



ABOVE & BEYOND



L319 MK4 - Discovery 4 MY2013-2015

Workshop Manual

- 1: General Information
 - 100: Service Information
 - 100-00: General Information
 - Description and Operation
 - [About This Manual](#)
 - [How To Use This Manual](#)
 - [Important Safety Instructions](#)
 - [General Service Information](#)
 - [Standard Workshop Practices](#)
 - [Health and Safety Precautions](#)
 - [Solvents, Sealants and Adhesives](#)
 - [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#)
 - [Road/Roller Testing](#)
 - [Special Tool Glossary](#)
 - [DTC: Air Suspension Control Module](#)
 - [DTC: Anti-Lock Brake System Control Module \(ABS\)](#)
 - [DTC: Audio Amplifier Module \(AAM\)](#)
 - [DTC: Audio Head Unit \(AHU\) - Low Line](#)
 - [DTC: Automatic Temperature Control Module \(ATC\)](#)
 - [DTC: Blindspot Monitoring Control Module \(BMCM\) - Left/Right](#)
 - [DTC: Central Junction Box \(CJB\)](#)
 - [DTC: Digital Radio Control Module \(DRCM\)](#)
 - [DTC: Driver/Passenger Door Control Module \(DDM/PDM\)](#)
 - [DTC: Driver/Passenger Seat Module \(DSM/PSM\)](#)
 - [DTC: Electric Park Brake Control Module \(EPBCM\)](#)
 - [DTC: Electric Steering Column Lock Control Module \(ESCL\)](#)
 - [TDV6 3.0L Diesel , DTC: Engine Control Module \(ECM\)](#)
 - [DTC: V6 3.0L S/C Petrol, DTC: Engine Control Module \(ECM\)](#)
 - [DTC: Fuel Fired Booster Heater Control Module \(FFBH\)](#)
 - [DTC: Gateway Module \(GWM\)](#)
 - [DTC: Headlamp Leveling Control Module \(HLCM\)](#)
 - [DTC: Instrument Cluster \(IC\)](#)
 - [DTC: Integrated Audio Module \(IAM\) - High Line](#)
 - [DTC: Integrated Control Panel \(ICP\)](#)
 - [DTC: Rear Integrated Control Panel \(RICP\)](#)
 - [DTC: Keyless Vehicle Module \(KVM\)](#)
 - [DTC: Multi-Function Display \(MFD\)](#)
 - [DTC: Navigation Control Module \(NCM\) - India & Israel](#)
 - [DTC: Navigation Control Module \(NCM\) - Extended Markets](#)
 - [DTC: Occupant Classification Sensor Control Module \(OCSCM\)](#)
 - [DTC: Parking Aid Control Module \(PACM\)](#)
 - [DTC: Proximity Camera Control Module \(PCCM\)](#)
 - [DTC: Rear Differential Control Module \(RDCM\)](#)
 - [DTC: Rear Seat Entertainment Control Module \(RSECM\)](#)
 - [DTC: Rear View Camera \(RVC\)](#)
 - [DTC: Rear View Mirror](#)
 - [DTC: Restraints Control Module \(RCM\)](#)
 - [DTC: Satellite Radio Control Module \(SRCM\)](#)
 - [DTC: Steering Angle Sensor Module \(SASM\)](#)
 - [DTC: Terrain Response Switchpack \(TR\)](#)
 - [DTC: Touch Screen \(TS\)](#)
 - [DTC: Transfer Case Control Module \(TCCM\)](#)
 - [DTC: Transmission Control Module \(TCM\)](#)
 - [DTC: Transmission Control Switch \(TCS\)](#)
 - [DTC: TV Control Module \(TVCM\) - Digital](#)
 - [DTC: Telephone Interface Module \(TIM\)](#)
 - [DTC: TV Control Module \(TVCM\) - Hybrid](#)
 - [DTC: TV Control Module \(TVCM\) - Conditional Access System](#)
 - [DTC: Wade Aid Control Module \(WACM\)](#)
 - 100-01: Identification Codes
 - Description and Operation
 - [Identification Codes](#)
 - [Identification Codes](#)
 - 100-02: Jacking and Lifting
 - Description and Operation
 - [Vehicle Recovery](#)
 - [Jacking](#)
 - [Lifting](#)

- 100-03: Maintenance Schedules
 - Description and Operation
 - [Maintenance Schedules - Gasoline Engines](#)
 - [Maintenance Schedules - Diesel Engines](#)
 - 100-11: Vehicle Transportation Aids and Vehicle Storage
 - Description and Operation
 - [New Vehicle Storage](#)
 - [New Vehicle Storage Form](#)
 - 101: Pre-Delivery Information
 - 101-01: Pre-Delivery Inspection Manual
 - Description and Operation
 - [Preliminary](#)
 - [Vehicle Interior](#)
 - [Vehicle Exterior](#)
 - [Road Test](#)
 - [Quality Assurance Checks](#)
 - Removal and Installation
 - [SD Memory Card](#)
 - 101-02: Showroom Preparation
 - Description and Operation
 - [Showroom Preparation](#)
 - 101-03: Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards
 - Description and Operation
 - [Introduction](#)
 - [Cosmetic Acceptance Standards](#)
 - [Exterior Surface Zone Identification](#)
 - [Paint Exceptions And Associated Repair Procedures](#)
 - [General Requirements](#)
 - [Identification Of Exceptions](#)
 - [Exterior Pre-Delivery Inspection \(PDI\) Process](#)
- 2: Chassis
 - 204: Suspension
 - 204-00: Suspension System - General Information
 - [Specification](#)
 - Diagnosis and Testing
 - [Suspension System](#)
 - General Procedures
 - [Four-Wheel Alignment \(57.65.04\)](#)
 - [Front Wheel Bearing and Wheel Hub Runout Check](#)
 - 204-01: Front Suspension
 - [Specification](#)
 - Description and Operation
 - [Front Suspension](#)
 - [Front Suspension](#)
 - Removal and Installation
 - [Front Stabilizer Bar \(60.10.01\)](#)
 - [Front Stabilizer Bar Link \(60.10.02/60.10.04\)](#)
 - [Upper Arm Ball Joint \(60.15.02\)](#)
 - [Lower Arm Ball Joint \(60.15.03\)](#)
 - [Wheel Knuckle \(60.25.01\)](#)
 - [Front Wheel Bearing and Wheel Hub \(60.25.14\)](#)
 - [Shock Absorber and Spring Assembly \(60.21.01\) \(60.30.25/99\)](#)
 - [Upper Arm \(60.35.01\)](#)
 - [Upper Arm Bushing \(60.35.32\)](#)
 - [Lower Arm \(60.35.02\)](#)
 - [Lower Arm Bushing \(60.35.33\)](#)
 - [Lower Arm Front Bushing \(60.35.24\)](#)
 - [Lower Arm Rear Bushing \(60.35.25\) \(60.35.36\) \(60.35.36.47\)](#)
 - Disassembly and Assembly
 - [Shock Absorber and Spring Assembly - TDV6 2.7L Diesel](#)
 - 204-02: Rear Suspension
 - [Specification](#)
 - Description and Operation
 - [Rear Suspension](#)
 - [Rear Suspension](#)
 - Removal and Installation
 - [Upper Arm Ball Joint \(64.15.07\)](#)
 - [Lower Arm Ball Joint \(64.15.08\)](#)

- [Wheel Bearing and Wheel Hub \(64.15.14\)](#)
 - [Rear Stabilizer Bar \(64.35.08\)](#)
 - [Upper Arm Bushing \(64.35.22\)](#)
 - [Rear Stabilizer Bar Link \(64.35.24\)](#)
 - [Lower Arm \(64.35.54\)](#)
 - [Upper Arm \(64.35.60\)](#)
 - [Toe Link \(64.35.70\)](#)
 - [Lower Arm Bushing \(64.35.15\)](#)
 - [Shock Absorber and Spring Assembly \(64.30.11/99\) - TDV6 2.7L Diesel](#)
 - [Wheel Knuckle \(64.35.10\)](#)
 - Disassembly and Assembly
 - [Shock Absorber and Spring Assembly - TDV6 2.7L Diesel](#)
 - 204-04: Wheels and Tires
 - [Specification](#)
 - Description and Operation
 - [Wheels and Tires](#)
 - Diagnosis and Testing
 - [Wheels and Tires](#)
 - Removal and Installation
 - [Tire Low Pressure Sensor \(74.10.05\)](#)
 - [Tire Pressure Monitoring System \(TPMS\) Front Antenna \(86.53.16\)](#)
 - [Tire Pressure Monitoring System \(TPMS\) Rear Antenna \(86.53.17\)](#)
 - 204-05: Vehicle Dynamic Suspension
 - [Specification](#)
 - Description and Operation
 - [Vehicle Dynamic Suspension](#)
 - [Vehicle Dynamic Suspension](#)
 - Diagnosis and Testing
 - [Vehicle Dynamic Suspension](#)
 - General Procedures
 - [Air Suspension System Depressurize and Pressurize \(60.50.38\)](#)
 - [Ride Height Adjustments \(60.90.03\)](#)
 - [Air Leaks](#)
 - Removal and Installation
 - [Suspension Height Sensor \(60.36.01\)](#)
 - [Air Suspension Reservoir \(60.50.03\)](#)
 - [Air Suspension Control Module \(60.50.04\)](#)
 - [Air Suspension Reservoir Solenoid Valve Block \(60.50.05\)](#)
 - [Air Suspension Compressor Drier \(60.50.09\)](#)
 - [Air Suspension Front Solenoid Valve Block \(60.50.11\)](#)
 - [Rear Air Spring \(64.21.01\)](#)
 - [Air Suspension Muffler \(64.50.01\)](#)
 - [Air Suspension Rear Solenoid Valve Block \(64.50.11\)](#)
 - [Air Suspension Air Filter \(64.50.12\)](#)
 - [Front Air Shock Absorber \(60.30.02.45\)](#)
 - [Rear Air Shock Absorber \(64.30.02.45\)](#)
 - [Front Shock Absorber and Air Spring Assembly \(60.21.01.99\)](#)
 - [Rear Shock Absorber and Air Spring Assembly \(64.21.01.99\)](#)
 - [Air Suspension Pressure Sensor](#)
 - [Air Suspension Compressor \(60.50.10\)](#)
 - 204-06: Ride and Handling Optimization
 - Description and Operation
 - [Ride and Handling Optimization](#)
 - [Ride and Handling Optimization](#)
 - Diagnosis and Testing
 - [Ride and Handling Optimization](#)
 - Removal and Installation
 - [Ride and Handling Optimization Switch \(86.65.11\)](#)
 - [Ride and Handling Optimization Switch \(86.65.11\)](#)
- 205: Driveline
 - 205-01: Driveshaft
 - [Specification](#)
 - Description and Operation
 - [Driveshaft](#)
 - [Universal Joints](#)
 - Removal and Installation
 - [Front Driveshaft - V6 S/C 3.0L Petrol](#)
 - [Front Driveshaft \(47.15.02\) - TDV6 3.0L Diesel](#)

- [Brake Pad Bedding-In](#)
 - 206-03: Front Disc Brake
 - [Specification](#)
 - Description and Operation
 - [Front Disc Brake](#)
 - [Front Disc Brake](#)
 - Removal and Installation
 - [Brake Disc \(70.12.10\) - Vehicles With: Standard Brakes](#)
 - [Brake Pads \(70.40.02\) - Vehicles With: Standard Brakes](#)
 - [Brake Caliper \(70.55.24\) - Vehicles With: Standard Brakes](#)
 - 206-04: Rear Disc Brake
 - [Specification](#)
 - Description and Operation
 - [Rear Disc Brake](#)
 - [Rear Disc Brake](#)
 - Removal and Installation
 - [Brake Disc \(70.12.33\)](#)
 - [Brake Pads \(70.40.03\)](#)
 - [Brake Caliper \(70.55.25\)](#)
 - [Brake Caliper Anchor Plate \(70.55.29\)](#)
 - 206-05: Parking Brake and Actuation
 - [Specification](#)
 - Description and Operation
 - [Parking Brake](#)
 - [Parking Brake](#)
 - Diagnosis and Testing
 - [Parking Brake](#)
 - General Procedures
 - [Parking Brake Shoe and Lining Adjustment \(70.40.11\)](#)
 - [Parking Brake Shoes Bedding-In \(70.40.12\)](#)
 - Removal and Installation
 - [Parking Brake Cable LH](#)
 - [Parking Brake Cable RH](#)
 - [Parking Brake Switch](#)
 - [Parking Brake Actuator \(70.35.48\)](#)
 - [Parking Brake Shoes \(70.40.09\)](#)
 - 206-06: Hydraulic Brake Actuation
 - [Specification](#)
 - Description and Operation
 - [Hydraulic Brake Actuation](#)
 - Removal and Installation
 - [Brake Fluid Reservoir \(70.25.31\)](#)
 - [Brake Master Cylinder \(70.30.08\)](#)
 - [Brake Pedal \(70.35.01\)](#)
 - [Brake Pedal and Bracket \(70.35.03\)](#)
 - 206-07: Power Brake Actuation
 - [Specification](#)
 - Description and Operation
 - [Brake Booster](#)
 - Removal and Installation
 - [Brake Booster \(70.50.01\)](#)
 - [Brake Vacuum Pump - TDV6 3.0L Diesel](#)
 - [Brake Vacuum Pump - V6 S/C 3.0L Petrol](#)
 - 206-09A: Anti-Lock Control - Traction Control
 - [Specification](#)
 - Description and Operation
 - [Anti-Lock Control - Traction Control](#)
 - Diagnosis and Testing
 - [Anti-Lock Control - Traction Control](#)
 - Removal and Installation
 - [Anti-Lock Brake System \(ABS\) Module \(70.25.12\)](#)
 - [Front Wheel Speed Sensor \(70.65.30\)](#)
 - [Rear Wheel Speed Sensor \(70.65.31\)](#)
 - 206-09B: Anti-Lock Control - Stability Assist
 - Removal and Installation
 - [Yaw Rate Sensor \(70.70.35\)](#)
- 211: Steering System
 - 211-00: Steering System - General Information

- Diagnosis and Testing
 - [Steering System](#)
 - General Procedures
 - [Power Steering System Filling and Bleeding](#)
 - [Power Steering System Flushing](#)
 - 211-02: Power Steering
 - [Specification](#)
 - Description and Operation
 - [Power Steering](#)
 - General Procedures
 - [Power Steering Pressure Test - TDV6 3.0L Diesel](#)
 - [Power Steering Pressure Test - V6 S/C 3.0L Petrol](#)
 - Removal and Installation
 - [Steering Gear \(57.10.01\) - TDV6 3.0L Diesel](#)
 - [Steering Gear \(57.10.01\) - V6 S/C 3.0L Petrol](#)
 - [Power Steering Fluid Reservoir \(57.15.08\) - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol](#)
 - [Power Steering Fluid Cooler \(57.15.11\) - V6 S/C 3.0L Petrol](#)
 - [Power Steering Pump \(57.20.14\) - TDV6 3.0L Diesel](#)
 - [Power Steering Pump \(57.20.14\) - V6 S/C 3.0L Petrol](#)
 - [Steering Angle Sensor \(57.40.02\)](#)
 - [Power Steering Pump to Steering Gear Pressure Line](#)
 - 211-03: Steering Linkage
 - [Specification](#)
 - Description and Operation
 - [Steering Linkage](#)
 - Removal and Installation
 - [Tie Rod End \(57.55.07\)](#)
 - [Steering Gear Boot \(57.10.29\)](#)
 - [Tie Rod \(57.55.09\)](#)
 - 211-04: Steering Column
 - [Specification](#)
 - Description and Operation
 - [Steering Column](#)
 - Removal and Installation
 - [Steering Column \(57.40.01\) \(57.40.06\)](#)
 - [Steering Column Shaft \(57.40.22\)](#)
 - [Steering Column Lower Shaft \(57.40.16 / 57.40.27\)](#)
 - [Steering Wheel \(57.61.01\)](#)
 - 211-05: Steering Column Switches
 - [Specification](#)
 - Diagnosis and Testing
 - [Steering Column Switches](#)
 - Removal and Installation
 - [Steering Column Lock and Ignition Switch Housing \(57.40.31\)](#)
 - [Ignition Switch \(86.65.02\)](#)
 - [Steering Column Multifunction Switch RH \(86.65.41\)](#)
 - [Steering Column Multifunction Switch LH \(86.65.55\)](#)
- 3: Powertrain
 - 303: Engine
 - 303-00: Engine System - General Information
 - Diagnosis and Testing
 - [Engine \(12.90.09.01\) - TDV6 3.0L Diesel](#)
 - [Engine \(12.90.09.01\) - V6 S/C 3.0L Petrol](#)
 - General Procedures
 - [Bearing Inspection](#)
 - [Camshaft Bearing Journal Diameter](#)
 - [Camshaft End Play](#)
 - [Camshaft Lobe Lift](#)
 - [Camshaft Surface Inspection](#)
 - [Connecting Rod Cleaning](#)
 - [Connecting Rod Large End Bore](#)
 - [Crankshaft End Play](#)
 - [Cylinder Bore Out-of-Round](#)
 - [Exhaust Manifold Cleaning and Inspection](#)
 - [Piston Inspection](#)
 - [Piston Pin Diameter](#)
 - [Piston Pin to Bore Diameter](#)

- [Piston Ring End Gap](#)
 - [Piston Ring-to-Groove Clearance](#)
 - [Valve Spring Free Length](#)
 - [Valve Stem Diameter](#)
 - [Leakage Test Using Smoke Test Equipment](#)
 - [Cylinder Head Gasket Selection - TDV6 3.0L Diesel](#)
 - [Cylinder Head Distortion](#)
 - [Cylinder Compression Test - TDV6 3.0L Diesel](#)
- 303-01A: Engine - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - [Component Location](#)
 - [Overview](#)
 - [System Operation and Component Description](#)
 - Diagnosis and Testing
 - [Engine](#)
 - General Procedures
 - [Engine Oil Draining and Filling \(12.60.05\)](#)
 - [Engine Oil Vacuum Draining and Filling](#)
 - Removal and Installation
 - [Camshaft LH](#)
 - [Camshaft RH](#)
 - [Camshaft Front Seal](#)
 - [Camshaft Rear Seal](#)
 - [Crankshaft Front Seal \(12.21.14\)](#)
 - [Crankshaft Pulley \(12.21.01\)](#)
 - [Crankshaft Rear Seal \(12.21.20\)](#)
 - [Cylinder Head LH](#)
 - [Cylinder Head RH](#)
 - [Engine Mount LH \(12.45.11\)](#)
 - [Engine Mount RH \(12.45.12\)](#)
 - [Exhaust Manifold LH](#)
 - [Exhaust Manifold RH](#)
 - [Exhaust Manifold Crossover Pipe](#)
 - [Flexplate \(12.53.13\)](#)
 - [Oil Cooler \(12.60.68\)](#)
 - [Oil Filter Element \(12.60.02\)](#)
 - [Oil Pan \(12.60.44\)](#)
 - [Oil Pan Extension \(12.60.41\)](#)
 - [Oil Pump \(12.60.26\)](#)
 - [Timing Belt \(12.65.18\)](#)
 - [Timing Cover \(12.65.01 or 12.65.43\)](#)
 - [Valve Cover LH](#)
 - [Valve Cover RH](#)
 - Removal
 - [Engine](#)
 - Installation
 - [Engine](#)
 - 303-01B: Engine - V6 S/C 3.0L Petrol
 - [Specification](#)
 - Description and Operation
 - [Engine](#)
 - Diagnosis and Testing
 - [Engine](#)
 - General Procedures
 - [Engine Oil Draining and Filling \(12.60.05\)](#)
 - [Engine Oil Vacuum Draining and Filling](#)
 - [Fuel Pump Camshaft Timing Check](#)
 - [Fuel Pump Camshaft Timing Adjustment](#)
 - [Valve Clearance Check \(12.29.73\)](#)
 - [Valve Clearance Adjustment \(12.29.76\)](#)
 - Removal and Installation
 - [Camshaft LH](#)
 - [Camshaft RH](#)
 - [Crankshaft Front Seal \(12.21.14\)](#)
 - [Crankshaft Pulley \(12.21.01\)](#)
 - [Crankshaft Rear Seal \(12.21.20\)](#)
 - [Cylinder Head LH](#)

- [Cylinder Head RH](#)
 - [Engine Mount LH \(12.45.11\)](#)
 - [Engine Mount RH \(12.45.12\)](#)
 - [Exhaust Manifold LH](#)
 - [Exhaust Manifold RH](#)
 - [Flexplate \(12.53.13\)](#)
 - [Oil Cooler \(12.60.68\)](#)
 - [Oil Filter Element \(12.60.02\)](#)
 - [Oil Pan Extension \(12.60.41\)](#)
 - [Oil Pump \(12.60.26\)](#)
 - [Timing Cover \(12.65.01 or 12.65.43\)](#)
 - [Timing Drive Components](#)
 - [Valve Cover LH](#)
 - [Valve Cover RH](#)
 - [Fuel Pump Camshaft](#)
 - [Lower Timing Cover](#)
- Removal
 - [Engine](#)
- Installation
 - [Engine](#)
- 303-03A: Engine Cooling - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - [Component Location](#)
 - [Overview](#)
 - [System Operation and Component Description](#)
 - Diagnosis and Testing
 - [Engine Cooling](#)
 - General Procedures
 - [Cooling System Draining, Filling and Bleeding](#)
 - Removal and Installation
 - [Auxiliary Radiator](#)
 - [Coolant Expansion Tank](#)
 - [Coolant Pump](#)
 - [Cooling Fan](#)
 - [Cooling Fan Shroud](#)
 - [Radiator](#)
 - [Thermostat](#)
- 303-03B: Engine Cooling - V6 S/C 3.0L Petrol
 - [Specification](#)
 - Description and Operation
 - [Engine Cooling](#)
 - Diagnosis and Testing
 - [Engine Cooling](#)
 - General Procedures
 - [Cooling System Draining and Vacuum Filling](#)
 - [Cooling System Draining, Filling and Bleeding](#)
 - [Cooling System Partial Draining, Filling and Bleeding](#)
 - Removal and Installation
 - [Coolant Expansion Tank](#)
 - [Cooling Fan](#)
 - [Coolant Pump](#)
 - [Radiator](#)
 - [Thermostat Housing](#)
- 303-03C: Supercharger Cooling - V6 S/C 3.0L Petrol
 - [Specification](#)
 - Description and Operation
 - [Supercharger Cooling](#)
 - Diagnosis and Testing
 - [Supercharger Cooling](#)
 - Removal and Installation
 - [Coolant Pump](#)
 - [Radiator](#)
- 303-04A: Fuel Charging and Controls - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - [Component Location](#)
 - [Overview](#)

[System Operation and Component Description](#)

- Diagnosis and Testing
 - [Fuel Charging and Controls](#)
- General Procedures
 - [Fuel Injection Component Cleaning](#)
- Removal and Installation
 - [Fuel Injection Pump](#)
 - [Fuel Injectors LH](#)
 - [Fuel Injectors RH](#)
 - [Fuel Rail LH](#)
 - [Fuel Rail RH](#)
 - [Intake Air Shutoff Throttle](#)
- 303-04B: Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - [Component Location](#)
 - [Overview](#)
 - [System Operation and Component Description](#)
 - Diagnosis and Testing
 - [Turbocharger](#)
 - Removal and Installation
 - [Turbocharger LH](#)
 - [Turbocharger RH](#)
 - [Fixed Vane Turbocharger Actuator](#)
 - [Turbocharger Bypass Valve](#)
- 303-04C: Fuel Charging and Controls - V6 S/C 3.0L Petrol
 - [Specification](#)
 - Description and Operation
 - [Fuel Charging and Controls](#)
 - Diagnosis and Testing
 - [Fuel Charging and Controls](#)
 - General Procedures
 - [Fuel Injection Component Cleaning](#)
 - [Fuel Injection Component Cleaning Using Pressure Cleaner](#)
 - Removal and Installation
 - [Fuel Injectors](#)
 - [Fuel Rail LH](#)
 - [Fuel Rail RH](#)
 - [High Pressure Fuel Pump 1](#)
 - [High Pressure Fuel Pump 2](#)
 - [Fuel Pump Driver Module \(FPDM\)](#)
 - [Throttle Body](#)
- 303-05A: Accessory Drive - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - [Component Location](#)
 - [Overview](#)
 - [System Operation and Component Description](#)
 - Diagnosis and Testing
 - [Accessory Drive](#)
 - Removal and Installation
 - [Accessory Drive Belt](#)
 - [Accessory Drive Belt Idler Pulley](#)
 - [Accessory Drive Belt Tensioner](#)
 - [Fuel Injection Pump Pulley](#)
 - [Rear End Accessory Drive \(READ\)](#)
- 303-05B: Accessory Drive - V6 S/C 3.0L Petrol
 - [Specification](#)
 - Description and Operation
 - [Accessory Drive](#)
 - Diagnosis and Testing
 - [Accessory Drive](#)
 - Removal and Installation
 - [Accessory Drive Belt](#)
 - [Accessory Drive Belt Idler Pulley](#)
 - [Accessory Drive Belt Tensioner](#)
 - [Supercharger Belt Idler Pulley](#)
 - [Supercharger Belt Tensioner](#)

- [Supercharger Belt](#)
- 303-06A: Starting System - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - Diagnosis and Testing
 - [Starting System](#)
 - Removal and Installation
 - [Starter Motor](#)
 - 303-06B: Starting System - V6 S/C 3.0L Petrol
 - [Specification](#)
 - Description and Operation
 - [Starting System](#)
 - Diagnosis and Testing
 - [Starting System](#)
 - Removal and Installation
 - [Starter Motor](#)
 - 303-07A: Glow Plug System - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - [Component Location](#)
 - [Overview](#)
 - [System Operation and Component Description](#)
 - Diagnosis and Testing
 - [Glow Plug System](#)
 - Removal and Installation
 - [Glow Plugs](#)
 - 303-07B: Engine Ignition - V6 S/C 3.0L Petrol
 - [Specification](#)
 - Description and Operation
 - [Engine Ignition](#)
 - Diagnosis and Testing
 - [Engine Ignition](#)
 - Removal and Installation
 - [Ignition Coil-On-Plug](#)
 - [Spark Plugs](#)
 - 303-08A: Engine Emission Control - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - [Component Location](#)
 - [Overview](#)
 - [System Operation and Component Description](#)
 - Diagnosis and Testing
 - [Engine Emission Control](#)
 - Removal and Installation
 - [Crankcase Vent Oil Separator](#)
 - [Exhaust Gas Recirculation \(EGR\) Valve LH](#)
 - [Exhaust Gas Recirculation \(EGR\) Valve RH](#)
 - [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube LH](#)
 - [Exhaust Gas Recirculation \(EGR\) Valve Outlet Tube RH](#)
 - 303-08B: Engine Emission Control - V6 S/C 3.0L Petrol
 - Description and Operation
 - [Engine Emission Control](#)
 - Diagnosis and Testing
 - [Engine Emission Control](#)
 - 303-12A: Intake Air Distribution and Filtering - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - [Component Location](#)
 - [Overview](#)
 - [System Operation and Component Description](#)
 - Diagnosis and Testing
 - [Intake Air Distribution and Filtering](#)
 - Removal and Installation
 - [Air Cleaner](#)
 - [Air Cleaner Element \(19.10.10\)](#)
 - [Charge Air Cooler](#)
 - 303-12B: Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol
 - [Specification](#)

- Description and Operation
 - [Intake Air Distribution and Filtering](#)
 - Diagnosis and Testing
 - [Intake Air Distribution and Filtering](#)
 - Removal and Installation
 - [Air Cleaner Outlet Pipe T-Connector](#)
 - [Charge Air Cooler](#)
 - [Supercharger](#)
 - [Air Cleaner Element](#)
 - [Air Cleaner LH](#)
 - [Air Cleaner RH](#)
 - [Air Cleaner Outlet Pipe LH](#)
 - [Air Cleaner Outlet Pipe RH](#)
- 303-13: Evaporative Emissions - V6 S/C 3.0L Petrol
 - Description and Operation
 - [Evaporative Emissions](#)
 - Diagnosis and Testing
 - [Evaporative Emissions](#)
- 303-14A: Electronic Engine Controls - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - [Component Location](#)
 - [Overview](#)
 - [System Operation and Component Description](#)
 - Diagnosis and Testing
 - [Electronic Engine Controls](#)
 - Removal and Installation
 - [Camshaft Position \(CMP\) Sensor \(18.30.24\)](#)
 - [Crankshaft Position \(CKP\) Sensor \(18.30.12\)](#)
 - [Crankshaft Position \(CKP\) Sensor Ring \(18.30.14\)](#)
 - [Diesel Particulate Filter \(DPF\) Differential Pressure Sensor](#)
 - [Engine Coolant Temperature \(ECT\) Sensor \(18.30.10\)](#)
 - [Engine Control Module \(ECM\) \(18.30.03\)](#)
 - [Engine Oil Level Sensor \(12.60.51\)](#)
 - [Engine Oil Pressure \(EOP\) Sensor](#)
 - [Exhaust Gas Temperature Sensor RH](#)
 - [Heated Oxygen Sensor \(HO2S\) \(19.22.16\)](#)
 - [Intake Air Temperature \(IAT\) Sensor \(18.30.09\)](#)
 - [Manifold Absolute Pressure \(MAP\) Sensor \(18.30.56\)](#)
 - [Mass Air Flow \(MAF\) Sensor \(19.22.25\)](#)
 - [Oil Temperature Sensor \(18.30.41\)](#)
 - [Post Catalytic Converter Temperature Sensor](#)
 - [Post DPF Exhaust Gas Temperature Sensor](#)
 - [Pre Catalytic Converter Temperature Sensor](#)
 - [Pre DPF Exhaust Gas Temperature Sensor](#)
- 303-14B: Electronic Engine Controls - V6 S/C 3.0L Petrol
 - [Specification](#)
 - Description and Operation
 - [Electronic Engine Controls](#)
 - Diagnosis and Testing
 - [Electronic Engine Controls](#)
 - General Procedures
 - [Brake Pedal Position \(BPP\) Switch Adjustment](#)
 - Removal and Installation
 - [Camshaft Position \(CMP\) Sensor LH](#)
 - [Camshaft Position \(CMP\) Sensor RH](#)
 - [Crankshaft Position \(CKP\) Sensor \(18.30.12\)](#)
 - [Engine Coolant Temperature \(ECT\) Sensor \(18.30.10\)](#)
 - [Engine Oil Level Sensor \(12.60.51\)](#)
 - [Fuel Rail Pressure \(FRP\) Sensor](#)
 - [Knock Sensor \(KS\) LH](#)
 - [Knock Sensor \(KS\) RH](#)
 - [Manifold Absolute Pressure \(MAP\) Sensor \(18.30.56\)](#)
 - [Variable Valve Timing \(VVT\) Oil Control Solenoid LH](#)
 - [Variable Valve Timing \(VVT\) Oil Control Solenoid RH](#)
 - [Left Mid catalyst Heated Oxygen Sensor \(HO2S\)](#)
 - [Right Mid catalyst Heated Oxygen Sensor \(HO2S\)](#)
 - [Pre catalyst Heated Oxygen Sensor \(HO2S\)](#)

- [Post catalyst Heated Oxygen Sensor \(HO2S\)](#)
 - [Mass Air Flow \(MAF\) Sensor \(19.22.25\)](#)
 - [Engine Control Module \(ECM\) \(18.30.03\)](#)
- 307: Automatic Transmission/Transaxle
 - 307-01: Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD
 - [Specification](#)
 - Description and Operation
 - [Transmission Description](#)
 - Diagnosis and Testing
 - [Diagnostics - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD](#)
 - General Procedures
 - [Transmission Fluid Level Check](#)
 - [Transmission Fluid Drain and Refill](#)
 - Removal and Installation
 - [Input Shaft Seal](#)
 - [Extension Housing Seal](#)
 - [Transmission Control Module \(TCM\) and Main Control Valve Body](#)
 - [Transmission Fluid Pan, Gasket and Filter](#)
 - [Transmission Support Insulator](#)
 - [Selector Shaft Seal](#)
 - Removal
 - [Transmission - TDV6 3.0L Diesel](#)
 - [Transmission - V6 S/C 3.0L Petrol](#)
 - Installation
 - [Transmission - TDV6 3.0L Diesel](#)
 - [Transmission - V6 S/C 3.0L Petrol](#)
 - 307-02: Transmission/Transaxle Cooling - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD
 - [Specification](#)
 - Description and Operation
 - [Transmission Cooling](#)
 - Diagnosis and Testing
 - [Transmission Cooling](#)
 - 307-05: Automatic Transmission/Transaxle External Controls - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD
 - [Specification](#)
 - Description and Operation
 - [External Controls](#)
 - Diagnosis and Testing
 - [External Controls](#)
 - Removal and Installation
 - [Transmission Control Switch \(TCS\)](#)
 - [Transmission Control Switch \(TCS\) Knob](#)
 - [Emergency Park Position Release Lever](#)
 - [Upshift Paddle Switch](#)
 - [Downshift Paddle Switch](#)
- 308: Manual Transmission/Transaxle, Clutch and Transfer Case
 - 308-07A: Four-Wheel Drive Systems
 - [Specification](#)
 - Description and Operation
 - [Four-Wheel Drive Systems](#)
 - Removal and Installation
 - [Transfer Case Clutch Solenoid](#)
 - [High/Low Range Sensor \(41.30.07\)](#)
 - [Four-Wheel Drive \(4WD\) Control Module](#)
 - [Transfer Case Shift Motor \(41.30.03\)](#)
 - 308-07B: Transfer Case - Vehicles With: Single Speed Transfer Case
 - [Specification](#)
 - Description and Operation
 - [Transfer Case](#)
 - Diagnosis and Testing
 - [Transfer Case](#)
 - General Procedures
 - [Transfer Case Draining and Filling](#)
 - Removal and Installation
 - [Transfer Case Front Output Seal](#)

- [Transfer Case Front Output Shaft Bearing](#)
 - [Transfer Case Rear Output Seal](#)
 - [Transfer Case Rear Output Shaft Bearing](#)
 - [Transfer Case Connecting Sleeve Seals](#)
 - [Transfer Case Differential](#)
 - Removal
 - [Transfer Case - TDV6 3.0L Diesel](#)
 - [Transfer Case - V6 S/C 3.0L Petrol](#)
 - Installation
 - [Transfer Case - TDV6 3.0L Diesel](#)
 - [Transfer Case - V6 S/C 3.0L Petrol](#)
 - 308-07C: Transfer Case - Vehicles With: Twin Speed Transfer Case
 - [Specification](#)
 - Description and Operation
 - [Transfer Case](#)
 - Diagnosis and Testing
 - [Transfer Case](#)
 - General Procedures
 - [Transfer Case Draining and Filling \(41.20.04\)](#)
 - Removal and Installation
 - [Transfer Case Front Output Seal](#)
 - [Transfer Case Front Output Shaft Bearing](#)
 - [Transfer Case Rear Output Seal](#)
 - [Transfer Case Rear Output Shaft Bearing](#)
 - [Transfer Case Connecting Sleeve Seals](#)
 - [Transfer Case Chain](#)
 - Removal
 - [Transfer Case \(41.20.25.99\) - TDV6 3.0L Diesel](#)
 - [Transfer Case \(41.20.25.99\) - V6 S/C 3.0L Petrol](#)
 - Installation
 - [Transfer Case \(41.20.25\) - TDV6 3.0L Diesel](#)
 - [Transfer Case \(41.20.25\) - V6 S/C 3.0L Petrol](#)
- 309: Exhaust System
 - 309-00A: Exhaust System - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - [Exhaust System](#)
 - [Exhaust System](#)
 - [Component Location](#)
 - [System Operation and Component Description](#)
 - Diagnosis and Testing
 - [Diesel Particulate Filter](#)
 - [Exhaust System](#)
 - General Procedures
 - [Exhaust System Repair](#)
 - Removal and Installation
 - [Catalytic Converter \(17.50.01\)](#)
 - [Diesel Particulate Filter \(DPF\)](#)
 - [Exhaust System \(30.10.01\)](#)
 - [Front Muffler \(30.10.11\)](#)
 - [Rear Muffler \(30.10.22\)](#)
 - 309-00B: Exhaust System - V6 S/C 3.0L Petrol
 - [Specification](#)
 - Description and Operation
 - [Exhaust System](#)
 - General Procedures
 - [Exhaust System Repair](#)
 - Removal and Installation
 - [Catalytic Converter LH](#)
 - [Catalytic Converter RH](#)
 - [Exhaust System \(30.10.01\)](#)
 - [Front Muffler \(30.10.11\)](#)
 - [Rear Muffler \(30.10.22\)](#)
- 310: Fuel System
 - 310-00: Fuel System - General Information
 - General Procedures
 - [Diesel Filter Water Drain-Off](#)
 - [Low-Pressure Fuel System Bleeding \(19.50.07\)](#)

- [Fuel Tank Draining \(19.55.02\)](#)
 - [Fuel System Pressure Release \(19.50.02\) - V6 S/C 3.0L Petrol](#)
 - 310-01A: Fuel Tank and Lines - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - [Fuel Tank and Lines](#)
 - [Fuel Tank and Lines](#)
 - Diagnosis and Testing
 - [Fuel Tank and Lines](#)
 - Removal and Installation
 - [Fuel Cooler](#)
 - [Fuel Pump and Sender Unit](#)
 - [Fuel Tank \(19.55.01\)](#)
 - [Fuel Tank Filler Pipe \(19.55.07\)](#)
 - [Fuel Filter Element \(192502\)](#)
 - 310-01B: Fuel Tank and Lines - V6 S/C 3.0L Petrol
 - [Specification](#)
 - Description and Operation
 - [Fuel Tank and Lines](#)
 - Diagnosis and Testing
 - [Fuel Tank and Lines](#)
 - Removal and Installation
 - [Fuel Tank Filler Pipe \(19.55.07\)](#)
 - [Fuel Pump and Sender Unit](#)
 - [Fuel Tank \(19.55.01\)](#)
 - [Fuel Filter \(19.25.03\)](#)
 - 310-02: Acceleration Control
 - [Specification](#)
 - Removal and Installation
 - [Accelerator Pedal \(19.20.01\)](#)
 - 310-03A: Speed Control - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - [Speed Control](#)
 - Removal and Installation
 - [Speed Control Switch](#)
 - 310-03B: Speed Control - V6 S/C 3.0L Petrol
 - Description and Operation
 - [Speed Control](#)
- 4: Electrical
 - 412: Climate Control System
 - 412-00: Climate Control System - General Information
 - [Specification](#)
 - Diagnosis and Testing
 - [Climate Control System](#)
 - General Procedures
 - [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging \(82.30.02\)](#)
 - [Air Conditioning \(A/C\) Compressor Commissioning](#)
 - 412-01: Air Distribution and Filtering
 - Description and Operation
 - [Air Distribution and Filtering](#)
 - Removal and Installation
 - [Driver Side Register Trim Panel \(76.46.12\)](#)
 - [Passenger Side Register Trim Panel \(76.46.13\)](#)
 - [Pollen Filter \(80.15.42\)](#)
 - [Plenum Chamber \(80.15.62\)](#)
 - 412-02A: Heating and Ventilation
 - Description and Operation
 - [Heating and Ventilation](#)
 - Diagnosis and Testing
 - [Heating and Ventilation](#)
 - Removal and Installation
 - [Blower Motor \(80.20.15\)](#)
 - [Heater Core \(80.20.29\) - LHD AWD](#)
 - [Heater Core \(80.20.29\) - RHD AWD](#)
 - 412-02B: Auxiliary Heating
 - [Specification](#)

- Description and Operation
 - [Auxiliary Heater](#)
 - Diagnosis and Testing
 - [Fuel Fired Booster Heater](#)
 - Removal and Installation
 - [Fuel Fired Booster Heater \(80.40.01\) - TDV6 2.7L Diesel](#)
 - [Fuel Fired Booster Heater - TDV6 3.0L Diesel](#)
 - [Fuel Fired Booster Heater Glow Plug And Burner Assembly - TDV6 2.7L Diesel](#)
 - [Fuel Fired Booster Heater Glow Plug And Burner Assembly - TDV6 3.0L Diesel](#)
 - [Fuel Fired Booster Heater Receiver Unit](#)
- 412-03A: Air Conditioning - TDV6 3.0L Diesel
 - [Specification](#)
 - Description and Operation
 - [Air Conditioning](#)
 - Diagnosis and Testing
 - [Air Conditioning](#)
 - Removal and Installation
 - [Air Conditioning \(A/C\) Compressor](#)
 - [Air Conditioning \(A/C\) Pressure Transducer \(82.20.38\)](#)
 - [Condenser Core \(82.15.07\)](#)
 - [Evaporator Core \(82.25.20\) \(82.25.22\)](#)
 - [Thermostatic Expansion Valve \(82.25.01\)](#)
- 412-03B: Air Conditioning - V6 S/C 3.0L Petrol
 - [Specification](#)
 - Description and Operation
 - [Air Conditioning](#)
 - Diagnosis and Testing
 - [Air Conditioning](#)
 - Removal and Installation
 - [Air Conditioning \(A/C\) Compressor](#)
 - [Condenser Core](#)
 - [Condenser Fan](#)
 - [Evaporator Core \(82.25.20\) \(82.25.22\)](#)
 - [Thermostatic Expansion Valve \(82.25.01\)](#)
 - [Air Conditioning \(A/C\) Pressure Transducer \(82.20.38\)](#)
- 412-03C: Auxiliary Climate Control
 - [Specification](#)
 - Description and Operation
 - [Auxiliary Climate Control](#)
 - Diagnosis and Testing
 - [Auxiliary Climate Control](#)
 - Removal and Installation
 - [Thermostatic Expansion Valve \(82.26.01\)](#)
 - [Heater Core \(82.26.19\)](#)
 - [Evaporator Core \(82.26.20\)](#)
 - [Auxiliary Climate Control Assembly \(82.26.22\)](#)
 - [Auxiliary Blower Motor \(82.26.33\)](#)
 - [Auxiliary Temperature Blend Door Actuator \(82.26.34\)](#)
 - [Auxiliary Blend Door Actuator \(82.26.35\)](#)
 - [Auxiliary Blower Motor Control Module \(82.26.45\)](#)
- 412-04: Control Components
 - Description and Operation
 - [Control Components](#)
 - Diagnosis and Testing
 - [Control Components](#)
 - Removal and Installation
 - [Ambient Air Temperature Sensor \(80.40.31\)](#)
 - [Climate Control Assembly](#)
 - [Defrost Vent/Register Blend Door Actuator \(80.10.36\) - LHD AWD](#)
 - [Defrost Vent/Register Blend Door Actuator \(80.10.36\) - RHD AWD](#)
 - [Driver Side Temperature Blend Door Actuator \(80.10.37\) - LHD AWD](#)
 - [Driver Side Temperature Blend Door Actuator \(80.10.37\) - RHD AWD](#)
 - [Instrument Panel Blend Door Actuator \(80.20.09\) - LHD AWD](#)
 - [Instrument Panel Blend Door Actuator \(80.20.09\) - RHD AWD](#)
 - [In-Vehicle Temperature Sensor \(82.20.93\)](#)
 - [Passenger Side Temperature Blend Door Actuator \(80.10.38\) - LHD AWD](#)

- [Passenger Side Temperature Blend Door Actuator \(80.10.38\) - RHD AWD](#)
 - [Recirculation Blend Door Actuator - LHD AWD](#)
 - [Recirculation Blend Door Actuator - RHD AWD](#)
 - [Sunload Sensor \(82.20.92\)](#)
 - 413: Instrumentation and Warning Systems
 - 413-01: Instrument Cluster
 - [Specification](#)
 - Description and Operation
 - [Instrument Cluster](#)
 - [Instrument Cluster](#)
 - Diagnosis and Testing
 - [Instrument Cluster](#)
 - Removal and Installation
 - [Instrument Cluster \(80.20.01.99\) \(88.20.01\)](#)
 - [Instrument Cluster Lens](#)
 - 413-06: Horn
 - Description and Operation
 - [Horn](#)
 - [Horn](#)
 - Diagnosis and Testing
 - [Horn](#)
 - 413-08: Information and Message Center
 - Description and Operation
 - [Information and Message Center](#)
 - Diagnosis and Testing
 - [Information and Message Center](#)
 - 413-09A: Warning Devices
 - [Specification](#)
 - Description and Operation
 - [Blindspot Monitoring System](#)
 - Removal and Installation
 - [Low Tire Pressure Module \(86.54.05\)](#)
 - [Door Mirror Wade Sensor](#)
 - [General Proximity Sensor Module](#)
 - [Blindspot Monitoring Sensor LH](#)
 - 413-09B: Engine Protection System
 - [Specification](#)
 - Description and Operation
 - [Engine Protection System](#)
 - 413-13: Parking Aid
 - [Specification](#)
 - Description and Operation
 - [Parking Aid](#)
 - Diagnosis and Testing
 - [Parking Aid](#)
 - Removal and Installation
 - [Parking Aid Camera](#)
 - [Parking Aid Camera Module](#)
 - [Parking Aid Module \(86.54.10\)](#)
 - [Front Parking Aid Camera](#)
 - [Front Inner Parking Aid Sensor](#)
 - [Front Outer Parking Aid Sensor](#)
 - [Rear Inner Parking Aid Sensor](#)
 - [Rear Outer Parking Aid Sensor](#)
 - [Side Parking Aid Camera](#)
 - 414: Battery and Charging System
 - 414-00: Battery and Charging System - General Information
 - [Specification](#)
 - Description and Operation
 - [Battery Care Requirements](#)
 - [Quiescent Drain](#)
 - [Battery Report Form – In Service Batteries Only](#)
 - Diagnosis and Testing
 - [Charging System](#)
 - 414-01: Battery, Mounting and Cables
 - [Specification](#)
 - Description and Operation
 - [Battery and Cables](#)

- Diagnosis and Testing
 - [Video System](#)
 - Removal and Installation
 - [Digital Versatile Disc \(DVD\) Player](#)
 - [Video Display](#)
 - 417: Lighting
 - 417-01: Exterior Lighting
 - [Specification](#)
 - Description and Operation
 - [Exterior Lighting](#)
 - [Exterior Lighting](#)
 - Diagnosis and Testing
 - [Headlamps](#)
 - [Headlamp Leveling](#)
 - [Stoplamps](#)
 - [Turn Signal, Cornering and Hazard Lamps](#)
 - [Parking, Rear and License Plate Lamps](#)
 - [Front Fog Lamps](#)
 - [Rear Fog Lamps](#)
 - [Reversing Lamps](#)
 - [Trailer Lamps](#)
 - [Autolamps](#)
 - General Procedures
 - [Headlamp Adjustment \(86.40.17\)](#)
 - [Front Fog Lamp Adjustment](#)
 - Removal and Installation
 - [Stoplamp Switch \(70.35.42\)](#)
 - [Headlamp Assembly](#)
 - [Side Turn Signal Lamp \(86.40.53\)](#)
 - [Front Fog Lamp](#)
 - [High Mounted Stoplamp \(86.41.32\)](#)
 - [Adaptive Front Lighting Module \(86.54.06\)](#)
 - [Headlamp Switch](#)
 - [Approach Lamp - Vehicles With: Parking Aid Camera](#)
 - [Rear Lamp Assembly](#)
 - 417-02: Interior Lighting
 - [Specification](#)
 - Description and Operation
 - [Interior Lighting](#)
 - Diagnosis and Testing
 - [Interior Lighting](#)
 - 417-04: Daytime Running Lamps (DRL)
 - Description and Operation
 - [Daytime Running Lamps \(DRL\)](#)
 - Diagnosis and Testing
 - [Daytime Running Lamps \(DRL\)](#)
 - 418: Electrical Distribution
 - 418-00: Module Communications Network
 - [Specification](#)
 - Diagnosis and Testing
 - [Communications Network](#)
 - Removal and Installation
 - [Battery Junction Box \(BJB\) \(86.70.55\) - V6 S/C 3.0L Petrol](#)
 - [Battery Junction Box \(BJB\) \(86.70.55\) - TDV6 3.0L Diesel](#)
 - [Central Junction Box \(CJB\)](#)
 - [Gateway Module](#)
 - [Quiescent Current Control Module](#)
 - 418-02: Wiring Harnesses
 - [Specification](#)
 - Description and Operation
 - [Wiring Harness](#)
 - General Procedures
 - [Wiring Harness Repair](#)
 - Removal and Installation
 - [Engine Wiring Harness - V6 S/C 3.0L Petrol](#)
 - [Engine Wiring Harness \(86.70.17\) - TDV6 3.0L Diesel](#)
 - [Liftgate Wiring Harness \(86.70.84\)](#)
 - [Frame Wiring Harness](#)

- [Front Parking Aid Camera Wiring Harness - Front Section](#)
 - [Front Parking Aid Camera Wiring Harness - Main Body Section](#)
 - [Left Hand Parking Aid Camera Wiring Harness](#)
 - [Right Hand Parking Aid Camera Wiring Harness](#)
 - [Rear Parking Aid Camera Wiring Harness](#)
 - [Suspension Air Supply Unit Wiring Harness](#)
 - 419: Electronic Feature Group
 - 419-01A: Anti-Theft - Active
 - [Specification](#)
 - Description and Operation
 - [Anti-Theft - Active](#)
 - Removal and Installation
 - [Hood Switch \(86.77.20\)](#)
 - [Antenna \(86.77.31\)](#)
 - [Anti-Theft Alarm Horn with Integral Battery](#)
 - 419-01B: Anti-Theft - Passive
 - Description and Operation
 - [Anti-Theft - Passive](#)
 - Removal and Installation
 - [Passive Anti-Theft System \(PATS\) Module \(86.77.07\)](#)
 - 419-02: Remote Convenience
 - Description and Operation
 - [Universal Transmitter](#)
 - Diagnosis and Testing
 - [Universal Transmitter](#)
 - 419-07: Navigation System
 - Description and Operation
 - [Navigation System](#)
 - Diagnosis and Testing
 - [Navigation System](#)
 - Removal and Installation
 - [Navigation System Compact Disc \(CD\) Unit \(86.53.01\)](#)
 - [Navigation System Display Module](#)
 - [Navigation System Traffic Amplifier \(86.53.23\)](#)
 - [Navigation System Antenna \(86.53.61\)](#)
 - 419-08: Cellular Phone
 - [Specification](#)
 - Description and Operation
 - [Cellular Phone](#)
 - Removal and Installation
 - [Cellular Phone Antenna \(86.53.11\) - Vehicles With: Metal Roof Panel](#)
 - [Cellular Phone Antenna \(86.53.11\) - Vehicles With: Glass Roof Panel](#)
 - [Transceiver Module](#)
 - 419-10: Multifunction Electronic Modules
 - Diagnosis and Testing
 - [Driver Door Module \(DDM\)](#)
 - [Driver Seat Module \(DSM\)](#)
 - Removal and Installation
 - [Driver Seat Module \(DSM\)](#)
 - [Rear Entertainment Control Module](#)
 - 419-12: Winch
 - Description and Operation
 - [Component Location](#)
 - [Overview](#)
 - [System Operation and Component Description](#)
 - Diagnosis and Testing
 - [Winch](#)
 - Removal and Installation
 - [Winch](#)
 - [Winch Motor](#)
 - [Winch Solenoid](#)
 - [Licence Plate Panel](#)
 - [Winch Cable Roller Assembly](#)
 - [Winch Control Unit](#)
 - [Winch Gear Assembly](#)
- 5: Body and Paint
 - 501: Body and Paint
 - 501-02: Front End Body Panels

- [Specification](#)
- Removal and Installation
 - [Fender \(76.10.24\)](#)
 - [Fender Splash Shield \(76.10.48\)](#)
 - [Engine Undershield \(76.10.50\)](#)
- 501-03: Body Closures
 - Description and Operation
 - [Body Closures](#)
 - General Procedures
 - [Liftgate Alignment \(76.28.31\)](#)
 - Removal and Installation
 - [Fuel Filler Door Assembly \(19.55.04\)](#)
 - [Fuel Filler Interlock Catch \(19.55.17\)](#)
 - [Liftgate \(76.28.29\)](#)
- 501-05: Interior Trim and Ornamentation
 - [Specification](#)
 - Removal and Installation
 - [Engine Cover \(12.30.50\) - V6 S/C 3.0L Petrol](#)
 - [Engine Cover \(12.30.50\) - TDV6 3.0L Diesel](#)
 - [Rear Quarter Trim Panel \(76.13.12\)](#)
 - [Cowl Side Trim Panel \(76.13.27\)](#)
 - [A-Pillar Trim Panel \(76.13.26\)](#)
 - [B-Pillar Upper Trim Panel \(76.13.28\)](#)
 - [B-Pillar Lower Trim Panel \(76.13.29\)](#)
 - [D-Pillar Trim Panel \(76.13.30\)](#)
 - [C-Pillar Lower Trim Panel \(76.13.34\) \(76.13.37\)](#)
 - [C-Pillar Upper Trim Panel \(76.13.35\)](#)
 - [Front Door Trim Panel \(76.34.01\)](#)
 - [Rear Door Trim Panel \(76.34.04\)](#)
 - [Liftgate Trim Panel \(76.34.11\)](#)
 - [Tailgate Trim Panel \(76.49.23\)](#)
 - [Scuff Plate Trim Panel \(76.49.54\)](#)
 - [Headliner \(76.64.15\)](#)
 - [Loadspace Trim Panel RH \(76.19.22\)](#)
 - [Front Door Trim Veneer](#)
 - [Rear Door Trim Veneer](#)
- 501-08: Exterior Trim and Ornamentation
 - Removal and Installation
 - [A-Pillar Moulding LH](#)
 - [Front Fender Moulding \(76.43.54\)](#)
 - [Rear Quarter Panel Moulding \(76.43.55\)](#)
 - [Radiator Grille \(76.55.03\)](#)
 - [Rear Quarter Window Moulding](#)
- 501-09: Rear View Mirrors
 - [Specification](#)
 - Description and Operation
 - [Rear View Mirrors](#)
 - Diagnosis and Testing
 - [Rear View Mirrors](#)
 - Removal and Installation
 - [Interior Mirror \(76.10.51\)](#)
 - [Exterior Mirror \(76.11.10\) - Vehicles With: Parking Aid Camera](#)
 - [Exterior Mirror \(76.11.10\) - Vehicles Without: Parking Aid Camera](#)
 - [Exterior Mirror Glass \(76.11.08\)](#)
 - [Exterior Mirror Cover](#)
 - [Exterior Mirror Motor \(76.11.09\)](#)
- 501-10: Seating
 - [Specification](#)
 - Description and Operation
 - [Seats](#)
 - Diagnosis and Testing
 - [Seats](#)
 - Removal and Installation
 - [Front Seat Cushion \(78.10.12/99\)](#)
 - [Front Seat \(78.10.44/99\)](#)
 - [Third Row Seat \(78.10.39\)](#)
 - [Rear Seat \(78.10.70/78.10.71\) - Vehicles With: 60/40 Split Seat](#)
 - [Rear Seat \(78.10.70/78.10.71\) - Vehicles With: 40/20/40 Split Seat](#)

- [Front Seat Cushion Cover \(78.30.01\)](#)
 - [Front Seat Cushion Heater Mat \(78.30.23\)](#)
 - [Third Row Seat Cushion Cover \(78.40.06\)](#)
 - [Third Row Seat Cushion \(78.40.52\)](#)
 - [Rear Seat Cushion Cover \(78.40.70\) - Vehicles With: 60/40 Split Seat](#)
 - [Rear Seat Cushion Cover \(78.40.70\) - Vehicles With: 40/20/40 Split Seat](#)
 - [Front Seat Track Motor \(78.70.25\)](#)
 - [Front Seat Height Adjustment Motor \(78.70.27\)](#)
 - [Front Seat Tilt Motor \(78.70.29\)](#)
 - [Front Seat Recliner Motor \(78.70.34\)](#)
 - [Front Seat Control Switch \(78.70.89\)](#)
 - [Front Seat Backrest Cover \(78.90.08\)](#)
 - [Third Row Seat Backrest Cover \(78.90.17\)](#)
 - [Front Seat Backrest Heater Mat \(78.90.36\)](#)
 - [Rear Seat Backrest Cover \(78.90.72\) - Vehicles With: 60/40 Split Seat](#)
 - [Rear Seat Backrest Cover \(78.90.72\) - Vehicles With: 40/20/40 Split Seat](#)
 - [Seat Track - Vehicles Without: Power Seats](#)
 - [Seat Track - Vehicles With: Power Seats](#)
 - [Front Seat Manual Height Adjustment Lever](#)
 - 501-11: Glass, Frames and Mechanisms
 - [Specification](#)
 - Description and Operation
 - [Glass, Frames and Mechanisms](#)
 - [Glass, Frames and Mechanisms](#)
 - Diagnosis and Testing
 - [Glass, Frames and Mechanisms](#)
 - [Fixed Window Glass](#)
 - General Procedures
 - [Door Window Motor Initialization](#)
 - Removal and Installation
 - [Front Door Window Glass](#)
 - [Rear Door Window Glass \(76.31.02\)](#)
 - [Liftgate Window Glass \(76.31.22\)](#)
 - [Rear Door Fixed Window Glass \(76.31.31\)](#)
 - [Windshield Glass \(76.81.01\)](#)
 - [Glass Roof Panel \(76.81.05\)](#)
 - [Rear Quarter Window Glass \(76.81.20\)](#)
 - [Front Door Window Regulator and Motor \(86.25.03\)](#)
 - [Front Door Window Regulator and Motor](#)
 - [Rear Door Window Regulator and Motor \(86.25.05\)](#)
 - [Front Door Window Control Switch](#)
 - [Rear Door Window Control Switch](#)
 - 501-12: Instrument Panel and Console
 - [Specification](#)
 - Description and Operation
 - [Instrument Panel](#)
 - [Floor Console](#)
 - [Overhead Console](#)
 - Removal and Installation
 - [Floor Console \(76.25.01\)](#)
 - [Floor Console Upper Section](#)
 - [Instrument Panel Upper Section \(76.46.04\)](#)
 - [Instrument Panel \(76.46.23/99\)](#)
 - [Instrument Panel Driver Side Reinforcement](#)
 - [Instrument Panel Passenger Side Reinforcement \(76.46.32\)](#)
 - [Instrument Panel Center Reinforcement](#)
 - [Glove Compartment \(76.52.03\)](#)
 - [Instrument Panel Console Switch Assembly](#)
 - [Cool Box](#)
 - 501-14: Handles, Locks, Latches and Entry Systems
 - [Specification](#)
 - Description and Operation
 - [Handles, Locks, Latches and Entry Systems](#)
 - Diagnosis and Testing
 - [Locks, Latches and Entry Systems](#)
 - General Procedures
 - [Tailgate Striker Adjustment \(76.28.03\)](#)
 - [Liftgate Striker Adjustment \(76.37.28\)](#)

Removal and Installation

- [Ignition Lock Cylinder \(57.40.28\)](#)
- [Hood Latch Release Handle \(76.16.30\)](#)
- [Front Door Latch \(76.37.12\)](#)
- [Rear Door Latch \(76.37.13\)](#)
- [Liftgate Latch \(76.37.19\)](#)
- [Door Lock Cylinder \(76.37.39\)](#)
- [Tailgate Latch \(76.37.83\)](#)
- [Exterior Front Door Handle \(76.58.07\)](#)
- [Exterior Rear Door Handle \(76.58.02\)](#)
- [Liftgate Latch Actuator \(86.26.27\)](#)
- [Remote Keyless Entry \(RKE\) Module](#)
- 501-16: Wipers and Washers
 - [Specification](#)
 - Description and Operation
 - [Wipers and Washers](#)
 - Diagnosis and Testing
 - [Wipers and Washers](#)
 - Removal and Installation
 - [Windshield Washer Reservoir \(84.10.03\)](#)
 - [Windshield Washer Pump \(84.10.21\)](#)
 - [Rain Sensor \(84.12.11\)](#)
 - [Front Wiper Pivot Arm \(84.15.02\)](#)
 - [Windshield Wiper Motor \(84.15.12\)](#)
 - [Headlamp Washer Jet \(84.20.08\)](#)
 - [Headlamp Washer Pump \(84.20.21\)](#)
 - [Rear Wiper Pivot Arm \(84.35.01\)](#)
 - [Rear Window Wiper Motor \(84.35.12\)](#)
- 501-17: Roof Opening Panel
 - [Specification](#)
 - Description and Operation
 - [Roof Opening Panel](#)
 - Diagnosis and Testing
 - [Roof Opening Panel](#)
 - General Procedures
 - [Roof Opening Panel Blind Rewind Procedure](#)
 - [Roof Opening Panel Alignment \(76.84.82\)](#)
 - [Power Roof Opening Panel Initialization](#)
 - Removal and Installation
 - [Lifter Arms](#)
 - [Roof Opening Panel \(76.84.01\)](#)
 - [Roof Opening Panel Glass \(76.84.03\)](#)
 - [Roof Opening Panel Motor \(76.84.07\)](#)
 - [Roof Opening Panel Module \(76.84.46\)](#)
 - [Roof Opening Panel Blind](#)
 - [Driver Side Roof Opening Panel Front Drain Hose](#)
 - [Passenger Side Roof Opening Panel Front Drain Hose](#)
- 501-19: Bumpers
 - [Specification](#)
 - Removal and Installation
 - [Front Bumper](#)
 - [Front Bumper Cover](#)
 - [Front Bumper Lower Cover](#)
 - [Rear Bumper Cover](#)
- 501-20A: Safety Belt System
 - [Specification](#)
 - Description and Operation
 - [Safety Belt System](#)
 - Diagnosis and Testing
 - [Safety Belt System](#)
 - Removal and Installation
 - [Front Safety Belt Retractor \(76.73.13\)](#)
 - [Second Row Center Safety Belt Retractor \(76.73.20\) - Vehicles With: 60/40 Split Seat](#)
 - [Second Row Center Safety Belt Retractor \(76.73.20\) - Vehicles With: 40/20/40 Split Seat](#)
 - [Second Row Safety Belt Retractor \(76.73.23\)](#)
 - [Third Row Safety Belt Retractor \(76.73.28\)](#)

- [Front Safety Belt Buckle \(76.73.30\)](#)
 - [Rear Safety Belt Buckle \(76.73.30\) - Vehicles With: 40/20/40 Split Seat](#)
 - [Rear Safety Belt Buckle LH \(76.73.60\) - Vehicles With: 60/40 Split Seat](#)
 - [Rear Safety Belt Buckle RH \(76.73.62\) - Vehicles With: 60/40 Split Seat](#)
 - [Rear Center Safety Belt Buckle \(76.73.64\) - Vehicles With: 60/40 Split Seat](#)
- 501-20B: Supplemental Restraint System
 - [Specification](#)
 - Description and Operation
 - [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#)
 - [Air Bag Supplemental Restraint System \(SRS\)](#)
 - Diagnosis and Testing
 - [Air Bag Supplemental Restraint System \(SRS\)](#)
 - Removal and Installation
 - [Driver Air Bag Module \(76.74.01\)](#)
 - [Passenger Air Bag Module \(76.74.02\)](#)
 - [Rear Side Air Curtain Module \(76.74.04\)](#)
 - [Front Impact Severity Sensor \(76.74.08\)](#)
 - [Passenger Air Bag Deactivation \(PAD\) Switch \(76.74.19\)](#)
 - [Clockspring \(76.74.20\)](#)
 - [B-Pillar Side Impact Sensor \(76.74.23\)](#)
 - [C-Pillar Side Impact Sensor \(76.74.24\)](#)
 - [Front Door Side Impact Sensor \(76.74.25\)](#)
 - [Side Air Bag Module \(76.74.30\)](#)
 - [Side Air Curtain Module \(76.74.40\)](#)
 - [Restraints Control Module \(RCM\) \(76.74.68\)](#)
 - [Occupant Classification Sensor \(76.74.76\)](#)
- 501-25A: Body Repairs - General Information
 - Description and Operation
 - [Body Repairs](#)
- 501-25B: Body Repairs - Corrosion Protection
 - Description and Operation
 - [Corrosion Protection](#)
- 501-25C: Body Repairs - Water Leaks
 - Description and Operation
 - [Water Leaks](#)
- 501-26: Body Repairs - Vehicle Specific Information and Tolerance Checks
 - Description and Operation
 - [Body and Frame](#)
- 501-27: Front End Sheet Metal Repairs
 - [Specification](#)
 - Description and Operation
 - [Front End Sheet Metal](#)
 - Removal and Installation
 - [Hood Latch Panel \(76.16.22\)](#)
 - [Front Crossmember \(77.20.25\)](#)
 - [Front Side Member \(77.30.22/23\)](#)
 - [Front Side Member Section \(77.30.20/21\)](#)
 - [Fender Apron Panel Reinforcement](#)
 - [Fender Apron Panel](#)
 - [Fender Apron Panel Section](#)
 - [Front Wheelhouse](#)
 - [Front Wheelhouse Reinforcement](#)
 - [Front Wheelhouse Section](#)
 - [Fender Apron Panel Closing Panel](#)
 - [Fender Apron Panel Reinforcement Front Section](#)
 - [Fender Apron Panel Reinforcement Rear Section](#)
- 501-28: Roof Sheet Metal Repairs
 - Description and Operation
 - [Roof](#)
 - Removal and Installation
 - [Roof Panel](#)
- 501-29: Side Panel Sheet Metal Repairs
 - [Specification](#)
 - Description and Operation
 - [Side Panel Sheet Metal](#)
 - Removal and Installation

- [Rocker Panel \(77.40.60\)](#)
 - [A-Pillar Outer Panel](#)
 - [Side Panel \(77.40.01\)](#)
 - [B-Pillar Outer Panel](#)
 - [A-Pillar Reinforcement](#)
 - [B-Pillar Reinforcement](#)
 - [Side Panel Front Section](#)
 - 501-30: Rear End Sheet Metal Repairs
 - [Specification](#)
 - Description and Operation
 - [Rear End Sheet Metal](#)
 - Removal and Installation
 - [Quarter Panel \(77.40.09\)](#)
 - [Inner Quarter Panel \(77.40.37\)](#)
 - [Water Drain Panel](#)
 - [Rear Wheelhouse Outer \(77.40.36\)](#)
 - [Rear Lamp Mounting Panel \(77.80.25\)](#)
 - [Back Panel \(77.80.20\)](#)
 - [Rear Floor Panel Section \(77.70.02\)](#)
 - [Rear Crossmember](#)
 - [Rear Side Member](#)
 - [Quarter/Side Panel Rear Section LH](#)
 - [Rear Side Member Section \(77.70.07\)](#)
 - [D-Pillar Inner Lower Panel](#)
 - [D-Pillar Closing Panel](#)
- 502: Frame and Mounting
 - 502-02: Full Frame and Body Mounting
 - [Specification](#)
 - General Procedures
 - [Tow Bar Mounting Check](#)
 - Removal and Installation
 - [Transmission Support Crossmember \(76.10.09 or 76.10.92\) - TDV6 3.0L Diesel](#)
 - [Transmission Support Crossmember \(76.10.09 or 76.10.92\) - V6 S/C 3.0L Petrol](#)
 - [Rear Crossmember](#)
 - [Body - V6 S/C 3.0L Petrol](#)
 - [Body - TDV6 3.0L Diesel](#)

General Information - About This Manual

Description and Operation

Introduction

This manual has been written in a format that is designed to meet the needs of technicians worldwide. The objective is to use common formats and include similar content in each manual.

This manual provides general descriptions for accomplishing diagnosis and testing, service and repair work with tested and effective techniques. Following them will help to ensure reliability.

Important Safety Instructions

Appropriate service methods and correct repair procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual carrying out the work.

Anyone who departs from the instructions provided in this manual must first establish that personal safety or vehicle integrity is not compromised by the choice of method, tools or components.

Warnings, Cautions and Notes in This Manual



WARNING: Warnings are used to indicate that failure to follow a procedure correctly may result in personal injury.



CAUTION: Cautions are used to indicate that failure to follow a procedure correctly may result in damage to the vehicle or equipment being used.



NOTE: Notes are used to provide additional essential information required to carry out a complete and satisfactory repair.

Generic warnings or cautions are in their relevant description and operation procedure within section 100-00. If the generic warnings or cautions are required for a procedure, there will be a referral to the appropriate description and operation procedure.

If a warning, caution or note only applies to one step, it is placed at the beginning of the specific step.

Trustmark Authoring Standards (TAS) Removal and Installation Procedures



NOTE: TAS style procedures can be identified by steps that have no accompanying step text and the magenta color of the electrical connectors and fasteners such as nuts, bolts, clamps or clips.

A TAS removal and installation procedure uses a sequence of color illustrations to indicate the order to be followed when removing/disassembling or installing/assembling a component.

Many of the TAS procedures will have the installation information within the removal steps. These procedures will have the following note at the beginning of the procedure:



NOTE: Removal steps in this procedure may contain installation details.

Items such as O-ring seals, gaskets, seals, self-locking nuts and bolts are to be discarded and new components installed unless otherwise stated within the procedure. Coated nuts or bolts are to be reused, unless damaged or otherwise stated within the procedure.

Specification procedures will contain all technical data that are not part of a repair procedure.

TAS Graphics

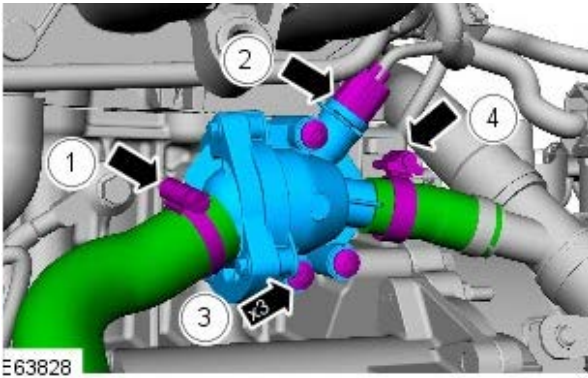
Colors used in the graphic are as follows:

- Blue - Indicates the target item, item to be removed/installed or disassembled/assembled
- Green and Brown - Indicates a secondary item that needs to be detached, removed/installed or disassembled/assembled prior to the target item
- Magenta - Indicates electrical connectors and fasteners such as nuts, bolts, clamps or clips
- Pale Blue - is for the special tool(s) and general equipment.

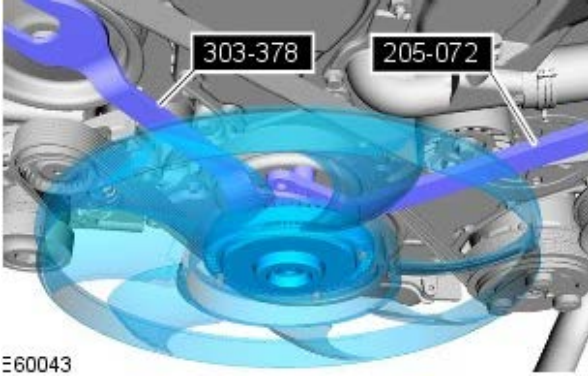
There may be multiple steps assigned to one illustration.

Numbered pointers are used to indicate the number of electrical connectors and fasteners such as nuts, bolts, clamps or clips.

Items in the illustration can be transparent or use cutouts to show hidden detail(s).



E63828



E60043

TAS Symbols

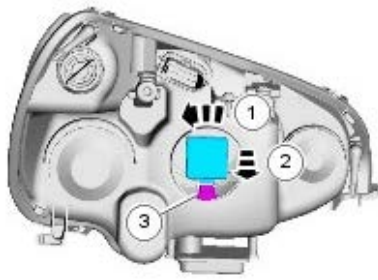
Symbols are used inside the graphics and in the text area to enhance the information display. The following paragraphs describe the various types and categories of symbols.

Prohibition symbols advise on prohibited actions to either avoid damage or health and safety related risks.



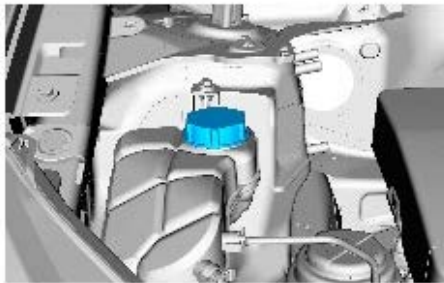
E85028

Health and Safety symbols recommend the use of particular protection equipment to avoid or at least reduce the risk or severity of possible injuries.



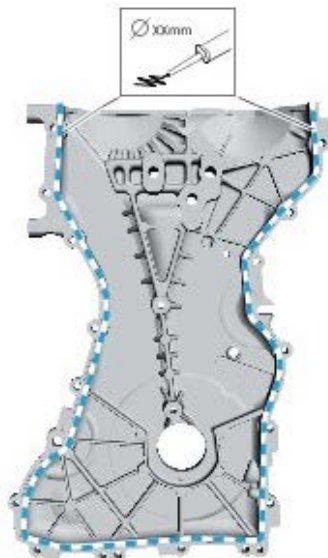
E85027

Warning symbols are used to indicate potential risks resulting from a certain component or area.



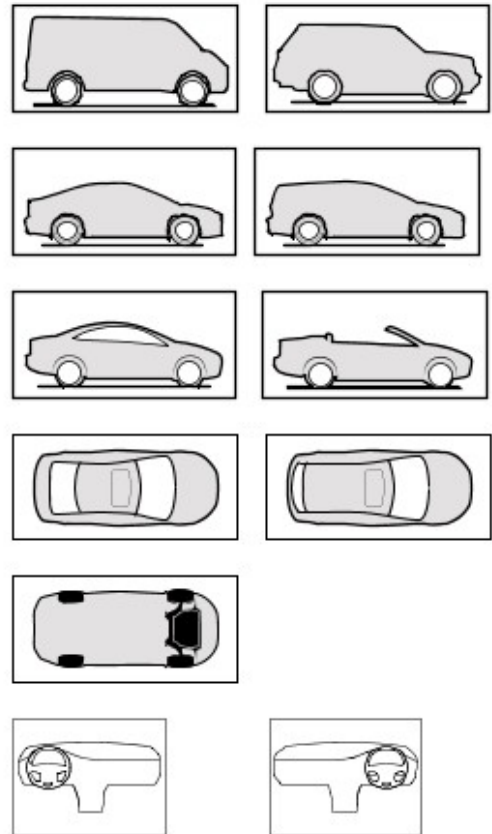
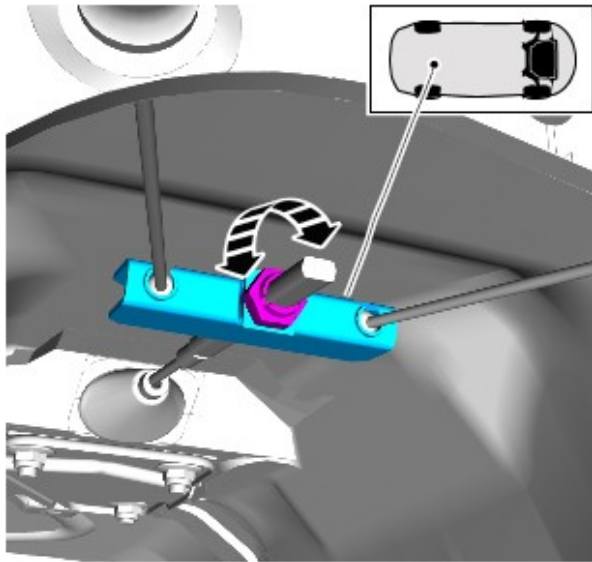
E85028

Instruction symbols are used to apply sealer, lubricant, weight, tape or cleaning detergent to a component.



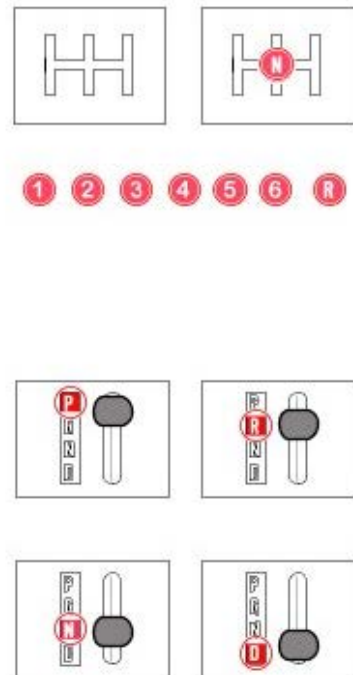
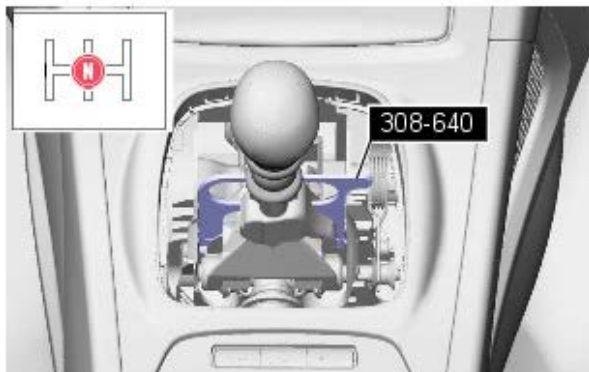
E84834

Location symbols are used to show the location of a component or system within the vehicle.



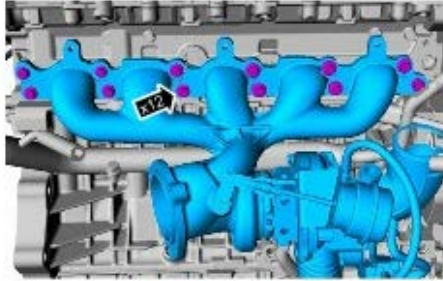
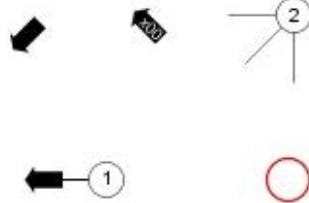
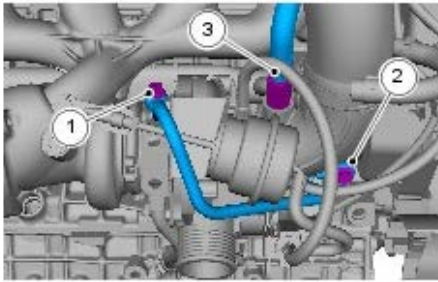
E84835

Gearshift lever or selector lever position symbols are used to show which gearshift lever or selector lever position is to be set.



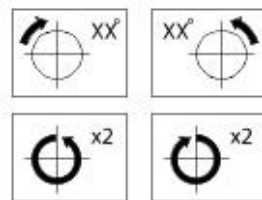
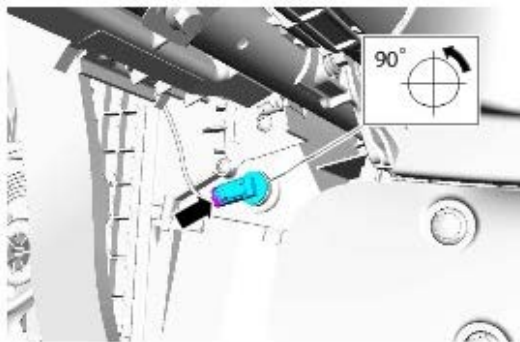
E84836

Pointer symbols are used to draw the attention to components and give special instructions such as a required sequence or number of components. The number of components is reflected by the value inside the luty arrow. A sequence number is located inside the circle. Numbers inside circles are also used to allocate special information such as tightening torques or chemicals to a particular component.



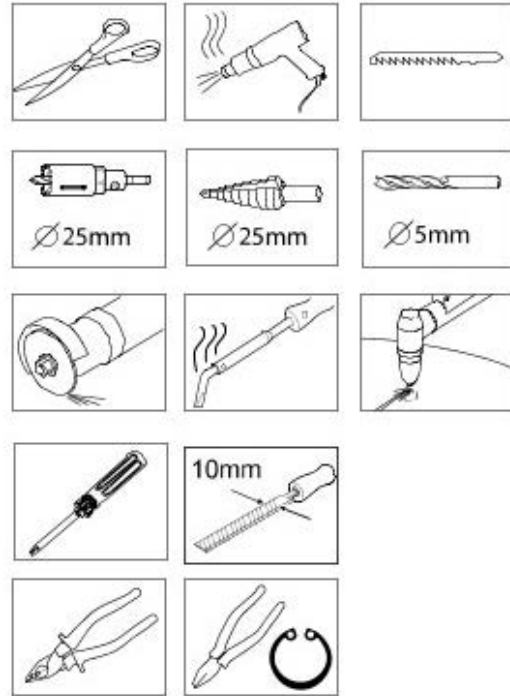
EB4837

Movement arrows are used to show three dimensional or rotational movements. These movements can include specific values inside the symbol if required.



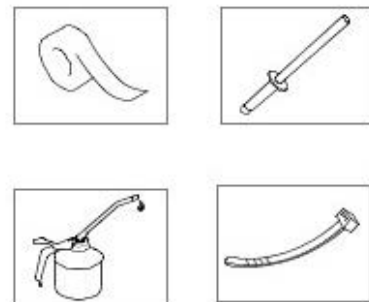
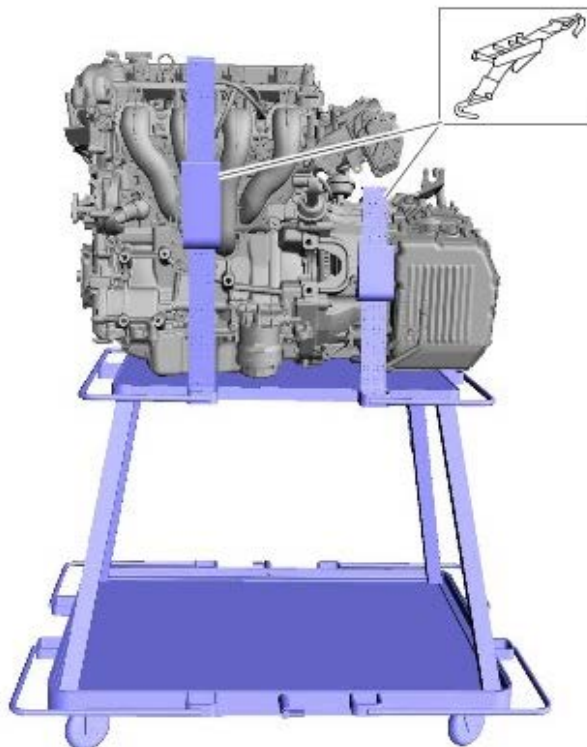
EB4838

Standard tool symbols recommend the use of certain standard tools. These tools can include dimension values if required.



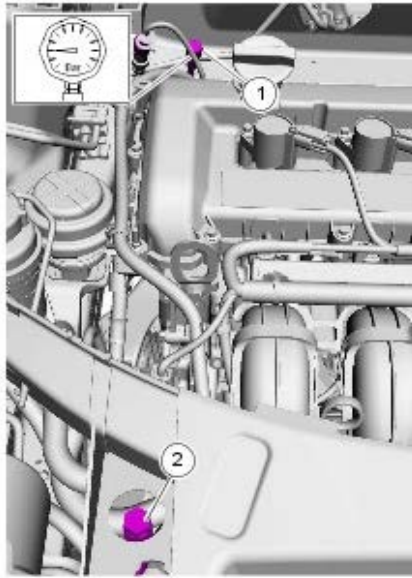
E84839

The following graphic illustrates a set of symbols that are used to provide detailed information on where to apply a material.

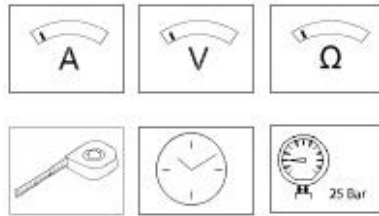


E84840

Measurement symbols provide detailed information on where to carry out a specific measurement. These symbols can include specific values if required.



E84841



Special Tools and Torque Figure(s)

Special tools will be shown with the tool number in the illustration. The special tool number(s), general equipment, material(s) and torque figure(s) used for the procedure step will be shown in the text column.

General Information - How To Use This Manual

Description and Operation

How to use This Manual

This manual covers all aspects necessary in order to service the vehicle effectively.

The manual is structured into five main sections, General Information, Chassis, Powertrain, Electrical and Body and Paint with each section dealing with a specific part of a vehicle system.

Each of the five main sections contain sub-sections dealing with items which form a part of that specific system.

Pages at the start of the manual list all sections available. Each section has a contents list detailing, where applicable, Specifications, Description and Operation, Diagnosis and Testing, General Procedures and Repair Procedures.

Where components need to be removed or disassembled in sequence, each operation in the sequence will be identified numerically and also graphically in an accompanying illustration.



NOTE: Dimensions quoted are to design engineering specifications with service limits quoted, where applicable.

Workshop Manual Organization

The five main sections, together with the areas which they cover are given below:

- **Section 1** - General Information.
- **Section 2** - Chassis.
- **Section 3** - Powertrain.
- **Section 4** - Electrical.
- **Section 5** - Body and Paint.

Sub-section numbers appear after the initial section number, for example, **Section 412-03** covers air conditioning, which is part of the electrical section.

In the number given above, the first digit of the number '**4**' indicates the section **i.e. Electrical**.

The second and third digits '**12**' of the number indicate the vehicle system **i.e. Air Conditioning**.

The last two digits of the number '**03**' indicate the part of the system covered by the sub-section **i.e. Air Conditioning Compressor**.

General Information - Important Safety Instructions

Description and Operation

Safety Notice

Appropriate service methods and correct repair procedures are essential for the safe, reliable operation of all motor vehicles, as well as the safety of the person doing the work. This manual provides general directions for accomplishing service and repair work with tested effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the person doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in the manual must first establish that neither personal safety or vehicle integrity is compromised from choices of methods, tools or parts.

General Information - General Service Information

Description and Operation

Introduction

This manual has been written in a format that is designed to meet the needs of Land Rover technicians worldwide and to assist them in the efficient repair and maintenance of Land Rover vehicles.

This manual provides descriptions and methods for accomplishing adjustment, service and repair work using tested and effective procedures. Following these procedures will help ensure product reliability.

Special Tools

The Special Tool(s) Table provided at the beginning of each procedure lists the special tool(s) required to carry out repair operations within that specific procedure. Wherever possible, illustrations are provided which will assist technicians in identifying the special tool(s) required and also showing such tool(s) in use.

Special tools may be obtained from the manufacturer, SPX Tools, the addresses of their branches will be found in the Special Tools Glossary contained within this Section.

Important Safety Instructions

Appropriate service methods and correct repair procedures are essential for the safe and reliable operation of all motor vehicles as well as ensuring the personal safety of the individual carrying out the work.

This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Any person who departs from the instructions provided in this manual must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools or parts.

Individuals who undertake their own repairs should have some skill or training and limit repairs to components which could not affect the safety of the vehicle or its passengers. Any repairs required to safety critical items such as steering, brakes, suspension or supplemental restraint system should be carried out by a Land Rover Dealer. Repairs to such items should NEVER be attempted by untrained individuals.

Warnings, Cautions and Notes which appear in this manual

As you read through this manual, you will come across Warnings, Cautions and Notes. A Warning, Caution or Note is placed at the beginning of a series of steps. If the warning, caution or note only applies to one step, it is placed at the beginning of the specific step after the step number.

Warnings, Cautions and Notes have the following meanings:

Warning: Procedures which must be followed to avoid the possibility of personal injury.

Caution: Calls attention to procedures which must be followed to avoid damage to components.

Note: Gives helpful information.

References

References to the Left Hand (LH) or Right Hand (RH) side given in this manual are made when viewing the vehicle or unit from the rear.

Fault Diagnostic Equipment

The vehicle is equipped with a number of electronic control systems to provide optimum performance of the vehicle's systems.

Diagnostic Equipment (T4) is available and must be used where specified. The use of this equipment will assist with the fault diagnostic abilities of the Dealer workshop. In particular, the equipment can be used to interrogate the electronic systems for diagnosis of faults which may become evident during the life of the vehicle.

This manual is produced as a reference source to supplement T4.

Features of the equipment include:

- a. Fully upgradeable support for the technician
- b. Structured diagnostics to accommodate all skill levels
- c. Direct print-out of screen information and test results

Testing the vehicle

Operations covered in this manual do not include reference to testing the vehicle after repair. It is essential that work is inspected and tested after completion and if necessary, a road test of the vehicle is carried out, particularly where safety related items are concerned.

Repairs and Replacement Parts

Land Rover parts are manufactured to the same exacting standards as the original factory fitted components. For this reason, it is essential that only genuine Land Rover parts are used during maintenance or repair.

Attention is particularly drawn to the following points concerning repairs and the fitting of replacement parts and accessories.

Safety features and corrosion prevention treatments embodied in the vehicle may be impaired if other than Land Rover recommended parts are fitted. In certain territories, legislation prohibits the fitting of parts not to manufacturer's specification. Torque wrench setting figures, where given, must be adhered to and locking devices, where specified must be used. If the efficiency of a locking device is impaired during removal it must be replaced.

Owners purchasing accessories whilst travelling abroad must ensure that the accessory and its fitted location on the vehicle conform to legal requirements.

The terms of the vehicle warranty may be invalidated by the fitting of parts other than those recommended by Land Rover.



NOTE: The fitting of non-approved Land Rover parts and accessories or the carrying out of non-approved alterations or conversions may be dangerous. Any of the foregoing could affect the safety of the vehicle and occupants; also, the terms and conditions of the vehicle warranty may also be invalidated .

All Land Rover recommended parts have the full backing of the vehicle warranty.

Land Rover Dealers are obliged to supply only Land Rover recommended parts.

Specifications

Land Rover are constantly seeking to improve the specification, design and production of their vehicles and alterations take place accordingly. Whilst every effort is made to ensure the accuracy of this Manual, it should not be regarded as an infallible guide to current specifications of any particular vehicle.

This Manual does not constitute an offer for sale of any particular vehicle. Land Rover dealers are not agents of Land Rover and have no authority to bind the manufacturer by any expressed or implied undertaking or representation.

General Information - Standard Workshop Practices

Description and Operation

Vehicle in Workshop

When working on a vehicle in the workshop always make sure that:

Where practicable, the parking brake is applied and the wheels are securely chocked to prevent the vehicle moving forwards or backwards.

Whenever possible, the ignition key is removed before any work is carried out on the vehicle.

If the engine is to be run, there is adequate ventilation, or an extraction hose is used to remove exhaust fumes.

There is adequate room to raise the vehicle and remove the wheels, if necessary.

Fender covers are always installed if any work is to be carried out in the engine compartment.

Where practicable, the battery is disconnected if working on the engine, underneath the vehicle, or if the vehicle is raised.

- **Caution: Prior to disconnecting the battery, refer to the Electrical Section of this manual - Battery disconnection/connection and the following paragraphs.** For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).



CAUTION: When electric arc welding on a vehicle, always disconnect the generator wiring to prevent the possibility of a surge of current causing damage to the internal components of the generator.

If using welding equipment on the vehicle, a suitable fire extinguisher is readily available.

Battery - General



WARNING: It is essential that a period of 2 minutes elapses after the battery is disconnected before any work is undertaken on any part of the SRS system.



CAUTION: A discharged battery condition may have been caused by an electrical short circuit. If this condition exists there will be an apparently live circuit on the vehicle even when all normal circuits are switched off. This can cause arcing when the jumper cables are connected.

- **Caution: Prior to carrying out any procedures which involve disconnecting/ or connecting the battery, refer to the Electrical Section of this manual - Battery disconnection/connection.** For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Jump Starting a Vehicle

CAUTIONS:



While it is not recommended that a vehicle is jump started, it is recognized that this may occasionally be the only practical way to mobilize a vehicle. Reference should be made to the following and also to the Electrical Section of this manual - Jump Starting.



It is advisable not to use starter/charger sets for jump starting but if this is unavoidable, make sure that the sets are not used in the 'START' mode.

Always make sure that the jumper cables are adequate for the task.

Always make sure that the slave battery is of the same voltage (12 volts) as the vehicle battery. The batteries must be connected in parallel.

Make sure that the battery terminals of both batteries are fully tightened.

Where another vehicle is used to jump start a disabled vehicle, make sure that the two vehicles are not touching.

It is advisable that the engine of the donor vehicle is switched off during jump starting; take care to make sure that the battery of the donor vehicle does not also become discharged.

Always make sure that switchable electric circuits are OFF before connecting jump cables. This reduces the risk of arcing occurring when the final connection is made.

Following jump starting of a disabled vehicle, the discharged battery must be checked for serviceability and recharged as soon as possible to avoid permanent damage.

Do not rely on the generator to restore a discharged battery. For a generator to recharge a battery, it would take in excess of eight hours continuous driving with no additional loads placed on the battery.

Trickle charging (defined as voltages <16 volts) may be carried out with the battery connected. Make sure that the battery terminals are fully tightened prior to trickle charging.



CAUTION: Boost charging may only be carried out with the battery disconnected from the vehicle.

Towing the Vehicle



WARNING: When towing is necessary, reference must be made to the Jacking, Lifting and Towing Section of this Manual.

When the vehicle is being towed the ignition switch must be in position II (steering lock released and warning lights illuminated). Only then will the steering, turn signal lamps, horn and stop lamps be operational. Failure to follow these instructions may result in personal injury. It must be noted that with the engine not running, the power steering and brake booster will be inoperative therefore, greater effort will be needed to steer the vehicle and apply the brakes.

General installation Instructions

Component removal

Whenever possible, clean components and the surrounding area before removal.

- Blank off openings exposed by component removal.
- Following disconnection, seal fuel, oil or hydraulic lines immediately using suitable blanking plugs or caps.
- Seal open ends of exposed oilways using suitable tapered hardwood plugs or conspicuous plastic plugs.
- Immediately a component is removed, place it in a suitable container; use a separate container for each component and its associated parts.
- Clean bench and provide marking materials, labels and containers before disassembling components.

Disassembling

Observe scrupulous cleanliness when disassembling components, particularly when brake, fuel, air suspension or hydraulic system parts are disassembled. A particle of dirt or cloth fragment could cause a serious malfunction if trapped in these systems.

- Blow out all tapped holes, crevices, oilways and fluid passages with dry, compressed air.



WARNING: Suitable eye protection must be worn.

- Use suitable marker ink to identify mating parts, do not use a scribe or centre punch as they could initiate cracks or distortion.
- Wire or tape mating parts together where necessary to prevent accidental interchange.
- Suitably identify parts which are to be renewed and to those parts requiring further inspection. Keep these parts separate.
- To make sure that the correct replacement part has been obtained, do not discard a part due for renewal until after comparing it with the new part.

Cleaning components

Always use cleaning agents which are suitable for the work being undertaken and the components being cleaned. NEVER use gasoline (petrol) as a cleaning agent (degreaser). Always make sure that the component being cleaned is compatible with the cleaning agent.

Always follow the manufacturer's instructions regarding the use of cleaning agents and make sure that the environment in which the work is being undertaken is suitable. See Health and Safety Precautions for further information regarding cleaning.

General inspection of components

All components should be inspected for wear or damage before reassembling.

- Always make sure that component to be inspected is clean and free from oil or grease.
- When a component is to be checked dimensionally against design specified values, use the appropriate measuring equipment i.e. micrometers, verniers, surface plates, dial test indicators (DTI).
- Always make sure that all measuring equipment is correctly calibrated before use.
- Reject a component which is not within specified values/limits or if it appears to be damaged.
- A component may be reinstalled if dimensions obtained during checking are at the maximum tolerance limit and it is in an undamaged condition.
- Bearing journal clearances should be checked where necessary using Plastigage.
- Gaskets, seals and O-ring seals are to be re-used unless damaged.

Joints and Joint Faces

All gaskets should be installed dry unless stated otherwise. Always apply the specified lubricant to O-rings and install O-rings using the fingers only.

Use gasket removal spray and/or plastic scrapers to remove traces of old gasket.



CAUTION: DO NOT use metal scrapers or emery cloth as these may damage the sealing surfaces.

Many joints use sealants instead of gaskets as the sealing medium. Where this is the case, the sealant together with its part number will be found listed in the relevant repair operation and also in the sealants table.



CAUTION: Always remove all traces of the old sealant prior to reassembly. Use plastic scrapers, specified solvents where available or dry, lint free cloth. **DO NOT** use metal scrapers or emery cloth as these may damage the sealing surfaces. Make sure that sealing surfaces are free from oil or grease as sealants will not adhere properly to contaminated surfaces.

Do not allow sealant to enter tapped holes or oilways.

Locking Devices

Always replace locking devices with one of the same design and of the correct size.

Tab washers

Always release locking tabs before loosening fixings, do not re-use tab washers.

Locknuts

Always use a backing spanner when loosening and tightening locknuts, brake and fuel pipe unions.

Roll pins

Always install new roll pins of the correct size.

Circlips

Always install new circlips ensuring that they are of the correct size for the groove.

Woodruff keys

Woodruff keys may be re-used provided there is no indication of wear or distortion.

Remove any burrs from edges of keyways using a fine file.

Split pins

Never attempt to straighten and re-use a split pin, always make sure that replacement pins are of the correct size for the hole in which they are to be installed.

Screw Threads

- Damaged nuts, bolts and screws must always be discarded. Attempting to recut or repair damaged threads with a tap or die impairs the strength and fit of the threads and is not recommended.

NOTES:



During certain repair operations, it may be necessary to remove traces of thread locking agents using a tap. Where this is necessary, the instruction to do so will appear in the relevant operation and it is essential that a tap of the correct size and thread is used.



New Taptite bolts when used cut their own threads on the first application.

- Some bolts are coated with a thread locking agent and unless stated otherwise, they must not be re-used. New bolts having the same part number as the original must always be installed. When nuts or bolts are to be discarded, the repair operation and relevant torque chart will include an instruction to that effect. Do not use proprietary thread locking agents as they may not meet the specification required. See also Encapsulated ('Patched') Bolts and Screws.
- Always make sure that replacement nuts and bolts are at least equal in strength to those that they are replacing. Castellated nuts must not be loosened to accept a split pin except in recommended cases when this forms part of an adjustment.
- Do not allow oil or grease to enter blind holes, the hydraulic action resulting from tightening the bolt or stud can split the housing and also give a false torque reading.
- Always tighten a nut, bolt or screw to the specified torque figure, damaged or corroded threads can give a false torque reading.
- Nut and bolt loosening and tightening sequences, where given, must ALWAYS be followed. Distortion of components or faulty sealing of joints will result if the sequences are not followed. Where an instruction is given to tighten in stages, these stages must be adhered to; do not attempt to combine stages particularly where certain stages involve tightening by degrees.
- To check or re-tighten a fixing to a specified torque, first loosen a quarter of a turn, then retighten to the specified torque figure.
- Unless instructed otherwise, do not lubricate bolt or nut threads prior to installing.

Where it is stated that bolts and screws may be re-used, the following procedures must be carried out:

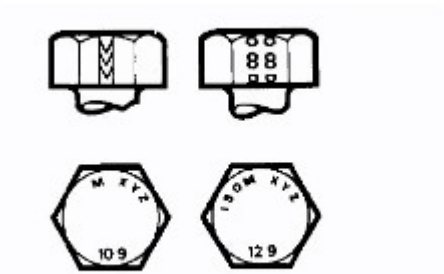
- Check that threads are undamaged.
- Remove all traces of locking agent from the threads.



CAUTION: DO NOT use a wire brush; take care that threads are not damaged.

- Make sure that threads are clean and free from oil or grease.
- Apply the specified locking agent to the bolt threads.

Bolt and Nut Identification

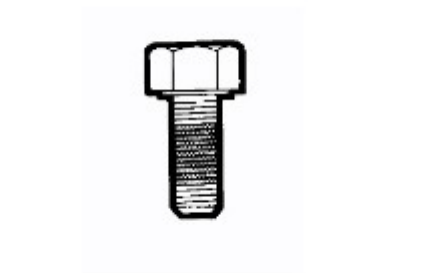


E48627

An ISO metric bolt or screw made of steel and larger than 6 mm in diameter can be identified by either of the symbols ISO M or M embossed or indented on top of the bolt head.

In addition to marks identifying the manufacturer, the top of the bolt head is also marked with symbols indicating the strength grade e.g. 8.8, 10.9, 12.9, 14.9. Alternatively, some bolts and screws have the M and strength grade symbol stamped on the flats of the hexagon.

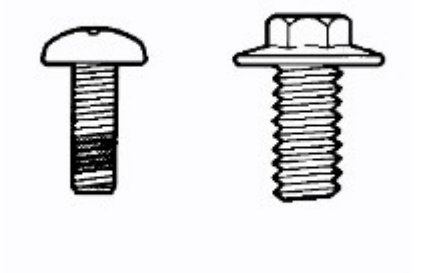
Encapsulated ('Patched') bolts and screws



E48628

Encapsulated ('patched') bolts and screws have a thread locking agent applied to the threads during manufacture. Most thread locking agents are colored, the band of color extending for 360° around the thread. Some locking agents however, are neutral in color and may not be so easily identified apart from a slightly darker area of thread where the locking agent has been applied. The locking agent is released and activated by the tightening process and is then chemically cured to provide the locking action.

Self-locking bolts and screws



E48629

Unless stated in a specific repair procedure, self-locking bolts and screws i.e. nylon patched or trilobular thread can be re-used provided that resistance is felt when the locking portion enters the female thread.

Nylon patched bolts and screws have a locking agent either applied to, or inserted in the threaded portion. They are identified by the presence of a colored section of thread extending approximately 180° around the thread or by a colored plug inserted into the bolt.

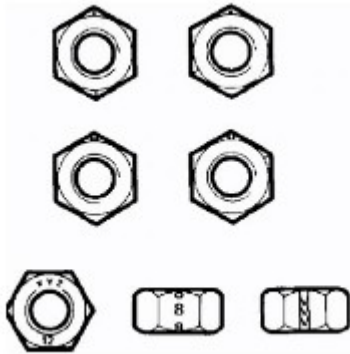
Trilobular bolts have a special thread form which creates a slight interference with the thread of the hole or nut into which it is screwed.



CAUTION: Do Not re-use self-locking fasteners in critical locations e.g. drive plates/flywheel or engine bearings. Do not install non self-locking fasteners where a self-locking fastener is specified.

Trilobular bolts should not be used as a substitute for patched bolts.

Nut identification



E48630

A nut with an ISO metric thread is marked on one face or one of the hexagonal flats with the strength grade symbol 8, 12, 14. Some nuts with the strength grade 4, 5 or 6 are also marked and some have the metric symbol M on the hexagonal flat opposite the strength grade marking.

A clock face system is sometimes used as an alternative method of indicating the strength grade. The external chamfers or a face of the nut is marked in a position relative to the appropriate hour mark on a clock face to indicate the strength grade.

A dot is used to locate the 12 o'clock position and a dash to indicate the strength grade. If the grade is above 12, two dots identify the 12 o'clock position.

When tightening a slotted or castellated nut, never loosen it to insert a split pin except where specified as part of an adjustment procedure. If difficulty is experienced in correctly positioning the slot, alternative washers or nuts should be selected.

Where a nut is tightened to adjust or maintain bearing pre-load, the tightening procedure must be adhered to.

Self-locking nuts

Unless stated otherwise, self-locking nuts once removed must be discarded and new nuts of the same type and strength grade installed.

Air Suspension

Always make sure that suitable eye protection is worn when working on the air suspension system.

Ball and Roller Bearings

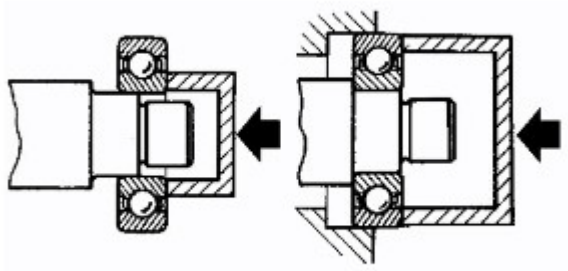
When removing and installing bearings, make sure that the following practices are observed to make sure component serviceability:



CAUTION: Service tools have been developed for removing the majority of bearings; these must always be used where specified.

- Remove all traces from bearing under inspection by cleaning with a suitable degreasant; maintain absolute cleanliness throughout operations.
- Conduct a visual inspection for markings on rolling elements, raceways, outer surfaces of outer or inner surfaces of inner rings. Reject any bearings found to be marked since marking in these areas indicates onset of wear.
- Hold inner race of bearing between finger and thumb of one hand and rotate outer race to check that it revolves absolutely smoothly. Repeat holding outer race and rotating inner race. DO NOT spin the bearing.
- Rotate outer ring gently using a reciprocating movement whilst holding inner ring; feel for any check or obstruction to rotation. Reject bearing if movement is not absolutely smooth.
- Check bearing for blueing or signs of overheating.
- Lubricate bearing with the specified lubricant.
- Inspect bearing surface of shaft and bearing housing for discoloration or other markings which indicate overheating of bearing or movement between bearing and seating.
- Before installing bearing, make sure that shaft and bearing housing are clean and free from burrs.
- If one bearing of a pair shows signs of wear, overheating etc., it is advisable to replace bearings as a pair unless it is suspected that one bearing may have been faulty when installed, was installed incorrectly or the fault arose due to oil seal failure.

- Never reinstall a bearing unless it is in a fully serviceable condition.



E48560

- When installing a bearing to a shaft, only apply force to the inner ring of the bearing. When installing a bearing into a housing, only apply force to the outer ring of the bearing.



CAUTION: Service tools have been developed for installing the majority of bearings; these must always be used where specified.

- In the case of grease lubricated bearings, fill the space between the bearing and outer seal with the recommended grade of grease before installing the seal.



CAUTION: When a waxed oil seal (installed dry) type of oil seal is to be installed, take great care that grease does not contaminate the running surface of the seal.

- Always make suitable reference marks between the components of separable bearings e.g. taper roller bearings when disassembling to make sure correct location of components when assembling. Never install new rollers in an outer ring, always install a new bearing assembly.

Brake Pads and Linings

Always install the correct grade and specification of brake pads and linings. When replacing these items, always replace as complete axle sets.

Brake Hydraulics

Always observe the following recommendations when working on the braking system:



WARNING: Do not intermix brake fluid of different specifications.

- Always use two spanners when loosening or tightening brake pipes or hose connections.
- Make sure that hoses run in a natural curve and are not kinked or twisted.
- Install brake pipes and hoses securely in their retaining clips and make sure that they cannot contact a potential chafing point.
- Containers used for brake fluid must be kept absolutely clean.
- Do not store brake fluid in unsealed containers, the fluid will absorb water which will lower the boiling point of the fluid.
- Do not allow brake fluid to be contaminated with other fluids such as mineral oil and do not put brake fluid in a container which has previously been used for storing other fluids.
- Do not re-use brake fluid which has been bled from the system.
- Always use brake fluid or a suitable brake cleaning fluid to clean hydraulic components.
- Unless stated otherwise, use only clean brake fluid to lubricate hydraulic seals and components.
- Always install blanking plugs to hoses, pipes or components immediately after disconnection.
- Check thread compatibility of original equipment with replacement components.
- Observe absolute cleanliness when working with hydraulic components.

Pipes and Hoses

When removing or installing flexible hydraulic pipes and hoses, make sure that the following procedures are observed to make sure component serviceability:

- Prior to removal, clean area around hose or pipe end which is to be disconnected.
- Obtain appropriate blanking plugs or caps before disconnecting hose or pipe end fittings in order that connections can be plugged immediately following disconnection.
- Always install blanking plugs or caps to pipes and unions immediately following disconnection.
- Clean hose or pipe and blow through with an air line.



WARNING: Suitable eye protection must be worn.

- Check hoses externally for cracks, separation of plies, security of end fittings and external damage;

- replace faulty hoses.
- Check pipes for signs of corrosion and chafing, replace as necessary.



CAUTION: If pipes are found to be chafed, rectify clips, mounting points etc., to prevent further problems in service.

- When installing hoses, make sure that no unnecessary bends are introduced and that hoses are not kinked, twisted or positioned close to potential chafing points.
- When installing pipes, make sure that pipes are positioned and clipped clear of potential chafing points.
- Always replace sealing washers installed to banjo bolts, sealing plugs etc.
- Always use a backing spanner when tightening unions and do not overtighten union nuts or banjo bolts.
- After engagement of 'quick-fit' connection hoses, perform a 'tug' test to make sure connection is securely installed.
- After any work on hydraulic systems, always check for fluid leaks whilst a second operator applies working pressure to the brake pedal or operates the system that has been worked on.

Fuel system hoses

Some fuel hoses are made up of two laminations, an armoured rubber outer sleeve and an inner viton core. Whenever a hose is removed, make sure that the inner bore is inspected to check that the viton lining has not become separated from the outer sleeve.



WARNING: Never attempt to repair fuel hoses or rectify leaking 'quick-fit' connectors. The fuel hose and connectors must be replaced as an assembly.

Fuel system hose clips



E48636

Certain fuel system hose clips are of the 'break-off head' type where a slot in the screw head shears off when the clip is tightened to a specific torque. These clips may be removed using a screwdriver and must be replaced with new clips on reassembly. Clips must be tightened until the portion of the slot shears off. Do not attempt to tighten clips by any other method, do not install any other type of clip.

'Quick-fit' connections are also installed to certain fuel hoses. After engagement of 'quick-fit' connections, perform a 'tug' test to make sure connection is securely installed.

Other fuel system hose clips are of the 'Jubilee' type and there may be a tamper proof cover installed over the screw head. These cover must be carefully removed before slackening the clip and should be replaced after final tightening, ensuring that the internal hexagon on the cover is correctly located on the clip screw.

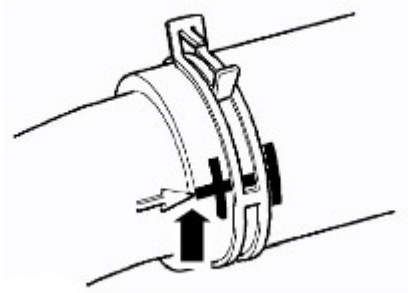
Cooling system hoses



CAUTION: The following precautions must be observed to make sure that the integrity of the cooling system hoses and their connection to the system is maintained.

Hose orientation and connection

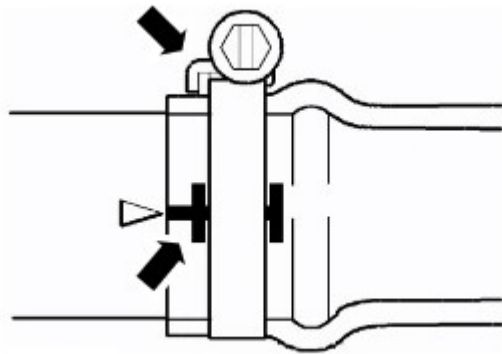
Correct orientation of cooling system hoses is important to make sure that hoses do not become fatigued or damaged through contact with adjacent components.



E48633

Where orientation marks are provided on the hose and corresponding component, the marks must be aligned when the hose is installed. Hoses must be installed fully on to their connection points, usually a moulded form on a pipe provides a positive indicator.

Hose clips



E48634

Markings are usually provided on the hose to indicate the correct clip position. If no markings are provided, position the clip directly behind the retaining lip at the end of the stub pipe. Worm drive clips should be orientated with the crimped side of the drive housing facing towards the end of the hose or the hose may become pinched between the clip and the stub pipe retaining lip. Unless otherwise stated, worm drive clips should be tightened to 3 Nm (2 lb-ft). Make sure that hose clips do not foul adjacent components.



E48635

Oetiker clips may be removed by bending the tag (arrowed) and releasing the free end of the clip. Clips must not be re-used. When installing new clips, make sure clip is positioned on hose before tightening and make sure that when clip is tightened, the tag is located in the longitudinal slot in the free end of the clip (arrowed in illustration).

'Quick-fit' connections are also installed to certain hoses/pipes. Inspect 'quick-fit' connections for damage, prior to connection. Replace if damaged. After engagement of 'quick-fit' connections, perform a 'tug' test to make sure connection is securely installed.

Heat protection

Always make sure that heat shields and protective sheathing are in good condition; replace if damage is evident. Particular care must be taken when routing hoses close to hot engine components such as the exhaust manifolds and exhaust gas recirculation (EGR) pipes. Hoses will relax and deflect slightly when hot, make sure this movement is taken into account when routing and securing hoses.

Electrical Precautions

General

The following guidelines are intended to make sure the safety of the operator whilst preventing damage to the electrical and electronic components of this vehicle.

Equipment

Prior to commencing any test procedure on the vehicle, make sure that the relevant test equipment is working correctly and that any harness or connectors are in good condition. It is particularly important to check the condition of all plugs and leads of mains operated equipment.

Polarity

Never reverse connect the vehicle battery and always make sure the correct polarity when connecting test equipment.

High voltage circuits

Whenever disconnecting live ht circuits, always use insulated pliers and never allow the open end of the ht lead to contact other components, particularly ECU's.

Vehicles installed with Bi-Xenon headlamp bulbs



WARNING: The following precautions must be observed as failure to comply may result in exposure to ultra-violet rays, severe electric shock, burns or risk of an explosion.

- Safety goggles and gloves must be worn.
- Make sure that headlamps are switched off before removing bulbs.
- Do not touch the glass portion of the bulb.
- On no account should headlamps be switched on with the bulb removed from the headlamp.
- Bulb testing may only be carried out with the bulb installed in the headlamp.
- Bulbs must be disposed of in accordance with the local authority bye-laws.

Connectors and harnesses

The engine compartment of a vehicle is a particularly hostile environment for electrical components and connectors. Always observe the following:

- Make sure electrically related items are dry and oil free before disconnecting/connecting test equipment.
- Make sure that disconnected multiplugs and sensors are protected from any possible oil, coolant or other liquid contamination. Any such contamination could impair performance or lead to component failure.
- Never force connectors apart or pull on the wiring harness.
- Always make sure locking tabs are disengaged before disconnecting multiplugs etc. and make sure that correct orientation is achieved before connection.
- Make sure that any protection covers, insulation etc. are replaced if disturbed.

Having confirmed that a component is faulty, carry out the following:

- Switch off the ignition and disconnect the battery.
- Remove the component and support the disconnected harness.
- When replacing electrical components, keep oily hands away from electrical connections and make sure that locking tabs on connectors are fully engaged.

Battery Disconnection/Connection

Always refer to the Electrical Section of this manual - Battery Connection/Disconnection prior to attempting to connect or disconnect the battery.

For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Fuel Handling Precautions

The following information lists basic precautions which must be observed if fuel is to be handled safely. It also outlines other areas of risk which must not be ignored. As this information is issued for basic guidance only, consult your local Fire Department where any doubt as to personal and environmental safety exists - See also Health and Safety Precautions.

General precautions

Always have the correct type of fire extinguisher containing Foam, CO₂, Gas or powder accessible when handling or draining fuel or dismantling fuel systems. Fire extinguishers must also be located in areas where fuel is stored.

Make sure that suitable warning signs are exhibited.

Keep all sources of ignition well away from areas where fuel is being handled.

Make sure that any leadlamps are flameproof and kept clear of spillage.

WARNINGS:



Do not disassemble or reassemble fuel system components whilst vehicle is over a pit.



No one should be permitted to repair components associated with fuel without first having specialist training.

Always disconnect the vehicle battery before carrying out disassembly, reassembly or draining work on a fuel system.

Fuel tank and system draining

Draining must be carried out in accordance with the procedures given in the relevant Fuel System section of this manual.

WARNINGS:



Never drain fuel or work on a fuel system while the vehicle is over a pit. Extraction or draining of fuel must be carried out in a well ventilated area.



Never switch on or operate mobile (cellular) phones in the vicinity of vehicles when operations are being carried out on the fuel system.



Always attach fuel vapor warning labels to fuel tanks immediately after draining.



Containers used for storing fuel must be clearly marked with the contents and placed in a safe storage area which meets the requirements of the local authority.



CAUTION: Some fuel lines are now installed with 'quick release' connectors. If a connector is damaged, no attempt must be made to repair the connector, a new fuel line and connector(s) assembly must be installed.

Always release pipe clips fully before attempting to disconnect fuel pipes.

Fuel tank repairs

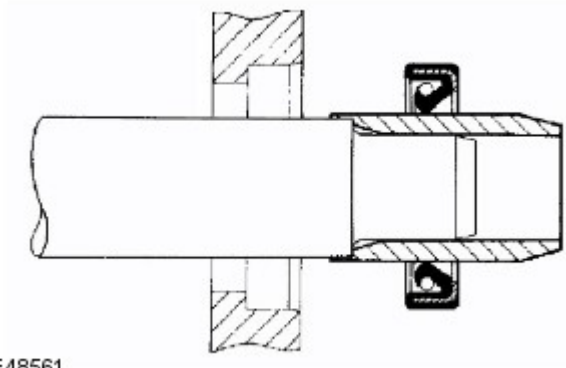


CAUTION: No attempt should be made to repair a plastic fuel tank. If the structure of the tank is damaged, a new tank must be installed.

Oil seals

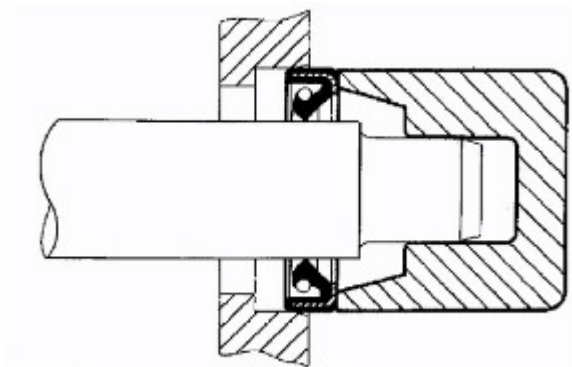
Never use a seal which has been improperly stored or handled.

- Take great care when removing old seals that the sealing surfaces and seal housing are not damaged.
- Carefully examine seal before installing to make sure that it is clean and undamaged.
- Make sure that the surface on which the seal is to run and also the seal housing is clean and free from burrs or scratches. Renew the component if the sealing surface cannot be restored.
- Special tools and protection sleeves are provided for installing the majority of seals and must be used when specified.
- Many seals are now coated with a protective wax and DO NOT need to be lubricated prior to installing. Always check the relevant repair procedure which will state if a seal must be installed dry. Never touch these seals with oily hands as the oil will contaminate the protective coating and affect the sealing properties of the seal; also, make sure that installing tools and protection sleeves are free from oil and grease. Seals which must be lubricated prior to installing should have the recommended lubricant applied to the areas specified in the repair procedure.
- Make sure that a seal is installed the correct way round. For example, the lip of the seal must face towards the lubricant which it is sealing.
- When installing an oil seal, make sure that it is positioned square to shaft and housing. Where the seal is to be installed to a housing prior to installing over a shaft, take care not to allow the weight of an unsupported shaft to rest on the seal.



E48561

- Always use the recommended special tool and protection sleeve to install an oil seal. If no tool is specified, use a suitable mandrel approximately 0.4 mm (0.015 in) smaller than the outside diameter of the seal. Use adhesive tape on the shaft to protect the sealing lip of the seal.



E48562

- Press or drift the seal in to the depth of its housing if the housing is shouldered or flush with the face of the housing where no shoulder is provided. Make sure that the seal is not tilted in the housing when it is installed.

Supplementary Restraint System (SRS) Precautions



WARNING: Do not install rear facing child seats in the front passenger seat.

The SRS contains components which are potentially hazardous to service personnel if not handled correctly. The following guidelines and precautions are intended to alert personnel to potential sources of danger and emphasise the importance of ensuring the integrity of the SRS components installed to the vehicle.



WARNING: The following precautions **MUST** be adhered to when working on the SRS system:

- The correct procedures must always be used when working on SRS components.
- Persons working on the SRS system must be fully trained and have been issued with the safety guidelines.
- The airbag modules contain extremely flammable and hazardous compounds. Contact with water, acids or heavy metals may produce harmful or explosive results. Do not dismantle, incinerate or bring into contact with electricity before the unit has been deployed.
- Always replace a seat belt assembly that has withstood the strain of a severe vehicle impact or if the webbing shows signs of fraying.
- Allow a period of 2 minutes to elapse after disconnecting the battery before undertaking any work on the SRS system.
- Always disconnect the vehicle battery before carrying out any electric welding on a vehicle installed with an SRS system.



CAUTION: Do not expose airbag modules or seat belt pre-tensioners to temperatures exceeding 85° C (185° F).

It should be noted that these precautions are not restricted to operations performed when servicing the SRS system. The same care should be exercised when working on ancillary systems and components located in the vicinity of SRS components; these include but are not limited to:

- Steering wheel airbag, clock spring.
- Passenger front airbag.
- Head airbag modules - front and rear.
- Seat belt pre-tensioners.
- SRS harnesses, link leads and connectors.

- Side curtain air bags.

Making the system safe

Before working on or in the vicinity of SRS components, make sure the system is rendered safe by performing the following operations:

- Remove the ignition key.
- Disconnect the battery, earth lead first.
- Wait 2 minutes for the SRS power circuit to discharge before commencing work.



NOTE: The SRS uses energy reserve capacitors to keep the system active in the event of electrical supply failure under crash conditions. It is necessary to allow the capacitors sufficient time to discharge (2 minutes) in order to avoid the risk of accidental deployment.

Installation

In order to make sure system integrity, it is essential that the SRS system is regularly checked and maintained so that it is ready for effective operation in the event of a collision. Carefully inspect SRS components before installation. Do not install a part that shows signs of being dropped or improperly handled, such as dents, cracks or deformation.



WARNING: The integrity of the SRS systems is critical for safety reasons. Make sure the following precautions are always adhered to:

- **Do not install accessories or other objects to trim panels which cover airbags.**
- **Never install used SRS components from another vehicle or attempt to repair an SRS component.**
- **When repairing an SRS system, only use genuine new parts.**
- **Never apply electrical power to an SRS component unless instructed to do so as part of an approved test procedure.**
- **Special fixings are necessary for installing an airbag module – do not use other fixings and make sure that all fixings are tightened to the correct torque.**
- **Always use new fixings when replacing an SRS component.**

CAUTIONS:



Take care not to trap airbag modules when installing interior trim components.



Make sure SRS components are not contaminated by oil or grease.

NOTES:



Following seat belt pre-tensioner deployment, the seat belts can still be used as conventional seat belts but will need to be replaced as soon as possible to make sure full SRS protection.



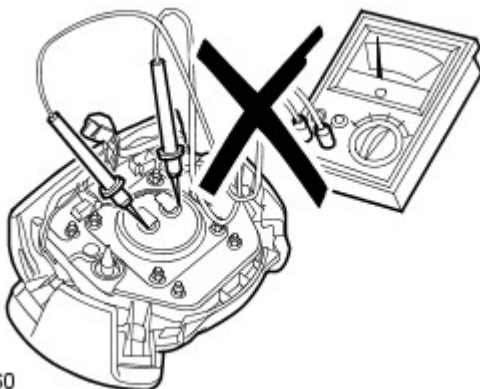
If the SRS components are to be replaced, the part number/bar code of the new unit must be recorded.

SRS component testing precautions

The SRS components are triggered using relatively low operating currents, always adhere to the following :



WARNING: Never use a multimeter or other general purpose equipment on SRS components. Use only T4 to diagnose system faults.



E48960



WARNING: Do not use electrical test equipment on the SRS harness while it is connected to any of the SRS

components, it may cause accidental deployment and injury.

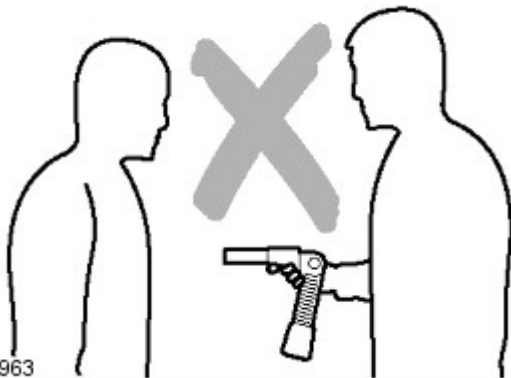
Handling and storage

Always observe the following precautions when handling SRS components:



E48961

- Never drop an SRS component. The airbag diagnostic control unit is a particularly shock sensitive device and must be handled with extreme care. Airbag modules and seat belt pre-tensioners could deploy if subjected to a strong shock.
- Never wrap your arms around an airbag module. If a module has to be carried, hold it by the cover with the cover uppermost and the base away from your body.
- Never transport airbag modules or seat belt pre-tensioners in the passenger compartment of a vehicle. Always use the luggage compartment of the vehicle for carrying airbag modules and seat belt pre-tensioner units.
- Never attach anything to an airbag cover or any trim component covering an airbag module. Do not allow anything to rest on top of an airbag module.
- Always keep components cool, dry and free from contamination.
- Never apply grease or cleaning solvents to seat belt pre-tensioner units, component failure could result.
- Always store an airbag module with the deployment side uppermost. If it is stored deployment side down, accidental deployment will propel the airbag module with sufficient force to cause serious injury.
- Keep new airbag modules in their original packaging until just prior to installing. Place the old module in the empty packaging for carriage.



E48963

WARNINGS:



When handling any SRS component, hold by the gas generator housing, DO NOT hold by the airbag. Do not wrap the thumb around the gas generator while holding. Do not drape airbag over shoulder or around neck. For seat buckle type pre-tensioners, hold by the piston tube, with the open end of the piston tube pointing towards the ground and the buckle facing away from your body. Do not cover the end of the piston tube. DO NOT hold buckle type pre-tensioners by the bracket assembly or cable. Never point the piston tube towards your body or other people.



Airbag modules and seat belt pre-tensioners are classed as explosive devices. For overnight and longer term storage, they must be stored in a secure steel cabinet which has been approved as suitable for the purpose and has been registered with the local authority.



Store airbag modules or seat belt pre-tensioners in a designated storage area. If there is no designated storage area available, store in the locked luggage compartment of the vehicle and inform the workshop supervisor.

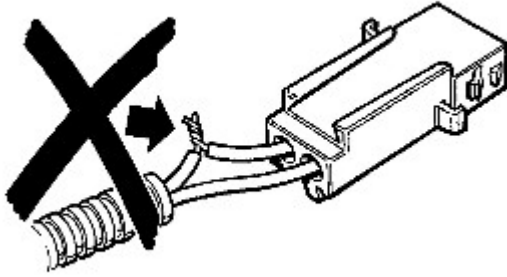


CAUTION: Improper handling or storage can internally damage the airbag module making it inoperative. If you suspect the airbag module has been damaged, install a new module and refer to the deployment/disposal

procedures for disposal of the damaged module.

SRS harness and connectors

Always observe the following precautions with regards to SRS system electrical wiring:

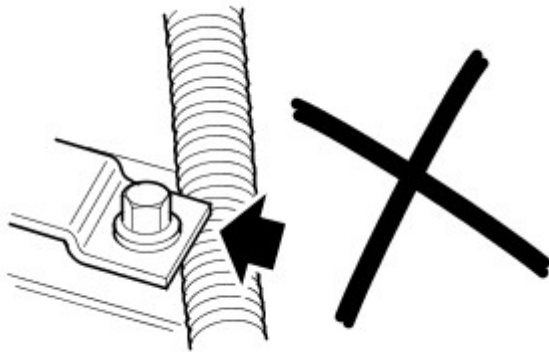


E48965

- Never attempt to modify, splice or repair SRS wiring.
- Never install electrical equipment such as a mobile telephone, two-way radio or in-car entertainment system in such a way that it could generate electrical interference in the airbag harness. Seek specialist advice when installing such equipment.



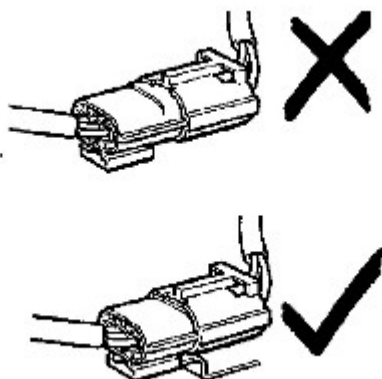
NOTE: SRS wiring can be identified by a special yellow outer sleeve protecting the wires (black with yellow stripe protective coverings are sometimes used).



E48964



WARNING: Always make sure SRS wiring is routed correctly. Be careful to avoid trapping or pinching the SRS wiring.



E48966



WARNING: Do not leave the connectors hanging loose or allow SRS components to hang from their harnesses. Look for possible chafing points.

Impact crash sensors - inspection

After any degree of side or frontal body damage, inspect the impact crash sensors. Replace a crash sensor if there is any sign of damage.



CAUTION: Take extra care when painting or carrying out bodywork repairs in the vicinity of the crash sensors. Avoid direct exposure of the crash sensors or link harnesses to heat guns, welding or spraying equipment. Take care not to damage sensor or harness when reinstalling components.

Clock spring



CAUTION: Always follow the procedure for installing and checking the clock spring as instructed in the SRS repairs section. Comply with all safety and installation procedures to make sure the system functions correctly. Observe the following precautions:

- Do not unlock and rotate the clock spring when it is removed from the vehicle.
- Do not turn the road wheels when the clock spring is removed from the vehicle.
- Always make sure the clock spring is removed and installed in its central position and with the front road wheels in the straight ahead position - refer to SRS repair section for the correct removal and installation procedure.
- If a new clock spring is being installed, make sure the locking tab holding the spring's rotational position is not broken; units with a broken locking tab must not be used.

Airbag and pre-tensioner deployment



WARNING: During deployment parts of the airbag module become hot enough to burn you. Wait 30 minutes after deployment before touching the airbag module.

Deployment procedures and precautions as detailed in this manual should be strictly adhered to. Only personnel who have undergone the appropriate training should undertake deployment of airbag and pre-tensioner modules. The following precautions must be complied with:

- Only use deployment equipment approved for the intended purpose.
- Deployment of airbag / pre-tensioner modules must be performed in a well ventilated area which has been designated for the purpose.
- Make sure airbag / pre-tensioner modules are not damaged or ruptured before attempting to deploy.
- Where local legislation exists, notify the relevant authorities of intention to deploy airbag and pretensioner units.
- When deploying airbag pre-tensioner units, make sure that all personnel are at least 15 metres (45 feet) away from the deployment zone.
- Make sure deployment tool is connected correctly, in compliance with the instructions detailed in the SRS section of this manual. In particular, make sure deployment tool is NOT connected to battery supply before connecting to airbag module connector.
- When deploying seat belt pre-tensioners, make sure pre-tensioner unit is secured correctly to the seat.
- When removing deployed airbag modules and pre-tensioner units, wear protective clothing. Use gloves and seal deployed units in a plastic bag.
- Following deployment of any component of the SRS system within the vehicle, all SRS components must be replaced. DO NOT re-use or salvage any parts of the SRS system.
- Do not lean over an airbag module when connecting deployment equipment.

If a vehicle is to be scrapped, undeployed airbag modules and pre-tensioner units must be manually deployed. In this case airbags can be deployed in the vehicle. Before deployment, make sure the airbag module is secure within its correct mounting position. Deployment of the driver's airbag in the vehicle may damage the steering wheel; if the vehicle is not being scrapped, deploy the module outside of the vehicle.

SRS Component Replacement Policy

CAUTIONS:



The Restraints Control Module (RCM) will log a crash fault after every impact which is severe enough to cause airbag deployment. **It is possible to have three crashes/impacts logged after one event where, for example, a front, side and rollover has occurred. After the third fault is logged, the SRS warning lamp will be illuminated and the restraints control module (RCM) must be replaced.**



The SRS side/front impact sensor(s) must be replaced if there are any signs of physical damage or if the restraints control module (RCM) is registering a fault.

The following information details the policy for replacement of SRS components as a result of a vehicle accident.

Impacts which do not deploy the airbags or pre-tensioners

Check for structural damage in the area of the impact paying particular attention to bumper armatures, longitudinals and bracketry.

Impacts which deploy the airbags or pre-tensioners

The replacement and inspection policy is dependent on the type and severity of the crash condition. The following guidelines are the minimum that should be exercised as a result of the deployment of specific SRS components.

Check for structural damage in the area of impact paying particular attention to bumper armatures,

longitudinals and bracketry.

Front Airbag Deployment - Driver and Passenger



CAUTION: If the front airbags are deployed, the following components must be replaced:

- Driver airbag module
- Passenger airbag module
- Fly leads (where applicable) connecting front airbag modules to SRS harness
- Front seat belt buckle pre-tensioner
- Rear seat belt pre-tensioners - if installed
- Driver's seat belt retractor - if installed
- Clock spring
- Any front impact sensors that have been physically damaged or if a fault is being registered
- Restraints control module (RCM) if the three crashes/impacts have been stored

Additionally, the following items must be inspected for damage and replaced as necessary:

- Front passenger's seat belt retractor and webbing, tongue latching function, 'D' loop and body anchorage point
- Rear seat belt buckles, webbing, buckle covers, body anchorage points and tongue latching function
- Instrument panel moulding adjacent to passenger airbag module
- Steering wheel
- Front seat frames and head restraints
- Steering column - if adjustment is lost or if there are signs of collapse
- Seat belt height adjusters
- Rear seat belts

Side Air Bags



CAUTION: If the side curtain air bags are deployed, the following components must be replaced on the side of the vehicle on which the deployment occurred:

- Side curtain airbag
- Any side impact sensors that have been physically damaged or if a fault is being registered
- Restraints Control Module (RCM) if the three crashes/impacts have been stored

Additionally, the following items must be inspected for damage and replaced as necessary:

- Front seat belts, retractors and webbing, tongue latching function, 'D' loop and body anchorage points
- Rear seat belt buckles, webbing, buckle covers, tongue latching function, and body anchorage points
- Front seat frame and head restraints
- Door trim casing
- Seat belt height adjusters
- Rear seat belts

Head airbag modules



CAUTION: If the head airbag modules are deployed, the following components must be replaced on the side of the vehicle on which the deployment occurred:

- Head airbag modules
- Link lead between airbag gas generator and restraints control module (RCM) harness
- Airbag retaining clips
- Internal trim finisher
- Front seat belt buckle pre-tensioners
- Any side impact sensors that have been physically damaged or if a fault is being registered
- Restraints Control Module (RCM) if the three crashes/impacts have been stored

Additionally, the following items must be inspected for damage and replaced as necessary:

- Headlining
- Component mounting brackets
- Front seat belts, retractors and webbing, tongue latching function, 'D' loop and body anchorage points
- Rear seat belt buckles, webbing, buckle covers, tongue latching function, and body anchorage points
- Adjacent trim components
- Seat belt height adjusters

Rear impacts



CAUTION: If the seat belt pre-tensioners are deployed during a rear impact, the following components must be replaced:

- Seat belt pre-tensioners
- Front and rear seat belt retractors used during the impact
- Restraints Control Module (RCM) if the three crashes/impacts have been stored

Additionally, the following items must be inspected for damage and replaced as necessary:

- Seat belt height adjusters
- Front seat belts, retractors and webbing, tongue latching function, 'D' loop and body anchorage points
- Rear seat belt buckles, webbing, buckle covers, tongue latching function, and body anchorage points

(A/C) System Precautions

The A/C system contains fluids and components which could be potentially hazardous to the service engineer or the environment if not serviced and handled correctly. The following guidelines are intended to alert the service engineer to potential sources of danger and emphasise the importance of ensuring the integrity of the A/C operating conditions and components installed to the vehicle.

Where necessary, additional specific precautions are detailed in the relevant sections of this Manual and also in the Health and Safety Section. These precautions must be referred to prior to commencing repair operations.

The refrigerant used in the A/C system is HC-134a (Hydrofluorocarbon) R134a.

WARNINGS:



Service must only be carried out by personnel familiar with both the vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.



R134a is a hazardous liquid and when handled incorrectly can cause serious injury. Suitable protective clothing, consisting of face protection, heat proof gloves, rubber boots and rubber apron or waterproof overalls, must be worn when carrying out operations on the A/C system.

Remedial actions



WARNING: Due to its low evaporating temperature, R134a must be handled with care. R134a splashed on any part of the body will cause immediate freezing of that area. Also, refrigerant cylinders and replenishment trolleys when discharging will freeze skin to them if contact is made.

If an accident involving R134a should occur, conduct the following remedial actions:

- If liquid R134a enters the eye, do not rub it. Gently run large quantities of eye wash over affected eye to raise the temperature. If an eye wash is not available, cool, clean water may be used to flush the eye. After rinsing, cover the eye with a clean pad and seek immediate medical attention.
- If liquid R134a is splashed onto the skin, run large quantities of water over the affected area to raise the temperature. Implement the same action if the skin comes in contact with discharging cylinders. Wrap the contaminated body parts in blankets (or similar materials) and seek immediate medical attention.
- If the debilitating effects of inhalation of R134a vapour are suspected, seek fresh air. If the affected person is unconscious, move them away from the contaminated area to fresh air and apply artificial respiration and/or oxygen and seek immediate medical attention.

Service precautions

Observe the following precautions when handling components used in the system:

- A/C units must not be lifted by their hoses, pipes or capillary lines.
- Hoses and lines must not be subjected to any twist or stress; the efficiency of the system will be impaired by kinks or restrictions. Make sure that hoses are correctly positioned before tightening couplings, and make sure that all clips and supports are utilised.
- Flexible hoses should not be positioned closer than 100 mm (4.0 in) to the exhaust manifold unless protected by heat shielding.
- Completed assemblies must be checked for refrigeration lines touching metal panels. Any direct contact of components and panels may transmit noise and so must be eliminated.
- The appropriate torque wrench must be used when tightening refrigerant connections to the stipulated value. An additional spanner must be used to hold the union to prevent twisting of the pipe when tightening connections.
- Before connecting any hose or pipe, make sure that refrigerant oil is applied to the seat of the new O-rings, **BUT NOT** to the threads of the connection.
- All protective plugs or caps must remain in place in the component until immediately prior to connection.
- Make sure components are at room temperature before uncapping/unplugging, to prevent condensation of moisture from the air that enters it.
- When disconnecting, immediately plug or cap all pipes to prevent ingress of dirt and moisture into the system.
- Components must not remain uncapped/unplugged, if a system has been left uncapped/unplugged for 24 hours or longer, a new receiver/drier must be installed.
- The receiver/drier contains desiccant which absorbs moisture. It must be positively sealed at all times. A receiver/drier that has been left uncapped for longer than 24 hours must not be used; install a new unit.
- The receiver/drier should be the last component connected to the system to make sure optimum dehydration and maximum moisture protection of the system.
- Whenever a component of the refrigeration system is replaced, it will also be necessary to install a new receiver/drier unit.
- Use alcohol and a clean lint-free cloth to clean dirty connections.
- Make sure that all new parts installed are marked for use with R134a.
- When a major repair has been completed, a leak test should be conducted; refer to the Repairs Section of this manual for the correct procedure.

Refrigerant oil



CAUTION: Refrigerant oil (ND-8 PAG) easily absorbs water and must not be stored for long periods. Do not pour unused refrigerant oil back into the container. Always use an approved refrigerant oil.

When replacing components in the system, drain the refrigerant oil from the component being replaced into a graduated container. On assembly, add the quantity of refrigerant oil drained to the new component - See Compressor Replacement in this Section.

A/C Compressor

A new compressor is sealed and pressurised with Nitrogen gas. When installing a new compressor, slowly release the sealing cap; gas pressure should be heard to vent as the seal is broken.



CAUTION: A new compressor should always be sealed and could be pressurised with nitrogen gas. To avoid possible oil loss, release the sealing cap(s) slowly. Do not remove the cap(s) until immediately prior to connecting the pipes to the compressor.

Rapid refrigerant discharge

If the A/C system is damaged as a result of an accident and the system is punctured, the refrigerant will discharge rapidly. The rapid discharge of refrigerant will also result in the loss of most of the oil from the system. The compressor must be removed and all the remaining oil in the compressor drained and refilled as instructed in the air conditioning section of this manual.

Precautions for refrigerant recovery, recycling and recharging

When the A/C system is recharged, any existing refrigerant is first recovered from the system and recycled. The system is then charged with the required weight of refrigerant and volume of refrigerant oil.



WARNING: Refrigerant must always be recycled before re-use to make sure that the purity of the refrigerant is high enough for safe use in the system. Recycling should always be carried out with equipment which is design certified by Underwriter Laboratory Inc. for compliance with SAE J1991. Other equipment may not recycle refrigerant to the required level of purity.

CAUTIONS:



A R134a Refrigerant Recovery Recycling Recharging Station must not be used with any other type of refrigerant. Refrigerant R134a from domestic and commercial sources must not be used in motor vehicle systems.



The system must be evacuated immediately before recharging commences. Delay between evacuation and recharging is not permitted.

A/C Compressor Replacement

A new compressor is supplied filled with a full charge (X cm³) of refrigerant oil.

A calculated quantity of oil must be drained from the new compressor before installing. To calculate the quantity of oil to be drained:

- Remove the drain plug from the old compressor.
- Invert the compressor and gravity drain the oil into a calibrated measuring cylinder. Rotate the compressor clutch to make sure the compressor is completely drained.
- Note the quantity of oil drained (Y cm³).
- Calculate the quantity of oil to be drained from the new compressor using the following formula: **X cm³ – (Y cm³ + 20 cm³) = Q cm³**
- Remove the drain plug from the new compressor and drain Q cm³ of oil. install and tighten the compressor drain plug.

Vehicle Weights

Item	kg	lb
Maximum Gross Vehicle Weight (GVW) - All models*	3230	7106
Maximum weight of unbraked trailer:		
On-road	750	1650
Off-road	750	1650
Maximum towable weight (mass) - Trailers with overrun brakes		
On-road	3500	7700
Off-road	1000	2205
Maximum roof rack load (Including the mass of the roof rack):		
On-road	75	110
Off-road	75	110

* Weight quoted is the maximum weight possible for vehicles in this model range; weights may be

less for certain variants depending upon trim level, territorial requirements etc.

Vehicle Dimensions

Item	mm	in
Length - including number plate plinth - All models	4842	190.6
Width - All models:		
Mirrors extended	2189	86.2
Mirrors folded	2009	79.1
Coil Suspension - Maximum height - At EEC kerb weight - All models:		
With roof rack and rails	1891	74.4
With roof antenna module	1938	76.3
Air Suspension - Maximum height - At normal ride height - All models:		
With roof rack and rails	1891	74.4
With roof antenna module	1938	76.3
Wheelbase - All models	2885	113.5
Front overhang - All models	820	32.3
Rear overhang - All models	1130	44.5
Maximum roof load	75 kg	165 lb
Track - All models:		
Front	1601	63.0
Rear	1601	63.0
Coil Suspension:		
Underbody - Running clearance to exhaust - Minimum - Kerb weight	185	7.3
Front axle to axle undertray clearance	203	7.9
Rear axle to differential casing clearance	214	8.4
Air Suspension:		
Underbody - Running clearance to exhaust - Minimum - Kerb weight	185	7.3
Front axle to axle undertray clearance	203	7.9
Rear axle to differential casing clearance	214	8.4
Suspension articulation - All models:		
Front	255	10.03
Rear	330	12.9
Coil Suspension:		
Wading depth	600	23.6
Approach angle	32.2°	32.2°
Departure angle - Towbar NOT installed:		
With full size spare wheel	24.9°	24.9°
With space saver wheel	26.7°	26.7°
Departure angle - Towbar installed - NOT NAS vehicles	15.7°	15.7°
Departure angle - Towbar installed - NAS vehicles	18°	18°
Departure angle - Adjustable height towbar installed	14°	14°
Air Suspension:		
Wading depth - Off-road height	700	27.5
Approach angle:		
Standard ride height	32.2°	32.2°
Off-road ride height	37.2°	37.2°
Departure angle - Towbar NOT installed - Standard ride height:		
With full size spare wheel	24.9°	24.9°
With space saver wheel	26.7°	26.7°
Departure angle - Towbar NOT installed - Off-road ride height:		
With full size spare wheel	27.9°	27.9°
With space saver wheel	29.5°	29.5°
Departure angle - Towbar installed - NOT NAS vehicles:		
Standard ride height	15.7°	15.7°
Off-road ride height	18.5°	18.5°
Departure angle - Towbar installed - NAS vehicles:		
Standard ride height	18°	18°
Off-road ride height	21°	21°
Departure angle - Adjustable height towbar installed:		
Standard ride height	14°	14°
Off-road ride height	16.6°	16.6°
Ramp angle - Coil Suspension	22.8°	
Ramp angle - Air Suspension		
Standard ride height	22.8°	22.8°
Off-road ride height	27.9°	27.9°

General Information - Health and Safety Precautions

Description and Operation

Introduction

Modern vehicles contain many materials and liquids which if not handled with care can be hazardous to both personal health and the environment. Also, many of the procedures associated with vehicle maintenance and repair involve physical hazards or other risks to health.

This subsection lists some of these hazardous operations and the materials and equipment associated with them. Precautions necessary to avoid these hazards are identified.

The list is not exhaustive and all operations and procedures and the handling of materials, should be carried out with health and safety in mind.

Before using any product the Materials Safety Data Sheet supplied by the manufacturer or supplier should be consulted.



WARNING: Many liquids and other substances used in motor vehicles are poisonous and should under no circumstances be consumed and should, as far as possible, be kept from contact with the skin. These liquids and substances include acid, anti-freeze, brake fluid, fuel, windscreen washer additives, lubricants, refrigerants and various adhesives.

Acids and Alkalis

For example - alkalis such as caustic soda used in cleaning materials; acids such as sulphuric acid used in batteries.

Both alkalis and acids are irritant and corrosive to the skin, eyes, nose and throat. They cause burns and can destroy ordinary protective clothing.

Avoid splashes to the skin, eyes and clothing. Wear suitable protective impervious apron, gloves and goggles. Do not breath mists.

Make sure access to eye wash bottles, shower and soap are readily available for splashing accidents.

Display Eye Hazard sign.

Air Bags

Highly flammable, explosive – observe No Smoking policy.

Used within the vehicle as safety restraints.

The inflator contains a high-energy propellant which, when ignited, produces a VERY HOT GAS (2500°C).

The gas inflator (generator) used in air bags is Sodium Azide. This material is hermetically sealed in each air bag module and is completely consumed during deployment. No attempt should be made to open an air bag inflator as this will lead to the risk of exposure to Sodium Azide. If a gas generator is ruptured, full protective clothing should be worn when dealing with the spillage.

After normal deployment, gloves and safety goggles should be worn during the handling process.

Deployed air bags should be disposed of in a plastic bag in accordance with local regulations at an approved chemical waste site.

Following any direct contact with Sodium Azide:

Wash affected areas thoroughly with water.
SEEK IMMEDIATE MEDICAL ASSISTANCE.

Air Bags - Do's

- Do store modules in an upright position.
- Do keep modules dry.
- Do carry modules with the cover side pointing away from the body.
- Do place modules with their cover side upwards.
- Do carefully inspect modules for damage.
- Do stand to one side when connecting modules.
- Do make sure all test equipment is properly calibrated and maintained.
- Do wash hands after handling deployed air bags.

Air Bags - Do Not

- Do Not store highly flammable material together with modules or gas generators.
- Do Not store gas generators at temperatures exceeding 80°C.
- Do Not store modules upside down.
- Do Not attempt to open a gas generator housing.
- Do Not expose gas generators to open flame or sources of heat.
- Do Not place anything on top of a module cover.

- Do Not use damaged modules.
- Do Not touch a fired module or gas generator for at least 10 minutes after firing.
- Do Not use any electrical probes on the wiring circuit.

Air Suspension

Whenever work is being undertaken on the air suspension system, suitable eye protection must be worn.

Air Conditioning Refrigerant

Highly flammable, combustible – observe No Smoking policy.

Skin contact may result in frostbite.

Instructions given by the manufacturer must be followed. Avoid naked lights, wear suitable protective gloves and goggles.

If refrigerant comes into contact with the skin or eyes, rinse the affected areas with water immediately. Eyes should also be rinsed with an appropriate irrigation solution such as a solution of 9% Sodium Chloride and Purified Water. **DO NOT RUB THE EYES AND SEEK IMMEDIATE MEDICAL ATTENTION.**

Air Conditioning Refrigerant

Do Not

- Do Not expose refrigerant bottles to sunlight or heat.
- Do Not expose refrigerant bottles to frost.
- Do Not drop refrigerant bottles.
- Do Not vent refrigerant to atmosphere under any circumstance.
- Do Not mix refrigerants.

Adhesives and Sealants

Many adhesives and sealants are highly flammable – OBSERVE NO SMOKING POLICY. These items, should be stored in flameproof cabinets in No Smoking areas. Cleanliness and tidiness in use should be observed, for example disposable paper covering benches. All adhesives and sealants should be dispensed from applicators where possible; containers, including secondary containers, should be labelled appropriately.

Anaerobic, Cyanoacrylate (super-glues) and other Acrylic Adhesives

Many are irritant, sensitizing or harmful to the skin and respiratory tract. Some are eye irritants.

Skin and eye contact should be avoided and the manufacturer's instructions followed.

Cyanoacrylate adhesives (super-glues) MUST NOT contact the skin or eyes. If skin or eye tissue is bonded, cover with a clean moist pad and **SEEK IMMEDIATE MEDICAL ATTENTION.** Do not attempt to pull skin tissue apart. Use in well ventilated areas as vapors can cause irritation to the nose and eyes.

For two-pack systems see Resin-based and Isocyanate Adhesives/Sealers.

Solvent-based Adhesives/Sealers - See Solvents

Follow manufacturers instructions.

Water-based Adhesives/Sealers

Those based on polymer emulsions and rubber/latex may contain small amounts of volatile, toxic and harmful chemicals. Skin and eye contact should be avoided and adequate ventilation provided during use.

Hot Melt Adhesives

In the solid state, they are safe. In the molten state they may cause burns and health hazards may arise from the inhalation of toxic fumes.

Use appropriate protective clothing and a thermostatically controlled heater with a thermal cut-out and adequate extraction.

Resin-based Adhesives/Sealers, for example Epoxide and Formaldehyde Resin-based

Mixing should be carried out in well ventilated areas as harmful or toxic volatile chemicals may be released.

Skin contact with uncured resins and hardeners can result in irritation, dermatitis, and absorption of toxic or harmful chemicals through the skin. Splashes can damage the eyes.

Provide adequate ventilation and avoid skin and eye contact.

Isocyanate (Polyurethane) Adhesives/Sealers

See also Resin-based Adhesives

Individuals suffering from asthma or respiratory allergies should not work with or near these materials as sensitivity reactions can occur.

Over exposure is irritating to the eyes and respiratory system. Excessive concentrations may produce effects on the nervous system including drowsiness. In extreme cases, loss of consciousness may result. Long term exposure to vapour concentrations may result in adverse health effects.

Prolonged contact with the skin may lead to skin irritation and in some cases, dermatitis.

Splashes entering the eye will cause discomfort and possible damage.

Any spraying should preferably be carried out in ventilated booths which incorporate facilities for removing vapors and spray droplets from the breathing zone.

Wear appropriate gloves, eye and respiratory protection.

Antifreeze

May be flammable when undiluted.

Vapors may be given off from coolant antifreeze when heated. Avoid breathing these vapors.

Antifreeze may be absorbed through the skin in toxic or harmful quantities. Antifreeze, if swallowed, can be fatal; **SEEK IMMEDIATE MEDICAL ATTENTION.**

Battery Acids

See also Alkalis and Acids.

Gases released during battery charging are explosive. Always remove the battery from the vehicle prior to charging. Never use naked flames or allow sparks near charging or recently charged batteries. NEVER add acid to a battery, the chemical reaction produced will be violent and explosive. In cases of eye contact, wash affected area with copious amounts of water and **SEEK IMMEDIATE MEDICAL ATTENTION.**

Make sure there is adequate ventilation during battery charging, observe NO SMOKING POLICY.

Brake Pads and Linings

Always fit the correct grade and specification of brake pads and linings. When renewing pads and linings, always replace as complete axle sets.

Brake and Clutch Fluid

Splashes to the skin and eyes are irritating and in the long term can be damaging, avoid prolonged skin contact. In cases of eye contact, wash affected area with copious amounts of water and **SEEK IMMEDIATE MEDICAL ATTENTION.**

Chemical Materials

All chemical materials should always be used with caution and stored and handled with care. They may be toxic, harmful, corrosive, irritant or highly flammable and give rise to hazardous fumes and dusts.

The effects of excessive exposure to chemicals may be immediate or delayed; briefly experienced or permanent; cumulative; superficial; life threatening; or may reduce life expectancy.

Chemical Materials - Do's

Do carefully read and observe hazard and precaution warnings given on material containers (labels) and in any accompanying leaflets, posters or other instructions. Material health and safety data sheets can be obtained from manufacturers.

Do remove chemical materials from the skin and clothing as soon as practicable after soiling. Change heavily soiled clothing and have it cleaned.

Do organise work practices and protective clothing to avoid soiling of the skin and eyes.

Do avoid breathing vapors, aerosols, dusts or fumes; inadequate container labelling; fire and explosion hazards.

Do wash before job breaks, before eating, smoking, drinking or using toilet facilities when handling chemical materials.

Do keep work areas clean, uncluttered and free of spills.

Do store chemical materials according to national and local regulations.

Do keep chemical materials out of the reach of children.

Chemical Materials - Do Not

Do Not mix chemical materials except under the manufacturers instructions; some chemicals can form other toxic or harmful chemicals, give off toxic or harmful fumes or become explosive when mixed together.

Do Not spray chemical materials, particularly those based on solvents, in confined spaces, for example when people are inside a vehicle.

Do Not apply heat or flame to chemical materials except under the manufacturers instructions. Some are highly flammable and some may release toxic or harmful fumes.

Do Not leave containers open. Fumes given off can build up to toxic, harmful or explosive concentrations. Some fumes are heavier than air and will accumulate in confined areas such as pits.

Do Not transfer chemical materials to unlabelled containers.

Do Not clean hands or clothing with chemicals. Chemicals, particularly solvents and fuels, will dry skin

and may cause irritation leading to dermatitis or be absorbed through the skin in toxic or harmful quantities.

Do Not use emptied containers for other materials except when they have been cleaned under supervised conditions.

Do Not sniff or smell chemical materials, even brief exposure to high concentrations of fumes can be toxic or harmful.

Corrosion Protection Materials

Some corrosion protection materials are highly flammable – observe NO SMOKING POLICY.

These materials are varied and the manufacturers instructions must always be followed. The materials may contain solvents, resins or petroleum products. Skin and eye contact should be avoided. They should only be sprayed in conditions of adequate ventilation and not in confined spaces.

Dust

Dust or powder produced during repair operations may be irritant, harmful or toxic. Avoid breathing dusts from powdery chemical materials or those arising from dry abrasion operations. Wear respiratory protection if ventilation is inadequate.

Fine dusts of combustible material can present an explosion hazard. Avoid explosive limits and sources of ignition.

Electrical Equipment

Electric shock can result from the use of faulty electrical equipment or from the misuse of equipment in good condition.

Make sure that electrical equipment is maintained in good condition and frequently tested. Faulty equipment should be labelled and preferably removed from the work station.

Make sure that flexes, cables, plugs and sockets are not frayed, kinked, cut, cracked or otherwise damaged. If using cable reel extension equipment, ALWAYS ensure that the cable is fully unwound from the reel.

Make sure that electrical equipment and flexes do not come into contact with water.

Make sure that electrical equipment is protected by the correct rated fuse.

Never misuse electrical equipment and never use equipment which is in any way faulty. The results could be fatal.

Make sure that the cables of mobile electrical equipment cannot get trapped and damaged, such as in a vehicle hoist.

Make sure that the designated electrical workers are trained in basic First Aid.

In cases of electrocution:

Switch off the power supply before approaching the victim.

If this is not possible, **DO NOT TOUCH THE VICTIM** but push or drag the person from the source of electricity using dry, non-conductive material.

Commence resuscitation if trained to do so.

SEEK IMMEDIATE MEDICAL ATTENTION.

Exhaust Fumes

These contain asphyxiating, harmful and toxic chemicals and particles such as carbon oxides, nitrogen oxides, aldehydes, lead and aromatic hydrocarbons. Engines should be run only under conditions of adequate exhaust extraction or general ventilation and not in confined spaces.

Gasoline (Petrol) engine

There may not be adequate warning of odour or of irritation before toxic or harmful effects arise. These may be immediate or delayed.

Gas Oil (Diesel engine)

Soot, discomfort and irritation usually give adequate warning of hazardous fume concentrations.

Fibre Insulation

The fibrous nature of surfaces and cut edges can cause skin irritation. This is usually a physical and not a chemical effect.

Precautions should be taken to avoid excessive skin contact through careful organization of work practices and the use of gloves.

Fire

Many of the materials found on or associated with the repair of vehicles are highly flammable. Some give off toxic or harmful fumes if burnt; others such as fluoroelastomers when burnt or damaged by excessive heat can

break down and produce highly corrosive hydrofluoric acid - See Fluoroelastomers.

Should any material be in a burnt or overheated condition, handle with extreme caution and wear protective clothing when handling such items. Dispose of such material in accordance with local regulations.

Decontaminate and dispose of protective clothing immediately after use.

Observe strict fire safety when storing and handling flammable materials or solvents, particularly near electrical equipment or welding processes.

Make sure, before using electrical or welding equipment, that there is no fire hazard present.

Have a suitable fire extinguisher available when using welding or heating equipment.

First Aid

Apart from meeting any legal requirements it is desirable for someone in the workshop to be trained in First Aid procedures.

Splashes in the eye should be flushed carefully with clean water for at least ten minutes.

Soiled skin should be washed with soap and water.

In case of cold burns, from alternative fuels, place affected area in cool to cold water.

Individuals affected by inhalation of gases and fumes should be removed to fresh air immediately. If effects persist, consult a doctor.

If liquids are swallowed inadvertently, consult a doctor giving him the information on the container or label. Do not induce vomiting unless this action is indicated on the label.

Fluoroelastomers (Synthetic Rubber)

Many 'O' rings, seals, hoses, flexible pipes and other similar which appear to be manufactured from natural rubber are, in fact, made of synthetic materials called Fluoroelastomers.

Under normal operating conditions, these materials are safe and do not constitute a health hazard. However, if the materials are damaged by burning or exposure to excessive heat, they can break down and produce highly corrosive hydrofluoric acid.



WARNING: Contact with hydrofluoric acid can cause serious burns on contact with the skin. If skin contact does occur, carry out the following steps immediately:

Remove any contaminated clothing.

SEEK IMMEDIATE MEDICAL ATTENTION

Irrigate affected area of skin with copious amounts of cold water or limewater for 15 to 60 minutes.

Foams - Polyurethane

Used in sound and noise insulation. Cured foams used in seat and trim cushioning.

Unreacted components are irritating and may be harmful to the skin and eyes. Wear gloves and goggles.

Individuals with chronic respiratory diseases, asthma, bronchial medical problems, or histories of allergic diseases should not work in or near uncured materials.

The components, vapors or spray mists can cause direct irritation, sensitivity reactions and may be toxic or harmful.

Vapors and spray mists must not be inhaled. These materials must be applied with adequate ventilation and respiratory protection. Do not remove the respirator immediately after spraying, wait until the vapour/mists have cleared.

Burning of the uncured components and the cured foams can generate toxic and harmful fumes. Smoking, naked flames or the use of electrical equipment during foaming operations and until vapors/mists have cleared should not be allowed. Any heat cutting of cured foams or partially cured foams should be carried out in areas having suitable fume extraction equipment.

Fuels

Avoid skin contact with fuel where possible. Should contact occur, wash the affected skin with soap and water.

Gasoline (Petrol)

Highly flammable - OBSERVE NO SMOKING POLICY.

Swallowing gasoline (petrol) can result in mouth and throat irritation and absorption from the stomach can result in drowsiness and unconsciousness. Small amounts can be fatal to children. Inhalation into the lungs, through vomiting, is a very serious hazard.

Gasoline (petrol) dries the skin and can cause irritation and prolonged or repeated contact may cause dermatitis;

if it is allowed to enter the eyes, it will cause severe smarting. Wash affected area with copious amounts of water and **SEEK IMMEDIATE MEDICAL ATTENTION.**

Gasoline (petrol) may contain appreciable quantities of benzene, which is toxic upon inhalation and the concentration of vapors must be kept very low. High concentrations will cause eye, nose and throat irritation, nausea, headache, depression and symptoms of drunkenness. Very high concentrations will result in rapid loss of consciousness.

Make sure there is adequate ventilation when handling and using gasoline (petrol). Great care must be taken to avoid the serious consequences of inhalation in the event of vapour build up arising from spillages in confined spaces.

Special precautions apply to cleaning and maintenance operations on gasoline (petrol) storage tanks.

Gasoline (petrol) should not be used as a cleaning agent. It must not be siphoned by mouth.

Gas-oil (Diesel Fuel)

Combustible.

Prolonged skin contact with high boiling point gas oils (diesel fuel) may cause serious skin disorders including skin cancer.

Inhalation into the lungs will cause internal bleeding - **SEEK IMMEDIATE MEDICAL ATTENTION.**

If swallowed, DO NOT induce vomiting - SEEK IMMEDIATE MEDICAL ATTENTION.

Kerosene (Paraffin)

Used also as heating fuel, solvent and cleaning agent.

Flammable - OBSERVE NO SMOKING POLICY.

Irritation of the mouth and throat may result from swallowing. The main hazard from swallowing arises if liquid aspiration into the lungs occurs.

Liquid contact dries the skin and can cause irritation or dermatitis. Splashes in the eye may be slightly irritating.

In normal circumstances the low volatility does not give rise to harmful vapors. Exposure to mists and vapors from kerosene at elevated temperature should be avoided (mists may arise in dewaxing). Avoid skin and eye contact and make sure there is adequate ventilation.

If swallowed, DO NOT induce vomiting - SEEK IMMEDIATE MEDICAL ATTENTION.

Gas Cylinders

Gases such as oxygen, acetylene, argon and propane are normally stored in cylinders at pressures of up to 138 bar (13800 kPa) (2000 lbf/in²) and great care should be taken in handling these cylinders to avoid mechanical damage to them or to the valve gear attached. The contents of each cylinder should be clearly identified by appropriate markings.

Cylinders should be stored in well ventilated enclosures, and protected from ice and snow or direct sunlight. Fuel gases, for example acetylene and propane should not be stored in close proximity to oxygen cylinders.

Care should be exercised to prevent leaks from gas cylinders and lines and also to avoid sources of ignition.

Only trained personnel should undertake work involving gas cylinders.

General Workshop Tools and Equipment

It is essential that all tools and equipment are maintained in good condition and the correct safety equipment is used where required.

Never use tools or equipment for any purpose other than that for which they were designed. Never overload equipment such as hoists, jacks, axle and chassis stands or lifting slings. Damage caused by overloading is not always immediately apparent and may result in a fatal failure the next time that the equipment is used.

Do not use damaged or defective tools or equipment, particularly high speed equipment such as grinding wheels. A damaged grinding wheel can disintegrate without warning and cause serious injury.

Wear suitable eye protection when using grinding, chiselling or sand blasting equipment.

Wear a suitable breathing mask when using abrasive blasting equipment or using spraying equipment.

Make sure there is adequate ventilation to control dusts, mists and fumes.

High Pressure Air, Lubrication and Oil Test Equipment

Always keep high pressure equipment in good condition, and regularly maintained, particularly at joints and unions.

Never direct a high pressure nozzle, for example diesel injector, at the skin as the fluid may penetrate to the underlying tissue and cause serious injury.

Jacking

Always refer to the Jacking and Lifting section of this manual prior to raising the vehicle off the ground.

When vehicle is to be raised by means of a jack, ensure that it is standing on level ground, that parking brake is applied and wheels are chocked. ALWAYS use the recommended jacking points and ensure that vehicle jack has sufficient load capacity for the weight of the vehicle.



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Ensure that hoists have sufficient load capacity for the weight of the vehicle.

Legal Aspects

There are many laws and regulations relating to health and safety in the use and disposal of materials and equipment in a workshop.

For a safe working environment and to avoid environmental pollution, workshops should be familiar, in detail, with the many health and safety laws and regulations within their country, published by both national and local authorities.

Lubricants and Greases

Avoid all prolonged and repeated contact with mineral oils. All lubricants and greases may be irritating to the eyes and skin.

Used Engine Oil

Prolonged and repeated contact with engine oil will result in the removal of natural fats from the skin, leading to dryness, irritation and dermatitis. In addition, used engine oil contains potentially harmful contaminants which may cause skin cancer. Adequate means of skin protection and washing facilities must be provided.

Do not employ used engine oils as lubricants or for any application where appreciable skin contact is likely to occur.

Health Protection Precautions

Avoid prolonged and repeated contact with oils, particularly used engine oils.

Wear protective clothing, including impervious gloves where practicable.

Do not put oily rags into pockets.

Avoid contaminating clothes, particularly underpants, with oil.

Heavily soiled clothing and oil-impregnated footwear should not be worn. Overalls must be cleaned regularly.

First Aid treatment should be obtained immediately for open cuts and wounds.

Use barrier creams, applying them before each work period, to help the removal of oil from the skin.

Wash with soap and water to make sure all oil is removed (skin cleansers and nail brushes will help).

Preparations containing lanoline replace the natural skin oils which have been removed.

Do not use gasoline (petrol), kerosene (paraffin), diesel fuel (gas oil), thinners or solvents for cleaning skin.

If skin disorders develop, obtain medical advice without delay.

Where practicable, degrease components prior to handling.

Where there is a risk of eye contact, eye protection should be worn, for example chemical goggles or face shields; in addition an eye wash facility should be provided.

Environmental Precautions

This section provides general information which can help to reduce the environmental impacts from the activities carried out in workshops.

Emissions to air

Many of the activities that are carried out in workshops emit gases and fumes which can contribute to global warming, depletion of the ozone layer and/or the formation of photochemical smog at ground level. By considering how the workshop activities are carried out, these gases and fumes can be minimised, thus reducing the impact on the environment.

Exhaust fumes

Running car engines is an essential part of workshop activities and exhaust fumes need to be ventilated to atmosphere. However, the amount of time engines are running and the position of the vehicle should be carefully considered at all times, to reduce the release of poisonous gases and minimise the inconvenience to people living nearby.

Solvents

Some of the cleaning agents used are solvent based and will evaporate rapidly to atmosphere if used carelessly, or if containers are left unsealed. All containers must be firmly closed when not required and solvent should be used sparingly. Wherever possible, solvents having a low toxicity and flammability should be selected. Always follow the instructions supplied by the solvent manufacturer. Similarly, many paints are solvent based and the

spray should be used in such a way as to reduce emissions to a minimum.

Refrigerant

It is illegal to release any refrigerant into the atmosphere. Discharge and replacement of these materials from air conditioning units should only be carried out using the appropriate equipment.

Discharges to water

Most workshops will have two systems for discharging waste water - storm drains and foul drains. Storm drains should only receive clean water i.e. rainwater. Foul drains will accept many of the normal waste water i.e. washing water, detergents and domestic type waste BUT NOT oil, petrol, solvent, acids, hydraulic fluid, antifreeze and similar fluids. If in doubt, always consult the local authority or water company.

Spillages

Every precaution must be taken to prevent spillage of oil, fuel, solvents etc., reaching the drains. All handling of such materials must take place well away from drains and preferably in an area with a suitable containing wall to prevent discharge into drains or watercourses. If a spillage occurs, it must be soaked up immediately using a spill kit where provided.

Checklist

Spillage prevention:

- Store liquids in a secure area.
- Make sure that taps on liquid containers are secure and cannot be accidentally turned on.
- Protect bulk storage tanks from vandalism by locking the valves.
- Transfer liquids from one container to another in an area away from open drains.
- Ensure lids are replaced securely on containers.
- Have spill kits available near to points of storage and liquid handling areas.

Spill Kits

Special materials are available to absorb a number of different substances. They can be in granular form, ready to use and are supplied in suitable containers. Disposal of used spill absorbing material is dealt with in Waste management.

Land contamination

Oils, fuels and solvents etc. can contaminate any soil with which they come into contact. Such materials MUST never be disposed of by pouring on to soil and every precaution must be taken to avoid spillage reaching soil. Waste materials stored on open ground could either leak or have contaminating substances washed off them that would contaminate the land. Always store these materials in suitable skips or similarly robust containers.

Legal compliance

Some sites may have a discharge consent for effluent discharge to the foul drain for a car wash etc. It is essential to know the types of effluent which are allowed to be discharged into the drain and to check the results of any monitoring carried out by the Water Company.

Where paint spraying operations are carried out it may be necessary to apply to the Local Authority for an air emissions licence to operate the plant. If such a licence is necessary, additional precautions will be necessary to comply with the requirements and the results of any air quality monitoring must be checked regularly.

Checklist

Always adhere to the following:

- Know what legal consents and licences apply to the operations.
- Check that the emissions and discharges comply with legal requirements.

Waste Management

Pollution can be reduced by careful handling, storage and disposal of all waste materials that occur on sites. Legislation makes it illegal to dispose of waste materials other than to licensed waste carriers and disposal sites.

This means that it is necessary to not only know what the waste materials are but also to have the necessary documentation and licences.

Handling and storage of waste

Ensure that waste materials are not poured down the drain or on to soil and are stored in such a way that they do not escape on to land or soil.

All waste must be segregated into individual types e.g. oils, metals, batteries, scrap components etc. This will prevent any reaction between different materials and assist in disposal.

Disposal of waste

Dispose of waste in accordance with the following guidelines:

- **Fuel, hydraulic fluid, anti-freeze and oil:** Keep separate and dispose of to specialist contractors.
- **Refrigerant:** Collect in specialist equipment and reuse.
- **Detergents:** Safe to pour down the foul drain if diluted.
- **Paint, thinners:** Keep separate and dispose of to specialist contractor.
- **Components:** Return to supplier for refurbishment or disassemble and reuse any suitable parts. Dispose of remainder in ordinary waste.
- **Small parts:** Reuse any suitable parts, dispose of the remainder in ordinary waste.
- **Metals:** Can be sold if separate from general waste.
- **Tyres:** Keep separate and dispose of to specialist contractor. DO NOT attempt to dispose of tyres by burning.
- **Components/materials containing asbestos:** Keep separate and dispose of to specialist contractor.
- **Oil and fuel wastes (e.g. rags, used spill kit material):** Keep separate and dispose of to specialist contractors.
- **Air filters:** Keep separate and dispose of to specialist contractors.
- **Rubber/plastics:** Dispose of in ordinary waste.
- **Hoses:** Dispose of in ordinary waste.
- **Batteries:** Keep separate and dispose of to specialist contractors.
- **Air bags - DANGER EXPLOSIVES:** Keep separate and dispose of to specialist contractors.
- **Electrical components:** Return to supplier for refurbishment or disassemble and reuse any suitable components. Dispose of remainder in ordinary waste.
- **Catalytic converters:** May be sold if kept separate from general waste.
- **Packaging:** Compact/recycle as much as possible and dispose of in ordinary waste.
- **Office/paper waste:** Recycle paper and toner and ink cartridges, dispose of remainder in ordinary waste.

Noise

Car alarm testing, panel beating, running engines, using air tools etc. are operations which invariably produce a large amount of noise. The location of such activities and also the time of day must be carefully considered having regard to the proximity of houses schools etc.

Some operations may produce high noise levels which could, in time, damage hearing. In these cases, suitable ear protection must be worn.

Solder

Solders are mixtures of metals such that the melting point of the mixture is below that of the constituent metals (normally lead and tin). Solder application does not normally give rise to toxic lead fumes, provided a gas/air flame is used. Oxy-acetylene flames should not be used, as they are much hotter and will cause lead fumes to be produced.

Some fumes may be produced by the application of any flame to surfaces coated with grease, and inhalation of these should be avoided.

Removal of excess solder should be undertaken with care, to make sure that fine lead dust is not produced, which can give toxic effects if inhaled. Respiratory protection may be necessary.

Solder spillage and filings should be collected and removed promptly to prevent general air contamination by lead.

High standards of personal hygiene are necessary in order to avoid ingestion of lead or inhalation of solder dust from clothing.

Solvents

For example acetone, white spirit, toluene, xylene, trichloroethane.

Used in cleaning and dewaxing materials, paints, plastics, resins and thinners.

Some may be highly flammable or flammable.

Skin contact will degrease the skin and may result in irritation and dermatitis following repeated or prolonged contact. Some can be absorbed through the skin in toxic or harmful quantities.

Splashes in the eye may cause severe irritation and could lead to loss of vision.

Brief exposure of high concentrations of vapors or mists will cause eye and throat irritation, drowsiness, dizziness, headaches and, in the worst circumstances, unconsciousness.

Repeated or prolonged exposure to excessive but lower concentrations of vapors or mists, for which there might not be adequate warning indications, can cause more serious toxic or harmful effects.

Aspiration into the lungs, for example through vomiting, is the most serious consequence of swallowing.

Avoid splashes to the skin, eyes and clothing. Wear protective gloves, goggles and clothing if necessary.

Make sure there is good ventilation when in use, avoid breathing fumes, vapors and spray mists and keep containers tightly sealed. Do not use in confined spaces.

When spraying materials containing solvents, for example paints, adhesives, and metal coatings, use extraction ventilation or personal respiratory protection in the absence of adequate general ventilation.

Do not apply heat or flame except under specific and detailed manufacturers instructions.

Suspended Loads



CAUTION: Never improvise lifting tackle.

There is always a danger when loads are lifted or suspended. Never work under an unsupported, suspended or raised load, for example a suspended engine.

Always make sure that lifting equipment such as jacks, hoists, axle stands and slings are adequate and suitable for the job, in good condition and regularly maintained.

Viton

In common with many other manufacturers vehicles, some components installed to Land Rover vehicles have seals, 'O' rings or gaskets which contain a material known as 'Viton'.

Viton is a fluoroelastomer, that is a synthetic rubber type which contains Fluorine. Although Viton is the most well known fluoroelastomer, there are others, including Fluorel and Tecmoflon.

When used under design conditions fluoroelastomers are perfectly safe. If, however, they are exposed to temperatures in excess of 400°C, the material will not burn, but will decompose, and one of the products formed is hydrofluoric acid.

This acid is extremely corrosive and may be absorbed directly, through contact, into the general body system.

WHERE CASES OF SKIN CONTACT OCCUR, SEEK IMMEDIATE MEDICAL HELP.

O-rings, seals or gaskets which have been exposed to very high temperatures will appear charred or as a black sticky substance.

DO NOT, under any circumstances touch them or the attached components.

Enquiries should be made to determine whether Viton or any other fluoroelastomer has been used in the affected O-ring, seal or gasket. If they are of natural rubber or nitrile there is no hazard. If in doubt, be cautious as the material may be Viton or any fluoroelastomer.

If Viton or any other fluoroelastomers have been used, the affected area should be decontaminated before the commencement of work.

Disposable heavy duty plastic gloves should be worn at all times, and the affected area washed down using wire wool and a limewater (calcium hydroxide) solution to neutralise the acid before disposing of the decomposed Viton residue and final cleaning of the area. After use, the plastic gloves should be discarded carefully and safely.

Welding

Welding processes include Resistance Welding (Spot Welding), Arc Welding and Gas Welding.

Resistance Welding

This process may cause particles of molten metal to be emitted at a high velocity, and the eyes and skin must be protected.

Arc Welding

This process emits a high level of ultra-violet radiation which may cause arc-eye and skin burns to the operator and to other persons nearby. Gas-shielded welding processes are particularly hazardous in this respect. Personal protection must be worn, and screens used to shield other people.

CONTACT LENS WEARERS ARE ADVISED TO REVERT TO ORDINARY SPECTACLES WHEN ARC WELDING as the arc spectrum is believed to emit microwaves which dry out the fluid between the lens and the eye. This may result in blindness when the lens is removed from the eye.

Metal spatter will also occur, and appropriate eye and skin protection is necessary.

The heat of the welding arc will produce fumes and gases from the metals being welded, the rods and from any applied coatings or contamination on the surfaces being worked on. These gases and fumes may be toxic and

inhalation of these should be avoided. The use of extraction ventilation to remove the fumes from the working area may be necessary particularly in cases where the general ventilation is poor, or where considerable welding work is anticipated. In extreme cases or confined spaces where adequate ventilation cannot be provided, air-fed respirators may be necessary.



CAUTION: Some of the components installed to the vehicle e.g. the interior cross beam and underbonnet cross member are manufactured from magnesium alloy. On no account should any welding operations be attempted on these components.

Gas Welding (and Cutting)

Oxy-acetylene torches may be used for welding and cutting, and special care must be taken to prevent leakage of these gases, with consequent risk of fire and explosion.

The process will produce metal spatter and eye and skin protection is necessary.

The flame is bright, and eye protection should be used, but the ultra-violet emission is much less than that from arc welding, and lighter filters may be used.

The process itself produces few toxic fumes, but such fumes and gases may be produced from coatings on the work, particularly during cutting away of damaged body parts, and inhalation of the fumes should be avoided.

In brazing, toxic fumes may be produced from the metals in the brazing rod, and a severe hazard may arise if brazing rods containing cadmium are used. In this event particular care must be taken to avoid inhalation of fumes and expert advice may be required.

SPECIAL PRECAUTIONS MUST BE TAKEN BEFORE ANY WELDING OR CUTTING TAKES PLACE ON VESSELS WHICH HAVE CONTAINED COMBUSTIBLE MATERIALS, FOR EXAMPLE BOILING OR STEAMING OUT OF FUEL TANKS.

Warning Symbols on Vehicles

Decals showing warning symbols will be found on various vehicle components.

These decals must not be removed. The warnings are for the attention of owners/operators and persons carrying out service or repair operations on the vehicle.

General Information - Solvents, Sealants and Adhesives

Description and Operation

Solvents



WARNING: Always handle all solvents, sealers and adhesives with extreme care. Some contain chemicals or give off fumes which can be dangerous to health. Always follow the manufacturers instructions. If in doubt about any substance, particularly a solvent, DO NOT use it.



CAUTION: If in doubt about the suitability of any proprietary solvent or sealer for a particular application, contact the manufacturer of the product for information.

The Health and Safety Precautions subsection refers to some commonly used chemicals and materials, hazards associated with their use, and safety measures to be taken. Some of these chemicals may be included as an ingredient in a sealer or adhesive.

Sealers

Certain procedures in this manual involve the use of sealants during installation of components. Where a sealant is required, the application, together with the Land Rover part number is given in the General Specification at the start of each section and an instruction that a sealant must be used appears in the relevant repair procedure.

It is essential that the sealant(s) specified for a particular procedure are used, DO NOT use any other sealant.

Always remove traces of old sealant using a plastic scraper or suitable solvent, never use emery cloth or metal scrapers.

Adhesives

Whenever a procedure involves the use of an adhesive, the adhesive specified must be used and the manufacturer's instructions regarding application together with any health and safety precautions must be followed.

General Information - Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions

Description and Operation

WARNINGS:



Fuel may not give adequate warning before toxic or harmful effects arise.



Exposure to fuel can be harmful and can cause severe health damage or death.



Extreme care must be exercised when handling hot fluids. Always wash off spilled fluids from affected areas of skin immediately.



Highly flammable mixtures are always present and may ignite when working on fuel systems. Do not allow naked flames, sparks or lighted substances to come near fuel related components.



Fuel must not be used as a cleaning agent.



Keep fuel containers tightly closed, out of direct sunlight and in a cool area. Keep away from heat sources, ignition sources and oxidizing agents.



SKIN CONTACT: Excessive or prolonged skin contact with diesel fuel may cause serious skin disorders including skin cancer.



SKIN CONTACT: Fuel is mildly irritating to the skin and may cause dermatitis due to defatting effect. Remove contaminated clothing. Wash affected areas of skin with soap and water. Seek medical attention for any persistent skin irritation or abnormality. Wash contaminated clothing before reuse.



EYE CONTACT: Fuel is mildly irritating to the eyes. Flush with plenty of running water, blinking as often as possible. Do not force the eyelid open. Seek medical attention for any persistent eye irritation or abnormality.



SWALLOWED: Fuel is moderately toxic and tends to foam on vomiting. If drawn into the lungs, inflammation may develop. Do not induce vomiting. If spontaneous vomiting occurs place the victim in a forward position to reduce the risk of fuel being drawn into the lungs. Give nothing by mouth. If breathing but unconscious, place in the recovery position. If breathing has stopped, apply artificial respiration. Seek immediate medical attention.



INHALED: Fuel is toxic to the respiratory and other body systems. Exposure may result in various symptoms including drowsiness, unconsciousness or severe health damage. Move a victim to fresh air. Keep a victim warm and at rest. If unconscious, place in the recovery position. If not breathing, apply artificial respiration. Give cardiac massage if necessary. Seek immediate medical attention.

CAUTIONS:



Fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is essential that absolute cleanliness is observed when working with these components.



Make sure that the workshop area in which the vehicle is being worked on is as clean and as dust free as possible.

General Information - Road/Roller Testing

Description and Operation

Road or rolling road testing may be carried out for various reasons and a procedure detailing pre-test checks, through engine starting and stopping, pre-driving checks, on-test checks to final checks on completion of the test are given.

Unless complete vehicle performance is being checked, the full road test procedure need not be carried out. Instead, those items particularly relevant to the system(s) being checked can be extracted.

Pre-Test Checks



WARNING: If the brake system hydraulic fluid level is low, pedal travel is excessive or a hydraulic leak is found, do not attempt to road test the vehicle until the reason for the low fluid level, excessive pedal travel or hydraulic leak is found and rectified.

It is suggested that pre-test and functional tests of those systems/circuits which affect the safe and legal operations of the vehicle, such as brakes, lights and steering, should always be carried out before the road or rolling road test.

Engine oil level

Engine coolant level

Tires, for correct pressure, compatible types and tread patterns, and wear within limits.

There is sufficient fuel in the tank to complete the test.

Check all around the engine, transmission and under the vehicle for oil, coolant, hydraulic and fuel leaks.

Make a note of any apparent leaks and wipe off the surrounding areas to make it easier to identify the extent of the leak on completion of the test.

Starting the Engine



NOTE: On initial drive away from cold and within the first 1.5 km (1 mile), do not depress accelerator pedal beyond half travel until the vehicle has attained a minimum speed of 25 km/h (15 miles/h). Never operate at high engine speed or with the accelerator pedal at full travel whilst the engine is cold.

With the ignition switched off, check:

The parking brake is applied.

Manual gearbox: The gear lever is in neutral.

Automatic gearbox: The selector lever is in 'P' - Park

Transfer box: 'H' - High is selected

All instrument gauges read zero.

With the ignition switched on, check:

Ignition controlled warning lights come on.

Engine temperature gauge registers a reading compatible with the engine temperature.

Fuel gauge registers a reading appropriate to the fuel level in the tank.

The operation of the parking brake warning light and fluid level warning indicator light.

On Road Test Check:



CAUTION: At commencement of road testing, check the brake operation while still travelling at low speed before continuing with the test. If the brakes pull to one side, or appear to be otherwise faulty, do not continue with the road test until the fault has been found and rectified.

Manual gearbox: Clutch pedal operation is not stiff or heavy.

Manual gearbox: Initial gear engagement is smooth and there is no evidence of clutch drag.

The parking brake releases completely.

Manual gearbox: Clutch takes up the drive smoothly, without slip or judder.

Gear changing is smooth, and there are no abnormal noises or vibrations from the gearbox.

The engine power output is satisfactory, acceleration is smooth and accelerator pedal operation is not stiff or heavy, and engine speed returns to idle correctly.

There is no excessive or abnormally colored smoke from the engine under normal driving, heavy load or overrun conditions.

Steering operation is smooth, accurate, not excessively heavy or with excessive free play or vibration.

Does not pull to one side and self centres smoothly after cornering.

All instruments register the correct readings and operate correctly.

Switches and controls operate smoothly and positively, warning or indicator lights operate correctly and the direction indicator control self cancels when the steering is returned to the straight ahead position.

Heating and ventilation systems work correctly and effectively.

Brakes operate efficiently.

Brake Testing

Avoid brake testing on busy roads where it can cause inconvenience or danger to other road users.



CAUTION: Brake testing which includes heavy brake applications should not be carried out with new brake pads/discs until the components have bedded-in. New brake friction components will not reach full efficiency until the bedding-in process is complete. Note that when new parking brake shoes or rear brake discs have been fitted, it is essential that the 'bedding-in' procedure given in Section 206-05 - Parking Brake Removal and Installation is carried out.

Test the brakes at several speeds within the normal operating range using both light and heavy pedal pressure. Note any tendency to snatch, pull or drag, and any undue delay in application or release.

Allow the vehicle to coast and note any tendency to pull to one side, or evidence that the brakes are binding.

After stopping the vehicle (not immediately after a period of heavy braking), carefully check the brake temperature. A disc which feels appreciably hotter than the others, could indicate that the pads on that disc are binding.

After completion of the test, check for:

Oil, coolant, hydraulic, air and fuel leaks.

Abnormal temperature of any moving components or assemblies, e.g. wheel hubs, transmission etc., which might indicate over tightness or lack of lubrication.

Rolling Road Testing

Four-Wheel Rolling Road



WARNING: Do not operate the footbrake or parking brake whilst the rollers are driving the road wheels. Ensure that once disconnected, propeller shafts are properly secured and clear of all moving components.

Provided that front and rear rollers are rotating at identical speeds and that normal workshop safety standards are applied, there is no speed restriction during testing except any that may apply to the tires.

Ensure that the parking brake is released prior to engaging roller driving mechanism.

Two-Wheel Rolling Road



CAUTION: On no account should an attempt be made to carry out any form of testing on a two-wheel rolling road.

Two-wheel rolling road testing must not be performed on this vehicle.

General Information - Special Tool Glossary

Description and Operation

Service Tools

Special service tools have been developed to facilitate removal, dismantling and assembly of mechanical components in a cost effective and time efficient manner. The use of such special tools also helps prevent the potential for damage to components.

Some operations described in this manual cannot be carried out properly without the aid of the relevant service tools.

See the following list for regional special tool points of contact:

Europe and European countries not in the following list.

Tel: 0049 (0) 6182 959 497

Fax: 0049 (0) 6182 959 226

e-mail: CSS2@bosch-automotive.com

Non-European Export

Tel: 0049 (0) 6182 959 491

Fax: 0049 (0) 6182 959 246

e-mail: CSS4@bosch-automotive.com

Overseas orders for the following countries should be placed with the local distributor.

United Kingdom

Tel: 0044 (0)1327 303400

Fax: 0044 (0)1327 303499

e-mail: CSS.UK@bosch-automotive.com

Scandinavia and the Baltics

Tel: 0049 (0) 6182 959 495

Fax: 0049 (0) 6182 959 228

e-mail: CSS5@bosch-automotive.com

Spain and Portugal

Tel: 0034 949 208329

Fax: 0034 949 208327

e-mail: CSS.iberica@bosch-automotive.com

North America

Tel: 001 866 628 5508

Fax: 001 800 578 7375 or 001 586 578 7375

Australia

Tel: 0061 3 9544 6222

Fax: 0061 3 9544 5222

e-mail: customerservice.au@service-solutions.com

Japan and East Asia

Tel: 0081 3 5436 3615

Fax: 0081 3 5436 3622

e-mail: jp.customerservices@service-solutions.com

Italy

Tel: 0039 0521 338170

Fax: 0039 0521 837370

e-mail: CSS.Italy@bosch-automotive.com

Belgium, Netherlands and Luxembourg

Tel: 0031 4645 72716

Fax: 0031 4645 72711

e-mail: CSS.Benelux@bosch-automotive.com

China

Tel: 0086 21 2218 2668

Fax: 0086 21 2218 2677

e-mail: karen.zhai@cn-bosch.com

India

Tel: 0091 20 6725 4823

Fax: 0091 96 2393 1332

e-mail: semi.singh@in.bosch.com

Mexico - LAM Region

Tel: 0052 55 2595 1630

Fax: 0052 55 2595 1639

e-mail: herramientas@service-solutions.com

Brazil

Tel: 0055 (11) 5853 7487

Fax: 0055 (11) 5853 7489

e-mail: ferramentas@service-solutions.com

France

Tel: 0033 2 52 84 00 40

Fax: 0033 2 43 60 43 62

e-mail: css-france@bosch-automotive.com

Korea

Tel: 0082 31 457 9520

Fax: 0082 31 427 9522

e-mail: sungmin.kim@kr.bosch.com / hongyoung.choi@kr.bosch.com

General Information - Diagnostic Trouble Code (DTC) Index DTC: Air Suspension Control Module

Description and Operation

Air Suspension Control Module

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.












Check DDW for open campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint and carry out the recommendations as required.





The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Air Suspension Control Module. For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.





For additional information, refer to: [Vehicle Dynamic Suspension](#) (204-05 Vehicle Dynamic Suspension, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1A84-55	Car Configuration Data - Not configured	<ul style="list-style-type: none"> Air suspension control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the air suspension control module with the latest level software
C112F-72	Air Spring Valve - Actuator stuck open	<ul style="list-style-type: none"> Corner valve stuck open (fully or partially) Vehicle driven while system in "Tight Tolerance Mode" 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, test the operation of the corner valves (vehicle ride height interface) Using the manufacturer approved diagnostic system, clear "Tight Tolerance Mode"
C1130-66	Air Spring Air Supply - Signal has too many transitions/events	<ul style="list-style-type: none"> Air spring or pipe air leak Corner valve stuck open (fully or partially) Vehicle driven while system in "Tight Tolerance Mode" 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and test the air suspension system for air leaks Using the manufacturer approved diagnostic system, test the operation of the corner valves (vehicle ride height interface) Using the manufacturer approved diagnostic system, clear "Tight Tolerance Mode"
C1130-7A	Air Spring Air Supply - Fluid	<ul style="list-style-type: none"> Air spring or pipe air leak Suspension air supply 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and test the air suspension system








	leak or seal failure	<ul style="list-style-type: none"> unit failure Height sensor signal failure 	<ul style="list-style-type: none"> for air leaks Using the manufacturer approved diagnostic system, check for suspension air supply unit related DTCs Using the manufacturer approved diagnostic system, check for height sensor related DTCs
C1131-92	Air Supply - Performance or incorrect operation	<ul style="list-style-type: none"> Air spring or pipe air leak Suspension air supply unit failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and test the air suspension system for air leaks Using the manufacturer approved diagnostic system, check for suspension air supply unit related DTCs
C1A01-19	LED - Circuit current above threshold	 <p>NOTE: Circuit reference LED_NEG</p> <ul style="list-style-type: none"> Suspension status LED ground circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the suspension status LED ground circuit for short circuit to power
C1A03-1C	Left Front Height Sensor - Circuit voltage out of range	<ul style="list-style-type: none"> Front left height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance Front left height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Left Front Height Sensor (0x3B70). Refer to the electrical circuit diagrams and check the front left height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Install a new front left height sensor
C1A03-26	Left Front Height Sensor - Signal rate of change below threshold	<ul style="list-style-type: none"> Front left height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance Front left height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Left Front Height Sensor (0x3B70). Refer to the electrical circuit diagrams and check the front left height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Install a new front left height sensor
C1A03-27	Left Front Height Sensor - Signal rate of change above threshold	<ul style="list-style-type: none"> Front left height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance Front left height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Left Front Height Sensor (0x3B70). Refer to the electrical circuit diagrams and check the front left height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Install a new front left height sensor
C1A03-29	Left Front Height Sensor - Signal invalid	<ul style="list-style-type: none"> Incorrect height calibration process 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, calibrate the vehicle ride height
C1A03-78	Left Front Height Sensor - Alignment or adjustment incorrect	<ul style="list-style-type: none"> Front left height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance Front left height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Left Front Height Sensor (0x3B70). Refer to the electrical circuit diagrams and check the front left height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance









			<ul style="list-style-type: none"> Install a new front left height sensor
C1A03-92	Left Front Height Sensor - Performance or incorrect operation	<ul style="list-style-type: none"> Front left air spring leaking Front axle valve block pipes connected incorrectly Gallery pipe blocked/damaged/crushed Front left air spring pipe blocked/damaged/crushed Front left corner valve stuck closed (mechanically) Reservoir valve stuck open (mechanically) 	<ul style="list-style-type: none"> Check the front left air spring for leaks Check the front axle valve block pipes for correct installation Check the gallery pipe for blockages/damage/crushing Check the front left air spring pipe for blockages/damage/crushing Using the manufacturer approved diagnostic system, test the operation of the front left corner valve (vehicle ride height interface) Using the manufacturer approved diagnostic system, test the operation of the reservoir valve (vehicle ride height interface)
C1A04-1C	Right Front Height Sensor - Circuit voltage out of range	<ul style="list-style-type: none"> Front right height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance Front right height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Right Front Height Sensor (0x3B71). Refer to the electrical circuit diagrams and check the front right height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Install a new front right height sensor
C1A04-26	Right Front Height Sensor - Signal rate of change below threshold	<ul style="list-style-type: none"> Front right height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance Front right height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Right Front Height Sensor (0x3B71). Refer to the electrical circuit diagrams and check the front right height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Install a new front right height sensor
C1A04-27	Right Front Height Sensor - Signal rate of change above threshold	<ul style="list-style-type: none"> Front right height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance Front right height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Right Front Height Sensor (0x3B71). Refer to the electrical circuit diagrams and check the front right height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Install a new front right height sensor
C1A04-29	Right Front Height Sensor - Signal invalid	<ul style="list-style-type: none"> Incorrect height calibration process 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, calibrate the vehicle ride height
C1A04-78	Right Front Height Sensor - Alignment or adjustment incorrect	<ul style="list-style-type: none"> Front right height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance Front right height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Right Front Height Sensor (0x3B71). Refer to the electrical circuit diagrams and check the front right height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Install a new front right height sensor
C1A04-92	Right Front Height Sensor - Performance or	<ul style="list-style-type: none"> Front right air spring leaking Front axle valve block 	<ul style="list-style-type: none"> Check the front right air spring for leaks Check the front axle valve block pipes for correct installation







	incorrect operation	<p>pipes connected incorrectly</p> <ul style="list-style-type: none"> • Gallery pipe blocked/damaged/crushed • Front right air spring pipe blocked/damaged/crushed • Front right corner valve stuck closed (mechanically) • Reservoir valve stuck open (mechanically) 	<ul style="list-style-type: none"> • Check the gallery pipe for blockages/damage/crushing • Check the front right air spring pipe for blockages/damage/crushing • Using the manufacturer approved diagnostic system, test the operation of the front right corner valve (vehicle ride height interface) • Using the manufacturer approved diagnostic system, test the operation of the reservoir valve (vehicle ride height interface)
C1A05-1C	Left Rear Height Sensor - Circuit voltage out of range	<ul style="list-style-type: none"> • Rear left height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance • Rear left height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Left Rear Height Sensor (0x3B72). Refer to the electrical circuit diagrams and check the rear left height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance • Install a new rear left height sensor
C1A05-26	Left Rear Height Sensor - Signal rate of change below threshold	<ul style="list-style-type: none"> • Rear left height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance • Rear left height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Left Rear Height Sensor (0x3B72). Refer to the electrical circuit diagrams and check the rear left height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance • Install a new rear left height sensor
C1A05-27	Left Rear Height Sensor - Signal rate of change above threshold	<ul style="list-style-type: none"> • Rear left height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance • Rear left height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Left Rear Height Sensor (0x3B72). Refer to the electrical circuit diagrams and check the rear left height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance • Install a new rear left height sensor
C1A05-29	Left Rear Height Sensor - Signal invalid	<ul style="list-style-type: none"> • Incorrect height calibration process 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, calibrate the vehicle ride height
C1A05-78	Left Rear Height Sensor - Alignment or adjustment incorrect	<ul style="list-style-type: none"> • Rear left height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance • Rear left height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Left Rear Height Sensor (0x3B72). Refer to the electrical circuit diagrams and check the rear left height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance • Install a new rear left height sensor
C1A05-92	Left Rear Height Sensor - Performance or incorrect operation	<ul style="list-style-type: none"> • Rear left air spring leaking • Rear axle valve block pipes connected incorrectly • Gallery pipe blocked/damaged/crushed • Rear left air spring pipe 	<ul style="list-style-type: none"> • Check the rear left air spring for leaks • Check the rear axle valve block pipes for correct installation • Check the gallery pipe for blockages/damage/crushing • Check the rear left air spring pipe for blockages/damage/crushing • Using the manufacturer approved diagnostic

		<ul style="list-style-type: none"> blocked/damaged/crushed Rear left corner valve stuck closed (mechanically) Reservoir valve stuck open (mechanically) 	<ul style="list-style-type: none"> system, test the operation of the rear left corner valve (vehicle ride height interface) Using the manufacturer approved diagnostic system, test the operation of the reservoir valve (vehicle ride height interface)
C1A06-1C	Right Rear Height Sensor - Circuit voltage out of range	<ul style="list-style-type: none"> Rear right height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance Rear right height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Right Rear Height Sensor (0x3B73). Refer to the electrical circuit diagrams and check the rear right height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Install a new rear right height sensor
C1A06-26	Right Rear Height Sensor - Signal rate of change below threshold	<ul style="list-style-type: none"> Rear right height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance Rear right height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Right Rear Height Sensor (0x3B73). Refer to the electrical circuit diagrams and check the rear right height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Install a new rear right height sensor
C1A06-27	Right Rear Height Sensor - Signal rate of change above threshold	<ul style="list-style-type: none"> Rear right height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance Rear right height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Right Rear Height Sensor (0x3B73). Refer to the electrical circuit diagrams and check the rear right height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Install a new rear right height sensor
C1A06-29	Right Rear Height Sensor - Signal invalid	<ul style="list-style-type: none"> Incorrect height calibration process 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, calibrate the vehicle ride height
C1A06-78	Right Rear Height Sensor - Alignment or adjustment incorrect	<ul style="list-style-type: none"> Rear right height sensor circuits short circuit to ground, short circuit to power, open circuit, high resistance Rear right height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Right Rear Height Sensor (0x3B73). Refer to the electrical circuit diagrams and check the rear right height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Install a new rear right height sensor
C1A06-92	Right Rear Height Sensor - Performance or incorrect operation	<ul style="list-style-type: none"> Rear right air spring leaking Rear axle valve block pipes connected incorrectly Gallery pipe blocked/damaged/crushed Rear right air spring pipe blocked/damaged/crushed Rear right corner valve stuck closed (mechanically) Reservoir valve stuck 	<ul style="list-style-type: none"> Check the rear right air spring for leaks Check the rear axle valve block pipes for correct installation Check the gallery pipe for blockages/damage/crushing Check the rear right air spring pipe for blockages/damage/crushing Using the manufacturer approved diagnostic system, test the operation of the rear right corner valve (vehicle ride height interface) Using the manufacturer approved diagnostic system, test the operation of the reservoir valve (vehicle ride height interface)

		open (mechanically)	
C1A07-62	Cross Articulation - Signal compare failure	<ul style="list-style-type: none"> Incorrect vehicle ride height calibration. For example, height sensor removed and re-installed or renewed without re-calibrating Height sensor circuit(s) short circuit to ground, short circuit to power, open circuit, high resistance Height sensor mechanical failure - Linkage bent/broken 	 <p>NOTE: This DTC may be set by a fault relating to any of the height sensors. It will only set if fault is present and vehicle speed is greater than 55kph (35mph) for more than 25 seconds.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform the Vehicle Ride Height Calibration routine Using the manufacturer approved diagnostic system, check datalogger signals - Left Front Height Sensor (0x3B70) - Right Front Height Sensor (0x3B71) - Left Rear Height Sensor (0x3B72) - Right Rear Height Sensor (0x3B73). Refer to the electrical circuit diagrams and check the height sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Install a new height sensor
C1A08-1C	Pressure Sensor Supply - Circuit voltage out of range	<ul style="list-style-type: none"> Air suspension pressure sensor supply circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the air suspension pressure sensor supply circuit for short circuit to ground
C1A10-64	Pressure Fluctuates When System Inactive - Signal plausibility failure	<ul style="list-style-type: none"> Front axle valve block pipes connected incorrectly Rear axle valve block pipes connected incorrectly Air suspension pipe disconnected while ignition is set to on Corner valve stuck open (mechanically) Air suspension pressure sensor circuit short circuit(s) to ground, short circuit to power, open circuit, high resistance Air suspension pressure sensor fault (calibration drift) Air suspension system air leak 	<ul style="list-style-type: none"> Check the front axle valve block pipes for correct installation Check the rear axle valve block pipes for correct installation Using the manufacturer approved diagnostic system, clear the DTCs and retest Using the manufacturer approved diagnostic system, test the operation of the corner valves (vehicle ride height interface) Refer to the electrical circuit diagrams and check the air suspension pressure sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check datalogger signal - Gallery Pressure (0x3B07) Refer to the relevant section of the workshop manual and test the air suspension system for air leaks
C1A13-64	Pressure Does Not Decrease When Venting Gallery - Signal plausibility failure	<ul style="list-style-type: none"> Exhaust valve stuck closed Gallery pipe blocked/damaged/crushed Air suspension exhaust silencer blocked/restricted 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, test the operation of the exhaust valve (vehicle ride height interface) Check the gallery pipe for blockages/damage/crushing Check the air suspension exhaust silencer for blockages/restrictions
C1A18-64	Pressure Increase Too Rapid When Filling Reservoir - Signal plausibility failure	<ul style="list-style-type: none"> Reservoir valve stuck closed (mechanically) Gallery pipe blocked/damaged/crushed Air reservoir pipe blocked/damaged/crushed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, test the operation of the reservoir valve (vehicle ride height interface) Check the gallery pipe for blockages/damage/crushing Check the air reservoir pipe for blockages/damage/crushing
C1A20-64	Pressure Increase Too Slow When Filling Reservoir - Signal plausibility failure	<ul style="list-style-type: none"> Suspension air supply unit failure Air suspension system air leak Air suspension intake filter blocked/restricted Corner valve stuck open (mechanically) 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, test the operation of the suspension air supply unit (vehicle ride height interface) Refer to the relevant section of the workshop manual and test the air suspension system for air leaks Check the air suspension intake filter for blockages/restrictions Using the manufacturer approved diagnostic system, test the operation of the corner valves (vehicle ride height interface)
C1A24-64	No Temperature Increase When Compressor	 <p>NOTE: Circuit reference COMP_TEMP_SIG /</p>	 <p>NOTE: This DTC is set when the air supply unit is operating but there is no corresponding increase in</p>




	Requested - Signal plausibility failure	<p>COMP_TEMP_GND</p> <ul style="list-style-type: none"> • Suspension air supply unit temperature sensor circuit open circuit • Suspension air supply unit temperature sensor detached from air supply unit • Suspension air supply unit not operating when demanded 	<p>temperature</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the suspension air supply unit temperature sensor circuit for open circuit, high resistance • Check the installation of the suspension air supply unit temperature sensor • Refer to the electrical circuit diagrams and check the suspension air supply unit circuit for open circuit, high resistance
C1A24-67	No Temperature Increase When Compressor Requested - Signal incorrect after event	<p> NOTE: Circuit reference COMP_TEMP_SIG / COMP_TEMP_GND</p> <ul style="list-style-type: none"> • Suspension air supply unit temperature sensor circuit open circuit • Suspension air supply unit temperature sensor detached from air supply unit • Suspension air supply unit not operating when demanded 	<p> NOTE: This DTC is set when the air supply unit is operating but there is no corresponding increase in temperature</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the suspension air supply unit temperature sensor circuit for open circuit, high resistance • Check the installation of the suspension air supply unit temperature sensor • Refer to the electrical circuit diagrams and check the suspension air supply unit circuit for open circuit, high resistance
C1A27-12	Compressor - Circuit short to battery	<p> NOTE: Circuit reference COMP_V</p> <ul style="list-style-type: none"> • Suspension air supply unit relay stuck on • Suspension air supply unit supply circuit short circuit to power 	<ul style="list-style-type: none"> • Check the operation of the suspension air supply unit relay • Refer to the electrical circuit diagrams and check the suspension air supply unit supply circuit for short circuit to power
C1A27-14	Compressor - Circuit short to ground or open	<p> NOTE: Circuit reference COMP_V</p> <ul style="list-style-type: none"> • Suspension air supply unit relay stuck off • Suspension air supply unit supply circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Check the operation of the suspension air supply unit relay • Refer to the electrical circuit diagrams and check the suspension air supply unit supply circuit for short circuit to ground, open circuit, high resistance
C1A27-29	Compressor - Signal invalid	<p> NOTE: Circuit reference COMP_V</p> <ul style="list-style-type: none"> • Suspension air supply unit relay stuck on • Suspension air supply unit supply circuit short circuit to power 	<ul style="list-style-type: none"> • Check the operation of the suspension air supply unit relay • Refer to the electrical circuit diagrams and check the suspension air supply unit supply circuit for short circuit to power
C1A28-64	Wrong Number of LEDs Illuminated - Signal plausibility failure	<p> NOTE: Circuit reference LED_NEG / HIGH_LED / STD_HT_LED / CRAWL_LED / ACCESS_HT_LED / RAISING_LED / LOWERING_LED</p> <ul style="list-style-type: none"> • Suspension status LED circuit(s) short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the suspension status LED circuit(s) for short circuit to ground, short circuit to power, open circuit, high resistance
C1A29-92	Switch Activation Too Long - Performance or incorrect operation	<p> NOTE: Circuit reference LOWER_SW / RAISE_SW</p> <ul style="list-style-type: none"> • Air suspension switchpack raise switch stuck active 	<ul style="list-style-type: none"> • Test the operation of the air suspension switchpack raise switch • Test the operation of the air suspension switchpack lower switch • Refer to the electrical circuit diagrams and check the air suspension switchpack raise





		<ul style="list-style-type: none"> • Air suspension switchpack lower switch stuck active • Air suspension switchpack raise switch circuit short circuit to ground • Air suspension switchpack lower switch circuit short circuit to ground 	<ul style="list-style-type: none"> • switch circuit for short circuit to ground • Refer to the electrical circuit diagrams and check the air suspension switchpack lower switch circuit for short circuit to ground
C1A30-64	Both Switches Pressed At Same Time - Signal plausibility failure	 <p>NOTE: Circuit reference LOWER_SW / RAISE_SW</p> <ul style="list-style-type: none"> • Air suspension switchpack raise switch circuit short circuit to air suspension switchpack lower switch circuit • Air suspension switchpack internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the air suspension switchpack raise switch circuit for short circuit to air suspension switchpack lower switch circuit • Install a new air suspension switchpack
C1A31-01	Left Front Corner Valve - General electrical failure	 <p>NOTE: Circuit reference FL_CV_POS / FL_CV_NEG</p> <ul style="list-style-type: none"> • Front left corner valve circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left corner valve circuit for short circuit to ground, open circuit, high resistance
C1A32-01	Right Front Corner Valve - General electrical failure	 <p>NOTE: Circuit reference FR_CV_POS / FR_CV_NEG</p> <ul style="list-style-type: none"> • Front right corner valve circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right corner valve circuit for short circuit to ground, open circuit, high resistance
C1A33-01	Left Rear Corner Valve - General electrical failure	 <p>NOTE: Circuit reference RL_CV_POS / RL_CV_NEG</p> <ul style="list-style-type: none"> • Rear left corner valve circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left corner valve circuit for short circuit to ground, open circuit, high resistance
C1A34-01	Right Rear Corner Valve - General electrical failure	 <p>NOTE: Circuit reference RR_CV_POS / RR_CV_NEG</p> <ul style="list-style-type: none"> • Rear right corner valve circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear right corner valve circuit for short circuit to ground, open circuit, high resistance
C1A35-01	Reservoir Valve - General electrical failure	 <p>NOTE: Circuit reference RES_V_POS / RES_V_NEG</p> <ul style="list-style-type: none"> • Air reservoir valve circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the air reservoir valve circuit for short circuit to ground, open circuit, high resistance
C1A36-01	Exhaust Valve - General electrical failure	 <p>NOTE: Circuit reference EXH_V_POS / EXH_V_NEG</p> <ul style="list-style-type: none"> • Pilot exhaust valve circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the pilot exhaust valve circuit for short circuit to ground, open circuit, high resistance
C1A37-01	Front Cross-Link Valve - General electrical failure	 <p>NOTE: Circuit reference F_XV_POS / F_XV_NEG</p>	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front axle cross link valve circuit for short circuit to ground, open circuit, high resistance






		<ul style="list-style-type: none"> • Front axle cross link valve circuit short circuit to ground, open circuit, high resistance 	
C1A38-01	Rear Cross-Link Valve - General electrical failure	 <p>NOTE: Circuit reference R_XV_POS / R_XV_NEG</p> <ul style="list-style-type: none"> • Rear axle cross link valve circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear axle cross link valve circuit for short circuit to ground, open circuit, high resistance
C1A68-1C	Left Front Height Sensor Supply - Circuit voltage out of range	<ul style="list-style-type: none"> • Front left height sensor supply circuit short circuit to ground, short circuit to power 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left height sensor supply circuit for short circuit to ground, short circuit to power
C1A69-1C	Right Front Height Sensor Supply - Circuit voltage out of range	<ul style="list-style-type: none"> • Front right height sensor supply circuit short circuit to ground, short circuit to power 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right height sensor supply circuit for short circuit to ground, short circuit to power
C1A70-1C	Left Rear Height Sensor Supply - Circuit voltage out of range	<ul style="list-style-type: none"> • Rear left height sensor supply circuit short circuit to ground, short circuit to power 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left height sensor supply circuit for short circuit to ground, short circuit to power
C1A71-1C	Right Rear Height Sensor Supply - Circuit voltage out of range	<ul style="list-style-type: none"> • Rear right height sensor supply circuit short circuit to ground, short circuit to power 	 <p>NOTE: The vehicle ride height must be calibrated if a new height sensor is installed or any height sensor fixings loosened/tightened</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear right height sensor supply circuit for short circuit to ground, short circuit to power
C1A99-1C	Pressure Sensor - Circuit voltage out of range	 <p>NOTE: Circuit reference PRESSURE_5V / PRESSURE_SIG / PRESSURE_GND</p> <ul style="list-style-type: none"> • Air suspension pressure sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the air suspension pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C1B18-62	Module Power Supplies - Signal compare failure	<ul style="list-style-type: none"> • Air suspension control module supply circuit open circuit, high resistance • Air suspension control module ignition circuit open circuit, high resistance • Air suspension sensor/actuator supply circuit(s) short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the air suspension control module supply circuit for open circuit, high resistance • Refer to the electrical circuit diagrams and check the air suspension control module ignition circuit for open circuit, high resistance • Refer to the electrical circuit diagrams and check the air suspension sensor/actuator supply circuits circuit for short circuit to ground
C1B21-	Compressor		<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and

1C	Brush Card Temperature Sensor - Circuit voltage out of range	 <p>NOTE: Circuit reference MOT_TEMP_SIG / MOT_TEMP_GND</p> <ul style="list-style-type: none"> • Suspension air supply unit temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	check the suspension air supply unit temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0073-88	Control Module Communication Bus 'A' Off - Bus off	<ul style="list-style-type: none"> • High speed CAN bus high circuit short circuit to high speed CAN bus low circuit 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the high speed CAN bus high circuit for short circuit to the high speed CAN bus low circuit
U0100-00	Lost Communication With ECM/PCM "A" - No sub type information	<ul style="list-style-type: none"> • Engine control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Engine system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the engine control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0101-00	Lost Communication With TCM - No sub type information	<ul style="list-style-type: none"> • Transmission control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transmission system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0102-00	Lost Communication With Transfer Case Control Module - No sub type information	<ul style="list-style-type: none"> • Transfer case control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transfer case system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
U0122-00	Lost Communication With Vehicle Dynamics Control Module - No sub type information	<ul style="list-style-type: none"> • Anti-lock brake system control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Anti-lock brake system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0126-00	Lost Communication	<ul style="list-style-type: none"> • Steering angle sensor module power or ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the steering angle sensor module power

	With Steering Angle Sensor Module - No sub type information	<ul style="list-style-type: none"> circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Steering angle sensor system fault 	<ul style="list-style-type: none"> and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
U0128-00	Lost Communication With Park Brake Control Module - No sub type information	<ul style="list-style-type: none"> Electric park brake control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Electric park brake system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the electric park brake control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the electric park brake control module for related DTCs and refer to the relevant DTC index
U0133-00	Lost Communication With Active Roll Control Module - No sub type information	<ul style="list-style-type: none"> Dynamic response control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Dynamic response system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the dynamic response control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the dynamic response control module for related DTCs and refer to the relevant DTC index
U0136-00	Lost Communication With Differential Control Module - Rear - No sub type information	<ul style="list-style-type: none"> Rear differential control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear differential system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear differential control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the rear differential control module for related DTCs and refer to the relevant DTC index
U0138-00	Lost Communication with All Terrain Control Module - No sub type information	<ul style="list-style-type: none"> Terrain response switchpack power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Terrain response system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the terrain response switchpack power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the terrain response switchpack for related DTCs and refer to the relevant DTC index
U0140-00	Lost Communication With Body Control Module - No sub type information	<ul style="list-style-type: none"> Central junction box power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test.

		<p>ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> Central junction box system fault 	<p>Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0300-55	Internal Control Module Software Incompatibility - Not configured	<ul style="list-style-type: none"> Air suspension control module is not configured correctly Instrument cluster is not configured correctly High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the air suspension control module with the latest level software Using the manufacturer approved diagnostic system, re-configure the instrument cluster with the latest level software Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0416-68	Invalid Data Received From Vehicle Dynamics Control Module - Event information	<ul style="list-style-type: none"> Missing/invalid data from the anti-lock brake system control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0417-68	Invalid Data Received From Park Brake Control Module - Event information	<ul style="list-style-type: none"> Missing/invalid data from the electric park brake control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the electric park brake control module for related DTCs and refer to the relevant DTC index
U0428-68	Invalid Data Received From Steering Angle Sensor Module - Event information	<ul style="list-style-type: none"> Missing/invalid data from the steering angle sensor module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
U1A14-49	CAN Initialization failure- Internal electronic failure	<ul style="list-style-type: none"> Air suspension control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new air suspension control module
U2000-67	Motor Temperature - Signal incorrect after event	 <p>NOTE: Circuit reference MOT_TEMP_SIG / MOT_TEMP_GND</p> <ul style="list-style-type: none"> Suspension air supply unit temperature sensor circuit open circuit Suspension air supply unit not operating when demanded 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the suspension air supply unit temperature sensor circuit for open circuit, high resistance Refer to the electrical circuit diagrams and check the suspension air supply unit circuit for open circuit, high resistance
U2007-11	Valve(s) - Circuit short to ground	 <p>NOTE: Circuit reference RES_V_NEG / EXH_V_NEG / FL_CV_NEG / FR_CV_NEG / RL_CV_NEG / RR_CV_NEG / F_XV_NEG / R_XV_NEG</p> <ul style="list-style-type: none"> Air reservoir valve circuit short circuit to ground Pilot exhaust valve circuit short circuit to ground Corner valve circuit short circuit to ground Axle cross link valve circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the air reservoir valve circuit for short circuit to ground Refer to the electrical circuit diagrams and check the pilot exhaust valve circuit for short circuit to ground Refer to the electrical circuit diagrams and check the corner valve circuits for short circuit to ground Refer to the electrical circuit diagrams and check the axle cross link valve circuits for short circuit to ground
U2007-67	Valve(s) - Signal incorrect after event	 <p>NOTE: Circuit reference RES_V_POS / EXH_V_POS / FL_CV_POS / FR_CV_POS / RL_CV_POS / RR_CV_POS / F_XV_POS / R_XV_POS</p> <ul style="list-style-type: none"> Air reservoir valve circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the air reservoir valve circuit for short circuit to ground, short circuit to power Refer to the electrical circuit diagrams and check the pilot exhaust valve circuit for short circuit to ground, short circuit to power Refer to the electrical circuit diagrams and check the corner valve circuits for short

		<p>short circuit to ground, short circuit to power</p> <ul style="list-style-type: none"> • Pilot exhaust valve circuit short circuit to ground, short circuit to power • Corner valve circuit short circuit to ground, short circuit to power • Axle cross link valve circuit short circuit to ground, short circuit to power 	<p>circuit to ground, short circuit to power</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the axle cross link valve circuits for short circuit to ground, short circuit to power
U210A-16	Temperature Sensor - Circuit voltage below threshold	 <p>NOTE: Circuit reference COMP_TEMP_SIG / COMP_TEMP_GND</p> <ul style="list-style-type: none"> • Suspension air supply unit temperature sensor circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the suspension air supply unit temperature sensor circuit for short circuit to ground
U3000-05	Control Module - System programming failures	<ul style="list-style-type: none"> • Air suspension control module has been set in "Tight Tolerance" mode 	 <p>NOTE: This DTC is for information only.</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear "Tight Tolerance" mode
U3000-1C	Control Module - Circuit voltage out of range	 <p>NOTE: Circuit reference VBATT / GROUND / RES_V_NEG / EXH_V_NEG / FL_CV_NEG / FR_CV_NEG / RL_CV_NEG / RR_CV_NEG / F_XV_NEG / R_XV_NEG</p> <ul style="list-style-type: none"> • Air suspension control module power or ground circuit open circuit, high resistance • Battery/charging system fault • Air reservoir valve circuit short circuit to ground • Pilot exhaust valve circuit short circuit to ground • Corner valve circuit short circuit to ground • Axle cross link valve circuit short circuit to ground 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the electrical circuit diagrams and check the air suspension control module power and ground circuits for open circuit, high resistance • Refer to the relevant section of the workshop manual and test the battery and charging system • Refer to the electrical circuit diagrams and check the air reservoir valve circuit for short circuit to ground • Refer to the electrical circuit diagrams and check the pilot exhaust valve circuit for short circuit to ground • Refer to the electrical circuit diagrams and check the corner valve circuits for short circuit to ground • Refer to the electrical circuit diagrams and check the axle cross link valve circuits for short circuit to ground
U3000-1D	Control Module - Circuit current out of range	 <p>NOTE: Circuit reference RES_V_POS / EXH_V_POS / FL_CV_POS / FR_CV_POS / RL_CV_POS / RR_CV_POS / F_XV_POS / R_XV_POS</p> <ul style="list-style-type: none"> • Air reservoir valve circuit short circuit to ground, open circuit, high resistance • Pilot exhaust valve circuit short circuit to ground, open circuit, high resistance • Corner valve circuit short circuit to ground, open circuit, high resistance • Axle cross link valve circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the air reservoir valve circuit for short circuit to ground, open circuit, high resistance • Refer to the electrical circuit diagrams and check the pilot exhaust valve circuit for short circuit to ground, open circuit, high resistance • Refer to the electrical circuit diagrams and check the corner valve circuits for short circuit to ground, open circuit, high resistance • Refer to the electrical circuit diagrams and check the axle cross link valve circuits for short circuit to ground, open circuit, high resistance
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> • Air suspension control module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new air suspension control

			module
U3000-52	Control Module - Not activated	<ul style="list-style-type: none"> Air suspension control module set to "Manufacturing Mode" 	 <p>NOTE: This DTC is for information only.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear "Manufacturing Mode"
U3000-53	Control Module - Deactivated	<ul style="list-style-type: none"> Air Suspension Deflation (0x3004) routine has been performed 	 <p>NOTE: This DTC is for information only.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform routine - Air Suspension Deflation (0x3004)
U3000-54	Control Module - Missing calibration	<ul style="list-style-type: none"> Vehicle Ride Height Calibration routine not completed 	 <p>NOTE: This DTC is for information only.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform the Vehicle Ride Height Calibration routine
U3000-55	Control Module - Not configured	<ul style="list-style-type: none"> Vehicle Ride Height Calibration routine in progress 	 <p>NOTE: This DTC is for information only.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform the Vehicle Ride Height Calibration routine
U3002-62	Vehicle Identification Number - Signal compare failure	<ul style="list-style-type: none"> Air suspension control module previously installed on another vehicle New instrument cluster installed and not configured correctly 	<ul style="list-style-type: none"> Install the original or a new air suspension control module as necessary. Using the manufacturer approved diagnostic system, perform the Vehicle Ride Height Calibration routine Using the manufacturer approved diagnostic system, re-configure the instrument cluster with the latest level software
U300D-01	Ignition Input On/Start - General electrical failure	 <p>NOTE: Circuit reference IGN</p> <ul style="list-style-type: none"> Ignition signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the ignition signal circuit for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Anti-Lock Brake System Control Module (ABS)

Description and Operation

Anti-Lock Braking System (ABS)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.
















Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.







The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Anti-Lock Braking System (ABS). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.







For additional information, refer to: [Anti-Lock Control - Traction Control](#) (206-09A Anti-Lock Control - Traction Control, Diagnosis and Testing).




DTC	Description	Possible Causes	Action
C0030-38	Left Front Tone Wheel - Signal frequency incorrect	<ul style="list-style-type: none"> Front left wheel speed sensor reluctor ring damaged Front left wheel bearing failure Front left wheel/tire size incorrect 	<p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Check the integrity of the front left wheel speed sensor reluctor ring Check the front left wheel bearing Check that the wheels and tires comply with the manufacturer's specification for the vehicle. Check the front left wheel and tire for condition and balance. Check and tighten the wheel nuts
C0031-14	Left Front Wheel Speed Sensor - Circuit short to ground or open	<ul style="list-style-type: none"> Front left wheel speed sensor signal circuit short circuit to ground, open circuit, high resistance 	<p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left wheel speed sensor signal circuit for short

			<p>circuit to ground, open circuit, high resistance. Using the manufacturer approved diagnostic system, check datalogger signal - Left Front Wheel Speed Sensor Input (0x2B06)</p>
C0031-25	Left Front Wheel Speed Sensor - Signal shape/waveform failure	<ul style="list-style-type: none"> Front left wheel speed sensor signal circuit short circuit to ground 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left wheel speed sensor signal circuit for short circuit to ground
C0031-2F	Left Front Wheel Speed Sensor - Signal erratic	<ul style="list-style-type: none"> Front left wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C0031-31	Left Front Wheel Speed Sensor - No signal	<ul style="list-style-type: none"> Front left wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C0031-62	Left Front Wheel Speed Sensor - Signal compare failure	<ul style="list-style-type: none"> Front left wheel speed sensor power circuit short circuit to ground, short circuit to power, open circuit, high resistance Front left wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left wheel speed sensor power circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the front left wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C0031-64	Left Front Wheel Speed Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Front left wheel speed sensor power circuit short circuit to ground, short circuit to power, open circuit, high resistance Front left wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left wheel speed sensor power circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the front left wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C0033-38	Right Front Tone Wheel - Signal frequency incorrect	<ul style="list-style-type: none"> Front right wheel speed sensor reluctor ring damaged Front right wheel bearing failure Front right wheel/tire size incorrect 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Check the integrity of the front right wheel speed sensor reluctor ring Check the front right wheel bearing Check that the wheels and tires comply with the manufacturer's specification for the vehicle. Check the front right wheel and tire for condition and balance.





			Check and tighten the wheel nuts
C0034-14	Right Front Wheel Speed Sensor - Circuit short to ground or open	<ul style="list-style-type: none"> Front right wheel speed sensor signal circuit short circuit to ground, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right wheel speed sensor signal circuit for short circuit to ground, open circuit, high resistance. Using the manufacturer approved diagnostic system, check datalogger signal - Right Front Wheel Speed Sensor Input (0x2B07)
C0034-25	Right Front Wheel Speed Sensor - Signal shape/waveform failure	<ul style="list-style-type: none"> Front right wheel speed sensor signal circuit short circuit to ground 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right wheel speed sensor signal circuit for short circuit to ground
C0034-2F	Right Front Wheel Speed Sensor - Signal erratic	<ul style="list-style-type: none"> Front right wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C0034-31	Right Front Wheel Speed Sensor - No signal	<ul style="list-style-type: none"> Front right wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C0034-62	Right Front Wheel Speed Sensor - Signal compare failure	<ul style="list-style-type: none"> Front right wheel speed sensor power circuit short circuit to ground, short circuit to power, open circuit, high resistance Front right wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right wheel speed sensor power circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the front right wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C0034-64	Right Front Wheel Speed Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Front right wheel speed sensor power circuit short circuit to ground, short circuit to power, open circuit, high resistance Front right wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right wheel speed sensor power circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the front right wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C0036-38	Left Rear Tone Wheel - Signal	<ul style="list-style-type: none"> Rear left wheel speed sensor 	 <p>NOTE: After clearing the DTCs, the warning indicator(s)</p>




	frequency incorrect	<ul style="list-style-type: none"> reluctor ring damaged Rear left wheel bearing failure Rear left wheel/tire size incorrect 	<p>may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Check the integrity of the rear left wheel speed sensor reluctor ring Check the rear left wheel bearing Check that the wheels and tires comply with the manufacturer's specification for the vehicle. Check the rear left wheel and tire for condition and balance. Check and tighten the wheel nuts
C0037-14	Left Rear Wheel Speed Sensor - Circuit short to ground or open	<ul style="list-style-type: none"> Rear left wheel speed sensor signal circuit short circuit to ground, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left wheel speed sensor signal circuit for short circuit to ground, open circuit, high resistance. Using the manufacturer approved diagnostic system, check datalogger signal - Left Rear Wheel Speed Sensor Input (0x2B08)
C0037-25	Left Rear Wheel Speed Sensor - Signal shape/waveform failure	<ul style="list-style-type: none"> Rear left wheel speed sensor signal circuit short circuit to ground 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left wheel speed sensor signal circuit for short circuit to ground
C0037-2F	Left Rear Wheel Speed Sensor - Signal erratic	<ul style="list-style-type: none"> Rear left wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C0037-31	Left Rear Wheel Speed Sensor - No signal	<ul style="list-style-type: none"> Rear left wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C0037-62	Left Rear Wheel Speed Sensor - Signal compare failure	<ul style="list-style-type: none"> Rear left wheel speed sensor power circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear left wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left wheel speed sensor power circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the rear left wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C0037-64	Left Rear Wheel Speed Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Rear left wheel speed sensor power circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear left wheel speed sensor 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left wheel speed sensor power circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the







		signal circuit short circuit to ground, short circuit to power, open circuit, high resistance	rear left wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C0039-38	Right Rear Tone Wheel - Signal frequency incorrect	<ul style="list-style-type: none"> Rear right wheel speed sensor reluctor ring damaged Rear right wheel bearing failure Rear right wheel/tire size incorrect 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Check the integrity of the rear right wheel speed sensor reluctor ring Check the rear right wheel bearing Check that the wheels and tires comply with the manufacturer's specification for the vehicle. Check the rear right wheel and tire for condition and balance. Check and tighten the wheel nuts
C003A-14	Right Rear Wheel Speed Sensor - Circuit short to ground or open	<ul style="list-style-type: none"> Rear right wheel speed sensor signal circuit short circuit to ground, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right wheel speed sensor signal circuit for short circuit to ground, open circuit, high resistance. Using the manufacturer approved diagnostic system, check datalogger signal - Right Rear Wheel Speed Sensor Input (0x2B09)
C003A-25	Right Rear Wheel Speed Sensor - Signal shape/waveform failure	<ul style="list-style-type: none"> Rear right wheel speed sensor signal circuit short circuit to ground 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right wheel speed sensor signal circuit for short circuit to ground
C003A-2F	Right Rear Wheel Speed Sensor - Signal erratic	<ul style="list-style-type: none"> Rear right wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C003A-31	Right Rear Wheel Speed Sensor - No signal	<ul style="list-style-type: none"> Rear right wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C003A-62	Right Rear Wheel Speed Sensor - Signal compare failure	<ul style="list-style-type: none"> Rear right wheel speed sensor power circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear right wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right wheel speed sensor power circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the rear right wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C003A-	Right Rear Wheel	<ul style="list-style-type: none"> Rear right wheel 	

64	Speed Sensor - Signal plausibility failure	<p>speed sensor power circuit short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> Rear right wheel speed sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right wheel speed sensor power circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the rear right wheel speed sensor signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C0051-28	Steering Wheel Position Sensor - Signal bias level out of range / zero adjustment failure	<ul style="list-style-type: none"> Incorrect steering angle sensor module installed Front wheel speed sensor circuits transposed Rear wheel speed sensor circuits transposed Missing/invalid data from the steering angle sensor module 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Check that the correct steering angle sensor module is installed Refer to the electrical circuit diagrams and check the front wheel speed sensor circuits for correct connection to the anti-lock brake system control module Refer to the electrical circuit diagrams and check the rear wheel speed sensor circuits for correct connection to the anti-lock brake system control module Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
C0051-67	Steering Wheel Position Sensor - Signal incorrect after event	<ul style="list-style-type: none"> Missing/invalid data from the steering angle sensor module Anti-lock brake system control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
C0062-28	Longitudinal Acceleration Sensor - Signal bias level out of range / zero adjustment failure	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor incorrectly installed Yaw rate lateral acceleration sensor internal failure 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Check the installation of the yaw rate lateral acceleration sensor Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F)
C0062-54	Longitudinal Acceleration Sensor - Missing calibration	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor incorrectly installed Yaw rate lateral acceleration sensor not calibrated 	<ul style="list-style-type: none"> Check the installation of the yaw rate lateral acceleration sensor Using the manufacturer approved diagnostic system, perform routine - Calibrate Acceleration Sensor(s) (0x300F)
C0062-64	Longitudinal Acceleration Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Anti-lock brake system control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
C0063-14	Yaw Rate Sensor - Circuit short to ground or open	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor power or ground circuit open circuit, high resistance Private high speed CAN bus circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the yaw rate lateral acceleration sensor power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the private high speed CAN bus circuit for short circuit to ground, open circuit, high resistance


		<ul style="list-style-type: none"> short circuit to ground, open circuit, high resistance Yaw rate lateral acceleration sensor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F)
C0063-1C	Yaw Rate Sensor - Circuit voltage out of range	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor power or ground circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the yaw rate lateral acceleration sensor power and ground circuits for open circuit, high resistance
C0063-27	Yaw Rate Sensor - Signal rate of change above threshold	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor power or ground circuit open circuit, high resistance Private high speed CAN bus circuit short circuit to ground, open circuit, high resistance Yaw rate lateral acceleration sensor incorrectly installed Yaw rate lateral acceleration sensor internal failure Anti-lock brake system control module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the yaw rate lateral acceleration sensor power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the private high speed CAN bus circuit for short circuit to ground, open circuit, high resistance Check the installation of the yaw rate lateral acceleration sensor Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F) Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
C0063-28	Yaw Rate Sensor - Signal bias level out of range / zero adjustment failure	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor incorrectly installed Yaw rate lateral acceleration sensor internal failure 	<ul style="list-style-type: none"> Check the installation of the yaw rate lateral acceleration sensor Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F)
C0063-41	Yaw Rate Sensor - General checksum failure	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor internal failure Anti-lock brake system control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F) Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
C0063-49	Yaw Rate Sensor - Internal electronic failure	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F)
C0063-4A	Yaw Rate Sensor - Incorrect component installed	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor internal failure Anti-lock brake system control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F) Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
C0063-64	Yaw Rate Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor incorrectly installed Missing/invalid data from the 	 <p>NOTE: This DTC can be set if the vehicle is being tested on chassis dyno rollers.</p> <ul style="list-style-type: none"> Check the installation of the yaw rate lateral acceleration sensor

		steering angle sensor module <ul style="list-style-type: none"> Yaw rate lateral acceleration sensor internal failure 	Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F)
C0063-86	Yaw Rate Sensor - Signal invalid	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor internal failure Anti-lock brake system control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F) Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
C0063-95	Yaw Rate Sensor - Incorrect assembly	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor internal failure Anti-lock brake system control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F) Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
C0063-96	Yaw Rate Sensor - Component internal failure	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor power or ground circuit open circuit, high resistance Yaw rate lateral acceleration sensor internal failure Anti-lock brake system control module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the yaw rate lateral acceleration sensor power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F). Perform routine - Calibrate Acceleration Sensor(s) (0x300F) Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
C0064-64	Roll Rate Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor incorrectly installed Yaw rate lateral acceleration sensor internal failure 	<ul style="list-style-type: none"> Check the installation of the yaw rate lateral acceleration sensor Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F)
C006A-54	Multi-axis Acceleration Sensor - Missing calibration	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor not calibrated 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform routine - Calibrate Acceleration Sensor(s) (0x300F). If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F)
C0072-4B	Brake Temperature Too High - Over temperature	<ul style="list-style-type: none"> Excessive use of brakes and/or traction control system 	 <p>NOTE: This DTC is for information only.</p> <ul style="list-style-type: none"> Allow the vehicle to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest
C101F-49	Generic Valve Failure - Internal electronic failure	<ul style="list-style-type: none"> Anti-lock brake system hydraulic control unit internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
C1109-24	Vehicle Dynamics Control Switch - Signal stuck high	<ul style="list-style-type: none"> Dynamic stability control switch stuck active Dynamic stability control switch signal circuit short circuit to power 	 <p>NOTE: This DTC may be induced by the driver.</p> <ul style="list-style-type: none"> Test the operation of the dynamic stability control switch Refer to the electrical circuit diagrams and check the dynamic stability control switch signal circuit for short circuit to power
C1A77-16	Valve Relay Supply Circuit -	 <p>NOTE: Circuit</p>	 <p>NOTE: After clearing the DTCs, the warning indicator(s)</p>

	Circuit voltage below threshold	reference UBVR / GND <ul style="list-style-type: none"> Anti-lock brake system hydraulic control unit valve circuit short circuit to ground, open circuit, high resistance 	may not extinguish until the vehicle speed has exceeded 10mph (15kph). <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the anti-lock brake system hydraulic control unit valve circuit for short circuit to ground, open circuit, high resistance
C1A90-12	Wheel Speed Sensor Supply - Circuit short to battery	<ul style="list-style-type: none"> Wheel speed sensor supply circuit(s) short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the wheel speed sensor supply circuits for short circuit to power
C1A95-4A	Wheel Speed Sensor - Incorrect component installed	<ul style="list-style-type: none"> Incorrect wheel speed sensor installed 	<ul style="list-style-type: none"> Install a new wheel speed sensor as necessary
C1A95-64	Wheel Speed Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Wheel speed sensor circuit(s) short circuit to ground, short circuit to power, open circuit, high resistance Wheel speed sensor reluctor ring fault Wheel bearing failure Wheel and/or tire size incorrect 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the wheel speed sensor circuits for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check datalogger signals - Left Front Wheel Speed Sensor Input (0x2B06) - Right Front Wheel Speed Sensor Input (0x2B07) - Left Rear Wheel Speed Sensor Input (0x2B08) - Right Rear Wheel Speed Sensor Input (0x2B09) Check the integrity of the wheel bearings Check that the wheel and tire sizes are correct to the vehicle specification
C1A96-64	Brake Light Switch - Signal plausibility failure	<ul style="list-style-type: none"> Brake pedal switch incorrectly installed Brake pedal switch circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Check the brake pedal switch installation Refer to the electrical circuit diagrams and check the brake pedal switch circuit for short circuit to ground, short circuit to power, open circuit, high resistance
C1A97-24	Lateral Accelerometer - Signal stuck high	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F)
C1A98-2F	Yaw Rate Sensor - Signal erratic	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor signal erratic (for >2 minutes) 	 <p>NOTE: This DTC is for information only.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest
C1A98-96	Yaw Rate Sensor - Component internal failure	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor incorrectly installed Yaw rate lateral acceleration sensor internal failure 	<ul style="list-style-type: none"> Check the installation of the yaw rate lateral acceleration sensor Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new yaw rate lateral acceleration sensor. Perform routine - Calibrate Acceleration Sensor(s) (0x300F)
C1B00-29	Steering Angle Sensor - Signal invalid	<ul style="list-style-type: none"> Missing/invalid data from the steering angle sensor module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
C1B00-49	Steering Angle Sensor - Internal electronic failure	<ul style="list-style-type: none"> Missing/invalid data from the steering angle sensor module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index



C1B00-64	Steering Angle Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Yaw rate lateral acceleration sensor incorrectly installed Missing/invalid data from the steering angle sensor module 	<ul style="list-style-type: none"> Check the installation of the yaw rate lateral acceleration sensor Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
C1B00-92	Steering Angle Sensor - Performance or incorrect operation	<ul style="list-style-type: none"> Missing/invalid data from the steering angle sensor module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
C1B02-16	Return Pump - Circuit voltage below threshold	 <p>NOTE: Circuit reference UBMR / M GND</p> <ul style="list-style-type: none"> Anti-lock brake system hydraulic control unit pump circuit short circuit to ground, open circuit, high resistance 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the anti-lock brake system hydraulic control unit pump circuit for short circuit to ground, open circuit, high resistance
C1B02-49	Return Pump - Internal electronic failure	<ul style="list-style-type: none"> Anti-lock brake system hydraulic control unit internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
C1B22-24	Hill Descent Switch - Signal stuck high	<ul style="list-style-type: none"> Hill descent control switch stuck active Hill descent control switch signal circuit short circuit to power 	 <p>NOTE: This DTC may be induced by the driver.</p> <ul style="list-style-type: none"> Test the operation of the hill descent control switch Refer to the electrical circuit diagrams and check the hill descent control switch signal circuit for short circuit to power
C2009-64	Front Axle Wheel Speed Sensors Swapped - Signal plausibility failure	<ul style="list-style-type: none"> Front wheel speed sensor circuits transposed 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front wheel speed sensor circuits for correct connection to the anti-lock brake system control module
C200A-64	Rear Axle Wheel Speed Sensors Swapped - Signal plausibility failure	<ul style="list-style-type: none"> Rear wheel speed sensor circuits transposed 	 <p>NOTE: After clearing the DTCs, the warning indicator(s) may not extinguish until the vehicle speed has exceeded 10mph (15kph).</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear wheel speed sensor circuits for correct connection to the anti-lock brake system control module
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0074-88	Control Module Communication Bus "B" Off - Bus off	 <p>NOTE: Circuit reference CANM2 / CANP2</p> <ul style="list-style-type: none"> Private CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the private CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance

U0100-00	Lost Communication With ECM/PCM "A" - No sub type information	<ul style="list-style-type: none"> • Engine control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Engine system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the engine control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0101-00	Lost Communication With TCM - No sub type information	<ul style="list-style-type: none"> • Transmission control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transmission system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0102-00	Lost Communication With Transfer Case Control Module - No sub type information	<ul style="list-style-type: none"> • Transfer case control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transfer case system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
U0103-00	Lost Communication With Gear Shift Control Module A - No sub type information	<ul style="list-style-type: none"> • Transmission control switch power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transmission control switch fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transmission control switch power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transmission control switch for related DTCs and refer to the relevant DTC index
U0104-00	Lost Communication With Cruise Control Module - No sub type information	<ul style="list-style-type: none"> • Adaptive speed control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Adaptive speed control system 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the adaptive speed control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the adaptive speed control module for related DTCs and refer to the relevant DTC index

		fault	
U0123-00	Lost Communication With Yaw Rate Sensor Module - No sub type information	 <p>NOTE: Circuit reference CANM2 / CANP2</p> <ul style="list-style-type: none"> Yaw rate lateral acceleration sensor power or ground circuit open circuit, high resistance Private CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the yaw rate lateral acceleration sensor power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the private CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0126-00	Lost Communication With Steering Angle Sensor Module - No sub type information	<ul style="list-style-type: none"> Steering angle sensor module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Steering angle sensor system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering angle sensor module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
U0128-00	Lost Communication With Park Brake Control Module - No sub type information	<ul style="list-style-type: none"> Electric park brake control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Electric park brake system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the electric park brake control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the electric park brake control module for related DTCs and refer to the relevant DTC index
U0132-00	Lost Communication With Suspension Control Module "A" - No sub type information	<ul style="list-style-type: none"> Air suspension control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Air suspension system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the air suspension control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the air suspension control module for related DTCs and refer to the relevant DTC index
U0133-00	Lost Communication With Active Roll Control Module - No sub type information	<ul style="list-style-type: none"> Dynamic response control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the dynamic response control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the dynamic response control module for

		<p>power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Dynamic response system fault 	<p>related DTCs and refer to the relevant DTC index</p>
U0136-00	<p>Lost Communication With Differential Control Module - Rear - No sub type information</p>	<ul style="list-style-type: none"> • Rear differential control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Rear differential system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear differential control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the rear differential control module for related DTCs and refer to the relevant DTC index
U0138-00	<p>Lost Communication With All Terrain Control Module - No sub type information</p>	<ul style="list-style-type: none"> • Terrain response switchpack power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Terrain response system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the terrain response switchpack power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the terrain response switchpack for related DTCs and refer to the relevant DTC index
U0140-00	<p>Lost Communication With Body Control Module - No sub type information</p>	<ul style="list-style-type: none"> • Central junction box power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Central junction box system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0300-00	<p>Internal Control Module Software Incompatibility - No sub type information</p>	<ul style="list-style-type: none"> • Incorrect anti-lock brake system control module installed 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
U0401-68	<p>Invalid Data Received from ECM/PCM A - Event information</p>	<ul style="list-style-type: none"> • Missing/invalid data from the engine control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0402-68	<p>Invalid Data Received from TCM - Event information</p>	<ul style="list-style-type: none"> • Missing/invalid data from the transmission control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0403-68	<p>Invalid Data Received From Transfer Case Control Module - Event information</p>	<ul style="list-style-type: none"> • Missing/invalid data from the transfer case control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
U0404-68	<p>Invalid Data Received From Gear Shift Control Module A - Event information</p>	<ul style="list-style-type: none"> • Missing/invalid data from the transmission control switch 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the transmission control switch for related DTCs and refer to the relevant DTC index

U0405-68	Invalid Data Received From Cruise Control Module - Event information	<ul style="list-style-type: none"> Missing/invalid data from the adaptive speed control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the adaptive speed control module for related DTCs and refer to the relevant DTC index
U0417-68	Invalid Data Received From Park Brake Control Module - Event information	<ul style="list-style-type: none"> Missing/invalid data from the electric park brake control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the electric park brake control module for related DTCs and refer to the relevant DTC index
U0421-68	Invalid Data Received from Suspension Control Module A - Event information	<ul style="list-style-type: none"> Missing/invalid data from the air suspension control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the air suspension control module for related DTCs and refer to the relevant DTC index
U0428-68	Invalid Data Received From Steering Angle Sensor Module - Event information	<ul style="list-style-type: none"> Missing/invalid data from the steering angle sensor module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
U0437-68	Invalid Data Received From Differential Control Module-Rear - Event information	<ul style="list-style-type: none"> Missing/invalid data from the rear differential control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the rear differential control module for related DTCs and refer to the relevant DTC index
U0439-68	Invalid Data Received From All Terrain Control Module - Event information	<ul style="list-style-type: none"> Missing/invalid data from the terrain response switchpack 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the terrain response switchpack for related DTCs and refer to the relevant DTC index
U1A14-00	CAN Initialisation Failure - No sub type information	<ul style="list-style-type: none"> Incorrect anti-lock brake system control module installed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification Incorrect anti-lock brake system control module installed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary Install a new anti-lock brake system control module as necessary
U2101-68	Control Module Configuration Incompatible - Event information	<ul style="list-style-type: none"> Incorrect anti-lock brake system control module installed New anti-lock brake system control module installed 	<ul style="list-style-type: none"> Install a new anti-lock brake system control module as necessary Using the manufacturer approved diagnostic system, clear the DTCs and retest
U3000-00	Control Module - No sub type information	<ul style="list-style-type: none"> Incorrect anti-lock brake system control module installed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
U3000-45	Control Module - Program memory failure	<ul style="list-style-type: none"> Anti-lock brake system control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> Anti-lock brake system control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new anti-lock brake system control module
U3000-4B	Control Module - Over temperature	<ul style="list-style-type: none"> Excessive use of brakes and/or traction control system 	<ul style="list-style-type: none"> Allow the vehicle to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest
U3000-	Control Module -	<ul style="list-style-type: none"> Anti-lock brake 	

53	De-activated	system control module temporarily deactivated during diagnostic session	 <p>NOTE: This DTC is for information only.</p> <ul style="list-style-type: none"> Anti-lock brake system control module normal operation will resume at next ignition cycle
U3000-68	Control Module - Event information	<ul style="list-style-type: none"> Tire pressure(s) incorrect Yaw rate lateral acceleration sensor incorrectly installed Missing/invalid data from the steering angle sensor module 	 <p>NOTE: This DTC is set when the dynamic stability control has been active for an unfeasibly long period of time.</p> <ul style="list-style-type: none"> Check and adjust the tire pressures as necessary Check the installation of the yaw rate lateral acceleration sensor Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
U3000-87	Control Module - Missing message	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U3002-81	Vehicle Identification Number - Invalid serial data received	<ul style="list-style-type: none"> Anti-lock brake system control module previously installed on another vehicle New anti-lock brake system control module installed and VIN not yet programmed 	<ul style="list-style-type: none"> Install the original or a new anti-lock brake system control module as necessary Using the manufacturer approved diagnostic system, perform routine - Learn VIN (0x0404)
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> Mismatch between the voltage at the anti-lock brake system control module and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD112) - and compare it to battery voltage. Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance
U3006-16	Control Module Input Power "A" - Circuit voltage below threshold	<ul style="list-style-type: none"> Anti-lock brake system control module power or ground circuit open circuit, high resistance Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD112). Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance Refer to the relevant section of the workshop manual and test the battery and charging system
U3006-17	Control Module Input Power "A" - Circuit voltage above threshold	<ul style="list-style-type: none"> Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD112). Refer to the relevant section of the workshop manual and test the battery and charging system
U3006-1C	Control Module Input Power "A" - Circuit voltage out of range	<ul style="list-style-type: none"> Anti-lock brake system control module power or ground circuit open circuit, high resistance Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD112). Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance Refer to the relevant section of the workshop manual and test the battery and charging system

General Information - Diagnostic Trouble Code (DTC) Index DTC: Audio Amplifier Module (AAM)

Description and Operation

Audio Amplifier Module (AAM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.














Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.








The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Audio Amplifier Module (AAM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.






For additional information, refer to: [Information and Entertainment System](#) (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).







DTC	Description	Possible Causes	Action
B128A-11	Speaker #13 - Circuit short to ground	<p>NOTE: Circuit reference L_RS+ / L_RS-</p> <ul style="list-style-type: none"> Rear left surround speaker circuit short circuit to ground Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left surround speaker circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left surround speaker as necessary Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B128A-12	Speaker #13 - Circuit short to battery	<p>NOTE: Circuit reference L_RS+ / L_RS-</p> <ul style="list-style-type: none"> Rear left 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left surround speaker circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left surround speaker as necessary







		<p>surround speaker circuit short circuit to power</p> <ul style="list-style-type: none"> • Audio amplifier module internal failure 	<p>Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module</p>
B128A-13	Speaker #13 - Circuit open	 <p>NOTE: Circuit reference L_RS+ / L_RS-</p> <ul style="list-style-type: none"> • Rear left surround speaker circuit open circuit, high resistance • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left surround speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left surround speaker as necessary • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B128A-1A	Speaker #13 - Circuit resistance below threshold	 <p>NOTE: Circuit reference L_RS+ / L_RS-</p> <ul style="list-style-type: none"> • Rear left surround speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left surround speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left surround speaker as necessary • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B128A-1E	Speaker #13 - Circuit resistance out of range	 <p>NOTE: Circuit reference L_RS+ / L_RS-</p> <ul style="list-style-type: none"> • Rear left surround speaker circuit open circuit, high resistance • Rear left surround speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left surround speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left surround speaker as necessary • Refer to the electrical circuit diagrams and check the rear left surround speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left surround speaker as necessary • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B128B-11	Speaker #14 - Circuit short to ground	 <p>NOTE: Circuit reference R_RS+ / R_RS-</p> <ul style="list-style-type: none"> • Rear right surround speaker circuit short circuit to ground • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear right surround speaker circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right surround speaker as necessary • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B128B-12	Speaker #14 - Circuit short to battery	 <p>NOTE: Circuit reference R_RS+ / R_RS-</p> <ul style="list-style-type: none"> • Rear right surround speaker circuit short circuit to power • Audio amplifier module internal 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear right surround speaker circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right surround speaker as necessary • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module






		failure	
B128B-13	Speaker #14 - Circuit open	 <p>NOTE: Circuit reference R_RS+ / R_RS-</p> <ul style="list-style-type: none"> Rear right surround speaker circuit open circuit, high resistance Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right surround speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right surround speaker as necessary Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B128B-1A	Speaker #14 - Circuit resistance below threshold	 <p>NOTE: Circuit reference R_RS+ / R_RS-</p> <ul style="list-style-type: none"> Rear right surround speaker circuit short circuit Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right surround speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right surround speaker as necessary Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B128B-1E	Speaker #14 - Circuit resistance out of range	 <p>NOTE: Circuit reference R_RS+ / R_RS-</p> <ul style="list-style-type: none"> Rear right surround speaker circuit open circuit, high resistance Rear right surround speaker circuit short circuit Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right surround speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right surround speaker as necessary Refer to the electrical circuit diagrams and check the rear right surround speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right surround speaker as necessary Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B128C-11	Speaker #15 - Circuit short to ground	 <p>NOTE: Circuit reference CENTRE+ / CENTRE-</p> <ul style="list-style-type: none"> Front centre speaker circuit short circuit to ground Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front centre speaker circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front centre speaker Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B128C-12	Speaker #15 - Circuit short to battery	 <p>NOTE: Circuit reference CENTRE+ / CENTRE-</p> <ul style="list-style-type: none"> Front centre speaker circuit short circuit to power Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front centre speaker circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front centre speaker Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B128C-13	Speaker #15 - Circuit open	 <p>NOTE: Circuit reference CENTRE+ / CENTRE-</p> <ul style="list-style-type: none"> Front centre 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front centre speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front centre speaker Using the manufacturer approved diagnostic system,







		<p>speaker circuit open circuit, high resistance</p> <ul style="list-style-type: none"> • Audio amplifier module internal failure 	<p>clear the DTCs and retest. If the fault persists, install a new audio amplifier module</p>
B128C-1A	Speaker #15 - Circuit resistance below threshold	 <p>NOTE: Circuit reference CENTRE+ / CENTRE-</p> <ul style="list-style-type: none"> • Front centre speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front centre speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front centre speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B128C-1E	Speaker #15 - Circuit resistance out of range	 <p>NOTE: Circuit reference CENTRE+ / CENTRE-</p> <ul style="list-style-type: none"> • Front centre speaker circuit open circuit, high resistance • Front centre speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front centre speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front centre speaker • Refer to the electrical circuit diagrams and check the front centre speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front centre speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1297-01	Digital Headphone Module - General electrical failure	<ul style="list-style-type: none"> • Headphone transmitter circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: Digital headphones (Whitefire) only</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the headphone transmitter circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1297-13	Digital Headphone Module - Circuit open	<ul style="list-style-type: none"> • Headphone transmitter circuit open circuit, high resistance 	 <p>NOTE: Digital headphones (Whitefire) only</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the headphone transmitter circuit for open circuit, high resistance
B1A01-11	Speaker #1 - Circuit short to ground	 <p>NOTE: Circuit reference LF_H+ / LF_H-</p> <ul style="list-style-type: none"> • Front left door tweeter speaker circuit short circuit to ground • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left door tweeter speaker circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door tweeter speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A01-12	Speaker #1 - Circuit short to battery	 <p>NOTE: Circuit reference LF_H+ / LF_H-</p> <ul style="list-style-type: none"> • Front left door tweeter speaker circuit short circuit to power • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left door tweeter speaker circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door tweeter speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A01-13	Speaker #1 - Circuit open	 <p>NOTE: Circuit</p>	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left door tweeter speaker circuit for open circuit,






		<p>reference LF_H+ / LF_H-</p> <ul style="list-style-type: none"> • Front left door tweeter speaker circuit open circuit, high resistance • Audio amplifier module internal failure 	<p>high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door tweeter speaker</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A01-1A	Speaker #1 - Circuit resistance below threshold	 <p>NOTE: Circuit reference LF_H+ / LF_H-</p> <ul style="list-style-type: none"> • Front left door tweeter speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left door tweeter speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door tweeter speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A01-1E	Speaker #1 - Circuit resistance out of range	 <p>NOTE: Circuit reference LF_H+ / LF_H-</p> <ul style="list-style-type: none"> • Front left door tweeter speaker circuit open circuit, high resistance • Front left door tweeter speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left door tweeter speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door tweeter speaker • Refer to the electrical circuit diagrams and check the front left door tweeter speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door tweeter speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A02-11	Speaker #2 - Circuit short to ground	 <p>NOTE: Circuit reference LF_L+ / LF_L-</p> <ul style="list-style-type: none"> • Front left door bass speaker circuit short circuit to ground • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left door bass speaker circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A02-12	Speaker #2 - Circuit short to battery	 <p>NOTE: Circuit reference LF_L+ / LF_L-</p> <ul style="list-style-type: none"> • Front left door bass speaker circuit short circuit to power • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left door bass speaker circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A02-13	Speaker #2 - Circuit open	 <p>NOTE: Circuit reference LF_L+ / LF_L-</p> <ul style="list-style-type: none"> • Front left door bass speaker circuit open circuit, high resistance • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left door bass speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module







B1A02-1A	Speaker #2 - Circuit resistance below threshold	 <p>NOTE: Circuit reference LF_L+ / LF_L-</p> <ul style="list-style-type: none"> • Front left door bass speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left door bass speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A02-1E	Speaker #2 - Circuit resistance out of range	 <p>NOTE: Circuit reference LF_L+ / LF_L-</p> <ul style="list-style-type: none"> • Front left door bass speaker circuit open circuit, high resistance • Front left door bass speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left door bass speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door bass speaker • Refer to the electrical circuit diagrams and check the front left door bass speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A03-11	Speaker #3 - Circuit short to ground	 <p>NOTE: Circuit reference RF_H+ / RF_H-</p> <ul style="list-style-type: none"> • Front right door tweeter speaker circuit short circuit to ground • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door tweeter speaker circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door tweeter speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A03-12	Speaker #3 - Circuit short to battery	 <p>NOTE: Circuit reference RF_H+ / RF_H-</p> <ul style="list-style-type: none"> • Front right door tweeter speaker circuit short circuit to power • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door tweeter speaker circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door tweeter speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A03-13	Speaker #3 - Circuit open	 <p>NOTE: Circuit reference RF_H+ / RF_H-</p> <ul style="list-style-type: none"> • Front right door tweeter speaker circuit open circuit, high resistance • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door tweeter speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door tweeter speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A03-1A	Speaker #3 - Circuit resistance below threshold	 <p>NOTE: Circuit reference RF_H+ / RF_H-</p> <ul style="list-style-type: none"> • Front right door tweeter speaker circuit short circuit 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door tweeter speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door tweeter speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module






		<ul style="list-style-type: none"> • Audio amplifier module internal failure 	
B1A03-1E	Speaker #3 - Circuit resistance out of range	 <p>NOTE: Circuit reference RF_H+ / RF_H-</p> <ul style="list-style-type: none"> • Front right door tweeter speaker circuit open circuit, high resistance • Front right door tweeter speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door tweeter speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door tweeter speaker • Refer to the electrical circuit diagrams and check the front right door tweeter speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door tweeter speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A04-11	Speaker #4 - Circuit short to ground	 <p>NOTE: Circuit reference RF_L+ / RF_L-</p> <ul style="list-style-type: none"> • Front right door bass speaker circuit short circuit to ground • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door bass speaker circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A04-12	Speaker #4 - Circuit short to battery	 <p>NOTE: Circuit reference RF_L+ / RF_L-</p> <ul style="list-style-type: none"> • Front right door bass speaker circuit short circuit to power • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door bass speaker circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A04-13	Speaker #4 - Circuit open	 <p>NOTE: Circuit reference RF_L+ / RF_L-</p> <ul style="list-style-type: none"> • Front right door bass speaker circuit open circuit, high resistance • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door bass speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A04-1A	Speaker #4 - Circuit resistance below threshold	 <p>NOTE: Circuit reference RF_L+ / RF_L-</p> <ul style="list-style-type: none"> • Front right door bass speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door bass speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A04-1E	Speaker #4 - Circuit resistance out of range	 <p>NOTE: Circuit reference RF_L+ / RF_L-</p>	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door bass speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the







		<ul style="list-style-type: none"> • Front right door bass speaker circuit open circuit, high resistance • Front right door bass speaker circuit short circuit • Audio amplifier module internal failure 	<p>fault persists, install a new front right door bass speaker</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door bass speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A05-11	Speaker #5 - Circuit short to ground	 <p>NOTE: Circuit reference LR_H+ / LR_H-</p> <ul style="list-style-type: none"> • Rear left door tweeter speaker circuit short circuit to ground • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left door tweeter speaker circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left door tweeter speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A05-12	Speaker #5 - Circuit short to battery	 <p>NOTE: Circuit reference LR_H+ / LR_H-</p> <ul style="list-style-type: none"> • Rear left door tweeter speaker circuit short circuit to power • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left door tweeter speaker circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left door tweeter speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A05-13	Speaker #5 - Circuit open	 <p>NOTE: Circuit reference LR_H+ / LR_H-</p> <ul style="list-style-type: none"> • Rear left door tweeter speaker circuit open circuit, high resistance • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left door tweeter speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left door tweeter speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A05-1A	Speaker #5 - Circuit resistance below threshold	 <p>NOTE: Circuit reference LR_H+ / LR_H-</p> <ul style="list-style-type: none"> • Rear left door tweeter speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left door tweeter speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left door tweeter speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A05-1E	Speaker #5 - Circuit resistance out of range	 <p>NOTE: Circuit reference LR_H+ / LR_H-</p> <ul style="list-style-type: none"> • Rear left door tweeter speaker circuit open circuit, high resistance • Rear left door tweeter speaker 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left door tweeter speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left door tweeter speaker • Refer to the electrical circuit diagrams and check the rear left door tweeter speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left door tweeter speaker • Using the manufacturer approved diagnostic system,







		<p>circuit short circuit</p> <ul style="list-style-type: none"> • Audio amplifier module internal failure 	<p>clear the DTCs and retest. If the fault persists, install a new audio amplifier module</p>
B1A06-11	Speaker #6 - Circuit short to ground	 <p>NOTE: Circuit reference LR_L+ / LR_L-</p> <ul style="list-style-type: none"> • Rear left door bass speaker circuit short circuit to ground • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left door bass speaker circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A06-12	Speaker #6 - Circuit short to battery	 <p>NOTE: Circuit reference LR_L+ / LR_L-</p> <ul style="list-style-type: none"> • Rear left door bass speaker circuit short circuit to power • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left door bass speaker circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A06-13	Speaker #6 - Circuit open	 <p>NOTE: Circuit reference LR_L+ / LR_L-</p> <ul style="list-style-type: none"> • Rear left door bass speaker circuit open circuit, high resistance • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left door bass speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A06-1A	Speaker #6 - Circuit resistance below threshold	 <p>NOTE: Circuit reference LR_L+ / LR_L-</p> <ul style="list-style-type: none"> • Rear left door bass speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left door bass speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A06-1E	Speaker #6 - Circuit resistance out of range	 <p>NOTE: Circuit reference LR_L+ / LR_L-</p> <ul style="list-style-type: none"> • Rear left door bass speaker circuit open circuit, high resistance • Rear left door bass speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left door bass speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left door bass speaker • Refer to the electrical circuit diagrams and check the rear left door bass speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left door bass speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A07-11	Speaker #7 - Circuit short to	 <p>NOTE: Circuit</p>	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear right door tweeter speaker circuit for short circuit

	ground	<p>reference RR_H+ / RR_H-</p> <ul style="list-style-type: none"> Rear right door tweeter speaker circuit short circuit to ground Audio amplifier module internal failure 	<p>to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right door tweeter speaker</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A07-12	Speaker #7 - Circuit short to battery	<p> NOTE: Circuit reference RR_H+ / RR_H-</p> <ul style="list-style-type: none"> Rear right door tweeter speaker circuit short circuit to power Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right door tweeter speaker circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right door tweeter speaker Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A07-13	Speaker #7 - Circuit open	<p> NOTE: Circuit reference RR_H+ / RR_H-</p> <ul style="list-style-type: none"> Rear right door tweeter speaker circuit open circuit, high resistance Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right door tweeter speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right door tweeter speaker Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A07-1A	Speaker #7 - Circuit resistance below threshold	<p> NOTE: Circuit reference RR_H+ / RR_H-</p> <ul style="list-style-type: none"> Rear right door tweeter speaker circuit short circuit Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right door tweeter speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right door tweeter speaker Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A07-1E	Speaker #7 - Circuit resistance out of range	<p> NOTE: Circuit reference RR_H+ / RR_H-</p> <ul style="list-style-type: none"> Rear right door tweeter speaker circuit open circuit, high resistance Rear right door tweeter speaker circuit short circuit Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right door tweeter speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right door tweeter speaker Refer to the electrical circuit diagrams and check the rear right door tweeter speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right door tweeter speaker Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A08-11	Speaker #8 - Circuit short to ground	<p> NOTE: Circuit reference RR_L+ / RR_L-</p> <ul style="list-style-type: none"> Rear right door bass speaker circuit short circuit to ground Audio amplifier 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right door bass speaker circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right door bass speaker Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module

		module internal failure	
B1A08-12	Speaker #8 - Circuit short to battery	 <p>NOTE: Circuit reference RR_L+ / RR_L-</p> <ul style="list-style-type: none"> Rear right door bass speaker circuit short circuit to power Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right door bass speaker circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right door bass speaker Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A08-13	Speaker #8 - Circuit open	 <p>NOTE: Circuit reference RR_L+ / RR_L-</p> <ul style="list-style-type: none"> Rear right door bass speaker circuit open circuit, high resistance Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right door bass speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right door bass speaker Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A08-1A	Speaker #8 - Circuit resistance below threshold	 <p>NOTE: Circuit reference RR_L+ / RR_L-</p> <ul style="list-style-type: none"> Rear right door bass speaker circuit short circuit Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right door bass speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right door bass speaker Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A08-1E	Speaker #8 - Circuit resistance out of range	 <p>NOTE: Circuit reference RR_L+ / RR_L-</p> <ul style="list-style-type: none"> Rear right door bass speaker circuit open circuit, high resistance Rear right door bass speaker circuit short circuit Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right door bass speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right door bass speaker Refer to the electrical circuit diagrams and check the rear right door bass speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right door bass speaker Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A09-11	Speaker #9 - Circuit short to ground	 <p>NOTE: Circuit reference LF_M+ / LF_M-</p> <ul style="list-style-type: none"> Front left door mid-range speaker circuit short circuit to ground Audio amplifier module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left door mid-range speaker circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door mid-range speaker Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A09-12	Speaker #9 - Circuit short to battery	 <p>NOTE: Circuit reference LF_M+ / LF_M-</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left door mid-range speaker circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the

		<ul style="list-style-type: none"> • Front left door mid-range speaker circuit short circuit to power • Audio amplifier module internal failure 	<p>fault persists, install a new front left door mid-range speaker</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A09-13	Speaker #9 - Circuit open	 <p>NOTE: Circuit reference LF_M+ / LF_M-</p> <ul style="list-style-type: none"> • Front left door mid-range speaker circuit open circuit, high resistance • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left door mid-range speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door mid-range speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A09-1A	Speaker #9 - Circuit resistance below threshold	 <p>NOTE: Circuit reference LF_M+ / LF_M-</p> <ul style="list-style-type: none"> • Front left door mid-range speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left door mid-range speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door mid-range speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A09-1E	Speaker #9 - Circuit resistance out of range	 <p>NOTE: Circuit reference LF_M+ / LF_M-</p> <ul style="list-style-type: none"> • Front left door mid-range speaker circuit open circuit, high resistance • Front left door mid-range speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left door mid-range speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door mid-range speaker • Refer to the electrical circuit diagrams and check the front left door mid-range speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left door mid-range speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A10-11	Speaker #10 - Circuit short to ground	 <p>NOTE: Circuit reference RF_M+ / RF_M-</p> <ul style="list-style-type: none"> • Front right door mid-range speaker circuit short circuit to ground • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door mid-range speaker circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door mid-range speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A10-12	Speaker #10 - Circuit short to battery	 <p>NOTE: Circuit reference RF_M+ / RF_M-</p> <ul style="list-style-type: none"> • Front right door mid-range speaker circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door mid-range speaker circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door mid-range speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module

		<ul style="list-style-type: none"> • Audio amplifier module internal failure 	
B1A10-13	Speaker #10 - Circuit open	 <p>NOTE: Circuit reference RF_M+ / RF_M-</p> <ul style="list-style-type: none"> • Front right door mid-range speaker circuit open circuit, high resistance • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door mid-range speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door mid-range speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A10-1A	Speaker #10 - Circuit resistance below threshold	 <p>NOTE: Circuit reference RF_M+ / RF_M-</p> <ul style="list-style-type: none"> • Front right door mid-range speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door mid-range speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door mid-range speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A10-1E	Speaker #10 - Circuit resistance out of range	 <p>NOTE: Circuit reference RF_M+ / RF_M-</p> <ul style="list-style-type: none"> • Front right door mid-range speaker circuit open circuit, high resistance • Front right door mid-range speaker circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right door mid-range speaker circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door mid-range speaker • Refer to the electrical circuit diagrams and check the front right door mid-range speaker circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right door mid-range speaker • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A11-11	Speaker #11 - Circuit short to ground	 <p>NOTE: Circuit reference SW_1+ / SW_1-</p> <ul style="list-style-type: none"> • Sub-woofer 1 circuit short circuit to ground • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the sub-woofer 1 circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new sub-woofer • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A11-12	Speaker #11 - Circuit short to battery	 <p>NOTE: Circuit reference SW_1+ / SW_1-</p> <ul style="list-style-type: none"> • Sub-woofer 1 circuit short circuit to power • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the sub-woofer 1 circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new sub-woofer • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A11-13	Speaker #11 - Circuit open	 <p>NOTE: Circuit reference SW_1+ / SW_1-</p> <ul style="list-style-type: none"> • Sub-woofer 1 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the sub-woofer 1 circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new sub-woofer • Using the manufacturer approved diagnostic system,

		<p>circuit open circuit, high resistance</p> <ul style="list-style-type: none"> • Audio amplifier module internal failure 	<p>clear the DTCs and retest. If the fault persists, install a new audio amplifier module</p>
B1A11-1A	Speaker #11 - Circuit resistance below threshold	 <p>NOTE: Circuit reference SW_1+ / SW_1-</p> <ul style="list-style-type: none"> • Sub-woofer 1 circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the sub-woofer 1 circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new sub-woofer • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A11-1E	Speaker #11 - Circuit resistance out of range	 <p>NOTE: Circuit reference SW_1+ / SW_1-</p> <ul style="list-style-type: none"> • Sub-woofer 1 circuit open circuit, high resistance • Sub-woofer 1 circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the sub-woofer 1 circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new sub-woofer • Refer to the electrical circuit diagrams and check the sub-woofer 1 circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new sub-woofer • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A12-11	Speaker #12 - Circuit short to ground	 <p>NOTE: Circuit reference SW_2+ / SW_2-</p> <ul style="list-style-type: none"> • Sub-woofer 2 circuit short circuit to ground • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the sub-woofer 2 circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new sub-woofer • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B2A12-12	Speaker #12 - Circuit short to battery	 <p>NOTE: Circuit reference SW_2+ / SW_2-</p> <ul style="list-style-type: none"> • Sub-woofer 2 circuit short circuit to power • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the sub-woofer 2 circuit for short circuit to power. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new sub-woofer • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A12-13	Speaker #12 - Circuit open	 <p>NOTE: Circuit reference SW_2+ / SW_2-</p> <ul style="list-style-type: none"> • Sub-woofer 2 circuit open circuit, high resistance • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the sub-woofer 2 circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new sub-woofer • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
B1A12-1A	Speaker #12 - Circuit resistance below threshold	 <p>NOTE: Circuit reference SW_2+ / SW_2-</p> <ul style="list-style-type: none"> • Sub-woofer 2 circuit short 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the sub-woofer 2 circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new sub-woofer • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module

		<p>circuit</p> <ul style="list-style-type: none"> • Audio amplifier module internal failure 	a new audio amplifier module
B1A12-1E	Speaker #12 - Circuit resistance out of range	 <p>NOTE: Circuit reference SW_2+ / SW_2-</p> <ul style="list-style-type: none"> • Sub-woofer 2 circuit open circuit, high resistance • Sub-woofer 2 circuit short circuit • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the sub-woofer 2 circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new sub-woofer • Refer to the electrical circuit diagrams and check the sub-woofer 2 circuit for short circuit. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new sub-woofer • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio amplifier module
U2300-54	Central Configuration - Missing calibration	<ul style="list-style-type: none"> • Audio amplifier module is not configured correctly • Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the audio amplifier module with the latest level software • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U2300-56	Central Configuration - Invalid/incomplete configuration	<ul style="list-style-type: none"> • Audio amplifier module is not configured correctly • Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the audio amplifier module with the latest level software • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U2300-64	Central Configuration - Signal plausibility failure	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification • Incorrect audio amplifier module installed 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary • Install a new audio amplifier module as necessary
U3000-55	Control Module - Not configured	<ul style="list-style-type: none"> • Audio amplifier module is not configured correctly • New audio amplifier module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the audio amplifier module with the latest level software • This DTC will occur once if a new module is installed. Clear the DTC, cycle the ignition state to off. Lock the vehicle (to ensure the infotainment system has reset). Unlock the vehicle, cycle the ignition state to on. Retest the system
U3000-96	Control Module - Component internal failure	<ul style="list-style-type: none"> • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - On Demand Self Test (0x0202). If the fault persists, install a new audio amplifier module
U3000-98	Control Module - Component or system over temperature	<ul style="list-style-type: none"> • Audio amplifier cooling vents obstructed • Speaker circuit fault • Audio amplifier module internal failure 	<ul style="list-style-type: none"> • Check that the amplifier module ventilation is not obstructed • Rectify speaker related faults first. Clear the DTCs and retest • Rectify audio amplifier module internal failure related faults first. Clear the DTCs and retest
U3003-16	Battery Voltage - Circuit voltage below threshold	<ul style="list-style-type: none"> • Audio amplifier module power or ground circuit open circuit, high resistance • Battery/charging system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD110). Refer to the electrical circuit diagrams and check the audio amplifier module power and ground circuits for open circuit, high resistance • Refer to the relevant section of the workshop manual and test the battery and charging system
U3003-	Battery Voltage -	<ul style="list-style-type: none"> • Battery/charging 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system,

17	Circuit voltage above threshold	system fault	check datalogger signal - ECU Power Supply Voltage (0xD110). Refer to the relevant section of the workshop manual and test the battery and charging system
----	---------------------------------	--------------	--

General Information - Diagnostic Trouble Code (DTC) Index DTC:

Audio Head Unit (AHU) - Low Line

Description and Operation

Audio Head Unit (AHU)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.




Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Audio Head Unit (AHU). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Information and Entertainment System](#) (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B11A4-11	L-Band Antenna - Circuit short to ground	<ul style="list-style-type: none"> Digital radio L-band antenna circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the digital radio L-band antenna circuit for short circuit to ground
B11A4-15	L-Band Antenna - Circuit short to battery or open	<ul style="list-style-type: none"> Digital radio L-band antenna circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the digital radio L-band antenna circuit for short circuit to power, open circuit, high resistance
B11A5-11	Band 3 Antenna - Circuit short to ground	<ul style="list-style-type: none"> Digital radio band 3 antenna circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the digital radio band 3 antenna circuit for short circuit to ground
B11A5-15	Band 3 Antenna - Circuit short to battery or open	<ul style="list-style-type: none"> Digital radio band 3 antenna circuit short circuit to power, 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the digital radio band 3 antenna circuit for short circuit to power, open circuit, high resistance

		open circuit, high resistance	
B1A01-11	Speaker #1 - Circuit short to ground	<ul style="list-style-type: none"> • Speaker circuit(s) short circuit to ground • Audio head unit internal failure 	<p>NOTES:</p>  This diagnostic trouble code may be set by a fault with any speaker circuit
			 Use the fade and balance controls to identify the malfunctioning speaker circuit <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the speaker circuits for short circuit to ground • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio head unit
B1A56-11	Antenna - Circuit short to ground	<ul style="list-style-type: none"> • AM/FM antenna amplifier circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the AM/FM antenna amplifier circuit for short circuit to ground
B1A56-15	Antenna - Circuit short to battery or open	<ul style="list-style-type: none"> • AM/FM antenna amplifier circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the AM/FM antenna amplifier circuit for short circuit to power, open circuit, high resistance
B1D55-11	Antenna#2 - Circuit short to ground	<ul style="list-style-type: none"> • FM/TMC antenna amplifier circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the FM/TMC antenna amplifier circuit for short circuit to ground
B1D55-15	Antenna#2 - Circuit short to battery or open	<ul style="list-style-type: none"> • FM/TMC antenna amplifier circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the FM/TMC antenna amplifier circuit for short circuit to power, open circuit, high resistance
U0257-00	Lost Communication With Front Controls / Display Interface Module - No sub type information	<ul style="list-style-type: none"> • Multi-function display power or ground circuit open circuit, high resistance • Private CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Multi-function display system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the multi-function display power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the private CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the multi-function display for related DTCs and refer to the relevant DTC index
U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> • Audio head unit is not configured correctly 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the audio head unit with the latest level software
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification • Incorrect audio head unit installed 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary • Install a new audio head unit as necessary
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> • Audio head unit internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new audio head unit
U3006-16	Control Module Input Power "A" - Circuit voltage below threshold	<ul style="list-style-type: none"> • Audio head unit power or ground circuit open circuit, high resistance 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the electrical circuit diagrams and check the audio head unit power and ground circuits for open circuit, high resistance

		<ul style="list-style-type: none">• Battery/charging system fault	<ul style="list-style-type: none">• Refer to the relevant section of the workshop manual and test the battery and charging system
--	--	---	---

General Information - Diagnostic Trouble Code (DTC) Index DTC: Automatic Temperature Control Module (ATC)

Description and Operation

Automatic Temperature Control Module (ATCM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Automatic Temperature Control Module (ATCM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Climate Control System](#) (412-00 Climate Control System - General Information, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1030-01	Left Front Seat Heater - General electrical failure	<ul style="list-style-type: none"> Front left seat heater control module power or ground circuit open circuit, high resistance LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Front left heated seat backrest element circuit short 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left seat heater control module power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the front left heated seat backrest element circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the front left heated seat cushion element circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the front left heated seat temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists,

		<p>circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Front left heated seat cushion element circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front left heated seat temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front left seat heater control module internal failure 	<p>install a new front left seat heater control module</p>
B1030-4B	Left Front Seat Heater - Over temperature	<ul style="list-style-type: none"> • Front left heated seat temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front left seat heater control module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left heated seat temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left seat heater control module
B1030-87	Left Front Seat Heater - Missing message	<ul style="list-style-type: none"> • Front left seat heater control module power or ground circuit open circuit, high resistance • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front left seat heater control module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left seat heater control module power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left seat heater control module
B1032-01	Right Front Seat Heater - General electrical failure	<ul style="list-style-type: none"> • Front right seat heater control module power or ground circuit open circuit, high resistance • LIN bus circuit short circuit 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right seat heater control module power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the front right heated seat backrest element circuit for short circuit to ground, short circuit to power, open circuit, high resistance

		<p>to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Front right heated seat backrest element circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front right heated seat cushion element circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front right heated seat temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front right seat heater control module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right heated seat cushion element circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the front right heated seat temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right seat heater control module
B1032-4B	Right Front Seat Heater - Over temperature	<ul style="list-style-type: none"> • Front right heated seat temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front right seat heater control module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right heated seat temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right seat heater control module
B1032-87	Right Front Seat Heater - Missing message	<ul style="list-style-type: none"> • Front right seat heater control module power or ground circuit open circuit, high resistance • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front right 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right seat heater control module power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right seat heater control module

		seat heater control module internal failure	
B1034-01	Left Front Seat Heater Element - General electrical failure	<ul style="list-style-type: none"> • Front left heated seat backrest element circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front left heated seat cushion element circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front left seat heater control module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left heated seat backrest element circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the front left heated seat cushion element circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left seat heater control module
B1036-01	Right Front Seat Heater Element - General electrical failure	<ul style="list-style-type: none"> • Front right heated seat backrest element circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front right heated seat cushion element circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front right seat heater control module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right heated seat backrest element circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the front right heated seat cushion element circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right seat heater control module
B1038-01	Left Front Seat Heater Sensor - General electrical failure	<ul style="list-style-type: none"> • Front left heated seat temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Front left seat heater control module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left heated seat temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left seat heater control module
B103A-01	Right Front Seat Heater Sensor - General electrical	<ul style="list-style-type: none"> • Front right heated seat temperature 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right heated seat temperature sensor circuit for short circuit to ground, short circuit to

	failure	<p>sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Front right seat heater control module internal failure 	<p>power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right seat heater control module
B1081-00	Left Temperature Damper Motor - No sub type information	<ul style="list-style-type: none"> • Foreign object obstructing left temperature blend door • Left temperature blend motor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Left temperature blend door damaged • Left temperature blend motor failure 	<ul style="list-style-type: none"> • Check and remove any obstruction in the left temperature blend door • Refer to the electrical circuit diagrams and check the left temperature blend motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Install a new left temperature blend door as necessary • Install a new left temperature blend motor as necessary
B1081-49	Left Temperature Damper Motor - Internal electronic failure	<ul style="list-style-type: none"> • Left temperature blend motor failure 	<ul style="list-style-type: none"> • Install a new left temperature blend motor as necessary
B1082-00	Right Temperature Damper Motor - No sub type information	<ul style="list-style-type: none"> • Foreign object obstructing right temperature blend door • Right temperature blend motor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Right temperature blend door damaged • Right temperature blend motor failure 	<ul style="list-style-type: none"> • Check and remove any obstruction in the right temperature blend door • Refer to the electrical circuit diagrams and check the right temperature blend motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Install a new right temperature blend door as necessary • Install a new right temperature blend motor as necessary
B1082-49	Right Temperature Damper Motor - Internal electronic failure	<ul style="list-style-type: none"> • Right temperature blend motor failure 	<ul style="list-style-type: none"> • Install a new right temperature blend motor as necessary
B1083-01	Recirculation Damper Motor - General electrical failure	<ul style="list-style-type: none"> • Foreign object obstructing recirculation door • Recirculation motor circuit short circuit 	<ul style="list-style-type: none"> • Check and remove any obstruction in the recirculation door • Refer to the electrical circuit diagrams and check the recirculation motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Install a new recirculation door as necessary

		<p>to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Recirculation door damaged • Recirculation motor failure 	<p>Install a new recirculation motor as necessary</p>
B1085-00	Defroster Damper Motor - No sub type information	<ul style="list-style-type: none"> • Foreign object obstructing demist distribution door • Demist distribution motor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Demist distribution door damaged • Demist distribution motor failure 	<ul style="list-style-type: none"> • Check and remove any obstruction in the demist distribution door • Refer to the electrical circuit diagrams and check the demist distribution motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Install a new demist distribution door as necessary • Install a new demist distribution motor as necessary
B1085-49	Defroster Damper Motor - Internal electronic failure	<ul style="list-style-type: none"> • Demist distribution motor failure 	<ul style="list-style-type: none"> • Install a new demist distribution motor as necessary
B1086-00	Air Distribution Damper Motor - No sub type information	<ul style="list-style-type: none"> • Foreign object obstructing face/feet distribution door • Face/feet distribution motor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Face/feet distribution door damaged • Face/feet distribution motor failure 	<ul style="list-style-type: none"> • Check and remove any obstruction in the face/feet distribution door • Refer to the electrical circuit diagrams and check the face/feet distribution motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Install a new face/feet distribution door as necessary • Install a new face/feet distribution motor as necessary
B1086-49	Air Distribution Damper Motor - Internal electronic failure	<ul style="list-style-type: none"> • Face/feet distribution motor failure 	<ul style="list-style-type: none"> • Install a new face/feet distribution motor as necessary
B1087-88	LIN Bus "A" - Bus off	<ul style="list-style-type: none"> • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1088-88	LIN Bus "B" - Bus off	<ul style="list-style-type: none"> • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance

		resistance	
B10BE-11	Solar Sensor - Circuit short to ground	<ul style="list-style-type: none"> Sunload sensor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the sunload sensor circuit for short circuit to ground
B11EE-01	A/C Compressor - General electrical failure	<ul style="list-style-type: none"> Refrigerant solenoid valve circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the refrigerant solenoid valve circuit for short circuit to ground, open circuit, high resistance
B11F0-11	Air Intake Damper Position Sensor - Circuit short to ground	<ul style="list-style-type: none"> Recirculation motor position sensor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the recirculation motor position sensor circuit for short circuit to ground
B11F0-15	Air Intake Damper Position Sensor - Circuit short to battery or open	<ul style="list-style-type: none"> Recirculation motor position sensor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the recirculation motor position sensor circuit for short circuit to power, open circuit, high resistance
B11FF-84	A/C Refrigerant Pressure - Signal below allowable range	<ul style="list-style-type: none"> Insufficient refrigerant in system Refrigerant pressure sensor failure Automatic temperature control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, datalogger test and review Climate control system / Air conditioning / External ambient temperature. If the external ambient temperature is $< 5^{\circ}\text{C}$, this DTC should be ignored and cleared. If the external ambient temperature shows $> 5^{\circ}\text{C}$, test the refrigerant system using a suitable charging station Install a new refrigerant pressure sensor as necessary Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new automatic temperature control module
B11FF-85	A/C Refrigerant Pressure - Signal above allowable range	<ul style="list-style-type: none"> Excessive refrigerant in system Blockage in air conditioning system pipework or condenser Air conditioning fan inoperative Refrigerant pressure sensor failure Automatic temperature control module internal failure 	<ul style="list-style-type: none"> Test the refrigerant system using a suitable charging station Test the condenser and pipework for damage or restriction Test the air conditioning fan for correct operation Install a new refrigerant pressure sensor as necessary Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new automatic temperature control module
B12B2-11	AUX Heater Coolant Diverter Valve - Circuit short to ground	<ul style="list-style-type: none"> Auxiliary heater coolant diverter valve circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the auxiliary heater coolant diverter valve circuit for short circuit to ground
B13C2-86	Front Windscreen/Windshield Misting Sensor - Signal invalid	<ul style="list-style-type: none"> Humidity sensor power or ground circuit open circuit, high resistance LIN bus circuit short circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the humidity sensor power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Install a new humidity sensor

		<p>to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Humidity sensor failure 	
B13C2-87	Front Windscreen/Windshield Misting Sensor - Missing message	<ul style="list-style-type: none"> • Humidity sensor power or ground circuit open circuit, high resistance • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Humidity sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the humidity sensor power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Install a new humidity sensor
B13C2-96	Front Windscreen/Windshield Misting Sensor - Component internal failure	<ul style="list-style-type: none"> • Humidity sensor power or ground circuit open circuit, high resistance • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Humidity sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the humidity sensor power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Install a new humidity sensor
B1A59-11	Sensor 5 Volt Supply - Circuit short to ground	<ul style="list-style-type: none"> • Refrigerant pressure sensor supply circuit short circuit to ground • Recirculation motor position sensor supply circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the refrigerant pressure sensor supply circuit for short circuit to ground • Refer to the electrical circuit diagrams and check the recirculation motor position sensor supply circuit for short circuit to ground
B1A59-13	Sensor 5 Volt Supply - Circuit open	<ul style="list-style-type: none"> • Refrigerant pressure sensor supply circuit open circuit, high resistance • Recirculation motor position sensor supply circuit open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the refrigerant pressure sensor supply circuit for open circuit, high resistance • Refer to the electrical circuit diagrams and check the recirculation motor position sensor supply circuit for open circuit, high resistance
B1A60-11	Pollution Sensor - Hydrocarbon - Circuit short to ground	<ul style="list-style-type: none"> • Pollution sensor (hydrocarbon) signal circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the pollution sensor (hydrocarbon) signal circuit for short circuit to ground
B1A61-11	Cabin Temperature Sensor - Circuit short to ground	<ul style="list-style-type: none"> • In-vehicle temperature sensor signal 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the in-vehicle temperature sensor signal circuit for short circuit to ground

		circuit short circuit to ground	
B1A61-15	Cabin Temperature Sensor - Circuit short to battery or open	<ul style="list-style-type: none"> In-vehicle temperature sensor signal circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the in-vehicle temperature sensor signal circuit for short circuit to power, open circuit, high resistance
B1A63-11	Right Solar Sensor - Circuit short to ground	<ul style="list-style-type: none"> Sunload sensor right signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the sunload sensor right signal circuit for short circuit to ground
B1A64-11	Left Solar Sensor - Circuit short to ground	<ul style="list-style-type: none"> Sunload sensor left signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the sunload sensor left signal circuit for short circuit to ground
B1A67-13	Sensor Ground - Circuit open	<ul style="list-style-type: none"> In-vehicle temperature sensor earth circuit open circuit, high resistance Sunload sensor earth circuit open circuit, high resistance Refrigerant pressure sensor earth circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the in-vehicle temperature sensor earth circuit for open circuit, high resistance Refer to the electrical circuit diagrams and check the sunload sensor earth circuit for open circuit, high resistance Refer to the electrical circuit diagrams and check the refrigerant pressure sensor earth circuit for open circuit, high resistance
B1A69-11	Humidity Sensor - Circuit short to ground	<ul style="list-style-type: none"> Humidity sensor signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the humidity sensor signal circuit for short circuit to ground
B1A69-15	Humidity Sensor - Circuit short to battery or open	<ul style="list-style-type: none"> Humidity sensor signal circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the humidity sensor signal circuit for short circuit to power, open circuit, high resistance
B1B62-11	Pollution Sensor - NOx - Circuit short to ground	<ul style="list-style-type: none"> Pollution sensor (NOx) signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the pollution sensor (NOx) signal circuit for short circuit to ground
B1B71-11	Evaporator Temperature Sensor - Circuit short to ground	<ul style="list-style-type: none"> Evaporator temperature sensor signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the evaporator temperature sensor signal circuit for short circuit to ground
B1B71-15	Evaporator Temperature Sensor - Circuit short to battery or open	<ul style="list-style-type: none"> Evaporator temperature sensor signal circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the evaporator temperature sensor signal circuit for short circuit to power, open circuit, high resistance
B1B72-	LIN Bus #1 Power	<ul style="list-style-type: none"> LIN bus A 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check

11	Supply Circuit - Circuit short to ground	circuit short circuit to ground	the LIN bus A circuit for short circuit to ground
B1B73-11	LIN Bus #2 Power Supply Circuit - Circuit short to ground	<ul style="list-style-type: none"> LIN bus B circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the LIN bus B circuit for short circuit to ground
B1B7B-00	Left Rear Air Blend Actuator - No sub type information	<ul style="list-style-type: none"> Foreign object obstructing rear temperature blend door Rear temperature blend motor circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear temperature blend door damaged Rear temperature blend motor failure 	<ul style="list-style-type: none"> Check and remove any obstruction in the rear temperature blend door Refer to the electrical circuit diagrams and check the rear temperature blend motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Install a new rear temperature blend door as necessary Install a new rear temperature blend motor as necessary
B1B7B-49	Left Rear Air Blend Actuator - Internal electronic failure	<ul style="list-style-type: none"> Rear temperature blend motor failure 	<ul style="list-style-type: none"> Install a new rear temperature blend motor as necessary
B1B7D-00	Rear Air Distribution Actuator - No sub type information	<ul style="list-style-type: none"> Foreign object obstructing rear distribution door Rear distribution motor circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear distribution door damaged Rear distribution motor failure 	<ul style="list-style-type: none"> Check and remove any obstruction in rear distribution door Refer to the electrical circuit diagrams and check the rear distribution motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Install a new rear distribution door as necessary Install a new rear distribution motor as necessary
B1B7D-49	Rear Air Distribution Actuator - Internal electronic failure	<ul style="list-style-type: none"> Rear distribution motor failure 	<ul style="list-style-type: none"> Install a new rear distribution motor as necessary
B1B81-11	Rear Evaporator Temperature Sensor - Circuit short to ground	<ul style="list-style-type: none"> Rear evaporator temperature sensor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear evaporator temperature sensor circuit for short circuit to ground
B1B81-15	Rear Evaporator Temperature Sensor - Circuit short to battery or open	<ul style="list-style-type: none"> Rear evaporator temperature sensor circuit short circuit to power, open circuit, high 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear evaporator temperature sensor circuit for short circuit to power, open circuit, high resistance

		resistance	
B1COA-88	Rear Control panel - Bus off	<ul style="list-style-type: none"> • Rear integrated control panel power or ground circuit open circuit, high resistance • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Rear integrated control panel fault • Rear temperature blend motor internal failure • Rear face/feet motor internal failure • Automatic temperature control module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear integrated control panel power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the rear integrated control panel for related DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear temperature blend motor • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear face/feet motor • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new automatic temperature control module
C1B14-13	Sensor Supply Voltage A - Circuit open	<ul style="list-style-type: none"> • Recirculation motor position sensor supply circuit short circuit to ground • Recirculation motor position sensor signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the recirculation motor position sensor supply circuit for short circuit to ground • Refer to the electrical circuit diagrams and check the recirculation motor position sensor signal circuit for open circuit, high resistance
C1B15-13	Sensor Supply Voltage B - Circuit open	<ul style="list-style-type: none"> • Recirculation motor position sensor ground circuit open circuit, high resistance • Evaporator temperature sensor ground circuit open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the recirculation motor position sensor ground circuit for open circuit, high resistance • Refer to the electrical circuit diagrams and check the evaporator position sensor ground circuit for open circuit, high resistance
P0530-11	A/C Refrigerant Pressure Sensor A Circuit - Circuit short to ground	<ul style="list-style-type: none"> • Refrigerant pressure sensor signal circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the refrigerant pressure sensor signal circuit for short circuit to ground
P0530-15	A/C Refrigerant Pressure Sensor A Circuit - Circuit short to battery or open	<ul style="list-style-type: none"> • Refrigerant pressure sensor signal circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the refrigerant pressure sensor signal circuit for short circuit to power, open circuit, high resistance
P0645-11	A/C Clutch Relay Control Circuit -	<ul style="list-style-type: none"> • Air conditioning 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the air conditioning compressor clutch relay circuit

	Circuit short to ground	compressor clutch relay circuit short circuit to ground	for short circuit to ground
U0010-88	Medium Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0140-87	Lost Communication With Body Control Module - Missing message	<ul style="list-style-type: none"> • Central junction box power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Central junction box system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0166-87	Lost Communication With Auxiliary Heater Control Module - Missing message	<ul style="list-style-type: none"> • Fuel fired booster heater power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Fuel fired booster heater system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the fuel fired booster heater power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the fuel fired booster heater for related DTCs and refer to the relevant DTC index
U0256-87	Lost Communication With Front Controls Interface Module "A" - Missing message	<ul style="list-style-type: none"> • Integrated control panel power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Integrated control panel fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the integrated control panel power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the integrated control panel for related DTCs and refer to the relevant DTC index
U0300-00	Internal Control Module Software Incompatibility - No	<ul style="list-style-type: none"> • Automatic temperature control 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the automatic temperature control module with the latest level software

	sub type information	module is not configured correctly	
U0422-86	Invalid Data Received From Body Control Module - Signal invalid	<ul style="list-style-type: none"> Missing/invalid data from the central junction box 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0425-86	Invalid Data Received From Auxiliary Heater Control Module - Signal invalid	<ul style="list-style-type: none"> Missing/invalid data from the fuel fired booster heater 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the fuel fired booster heater for related DTCs and refer to the relevant DTC index
U0557-86	Invalid Data Received From Front Controls Interface Module "A" - Signal invalid	<ul style="list-style-type: none"> Missing/invalid data from the integrated control panel 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the integrated control panel for related DTCs and refer to the relevant DTC index
U1A14-49	CAN Initialisation failure - Internal electronic failure	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Automatic temperature control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new automatic temperature control module
U3000-55	Control Module - Not configured	<ul style="list-style-type: none"> Automatic temperature control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the automatic temperature control module with the latest level software
U3000-87	Control Module - Missing message	<ul style="list-style-type: none"> Missing/invalid data from the instrument cluster Automatic temperature control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the instrument cluster for related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new automatic temperature control module
U3002-81	Vehicle Identification Number - Invalid serial data received	<ul style="list-style-type: none"> Automatic temperature control module previously installed on another vehicle New automatic temperature control module installed and VIN not yet programmed 	<ul style="list-style-type: none"> Install the original or a new automatic temperature control module as necessary Using the manufacturer approved diagnostic system, perform routine - Learn VIN (0x0404)

General Information - Diagnostic Trouble Code (DTC) Index DTC: Blindspot Monitoring Control Module (BMCM) - Left/Right

Description and Operation

Blindspot Monitoring Control Module (BMCM) - Left/Right

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.






If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Blindspot Monitoring Control Module (BMCM) - Left/Right. For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

DTC	Description	Possible Causes	Action
B11C9-11	Driver Display Status LED - Circuit short to ground	<p>NOTE: Circuit reference SYSTEM_STATUS_LED</p> <ul style="list-style-type: none"> Door mirror status lamp circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the door mirror status lamp circuit for short circuit to ground
B11C9-15	Driver Display Status LED - Circuit short to battery or open	<p>NOTE: Circuit reference SYSTEM_STATUS_LED</p> <ul style="list-style-type: none"> Door mirror status lamp circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the door mirror status lamp circuit for short circuit to power, open circuit, high resistance

B11D6-11	Driver Display Alert LED - Circuit short to ground	 <p>NOTE: Circuit reference WARNING_ALERT_LED</p> <ul style="list-style-type: none"> • Door mirror warning lamp circuit short circuit to ground 	<p>Refer to the electrical circuit diagrams and check the door mirror warning lamp circuit for short circuit to ground</p>
B11D6-15	Driver Display Alert LED - Circuit short to battery or open	 <p>NOTE: Circuit reference WARNING_ALERT_LED</p> <ul style="list-style-type: none"> • Door mirror warning lamp circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the door mirror warning lamp circuit for short circuit to power, open circuit, high resistance
U0010-87	Medium Speed CAN Communication Bus - Missing message	<ul style="list-style-type: none"> • Missing message from another control module via the medium speed CAN bus 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the snapshot data to determine the missing message source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index
U0010-88	Medium Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification • Blindspot monitoring control module is not configured correctly • Incorrect blindspot monitoring control module installed 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary • Using the manufacturer approved diagnostic system, re-configure the blindspot monitoring control module with the latest level software • Install a new blindspot monitoring control module as necessary
U1000-00	Solid State Driver Protection Activated - Driver Disabled - No sub type information	<ul style="list-style-type: none"> • Blindspot monitoring control module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new blindspot monitoring control module
U1A00-88	Private Communication Network - Bus off	 <p>NOTE: Circuit reference PRIVATE_CAN_H / PRIVATE_CAN_L</p> <ul style="list-style-type: none"> • Other side blindspot monitoring control module power or ground circuit open circuit, high resistance • Private CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the other side blindspot monitoring control module power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the private CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U2100-	Initial Configuration	<ul style="list-style-type: none"> • Blindspot 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic

00	Not Complete - No sub type information	monitoring control module is not configured correctly	system, re-configure the blindspot monitoring control module with the latest level software
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U2300-45	Central Configuration - Program memory failure	<ul style="list-style-type: none"> Blindspot monitoring control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new blindspot monitoring control module
U2300-48	Central Configuration - Supervision software failure	<ul style="list-style-type: none"> Blindspot monitoring control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new blindspot monitoring control module
U2300-96	Central Configuration - Component internal failure	<ul style="list-style-type: none"> Blindspot monitoring control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new blindspot monitoring control module
U3000-44	Control Module - Data memory failure	<ul style="list-style-type: none"> Blindspot monitoring control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new blindspot monitoring control module
U3000-45	Control Module - Program memory failure	<ul style="list-style-type: none"> Blindspot monitoring control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new blindspot monitoring control module
U3000-46	Control Module - Calibration/parameter memory failure	<ul style="list-style-type: none"> Blindspot monitoring control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new blindspot monitoring control module
U3000-48	Control Module - Supervision software failure	<ul style="list-style-type: none"> Blindspot monitoring control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new blindspot monitoring control module
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> Blindspot monitoring control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new blindspot monitoring control module
U3000-78	Control Module - Alignment or adjustment incorrect	<ul style="list-style-type: none"> Blindspot monitoring control module incorrectly mounted Blindspot monitoring control module internal failure 	<p> NOTE: If the DTC is cleared, a test drive of at least 40 minutes duration is required in order to confirm that the fault is rectified (DTC will not re-trigger prior to this interval)</p> <ul style="list-style-type: none"> Check the blindspot monitoring control module for correct mounting Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new blindspot monitoring control module
U3000-96	Control Module - Component internal failure	<ul style="list-style-type: none"> Blindspot monitoring control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new blindspot monitoring control module

General Information - Diagnostic Trouble Code (DTC) Index DTC: Central Junction Box (CJB)

Description and Operation

Central Junction Box (CJB)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.










Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.






The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Central Junction Box (CJB). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.













For additional information, refer to: [Communications Network](#) (418-00 Module Communications Network, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1009-51	Ignition Authorization - Not programmed	<ul style="list-style-type: none"> Central junction box is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the central junction box with the latest level software
B1009-62	Ignition Authorization - Signal compare failure	<ul style="list-style-type: none"> Central junction box is not configured correctly Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<p> NOTE: This DTC is only likely to occur following component replacement applications failing prior to completion.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the central junction box with the latest level software Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1009-	Ignition Authorization	<ul style="list-style-type: none"> Instrument cluster fault 	


63	- Circuit/component protection time-out	<ul style="list-style-type: none"> • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 NOTE: Only diagnose this DTC if the customer has reporting a starting fault. <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the instrument cluster for related DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1009-81	Ignition Authorization - Invalid serial data received	<ul style="list-style-type: none"> • Instrument cluster fault • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the instrument cluster for related DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B100D-51	Column Lock Authorization - Not programmed	<ul style="list-style-type: none"> • Electric steering column lock is not configured correctly 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the electric steering column lock with the latest level software
B100D-64	Column Lock Authorization - Signal plausibility failure	<ul style="list-style-type: none"> • Engine system fault • Anti-lock brake system fault • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 NOTE: Prior to clearing this DTC, carry out the Vehicle Functional Reset application using the manufacturer approved diagnostic system. <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B100D-67	Column Lock Authorization - Signal incorrect after event	<ul style="list-style-type: none"> • Instrument cluster fault • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the instrument cluster for related DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B100D-81	Column Lock Authorization - Invalid serial data received	<ul style="list-style-type: none"> • Encrypted data exchange between electric steering column lock control module and the central junction box does not match • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	NOTES:  This DTC is only likely to occur following component replacement applications failing prior to completion.  Prior to clearing this DTC, carry out the Vehicle Functional Reset application using the manufacturer approved diagnostic system. <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the central junction box with the latest level software • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance






			system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B100D-87	Column Lock Authorization - Missing message	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Electric steering column lock fault Instrument cluster fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the electric steering column lock control module for related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, check the instrument cluster for related DTCs and refer to the relevant DTC index
B100D-96	Column Lock Authorization - Component internal failure	<ul style="list-style-type: none"> Parked position of the road wheels exerting a torque on the steering column, preventing the electric steering column lock mechanism from moving freely Electric steering column lock control module power or ground circuit open circuit, high resistance Electric steering column lock control module internal failure 	 <p>NOTE: Prior to clearing this DTC, carry out the Vehicle Functional Reset application using the manufacturer approved diagnostic system.</p> <ul style="list-style-type: none"> Turn the steering wheel to ensure that the electric steering column lock mechanism is free to move. Using the manufacturer approved diagnostic system, clear the DTCs and retest Refer to the electrical circuit diagrams and check the electric steering column lock control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new electric steering column lock control module
B1024-87	Start Control Unit - Missing message	<ul style="list-style-type: none"> Central junction box internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new central junction box
B1026-11	Steering Column Lock - Circuit short to ground	 <p>NOTE: Circuit reference POWER</p> <ul style="list-style-type: none"> Electric steering column lock circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the electric steering column lock circuit for short circuit to ground
B102B-67	Passive Key - Signal incorrect after event	<ul style="list-style-type: none"> Encrypted data exchange between keyless vehicle module and central junction box does not match Keyless vehicle module power or ground circuit open circuit, high resistance Keyless vehicle system fault Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Re-synchronise ID by reconfiguring the central junction box as a new module. Re-synchronise ID by reconfiguring the keyless vehicle module as a new module Refer to the electrical circuit diagrams and check the keyless vehicle module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, check the keyless vehicle module for related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B102B-87	Passive Key - Missing message	<ul style="list-style-type: none"> Smart key not in vehicle when stop/start switch operated Interference from spurious RF signal Smart key battery low 	 <p>NOTE: The action below is only required if this DTC and DTC B1B01-87 have been stored, or vehicle start issue has been reported.</p> <ul style="list-style-type: none"> Confirm placement of key within vehicle


		<ul style="list-style-type: none"> • Smart key internal failure • Immobilizer antenna unit LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Keyless vehicle module power or ground circuit open circuit, high resistance • RF receiver power or ground circuit open circuit, high resistance • Keyless vehicle system fault • Passive antenna circuit(s) short circuit to ground, short circuit to power, open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Check vehicle surroundings for possible sources of interference, move vehicle and retest • Install a new smart key battery • Test the operation of the other smart key(s) • Refer to the electrical circuit diagrams and check the immobilizer antenna unit LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the keyless vehicle module power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the RF receiver power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, check the keyless vehicle module for related DTCs and refer to the relevant DTC index • Refer to the electrical circuit diagrams and check the passive antenna circuits for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1046-23	Front Fog Lamp Control Switch - Signal stuck low	<ul style="list-style-type: none"> • Front fog lamp switch stuck active • Front fog lamp switch circuit short circuit to ground 	 <p>NOTE: This DTC will set if the switch is active for more than 60 seconds.</p> <ul style="list-style-type: none"> • Test the operation of the front fog lamp switch • Refer to the electrical circuit diagrams and check the front fog lamp switch circuit for short circuit to ground
B1051-23	Front Washer Switch - Signal stuck low	<ul style="list-style-type: none"> • Front washer pump switch stuck active • Front washer pump switch circuit short circuit to ground 	 <p>NOTE: This DTC will set if the switch is active for more than 60 seconds.</p> <ul style="list-style-type: none"> • Test the operation of the front washer pump switch • Refer to the electrical circuit diagrams and check the front washer pump switch circuit for short circuit to ground
B1052-23	Rear Washer Switch - Signal stuck low	<ul style="list-style-type: none"> • Rear washer pump switch stuck active • Rear washer pump switch circuit short circuit to ground 	 <p>NOTE: This DTC will set if the switch is active for more than 60 seconds.</p> <ul style="list-style-type: none"> • Test the operation of the rear washer pump switch • Refer to the electrical circuit diagrams and check the rear washer pump switch circuit for short circuit to ground
B108B-11	Start Button Circuit "A" - Circuit short to ground	 <p>NOTE: Circuit reference SW1</p> <ul style="list-style-type: none"> • Stop/start switch circuit 1 short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the stop/start switch circuit 1 for short circuit to ground
B108B-12	Start Button Circuit "A" - Circuit short to battery	 <p>NOTE: Circuit reference SW1</p> <ul style="list-style-type: none"> • Stop/start switch circuit 1 short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the stop/start switch circuit 1 for short circuit to power


B108B-13	Start Button Circuit "A" - Circuit open	 <p>NOTE: Circuit reference SW1</p> <ul style="list-style-type: none"> Stop/start switch circuit 1 open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the stop/start switch circuit 1 for open circuit, high resistance
B108B-23	Start Button Circuit "A" - Signal stuck low	 <p>NOTE: Circuit reference SW1</p> <ul style="list-style-type: none"> Stop/start switch stuck active Stop/start switch circuit 1 short circuit to ground 	 <p>NOTE: This DTC will set if the switch is active for more than 30 seconds.</p> <ul style="list-style-type: none"> Test the operation of the stop/start switch Refer to the electrical circuit diagrams and check the stop/start switch circuit 1 for short circuit to ground
B108C-11	Start Button Circuit "B" - Circuit short to ground	 <p>NOTE: Circuit reference SW2</p> <ul style="list-style-type: none"> Stop/start switch circuit 2 short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the stop/start switch circuit 2 for short circuit to ground
B108C-12	Start Button Circuit "B" - Circuit short to battery	 <p>NOTE: Circuit reference SW2</p> <ul style="list-style-type: none"> Stop/start switch circuit 2 short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the stop/start switch circuit 2 for short circuit to power
B108C-13	Start Button Circuit "B" - Circuit open	 <p>NOTE: Circuit reference SW2</p> <ul style="list-style-type: none"> Stop/start switch circuit 2 open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the stop/start switch circuit 2 for open circuit, high resistance
B108C-23	Start Button Circuit "B" - Signal stuck low	 <p>NOTE: Circuit reference SW2</p> <ul style="list-style-type: none"> Stop/start switch stuck active Stop/start switch circuit 2 short circuit to ground 	 <p>NOTE: This DTC will set if the switch is active for more than 30 seconds.</p> <ul style="list-style-type: none"> Test the operation of the stop/start switch Refer to the electrical circuit diagrams and check the stop/start switch circuit 2 for short circuit to ground
B1095-11	Wiper On/Off Relay - Circuit short to ground	 <p>NOTE: Circuit reference FR WIPER ON/OFF</p> <ul style="list-style-type: none"> Wiper on/off relay circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the wiper on/off relay circuit for short circuit to ground
B1095-12	Wiper On/Off Relay - Circuit short to battery	 <p>NOTE: Circuit reference FR WIPER ON/OFF</p> <ul style="list-style-type: none"> Wiper on/off relay circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the wiper on/off relay circuit for short circuit to power
B1095-13	Wiper On/Off Relay - Circuit open	 <p>NOTE: Circuit reference FR WIPER ON/OFF</p> <ul style="list-style-type: none"> Wiper on/off relay circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the wiper on/off relay circuit for open circuit, high resistance
B1096-11	Wiper High/Low Relay - Circuit short to ground	 <p>NOTE: Circuit reference FR WIPER SLOW/FAST</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the wiper fast/slow relay circuit for short circuit to ground

		<ul style="list-style-type: none"> Wiper fast/slow relay circuit short circuit to ground 	
B1096-12	Wiper High/Low Relay - Circuit short to battery	 <p>NOTE: Circuit reference FR WIPER SLOW/FAST</p> <ul style="list-style-type: none"> Wiper fast/slow relay circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the wiper fast/slow relay circuit for short circuit to power
B1096-13	Wiper High/Low Relay - Circuit open	 <p>NOTE: Circuit reference FR WIPER SLOW/FAST</p> <ul style="list-style-type: none"> Wiper fast/slow relay circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the wiper fast/slow relay circuit for open circuit, high resistance
B1097-11	Heated Windshield Relay - Circuit short to ground	<ul style="list-style-type: none"> Heated windshield relay circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the heated windshield relay circuit for short circuit to ground
B1097-12	Heated Windshield Relay - Circuit short to battery	<ul style="list-style-type: none"> Heated windshield relay circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the heated windshield relay circuit for short circuit to power
B1097-13	Heated Windshield Relay - Circuit open	<ul style="list-style-type: none"> Heated windshield relay circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the heated windshield relay circuit for open circuit, high resistance
B109E-51	Remote Keyless Entry - Not programmed	<ul style="list-style-type: none"> Keyless vehicle module not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the keyless vehicle module with the latest level software
B10A2-31	Crash Input - No signal	<ul style="list-style-type: none"> Restraints system fault Crash signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the restraints control module for related DTCs and refer to the relevant DTC index Refer to the electrical circuit diagrams and check the crash signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B10A2-38	Crash Input - Signal frequency incorrect	<ul style="list-style-type: none"> Restraints system fault Crash signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the restraints control module for related DTCs and refer to the relevant DTC index Refer to the electrical circuit diagrams and check the crash signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B10AB-51	Remote Keyless Entry Synchronization - Not programmed	<ul style="list-style-type: none"> Keyless vehicle module not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the keyless vehicle module with the latest level software
B10AD-87	Rain Sensor - Missing message	<ul style="list-style-type: none"> Rain/light sensor power or ground circuit open circuit, high resistance LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Rain/light sensor internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rain/light sensor power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rain/light sensor
B10AD-96	Rain Sensor - Component internal failure	<ul style="list-style-type: none"> Rain/light sensor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rain/light sensor
B10C0-53	Fuel Pump Power Supply - Deactivated	<ul style="list-style-type: none"> Fuel pump power supply deactivated 	 <p>NOTE: This DTC indicates that the fuel pump has been disabled diagnostically to protect the in-tank fuel pump from dry running following replacement of the fuel tank or replacement of the</p>








			<p>central junction box.</p> <ul style="list-style-type: none"> Ensure there is sufficient fuel in the fuel tank to submerge the in-tank fuel pump (minimum of 10 litres). Using the manufacturer approved diagnostic system, re-configure the central junction box with the latest level software
B10E5-11	PCM Wake-Up Signal - Circuit short to ground	<ul style="list-style-type: none"> Engine control module wake-up signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the engine control module wake-up signal circuit for short circuit to ground
B10F2-4B	Sunroof Control - Over temperature	<ul style="list-style-type: none"> Roof opening panel movement restricted by debris or damage Roof opening panel temperature sensor not calibrated/defective 	<ul style="list-style-type: none"> Test the roof opening panel for smooth operation. If the fault persists, install a new roof opening panel control module Install a new roof opening panel motor as necessary
B10F2-74	Sunroof Control - Actuator slipping	<ul style="list-style-type: none"> Roof opening panel control motor slipping due to mechanical failure 	<ul style="list-style-type: none"> Remove the roof opening panel motor and inspect the cables and mechanism. Test the roof opening panel for smooth operation and obstructions that would cause the motor to slip. Install a new roof opening panel motor as necessary
B10F2-93	Sunroof Control - No operation	<ul style="list-style-type: none"> Roof opening panel control module power or ground circuit open circuit, high resistance LIN bus 3 circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the roof opening panel control module power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus 3 circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B10F2-9A	Sunroof Control - Component or system operating conditions	<ul style="list-style-type: none"> Roof opening panel motor time out 	<p> NOTE: This DTC may be set if the roof opening panel is operated excessively.</p> <ul style="list-style-type: none"> Allow the roof opening panel motor to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest
B10F3-11	Left front position light - Circuit short to ground	<ul style="list-style-type: none"> Front left side lamp circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left side lamp circuit for short circuit to ground
B10F4-11	Right front position light - Circuit short to ground	<ul style="list-style-type: none"> Front right side lamp circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right side lamp circuit for short circuit to ground
B10F8-11	Accessory Socket 'A' Relay - Circuit short to ground	<ul style="list-style-type: none"> Accessory relay A circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the accessory relay A circuit for short circuit to ground
B10F8-12	Accessory Socket 'A' Relay - Circuit short to battery	<ul style="list-style-type: none"> Accessory relay A circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the accessory relay A circuit for short circuit to power
B10F8-13	Accessory Socket 'A' Relay - Circuit open	<ul style="list-style-type: none"> Accessory relay A circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the accessory relay A circuit for open circuit, high resistance
B10F9-11	Accessory Socket 'B' Relay - Circuit short to ground	<ul style="list-style-type: none"> Accessory relay B circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the accessory relay B circuit for short circuit to ground
B10F9-12	Accessory Socket 'B' Relay - Circuit short to battery	<ul style="list-style-type: none"> Accessory relay B circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the accessory relay B circuit for short circuit to power
B10F9-13	Accessory Socket 'B' Relay - Circuit open	<ul style="list-style-type: none"> Accessory relay B circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the accessory relay B circuit for open circuit, high resistance
B1102-11	Trailer Stop Lamp - Circuit short to ground	<ul style="list-style-type: none"> Trailer stop lamp circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the trailer stop lamp circuit for short circuit to ground



B1118-11	Left Rear Sidemarker - Circuit short to ground	<ul style="list-style-type: none"> • Front left side marker lamp circuit short circuit to ground • Front right side marker lamp circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front left side marker lamp circuit for short circuit to ground • Refer to the electrical circuit diagrams and check the front right side marker lamp circuit for short circuit to ground
B112B-87	Steering Wheel Module - Missing message	 <p>NOTE: Circuit reference LIN 1</p> <ul style="list-style-type: none"> • Steering wheel left switchpack power or ground circuit open circuit, high resistance • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Steering wheel left switchpack internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the steering wheel left switchpack power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new steering wheel left switchpack
B112C-87	Interior Motion Sensor - Missing message	 <p>NOTE: Circuit reference BBS LIN</p> <ul style="list-style-type: none"> • Volumetric sensor power or ground circuit open circuit, high resistance • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Volumetric sensor internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the volumetric sensor power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new volumetric sensor
B112C-96	Interior Motion Sensor - Component internal failure	<ul style="list-style-type: none"> • Volumetric sensor internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new volumetric sensor
B113E-23	External Boot/Trunk Release Switch - Signal stuck low	<ul style="list-style-type: none"> • Upper tailgate release switch stuck active • Upper tailgate release switch circuit short circuit to ground 	 <p>NOTE: This DTC will set if the switch is active for more than 60 seconds.</p> <ul style="list-style-type: none"> • Test the operation of the upper tailgate release switch • Refer to the electrical circuit diagrams and check the upper tailgate release switch circuit for short circuit to ground
B1140-11	Engine Crank Authorization - Circuit short to ground	 <p>NOTE: Circuit reference CRANK</p> <ul style="list-style-type: none"> • Engine crank signal circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the engine crank signal circuit for short circuit to ground
B1140-15	Engine Crank Authorization - Circuit short to battery or open	 <p>NOTE: Circuit reference CRANK</p> <ul style="list-style-type: none"> • Engine crank signal circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the engine crank signal circuit for short circuit to power, open circuit, high resistance
B1146-11	Passive Sounder Supply - Circuit short to ground	<ul style="list-style-type: none"> • Passive sounder circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passive sounder circuit for short circuit to ground
B1146-15	Passive Sounder Supply - Circuit short to battery or open	<ul style="list-style-type: none"> • Passive sounder circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passive sounder circuit for short circuit to power, open circuit, high resistance






B1182-51	Tire Pressure Monitoring System - Not programmed	<ul style="list-style-type: none"> Diagnostic test to verify reception of all tire low pressure sensors has failed 	 <p>NOTE: If additional tire pressure monitoring system related DTCs are also set, perform the relevant corrective action(s) first.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform routine - Tire Pressure Monitor Confirmation Application
B123A-11	Left Front Turn Indicator - Circuit short to ground	<ul style="list-style-type: none"> Front left turn signal indicator circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left turn signal indicator circuit for short circuit to ground
B123A-15	Left Front Turn Indicator - Circuit short to battery or open	<ul style="list-style-type: none"> Front left turn signal indicator circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left turn signal indicator circuit for short circuit to power, open circuit, high resistance
B123B-11	Right Front Turn Indicator - Circuit short to ground	<ul style="list-style-type: none"> Front right turn signal indicator circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right turn signal indicator circuit for short circuit to ground
B123B-15	Right Front Turn Indicator - Circuit short to battery or open	<ul style="list-style-type: none"> Front right turn signal indicator circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right turn signal indicator circuit for short circuit to power, open circuit, high resistance
B1247-11	Left Rear Turn Indicator - Circuit short to ground	<ul style="list-style-type: none"> Rear left turn signal indicator circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left turn signal indicator circuit for short circuit to ground
B1247-15	Left Rear Turn Indicator - Circuit short to battery or open	<ul style="list-style-type: none"> Rear left turn signal indicator circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left turn signal indicator circuit for short circuit to power, open circuit, high resistance
B1248-11	Right Rear Turn Indicator - Circuit short to ground	<ul style="list-style-type: none"> Rear right turn signal indicator circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right turn signal indicator circuit for short circuit to ground
B1248-15	Right Rear Turn Indicator - Circuit short to battery or open	<ul style="list-style-type: none"> Rear right turn signal indicator circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right turn signal indicator circuit for short circuit to power, open circuit, high resistance
B124A-11	Right Daytime Running Light - Circuit short to ground	<ul style="list-style-type: none"> Right daytime running light circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right daytime running light circuit for short circuit to ground
B124B-11	Left Daytime Running Light - Circuit short to ground	<ul style="list-style-type: none"> Left daytime running light circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left daytime running light circuit for short circuit to ground
B1298-73	Steering Column Adjust Up Switch - Actuator stuck closed	<ul style="list-style-type: none"> Steering column adjust switch internal failure - Tilt up switch stuck active 	<ul style="list-style-type: none"> Test the operation of the steering column adjust switch
B1299-73	Steering Column Adjust Down Switch - Actuator stuck closed	<ul style="list-style-type: none"> Steering column adjust switch internal failure - Tilt down switch stuck active 	<ul style="list-style-type: none"> Test the operation of the steering column adjust switch
B12A1-73	Steering Column Adjust Out Switch - Actuator stuck closed	<ul style="list-style-type: none"> Steering column adjust switch internal failure - Reach out switch stuck active 	<ul style="list-style-type: none"> Test the operation of the steering column adjust switch
B12A2-73	Steering Column Adjust In Switch - Actuator stuck closed	<ul style="list-style-type: none"> Steering column adjust switch internal failure - Reach in switch stuck active 	<ul style="list-style-type: none"> Test the operation of the steering column adjust switch
B12A3-11	Steering Column Adjust Motor Drive A - Circuit short to ground	<ul style="list-style-type: none"> Steering column adjust motor drive A circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering column adjust motor drive A circuit for short circuit to ground
B12A3-12	Steering Column Adjust Motor Drive A - Circuit short to	<ul style="list-style-type: none"> Steering column adjust motor drive A circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering column adjust motor drive A circuit for short circuit to power






	battery		
B12A3-15	Steering Column Adjust Motor Drive A - Circuit short to battery or open	<ul style="list-style-type: none"> Steering column adjust motor drive A circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering column adjust motor drive A circuit for short circuit to power, open circuit, high resistance
B12A4-11	Steering Column Adjust Motor Drive B - Circuit short to ground	<ul style="list-style-type: none"> Steering column adjust motor drive B circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering column adjust motor drive B circuit for short circuit to ground
B12A4-12	Steering Column Adjust Motor Drive B - Circuit short to battery	<ul style="list-style-type: none"> Steering column adjust motor drive B circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering column adjust motor drive B circuit for short circuit to power
B12A4-15	Steering Column Adjust Motor Drive B - Circuit short to battery or open	<ul style="list-style-type: none"> Steering column adjust motor drive B circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering column adjust motor drive B circuit for short circuit to power, open circuit, high resistance
B12CB-23	Start/Stop "Eco-Start" Enable Button - Signal stuck low	<ul style="list-style-type: none"> ECO switch stuck active ECO switch circuit short circuit to ground 	<ul style="list-style-type: none"> Test the operation of the ECO switch Refer to the electrical circuit diagrams and check the ECO switch circuit for short circuit to ground
B12E8-23	Liftgate/Tailgate Control/Release Switch - Signal stuck low	<ul style="list-style-type: none"> Lower tailgate release switch stuck active Lower tailgate release switch circuit short circuit to ground 	 <p>NOTE: This DTC will set if the switch is active for more than 60 seconds.</p> <ul style="list-style-type: none"> Test the operation of the lower tailgate release switch Refer to the electrical circuit diagrams and check the lower tailgate release switch circuit for short circuit to ground
B12EE-11	Tailgate/Trunk Release - Circuit short to ground	<ul style="list-style-type: none"> Upper tailgate release actuator circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the upper tailgate release actuator circuit for short circuit to ground
B12EE-15	Tailgate/Trunk Release - Circuit short to battery or open	<ul style="list-style-type: none"> Upper tailgate release actuator circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the upper tailgate release actuator circuit for short circuit to power, open circuit, high resistance
B12F3-11	Secondary Tailgate Release - Circuit short to ground	<ul style="list-style-type: none"> Lower tailgate release actuators circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the lower tailgate release actuators circuit for short circuit to ground
B12F3-15	Secondary Tailgate Release - Circuit short to battery or open	<ul style="list-style-type: none"> Lower tailgate release actuators circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the lower tailgate release actuators circuit for short circuit to power, open circuit, high resistance
B12F4-12	Vehicle Speed Output - Circuit short to battery	<ul style="list-style-type: none"> Accessory road speed signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the accessory road speed signal circuit for short circuit to power
B12F5-12	Fridge Relay Control - Circuit short to battery	<ul style="list-style-type: none"> Fridge relay circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fridge relay circuit for short circuit to power
B130B-11	Right Rear Fog Lamp - Circuit short to ground	<ul style="list-style-type: none"> Rear right fog lamp circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right fog lamp circuit for short circuit to ground
B130B-15	Right Rear Fog Lamp - Circuit short to battery or open	<ul style="list-style-type: none"> Rear right fog lamp circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right fog lamp circuit for short circuit to power, open circuit, high resistance
B130E-11	Left Rear Fog Lamp - Circuit short to ground	<ul style="list-style-type: none"> Rear left fog lamp circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left fog lamp circuit for short circuit to ground
B130E-15	Left Rear Fog Lamp - Circuit short to battery or open	<ul style="list-style-type: none"> Rear left fog lamp circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left fog lamp circuit for short circuit to power, open circuit, high resistance









B1311-87	Clock Module - Missing message	 <p>NOTE: Circuit reference LIN1</p> <ul style="list-style-type: none"> • Clock power or ground circuit open circuit, high resistance • Clock LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Clock internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the clock power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the clock LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new clock
B134E-11	Switch Illumination Adjustment Control - Circuit short to ground	<ul style="list-style-type: none"> • Switch illumination adjustment circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the switch illumination adjustment circuit for short circuit to ground
B134E-12	Switch Illumination Adjustment Control - Circuit short to battery	<ul style="list-style-type: none"> • Switch illumination adjustment circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the switch illumination adjustment circuit for short circuit to power
B134E-13	Switch Illumination Adjustment Control - Circuit open	<ul style="list-style-type: none"> • Switch illumination adjustment circuit open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the switch illumination adjustment circuit for open circuit, high resistance
B134F-23	Headlamp Flash Switch - Signal stuck low	<ul style="list-style-type: none"> • Headlamp flash switch circuit short circuit to ground • Headlamp flash switch stuck active 	 <p>NOTE: This DTC will set if the switch is active for more than 60 seconds.</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the headlamp flash switch circuit for short circuit to ground • Test the operation of the headlamp flash switch
B136A-11	Heated Washer Jet/Nozzle Output Control - Circuit short to ground	<ul style="list-style-type: none"> • Heated washer jet circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the heated washer jet circuit for short circuit to ground
B136A-12	Heated Washer Jet/Nozzle Output Control - Circuit short to battery	<ul style="list-style-type: none"> • Heated washer jet circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the heated washer jet circuit for short circuit to power
B136A-13	Heated Washer Jet/Nozzle Output Control - Circuit open	<ul style="list-style-type: none"> • Heated washer jet circuit open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the heated washer jet circuit for open circuit, high resistance
B136B-11	Suspension Control Module Wake-up Signal - Circuit short to ground	<ul style="list-style-type: none"> • Air suspension control module wake-up signal circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the air suspension control module wake-up signal circuit for short circuit to ground
B136B-15	Suspension Control Module Wake-up Signal - Circuit short to battery or open	<ul style="list-style-type: none"> • Air suspension control module wake-up signal circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the air suspension control module wake-up signal circuit for short circuit to power, open circuit, high resistance
B137F-16	Steering Wheel Left Switch Pack - Circuit voltage below threshold	<ul style="list-style-type: none"> • Steering wheel left switchpack internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new steering wheel left switchpack
B137F-17	Steering Wheel Left Switch Pack - Circuit voltage above threshold	<ul style="list-style-type: none"> • Steering wheel left switchpack internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new steering wheel left switchpack
B137F-49	Steering Wheel Left Switch Pack - Internal electronic failure	<ul style="list-style-type: none"> • Steering wheel left switchpack internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new steering wheel left switchpack
B1380-16	Steering Wheel Right Switch Pack - Circuit voltage below threshold	<ul style="list-style-type: none"> • Steering wheel left switchpack internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new steering wheel left switchpack




B1380-17	Steering Wheel Right Switch Pack - Circuit voltage above threshold	<ul style="list-style-type: none"> Steering wheel left switchpack internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new steering wheel left switchpack
B1380-49	Steering Wheel Right Switch Pack - Internal electronic failure	<ul style="list-style-type: none"> Steering wheel left switchpack internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new steering wheel left switchpack
B13BD-87	Steering Wheel Heater Module - Missing message	 <p>NOTE: Circuit reference LIN 1</p> <ul style="list-style-type: none"> Steering wheel heater control module power or ground circuit open circuit, high resistance LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Steering wheel heater control module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering wheel heater control module power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new steering wheel heater control module
B1A75-11	Fuel sender No.1 - Circuit short to ground	 <p>NOTE: Circuit reference ACTIVE</p> <ul style="list-style-type: none"> Fuel level sensor A circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel level sensor A circuit for short circuit to ground
B1A75-15	Fuel sender No.1 - Circuit short to battery or open	 <p>NOTE: Circuit reference ACTIVE</p> <ul style="list-style-type: none"> Fuel level sensor A circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel level sensor A circuit for short circuit to power, open circuit, high resistance
B1A75-1C	Fuel sender No.1 - Circuit voltage out of range	 <p>NOTE: Circuit reference ACTIVE</p> <ul style="list-style-type: none"> Fuel level sensor A circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel level sensor A circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1A76-11	Fuel sender No.2 - Circuit short to ground	 <p>NOTE: Circuit reference PASSIVE</p> <ul style="list-style-type: none"> Fuel level sensor B circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel level sensor B circuit for short circuit to ground
B1A76-15	Fuel sender No.2 - Circuit short to battery or open	 <p>NOTE: Circuit reference PASSIVE</p> <ul style="list-style-type: none"> Fuel level sensor B circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel level sensor B circuit for short circuit to power, open circuit, high resistance
B1A76-1C	Fuel sender No.2 - Circuit voltage out of range	 <p>NOTE: Circuit reference PASSIVE</p> <ul style="list-style-type: none"> Fuel level sensor B circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel level sensor B circuit for short circuit to ground, short circuit to power, open circuit, high resistance

B1A84-51	Car Configuration Data - Not programmed	<ul style="list-style-type: none"> Central junction box not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the central junction box with the latest level software
B1A85-96	Ambient Light Sensor - Component internal failure	<ul style="list-style-type: none"> Rain/light sensor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rain/light sensor
B1A91-31	Speed/Position Sensor A - No signal	 <p>NOTE: Circuit reference LIN 3</p> <ul style="list-style-type: none"> Roof opening panel control module power or ground circuit open circuit, high resistance LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Roof opening panel control module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the roof opening panel control module power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, perform routine - Sunroof Calibration (0x2039). Clear the DTCs and retest. If the fault persists, install a new roof opening panel control module
B1A92-31	Speed/Position Sensor B - No signal	 <p>NOTE: Circuit reference LIN 3</p> <ul style="list-style-type: none"> Roof opening panel control module power or ground circuit open circuit, high resistance LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Roof opening panel control module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the roof opening panel control module power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, perform routine - Sunroof Calibration (0x2039). Clear the DTCs and retest. If the fault persists, install a new roof opening panel control module
B1B01-55	Key Transponder - Not configured	<ul style="list-style-type: none"> Keyless vehicle module not configured 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, configure the keyless vehicle module
B1B01-64	Key Transponder - Signal plausibility failure	<ul style="list-style-type: none"> Keyless vehicle module power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Keyless vehicle module ID not synchronised 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the keyless vehicle module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, re-configure the keyless vehicle module as a new module
B1B01-81	Key Transponder - Invalid serial data received	<ul style="list-style-type: none"> Keyless vehicle module power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Keyless vehicle module ID not synchronised 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the keyless vehicle module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, re-configure the keyless vehicle module as a new module
B1B01-87	Key Transponder - Missing message	<ul style="list-style-type: none"> Keyless vehicle module power or ground circuit open circuit, high resistance Medium speed CAN bus 	 <p>NOTE: This DTC may be set if the engine start switch is operated without a valid smart key present.</p>

		<p>circuit short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Keyless vehicle module ID not synchronised 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the keyless vehicle module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, re-configure the keyless vehicle module as a new module
B1B33-51	Target ID Transfer - Not programmed	<ul style="list-style-type: none"> • A new engine control module has been installed 	<ul style="list-style-type: none"> • Re-synchronise ID by reconfiguring the engine control module as a new module. Clear DTC and retest
B1B33-64	Target ID Transfer - Signal plausibility failure	<ul style="list-style-type: none"> • Invalid signal received from engine control module 	<ul style="list-style-type: none"> • No action necessary, clear/ignore DTC
B1B33-81	Target ID Transfer - Invalid serial data received	<ul style="list-style-type: none"> • Invalid serial data received from engine control module 	<ul style="list-style-type: none"> • No action necessary, clear/ignore DTC
B1B33-87	Target ID Transfer - Missing message	<ul style="list-style-type: none"> • Invalid message received from engine control module 	<p> NOTE: Only diagnose this DTC if the customer has reporting a starting fault.</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1B56-46	Sunroof Module - Calibration/parameter memory failure	<ul style="list-style-type: none"> • Roof opening panel control module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform routine - Sunroof Calibration (0x2039). Clear the DTCs and retest. If the fault persists, install a new roof opening panel control module
B1B56-87	Sunroof Module - Missing message	<p> NOTE: Circuit reference LIN3</p> <ul style="list-style-type: none"> • Roof opening panel control module power or ground circuit open circuit, high resistance • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<p> NOTE: This DTC is inhibited if the car configuration file is correct.</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the roof opening panel control module power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1C32-11	Steering Column Tilt Solenoid - Circuit short to ground	<ul style="list-style-type: none"> • Steering column tilt adjustment motor circuit short circuit to ground 	<p> NOTE: This component is a serviceable item.</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the steering column tilt adjustment motor circuit for short circuit to ground
B1C32-15	Steering Column Tilt Solenoid - Circuit short to battery or open	<ul style="list-style-type: none"> • Steering column tilt adjustment motor circuit short circuit to power, open circuit, high resistance 	<p> NOTE: This component is a serviceable item.</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the steering column tilt adjustment motor circuit for short circuit to power, open circuit, high resistance
B1C33-12	Steering Column Tilt Feedback Signal - Circuit short to battery	<ul style="list-style-type: none"> • Steering column tilt adjustment motor position sensor circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the steering column tilt adjustment motor position sensor circuit for short circuit to power
B1C33-14	Steering Column Tilt Feedback Signal -	<ul style="list-style-type: none"> • Steering column tilt adjustment motor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the steering column tilt adjustment

	Circuit short to ground or open	position sensor circuit short circuit to ground, open circuit, high resistance	motor position sensor circuit for short circuit to ground, open circuit, high resistance
B1C34-11	Steering Column Telescopic Solenoid - Circuit short to ground	<ul style="list-style-type: none"> Steering column reach adjustment motor circuit short circuit to ground 	 NOTE: This component is a serviceable item. <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering column reach adjustment motor circuit for short circuit to ground
B1C34-15	Steering Column Telescopic Solenoid - Circuit short to battery or open	<ul style="list-style-type: none"> Steering column reach adjustment motor circuit short circuit to power, open circuit, high resistance 	 NOTE: This component is a serviceable item. <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering column reach adjustment motor circuit for short circuit to power, open circuit, high resistance
B1C35-12	Steering Column Telescopic Feedback Signal - Circuit short to battery	<ul style="list-style-type: none"> Steering column reach adjustment motor position sensor circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering column reach adjustment motor position sensor circuit for short circuit to power
B1C35-14	Steering Column Telescopic Feedback Signal - Circuit short to ground or open	<ul style="list-style-type: none"> Steering column reach adjustment motor position sensor circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering column reach adjustment motor position sensor circuit for short circuit to ground, open circuit, high resistance
B1C36-11	Steering Column Adjust Switch - Circuit short to ground	<ul style="list-style-type: none"> Steering column adjustment switch circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering column adjustment switch circuit for short circuit to ground
B1C37-23	Master Lock Switch Stuck - Signal stuck low	<ul style="list-style-type: none"> Interior central locking lock switch circuit short circuit to ground Interior central locking lock switch stuck active 	 NOTE: This DTC will set if the switch is active for more than 60 seconds. <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the interior central locking lock switches circuits for short circuit to ground Test the operation of the interior central locking lock switches
B1C38-23	Master Unlock Switch Stuck - Signal stuck low	<ul style="list-style-type: none"> Interior central locking unlock switch circuit short circuit to ground Interior central locking unlock switch stuck active 	 NOTE: This DTC will set if the switch is active for more than 60 seconds. <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the interior central locking unlock switches circuits for short circuit to ground Test the operation of the interior central locking unlock switches
B1C43-23	Master Interior Lamp Switch Stuck - Signal stuck low	<ul style="list-style-type: none"> Interior lamp switch circuit short circuit to ground Interior lamp switch stuck active 	 NOTE: This DTC will set if the switch is active for more than 60 seconds. <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the interior lamp switch circuit for short circuit to ground Test the operation of the interior lamp switch
B1C44-67	Rear Wiper Park Position Switch Stuck - Signal incorrect after event	<ul style="list-style-type: none"> Rear wiper park position switch circuit short circuit to power, short circuit to ground, open circuit 	<ul style="list-style-type: none"> Ensure motor/mechanism is not jammed or seized. Refer to the electrical circuit diagrams and check the rear wiper park position switch circuit for short circuit to ground. Install a new rear wiper motor as necessary
B1C45-67	Front Wiper Park Position Switch Stuck - Signal incorrect after event	<ul style="list-style-type: none"> Front wiper park position switch circuit short circuit to power, short circuit to ground, open circuit 	<ul style="list-style-type: none"> Ensure motor/mechanism is not jammed or seized. Refer to the electrical circuit diagrams and check the front wiper park position switch circuit for short circuit to ground. Install a new front wiper motor as



			necessary
B1C53-29	Front Wiper Intermittent Data - Signal invalid	 <p>NOTE: Circuit reference DATA 1 / DATA 2 / DATA 3</p> <ul style="list-style-type: none"> Front wiper variable intermittent wipe switch circuits short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front wiper variable intermittent wipe switch circuits for short circuit to ground, short circuit to power, open circuit, high resistance
B1C55-12	Horn Relay - Circuit short to battery	 <p>NOTE: Circuit reference HORN</p> <ul style="list-style-type: none"> Horn relay / horn switch circuits short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the horn relay / horn switch circuits for short circuit to power
B1C77-11	Rear Wiper Relay - Circuit short to ground	 <p>NOTE: Circuit reference REAR WIPER</p> <ul style="list-style-type: none"> Rear wiper relay circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear wiper relay circuit for short circuit to ground
B1C77-12	Rear Wiper Relay - Circuit short to battery	 <p>NOTE: Circuit reference REAR WIPER</p> <ul style="list-style-type: none"> Rear wiper relay circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear wiper relay circuit for short circuit to power
B1C77-13	Rear Wiper Relay - Circuit open	 <p>NOTE: Circuit reference REAR WIPER</p> <ul style="list-style-type: none"> Rear wiper relay circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear wiper relay circuit for open circuit, high resistance
B1C82-11	Headlamp Washer Relay A - Circuit short to ground	 <p>NOTE: Circuit reference POWER WASH L</p> <ul style="list-style-type: none"> Headlamp wash relay A circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the headlamp wash relay A circuit for short circuit to ground
B1C82-12	Headlamp Washer Relay A - Circuit short to battery	 <p>NOTE: Circuit reference POWER WASH L</p> <ul style="list-style-type: none"> Headlamp wash relay A circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the headlamp wash relay A circuit for short circuit to power
B1C82-13	Headlamp Washer Relay A - Circuit open	 <p>NOTE: Circuit reference POWER WASH L</p> <ul style="list-style-type: none"> Headlamp wash relay A circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the headlamp wash relay A circuit for open circuit, high resistance
B1C90-11	Auxiliary Driving Lamps Relay - Circuit short to ground	<ul style="list-style-type: none"> Auxiliary driving lamps relay circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the auxiliary driving lamps relay circuit for short circuit to ground
B1C90-12	Auxiliary Driving Lamps Relay - Circuit short to battery	<ul style="list-style-type: none"> Auxiliary driving lamps relay circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the auxiliary driving lamps relay circuit for short circuit to power
B1C90-13	Auxiliary Driving Lamps Relay - Circuit open	<ul style="list-style-type: none"> Auxiliary driving lamps relay circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the auxiliary driving lamps relay circuit for open circuit, high resistance

B1C98-11	Left Corner Lamp Circuit - Circuit short to ground	<ul style="list-style-type: none"> Left cornering lamp circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left cornering lamp circuit for short circuit to ground
B1C98-15	Left Corner Lamp Circuit - Circuit short to battery or open	<ul style="list-style-type: none"> Left cornering lamp circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left cornering lamp circuit for short circuit to power, open circuit, high resistance
B1C99-11	Right Corner Lamp Circuit - Circuit short to ground	<ul style="list-style-type: none"> Right cornering lamp circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right cornering lamp circuit for short circuit to ground
B1C99-15	Right Corner Lamp Circuit - Circuit short to battery or open	<ul style="list-style-type: none"> Right cornering lamp circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right cornering lamp circuit for short circuit to power, open circuit, high resistance
B1D00-11	Left Low Beam - Circuit short to ground	<ul style="list-style-type: none"> Left headlamp low beam circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left headlamp low beam circuit for short circuit to ground
B1D00-15	Left Low Beam - Circuit short to battery or open	<ul style="list-style-type: none"> Left headlamp low beam circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left headlamp low beam circuit for short circuit to power, open circuit, high resistance
B1D01-11	Right Low Beam - Circuit short to ground	<ul style="list-style-type: none"> Right headlamp low beam circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right headlamp low beam circuit for short circuit to ground
B1D01-15	Right Low Beam - Circuit short to battery or open	<ul style="list-style-type: none"> Right headlamp low beam circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right headlamp low beam circuit for short circuit to power, open circuit, high resistance
B1D02-11	Left High Beam - Circuit short to ground	<ul style="list-style-type: none"> Left headlamp high beam circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left headlamp high beam circuit for short circuit to ground
B1D03-11	Right High Beam - Circuit short to ground	<ul style="list-style-type: none"> Right headlamp high beam circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right headlamp high beam circuit for short circuit to ground
B1D03-15	Right High Beam - Circuit short to battery or open	<ul style="list-style-type: none"> Right headlamp high beam circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right headlamp high beam circuit for short circuit to power, open circuit, high resistance
B1D08-11	Left Trailer Direction Indicator Circuit - Circuit short to ground	<ul style="list-style-type: none"> Trailer left turn signal indicator circuit short circuit to ground 	 <p>NOTE: This DTC may be set by a fault in the trailer.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the trailer left turn signal indicator circuit for short circuit to ground
B1D09-11	Right Trailer Direction Indicator Circuit - Circuit short to ground	<ul style="list-style-type: none"> Trailer right turn signal indicator circuit short circuit to ground 	 <p>NOTE: This DTC may be set by a fault in the trailer.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the trailer right turn signal indicator circuit for short circuit to ground
B1D13-11	Interior Lights Circuit "A" - Circuit short to ground	<ul style="list-style-type: none"> Interior lamps circuits short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the interior lamps circuits for short circuit to ground
B1D17-87	Battery Backed Sounder - Missing message	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	 <p>NOTE: This DTC is inhibited if the car configuration file is correct.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
B1D17-96	Battery Backed Sounder - Component internal	<ul style="list-style-type: none"> Battery back-up sounder internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new battery back-up

	failure		sounder
B1D35-23	Hazard Switch Stuck - Signal stuck low	<ul style="list-style-type: none"> Hazard warning lamp switch stuck active Hazard warning lamp switch circuit short circuit to ground 	 <p>NOTE: This DTC will set if the switch is active for more than 60 seconds.</p> <ul style="list-style-type: none"> Test the operation of the hazard warning lamp switch Refer to the electrical circuit diagrams and check the hazard warning lamp switch circuit for short circuit to ground
B1D97-96	Tilt Sensor - Component internal failure	<ul style="list-style-type: none"> Battery back-up sounder internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new battery back-up sounder
C111A-11	Right Stop Lamp - Circuit short to ground	<ul style="list-style-type: none"> Right stop lamp circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right stop lamp circuit for short circuit to ground
C111A-15	Right Stop Lamp - Circuit short to battery or open	<ul style="list-style-type: none"> Right stop lamp circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right stop lamp circuit for short circuit to power, open circuit, high resistance
C111B-11	Left Stop Lamp - Circuit short to ground	<ul style="list-style-type: none"> Left stop lamp circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left stop lamp circuit for short circuit to ground
C111B-15	Left Stop Lamp - Circuit short to battery or open	<ul style="list-style-type: none"> Left stop lamp circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left stop lamp circuit for short circuit to power, open circuit, high resistance
C1A56-16	Left Front Tire Pressure Sensor and Transmitter Assembly - Circuit voltage below threshold	<ul style="list-style-type: none"> Front left tire pressure sensor internal battery voltage low 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left tire pressure sensor
C1A56-86	Left Front Tire Pressure Sensor and Transmitter Assembly - Signal invalid	<ul style="list-style-type: none"> Front left tire pressure sensor internal failure - Pressure, temperature or acceleration signal(s) out of range 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left tire pressure sensor
C1A56-93	Left Front Tire Pressure Sensor and Transmitter Assembly - No operation	<ul style="list-style-type: none"> Front left tire pressure sensor not installed Front left tire pressure sensor internal failure Front left initiator circuit short circuit to ground, short circuit to power, open circuit, high resistance Tire pressure monitoring system RF receiver power or ground circuit open circuit, high resistance Tire pressure monitoring system RF receiver internal failure Electrical interference 	<ul style="list-style-type: none"> Check the installation of the front left tire pressure sensor Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left tire pressure sensor Using the manufacturer approved diagnostic system, check for related DTCs C1A57-12 and/or C1A57-14 and perform the relevant corrective actions Refer to the electrical circuit diagrams and check the tire pressure monitoring system RF receiver power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new tire pressure monitoring system RF receiver Check for potential sources of interference inside the vehicle (for example, power adapters, laptop/navigation screens, etc)
C1A57-12	Left Front Initiator - Circuit short to battery	<ul style="list-style-type: none"> Front left initiator circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left initiator circuit for short circuit to power
C1A57-14	Left Front Initiator - Circuit short to ground or open	<ul style="list-style-type: none"> Front left initiator circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left initiator circuit for short circuit to ground, open circuit, high resistance
C1A58-16	Right Front Tire Pressure Sensor and Transmitter Assembly	<ul style="list-style-type: none"> Front right tire pressure sensor internal battery voltage low 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right tire

	- Circuit voltage below threshold		pressure sensor
C1A58-86	Right Front Tire Pressure Sensor and Transmitter Assembly - Signal invalid	<ul style="list-style-type: none"> • Front right tire pressure sensor internal failure - Pressure, temperature or acceleration signal(s) out of range 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right tire pressure sensor
C1A58-93	Right Front Tire Pressure Sensor and Transmitter Assembly - No operation	<ul style="list-style-type: none"> • Front right tire pressure sensor not installed • Front right tire pressure sensor internal failure • Front right initiator circuit short circuit to ground, short circuit to power, open circuit, high resistance • Tire pressure monitoring system RF receiver power or ground circuit open circuit, high resistance • Tire pressure monitoring system RF receiver internal failure • Electrical interference 	<ul style="list-style-type: none"> • Check the installation of the front right tire pressure sensor • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right tire pressure sensor • Using the manufacturer approved diagnostic system, check for related DTCs C1A59-12 and/or C1A59-14 and perform the relevant corrective actions • Refer to the electrical circuit diagrams and check the tire pressure monitoring system RF receiver power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new tire pressure monitoring system RF receiver • Check for potential sources of interference inside the vehicle (for example, power adapters, laptop/navigation screens, etc)
C1A59-12	Right Front Initiator - Circuit short to battery	<ul style="list-style-type: none"> • Front right initiator circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right initiator circuit for short circuit to power
C1A59-14	Right Front Initiator - Circuit short to ground or open	<ul style="list-style-type: none"> • Front right initiator circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right initiator circuit for short circuit to ground, open circuit, high resistance
C1A60-16	Left Rear Tire Pressure Sensor and Transmitter Assembly - Circuit voltage below threshold	<ul style="list-style-type: none"> • Rear left tire pressure sensor internal battery voltage low 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left tire pressure sensor
C1A60-86	Left Rear Tire Pressure Sensor and Transmitter Assembly - Signal invalid	<ul style="list-style-type: none"> • Rear left tire pressure sensor internal failure - Pressure, temperature or acceleration signal(s) out of range 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left tire pressure sensor
C1A60-93	Left Rear Tire Pressure Sensor and Transmitter Assembly - No operation	<ul style="list-style-type: none"> • Rear left tire pressure sensor not installed • Rear left tire pressure sensor internal failure • Rear left initiator circuit short circuit to ground, short circuit to power, open circuit, high resistance • Tire pressure monitoring system RF receiver power or ground circuit open circuit, high resistance • Tire pressure monitoring system RF receiver internal failure • Electrical interference 	<ul style="list-style-type: none"> • Check the installation of the rear left tire pressure sensor • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left tire pressure sensor • Using the manufacturer approved diagnostic system, check for related DTCs C1A61-12 and/or C1A61-14 and perform the relevant corrective actions • Refer to the electrical circuit diagrams and check the tire pressure monitoring system RF receiver power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new tire pressure monitoring system RF receiver • Check for potential sources of interference inside the vehicle (for example, power adapters, laptop/navigation screens, etc)
C1A61-12	Left Rear Initiator - Circuit short to battery	<ul style="list-style-type: none"> • Rear left initiator circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left initiator circuit for short circuit to power
C1A61-14	Left Rear Initiator - Circuit short to ground or open	<ul style="list-style-type: none"> • Rear left initiator circuit short circuit to ground, open circuit, high 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear left initiator circuit for short circuit to ground, open circuit, high

		resistance	resistance
C1A62-16	Right Rear Tire Pressure Sensor and Transmitter Assembly - Circuit voltage below threshold	<ul style="list-style-type: none"> Rear right tire pressure sensor internal battery voltage low 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right tire pressure sensor
C1A62-86	Right Rear Tire Pressure Sensor and Transmitter Assembly - Signal invalid	<ul style="list-style-type: none"> Rear right tire pressure sensor internal failure - Pressure, temperature or acceleration signal(s) out of range 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right tire pressure sensor
C1A62-93	Right Rear Tire Pressure Sensor and Transmitter Assembly - No operation	<ul style="list-style-type: none"> Rear right tire pressure sensor not installed Rear right tire pressure sensor internal failure Rear right initiator circuit short circuit to ground, short circuit to power, open circuit, high resistance Tire pressure monitoring system RF receiver power or ground circuit open circuit, high resistance Tire pressure monitoring system RF receiver internal failure Electrical interference 	<ul style="list-style-type: none"> Check the installation of the rear right tire pressure sensor Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right tire pressure sensor Using the manufacturer approved diagnostic system, check for related DTCs C1A63-12 and/or C1A63-14 and perform the relevant corrective actions Refer to the electrical circuit diagrams and check the tire pressure monitoring system RF receiver power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new tire pressure monitoring system RF receiver Check for potential sources of interference inside the vehicle (for example, power adapters, laptop/navigation screens, etc)
C1A63-12	Right Rear Initiator - Circuit short to battery	<ul style="list-style-type: none"> Rear right initiator circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right initiator circuit for short circuit to power
C1A63-14	Right Rear Initiator - Circuit short to ground or open	<ul style="list-style-type: none"> Rear right initiator circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right initiator circuit for short circuit to ground, open circuit, high resistance
C1D18-00	Wheel Localization Failed - No sub type information	<ul style="list-style-type: none"> Two or more initiators incorrectly installed Tire pressure sensor signal(s) missing 	<ul style="list-style-type: none"> Check the installation of the initiators Using the manufacturer approved diagnostic system, check for related DTCs C1A56-93, C1A58-93, C1A60-93 and/or C1A62-93 and perform the relevant corrective actions
C1D21-05	Wheel Module - System programming failures	<ul style="list-style-type: none"> Tire pressure sensor(s) not installed Tire pressure sensor(s) internal failure(s) Initiator circuit(s) short circuit to ground, short circuit to power, open circuit, high resistance Tire pressure monitoring system RF receiver power or ground circuit open circuit, high resistance Tire pressure monitoring system RF receiver internal failure Electrical interference 	<ul style="list-style-type: none"> Check the installation of the tire pressure sensors Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new tire pressure sensor as necessary Using the manufacturer approved diagnostic system, check for related DTCs C1A57-12, C1A57-14, C1A59-12, C1A59-14, C1A61-12, C1A61-14, C1A63-12 and/or C1A63-14 and perform the relevant corrective actions Refer to the electrical circuit diagrams and check the tire pressure monitoring system RF receiver power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new tire pressure monitoring system RF receiver Check for potential sources of interference inside the vehicle (for example, power adapters, laptop/navigation screens, etc)
C2004-11	Headlamp washer relay B - Circuit short to ground	 <p>NOTE: Circuit reference POWER WASH R</p> <ul style="list-style-type: none"> Headlamp washer relay B circuit short circuit to 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the headlamp washer relay B circuit for short circuit to ground









		ground	
C2004-12	Headlamp washer relay B - Circuit short to battery	 <p>NOTE: Circuit reference POWER WASH R</p> <ul style="list-style-type: none"> Headlamp washer relay B circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the headlamp washer relay B circuit for short circuit to power
C2004-13	Headlamp washer relay B - Circuit open	 <p>NOTE: Circuit reference POWER WASH R</p> <ul style="list-style-type: none"> Headlamp washer relay B circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the headlamp washer relay B circuit for open circuit, high resistance
PQ230-12	Fuel Pump Primary Circuit - Circuit short to battery	<ul style="list-style-type: none"> Fuel pump relay circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel pump relay circuit for short circuit to power
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0004-00	High Speed CAN Communication Bus (+) Low - No sub type information	<ul style="list-style-type: none"> High speed CAN bus high circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the high speed CAN bus high circuit for short circuit to ground
U0005-00	High Speed CAN Communication Bus (+) High - No sub type information	<ul style="list-style-type: none"> High speed CAN bus high circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the high speed CAN bus high circuit for short circuit to power
U0008-00	High Speed CAN Communication Bus (-) High - No sub type information	<ul style="list-style-type: none"> High speed CAN bus low circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the high speed CAN bus low circuit for short circuit to power
U0009-00	High Speed CAN Communication Bus (-) shorted to Bus (+) - No sub type information	<ul style="list-style-type: none"> High speed CAN bus high circuit short circuit to high speed CAN bus low circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the high speed CAN bus high circuit for short circuit to the high speed CAN bus low circuit
U0010-88	Medium Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0013-00	Medium Speed CAN Communication Bus (+) Low - No sub type information	<ul style="list-style-type: none"> Medium speed CAN bus high circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the medium speed CAN bus high circuit for short circuit to ground
U0014-00	Medium Speed CAN Communication Bus (+) High - No sub type information	<ul style="list-style-type: none"> Medium speed CAN bus high circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the medium speed CAN bus high circuit for short circuit to power
U0017-00	Medium Speed CAN Communication Bus (-) High - No sub type information	<ul style="list-style-type: none"> Medium speed CAN bus low circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the medium speed CAN bus low circuit for short circuit to power
U0018-00	Medium Speed CAN Communication Bus (-) shorted to Bus (+) - No sub type information	<ul style="list-style-type: none"> Medium speed CAN bus high circuit short circuit to high speed CAN bus low circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the medium speed CAN bus high circuit for short circuit to the medium speed CAN bus low circuit
U0100-00	Lost Communication With ECM/PCM "A" - No sub type information	<ul style="list-style-type: none"> Engine control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the engine control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams




		<p>power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Engine system fault 	<p>and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0101-00	Lost Communication With Transmission Control Module - No sub type information	<ul style="list-style-type: none"> • Transmission control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transmission system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0102-00	Lost Communication With Transfer Case Control Module - No sub type information	<ul style="list-style-type: none"> • Transfer case control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transfer case system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
U0103-00	Lost communication with gear shift control module A - No sub type information	<ul style="list-style-type: none"> • Transmission control switch power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transmission control switch system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transmission control switch power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transmission control switch for related DTCs and refer to the relevant DTC index
U0121-00	Lost Communication With Anti-Lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> • Anti-lock brake system control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Anti-lock brake system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0126-00	Lost Communication With Steering Angle Sensor Module - No sub type information	<ul style="list-style-type: none"> • Steering angle sensor module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Steering angle sensor system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the steering angle sensor module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index

			system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
U0128-00	Lost Communication With Park Brake Control Module - No sub type information	<ul style="list-style-type: none"> • Electric park brake control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Electric park brake system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the electric park brake control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the electric park brake control module for related DTCs and refer to the relevant DTC index
U0132-00	Lost Communication With Suspension Control Module "A" - No sub type information	<ul style="list-style-type: none"> • Air suspension control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Air suspension system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the air suspension control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the air suspension control module for related DTCs and refer to the relevant DTC index
U0138-00	Lost Communication with All Terrain Control Module - No sub type information	<ul style="list-style-type: none"> • Terrain response switchpack power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Terrain response system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the terrain response switchpack power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the terrain response switchpack for related DTCs and refer to the relevant DTC index
U0139-00	Lost Communication With Suspension Control Module "B" - No sub type information	<ul style="list-style-type: none"> • Adaptive damping system control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Adaptive damping system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the adaptive damping system control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the adaptive damping system control module for related DTCs and refer to the relevant DTC index
U0151-00	Lost Communication With Restraints Control Module - No sub type information	<ul style="list-style-type: none"> • Restraints control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Restraints system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the restraints control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the restraints control module for related DTCs and refer to the relevant DTC index

U0155-00	Lost Communication With Instrument Panel Cluster (IPC) Control Module - No sub type information	<p>Instrument cluster power or ground circuit open circuit, high resistance</p> <ul style="list-style-type: none"> • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Instrument cluster system fault 	<p>Refer to the electrical circuit diagrams and check the instrument cluster power and ground circuits for open circuit, high resistance</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the instrument cluster for related DTCs and refer to the relevant DTC index
U0164-00	Lost Communication With HVAC Control Module - No sub type information	<ul style="list-style-type: none"> • Automatic temperature control module power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Automatic temperature control system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the automatic temperature control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the automatic temperature control module for related DTCs and refer to the relevant DTC index
U0184-00	Lost Communication With Radio - No sub type information	<ul style="list-style-type: none"> • Integrated audio module / audio head unit power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Integrated audio module / audio head unit fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the integrated audio module / audio head unit power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the integrated audio module / audio head unit for related DTCs and refer to the relevant DTC index
U0199-00	Lost communication with Driver Door Module (DDM) - No sub type information	<ul style="list-style-type: none"> • Driver door module power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Driver door module fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver door module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the driver door module for related DTCs and refer to the relevant DTC index
U0200-00	Lost Communication With "Door Control Module "B" - No sub type information	<ul style="list-style-type: none"> • Passenger door module power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Passenger door module fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passenger door module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the passenger door module for related DTCs and refer to the relevant DTC index

U0208-00	Lost Communication With "Seat Control Module "A" - No sub type information	<p>Driver seat module power or ground circuit open circuit, high resistance</p> <ul style="list-style-type: none"> • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Driver seat module fault 	<p>Refer to the electrical circuit diagrams and check the driver seat module power and ground circuits for open circuit, high resistance</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the driver seat module for related DTCs and refer to the relevant DTC index
U0214-00	Lost Communication With Remote Function Actuation - No sub type information	<ul style="list-style-type: none"> • Keyless vehicle module power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Keyless vehicle module system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the keyless vehicle module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the keyless vehicle module for related DTCs and refer to the relevant DTC index
U0241-00	Lost Communication With Headlamp Control Module "A" - No sub type information	<ul style="list-style-type: none"> • Headlamp leveling control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Headlamp leveling control module fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the headlamp leveling control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the headlamp leveling control module for related DTCs and refer to the relevant DTC index
U0242-00	Lost Communication With Headlamp Control Module "B" - No sub type information	<ul style="list-style-type: none"> • Rear view mirror power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Rear view mirror fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear view mirror power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the rear view mirror for related DTCs and refer to the relevant DTC index
U0257-00	Lost Communication With Front Controls / Display Interface Module - No sub type information	<ul style="list-style-type: none"> • Touch screen / multi-function display power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Touch screen / multi-function display fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the touch screen / multi-function display power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the touch screen / multi-function display for related DTCs and refer to the relevant DTC index

U025D-00	Lost Communication With Front Controls Interface Module "B" - No sub type information	<p>Integrated control panel power or ground circuit open circuit, high resistance</p> <ul style="list-style-type: none"> • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Integrated control panel fault 	<p>Refer to the electrical circuit diagrams and check the integrated control panel power and ground circuits for open circuit, high resistance</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the integrated control panel for related DTCs and refer to the relevant DTC index
U1000-00	Solid State Driver Protection Active - Driver Disabled - No sub type information	<ul style="list-style-type: none"> • Central junction box output circuit short circuit to ground, short circuit to power 	 <p>NOTE: When this DTC is set the relevant output is disabled.</p> <ul style="list-style-type: none"> • Check for other central junction box output circuit short circuit to ground/power DTCs and perform the relevant corrective action(s)
U200D-11	Control Module Output Power A - Circuit short to ground	<ul style="list-style-type: none"> • Output power A circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the output power A circuit for short circuit to ground
U200E-11	Control Module Output Power B - Circuit short to ground	<ul style="list-style-type: none"> • Output power B circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the output power B circuit for short circuit to ground
U2010-11	Switch Illumination - Circuit short to ground	<ul style="list-style-type: none"> • Switch illumination circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the switch illumination circuit for short circuit to ground
U2017-51	Control Module Software #2 - Not programmed	<ul style="list-style-type: none"> • Central junction box is not configured correctly 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the central junction box with the latest level software
U201B-54	Control Module Calibration Data #2 - Missing calibration	<ul style="list-style-type: none"> • Central junction box has not stored the steering column telescope/tilt position 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform routine - Calibrate Steering Column (0x203E)
U201F-04	External Receiver - System internal failures	<ul style="list-style-type: none"> • Tire pressure monitoring system RF receiver internal failure 	 <p>NOTE: Ignore all other tire pressure monitoring system DTCs if this DTC is set.</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new tire pressure monitoring system RF receiver
U201F-11	External Receiver - Circuit short to ground	 <p>NOTE: Circuit reference ISO</p> <ul style="list-style-type: none"> • Tire pressure monitoring system RF receiver circuit short bus circuit to ground 	 <p>NOTE: Ignore all other tire pressure monitoring system DTCs if this DTC is set.</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the tire pressure monitoring system RF receiver bus circuit for short circuit to ground
U201F-12	External Receiver - Circuit short to battery	 <p>NOTE: Circuit reference ISO</p> <ul style="list-style-type: none"> • Tire pressure monitoring system RF receiver bus circuit short circuit to power 	 <p>NOTE: Ignore all other tire pressure monitoring system DTCs if this is set.</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the tire pressure monitoring system RF receiver bus circuit for short circuit to power
U201F-87	External Receiver - Missing message	 <p>NOTE: Circuit reference ISO</p> <ul style="list-style-type: none"> • Tire pressure monitoring system RF 	 <p>NOTE: Ignore all other tire pressure monitoring system DTCs if this is set.</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the tire pressure monitoring system

		<p>receiver power or ground circuit open circuit, high resistance</p> <ul style="list-style-type: none"> • Tire pressure monitoring system RF receiver bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Tire pressure monitoring system RF receiver internal failure 	<p>RF receiver power and ground circuits for open circuit, high resistance</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the tire pressure monitoring system RF receiver bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new tire pressure monitoring system RF receiver
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U2104-23	Trip Meter Reset Button - Signal stuck low	<ul style="list-style-type: none"> • Steering column left multifunction switch (trip switch) stuck active • Steering column left multifunction switch (trip switch) circuit short circuit to ground 	<p>NOTES:</p> <p> This DTC will set if the switch is active for more than 60 seconds.</p> <p> The trip computer switch is integral with the steering column left multifunction switch.</p> <ul style="list-style-type: none"> • Test the operation of the steering column left multifunction switch (trip switch) • Refer to the electrical circuit diagrams and check the steering column left multifunction switch (trip switch) circuit for short circuit to ground
U2300-64	Central Configuration - Signal plausibility failure	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification - Tire pressure monitoring system configuration data is invalid 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> • Central junction box internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new central junction box
U3001-54	Control Module Improper Shutdown - Missing calibration	<ul style="list-style-type: none"> • Steering column tilt/reach position not stored 	<p> NOTE: This DTC is set when the steering column tilt or reach motor is active. The DTC is cleared when the new steering column position has been successfully stored.</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check for steering column adjustment related DTCs. Clear the DTC and operate the steering column through the complete tilt and reach range

General Information - Diagnostic Trouble Code (DTC) Index DTC: Digital Radio Control Module (DRCM)

Description and Operation

Digital Radio Control Module (DRCM)



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Digital Radio Control Module (DRCM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: Information and Entertainment System (415-00, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1A56-11	Antenna - Circuit short to ground	<ul style="list-style-type: none"> Digital radio L-band antenna circuit short circuit to ground Digital radio L-band antenna amplifier circuit short circuit to ground Digital radio L-band antenna amplifier internal failure Digital radio control module internal failure 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the digital radio L-band antenna circuit for short circuit to ground Refer to electrical circuit diagrams and check the digital radio L-band antenna amplifier circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio L-band antenna amplifier Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio control module
B1A56-12	Antenna - Circuit short to battery	<ul style="list-style-type: none"> Digital radio L-band antenna circuit short circuit to power Digital radio L-band antenna amplifier circuit short circuit to power Digital radio L- 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the digital radio L-band antenna circuit for short circuit to power Refer to electrical circuit diagrams and check the digital radio L-band antenna amplifier circuit for short circuit to power Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio L-band antenna amplifier

		<ul style="list-style-type: none"> band antenna amplifier internal failure Digital radio control module internal failure 	<p>Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio control module</p>
B1A56-13	Antenna - Circuit open	<ul style="list-style-type: none"> Digital radio L-band antenna circuit open circuit, high resistance Digital radio L-band antenna amplifier circuit open circuit, high resistance Digital radio L-band antenna amplifier internal failure Digital radio control module internal failure 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the digital radio L-band antenna circuit for open circuit, high resistance Refer to electrical circuit diagrams and check the digital radio L-band antenna amplifier circuit for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio L-band antenna amplifier Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio control module
B1D55-11	Antenna #2 - Circuit short to ground	<ul style="list-style-type: none"> Digital radio band 3 antenna circuit short circuit to ground Digital radio band 3 antenna amplifier circuit short circuit to ground Digital radio band 3 antenna amplifier internal failure Digital radio control module internal failure 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the digital radio band 3 antenna circuit for short circuit to ground Refer to electrical circuit diagrams and check the digital radio band 3 antenna amplifier circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio band 3 antenna amplifier Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio control module
B1D55-12	Antenna #2 - Circuit short to battery	<ul style="list-style-type: none"> Digital radio band 3 antenna circuit short circuit to power Digital radio band 3 antenna amplifier circuit short circuit to power Digital radio band 3 antenna amplifier internal failure Digital radio control module internal failure 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the digital radio band 3 antenna circuit for short circuit to power Refer to electrical circuit diagrams and check the digital radio band 3 antenna amplifier circuit for short circuit to power Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio band 3 antenna amplifier Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio control module
B1D55-13	Antenna #2 - Circuit open	<ul style="list-style-type: none"> Digital radio band 3 antenna circuit open circuit, high resistance Digital radio band 3 antenna amplifier circuit open circuit, high resistance Digital radio band 3 antenna amplifier internal failure Digital radio control module internal failure 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the digital radio band 3 antenna circuit for open circuit, high resistance Refer to electrical circuit diagrams and check the digital radio band 3 antenna amplifier circuit for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio band 3 antenna amplifier Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio control module
U2100-00	Initial Configuration Not Complete - No	<ul style="list-style-type: none"> Car configuration 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the digital radio control

	sub type information	<p>data not loaded (new module installed to vehicle and not initialized)</p> <ul style="list-style-type: none"> Digital radio control module internal failure 	<p>module with the latest level software</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio control module
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Central car configuration parameter missing or corrupted 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the digital radio control module with the latest level software
U3000-46	Control module - Calibration/parameter memory failure	<ul style="list-style-type: none"> Digital radio control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio control module
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> Digital radio control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio control module
U3000-98	Control Module - Component or system over temperature	<ul style="list-style-type: none"> Digital radio control module cooling vents obstructed Digital radio control module internal failure 	<ul style="list-style-type: none"> Check that the digital radio control module cooling vents / air circulation are not obstructed. Cool the vehicle interior down by ensuring it is in the shade and have the air conditioning on cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new digital radio control module
U3003-62	Battery voltage - Signal compare failure	<ul style="list-style-type: none"> Mismatch between the voltage at the digital radio control module and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111) - and compare it to battery voltage. Refer to the electrical circuit diagrams and check the digital radio control module power and ground circuits for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Driver/Passenger Door Control Module (DDM/PDM)

Description and Operation

Driver/Passenger Door Module (DDM/PDM)



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.




















Check DDW for open campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint and carry out the recommendations as required.







The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Driver/Passenger Door Module (DDM/PDM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.




For additional information, refer to: [Driver Door Module \(DDM\)](#) (419-10 Multifunction Electronic Modules, Diagnosis and Testing).








DTC	Description	Possible Causes	Action
B108F-23	Cabin Lock/Unlock Switch - Signal stuck low	<ul style="list-style-type: none"> Central door locking lock/unlock switch stuck active Central door locking lock/unlock switch signal circuit short circuit to ground 	NOTE: This DTC may be induced by the driver <ul style="list-style-type: none"> Test the operation of the central door locking lock/unlock switch Refer to the electrical circuit diagrams and check the central door locking lock/unlock switch signal circuit for short circuit to ground
B109C-11	Front Courtesy Light - Circuit short to ground	<ul style="list-style-type: none"> Front courtesy light circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front courtesy light circuit for short to ground
B109C-15	Front Courtesy Light - Circuit short to battery or open	<ul style="list-style-type: none"> Front courtesy light circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front courtesy light circuit for short circuit to power, open circuit, high resistance
B10EB-11	Driver Door Double Locking Motor - Circuit short to ground	NOTE: Circuit reference LOCK M3 <ul style="list-style-type: none"> Front driver side door double locking motor circuit short circuit to 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front driver side door double locking motor circuit for short circuit to ground

		ground	
B10EB-15	Driver Door Double Locking Motor - Circuit short to battery or open	 <p>NOTE: Circuit reference LOCK M3</p> <ul style="list-style-type: none"> Front driver side door double locking motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front driver side door double locking motor circuit for short circuit to power, open circuit, high resistance
B10EC-11	Passenger Door Double Locking Motor - Circuit short to ground	 <p>NOTE: Circuit reference D LOCK</p> <ul style="list-style-type: none"> Front passenger side door double locking motor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front passenger side door double locking motor circuit for short circuit to ground
B10EC-15	Passenger Door Double Locking Motor - Circuit short to battery or open	 <p>NOTE: Circuit reference D LOCK</p> <ul style="list-style-type: none"> Front passenger side door double locking motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front passenger side door double locking motor circuit for short circuit to power, open circuit, high resistance
B10ED-11	Rear Door Driver Side Double Locking Motor - Circuit short to ground	 <p>NOTE: Circuit reference D LOCK</p> <ul style="list-style-type: none"> Rear driver side door double locking motor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear driver side door double locking motor circuit for short circuit to ground
B10ED-15	Rear Door Driver Side Double Locking Motor - Circuit short to battery or open	 <p>NOTE: Circuit reference D LOCK</p> <ul style="list-style-type: none"> Rear driver side door double locking motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear driver side door double locking motor circuit for short circuit to power, open circuit, high resistance
B10EE-11	Rear Door Passenger Side Double Locking Motor - Circuit short to ground	 <p>NOTE: Circuit reference D LOCK</p> <ul style="list-style-type: none"> Rear passenger side door double locking motor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear passenger side door double locking motor circuit for short circuit to ground
B10EE-15	Rear Door Passenger Side Double Locking Motor - Circuit short to battery or open	 <p>NOTE: Circuit reference D LOCK</p> <ul style="list-style-type: none"> Rear passenger side door double locking motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear passenger side door double locking motor circuit for short circuit to power, open circuit, high resistance
B1108-11	Driver Door Central Locking Motor - Circuit short to ground	 <p>NOTE: Circuit reference C LOCK</p> <ul style="list-style-type: none"> Front driver side door central locking motor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front driver side door central locking motor circuit for short circuit to ground
B1108-	Driver Door		<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and


15	Central Locking Motor - Circuit short to battery or open	 <p>NOTE: Circuit reference C LOCK</p> <ul style="list-style-type: none"> Front driver side door central locking motor circuit short circuit to power, open circuit, high resistance 	check the front driver side door central locking motor circuit for short circuit to power, open circuit, high resistance
B1109-11	Passenger Door Central Locking Motor - Circuit short to ground	 <p>NOTE: Circuit reference C LOCK</p> <ul style="list-style-type: none"> Front passenger side door central locking motor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front passenger side door central locking motor circuit for short circuit to ground
B1109-15	Passenger Door Central Locking Motor - Circuit short to battery or open	 <p>NOTE: Circuit reference C LOCK</p> <ul style="list-style-type: none"> Front passenger side door central locking motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front passenger side door central locking motor circuit for short circuit to power, open circuit, high resistance
B110A-11	Rear Door Driver Side Central Locking Motor - Circuit short to ground	 <p>NOTE: Circuit reference C LOCK</p> <ul style="list-style-type: none"> Rear driver side door central locking motor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear driver side door central locking motor circuit for short circuit to ground
B110A-15	Rear Door Driver Side Central Locking Motor - Circuit short to battery or open	 <p>NOTE: Circuit reference C LOCK</p> <ul style="list-style-type: none"> Rear driver side door central locking motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear driver side door central locking motor circuit for short circuit to power, open circuit, high resistance
B110B-11	Rear Door Passenger Side Central Locking Motor - Circuit short to ground	 <p>NOTE: Circuit reference C LOCK</p> <ul style="list-style-type: none"> Rear passenger side door central locking motor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear passenger side door central locking motor circuit for short circuit to ground
B110B-15	Rear Door Passenger Side Central Locking Motor - Circuit short to battery or open	 <p>NOTE: Circuit reference C LOCK</p> <ul style="list-style-type: none"> Rear passenger side door central locking motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear passenger side door central locking motor circuit for short circuit to power, open circuit, high resistance
B1163-11	Left Mirror Heater Output Short To Ground - Circuit short to ground	 <p>NOTE: Circuit reference MIRROR HEATING</p> <ul style="list-style-type: none"> Left door mirror heater circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left door mirror heater circuit for short circuit to ground
B1163-15	Left Mirror Heater Output Short To Power - Circuit short to battery or	 <p>NOTE: Circuit reference MIRROR HEATING</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left door mirror heater circuit for short circuit to power, open circuit, high resistance




	open	<ul style="list-style-type: none"> Left door mirror heater circuit short circuit to power, open circuit, high resistance 	
B1164-11	Right Mirror Heater Output Short To Ground - Circuit short to ground	 <p>NOTE: Circuit reference MIRROR HEATING</p> <ul style="list-style-type: none"> Right door mirror heater circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right door mirror heater circuit for short circuit to ground
B1164-15	Right Mirror Heater Output Short To Power - Circuit short to battery or open	 <p>NOTE: Circuit reference MIRROR HEATING</p> <ul style="list-style-type: none"> Right door mirror heater circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right door mirror heater circuit for short circuit to power, open circuit, high resistance
B1165-11	Left Front Puddle Lamp Output Short To Ground - Circuit short to ground	 <p>NOTE: Circuit reference APPROACH LAMP</p> <ul style="list-style-type: none"> Left puddle lamp circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left puddle lamp circuit for short circuit to ground
B1165-15	Left Front Puddle Lamp Output Open Load Or Short To Power - Circuit short to battery or open	 <p>NOTE: Circuit reference APPROACH LAMP</p> <ul style="list-style-type: none"> Left puddle lamp circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left puddle lamp circuit for short circuit to power, open circuit, high resistance
B1166-11	Right Front Puddle Lamp Output Short To Ground - Circuit short to ground	 <p>NOTE: Circuit reference APPROACH LAMP</p> <ul style="list-style-type: none"> Right puddle lamp circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right puddle lamp circuit for short circuit to ground
B1166-15	Right Front Puddle Lamp Output Open Load Or Short To Battery - Circuit short to battery or open	 <p>NOTE: Circuit reference APPROACH LAMP</p> <ul style="list-style-type: none"> Right puddle lamp circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right puddle lamp circuit for short circuit to power, open circuit, high resistance
B117C-07	Rear Power Window Up - Mechanical failures	<ul style="list-style-type: none"> Set when window is reversed during window up due to mechanical problems, window channel restriction preventing window closure or window mechanism fault 	<ul style="list-style-type: none"> Check for mechanical problems with the window operation. Check for obstructions in the window channels and that the glass is not restricted in the full range of travel
B117C-72	Rear Power Window Up - Actuator stuck open	<ul style="list-style-type: none"> Door module internal relay sticking open 	<ul style="list-style-type: none"> Renew the relevant rear door module
B117C-73	Rear Power Window Up - Actuator stuck closed	<ul style="list-style-type: none"> Door module internal relay sticking closed 	<ul style="list-style-type: none"> Renew the relevant rear door module
B117C-92	Rear Power Window Up - Performance or incorrect operation	<ul style="list-style-type: none"> Set when auto window up was interrupted (e.g. by pressing local switch) 	<ul style="list-style-type: none"> Check the window operation. Clear the DTC and retest
B117D-72	Rear Power Window Down - Actuator stuck open	<ul style="list-style-type: none"> Door module internal relay sticking open 	<ul style="list-style-type: none"> Renew the relevant rear door module

B117D-73	Rear Power Window Down - Actuator stuck closed	<ul style="list-style-type: none"> Door module internal relay sticking closed 	<ul style="list-style-type: none"> Renew the relevant rear door module
B117E-07	Front Power Window Up - Mechanical failures	<ul style="list-style-type: none"> Set when window is reversed during window up due to mechanical problems, window channel restriction preventing window closure or Window mechanism fault 	<ul style="list-style-type: none"> Check for mechanical problems with the window operation. Check for obstructions in the window channels and that the glass is not restricted in the full range of travel
B117E-72	Front Power Window Up - Actuator stuck open	<ul style="list-style-type: none"> Door module internal relay sticking open 	<ul style="list-style-type: none"> Renew the relevant front door module
B117E-73	Front Power Window Up - Actuator stuck closed	<ul style="list-style-type: none"> Door module internal relay sticking closed 	<ul style="list-style-type: none"> Renew the relevant front door module
B117E-92	Front Power Window Up - Performance or incorrect operation	<ul style="list-style-type: none"> Set when auto window up was interrupted (e.g. by pressing local switch) 	<ul style="list-style-type: none"> Check the window operation. Clear the DTC and retest
B117F-72	Front Power Window Down - Actuator stuck open	<ul style="list-style-type: none"> Door module internal relay sticking open 	<ul style="list-style-type: none"> Renew the relevant front door module
B117F-73	Front Power Window Down - Actuator stuck closed	<ul style="list-style-type: none"> Door module internal relay sticking closed 	<ul style="list-style-type: none"> Renew the relevant front door module
B1189-29	Front Window Position Sensor - Signal invalid	<ul style="list-style-type: none"> Front window regulator motor position sensor signal circuit(s) short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front window regulator motor position sensor signal circuits for short circuit to ground, short circuit to power, open circuit, high resistance
B118A-29	Rear Window Position Sensor - Signal invalid	<ul style="list-style-type: none"> Rear window regulator motor position sensor signal circuit(s) short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear window regulator motor position sensor signal circuits for short circuit to ground, short circuit to power, open circuit, high resistance
B11D1-83	LIN Bus "C" - Value of signal protection calculation incorrect	 <p>NOTE: Circuit reference LIN</p> <ul style="list-style-type: none"> Driver door switchpack power or ground circuit open circuit, high resistance LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Driver door switchpack internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver door switchpack power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new driver door switchpack
B11D1-86	LIN Bus "C" - Signal invalid	 <p>NOTE: Circuit reference LIN</p> <ul style="list-style-type: none"> Driver door switchpack power or ground circuit open circuit, high resistance LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Driver door switchpack internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver door switchpack power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new driver door switchpack
B11D1-87	LIN Bus "C" - Missing message	 <p>NOTE: Circuit reference LIN</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver door switchpack power and ground circuits for open circuit, high

		<ul style="list-style-type: none"> • Driver door switchpack power or ground circuit open circuit, high resistance • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Driver door switchpack internal failure 	<ul style="list-style-type: none"> • resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new driver door switchpack
B11F6-11	Driver Folding Mirror Motor - Circuit short to ground	 <p>NOTE: Circuit reference MIRROR FOLD IN / MIRRORS Y/FOLDOUT</p> <ul style="list-style-type: none"> • Driver powerfold door mirror actuator circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver powerfold door mirror actuator circuit for short circuit to ground
B11F6-15	Driver Folding Mirror Motor - Circuit short to battery or open	 <p>NOTE: Circuit reference MIRROR FOLD IN / MIRRORS Y/FOLDOUT</p> <ul style="list-style-type: none"> • Driver powerfold door mirror actuator circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver powerfold door mirror actuator circuit for short circuit to power, open circuit, high resistance
B11F7-11	Passenger Folding Mirror Motor - Circuit short to ground	 <p>NOTE: Circuit reference MIRROR FOLD IN / MIRRORS Y/FOLDOUT</p> <ul style="list-style-type: none"> • Passenger powerfold door mirror actuator circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passenger powerfold door mirror actuator circuit for short circuit to ground
B11F7-15	Passenger Folding Mirror Motor - Circuit short to battery or open	 <p>NOTE: Circuit reference MIRROR FOLD IN / MIRRORS Y/FOLDOUT</p> <ul style="list-style-type: none"> • Passenger powerfold door mirror actuator circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passenger powerfold door mirror actuator circuit for short circuit to power, open circuit, high resistance
B1A98-83	LIN Bus Circuit #1 - Value of signal protection calculation incorrect	 <p>NOTE: Circuit reference LIN</p> <ul style="list-style-type: none"> • Rear door module power or ground circuit open circuit, high resistance • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Rear door module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear door module power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear door module
B1A98-86	LIN Bus Circuit #1 - Signal invalid	 <p>NOTE: Circuit reference LIN</p> <ul style="list-style-type: none"> • Rear door module power or ground circuit open circuit, high resistance • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Rear door module internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear door module power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear door module
B1A98-87	LIN Bus Circuit #1 - Missing message	 <p>NOTE: Circuit reference LIN</p>	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear door module power and

		<ul style="list-style-type: none"> • Rear door module power or ground circuit open circuit, high resistance • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Rear door module internal failure 	<ul style="list-style-type: none"> • ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear door module
B1C09-11	Driver Left/Right Mirror Motor Circuit - Circuit short to ground	<ul style="list-style-type: none"> • Driver door mirror left/right motor circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver door mirror left/right motor circuit for short circuit to ground
B1C09-15	Driver Left/Right Mirror Motor Circuit - Circuit short to battery or open	<ul style="list-style-type: none"> • Driver door mirror left/right motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver door mirror left/right motor circuit for short circuit to power, open circuit, high resistance
B1C10-11	Driver Up/Down Mirror Motor Circuit - Circuit short to ground	<ul style="list-style-type: none"> • Driver door mirror up/down motor circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver door mirror up/down motor circuit for short circuit to ground
B1C10-15	Driver Up/Down Mirror Motor Circuit - Circuit short to battery or open	<ul style="list-style-type: none"> • Driver door mirror up/down motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver door mirror up/down motor circuit for short circuit to power, open circuit, high resistance
B1C11-11	Passenger Left/Right Mirror Motor Circuit - Circuit short to ground	<ul style="list-style-type: none"> • Passenger door mirror left/right motor circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passenger door mirror left/right motor circuit for short circuit to ground
B1C11-15	Passenger Left/Right Mirror Motor Circuit - Circuit short to battery or open	<ul style="list-style-type: none"> • Passenger door mirror left/right motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passenger door mirror left/right motor circuit for short circuit to power, open circuit, high resistance
B1C12-11	Passenger Up/Down Mirror Motor Circuit - Circuit short to ground	<ul style="list-style-type: none"> • Passenger door mirror up/down motor circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passenger door mirror up/down motor circuit for short circuit to ground
B1C12-15	Passenger Up/Down Mirror Motor Circuit - Circuit short to battery or open	<ul style="list-style-type: none"> • Passenger door mirror up/down motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passenger door mirror up/down motor circuit for short circuit to power, open circuit, high resistance
B1C13-11	Driver Up/Down Mirror Motor Feedback Circuit - Circuit short to ground	<ul style="list-style-type: none"> • Driver door mirror up/down motor position sensor circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver door mirror up/down motor position sensor circuit for short circuit to ground
B1C13-15	Driver Up/Down Mirror Motor Feedback Circuit - Circuit short to battery or open	<ul style="list-style-type: none"> • Driver door mirror up/down motor position sensor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver door mirror up/down motor position sensor circuit for short circuit to power, open circuit, high resistance
B1C14-11	Driver Left/Right Mirror Motor Feedback Circuit - Circuit short to ground	<ul style="list-style-type: none"> • Driver door mirror left/right motor position sensor circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver door mirror left/right motor position sensor circuit for short circuit to ground
B1C14-15	Driver Left/Right Mirror Motor Feedback Circuit - Circuit short to battery or open	<ul style="list-style-type: none"> • Driver door mirror left/right motor position sensor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver door mirror left/right motor position sensor circuit for short circuit to power, open circuit, high resistance
B1C15-11	Passenger Up/Down Mirror Motor Feedback	<ul style="list-style-type: none"> • Passenger door mirror up/down motor position sensor circuit short circuit 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passenger door mirror up/down motor position sensor circuit for short circuit

	Circuit - Circuit short to ground	to ground	to ground
B1C15-15	Passenger Up/Down Mirror Motor Feedback Circuit - Circuit short to battery or open	<ul style="list-style-type: none"> Passenger door mirror up/down motor position sensor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger door mirror up/down motor position sensor circuit for short circuit to power, open circuit, high resistance
B1C16-11	Passenger Left/Right Mirror Motor Feedback Circuit - Circuit short to ground	<ul style="list-style-type: none"> Passenger door mirror left/right motor position sensor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger door mirror left/right motor position sensor circuit for short circuit to ground
B1C16-15	Passenger Left/Right Mirror Motor Feedback Circuit - Circuit short to battery or open	<ul style="list-style-type: none"> Passenger door mirror left/right motor position sensor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger door mirror left/right motor position sensor circuit for short circuit to power, open circuit, high resistance
B1C39-29	Key Lock Switch - Signal invalid	<ul style="list-style-type: none"> Emergency key barrel lock/unlock switch stuck active Emergency key barrel lock/unlock switch circuit short circuit to ground 	 NOTE: This DTC may be induced by the driver <ul style="list-style-type: none"> Test the operation of the emergency key barrel lock/unlock switch Refer to the electrical circuit diagrams and check the emergency key barrel lock/unlock switch circuit for short circuit to ground
B1D06-11	Left Turn Indicator - Circuit short to ground	<ul style="list-style-type: none"> Left turn signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check left turn signal circuit for short circuit to ground
B1D06-15	Left Turn Indicator - Circuit short to battery or open	<ul style="list-style-type: none"> Left turn signal circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left turn signal circuit for short circuit to power, open circuit, high resistance
B1D07-11	Right Turn Indicator - Circuit short to ground	<ul style="list-style-type: none"> Right turn signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check right turn signal circuit for short circuit to ground
B1D07-15	Right Turn Indicator - Circuit short to battery or open	<ul style="list-style-type: none"> Right turn signal circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right turn signal circuit for short circuit to power, open circuit, high resistance
C1B14-11	Sensor Supply Voltage A - Circuit short to ground	<ul style="list-style-type: none"> Front window regulator motor position sensor supply circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front window regulator motor position sensor supply circuit for short circuit to ground
C1B14-15	Sensor Supply Voltage A - Circuit short to battery or open	<ul style="list-style-type: none"> Front window regulator motor position sensor supply circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front window regulator motor position sensor supply circuit for short circuit to power, open circuit, high resistance
C1B15-11	Sensor Supply Voltage B - Circuit short to ground	<ul style="list-style-type: none"> Rear window regulator motor position sensor supply circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear window regulator motor position sensor supply circuit for short circuit to ground
C1B15-15	Sensor Supply Voltage B - Circuit short to battery or open	<ul style="list-style-type: none"> Rear window regulator motor position sensor supply circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear window regulator motor position sensor supply circuit for short circuit to power, open circuit, high resistance
U0010-00	Medium speed CAN communication Bus - No sub type information	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0140-00	Lost Communication With CJB - No sub type information	<ul style="list-style-type: none"> Central junction box power or ground circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance

		<ul style="list-style-type: none"> • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Central junction box system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0208-00	Lost Communication With Driver Seat Module (DSM) - No sub type information	<ul style="list-style-type: none"> • Driver seat module power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Driver seat system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver seat module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the driver seat module for related DTCs and refer to the relevant DTC index
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification 	 NOTE: After updating the car configuration file, set the ignition to on and wait 30 seconds before clearing the DTCs <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U2002-24	Switch - Signal stuck high	<ul style="list-style-type: none"> • Passenger door window up/down switch stuck active • Passenger door window up/down switch circuit short circuit to ground 	 NOTE: This DTC may be induced by the driver <ul style="list-style-type: none"> • Test the operation of the passenger door window up/down switch • Refer to the electrical circuit diagrams and check the passenger door window up/down switch circuit for short circuit to ground
U2004-24	Auxiliary Switch Pack - Signal stuck high	<ul style="list-style-type: none"> • Rear door window up/down switch stuck active • Rear door window up/down switch circuit short circuit to ground 	 NOTE: This DTC may be induced by the driver <ul style="list-style-type: none"> • Test the operation of the rear door window up/down switch • Refer to the electrical circuit diagrams and check the rear door window up/down switch circuit for short circuit to ground
U2010-11	Switch Illumination - Circuit short to ground	<ul style="list-style-type: none"> • Front/rear door window switch illumination circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front/rear door window switch illumination circuit for short circuit to ground
U2012-08	Car Configuration Parameter(s) - Bus signal/message failures	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification • Incorrect door module installed 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary • Install a new door module as necessary
U2013-24	Switch Pack - Signal stuck high	<ul style="list-style-type: none"> • Driver door switchpack switch stuck active 	<ul style="list-style-type: none"> • Test the operation of the driver door switchpack switches. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new driver door switchpack
U2014-44	Control Module Hardware - Data memory failure	<ul style="list-style-type: none"> • Driver/passenger door module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new driver/passenger door module
U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> • Driver/passenger door module is not configured correctly 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the driver/passenger door module with the latest level software
U2101-	Control Module	<ul style="list-style-type: none"> • Car configuration file 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic

00	Configuration Incompatible - No sub type information	mismatch with vehicle specification	system, check and up-date the car configuration file as necessary
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> Mismatch between the voltage at the driver/passenger door module and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver/passenger door module power and ground circuits for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Driver/Passenger Seat Module (DSM/PSM)

Description and Operation

Driver Seat Module (DSM) / Passenger Seat Module (PSM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.














Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Driver Seat Module (DSM) / Passenger Seat Module (PSM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Seats](#) (501-10 Seating, Diagnosis and Testing).


DTC	Description	Possible Causes	Action
B1060-11	Seat Headrest Motor Output - Circuit short to ground	<ul style="list-style-type: none"> Head restraint motor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the head restraint motor circuit for short circuit to ground
B1060-15	Seat Headrest Motor Output - Circuit short to battery or open	<ul style="list-style-type: none"> Head restraint motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the head restraint motor circuit for short circuit to power, open circuit, high resistance
B1064-31	Seat Headrest Motor Sensor - No signal	<ul style="list-style-type: none"> Head restraint motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the head restraint motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B106D-24	Headrest Up Switch - Signal stuck high	<ul style="list-style-type: none"> Head restraint up switch circuit short circuit to power Head restraint up 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the head restraint up switch circuit for short circuit to power Test the operation of the head restraint up

		switch stuck active	switch
B106E-24	Headrest Down Switch - Signal stuck high	<ul style="list-style-type: none"> Head restraint down switch circuit short circuit to power Head restraint down switch stuck active 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the head restraint down switch circuit for short circuit to power Test the operation of the head restraint down switch
B1087-83	LIN Bus "A" - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> Seat memory switchpack internal failure 	<ul style="list-style-type: none"> Install a new seat memory switchpack
B1087-86	LIN Bus "A" - Signal invalid	<ul style="list-style-type: none"> Seat memory switchpack internal failure 	<ul style="list-style-type: none"> Install a new seat memory switchpack
B1087-87	LIN Bus "A" - Missing message	<ul style="list-style-type: none"> Seat memory switchpack power or ground circuit open circuit, high resistance LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Seat memory switchpack internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the seat memory switchpack power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Install a new seat memory switchpack
B1B86-11	Seat Height Motor Relay - Circuit short to ground	 <p>NOTE: Circuit reference HEIGHT MOTOR UP / HEIGHT MOTOR DOWN</p> <ul style="list-style-type: none"> Seat height motor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the seat height motor circuit for short circuit to ground
B1B86-15	Seat Height Motor Relay - Circuit short to battery or open	 <p>NOTE: Circuit reference HEIGHT MOTOR UP / HEIGHT MOTOR DOWN</p> <ul style="list-style-type: none"> Seat height motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the seat height motor circuit for short circuit to power, open circuit, high resistance
B1B87-31	Seat Height Motor Speed/Position Sensor - no signal	 <p>NOTE: Circuit reference HEIGHT MOTOR SENSE / HEIGHT HALL SENS GND</p> <ul style="list-style-type: none"> Seat height motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the seat height motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1B88-11	Seat Slide Motor Relay - Circuit short to ground	 <p>NOTE: Circuit reference SLIDE MOTOR FORWARD / SLIDE MOTOR REARWARD</p> <ul style="list-style-type: none"> Seat forward/rearward motor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the seat forward/rearward motor circuit for short circuit to ground
B1B88-15	Seat Slide Motor Relay - Circuit short	 <p>NOTE: Circuit</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the seat forward/rearward motor circuit

	to battery or open	<p>reference SLIDE MOTOR FORWARD / SLIDE MOTOR REARWARD</p> <ul style="list-style-type: none"> • Seat forward/rearward motor circuit short circuit to power, open circuit, high resistance 	for short circuit to power, open circuit, high resistance
B1B89-31	Seat Slide Motor Speed/Position Sensor - No signal	 <p>NOTE: Circuit reference SLIDE MOTOR SENSE / SLIDE HALL SENS GND</p> <ul style="list-style-type: none"> • Seat forward/rearward motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat forward/rearward motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1B90-11	Seat Tilt Motor Relay - Circuit short to ground	 <p>NOTE: Circuit reference TILT MOTOR UP / TILT MOTOR DOWN</p> <ul style="list-style-type: none"> • Seat tilt motor circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat tilt motor circuit for short circuit to ground
B1B90-15	Seat Tilt Motor Relay - Circuit short to battery or open	 <p>NOTE: Circuit reference TILT MOTOR UP / TILT MOTOR DOWN</p> <ul style="list-style-type: none"> • Seat tilt motor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat tilt motor circuit for short circuit to power, open circuit, high resistance
B1B91-31	Seat Tilt Motor Speed/Position Sensor - No signal	 <p>NOTE: Circuit reference TILT MOTOR SENSE / TILT HALL SENS GND</p> <ul style="list-style-type: none"> • Seat tilt motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat tilt motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1B92-11	Seat Recline Motor Relay - Circuit short to ground	 <p>NOTE: Circuit reference SQUAB MOTOR INCLINE / SQUAB MOTOR RECLINE</p> <ul style="list-style-type: none"> • Seat backrest recline motor circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat backrest recline motor circuit for short circuit to ground
B1B92-15	Seat Recline Motor Relay - Circuit short to battery or open	 <p>NOTE: Circuit reference SQUAB MOTOR INCLINE / SQUAB MOTOR RECLINE</p> <ul style="list-style-type: none"> • Seat backrest recline motor circuit 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat backrest recline motor circuit for short circuit to power, open circuit, high resistance

		short circuit to power, open circuit, high resistance	
B1B93-31	Seat Recline Motor Speed/Position Sensor - No signal	 <p>NOTE: Circuit reference SQUAB MOTOR SENSE / SQUAB HALL SENS GND</p> <ul style="list-style-type: none"> • Seat backrest recline motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat backrest recline motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1B94-24	Seat Height Up Switch - Signal stuck high	<ul style="list-style-type: none"> • Seat height up switch circuit short circuit to power • Seat height up switch stuck active 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat height up switch circuit for short circuit to power • Test the operation of the seat height up switch
B1B95-24	Seat Height Down Switch - Signal stuck high	<ul style="list-style-type: none"> • Seat height down switch circuit short circuit to power • Seat height down switch stuck active 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat height down switch circuit for short circuit to power • Test the operation of the seat height down switch
B1B96-24	Seat Slide Forward Switch - Signal stuck high	<ul style="list-style-type: none"> • Seat slide forward switch circuit short circuit to power • Seat slide forward switch stuck active 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat slide forward switch circuit for short circuit to power • Test the operation of the seat slide forward switch
B1B97-24	Seat Slide Backward Switch - Signal stuck high	<ul style="list-style-type: none"> • Seat slide rearward switch circuit short circuit to power • Seat slide rearward switch stuck active 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat slide rearward switch circuit for short circuit to power • Test the operation of the seat slide rearward switch
B1B98-24	Seat Tilt Up Switch - Signal stuck high	<ul style="list-style-type: none"> • Seat tilt up switch circuit short circuit to power • Seat tilt up switch stuck active 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat tilt up switch circuit for short circuit to power • Test the operation of the seat tilt up switch
B1B99-24	Seat Tilt Down Switch - Signal stuck high	<ul style="list-style-type: none"> • Seat tilt down switch circuit short circuit to power • Seat tilt down switch stuck active 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat tilt down switch circuit for short circuit to power • Test the operation of the seat tilt down switch
B1C00-24	Seat Recline Up Switch - Signal stuck high	<ul style="list-style-type: none"> • Seat backrest recline up switch circuit short circuit to power • Seat backrest recline up switch stuck active 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat backrest recline up switch circuit for short circuit to power • Test the operation of the seat backrest recline up switch
B1C01-24	Seat Recline Down Switch - Signal stuck high	<ul style="list-style-type: none"> • Seat backrest recline down switch circuit short circuit to power • Seat backrest recline down switch stuck active 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the seat backrest recline down switch circuit for short circuit to power • Test the operation of the seat backrest recline down switch
B1C02-24	Memory Store Switch - Signal stuck high	<ul style="list-style-type: none"> • Memory store switch stuck active 	<ul style="list-style-type: none"> • Test the operation of the memory store switch
B1C03-24	Memory #1 Switch - Signal stuck high	<ul style="list-style-type: none"> • Memory 1 switch stuck active 	<ul style="list-style-type: none"> • Test the operation of the memory 1 switch
B1C04-24	Memory #2 Switch - Signal stuck high	<ul style="list-style-type: none"> • Memory 2 switch stuck active 	<ul style="list-style-type: none"> • Test the operation of the memory 2 switch

B1C05-24	Memory #3 Switch - Signal stuck high	<ul style="list-style-type: none"> Memory 3 switch stuck active 	<ul style="list-style-type: none"> Test the operation of the memory 3 switch
U0010-88	Medium speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0140-00	Lost Communication With Body Control Module - No sub type information	<ul style="list-style-type: none"> Central junction box power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Central junction box system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0142-00	Lost Communication With Body Control Module "B" - No sub type information	<ul style="list-style-type: none"> Central junction box power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Central junction box system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0155-00	Lost Communication With Instrument Panel Cluster (IPC) Control Module - No sub type information	<ul style="list-style-type: none"> Instrument cluster power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Instrument cluster system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the instrument cluster power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the instrument cluster for related DTCs and refer to the relevant DTC index
U0199-00	Lost Communication With "Door Control Module A" - No sub type information	<ul style="list-style-type: none"> Driver door module power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Driver door module fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver door module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the driver door module for related DTCs and refer to the relevant DTC index
U0300-00	Software Incompatibility - No sub type information	<ul style="list-style-type: none"> Driver/passenger seat module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the driver/passenger seat module with the latest level software
U1A14-49	CAN Initialization Failure - Internal electronic failure	<ul style="list-style-type: none"> Driver/passenger seat module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the driver/passenger seat module with the latest level software. Clear the DTCs and retest. If the fault persists, install a new driver/passenger seat module
U1A4C-00	Build / End of Line mode Active - No sub type information	<ul style="list-style-type: none"> Error/mismatch in car configuration file 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary. Clear the DTC and re-test

U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> • Driver/passenger seat module internal failure 	<ul style="list-style-type: none"> • Install a new driver/passenger seat module
U3001-46	Control Module Improper Shutdown - Calibration/parameter memory failure	<ul style="list-style-type: none"> • Driver/passenger seat module power has been disconnected whilst in manufacturing mode 	 <p>NOTE: This DTC is for information only</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, re-configure the driver/passenger seat module with the latest level software
U3002-81	Vehicle Identification Number - Invalid serial data received	<ul style="list-style-type: none"> • Driver/passenger seat module previously installed on another vehicle • New driver/passenger seat module installed and VIN not yet programmed 	<ul style="list-style-type: none"> • Install the original or a new driver/passenger seat module as necessary • Using the manufacturer approved diagnostic system, perform routine - Learn VIN (0x0404)
U3003-16	Battery Voltage - Circuit voltage below threshold	<ul style="list-style-type: none"> • Driver/passenger seat module power or ground circuit open circuit, high resistance • Battery/charging system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the electrical circuit diagrams and check the driver/passenger seat module power and ground circuits for open circuit, high resistance • Refer to the relevant section of the workshop manual and test the battery and charging system
U3003-17	Battery Voltage - Circuit voltage above threshold	<ul style="list-style-type: none"> • Battery/charging system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the relevant section of the workshop manual and test the battery and charging system

General Information - Diagnostic Trouble Code (DTC) Index DTC: Electric Park Brake Control Module (EPBCM)

Description and Operation

Electric Park Brake Control Module (EPBCM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.











Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Electric Park Brake Control Module (EPBCM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.








For additional information, refer to: Parking Brake (206-05, Diagnosis and Testing).


DTC	Description	Possible Causes	Action
C0062-01	Longitudinal Acceleration Sensor - General electrical failure	<ul style="list-style-type: none"> Electric park brake control module internal failure 	<p>NOTE: The longitudinal acceleration sensor is integral with the electric park brake control module</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs. Perform Drive Cycle 2. If the fault persists, install a new electric park brake control module
C0062-02	Longitudinal Acceleration Sensor - General signal failure	<ul style="list-style-type: none"> Electric park brake control module internal failure 	<p>NOTE: The longitudinal acceleration sensor is integral with the electric park brake control module</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs. Perform Drive Cycle 2. If the fault persists, install a new electric park brake control module
C0062-54	Longitudinal Acceleration Sensor - Missing calibration	<ul style="list-style-type: none"> Longitudinal acceleration sensor 	<p>NOTE: The longitudinal acceleration sensor is integral with the electric park brake control module</p>

		calibration failure	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform routine - Sensor Calibration (0x211D)
C1104-68	Brake Bedding Mode - Event information	<ul style="list-style-type: none"> Electric park brake control module in brake bedding mode 	 <p>NOTE: This DTC is for information only</p> <ul style="list-style-type: none"> Cycle the ignition to exit brake bedding mode
C1A43-01	Motor Supply - General electrical failure	<ul style="list-style-type: none"> Electric park brake control module internal failure 	 <p>NOTE: The electric park brake actuator is integral with the electric park brake control module</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs. Perform Drive Cycle 3. If the fault persists, install a new electric park brake control module
C1A43-19	Motor Supply - Circuit current above threshold	<ul style="list-style-type: none"> Electric park brake actuator current above threshold 	 <p>NOTE: The electric park brake actuator is integral with the electric park brake control module</p> <ul style="list-style-type: none"> Check for mechanical failures causing the electric park brake to jam on
C1A43-67	Motor Supply - Signal incorrect after event	<ul style="list-style-type: none"> Electric park brake control module internal failure 	 <p>NOTE: The electric park brake actuator is integral with the electric park brake control module</p> <ul style="list-style-type: none"> Test the functionality of the electric park brake. Using the manufacturer approved diagnostic system, check for related DTCs. Clear the DTCs and retest. If the fault persists, install a new electric park brake control module
C1A46-01	Mismatch Between Motor Drive Current and Resultant Force - General electrical failure	<ul style="list-style-type: none"> Electric park brake control module internal failure 	<ul style="list-style-type: none"> Test the functionality of the electric park brake. Using the manufacturer approved diagnostic system, check for related DTCs. Clear the DTCs and retest. If the fault persists, install a new electric park brake control module
C1A46-64	Mismatch Between Motor Drive Current and Resultant Force - Signal plausibility failure	<ul style="list-style-type: none"> Electric park brake control module internal failure 	<ul style="list-style-type: none"> Test the functionality of the electric park brake. Using the manufacturer approved diagnostic system, check for related DTCs. Clear the DTCs and retest. If the fault persists, install a new electric park brake control module
C1A47-01	Force Sensor - General electrical failure	<ul style="list-style-type: none"> Electric park brake control module internal failure 	 <p>NOTE: The force sensor is integral with the electric park brake control module</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs. Perform Drive Cycle 1. If the fault persists, install a new electric park brake control module
C1A47-02	Force Sensor - General signal failure	<ul style="list-style-type: none"> Electric park brake control module internal failure 	 <p>NOTE: The force sensor is integral with the electric park brake control module</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs. Perform Drive Cycle 3. If the fault persists, install a new electric park brake control module
C1A47-54	Force Sensor - Missing calibration	<ul style="list-style-type: none"> Electric park brake control module internal failure 	 <p>NOTE: The force sensor is integral with the electric park brake control module</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs. Perform Drive Cycle 1. If the fault persists, install a new electric park brake control module
C1A48-01	Warning Lamp - General electrical failure	 <p>NOTE: Circuit reference STATUS LAMP</p> <ul style="list-style-type: none"> Electric park 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the electric park brake warning lamp circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system,

		<p>brake warning lamp circuit short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Electric park brake control module internal failure • Instrument cluster internal failure 	<p>clear the DTCs and retest. If the fault persists, install a new electric park brake control module</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new instrument cluster
C1A53-68	Manual Emergency Release Activated - Event information	<ul style="list-style-type: none"> • Electric park brake emergency release cable has been activated or is stuck/damaged • Park brake cables seized/damaged • Electric park brake control module internal failure 	<ul style="list-style-type: none"> • Check that the electric park brake emergency release cable is not permanently pulled (or stuck). Attempt to re-engage the electric park brake by operating the apply switch twice. If successful, clear the DTCs and test by operating the emergency release and re-engaging the electric park brake • Check the integrity of the park brake cables • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new electric park brake control module
U0073-88	Control Module Communication Bus "A" Off - Bus off	<ul style="list-style-type: none"> • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0100-00	Lost Communication With ECM/PCM "A" - No sub type information	<ul style="list-style-type: none"> • Engine control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Engine system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the engine control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0101-00	Lost Communication with TCM - No sub type information	<ul style="list-style-type: none"> • Transmission control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transmission system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0102-00	Lost Communication With Transfer Case Control Module - No sub type information	<ul style="list-style-type: none"> • Transfer case control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transfer case control module for related

		<p>circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Transfer case system fault 	DTCs and refer to the relevant DTC index
U0121-00	Lost Communication With Anti-Lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> • Anti-lock brake system control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Anti-lock brake system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0140-00	Lost Communication With Body Control Module - No sub type information	<ul style="list-style-type: none"> • Central junction box power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Central junction box system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0300-55	Internal Control Module Software Incompatibility - Not configured	<ul style="list-style-type: none"> • Electric park brake control module is not configured correctly 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the electric park brake control module with the latest level software
U0401-00	Invalid Data Received From ECM/PCM A - No sub type information	<ul style="list-style-type: none"> • Missing/invalid data from the engine control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0401-68	Invalid Data Received from ECM/PCM A - Event information	<ul style="list-style-type: none"> • Missing/invalid data from the engine control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0402-00	Invalid data received from the TCM - No sub type information	<ul style="list-style-type: none"> • Missing/invalid data from the transmission control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0403-00	Invalid Data Received From The Transfer Case Control Module - No sub type information	<ul style="list-style-type: none"> • Missing/invalid data from the transfer case control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
U0415-00	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> • Missing/invalid data from the anti-lock brake system control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0422-00	Invalid Data Received From Body Control Module - No sub type information	<ul style="list-style-type: none"> • Missing/invalid data from the central junction box 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0422-68	Invalid Data Received From Body Control	<ul style="list-style-type: none"> • Missing/invalid data from the central junction 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index

	Module - Event information	box	
U0452-68	Invalid Data Received From Restraints Control Module - Event information	<ul style="list-style-type: none"> Missing/invalid data from the restraints control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the restraints control module for related DTCs and refer to the relevant DTC index
U1A14-49	CAN Initialization Failure - Internal electronic failure	<ul style="list-style-type: none"> Electric park brake control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs. Perform Drive Cycle 1. If the fault persists, install a new electric park brake control module
U2002-01	Switch - General electrical failure	 <p>NOTE: Circuit reference SW1 / SW2 / SW3 / SW4</p> <ul style="list-style-type: none"> Electric park brake switch circuits short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: This DTC can be set by operating the electric park brake switch very slowly</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the electric park brake switch circuits for short circuit to ground, short circuit to power, open circuit, high resistance
U2002-12	Switch - Circuit short to battery	 <p>NOTE: Circuit reference SW1 / SW2 / SW3 / SW4</p> <ul style="list-style-type: none"> Electric park brake switch circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the electric park brake switch circuit for short circuit to power
U2002-2F	Switch - Signal erratic	 <p>NOTE: Circuit reference SW1 / SW2 / SW3 / SW4</p> <ul style="list-style-type: none"> Electric park brake switch circuits short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: This DTC can be set by operating the electric park brake switch very slowly</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the electric park brake switch circuits for short circuit to ground, short circuit to power, open circuit, high resistance
U2002-92	Switch - Performance or incorrect operation	 <p>NOTE: Circuit reference SW1 / SW2 / SW3 / SW4</p> <ul style="list-style-type: none"> Electric park brake switch circuits short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: This DTC can be set by operating the electric park brake switch very slowly</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the electric park brake switch circuits for short circuit to ground, short circuit to power, open circuit, high resistance
U2012-00	Car Configuration Parameter(s) - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U3000-00	Control Module - No sub type information	<ul style="list-style-type: none"> Electric park brake control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest
U3000-16	Control Module - Circuit voltage below threshold	<ul style="list-style-type: none"> Electric park brake control module power or ground circuit open circuit, 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the electrical circuit diagrams and check the electric park brake control module power and ground circuits for open circuit, high

		<ul style="list-style-type: none"> high resistance Battery/charging system fault 	<ul style="list-style-type: none"> resistance Refer to the relevant section of the workshop manual and test the battery and charging system
U3000-17	Control Module - Circuit voltage above threshold	<ul style="list-style-type: none"> Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the relevant section of the workshop manual and test the battery and charging system
U3000-4B	Control Module - Over temperature	<ul style="list-style-type: none"> Electric park brake control module internal temperature above threshold 	<ul style="list-style-type: none"> Allow the electric park brake control module to cool, clear the DTC and retest. Do not renew the electric park brake control module as this is a protection function to ensure no internal damage occurs
U300A-64	Ignition Switch - Signal plausibility failure	 <p>NOTE: Circuit reference IGN</p> <ul style="list-style-type: none"> Ignition sense circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the ignition sense circuit for short circuit to ground, short circuit to power, open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Electric Steering Column Lock Control Module (ESCL)

Description and Operation

Electric Steering Column Lock Control Module (ESCL)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Electric Steering Column Lock Control Module (ESCL). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

DTC	Description	Possible Causes	Action
B100D-16	Column Lock Authorisation - Circuit voltage below threshold	<ul style="list-style-type: none"> Electric steering column lock circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the electric steering column lock circuit for short circuit to ground, open circuit, high resistance. If the fault persists, install a new electric steering column lock
B100D-29	Column Lock Authorisation - Signal invalid	<ul style="list-style-type: none"> Electric steering column lock control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - On Demand Self Test (0x0202). If the fault persists, install a new electric steering column lock
B100D-42	Column Lock Authorisation - General memory failure	<ul style="list-style-type: none"> Electric steering column lock control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - On Demand Self Test (0x0202). If the fault persists, install a new electric steering column lock

		internal failure	
B100D-51	Column Lock Authorisation - Not programmed	<ul style="list-style-type: none"> Electric steering column lock control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the electric steering column lock control module with the latest level software
B100D-62	Column Lock Authorisation - Signal compare failure	<ul style="list-style-type: none"> Encrypted data exchange does not match between electric steering column lock and the instrument cluster 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the electric steering column lock control module with the latest level software. Re-configure the instrument cluster with the latest level software. If the fault persists, perform a CAN network integrity test. Perform routine - On Demand Self Test (0x0202)
B100D-64	Column Lock Authorisation - Signal plausibility failure	<ul style="list-style-type: none"> Incorrect conditions to allow locking action to continue 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform a CAN network integrity test. Perform routine - On Demand Self Test (0x0202). Check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index. Check the engine control module for related DTCs and refer to the relevant DTC index
B100D-72	Column Lock Authorisation - Actuator stuck open	<ul style="list-style-type: none"> Electric steering column lock unable to reach locked state 	<ul style="list-style-type: none"> Ensure that the vehicle battery supply voltage is between 9 and 16volts. Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Voltage Supply (0xDD02). Clear the DTCs. Perform a CAN network integrity test. Perform routine - On Demand Self Test (0x0202). If the fault persists, install a new electric steering column lock
B100D-73	Column Lock Authorisation - Actuator stuck closed	<ul style="list-style-type: none"> Electric steering column lock unable to reach unlocked state 	<ul style="list-style-type: none"> Ensure that the vehicle battery supply voltage is between 9 and 16volts. Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Voltage Supply (0xDD02). Clear the DTCs. Ensure that the column lock bolt movement is not obstructed or restricted (the parked position of the road wheels may be exerting a turning force through the steering column, preventing the lock from releasing. The steering wheel may need to be held against the force to allow the column lock to release). Perform a CAN network integrity test. Perform routine - On Demand Self Test (0x0202). If the fault persists, install a new electric steering column lock
B100D-77	Column Lock Authorisation - Commanded position not reachable	<ul style="list-style-type: none"> Electric steering column lock unable to reach unlocked or locked state 	<ul style="list-style-type: none"> Ensure that the vehicle battery supply voltage is between 9 and 16volts. Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Voltage Supply (0xDD02). Clear the DTCs. Ensure that the column lock bolt movement is not obstructed or restricted (the parked position of the road wheels may be exerting a turning force through the steering column, preventing the lock from releasing. The steering wheel may need to be held against the force to allow the column lock to release). Perform a CAN network integrity test. Perform routine - On Demand Self Test (0x0202). If the fault persists, install a new electric steering column lock
B100D-92	Column Lock Authorisation - Performance or incorrect operation	<ul style="list-style-type: none"> Electric steering column lock mechanism jammed, obstructed 	<ul style="list-style-type: none"> Ensure that the vehicle battery supply voltage is between 9 and 16volts. Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Voltage Supply (0xDD02). Clear the DTCs. Ensure that the column lock bolt movement is not obstructed or restricted (the parked position of the road wheels may be exerting a turning force through the steering column, preventing the lock from releasing. The steering wheel may need to be held against the force to allow the column lock to release). Perform a CAN network integrity test. Perform routine - On Demand Self Test (0x0202). If the problem persists, install a new electric steering column lock
B100D-94	Column Lock Authorisation -	<ul style="list-style-type: none"> Electric steering 	<ul style="list-style-type: none"> Ensure that the vehicle battery supply voltage is between 9 and 16volts. Using the manufacturer approved diagnostic

	Unexpected operation	column lock mechanism jammed, obstructed	system, check datalogger signal - Main ECU Voltage Supply (0xDD02). Clear the DTCs. Ensure that the column lock bolt movement is not obstructed or restricted (the parked position of the road wheels may be exerting a turning force through the steering column, preventing the lock from releasing. The steering wheel may need to be held against the force to allow the column lock to release). Perform a CAN network integrity test. Perform routine - On Demand Self Test (0x0202). If the problem persists, install a new electric steering column lock
B100D-96	Column Lock Authorisation - Component internal failure	<ul style="list-style-type: none"> Electric steering column lock mechanism jammed, obstructed 	<ul style="list-style-type: none"> Ensure that the vehicle battery supply voltage is between 9 and 16volts. Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Voltage Supply (0xDD02). Clear the DTCs. Ensure that the column lock bolt movement is not obstructed or restricted (the parked position of the road wheels may be exerting a turning force through the steering column, preventing the lock from releasing. The steering wheel may need to be held against the force to allow the column lock to release). Perform a CAN network integrity test. Perform routine - On Demand Self Test (0x0202). If the problem persists, install a new electric steering column lock
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> Electric steering column lock is not configured correctly 	<ul style="list-style-type: none"> Ensure that the vehicle battery supply voltage is between 9 and 16volts. Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Voltage Supply (0xDD02). Clear the DTCs. Ensure that the column lock bolt movement is not obstructed or restricted (the parked position of the road wheels may be exerting a turning force through the steering column, preventing the lock from releasing. The steering wheel may need to be held against the force to allow the column lock to release). Re-configure the electric steering column lock with the latest level software Perform a CAN network integrity test. Perform routine - On Demand Self Test (0x0202). If the problem persists, install a new electric steering column lock
U3002-81	Vehicle Identification Number - Invalid serial data received	<ul style="list-style-type: none"> Electric steering column lock previously installed on another vehicle New electric steering column lock installed and VIN not yet programmed 	<ul style="list-style-type: none"> Install the original or a new electric steering column lock as necessary Using the manufacturer approved diagnostic system, perform routine - Learn VIN (0x0404)

General Information - Diagnostic Trouble Code (DTC) Index TDV6 3.0L Diesel , DTC: Engine Control Module (ECM)

Description and Operation

Engine Control Module (ECM) - TDV6 3.0L Diesel

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.




The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Engine Control Module (ECM) - TDV6 3.0L Diesel. For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing Section in the workshop manual.


For additional information, refer to: [Electronic Engine Controls](#) (303-14A Electronic Engine Controls - TDV6 3.0L Diesel, Diagnosis and Testing).



The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Engine Control Module (ECM) - TDV6 3.0L Diesel. For additional Diesel Particulate Filter (DPF) diagnosis and testing information, refer to the relevant Diagnosis and Testing Section in the workshop manual.




For additional information, refer to: [Diesel Particulate Filter](#) (309-00A Exhaust System - TDV6 3.0L Diesel, Diagnosis and Testing).





DTC	Description	Possible Causes	Action
B1087-93	LIN Bus "A" - No operation	<ul style="list-style-type: none"> Generator LIN bus communication circuit failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the generator LIN bus circuit, for short circuit to power, short circuit to ground, open circuit. Repair wiring harness as required. Clear DTC and retest
B10A2-32	Crash Input - Signal low time < minimum	<p>NOTE: - Circuit SRS_INPUT -</p> <ul style="list-style-type: none"> Restraints control module fault Auxiliary junction box fault 	<ul style="list-style-type: none"> This DTC is set when the 'airbag deployed' signal supplied by the restraints control module is outside the specification expected by the engine control module Check the restraints control module for DTCs and refer to the relevant DTC index




		<ul style="list-style-type: none"> • Harness fault 	<ul style="list-style-type: none"> • Check auxiliary junction box for DTCs and refer to the relevant DTC index • Refer to electrical circuit diagrams and check the supplementary restraints system input circuit for faults. This circuit is a single wire which connects the restraints control module to the auxiliary junction box and the engine control module. Check this circuit for short circuit to power or ground, open circuit including intermittent faults. Repair wiring as required. Clear DTC and retest
B10A2-35	Crash Input - Signal high time > maximum	 <p>NOTE: - Circuit SRS_INPUT -</p> <ul style="list-style-type: none"> • Restraints control module fault • Auxiliary junction box fault • Harness fault 	<ul style="list-style-type: none"> • This DTC is set when the 'airbag deployed' signal supplied by the restraints control module is outside the specification expected by the engine control module • Check the restraints control module for DTCs and refer to the relevant DTC index • Check auxiliary junction box for DTCs and refer to the relevant DTC index • Refer to electrical circuit diagrams and check the supplementary restraints system input circuit for faults. This circuit is a single wire which connects the restraints control module to the auxiliary junction box and the engine control module. Check this circuit for short circuit to power or ground, open circuit including intermittent faults. Repair wiring as required. Clear DTC and retest
B10A2-36	Crash Input - Signal frequency too low	 <p>NOTE: - Circuit SRS_INPUT -</p> <ul style="list-style-type: none"> • The engine control module detected excessive duration for one cycle of the output across a specified sample size • Restraints control module fault • Auxiliary junction box fault • Harness fault 	<ul style="list-style-type: none"> • This DTC is set when the 'airbag deployed' signal supplied by the restraints control module is outside the specification expected by the engine control module • Check the restraints control module for DTCs and refer to the relevant DTC index • Check auxiliary junction box for DTCs and refer to the relevant DTC index • Refer to electrical circuit diagrams and check the supplementary restraints system input circuit for faults. This circuit is a single wire which connects the restraints control module to the auxiliary junction box and the engine control module. Check this circuit for short circuit to power or ground, open circuit including intermittent faults. Repair wiring as required. Clear DTC and retest
B10A2-37	Crash Input - Signal frequency too high	 <p>NOTE: - Circuit SRS_INPUT -</p> <ul style="list-style-type: none"> • The engine control module detected insufficient duration for one cycle of the output across a specified sample size • Restraints control module fault • Auxiliary junction box fault • Harness fault 	<ul style="list-style-type: none"> • This DTC is set when the 'airbag deployed' signal supplied by the restraints control module is outside the specification expected by the engine control module • Check the restraints control module for DTCs and refer to the relevant DTC index • Check auxiliary junction box for DTCs and refer to the relevant DTC index • Refer to electrical circuit diagrams and check the supplementary restraints system input circuit for faults. This circuit is a single wire which connects the restraints control module to the auxiliary junction box and the engine control module. Check this circuit for short circuit to power or ground, open circuit including intermittent faults. Repair wiring as required. Clear DTC and retest



B11D9-00	Vehicle Battery - No sub type information	<ul style="list-style-type: none"> • Harness fault • Battery fault • Battery monitoring system module fault 	<ul style="list-style-type: none"> • This DTC is set when the battery monitoring system fails a diagnostic check • Refer to the battery care manual and verify that the vehicle battery is fully charged and serviceable before continuing with further diagnostic tests. If a battery fault is indicated Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • Refer to the electrical circuit diagrams and check the connections between the battery and the battery monitoring module are clean and secure • Ensure that full battery voltage is present on the monitor line pin at the battery monitoring system module connector. Ensure the battery ground connection is clean and secure • Check the LIN bus connections to the battery monitoring system module. Check LIN bus integrity. If no fault found in wiring harness suspect battery monitoring system module failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
B11DB-87	Battery Monitoring Module - Missing message	<ul style="list-style-type: none"> • Harness fault • Battery monitoring system module fault 	<ul style="list-style-type: none"> • This DTC is set when the engine control module has lost communication with the battery monitoring system module • Refer to the battery care manual and verify that the vehicle battery is fully charged and serviceable before continuing with further diagnostic tests. If a battery fault is indicated Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • Refer to the electrical circuit diagrams and check the connections between the battery and the battery monitoring module are clean and secure • Ensure that full battery voltage is present on the monitor line pin at the battery monitoring system module connector. Ensure the battery ground connection is clean and secure • Check the LIN bus connections to the battery monitoring system module. Check LIN bus integrity. If no fault found in wiring harness suspect battery monitoring system module failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
B1206-68	Crash Occurred - Event information	<ul style="list-style-type: none"> • Event information - the engine control module has received a crash signal from the restraints control module 	<ul style="list-style-type: none"> • This DTC is set if the restraints control module has deployed the restraints systems following activation of the crash sensors. Check the restraints control module for DTCs and refer to the relevant DTC index
P0030-11	HO2S Heater Control Circuit (Bank 1, Sensor 1) - Circuit short to ground	 <p>NOTE: - Circuit LPPH_A</p> <ul style="list-style-type: none"> • The engine control module has detected a 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Oxygen Sensor (O2S) Heater Duty Cycle Bank 1 Sensor 1 (0x03A1). Refer to the electrical circuit diagrams and check the pre catalyst oxygen

		<p>ground measurement for a period longer than expected or has detected a ground measurement when another value was expected</p> <ul style="list-style-type: none"> • Harness fault - Pre catalyst oxygen sensor heater control circuit short circuit to ground • Pre catalyst oxygen sensor failure 	<p>sensor heater control (heater ground) circuit for short circuit to ground. This circuit runs from the engine control module through the transmission harness to the exhaust system. Check for external harness damage due to chafing or heat. Repair harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> • Suspect sensor failure if DTC resets. Heater circuit resistance measured at the component connector at approximately 20°C ambient temperature should be 2.4 - 4.0 Ohms. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0030-12	HO2S Heater Control Circuit (Bank 1, Sensor 1) - Circuit short to battery	 <p>NOTE: - Circuit LPPH_A</p> <ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Harness fault - Pre catalyst oxygen sensor heater control circuit short circuit to power • Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Oxygen Sensor (O2S) Heater Duty Cycle Bank 1 Sensor 1 (0x03A1). Refer to the electrical circuit diagrams and check the pre catalyst oxygen sensor heater control (heater ground) circuit for short circuit to power. This circuit runs from the engine control module through the transmission harness to the exhaust system. Check for external harness damage due to chafing or heat. Repair harness as required. Clear DTC and retest • Suspect sensor failure if DTC resets. Heater circuit resistance measured at the component connector at approximately 20°C ambient temperature should be 2.4 - 4.0 Ohms. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0030-13	HO2S Heater Control Circuit (Bank 1, Sensor 1) - Circuit open	 <p>NOTE: - Circuit LPPH_A</p> <ul style="list-style-type: none"> • The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Harness fault - Pre catalyst oxygen sensor heater control circuit open circuit • Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Oxygen Sensor (O2S) Heater Duty Cycle Bank 1 Sensor 1 (0x03A1). Refer to the electrical circuit diagrams and check the pre catalyst oxygen sensor heater control (heater ground) circuit for open circuit. This circuit runs from the engine control module through the transmission harness to the exhaust system. Check for external harness damage due to chafing or heat. Repair harness as required. Clear DTC and retest • Suspect sensor failure if DTC resets. Heater circuit resistance measured at the component connector at approximately 20°C ambient temperature should be 2.4 - 4.0 Ohms. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0030-4B	HO2S Heater Control Circuit (Bank 1, Sensor 1) - Over temperature	<ul style="list-style-type: none"> • Harness fault - Pre catalyst oxygen sensor heater control circuit short circuit to power • Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Oxygen Sensor (O2S) Heater Duty Cycle Bank 1 Sensor 1 (0x03A1). Refer to the electrical circuit diagrams and check the pre catalyst oxygen sensor heater control (heater ground) circuit for short circuit to power. This circuit runs from the engine control module through the transmission




			<p>harness to the exhaust system. Check for external harness damage due to chafing or heat. Repair harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> • Suspect sensor failure if DTC resets. Heater circuit resistance measured at the component connector at approximately 20°C ambient temperature should be 2.4 - 4.0 Ohms. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0033-00	Turbocharger/Supercharger Bypass Valve Control Circuit / Open - No sub type information	 <p>NOTE: - Circuit CRV -</p> <ul style="list-style-type: none"> • Harness fault - Boost air recirculation solenoid control circuit open circuit • Boost air recirculation solenoid failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the boost air recirculation solenoid control circuit between the engine control module and the control valve for open circuit. Check the power supply to the control valve. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect boost air recirculation solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0034-00	Turbocharger/Supercharger Bypass Valve Control Circuit Low - No sub type information	 <p>NOTE: - Circuit CRV -</p> <ul style="list-style-type: none"> • Harness fault - Boost air recirculation solenoid circuit short circuit to ground • Boost air recirculation solenoid failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the boost air recirculation solenoid circuit between the engine control module and the control valve for a short circuit to ground. Check the power supply to the control valve. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect boost air recirculation solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0035-00	Turbocharger/Supercharger Bypass Valve Control Circuit High - No sub type information	 <p>NOTE: - Circuit CRV -</p> <ul style="list-style-type: none"> • Harness fault - Boost air recirculation solenoid circuit short circuit to power • Boost air recirculation solenoid failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the boost air recirculation solenoid circuit between the engine control module and the control valve for a short circuit to power. Check the power supply to the control valve. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect boost air recirculation solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0039-4B	Turbocharger/Supercharger Bypass Valve Control Circuit Range/Performance - Over temperature	<ul style="list-style-type: none"> • Harness fault - Boost air recirculation solenoid circuit short to ground, short circuit to power, high resistance • Boost air recirculation solenoid failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the boost air recirculation solenoid circuit between the engine control module and the control valve for a short circuit to ground, short circuit to power, high resistance. Check the power supply to the control valve. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect boost air recirculation solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component


P004A-00	Turbocharger/Supercharger Boost Control B Circuit / Open - No sub type information	 <p>NOTE: - Circuit VGT_POS - VGT_NEG -</p> <ul style="list-style-type: none"> • Harness fault - Variable geometry turbocharger actuator vane control circuit open circuit 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Commanded Boost Actuator Control Bank 2 (0x0533), Boost Pressure Actuator Bank 2 - controller output (0x03DE). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane control circuit for open circuit. This circuit consists of a twisted pair of wires between the engine control module and the variable geometry turbocharger actuator vane control unit. Check both of the circuits for open circuit. Repair wiring as required. Clear DTC and retest
P004A-71	Turbocharger/Supercharger Boost Control B Circuit / Open - Actuator stuck	 <p>NOTE: - Circuit VGT_POS - VGT_NEG -</p> <ul style="list-style-type: none"> • Harness fault - Variable geometry turbocharger actuator vane control circuit open circuit • Variable geometry turbocharger actuator vane failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Commanded Boost Actuator Control Bank 2 (0x0533), Boost Pressure Actuator Bank 2 - controller output (0x03DE). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane control circuit for open circuit. This circuit consists of a twisted pair of wires between the engine control module and the variable geometry turbocharger actuator vane control unit. Check both of the circuits for open circuit. Repair wiring as required. Clear DTC and retest • Check and install new turbocharger actuator vane control unit as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P004B-16	Turbocharger/Supercharger Boost Control B Circuit Range/Performance - Circuit Voltage Below Threshold	 <p>NOTE: - Circuit VGT_POS - VGT_NEG -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Harness fault - Variable geometry turbocharger actuator vane control circuit • Variable geometry turbocharger actuator vane control unit failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Commanded Boost Actuator Control Bank 2 (0x0533). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane control circuit for high resistance or short circuits to another circuit. This circuit consists of a twisted pair of wires between the engine control module and the variable geometry turbocharger actuator vane control unit. Check both of the circuits for faults. Repair wiring as required. Clear DTC and retest • If no fault found in wiring harness suspect variable geometry turbocharger control module failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P004B-19	Turbocharger/Supercharger Boost Control B Circuit Range/Performance - Circuit Current Above Threshold	 <p>NOTE: - Circuit VGT_POS - VGT_NEG -</p> <ul style="list-style-type: none"> • Harness fault - Variable geometry turbocharger actuator vane control circuit short circuit to ground, short circuit to power, high resistance • Variable geometry turbocharger actuator 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Commanded Boost Actuator Control Bank 2 (0x0533). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane control circuit for short circuit to ground, short circuit to power, high resistance. This circuit consists of a twisted pair of wires between the engine control module and the variable geometry turbocharger actuator vane control unit. Check both of the circuits for faults. Repair wiring

		vane control unit failure	<ul style="list-style-type: none"> as required. Clear DTC and retest If no fault found in wiring harness suspect variable geometry turbocharger control module failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P004B-1D	Turbocharger/Supercharger Boost Control B Circuit Range/Performance - Circuit Current Out Of Range	 <p>NOTE: - Circuit VGT_POS - VGT_NEG -</p> <ul style="list-style-type: none"> Harness fault - Variable geometry turbocharger actuator vane control circuit Variable geometry turbocharger actuator vane control unit failure Mechanical fault on actuator mechanism 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded Boost Actuator Control Bank 2 (0x0533). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane control circuit for short circuits to another circuit. This circuit consists of a twisted pair of wires between the engine control module and the variable geometry turbocharger actuator vane control unit. Check both of the circuits for faults. Repair wiring as required. Clear DTC and retest If no fault found in wiring harness check variable geometry turbocharger control module for failure Check for mechanical fault on actuator mechanism. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P004B-4B	Turbocharger/Supercharger Boost Control B Circuit Range/Performance - Over temperature	<ul style="list-style-type: none"> Harness fault - Variable geometry turbocharger actuator vane control circuit short circuit to ground, short circuit to power, high resistance. Variable geometry turbocharger actuator vane control unit failure Mechanical fault on actuator mechanism 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded Boost Actuator Control Bank 2 (0x0533). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane control circuit for short circuit to ground, short circuit to power, high resistance. This circuit consists of a twisted pair of wires between the engine control module and the variable geometry turbocharger actuator vane control unit. Check both of the circuits for faults. Repair wiring as required. Clear DTC and retest If no fault found in wiring harness check variable geometry turbocharger control module for failure Check for mechanical fault on actuator mechanism. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P004C-00	Turbocharger/Supercharger Boost Control B Circuit Low - No sub type information	 <p>NOTE: - Circuit VGT_POS - VGT_NEG -</p> <ul style="list-style-type: none"> Harness fault - Variable geometry turbocharger actuator vane control circuit short circuit to ground 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded Boost Actuator Control Bank 2 (0x0533). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane control circuit for short circuit to ground. This circuit consists of a twisted pair of wires between the engine control module and the variable geometry turbocharger actuator vane control unit. Check both sides of this circuit. Repair wiring as required. Clear DTC and retest
P004C-11	Turbocharger/Supercharger Boost Control B Circuit Low - Circuit short to ground	 <p>NOTE: - Circuit VGT_POS - VGT_NEG -</p>	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded Boost Actuator

		<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Harness fault - Variable geometry turbocharger actuator vane control circuit short circuit to ground 	<p>Control Bank 2 (0x0533). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane control circuit for short circuit to ground. This circuit consists of a twisted pair of wires between the engine control module and the variable geometry turbocharger actuator vane control unit. Repair wiring as required. Clear DTC and retest</p>
P004C-12	Turbocharger/Supercharger Boost Control B Circuit Low circuit - Short to battery	 <p>NOTE: - Circuit VGT_POS - VGT_NEG -</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Harness fault - Variable geometry turbocharger actuator vane control circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded Boost Actuator Control Bank 2 (0x0533). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane control circuit for short circuit to power. This circuit consists of a twisted pair of wires between the engine control module and the variable geometry turbocharger actuator vane control unit. Repair wiring as required. Clear DTC and retest
P004C-77	Turbocharger/Supercharger Boost Control B Circuit Low - Commanded position not reachable	<ul style="list-style-type: none"> Harness fault - Variable geometry turbocharger actuator vane control circuit short circuit to ground, high resistance, open circuit Harness fault - Variable geometry turbocharger sensor circuit, short circuit to ground, high resistance, open circuit Variable geometry turbocharger actuator vane control unit failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded Boost Actuator Control Bank 2 (0x0533). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane control circuit for short circuit to ground, high resistance, open circuit. This circuit consists of a twisted pair of wires between the engine control module and the variable geometry turbocharger actuator vane control unit. Repair wiring as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the variable geometry turbocharger sensor circuit for short circuit to ground, high resistance, open circuit If no fault found in wiring harness suspect variable geometry turbocharger control module failure or mechanical fault on actuator mechanism. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P004D-00	Turbocharger/Supercharger Boost Control B Circuit High - No sub type information	 <p>NOTE: - Circuit VGT_POS - VGT_NEG -</p> <ul style="list-style-type: none"> Harness fault - Variable geometry turbocharger actuator vane control circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded Boost Actuator Control Bank 2 (0x0533). Refer to the electrical circuit diagrams and check the boost control circuit for short circuit to power. This circuit consists of a twisted pair of wires between the engine control module and the variable geometry turbocharger actuator vane control unit. Check both sides of this circuit. Repair wiring as required. Clear DTC and retest




P004D-77	Turbocharger/Supercharger Boost Control B Circuit High - Commanded Position Not Reachable	<ul style="list-style-type: none"> • Harness fault - Variable geometry turbocharger actuator vane control circuit short circuit to power • Harness fault - Variable geometry turbocharger sensor circuit, short circuit to power • Variable geometry turbocharger actuator vane control unit failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Commanded Boost Actuator Control Bank 2 (0x0533). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane control circuit for short circuit to power. This circuit consists of a twisted pair of wires between the engine control module and the variable geometry turbocharger actuator vane control unit. Repair wiring as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check the variable geometry turbocharger sensor circuit for short circuit to power • If no fault found in wiring harness suspect variable geometry turbocharger control module failure or mechanical fault on actuator mechanism. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P006A-00	MAP - Mass or Volume Air Flow Correlation - No sub type information	<ul style="list-style-type: none"> • Intake air system, high pressure boost leak bank A • Intake air system, high pressure boost leak bi-turbo mode bank B • Intake air system, low pressure boost leak bank A • Intake air system, low pressure boost leak bank B 	<ul style="list-style-type: none"> • If this DTC is logged with P1247-00, P0402-00 & P00BF-07, suspect intake air system, high pressure boost leak bank A • If this DTC is logged with P1247-00, suspect intake air system, high pressure boost leak bi-turbo mode bank B • If this DTC is logged with P00BE-07 & P0401-00, suspect intake air system, low pressure boost leak bank A • If this DTC is logged with P00BC-00, suspect intake air system, low pressure boost leak bank B • Using the manufacturer approved diagnostic system perform the (Turbo, EGR and air path dynamic test) routine
P006A-22	MAP - Mass or Volume Air Flow Correlation - Signal Amplitude > Maximum	<ul style="list-style-type: none"> • The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high • Error path indicating whether over boost monitoring is active or not • Fault in induction air circuit • Fault in boost air circuit • Mass air flow sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit • Manifold absolute pressure sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit • Mass air flow sensor failure • Manifold absolute pressure sensor failure 	<ul style="list-style-type: none"> • Check for other DTCs associated with intake and boost airflow control actuators, refer to the relevant DTC index and act on those DTCs first • Refer to workshop manual and check intake air circuit, boost air circuit and associated control valves, intercooler and air filter for leaks, blockages, restrictions and control valve actuator malfunctions • Refer to the electrical circuit diagrams and check both mass air flow sensor circuits for short circuit to ground, short circuit to power, high resistance, open circuit. Repair wiring as required. Clear DTC and retest • Check manifold absolute pressure sensor wiring circuits for short circuit to ground, short circuit to power, high resistance, open circuit. Repair wiring as required. Clear DTC and retest • If no fault found in wiring harness suspect mass air flow sensor or manifold absolute pressure sensor. Check and install new mass air flow or manifold absolute pressure sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0070-	Ambient Air Temperature		<ul style="list-style-type: none"> • Using the manufacturer approved





16	Sensor Circuit - Circuit Voltage Below Threshold	 <p>NOTE: - Circuit AMBIENT_AIR_TEMP -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Harness fault - ambient air temperature sensor circuit • Ambient air temperature sensor fault 	<p>diagnostic system check datalogger signals, Ambient Air Temperature Sensor Voltage (0x03BA), Ambient Air Temperature (0xF466). This DTC is set when the ambient air temperature sensor signal line voltage at the engine control module is less than the threshold value. The ambient air temperature sensor thermistor is mounted in the left door mirror and the circuit consists of a ambient air temperature sensor signal line and a sensor ground circuit. Refer to the electrical circuit diagrams and check both sides of the circuit for high resistance or short circuits. Repair wiring as required</p> <ul style="list-style-type: none"> • If no faults are found in the wiring circuits suspect the ambient air temperature sensor, refer to the relevant section of the workshop manual and check the sensor operation. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0070-17	Ambient Air Temperature Sensor Circuit - Circuit Voltage Above Threshold	 <p>NOTE: - Circuit AMBIENT_AIR_TEMP -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Harness fault - ambient air temperature sensor circuit • Ambient air temperature sensor fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Ambient Air Temperature Sensor Voltage (0x03BA), Ambient Air Temperature (0xF466). This DTC is set when the ambient air temperature sensor signal line voltage at the engine control module is greater than the threshold value. The ambient air temperature sensor thermistor is mounted in the left door mirror and the circuit consists of a ambient air temperature sensor signal line and a sensor ground circuit. Refer to the electrical circuit diagrams and check both sides of the circuit for high resistance or short circuits. Repair wiring as required • If no faults are found in the wiring circuits suspect the ambient air temperature sensor, refer to the relevant section of the workshop manual and check the sensor operation. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P007A-16	Charge Air Cooler Temperature Sensor Circuit (Bank 1) - Circuit Voltage Below Threshold	 <p>NOTE: - Circuit ACT -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Harness fault - air charge temperature sensor circuit • Air charge temperature sensor fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Charge Air Temperature Voltage (0x03EE). This DTC is set when the air charge temperature sensor signal line voltage at the engine control module is less than the threshold value. The air charge temperature sensor thermistor is located in the air intake system downstream of the intercooler and consists of a signal line and a sensor ground circuit. Refer to the electrical circuit diagrams and check both sides of the circuit for high resistance or short circuits. Repair wiring as required • If no faults are found in the wiring circuits suspect the air charge temperature sensor, refer to the relevant section of the workshop manual and check the sensor



			operation. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P007A-17	Charge Air Cooler Temperature Sensor Circuit (Bank 1) - Circuit Voltage Above Threshold	 NOTE: - Circuit ACT - <ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Harness fault - air charge temperature sensor circuit Air charge temperature sensor fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Air Charge Temperature (0x051C). This DTC is set when the air charge temperature sensor signal line voltage at the engine control module is greater than the threshold value. The air charge temperature sensor thermistor is located in the air intake system downstream of the intercooler and consists of a signal line and a sensor ground circuit. Refer to the electrical circuit diagrams and check both sides of the circuit for high resistance or short circuits. Repair wiring as required If no faults are found in the wiring circuits suspect the air charge temperature sensor, refer to the relevant section of the workshop manual and check the sensor operation. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P007A-62	Charge Air Cooler Temperature Sensor Circuit (Bank 1) - Signal Compare Failure	<ul style="list-style-type: none"> Harness fault - air charge temperature sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit Air charge temperature sensor fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Charge Air Temperature Voltage (0x03EE). Refer to the electrical circuit diagrams and check air charge temperature sensor circuit for short circuit to ground, short circuit to power, high resistance, open circuit. Repair wiring as required If no faults are found in the wiring circuits suspect the air charge temperature sensor, refer to the relevant section of the workshop manual and check the sensor operation. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0087-00	Fuel Rail/System Pressure - Too Low - No sub type information	<ul style="list-style-type: none"> Low level fuel condition Fuel gauge sender unit sticking Fuel rail pressure sensor signal circuit short circuit to power Fuel lines restricted Fuel lines leaking Fuel pump failure Fuel rail pressure sensor signal circuit short circuit to ground Fuel rail pressure sensor signal circuit open circuit Fuel rail pressure sensor circuit high resistance Fuel rail pressure sensor failure 	<ul style="list-style-type: none"> Check the fuel volume available in the fuel tank is sufficient, add fuel as required. Clear DTC and retest Check the fuel gauge sender units for correct operation Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuit for short circuit to power Check fuel lines for restriction Check fuel lines for leakage Check for fuel pump related DTCs and refer to the relevant DTC index Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuit for short circuit to ground, open circuit, high resistance Repair wiring as required. If no wiring faults are found suspect fuel rail pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0087-	Fuel Rail/System Pressure	<ul style="list-style-type: none"> The engine control 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams



16	- Too Low - Circuit Voltage Below Threshold	<p>module measured a voltage below a specified range but not necessarily a short circuit to ground</p> <ul style="list-style-type: none"> • Fuel rail pressure sensor circuit, short circuit to ground, open circuit, high resistance • Fuel rail pressure sensor failure 	<p>and check fuel rail pressure sensor circuit for short circuit to ground, open circuit, high resistance</p> <ul style="list-style-type: none"> • Repair wiring as required. If no wiring faults are found suspect fuel rail pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0087-21	Fuel Rail/System Pressure - Too Low - Signal Amplitude < Minimum	<ul style="list-style-type: none"> • The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low • Fuel lines restricted • Fuel lines leaking • Fuel injector's stuck open, leaking • Fuel pump failure • Fuel rail pressure sensor circuit short circuit to ground, open circuit, high resistance • Fuel pressure control valve circuit short circuit to ground, open circuit, high resistance • Fuel volume control valve circuit short circuit to ground, open circuit, high resistance • Fuel rail pressure sensor failure • Fuel pressure control valve failure • Fuel volume control valve failure 	<ul style="list-style-type: none"> • Check fuel lines for restriction • Check fuel lines for leakage • Check fuel injector's for stuck open, leakage • Check for fuel pump related DTCs and refer to the relevant DTC index • Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuit for short circuit to ground, open circuit, high resistance • Refer to the electrical circuit diagrams and check fuel pressure control valve circuit for short circuit to ground, open circuit, high resistance • Refer to the electrical circuit diagrams and check fuel volume control valve circuit for short circuit to ground, open circuit, high resistance • If no wiring faults are found suspect fuel rail pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • If no wiring faults are found suspect fuel pressure control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • If no wiring faults are found suspect fuel volume control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0088-00	Fuel Rail/System Pressure - Too High - No sub type information	<ul style="list-style-type: none"> • Fuel gauge sender unit sticking • Fuel rail pressure sensor signal circuit short circuit to power • Fuel rail pressure sensor ground circuit high resistance • Fuel rail pressure sensor ground circuit open circuit • Fuel pressure control valve circuit short circuit to power, ground, open circuit, high resistance • Fuel volume control valve circuit short circuit to power, ground, open circuit, high resistance • Fuel rail pressure sensor failure • Fuel pressure control valve failure • Fuel volume control 	<ul style="list-style-type: none"> • Check the fuel gauge sender units for correct operation • Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuit for short circuit to power • Refer to the electrical circuit diagrams and check fuel rail pressure sensor ground circuit for high resistance • Refer to the electrical circuit diagrams and check fuel rail pressure sensor ground circuit for open circuit • Refer to the electrical circuit diagrams and check fuel pressure control valve circuit for short circuit to power, ground, open circuit, high resistance • Refer to the electrical circuit diagrams and check fuel volume control valve circuit for short circuit to power, ground, open circuit, high resistance • If no wiring faults are found suspect fuel rail pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component



		valve failure	<ul style="list-style-type: none"> If no wiring faults are found suspect fuel pressure control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component If no wiring faults are found suspect fuel volume control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0088-17	Fuel Rail/System Pressure - Too High - circuit voltage above threshold	<ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Fuel rail pressure sensor signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuit for short circuit to power
P0088-22	Fuel Rail/System Pressure - Too High - Signal Amplitude > Maximum	<ul style="list-style-type: none"> The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high Fuel gauge sender unit sticking Fuel lines restricted Fuel rail pressure sensor circuit short circuit to power, ground, open circuit, high resistance Fuel pressure control valve circuit short circuit to power, ground, open circuit, high resistance Fuel volume control valve circuit short circuit to power, ground, open circuit, high resistance Fuel rail pressure sensor failure Fuel pressure control valve failure Fuel volume control valve failure Fuel pump failure 	<ul style="list-style-type: none"> Check the fuel gauge sender units for correct operation Check fuel lines for restriction Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuit for short circuit to power, ground, open circuit, high resistance Refer to the electrical circuit diagrams and check fuel pressure control valve circuit for short circuit to power, ground, open circuit, high resistance Refer to the electrical circuit diagrams and check fuel volume control valve circuit for short circuit to power, ground, open circuit, high resistance If no wiring faults are found suspect fuel rail pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component If no wiring faults are found suspect fuel pressure control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component If no wiring faults are found suspect fuel volume control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component Check for fuel pump related DTCs and refer to the relevant DTC index
P0089-21	Fuel Pressure Regulator Performance - Signal Amplitude < Minimum	<ul style="list-style-type: none"> The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low Fuel pressure regulator signal circuit short circuit to ground Fuel pressure regulator signal circuit open circuit Fuel pressure regulator reference 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel pressure regulator circuit for short circuit to ground Refer to the electrical circuit diagrams and check fuel pressure regulator circuit for open circuit Refer to the electrical circuit diagrams and check fuel pressure regulator reference voltage circuit for high resistance If no wiring faults are found suspect fuel rail pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation,



		<p>voltage circuit high resistance</p> <ul style="list-style-type: none"> Fuel pressure regulator failure 	<p>prior to the installation of a new module/component</p>
P0089-22	Fuel Pressure Regulator Performance - Signal Amplitude > Maximum	<ul style="list-style-type: none"> The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high Fuel pressure regulator signal circuit short circuit to power Fuel pressure regulator failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel pressure regulator circuit for short circuit to power If no wiring faults are found suspect fuel rail pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0090-13	Fuel Pressure Regulator 1 Control Circuit/Open - Circuit open	 <p>NOTE: - Circuit PCV -</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Harness fault - Fuel pressure control valve control circuit open circuit 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Fuel Pressure Relief Control Valve Duty Cycle (0x03C3). Refer to the electrical circuit diagrams and check the fuel pressure control valve control circuit for open circuit. Repair wiring as required. Clear DTC and retest
P0090-4B	Fuel Pressure Regulator 1 Control Circuit/Open - Over temperature	<ul style="list-style-type: none"> Fuel pressure control valve signal circuit short circuit to power, open circuit Fuel pressure regulator failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Fuel Pressure Relief Control Valve Duty Cycle (0x03C3). Refer to the electrical circuit diagrams and check fuel pressure control valve circuit for short circuit to power, open circuit If no wiring faults are found suspect fuel rail pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0091-11	Fuel Pressure Regulator 1 Control Circuit Low - Circuit short to ground	 <p>NOTE: - Circuit PCV -</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Harness fault - fuel pressure control valve circuit short circuit to ground Fuel pressure control valve failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Fuel Pressure Relief Control Valve Duty Cycle (0x03C3). Refer to the electrical circuit diagrams and check the fuel pressure control valve circuit for short circuit to ground. Check harness from engine control module to control valve connector for external damage caused by chafing or heat. Check power supply circuit to control valve. Repair wiring as required. Clear DTC and retest If no wiring faults are found suspect the fuel pressure control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0091-16	Fuel Pressure Regulator 1 Control Circuit Low - Circuit Voltage Below Threshold	 <p>NOTE: - Circuit PCV -</p> <ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Fuel Pressure Relief Control Valve Duty Cycle (0x03C3). This DTC is set when the voltage on the fuel pressure control valve circuit is less than the threshold expected by the engine control module. Check harness from engine control module to control



		<ul style="list-style-type: none"> • Harness fault - fuel pressure control valve circuit • Fuel pressure control valve failure 	<p>valve connector for external damage caused by chafing or heat. Refer to the electrical circuit diagrams and check the power supply circuit to the control valve. Check the control circuit between the engine control module and the fuel pressure control valve for faults such as high resistance, short circuit to ground, intermittent open circuit. Repair wiring as required. Clear DTC and retest</p> <ul style="list-style-type: none"> • If no wiring faults are found suspect the fuel pressure control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0092-12	Fuel Pressure Regulator 1 Control Circuit High - Circuit short to battery	 <p>NOTE: - Circuit PCV -</p> <ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Harness fault - fuel pressure control valve circuit short circuit to power 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Fuel Pressure Relief Control Valve Duty Cycle (0x03C3). Refer to the electrical circuit diagrams and check the fuel pressure control valve circuit for short circuit to power. Check harness from engine control module to control valve connector for external damage caused by chafing or heat. Check power supply circuit to control valve. Repair wiring as required. Clear DTC and retest
P0092-17	Fuel Pressure Regulator 1 Control Circuit High - Circuit Voltage Above Threshold	 <p>NOTE: - Circuit PCV -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Harness fault - fuel pressure control valve circuit • Fuel pressure control valve failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Fuel Pressure Relief Control Valve Duty Cycle (0x03C3). This DTC is set when the voltage on the fuel pressure control valve circuit is more than the threshold expected by the engine control module. Check harness from engine control module to fuel pressure control valve connector for external damage caused by chafing or heat. Refer to the electrical circuit diagrams and check the control circuit between the engine control module and the fuel pressure control valve for faults such as high resistance, short circuit to power. Repair wiring as required. Clear DTC and retest • If no wiring faults are found suspect the fuel pressure control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P00AA-16	Intake Air Temperature Sensor 1 Circuit (Bank 2) - Circuit Voltage Below Threshold	<p>NOTES:</p>  <p>- Circuit AIR_INTAKE_TEMP -</p>  <p>Circuit diagram component name maf/iat sensor</p> <ul style="list-style-type: none"> • The engine control module measured a voltage below a specified range but not necessarily a short 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Intake Air Temperature Sensor (0x1279), Intake Air Temperature (0xF40F). This DTC is set when the voltage on the intake air temperature sensor circuit is less than the threshold expected by the engine control module. The intake air temperature sensor is integrated into the electronics package of the mass air flow. The sensor circuit consists of a thermistor exposed to air passing through the mass air flow sensor, the engine control module signal line voltage passes through the thermistor and shares the same ground




		<p>circuit to ground</p> <ul style="list-style-type: none"> • Harness fault - Intake air temperature sensor circuit • Intake air temperature sensor fault (part of mass air flow sensor) 	<p>circuit as the mass air flow element of the sensor. Check the harness between the engine control module and the mass airflow sensor for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check all the circuits connected to the mass air flow sensor for open circuits, short circuits, high resistance and intermittent connections. Check mass airflow sensor 2 circuits as both sensors share the ground connection. Repair wiring as required, clear the DTC and retest the system</p> <ul style="list-style-type: none"> • If the DTC resets and there are no harness faults suspect the intake air temperature sensor fault (part of mass air flow sensor). Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P00AA-17	Intake Air Temperature Sensor 1 Circuit (Bank 2) - Circuit Voltage Above Threshold	<p>NOTES:</p> <p> - Circuit AIR_INTAKE_TEMP -</p> <p> Circuit diagram component name maf/iat sensor</p> <ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Harness fault - Intake air temperature sensor circuit • Intake air temperature sensor fault (part of mass air flow sensor) 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Intake Air Temperature Sensor (0x1279), Intake Air Temperature (0xF40F). This DTC is set when the voltage on the intake air temperature sensor circuit is greater than the threshold expected by the engine control module. The intake air temperature sensor is integrated into the electronics package of the mass air flow. The sensor circuit consists of a thermistor exposed to air passing through the mass air flow sensor, the engine control module signal line voltage passes through the thermistor and shares the same ground circuit as the mass air flow element of the sensor. Check the harness between the engine control module and the mass airflow sensor for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check all the circuits connected to the mass air flow sensor for open circuits, short circuits, high resistance and intermittent connections. Check mass airflow sensor 2 circuits as both sensors share the ground connection. Repair wiring as required, clear the DTC and retest the system • If the DTC resets and there are no harness faults suspect the intake air temperature sensor fault (part of mass air flow sensor). Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P00AA-62	Intake Air Temperature Sensor 1 Circuit (Bank 2) - Signal Compare Failure	<ul style="list-style-type: none"> • Harness fault - Intake air temperature sensor circuit • Intake air temperature sensor fault (part of mass air flow sensor) 	<ul style="list-style-type: none"> • Check the harness between the engine control module and the mass airflow sensor for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check all the circuits connected to the mass air flow sensor for open circuit, short circuit, high resistance and intermittent connections. Check mass airflow sensor 2 circuits as both sensors share the ground connection. Repair wiring as required, clear the DTC and retest the system • If the DTC resets and there are no harness faults suspect the intake air



			temperature sensor fault (part of mass air flow sensor). Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P00BC-00	Mass or Volume Air Flow A Circuit Range/Performance - Air Flow Too Low - No sub type information	<ul style="list-style-type: none"> Boost air solenoid stuck shut bi-turbo mode Turbine intake solenoid stuck shut Intake system low pressure boost leak bank 2 	<ul style="list-style-type: none"> If this DTC is logged with P1247-00, suspect boost air solenoid stuck shut bi-turbo mode If this DTC is logged with P22D3-77 & P22CF-71, suspect turbine intake solenoid stuck shut If this DTC is logged with P006A-00, suspect intake system low pressure boost leak bank 2
P00BC-07	Mass or Volume Air Flow A Circuit Range/Performance - Air Flow Too Low - Mechanical Failures	 <p>NOTE: Circuit diagram component name maf/iat sensor</p> <ul style="list-style-type: none"> Airflow disruption at sensing element of mass air flow sensor Mass air flow sensor failure 	<ul style="list-style-type: none"> This DTC is set if the mass air flow signal from sensor 1 is less than the value expected by the engine control module. Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine the induction pipes for debris which could disrupt air flow at the sensing element. Clear the DTC and retest the system If the DTC resets and there are no harness faults suspect the mass air flow sensor . Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P00BD-00	Mass or Volume Air Flow A Circuit Range/Performance - Air Flow Too High - No sub type information	 <p>NOTE: Circuit diagram component name maf/iat sensor</p> <ul style="list-style-type: none"> Air leak at air intake system A Harness fault - Mass air flow sensor circuit short circuit to power Mass air flow sensor failure 	<ul style="list-style-type: none"> Refer to the relevant sections of the workshop manual and check the induction system for air leaks Refer to the electrical circuit diagrams and check mass air flow sensor for short circuit to power. Repair wiring as required, clear the DTC and retest the system If the DTC resets and there are no harness faults suspect the mass air flow sensor . Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P00BD-07	Mass or Volume Air Flow A Circuit Range/Performance - Air Flow Too High - Mechanical Failures	<ul style="list-style-type: none"> Boost air solenoid stuck open mono turbo mode Turbine intake solenoid leakage when closed Turbine intake solenoid stuck open Intake air system, blocked low pressure air intake. This failure mode can be caused by snow packing in the intake system. Symptoms often disappear after the vehicle has been warmed and heat soaked. Similar symptoms to seized primary turbo Primary turbo charger seized 	<ul style="list-style-type: none"> If this DTC is logged with P0235-94 suspect, boost air solenoid stuck open mono turbo mode If this DTC is logged with P0235-94 suspect, turbine intake solenoid leakage when closed If this DTC is logged with P0235-94, P22D2-77, P1247-00 & P22CF-71 suspect, turbine intake solenoid stuck open If this DTC is logged with P0235-94, P22D2-77, P1247-00 & P22CF-71 suspect, intake air system, blocked low pressure air intake If this DTC is logged with P00BE-07 & P1247-00 suspect, primary turbocharger seized Using the manufacturer approved diagnostic system perform the (Turbo, EGR and air path dynamic test) routine



<p>POOBE-00</p>	<p>Mass or Volume Air Flow B Circuit Range/Performance - Air Flow Too Low - No sub type information</p>	 <p>NOTE: Circuit diagram component name maf/iat sensor</p> <ul style="list-style-type: none"> • Boost air recirculation solenoid stuck open bi-turbo mode • Airflow disruption at sensing element of mass air flow sensor 2 • Harness fault - Mass air flow sensor circuit short circuit to ground, high resistance, open circuit • Mass air flow sensor 2 failure 	<ul style="list-style-type: none"> • If this DTC is logged with P1247-00, suspect boost air recirculation solenoid stuck open. Refer to the relevant sections of the workshop manual and check the boost air recirculation solenoid circuit for short circuit to power, ground, open circuit. Check and install a new boost air recirculation solenoid as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine the induction pipes for debris which could disrupt air flow at the sensing element • Refer to the electrical circuit diagrams and check mass air flow sensor 2 for short circuit to ground, high resistance, open circuit. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the mass air flow sensor. Check and install a new mass air flow sensor 2 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
<p>POOBE-07</p>	<p>Mass or Volume Air Flow B Circuit Range/Performance - Air Flow Too Low - Mechanical Failures</p>	 <p>NOTE: Circuit diagram component name maf/iat sensor</p> <ul style="list-style-type: none"> • Airflow disruption at sensing element of mass air flow • Mass air flow failure 	<ul style="list-style-type: none"> • This DTC is set if the mass air flow signal from sensor 2 is less than the value expected by the engine control module. Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine the induction pipes for debris which could disrupt air flow at the sensing element. Clear the DTC and retest the system • If the DTC resets suspect the mass air flow sensor. Check and install a new mass air flow as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
<p>POOBF-00</p>	<p>Mass or Volume Air Flow B Circuit Range/Performance - Air Flow Too High - No sub type information</p>	<ul style="list-style-type: none"> • Air leak at air intake system B • Harness fault - Mass air flow sensor circuit short circuit to power • Mass air flow sensor 2 failure 	<ul style="list-style-type: none"> • If this DTC is logged with P00BE-00, suspect boost air recirculation solenoid stuck open. Refer to the relevant sections of the workshop manual and check the boost air recirculation solenoid circuit for short circuit to power, ground, open circuit. Check and install a new boost air recirculation solenoid as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. Refer to the relevant sections of the workshop manual and check the induction system for air leaks • Refer to the electrical circuit diagrams and check mass air flow sensor 2 for short circuit to power. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the mass air


			<p>flow sensor. Check and install a new mass air flow sensor 2 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p>
P00BF-07	Mass or Volume Air Flow B Circuit Range/Performance - Air Flow Too High - Mechanical Failures	<ul style="list-style-type: none"> Intake air system, high pressure boost leak bank A 	<ul style="list-style-type: none"> If this DTC is logged with P1247-00, P006A-00 & P00BF-07, suspect intake air system, high pressure boost leak bank A
P00CF-62	Secondary Compressor Outlet Pressure Sensor - Signal compare failure	<ul style="list-style-type: none"> Boost air circuit leak or blockage Boost air recirculation solenoid fault Boost air solenoid fault Mechanical fault - sensor hose blocked or leaking Harness fault - Boost air pressure sensor circuit Boost air pressure sensor failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects a signal compare failure on the boost air pressure sensor signal. Check the sensor hose for blockages or leaks. Check the sensor and harness for mechanical damage caused by heat or chaffing. Check for DTCs relating to faults on the Accelerator Pedal Position sensor as these sensors share power supply and ground connections The boost air pressure sensor has three circuits, a 5 volt supply, a sensor ground, and an analogue voltage signal line. Refer to the electrical circuit diagrams and check the sensor voltage and ground supplies for open circuits or short circuit to ground. Check the signal line for open circuit, short circuit to power, short circuit to ground. Repair the wiring harness as required If no fault found in wiring harness suspect boost air pressure sensor failure. The sensor provides an analogue voltage output in response to the pressure applied at the sensing orifice. The output voltage range is between 0.2 and 4.8 volts. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0101-21	Mass or Volume Air Flow A Circuit Range/Performance - Signal Amplitude < Minimum	 <p>NOTE: Circuit diagram component name maf/iat sensor</p> <ul style="list-style-type: none"> The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low Airflow disruption at sensing element of mass air flow sensor Harness fault - Mass air flow sensor circuit short circuit to ground, high resistance, open circuit Mass air flow sensor failure 	<ul style="list-style-type: none"> This DTC is set if the mass air flow signal from sensor 1 is less than the value expected by the engine control module. Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine the induction pipes for debris which could disrupt air flow at the sensing element Refer to the electrical circuit diagrams and check mass air flow sensor for short circuit to ground, high resistance, open circuit. Repair wiring as required, clear the DTC and retest the system If the DTC resets suspect the mass air flow sensor. Check and install a new mass air flow sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0101-22	Mass or Volume Air Flow A Circuit Range/Performance - Signal Amplitude > Maximum	 <p>NOTE: Circuit diagram component name maf/iat sensor</p> <ul style="list-style-type: none"> The engine control module measured a signal voltage above a 	<ul style="list-style-type: none"> This DTC is set if the mass air flow signal from sensor 1 is less than the value expected by the engine control module. Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine




		<p>specified range but not necessarily a short circuit to power, gain too high</p> <ul style="list-style-type: none"> • Airflow disruption at sensing element of mass air flow sensor • Harness fault - Mass air flow sensor circuit short circuit to power • Mass air flow sensor failure 	<p>the induction pipes for debris which could disrupt air flow at the sensing element</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check mass air flow sensor for short circuit to power. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the mass air flow sensor. Check and install a new mass air flow sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0101-92	Mass or Volume Air Flow Sensor "A" Circuit Range/Performance - Performance or incorrect operation	<ul style="list-style-type: none"> • Airflow disruption at sensing element of mass air flow sensor • Harness fault - Mass air flow sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Mass air flow sensor failure 	<ul style="list-style-type: none"> • This DTC is set if the mass air flow signal from sensor 1 is less than the value expected by the engine control module. Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine the induction pipes for debris which could disrupt air flow at the sensing element • Refer to the electrical circuit diagrams and check mass air flow sensor for short circuit to ground, short circuit to power, open circuit, high resistance. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the mass air flow sensor. Check and install a new mass air flow sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0102-00	Mass or Volume Air Flow A Circuit Low - No sub type information	<p>NOTES:</p>  - Circuit MAFS_B -  Circuit diagram component name maf/iat sensor <ul style="list-style-type: none"> • Airflow disruption at sensing element of mass air flow sensor • Harness fault - Mass air flow sensor circuits • Mass air flow sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Air Flow Rate From mass air flow Sensor Bank 1 (0x0504). This DTC is set if the mass air flow signal from sensor 1 is less than the value expected by the engine control module. Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine the induction pipes for debris which could disrupt air flow at the sensing element • Refer to the electrical circuit diagrams and check the power and ground circuits for the mass air flow sensors for high resistance, short circuits to power or ground, check the mass air flow signal line between the engine control module and the mass air flow sensor for high resistance, and intermittent faults. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the mass air flow sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0103-00	Mass or Volume Air Flow A Circuit High - No sub type	<p>NOTES:</p>	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger






	<p>information</p>	 - Circuit MAFS_B -  Circuit diagram component name maf/iat sensor <ul style="list-style-type: none"> • Airflow disruption at sensing element of mass air flow sensor • Harness fault - Mass air flow sensor circuits • Mass air flow sensor failure 	<p>signals, Air Flow Rate From Mass Air Flow Sensor Bank 1 (0x0504). This DTC is set if the mass air flow signal from sensor 1 is greater than the value expected by the engine control module. Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine the induction pipes for debris which could disrupt air flow at the sensing element. Refer to the electrical circuit diagrams and check the power and ground circuits for the mass air flow sensors for high resistance, short circuits to power or ground, check the mass air flow signal line between the engine control module and the mass air flow sensor for high resistance, and intermittent faults. Repair wiring as required, clear the DTC and retest the system. If the DTC resets suspect the mass air flow sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Air Flow Rate From Mass Air Flow Sensor Bank 1 (0x0504). This DTC is set if the mass air flow signal from sensor 1 is greater than the value expected by the engine control module. Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine the induction pipes for debris which could disrupt air flow at the sensing element • Refer to the electrical circuit diagrams and check the power and ground circuits for the mass air flow sensors for high resistance, short circuits to power or ground, check the mass air flow signal line between the engine control module and the mass air flow sensor for high resistance, and intermittent faults. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the mass air flow sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0105-16	<p>Manifold Absolute Pressure/BARO circuit - Circuit voltage below threshold</p>	 NOTE: - Circuit MAP - <ul style="list-style-type: none"> • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Harness fault - Manifold absolute pressure sensor circuits • Manifold absolute pressure sensor failure • Blockage or leak 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the 5 volt supply circuit for open circuits, high resistance, short circuit to ground. Check the sensor ground for open circuit, short circuit to power. Check the signal circuit for short circuit to ground, high resistance. Repair wiring as required, clear the DTC and retest the system • . If the DTC resets and there are no harness faults suspect the manifold absolute pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new



		<p>between the intake manifold and the manifold absolute pressure sensor</p>	<p>module/component</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Corrected Intake Manifold Absolute Pressure (0x0322), Manifold Absolute Pressure Sensor Voltage (0x0301), Manifold Absolute Pressure Bank 1 (0x052C). This DTC is set when the voltage on the manifold absolute pressure sensor signal circuit is less than the threshold expected by the engine control module. This sensor is a pressure transducer with a 5 volt sensor supply, a sensor ground, and a signal circuit. Refer to the workshop manual and check the manifold absolute pressure sensor is correctly connected to the air intake manifold and there are no blockages or air leaks preventing communication of pressure changes between the manifold and the sensor. Check for DTCs associated with the throttle position sensor which has a common power supply
P0105-17	Manifold Absolute Pressure/BARO circuit - Circuit voltage above threshold	 <p>NOTE: - Circuit MAP -</p> <ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Harness fault - Manifold absolute pressure sensor circuits Manifold absolute pressure sensor failure Blockage or leak between the intake manifold and the manifold pressure sensor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the 5 volt supply circuit for short circuit to power. Check the sensor ground for open circuit, short circuit to power. Check the signal circuit for short circuit to power. Repair wiring as required, clear the DTC and retest the system If the DTC resets and there are no harness faults suspect the manifold absolute pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component Using the manufacturer approved diagnostic system check datalogger signals, Corrected Intake Manifold Absolute Pressure (0x0504), Manifold Absolute Pressure Sensor Voltage (0x0301), Manifold Absolute Pressure Bank 1 (0x052C). This DTC is set when the voltage on the manifold absolute pressure sensor signal circuit is greater than the threshold expected by the engine control module. This sensor is a pressure transducer with a 5 volt sensor supply, a sensor ground, and a signal circuit. The sensing element is connected to intake manifold pressure downstream of the throttle plate. Refer to the workshop manual and check the manifold absolute pressure sensor is correctly connected to the air intake manifold and there are no blockages or air leaks preventing communication of pressure changes between the manifold and the sensor. Check for DTCs associated with the throttle position sensor which has a common power supply
P0105-65	Manifold Absolute Pressure/Barometric Pressure Sensor Circuit - Signal has too few transitions / events	 <p>NOTE: - Circuit MAP -</p> <ul style="list-style-type: none"> Harness fault - Manifold absolute pressure sensor circuits Manifold absolute pressure sensor failure Blockage or leak between the intake 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the 5 volt supply circuit for short circuit to power. Check the sensor ground for open circuit, short circuit to power. Check the signal circuit for short circuit to power. Repair wiring as required, clear the DTC and retest the system If the DTC resets and there are no harness faults suspect the manifold absolute pressure sensor. Refer to the



		manifold and the manifold pressure sensor	<p>warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Corrected Intake Manifold Absolute Pressure (0x0504), Manifold Absolute Pressure Sensor Voltage (0x0301), Manifold Absolute Pressure Bank 1 (0x052C). This DTC is set when the voltage on the manifold absolute pressure sensor signal circuit is greater than the threshold expected by the engine control module. This sensor is a pressure transducer with a 5 volt sensor supply, a sensor ground, and a signal circuit. The sensing element is connected to Intake Manifold Pressure downstream of the throttle plate. Refer to the workshop manual and check the manifold absolute pressure sensor is correctly connected to the air intake manifold and there are no blockages or air leaks preventing communication of pressure changes between the manifold and the sensor. Check for DTCs associated with the throttle position sensor which has a common power supply
P0107-00	Manifold Absolute Pressure/Barometric Pressure Sensor Circuit Low - No sub type information	 <p>NOTE: - Circuit MAP -</p> <ul style="list-style-type: none"> Harness fault - Manifold absolute pressure sensor circuits Manifold absolute pressure sensor failure Blockage or leak between the intake manifold and the manifold pressure sensor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the 5 volt supply circuit for short circuit to power. Check the sensor ground for open circuit, short circuit to power. Check the signal circuit for short circuit to power. Repair wiring as required, clear the DTC and retest the system If the DTC resets and there are no harness faults suspect the manifold absolute pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component Using the manufacturer approved diagnostic system check datalogger signals, Corrected Intake Manifold Absolute Pressure (0x0504), Manifold Absolute Pressure Sensor Voltage (0x0301), Manifold Absolute Pressure Bank 1 (0x052C). This DTC is set when the voltage on the manifold absolute pressure sensor signal circuit is greater than the threshold expected by the engine control module. This sensor is a pressure transducer with a 5 volt sensor supply, a sensor ground, and a signal circuit. The sensing element is connected to Intake Manifold Pressure downstream of the throttle plate. Refer to the workshop manual and check the manifold absolute pressure sensor is correctly connected to the air intake manifold and there are no blockages or air leaks preventing communication of pressure changes between the manifold and the sensor. Check for DTCs associated with the throttle position sensor which has a common power supply
P0107-16	Manifold Absolute Pressure/Barometric Pressure Sensor Circuit Low - Circuit voltage below	 <p>NOTE: - Circuit MAP -</p> <ul style="list-style-type: none"> The engine control 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the 5 volt supply circuit for open circuit, short circuit to power, short circuit to ground. Check the





	threshold	<p>module measured a voltage below a specified range but not necessarily a short circuit to ground</p> <ul style="list-style-type: none"> • Harness fault - Manifold absolute pressure sensor circuits • Manifold absolute pressure sensor failure • Blockage or leak between the intake manifold and the manifold pressure sensor 	<p>sensor ground for open circuit, short circuit to power. Check the signal circuit for open circuit, short circuit to power, short circuit to ground. Repair wiring as required, clear the DTC and retest the system</p> <ul style="list-style-type: none"> • If the DTC resets and there are no harness faults suspect the manifold absolute pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • Using the manufacturer approved diagnostic system check datalogger signals, Corrected Intake Manifold Absolute Pressure (0x0504), Manifold Absolute Pressure Sensor Voltage (0x0301), Manifold Absolute Pressure Bank 1 (0x052C). This DTC is set when the manifold absolute pressure sensor signal voltage is lower than expected by the engine control module. This sensor is a pressure transducer with a 5 volt sensor supply, a sensor ground, and a signal circuit. The sensing element is connected to intake manifold pressure downstream of the throttle plate. Refer to the workshop manual and check the manifold absolute pressure sensor is correctly connected to the air intake manifold and there are no blockages or air leaks preventing communication of pressure changes between the manifold and the sensor
P0108-00	Manifold Absolute Pressure/Barometric Pressure Sensor Circuit High - No sub type information	 <p>NOTE: - Circuit MAP -</p> <ul style="list-style-type: none"> • Harness fault - Manifold absolute pressure sensor circuits • Manifold absolute pressure sensor failure • Blockage or leak between the intake manifold and the manifold pressure sensor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the 5 volt supply circuit for open circuit, short circuit to power, short circuit to ground. Check the sensor ground for open circuit, short circuit to power. Check the signal circuit for open circuit, short circuit to power, short circuit to ground. Repair wiring as required, clear the DTC and retest the system • If the DTC resets and there are no harness faults suspect the manifold absolute pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • Using the manufacturer approved diagnostic system check datalogger signals, Corrected Intake Manifold Absolute Pressure (0x0504), Manifold Absolute Pressure Sensor Voltage (0x0301), Manifold Absolute Pressure Bank 1 (0x052C). This DTC is set when the manifold absolute pressure sensor signal voltage is greater than expected by the engine control module. This sensor is a pressure transducer with a 5 volt sensor supply, a sensor ground, and a signal circuit. The sensing element is connected to Intake Manifold Pressure downstream of the throttle plate. Refer to the workshop manual and check the manifold absolute pressure sensor is corrected connected to the air intake manifold and there are no blockages or air leaks preventing communication of pressure changes between the manifold and the sensor



P0108-17	Manifold Absolute Pressure/Barometric Pressure Sensor Circuit High - Circuit voltage above threshold	 <p>NOTE: - Circuit MAP -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Harness fault - Manifold absolute pressure sensor circuits • Manifold absolute pressure sensor failure • Blockage or leak between the intake manifold and the manifold pressure sensor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the 5 volt supply circuit for open circuit, short circuit to power, short circuit to ground. Check the sensor ground for open circuit, short circuit to power. Check the signal circuit for open circuit, short circuit to power, short circuit to ground. Repair wiring as required, clear the DTC and retest the system • If the DTC resets and there are no harness faults suspect the manifold absolute pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • Using the manufacturer approved diagnostic system check datalogger signals, Corrected Intake Manifold Absolute Pressure (0x0504), Manifold Absolute Pressure Sensor Voltage (0x0301), Manifold Absolute Pressure Bank 1 (0x052C). This DTC is set when the manifold absolute pressure sensor signal voltage is greater than expected by the engine control module. This sensor is a pressure transducer with a 5 volt sensor supply, a sensor ground, and a signal circuit. The sensing element is connected to intake manifold pressure downstream of the throttle plate. Refer to the workshop manual and check the manifold absolute pressure sensor is correctly connected to the air intake manifold and there are no blockages or air leaks preventing communication of pressure changes between the manifold and the sensor
P010A-92	Mass or Volume Air Flow Sensor "B" Circuit - Performance or incorrect operation	 <p>NOTE: Circuit diagram component name maf/iat sensor</p> <ul style="list-style-type: none"> • Airflow disruption at sensing element of mass air flow • Harness fault - Mass air flow sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Mass air flow failure 	<ul style="list-style-type: none"> • This DTC is set if the mass air flow signal from sensor 2 is greater than the value expected by the engine control module. Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine the induction pipes for debris which could disrupt air flow at the sensing element • Refer to the electrical circuit diagrams and check mass air flow sensor 2 for short circuit to ground, short circuit to power, open circuit, high resistance. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the mass air flow sensor. Check and install a new mass air flow sensor 2 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P010B-21	Mass or Volume Air Flow B Circuit Range/Performance - Signal Amplitude < Minimum	 <p>NOTE: Circuit diagram component name maf/iat sensor</p> <ul style="list-style-type: none"> • The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low 	<ul style="list-style-type: none"> • This DTC is set if the mass air flow signal from sensor 2 is less than the value expected by the engine control module. Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine the induction pipes for debris which could disrupt air flow at the sensing element • Refer to the electrical circuit diagrams





		<ul style="list-style-type: none"> • Airflow disruption at sensing element of mass air flow • Harness fault - Mass air flow sensor circuit short circuit to ground, high resistance, open circuit • Mass air flow failure 	<p>and check mass air flow sensor 2 for short circuit to ground, high resistance, open circuit. Repair wiring as required, clear the DTC and retest the system</p> <ul style="list-style-type: none"> • If the DTC resets suspect the mass air flow sensor. Check and install a new mass air flow sensor 2 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P010B-22	Mass or Volume Air Flow B Circuit Range/Performance - Signal Amplitude > Maximum	 <p>NOTE: Circuit diagram component name maf/iat sensor</p> <ul style="list-style-type: none"> • The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high • Airflow disruption at sensing element of mass air flow sensor 2 • Harness fault - Mass air flow sensor circuit short circuit to power • Mass air flow failure 	<ul style="list-style-type: none"> • This DTC is set if the mass air flow signal from sensor 2 is less than the value expected by the engine control module. Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine the induction pipes for debris which could disrupt air flow at the sensing element • Refer to the electrical circuit diagrams and check mass air flow sensor 2 for short circuit to power. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the mass air flow sensor. Check and install a new mass air flow sensor 2 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P010C-00	Mass or Volume Air Flow B Circuit Low - No sub type information	<p>NOTES:</p>  <p>- Circuit MAFS_A -</p>  <p>Circuit diagram component name maf/iat sensor</p> <ul style="list-style-type: none"> • Airflow disruption at sensing element of mass air flow • Harness fault - Mass air flow sensor circuits • Mass air flow failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Air Flow Rate From Mass Air Flow Sensor Bank 2 (0x0505). This DTC is set if the mass air flow signal from sensor 2 is less than the value expected by the engine control module. Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine the induction pipes for debris which could disrupt air flow at the sensing element • Refer to the electrical circuit diagrams and check the power and ground circuits for the mass air flow sensors for high resistance, short circuits to power or ground, check the mass air flow signal line between the engine control module and the mass air flow sensor for high resistance, and intermittent faults. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the mass air flow sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P010D-00	Mass or Volume Air Flow B Circuit High - No sub type information	<p>NOTES:</p>  <p>- Circuit MAFS_A -</p>  <p>Circuit diagram</p>	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Air Flow Rate From Mass Air Flow Sensor Bank 2 (0x0505). This DTC is set if the mass air flow signal from sensor 2 is greater than the value expected by the engine control module.



		<p>component name maf/iat sensor</p> <ul style="list-style-type: none"> • Airflow disruption at sensing element of mass air flow • Harness fault - Mass air flow sensor circuits • Mass air flow failure 	<p>Refer to the relevant sections of the workshop manual and check the induction system for air leaks, and obstructions to flow. Check the condition of the air filter and examine the induction pipes for debris which could disrupt air flow at the sensing element</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the power and ground circuits for the mass air flow sensors for high resistance, short circuits to power or ground, check the mass air flow signal line between the engine control module and the mass air flow sensor for high resistance, and intermittent faults. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the mass air flow sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0116-00	Engine Coolant Temperature Sensor 1 Circuit Range/Performance - No sub type information	 <p>NOTE: - Circuit ECT -</p> <ul style="list-style-type: none"> • Engine coolant level or flow fault • Harness fault - engine coolant temperature sensor circuits • Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Engine Coolant Temperature Sensor (0x0357), Engine Coolant Temperature (0xF405). This DTC is set if the engine coolant temperature value fails plausibility checks by the engine control module. Refer to the workshop manual and check the engine cooling system to ensure the coolant condition and level is correct • Refer to the electrical circuit diagrams and check the engine coolant temperature sensor circuits for high resistance, short circuit to other circuits, intermittent faults. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the engine coolant temperature sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0116-16	Engine Coolant Temperature Sensor 1 Circuit Range/Performance - Circuit Voltage Below Threshold	 <p>NOTE: - Circuit ECT -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Engine coolant level or flow fault • Harness fault - engine coolant temperature sensor circuits • Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Engine Coolant Temperature Sensor (0x0357), Engine Coolant Temperature (0xF405). This DTC is set if the engine coolant temperature sensor signal voltage is less than the value expected by the engine control module. Refer to the workshop manual and check the engine cooling system to ensure the coolant condition and level is correct • Refer to the electrical circuit diagrams and check the engine coolant temperature sensor circuits for high resistance, short circuit to other circuits, intermittent faults. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the engine coolant temperature sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component



P0116-17	Engine Coolant Temperature Sensor 1 Circuit Range/Performance - Circuit Voltage Above Threshold	 <p>NOTE: - Circuit ECT -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Engine coolant level or flow fault • Harness fault - engine coolant temperature sensor circuits • Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Engine Coolant Temperature Sensor (0x0357), Engine Coolant Temperature (0xF405). This DTC is set if the engine coolant temperature sensor signal voltage is greater than the value expected by the control module. Refer to the workshop manual and check the engine cooling system to ensure the coolant condition and level is correct • Refer to the electrical circuit diagrams and check the engine coolant temperature sensor circuits for high resistance, short circuit to other circuits, intermittent faults. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the engine coolant temperature sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0116-21	Engine Coolant Temperature Sensor 1 Circuit Range/Performance - Signal Amplitude < Minimum	<ul style="list-style-type: none"> • The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low • Engine coolant level or flow fault • Harness fault - engine coolant temperature sensor circuit short circuit to ground, high resistance, open circuit • Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Engine Coolant Temperature Sensor (0x0357), Engine Coolant Temperature (0xF405). This DTC is set if the engine coolant temperature sensor signal amplitude is lower than the value expected by the control module. Refer to the workshop manual and check the engine cooling system to ensure the coolant condition and level is correct • Refer to the electrical circuit diagrams and check the engine coolant temperature sensor for short circuit to ground, high resistance, open circuit. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the engine coolant temperature sensor. Check and install a new engine coolant temperature sensor as required
P0116-22	Engine Coolant Temperature Sensor 1 Circuit Range/Performance - Signal Amplitude > Maximum	<ul style="list-style-type: none"> • The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high • Engine coolant level or flow fault • Harness fault - engine coolant temperature sensor circuit short circuit to power • Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Engine Coolant Temperature Sensor (0x0357), Engine Coolant Temperature (0xF405). This DTC is set if the engine coolant temperature sensor signal amplitude is greater than the value expected by the control module. Refer to the workshop manual and check the engine cooling system to ensure the coolant condition and level is correct • Refer to the electrical circuit diagrams and check the engine coolant temperature sensor circuit for short circuit to power. Repair wiring as required, clear the DTC and retest the system • If the DTC resets suspect the engine coolant temperature sensor. Check and install a new engine coolant temperature sensor as required
P0130-00	O2 Sensor Circuit (Bank 1 Sensor 1) - No sub type information	 <p>NOTE: - Circuit LPV_A - LPPC_A</p> <ul style="list-style-type: none"> • Harness fault - Pre catalyst oxygen sensor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the pre catalyst oxygen sensor circuits for open circuit. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness




		<ul style="list-style-type: none"> circuit open circuit Pre catalyst oxygen sensor component fault 	<ul style="list-style-type: none"> suspect pre catalyst oxygen sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0130-11	O2 Circuit (Bank 1, Sensor 1) - Circuit short to ground	 <p>NOTE: - Circuit LPV_A -</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Harness fault - Pre catalyst oxygen sensor circuit short circuit to ground Pre catalyst oxygen sensor component fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the pre catalyst oxygen sensor circuits for short circuit to ground. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect pre catalyst oxygen sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0130-12	O2 Circuit (Bank 1, Sensor 1) - Circuit short to battery	 <p>NOTE: - Circuit LPV_A -</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Harness fault - Pre catalyst oxygen sensor circuit short circuit to power Pre catalyst oxygen sensor component fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the pre catalyst oxygen sensor circuits for short circuit to power. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect pre catalyst oxygen sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0130-13	O2 Circuit (Bank 1, Sensor 1) - Circuit open	 <p>NOTE: - Circuit LPPC_A - LPV_A -</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Harness fault - Pre catalyst oxygen sensor circuit open circuit Pre catalyst oxygen sensor component fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the pre catalyst oxygen sensor circuits for open circuit. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect pre catalyst oxygen sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0130-1A	O2 Circuit (Bank 1, Sensor 1) - Circuit Resistance Below Threshold	 <p>NOTE: - Circuit LPTR_A -</p> <ul style="list-style-type: none"> Harness fault - Pre catalyst oxygen sensor circuit fault Pre catalyst oxygen sensor component fault 	<ul style="list-style-type: none"> This DTC is set when the pre catalyst oxygen sensor internal trim resistance value is less than that expected by the engine control module. Refer to the electrical circuit diagrams and check the pre catalyst oxygen sensor circuits for short circuits. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect pre catalyst oxygen sensor failure. Refer to the warranty policy and procedures manual, or determine if





			any prior approval programme is in operation, prior to the installation of a new module/component
P0130-1B	O2 Circuit (Bank 1, Sensor 1) - Circuit Resistance Above Threshold	 <p>NOTE: - Circuit LPTR_A</p> <ul style="list-style-type: none"> • Harness fault - Pre catalyst oxygen sensor circuit fault • Pre catalyst oxygen sensor component fault 	<ul style="list-style-type: none"> • This DTC is set when the oxygen sensor internal trim resistance value is greater than that expected by the engine control module. Refer to the electrical circuit diagrams and check the pre catalyst oxygen sensor circuits for short circuits, open circuits. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect pre catalyst oxygen sensor failure. refer to the new module/component installation note at the top of the DTC index
P0130-26	O2 Circuit (Bank 1, Sensor 1) - Signal Rate Of Change Below Threshold	<ul style="list-style-type: none"> • The signal transitions more slowly than is reasonably allowed • Exhaust system leak • Fuel control system fault • Pre catalyst oxygen sensor to engine control module circuit short circuit to ground, short circuit to power, high resistance • Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> • Check for and rectify any exhaust leak between cylinder head and catalytic converter. Check pre catalyst oxygen sensor is correctly installed in exhaust manifold • Check fuel control system for related DTCs and refer to the relevant DTC index • Refer to the electrical circuit diagrams and check pre catalyst oxygen sensor to engine control module circuit for short circuit to ground, short circuit to power, high resistance, open circuit • Check and install a new pre catalyst oxygen sensor as required
P0133-00	O2 Circuit Slow Response (Bank 1, Sensor 1) - No sub type information	<ul style="list-style-type: none"> • Exhaust system leak • Fuel control system fault • Pre catalyst oxygen sensor to engine control module wiring shield high resistance • Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> • Check for and rectify any exhaust leak between cylinder head and catalytic converter. Check pre catalyst oxygen sensor is correctly installed in exhaust manifold • Check fuel control system for related DTCs and refer to the relevant DTC index • Refer to the electrical circuit diagrams and check pre catalyst oxygen sensor to engine control module wiring shield for high resistance • Check and install a new pre catalyst oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0135-16	O2 Sensor Heater Circuit (Bank 1 Sensor 1) - Circuit voltage below threshold	 <p>NOTE: - Circuit LPPH_A</p> <ul style="list-style-type: none"> • Pre catalyst oxygen sensor to engine control module circuit short circuit to ground, open circuit • Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> • Check fuel control system for related DTCs and refer to the relevant DTC index • Refer to the electrical circuit diagrams and check pre catalyst oxygen sensor to engine control module circuit for short circuit to ground, open circuit • Check and install a new pre catalyst oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0148-00	Fuel Delivery Error - No sub type information	<ul style="list-style-type: none"> • This DTC is set after the engine control module internal monitoring function has evaluated high pressure fuel pump fatigue and wear against fuel rail pressure 	<ul style="list-style-type: none"> • Check high pressure fuel pump for mechanical damage and excessive wear • Using the manufacturer approved diagnostic system, clear DTC and retest • Check and install a new high pressure fuel pump as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation,



			prior to the installation of a new module/component
P0181-16	Fuel Temperature Sensor A Circuit Range/Performance - Circuit Voltage Below Threshold	 <p>NOTE: - Circuit IFTS -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Harness fault - fuel temperature sensor circuit fault • Sensor component fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Fuel Temperature "A" (0x0522), Fuel Rail Temperature Sensor Voltage (0x033F). This DTC is set when the voltage on the fuel temperature sensor circuit is less than that expected by the engine control module. The fuel temperature sensor is a thermistor type sensor with a signal and ground circuit. Refer to the electrical circuit diagrams and check the fuel temperature sensor signal circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel temperature sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0181-17	Fuel Temperature Sensor A Circuit Range/Performance - Circuit Voltage Above Threshold	 <p>NOTE: - Circuit IFTS -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Harness fault - fuel temperature sensor circuit fault • Sensor component fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Fuel Temperature "A" (0x0522), Fuel Rail Temperature Sensor Voltage (0x033F). This DTC is set when the voltage on the fuel temperature sensor circuit is greater than that expected by the engine control module. The fuel temperature sensor is a thermistor type sensor with a signal and ground circuit. Refer to the electrical circuit diagrams and check the fuel temperature sensor signal and ground circuits for open circuit or high resistance. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel temperature sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0182-00	Fuel Temperature Sensor A Circuit Low - No sub type information	 <p>NOTE: - Circuit IFTS -</p> <ul style="list-style-type: none"> • Harness fault - fuel temperature sensor circuit fault • Sensor component fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Fuel Temperature "A" (0x0522), Fuel Rail Temperature Sensor Voltage (0x033F). This DTC is set when the voltage on the fuel temperature sensor circuit is less than that expected by the engine control module. The fuel temperature sensor is a thermistor type sensor with a signal and ground circuit. Refer to the electrical circuit diagrams and check the fuel temperature sensor signal circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel temperature sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0183-00	Fuel Temperature Sensor A Circuit High - No sub type information	 <p>NOTE: - Circuit IFTS -</p>	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Fuel Temperature "A"



		<ul style="list-style-type: none"> • Harness fault - fuel temperature sensor circuit fault • Sensor component fault 	<p>(0x0522), Fuel Rail Temperature Sensor Voltage (0x033F). This DTC is set when the voltage on the fuel temperature sensor circuit is greater than that expected by the engine control module. The fuel temperature sensor is a thermistor type sensor with a signal and ground circuit. Refer to the electrical circuit diagrams and check the fuel temperature sensor signal and ground circuits for open circuit or high resistance. Repair wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> • If no fault found in wiring harness suspect fuel temperature sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0191-16	Fuel Rail Pressure Sensor A Circuit Range/Performance - Circuit voltage below threshold	 <p>NOTE: - Circuit RPS -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Fuel supply system fault • Harness fault - fuel rail pressure sensor circuit fault • Sensor component fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Fuel Rail Pressure Sensor (0x0324), Fuel Rail Pressure (0xF423). The fuel rail pressure sensor is a pressure transducer mounted on the fuel rail, it has three circuits: a 5volt supply, a sensor ground, and the sensor output signal line. This DTC is set when the voltage on the signal line is less than that expected by the engine control module. Refer to the workshop manual and ensure that the fuel supply system is working correctly • Refer to the electrical circuit diagrams and check the sensor supply, signal and ground connections for intermittent faults, open circuits, short circuits, high resistance. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel rail pressure sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0191-17	Fuel Rail Pressure Sensor A Circuit Range/Performance - Circuit voltage above threshold	 <p>NOTE: - Circuit RPS -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Fuel supply system fault • Harness fault - fuel rail pressure sensor circuit fault • Sensor component fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Fuel Rail Pressure Sensor (0x0324), Fuel Rail Pressure (0xF423). The fuel rail pressure sensor is a pressure transducer mounted on the fuel rail, it has three circuits: a 5volt supply, a sensor ground, and the sensor output signal line. This DTC is set when the voltage on the signal line is greater than that expected by the engine control module. Refer to the workshop manual and ensure that the fuel supply system is working correctly • Refer to the electrical circuit diagrams and check the sensor supply, signal and ground connections for intermittent faults, open circuits, short circuits, high resistance. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel rail pressure sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0192-	Fuel Rail Pressure Sensor		<ul style="list-style-type: none"> • Using the manufacturer approved


16	A Circuit Low - Circuit Voltage Below Threshold	 <p>NOTE: - Circuit RPS -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Fuel supply system fault • Harness fault - fuel rail pressure sensor circuit fault • Sensor component fault 	<p>diagnostic system check datalogger signals, Fuel Rail Pressure Sensor (0x0324), Fuel Rail Pressure (0xF423). The fuel rail pressure sensor is a pressure transducer mounted on the fuel rail, it has three circuits: a 5volt supply, a sensor ground, and the sensor output signal line. This DTC is set when the voltage on the signal line is less than that expected by the engine control module. Refer to the workshop manual and ensure that the fuel supply system is working correctly</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the sensor supply, signal and ground connections for intermittent faults, open circuits, short circuits, high resistance. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel rail pressure sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0193-17	Fuel Rail Pressure Sensor A Circuit High - Circuit Voltage Above Threshold	 <p>NOTE: - Circuit RPS -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Fuel supply system fault • Harness fault - fuel rail pressure sensor circuit fault • Sensor component fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Fuel Rail Pressure Sensor (0x0324), Fuel Rail Pressure (0xF423). The fuel rail pressure sensor is a pressure transducer mounted on the fuel rail, it has three circuits: a 5volt supply, a sensor ground, and the sensor output signal line. This DTC is set when the voltage on the signal line is greater than that expected by the engine control module. Refer to the workshop manual and ensure that the fuel supply system is working correctly • Refer to the electrical circuit diagrams and check the sensor supply, signal and ground connections for intermittent faults, open circuits, short circuits, high resistance. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel rail pressure sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0194-00	Fuel Rail Pressure Sensor A Circuit Intermittent/Erratic - No sub type information	<ul style="list-style-type: none"> • Fuel supply system fault • Harness fault - fuel rail pressure sensor circuit fault • Sensor component fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Fuel Rail Pressure Sensor (0x0324), Fuel Rail Pressure (0xF423). The fuel rail pressure sensor is a pressure transducer mounted on the fuel rail, it has three circuits: a 5volt supply, a sensor ground, and the sensor output signal line. Refer to the workshop manual and ensure that the fuel supply system is working correctly • Refer to the electrical circuit diagrams and check the sensor supply, signal and ground connections for intermittent faults, open circuits, short circuits, high resistance. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel rail pressure sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a




			new module/component
P0195-00	Engine Oil Temperature Sensor Circuit - No sub type information	 <p>NOTE: - Circuit OTL -</p> <ul style="list-style-type: none"> Oil contaminated or level incorrect Harness fault - oil temperature sensor circuits Oil temperature sensor failure 	<ul style="list-style-type: none"> Check the oil level is correct and the oil does not appear contaminated. Renew or top up oil as required The oil temperature sensor has three circuits, a supply voltage, a sensor ground, and a signal line. Refer to the electrical circuit diagrams and check the sensor voltage and ground supplies for open circuits or short circuit to ground. Check the signal line for open circuit, short circuit to power or ground, high resistance and intermittent connections. Repair the wiring harness as required If no fault found in wiring harness suspect engine oil temperature sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0195-23	Engine Oil Temperature Sensor Circuit - Signal Stuck Low	 <p>NOTE: - Circuit OTL -</p> <ul style="list-style-type: none"> The engine control module measures a signal that remains low when transitions are expected Oil contaminated or level incorrect Harness fault - oil temperature sensor circuits Oil temperature sensor failure 	<ul style="list-style-type: none"> Check the oil level is correct and the oil does not appear contaminated. Renew or top up oil as required The oil temperature sensor has three circuits, a supply voltage, a sensor ground, and a signal line. Refer to the electrical circuit diagrams and check the sensor voltage and ground supplies for open circuits or short circuit to ground. Check the signal line for open circuit, short circuit to power or ground, high resistance and intermittent connections. Repair the wiring harness as required If no fault found in wiring harness suspect engine oil temperature sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0195-62	Engine Oil Temperature Sensor Circuit - Signal Compare Failure	<ul style="list-style-type: none"> Oil contaminated or level incorrect Harness fault - oil temperature sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit, disconnected Oil temperature sensor failure 	<ul style="list-style-type: none"> Check the oil does not appear contaminated and the level is correct. Renew or top up oil as required Refer to the electrical circuit diagrams and check oil temperature sensor signal circuit for short circuit to ground, short circuit to power, high resistance, open circuit, disconnected Start the engine from cold and allow to idle, check and record Sump Oil Temperature - Measured (0x03F3) datalogger signal. Continue to warm up at idle, after approximately 10 minutes check and record Sump Oil Temperature - Measured (0x03F3) signal. If value of signal has not increased by 5°C suspect oil temperature sensor failure. Check and install a new oil temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0201-00	Cylinder 1 Injector Circuit/Open - No sub type information	 <p>NOTE: - Circuit INJ_1_PWR_OUT_LOW - INJ_1_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - cylinder 1 injector circuit open circuit 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects open circuit on the cylinder 1 injector control circuit. Refer to the electrical circuit diagrams and check the two control circuits between the engine control module and the fuel injector for high resistance, open circuits or intermittent connections.




		<ul style="list-style-type: none"> cylinder 1 injector failure 	<ul style="list-style-type: none"> Repair the wiring harness as required If no fault found in wiring harness suspect the fuel injector, refer to the relevant section of the workshop manual and check the internal resistance of the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0202-00	Cylinder 2 Injector Circuit/Open - No sub type information	 <p>NOTE: - Circuit INJ_2_PWR_OUT_LOW - INJ_2_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - cylinder 2 injector circuit open circuit cylinder 2 injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects open circuit on the cylinder 2 injector control circuit. Refer to the electrical circuit diagrams and check the two control circuits between the engine control module and the fuel injector for high resistance, open circuits or intermittent connections. Repair the wiring harness as required If no fault found in wiring harness suspect the fuel injector, refer to the relevant section of the workshop manual and check the internal resistance of the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0203-00	Cylinder 3 Injector Circuit/Open - No sub type information	 <p>NOTE: - Circuit INJ_3_PWR_OUT_LOW - INJ_3_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - cylinder 3 injector circuit open circuit cylinder 3 injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects open circuit on the cylinder 3 injector control circuit. Refer to the electrical circuit diagrams and check the two control circuits between the engine control module and the fuel injector for high resistance, open circuits or intermittent connections. Repair the wiring harness as required If no fault found in wiring harness suspect the fuel injector, refer to the relevant section of the workshop manual and check the internal resistance of the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0204-00	Cylinder 4 Injector Circuit/Open - No sub type information	 <p>NOTE: - Circuit INJ_4_PWR_OUT_LOW - INJ_4_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - cylinder 4 injector circuit open circuit cylinder 4 injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects open circuit on the cylinder 4 injector control circuit. Refer to the electrical circuit diagrams and check the two control circuits between the engine control module and the fuel injector for high resistance, open circuits or intermittent connections. Repair the wiring harness as required If no fault found in wiring harness suspect the fuel injector, refer to the relevant section of the workshop manual and check the internal resistance of the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0205-00	Cylinder 5 Injector Circuit/Open - No sub type information	 <p>NOTE: - Circuit INJ_5_PWR_OUT_LOW - INJ_5_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - cylinder 5 injector 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects open circuit on the cylinder 5 injector control circuit. Refer to the electrical circuit diagrams and check the two control circuits between the engine control module and the fuel injector for high resistance, open






		<ul style="list-style-type: none"> circuit open circuit cylinder 5 injector failure 	<p>circuits or intermittent connections. Repair the wiring harness as required</p> <ul style="list-style-type: none"> If no fault found in wiring harness suspect the fuel injector, refer to the relevant section of the workshop manual and check the internal resistance of the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0206-00	Cylinder 6 Injector Circuit/Open - No sub type information	 <p>NOTE: - Circuit INJ_6_PWR_OUT_LOW - INJ_6_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - cylinder 6 injector circuit open circuit cylinder 6 injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects open circuit on the cylinder 6 injector control circuit. Refer to the electrical circuit diagrams and check the two control circuits between the engine control module and the fuel injector for high resistance, open circuits or intermittent connections. Repair the wiring harness as required If no fault found in wiring harness suspect the fuel injector, refer to the relevant section of the workshop manual and check the internal resistance of the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0216-00	Injector/Injection timing Control Circuit - No sub type information	<ul style="list-style-type: none"> Internal engine control module power supply is unable to supply the fuel injectors with the maximum number of injections required Internal engine control module monitoring has detected a fuel pressure not able to meet the demand for the number of fuel injections At high engine speeds the internal engine control module monitoring has detected that the computing time available for the desired number of injections is not sufficient 	<ul style="list-style-type: none"> Refer to the workshop manual and the battery care manual, inspect the vehicle battery and ensure it is fully charged and serviceable before performing further tests Check the vehicle charging system performance to ensure the voltage regulation is correct Refer to the electrical circuit diagrams and check engine control module power and ground circuits Check fuel control system for related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, clear DTC and retest
P0219-00	Engine Overspeed Condition - No sub type information	<ul style="list-style-type: none"> Camshaft or Crankshaft position sensor circuit short circuit to ground, short circuit to power, open circuit Camshaft or crankshaft position sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check camshaft and crankshaft position sensor circuits for short circuit to ground, short circuit to power, open circuit Check for engine oil ingestion to sensors. Check and install new camshaft and crankshaft position sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0235-16	Turbocharger/Supercharger Boost Sensor A Circuit - Circuit Voltage Below Threshold	 <p>NOTE: - Circuit SCOP_SENSOR -</p> <ul style="list-style-type: none"> The engine control module measured a voltage below a 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Turbocharger/Supercharger Boost Sensor A Circuit (0x033C), Boost Absolute Pressure - Raw Value (0x033E). This DTC is set when the engine control module detects a signal





		<p>specified range but not necessarily a short circuit to ground</p> <ul style="list-style-type: none"> • Mechanical fault - sensor hose blocked or leaking • Fault affecting intake air circuit or boost air circuit control valves or actuators • Harness fault - Boost air pressure sensor circuit • Boost air pressure sensor failure 	<p>voltage from the boost air pressure sensor signal line which is less than the threshold value. Check the sensor hose for blockages or leaks</p> <ul style="list-style-type: none"> • Check the intake air and boost air circuits for faults including leaks, blockages, control valve actuator malfunctions • Check the sensor and harness for mechanical damage caused by heat or chaffing. Check for DTCs relating to faults on the Accelerator Pedal Position sensor as these sensors share power supply and ground connections. The boost air pressure sensor has three circuits, a 5 volt supply, a sensor ground, and an analogue voltage output signal line. Refer to the electrical circuit diagrams and check the sensor voltage and ground supplies for open circuits or short circuit to ground. Check the signal line for open circuit, short circuit to ground, high resistance and intermittent connections. Repair the wiring harness as required • If no fault found in wiring harness suspect boost air pressure sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0235-17	Turbocharger/Supercharger Boost Sensor A Circuit - Circuit Voltage Above Threshold	 <p>NOTE: - Circuit SCOP_SENSOR -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Mechanical fault - sensor hose blocked or leaking • Fault affecting intake air circuit or boost air circuit control valves or actuators • Harness fault - Boost air pressure sensor circuit • Boost air pressure sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Turbocharger/Supercharger Boost Sensor A Circuit (0x033C), Boost Absolute Pressure - Raw Value (0x033E). This DTC is set when the engine control module detects a signal voltage from the boost air pressure sensor signal line which is greater than the threshold value. Check the sensor hose for blockages or leaks • Check the intake air and boost air circuits for faults including leaks, blockages, control valve actuator malfunctions • Check the sensor and harness for mechanical damage caused by heat or chaffing. Check for DTCs relating to faults on the Accelerator Pedal Position sensor as these sensors share power supply and ground connections. The boost air pressure sensor has three circuits, a 5 volts supply, a sensor ground, and an analogue voltage output signal line. Refer to the electrical circuit diagrams and check the sensor voltage and ground supplies for open circuits or short circuit to ground. Check the signal line for open circuit, short circuit to power. Repair the wiring harness as required • If no fault found in wiring harness suspect boost air pressure sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0235-94	Turbocharger/Supercharger Boost Sensor A Circuit - Unexpected operation	 <p>NOTE: - Circuit SCOP_SENSOR -</p> <ul style="list-style-type: none"> • Boost air solenoid stuck open mono turbo mode 	<ul style="list-style-type: none"> • If this DTC is logged with P00BD-07 suspect, boost air solenoid stuck open mono turbo mode • If this DTC is logged with P00BD-07 suspect, turbine intake solenoid leakage when closed • If this DTC is logged with P00BD-07,






		<ul style="list-style-type: none"> • Turbine intake solenoid leakage when closed • Turbine intake solenoid stuck open • Intake air system, blocked low pressure air intake. This failure mode can be caused by snow packing in the intake system. Symptoms often disappear after the vehicle has been warmed and heat soaked. Similar symptoms to seized primary turbo 	<p>P22D2-77, P1247-00 & P22CF-71 suspect, turbine intake solenoid stuck open</p> <ul style="list-style-type: none"> • If this DTC is logged with P00BD-07, P22D2-77, P1247-00 & P22CF-71 suspect, intake air system, blocked low pressure air intake • Using the manufacturer approved diagnostic system perform the (Turbo, EGR and air path dynamic test) routine
P023D-00	Manifold Absolute Pressure-Turbocharger/Supercharger Boost Sensor A Correlation - No sub type information	<ul style="list-style-type: none"> • Induction system air leak or blockage • Boost air system leak or blockage • Manifold absolute pressure sensor A failure • Variable geometry turbocharger actuator A sticking, failure • Turbocharger A failure 	<ul style="list-style-type: none"> • Check induction system for leaks, blockages • Check boost air system for leaks, blockages. Check for related DTCs and refer to the relevant DTC index • Check and install a new manifold absolute pressure sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • Check and install a new variable geometry turbocharger actuator as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • Check turbocharger rod connection and oil seals. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0251-13	Injection Pump Fuel Metering Control A - Circuit open	 NOTE: - Circuit MEU - <ul style="list-style-type: none"> • The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Harness fault - fuel volume control valve circuit open circuit • Fuel volume control valve failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Fuel Volume Control Valve Duty Cycle (0x03C2), Fuel Volume Control Valve Current - Measured (0x03EA). Refer to the electrical circuit diagrams and check the fuel volume control valve circuit between the engine control module and the fuel volume control valve for open circuit. Check power supply to fuel volume control valve. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel volume control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0251-4B	Injection Pump Fuel Metering Control A - Over temperature	<ul style="list-style-type: none"> • Harness fault - fuel volume control valve circuit short circuit to ground, short circuit to power, high resistance • Fuel volume control valve failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Fuel Volume Control Valve Duty Cycle (0x03C2), Fuel Volume Control Valve Current - Measured (0x03EA). Refer to the electrical circuit diagrams and check the fuel volume control valve circuit between the engine control module and the fuel volume control valve for short circuit to ground, short circuit to power, high resistance. Check power supply to fuel volume control valve. Repair wiring



			<p>harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> If no fault found in wiring harness suspect fuel volume control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0252-16	Injection Pump Fuel Metering Control A Range/Performance - Circuit Voltage Below Threshold	 <p>NOTE: - Circuit MEU -</p> <ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Harness fault - fuel volume control valve circuit Fuel volume control valve failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Fuel Volume Control Valve Duty Cycle (0x03C2), Fuel Volume Control Valve Current - Measured (0x03EA). This DTC is set when the voltage on the signal circuit to the fuel volume control valve is less than that expected by the engine control module. Refer to the electrical circuit diagrams and check the fuel volume control valve circuit between the engine control module and the fuel volume control valve for an intermittent open circuit, high resistance, or short circuit to ground. Check the power supply to fuel volume control valve. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect fuel volume control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0252-17	Injection Pump Fuel Metering Control A Range/Performance - Circuit Voltage Above Threshold	 <p>NOTE: - Circuit MEU -</p> <ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Harness fault - fuel volume control valve circuit Fuel volume control valve failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Fuel Volume Control Valve Duty Cycle (0x03C2), Fuel Volume Control Valve Current - Measured (0x03EA). This DTC is set when the voltage on the signal circuit to the fuel volume control valve is greater than that expected by the engine control module. Refer to the electrical circuit diagrams and check the fuel volume control valve circuit between the engine control module and the volume control valve for a short circuit to power. Check the power supply to fuel volume control valve. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect fuel volume control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0253-00	Injection Pump Fuel Metering Control A Low - No sub type information	 <p>NOTE: - Circuit MEU -</p> <ul style="list-style-type: none"> Harness fault - fuel volume control valve circuit short circuit to ground, open circuit Fuel volume control valve failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Fuel Volume Control Valve Duty Cycle (0x03C2), Fuel Volume Control Valve Current - Measured (0x03EA). This DTC is set when the voltage on the signal circuit to the fuel volume control valve is greater than that expected by the engine control module. Refer to the electrical circuit diagrams and check the fuel volume control valve circuit between the engine control module and the fuel volume control valve for a short circuit to ground, open circuit. Repair wiring harness as required. Clear DTC and retest




			<ul style="list-style-type: none"> If no fault found in wiring harness suspect fuel volume control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0254-00	Injection Pump Fuel Metering Control A High - No sub type information	 <p>NOTE: - Circuit MEU -</p> <ul style="list-style-type: none"> Harness fault - fuel volume control valve circuit short circuit to power Fuel volume control valve failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Fuel Volume Control Valve Duty Cycle (0x03C2), Fuel Volume Control Valve Current - Measured (0x03EA). This DTC is set when the voltage on the signal circuit to the fuel volume control valve is greater than that expected by the engine control module. Refer to the electrical circuit diagrams and check the fuel volume control valve circuit between the engine control module and the fuel volume control valve for a short circuit to power. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect fuel volume control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0255-00	Injection Pump Fuel Metering Control A Intermittent - No sub type information	<ul style="list-style-type: none"> Harness fault - fuel volume control valve circuit intermittent short circuit to ground, short circuit to power, high resistance Fuel volume control valve intermittent failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Fuel Volume Control Valve Duty Cycle (0x03C2), Fuel Volume Control Valve Current - Measured (0x03EA). Refer to the electrical circuit diagrams and check the fuel volume control valve circuit between the engine control module and the fuel volume control valve for an intermittent short circuit to ground, short circuit to power, high resistance. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect fuel volume control valve. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0261-00	Cylinder 1 Injector Circuit Low - No sub type information	 <p>NOTE: - Circuit INJ_1_PWR_OUT_LOW - INJ_1_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - injector control circuit short circuit Injector failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the injector control circuit between the engine control module and the cylinder 1 injector for short circuit to ground or short between the two wires. This circuit is a twisted pair, check both hi and low sides for short circuit to power. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0261-11	Cylinder 1 Injector Circuit Low - Circuit short to ground	 <p>NOTE: - Circuit INJ_1_PWR_OUT_LOW - INJ_1_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the injector control circuit between the engine control module and the cylinder 1 injector for short circuit to ground or short between the two wires. This circuit is a twisted pair, check both hi and low sides for short circuit to ground. Repair wiring harness




		<p>for a period longer than expected or has detected a ground measurement when another value was expected</p> <ul style="list-style-type: none"> • Harness fault - injector control circuit short circuit to ground 	<p>as required. Clear DTC and retest</p> <ul style="list-style-type: none"> • If no fault found in wiring harness suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0261-23	Cylinder 1 Injector Circuit Low - Signal Stuck Low	 <p>NOTE: - Circuit INJ_1_PWR_OUT_LOW - INJ_1_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • The engine control module measures a signal that remains low when transitions are expected • Harness fault - short circuit between injector control circuits on different cylinders 	<ul style="list-style-type: none"> • Check injector/engine wiring harness for damage due to chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits between the engine control module and the cylinder 1 injector for short to other injector control circuits. Repair wiring harness as required. Clear DTC and retest
P0264-00	Cylinder 2 Injector Circuit Low - No sub type information	 <p>NOTE: - Circuit INJ_2_PWR_OUT_LOW - INJ_2_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • Harness fault - injector control circuit short circuit • Injector failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the injector control circuit between the engine control module and the cylinder 2 injector for short circuit to ground or short between the two wires. This circuit is a twisted pair, check both hi and low sides for short circuit to power. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0264-11	Cylinder 2 Injector Circuit Low - Circuit short To Ground	 <p>NOTE: - Circuit INJ_2_PWR_OUT_LOW - INJ_2_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Harness fault - injector control circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the injector control circuit between the engine control module and the cylinder 2 injector for short circuit to ground or short between the two wires. This circuit is a twisted pair, check both hi and low sides for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0264-23	Cylinder 2 Injector Circuit Low - Signal Stuck Low	 <p>NOTE: - Circuit INJ_2_PWR_OUT_LOW - INJ_2_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • The engine control module measures a signal that remains low when transitions are expected • Harness fault - short circuit between injector control circuits on different cylinders 	<ul style="list-style-type: none"> • Check injector/engine wiring harness for damage due to chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits between the engine control module and the cylinder 2 injector for short to other injector control circuits. Repair wiring harness as required. Clear DTC and retest
P0267-00	Cylinder 3 Injector Circuit Low - No sub type information	 <p>NOTE: - Circuit INJ_3_PWR_OUT_LOW - INJ_3_PWR_OUT_HIGH -</p>	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the injector control circuit between the engine control module and the cylinder 3 injector for short circuit




		<ul style="list-style-type: none"> • Harness fault - injector control circuit short circuit • Injector failure 	<p>to ground or short between the two wires. This circuit is a twisted pair, check both hi and low sides for short circuit to power. Repair wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> • If no fault found in wiring harness suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0267-11	Cylinder 3 Injector Circuit Low - Circuit short To Ground	 <p>NOTE: - Circuit INJ_3_PWR_OUT_LOW - INJ_3_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Harness fault - injector control circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the injector control circuit between the engine control module and the cylinder 3 injector for short circuit to ground or short between the two wires. This circuit is a twisted pair, check both hi and low sides for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0267-23	Cylinder 3 Injector Circuit Low - Signal Stuck Low	 <p>NOTE: - Circuit INJ_3_PWR_OUT_LOW - INJ_3_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • The engine control module measures a signal that remains low when transitions are expected • Harness fault - short circuit between injector control circuits on different cylinders 	<ul style="list-style-type: none"> • Check injector/engine wiring harness for damage due to chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits between the engine control module and the cylinder 3 injector for short to other injector control circuits. Repair wiring harness as required. Clear DTC and retest
P0270-00	Cylinder 4 Injector Circuit Low - No sub type information	 <p>NOTE: - Circuit INJ_4_PWR_OUT_LOW - INJ_4_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • Harness fault - injector control circuit short circuit • Injector failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the injector control circuit between the engine control module and the cylinder 4 injector for short circuit to ground or short between the two wires. This circuit is a twisted pair, check both hi and low sides for short circuit to power. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0270-11	Cylinder 4 Injector Circuit Low - Circuit short to ground	 <p>NOTE: - Circuit INJ_4_PWR_OUT_LOW - INJ_4_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Harness fault - injector control circuit short 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the injector control circuit between the engine control module and the cylinder 4 injector for short circuit to ground or short between the two wires. This circuit is a twisted pair, check both hi and low sides for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component




		circuit to ground	
P0270-23	Cylinder 4 Injector Circuit Low - Signal stuck low	 <p>NOTE: - Circuit INJ_4_PWR_OUT_LOW - INJ_4_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module measures a signal that remains low when transitions are expected Harness fault - short circuit between injector control circuits on different cylinders 	<ul style="list-style-type: none"> Check injector/engine wiring harness for damage due to chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits between the engine control module and the cylinder 4 injector for short to other injector control circuits. Repair wiring harness as required. Clear DTC and retest
P0273-00	Cylinder 5 Injector Circuit Low - No sub type information	 <p>NOTE: - Circuit INJ_5_PWR_OUT_LOW - INJ_5_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - injector control circuit short circuit Injector failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the injector control circuit between the engine control module and the cylinder 5 injector for short circuit to ground or short between the two wires. This circuit is a twisted pair, check both hi and low sides for short circuit to power. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0273-11	Cylinder 5 Injector Circuit Low - Circuit short to ground	 <p>NOTE: - Circuit INJ_5_PWR_OUT_LOW - INJ_5_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Harness fault - injector control circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the injector control circuit between the engine control module and the cylinder 5 injector for short circuit to ground or short between the two wires. This circuit is a twisted pair, check both hi and low sides for short circuit to ground. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0273-23	Cylinder 5 Injector Circuit Low - Signal Stuck Low	 <p>NOTE: - Circuit INJ_5_PWR_OUT_LOW - INJ_5_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module measures a signal that remains low when transitions are expected Harness fault - short circuit between injector control circuits on different cylinders 	<ul style="list-style-type: none"> Check injector/engine wiring harness for damage due to chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits between the engine control module and the cylinder 5 injector for short to other injector control circuits. Repair wiring harness as required. Clear DTC and retest
P0276-00	Cylinder 6 Injector Circuit Low - No sub type information	 <p>NOTE: - Circuit INJ_6_PWR_OUT_LOW - INJ_6_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - injector control circuit short circuit Injector failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the injector control circuit between the engine control module and the cylinder 6 injector for short circuit to ground or short between the two wires. This circuit is a twisted pair, check both hi and low sides for short circuit to power. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect fuel injector. Refer to the warranty policy and procedures




			<p>manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p>
P0276-11	Cylinder 6 Injector Circuit Low - Circuit short to ground	 <p>NOTE: - Circuit INJ_6_PWR_OUT_LOW - INJ_6_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Harness fault - injector control circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the injector control circuit between the engine control module and the cylinder 6 injector for short circuit to ground or short between the two wires. This circuit is a twisted pair, check both hi and low sides for short circuit to ground. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0276-23	Cylinder 6 Injector Circuit Low - Signal Stuck Low	 <p>NOTE: - Circuit INJ_6_PWR_OUT_LOW - INJ_6_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module measures a signal that remains low when transitions are expected Harness fault - short circuit between injector control circuits on different cylinders 	<ul style="list-style-type: none"> Check injector/engine wiring harness for damage due to chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits between the engine control module and the cylinder 6 injector for short to other injector control circuits. Repair wiring harness as required. Clear DTC and retest
P02CD-00	Cylinder 1 Fuel Injector Offset Learning at Max Limit - No sub type information	<ul style="list-style-type: none"> Corrected set point voltage of the piezo actuator violates the On Board Diagnostic limit 	<ul style="list-style-type: none"> Check for other related DTCs and refer to the relevant DTC index. Clear the DTC and retest If DTC persists suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02CF-00	Cylinder 2 Fuel Injector Offset Learning at Max Limit - No sub type information	<ul style="list-style-type: none"> Corrected set point voltage of the piezo actuator violates the On Board Diagnostic limit 	<ul style="list-style-type: none"> Check for other related DTCs and refer to the relevant DTC index. Clear the DTC and retest If DTC persists suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02D1-00	Cylinder 3 Fuel Injector Offset Learning at Max Limit - No sub type information	<ul style="list-style-type: none"> Corrected set point voltage of the piezo actuator violates the On Board Diagnostic limit 	<ul style="list-style-type: none"> Check for other related DTCs and refer to the relevant DTC index. Clear the DTC and retest If DTC persists suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02D3-00	Cylinder 4 Fuel Injector Offset Learning at Max Limit - No sub type information	<ul style="list-style-type: none"> Corrected set point voltage of the piezo actuator violates the On Board Diagnostic limit 	<ul style="list-style-type: none"> Check for other related DTCs and refer to the relevant DTC index. Clear the DTC and retest If DTC persists suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02D5-	Cylinder 5 Fuel Injector	<ul style="list-style-type: none"> Corrected set point 	<ul style="list-style-type: none"> Check for other related DTCs and refer




00	Offset Learning at Max Limit - No sub type information	voltage of the piezo actuator violates the On Board Diagnostic limit	<p>to the relevant DTC index. Clear the DTC and retest</p> <ul style="list-style-type: none"> If DTC persists suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02D7-00	Cylinder 6 Fuel Injector Offset Learning at Max Limit - No sub type information	<ul style="list-style-type: none"> Corrected set point voltage of the piezo actuator violates the On Board Diagnostic limit 	<ul style="list-style-type: none"> Check for other related DTCs and refer to the relevant DTC index. Clear the DTC and retest If DTC persists suspect fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02EE-17	Cylinder 1 Injector Circuit Range/Performance - Circuit Voltage Above Threshold	 <p>NOTE: - Circuit INJ_1_PWR_OUT_LOW - INJ_1_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Harness fault - injector control circuit Fuel injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module monitors a voltage on the cylinder 1 injector control circuit that is above the diagnostic threshold. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02EE-1C	Cylinder 1 Injector Circuit Range/Performance - Circuit Voltage Out Of Range	 <p>NOTE: - Circuit INJ_1_PWR_OUT_LOW - INJ_1_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module measured a voltage outside of the expected range, but not identified as too high or too low Harness fault - injector control circuit Fuel injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module monitors a voltage on the cylinder 1 injector control circuit that is out of range. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02EE-68	Cylinder 1 Injector Circuit Range/Performance - Event information	 <p>NOTE: - Circuit INJ_1_PWR_OUT_LOW - INJ_1_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - injector control circuit Fuel injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module monitors a voltage on the cylinder 1 injector control circuit that is out of range. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits

			<p>(high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required</p> <ul style="list-style-type: none"> If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02EF-17	Cylinder 2 Injector Circuit Range/Performance - Circuit Voltage Above Threshold	 <p>NOTE: - Circuit INJ_2_PWR_OUT_LOW - INJ_2_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Harness fault - injector control circuit Fuel injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module monitors a voltage on the cylinder2 injector control circuit that is above the diagnostic threshold. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02EF-1C	Cylinder 2 Injector Circuit Range/Performance - Circuit Voltage Out Of Range	 <p>NOTE: - Circuit INJ_2_PWR_OUT_LOW - INJ_2_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module measured a voltage outside of the expected range, but not identified as too high or too low Harness fault - injector control circuit Fuel injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module monitors a voltage on the cylinder 2 injector control circuit that is out of range. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02EF-68	Cylinder 2 Injector Circuit Range/Performance - Event information	 <p>NOTE: - Circuit INJ_2_PWR_OUT_LOW - INJ_2_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - injector control circuit Fuel injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module monitors a voltage on the cylinder 2 injector control circuit that is out of range. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high



			<p>resistance, short to or interference from other circuits. Repair wiring harness as required</p> <ul style="list-style-type: none"> If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02F0-17	Cylinder 3 Injector Circuit Range/Performance - Circuit Voltage Above Threshold	 <p>NOTE: - Circuit INJ_3_PWR_OUT_LOW - INJ_3_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Harness fault - injector control circuit Fuel injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module monitors a voltage on the cylinder 3 injector control circuit that is above the diagnostic threshold. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02F0-1C	Cylinder 3 Injector Circuit Range/Performance - Circuit Voltage Out Of Range	 <p>NOTE: - Circuit INJ_3_PWR_OUT_LOW - INJ_3_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module measured a voltage outside of the expected range, but not identified as too high or too low Harness fault - injector control circuit Fuel injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module monitors a voltage on the cylinder 3 injector control circuit that is out of range. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02F0-68	Cylinder 3 Injector Circuit Range/Performance - Event information	 <p>NOTE: - Circuit INJ_3_PWR_OUT_LOW - INJ_3_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - injector control circuit Fuel injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module monitors a voltage on the cylinder 3 injector control circuit that is out of range. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required




			<ul style="list-style-type: none"> If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02F1-17	Cylinder 4 Injector Circuit Range/Performance - Circuit Voltage Above Threshold	 <p>NOTE: - Circuit INJ_4_PWR_OUT_LOW - INJ_4_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Harness fault - injector control circuit Fuel injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module monitors a voltage on the cylinder 4 injector control circuit that is above the diagnostic threshold. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02F1-1C	Cylinder 4 Injector Circuit Range/Performance - Circuit Voltage Out Of Range	 <p>NOTE: - Circuit INJ_4_PWR_OUT_LOW - INJ_4_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> The engine control module measured a voltage outside of the expected range, but not identified as too high or too low Harness fault - injector control circuit Fuel injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module monitors a voltage on the cylinder 4 injector control circuit that is out of range. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02F1-68	Cylinder 4 Injector Circuit Range/Performance - Event information	 <p>NOTE: - Circuit INJ_4_PWR_OUT_LOW - INJ_4_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - injector control circuit Fuel injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module monitors a voltage on the cylinder 4 injector control circuit that is out of range. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace


			the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02F2-17	Cylinder 5 Injector Circuit Range/Performance - Circuit Voltage Above Threshold	 <p>NOTE: - Circuit INJ_5_PWR_OUT_LOW - INJ_5_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Harness fault - injector control circuit • Fuel injector failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module monitors a voltage on the cylinder 5 injector control circuit that is above the diagnostic threshold. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required • If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02F2-1C	Cylinder 5 Injector Circuit Range/Performance - Circuit Voltage Out Of Range	 <p>NOTE: - Circuit INJ_5_PWR_OUT_LOW - INJ_5_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage outside of the expected range, but not identified as too high or too low • Harness fault - injector control circuit • Fuel injector failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module monitors a voltage on the cylinder 5 injector control circuit that is out of range. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required • If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02F2-68	Cylinder 5 Injector Circuit Range/Performance - Event information	 <p>NOTE: - Circuit INJ_5_PWR_OUT_LOW - INJ_5_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • Harness fault - injector control circuit • Fuel injector failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module monitors a voltage on the cylinder 5 injector control circuit that is out of range. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required • If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval




			programme is in operation, prior to the installation of a new module/component
P02F3-17	Cylinder 6 Injector Circuit Range/Performance - Circuit Voltage Above Threshold	 <p>NOTE: - Circuit INJ_6_PWR_OUT_LOW - INJ_6_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Harness fault - injector control circuit • Fuel injector failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module monitors a voltage on the cylinder 6 injector control circuit that is above the diagnostic threshold. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required • If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02F3-1C	Cylinder 6 Injector Circuit Range/Performance - Circuit Voltage Out Of Range	 <p>NOTE: - Circuit INJ_6_PWR_OUT_LOW - INJ_6_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage outside of the expected range, but not identified as too high or too low • Harness fault - injector control circuit • Fuel injector failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module monitors a voltage on the cylinder 6 injector control circuit that is out of range. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required • If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P02F3-68	Cylinder 6 Injector Circuit Range/Performance - Event information	 <p>NOTE: - Circuit INJ_6_PWR_OUT_LOW - INJ_6_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • Harness fault - injector control circuit • Fuel injector failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module monitors a voltage on the cylinder 6 injector control circuit that is out of range. The injector control circuit consists of a twisted pair of wires between the engine control module and the Piezo actuator within the injector. Refer to the electrical circuit diagrams and check both the control circuits (high and low) for open circuit, short circuit to ground, short circuit to power, intermittent connections, high resistance, short to or interference from other circuits. Repair wiring harness as required • If there are no wiring harness faults suspect the fuel injector. Refer to the workshop manual and check/replace the fuel injector. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component



P0300-00	Random Misfire Detected - No sub type information	<ul style="list-style-type: none"> Fuel injector circuit fault(s) (injector DTCs also flagged) Fuel system fault 	<ul style="list-style-type: none"> Check for cylinder mis-fire, glow plug and injector DTCs and refer to the relevant DTC index. Refer to the electrical circuit diagrams and check injector circuit for short circuit to ground, short circuit to power, open circuit. Repair wiring harness as required. Clear DTC and retest Check for fuel system failure. Repair wiring harness as required. Clear DTC and retest
P0301-00	Cylinder 1 Misfire Detected - No sub type information	<ul style="list-style-type: none"> Fuel injector electrical circuit fault(s) (injector DTCs also flagged) Fuel injector fault Cylinder compression low 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check injector circuit for short circuit to ground, short circuit to power, open circuit. Repair wiring harness as required. Clear DTC and retest Check for cylinder mis-fire, glow plug and injector DTCs and refer to the relevant DTC index Check for fuel injector fault or blockage. Carry out cylinder compression tests
P0302-00	Cylinder 2 Misfire Detected - No sub type information	<ul style="list-style-type: none"> Fuel injector electrical circuit fault(s) (injector DTCs also flagged) Fuel injector fault Cylinder compression low 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check injector circuit for short circuit to ground, short circuit to power, open circuit. Repair wiring harness as required. Clear DTC and retest Check for cylinder mis-fire, glow plug and injector DTCs and refer to the relevant DTC index Check for fuel injector fault or blockage. Carry out cylinder compression tests
P0303-00	Cylinder 3 Misfire Detected - No sub type information	<ul style="list-style-type: none"> Fuel injector electrical circuit fault(s) (injector DTCs also flagged) Fuel injector fault Cylinder compression low 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check injector circuit for short circuit to ground, short circuit to power, open circuit. Repair wiring harness as required. Clear DTC and retest Check for cylinder mis-fire, glow plug and injector DTCs and refer to the relevant DTC index Check for fuel injector fault or blockage. Carry out cylinder compression tests
P0304-00	Cylinder 4 Misfire Detected - No sub type information	<ul style="list-style-type: none"> Fuel injector electrical circuit fault(s) (injector DTCs also flagged) Fuel injector fault Cylinder compression low 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check injector circuit for short circuit to ground, short circuit to power, open circuit. Repair wiring harness as required. Clear DTC and retest Check for cylinder mis-fire, glow plug and injector DTCs and refer to the relevant DTC index Check for fuel injector fault or blockage. Carry out cylinder compression tests
P0305-00	Cylinder 5 Misfire Detected - No sub type information	<ul style="list-style-type: none"> Fuel injector electrical circuit fault(s) (injector DTCs also flagged) Fuel injector fault Cylinder compression low 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check injector circuit for short circuit to ground, short circuit to power, open circuit. Repair wiring harness as required. Clear DTC and retest Check for cylinder mis-fire, glow plug and injector DTCs and refer to the relevant DTC index Check for fuel injector fault or blockage. Carry out cylinder compression tests
P0306-00	Cylinder 6 Misfire Detected - No sub type information	<ul style="list-style-type: none"> Fuel injector electrical circuit fault(s) 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check injector circuit for short




		<p>(injector DTCs also flagged)</p> <ul style="list-style-type: none"> • Fuel injector fault • Cylinder compression low 	<p>circuit to ground, short circuit to power, open circuit. Repair wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> • Check for cylinder mis-fire, glow plug and injector DTCs and refer to the relevant DTC index • Check for fuel injector fault or blockage. Carry out cylinder compression tests
P0336-31	Crankshaft Position Sensor A Circuit Range/Performance - No Signal	 <p>NOTE: - Circuit CPS -</p> <ul style="list-style-type: none"> • Harness fault - Crankshaft position sensor circuits • Crankshaft position sensor failure • Crankshaft position sensor or reference target positioning incorrect 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams. Check the wiring harness between the engine control module and the crankshaft position sensor for damage due to chaffing or heat. Check the 5 volt power supply and ground circuits to the sensor, check the signal circuit for open circuits, short circuit to power, and short circuit to ground. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness and sensor/target installation is correct suspect sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • Refer to the relevant section of the workshop manual. Check the sensor and crankshaft target for damage, contamination, and correct mounting
P0336-64	Crankshaft Position Sensor A Circuit Range/Performance - Signal Plausibility Failure	<ul style="list-style-type: none"> • Crankshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, disconnected • Crankshaft position sensor circuit shielding failure • Crankshaft Position sensor failure • Crankshaft position sensor foreign matter on sensor face, gap incorrect • Target wheel failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check crankshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, disconnected. Repair wiring harness as required. Clear DTC and retest • Check and install new crankshaft position sensor circuit shielding as required • Check crankshaft position sensor for foreign matter on crankshaft position sensor face. Check crankshaft position sensor air gap (check at 90° intervals, should be no greater than 4.5mm) • Check and install a new crankshaft position sensor as required. Check and install a new target wheel as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0341-31	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or single sensor) - No Signal	 <p>NOTE: - Circuit CID -</p> <ul style="list-style-type: none"> • Harness fault - camshaft position sensor circuits • Camshaft position sensor failure • Camshaft position sensor or reference target positioning incorrect 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams. Check the wiring harness between the engine control module and the camshaft position sensor for damage due to chaffing or heat. Check the 5 volt power supply and ground circuits to the sensor, check the signal circuit for open circuits, short circuit to power, and short circuit to ground. Repair wiring harness as required. Clear DTC and retest • Refer to the relevant section of the workshop manual. Check the sensor and camshaft target for damage, contamination, and correct mounting • If no fault found in wiring harness and sensor/target installation is correct suspect sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation,



			prior to the installation of a new module/component
P0341-3A	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or single sensor) - Incorrect Has Too Many Pulses	 <p>NOTE: - Circuit CID -</p> <ul style="list-style-type: none"> • Harness fault - camshaft position sensor circuits • Camshaft position sensor failure • Camshaft position sensor or reference target positioning incorrect 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams. Check the wiring harness between the engine control module and the camshaft position sensor for damage due to chaffing or heat. Check the 5 volt power supply and ground circuits to the sensor, check the signal circuit for intermittent faults such as open circuits, short circuit to power, and short circuit to ground. Repair wiring harness as required. Clear DTC and retest • Refer to the relevant section of the workshop manual. Check the sensor and camshaft target for damage, contamination, and correct mounting. Check camshaft timing is to specification • If no fault found in wiring harness and sensor/target installation is correct suspect sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0342-64	Camshaft Position Sensor A Circuit Low (Bank 1 or single sensor) - Signal Plausibility Failure	<ul style="list-style-type: none"> • Harness fault - camshaft position sensor circuit • Camshaft position sensor failure • Camshaft position sensor or reference target positioning incorrect 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the wiring harness between the engine control module and the camshaft position sensor for damage due to chaffing or heat. Check the 5 volt power supply and ground circuits to the sensor, check the signal circuit for intermittent faults such as open circuits, short circuit to power, and short circuit to ground. Repair wiring harness as required. Clear DTC and retest • Check the sensor and camshaft target for damage, contamination, and correct mounting. Check camshaft timing is to specification • If no fault found in wiring harness and sensor/target installation is correct suspect sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0380-11	Glow Plug/Heater Circuit A - Circuit short to ground	 <p>NOTE: - Circuit GLOWPLUG_CTRL -</p> <ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Harness fault between engine control module and glow plug control module - short circuit to ground • Component fault - glow plug control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal, Glow Plug Coil Duty Cycle (0x9A04). Refer to the electrical circuit diagrams and check the control circuit from the engine control module to the glow plug control module for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect glow plug control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0380-12	Glow Plug/Heater Circuit A - Circuit short to battery	 <p>NOTE: - Circuit</p>	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger





		<p>GLOWPLUG_CTRL -</p> <ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Harness fault between engine control module and glow plug control module - short circuit to power • Component fault - glow plug control module failure 	<p>signal, Glow Plug Coil Duty Cycle (0x9A04). Refer to the electrical circuit diagrams and check the control circuit from the engine control module to the glow plug control module for short circuit to ground. Repair wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> • If no fault found in wiring harness suspect glow plug control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0380-13	Glow Plug/Heater Circuit A - Circuit open	 <p>NOTE: - Circuit GLOWPLUG_CTRL -</p> <ul style="list-style-type: none"> • The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Harness fault between engine control module and glow plug control module - open circuit • Component fault - glow plug control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal, Glow Plug Coil Duty Cycle (0x9A04) • Refer to the electrical circuit diagrams and check the control circuit from the engine control module to the glow plug control module for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect glow plug control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0380-4B	Glow Plug/Heater Circuit A - Over temperature	<ul style="list-style-type: none"> • Harness fault - glow plug heater circuit A short circuit to ground, short circuit to power, high resistance 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal, Glow Plug Coil Duty Cycle (0x9A04) • Refer to the electrical circuit diagrams and check the glow plug heater circuit A for short circuit to ground, short circuit to power, high resistance. Repair wiring harness as required. Clear DTC and retest
P0401-00	Exhaust Gas Recirculation A Flow Insufficient Detected - No sub type information	<ul style="list-style-type: none"> • Intake air system, low pressure boost leak bank A • Exhaust gas recirculation valve A circuit short circuit to ground, high resistance, open circuit, disconnected • Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> • If this DTC is logged with P00BE-07 & P006A-00, suspect intake air system, low pressure boost leak bank A • Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to ground, high resistance, open circuit, disconnected. Repair wiring harness as required. Clear DTC and retest • Check and install a new exhaust gas recirculation valve A as required
P0402-00	Exhaust Gas Recirculation A Flow Excessive Detected - No sub type information	<ul style="list-style-type: none"> • Intake air system, high pressure boost leak bank A • Exhaust gas recirculation valve A circuit short circuit to power, high resistance, open circuit, disconnected • Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> • If this DTC is logged with P1247-00, P006A-00 & P00BF-07, suspect intake air system, high pressure boost leak bank A • Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to power, high resistance, open circuit, disconnected. Repair wiring harness as required. Clear DTC and retest • Check and install a new exhaust gas recirculation valve A as required
P0403-	Exhaust Gas Recirculation		<ul style="list-style-type: none"> • Using the manufacturer approved


13	A Control Circuit - Circuit open	 <p>NOTE: - Circuit EGR_A_NEG - EGR_A_POS -</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Exhaust gas recirculation valve A circuit high resistance Exhaust gas recirculation valve A circuit open circuit Exhaust gas recirculation valve A circuit disconnected Exhaust gas recirculation valve A failure 	<p>diagnostic system check datalogger signals, EGR Bank 1 - Commanded (0x03FB)</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the bank 1 exhaust gas recirculation control circuit for open circuit. This circuit consists of two wires connected between the engine control module and the exhaust gas recirculation valve motor. Check both wires for open circuit, inspect the harness for signs of chaffing due to vibration or heat damage. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect exhaust gas recirculation control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0403-16	Exhaust Gas Recirculation A Control Circuit - Circuit voltage below threshold	 <p>NOTE: - Circuit EGR_A_NEG - EGR_A_POS -</p> <ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Exhaust gas recirculation valve A circuit short circuit to ground Exhaust gas recirculation valve A circuit high resistance Exhaust gas recirculation valve A circuit open circuit Exhaust gas recirculation valve A circuit disconnected Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Bank 1 - Commanded (0x03FB) Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve A as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0403-19	Exhaust Gas Recirculation A Control Circuit - Circuit current above threshold	<ul style="list-style-type: none"> Exhaust gas recirculation valve A circuit short circuit to power Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Bank 1 - Commanded (0x03FB). Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short power. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve A as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0403-1D	Exhaust Gas Recirculation A Control Circuit - Circuit current out of range	 <p>NOTE: - Circuit EGR_A_NEG - EGR_A_POS -</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve A 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Bank 1 - Commanded (0x03FB) Refer to the electrical circuit diagrams and check exhaust gas recirculation


		<p>circuit short circuit to ground</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve A circuit short circuit to power Exhaust gas recirculation valve A circuit high resistance Exhaust gas recirculation valve A circuit open circuit Exhaust gas recirculation valve A circuit disconnected Exhaust gas recirculation valve A failure 	<p>valve A circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve A as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0403-4B	Exhaust Gas Recirculation A Control Circuit - Over temperature	 <p>NOTE: - Circuit EGR_A_NEG - EGR_A_POS -</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve A circuit short circuit to ground Exhaust gas recirculation valve A circuit short circuit to power Exhaust gas recirculation valve A circuit high resistance Exhaust gas recirculation valve A circuit open circuit Exhaust gas recirculation valve A circuit disconnected Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Bank 1 - Commanded (0x03FB) Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve A as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0403-71	Exhaust Gas Recirculation "A" Control Circuit / Open - Actuator stuck	 <p>NOTE: - Circuit EGR_A_NEG - EGR_A_POS -</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve A circuit open circuit Exhaust gas recirculation valve A circuit disconnected Exhaust gas 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas



		recirculation valve A failure	recirculation valve A as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0404-19	Exhaust Gas Recirculation A Control Circuit Range/Performance - Circuit current above threshold	 <p>NOTE: - Circuit EGR_A_NEG - EGR_A_POS -</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve A circuit short circuit to ground Exhaust gas recirculation valve A circuit short circuit to power Exhaust gas recirculation valve A circuit high resistance Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Bank 1 - Commanded (0x03FB) Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve A as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0405-00	Exhaust Gas Recirculation Sensor A Circuit Low - No sub type information	 <p>NOTE: - Circuit EVP_A -</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve A circuit short circuit to ground Exhaust gas recirculation valve A circuit high resistance Exhaust gas recirculation valve A circuit open circuit Exhaust gas recirculation valve A circuit disconnected Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve A as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0405-11	Exhaust Gas Recirculation Sensor A Circuit Low - Circuit short to ground	 <p>NOTE: - Circuit EVP_A -</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Exhaust gas recirculation valve A position sensor circuit short circuit to ground Exhaust gas 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Valve Position Bank 1 (0x052E) Refer to the electrical circuit diagrams and check the bank A exhaust gas recirculation sensor signal circuit for short circuit to ground. Check the harness between the engine control module and the exhaust gas recirculation valve for signs of chaffing or heat damage. Check the three circuits which supply the sensor. 5 volts supply, sensor signal, and sensor ground. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness




		recirculation valve A failure	suspect exhaust gas recirculation sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0405-77	Exhaust Gas Recirculation Sensor A Circuit Low - Commanded position not reachable	<ul style="list-style-type: none"> Exhaust gas recirculation valve A position sensor circuit short circuit to ground Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Valve Position Bank 1 (0x052E) Refer to the electrical circuit diagrams and check the bank A exhaust gas recirculation sensor signal circuit for short circuit to ground. Check the harness between the engine control module and the exhaust gas recirculation valve for signs of chaffing or heat damage. Check the three circuits which supply the sensor. 5 volts supply, sensor signal, and sensor ground. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect exhaust gas recirculation sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0406-00	Exhaust Gas Recirculation Sensor A Circuit High - No sub type information	 NOTE: - Circuit EVP_A - <ul style="list-style-type: none"> Exhaust gas recirculation valve A circuit short circuit to power Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank A circuits for short circuit to power. Repair Wiring as required, clear the DTC and retest system If no fault found in wiring harness suspect exhaust gas recirculation sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0406-12	Exhaust Gas Recirculation Sensor A Circuit High - Circuit short to battery	 NOTE: - Circuit EVP_A - <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Exhaust gas recirculation valve A circuit short circuit to power Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the bank A exhaust gas recirculation sensor signal circuit for short circuit to power. Check the harness between the engine control module and the exhaust gas recirculation valve for signs of chaffing or heat damage. Check the three circuits which supply the sensor. 5 volts supply, sensor signal, and sensor ground. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect exhaust gas recirculation sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0406-77	Exhaust Gas Recirculation Sensor A Circuit High - Commanded position not reachable	<ul style="list-style-type: none"> Exhaust gas recirculation valve A circuit short circuit to power Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the bank A exhaust gas recirculation sensor signal circuit for short circuit to power. Check the harness between the engine control module and the exhaust gas recirculation valve for signs of chaffing or heat damage. Check the three circuits which supply the sensor. 5 volts supply, sensor signal, and sensor ground. Repair wiring harness as



			<ul style="list-style-type: none"> required. Clear DTC and retest If no fault found in wiring harness suspect exhaust gas recirculation sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0407-00	Exhaust Gas Recirculation Sensor B Circuit Low - No sub type information	 <p>NOTE: - Circuit TPS -</p> <ul style="list-style-type: none"> Harness fault - Throttle position sensor circuit Throttle position sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the throttle position sensor circuits for short circuit to ground, open circuit. Repair wiring as required, clear the DTC and retest system If no fault found in wiring harness suspect throttle position sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0408-00	Exhaust Gas Recirculation Sensor B Circuit High - No sub type information	 <p>NOTE: - Circuit TPS -</p> <ul style="list-style-type: none"> Harness fault - Throttle position sensor circuit Throttle position sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the throttle position sensor circuits for short circuit to ground, open circuit. Repair wiring as required, clear the DTC and retest system If no fault found in wiring harness suspect throttle position sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0409-13	Exhaust Gas Recirculation Sensor A Circuit - Circuit open	 <p>NOTE: - Circuit EVP_A -</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Harness fault - Exhaust gas recirculation valve A circuit Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the bank 1 exhaust gas recirculation sensor signal circuit for open circuit. Check the harness between the engine control module and the exhaust gas recirculation valve for signs of chaffing or heat damage. Check the three circuits which supply the sensor. 5 volts supply, sensor signal, and sensor ground. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect exhaust gas recirculation sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0409-16	Exhaust Gas Recirculation Sensor A Circuit - Circuit voltage below threshold	 <p>NOTE: - Circuit EVP_A -</p> <ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Exhaust gas recirculation valve A circuit short circuit to ground Exhaust gas recirculation valve A circuit high resistance Exhaust gas recirculation valve A circuit open circuit Exhaust gas recirculation valve A circuit disconnected 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve A as required. Refer




		<ul style="list-style-type: none"> Exhaust gas recirculation valve A failure 	<p>to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p>
P0409-17	Exhaust Gas Recirculation Sensor A Circuit - Circuit voltage above threshold	 <p>NOTE: - Circuit EVP_A -</p> <ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Exhaust gas recirculation valve A circuit short circuit to power Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve A as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0409-92	Exhaust Gas Recirculation Sensor A Circuit - Performance or incorrect operation	<ul style="list-style-type: none"> Exhaust gas recirculation valve A circuit short circuit to ground Exhaust gas recirculation valve A circuit high resistance Exhaust gas recirculation valve A circuit open circuit Exhaust gas recirculation valve A circuit disconnected Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve A as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P042E-77	Exhaust Gas Recirculation A Control Stuck Open - Commanded position not reachable	<ul style="list-style-type: none"> Exhaust gas recirculation valve A circuit short circuit to ground Exhaust gas recirculation valve A circuit short circuit to power Exhaust gas recirculation valve A circuit high resistance Exhaust gas recirculation valve A circuit open circuit Exhaust gas recirculation valve A circuit disconnected Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Check for other related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, operate the Exhaust Recirculation Valve through the full operating range whilst monitoring the position sensor signal value. If the position signal does not change smoothly in proportion to the commands check the operation of the valve Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation




			<p>valve A circuit for open circuit. Repair wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve A as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P042F-77	Exhaust Gas Recirculation A Control Stuck Closed - Commanded position not reachable	<ul style="list-style-type: none"> Exhaust gas recirculation valve A circuit short circuit to ground Exhaust gas recirculation valve A circuit short circuit to power Exhaust gas recirculation valve A circuit high resistance Exhaust gas recirculation valve A circuit open circuit Exhaust gas recirculation valve A circuit disconnected Exhaust gas recirculation valve A failure 	<ul style="list-style-type: none"> Check for other related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, operate the Exhaust Recirculation Valve through the full operating range whilst monitoring the position sensor signal value. If the position signal does not change smoothly in proportion to the commands check the operation of the valve Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve A circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve A as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0435-00	Catalyst Temperature Sensor Circuit (Bank 2, Sensor Circuit 1) - No subtype information	 <p>NOTE: - Circuit CCCIT_B</p> <ul style="list-style-type: none"> Catalyst temperature sensor bank 2, sensor 1 circuit short circuit to ground Catalyst temperature sensor bank 2, sensor 1 circuit short circuit to power Catalyst temperature sensor bank 2, sensor 1 circuit high resistance Catalyst temperature sensor bank 2, sensor 1 circuit open circuit 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 1 Voltage (0x03BF), Exhaust Gas Temperature Bank 2 Sensor 1 (0x03F7) Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for high




		<ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 1 circuit disconnected • Catalyst temperature sensor bank 2, sensor 1 failure 	<ul style="list-style-type: none"> • resistance. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for disconnected. Repair wiring harness as required. Clear DTC and retest • Check and install a new catalyst temperature sensor - bank 2, sensor 1 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0436-00	Catalyst Temperature Sensor Circuit Range/Performance (Bank 2, Sensor Circuit 1) - No sub type information	 <p>NOTE: - Circuit CCCIT_B</p> <ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 1 circuit short circuit to ground • Catalyst temperature sensor bank 2, sensor 1 circuit short circuit to power • Catalyst temperature sensor bank 2, sensor 1 circuit high resistance • Catalyst temperature sensor bank 2, sensor 1 circuit open circuit • Catalyst temperature sensor bank 2, sensor 1 circuit disconnected • Catalyst temperature sensor bank 2, sensor 1 failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 1 Voltage (0x03BF), Exhaust Gas Temperature Bank 2 Sensor 1 (0x03F7) • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for high resistance. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for disconnected. Repair wiring harness as required. Clear DTC and retest • Check and install a new catalyst temperature sensor - bank 2, sensor 1 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0437-00	Catalyst Temperature Sensor Circuit Low (Bank 2, Sensor Circuit 1) - No sub type information	 <p>NOTE: - Circuit CCCIT_B</p> <ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 1 circuit short circuit to ground • Catalyst temperature sensor bank 2, sensor 1 circuit high resistance • Catalyst temperature sensor bank 2, sensor 1 circuit open circuit • Catalyst temperature sensor bank 2, sensor 1 circuit disconnected 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 1 Voltage (0x03BF), Exhaust Gas Temperature Bank 2 Sensor 1 (0x03F7) • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for high resistance. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor




		<ul style="list-style-type: none"> Catalyst temperature sensor bank 2, sensor 1 failure 	<p>bank 2, sensor 1 circuit for open circuit. Repair wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new catalyst temperature sensor - bank 2, sensor 1 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0438-00	Catalyst Temperature Sensor Circuit High (Bank 2, Sensor Circuit 1) - No sub type information	 <p>NOTE: - Circuit CCCIT_B -</p> <ul style="list-style-type: none"> Catalyst temperature sensor bank 2, sensor 1 circuit short circuit to power Catalyst temperature sensor bank 2, sensor 1 failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 1 Voltage (0x03BF), Exhaust Gas Temperature Bank 2 Sensor 1 (0x03F7). Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Check and install a new catalyst temperature sensor - bank 2, sensor 1 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P043A-00	Catalyst Temperature Sensor Circuit (Bank 2, Sensor Circuit 2) - No sub type information	 <p>NOTE: - Circuit CCCOT_B -</p> <ul style="list-style-type: none"> Catalyst temperature sensor bank 2, sensor 2 circuit short circuit to ground Catalyst temperature sensor bank 2, sensor 2 circuit short circuit to power Catalyst temperature sensor bank 2, sensor 2 circuit high resistance Catalyst temperature sensor bank 2, sensor 2 circuit open circuit Catalyst temperature sensor bank 2, sensor 2 circuit disconnected Catalyst temperature sensor bank 2, sensor 2 failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 2 Sensor 2 (0x03F8), Exhaust Gas Temperature Sensor Bank 2 Sensor 2 Voltage (0x03E9) Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new catalyst temperature sensor - bank 2, sensor 2 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P043B-00	Catalyst Temperature Sensor Circuit	 <p>NOTE: - Circuit</p>	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger



	Range/Performance (Bank 2, Sensor Circuit 2) - No sub type information	<p>CCCOT_B -</p> <ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 2 circuit short circuit to ground • Catalyst temperature sensor bank 2, sensor 2 circuit short circuit to power • Catalyst temperature sensor bank 2, sensor 2 circuit high resistance • Catalyst temperature sensor bank 2, sensor 2 circuit open circuit • Catalyst temperature sensor bank 2, sensor 2 circuit disconnected • Catalyst temperature sensor bank 2, sensor 2 failure 	<p>signals, Exhaust Gas Temperature Bank 2 Sensor 2 (0x03F8), Exhaust Gas Temperature Sensor Bank 2 Sensor 2 Voltage (0x03E9)</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for high resistance. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for disconnected. Repair wiring harness as required. Clear DTC and retest • Check and install a new catalyst temperature sensor - bank 2, sensor 2 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P043C-00	Catalyst Temperature Sensor Circuit Low (Bank 2, Sensor Circuit 2) - No sub type information	<p> NOTE: - Circuit CCCOT_B -</p> <ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 2 circuit short circuit to ground • Catalyst temperature sensor bank 2, sensor 2 circuit high resistance • Catalyst temperature sensor bank 2, sensor 2 circuit open circuit • Catalyst temperature sensor bank 2, sensor 2 circuit disconnected • Catalyst temperature sensor bank 2, sensor 2 failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 2 Sensor 2 (0x03F8), Exhaust Gas Temperature Sensor Bank 2 Sensor 2 Voltage (0x03E9) • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for high resistance. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for disconnected. Repair wiring harness as required. Clear DTC and retest • Check and install a new catalyst temperature sensor - bank 2, sensor 2 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P043D-00	Catalyst Temperature Sensor Circuit High (Bank 2, Sensor Circuit 2) - No sub type information	<p> NOTE: - Circuit CCCOT_B -</p> <ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 2 Sensor 2 (0x03F8), Exhaust Gas Temperature Sensor Bank 2 Sensor 2 Voltage (0x03E9)



		<p>2 circuit short circuit to power</p> <ul style="list-style-type: none"> Catalyst temperature sensor bank 2, sensor 2 failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Check and install a new catalyst temperature sensor - bank 2, sensor 2 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P044A-13	Exhaust Gas Recirculation Sensor C Circuit - Circuit open	 <p>NOTE: - Circuit EVP_B -</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Exhaust gas recirculation valve bank B circuit high resistance Exhaust gas recirculation valve bank B circuit open circuit Exhaust gas recirculation valve bank B circuit disconnected Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Valve Position Bank 2 (0x052F) Refer to the electrical circuit diagrams and check the bank B exhaust gas recirculation sensor signal circuit for open circuit. Check the harness between the engine control module and the exhaust gas recirculation valve for signs of chaffing or heat damage. Check the three circuits which supply the sensor. 5 volts supply, sensor signal, and sensor ground. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect exhaust gas recirculation sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P044A-16	Exhaust Gas Recirculation Sensor C Circuit - Circuit voltage below threshold	 <p>NOTE: - Circuit EVP_B -</p> <ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Exhaust gas recirculation valve bank B circuit short circuit to ground Exhaust gas recirculation valve bank B circuit high resistance Exhaust gas recirculation valve bank B circuit disconnected Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Valve Position Bank 2 (0x052F) Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P044A-17	Exhaust Gas Recirculation Sensor C Circuit - Circuit voltage above threshold	 <p>NOTE: - Circuit EVP_B -</p> <ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Exhaust gas recirculation valve 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Valve Position Bank 2 (0x052F). Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve bank B as required.

		<p>bank B circuit short circuit to power</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve bank B failure 	<p>Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p>
P044A-92	Exhaust Gas Recirculation Sensor C Circuit - Performance or incorrect operation	 <p>NOTE: - Circuit EVP_B -</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve bank B circuit short circuit to ground Exhaust gas recirculation valve bank B circuit short circuit to power Exhaust gas recirculation valve bank B circuit open circuit Exhaust gas recirculation valve bank B circuit high resistance Exhaust gas recirculation valve bank B circuit disconnected Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Valve Position Bank 2 (0x052F) Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P044C-00	Exhaust Gas Recirculation Sensor C Circuit Low - No sub type information	 <p>NOTE: - Circuit EVP_B -</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve bank B circuit short circuit to ground Exhaust gas recirculation valve bank B circuit high resistance Exhaust gas recirculation valve bank B circuit open circuit Exhaust gas recirculation valve bank B circuit disconnected Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Valve Position Bank 2 (0x052F) Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P044D-00	Exhaust Gas Recirculation Sensor C Circuit High - No sub type information	 <p>NOTE: - Circuit EVP_B -</p> <ul style="list-style-type: none"> Exhaust gas 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Valve Position Bank 2 (0x052F)





		<p>recirculation valve bank B circuit short circuit to power</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045A-13	Exhaust Gas Recirculation B Control Circuit - Circuit open	 <p>NOTE: - Circuit EGR_B_NEG - EGR_B_POS -</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Exhaust gas recirculation valve bank B circuit open circuit Exhaust gas recirculation valve bank B circuit disconnected Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded EGR Bank 2 (0x0525) Refer to the electrical circuit diagrams and check the bank B exhaust gas recirculation control circuit for open circuit. This circuit consists of two wires connected between the engine control module and the exhaust gas recirculation valve motor. Check both wires for open circuit, inspect the harness for signs of chaffing due to vibration or heat damage. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the bank B exhaust gas recirculation control circuit for disconnected If no fault found in wiring harness suspect exhaust gas recirculation control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045A-16	Exhaust Gas Recirculation B Control Circuit - Circuit voltage below threshold	 <p>NOTE: - Circuit EGR_B_NEG - EGR_B_POS -</p> <ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Exhaust gas recirculation valve bank B circuit short circuit to ground Exhaust gas recirculation valve bank B circuit high resistance Exhaust gas recirculation valve bank B circuit open circuit Exhaust gas recirculation valve bank B circuit disconnected Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded EGR Bank 2 (0x0525) Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to ground Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for high resistance Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for open circuit Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for disconnected Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045A-19	Exhaust Gas Recirculation B Control Circuit - Circuit current above threshold	 <p>NOTE: - Circuit EGR_B_NEG - EGR_B_POS -</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve bank B circuit short 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded EGR Bank 2 (0x0525) Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to





		<ul style="list-style-type: none"> circuit to ground Exhaust gas recirculation valve bank B circuit short circuit to power Exhaust gas recirculation valve bank B circuit high resistance Exhaust gas recirculation valve bank B circuit open circuit Exhaust gas recirculation valve bank B circuit disconnected Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> ground Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to power Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for high resistance Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for open circuit Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for disconnected Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045A-1D	Exhaust Gas Recirculation B Control Circuit - Circuit current out of range	 <p>NOTE: - Circuit EGR_B_NEG - EGR_B_POS -</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve bank B circuit short circuit to ground Exhaust gas recirculation valve bank B circuit short circuit to power Exhaust gas recirculation valve bank B circuit high resistance Exhaust gas recirculation valve bank B circuit open circuit Exhaust gas recirculation valve bank B circuit disconnected Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded EGR Bank 2 (0x0525) Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to ground Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to power Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for high resistance Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for open circuit Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for disconnected Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045A-4B	Exhaust Gas Recirculation B Control Circuit - Over temperature	 <p>NOTE: - Circuit EGR_B_NEG - EGR_B_POS -</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve bank B circuit short circuit to ground Exhaust gas recirculation valve bank B circuit short circuit to power Exhaust gas recirculation valve bank B circuit high resistance Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded EGR Bank 2 (0x0525) Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to ground Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to power Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for high resistance Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045A-71	Exhaust Gas Recirculation B Control Circuit - Actuator stuck	 <p>NOTE: - Circuit EGR_B_NEG - EGR_B_POS -</p> <ul style="list-style-type: none"> Exhaust gas 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded EGR Bank 2 (0x0525) Refer to the electrical circuit diagrams




		<ul style="list-style-type: none"> recirculation valve bank B circuit short circuit to ground Exhaust gas recirculation valve bank B circuit short circuit to power Exhaust gas recirculation valve bank B circuit open circuit Exhaust gas recirculation valve bank B circuit high resistance Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> and check exhaust gas recirculation valve bank B circuit for short circuit to ground Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to power Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for open circuit Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for high resistance Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045B-19	Exhaust Gas Recirculation B Control Circuit Range/Performance - Circuit current above threshold	<ul style="list-style-type: none"> Exhaust gas recirculation valve bank B circuit short circuit to ground Exhaust gas recirculation valve bank B circuit short circuit to power Exhaust gas recirculation valve bank B circuit high resistance Exhaust gas recirculation valve bank B circuit open circuit Exhaust gas recirculation valve bank B circuit disconnected Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded EGR Bank 2 (0x0525) Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to ground Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to power Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for high resistance Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for open circuit Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for disconnected Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045C-00	Exhaust Gas Recirculation B Control Circuit Low - No sub type information	 <p>NOTE: - Circuit EGR_B_NEG - EGR_B_POS -</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve bank B circuit short circuit to ground Exhaust gas recirculation valve bank B circuit high resistance Exhaust gas recirculation valve bank B circuit open circuit Exhaust gas recirculation valve bank B circuit disconnected Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded EGR Bank 2 (0x0525) Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to ground Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for high resistance Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for open circuit Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for disconnected Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045C-11	Exhaust Gas Recirculation B Control Circuit Low - Circuit short to ground	 <p>NOTE: - Circuit EGR_B_NEG - EGR_B_POS -</p>	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded EGR Bank 2 (0x0525). Refer to the electrical circuit




		<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Exhaust gas recirculation valve bank B circuit short circuit to ground Exhaust gas recirculation valve bank B failure 	<p>diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045C-77	Exhaust Gas Recirculation B Control Circuit Low - Commanded position not reachable	<ul style="list-style-type: none"> Exhaust gas recirculation valve bank B circuit short circuit to ground Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded EGR Bank 2 (0x0525). Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045D-00	Exhaust Gas Recirculation B Control Circuit High - No sub type information	 <p>NOTE: - Circuit EGR_B_NEG - EGR_B_POS -</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve bank B circuit short circuit to power Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded EGR Bank 2 (0x0525). Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045D-12	Exhaust Gas Recirculation B Control Circuit High - Circuit short to battery	 <p>NOTE: - Circuit EGR_B_NEG - EGR_B_POS -</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Exhaust gas recirculation valve bank B circuit short circuit to power Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded EGR Bank 2 (0x0525). Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045D-77	Exhaust Gas Recirculation B Control Circuit High - Commanded position not reachable	<ul style="list-style-type: none"> Exhaust gas recirculation valve bank B circuit short circuit to power Exhaust gas recirculation valve 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded EGR Bank 2 (0x0525). Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for


		bank B failure	<p>short circuit to power. Repair wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> • Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045E-77	Exhaust Gas Recirculation B Control Stuck Open - Commanded position not reachable	<ul style="list-style-type: none"> • Exhaust gas recirculation valve B circuit short circuit to ground • Exhaust gas recirculation valve B circuit short circuit to power • Exhaust gas recirculation valve B circuit high resistance • Exhaust gas recirculation valve B circuit open circuit • Exhaust gas recirculation valve B circuit disconnected • Exhaust gas recirculation valve B failure 	<ul style="list-style-type: none"> • Check for other related DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system, operate the Exhaust Recirculation Valve through the full operating range whilst monitoring the position sensor signal value. If the position signal does not change smoothly in proportion to the commands check the operation of the valve • Refer to the electrical circuit diagrams and check exhaust gas recirculation valve B circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check exhaust gas recirculation valve B circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check exhaust gas recirculation valve B circuit for high resistance. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check exhaust gas recirculation valve B circuit for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check exhaust gas recirculation valve B circuit for disconnected. Repair wiring harness as required. Clear DTC and retest • Check and install a new exhaust gas recirculation valve B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P045F-77	Exhaust Gas Recirculation B Control Stuck Closed - Commanded position not reachable	<ul style="list-style-type: none"> • Exhaust gas recirculation valve B circuit short circuit to ground • Exhaust gas recirculation valve B circuit short circuit to power • Exhaust gas recirculation valve B circuit high resistance • Exhaust gas recirculation valve B circuit open circuit • Exhaust gas recirculation valve B circuit disconnected • Exhaust gas recirculation valve B failure 	<ul style="list-style-type: none"> • Check for other related DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system, operate the Exhaust Recirculation Valve through the full operating range whilst monitoring the position sensor signal value. If the position signal does not change smoothly in proportion to the commands check the operation of the valve • Refer to the electrical circuit diagrams and check exhaust gas recirculation valve B circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check exhaust gas recirculation valve B circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check exhaust gas recirculation valve B circuit for high resistance.




			<p>Repair wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas recirculation valve B circuit for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check exhaust gas recirculation valve B circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P046E-00	Exhaust Gas Recirculation Sensor "B" Circuit Range/Performance - No sub type information	 <p>NOTE: - Circuit TPS -</p> <ul style="list-style-type: none"> Throttle position sensor short circuit to ground, short circuit to power, open circuit, high resistance Throttle position sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check throttle position sensor for short circuit to ground, short circuit to power, open circuit, high resistance. Clear DTC and retest Check and install a new throttle position sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0480-11	Fan 1 Control Circuit - Circuit short to ground	 <p>NOTE: - Circuit VCFC -</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Wiring harness fault - short circuit to ground Cooling fan component fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Electric Fan PWM Control - Commanded (0x03F9). Refer to the electrical circuit diagrams and check the cooling fan control circuit from the engine control module to the cooling fan fly lead for short circuit to ground Check power and ground supplies to cooling fan control module, repair any wiring faults found. Clear DTC and retest
P0480-12	Fan 1 Control Circuit - Circuit short to battery	 <p>NOTE: - Circuit VCFC -</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Wiring harness fault - short circuit to power Cooling fan component fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Electric Fan PWM Control - Commanded (0x03F9). Refer to the electrical circuit diagrams and check the cooling fan control circuit from the engine control module to the cooling fan fly lead for short circuit to power Check power and ground supplies to cooling fan control module, repair any wiring faults found. Clear DTC and retest
P0480-13	Fan 1 Control Circuit - Circuit open	 <p>NOTE: - Circuit VCFC -</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Electric Fan PWM Control - Commanded (0x03F9). Refer to the electrical circuit diagrams and check the cooling fan control circuit from the engine control module to the cooling fan fly lead for open circuit Check power and ground supplies to cooling fan control module, repair any wiring faults found. Clear DTC and




		<ul style="list-style-type: none"> Wiring harness fault - open circuit Cooling fan component fault 	retest
P0483-27	Fan Performance - Signal rate of change above threshold	<ul style="list-style-type: none"> Engine cooling fan acceleration plausibility defect This DTC is set if the calculated engine cooling fan acceleration value is greater than a calibrated value 	<ul style="list-style-type: none"> Refer to relevant section of workshop manual and check the viscous fan unit
P0483-36	Fan Performance - Signal frequency too low	 <p>NOTE: - Circuit VCFC - CFM -</p> <ul style="list-style-type: none"> The engine control module detected excessive duration for one cycle of the output across a specified sample size Engine cooling fan speed below maximum threshold Viscous fan circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the viscous fan circuit for short circuit to ground, short circuit to power, open circuit, high resistance
P0483-37	Fan Performance - Signal frequency too high	 <p>NOTE: - Circuit VCFC - CFM -</p> <ul style="list-style-type: none"> The engine control module detected insufficient duration for one cycle of the output across a specified sample size Engine cooling fan speed above maximum threshold Viscous fan circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the viscous fan circuit for short circuit to ground, short circuit to power, open circuit, high resistance
P0486-13	Exhaust Gas Recirculation Sensor B Circuit - Circuit open	 <p>NOTE: - Circuit TPS -</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Harness fault - Intake air shut off throttle position sensor circuit open circuit Intake air shut off throttle position sensor failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects a no load error on the intake air shut off throttle position sensor circuit. This sensor is a potentiometer. Refer to the electrical circuit diagrams and check the sensor 5 volt supply and ground circuits. Check the sensor circuits for open circuits, short circuit to ground, short circuit to power. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect intake air shut off throttle position sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0486-16	Exhaust Gas Recirculation Sensor B Circuit - Circuit voltage below threshold	 <p>NOTE: - Circuit TPS -</p> <ul style="list-style-type: none"> The engine control module measured a voltage below a 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas recirculation valve B circuit for short circuit to ground Refer to the electrical circuit diagrams and check exhaust gas recirculation



		<p>specified range but not necessarily a short circuit to ground</p> <ul style="list-style-type: none"> Exhaust gas recirculation valve bank B circuit short circuit to ground Exhaust gas recirculation valve bank B circuit high resistance Exhaust gas recirculation valve bank B circuit open circuit Exhaust gas recirculation valve bank B circuit disconnected Exhaust gas recirculation valve bank B failure 	<p>valve B circuit high resistance</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas recirculation valve B circuit open circuit Refer to the electrical circuit diagrams and check exhaust gas recirculation valve B circuit disconnected Check and install a new exhaust gas recirculation valve B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0486-17	Exhaust Gas Recirculation Sensor B Circuit - Circuit voltage above threshold	 <p>NOTE: - Circuit TPS -</p> <ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Exhaust gas recirculation valve bank B circuit short circuit to power Exhaust gas recirculation valve bank B failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas recirculation valve bank B circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas recirculation valve bank B as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0486-92	Exhaust Gas Recirculation Sensor B Circuit - Performance or incorrect operation	 <p>NOTE: - Circuit TPS -</p> <ul style="list-style-type: none"> Throttle position sensor circuit short circuit to ground Throttle position sensor circuit short circuit to power Throttle position sensor circuit high resistance Throttle position sensor circuit open circuit Throttle position sensor circuit disconnected Throttle position sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check throttle position sensor circuit for short circuit to ground Refer to the electrical circuit diagrams and check throttle position sensor circuit for short circuit to power Refer to the electrical circuit diagrams and check throttle position sensor circuit high resistance Refer to the electrical circuit diagrams and check throttle position sensor circuit open circuit Refer to the electrical circuit diagrams and check throttle position sensor circuit disconnected Check and install a new throttle position sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0487-00	Exhaust Gas Recirculation Throttle Control Circuit A / Open - No sub type information	 <p>NOTE: - Circuit TPA_POS - TPA_NEG -</p> <ul style="list-style-type: none"> Harness fault - Intake air shut off throttle control circuit Intake air shut off throttle failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded Throttle Actuator Control (0xF44C). This DTC is set when the engine control module detects an open load error on the intake air shut off throttle control circuit. Refer to the electrical circuit diagrams and check the Throttle Plate Actuator control circuits for open circuits, short circuit to ground, short circuit to power. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect intake air shut off throttle control actuator failure. Refer to the

			warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0487-19	Exhaust Gas Recirculation Throttle Control Circuit A / Open - Circuit current above threshold	 <p>NOTE: - Circuit TPA_POS - TPA_NEG -</p> <ul style="list-style-type: none"> • Harness fault - Intake air shut off throttle control circuit short circuit to ground, high resistance, open circuit • Intake air shut off throttle failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Commanded Throttle Actuator Control (0xF44C). This DTC is set when the engine control module detects current out of range on the intake air shut off throttle control circuit. Refer to the electrical circuit diagrams and check the Throttle Plate Actuator control circuit for short circuit to ground, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect intake air shut off throttle control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0487-1D	Exhaust Gas Recirculation Throttle Control Circuit A / Open - Circuit current out of range	 <p>NOTE: - Circuit TPA_POS - TPA_NEG -</p> <ul style="list-style-type: none"> • Harness fault - Intake air shut off throttle control circuit • Intake air shut off throttle failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Commanded Throttle Actuator Control (0xF44C). This DTC is set when the engine control module detects current out of range on the intake air shut off throttle control circuit. Refer to the electrical circuit diagrams and check the Throttle Plate Actuator control circuits for short circuit to ground, short circuit to power, short to other circuit. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect intake air shut off throttle control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0488-16	Exhaust Gas Recirculation Throttle Control Circuit A Range/Performance - Circuit voltage below threshold	 <p>NOTE: - Circuit TPA_POS - TPA_NEG -</p> <ul style="list-style-type: none"> • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Harness fault - Intake air shut off throttle control circuit • Intake air shut off throttle failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Commanded Throttle Actuator Control (0xF44C). This DTC is set when the engine control module detects voltage on the intake air shut off throttle control circuit below threshold. Refer to the electrical circuit diagrams and check the Throttle Plate Actuator control circuits for high resistance, open circuit, short circuit to ground, short circuit to power, short to other circuit. Repair wiring harness as required. Clear DTC and retest • If no fault found in wiring harness suspect intake air shut off throttle control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0488-19	Exhaust Gas Recirculation Throttle Control Circuit A Range/Performance - Circuit current above threshold	<ul style="list-style-type: none"> • Harness fault - Intake air shut off throttle control circuit short circuit to ground, high resistance • Intake air shut off 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Commanded Throttle Actuator Control (0xF44C). This DTC is set when the engine control module detects current out of range on the intake air

		throttle failure	<p>shut off throttle control circuit. Refer to the electrical circuit diagrams and check the Throttle Plate Actuator control circuit for short circuit to ground, high resistance. Repair wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> If no fault found in wiring harness suspect intake air shut off throttle control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0488-1D	Exhaust Gas Recirculation Throttle Control Circuit A Range/Performance - Circuit current out of range	 <p>NOTE: - Circuit TPA_POS - TPA_NEG -</p> <ul style="list-style-type: none"> Harness fault - Intake air shut off throttle control circuit Intake air shut off throttle failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded Throttle Actuator Control (0xF44C). This DTC is set when the engine control module detects current on the intake air shut off throttle control circuit out of range. Refer to the electrical circuit diagrams and check the Throttle Plate Actuator control circuits for high resistance, open circuit, short circuit to ground, short circuit to power, short to other circuit. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect intake air shut off throttle control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0488-4B	Exhaust Gas Recirculation Throttle Control Circuit A Range/Performance - Over temperature	<ul style="list-style-type: none"> Harness fault - Intake air shut off throttle control circuit short circuit to ground, short circuit to power, high resistance Intake air shut off throttle failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Commanded Throttle Actuator Control (0xF44C). Refer to the electrical circuit diagrams and check the intake air shut off throttle control circuit for short circuit to ground, short circuit to power, high resistance. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect intake air shut off throttle control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0488-72	Exhaust Gas Recirculation Throttle Control Circuit A Range/Performance - Actuator stuck open	<ul style="list-style-type: none"> Harness fault - EGR throttle inlet control circuit short circuit to ground, short circuit to power, high resistance, open circuit EGR throttle inlet control actuator failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the EGR throttle inlet control circuit for short circuit to ground, short circuit to power, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect EGR throttle inlet control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0488-73	Exhaust Gas Recirculation Throttle Control Circuit A Range/Performance - Actuator stuck closed	<ul style="list-style-type: none"> Harness fault - EGR throttle inlet control circuit short circuit to ground, short circuit to power, high resistance, open 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the EGR throttle inlet control circuit for short circuit to ground, short circuit to power, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest

		<ul style="list-style-type: none"> circuit EGR throttle inlet control actuator failure 	<ul style="list-style-type: none"> If no fault found in wiring harness suspect EGR throttle inlet control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0489-77	Exhaust Gas Recirculation Control Circuit Low - Commanded position not reachable	 <p>NOTE: - Circuit SENSOR_GND_5 -</p> <ul style="list-style-type: none"> Throttle position sensor circuit, open circuit 	<ul style="list-style-type: none"> Check for related DTCs and refer to the relevant DTC index Refer to the electrical circuit diagrams and check the throttle position sensor circuit for open circuit
P0490-77	Exhaust Gas Recirculation A Control Circuit High - Commanded position not reachable	<ul style="list-style-type: none"> Throttle position sensor circuit, short circuit to ground, short circuit to power, open circuit 	<ul style="list-style-type: none"> Check for related DTCs and refer to the relevant DTC index Refer to the electrical circuit diagrams and check the throttle position sensor circuit for short circuit to ground, short circuit to power, open circuit
P049D-00	Exhaust Gas Recirculation A Control Position Exceeded Learning Limit - No sub type information	<ul style="list-style-type: none"> Harness fault - Exhaust gas recirculation valve bank 1 control circuit short circuit to ground, short circuit to power, high resistance, open circuit Exhaust gas recirculation valve bank 1 actuator failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the bank 1 exhaust gas recirculation control circuit for short circuit to ground, short circuit to power, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect exhaust gas recirculation control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P049E-00	Exhaust Gas Recirculation B Control Position Exceeded Learning Limit - No sub type information	<ul style="list-style-type: none"> Harness fault - Exhaust gas recirculation valve bank 2 control circuit short circuit to ground, short circuit to power, high resistance, open circuit Exhaust gas recirculation valve bank 2 actuator failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the bank 2 exhaust gas recirculation control circuit for short circuit to ground, short circuit to power, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect exhaust gas recirculation control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0504-27	Brake Switch A / B Correlation - Signal rate of change above threshold	 <p>NOTE: - Circuit BRAKE_SW_1 - BRAKE_SW_2 -</p> <ul style="list-style-type: none"> Brake pedal switch plunger failure Brake pedal switch not fitted correctly Brake switch A failure 	<ul style="list-style-type: none"> Check for related brake pressure DTCs within the anti-lock braking control module Check brake pedal switch is fitted correctly Check and install a new brake switch as required. Clear DTC, start the engine press the brake pedal, using maximum travel for greater than 1 second taking care not to press the accelerator pedal. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0504-62	Brake Switch A / B Correlation - Signal compare failure	 <p>NOTE: - Circuit BRAKE_SW_1 - BRAKE_SW_2 -</p> <ul style="list-style-type: none"> Error check for Brake Plausibility 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check brake pedal switch circuit for short circuit to power, open circuit

		<ul style="list-style-type: none"> Brake pedal switch circuit short circuit to power, open circuit 	
P050E-00	Cold Start Engine Exhaust Temperature Too Low - No sub type information	<ul style="list-style-type: none"> Engine coolant temperature sensor circuit short circuit to ground, short circuit to power, open circuit, disconnected Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check engine coolant temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new engine coolant temperature sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0512-24	Starter Request Circuit - Signal stuck high	 NOTE: - Circuit CRANK - <ul style="list-style-type: none"> The engine control module measures a signal that remains high when transitions are expected Harness fault - starter request circuit fault Central junction box fault Post drive cycle not completed Harness fault - CAN circuit 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects the engine crank signal from the central junction box is stuck high. If this DTC is logged on its own clear the DTC using the manufacturer approved diagnostic system. Select PARK position. Set ignition OFF, wait 2 minutes for post drive to complete. Set ignition ON but do NOT crank. Wait 25 seconds. Crank engine and check if DTC is cleared. If this DTC is logged with lost communication DTCs refer to electrical circuit diagrams and check CAN circuit. If the engine cannot be cranked read the DTCs stored in the central junction box and refer to the relevant DTC index. Check the engine crank signal input circuit for open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Repair wiring harness as required. Clear DTC and retest
P0513-00	Incorrect Immobilizer Key - No sub type information	<ul style="list-style-type: none"> Security key invalid 	<ul style="list-style-type: none"> Check for CAN network interference/engine control module related error. Re-configure the engine control module using the manufacturer approved diagnostic system. Re-configure the instrument panel control module using the manufacturer approved diagnostic system
P0528-00	Fan Speed Sensor Circuit No Signal - No sub type information	 NOTE: - Circuit CFM - <ul style="list-style-type: none"> Harness fault - cooling fan monitor circuit 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Fan Speed Indicated (0x0702). This DTC is set when the engine control module does not receive a signal on the cooling fan monitor circuit. Check the cooling fan monitor signal input circuit for open circuits, short circuit to power, short circuit to ground or other circuits. Repair wiring harness as required. Clear DTC and retest
P052F-00	Glow Plug Control Module System Voltage - No sub type information	<ul style="list-style-type: none"> Glow plug control module circuit short circuit to ground, short circuit to power, open circuit, disconnected Glow plug control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check glow plug control module circuit for short circuit to ground, short circuit to power, open circuit, disconnected Check and install a new glow plug control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0544-00	Exhaust Gas Temperature Sensor Circuit - Bank 1 Sensor 1 - No sub type	 NOTE: - Circuit STOT -	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for

	information	<ul style="list-style-type: none"> Exhaust gas temperature sensor, bank 1 sensor 1 circuit short circuit to ground Exhaust gas temperature sensor, bank 1 sensor 1 circuit short circuit to power Exhaust gas temperature sensor, bank 1 sensor 1 circuit high resistance Exhaust gas temperature sensor, bank 1 sensor 1 circuit open circuit Exhaust gas temperature sensor, bank 1 sensor 1 circuit disconnected Exhaust gas temperature sensor, bank 1 sensor 1 failure 	<ul style="list-style-type: none"> short circuit to ground Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for short circuit to power Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for high resistance Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for open circuit Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas temperature sensor, bank1 sensor 1 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0545-00	Exhaust Gas Temperature Sensor Circuit Low - Bank 1 Sensor 1 - No sub type information	 NOTE: - Circuit STOT - <ul style="list-style-type: none"> Exhaust gas temperature sensor, bank 1 sensor 1 circuit short circuit to ground Exhaust gas temperature sensor, bank 1 sensor 1 circuit high resistance Exhaust gas temperature sensor, bank 1 sensor 1 circuit open circuit Exhaust gas temperature sensor, bank 1 sensor 1 circuit disconnected Exhaust gas temperature sensor, bank 1 sensor 1 failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for short circuit to ground Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for high resistance Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for open circuit Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for disconnected. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas temperature sensor, bank1 sensor 1 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0546-00	Exhaust Gas Temperature Sensor Circuit High - Bank 1 Sensor 1 - No sub type information	 NOTE: - Circuit STOT - <ul style="list-style-type: none"> Exhaust gas temperature sensor, bank 1 sensor 1 circuit short circuit to power Exhaust gas temperature sensor, bank 1 sensor 1 failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Check and install a new exhaust gas temperature sensor, bank1 sensor 1 as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0571-62	Brake Switch A Circuit - Signal compare failure	<ul style="list-style-type: none"> The brake switch signal received over CAN is defective Brake switch (footbrake switch) failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system carry out network integrity test Check for related DTCs and refer to the relevant DTC index Check and install a new brake switch as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0571-	Brake Switch A Circuit -	<ul style="list-style-type: none"> Brake pedal pressed 	<ul style="list-style-type: none"> Ensure driver has not lightly pressed

68	Event information	<p>by driver at same time as accelerator pedal pressed</p> <ul style="list-style-type: none"> • Brake pedal switch - Circuit Brake_SW_1 - short circuit to power • Brake switch (footbrake switch) failure 	<p>brake pedal and accelerator pedal at the same time</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check Brake switch - Circuit Brake_SW_1 - for short circuit to power. Repair wiring harness as required, Clear the DTCs, drive the vehicle at greater than 11mph (17kph) with a throttle pedal greater than 10% for greater than 3 seconds. Press the brake pedal, using maximum travel for greater than 3 seconds, with the vehicle stationary, press the brake pedal using maximum travel for greater than 1 second • Check and install a new brake switch as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0575-81	Cruise Control Input Circuit - Invalid serial data received	<ul style="list-style-type: none"> • The DTC sets whenever the cancel, set minus, set plus, resume, headway increase and headway decrease speed control buttons have been pressed for longer than a calibrated period of time. The system then assumes a stuck/damaged button and will cancel and/or disable cruise. The failure will be healed in the next driving cycle if the fault is removed 	<ul style="list-style-type: none"> • Check speed control buttons are not jammed/contaminated/damaged. Check speed control module for related DTCs and refer to the relevant DTC index
P0602-00	Powertrain Control Module Programming Error - No sub type information	<ul style="list-style-type: none"> • Mismatch between car configuration file and engine control module calibration for expected engine power output • Incorrect engine control module calibration for vehicle specification 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system re-configure the engine control module. Clear the DTC and retest the system
P0605-00	Internal Control Module Read Only Memory (ROM) Error - No sub type information	<ul style="list-style-type: none"> • Corrupt engine control module software flash • Engine control module power supply fault • Engine control module ground supply fault • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system re-configure the engine control module • Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0606-00	Control Module Processor - No sub type information	<ul style="list-style-type: none"> • Corrupt engine control module software flash • Engine control module power supply fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system re-configure the engine control module • Refer to the electrical circuit diagrams







		<ul style="list-style-type: none"> • Engine control module ground supply fault • Engine control module failure 	<p>and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0606-44	Control Module Processor - Data memory failure	<ul style="list-style-type: none"> • Corrupt engine control module software flash • Engine control module power supply fault • Engine control module ground supply fault • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system re-configure the engine control module • Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0606-49	Control Module Processor - Internal electronic failure	<ul style="list-style-type: none"> • Corrupt engine control module software flash • Engine control module power supply fault • Engine control module ground supply fault • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system re-configure the engine control module • Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0607-00	Control Module Performance - No sub type information	<ul style="list-style-type: none"> • Corrupt engine control module software flash • Engine control module power supply fault • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system re-configure the engine control module • Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P060A-00	Internal Control Module Monitoring Processor Performance - No sub type information	<ul style="list-style-type: none"> • Engine control module has reset due to hardware fault 	<ul style="list-style-type: none"> • Check engine control module power and ground supply circuits for open circuits. Re-configure the engine control module using the manufacturer

			<p>approved diagnostic system, clear the DTC and retest the system</p> <ul style="list-style-type: none"> If the DTC resets suspect the engine control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P060A-16	Internal Control Module Monitoring Processor Performance - Circuit voltage below threshold	<ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Corrupt engine control module software flash Engine control module power supply fault Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P060A-17	Internal Control Module Monitoring Processor Performance - Circuit voltage above threshold	<ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P060B-00	Internal Control Module A/D Processing Performance - No sub type information	<ul style="list-style-type: none"> Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P060B-16	Internal Control Module A/D Processing Performance - Circuit voltage below threshold	<ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Corrupt engine control module software flash Engine control module power supply fault Engine control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair

		<ul style="list-style-type: none"> ground supply fault Engine control module failure 	<p>wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P060B-17	Internal Control Module A/D Processing Performance - Circuit voltage above threshold	<ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P060B-46	Internal Control Module A/D Processing Performance - Calibration / parameter memory failure	<ul style="list-style-type: none"> Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P060B-49	Internal Control Module A/D Processing Performance - Internal electronic failure	<ul style="list-style-type: none"> Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P060B-63	Internal Control Module A/D Processing Performance - Circuit / component protection time-out	<ul style="list-style-type: none"> Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair

		<ul style="list-style-type: none"> Engine control module failure 	<p>wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P060C-00	Internal Control Module Main Processor Performance - No sub type information	<ul style="list-style-type: none"> Engine control module has reset due to hardware or software fault 	<ul style="list-style-type: none"> Clear DTC and road test vehicle including at least 5 ignition cycles. Re-check DTC and repeat above procedure. If DTC resets suspect engine control module. Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P060D-00	Internal Control Module Accelerator Pedal Position Performance - No sub type information	<ul style="list-style-type: none"> Accelerator pedal position sensor circuit, short circuit to ground, short circuit to power, high resistance, open circuit Accelerator pedal position sensor failure Engine control module failure 	<ul style="list-style-type: none"> The Accelerator Pedal Position sensor consists of two potentiometer circuits feeding independent pedal demand signals to the engine control module. Refer to the electrical circuit diagrams and check the reference voltage and ground connections to the Accelerator pedal position sensor. Check signal circuits for high resistance, open circuits, short circuit to power, short circuit to ground. clear DTC and retest system If there are no wiring faults suspect the accelerator pedal position sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0610-00	Control Module Vehicle Options Error - No sub type information	<ul style="list-style-type: none"> Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0615-00	Starter Relay Circuit - No sub type information	 <p>NOTE: - Circuit STARTER_RELAY_HIGH - STARTER_RELAY_LOW -</p>	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams

		<ul style="list-style-type: none"> • Corrupt engine control module software flash • Engine control module power supply fault • Engine control module ground supply fault • Engine control module failure 	<p>and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P061A-00	Internal Control Module Torque Performance - No sub type information	<ul style="list-style-type: none"> • Manifold air flow sensor failure • Electric throttle unit failure 	<ul style="list-style-type: none"> • Check and install a new manifold air flow sensor as required • Check and install a new electric throttle unit as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P061B-00	Internal Control Module Torque Calculation Performance - No sub type information	<ul style="list-style-type: none"> • Manifold air flow sensor failure • Electric throttle unit failure 	<ul style="list-style-type: none"> • Check and install a new manifold air flow sensor as required • Check and install a new electric throttle unit as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P061C-00	Internal Control Module Engine RPM Performance - No sub type information	<ul style="list-style-type: none"> • Corrupt engine control module software flash • Engine control module power supply fault • Engine control module ground supply fault • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system re-configure the engine control module • Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P061C-11	Internal Control Module Engine RPM Performance - Circuit short to ground	<ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Internal fault within engine control module - engine speed output short to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the power and ground supplies to the engine control module
P061C-12	Internal Control Module Engine RPM Performance - Circuit short to battery	<ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the power and ground supplies to the engine control module

		<p>power measurement when another value was expected</p> <ul style="list-style-type: none"> Internal fault within engine control module - engine speed output short to power 	
P061C-13	Internal Control Module Engine RPM Performance - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Internal fault within engine control module - engine speed output open circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power and ground supplies to the engine control module
P0620-00	Generator Control Circuit - No sub type information	<ul style="list-style-type: none"> Electrical fault has been detected by the generator and reported to the engine control module by LIN bus Generator failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the generator circuit, for short circuit to power, short circuit to ground, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new generator as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0627-13	Fuel Pump A Control Circuit / Open - Circuit open	 <p>NOTE: - Circuit LIFT_PUMP_RELAY_CTRL -</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Wiring harness fault between engine control module and auxiliary junction box Lift pump relay fault 	 <p>NOTE: When this DTC is set the engine control module limits engine torque to protect the engine and avoid pulling air into the fuel system under high load</p> <ul style="list-style-type: none"> Check the operation of the lift pump relay. Replace if required. Refer to the electrical circuit diagrams and check the fuel lift pump relay control circuit between the engine control module and the rear junction box for open circuit. Repair wiring harness as required. Clear DTC and retest
P0628-11	Fuel Pump A Control Circuit Low - Circuit short to ground	 <p>NOTE: - Circuit LIFT_PUMP_RELAY_CTRL -</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Wiring harness fault between engine control module and auxiliary junction box Lift pump relay fault 	 <p>NOTE: When this DTC is set the fuel lift pump will run continuously when the ignition is on, even when the engine is stopped</p> <ul style="list-style-type: none"> Check the operation of the lift pump relay. Replace if required. Refer to the electrical circuit diagrams and check the fuel lift pump relay control circuit between the engine control module and the auxiliary junction box for a short circuit to ground. Repair wiring harness as required. Clear DTC and retest
P0629-12	Fuel Pump A Control Circuit High - Circuit short to battery	 <p>NOTE: - Circuit LIFT_PUMP_RELAY_CTRL -</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a 	 <p>NOTE: When this DTC is set the engine control module limits engine torque to protect the engine and avoid pulling air into the fuel system under high load</p> <ul style="list-style-type: none"> Check the operation of the lift pump relay. Replace if required. Refer to the

		<p>period longer than expected or has detected a vehicle power measurement when another value was expected</p> <ul style="list-style-type: none"> • Wiring harness fault between engine control module and auxiliary junction box • Lift pump relay fault 	<p>electrical circuit diagrams and check the fuel lift pump relay control circuit between the engine control module and the auxiliary junction box for a short circuit to power. Repair wiring harness as required. Clear DTC and retest</p>
P062A-92	Fuel Pump A Control Circuit Range/Performance - Performance or incorrect operation	<ul style="list-style-type: none"> • Lift pump relay has been driven by the auxiliary junction, but has not been requested by the engine control module • Lift pump relay has been requested by the engine control module, but has not been driven by the auxiliary junction box • Wiring harness fault lift pump monitor circuit • Lift pump relay 	<ul style="list-style-type: none"> • Check for related DTCs within the rear junction box • Refer to the electrical circuit diagrams and check fuel lift pump relay circuit for short circuit to ground, short circuit to power, open circuit. Refer to the electrical circuit diagrams and check between the engine control module and the auxiliary junction box for short circuit to ground • Refer to the electrical circuit diagrams and check the rear junction box to low pressure in tank fuel pump relay for short circuit to power • Check and install a new fuel lift pump relay as required. Clear DTC and retest
P062B-00	Internal Control Module Fuel Injector Control Performance - No sub type information	<ul style="list-style-type: none"> • Injector failure(s) • Corrupt engine control module software flash • Engine control module power supply fault • Engine control module ground supply fault • Engine control module failure 	<ul style="list-style-type: none"> • Check for related injector DTCs and repair these first. Clear DTCs and retest • Using the manufacturer approved diagnostic system re-configure the engine control module • Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062B-41	Internal Control Module Fuel Injector Control Performance - General checksum failure	<ul style="list-style-type: none"> • Injector failure(s) • Corrupt engine control module software flash • Engine control module power supply fault • Engine control module ground supply fault • Engine control module failure 	<ul style="list-style-type: none"> • Check for related injector DTCs and repair these first. Clear DTCs and retest • Using the manufacturer approved diagnostic system re-configure the engine control module • Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062B-48	Internal Control Module Fuel Injector Control	<ul style="list-style-type: none"> • Injector failure(s) • Corrupt engine control 	<ul style="list-style-type: none"> • Check for related injector DTCs and repair these first. Clear DTCs and

	Performance - Supervision software failure	<ul style="list-style-type: none"> module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> retest Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062B-49	Internal Control Module Fuel Injector Control Performance - Internal electronic failure	<ul style="list-style-type: none"> Injector failure(s) Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Check for related injector DTCs and repair these first. Clear DTCs and retest Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062B-61	Internal Control Module Fuel Injector Control Performance - Signal calculation failure	<ul style="list-style-type: none"> Injector failure(s) Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Check for related injector DTCs and repair these first. Clear DTCs and retest Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062B-62	Internal Control Module Fuel Injector Control Performance - Signal compare failure	<ul style="list-style-type: none"> Injector failure(s) Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Check for related injector DTCs and repair these first. Clear DTCs and retest Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair

			<p>wiring harness as required. Clear DTC and retest</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062B-64	Internal Control Module Fuel Injector Control Performance - Signal plausibility failure	<ul style="list-style-type: none"> Injector failure(s) Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Check for related injector DTCs and repair these first. Clear DTCs and retest Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062B-67	Internal Control Module Fuel Injector Control Performance - Signal incorrect after event	<ul style="list-style-type: none"> Injector failure(s) Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Check for related injector DTCs and repair these first. Clear DTCs and retest Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062B-91	Internal Control Module Fuel Injector Control Performance - Parametric	<ul style="list-style-type: none"> Injector failure(s) Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Check for related injector DTCs and repair these first. Clear DTCs and retest Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest

			<ul style="list-style-type: none"> • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062B-92	Internal Control Module Fuel Injector Control Performance - Performance or incorrect operation	<ul style="list-style-type: none"> • Injector failure(s) • Corrupt engine control module software flash • Engine control module power supply fault • Engine control module ground supply fault • Engine control module failure 	<ul style="list-style-type: none"> • Check for related injector DTCs and repair these first. Clear DTCs and retest • Using the manufacturer approved diagnostic system re-configure the engine control module • Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062B-94	Internal Control Module Fuel Injector Control Performance - Unexpected operation	<ul style="list-style-type: none"> • Injector failure(s) • Corrupt engine control module software flash • Engine control module power supply fault • Engine control module ground supply fault • Engine control module failure 	<ul style="list-style-type: none"> • Check for related injector DTCs and repair these first. Clear DTCs and retest • Using the manufacturer approved diagnostic system re-configure the engine control module • Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062B-9A	Internal Control Module Fuel Injector Control Performance - Component or system operating conditions	<ul style="list-style-type: none"> • Injector failure(s) • Corrupt engine control module software flash • Engine control module power supply fault • Engine control module ground supply fault • Engine control module failure 	<ul style="list-style-type: none"> • Check for related injector DTCs and repair these first. Clear DTCs and retest • Using the manufacturer approved diagnostic system re-configure the engine control module • Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component

P062D-00	Fuel Injector Driver Circuit Performance Bank 1 - No sub type information	<ul style="list-style-type: none"> Bank 1 injector circuit(s) high resistance, short circuit to ground, short circuit to power, high resistance, open circuit, disconnected Injector bank 1 failure 	<ul style="list-style-type: none"> Check for related Injector DTCs. Check injector connections to Bank 1 cylinders. Refer to the electrical circuit diagrams and check Bank 1 injector circuits for short circuit to ground, short circuit to power, open circuit, high resistance. Clear DTC and retest. If DTC remains, disconnect engine control module connector, and with injector(s) connected check resistance across injector pins, this should be no higher than the injector resistance Check and install new injector(s) as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062D-11	Fuel Injector Driver Circuit Performance Bank 1 - Circuit short to ground	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Wiring harness fault - short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the wiring harness between engine control module and bank 1 fuel injectors for short circuit to ground
P062D-16	Fuel Injector Driver Circuit Performance Bank 1 - Circuit voltage below threshold	<ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Bank 1 injector circuit(s) high resistance, short circuit to ground, high resistance, open circuit, disconnected Injector bank 1 failure 	<ul style="list-style-type: none"> Check for related injector DTCs. Check injector connections to Bank 1 cylinders. Refer to the electrical circuit diagrams and check Bank 1 injector circuits for short circuit to ground, open circuit, high resistance. Clear DTC and retest. If DTC remains, disconnect engine control module connector, and with injector(s) connected check resistance across injector pins, this should be no higher than the injector resistance Check and install new injector(s) as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062D-17	Fuel Injector Driver Circuit Performance Bank 1 - Circuit voltage above threshold	<ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Bank 1 injector circuit(s) short circuit to power Injector bank 1 failure 	<ul style="list-style-type: none"> Check for related injector DTCs. Check injector connections to Bank 1 cylinders. Refer to the electrical circuit diagrams and check Bank 1 injector circuits for short circuit to power. Clear DTC and retest. If DTC remains, disconnect engine control module connector, and with injector(s) connected check resistance across injector pins, this should be no higher than the injector resistance Check and install new injector(s) as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062E-00	Fuel Injector Driver Circuit Performance Bank 2 - No sub type information	<ul style="list-style-type: none"> Bank 2 injector circuit(s) high resistance, short circuit to ground, short circuit to power, high resistance, open circuit, disconnected Injector bank 2 failure 	<ul style="list-style-type: none"> Check for related injector DTCs. Check injector connections to Bank 2 cylinders. Refer to the electrical circuit diagrams and check Bank 2 injector circuits for short circuit to ground, short circuit to power, open circuit, high resistance. Clear DTC and retest. If DTC remains, disconnect engine control module connector, and with injector(s) connected check resistance across injector pins, this should be no


			<ul style="list-style-type: none"> higher than the injector resistance • Check and install new injector(s) as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P062E-11	Fuel Injector Driver Circuit Performance Bank 2 - Circuit short to ground	<ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Wiring harness fault - short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the wiring harness between engine control module and bank 2 fuel injectors for short circuit to ground
P062E-17	Fuel Injector Driver Circuit Performance Bank 2 - Circuit voltage above threshold	<ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Bank 2 injector circuit(s) short circuit to power • Injector bank 2 failure 	<ul style="list-style-type: none"> • Check for related injector DTCs. Check injector connections to Bank 2 cylinders. Refer to the electrical circuit diagrams and check Bank 2 injector circuits for short circuit to power. Clear DTC and retest. If DTC remains, disconnect ECM connector, and with injector(s) connected check resistance across injector pins, this should be no higher than the injector resistance • Check and install new injector(s) as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0633-00	Immobilizer Key Not Programmed - ECM/PCM - No sub type information	<ul style="list-style-type: none"> • Security key not programmed 	<ul style="list-style-type: none"> • Check for CAN network interference/engine control module related error. Re-configure the engine control module using the manufacturer approved diagnostic system. Re-configure the instrument panel control module using the manufacturer approved diagnostic system
P0634-1B	Control Module Internal Temperature "A" Too High - Circuit resistance above threshold	<ul style="list-style-type: none"> • Engine control module internal temperature too high • Engine control module failure 	<ul style="list-style-type: none"> • Clear DTC, wait 10 minutes and re-check • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P064C-00	Glow Plug Control Module - No sub type information	<ul style="list-style-type: none"> • Glow plug control module circuit short circuit to ground, short circuit to power, open circuit, disconnected • Glow plug control module failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check glow plug control module circuit for short circuit to ground, short circuit to power, open circuit, disconnected • Check and install a new glow plug control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P064D-00	Internal Control Module O2 Sensor Processor Performance - Bank 1 - No sub type information	<ul style="list-style-type: none"> • Pre catalyst oxygen sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit • Pre catalyst oxygen sensor failure • Engine control module failure 	<ul style="list-style-type: none"> • Check and repair related Heated Exhaust Gas Oxygen sensor DTCs. Refer to the electrical circuit diagrams and check Heated Exhaust Gas Oxygen sensor for short circuit to ground, short circuit to power, high resistance, open circuit • Check and install a new Heated Exhaust Gas Oxygen sensor as required. Clear DTC and recheck


			If DTC remains, suspect engine control module fault. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P064D-16	Internal Control Module O2 Sensor Processor Performance - Bank 1 - Circuit voltage below threshold	<ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Pre catalyst oxygen sensor circuit short circuit to ground, high resistance, open circuit Pre catalyst oxygen sensor failure Engine control module failure 	<ul style="list-style-type: none"> Check and repair related Heated Exhaust Gas Oxygen sensor DTCs. Refer to the electrical circuit diagrams and check Heated Exhaust Gas Oxygen sensor for short circuit to ground, high resistance, open circuit Check and install a new Heated Exhaust Gas Oxygen sensor as required. Clear DTC and recheck If DTC remains, suspect engine control module fault. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0658-00	Actuator Supply Voltage A Circuit Low - No sub type information	<ul style="list-style-type: none"> Actuator supply circuit voltage below threshold 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system perform the (Turbo, EGR and air path dynamic test) routine Refer to the electrical circuit diagrams and check engine control module power and ground supplies for short circuit to ground, open circuit
P0659-00	Actuator Supply Voltage A Circuit High - No sub type information	<ul style="list-style-type: none"> Actuator supply circuit voltage above threshold 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system perform the (Turbo, EGR and air path dynamic test) routine Refer to the electrical circuit diagrams and check engine control module power and ground supplies for short circuit to power
P065A-00	Generator System Performance - No sub type information	<ul style="list-style-type: none"> Generator circuit short circuit to ground, high resistance, open circuit Generator mechanical failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check generator circuit for short circuit to ground, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new generator as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P065B-16	Generator Control Circuit Range/Performance - Circuit voltage below threshold	<ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Charging circuit short circuit to ground, short circuit to power, open circuit Quiescent current high Battery failure/worn out Generator failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check charging circuit for short circuit to ground, short circuit to power, open circuit. Clear DTC and repeat automated diagnostic procedure using the manufacturer approved diagnostic system If DTC remains check battery is in fully charged and serviceable condition using the Midtronics battery tester and battery care manual. If ok suspect the generator Check and install a new generator as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P065B-17	Generator Control Circuit Range/Performance - Circuit voltage above threshold	<ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Generator circuit short 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check generator circuit for short circuit to ground, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new generator as required. Refer to the warranty policy




		<p>circuit to ground, high resistance, open circuit</p> <ul style="list-style-type: none"> Generator mechanical failure 	<p>and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p>
P0668-00	PCM / ECM / TCM Internal Temperature Sensor A Circuit Low - No sub type information	<ul style="list-style-type: none"> Engine control module internal temperature sensor failure 	<ul style="list-style-type: none"> Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0669-00	PCM / ECM / TCM Internal Temperature Sensor A Circuit High - No sub type information	<ul style="list-style-type: none"> Engine control module internal temperature sensor failure 	<ul style="list-style-type: none"> Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P066A-00	Cylinder 1 Glow Plug Control Circuit Low - No sub type information	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Harness fault - cylinder 1 glow plug circuit short circuit to ground Component fault - glow plug failure Component fault - glow plug control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the glow plug control circuit between the glow plug control module and the glow plug connector for short circuit to ground, check the power supply and ground connections to the glow plug control module, ensure that the harness is checked for intermittent faults. Repair harness as required. Refer to relevant section of workshop manual, check cylinder 1 glow plug for internal short circuit to ground. Replace glow plug if required. clear DTC and retest system If DTC resets suspect glow plug control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P066C-00	Cylinder 2 Glow Plug Control Circuit Low - No sub type information	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Harness fault - cylinder 2 glow plug circuit short circuit to ground Component fault - glow plug failure Component fault - glow plug control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the glow plug control circuit between the glow plug control module and the glow plug connector for short circuit to ground, check the power supply and ground connections to the glow plug control module, ensure that the harness is checked for intermittent faults. Repair harness as required. Refer to relevant section of workshop manual, check cylinder 2 glow plug for internal short circuit to ground. Replace glow plug if required. clear DTC and retest system If DTC resets suspect glow plug control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P066E-00	Cylinder 3 Glow Plug Control Circuit Low - No sub type information	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Harness fault - cylinder 3 glow plug circuit short circuit to ground Component fault - glow plug failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the glow plug control circuit between the glow plug control module and the glow plug connector for short circuit to ground, check the power supply and ground connections to the glow plug control module, ensure that the harness is checked for intermittent faults. Repair harness as required. Refer to relevant section of workshop manual, check cylinder 3 glow plug for internal short circuit to ground. Replace glow plug if required. clear DTC and retest system If DTC resets suspect glow plug control


		Component fault - glow plug control module failure	module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0671-00	Cylinder 1 Glow Plug Circuit / Open - No sub type information	<ul style="list-style-type: none"> • Cylinder 1 glow plug control circuit high resistance • Cylinder 1 glow plug control circuit disconnected • Cylinder 1 glow plug failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check cylinder 1 glow plug circuit for high resistance. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check cylinder 1 glow plug circuit for high resistance. Repair wiring harness as required. Clear DTC and retest • Check and install a new cylinder 1 glow plug as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0672-00	Cylinder 2 Glow Plug Circuit / Open - No sub type information	<ul style="list-style-type: none"> • Cylinder 2 glow plug control circuit high resistance • Cylinder 2 glow plug control circuit disconnected • Cylinder 2 glow plug failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check cylinder 2 glow plug circuit for high resistance. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check cylinder 2 glow plug circuit for high resistance. Repair wiring harness as required. Clear DTC and retest • Check and install a new cylinder 2 glow plug as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0673-00	Cylinder 3 Glow Plug Circuit / Open - No sub type information	<ul style="list-style-type: none"> • Cylinder 3 glow plug control circuit high resistance • Cylinder 3 glow plug control circuit disconnected • Cylinder 3 glow plug failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check cylinder 3 glow plug circuit for high resistance. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check cylinder 3 glow plug circuit for high resistance. Repair wiring harness as required. Clear DTC and retest • Check and install a new cylinder 3 glow plug as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0674-00	Cylinder 4 Glow Plug Circuit / Open - No sub type information	<ul style="list-style-type: none"> • Cylinder 4 glow plug control circuit high resistance • Cylinder 4 glow plug control circuit disconnected • Cylinder 4 glow plug failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check cylinder 4 glow plug circuit for high resistance. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check cylinder 4 glow plug circuit for high resistance. Repair wiring harness as required. Clear DTC and retest • Check and install a new cylinder 4 glow plug as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0675-	Cylinder 5 Glow Plug	<ul style="list-style-type: none"> • Cylinder 5 glow plug 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams



00	Circuit / Open - No sub type information	<ul style="list-style-type: none"> control circuit high resistance Cylinder 5 glow plug control circuit disconnected Cylinder 5 glow plug failure 	<ul style="list-style-type: none"> and check cylinder 5 glow plug circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check cylinder 5 glow plug circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Check and install a new cylinder 5 glow plug as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0676-00	Cylinder 6 Glow Plug Circuit / Open - No sub type information	<ul style="list-style-type: none"> Cylinder 6 glow plug control circuit high resistance Cylinder 6 glow plug control circuit disconnected Cylinder 6 glow plug failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check cylinder 6 glow plug circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check cylinder 6 glow plug circuit for high resistance. Repair wiring harness as required. Clear DTC and retest Check and install a new cylinder 6 glow plug as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P067A-00	Cylinder 4 Glow Plug Control Circuit Low - No sub type information	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Harness fault - cylinder 4 glow plug circuit short circuit to ground Component fault - glow plug failure Component fault - glow plug control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the glow plug control circuit between the glow plug control module and the glow plug connector for short circuit to ground, check the power supply and ground connections to the glow plug control module, ensure that the harness is checked for intermittent faults. Repair harness as required. Refer to relevant section of workshop manual, check cylinder 4 glow plug for internal short circuit to ground. Replace glow plug if required. clear DTC and retest system If DTC resets suspect glow plug control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P067C-00	Cylinder 5 Glow Plug Control Circuit Low - No sub type information	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Harness fault - cylinder 5 glow plug circuit short circuit to ground Component fault - glow plug failure Component fault - glow plug control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the glow plug control circuit between the glow plug control module and the glow plug connector for short circuit to ground, check the power supply and ground connections to the glow plug control module, ensure that the harness is checked for intermittent faults. Repair harness as required. Refer to relevant section of workshop manual, check cylinder 5 glow plug for internal short circuit to ground. Replace glow plug if required. clear DTC and retest system If DTC resets suspect glow plug control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P067E-00	Cylinder 6 Glow Plug Control Circuit Low - No	<ul style="list-style-type: none"> The engine control module has detected a 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the glow plug control circuit


	sub type information	<p>ground measurement for a period longer than expected or has detected a ground measurement when another value was expected</p> <ul style="list-style-type: none"> • Harness fault - cylinder 6 glow plug circuit short circuit to ground • Component fault - glow plug failure • Component fault - glow plug control module failure 	<p>between the glow plug control module and the glow plug connector for short circuit to ground, check the power supply and ground connections to the glow plug control module, ensure that the harness is checked for intermittent faults. Repair harness as required. Refer to relevant section of workshop manual, check cylinder 6 glow plug for internal short circuit to ground. Replace glow plug if required. clear DTC and retest system</p> <ul style="list-style-type: none"> • If DTC resets suspect glow plug control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P0683-00	Glow Plug Control Module to PCM Communication Circuit - No sub type information	 <p>NOTE: - Circuit GLOWPLUG_CTRL -</p> <ul style="list-style-type: none"> • Harness fault - Engine control module to glow plug control module • Glow plug control module failure • Engine control module failure 	<ul style="list-style-type: none"> • This DTC is set when the data transmission on the control circuit between the engine control module and the glow plug control module has an error. Check for other related DTCs and refer to the relevant DTC index table. Refer to the electrical circuit diagrams and check the glowplug control signal line from the engine control module to the glow plug control module for faults such as intermittent open circuits, high resistance, short circuit to ground, short circuit to power. Check the glowplug monitor signal line from the glowplug control module to the engine control module for intermittent open circuits, high resistance, short circuit to ground, short circuit to power • Refer to the electrical circuit diagrams and check power and ground supplies to the glowplug control module. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P068A-00	ECM/PCM Power Relay De-Energized - Too Early - No sub type information	<ul style="list-style-type: none"> • Vehicle battery disconnected before engine management system relay has powered down • Engine management system high current relay fault • Central junction box fault • Harness fault - relay control circuit 	<ul style="list-style-type: none"> • This DTC is set when the engine management system high current relay contacts open early - indicating a power hold fault. Check the vehicle battery has not been disconnected before the engine management system relay has powered down. Check the operation of the engine management system high current relay. Refer to the electrical circuit diagrams and check the engine management system high current relay supply and control circuits for open circuits, high resistance, short circuit to ground, short circuit to power, short circuit to other circuits. Repair the wiring harness • Check and install a new relay or central junction box as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P06AF-00	Torque Management System - Forced Engine Shutdown - No sub type information	<ul style="list-style-type: none"> • Injection cut off demand for shut off coordinator • The DTC sets when the engine speed has 	<ul style="list-style-type: none"> • Check for related engine control module DTCs and repair these first. Clear the DTC and retest


		<p>exceeded the hard engine speed limiter. When this DTC sets, a request to the shut-off coordinator is made for a reversible shut-off of the injection power stages, ensuring no injections take place. It gets reset when engine speed falls less than or equal to the hard limiter</p> <ul style="list-style-type: none"> • Engine run away • Excessive injected fuel • Over boost from a turbocharger 	
P0700-00	Transmission Control System (MIL Request) - No sub type information	<ul style="list-style-type: none"> • MIL request by automatic gearbox 	<ul style="list-style-type: none"> • Check transmission control module for DTCs and refer to the relevant DTC index. Clear DTC and retest
P0850-64	Park / Neutral Switch Input Circuit - Signal plausibility failure	 <p>NOTE: - Circuit PARK/NEUTRAL SW -</p> <ul style="list-style-type: none"> • Park neutral switch circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the park neutral switch circuit between the engine control module and the transmission control module and control valve body for short circuit to ground, short circuit to power, open circuit, high resistance
POA09-16	DC/DC Converter Status Circuit Low - Circuit voltage below threshold	<ul style="list-style-type: none"> • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Engine control module power supply fault • Engine control module ground supply fault • Engine control module failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
POA0F-00	Engine Failed to Start - No sub type information	<ul style="list-style-type: none"> • Engine control module has logged an extended crank with no engine start • Engine control module failure 	<ul style="list-style-type: none"> • Check for related engine control module DTCs and repair these first. Clear the DTC and retest. If this DTC remains alone suspect engine control module failure • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
POA10-17	DC/DC Converter Status Circuit High - Circuit voltage above threshold	<ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Corrupt engine control module software flash • Engine control module power supply fault • Engine control module ground supply fault • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system re-configure the engine control module • Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new engine control module as required. Refer to the




			warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
POA14-13	Engine Mount Control A Circuit / Open - Circuit open	 <p>NOTE: - Circuit AEM1 -</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Wiring harness fault - engine mount control A circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the engine mount A control circuit for open circuit. Repair wiring harness as required. Clear DTC and retest
POA15-11	Engine Mount Control A Circuit Low - Circuit short to ground	 <p>NOTE: - Circuit AEM1 -</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Wiring harness fault - engine mount control A circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the engine mount A control circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest
POA16-12	Engine Mount Control A Circuit High - Circuit short to battery	 <p>NOTE: - Circuit AEM1 -</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Wiring harness fault - engine mount control A circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the engine mount A control circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest
POA16-4B	Engine Mount Control A Circuit High - Over temperature	<ul style="list-style-type: none"> Engine mount control A circuit short circuit to ground, short circuit to power Engine mount control A failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check engine mount control A circuit for short circuit to ground, power. Repair wiring harness as required. Clear DTC and retest Check and install a new engine mount control A as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
POA1A-00	Generator Control Module - No sub type information	<ul style="list-style-type: none"> Generator to engine control module LIN circuit, open circuit Generator/engine control module failure 	<ul style="list-style-type: none"> Check for good/clean contact at generator and engine control module LIN circuit connectors/pins. Refer to the electrical circuit diagrams and check generator to engine control module LIN circuit for open circuit. Check for engine control module hardware DTCs and refer to relevant DTC index. Clear DTCs and repeat automated diagnostic procedure using the manufacturer approved diagnostic system Check and install a new generator /




			engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
POA1A-87	Generator Control Module - Missing message	<ul style="list-style-type: none"> Generator to engine control module LIN circuit open circuit 	<ul style="list-style-type: none"> Check for good/clean contact at generator and engine control module LIN circuit connectors/pins. Refer to the electrical circuit diagrams and check generator to engine control module LIN circuit for open circuit. Check for engine control module hardware DTCs and refer to relevant DTC index. Clear DTCs and repeat automated diagnostic procedure using the manufacturer approved diagnostic system
POA3B-00	Generator Over Temperature - No sub type information	<ul style="list-style-type: none"> Generator wiring/connectors heat damaged Generator circuit short circuit to ground, high resistance Generator failure 	<ul style="list-style-type: none"> Check the generator wiring and connectors for heat damage Refer to the electrical circuit diagrams and check generator wiring for short circuit to ground, high resistance. Repair wiring harness as required. Clear DTC and retest Check and install a new generator as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
POA94-00	DC/DC Converter Performance - No sub type information	 <p>NOTE: - Circuit SENSOR_SUPPLY_10 - SENSOR_SUPPLY_9 - SENSOR_SUPPLY_8 - 5V_SENSOR_SUPPLY_1 - 5V_SENSOR_SUPPLY_4 - 5V_SENSOR_SUPPLY_5 - 5V_SENSOR_SUPPLY_6 - 5V_SENSOR_SUPPLY_2 - 5V_SENSOR_SUPPLY_8</p> <ul style="list-style-type: none"> Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check the engine control module power supply for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check the engine control module ground supply for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P115A-00	Low Fuel Level - Forced Limited Power - No sub type information	<ul style="list-style-type: none"> Low level fuel condition Critical fuel level switch signal circuit - short circuit to ground, short circuit to power, open circuit Critical fuel level switch failure Fuel level sensor signal circuit - short circuit to ground, short circuit to power, open circuit Fuel level sensor failure 	<ul style="list-style-type: none"> Check the fuel level, add fuel if required and clear the DTC If there is sufficient fuel, refer to the electrical circuit diagrams and check the critical fuel level switch circuits for short, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new critical fuel level switch as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component If there is sufficient fuel, refer to the electrical circuit diagrams and check the fuel level sensor circuits for short, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new fuel level sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation,



			prior to the installation of a new module/component
P115A-68	Low Fuel Level - Forced Limited Power - Event information	<ul style="list-style-type: none"> • Low level fuel condition • Critical fuel level switch signal circuit - short circuit to ground, short circuit to power, open circuit • Critical fuel level switch failure • Fuel level sensor signal circuit - short circuit to ground, short circuit to power, open circuit • Fuel level sensor failure 	<ul style="list-style-type: none"> • Check the fuel level, add fuel if required and clear the DTC • If there is sufficient fuel, refer to the electrical circuit diagrams and check the critical fuel level switch circuits for short, open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new critical fuel level switch as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • If there is sufficient fuel, refer to the electrical circuit diagrams and check the fuel level sensor circuits for short, open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new fuel level sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P115B-00	Low Fuel Level - Forced Engine Shutdown - No subtype information	<ul style="list-style-type: none"> • Low level fuel condition enabling run dry strategy • Critical fuel level switch signal circuit - short circuit to ground, short circuit to power, open circuit • Critical fuel level switch failure • Fuel level sensor signal circuit - short circuit to ground, short circuit to power, open circuit • Fuel level sensor failure 	<ul style="list-style-type: none"> • Check the fuel level, add fuel if required and clear the DTC • If there is sufficient fuel, refer to the electrical circuit diagrams and check the critical fuel level switch circuits for short, open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new critical fuel level switch as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • If there is sufficient fuel, refer to the electrical circuit diagrams and check the fuel level sensor circuits for short, open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new fuel level sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P115F-11	Electronic Control Module Cooling Fan Circuit - Circuit short to ground	 NOTE: - Circuit EFC - <ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Harness fault - Engine control module cooling fan circuits • Cooling fan fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the engine control module cooling fan circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest • Check and install new cooling fan as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P115F-12	Electronic Control Module Cooling Fan Circuit - Circuit short to battery	 NOTE: - Circuit EFC -	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the engine control module cooling fan circuit for short circuit to




		<ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Harness fault - Engine control module cooling fan circuits 	<p>power. Repair wiring harness as required. Clear DTC and retest. Repair wiring harness as required. Clear DTC and retest</p>
P115F-13	Electronic Control Module Cooling Fan Circuit - Circuit open	 <p>NOTE: - Circuit EFC -</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Harness fault - Engine control module cooling fan circuits Cooling fan fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the engine control module cooling fan circuit for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install new cooling fan as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P115F-19	Electronic Control Module Cooling Fan Circuit - Circuit current above threshold	<ul style="list-style-type: none"> Engine control module cooling fan circuit short circuit to ground Engine control module cooling fan failure or obstructed 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the engine control module cooling fan circuit for short circuit to ground. Repair wiring harness as required. Clear DTC and retest Check engine control module cooling fan for obstruction. Check and install a new engine control module cooling fan as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P120F-00	Fuel Pressure Regulator Excessive Variation - No sub type information	<ul style="list-style-type: none"> Fuel pressure regulator signal circuit short circuit to ground, short circuit to power, open circuit Fuel pressure regulator VREF circuit high resistance Fuel pressure regulator failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check for fuel pump related DTCs Refer to the electrical circuit diagrams and check the fuel pressure regulator signal circuit for short circuit to ground, short circuit to power, open circuit. Repair wiring harness as required, clear DTC and retest system Refer to the electrical circuit diagrams and check the fuel pressure regulator VREF circuit for high resistance. Repair wiring harness as required, clear DTC and retest system Check and install new Fuel pressure regulator as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1247-00	Turbocharger Boost Pressure Low - No sub type information	<ul style="list-style-type: none"> Boost air recirculation solenoid stuck open in bi-turbo mode Boost air solenoid stuck closed in bi-turbo mode Turbine intake solenoid stuck open Air intake system, boost air system high pressure boost air leak on bank 1 	<ul style="list-style-type: none"> If this DTC is logged with P00BE-00, suspect boost air recirculation solenoid stuck open in bi-turbo mode If this DTC is logged with P00BC-00, suspect boost air solenoid stuck closed in bi-turbo mode If this DTC is logged with P0235-94, P00BD-07, P22D2-77 & P22CF-71 suspect turbine intake solenoid stuck open If this DTC is logged with P006A-00, P0402-00 & P00BF-07 suspect air



		<ul style="list-style-type: none"> • Air intake system, boost air system high pressure boost air leak in bi-turbo mode on bank 2 • Variable geometry turbocharger compressor wheel seized • Air intake system, low pressure intake blocked or restricted 	<p>intake system, boost air system high pressure boost air leak on bank 1</p> <ul style="list-style-type: none"> • If this DTC is logged with P006A-00 suspect air intake system, boost air system high pressure boost air leak in bi-turbo mode on bank 2 • If this DTC is logged with P00BE-07 & P00BD-07 suspect variable geometry turbocharger compressor wheel seized • If this DTC is logged with P0235-94, P00BD-07, P22D2-77 & P22CF-71 suspect Air intake system, low pressure intake blocked or restricted
P1334-00	EGR Throttle Position Sensor Minimum/Maximum Stop Performance - No sub type information	<ul style="list-style-type: none"> • Exhaust gas recirculation throttle position sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit • Exhaust gas recirculation throttle position sensor failure • Engine control module failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check exhaust gas recirculation throttle position sensor circuit for short circuit to ground, short circuit to power, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new exhaust gas recirculation throttle position sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P151B-00	Idle Speed Control - RPM Lower Than Expected - No sub type information	<ul style="list-style-type: none"> • Indicated torque at idle < minimum 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check for additional DTCs and refer to the relevant DTC index. Check engine oil level. Carry out cylinder compression tests. Check for mechanical failure of engine
P151C-00	Idle Speed Control - RPM Higher Than Expected - No sub type information	<ul style="list-style-type: none"> • Indicated torque at idle > maximum 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check for additional DTCs and refer to the relevant DTC index. Check engine oil level. Carry out cylinder compression tests. Check for mechanical failure of engine
P1551-32	Cylinder 1 Injector Circuit Range/Performance - Signal low time < minimum	 <p>NOTE: - Circuit INJ_1_PWR_OUT_LOW - INJ_1_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • Harness fault - injector control circuit fault • Injector failure • Engine control module failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects that the injector signal low time is less than the minimum value. Check the injector wiring harness for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits for intermittent faults, open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Repair wiring harness as required • If there are no wiring faults refer to the workshop manual and check the injector is to specification and has been installed correctly. Replace the injector as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • If there are no injector faults suspect the engine control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component


P1551-35	Cylinder 1 Injector Circuit Range/Performance - Signal high time > maximum	 <p>NOTE: - Circuit INJ_1_PWR_OUT_LOW - INJ_1_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • Harness fault - injector control circuit fault • Injector failure • Engine control module failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects that the injector signal low time is greater than the maximum value. Check the injector wiring harness for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits for intermittent faults, open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Repair wiring harness as required • If there are no wiring faults refer to the workshop manual and check the injector is to specification and has been installed correctly. Replace the injector as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • If there are no injector faults suspect the engine control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1552-32	Cylinder 2 Injector Circuit Range/Performance - Signal low time < minimum	 <p>NOTE: - Circuit INJ_2_PWR_OUT_LOW - INJ_2_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • Harness fault - injector control circuit fault • Injector failure • Engine control module failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects that the injector signal low time is less than the minimum value. Check the injector wiring harness for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits for intermittent faults, open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Repair wiring harness as required • If there are no wiring faults refer to the workshop manual and check the injector is to specification and has been installed correctly. Replace the injector as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • If there are no injector faults suspect the engine control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1552-35	Cylinder 2 Injector Circuit Range/Performance - Signal high time > maximum	 <p>NOTE: - Circuit INJ_2_PWR_OUT_LOW - INJ_2_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • Harness fault - injector control circuit fault • Injector failure • Engine control module failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects that the injector signal low time is greater than the maximum value. Check the injector wiring harness for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits for intermittent faults, open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Repair wiring harness as required • If there are no wiring faults refer to the workshop manual and check the injector is to specification and has been installed correctly. Replace the injector as required. Refer to the warranty policy and procedures manual, or determine if any prior approval



			<p>programme is in operation, prior to the installation of a new module/component</p> <ul style="list-style-type: none"> If there are no injector faults suspect the engine control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1553-32	Cylinder 3 Injector Circuit Range/Performance - Signal low time < minimum	 <p>NOTE: - Circuit INJ_3_PWR_OUT_LOW - INJ_3_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - injector control circuit fault Injector failure Engine control module failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects that the injector signal low time is less than the minimum value. Check the injector wiring harness for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits for intermittent faults, open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Repair wiring harness as required If there are no wiring faults refer to the workshop manual and check the injector is to specification and has been installed correctly. Replace the injector as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component If there are no injector faults suspect the engine control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1553-35	Cylinder 3 Injector Circuit Range/Performance - Signal high time > maximum	 <p>NOTE: - Circuit INJ_3_PWR_OUT_LOW - INJ_3_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - injector control circuit fault Injector failure Engine control module failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects that the injector signal low time is greater than the maximum value. Check the injector wiring harness for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits for intermittent faults, open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Repair wiring harness as required If there are no wiring faults refer to the workshop manual and check the injector is to specification and has been installed correctly. Replace the injector as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component If there are no injector faults suspect the engine control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1554-32	Cylinder 4 Injector Circuit Range/Performance - Signal low time < minimum	 <p>NOTE: - Circuit INJ_4_PWR_OUT_LOW - INJ_4_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - injector control circuit fault Injector failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects that the injector signal low time is less than the minimum value. Check the injector wiring harness for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits for intermittent faults, open



		<ul style="list-style-type: none"> Engine control module failure 	<p>circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Repair wiring harness as required</p> <ul style="list-style-type: none"> If there are no wiring faults refer to the workshop manual and check the injector is to specification and has been installed correctly. Replace the injector as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component If there are no injector faults suspect the engine control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1554-35	Cylinder 4 Injector Circuit Range/Performance - Signal high time > maximum	 <p>NOTE: - Circuit INJ_4_PWR_OUT_LOW - INJ_4_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - injector control circuit fault Injector failure Engine control module failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects that the injector signal low time is greater than the maximum value. Check the injector wiring harness for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits for intermittent faults, open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Repair wiring harness as required If there are no wiring faults refer to the workshop manual and check the injector is to specification and has been installed correctly. Replace the injector as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component If there are no injector faults suspect the engine control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1555-32	Cylinder 5 Injector Circuit Range/Performance - Signal low time < minimum	 <p>NOTE: - Circuit INJ_5_PWR_OUT_LOW - INJ_5_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> Harness fault - injector control circuit fault Injector failure Engine control module failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects that the injector signal low time is less than the minimum value. Check the injector wiring harness for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits for intermittent faults, open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Repair wiring harness as required If there are no wiring faults refer to the workshop manual and check the injector is to specification and has been installed correctly. Replace the injector as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component If there are no injector faults suspect the engine control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation,




			prior to the installation of a new module/component
P1555-35	Cylinder 5 Injector Circuit Range/Performance - Signal high time > maximum	 <p>NOTE: - Circuit INJ_5_PWR_OUT_LOW - INJ_5_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • Harness fault - injector control circuit fault • Injector failure • Engine control module failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects that the injector signal low time is greater than the maximum value. Check the injector wiring harness for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits for intermittent faults, open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Repair wiring harness as required • If there are no wiring faults refer to the workshop manual and check the injector is to specification and has been installed correctly. Replace the injector as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • If there are no injector faults suspect the engine control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1556-32	Cylinder 6 Injector Circuit Range/Performance - Signal low time < minimum	 <p>NOTE: - Circuit INJ_6_PWR_OUT_LOW - INJ_6_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • Harness fault - injector control circuit fault • Injector failure • Engine control module failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects that the injector signal low time is less than the minimum value. Check the injector wiring harness for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits for intermittent faults, open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Repair wiring harness as required • If there are no wiring faults refer to the workshop manual and check the injector is to specification and has been installed correctly. Replace the injector as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • If there are no injector faults suspect the engine control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1556-35	Cylinder 6 Injector Circuit Range/Performance - Signal high time > maximum	 <p>NOTE: - Circuit INJ_6_PWR_OUT_LOW - INJ_6_PWR_OUT_HIGH -</p> <ul style="list-style-type: none"> • Harness fault - injector control circuit fault • Injector failure • Engine control module failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects that the injector signal low time is greater than the maximum value. Check the injector wiring harness for damage caused by chaffing or heat. Refer to the electrical circuit diagrams and check the injector control circuits for intermittent faults, open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Repair wiring harness as required • If there are no wiring faults refer to the workshop manual and check the injector is to specification and has been installed correctly. Replace the injector




			<p>as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p> <ul style="list-style-type: none"> If there are no injector faults suspect the engine control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1575-00	Pedal Position Out Of Self Test Range - No sub type information	<ul style="list-style-type: none"> Brake pedal switch - Circuit Brake_SW_2 - short circuit to power Brake pedal switch - Circuit Brake_SW_2 - open circuit Brake switch failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check brake pedal switch - Circuit Brake_SW_2 - for short circuit to power Refer to the electrical circuit diagrams and check brake pedal switch - Circuit Brake_SW_2 - for open circuit Check and install a new brake switch as required. Clear the DTCs, drive the vehicle at greater than 11mph (17kph) with a throttle pedal greater than 10% for greater than 3 seconds. Press the brake pedal, using maximum travel for greater than 3 seconds, with the vehicle stationary, press the brake pedal using maximum travel for greater than 1 second
P1627-16	Module Supply Voltage Out Of Range - Circuit voltage below threshold	 <p>NOTE: - Circuit SWITCHED_SUPPLY_1 - SWITCHED_SUPPLY_2 -</p> <ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Vehicle battery fault Charging system fault harness fault - Engine control module power or ground supply Central junction box fault Power distribution fault 	<ul style="list-style-type: none"> Refer to the workshop manual and the battery care manual, inspect the vehicle battery and ensure it is fully charged and serviceable before performing further tests Check the vehicle charging system performance to ensure the voltage regulation is correct Using the manufacturer approved diagnostic system check datalogger signals, Control module voltage (0xF442). This DTC is set when the engine control module supply voltage is below the threshold value. Refer to the electrical circuit diagrams and check the four engine control module power ground circuits for high resistance or open circuits Check the switched power supply feeds to the engine control module which come from the central junction box through the engine management system relay. Repair wiring harness as required. Clear DTC and retest
P1627-17	Module Supply Voltage Out Of Range - Circuit voltage above threshold	 <p>NOTE: - Circuit SWITCHED_SUPPLY_1 - SWITCHED_SUPPLY_2 -</p> <ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Vehicle battery fault Charging system fault harness fault - Engine control module power or ground supply Central junction box fault Power distribution fault 	<ul style="list-style-type: none"> Refer to the workshop manual and the battery care manual, inspect the vehicle battery and ensure it is fully charged and serviceable before performing further tests Check the vehicle charging system performance to ensure the voltage regulation is correct Using the manufacturer approved diagnostic system check datalogger signals, Control module voltage (0xF442). This DTC is set when the engine control module supply voltage is greater than the threshold value. Refer to the electrical circuit diagrams and check the four engine control module power ground circuits for high resistance or open circuits Check the switched power supply feeds to the engine control module which come from the central junction box through the engine management system


			relay. Repair wiring harness as required. Clear DTC and retest
P1631-00	Main Relay (power hold) - No sub type information	 <p>NOTE: - Circuit EMS_RELAY_CTRL -</p> <ul style="list-style-type: none"> • Vehicle battery disconnected before engine management system relay has powered down • Harness fault - relay control circuit • Engine management system high current relay fault • Central junction box fault • Harness fault - relay control circuit 	<ul style="list-style-type: none"> • This DTC is set when the engine management system high current relay contacts open early - indicating a power hold fault. Check the vehicle battery has not been disconnected before the engine management system relay has powered down. Check the operation of the engine management system high current relay • Refer to the electrical circuit diagrams and check the engine management system high current relay supply and control circuits for open circuits, high resistance, short circuit to ground, short circuit to power, short circuit to other circuits. Repair the wiring harness • Check and install a new relay as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • Check and install a new central junction box as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1631-73	Main Relay (power hold) - Actuator stuck closed	 <p>NOTE: - Circuit EMS_RELAY_CTRL -</p> <ul style="list-style-type: none"> • Engine management system high current relay fault • Harness fault - relay control circuit 	<ul style="list-style-type: none"> • This DTC is set when the engine management system high current relay contacts are detected stuck closed by the engine control module. Check the operation of the engine management system high current relay. Refer to the electrical circuit diagrams and check the engine management system high current relay supply and control circuits for open circuits, high resistance, short circuit to ground, short circuit to power, short circuit to other circuits. Repair the wiring harness • Check and install a new relay as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1695-00	CAN Link Injection Pump Control Module/Engine Control Module - No sub type information	<ul style="list-style-type: none"> • The engine control module internal powerstage is overheated 	<ul style="list-style-type: none"> • Check engine control module for DTCs and refer to the relevant DTC index. Clear DTC and retest • Check the engine control module is sufficiently able to be cooled
P1703-00	Brake Switch Out Of Self Test Range - No sub type information	<ul style="list-style-type: none"> • Brake switch circuit, short circuit to ground, short circuit to power, high resistance, open circuit • Brake switch incorrect adjustment • Brake switch internal fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the brake switch for short to ground, short circuit to power, high resistance, open circuit. Repair wiring harness as required, clear DTC and retest system • Check and adjust brake switch as required • Check and install a new brake switch as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P1712-00	Transmission Torque Reduction Request Signal - No sub type information	<ul style="list-style-type: none"> • Unintended torque request signal sent over CAN from 	<ul style="list-style-type: none"> • Check transmission control module for related DTCs and refer to relevant DTC index, clear the DTC and retest the



		transmission control module to engine control module. The engine control module recognises it is unintended and applies a torque limit and set the DTC	system
P1719-68	Engine Torque Signal - Event information	<ul style="list-style-type: none"> Working limitation information The DTC sets as a result of an engine torque limitation caused by an engine overheat situation 	<ul style="list-style-type: none"> Check engine control module for related DTCs and refer to relevant DTC index Refer to the workshop manual and check the cooling system is functioning correctly
P2002-68	Diesel Particulate Filter Efficiency Below Threshold (Bank 1) - Event information	<ul style="list-style-type: none"> Diesel particulate filter regeneration disabled by other DTCs logged 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC index. Carry out a diesel particulate filter regeneration
P2031-00	Exhaust Gas Temperature Sensor Circuit Bank 1 Sensor 2 - No sub type information	 <p>NOTE: - Circuit PFIT -</p> <ul style="list-style-type: none"> Harness fault - Particulate filter inlet exhaust gas temperature sensor Particulate filter inlet exhaust gas temperature sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 2 Voltage (0x03C4), Exhaust Gas Temperature Bank 1 Sensor 2 (0x03F5). This DTC is set if the particulate filter inlet exhaust gas temperature sensor fails a plausibility check at cold start. Refer to the workshop manual and check the particulate filter inlet exhaust gas temperature sensor and wiring harness for obvious signs of mechanical damage due to chaffing or heat. The particulate filter inlet exhaust gas temperature sensor is a thermistor located in the inlet to the particulate filter housing with a signal and ground connection. Refer to the electrical circuit diagrams and check the signal circuit for open circuit, short circuit to power, short circuit to ground, high resistance. Check the ground circuit for open circuit, high resistance, short circuit to power. Repair the wiring harness as required If there are no wiring faults, refer to the workshop manual and check the sensor resistance value. Replace the sensor if required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2032-00	Exhaust Gas Temperature Sensor Circuit Low Bank 1 Sensor 2 - No sub type information	 <p>NOTE: - Circuit PFIT -</p> <ul style="list-style-type: none"> Harness fault - Particulate filter inlet exhaust gas temperature sensor Particulate filter inlet exhaust gas temperature sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 2 Voltage (0x03C4), Exhaust Gas Temperature Bank 1 Sensor 2 (0x03F5). This DTC is set if the particulate filter inlet exhaust gas temperature sensor fails a diagnostic check due to the circuit voltage being less than the expected value. Refer to the workshop manual and check the particulate filter inlet exhaust gas temperature sensor and wiring harness for obvious signs of mechanical damage due to chaffing or heat. The particulate filter inlet exhaust gas temperature sensor is a thermistor located in the inlet to the particulate filter housing with a signal and ground connection. Refer to the electrical

			<p>circuit diagrams and check the signal circuit for open circuit, short circuit to power, short circuit to ground, high resistance. Check the ground circuit for open circuit, high resistance, short circuit to power. Repair the wiring harness as required</p> <ul style="list-style-type: none"> • If there are no wiring faults, refer to the workshop manual and check the sensor resistance value. Replace the sensor if required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2033-00	Exhaust Gas Temperature Sensor Circuit High Bank 1 Sensor 2 - No sub type information	 <p>NOTE: - Circuit PFIT -</p> <ul style="list-style-type: none"> • Harness fault - Particulate filter inlet exhaust gas temperature sensor • Particulate filter inlet exhaust gas temperature sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 2 Voltage (0x03C4), Exhaust Gas Temperature Bank 1 Sensor 2 (0x03F5). This DTC is set if the particulate filter inlet exhaust gas temperature sensor fails a diagnostic check due to the circuit voltage being greater than the expected value. Refer to the workshop manual and check the particulate filter inlet exhaust gas temperature sensor and wiring harness for obvious signs of mechanical damage due to chaffing or heat. The particulate filter inlet exhaust gas temperature sensor is a thermistor located in the inlet to the particulate filter housing with a signal and ground connection. Refer to the electrical circuit diagrams and check the signal circuit for open circuit, short circuit to power, short circuit to ground, high resistance. Check the ground circuit for open circuit, high resistance, short circuit to power. Repair the wiring harness as required • If there are no wiring faults, refer to the workshop manual and check the sensor resistance value. Replace the sensor if required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2080-00	Exhaust Gas Temperature Sensor Circuit Range/Performance Bank 1 Sensor 1 - No sub type information	 <p>NOTE: - Circuit STOT -</p> <ul style="list-style-type: none"> • Harness fault - Secondary turbo outlet temperature sensor • Secondary turbo outlet temperature sensor failure 	<ul style="list-style-type: none"> • This DTC is set when there is a plausibility error on the signal from the secondary turbo outlet temperature sensor. Refer to the workshop manual and check the secondary turbo outlet temperature sensor and wiring harness for obvious signs of mechanical damage due to chaffing or heat. The secondary turbo outlet temperature sensor is a thermistor with a signal and ground connection. Refer to the electrical circuit diagrams and check the signal circuit for open circuit, short circuit to power, short circuit to ground, high resistance. Check the ground circuit for open circuit, high resistance, short circuit to power. Repair the wiring harness as required • If there are no wiring faults, refer to the workshop manual and check the sensor resistance value. Replace the sensor if required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation,

			prior to the installation of a new module/component
P2084-00	Exhaust Gas Temperature Sensor Circuit Range/Performance Bank 1 Sensor 2 - No sub type information	 <p>NOTE: - Circuit PFIT -</p> <ul style="list-style-type: none"> • Harness fault - close coupled catalyst outlet temperature sensor • Close coupled catalyst outlet temperature sensor failure 	<ul style="list-style-type: none"> • This DTC is set when there is a plausibility error on the signal from the close coupled catalyst outlet temperature sensor. Refer to the workshop manual and check the close coupled catalyst outlet temperature sensor and wiring harness for obvious signs of mechanical damage due to chaffing or heat. The close coupled catalyst outlet temperature sensor is a thermistor with a signal and ground connection. Refer to the electrical circuit diagrams and check the signal circuit for open circuit, short circuit to power, short circuit to ground, high resistance. Check the ground circuit for open circuit, high resistance, short circuit to power. Repair the wiring harness as required • If there are no wiring faults, refer to the workshop manual and check the sensor resistance value. Replace the sensor if required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2121-1F	Throttle/Pedal Position Sensor/Switch D Circuit Range/Performance - Circuit intermittent	 <p>NOTE: - Circuit PED_DEMAND_1 -</p> <ul style="list-style-type: none"> • Harness fault - accelerator pedal position sensor circuit • Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Accelerator Pedal Position D (0xF449), Pedal Position Sensor Voltage - Sensor 2 (0x0195). The accelerator pedal position sensor consists of two potentiometer circuits feeding independent pedal demand signals to the engine control module. This DTC is set when the engine control module detects noise on the pedal demand 1 signal circuit. Refer to the electrical circuit diagrams and check the reference voltage and ground connections to the accelerator pedal position sensor. Check signal circuits for high resistance, open circuits, short circuit to power, short circuit to ground. Check all accelerator pedal position sensor circuits for intermittent faults. Repair wiring as required. Clear DTC and retest • If there are no wiring faults suspect the accelerator pedal position sensor Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2122-00	Throttle/Pedal Position Sensor/Switch D Circuit Low - No sub type information	 <p>NOTE: - Circuit PED_DEMAND_1 -</p> <ul style="list-style-type: none"> • Harness fault - accelerator pedal position sensor circuit • Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Accelerator Pedal Position D (0xF449), Pedal Position Sensor Voltage - Sensor 2 (0x0915). The Accelerator Pedal Position sensor consists of two potentiometer circuits feeding independent pedal demand signals to the engine control module. This DTC is set when the engine control module detects the pedal demand 1 signal range is low. Refer to the electrical circuit diagrams and check the reference voltage and ground connections to the accelerator pedal position sensor. Check signal circuits for high resistance, open circuits, short



			<p>circuit to power, short circuit to ground. Repair wiring as required. Clear DTC and retest</p> <ul style="list-style-type: none"> If there are no wiring faults suspect the accelerator pedal position sensor Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2123-00	Throttle/Pedal Position Sensor/Switch D Circuit High - No sub type information	 <p>NOTE: - Circuit PED_DEMAND_1 -</p> <ul style="list-style-type: none"> Harness fault - accelerator pedal position sensor circuit Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Accelerator Pedal Position D (0xF449), Pedal Position Sensor Voltage - Sensor 2 (0x0915). The Accelerator Pedal Position sensor consists of two potentiometer circuits feeding independent pedal demand signals to the engine control module. This DTC is set when the engine control module detects the pedal demand 1 signal range is high. Refer to the electrical circuit diagrams and check the reference voltage and ground connections to the accelerator pedal position sensor. Check signal circuits for high resistance, open circuits, short circuit to power, short circuit to ground. Repair wiring as required. Clear DTC and retest If there are no wiring faults suspect the accelerator pedal position sensor Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2126-1F	Throttle/Pedal Position Sensor/Switch E Circuit Range/Performance - Circuit intermittent	 <p>NOTE: - Circuit PED_DEMAND_2 -</p> <ul style="list-style-type: none"> Harness fault - accelerator pedal position sensor circuit Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Accelerator Pedal Position E (0xF44A), Pedal Position Sensor Voltage - Sensor 1 (0x0914). The Accelerator Pedal Position sensor consists of two potentiometer circuits feeding independent pedal demand signals to the engine control module. This DTC is set when the engine control module detects noise on the pedal demand 2 signal circuit. Refer to the electrical circuit diagrams and check the reference voltage and ground connections to the accelerator pedal position sensor. Check signal circuits for high resistance, open circuits, short circuit to power, short circuit to ground. Check all accelerator pedal position sensor circuits for intermittent faults. Repair wiring as required. Clear DTC and retest If there are no wiring faults suspect the accelerator pedal position sensor Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2127-00	Throttle/Pedal Position Sensor/Switch E Circuit Low - No sub type information	 <p>NOTE: - Circuit PED_DEMAND_2 -</p> <ul style="list-style-type: none"> Harness fault - accelerator pedal position sensor circuit Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Accelerator Pedal Position E (0xF44A), Pedal Position Sensor Voltage - Sensor 1 (0x0914). The Accelerator Pedal Position sensor consists of two potentiometer circuits feeding independent pedal demand signals to the engine control module. This DTC is set when the engine control


			<p>module detects the pedal demand 2 signal range is low. Refer to the electrical circuit diagrams and check the reference voltage and ground connections to the accelerator pedal position sensor. Check signal circuits for high resistance, open circuits, short circuit to power, short circuit to ground. Repair wiring as required. Clear DTC and retest</p> <ul style="list-style-type: none"> If there are no wiring faults suspect the accelerator pedal position sensor Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2128-00	Throttle/Pedal Position Sensor/Switch E Circuit High - No sub type information	 <p>NOTE: - Circuit PED_DEMAND_2 -</p> <ul style="list-style-type: none"> Harness fault - accelerator pedal position sensor circuit Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Accelerator Pedal Position E (0xF44A), Pedal Position Sensor Voltage - Sensor 1 (0x0914). The Accelerator Pedal Position sensor consists of two potentiometer circuits feeding independent pedal demand signals to the engine control module. This DTC is set when the engine control module detects the pedal demand 2 signal range is high. Refer to the electrical circuit diagrams and check the reference voltage and ground connections to the accelerator pedal position sensor. Check signal circuits for high resistance, open circuits, short circuit to power, short circuit to ground. Repair wiring as required. Clear DTC and retest If there are no wiring faults suspect the accelerator pedal position sensor Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2138-00	Throttle/Pedal Position Sensor/Switch D / E Voltage Correlation - No sub type information	<ul style="list-style-type: none"> Accelerator pedal position sensor circuit short circuit to ground, short circuit to power, open circuit Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check accelerator pedal position sensor 1 circuit for short circuit to ground, short circuit to power, open circuit. Refer to the electrical circuit diagrams and check accelerator pedal position sensor 2 circuit for short circuit to ground, short circuit to power, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new accelerator pedal position sensor as required Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2138-64	Throttle/Pedal Position Sensor/Switch D / E Voltage Correlation - Signal plausibility failure	<ul style="list-style-type: none"> Accelerator pedal position sensor circuit short circuit to ground, short circuit to power, open circuit Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check accelerator pedal position sensor 1 circuit for short circuit to ground, short circuit to power, open circuit. Refer to the electrical circuit diagrams and check accelerator pedal position sensor 2 circuit for short circuit to ground, short circuit to power, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new accelerator pedal position sensor as required Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation,

			prior to the installation of a new module/component
P2138-67	Throttle/Pedal Position Sensor/Switch D / E Voltage Correlation - Signal incorrect after event	<ul style="list-style-type: none"> Accelerator pedal position sensor circuit short circuit to ground, short circuit to power, open circuit Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check accelerator pedal position sensor 1 circuit for short circuit to ground, short circuit to power, open circuit. Refer to the electrical circuit diagrams and check accelerator pedal position sensor 2 circuit for short circuit to ground, short circuit to power, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new accelerator pedal position sensor as required Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P213E-01	Fuel Injection System Fault - Forced Engine Shutdown - General electrical failure	<ul style="list-style-type: none"> Quantity shut-off of the dual-mass flywheel 	<ul style="list-style-type: none"> Check for fuel / injector related DTCs and repair these first. Clear DTC and retest
P2141-00	Exhaust Gas Recirculation Throttle Control Circuit A Low - No sub type information	 <p>NOTE: - Circuit TPA_POS - TPA_NEG -</p> <ul style="list-style-type: none"> Harness fault - Intake air shut off throttle control circuit Intake air shut off throttle failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects a short circuit to ground on the intake air shut off throttle control circuit. Refer to the electrical circuit diagrams and check both the Throttle Plate Actuator control circuits for short circuit to ground. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect intake air shut off throttle control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2142-00	Exhaust Gas Recirculation Throttle Control Circuit A High - No sub type information	 <p>NOTE: - Circuit TPA_POS - TPA_NEG -</p> <ul style="list-style-type: none"> Harness fault - Intake air shut off throttle control circuit Intake air shut off throttle failure 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects a short circuit to power on the intake air shut off throttle control circuit. Refer to the electrical circuit diagrams and check both the Throttle Plate Actuator control circuits for short circuit to power. Repair wiring harness as required. Clear DTC and retest If no fault found in wiring harness suspect intake air shut off throttle control actuator failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2177-00	System Too Lean Off Idle - Bank 1 - No sub type information	<ul style="list-style-type: none"> Oxygen concentration implausibly high Pre catalyst oxygen sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> Check for excess fuel at exhaust manifold, downpipe, pre catalyst oxygen sensor Check for fuel / injector related DTCs and repair these first. Clear DTC and retest Refer to the electrical circuit diagrams and check pre catalyst oxygen sensor for short circuit to ground, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new pre catalyst oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new




			module/component
P2178-00	System Too Rich Off Idle - Bank 1 - No sub type information	<ul style="list-style-type: none"> Oxygen concentration implausibly low Pre catalyst oxygen sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> Check for air leaks at exhaust manifold, downpipe, pre catalyst oxygen sensor Check for fuel / injector related DTCs and repair these first. Clear DTC and retest Refer to the electrical circuit diagrams and check pre catalyst oxygen sensor for short circuit to ground, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new pre catalyst oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2191-00	System Too Lean at Higher Load - Bank 1 - No sub type information	<ul style="list-style-type: none"> Oxygen concentration implausibly high Pre catalyst oxygen sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> Check for excess fuel at exhaust manifold, downpipe, pre catalyst oxygen sensor Check for fuel / injector related DTCs and repair these first. Clear DTC and retest Refer to the electrical circuit diagrams and check pre catalyst oxygen sensor for short circuit to ground, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new pre catalyst oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2192-00	System Too Rich at Higher Load - Bank 1 - No sub type information	<ul style="list-style-type: none"> Oxygen concentration implausibly low Pre catalyst oxygen sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> Check for air leaks at exhaust manifold, downpipe, pre catalyst oxygen sensor Check for fuel / injector related DTCs and repair these first. Clear DTC and retest Refer to the electrical circuit diagrams and check pre catalyst oxygen sensor for short circuit to ground, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new pre catalyst oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2195-00	O2 Sensor Signal Biassed/Stuck Lean - Bank 1, Sensor 1 - No sub type information	<ul style="list-style-type: none"> Air leak at exhaust manifold, downpipe, pre catalyst oxygen sensor bank 1 Pre catalyst oxygen sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> Check for fuel / injector related DTCs and repair these first. Clear DTC and retest Refer to the electrical circuit diagrams and check pre catalyst oxygen sensor for short circuit to ground, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest Check for air leaks at exhaust manifold, downpipe, pre catalyst oxygen sensor. Check and install a new pre catalyst oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component




P2196-00	O2 Sensor Signal Biassed/Stuck Rich - Bank 1, Sensor 1 - No sub type information	<p>Fuel injection system fault</p> <ul style="list-style-type: none"> Pre catalyst oxygen sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit Pre catalyst oxygen sensor failure 	<p>Check for fuel / injector related DTCs and repair these first. Clear DTC and retest</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check pre catalyst oxygen sensor for short circuit to ground, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest Check for air leaks at exhaust manifold, downpipe, pre catalyst oxygen sensor. Check and install a new pre catalyst oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2226-62	Barometric Pressure Sensor A Circuit - Signal compare failure	<ul style="list-style-type: none"> The engine control module has been submersed in water or mud The engine control module has been sealed in a non approved covering 	<ul style="list-style-type: none"> Check the engine control module is clean and dry Check the engine control module is not sealed by any non approved covering If the DTC does not clear install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2228-00	Barometric Pressure Sensor A Circuit Low - No sub type information	<ul style="list-style-type: none"> Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check engine control module power supply circuits for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check engine control module ground supply circuits for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2229-00	Barometric Pressure Sensor A Circuit High - No sub type information	<ul style="list-style-type: none"> Corrupt engine control module software flash Engine control module power supply fault Engine control module ground supply fault Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system re-configure the engine control module Refer to the electrical circuit diagrams and check engine control module power supply circuits for open circuit. Repair wiring harness as required. Clear DTC and retest Refer to the electrical circuit diagrams and check engine control module ground supply circuits for open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2238-00	O2 Sensor Positive Current Control Circuit Low - Bank 1, Sensor 1 - No sub type information	<ul style="list-style-type: none"> Pre catalyst oxygen sensor positive current control circuit short circuit to ground, high resistance, open circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check pre catalyst oxygen sensor for short circuit to ground, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest



		<ul style="list-style-type: none"> Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> Check and install a new pre catalyst oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2245-00	O2 Sensor Reference Voltage Circuit Low - Bank 1, Sensor 1 - No sub type information	 <p>NOTE: - Circuit LPV_A -</p> <ul style="list-style-type: none"> Harness fault - Pre catalyst oxygen sensor circuit Oxygen sensor failure 	<ul style="list-style-type: none"> This DTC is set if the engine control module detects the bank 1, pre catalyst oxygen sensor 1 reference voltage is lower than expected. Refer to the electrical circuit diagrams and check the pre catalyst oxygen sensor harness for signs of damage caused by chaffing or heat. Check the pre catalyst oxygen sensor circuits for open circuits, high resistance, short circuit to ground. Repair wiring as required, clear the DTC and retest the system If there are no wiring faults suspect the pre catalyst oxygen sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2246-00	O2 Sensor Reference Voltage Circuit High - Bank 1, Sensor 1 - No sub type information	 <p>NOTE: - Circuit LPV_A -</p> <ul style="list-style-type: none"> Harness fault - Pre catalyst oxygen sensor circuit Oxygen sensor failure 	<ul style="list-style-type: none"> This DTC is set if the engine control module detects the bank 1, pre catalyst oxygen sensor 1 reference voltage is greater than expected. Refer to the electrical circuit diagrams and check the pre catalyst oxygen sensor harness for signs of damage caused by chaffing or heat. Check the pre catalyst oxygen sensor circuits for open circuits, high resistance, short circuit to power. Repair wiring as required, clear the DTC and retest the system If there are no wiring faults suspect the pre catalyst oxygen sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2261-73	Turbocharger/Supercharger Bypass Valve "A" - Mechanical - Actuator stuck closed	<ul style="list-style-type: none"> Boost air recirculation solenoid stuck shut during transition from mono turbo to bi-turbo mode 	<ul style="list-style-type: none"> This DTC is set when the engine control module detects that the turbocharger bypass valve is not operating. Refer to the workshop manual and inspect the boost air recirculation solenoid for sticking shut during transition from mono turbo to bi-turbo mode
P2263-21	Turbocharger/Supercharger Boost System Performance - Signal amplitude < minimum	<ul style="list-style-type: none"> The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low Induction system air leak or blockage Boost air system leak or blockage Manifold absolute pressure sensor circuit short circuit to power, ground, open circuit Manifold absolute pressure sensor failure Variable geometry turbocharger actuator A sticking, failure Turbocharger A failure 	<ul style="list-style-type: none"> Check induction system for leaks, blockages Check boost air system for leaks, blockages. Check for related DTCs Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to power, ground, open circuit Check and install a new manifold absolute pressure sensor as required Check turbocharger rod connection and oil seals Check and install a new variable geometry turbocharger actuator as required. Check install a new turbocharger as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2263-	Turbocharger/Supercharger	<ul style="list-style-type: none"> The engine control 	<ul style="list-style-type: none"> Check induction system for leaks,



22	Boost System Performance - Signal amplitude > maximum	<p>module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high</p> <ul style="list-style-type: none"> • Induction system air leak or blockage • Boost air system leak or blockage • Manifold absolute pressure sensor circuit short circuit to power, ground, open circuit • Manifold absolute pressure sensor failure • Variable geometry turbocharger actuator A sticking, failure • Turbocharger A failure 	<p>blockages</p> <ul style="list-style-type: none"> • Check boost air system for leaks, blockages. Check for related DTCs • Using the manufacturer approved diagnostic system perform the (Turbo, EGR and air path dynamic test) routine • Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to power, ground, open circuit • Check and install a new manifold absolute pressure sensor as required • Check turbocharger rod connection and oil seals • Check and install a new variable geometry turbocharger actuator as required. Check install a new turbocharger as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2264-00	Water in Fuel Sensor Circuit - No sub type information	 <p>NOTE: - Circuit WIF_SENSOR -</p> <ul style="list-style-type: none"> • Fuel supply incorrect/contaminated • Harness fault - Water in fuel sensor circuit • Water in fuel sensor fault • Central junction box power distribution fault 	<ul style="list-style-type: none"> • This DTC is set if the engine control module receives information indicating an implausible fuel level. Refer to the workshop manual and check the fuel system to ensure there is an adequate fuel level in the tank and the system is not leaking fuel or suffering from air ingress. Check the fuel for contamination by other fluids (petrol or water etc) • Refer to the electrical wiring diagrams and check the water in fuel sensor signal circuit between the sensor and the engine control module for high resistance, open circuit, short circuit to ground, short circuit to power, intermittent faults. Repair the wiring harness as required • If there are no wiring faults suspect the water in fuel sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • Refer to the electrical wiring diagrams and check the water in fuel sensor power supply from the central junction box for high resistance, open circuit, short circuit to ground. Check the water in fuel sensor ground supply circuit for high resistance, open circuit, short circuit to power. Check the voltage supply from the central junction box, check and replace fuses as required. Replace central junction box if there is no voltage supply to the water in fuel sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2269-68	Water in Fuel Condition - Event information	<ul style="list-style-type: none"> • Water in fuel • Water in fuel sensor circuit short circuit to power, open circuit • Water in fuel sensor failure 	<ul style="list-style-type: none"> • Drain water from fuel filter housing. Clear DTC and wait 30 seconds and re-check DTC has cleared • Refer to the electrical circuit diagrams and check water in fuel sensor circuit for short circuit to power, open circuit • Check and install a new water in fuel sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation,




			prior to the installation of a new module/component
P226B-00	Turbocharger/Supercharger Boost Pressure Too High - Mechanical - No sub type information	<ul style="list-style-type: none"> • Error path indicating whether over boost shut down is active or not • This DTC is set when overboost shut down is active. This means that the vehicle has lost control of boost. The engine is shut down as a safety precaution. The engine control module checks for an overboost by system monitoring and also monitors vehicle acceleration, if in gear and engine acceleration at idle, if in neutral 	<ul style="list-style-type: none"> • Check for turbocharging related DTCs and repair these first. Clear DTC and retest
P228C-00	Fuel Pressure Regulator 1 Exceeded Control Limits - Pressure Too Low - No sub type information	<ul style="list-style-type: none"> • Fuel pressure control valve, fuel leak from the high pressure side • Fuel injector stuck open / leaking • Blocked fuel filter • Low pressure fuel pipe leaking from the fuel tank fuel pump • Fuel supply system fault • Harness fault - fuel rail pressure sensor A circuit high resistance • Fuel rail pressure sensor A failure • Fuel lift pump failure 	<ul style="list-style-type: none"> • Check fuel pressure control valve for fuel leakage from the high pressure side • Check for fuel injector stuck open / leaking • Check for blocked fuel filter • Check for low pressure fuel pipe leakage from the fuel tank fuel pump • Using the manufacturer approved diagnostic system check datalogger signals, Fuel Rail Pressure Sensor (0x0324), Fuel Rail Pressure (0xF423). Check for related fuel system DTCs and refer to the relevant DTC index • Refer to the electrical circuit diagrams and check fuel pump circuit for high resistance. Check fuel rail pressure sensor A circuit for high resistance • Check and install a new fuel rail pressure sensor A as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component • Check and install a new fuel lift pump as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2297-00	O2 Sensor Out of Range During Deceleration Bank 1, Sensor 1 - No sub type information	<ul style="list-style-type: none"> • Pre catalyst oxygen sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit • Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> • Check for fuel / injector related DTCs and repair these first. Clear DTC and retest. Refer to the electrical circuit diagrams and check pre catalyst oxygen sensor for short circuit to ground, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest • Check and install a new pre catalyst oxygen sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2299-68	Brake Pedal Position/Accelerator Pedal Position Incompatible - Event information	<ul style="list-style-type: none"> • Brake pedal switch - Circuit Brake_SW_1 - short circuit to ground • Brake pedal switch - Circuit Brake_SW_1 - open circuit 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check brake pedal switch - Circuit Brake_SW_1 - for short circuit to ground • Refer to the electrical circuit diagrams and check brake pedal switch - Circuit




		<ul style="list-style-type: none"> • Brake pedal switch - Circuit Brake_SW_2 - short circuit to ground • Brake pedal switch incorrect adjustment • Brake pedal switch failure • Brake pedal pressed by driver at same time as accelerator pedal pressed 	<ul style="list-style-type: none"> • Brake_SW_1 - for open circuit • Refer to the electrical circuit diagrams and check brake pedal switch - Circuit Brake_SW_2 - for short circuit to ground • Repair wiring harness as required, clear DTC. Start the engine press the brake pedal, using maximum travel for greater than 1 second taking care not to press the accelerator pedal. Check the system is operating correctly and the DTC does not return • Check and adjust brake switch as required • Check and install a new brake pedal switch as required • Clear the DTCs, drive the vehicle at greater than 11mph (17kph) with a throttle pedal greater than 10% for greater than 3 seconds. Press the brake pedal, using maximum travel for greater than 3 seconds. Check the system is operating correctly and the DTC does not return
P22C5-11	Turbocharger Compressor Outlet Valve Control Circuit / Open - Circuit short to ground	 <p>NOTE: - Circuit CSOV -</p> <ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Harness fault - turbocharger boost air solenoid circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the turbocharger boost air solenoid circuit between the engine control module and the control valve for a short circuit to ground. Check power supply to the control valve. Repair any wiring faults found. Clear DTC and retest
P22C5-12	Turbocharger Compressor Outlet Valve Control Circuit / Open - Circuit short to battery	 <p>NOTE: - Circuit CSOV -</p> <ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Harness fault - turbocharger boost air solenoid circuit short circuit to power • Turbocharger boost air solenoid fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the turbocharger boost air solenoid circuit between the engine control module and the control valve for a short circuit to power. Check power supply to the control valve. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect turbocharger boost air solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22C5-13	Turbocharger Compressor Outlet Valve Control Circuit / Open - Circuit open	 <p>NOTE: - Circuit CSOV -</p> <ul style="list-style-type: none"> • The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Harness fault - turbocharger boost air solenoid circuit open circuit • Turbocharger boost air solenoid fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the turbocharger boost air solenoid circuit between the engine control module and the control valve for open circuit. Check power supply to the control valve. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect turbocharger boost air solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component



P22C5-4B	Turbocharger Compressor Outlet Valve Control Circuit / Open - Over temperature	<ul style="list-style-type: none"> • Harness fault - turbocharger boost air solenoid circuit open circuit • Turbocharger boost air solenoid failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the turbocharger boost air solenoid circuit between the engine control module and the control valve for open circuit. Check power supply to the control valve. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect turbocharger boost air solenoid failure. Check and install a new turbocharger boost air solenoid as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22CF-00	Turbocharger Turbine Inlet Valve Control Circuit / Open - No sub type information	 NOTE: - Circuit TSOV - <ul style="list-style-type: none"> • Harness fault - Turbine intake solenoid circuit open circuit • Turbine intake solenoid fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Turbo Shut Off Valve Opening Position - Commanded (0x03F0). Refer to the electrical circuit diagrams and check the turbine intake solenoid circuit between the engine control module and the control valve for open circuit. Check power supply to the control valve. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect turbine intake solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22CF-16	Turbocharger Turbine Inlet Valve Control Circuit / Open - Circuit voltage below threshold	 NOTE: - Circuit TSOV - <ul style="list-style-type: none"> • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Harness fault - Turbine intake solenoid circuit fault • Turbine intake solenoid fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Turbo Shut Off Valve Opening Position - Commanded (0x03F0). Refer to the electrical circuit diagrams and check the turbine intake solenoid circuit between the engine control module and the control valve for a high resistance, intermittent open circuit, short circuit to ground. Check power supply to the control valve. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect turbine intake solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22CF-19	Turbocharger Turbine Inlet Valve Control Circuit / Open - Circuit current above threshold	<ul style="list-style-type: none"> • Harness fault - Turbine intake solenoid circuit fault • Turbine intake solenoid fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Turbo Shut Off Valve Opening Position - Commanded (0x03F0). Refer to the electrical circuit diagrams and check the turbine intake valve control circuit for short circuit to ground. Check power supply to the solenoid. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect turbine intake solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22CF-1D	Turbocharger Turbine Inlet Valve Control Circuit / Open - Circuit current out of range	 NOTE: - Circuit TSOV - <ul style="list-style-type: none"> • Harness fault - Turbine intake solenoid circuit 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Turbo Shut Off Valve Opening Position - Commanded (0x03F0). Refer to the electrical circuit diagrams and




		<p>fault</p> <ul style="list-style-type: none"> • Turbine intake solenoid fault 	<p>check the turbine intake solenoid control circuit for short circuit to ground. Check power supply to the solenoid. Repair any wiring faults found. Clear DTC and retest</p> <ul style="list-style-type: none"> • If no fault found in wiring harness suspect turbine intake solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22CF-4B	Turbocharger Turbine Inlet Valve Control Circuit / Open - Over temperature	<ul style="list-style-type: none"> • Harness fault - Turbine intake solenoid circuit fault • Turbine intake solenoid fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Turbo Shut Off Valve Opening Position - Commanded (0x03F0). Refer to the electrical circuit diagrams and check the turbine intake valve control circuit for short circuit to ground. Check power supply to the solenoid. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect turbine intake solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22CF-71	Turbocharger Turbine Inlet Valve Control Circuit / Open - Actuator stuck	<ul style="list-style-type: none"> • Turbine intake solenoid sticking closed • Turbine intake solenoid sticking open • Intake air system, blocked low pressure air intake. This failure mode can be caused by snow packing in the intake system. Symptoms often disappear after the vehicle has been warmed and heat soaked. Similar symptoms to seized primary turbo 	<ul style="list-style-type: none"> • If this DTC is logged with P22D3-77 & P00BC-00 suspect, turbine intake solenoid sticking closed • If this DTC is logged with P0235-94, P00BD-07, P22D2-77 & P1247-00 suspect, turbine intake solenoid sticking open • If this DTC is logged with P00BD-07, P22D2-77, P1247-00 & P0235-94 suspect, intake air system, blocked low pressure air intake • Using the manufacturer approved diagnostic system perform the (Turbo, EGR and air path dynamic test) routine
P22D0-00	Turbocharger Turbine Inlet Valve Control Circuit Low - No sub type information	 <p>NOTE: - Circuit TSOV -</p> <ul style="list-style-type: none"> • Harness fault - Turbine intake solenoid circuit fault • Turbine intake solenoid failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Turbo Shut Off Valve Opening Position - Commanded (0x03F0). Refer to the electrical circuit diagrams and check the turbine intake solenoid control circuit for short circuit to ground. Check power supply to the solenoid. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect turbine intake solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22D0-11	Turbocharger Turbine Inlet Valve Control Circuit Low - Circuit short to ground	 <p>NOTE: - Circuit TSOV -</p> <ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Turbo Shut Off Valve Opening Position - Commanded (0x03F0). Refer to the electrical circuit diagrams and check the turbine intake solenoid control circuit on bank 2 for short circuit to ground. Check power supply to the solenoid. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness




		<ul style="list-style-type: none"> expected • Harness fault - Turbine intake solenoid bank 2 circuit short circuit to ground • Turbine intake solenoid failure 	<p>suspect turbine intake solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p>
P22D0-12	Turbocharger Turbine Inlet Valve Control Circuit Low - Circuit short to battery	 <p>NOTE: - Circuit TSOV -</p> <ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Harness fault - Turbine intake solenoid bank 2 circuit short circuit to power • Turbine intake solenoid failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Turbo Shut Off Valve Opening Position - Commanded (0x03F0). Refer to the electrical circuit diagrams and check the turbine intake solenoid control circuit on bank 2 for short circuit to power. Check power supply to the solenoid. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect turbine intake solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22D1-00	Turbocharger Turbine Inlet Valve Control Circuit High - No sub type information	 <p>NOTE: - Circuit TSOV -</p> <ul style="list-style-type: none"> • Harness fault - Turbine intake solenoid circuit short circuit to power • Turbine intake solenoid failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Turbo Shut Off Valve Opening Position - Commanded (0x03F0). Refer to the electrical circuit diagrams and check the turbine intake solenoid control circuit for short circuit to power. Check power supply to the solenoid. Repair any wiring faults found. Clear DTC and retest • If no fault found in wiring harness suspect turbine intake solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22D2-77	Turbocharger Turbine Inlet Valve Stuck Open - Commanded position not reachable	<ul style="list-style-type: none"> • Turbine intake solenoid sticking open • Blocked low pressure air intake 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system perform the (Turbo, EGR and air path dynamic test) routine • Using the manufacturer approved diagnostic system check datalogger signals, Turbo Shut Off Valve Opening Position - Commanded (0x03F0) and Turbo Shut Off Valve Opening Position - Measured (0x03F1). Refer to the electrical circuit diagrams and check the turbine intake solenoid control circuit for short circuit to power. Check power supply to the solenoid. Repair any wiring faults found. Clear DTC and retest • If this DTC is logged with P0235-94, P00BD-07, P1247-00 & P22CF-71, suspect turbine intake solenoid sticking open • If this DTC is logged with P1247-00, P0235-94, P00BD-07, & P22CF-71, suspect blocked low pressure air intake • If no fault found in wiring harness suspect turbine intake solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22D3-77	Turbocharger Turbine Inlet Valve Stuck Closed - Commanded position not	<ul style="list-style-type: none"> • Turbine intake solenoid sticking closed 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system perform the (Turbo, EGR and air path dynamic test) routine



	reachable		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Turbo Shut Off Valve Opening Position - Commanded (0x03F0) and Turbo Shut Off Valve Opening Position - Measured (0x03F1). Refer to the electrical circuit diagrams and check the turbine intake solenoid control circuit for short circuit to power. Check power supply to the solenoid. Repair any wiring faults found. Clear DTC and retest If this DTC is logged with P00BC-00, & P22CF-71, suspect turbine intake solenoid sticking closed If no fault found in wiring harness suspect turbine intake solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22D4-13	Turbocharger Turbine Inlet Valve Position Sensor Circuit - Circuit open	 NOTE: - Circuit TSVP - <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Turbine intake valve position sensor circuit open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system perform the (Turbo, EGR and air path dynamic test) routine Refer to the electrical circuit diagrams and check turbine intake valve position sensor circuit for open circuit, high resistance
P22D4-16	Turbocharger Turbine Inlet Valve Position Sensor Circuit - Circuit voltage below threshold	 NOTE: - Circuit TSVP - <ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Turbine intake valve position sensor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check turbine intake valve position sensor circuit short circuit to ground
P22D4-17	Turbocharger Turbine Inlet Valve Position Sensor Circuit - circuit voltage above threshold - Actuator stuck	 NOTE: - Circuit TSVP - <ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power This is the long term adaption limit diagnostic. It diagnoses that the adapted values for the actuator end stops is outside of tolerance. This could be caused by sensor drift over time Turbine intake valve position sensor circuit short circuit to power Turbine intake valve position sensor stuck 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check turbine intake valve position sensor circuit for short circuit to power Check and install a new turbine intake valve position sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22D4-71	Turbocharger Turbine Inlet Valve Position Sensor	<ul style="list-style-type: none"> This is the long term adaption limit 	<ul style="list-style-type: none"> Check and install a new turbine intake valve position sensor as required. Refer





	Circuit - Actuator stuck	<p>diagnostic. It diagnoses that the adapted values for the actuator end stops is outside of tolerance. This could be caused by sensor drift over time</p> <ul style="list-style-type: none"> • Turbine intake valve position sensor stuck 	<p>to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p>
P22D4-92	Turbocharger Turbine Inlet Valve Position Sensor Circuit - Performance or incorrect operation	<ul style="list-style-type: none"> • This is the long term adaption limit diagnostic. It diagnoses that the adapted values for the actuator end stops is outside of tolerance. This could be caused by sensor drift over time • Turbine intake valve position sensor stuck 	<ul style="list-style-type: none"> • Check and install a new turbine intake valve position sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22D5-92	Turbocharger Turbine Inlet Valve Position Sensor Circuit Range/Performance - Performance or incorrect operation	<ul style="list-style-type: none"> • This is the long term adaption limit diagnostic. It diagnoses that the adapted values for the actuator end stops is outside of tolerance. This could be caused by sensor drift over time • Turbine intake valve position sensor stuck 	<ul style="list-style-type: none"> • Check and install a new turbine intake valve position sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P22D6-11	Turbocharger Turbine Inlet Valve Position Sensor Circuit Low - Circuit short to ground	 NOTE: - Circuit TSVP - <ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Turbine intake valve position sensor circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check turbine intake valve position sensor circuit for short circuit to ground
P22D7-12	Turbocharger Turbine Inlet Valve Position Sensor Circuit High - Circuit short to battery	 NOTE: - Circuit TSVP - <ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Turbine intake valve position sensor circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check turbine intake valve position sensor circuit for short circuit to power
P242A-00	Exhaust Gas Temperature Sensor Circuit Bank 1 Sensor 3 - No sub type information	 NOTE: - Circuit PFOT - <ul style="list-style-type: none"> • Harness fault - particulate filter outlet temperature sensor • Particulate filter outlet temperature sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 3 (0x03F6), Exhaust Gas Temperature Bank 1 Sensor 3 Voltage (0x03F8). This DTC is set if the Particulate filter outlet temperature sensor fails a cold start diagnostic check by the engine control module.



			<p>Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter outlet temperature sensor signal circuit for open circuit, short circuit to ground, short circuit to other circuits. Check the sensor ground circuit for open circuit, short circuit to power, high resistance. Repair wiring as required</p> <ul style="list-style-type: none"> If there are no wiring faults suspect the particulate filter outlet temperature sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P242B-00	Exhaust Gas Temperature Sensor Circuit Range/Performance Bank 1 Sensor 3 - No sub type information	 <p>NOTE: - Circuit PFOT -</p> <ul style="list-style-type: none"> Harness fault - particulate filter outlet temperature sensor Particulate filter outlet temperature sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 3 (0x03F6), Exhaust Gas Temperature Bank 1 Sensor 3 Voltage (0x03F8). This DTC is set if the Particulate filter outlet temperature sensor fails a plausibility check by the engine control module. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter outlet temperature sensor signal circuit for open circuit, short circuit to ground, short circuit to other circuits. Check the sensor ground circuit for open circuit, short circuit to power, high resistance. Repair wiring as required If there are no wiring faults suspect the particulate filter outlet temperature sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P242C-00	Exhaust Gas Temperature Sensor Circuit Low Bank 1 Sensor 3 - No sub type information	 <p>NOTE: - Circuit PFOT -</p> <ul style="list-style-type: none"> Harness fault - particulate filter outlet temperature sensor Particulate filter outlet temperature sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 3 (0x03F6), Exhaust Gas Temperature Bank 1 Sensor 3 Voltage (0x03F8). This DTC is set if the Particulate filter outlet temperature sensor signal voltage is less than the engine control module was expecting. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter outlet temperature sensor signal circuit for open circuit, short circuit to ground, short circuit to other circuits. Check the sensor ground circuit for open circuit, short circuit to power, high resistance. Repair wiring as required If there are no wiring faults suspect the particulate filter outlet temperature sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component






P242D-00	Exhaust Gas Temperature Sensor Circuit High Bank 1 Sensor 3 - No sub type information	 <p>NOTE: - Circuit PFOT -</p> <ul style="list-style-type: none"> • Harness fault - particulate filter outlet temperature sensor • Particulate filter outlet temperature sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 3 (0x03F6), Exhaust Gas Temperature Bank 1 Sensor 3 Voltage (0x03F8). This DTC is set if the Particulate filter outlet temperature sensor signal voltage is greater than the engine control module was expecting. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter outlet temperature sensor signal circuit for open circuit, short circuit to ground, short circuit to other circuits. Check the sensor ground circuit for open circuit, short circuit to power, high resistance. Repair wiring as required • If there are no wiring faults suspect the particulate filter outlet temperature sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P242F-00	Diesel Particulate Filter Restriction - Ash Accumulation (Bank 1) - no sub type information	<ul style="list-style-type: none"> • Maximum ash load 	 <p>NOTE: The setting value of this DTC is inhibited</p> <ul style="list-style-type: none"> • Contact dealer technical support
P244A-00	Diesel Particulate Filter Differential Pressure Too Low(Bank1) - no sub type information	<ul style="list-style-type: none"> • Diagnostic fault check for minimum pressure differential characteristics 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC index • Clear DTC and re-test
P244A-96	Diesel Particulate Filter Differential Pressure Too Low(Bank1) - Component internal failure	<ul style="list-style-type: none"> • Destroyed particulate filter 	<ul style="list-style-type: none"> • Refer to the relevant pinpoint test in section 309-00
P244B-68	Diesel Particulate Filter Differential Pressure Too High (Bank 1) - event information	<ul style="list-style-type: none"> • Engine protection back pressure high • Sudden increases in differential pressure across the diesel particulate filter 	 <p>NOTE: This DTC when logged on its own is advisory only and no further action should be taken</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check for related DTCs. If this DTC exists with any other diesel particulate filter differential pressure sensor DTCs, follow the advise given for that DTC
P244E-00	Exhaust Temperature Too Low For Particulate Filter Regeneration, Bank 2 - No sub type information	<ul style="list-style-type: none"> • Error path for not reaching the setpoint of the inner loop with maximal control variable 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check for related DTCs and refer to the relevant DTC index. Clear DTC and re-test. This DTC has been calibrated not to flag
P244F-00	Exhaust Temperature Too High For Particulate Filter Regeneration, Bank 2 - No sub type information	<ul style="list-style-type: none"> • Error path for not reaching the setpoint of the inner loop with minimal control variable 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check for related DTCs and refer to the relevant DTC index. Clear DTC and re-test. This DTC has been calibrated not to flag
P2452-23	Diesel Particulate Filter Pressure Sensor A Circuit - signal stuck low	<ul style="list-style-type: none"> • Differential pressure sensor circuit, short circuit to ground • Diesel particulate filter pressure sensor A circuit, hose line error 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the differential pressure sensor circuit, for short circuit to ground • Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC Index



P2452-29	Diesel Particulate Filter Pressure Sensor A Circuit - Signal invalid	<ul style="list-style-type: none"> Diagnostic fault check for frozen differential pressure sensor 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check for related DTCs and refer to the relevant DTC index
P2452-95	Diesel Particulate Filter Pressure Sensor A Circuit - Incorrect assembly	<ul style="list-style-type: none"> Diesel particulate filter pressure sensor hoses connected incorrectly Diesel particulate filter pressure sensor hoses crushed, blocked, split 	 <p>NOTE: If a new diesel particulate filter pressure sensor or hose lines have been installed or incorrectly routed, or any pressure sensor circuit repairs carried out, the engine control module must learn and store the new diesel particulate filter pressure sensor offset value. The following conditions must be met to allow the diesel particulate filter pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system, clear DTCs from engine control module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500RPM for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park and set ignition status to off. Wait 30 seconds for the engine control module to power down, learn and store diesel particulate filter pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Particulate Filter Differential Pressure Sensor Voltage - Bank 1 (0x03DB). Refer to the workshop manual and check diesel particulate filter pressure sensor hoses are installed correctly Check diesel particulate filter pressure sensor hoses for crushed, blockage, split
P2453-00	Diesel Particulate Filter Pressure Sensor A Circuit Range/Performance - No sub type information	 <p>NOTE: - Circuit DPF_PRESSURE_SENSOR -</p> <ul style="list-style-type: none"> Harness fault - Particulate filter pressure sensor Particulate filter pressure sensor failure 	 <p>NOTE: If a new diesel particulate filter pressure sensor or hose lines have been installed or incorrectly routed, or any pressure sensor circuit repairs carried out, the engine control module must learn and store the new diesel particulate filter pressure sensor offset value. The following conditions must be met to allow the diesel particulate filter pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system, clear DTCs from engine control module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500RPM for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park and set ignition status to off. Wait 30 seconds for the engine control module to power down, learn and store diesel particulate filter pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Particulate Filter Differential Pressure Sensor Voltage - Bank 1 (0x03DB). This DTC is set when the particulate pressure sensor fails a plausibility check. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams

			<p>and check the particulate filter pressure sensor signal circuit for open circuit, short circuit to ground, short circuit to other circuits. Check the sensor ground circuit for open circuit, short circuit to power, high resistance. Check the sensor power supply circuit for open circuit, short circuit to ground, high resistance. Repair wiring as required</p> <ul style="list-style-type: none"> • If there are no wiring faults suspect the particulate filter pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2453-16	Diesel Particulate Filter Pressure Sensor A Circuit Range/Performance - Circuit voltage below threshold	 <p>NOTE: - Circuit DPF_PRESSURE_SENSOR -</p> <ul style="list-style-type: none"> • Diagnostic fault check for signal range check low in flow resistance • Harness fault - Particulate filter pressure sensor • Particulate filter pressure sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check for related DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system check datalogger signals, Particulate Filter Differential Pressure Sensor Voltage - Bank 1 (0x03DB). This DTC is set when the particulate pressure sensor fails a plausibility check. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter pressure sensor signal circuit for open circuit, short circuit to ground, short circuit to other circuits. Check the sensor ground circuit for open circuit, short circuit to power, high resistance. Check the sensor power supply circuit for open circuit, short circuit to ground, high resistance. Repair wiring as required • If there are no wiring faults suspect the particulate filter pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2453-17	Diesel Particulate Filter Pressure Sensor A Circuit Range/Performance - Circuit voltage above threshold	 <p>NOTE: - Circuit DPF_PRESSURE_SENSOR -</p> <ul style="list-style-type: none"> • Diagnostic fault check for signal range check high in flow resistance • Harness fault - Particulate filter pressure sensor • Particulate filter pressure sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check for related DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system check datalogger signals, Particulate Filter Differential Pressure Sensor Voltage - Bank 1 (0x03DB). This DTC is set when the particulate pressure sensor fails a plausibility check. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter pressure sensor signal circuit for open circuit, short circuit to ground, short circuit to other circuits. Check the sensor ground circuit for open circuit, short circuit to power, high resistance. Check the sensor power supply circuit for open circuit, short circuit to ground, high resistance. Repair wiring as required • If there are no wiring faults suspect the particulate filter pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior




			approval programme is in operation, prior to the installation of a new module/component
P2454-00	Diesel Particulate Filter Pressure Sensor A Circuit Low - No sub type information	 <p>NOTE: - Circuit DPF_PRESSURE_SENSOR -</p> <ul style="list-style-type: none"> • Harness fault - Particulate filter pressure sensor • Particulate filter pressure sensor failure 	 <p>NOTE: If a new diesel particulate filter pressure sensor or hose lines have been installed or incorrectly routed, or any pressure sensor circuit repairs carried out, the engine control module must learn and store the new diesel particulate filter pressure sensor offset value. The following conditions must be met to allow the diesel particulate filter pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system, clear DTCs from engine control module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500rpm for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park and set ignition status to off. Wait 30 seconds for the engine control module to power down, learn and store diesel particulate filter pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Particulate Filter Differential Pressure Sensor Voltage - Bank 1 (0x03DB). This DTC is set when the particulate pressure sensor voltage is less than the threshold set in the engine control module diagnostic check. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter pressure sensor signal circuit for open circuit, short circuit to ground, short circuit to other circuits. Check the sensor ground circuit for open circuit, short circuit to power, high resistance. Check the sensor power supply circuit for open circuit, short circuit to ground, high resistance. Repair wiring as required • If there are no wiring faults suspect the particulate filter pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2455-00	Diesel Particulate Filter Pressure Sensor A Circuit High - No sub type information	 <p>NOTE: - Circuit DPF_PRESSURE_SENSOR -</p> <ul style="list-style-type: none"> • Harness fault - Particulate filter pressure sensor • Particulate filter pressure sensor failure 	 <p>NOTE: If a new diesel particulate filter pressure sensor or hose lines have been installed or incorrectly routed, or any pressure sensor circuit repairs carried out, the engine control module must learn and store the new diesel particulate filter pressure sensor offset value. The following conditions must be met to allow the diesel particulate filter pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system, clear DTCs from engine control module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500RPM for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park and set ignition status to off. Wait 30 seconds</p>


			<p>for the engine control module to power down, learn and store diesel particulate filter pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Particulate Filter Differential Pressure Sensor Voltage - Bank 1 (0x03DB). This DTC is set when the particulate pressure sensor voltage is greater than the threshold set in the engine control module diagnostic check. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter pressure sensor signal circuit for open circuit, short circuit to ground, short circuit to other circuits. Check the sensor ground circuit for open circuit, short circuit to power, high resistance. Check the sensor power supply circuit for open circuit, short circuit to ground, high resistance. Repair wiring as required If there are no wiring faults suspect the particulate filter pressure sensor. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2456-00	Diesel Particulate Filter Pressure Sensor A Circuit Intermittent/Erratic - No sub type information	<ul style="list-style-type: none"> Diesel particulate filter pressure sensor hoses crushed, blocked, split Diesel particulate filter differential pressure sensor failure 	<p> NOTE: If a new diesel particulate filter pressure sensor or hose lines have been installed or incorrectly routed, or any pressure sensor circuit repairs carried out, the engine control module must learn and store the new diesel particulate filter pressure sensor offset value. The following conditions must be met to allow the diesel particulate filter pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system, clear DTCs from engine control module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500RPM for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park and set ignition status to off. Wait 30 seconds for the engine control module to power down, learn and store diesel particulate filter pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa</p> <ul style="list-style-type: none"> Check diesel particulate filter pressure sensor hoses for crushed, blocked, split Check and replace diesel particulate filter differential pressure sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2458-66	Diesel Particulate Filter Regeneration Duration (Bank 1) - Signal has too many transitions / events	<ul style="list-style-type: none"> Permanent regeneration 	<p> NOTE: This code is enabled for JLR engineering detailed diagnostics only. No further action should be taken</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check for related


			DTCs and refer to the relevant DTC index
P2459-65	Diesel Particulate Filter Regeneration Frequency (Bank 1) - Signal has too few transitions / events	<ul style="list-style-type: none"> Blocked regeneration Customer driving routine does not allow the system to clean the particulate filter 	 <p>NOTE: If DTC is P2459-65 or AMBER DPF FULL REFER TO HANDBOOK message is displayed with no other reported messages. No repair is required, if the vehicle is driven on a highway AS DIRECTED IN THE HANDBOOK then the light will be extinguished and the system self healed, nothing more than this is required</p> <ul style="list-style-type: none"> Refer to the diesel particulate filter regeneration procedure and carry out a diesel particulate filter regeneration Advise customer of driving routine required to regenerate diesel particulate filter as stated in the vehicle handbook
P2459-66	Diesel Particulate Filter Regeneration Frequency (Bank 1) - Signal has too many transitions / events	<ul style="list-style-type: none"> Regeneration frequency 	 <p>NOTE: This code is enabled for JLR engineering detailed diagnostics only. No further action should be taken</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC index
P245A-11	Exhaust Gas Recirculation Cooler Bypass Control Circuit - Circuit short to ground	 <p>NOTE: - Circuit EGRCBV</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Harness fault - Exhaust gas recirculation cooling bypass valve solenoid circuit short circuit to ground 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Cooler Bypass Valve Duty Cycle (0x03C5). Refer to the electrical circuit diagrams and check the exhaust gas recirculation cooling bypass valve solenoid circuit for short circuit to ground. Check power supply to the solenoid. Repair any wiring faults found. Clear DTC and retest
P245A-12	Exhaust Gas Recirculation Cooler Bypass Control Circuit - Circuit short to battery	 <p>NOTE: - Circuit EGRCBV</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Harness fault - Exhaust gas recirculation cooling bypass valve solenoid circuit short circuit to power Exhaust gas recirculation cooling bypass valve solenoid failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Cooler Bypass Valve Duty Cycle (0x03C5). Refer to the electrical circuit diagrams and check the exhaust gas recirculation cooling bypass valve solenoid circuit for short circuit to power. Check power supply to the solenoid. Repair any wiring faults found. Clear DTC and retest If no fault found in wiring harness suspect exhaust gas recirculation cooling bypass valve solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P245A-13	Exhaust Gas Recirculation Cooler Bypass Control Circuit - Circuit open	 <p>NOTE: - Circuit EGRCBV</p>	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Cooler Bypass Valve Duty

		<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Harness fault - Exhaust gas recirculation cooling bypass valve solenoid circuit open circuit Exhaust gas recirculation cooling bypass valve solenoid failure 	<p>Cycle (0x03C5). Refer to the electrical circuit diagrams and check the exhaust gas recirculation cooling bypass valve solenoid circuit for open circuit. Check power supply to the solenoid. Repair any wiring faults found. Clear DTC and retest</p> <ul style="list-style-type: none"> If no fault found in wiring harness suspect exhaust gas recirculation cooling bypass valve solenoid failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P245B-19	Exhaust Gas Recirculation Cooler Bypass Control Circuit Range/Performance - Circuit current above threshold	<ul style="list-style-type: none"> Harness fault - Exhaust gas recirculation cooling bypass valve solenoid circuit short circuit to ground, high resistance Exhaust gas recirculation cooling bypass valve solenoid failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, EGR Cooler Bypass Valve Duty Cycle (0x03C5). Refer to the electrical circuit diagrams and check the exhaust gas recirculation cooling bypass valve solenoid circuit for short circuit to ground, high resistance. Repair any wiring faults found. Clear DTC and retest Check and install a new exhaust gas recirculation cooling bypass valve solenoid as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2463-00	Diesel Particulate Filter Restriction - Soot Accumulation (Bank 1) - No sub type information	<ul style="list-style-type: none"> Maximum soot mass 	<ul style="list-style-type: none"> Refer to the relevant pinpoint test in section 309-00
P246C-00	Diesel Particulate Filter Restriction - Forced Limited Power (Bank 1) - No sub type information	<ul style="list-style-type: none"> Diagnostic fault check for maximum pressure differential characteristics 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check for related DTCs and refer to the relevant DTC index
P250A-36	Engine Oil Level Sensor Circuit - Signal frequency too low	 NOTE: - Circuit OTL - <ul style="list-style-type: none"> The engine control module detected excessive duration for one cycle of the output across a specified sample size Oil temperature level sensor circuit short circuit to ground, high resistance, open circuit Oil temperature level sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Engine Oil Level - Measured (0x03E6), Engine Oil Volume - Calculated (0x03F2), Sump Oil Temperature - Measured (0x03F3). Refer to the electrical circuit diagrams and check oil temperature level sensor circuit for short circuit to ground, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new oil temperature level sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P250A-37	Engine Oil Level Sensor Circuit - Signal frequency too high	 NOTE: - Circuit OTL - <ul style="list-style-type: none"> The engine control module detected insufficient duration for one cycle of the output across a specified sample size Oil temperature level sensor circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Engine Oil Level - Measured (0x03E6), Engine Oil Volume - Calculated (0x03F2), Sump Oil Temperature - Measured (0x03F3). Refer to the electrical circuit diagrams and check oil temperature level sensor circuit for short circuit to power. Repair wiring harness as required. Clear DTC and retest Check and install a new oil temperature



		<ul style="list-style-type: none"> Oil temperature level sensor failure 	<p>level sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p>
P250A-38	Engine Oil Level Sensor Circuit - Signal frequency incorrect	 <p>NOTE: - Circuit OTL -</p> <ul style="list-style-type: none"> Oil temperature level sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit Oil temperature level sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Engine Oil Level - Measured (0x03E6), Engine Oil Volume - Calculated (0x03F2), Sump Oil Temperature - Measured (0x03F3). Refer to the electrical circuit diagrams and check oil temperature level sensor circuit for short circuit to ground, short circuit to power, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new oil temperature level sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P250A-47	Engine Oil Level Sensor Circuit - Watchdog / safety Micro Controller failure	<ul style="list-style-type: none"> Oil temperature level sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit Oil temperature level sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Engine Oil Level - Measured (0x03E6), Engine Oil Volume - Calculated (0x03F2), Sump Oil Temperature - Measured (0x03F3). Refer to the electrical circuit diagrams and check oil temperature level sensor circuit for short circuit to ground, short circuit to power, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new oil temperature level sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P250A-92	Engine Oil Level Sensor Circuit - Performance or incorrect operation	<ul style="list-style-type: none"> Oil temperature level sensor circuit short circuit to ground, short circuit to power, high resistance, open circuit Oil temperature level sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Engine Oil Level - Measured (0x03E6), Engine Oil Volume - Calculated (0x03F2), Sump Oil Temperature - Measured (0x03F3). Refer to the electrical circuit diagrams and check oil temperature level sensor circuit for short circuit to ground, short circuit to power, high resistance, open circuit. Repair wiring harness as required. Clear DTC and retest Check and install a new oil temperature level sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2586-13	Turbocharger Boost Control Position Sensor B Circuit - Circuit open	 <p>NOTE: - Circuit VGT_FB -</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signal, Boost Pressure Actuator Bank 2 - Measured Position (0x0347). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane on bank 1 for open circuit. This circuit consists of three wires between the engine control module and the variable geometry turbocharger control module. The three sensor wires are a 5 volt sensor supply,

		<ul style="list-style-type: none"> • Harness fault - Variable geometry turbocharger actuator vane open circuit • Variable geometry turbocharger actuator vane failure 	<p>a sensor ground and a signal line. Check signal line for open circuit and power and ground supply to sensor. Repair wiring as required. Clear DTC and retest</p> <ul style="list-style-type: none"> • If no fault found in wiring harness suspect variable geometry turbocharger position sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2586-32	Turbocharger Boost Control Position Sensor B Circuit - Signal low time < minimum	 <p>NOTE: - Circuit VGT_FB</p> <ul style="list-style-type: none"> • Harness fault - Variable geometry turbocharger actuator vane circuit short circuit to ground, high resistance, open circuit • Variable geometry turbocharger actuator vane failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal, Boost Pressure Actuator Bank 2 - Measured Position (0x0347). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane on bank 1 for short circuit to ground, high resistance, open circuit. Repair wiring as required. Clear DTC and retest • If no fault found in wiring harness check and install a new variable geometry turbocharger position sensor as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2586-35	Turbocharger Boost Control Position Sensor B Circuit - Signal high time > maximum	 <p>NOTE: - Circuit VGT_FB</p> <ul style="list-style-type: none"> • Harness fault - Variable geometry turbocharger actuator vane • Variable geometry turbocharger actuator vane failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal, Boost Pressure Actuator Bank 2 - Measured Position (0x0347). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane on bank 1 for open circuit. This circuit consists of three wires between the engine control module and the variable geometry turbocharger control module. The three sensor wires are a 5 volt sensor supply, a sensor ground and a signal line. Check signal line for open circuit, short circuit to power, short circuit to ground. Check power and ground supply to sensor. Repair wiring as required. Clear DTC and retest • If no fault found in wiring harness suspect variable geometry turbocharger position sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2586-36	Turbocharger Boost Control Position Sensor B Circuit - Signal frequency too low	 <p>NOTE: - Circuit VGT_FB</p> <ul style="list-style-type: none"> • The engine control module detected excessive duration for one cycle of the output across a specified sample size • Harness fault - Variable geometry turbocharger actuator vane • Variable geometry turbocharger actuator vane failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal, Boost Pressure Actuator Bank 2 - Measured Position (0x0347). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane on bank 1 for open circuit. This circuit consists of three wires between the engine control module and the variable geometry turbocharger control module. The three sensor wires are a 5 volt sensor supply, a sensor ground and a signal line. Check signal line for open circuit, short circuit to power, short circuit to ground. Check power and ground supply to sensor. Repair wiring as required. Clear DTC and retest

			<ul style="list-style-type: none"> If no fault found in wiring harness suspect variable geometry turbocharger position sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2586-37	Turbocharger Boost Control Position Sensor B Circuit - Signal frequency too high	 <p>NOTE: - Circuit VGT_FB</p> <ul style="list-style-type: none"> The engine control module detected insufficient duration for one cycle of the output across a specified sample size Harness fault - Variable geometry turbocharger actuator vane Variable geometry turbocharger actuator vane failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signal, Boost Pressure Actuator Bank 2 - Measured Position (0x0347). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane on bank 1 for open circuit. This circuit consists of three wires between the engine control module and the variable geometry turbocharger control module. The three sensor wires are a 5 volt sensor supply, a sensor ground and a signal line. Check signal line for open circuit, short circuit to power, short circuit to ground. Check power and ground supply to sensor. Repair wiring as required. Clear DTC and retest If no fault found in wiring harness suspect variable geometry turbocharger actuator vane failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2587-92	Turbocharger Boost Control Position Sensor B Circuit Range/Performance - Performance or incorrect operation	<ul style="list-style-type: none"> Harness fault - Variable geometry turbocharger actuator vane Variable geometry turbocharger actuator vane failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signal, Boost Pressure Actuator Bank 2 - Measured Position (0x0347). Refer to the electrical circuit diagrams and check the variable geometry turbocharger actuator vane on bank 1 for open circuit. This circuit consists of three wires between the engine control module and the variable geometry turbocharger control module. The three sensor wires are a 5 volt sensor supply, a sensor ground and a signal line. Check signal line for open circuit, short circuit to power, short circuit to ground. Check power and ground supply to sensor. Repair wiring as required. Clear DTC and retest If no fault found in wiring harness suspect variable geometry turbocharger actuator vane failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2588-00	Turbocharger Boost Control Position Sensor B Circuit Low - No sub type information	 <p>NOTE: - Circuit VGT_FB</p> <ul style="list-style-type: none"> Harness fault - Variable geometry turbocharger actuator vane Variable geometry turbocharger actuator vane circuit short circuit to ground Variable geometry turbocharger actuator vane failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signal, Boost Pressure Actuator Bank 2 - Measured Position (0x0347). This DTC is set when the engine control module detects a low circuit voltage on the signal line from the variable geometry turbocharger actuator vane. This circuit consists of three wires between the engine control module and the variable geometry turbocharger control module. The three sensor wires are a 5 volt sensor supply, a sensor ground and a signal line. Check signal line for short circuit to ground. Check power and ground supply to sensor. Repair wiring

			<ul style="list-style-type: none"> as required. Clear DTC and retest Refer to the electrical circuit diagrams and check variable geometry turbocharger actuator vane circuit for short circuit to ground If no fault found in wiring harness suspect variable geometry turbocharger actuator vane failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2589-00	Turbocharger Boost Control Position Sensor B Circuit High - No sub type information	 <p>NOTE: - Circuit VGT_FB</p> <ul style="list-style-type: none"> Harness fault - Variable geometry turbocharger actuator vane Variable geometry turbocharger actuator vane circuit short circuit to power Variable geometry turbocharger actuator vane failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signal, Boost Pressure Actuator Bank 2 - Measured Position (0x0347). This DTC is set when the engine control module detects a high circuit voltage on the signal line from the variable geometry turbocharger actuator vane. This circuit consists of three wires between the engine control module and the variable geometry turbocharger control module. The three sensor wires are a 5 volt sensor supply, a sensor ground and a signal line. Check signal line for short circuit to power. Check power and ground supply to sensor. Repair wiring as required. Clear DTC and retest Refer to the electrical circuit diagrams and check variable geometry turbocharger actuator vane circuit for short circuit to power If no fault found in wiring harness suspect variable geometry turbocharger actuator vane failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P268C-00	Cylinder 1 Injector Data Incompatible - No sub type information	<ul style="list-style-type: none"> Cylinder 1 injector calibration data held in the engine control module is different to that read from the injector Cylinder 1 injector calibration data not stored / programmed Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system reprogram injector codes. Clear DTC and re-check. Re-configure the engine control module Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P268C-51	Cylinder 1 Injector Data Incompatible - Not programmed	<ul style="list-style-type: none"> Cylinder 1 injector calibration data not stored / programmed Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system reprogram injector codes. Clear DTC and re-check. Re-configure the engine control module Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P268D-00	Cylinder 2 Injector Data Incompatible - No sub type information	<ul style="list-style-type: none"> Cylinder 2 injector calibration data held in the engine control module is different to that read from the injector Cylinder 2 injector calibration data not stored / programmed Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system reprogram injector codes. Clear DTC and re-check. Re-configure the engine control module Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component

P268D-51	Cylinder 2 Injector Data Incompatible - Not programmed	<ul style="list-style-type: none"> • Cylinder 2 injector calibration data not stored / programmed • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system reprogram injector codes. Clear DTC and re-check. Re-configure the engine control module • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P268E-00	Cylinder 3 Injector Data Incompatible - No sub type information	<ul style="list-style-type: none"> • Cylinder 3 injector calibration data held in the engine control module is different to that read from the injector • Cylinder 3 injector calibration data not stored / programmed • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system reprogram injector codes. Clear DTC and re-check. Re-configure the engine control module • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P268E-51	Cylinder 3 Injector Data Incompatible - Not programmed	<ul style="list-style-type: none"> • Cylinder 3 injector calibration data not stored / programmed • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system reprogram injector codes. Clear DTC and re-check. Re-configure the engine control module • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P268F-00	Cylinder 4 Injector Data Incompatible - No sub type information	<ul style="list-style-type: none"> • Cylinder 4 injector calibration data held in the engine control module is different to that read from the injector • Cylinder 4 injector calibration data not stored / programmed • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system reprogram injector codes. Clear DTC and re-check. Re-configure the engine control module • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P268F-51	Cylinder 4 Injector Data Incompatible - Not programmed	<ul style="list-style-type: none"> • Cylinder 4 injector calibration data not stored / programmed • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system reprogram injector codes. Clear DTC and re-check. Re-configure the engine control module • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2690-00	Cylinder 5 Injector Data Incompatible - No sub type information	<ul style="list-style-type: none"> • Cylinder 5 injector calibration data held in the engine control module is different to that read from the injector • Cylinder 5 injector calibration data not stored / programmed • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system reprogram injector codes. Clear DTC and re-check. Re-configure the engine control module • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2690-51	Cylinder 5 Injector Data Incompatible - Not programmed	<ul style="list-style-type: none"> • Cylinder 5 injector calibration data not stored / programmed • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system reprogram injector codes. Clear DTC and re-check. Re-configure the engine control module • Check and install a new engine control module as required. Refer to the warranty policy and procedures

			<p>manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p>
P2691-00	Cylinder 6 Injector Data Incompatible - No sub type information	<ul style="list-style-type: none"> • Cylinder 6 injector calibration data held in the engine control module is different to that read from the injector • Cylinder 6 injector calibration data not stored / programmed • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system reprogram injector codes. Clear DTC and re-check. Re-configure the engine control module • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2691-51	Cylinder 6 Injector Data Incompatible - Not programmed	<ul style="list-style-type: none"> • Cylinder 6 injector calibration data not stored / programmed • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system reprogram injector codes. Clear DTC and re-check. Re-configure the engine control module • Check and install a new engine control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2A00-16	O2 Circuit Range / Performance (Bank 1, Sensor 1) - Circuit voltage below threshold	 <p>NOTE: - Circuit LPTR_A</p> <ul style="list-style-type: none"> • The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground • Harness fault - Pre catalyst oxygen sensor fault • Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects the voltage on the trim resistor circuit of the pre catalyst oxygen sensor is less than the voltage threshold. This may be caused by the pre catalyst oxygen sensor being too hot to operate correctly. Refer to the workshop manual and check the exhaust system and pre catalyst oxygen sensor harness for sign of mechanical damage. Refer to the electrical circuit diagrams and check all the pre catalyst oxygen sensor circuits for open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Check all engine control module power and ground supplies. Repair wiring as required. Clear DTC and retest • If no fault found in wiring harness suspect pre catalyst oxygen sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
P2A00-17	O2 Circuit Range / Performance (Bank 1, Sensor 1) - Circuit voltage above threshold	 <p>NOTE: - Circuit LPTR_A</p> <ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Harness fault - Pre catalyst oxygen sensor fault • Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects the voltage on the trim resistor circuit of the pre catalyst oxygen sensor is greater than the voltage threshold. This may be caused by the pre catalyst oxygen sensor being too hot to operate correctly. Refer to the workshop manual and check the exhaust system and pre catalyst oxygen sensor harness for sign of mechanical damage. Refer to the electrical circuit diagrams and check all the pre catalyst oxygen sensor circuits for open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Check all engine control module power and ground supplies. Repair wiring as required. Clear DTC and retest • If no fault found in wiring harness suspect pre catalyst oxygen sensor failure. Refer to the warranty policy and procedures manual, or determine if

			any prior approval programme is in operation, prior to the installation of a new module/component
P2A00-26	O2 Circuit Range / Performance (Bank 1, Sensor 1) - Signal rate of change below threshold	 <p>NOTE: - Circuit LPTR_A</p> <ul style="list-style-type: none"> • Harness fault - Pre catalyst oxygen sensor fault • Pre catalyst oxygen sensor failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects the voltage on the trim resistor circuit of the pre catalyst oxygen sensor is greater than the voltage threshold. This may be caused by the pre catalyst oxygen sensor being too hot to operate correctly. Refer to the workshop manual and check the exhaust system and pre catalyst oxygen sensor harness for sign of mechanical damage. Refer to the electrical circuit diagrams and check all the pre catalyst oxygen sensor circuits for open circuits, short circuit to power, short circuit to ground, short circuit to other circuits. Check all engine control module power and ground supplies. Repair wiring as required. Clear DTC and retest • If no fault found in wiring harness suspect pre catalyst oxygen sensor failure. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U0001-00	High Speed CAN Communication Bus - No sub type information	<ul style="list-style-type: none"> • High speed CAN bus failure • High speed CAN bus circuit, short circuit to ground, short circuit to power, open circuit 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system carry out network integrity test • Refer to the electrical circuit diagrams and check high speed CAN network for short circuit to ground, short circuit to power, open circuit
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> • High speed CAN bus failure • High speed CAN bus circuit, short circuit to ground, short circuit to power, open circuit 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system carry out network integrity test • Refer to the electrical circuit diagrams and check high speed CAN network for short circuit to ground, short circuit to power, open circuit
U0101-00	Lost Communication with TCM - No sub type information	<ul style="list-style-type: none"> • The engine control module has not received the expected CAN signal from the transmission control module within the specified time interval • CAN harness link between engine control module and transmission control module network malfunction 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check transmission control module for DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check transmission control module power and ground circuits for open circuit. Check CAN harness between engine control module and transmission control module, repair as necessary
U0101-26	Lost Communication with TCM - Signal rate of change below threshold	<ul style="list-style-type: none"> • The engine control module has not received the expected CAN signal from the transmission control module within the specified time interval • CAN harness link between engine control module and transmission control module network malfunction 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check transmission control module for DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check transmission control module power and ground circuits for open circuit. Check CAN harness between engine control module and transmission control module, repair as necessary
U0102-00	Lost Communication with Transfer Case Control Module - No sub type information	<ul style="list-style-type: none"> • The engine control module has not received the expected CAN signal from the 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check transfer case control module for DTCs and refer to the relevant DTC index

		<p>transfer case control module within the specified time interval</p> <ul style="list-style-type: none"> • CAN harness link between engine control module and transfer case control module network malfunction 	<p>Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check transfer case control module power and ground circuits for open circuit. Check CAN harness between engine control module and transfer case control module, repair as necessary</p>
U0103-00	Lost Communication With Gear Shift Control Module A - No sub type information	<ul style="list-style-type: none"> • The engine control module has not received the expected CAN signal from the gear shift module (automatic transmission selector) within the specified time interval • CAN harness link between engine control module and gear shift module (automatic transmission selector) network malfunction 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check gear shift module (automatic transmission selector) for DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check gear shift module (automatic transmission selector) power and ground circuits for open circuit. Check CAN harness between engine control module and gear shift module (automatic transmission selector), repair as necessary
U0104-00	Lost Communication With Cruise Control Module - No sub type information	<ul style="list-style-type: none"> • The engine control module has not received the expected CAN signal from the speed control module within the specified time interval • CAN harness link between engine control module and speed control module network malfunction 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check speed control module for DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check speed control module power and ground circuits for open circuit. Check CAN harness between engine control module and speed control module, repair as necessary
U0120-00	Lost Communication with Starter/ Generator Control Module - No sub type information	<ul style="list-style-type: none"> • The engine control module has not received the expected CAN signal from the anti-lock brake system control module within the specified time interval • CAN harness link between engine control module and anti-lock brake system control module network malfunction 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check anti-lock brake system control module for DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check anti-lock brake system control module power and ground circuits for open circuit. Check CAN harness between engine control module and anti-lock brake system control module, repair as necessary
U0121-00	Lost Communication With Anti-Lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> • The engine control module has not received the expected CAN signal from the anti-lock brake system control module within the specified time interval • CAN harness link between engine control module and anti-lock brake system control module network malfunction 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check anti-lock brake system control module for DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check anti-lock brake system control module power and ground circuits for open circuit. Check CAN harness between engine control module and anti-lock brake system control module, repair as necessary
U0126-00	Lost Communication With Steering Angle Sensor Module - No sub type information	<ul style="list-style-type: none"> • The engine control module has not received the expected CAN signal from the Steering Angle Sensor within the specified time interval • CAN harness link 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check Steering Angle Sensor for DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check Steering

		between engine control module and Steering Angle Sensor network malfunction	Angle Sensor power and ground circuits for open circuit. Check CAN harness between engine control module and Steering Angle Sensor, repair as necessary
U0128-00	Lost Communication With Park Brake Control Module - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the parking brake control module within the specified time interval CAN harness link between engine control module and parking brake control module network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check parking brake control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check parking brake control module power and ground circuits for open circuit. Check CAN harness between engine control module and parking brake control module, repair as necessary
U0133-00	Lost Communication With Active Roll Control Module - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the active roll control module within the specified time interval CAN harness link between engine control module and active roll control module network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check active roll control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check active roll control module power and ground circuits for open circuit. Check CAN harness between engine control module and active roll control module, repair as necessary
U0138-00	Lost Communication with All Terrain Control Module - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the all terrain control module within the specified time interval CAN harness link between engine control module and all terrain control module network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check all terrain control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check all terrain control module power and ground circuits for open circuit. Check CAN harness between engine control module and all terrain control module, repair as necessary
U0140-00	Lost Communication With Central Body Control Module - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the central junction box within the specified time interval CAN harness link between engine control module and central junction box network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check central junction box for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check central junction box power and ground circuits for open circuit. Check CAN harness between engine control module and central junction box, repair as necessary
U0151-00	Lost Communication With Restraints Control Module - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the restraints control module within the specified time interval CAN harness link between engine control module and restraints control module network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check restraints control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check restraints control module power and ground circuits for open circuit. Check CAN harness between engine control module and restraints control module, repair as necessary
U0151-08	Lost Communication With Restraints Control Module - Bus Signal / Message	<ul style="list-style-type: none"> The engine control module has not received the expected 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check restraints control module for DTCs and refer to

	Failures	<p>CAN signal from the restraints control module within the specified time interval</p> <ul style="list-style-type: none"> • CAN harness link between engine control module and restraints control module network malfunction 	<p>the relevant DTC index</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check restraints control module power and ground circuits for open circuit. Check CAN harness between engine control module and restraints control module, repair as necessary
U0155-00	Lost Communication With Instrument Panel Cluster (IPC) Control Module - No sub type information	<ul style="list-style-type: none"> • The engine control module has not received the expected CAN signal from the instrument cluster within the specified time interval • CAN harness link between engine control module and instrument cluster network malfunction 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check instrument cluster for DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check instrument cluster power and ground circuits for open circuit. Check CAN harness between engine control module and instrument cluster, repair as necessary
U0164-00	Lost Communication With HVAC Control Module - No sub type information	<ul style="list-style-type: none"> • Power distribution system fault - fuse fault • CAN network fault • Heating ventilation air and conditioning control module fault 	<ul style="list-style-type: none"> • This DTC is set if the engine control module loses communication with the heating ventilation air and conditioning control module. Check the heating ventilation air and conditioning control module for DTCs and refer to the relevant DTC index • Refer to the electrical circuit diagrams and check the power supply and ground connections to the heating ventilation air and conditioning control module • Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required • If there are no faults in the wiring harness and network communications suspect the heating ventilation air and conditioning control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U0167-00	Lost Communication With Vehicle Immobilizer Control Module - No sub type information	<ul style="list-style-type: none"> • engine control module identity transfer failed 	<ul style="list-style-type: none"> • Check the immobilizer control module for DTCs and refer to the relevant DTC index. Refer to the electrical circuit diagrams and check the power supply and ground connections to the immobilizer control module. Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required • If there are no faults in the wiring harness and network communications suspect the immobilizer control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> • CAN network fault • Central junction box fault • Car configuration file incorrect 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring as required • Car configuration signal not received. Check central junction box for DTCs and refer to the relevant DTC index

			<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check and up-date the car configuration file as required
U0405-68	Invalid Data Received From Cruise Control Module - Event information	<ul style="list-style-type: none"> Speed control system fault 	<ul style="list-style-type: none"> Check speed control module for related DTCs and refer to relevant DTC index Refer to the electrical circuit diagrams and check the power supply and ground connections to the speed control module Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring as required If no wiring or network faults found suspect speed control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U0405-82	Invalid Data Received From Cruise Control Module - Alive/sequence counter incorrect/not updated	<ul style="list-style-type: none"> Speed control system fault Harness fault - CAN circuits Harness fault - Speed control module power supply or ground failure 	<ul style="list-style-type: none"> Check speed control buttons are not jammed/contaminated/damaged. Check speed control module for related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring as required Refer to the electrical circuit diagrams and check the power supply and ground connections to the speed control module If no wiring or network faults found suspect speed control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U0405-84	Invalid Data Received From Cruise Control Module - Signal below allowable range	<ul style="list-style-type: none"> Speed control system fault 	<ul style="list-style-type: none"> Check speed control module for related DTCs and refer to relevant DTC index Refer to the electrical circuit diagrams and check the power supply and ground connections to the speed control module Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring as required If no wiring or network faults found suspect speed control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U0405-86	Invalid Data Received From Cruise Control Module - Signal invalid	<ul style="list-style-type: none"> Speed control system fault 	<ul style="list-style-type: none"> Check speed control buttons are not jammed/contaminated/damaged. Check speed control module for related DTCs and refer to the relevant DTC index
U0407-00	Invalid Data Received From Glow Plug Control Module - No sub type information	<ul style="list-style-type: none"> This DTC is set when the glow plug module does not match what is expected by the engine control module. Detection of the coding word is complete when 2 of 3 coding words match. This process is a one time operation and 	<ul style="list-style-type: none"> Check the correct glow plug module is installed to the vehicle

		will be completed during assembly of the vehicle	
U0407-81	Invalid Data Received From Glow Plug Control Module - Invalid serial data received	<ul style="list-style-type: none"> Glow plug control system fault 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the power supply and ground connections to the glow plug control module. Check the diagnostic circuit between the engine control module and the glow plug control module for intermittent faults, short circuits, open circuits. Clear the DTC and recheck the system If the DTC recurs suspect the glow plug control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U0415-68	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - Event information	<ul style="list-style-type: none"> Signal error for vehicle speed over CAN 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check anti-lock brake system control module for DTCs and refer to the relevant DTC index
U0416-46	Invalid Data Received From Vehicle Dynamics Control Module - Calibration / parameter memory failure	<ul style="list-style-type: none"> Anti-lock brake system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check anti-lock brake system control module for DTCs and refer to the relevant DTC index
U0416-68	Invalid Data Received From Vehicle Dynamics Control Module - Event information	<ul style="list-style-type: none"> The engine control module has received the default brake pressure signal value over CAN from the anti-lock brake system control module for a specified time interval Anti-lock brake system fault CAN harness link between engine control module and anti-lock brake system control module network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check anti-lock brake system control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check anti-lock brake system control module power and ground circuits for open circuit. Check CAN harness between engine control module and anti-lock brake system control module, repair as necessary Clear the DTCs, drive the vehicle at greater than 11mph (17kph) with a throttle pedal greater than 10% for greater than 1 second. Press the brake pedal, using maximum travel for greater than 1 second. Check the system is operating correctly and the DTC does not return
U0416-92	Invalid Data Received From Vehicle Dynamics Control Module - Performance or incorrect operation	<ul style="list-style-type: none"> Difference between anti-lock brake system speed signal value and instrument cluster speed value at low vehicle speeds 	Check the anti-lock brake system control module for DTCs and refer to the relevant DTC index
U0424-68	Invalid Data Received From HVAC Control Module - Event information	<ul style="list-style-type: none"> Power distribution system fault - fuse fault CAN network fault Heating ventilation air and conditioning control module fault 	<ul style="list-style-type: none"> This DTC is set if the engine control module loses communication with the heating ventilation air and conditioning control module. Check the heating ventilation air and conditioning control module for DTCs and refer to the relevant DTC index Refer to the electrical circuit diagrams and check the power supply and ground connections to the heating ventilation air and conditioning control module Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required If there are no faults in the wiring

			harness and network communications suspect the heating ventilation air and conditioning control module. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
U0426-00	Invalid Data Received From Vehicle Immobilizer Control Module - No sub type information	<ul style="list-style-type: none"> • Immobilizer control module has received an invalid identity response • Module substituted 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required. Using the manufacturer approved diagnostic system check and up-date the car configuration file as required • Ensure all modules installed in the vehicle which store vehicle identity are valid for this vehicle and are not substitutes from a donor vehicle
U0A1A-87	LIN Bus "A" - Missing message	<ul style="list-style-type: none"> • Generator LIN bus communication circuit failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the generator LIN bus circuit, for short circuit to power, short circuit to ground, open circuit. Repair wiring harness as required. Clear DTC and retest
U1A14-00	CAN Initialization Failure - No sub type information	<ul style="list-style-type: none"> • Harness fault - CAN circuit fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required
U2005-64	Vehicle Speed - Signal plausibility failure	<ul style="list-style-type: none"> • Anti-lock brake system fault 	<ul style="list-style-type: none"> • This DTC is set when the engine control module has recognised a vehicle speed signal plausibility fault. Check the anti-lock brake system module for related DTCs and refer to the relevant DTC index. Check the instrument cluster for related DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required
U2005-84	Vehicle Speed - Below allowable range	<ul style="list-style-type: none"> • Anti-lock brake system fault 	<ul style="list-style-type: none"> • This DTC is set when the engine control module has recognised a vehicle speed signal which is below the allowable range. Check the anti-lock brake system module for related DTCs and refer to the relevant DTC index. Check the instrument cluster for related DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required
U2005-85	Vehicle Speed - Above allowable range	<ul style="list-style-type: none"> • Anti-lock brake system fault 	<ul style="list-style-type: none"> • This DTC is set when the engine control module has recognised a vehicle speed signal which is above the allowable range. Check the anti-lock brake system module for related DTCs and refer to the relevant DTC index. Check the instrument cluster for related DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as

			required
U2108-00	Adaptive Cruise Control - No sub type information	<ul style="list-style-type: none"> Adaptive speed control system fault - error indicating adaptive speed control fault flag set 	<ul style="list-style-type: none"> Check adaptive speed control for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required
U2108-24	Adaptive Cruise Control - Signal stuck high	<ul style="list-style-type: none"> The engine control module measures a signal that remains high when transitions are expected Adaptive speed control system fault - Adaptive speed control follow speed error 	<ul style="list-style-type: none"> Check adaptive speed control for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required
U2108-64	Adaptive Cruise Control - Signal plausibility failure	<ul style="list-style-type: none"> Adaptive speed control system fault - Adaptive speed control follow speed range error 	<ul style="list-style-type: none"> Check adaptive speed control for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required
U2108-68	Adaptive Cruise Control - Event information	<ul style="list-style-type: none"> Adaptive speed control system fault - error indicating adaptive speed control follow speed check when stationary 	<ul style="list-style-type: none"> Check adaptive speed control for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required
U2108-86	Adaptive Cruise Control - Signal invalid	<ul style="list-style-type: none"> Adaptive speed control system fault - error when invalid adaptive speed control resume requests are present 	<ul style="list-style-type: none"> Check adaptive speed control for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system carry out a network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required

General Information - Diagnostic Trouble Code (DTC) Index DTC: V6 3.0L S/C Petrol, DTC: Engine Control Module (ECM)

Description and Operation

Engine Control Module (ECM) - V6 3.0L S/C Petrol



WARNING: Fuel injector voltage will reach 65Volts during operation and have a high current requirement.

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.









Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.




The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Engine Control Module (ECM) - V6 3.0L S/C Petrol. For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.




For additional information, refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 S/C 3.0L Petrol, Diagnosis and Testing).




DTC	Description	Possible Causes	Action
B10A2-32	Crash Input - Signal low time < minimum	<p>NOTE: Circuit reference I_F_CRASH</p> <ul style="list-style-type: none"> The engine control module detected the low pulse is too narrow with respect to time This DTC is set when the engine control module detects that the signal low time is less than the minimum value Restraints control module failure Auxiliary junction box failure Harness failure 	<ul style="list-style-type: none"> This DTC is set when the 'airbag deployed' signal supplied by the restraints control module is outside the specification expected by the engine control module Check the restraints control module for DTCs and refer to the relevant DTC index If this DTC is logged with U0151-00 & U0151-08, check for fuse failure, restraints control module power and ground circuits for open circuit. Refer to the electrical circuit diagrams and check CAN harness If this DTC is logged with



			<p>U0151-08, or on its own refer to the electrical circuit diagrams and check restraints control module crash signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Check auxiliary junction box for DTCs and refer to the relevant DTC index • Refer to electrical circuit diagrams and check the supplementary restraints system input circuit for failures. This circuit is a single wire which connects the restraints control module to the auxiliary junction box and the engine control module. Check this circuit for short circuit to power, short circuit to ground, open circuit. Repair harness as required • Clear the DTC and retest
B10A2-35	Crash Input - Signal high time > maximum	 <p>NOTE: Circuit reference I_F_CRASH</p> <ul style="list-style-type: none"> • This DTC is set when the engine control module detects that the signal high time is greater than the maximum value • This DTC is set when the engine control module detects that the signal high time is greater than the maximum value • Restraints control module failure • Auxiliary junction box failure • Harness failure 	<ul style="list-style-type: none"> • This DTC is set when the 'airbag deployed' signal supplied by the restraints control module is outside the specification expected by the engine control module • Check the restraints control module for DTCs and refer to the relevant DTC index • Check auxiliary junction box for DTCs and refer to the relevant DTC index • Refer to electrical circuit diagrams and check the supplementary restraints system input circuit for failures. This circuit is a single wire which connects the restraints control module to the auxiliary junction box and the engine control module. Check this circuit for short circuit to power, short circuit to ground, open circuit. Repair harness as required • Clear the DTC and retest
B1206-68	Crash Occurred - Event information	<ul style="list-style-type: none"> • This DTC is set if the restraints control module has deployed the restraints systems following activation of the crash sensors • Event information. The engine control module has received a crash signal from the restraints control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check the restraints control module for DTCs and refer to the relevant DTC index
B1A75-00	Fuel Sender No.1 - No sub type information	<ul style="list-style-type: none"> • The fuel tank active side fuel level sensor is stuck 	 <p>NOTE: Monitor description. Within the engine control module software a fuel level model is created. If the error between the fuel level model and the measured fuel level has gone over a threshold, and no change in fuel level is detected a DTC is set</p> <ul style="list-style-type: none"> • Check the fuel level sensor for correct movement across the entire range
B1A76-00	Fuel Sender No.2 - No sub type information	<ul style="list-style-type: none"> • The fuel tank passive side fuel level sensor is stuck 	 <p>NOTE: Monitor description. Within the engine control module software a fuel level model is created. If the error between the fuel level model and the measured fuel level has gone over a threshold, and no change</p>




			<p>in fuel level is detected a DTC is set</p> <ul style="list-style-type: none"> • Check the fuel level sensor for correct movement across the entire range
P000A-00	Intake (A) Camshaft Position Slow Response Bank 1 - No sub type information	<ul style="list-style-type: none"> • Oil level is low • Variable camshaft timing solenoid circuit intake and exhaust connectors swapped • Variable camshaft timing solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance • Oil pressure is low • Variable camshaft timing actuator mechanical failure • Excessive camshaft friction 	<p> NOTE: Monitor description. Inlet camshaft is unable to achieve the desired set point angle. The camshaft is stuck</p> <ul style="list-style-type: none"> • Check the oil level is correct • Check variable camshaft timing solenoid circuit intake and exhaust connectors are not swapped • Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to camshaft is correct and that oil gallery is free from debris • Clear the DTC and retest • Check and install new variable camshaft timing actuator as required • Refer to the relevant sections of the workshop manual and check the camshaft operation
P000B-00	Exhaust (B) Camshaft Position Slow Response Bank 1 - No sub type information	<ul style="list-style-type: none"> • Oil level is low • Variable camshaft timing solenoid circuit intake and exhaust connectors swapped • Variable camshaft timing solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance • Oil pressure is low • Variable camshaft timing actuator mechanical failure • Excessive camshaft friction, restricted movement or stuck 	<p> NOTE: Monitor description. Exhaust camshaft is unable to achieve the desired set point angle. The camshaft is stuck</p> <ul style="list-style-type: none"> • Check the oil level is correct • Check variable camshaft timing solenoid circuit intake and exhaust connectors are not swapped • Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to camshaft is correct and that oil gallery is free from debris • Clear the DTC and retest • Check and install new variable camshaft timing actuator as required • Refer to the relevant sections of the workshop manual and check the camshaft operation
P000C-00	Intake (A) Camshaft Position Slow Response Bank 2 - No sub type information	<ul style="list-style-type: none"> • Oil level is low • Variable camshaft timing solenoid circuit intake and exhaust connectors swapped • Variable camshaft timing solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance • Oil pressure is low • Variable camshaft timing actuator mechanical failure • Excessive camshaft friction, 	<p> NOTE: Monitor description. Inlet camshaft is unable to achieve the desired set point angle. The camshaft is stuck</p> <ul style="list-style-type: none"> • Check the oil level is correct • Check variable camshaft timing solenoid circuit intake and exhaust connectors are not swapped • Refer to the electrical circuit






		restricted movement or stuck	<p>diagrams and check variable camshaft timing solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to camshaft is correct and that oil gallery is free from debris Clear the DTC and retest Check and install new variable camshaft timing actuator as required Refer to the relevant sections of the workshop manual and check the camshaft operation
P000D-00	Exhaust (B) Camshaft Position Slow Response Bank 2 - No sub type information	<ul style="list-style-type: none"> Oil level is low Variable camshaft timing solenoid circuit intake and exhaust connectors swapped Variable camshaft timing solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance Oil pressure is low Variable camshaft timing actuator mechanical failure Excessive camshaft friction, restricted movement or stuck 	<p> NOTE: Monitor description. Exhaust camshaft is unable to achieve the desired set point angle. The camshaft is stuck</p> <ul style="list-style-type: none"> Check the oil level is correct Check variable camshaft timing solenoid circuit intake and exhaust connectors are not swapped Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to camshaft is correct and that oil gallery is free from debris Clear the DTC and retest Check and install new variable camshaft timing actuator as required Refer to the relevant sections of the workshop manual and check the camshaft operation
P0010-00	Intake (A) Camshaft Position Actuator Circuit / Open (Bank 1) - No sub type information	<p> NOTE: Circuit reference O_T_CASICA</p> <ul style="list-style-type: none"> Variable camshaft timing solenoid circuit open circuit, high resistance Variable camshaft timing solenoid failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for open circuit, high resistance Clear the DTC and retest Check and install new variable camshaft timing solenoid as required
P0011-00	Intake (A) Camshaft Position Timing - Over-Advanced (Bank 1) - No sub type information	<ul style="list-style-type: none"> Oil level is low Variable camshaft timing solenoid circuit intake and exhaust connectors swapped Variable camshaft timing solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance Oil pressure is low Variable camshaft timing actuator mechanical failure Excessive camshaft friction, restricted movement or stuck 	<p> NOTE: Monitor description. Inlet camshaft is unable to achieve the desired set point angle. The camshaft is stuck</p> <ul style="list-style-type: none"> Check the oil level is correct Check variable camshaft timing solenoid circuit intake and exhaust connectors are not swapped Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the relevant sections of the workshop manual and check







			<p>the oil pressure is within specification. Check oil supply to camshaft is correct and that oil gallery is free from debris</p> <ul style="list-style-type: none"> • Clear the DTC and retest • Check and install new variable camshaft timing actuator as required • Refer to the relevant sections of the workshop manual and check the camshaft operation
P0013-00	Exhaust (B) Camshaft Position Actuator Circuit / Open (Bank 1) - No sub type information	 <p>NOTE: Circuit reference O_T_CASECA</p> <ul style="list-style-type: none"> • Variable camshaft timing solenoid circuit open circuit, high resistance • Variable camshaft timing solenoid failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for open circuit, high resistance • Clear the DTC and retest • Check and install new variable camshaft timing solenoid as required
P0014-00	Exhaust (B) Camshaft Position Timing - Over-Advanced (Bank 1) - No sub type information	<ul style="list-style-type: none"> • Oil level is low • Variable camshaft timing solenoid circuit intake and exhaust connectors swapped • Variable camshaft timing solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance • Oil pressure is low • Variable camshaft timing actuator mechanical failure • Excessive camshaft friction, restricted movement or stuck 	 <p>NOTE: Monitor description. Exhaust camshaft is unable to achieve the desired set point angle. The camshaft is stuck</p> <ul style="list-style-type: none"> • Check the oil level is correct • Check variable camshaft timing solenoid circuit intake and exhaust connectors are not swapped • Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to camshaft is correct and that oil gallery is free from debris • Clear the DTC and retest • Check and install new variable camshaft timing actuator as required • Refer to the relevant sections of the workshop manual and check the camshaft operation
P0016-00	Crankshaft Position - Camshaft Position Correlation - Bank 1 Sensor A - No sub type information	<ul style="list-style-type: none"> • Loose camshaft position sensor • Loose crankshaft position sensor • Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Crankshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Camshaft or crankshaft position sensor reluctor ring air gap excessive • Timing chain stretch beyond a tolerable limit • Valve timing incorrect 	<ul style="list-style-type: none"> • Check camshaft position sensor is installed correctly • Check crankshaft position sensor is installed correctly • Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance. Check crankshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check reluctor ring to sensor runout and air gap are within specification • Refer to the relevant section of the workshop manual and check valve timing is within specification
P0016-76	Crankshaft Position - Camshaft Position Correlation - Bank 1 Sensor A - Wrong mounting position	<ul style="list-style-type: none"> • The engine control module has detected incorrectly installed components • Loose camshaft position sensor • Loose crankshaft position 	 <p>NOTE: Monitor description. Initial reference adaption of cam wheel edges to determine system is OK post</p>




		<ul style="list-style-type: none"> sensor Camshaft or crankshaft position sensor reluctor ring air gap excessive Engine assembled incorrectly Valve timing incorrect 	<p>engine rebuild or valve timing overhaul</p> <ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Check crankshaft position sensor is installed correctly Refer to the relevant section of the workshop manual and check valve timing is within specification Check reluctor ring to sensor runout and air gap are within specification
P0016-79	Crankshaft Position - Camshaft Position Correlation - Bank 1 Sensor A - Mechanical linkage failure	<ul style="list-style-type: none"> Camshaft locking pin is not engaged during start Loose camshaft position sensor Camshaft position sensor disturbed signal Oil pressure to variable camshaft timing actuator is low Camshaft chain tensioner failure 	 NOTE: Monitor description. Correct engagement of camshaft locking pin. The average camshaft position is outside of the allowable limit during engine start. The engine will start poorly <ul style="list-style-type: none"> Check variable camshaft timing actuator for mechanical damage Check camshaft position sensor is installed correctly Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to variable camshaft timing actuator is correct and that oil gallery is free from debris Refer to the relevant sections of the workshop manual and check the camshaft chain tensioner is operating correctly
P0017-00	Crankshaft Position - Camshaft Position Correlation - Bank 1 Sensor B - No sub type information	<ul style="list-style-type: none"> Loose camshaft position sensor Loose crankshaft position sensor Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Crankshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Camshaft or crankshaft position sensor reluctor ring air gap excessive Timing chain stretch beyond a tolerable limit Valve timing incorrect 	<ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Check crankshaft position sensor is installed correctly Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance. Check crankshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check reluctor ring to sensor runout and air gap are within specification Refer to the relevant section of the workshop manual and check valve timing is within specification
P0017-76	Crankshaft Position - Camshaft Position Correlation - Bank 1 Sensor B - Wrong mounting position	<ul style="list-style-type: none"> The engine control module has detected incorrectly installed components Loose camshaft position sensor Loose crankshaft position sensor Camshaft or crankshaft position sensor reluctor ring air gap excessive Engine assembled incorrectly Valve timing incorrect 	 NOTE: Monitor description. Initial reference adaption of cam wheel edges to determine system is OK post engine rebuild or valve timing overhaul <ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Check crankshaft position sensor is installed correctly Refer to the relevant section of the workshop manual and check valve timing is within specification Check reluctor ring to sensor runout and air gap are within specification
P0017-79	Crankshaft Position - Camshaft Position	<ul style="list-style-type: none"> Camshaft locking pin is not engaged during start 	 NOTE: Monitor description.






	Correlation - Bank 1 Sensor B - Mechanical linkage failure	<ul style="list-style-type: none"> Loose camshaft position sensor Camshaft position sensor disturbed signal Oil pressure to variable camshaft timing actuator is low Camshaft chain tensioner failure 	<p>Correct engagement of camshaft locking pin. The average camshaft position is outside of the allowable limit during engine start. The engine will start poorly</p> <ul style="list-style-type: none"> Check variable camshaft timing actuator for mechanical damage Check camshaft position sensor is installed correctly Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to variable camshaft timing actuator is correct and that oil gallery is free from debris Refer to the relevant sections of the workshop manual and check the camshaft chain tensioner is operating correctly
P0018-00	Crankshaft Position - Camshaft Position Correlation - Bank 2 Sensor A - No sub type information	<ul style="list-style-type: none"> Loose camshaft position sensor Loose crankshaft position sensor Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Crankshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Camshaft or crankshaft position sensor reluctor ring air gap excessive Timing chain stretch beyond a tolerable limit Valve timing incorrect 	<ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Check crankshaft position sensor is installed correctly Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance. Check crankshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check reluctor ring to sensor runout and air gap are within specification Refer to the relevant section of the workshop manual and check valve timing is within specification
P0018-76	Crankshaft Position - Camshaft Position Correlation - Bank 2 Sensor A - wrong mounting position	<ul style="list-style-type: none"> The engine control module has detected incorrectly installed components Loose camshaft position sensor Loose crankshaft position sensor Camshaft or crankshaft position sensor reluctor ring air gap excessive Engine assembled incorrectly Valve timing incorrect 	<p> NOTE: Monitor description. Initial reference adaption of cam wheel edges to determine system is OK post engine rebuild or valve timing overhaul</p> <ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Check crankshaft position sensor is installed correctly Refer to the relevant section of the workshop manual and check valve timing is within specification Check reluctor ring to sensor runout and air gap are within specification
P0018-79	Crankshaft Position - Camshaft Position Correlation - Bank 2 Sensor A - mechanical linkage failure	<ul style="list-style-type: none"> Camshaft locking pin is not engaged during start Loose camshaft position sensor Camshaft position sensor disturbed signal Oil pressure to variable camshaft timing actuator is low Camshaft chain tensioner failure 	<p> NOTE: Monitor description. Correct engagement of camshaft locking pin. The average camshaft position is outside of the allowable limit during engine start. The engine will start poorly</p> <ul style="list-style-type: none"> Check variable camshaft timing actuator for mechanical damage Check camshaft position sensor is installed correctly Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to variable camshaft timing







			<p>actuator is correct and that oil gallery is free from debris</p> <ul style="list-style-type: none"> Refer to the relevant sections of the workshop manual and check the camshaft chain tensioner is operating correctly
P0019-00	Crankshaft Position - Camshaft Position Correlation - Bank 2 Sensor B - No sub type information	<ul style="list-style-type: none"> Loose camshaft position sensor Loose crankshaft position sensor Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Crankshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Camshaft or crankshaft position sensor reluctor ring air gap excessive Timing chain stretch beyond a tolerable limit Valve timing incorrect 	<ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Check crankshaft position sensor is installed correctly Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance. Check crankshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check reluctor ring to sensor runout and air gap are within specification Refer to the relevant section of the workshop manual and check valve timing is within specification
P0019-76	Crankshaft Position - Camshaft Position Correlation - Bank 2 Sensor B - Wrong mounting position	<ul style="list-style-type: none"> The engine control module has detected incorrectly installed components Loose camshaft position sensor Loose crankshaft position sensor Camshaft or crankshaft position sensor reluctor ring air gap excessive Engine assembled incorrectly Valve timing incorrect 	 NOTE: Monitor description. Initial reference adaption of cam wheel edges to determine system is OK post engine rebuild or valve timing overhaul <ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Check crankshaft position sensor is installed correctly Refer to the relevant section of the workshop manual and check valve timing is within specification Check reluctor ring to sensor runout and air gap are within specification
P0019-79	Crankshaft Position - Camshaft Position Correlation - Bank 2 Sensor B - Mechanical linkage failure	<ul style="list-style-type: none"> Camshaft locking pin is not engaged during start Loose camshaft position sensor Camshaft position sensor disturbed signal Oil pressure to variable camshaft timing actuator is low Camshaft chain tensioner failure 	 NOTE: Monitor description. Correct engagement of camshaft locking pin. The average camshaft position is outside of the allowable limit during engine start. The engine will start poorly <ul style="list-style-type: none"> Check variable camshaft timing actuator for mechanical damage Check camshaft position sensor is installed correctly Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to variable camshaft timing actuator is correct and that oil gallery is free from debris Refer to the relevant sections of the workshop manual and check the camshaft chain tensioner is operating correctly
P0020-00	Intake (A) Camshaft Position Actuator Circuit / Open (Bank 2) - No sub type information	 NOTE: Circuit reference O_T_CASICB <ul style="list-style-type: none"> Variable camshaft timing solenoid circuit open circuit, high resistance Variable camshaft timing solenoid failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for open circuit, high resistance Clear the DTC and retest Check and install new variable camshaft timing solenoid as required





P0021-00	Intake (A) Camshaft Position Timing - Over-Advanced (Bank 2) - No sub type information	<ul style="list-style-type: none"> • Oil level is low • Variable camshaft timing solenoid circuit intake and exhaust connectors swapped • Variable camshaft timing solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance • Oil pressure is low • Variable camshaft timing actuator mechanical failure • Excessive camshaft friction, restricted movement or stuck 	 <p>NOTE: Monitor description. Inlet camshaft is unable to achieve the desired set point angle. The camshaft is stuck</p> <ul style="list-style-type: none"> • Check the oil level is correct • Check variable camshaft timing solenoid circuit intake and exhaust connectors are not swapped • Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to camshaft is correct and that oil gallery is free from debris • Clear the DTC and retest • Check and install new variable camshaft timing actuator as required • Refer to the relevant sections of the workshop manual and check the camshaft operation
P0023-00	Exhaust (B) Camshaft Position Actuator Circuit / Open (Bank 2) - No sub type information	 <p>NOTE: Circuit reference O_T_CASECB</p> <ul style="list-style-type: none"> • Variable camshaft timing solenoid circuit open circuit, high resistance • Variable camshaft timing solenoid failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for open circuit, high resistance • Clear the DTC and retest • Check and install new variable camshaft timing solenoid as required
P0024-00	Exhaust (B) Camshaft Position Timing - Over-Advanced (Bank 2) - No sub type information	<ul style="list-style-type: none"> • Oil level is low • Variable camshaft timing solenoid circuit intake and exhaust connectors swapped • Variable camshaft timing solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance • Oil pressure is low • Variable camshaft timing actuator mechanical failure • Excessive camshaft friction, restricted movement or stuck 	 <p>NOTE: Monitor description. Exhaust camshaft is unable to achieve the desired set point angle. The camshaft is stuck</p> <ul style="list-style-type: none"> • Check the oil level is correct • Check variable camshaft timing solenoid circuit intake and exhaust connectors are not swapped • Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to camshaft is correct and that oil gallery is free from debris • Clear the DTC and retest • Check and install new variable camshaft timing actuator as required • Refer to the relevant sections of the workshop manual and check the camshaft operation
P0030-00	HO2S Heater Control Circuit (Bank 1, Sensor 1) - No sub type information	 <p>NOTE: Circuit reference O_T_LSHUP1</p> <ul style="list-style-type: none"> • Heated oxygen sensor heater control circuit short circuit to 	 <p>NOTE: Monitor description. Heated oxygen sensor heater duty cycle maintains a constant value</p> <ul style="list-style-type: none"> • Refer to the electrical circuit

		<p>ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<p>diagrams and check heated oxygen sensor heater control circuit for short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0031-00	HO2S Heater Control Circuit Low (Bank 1, Sensor 1) - No sub type information	 <p>NOTE: Circuit reference O_T_LSHUP1</p> <ul style="list-style-type: none"> • Heated oxygen sensor heater control circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	 <p>NOTE: Monitor description. Heated oxygen sensor heater duty cycle below a threshold</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater control circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0032-00	HO2S Heater Control Circuit High (Bank 1, Sensor 1) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor heater control circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	 <p>NOTE: Monitor description. Heated oxygen sensor heater duty cycle above a threshold</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater control circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0033-00	Turbocharger/Supercharger Bypass Valve "A" Control Circuit / Open - No sub type information	 <p>NOTE: Circuit reference O_T_CBPPPOS & O_T_CBPNEG</p> <ul style="list-style-type: none"> • Supercharger bypass valve actuator circuit short circuit to ground, short circuit to power, open circuit, high resistance • Supercharger bypass valve actuator failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check supercharger bypass valve actuator circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new supercharger bypass valve actuator as required
P0034-00	Turbocharger/Supercharger Bypass Valve "A" Control Circuit Low - No sub type information	 <p>NOTE: Circuit reference O_T_CBPPPOS & O_T_CBPNEG</p> <ul style="list-style-type: none"> • Supercharger bypass valve actuator circuit short circuit to ground, short circuit to power, open circuit, high resistance • Supercharger bypass valve actuator failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check supercharger bypass valve actuator circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new supercharger bypass valve actuator as required
P0036-00	HO2S Heater Control Circuit (Bank 1, Sensor 2)		<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated





	- No sub type information	<p>NOTE: Circuit reference O_S_LSFH3</p> <ul style="list-style-type: none"> • Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0037-00	HO2S Heater Control Circuit Low (Bank 1, Sensor 2) - No sub type information	 <p>NOTE: Circuit reference O_S_LSFH3</p> <ul style="list-style-type: none"> • Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0038-00	HO2S Heater Control Circuit High (Bank 1, Sensor 2) - No sub type information	 <p>NOTE: Circuit reference O_S_LSFH3</p> <ul style="list-style-type: none"> • Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0039-00	Turbocharger/Supercharger Bypass Valve "A" Control Circuit Range/Performance - No sub type information	 <p>NOTE: Circuit reference O_T_CBPPOS & O_T_CBPNEG</p> <ul style="list-style-type: none"> • Supercharger bypass valve actuator circuit short circuit to ground, short circuit to power, open circuit, high resistance • Supercharger bypass valve actuator failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check supercharger bypass valve actuator circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new supercharger bypass valve actuator as required
P003A-21	Turbocharger/Supercharger Boost Control A Position Exceeded Learning Limit - Signal amplitude < minimum	<ul style="list-style-type: none"> • The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low • Supercharger mechanical end stop incorrect adjustment • Supercharger bypass blade and end stop assembly failure • Supercharger actuator failure 	<ul style="list-style-type: none"> • Inspect supercharger mechanical end stop for correct adjustment • Check for correct assembly of bypass blade and end stop • Clear the DTC and retest • Check and install new supercharger actuator as required
P003A-22	Turbocharger/Supercharger Boost Control A Position Exceeded Learning Limit - Signal amplitude > maximum	<ul style="list-style-type: none"> • The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high • Supercharger mechanical end stop incorrect adjustment • Bypass blade restriction due to debris or fouling • Supercharger bypass blade and end stop assembly failure • Supercharger actuator failure 	<ul style="list-style-type: none"> • Inspect supercharger mechanical end stop for correct adjustment • Check for correct assembly of bypass blade and for sign of restriction due to debris or fouling • Clear the DTC and retest • Check and install new supercharger actuator as required
P0040-00	Oxygen Sensor Signals Swapped Bank 1 Sensor 1 / Bank 2 Sensor 1 - No sub	<ul style="list-style-type: none"> • Heated oxygen sensor is installed in the wrong bank 	<ul style="list-style-type: none"> • Check and install the heated oxygen sensor to the correct position in the exhaust system




	type information		
P0041-00	Oxygen Sensor Signals Swapped Bank 1 Sensor 2 / Bank 2 Sensor 2 - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor is installed in the wrong bank 	<ul style="list-style-type: none"> • Check and install the heated oxygen sensor to the correct position in the exhaust system
P0042-00	HO2S Heater Control Circuit (Bank 1, Sensor 3) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0043-00	HO2S Heater Control Circuit Low (Bank 1, Sensor 3) - No sub type information	 <p>NOTE: Circuit reference O_T_LSFH1</p> <ul style="list-style-type: none"> • Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0044-00	HO2S Heater Control Circuit High (Bank 1, Sensor 3) - No sub type information	 <p>NOTE: Circuit reference O_T_LSFH1</p> <ul style="list-style-type: none"> • Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0050-00	HO2S Heater Control Circuit (Bank 2, Sensor 1) - No sub type information	 <p>NOTE: Circuit reference O_T_LSHUP2</p> <ul style="list-style-type: none"> • Heated oxygen sensor heater control circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	 <p>NOTE: Monitor description. Heated oxygen sensor heater duty cycle maintains a constant value</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater control circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0051-00	HO2S Heater Control Circuit Low (Bank 2, Sensor 1) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor heater control circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	 <p>NOTE: Monitor description. Heated oxygen sensor heater duty cycle below a threshold</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater control circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required






P0052-00	HO2S Heater Control Circuit High (Bank 2, Sensor 1) - No sub type information	 <p>NOTE: Circuit reference O_T_LSHUP2</p> <ul style="list-style-type: none"> • Heated oxygen sensor heater control circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	 <p>NOTE: Monitor description. Heated oxygen sensor heater duty cycle above a threshold</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater control circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0054-00	HO2S Heater Resistance (Bank 1, Sensor 2) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	 <p>NOTE: Monitor description. Heated oxygen sensor heater not heating enough</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0055-00	HO2S Heater Resistance (Bank 1, Sensor 3) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0056-00	HO2S Heater Control Circuit (Bank 2, Sensor 2) - No sub type information	 <p>NOTE: Circuit reference OS_ISF4</p> <ul style="list-style-type: none"> • Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0057-00	HO2S Heater Control Circuit Low (Bank 2, Sensor 2) - No sub type information	 <p>NOTE: Circuit reference OS_ISF4</p> <ul style="list-style-type: none"> • Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0058-00	HO2S Heater Control Circuit High (Bank 2, Sensor 2) - No sub type information	 <p>NOTE: Circuit reference OS_ISF4</p> <ul style="list-style-type: none"> • Heated oxygen sensor heater 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short







		<p>circuit short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<p>circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0060-00	HO2S Heater Resistance (Bank 2, Sensor 2) - No sub type information	<ul style="list-style-type: none"> Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0061-00	HO2S Heater Resistance (Bank 2, Sensor 3) - No sub type information	<ul style="list-style-type: none"> Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0062-00	HO2S Heater Control Circuit (Bank 2, Sensor 3) - No sub type information	 <p>NOTE: Circuit reference O_S_LSFH2</p> <ul style="list-style-type: none"> Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0063-00	HO2S Heater Control Circuit Low (Bank 2, Sensor 3) - No sub type information	 <p>NOTE: Circuit reference O_S_LSFH2</p> <ul style="list-style-type: none"> Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0064-00	HO2S Heater Control Circuit High (Bank 2, Sensor 3) - No sub type information	 <p>NOTE: Circuit reference O_S_LSFH2</p> <ul style="list-style-type: none"> Heated oxygen sensor heater circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0069-64	MAP - Barometric Pressure Correlation - Signal plausibility failure	<ul style="list-style-type: none"> The engine control module detected plausibility failures Engine control module failure 	 <p>NOTE: The sensor is installed within the engine control module and is not serviceable</p> <ul style="list-style-type: none"> Check and install new engine


			control module as required
P0071-21	Ambient Air Temperature Sensor Circuit "A" Range/Performance - Signal amplitude < minimum	<ul style="list-style-type: none"> The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low Rapid temperature change of ambient air temperature sensor Connector is disconnected, connector pin is backed out, connector pin corrosion Ambient air temperature sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals - Ambient Air Temperature - (0xF446) <ul style="list-style-type: none"> Check that a plausible value is displayed Refer to the electrical circuit diagrams and check ambient air temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new ambient air temperature sensor as required
P0071-22	Ambient Air Temperature Sensor Circuit "A" Range/Performance - Signal amplitude > maximum	<ul style="list-style-type: none"> The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high Rapid temperature change of ambient air temperature sensor Connector is disconnected, connector pin is backed out, connector pin corrosion Ambient air temperature sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals - Ambient Air Temperature - (0xF446) <ul style="list-style-type: none"> Check that a plausible value is displayed Refer to the electrical circuit diagrams and check ambient air temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new ambient air temperature sensor as required
P0071-23	Ambient Air Temperature Sensor Circuit "A" Range/Performance - Signal stuck low	<ul style="list-style-type: none"> The engine control module measures a signal that remains low when transitions are expected Battery disconnection resulting in errors in engine off time (short soaks may look like long soaks) Electric block heater applied and not detected Connector is disconnected, connector pin is backed out, connector pin corrosion Ambient air temperature sensor failure 	<ul style="list-style-type: none"> Leave vehicle turned off for a minimum of 8 hours and allow to soak to a stable temperature. Using the manufacturer approved diagnostic system check datalogger signals - Ambient Air Temperature - (0xF446) - Engine Coolant Temperature (0xF405) - Boost Air Temperature - Raw physical value (0x0341) - Intake Air Temperature (0xF40F) - Engine Coolant Temperature #2 (0x0489). All sensors should be within 20 deg°C of each other Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Check and install a new sensor that is biased higher or lower than the other sensors
P0071-24	Ambient Air Temperature Sensor Circuit "A" Range/Performance - Signal stuck high	<ul style="list-style-type: none"> The engine control module measures a signal that remains high when transitions are expected Battery disconnection resulting in errors in engine off time (short soaks may look like long soaks) Electric block heater applied and not detected Connector is disconnected, 	<ul style="list-style-type: none"> Leave vehicle turned off for a minimum of 8 hours and allow to soak to a stable temperature. Using the manufacturer approved diagnostic system check datalogger signals - Ambient Air Temperature - (0xF446) - Engine Coolant Temperature (0xF405) - Boost Air Temperature - Raw physical value (0x0341) - Intake Air





		<p>connector pin is backed out, connector pin corrosion</p> <ul style="list-style-type: none"> Ambient air temperature sensor failure 	<p>Temperature (0xF40F) - Engine Coolant Temperature #2 (0x0489). All sensors should be within 20 deg°C of each other</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Check and install a new sensor that is biased higher or lower than the other sensors
P0072-00	Ambient Air Temperature Sensor Circuit "A" Low - No sub type information	 <p>NOTE: Circuit reference I_A_ATS</p> <ul style="list-style-type: none"> Ambient air temperature sensor circuit, short circuit to ground Connector is disconnected, connector pin is backed out, connector pin corrosion Ambient air temperature sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check ambient air temperature sensor circuit for short circuit to ground Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new ambient air temperature sensor as required
P0073-00	Ambient Air Temperature Sensor Circuit "A" High - No sub type information	 <p>NOTE: Circuit reference I_A_ATS</p> <ul style="list-style-type: none"> Ambient air temperature sensor circuit, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Ambient air temperature sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check ambient air temperature sensor circuit for short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new ambient air temperature sensor as required
P007B-00	Charge Air Cooler Temperature Sensor Circuit Range/Performance (Bank 1) - No sub type information	 <p>NOTE: Circuit reference I_A_BTS</p> <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Manifold absolute pressure and temperature sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Manifold absolute pressure and temperature sensor failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to electrical circuit diagrams and check the manifold absolute pressure and temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check and install a new manifold absolute pressure and temperature sensor as required
P007B-22	Charge Air Cooler Temperature Sensor Circuit Range/Performance (Bank 1) - Signal amplitude > maximum	 <p>NOTE: Circuit reference I_A_BTS</p> <ul style="list-style-type: none"> The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high Connector is disconnected, connector pin is backed out, connector pin corrosion Manifold absolute pressure and temperature sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Manifold absolute pressure and temperature sensor failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to electrical circuit diagrams and check the manifold absolute pressure and temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check and install a new manifold absolute pressure and temperature sensor as required
P007B-23	Charge Air Cooler Temperature Sensor Circuit Range/Performance (Bank 1) -Signal stuck low	<ul style="list-style-type: none"> The engine control module measures a signal that remains low when transitions are expected Battery disconnection resulting in errors in engine off time (short soaks may look like long soaks) 	<ul style="list-style-type: none"> Leave vehicle turned off for a minimum of 8 hours and allow to soak to a stable temperature. Using the manufacturer approved diagnostic system check datalogger signals - Ambient Air Temperature - (0xF446) - Engine Coolant



		<ul style="list-style-type: none"> • Electric block heater applied and not detected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Ambient air temperature sensor failure 	<p>Temperature (0xF405) - Boost Air Temperature - Raw physical value (0x0341) - Intake Air Temperature (0xF40F) - Engine Coolant Temperature #2 (0x0489). All sensors should be within 20 deg°C of each other</p> <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check connections are secure and wiring integrity • Check and install a new sensor that is biased higher or lower than the other sensors
P007B-24	Charge Air Cooler Temperature Sensor Circuit Range/Performance (Bank 1) -Signal stuck high	 <p>NOTE: Jaguar circuit reference IC_COOLANT_PMP_CTRL & BOOST_PRESS_SENSOR_TEMP_SIG. Land Rover circuit reference O_S_CACWPR & I_A_BTS</p> <ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuse failure • Temperature and manifold absolute pressure sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Temperature and manifold absolute pressure sensor failure • Air charge coolant pump and control circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Air charge coolant pump relay failure • Air charge coolant pump failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to electrical circuit diagrams and check for fuse failure, install new fuse as required • Refer to electrical circuit diagrams and check the temperature and manifold absolute pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check and install a new temperature and manifold absolute pressure sensor as required • Refer to electrical circuit diagrams and check the air charge coolant pump and control circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to electrical circuit diagrams and check the air charge coolant pump for open circuit, high resistance • Refer to the relevant section of the workshop manual and check the air charge coolant pump for correct operation. Check and install a new air charge coolant pump as required • Clear DTC and retest
P007C-00	Charge Air Cooler Temperature Sensor Circuit Low (Bank 1) - No sub type information	 <p>NOTE: Circuit reference I_A_BTS</p> <ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Manifold absolute pressure and temperature sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Manifold absolute pressure and temperature sensor failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to electrical circuit diagrams and check the manifold absolute pressure and temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check and install a new manifold absolute pressure and temperature sensor as required
P007D-00	Charge Air Cooler Temperature Sensor Circuit High (Bank 1) - No sub type information	 <p>NOTE: Circuit reference I_A_BTS</p> <ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Manifold absolute pressure and temperature sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Manifold absolute pressure and temperature sensor failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to electrical circuit diagrams and check the manifold absolute pressure and temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check and install a new manifold absolute pressure and temperature sensor as required




P007E-1F	Charge Air Cooler Temperature Sensor Circuit Intermittent/Erratic (Bank 1) - Circuit intermittent	<ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Manifold absolute pressure and temperature sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Manifold absolute pressure and temperature sensor failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to electrical circuit diagrams and check the manifold absolute pressure and temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check and install a new manifold absolute pressure and temperature sensor as required
P0087-77	Fuel Rail/System Pressure - Too Low - Commanded position not reachable	<ul style="list-style-type: none"> Fuel leaking outside of the fuel system Fuel leaking into the low pressure system 	 NOTE: Monitor description. To detect under pressure in the fuel rail. The high pressure fuel pump signal is below a threshold <ul style="list-style-type: none"> Check for fuel leaks external of the fuel rail Check high pressure fuel pumps are not leaking from the high pressure system into the low pressure system
P0087-84	Fuel Rail/System Pressure - Too Low - Signal below allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range Fuel rail pressure sensor circuit short circuit to ground Fuel rail pressure sensor failure 	 NOTE: Monitor description. The fuel rail pressure is below a threshold <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuit for short circuit to ground Clear the DTC and retest Check and install new fuel rail pressure sensor as required
P0088-77	Fuel Rail/System Pressure - Too High - Commanded position not reachable	<ul style="list-style-type: none"> Fuel leaking outside of the fuel system Fuel leaking into the low pressure system 	 NOTE: Monitor description. To detect over pressure in the fuel rail. The high pressure fuel pump signal is above a threshold <ul style="list-style-type: none"> Check for fuel leaks external of the fuel rail Check high pressure fuel pumps are not leaking from the high pressure system into the low pressure system
P0088-85	Fuel Rail/System Pressure - Too High - Signal above allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Fuel pressure relief valve stuck Fuel rail pressure sensor circuit short circuit to power Fuel rail pressure sensor failure 	 NOTE: Monitor description. The fuel rail pressure is above a threshold <ul style="list-style-type: none"> Check fuel pressure relief valve for correct operation Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuit for short circuit to power Clear the DTC and retest Check and install new fuel rail pressure sensor as required
P0089-64	Fuel Pressure Regulator Performance - Signal plausibility failure	<ul style="list-style-type: none"> The engine control module detected plausibility failures Fuel system leakage from the fuel tank and lines Low pressure fuel pump failure 	 NOTE: Monitor description. The command signal to the fuel pump driver module is above a threshold <ul style="list-style-type: none"> Check for fuel system leakage from the fuel tank and lines both internal and external of the fuel tank Clear the DTC and retest Check and install new low pressure fuel pump as required





P0089-92	Fuel Pressure Regulator Performance - Performance or incorrect operation	<ul style="list-style-type: none"> The engine control module has detected that the component performance is outside its expected range or operating in an incorrect way Fuel system leakage from the fuel tank and lines Low pressure fuel pump failure 	 NOTE: Monitor description. The command signal to the fuel pump driver module is below a threshold <ul style="list-style-type: none"> Check for fuel system leakage from the fuel tank and lines both internal and external of the fuel tank Clear the DTC and retest Check and install new low pressure fuel pump as required
P008A-07	Low Pressure Fuel System Pressure - Too Low - Mechanical Failures	<ul style="list-style-type: none"> Fuel low pressure sensor circuit, high resistance Fuel low pressure sensor failure 	 NOTE: Monitor description. The monitor checks the low pressure fuel is not below the expected range <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel low pressure sensor circuit for high resistance Clear the DTC and retest Check and install new fuel low pressure sensor as required
P008A-84	Low Pressure Fuel System Pressure - Too Low - Signal below allowable range	 NOTE: Circuit reference O_V_5VFLPS <ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range Fuel low pressure sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Fuel system leakage from the fuel tank and lines Low pressure fuel pump failure 	 NOTE: Monitor description. Low pressure fuel signal is below the threshold <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel low pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check for fuel system leakage from the fuel tank and lines both internal and external of the fuel tank Clear the DTC and retest Check and install new low pressure fuel pump as required
P008B-07	Low Pressure Fuel System Pressure - Too High - Mechanical Failures	<ul style="list-style-type: none"> Fuel low pressure sensor circuit short circuit to ground, high resistance Fuel low pressure sensor failure 	 NOTE: Monitor description. The monitor checks the low pressure fuel is not above the expected range <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel low pressure sensor circuit for short circuit to ground, high resistance Clear the DTC and retest Check and install new fuel low pressure sensor as required
P008B-85	Low Pressure Fuel System Pressure - Too High - Signal above allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Fuel low pressure sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Fuel system leakage from the fuel tank and lines Low pressure fuel pump failure 	 NOTE: Monitor description. Low pressure fuel signal is above the threshold <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel low pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check for fuel system leakage from the fuel tank and lines both internal and external of the fuel tank





			<ul style="list-style-type: none"> Clear the DTC and retest Check and install new low pressure fuel pump as required
P0096-00	Intake Air Temperature Sensor 2 Circuit Range/Performance (Bank 1) - No sub type information	<ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Charge air cooler temperature sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Charge air cooler temperature sensor failure Ambient air temperature sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signal Boost Air Temperature - Raw physical value (0x0341) Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Check and install a new charge air temperature sensor as required Check and install a new air temperature sensor as required Clear the DTC and retest
P0096-23	Intake Air Temperature Sensor 2 Circuit Range/Performance (Bank 1) - Signal stuck low	<ul style="list-style-type: none"> The engine control module measures a signal that remains low when transitions are expected Battery disconnection resulting in errors in engine off time Electric block heater applied and not detected Connector is disconnected, connector pin is backed out, connector pin corrosion Charge air cooler temperature sensor circuit, short circuit to ground, open circuit, high resistance Charge air cooler temperature sensor failure Ambient air temperature sensor failure 	<ul style="list-style-type: none"> Leave vehicle turned off for a minimum of 8 hours and allow to soak to a stable temperature. Using the manufacturer approved diagnostic system check datalogger signals - Ambient Air Temperature - (0xF446) - Engine Coolant Temperature (0xF405) - Boost Air Temperature - Raw physical value (0x0341) - Intake Air Temperature (0xF40F) - Engine Coolant Temperature #2 (0x0489). All sensors should be within 20 deg°C of each other Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Check and install new sensor that is biased higher or lower than the other sensors
P0096-24	Intake Air Temperature Sensor 2 Circuit Range/Performance (Bank 1) - Signal stuck high	<ul style="list-style-type: none"> The engine control module measures a signal that remains high when transitions are expected Battery disconnection resulting in errors in engine off time Electric block heater applied and not detected Connector is disconnected, connector pin is backed out, connector pin corrosion Charge air cooler temperature sensor circuit, short circuit to power, open circuit, high resistance Charge air cooler temperature sensor failure Ambient air temperature sensor failure 	<ul style="list-style-type: none"> Leave vehicle turned off for a minimum of 8 hours and allow to soak to a stable temperature. Using the manufacturer approved diagnostic system check datalogger signals - Ambient Air Temperature - (0xF446) - Engine Coolant Temperature (0xF405) - Boost Air Temperature - Raw physical value (0x0341) - Intake Air Temperature (0xF40F) - Engine Coolant Temperature #2 (0x0489). All sensors should be within 20 deg°C of each other Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Check and install new sensor that is biased higher or lower than the other sensors
P0097-00	Intake Air Temperature Sensor 2 Circuit Low (Bank 1) - No sub type information	 <p>NOTE: Circuit reference - I_A_CACTS and G_R_SEN -</p> <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Charge air cooler temperature 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to electrical circuit diagrams and check the charge air cooler temperature sensor circuit for short circuit to ground, short circuit to power,



		<p>sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Charge air cooler temperature sensor failure 	<p>open circuit, high resistance</p> <ul style="list-style-type: none"> • Check and install a new charge air cooler temperature sensor as required
P0098-00	Intake Air Temperature Sensor 2 Circuit High (Bank 1) - No sub type information	 <p>NOTE: Circuit reference - G_R_SEN -</p> <ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Charge air cooler temperature sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Charge air cooler temperature sensor failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to electrical circuit diagrams and check the charge air cooler temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check and install a new charge air cooler temperature sensor as required
P0099-1F	Intake Air Temperature Sensor 2 Circuit Intermittent/Erratic (Bank 1) - Circuit intermittent	 <p>NOTE: Circuit reference - I_A_CACTS & G_R_SEN -</p> <ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Charge air cooler temperature sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Charge air cooler temperature sensor failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to electrical circuit diagrams and check the charge air cooler temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check and install a new charge air cooler temperature sensor as required
P00BC-00	"Mass or Volume Air Flow A Circuit Range/Performance - Air Flow Too Low" - No sub type information	<ul style="list-style-type: none"> • Blocked air filter • Other related DTCs • Air induction system, incorrectly installed components, loose hose clips or air leakage • Mass air flow sensor contamination by oil or debris • Electric throttle blade contamination by oil or debris • Mass air flow sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Throttle adaption failure 	 <p>NOTE: Monitor description. Rationality. Mass air flow sensor flow to low</p> <ul style="list-style-type: none"> • Check air filter is serviceable • Using the manufacturer approved diagnostic system check the engine control module for related DTCs and refer to the relevant DTC index • Refer to the relevant sections of the workshop manual and check the induction system for correctly installed components, loose hose clips or air leakage • Check mass air flow sensor for contamination by oil or debris clean as required • Check electric throttle blade for contamination by oil or debris clean as required • Refer to the electrical circuit diagrams and check mass air flow sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system carry out throttle adaption routine • Clear the DTC and retest
P00BD-00	"Mass or Volume Air Flow A Circuit Range/Performance - Air Flow Too High" - No sub type information	<ul style="list-style-type: none"> • Blocked air filter • Other related DTCs • Air induction system, incorrectly installed components, loose hose clips or air leakage • Mass air flow sensor contamination by oil or debris • Electric throttle blade 	 <p>NOTE: Monitor description. Rationality. Mass air flow sensor flow excessive</p> <ul style="list-style-type: none"> • Check air filter is serviceable • Using the manufacturer approved diagnostic system





		<ul style="list-style-type: none"> contamination by oil or debris • Mass air flow sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Throttle adaption failure 	<ul style="list-style-type: none"> check the engine control module for related DTCs and refer to the relevant DTC index • Refer to the relevant sections of the workshop manual and check the induction system for correctly installed components, loose hose clips or air leakage • Check mass air flow sensor for contamination by oil or debris clean as required • Check electric throttle blade for contamination by oil or debris clean as required • Refer to the electrical circuit diagrams and check mass air flow sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system carry out throttle adaption routine • Clear the DTC and retest
POOBE-00	"Mass or Volume Air Flow B Circuit Range/Performance - Air Flow Too Low" - No sub type information	<ul style="list-style-type: none"> • Blocked air filter • Other related DTCs • Air induction system, incorrectly installed components, loose hose clips or air leakage • Mass air flow sensor contamination by oil or debris • Electric throttle blade contamination by oil or debris • Mass air flow sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Throttle adaption failure 	 <p>NOTE: Monitor description. Rationality. Mass air flow sensor flow to low</p> <ul style="list-style-type: none"> • Check air filter is serviceable • Using the manufacturer approved diagnostic system check the engine control module for related DTCs and refer to the relevant DTC index • Refer to the relevant sections of the workshop manual and check the induction system for correctly installed components, loose hose clips or air leakage • Check mass air flow sensor for contamination by oil or debris clean as required • Check electric throttle blade for contamination by oil or debris clean as required • Refer to the electrical circuit diagrams and check mass air flow sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system carry out throttle adaption routine • Clear the DTC and retest
POOBF-00	"Mass or Volume Air Flow B Circuit Range/Performance - Air Flow Too High" - No sub type information	<ul style="list-style-type: none"> • Blocked air filter • Other related DTCs • Air induction system, incorrectly installed components, loose hose clips or air leakage • Mass air flow sensor contamination by oil or debris • Electric throttle blade contamination by oil or debris • Mass air flow sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: Monitor description. Rationality. Mass air flow sensor flow excessive</p> <ul style="list-style-type: none"> • Check air filter is serviceable • Using the manufacturer approved diagnostic system check the engine control module for related DTCs and refer to the relevant DTC index • Refer to the relevant sections of the workshop manual and check


		Throttle adaption failure	<p>the induction system for correctly installed components, loose hose clips or air leakage</p> <ul style="list-style-type: none"> • Check mass air flow sensor for contamination by oil or debris clean as required • Check electric throttle blade for contamination by oil or debris clean as required • Refer to the electrical circuit diagrams and check mass air flow sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system carry out throttle adaption routine • Clear the DTC and retest
P00C6-00	Fuel Rail Pressure Too Low - Engine Cranking - No sub type information	<ul style="list-style-type: none"> • Fuel rail has been removed • High pressure fuel pump mechanical failure 	 NOTE: Monitor description. The fuel rail pressure is checked against a threshold after a number of engine rotations from the start of cranking. A DTC is set if the fuel rail pressure is below the threshold <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check the fuel rail pressure during cranking. Clear the DTC and attempt another start • Check and install new high pressure fuel pump as required
P00D1-00	HO2S Heater Control Circuit Range/Performance (Bank 1 Sensor 1) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	 NOTE: Monitor description. The value of the correction factor of the heated oxygen sensor calibration resistor is checked against a threshold. A DTC is set if the value is above the threshold <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P00D1-29	HO2S Heater Control Circuit Range/Performance (Bank 1 Sensor 1) - signal invalid	<ul style="list-style-type: none"> • The value of the signal measured by the engine control module is not plausible given the operating conditions • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	 NOTE: Monitor description. The engine control module monitors the ceramic temperature of the heated oxygen sensor nerst cell to ensure it is sufficiently heated after engine start <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated


			oxygen sensor as required
P00D3-04	HO2S Heater Control Circuit Range/Performance (Bank 2 Sensor 1) - System Internal Failures	<ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	 <p>NOTE: Monitor description. The value of the correction factor of the heated oxygen sensor calibration resistor is checked against a threshold. A DTC is set if the value is above the threshold</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P00D3-64	HO2S Heater Control Circuit Range/Performance (Bank 2 Sensor 1) - Signal plausibility failure	<ul style="list-style-type: none"> • The engine control module detected plausibility failures • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	 <p>NOTE: Monitor description. The engine control module monitors the ceramic temperature of the heated oxygen sensor nernst cell to ensure it is sufficiently heated after engine start</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0100-00	Mass or Volume Air Flow Sensor "A" Circuit - No sub type information	 <p>NOTE: Circuit reference I_F_AMS1</p> <ul style="list-style-type: none"> • Mass air flow sensor connector is not correctly latched • Power feed to mass air flow sensor, open circuit • Mass air flow sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Mass air flow sensor failure 	 <p>NOTE: Monitor description. Engine control module monitors the input frequency signal from the sensor and sets the DTC if there is electrical failure</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Mass Air Flow Sensor Frequency - (0x033D) • Using the manufacturer approved diagnostic system check datalogger signal - Air Flow Rate from Mass Air Flow Sensor - (0xF410) • Check mass air flow sensor connector is correctly latched • Refer to electrical circuit diagrams and check power feed to mass air flow sensor for open circuit • Refer to electrical circuit diagrams and check the mass air flow sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new mass air flow sensor as required • Clear the DTC and retest
P0101-	Mass or Volume Air Flow	<ul style="list-style-type: none"> • Mass air flow sensor 	<ul style="list-style-type: none"> • Using the manufacturer



00	Sensor "A" Circuit Range/Performance - No sub type information	<p>contamination by oil or debris</p> <ul style="list-style-type: none"> • Mass air flow sensor connector is not correctly latched • Power feed to mass air flow sensor, open circuit • Mass air flow sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Mass air flow sensor failure 	<p>approved diagnostic system check datalogger signal - Mass Air Flow Sensor Frequency - (0x033D)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Air Flow Rate from Mass Air Flow Sensor - (0xF410) <ul style="list-style-type: none"> - Verify signal is operational when engine is idling • Check mass air flow sensor for contamination by oil or debris clean as required • Check mass air flow sensor connector is correctly latched • Refer to electrical circuit diagrams and check power feed to mass air flow sensor for open circuit • Refer to electrical circuit diagrams and check the mass air flow sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new mass air flow sensor as required • Clear the DTC and retest
P0102-00	Mass or Volume Air Flow Sensor "A" Circuit Low - No sub type information	 <p>NOTE: Circuit reference I_F_AMS1</p> <ul style="list-style-type: none"> • Mass air flow sensor connector is not correctly latched • Power feed to mass air flow sensor, open circuit • Mass air flow sensor circuit, short circuit to ground • Mass air flow sensor failure 	 <p>NOTE: Monitor description. Engine control module monitors the input frequency signal from the sensor and sets the DTC if there is electrical failure</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Mass Air Flow Sensor Frequency - (0x033D) • Using the manufacturer approved diagnostic system check datalogger signal - Air Flow Rate from Mass Air Flow Sensor - (0xF410) • Check mass air flow sensor connector is correctly latched • Refer to electrical circuit diagrams and check power feed to mass air flow sensor for open circuit • Refer to electrical circuit diagrams and check the mass air flow sensor circuit for short circuit to ground • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new mass air flow sensor as required • Clear the DTC and retest
P0103-85	Mass or Volume Air Flow Sensor "A" Circuit High - Signal above allowable range	 <p>NOTE: Circuit reference I_F_AMS1</p> <ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Mass air flow sensor connector is not correctly latched 	 <p>NOTE: Monitor description. Engine control module monitors the input frequency signal from the sensor and sets the DTC if there is electrical failure</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Mass Air Flow Sensor Frequency -



		<p>Power feed to mass air flow sensor, open circuit</p> <ul style="list-style-type: none"> • Mass air flow sensor circuit, short circuit to power • Mass air flow sensor failure 	<p>(0x033D)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Air Flow Rate from Mass Air Flow Sensor - (0xF410) • Check mass air flow sensor connector is correctly latched • Refer to electrical circuit diagrams and check power feed to mass air flow sensor for open circuit • Refer to electrical circuit diagrams and check the mass air flow sensor circuit for short circuit to power • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new mass air flow sensor as required • Clear the DTC and retest
P010A-00	Mass or Volume Air Flow Sensor "B" Circuit - No sub type information	 <p>NOTE: Circuit reference I_F_AMS2</p> <ul style="list-style-type: none"> • Mass air flow sensor connector is not correctly latched • Power feed to mass air flow sensor, open circuit • Mass air flow sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Mass air flow sensor failure 	 <p>NOTE: Monitor description. Engine control module monitors the input frequency signal from the sensor and sets the DTC if there is electrical failure</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Mass Air Flow Sensor Frequency - (0x033D) • Using the manufacturer approved diagnostic system check datalogger signal - Air Flow Rate from Mass Air Flow Sensor - (0xF410) • Check mass air flow sensor connector is correctly latched • Refer to electrical circuit diagrams and check power feed to mass air flow sensor for open circuit • Refer to electrical circuit diagrams and check the mass air flow sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new mass air flow sensor as required • Clear the DTC and retest
P010B-00	Mass or Volume Air Flow Sensor "B" Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> • Mass air flow sensor contamination by oil or debris • Mass air flow sensor connector is not correctly latched • Power feed to mass air flow sensor, open circuit • Mass air flow sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Mass air flow sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Mass Air Flow Sensor Frequency - (0x033D) • Using the manufacturer approved diagnostic system check datalogger signal - Air Flow Rate from Mass Air Flow Sensor - (0xF410) <ul style="list-style-type: none"> - Verify signal is operational when engine is idling • Check mass air flow sensor for contamination by oil or debris clean as required • Check mass air flow sensor connector is correctly latched • Refer to electrical circuit diagrams and check power feed to mass air flow sensor for open

			<ul style="list-style-type: none"> circuit Refer to electrical circuit diagrams and check the mass air flow sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check and install a new mass air flow sensor as required Clear the DTC and retest
P010C-00	Mass or Volume Air Flow Sensor "B" Circuit Low - No sub type information	 <p>NOTE: Circuit reference I_F_AMS2</p> <ul style="list-style-type: none"> Mass air flow sensor circuit, short circuit to ground Mass air flow sensor failure 	 <p>NOTE: Monitor description. Engine control module monitors the input frequency signal from the sensor and sets the DTC if there is electrical failure</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signal - Mass Air Flow Sensor Frequency - (0x033D) Using the manufacturer approved diagnostic system check datalogger signal - Air Flow Rate from Mass Air Flow Sensor - (0xF410) Refer to electrical circuit diagrams and check the mass air flow sensor circuit for short circuit to ground Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check and install a new mass air flow sensor as required Clear the DTC and retest
P010D-00	Mass or Volume Air Flow Sensor "B" Circuit High - No sub type information	 <p>NOTE: Circuit reference I_F_AMS2</p> <ul style="list-style-type: none"> Mass air flow sensor circuit, short circuit to power Mass air flow sensor failure 	 <p>NOTE: Monitor description. Engine control module monitors the input frequency signal from the sensor and sets the DTC if there is electrical failure</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signal - Mass Air Flow Sensor Frequency - (0x033D) Using the manufacturer approved diagnostic system check datalogger signal - Air Flow Rate from Mass Air Flow Sensor - (0xF410) Refer to electrical circuit diagrams and check the mass air flow sensor circuit for short circuit to power Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check and install a new mass air flow sensor as required Clear the DTC and retest
P0111-21	Intake Air Temperature Sensor 1 Circuit Range/Performance (Bank 1) - Signal amplitude < minimum	<ul style="list-style-type: none"> The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low Connector is disconnected, connector pin is backed out, connector pin corrosion Harness failure - Wiring integrity 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals - Charge Air Temperature Voltage - (0x03EE) & Intake Air Temperature Sensor Voltage - (0x1279) Inspect connectors for signs of water ingress, and pins for damage and/or corrosion

			<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Clear the DTC and retest
P0111-22	Intake Air Temperature Sensor 1 Circuit Range/Performance (Bank 1) - Signal amplitude > maximum	<ul style="list-style-type: none"> The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high Connector is disconnected, connector pin is backed out, connector pin corrosion Harness failure - Wiring integrity 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals - Charge Air Temperature Voltage - (0x03EE) & Intake Air Temperature Sensor Voltage - (0x1279) Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Clear the DTC and retest
P0111-23	Intake Air Temperature Sensor 1 Circuit Range/Performance (Bank 1) - Signal stuck low	<ul style="list-style-type: none"> The engine control module measures a signal that remains low when transitions are expected Battery disconnection resulting in errors in engine off time (short soaks may look like long soaks) Electric block heater applied and not detected Connector is disconnected, connector pin is backed out, connector pin corrosion Ambient air temperature sensor failure 	<ul style="list-style-type: none"> Leave vehicle turned off for a minimum of 8 hours and allow to soak to a stable temperature. Using the manufacturer approved diagnostic system check datalogger signals - Ambient Air Temperature - (0xF446) - Engine Coolant Temperature (0xF405) - Boost Air Temperature - Raw physical value (0x0341) - Intake Air Temperature (0xF40F) - Engine Coolant Temperature #2 (0x0489). All sensors should be within 20 deg°C of each other Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Check and install a new sensor that is biased higher or lower than the other sensors
P0111-24	Intake Air Temperature Sensor 1 Circuit Range/Performance (Bank 1) - Signal stuck high	<ul style="list-style-type: none"> The engine control module measures a signal that remains high when transitions are expected Battery disconnection resulting in errors in engine off time (short soaks may look like long soaks) Electric block heater applied and not detected Connector is disconnected, connector pin is backed out, connector pin corrosion Ambient air temperature sensor failure 	<ul style="list-style-type: none"> Leave vehicle turned off for a minimum of 8 hours and allow to soak to a stable temperature. Using the manufacturer approved diagnostic system check datalogger signals - Ambient Air Temperature - (0xF446) - Engine Coolant Temperature (0xF405) - Boost Air Temperature - Raw physical value (0x0341) - Intake Air Temperature (0xF40F) - Engine Coolant Temperature #2 (0x0489). All sensors should be within 20 deg°C of each other Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Check and install a new sensor that is biased higher or lower than the other sensors
P0112-00	Intake Air Temperature Sensor 1 Circuit Low (Bank 1) - No sub type information	 <p>NOTE: Circuit reference I_A_IAT1</p> <ul style="list-style-type: none"> Intake air temperature sensor circuit, short circuit to ground Connector is disconnected, connector pin is backed out, connector pin corrosion Intake air temperature sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check intake air temperature sensor circuit for short circuit to ground Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new intake air temperature sensor as required




P0113-00	Intake Air Temperature Sensor 1 Circuit High (Bank 1) - No sub type information	 <p>NOTE: Circuit reference I_A_IAT1</p> <ul style="list-style-type: none"> Intake air temperature sensor circuit open circuit, short circuit to power Connector is disconnected, connector pin is backed out, connector pin corrosion Intake air temperature sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check intake air temperature sensor circuit for open circuit, short circuit to power Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new intake air temperature sensor as required
P0114-1F	Intake Air Temperature Sensor 1 Intermittent/Erratic (Bank 1) - Circuit intermittent	<ul style="list-style-type: none"> Intake air temperature sensor circuit open circuit, short circuit to power, short circuit to ground Connector is disconnected or loose, connector pin is backed out, connector pin corrosion Intake air temperature sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check intake air temperature sensor circuit for open circuit, short circuit to power, short circuit to ground Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new intake air temperature sensor as required
P0116-00	Engine Coolant Temperature Sensor 1 Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Engine coolant temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check engine coolant temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Clear the DTC and retest Check and install new engine coolant temperature sensor as required
P0116-22	Engine Coolant Temperature Sensor 1 Circuit Range/Performance - Signal amplitude > maximum	<ul style="list-style-type: none"> The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high Connector is disconnected, connector pin is backed out, connector pin corrosion Engine coolant temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check engine coolant temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Clear the DTC and retest Check and install new engine coolant temperature sensor as required
P0116-23	Engine Coolant Temperature Sensor 1 Circuit Range/Performance - Signal stuck low	<ul style="list-style-type: none"> The engine control module measures a signal that remains low when transitions are expected Battery disconnection resulting in errors in engine off time (short soaks may look like long soaks) Electric block heater applied and not detected Connector is disconnected, connector pin is backed out, connector pin corrosion Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> Leave vehicle turned off for a minimum of 8 hours and allow to soak to a stable temperature. Using the manufacturer approved diagnostic system check datalogger signals - Ambient Air Temperature - (0xF446) - Engine Coolant Temperature (0xF405) - Boost Air Temperature - Raw physical value (0x0341) - Intake Air Temperature (0xF40F) - Engine Coolant Temperature #2 (0x0489). All sensors should be within 20 deg°C of each other Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Check and install a new sensor that is biased higher or lower than the other sensors
P0116-	Engine Coolant	<ul style="list-style-type: none"> The engine control module 	<ul style="list-style-type: none"> Leave vehicle turned off for a





24	Temperature Sensor 1 Circuit Range/Performance - Signal stuck high	<p>measures a signal that remains high when transitions are expected</p> <ul style="list-style-type: none"> • Battery disconnection resulting in errors in engine off time (short soaks may look like long soaks) • Electric block heater applied and not detected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Engine coolant temperature sensor failure 	<p>minimum of 8 hours and allow to soak to a stable temperature. Using the manufacturer approved diagnostic system check datalogger signals - Ambient Air Temperature - (0xF446) - Engine Coolant Temperature (0xF405) - Boost Air Temperature - Raw physical value (0x0341) - Intake Air Temperature (0xF40F) - Engine Coolant Temperature #2 (0x0489). All sensors should be within 20 deg°C of each other</p> <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check connections are secure and wiring integrity • Check and install a new sensor that is biased higher or lower than the other sensors
P0117-00	Engine Coolant Temperature Sensor 1 Circuit Low - No sub type information	 <p>NOTE: Circuit reference I_A_ENGTS</p> <ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Engine coolant temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check engine coolant temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new engine coolant temperature sensor as required
P0118-00	Engine Coolant Temperature Sensor 1 Circuit High - No sub type information	 <p>NOTE: Circuit reference I_A_ENGTS</p> <ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Engine coolant temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check engine coolant temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new engine coolant temperature sensor as required
P0119-1F	Engine Coolant Temperature Sensor 1 Circuit Intermittent/Erratic - Circuit intermittent	<ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Engine coolant temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check engine coolant temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new engine coolant temperature sensor as required
P0121-00	Throttle/Pedal Position Sensor A Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> • Electric throttle position sensor circuit short circuit to power, short circuit to ground, high resistance • Electric throttle position sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check electric throttle position sensor circuit for short circuit to power, short circuit to ground, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system, with ignition on but engine off, check electric throttle position sensor signal A is aligned to electric throttle position sensor



			<p>signal B</p> <ul style="list-style-type: none"> • Clear the DTC and retest • Check and install new electric throttle as required
P0121-04	Throttle/Pedal Position Sensor A Circuit Range/Performance - System Internal Failures	<ul style="list-style-type: none"> • Engine control module failure 	<ul style="list-style-type: none"> • Check and install new engine control module as required
P0122-00	Throttle/Pedal Position Sensor A Circuit Low - No sub type information	 <p>NOTE: Circuit reference I_A_TVA1</p> <ul style="list-style-type: none"> • Electric throttle position sensor circuit is below the valid electrical range • Electric throttle position sensor circuit open circuit, short circuit to ground • Electric throttle position sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check electric throttle position sensor circuit for open circuit, short circuit to ground • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new electric throttle as required
P0123-85	Throttle/Pedal Position Sensor A Circuit High - Signal above allowable range	 <p>NOTE: Circuit reference I_A_TVA1</p> <ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Electric throttle position sensor circuit is above the valid electrical range • Electric throttle position sensor circuit short circuit to power • Electric throttle position sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check electric throttle position sensor circuit for short circuit to power • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new electric throttle as required
P0126-00	Insufficient Coolant Temp For Stable Operation - No sub type information	<ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Engine coolant temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check engine coolant temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new engine coolant temperature sensor as required
P0128-00	Coolant Thermostat (Coolant Temp Below Thermostat Regulating Temperature) - No sub type information	<ul style="list-style-type: none"> • Thermostat stuck open or partially open • Thermostat failure 	<ul style="list-style-type: none"> • Check and install new thermostat
P012B-21	Turbocharger/Supercharger Inlet Pressure Sensor Circuit Range/Performance - Signal amplitude < minimum	<ul style="list-style-type: none"> • The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low • Manifold absolute pressure sensor circuit, for short circuit to ground, short circuit to power, open circuit, high resistance • Intake manifold air leak • Throttle adaption failure • Blocked air filter • Engine breather leakage • Carbon obstruction around throttle blade • Manifold absolute pressure sensor failure • Damaged catalytic converter • Blocked exhaust system 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system check throttle position voltage at ignition on • Check intake manifold for leakage, loose or missing components • Check air filter for blockage or restriction • Check engine breather system for leakage • Check throttle blade for carbon obstruction • Check and install new manifold




			<ul style="list-style-type: none"> absolute pressure sensor as required • Check catalytic converter for damage • Check exhaust system for blockage • Clear the DTC and retest
P012B-22	Turbocharger/Supercharger Inlet Pressure Sensor Circuit Range/Performance - Signal amplitude > maximum	<ul style="list-style-type: none"> • The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high • Manifold absolute pressure sensor circuit, for short circuit to ground, short circuit to power, open circuit, high resistance • Intake manifold air leak • Throttle adaption failure • Blocked air filter • Engine breather leakage • Carbon obstruction around throttle blade • Manifold absolute pressure sensor failure • Damaged catalytic converter • Blocked exhaust system 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system check throttle position voltage at ignition on • Check intake manifold for leakage, loose or missing components • Check air filter for blockage or restriction • Check engine breather system for leakage • Check throttle blade for carbon obstruction • Check and install new manifold absolute pressure sensor as required • Check catalytic converter for damage • Check exhaust system for blockage • Clear the DTC and retest
P012B-23	Turbocharger/Supercharger Inlet Pressure Sensor Circuit Range/Performance - Signal stuck low	<ul style="list-style-type: none"> • The engine control module measures a signal that remains low when transitions are expected • Manifold absolute pressure sensor circuit, for short circuit to ground, short circuit to power, open circuit, high resistance • Intake manifold air leak • Throttle adaption failure • Blocked air filter • Engine breather leakage • Carbon obstruction around throttle blade • Manifold absolute pressure sensor failure • Damaged catalytic converter • Blocked exhaust system 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system check throttle position voltage at ignition on • Check intake manifold for leakage, loose or missing components • Check air filter for blockage or restriction • Check engine breather system for leakage • Check throttle blade for carbon obstruction • Check and install new manifold absolute pressure sensor as required • Check catalytic converter for damage • Check exhaust system for blockage • Clear the DTC and retest
P012B-24	Turbocharger/Supercharger Inlet Pressure Sensor Circuit Range/Performance - Signal stuck high	<ul style="list-style-type: none"> • The engine control module measures a signal that remains high when transitions are expected • Manifold absolute pressure sensor circuit, for short circuit to power • Throttle adaption failure • Blocked air filter • Engine breather leakage 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to power • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system check throttle position voltage at



		<ul style="list-style-type: none"> • Carbon obstruction around throttle blade • Manifold absolute pressure sensor failure • Damaged catalytic converter • Blocked exhaust system 	<ul style="list-style-type: none"> • ignition on • Check air filter for blockage or restriction • Check engine breather system for leakage • Check throttle blade for carbon obstruction • Check and install new manifold absolute pressure sensor as required • Check catalytic converter for damage • Check exhaust system for blockage • Clear the DTC and retest
P012B-29	Turbocharger/Supercharger Inlet Pressure Sensor Circuit Range/Performance - Signal invalid	<ul style="list-style-type: none"> • The value of the signal measured by the engine control module is not plausible given the operating conditions • Manifold absolute pressure sensor circuit, for short circuit to ground, short circuit to power, open circuit, high resistance • Intake manifold air leak • Throttle adaption failure • Blocked air filter • Engine breather leakage • Carbon obstruction around throttle blade • Manifold absolute pressure sensor failure • Damaged catalytic converter • Blocked exhaust system 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system check throttle position voltage at ignition on • Check intake manifold for leakage, loose or missing components • Check air filter for blockage or restriction • Check engine breather system for leakage • Check throttle blade for carbon obstruction • Check and install new manifold absolute pressure sensor as required • Check catalytic converter for damage • Check exhaust system for blockage • Clear the DTC and retest
P012B-84	Turbocharger/Supercharger Inlet Pressure Sensor Circuit Range/Performance - Signal below allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Manifold absolute pressure sensor circuit, for short circuit to ground, short circuit to power, open circuit, high resistance • Intake manifold air leak • Throttle adaption failure • Blocked air filter • Engine breather leakage • Carbon obstruction around throttle blade • Manifold absolute pressure sensor failure • Damaged catalytic converter • Blocked exhaust system 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system check throttle position voltage at ignition on • Check intake manifold for leakage, loose or missing components • Check air filter for blockage or restriction • Check engine breather system for leakage • Check throttle blade for carbon obstruction • Check and install new manifold absolute pressure sensor as required • Check catalytic converter for damage • Check exhaust system for blockage • Clear the DTC and retest
P012B-85	Turbocharger/Supercharger Inlet Pressure Sensor	<ul style="list-style-type: none"> • The engine control module has determined failures where some 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check manifold




	Circuit Range/Performance - Signal above allowable range	<p>circuit quantity, reported via serial data, is above a specified range</p> <ul style="list-style-type: none"> Manifold absolute pressure sensor circuit, for short circuit to ground, short circuit to power, open circuit, high resistance Intake manifold air leak Throttle adaption failure Blocked air filter Engine breather leakage Carbon obstruction around throttle blade Manifold absolute pressure sensor failure Damaged catalytic converter Blocked exhaust system 	<p>absolute pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Using the manufacturer approved diagnostic system check throttle position voltage at ignition on Check intake manifold for leakage, loose or missing components Check air filter for blockage or restriction Check engine breather system for leakage Check throttle blade for carbon obstruction Check and install new manifold absolute pressure sensor as required Check catalytic converter for damage Check exhaust system for blockage Clear the DTC and retest
P012C-00	Turbocharger/Supercharger Inlet Pressure Sensor Circuit Low - No sub type information	 <p>NOTE: Circuit reference O_V_5VRAILPS</p> <ul style="list-style-type: none"> Manifold absolute pressure sensor circuit, for short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector terminal is backed out, connector terminal corrosion Manifold absolute pressure sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check and install new manifold absolute pressure sensor as required Clear the DTC and retest
P012D-00	Turbocharger/Supercharger Inlet Pressure Sensor Circuit High - No sub type information	 <p>NOTE: Circuit reference I_A_IMPS & G_R_IMPS</p> <ul style="list-style-type: none"> Manifold absolute pressure sensor circuit, for short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector terminal is backed out, connector terminal corrosion Manifold absolute pressure sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check and install new manifold absolute pressure sensor as required Clear the DTC and retest
P0130-00	O2 Sensor Circuit (Bank 1 Sensor 1) - No sub type information	<ul style="list-style-type: none"> Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0131-00	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1) - No sub type information	 <p>NOTE: Circuit reference I_A_LSCP1</p> <ul style="list-style-type: none"> Heated oxygen sensor circuit short circuit to ground, short 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance



		<p>circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0132-85	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1) -Signal above allowable range	 <p>NOTE: Circuit reference I_A_LSCP1</p> <ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0133-00	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor degraded • Heated oxygen sensor contamination by incorrect fuel or oil • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Check heated oxygen sensor for age degradation • Check heated oxygen sensor for contamination by incorrect fuel or oil • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0134-00	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1) - No sub type information	 <p>NOTE: Circuit reference I_A_LSF1</p> <ul style="list-style-type: none"> • Heated oxygen sensor incorrectly installed or missing • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Check heated oxygen sensor is correctly installed • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0135-00	O2 Sensor Heater Circuit (Bank 1 Sensor 1) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	 <p>NOTE: Monitor description. The heated oxygen sensor heater duty cycle is at its maximum value but the sensor does not reach operating temperature</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0136-00	O2 Sensor Circuit (Bank 1 Sensor 2) - No sub type information	 <p>NOTE: Circuit reference I_A_LSF3</p> <ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for





		<ul style="list-style-type: none"> connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0137-84	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2) - Signal below allowable range	 <p>NOTE: Circuit reference I_A_LSF3</p> <ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0138-85	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2) -Signal above allowable range	 <p>NOTE: Circuit reference I_A_LSF3</p> <ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P013A-00	O2 Sensor Slow Response - Rich to Lean (Bank 1 and Sensor 2) - No sub type information	<ul style="list-style-type: none"> Exhaust system leakage Incorrectly installed heated oxygen sensor Heated oxygen sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Check exhaust system for leakage Check heated oxygen sensors are installed correctly into the exhaust system Using the manufacturer approved diagnostic system check datalogger signals - Oxygen Sensor (O2S) Voltage Bank 1 Sensor 2 - (0x035F) Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P013C-00	O2 Sensor Slow Response - Rich to Lean (Bank 2, Sensor 2) - No sub type information	<ul style="list-style-type: none"> Exhaust system leakage Incorrectly installed heated oxygen sensor Heated oxygen sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Check exhaust system for leakage Check heated oxygen sensors are installed correctly into the exhaust system Using the manufacturer approved diagnostic system check datalogger signals - Oxygen Sensor (O2S) Voltage Bank 2 Sensor 2 - (0x0362) Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for




			<ul style="list-style-type: none"> damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P013E-00	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 2) - No sub type information	<ul style="list-style-type: none"> • Exhaust system leakage • Incorrectly installed heated oxygen sensor • Heated oxygen sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Check exhaust system for leakage • Check heated oxygen sensors are installed correctly into the exhaust system • Using the manufacturer approved diagnostic system check datalogger signals - Oxygen Sensor (O2S) Voltage Bank 1 Sensor 2 - (0x035F) • Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0141-00	O2 Sensor Heater Circuit (Bank 1 Sensor 2) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0142-00	O2 Sensor Circuit (Bank 1 Sensor 3) - No sub type information	 <p>NOTE: Circuit reference I_A_LSF1</p> <ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0143-00	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 3) - No sub type information	 <p>NOTE: Circuit reference I_A_LSF1</p> <ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0144-00	O2 Sensor Circuit High Voltage (Bank 1 Sensor 3) - No sub type information	 <p>NOTE: Circuit reference G_R_LSF1</p> <ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required




P0147-00	O2 Sensor Heater Circuit (Bank 1 Sensor 3) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P014A-00	O2 Sensor Delayed Response - Rich to Lean (Bank 2 Sensor 2) - No sub type information	<ul style="list-style-type: none"> • Exhaust system leakage • Incorrectly installed heated oxygen sensor • Heated oxygen sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Check exhaust system for leakage • Check heated oxygen sensors are installed correctly into the exhaust system • Using the manufacturer approved diagnostic system check datalogger signals - Oxygen Sensor (O2S) Voltage Bank 2 Sensor 2 - (Ox0362) • Refer to the electrical circuit diagrams and check heated oxygen sensor heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0150-00	O2 Sensor Circuit (Bank 2 Sensor 1) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0151-00	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1) - No sub type information	 <p>NOTE: Circuit reference O_R_LSVG2</p> <ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0152-17	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1) -Circuit voltage above threshold	 <p>NOTE: Circuit reference O_R_LSVG2</p> <ul style="list-style-type: none"> • The engine control module measured a voltage above a specified range but not necessarily a short circuit to power • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required




P0153-00	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor degraded • Heated oxygen sensor contamination by incorrect fuel or oil • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Check heated oxygen sensor for age degradation • Check heated oxygen sensor for contamination by incorrect fuel or oil • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0154-00	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor incorrectly installed or missing • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Check heated oxygen sensor is correctly installed • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0155-85	O2 Sensor Heater Circuit (Bank 2 Sensor 1) - Signal above allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	 NOTE: Monitor description. The heated oxygen sensor heater duty cycle is at its maximum value but the sensor does not reach operating temperature <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0156-00	O2 Sensor Circuit (Bank 2 Sensor 2) - No sub type information	 NOTE: Circuit reference I_A_LSF4 <ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0157-00	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2) - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P0158-00	O2 Sensor Circuit High Voltage (Bank 2 Sensor 2) - No sub type information	 NOTE: Circuit reference I_A_LSF4 <ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of





		<ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0161-00	O2 Sensor Heater Circuit (Bank 2 Sensor 2) - No sub type information	<ul style="list-style-type: none"> Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0162-00	O2 Sensor Circuit (Bank 2 Sensor 3) - No sub type information	 <p>NOTE: Circuit reference I_A_LSF2</p> <ul style="list-style-type: none"> Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0163-00	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 3) - No sub type information	<ul style="list-style-type: none"> Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0164-00	O2 Sensor Circuit High Voltage (Bank 2 Sensor 3) - No sub type information	 <p>NOTE: Circuit reference I_A_LSF2</p> <ul style="list-style-type: none"> Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0167-00	O2 Sensor Heater Circuit (Bank 2 Sensor 3) - No sub type information	<ul style="list-style-type: none"> Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P0169-00	Incorrect Fuel Composition - No sub type information	<ul style="list-style-type: none"> Desired fuelling control limits implausible. Engine control module software error Engine control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power and ground connections to the module Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module





			<ul style="list-style-type: none"> • Check and install new engine control module as required
P0169-42	Incorrect Fuel Composition - General memory failure	<ul style="list-style-type: none"> • Desired lambda was not found plausible. Engine control module software error • Engine control module failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the power and ground connections to the module • Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module • Check and install new engine control module as required
P0169-43	Incorrect Fuel Composition - Special memory failure	<ul style="list-style-type: none"> • Predicted fuel mass was found not plausible. Engine control module software error • Engine control module failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the power and ground connections to the module • Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module • Check and install new engine control module as required
P0170-00	Fuel Trim (Bank 1) - No sub type information	<ul style="list-style-type: none"> • Exhaust system leakage • Post catalyst heated oxygen sensor incorrectly installed • Pre catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Pre catalyst heated oxygen sensor contamination or failure • Post catalyst heated oxygen sensor contamination or failure 	<p>NOTES:</p> <p> Monitor description. Detects when secondary fuelling adaptation control signal is not plausible</p> <p> Operational requirements needed to allow the monitor to be fully tested. Drive vehicle under steady state conditions for up to 20 minutes</p> <ul style="list-style-type: none"> • Check exhaust system for leakage. Rectify as required • Check post catalyst heated oxygen sensor is correctly installed • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check pre catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check post catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new pre catalyst heated oxygen sensor as required • Check and install new post catalyst heated oxygen sensor as required
P0170-29	Fuel Trim (Bank 1) - Signal invalid	<ul style="list-style-type: none"> • The value of the signal measured by the engine control module is not plausible given the operating conditions • Exhaust system leakage • Post catalyst heated oxygen sensor incorrectly installed • Pre catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post catalyst heated oxygen 	<p>NOTES:</p> <p> Monitor description. Detects when secondary fuelling adaptation offset is too large to maintain emissions within limits</p> <p> Operational requirements needed to allow the monitor to be fully tested.</p>

		<p>sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Pre catalyst heated oxygen sensor contamination or failure • Post catalyst heated oxygen sensor contamination or failure 	<p>Drive vehicle under steady state conditions for up to 20 minutes</p> <ul style="list-style-type: none"> • Check exhaust system for leakage. Rectify as required • Check post catalyst heated oxygen sensor is correctly installed • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check pre catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check post catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new pre catalyst heated oxygen sensor as required • Check and install new post catalyst heated oxygen sensor as required
P0170-64	Fuel Trim (Bank 1) - Signal plausibility failure	<ul style="list-style-type: none"> • The engine control module detected plausibility failures • Exhaust system leakage • Post catalyst heated oxygen sensor incorrectly installed • Pre catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Pre catalyst heated oxygen sensor contamination or failure • Post catalyst heated oxygen sensor contamination or failure 	<p>NOTES:</p> <p> Monitor description. Detects when secondary fuelling adaptation offset is too large to maintain emissions within limits</p> <p> Operational requirements needed to allow the monitor to be fully tested. Drive vehicle under steady state conditions for up to 20 minutes</p> <ul style="list-style-type: none"> • Check exhaust system for leakage. Rectify as required • Check post catalyst heated oxygen sensor is correctly installed • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check pre catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check post catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new pre catalyst heated oxygen sensor as required • Check and install new post catalyst heated oxygen sensor as required
P0173-00	Fuel Trim (Bank 2) - No sub type information	<ul style="list-style-type: none"> • Exhaust system leakage • Post catalyst heated oxygen sensor incorrectly installed • Pre catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<p>NOTES:</p> <p> Monitor description. Detects when secondary fuelling adaptation control signal is not plausible</p>

		<ul style="list-style-type: none"> • Post catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Pre catalyst heated oxygen sensor contamination or failure • Post catalyst heated oxygen sensor contamination or failure 	 <p>Operational requirements needed to allow the monitor to be fully tested. Drive vehicle under steady state conditions for up to 20 minutes</p> <ul style="list-style-type: none"> • Check exhaust system for leakage. Rectify as required • Check post catalyst heated oxygen sensor is correctly installed • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check pre catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check post catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new pre catalyst heated oxygen sensor as required • Check and install new post catalyst heated oxygen sensor as required
P0173-29	Fuel Trim (Bank 2) - Signal invalid	<ul style="list-style-type: none"> • The value of the signal measured by the engine control module is not plausible given the operating conditions • Exhaust system leakage • Post catalyst heated oxygen sensor incorrectly installed • Pre catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Pre catalyst heated oxygen sensor contamination or failure • Post catalyst heated oxygen sensor contamination or failure 	<p>NOTES:</p>  <p>Monitor description. Detects when secondary fuelling adaptation offset is too large to maintain emissions within limits</p>  <p>Operational requirements needed to allow the monitor to be fully tested. Drive vehicle under steady state conditions for up to 20 minutes</p> <ul style="list-style-type: none"> • Check exhaust system for leakage. Rectify as required • Check post catalyst heated oxygen sensor is correctly installed • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check pre catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check post catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new pre catalyst heated oxygen sensor as required • Check and install new post catalyst heated oxygen sensor as required
P0173-64	Fuel Trim (Bank 2) - Signal plausibility failure	<ul style="list-style-type: none"> • The engine control module detected plausibility failures • Exhaust system leakage 	<p>NOTES:</p>



		<p>Post catalyst heated oxygen sensor incorrectly installed</p> <ul style="list-style-type: none"> • Pre catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Pre catalyst heated oxygen sensor contamination or failure • Post catalyst heated oxygen sensor contamination or failure 	 Monitor description. Detects when secondary fuelling adaptation offset is too small to maintain emissions within limits  Operational requirements needed to allow the monitor to be fully tested. Drive vehicle under steady state conditions for up to 20 minutes <ul style="list-style-type: none"> • Check exhaust system for leakage. Rectify as required • Check post catalyst heated oxygen sensor is correctly installed • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check pre catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check post catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new pre catalyst heated oxygen sensor as required • Check and install new post catalyst heated oxygen sensor as required
P0181-21	Fuel Temperature Sensor A Circuit Range/Performance - Signal amplitude < minimum	<ul style="list-style-type: none"> • The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel temperature sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Fuel temperature sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals - Fuel Temperature "A" - Raw - (0x0429) • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new fuel temperature sensor as required
P0181-22	Fuel Temperature Sensor A Circuit Range/Performance - Signal amplitude > maximum	<ul style="list-style-type: none"> • The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel temperature sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Fuel temperature sensor failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals - Fuel Temperature "A" - Raw - (0x0429) • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new fuel temperature sensor as required
P0182-00	Fuel Temperature Sensor A Circuit Low - No sub type information	 NOTE: Circuit reference O_V_5VRAILPS & I_A_FTS	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit






		<ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel temperature sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Fuel rail pressure sensor 5 volt power supply circuit, open circuit, high resistance Fuel temperature sensor failure 	<p>diagrams and check fuel temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> Check fuel rail pressure sensor 5 volt power supply circuit for open circuit, high resistance Clear the DTC and retest Check and install new fuel temperature sensor as required
P0183-00	Fuel Temperature Sensor A Circuit High - No sub type information	 <p>NOTE: Circuit reference I_A_FTS & G_R_RAILPS</p> <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel temperature sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Fuel temperature sensor failure 	<ul style="list-style-type: none"> Check engine control module for related DTCs and refer to this DTC index. Rectify these first Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Clear the DTC and retest Check and install new fuel temperature sensor as required
P0191-21	Fuel Rail Pressure Sensor A Circuit Range/Performance - Signal amplitude < minimum	<ul style="list-style-type: none"> The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low Fuel rail pressure sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Fuel rail pressure sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Clear the DTC and retest Check and install new fuel rail pressure sensor as required
P0191-64	Fuel Rail Pressure Sensor A Circuit Range/Performance - Signal plausibility failure	<ul style="list-style-type: none"> The engine control module detected plausibility failures Fuel rail pressure sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Fuel rail pressure sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Clear the DTC and retest Check and install new fuel rail pressure sensor as required
P0191-71	Fuel Rail Pressure Sensor A Circuit Range/Performance - Actuator stuck	<ul style="list-style-type: none"> Fuel rail pressure sensor failure 	 <p>NOTE: Monitor description. The fuel rail pressure is sampled over 3 injections, if no difference is seen then the DTC is set</p> <ul style="list-style-type: none"> Check and install new fuel rail pressure sensor as required Clear the DTC and retest
P0192-84	Fuel Rail Pressure Sensor A Circuit Low - Signal below allowable range	 <p>NOTE: Circuit reference I_A_RAILPS & O_V_5VRAILPS</p> <ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel rail pressure sensor circuit, short circuit to ground Fuel rail pressure sensor 5 volt power supply circuit, open circuit, high resistance Fuel rail pressure sensor failure 	<ul style="list-style-type: none"> Check connector is not disconnected, connector pin is not backed out Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuit for short circuit to ground Check fuel rail pressure sensor 5 volt power supply circuit for open circuit, high resistance Clear the DTC and retest Check and install new fuel rail pressure sensor as required
P0193-85	Fuel Rail Pressure Sensor A Circuit High - Signal		<ul style="list-style-type: none"> Check connector is not disconnected, connector pin is






	above allowable range	<p>NOTE: Circuit reference I_A_RAILPS & G_R_RAILPS</p> <ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel rail pressure sensor circuit, short circuit to power Fuel rail pressure sensor ground supply circuit, open circuit, high resistance Fuel rail pressure sensor failure 	<ul style="list-style-type: none"> not backed out Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel rail pressure sensor circuit for short circuit to power Check fuel rail pressure sensor ground supply circuit for open circuit, high resistance Clear the DTC and retest Check and install new fuel rail pressure sensor as required
P0219-00	Engine Overspeed Condition - No sub type information	<ul style="list-style-type: none"> Incorrect gear was selected Automatic transmission failure 	 <p>NOTE: Monitor description. The DTC is set if the engine speed is greater than 7100rpm for greater than 1 second</p> <ul style="list-style-type: none"> Check engine control module for related DTCs and refer to this DTC index. Rectify these first Check transmission control module for related DTCs and refer to the relevant DTC index
P0221-00	Throttle/Pedal Position Sensor/Switch B Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Electric throttle position sensor circuit short circuit to power, short circuit to ground, high resistance Electric throttle position sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check electric throttle position sensor circuit for short circuit to power, short circuit to ground, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Using the manufacturer approved diagnostic system, with ignition on but engine off, check electric throttle position sensor signal B is aligned to electric throttle position sensor signal A Clear the DTC and retest Check and install new electric throttle as required
P0222-00	Throttle/Pedal Position Sensor/Switch B Circuit Low - No sub type information	 <p>NOTE: Circuit reference I_A_TVA2</p> <ul style="list-style-type: none"> Electric throttle position sensor circuit is below the valid electrical range Electric throttle position sensor circuit open circuit, short circuit to ground Electric throttle position sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check electric throttle position sensor circuit for open circuit, short circuit to ground Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new electric throttle as required
P0223-85	Throttle/Pedal Position Sensor/Switch B Circuit High - Signal above allowable range	 <p>NOTE: Circuit reference I_A_TVA2</p> <ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Electric throttle position sensor circuit is above the valid electrical range Electric throttle position sensor circuit short circuit to power Electric throttle position sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check electric throttle position sensor circuit for short circuit to power Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new electric throttle as required
P0234-00	Turbocharger/Supercharger A Overboost Condition - No	<ul style="list-style-type: none"> Intake manifold pressure sensors incorrect readings 	 <p>NOTE: Monitor description. If</p>







	sub type information		<p>the pressure ratio across the supercharger and bypass is above the expected amount the DTC is set</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals - Boost Absolute Pressure - Raw Value - (0x033E)
P0236-21	Turbocharger/Supercharger Boost Sensor A Circuit Range/Performance - Signal amplitude < minimum	<ul style="list-style-type: none"> The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low Manifold absolute pressure sensor circuit, for short circuit to ground, short circuit to power, open circuit, high resistance Intake manifold air leak Throttle adaption failure Blocked air filter Engine breather leakage Carbon obstruction around throttle blade Manifold absolute pressure sensor failure Damaged catalytic converter Blocked exhaust system 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Using the manufacturer approved diagnostic system check throttle position voltage at ignition on Check intake manifold for leakage, loose or missing components Check air filter for blockage or restriction Check engine breather system for leakage Check throttle blade for carbon obstruction Check and install new manifold absolute pressure sensor as required Check catalytic converter for damage Check exhaust system for blockage Clear the DTC and retest
P0236-22	Turbocharger/Supercharger Boost Sensor A Circuit Range/Performance - Signal amplitude > maximum	<ul style="list-style-type: none"> The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high Manifold absolute pressure sensor circuit, for short circuit to ground, short circuit to power, open circuit, high resistance Intake manifold air leak Throttle adaption failure Blocked air filter Engine breather leakage Carbon obstruction around throttle blade Manifold absolute pressure sensor failure Damaged catalytic converter Blocked exhaust system 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Using the manufacturer approved diagnostic system check throttle position voltage at ignition on Check intake manifold for leakage, loose or missing components Check air filter for blockage or restriction Check engine breather system for leakage Check throttle blade for carbon obstruction Check and install new manifold absolute pressure sensor as required Check catalytic converter for damage Check exhaust system for blockage Clear the DTC and retest
P0236-23	Turbocharger/Supercharger Boost Sensor A Circuit Range/Performance - Signal stuck low	<ul style="list-style-type: none"> The engine control module measures a signal that remains low when transitions are expected Manifold absolute pressure sensor circuit, for short circuit to ground, short circuit to power, open circuit, high 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for






		<ul style="list-style-type: none"> resistance Intake manifold air leak Throttle adaption failure Blocked air filter Engine breather leakage Carbon obstruction around throttle blade Manifold absolute pressure sensor failure Damaged catalytic converter Blocked exhaust system 	<ul style="list-style-type: none"> damage and/or corrosion Using the manufacturer approved diagnostic system check throttle position voltage at ignition on Check intake manifold for leakage, loose or missing components Check air filter for blockage or restriction Check engine breather system for leakage Check throttle blade for carbon obstruction Check and install new manifold absolute pressure sensor as required Check catalytic converter for damage Check exhaust system for blockage Clear the DTC and retest
P0236-24	Turbocharger/Supercharger Boost Sensor A Circuit Range/Performance - Signal stuck high	<ul style="list-style-type: none"> The engine control module measures a signal that remains high when transitions are expected Manifold absolute pressure sensor circuit, for short circuit to ground, short circuit to power, open circuit, high resistance Intake manifold air leak Throttle adaption failure Blocked air filter Engine breather leakage Carbon obstruction around throttle blade Manifold absolute pressure sensor failure Damaged catalytic converter Blocked exhaust system 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check manifold absolute pressure sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Using the manufacturer approved diagnostic system check throttle position voltage at ignition on Check intake manifold for leakage, loose or missing components Check air filter for blockage or restriction Check engine breather system for leakage Check throttle blade for carbon obstruction Check and install new manifold absolute pressure sensor as required Check catalytic converter for damage Check exhaust system for blockage Clear the DTC and retest
P0236-29	Turbocharger/Supercharger Boost Sensor A Circuit Range/Performance - Signal invalid	<ul style="list-style-type: none"> The value of the signal measured by the engine control module is not plausible given the operating conditions Manifold absolute pressure and temperature sensor circuit, for short circuit to ground, short circuit to power, open circuit, high resistance Intake manifold air leak Throttle adaption failure Blocked air filter Engine breather leakage Carbon obstruction around throttle blade Manifold absolute pressure and temperature sensor failure Damaged catalytic converter 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check manifold absolute pressure and temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Using the manufacturer approved diagnostic system check throttle position voltage at ignition on Check intake manifold for leakage, loose or missing components Check air filter for blockage or restriction Check engine breather system for leakage Check throttle blade for carbon obstruction Check and install new manifold absolute pressure and temperature sensor as required





			<ul style="list-style-type: none"> • Check catalytic converter for damage • Clear the DTC and retest
P0236-84	Turbocharger/Supercharger Boost Sensor A Circuit Range/Performance - Signal below allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Manifold absolute pressure and temperature sensor circuit, for short circuit to ground • Intake manifold air leak • Throttle adaption failure • Blocked air filter • Engine breather leakage • Carbon obstruction around throttle blade • Manifold absolute pressure and temperature sensor failure • Damaged catalytic converter 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check manifold absolute pressure and temperature sensor circuit for short circuit to ground • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system check throttle position voltage at ignition on • Check intake manifold for leakage, loose or missing components • Check air filter for blockage or restriction • Check engine breather system for leakage • Check throttle blade for carbon obstruction • Check and install new manifold absolute pressure and temperature sensor as required • Check catalytic converter for damage • Clear the DTC and retest
P0236-85	Turbocharger/Supercharger Boost Sensor A Circuit Range/Performance - Signal above allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Manifold absolute pressure and temperature sensor circuit, for short circuit to power • Intake manifold air leak • Throttle adaption failure • Blocked air filter • Engine breather leakage • Carbon obstruction around throttle blade • Manifold absolute pressure and temperature sensor failure • Damaged catalytic converter 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check manifold absolute pressure and temperature sensor circuit for short circuit to power • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system check throttle position voltage at ignition on • Check intake manifold for leakage, loose or missing components • Check air filter for blockage or restriction • Check engine breather system for leakage • Check throttle blade for carbon obstruction • Check and install new manifold absolute pressure and temperature sensor as required • Check catalytic converter for damage • Clear the DTC and retest
P0237-00	Turbocharger/Supercharger Boost Sensor A Circuit Low - No sub type information	 <p>NOTE: Circuit reference O_V_5VBPS & I_A_BPS</p> <ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Harness failure - Wiring integrity 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check connections are secure and wiring integrity • Clear the DTC and retest
P0238-00	Turbocharger/Supercharger Boost Sensor A Circuit High - No sub type information	 <p>NOTE: Circuit reference G_R_BPS</p> <ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Harness failure - Wiring integrity 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check connections are secure and wiring integrity • Clear the DTC and retest
P023A-	Charge Air Cooler Coolant		<ul style="list-style-type: none"> • Inspect connectors for signs of





13	Pump Control Circuit/Open - Circuit open	 <p>NOTE: Circuit reference O_S_CACWPR</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector pin is backed out, connector pin corrosion Air charge coolant pump relay circuit open circuit, high resistance Air charge coolant pump relay failure 	<p>water ingress, and pins for damage and/or corrosion</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check air charge coolant pump relay circuit for open circuit, high resistance Clear the DTC and retest Check and install new air charge coolant pump relay as required
P023B-11	Charge Air Cooler Coolant Pump Control Circuit Low - Circuit short to ground	 <p>NOTE: Circuit reference O_S_CACWPR</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Air charge coolant pump relay circuit short circuit to ground Air charge coolant pump relay failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check air charge coolant pump relay circuit for short circuit to ground Clear the DTC and retest Check and install new air charge coolant pump relay as required
P023C-12	Charge Air Cooler Coolant Pump Control Circuit High - Circuit short to battery	 <p>NOTE: Circuit reference O_S_CACWPR</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Air charge coolant pump relay circuit short circuit to power Air charge coolant pump relay failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check air charge coolant pump relay circuit for short circuit to power Clear the DTC and retest Check and install new air charge coolant pump relay as required
P0251-13	Injection Pump Fuel Metering Control A - Circuit open	 <p>NOTE: Circuit reference O_P_FSCVH1 & O_P_FSCVL1</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel pump circuit, open circuit Fuel pump failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel pump circuit for open circuit Clear the DTC and retest Check and install new fuel pump as required
P0252-11	Injection Pump Fuel Metering Control A Range/Performance - Circuit short to ground	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another 	 <p>NOTE: Monitor description. To diagnose an internal serial peripheral interface communication failure between the main central processing unit and the pump control module</p>





		<ul style="list-style-type: none"> value was expected Engine control module failure 	<ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Clear the DTC and retest Check and install new engine control module as required
P0253-11	Injection Pump Fuel Metering Control A Low - Circuit short to ground	 <p>NOTE: Circuit reference O_P_FSCVH1</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel pump circuit, short circuit to ground Fuel pump failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel pump circuit for short circuit to ground Clear the DTC and retest Check and install new fuel pump as required
P0254-12	Injection Pump Fuel Metering Control A High - Circuit short to battery	 <p>NOTE: Circuit reference O_P_FSCVL1</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel pump circuit, short circuit to power Fuel pump failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel pump circuit for short circuit to power Clear the DTC and retest Check and install new fuel pump as required
P0256-13	Injection Pump Fuel Metering Control B - Circuit open	 <p>NOTE: Circuit reference O_P_FSCVH2 & O_P_FSCVL2</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel pump circuit, open circuit Fuel pump failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel pump circuit for open circuit Clear the DTC and retest Check and install new fuel pump as required
P0257-11	Injection Pump Fuel Metering Control B Range/Performance - Circuit short to ground	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Engine control module failure 	 <p>NOTE: Monitor description. To diagnose an internal serial peripheral interface communication failure between the main central processing unit and the pump control module</p> <ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Clear the DTC and retest Check and install new engine control module as required
P0258-11	Injection Pump Fuel Metering Control B Low - Circuit short to ground	 <p>NOTE: Circuit reference O_P_FSCVH2</p>	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion





		<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel pump circuit, short circuit to ground Fuel pump failure 	<p>Refer to the electrical circuit diagrams and check fuel pump circuit for short circuit to ground</p> <ul style="list-style-type: none"> Clear the DTC and retest Check and install new fuel pump as required
P0259-12	Injection Pump Fuel Metering Control B High - Circuit short to battery	 <p>NOTE: Circuit reference O_P_FSCVL2</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel pump circuit, short circuit to power Fuel pump failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel pump circuit for short circuit to power Clear the DTC and retest Check and install new fuel pump as required
P025A-13	Fuel Pump Module "A" Control Circuit/Open - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel pump driver module circuit, open circuit, high resistance 	 <p>NOTE: Monitor description. To diagnose a failure on the signal line to the fuel pump driver module</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel pump driver module circuit for open circuit, high resistance Clear the DTC and retest
P025C-11	Fuel Pump Module "A" Control Circuit Low - Circuit short to ground	 <p>NOTE: Circuit reference O_T_FPMC</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel pump driver module circuit, short circuit to ground 	 <p>NOTE: Monitor description. To diagnose a failure on the signal line to the fuel pump driver module</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel pump driver module circuit for short circuit to ground Clear the DTC and retest
P025D-12	Fuel Pump Module "A" Control Circuit High - Circuit short to battery	 <p>NOTE: Circuit reference O_T_FPMC</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel pump driver module 	 <p>NOTE: Monitor description. To diagnose a failure on the signal line to the fuel pump driver module</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel pump driver module circuit for short circuit to power Clear the DTC and retest





		circuit, short circuit to power	
P0261-11	Cylinder 1 Injector Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit to ground Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0261-12	Cylinder 1 Injector Circuit Low - Circuit short to battery	<ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit to power Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to power Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0261-13	Cylinder 1 Injector Circuit Low - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, open circuit, high resistance Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for open circuit, high resistance Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0262-11	Cylinder 1 Injector Circuit High - Circuit short to ground	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit to ground Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0262-12	Cylinder 1 Injector Circuit High - Circuit short to battery	<ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then</p>






		<p>measurement when another value was expected</p> <ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector circuit, short circuit to power • Fuel injector failure 	<p>passed to the main central processing unit</p> <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to power • Clear the DTC and retest • Check fuel injector resistance • Check and install new fuel injector as required
P0264-11	Cylinder 2 Injector Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector circuit, short circuit to ground • Fuel injector failure 	 NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground • Clear the DTC and retest • Check fuel injector resistance • Check and install new fuel injector as required
P0264-12	Cylinder 2 Injector Circuit Low - Circuit short to battery	<ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector circuit, short circuit to power • Fuel injector failure 	 NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to power • Clear the DTC and retest • Check fuel injector resistance • Check and install new fuel injector as required
P0264-13	Cylinder 2 Injector Circuit Low - Circuit open	<ul style="list-style-type: none"> • The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector circuit, open circuit, high resistance • Fuel injector failure 	 NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel injector circuit for open circuit, high resistance • Clear the DTC and retest • Check fuel injector resistance • Check and install new fuel injector as required
P0265-11	Cylinder 2 Injector Circuit High - Circuit short to ground	<ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector circuit, short circuit 	 NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit



		<ul style="list-style-type: none"> to ground Fuel injector failure 	<ul style="list-style-type: none"> diagrams and check fuel injector circuit for short circuit to ground Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0265-12	Cylinder 2 Injector Circuit High - Circuit short to battery	<ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit to power Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to power Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0267-11	Cylinder 3 Injector Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit to ground Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0267-12	Cylinder 3 Injector Circuit Low - Circuit short to battery	<ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit to power Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to power Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0267-13	Cylinder 3 Injector Circuit Low - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, open circuit, high resistance Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for open circuit, high resistance Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required



P0268-11	Cylinder 3 Injector Circuit High - Circuit short to ground	<ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector circuit, short circuit to ground • Fuel injector failure 	 NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground • Clear the DTC and retest • Check fuel injector resistance • Check and install new fuel injector as required
P0268-12	Cylinder 3 Injector Circuit High - Circuit short to battery	<ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector circuit, short circuit to power • Fuel injector failure 	 NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to power • Clear the DTC and retest • Check fuel injector resistance • Check and install new fuel injector as required
P026A-00	Charge Air Cooler Efficiency Below Threshold - No sub type information	<ul style="list-style-type: none"> • Loss of coolant • Air charge coolant pump relay • Connector is disconnected, connector pin is backed out, connector pin corrosion • Air charge coolant pump circuit • Air charge coolant pump failure 	<ul style="list-style-type: none"> • Check the engine coolant level is correct • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install new air charge coolant pump relay as required • Refer to the electrical circuit diagrams and check air charge coolant pump circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new air charge coolant pump as required <ul style="list-style-type: none"> - Is the impeller damaged. Does the impeller rotate and pump coolant
P0270-11	Cylinder 4 Injector Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector circuit, short circuit to ground • Fuel injector failure 	 NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground • Clear the DTC and retest • Check fuel injector resistance • Check and install new fuel injector as required
P0270-12	Cylinder 4 Injector Circuit Low - Circuit short to battery	<ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power 	 NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing




		<p>measurement when another value was expected</p> <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit to power Fuel injector failure 	<p>unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to power Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0270-13	Cylinder 4 Injector Circuit Low - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, open circuit, high resistance Fuel injector failure 	<p> NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for open circuit, high resistance Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0271-11	Cylinder 4 Injector Circuit High - Circuit short to ground	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit to ground Fuel injector failure 	<p> NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0271-12	Cylinder 4 Injector Circuit High - Circuit short to battery	<ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit to power Fuel injector failure 	<p> NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to power Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0273-11	Cylinder 5 Injector Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit 	<p> NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit



		<ul style="list-style-type: none"> to ground Fuel injector failure 	<ul style="list-style-type: none"> diagrams and check fuel injector circuit for short circuit to ground Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0273-12	Cylinder 5 Injector Circuit Low - Circuit short to battery	<ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit to power Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to power Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0273-13	Cylinder 5 Injector Circuit Low - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, open circuit, high resistance Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for open circuit, high resistance Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0274-11	Cylinder 5 Injector Circuit High - Circuit short to ground	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit to ground Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0274-12	Cylinder 5 Injector Circuit High - Circuit short to battery	<ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit to power Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to power Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required



P0276-11	Cylinder 6 Injector Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector circuit, short circuit to ground • Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground • Clear the DTC and retest • Check fuel injector resistance • Check and install new fuel injector as required
P0276-12	Cylinder 6 Injector Circuit Low - Circuit short to battery	<ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector circuit, short circuit to power • Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to power • Clear the DTC and retest • Check fuel injector resistance • Check and install new fuel injector as required
P0276-13	Cylinder 6 Injector Circuit Low - Circuit open	<ul style="list-style-type: none"> • The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector circuit, open circuit, high resistance • Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel injector circuit for open circuit, high resistance • Clear the DTC and retest • Check fuel injector resistance • Check and install new fuel injector as required
P0277-11	Cylinder 6 Injector Circuit High - Circuit short to ground	<ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector circuit, short circuit to ground • Fuel injector failure 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p> <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground • Clear the DTC and retest • Check fuel injector resistance • Check and install new fuel injector as required
P0277-12	Cylinder 6 Injector Circuit High - Circuit short to battery	<ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another 	 <p>NOTE: Monitor description. Fault detected by the injector control module's power stage diagnostic then passed to the main central processing unit</p>



		<ul style="list-style-type: none"> value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector circuit, short circuit to power Fuel injector failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to power Clear the DTC and retest Check fuel injector resistance Check and install new fuel injector as required
P0299-00	Turbocharger/Supercharger A Underboost Condition - No sub type information	<ul style="list-style-type: none"> Air intake system, boost air system high pressure boost air leak Air intake system, low pressure intake blocked or restricted Supercharger rotors worn or damaged Air intake system pressure sensors incorrect readings Supercharger failure 	<ul style="list-style-type: none"> Test air intake system, boost air system for air leaks Check air intake system, low pressure intake for blockages or restriction Check condition of supercharger and rotors Check engine control module for related air intake system pressure sensor DTCs and refer to this DTC index Check and install new supercharger as required
P02EE-01	"Cylinder 1 Injector Circuit Range/Performance" - General Electrical Failure	<ul style="list-style-type: none"> Fuel injector control circuits (high and low) short circuit to each other Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check both the fuel injector control circuits (high and low) for short circuit to each other Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check fuel injector resistance Clear the DTC and retest Check and install new fuel injector as required
P02EE-1C	Cylinder 1 Injector Circuit Range/Performance - Circuit voltage out of range	<ul style="list-style-type: none"> The engine control module has detected a voltage outside of the expected range, but not identified as too high or too low Fuel injector circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector failure 	 <p>NOTE: Monitor description. The fuel injector control within the engine control module monitors the current that the fuel injector uses to open, if the expected opening current is not seen within a set time the DTC is set</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check fuel injector resistance Clear the DTC and retest Check and install new fuel injector as required
P02EF-01	"Cylinder 2 Injector Circuit Range/Performance" - General Electrical Failure	<ul style="list-style-type: none"> Fuel injector control circuits (high and low) short circuit to each other Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check both the fuel injector control circuits (high and low) for short circuit to each other Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check fuel injector resistance Clear the DTC and retest Check and install new fuel injector as required
P02EF-1C	Cylinder 2 Injector Circuit Range/Performance - Circuit voltage out of range	<ul style="list-style-type: none"> The engine control module has detected a voltage outside of the expected range, but not identified as too high or too low Fuel injector circuit short circuit to ground, short circuit to power, open circuit, high 	 <p>NOTE: Monitor description. The fuel injector control within the engine control module monitors the current that the fuel injector uses to open, if the expected opening current is not</p>





		<p>resistance</p> <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector failure 	<p>seen within a set time the DTC is set</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check fuel injector resistance Clear the DTC and retest Check and install new fuel injector as required
P02F0-00	Cylinder 3 Injector Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Fuel injector circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector failure 	<p> NOTE: Monitor description. The fuel injector control within the engine control module monitors the current that the fuel injector uses to open, if the expected opening current is not seen within a set time the DTC is set</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check fuel injector resistance Clear the DTC and retest Check and install new fuel injector as required
P02F0-01	"Cylinder 3 Injector Circuit Range/Performance" - General Electrical Failure	<ul style="list-style-type: none"> Fuel injector control circuits (high and low) short circuit to each other Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check both the fuel injector control circuits (high and low) for short circuit to each other Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check fuel injector resistance Clear the DTC and retest Check and install new fuel injector as required
P02F1-01	"Cylinder 4 Injector Circuit Range/Performance" - General Electrical Failure	<ul style="list-style-type: none"> Fuel injector control circuits (high and low) short circuit to each other Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check both the fuel injector control circuits (high and low) for short circuit to each other Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check fuel injector resistance Clear the DTC and retest Check and install new fuel injector as required
P02F1-1C	Cylinder 4 Injector Circuit Range/Performance - Circuit voltage out of range	<ul style="list-style-type: none"> The engine control module has detected a voltage outside of the expected range, but not identified as too high or too low Fuel injector circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel injector failure 	<p> NOTE: Monitor description. The fuel injector control within the engine control module monitors the current that the fuel injector uses to open, if the expected opening current is not seen within a set time the DTC is set</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check fuel injector resistance Clear the DTC and retest







			<ul style="list-style-type: none"> • Check and install new fuel injector as required
P02F2-01	"Cylinder 5 Injector Circuit Range/Performance" - General Electrical Failure	<ul style="list-style-type: none"> • Fuel injector control circuits (high and low) short circuit to each other • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check both the fuel injector control circuits (high and low) for short circuit to each other • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check fuel injector resistance • Clear the DTC and retest • Check and install new fuel injector as required
P02F2-1C	Cylinder 5 Injector Circuit Range/Performance - Circuit voltage out of range	<ul style="list-style-type: none"> • The engine control module has detected a voltage outside of the expected range, but not identified as too high or too low • Fuel injector circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector failure 	 <p>NOTE: Monitor description. The fuel injector control within the engine control module monitors the current that the fuel injector uses to open, if the expected opening current is not seen within a set time the DTC is set</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check fuel injector resistance • Clear the DTC and retest • Check and install new fuel injector as required
P02F3-00	Cylinder 6 Injector Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> • Fuel injector circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector failure 	 <p>NOTE: Monitor description. The fuel injector control within the engine control module monitors the current that the fuel injector uses to open, if the expected opening current is not seen within a set time the DTC is set</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check fuel injector circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check fuel injector resistance • Clear the DTC and retest • Check and install new fuel injector as required
P02F3-01	"Cylinder 6 Injector Circuit Range/Performance" - General Electrical Failure	<ul style="list-style-type: none"> • Fuel injector control circuits (high and low) short circuit to each other • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel injector failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check both the fuel injector control circuits (high and low) for short circuit to each other • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check fuel injector resistance • Clear the DTC and retest • Check and install new fuel injector as required
P0300-00	Random Misfire Detected - No sub type information	<ul style="list-style-type: none"> • Poor fuel quality • Catalyst/exhaust system blockage • Spark plug(s) fouled or failed • Injector(s) circuit short circuit to ground, short circuit to power, open circuit • Connector is disconnected, connector pin is backed out, 	 <p>NOTE: Monitor description. Misfire detection</p> <ul style="list-style-type: none"> • Check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Clear the DTC and retest







		<ul style="list-style-type: none"> connector pin corrosion • Injector(s) failure • Fuel system excessively too lean or too rich • Camshaft position sensor failure • Reluctor ring • Crankshaft position sensor failure • Low cylinder compression 	<ul style="list-style-type: none"> • Check the fuel system for blockages, repair as required • Check the catalyst/exhaust system for blockage, repair as required • Check and install a new spark plug(s) as required • Refer to the electrical circuit diagrams and check injector(s) circuit for short circuit to ground, short circuit to power, open circuit • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new injector(s) as required • Check for air leaks within the intake system • Check and install a new camshaft position sensor as required • Inspect reluctor ring for damage • Check and install a new crankshaft position sensor as required • Carry out cylinder compression checks as required
P0301-00	Cylinder 1 Misfire Detected - No sub type information	<ul style="list-style-type: none"> • Poor fuel quality • Catalyst/exhaust system blockage • Spark plug(s) fouled or failed • Injector(s) circuit short circuit to ground, short circuit to power, open circuit • Connector is disconnected, connector pin is backed out, connector pin corrosion • Injector(s) failure • Fuel system excessively too lean or too rich • Camshaft position sensor failure • Reluctor ring • Crankshaft position sensor failure • Low cylinder compression 	 <p>NOTE: Monitor description. Misfire detected on this cylinder</p> <ul style="list-style-type: none"> • Check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Clear the DTC and retest • Check the fuel system for blockages, repair as required • Check the catalyst/exhaust system for blockage, repair as required • Check and install a new spark plug(s) as required • Refer to the electrical circuit diagrams and check injector(s) circuit for short circuit to ground, short circuit to power, open circuit • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new injector(s) as required • Check for air leaks within the intake system • Check and install a new camshaft position sensor as required • Inspect reluctor ring for damage • Check and install a new crankshaft position sensor as required • Carry out cylinder compression checks as required
P0302-00	Cylinder 2 Misfire Detected - No sub type information	<ul style="list-style-type: none"> • Poor fuel quality • Catalyst/exhaust system blockage • Spark plug(s) fouled or failed • Injector(s) circuit short circuit to ground, short circuit to power, open circuit • Connector is disconnected, connector pin is backed out, connector pin corrosion • Injector(s) failure • Fuel system excessively too 	 <p>NOTE: Monitor description. Misfire detected on this cylinder</p> <ul style="list-style-type: none"> • Check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Clear the DTC and retest • Check the fuel system for blockages, repair as required • Check the catalyst/exhaust







		<ul style="list-style-type: none"> lean or too rich • Camshaft position sensor failure • Reluctor ring • Crankshaft position sensor failure • Low cylinder compression 	<ul style="list-style-type: none"> system for blockage, repair as required • Check and install a new spark plug(s) as required • Refer to the electrical circuit diagrams and check injector(s) circuit for short circuit to ground, short circuit to power, open circuit • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new injector(s) as required • Check for air leaks within the intake system • Check and install a new camshaft position sensor as required • Inspect reluctor ring for damage • Check and install a new crankshaft position sensor as required • Carry out cylinder compression checks as required
P0303-00	Cylinder 3 Misfire Detected - No sub type information	<ul style="list-style-type: none"> • Poor fuel quality • Catalyst/exhaust system blockage • Spark plug(s) fouled or failed • Injector(s) circuit short circuit to ground, short circuit to power, open circuit • Connector is disconnected, connector pin is backed out, connector pin corrosion • Injector(s) failure • Fuel system excessively too lean or too rich • Camshaft position sensor failure • Reluctor ring • Crankshaft position sensor failure • Low cylinder compression 	 NOTE: Monitor description. Misfire detected on this cylinder <ul style="list-style-type: none"> • Check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Clear the DTC and retest • Check the fuel system for blockages, repair as required • Check the catalyst/exhaust system for blockage, repair as required • Check and install a new spark plug(s) as required • Refer to the electrical circuit diagrams and check injector(s) circuit for short circuit to ground, short circuit to power, open circuit • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new injector(s) as required • Check for air leaks within the intake system • Check and install a new camshaft position sensor as required • Inspect reluctor ring for damage • Check and install a new crankshaft position sensor as required • Carry out cylinder compression checks as required
P0304-00	Cylinder 4 Misfire Detected - No sub type information	<ul style="list-style-type: none"> • Poor fuel quality • Catalyst/exhaust system blockage • Spark plug(s) fouled or failed • Injector(s) circuit short circuit to ground, short circuit to power, open circuit • Connector is disconnected, connector pin is backed out, connector pin corrosion • Injector(s) failure • Fuel system excessively too lean or too rich • Camshaft position sensor failure • Reluctor ring 	 NOTE: Monitor description. Misfire detected on this cylinder <ul style="list-style-type: none"> • Check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Clear the DTC and retest • Check the fuel system for blockages, repair as required • Check the catalyst/exhaust system for blockage, repair as required • Check and install a new spark






		<p>Crankshaft position sensor failure</p> <ul style="list-style-type: none"> • Low cylinder compression 	<ul style="list-style-type: none"> • plug(s) as required • Refer to the electrical circuit diagrams and check injector(s) circuit for short circuit to ground, short circuit to power, open circuit • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new injector(s) as required • Check for air leaks within the intake system • Check and install a new camshaft position sensor as required • Inspect reluctor ring for damage • Check and install a new crankshaft position sensor as required • Carry out cylinder compression checks as required
P0305-00	Cylinder 5 Misfire Detected - No sub type information	<ul style="list-style-type: none"> • Poor fuel quality • Catalyst/exhaust system blockage • Spark plug(s) fouled or failed • Injector(s) circuit short circuit to ground, short circuit to power, open circuit • Connector is disconnected, connector pin is backed out, connector pin corrosion • Injector(s) failure • Fuel system excessively too lean or too rich • Camshaft position sensor failure • Reluctor ring • Crankshaft position sensor failure • Low cylinder compression 	 <p>NOTE: Monitor description. Misfire detected on this cylinder</p> <ul style="list-style-type: none"> • Check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Clear the DTC and retest • Check the fuel system for blockages, repair as required • Check the catalyst/exhaust system for blockage, repair as required • Check and install a new spark plug(s) as required • Refer to the electrical circuit diagrams and check injector(s) circuit for short circuit to ground, short circuit to power, open circuit • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check and install a new injector(s) as required • Check for air leaks within the intake system • Check and install a new camshaft position sensor as required • Inspect reluctor ring for damage • Check and install a new crankshaft position sensor as required • Carry out cylinder compression checks as required
P0306-00	Cylinder 6 Misfire Detected - No sub type information	<ul style="list-style-type: none"> • Poor fuel quality • Catalyst/exhaust system blockage • Spark plug(s) fouled or failed • Injector(s) circuit short circuit to ground, short circuit to power, open circuit • Connector is disconnected, connector pin is backed out, connector pin corrosion • Injector(s) failure • Fuel system excessively too lean or too rich • Camshaft position sensor failure • Reluctor ring • Crankshaft position sensor failure • Low cylinder compression 	 <p>NOTE: Monitor description. Misfire detected on this cylinder</p> <ul style="list-style-type: none"> • Check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Clear the DTC and retest • Check the fuel system for blockages, repair as required • Check the catalyst/exhaust system for blockage, repair as required • Check and install a new spark plug(s) as required • Refer to the electrical circuit diagrams and check injector(s)







			<p>circuit for short circuit to ground, short circuit to power, open circuit</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check and install a new injector(s) as required Check for air leaks within the intake system Check and install a new camshaft position sensor as required Inspect reluctor ring for damage Check and install a new crankshaft position sensor as required Carry out cylinder compression checks as required
P0324-00	Knock Control System Error - No sub type information	<ul style="list-style-type: none"> Crankshaft position sensor signal is corrupted Engine control module software failure Engine control module hardware failure 	<ul style="list-style-type: none"> Check engine control module for crankshaft position sensor DTCs and refer to this DTC index Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module Check and install a new engine control module as required
P0327-00	Knock Sensor 1 Circuit Low (Bank1) - No sub type information	 <p>NOTE: Circuit reference I_A_KS1B & I_A_KS1A</p> <ul style="list-style-type: none"> Knock sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Knock sensor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new knock sensor as required
P0327-11	Knock Sensor 1 Circuit Low (Bank1) - Circuit short to ground	 <p>NOTE: Circuit reference I_A_KS1B & I_A_KS1A</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Knock sensor circuit short circuit to ground Knock sensor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new knock sensor as required
P0327-21	Knock Sensor 1 Circuit Low (Bank1) - Signal amplitude < minimum	 <p>NOTE: Circuit reference I_A_KS1B & I_A_KS1A</p> <ul style="list-style-type: none"> The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low Engine misfire Knock sensor circuit short circuit to ground, short circuit to power Knock sensor 	 <p>NOTE: Monitor description. Plausibility of sensor output against engine speed</p> <ul style="list-style-type: none"> Check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground, short circuit to power Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for damage and/or corrosion






			<ul style="list-style-type: none"> • Clear the DTC and retest • Check and install new knock sensor as required
P0328-00	Knock Sensor 1 Circuit High (Bank 1) - No sub type information	 <p>NOTE: Circuit reference I_A_KS1B & I_A_KS1A</p> <ul style="list-style-type: none"> • Knock sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Knock sensor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new knock sensor as required
P0328-12	Knock Sensor 1 Circuit High (Bank 1) - Circuit short to battery	 <p>NOTE: Circuit reference I_A_KS1B & I_A_KS1A</p> <ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Knock sensor circuit short circuit to power • Knock sensor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to power • Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new knock sensor as required
P0328-22	Knock Sensor 1 Circuit High (Bank 1) - Signal amplitude > maximum	 <p>NOTE: Circuit reference I_A_KS1B & I_A_KS1A</p> <ul style="list-style-type: none"> • The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high • Knock sensor circuit short circuit to power • Knock sensor • Excessive mechanical noise from the engine 	 <p>NOTE: Monitor description. Plausibility of sensor output against engine speed</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to power • Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check for abnormal engine noise that may corrupt the knock sensor signal • Clear the DTC and retest • Check and install new knock sensor as required
P032C-00	Knock Sensor 3 Circuit Low (Bank1) - No sub type information	 <p>NOTE: Circuit reference I_A_KS3B & I_A_KS3A</p> <ul style="list-style-type: none"> • Knock sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Knock sensor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new knock sensor as required
P032C-11	Knock Sensor 3 Circuit Low (Bank1) - Circuit short to ground	 <p>NOTE: Circuit reference I_A_KS3B & I_A_KS3A</p> <ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground • Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms • Inspect connectors for signs of water ingress, and pins for






		<p>measurement when another value was expected</p> <ul style="list-style-type: none"> • Knock sensor circuit short circuit to ground • Knock sensor 	<p>damage and/or corrosion</p> <ul style="list-style-type: none"> • Clear the DTC and retest • Check and install new knock sensor as required
P032C-21	Knock Sensor 3 Circuit Low (Bank1) - Signal amplitude < minimum	 <p>NOTE: Circuit reference I_A_KS3B & I_A_KS3A</p> <ul style="list-style-type: none"> • The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low • Engine misfire • Knock sensor circuit short circuit to ground, short circuit to power • Knock sensor 	 <p>NOTE: Monitor description. Plausibility of sensor output against engine speed</p> <ul style="list-style-type: none"> • Check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground, short circuit to power • Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new knock sensor as required
P032D-00	Knock Sensor 3 Circuit High (Bank1) - No sub type information	 <p>NOTE: Circuit reference I_A_KS3B & I_A_KS3A</p> <ul style="list-style-type: none"> • Knock sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Knock sensor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new knock sensor as required
P032D-12	Knock Sensor 3 Circuit High (Bank1) - Circuit short to battery	 <p>NOTE: Circuit reference I_A_KS3B & I_A_KS3A</p> <ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Knock sensor circuit short circuit to power • Knock sensor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to power • Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new knock sensor as required
P032D-22	Knock Sensor 3 Circuit High (Bank1) - Signal amplitude > maximum	 <p>NOTE: Circuit reference I_A_KS3B & I_A_KS3A</p> <ul style="list-style-type: none"> • The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high • Knock sensor circuit short circuit to power • Knock sensor • Excessive mechanical noise from the engine 	 <p>NOTE: Monitor description. Plausibility of sensor output against engine speed</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to power • Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check for abnormal engine noise that may corrupt the knock sensor signal • Clear the DTC and retest • Check and install new knock sensor as required







			sensor as required
P0332-00	Knock Sensor 2 Circuit Low (Bank 2) - No sub type information	 <p>NOTE: Circuit reference I_A_KS2B & I_A_KS2A</p> <ul style="list-style-type: none"> Knock sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Knock sensor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new knock sensor as required
P0332-11	Knock Sensor 2 Circuit Low (Bank 2) - Circuit short to ground	 <p>NOTE: Circuit reference I_A_KS2B & I_A_KS2A</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Knock sensor circuit short circuit to ground Knock sensor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new knock sensor as required
P0332-21	Knock Sensor 2 Circuit Low (Bank 2) - Signal amplitude < minimum	 <p>NOTE: Circuit reference I_A_KS2B & I_A_KS2A</p> <ul style="list-style-type: none"> The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low Engine misfire Knock sensor circuit short circuit to ground, short circuit to power Knock sensor 	 <p>NOTE: Monitor description. Plausibility of sensor output against engine speed</p> <ul style="list-style-type: none"> Check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground, short circuit to power Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new knock sensor as required
P0333-00	Knock Sensor 2 Circuit High (Bank 2) - No sub type information	 <p>NOTE: Circuit reference I_A_KS2B & I_A_KS2A</p> <ul style="list-style-type: none"> Knock sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Knock sensor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new knock sensor as required
P0333-12	Knock Sensor 2 Circuit High (Bank 2) - Circuit short to battery	 <p>NOTE: Circuit reference I_A_KS2B & I_A_KS2A</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to power Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for damage and/or corrosion








		<ul style="list-style-type: none"> value was expected Knock sensor circuit short circuit to power Knock sensor 	<ul style="list-style-type: none"> Clear the DTC and retest Check and install new knock sensor as required
P0333-22	Knock Sensor 2 Circuit High (Bank 2) - Signal amplitude > maximum	 <p>NOTE: Circuit reference I_A_KS2B & I_A_KS2A</p> <ul style="list-style-type: none"> The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high Knock sensor circuit short circuit to power Knock sensor Excessive mechanical noise from the engine 	 <p>NOTE: Monitor description. Plausibility of sensor output against engine speed</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to power Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check for abnormal engine noise that may corrupt the knock sensor signal Clear the DTC and retest Check and install new knock sensor as required
P0335-00	Crankshaft Position Sensor A Circuit - No sub type information	 <p>NOTE: Circuit reference O_V_CRS</p> <ul style="list-style-type: none"> Crankshaft position sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Crankshaft position sensor air gap to target rotor excessive Crankshaft position sensor failure 	 <p>NOTE: Monitor description. Missing frequency input signal detected from the crankshaft position sensor</p> <ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the crankshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check crankshaft position sensor air gap to target rotor is correct Check and install a new crankshaft position sensor as required
P0336-00	Crankshaft Position Sensor A Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Crankshaft position sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Crankshaft position sensor air gap to target rotor excessive Crankshaft position sensor failure 	 <p>NOTE: Monitor description. Disturbance detected on the crankshaft frequency input signal</p> <ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the crankshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check crankshaft position sensor air gap to target rotor is correct Check and install a new crankshaft position sensor as required
P0336-03	Crankshaft Position Sensor A Circuit Range/Performance - FM (Frequency Modulated) / PWM (Pulse Width Modulated) Failures	<ul style="list-style-type: none"> Crankshaft position sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Crankshaft position sensor air gap to target rotor excessive Crankshaft position sensor failure 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the crankshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check crankshaft position sensor air gap to target rotor is correct Check and install a new








			crankshaft position sensor as required
P033C-00	Knock Sensor 4 Circuit Low (Bank 2) - No sub type information	 <p>NOTE: Circuit reference I_A_KS4B & I_A_KS4A</p> <ul style="list-style-type: none"> Knock sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Knock sensor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new knock sensor as required
P033C-11	Knock Sensor 4 Circuit Low (Bank 2) - Circuit short to ground	 <p>NOTE: Circuit reference I_A_KS4B & I_A_KS4A</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Knock sensor circuit short circuit to ground Knock sensor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new knock sensor as required
P033C-21	Knock Sensor 4 Circuit Low (Bank 2) - Signal amplitude < minimum	 <p>NOTE: Circuit reference I_A_KS4B & I_A_KS4A</p> <ul style="list-style-type: none"> The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low Engine misfire Knock sensor circuit short circuit to ground, short circuit to power Knock sensor 	 <p>NOTE: Monitor description. Plausibility of sensor output against engine speed</p> <ul style="list-style-type: none"> Check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground, short circuit to power Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new knock sensor as required
P033D-00	Knock Sensor 4 Circuit High (Bank 2) - No sub type information	 <p>NOTE: Circuit reference I_A_KS4B & I_A_KS4A</p> <ul style="list-style-type: none"> Knock sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Knock sensor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new knock sensor as required
P033D-12	Knock Sensor 4 Circuit High (Bank 2) - Circuit short to battery	 <p>NOTE: Circuit reference I_A_KS4B & I_A_KS4A</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to power Measure knock sensor circuit for correct resistance <ul style="list-style-type: none"> - 1 to 1.8 Mega Ohms Inspect connectors for signs of water ingress, and pins for





		<p>measurement when another value was expected</p> <ul style="list-style-type: none"> • Knock sensor circuit short circuit to power • Knock sensor 	<p>damage and/or corrosion</p> <ul style="list-style-type: none"> • Clear the DTC and retest • Check and install new knock sensor as required
P033D-22	Knock Sensor 4 Circuit High (Bank 2) - Signal amplitude > maximum	 <p>NOTE: Circuit reference I_A_KS4B & I_A_KS4A</p> <ul style="list-style-type: none"> • The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high • Knock sensor circuit short circuit to power • Knock sensor • Excessive mechanical noise from the engine 	 <p>NOTE: Monitor description. Plausibility of sensor output against engine speed</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check knock sensor circuit for short circuit to power • Measure knock sensor circuit for correct resistance - 1 to 1.8 Mega Ohms • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check for abnormal engine noise that may corrupt the knock sensor signal • Clear the DTC and retest • Check and install new knock sensor as required
P0341-00	Camshaft Position Sensor A Circuit Range/Performance (Bank 1 or single sensor) - No sub type information	<ul style="list-style-type: none"> • Loose camshaft position sensor • Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Camshaft position sensor reluctor ring air gap excessive 	 <p>NOTE: Monitor description. Disturbance detected on the camshaft input signal</p> <ul style="list-style-type: none"> • Check camshaft position sensor is installed correctly • Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check reluctor ring to sensor runout and air gap are within specification
P0342-00	Camshaft Position Sensor A Circuit Low (Bank 1 or single sensor) - No sub type information	<ul style="list-style-type: none"> • Loose camshaft position sensor • Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Camshaft position sensor reluctor ring air gap excessive 	 <p>NOTE: Monitor description. Missing input signal detected from the camshaft position sensor. No rise or falling edge detected from the camshaft position sensor. Input signal from the camshaft position sensor is low</p> <ul style="list-style-type: none"> • Check camshaft position sensor is installed correctly • Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check reluctor ring to sensor runout and air gap are within specification
P0343-00	Camshaft Position Sensor A Circuit High (Bank 1 or single sensor) - No sub type information	<ul style="list-style-type: none"> • Loose camshaft position sensor • Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Camshaft position sensor reluctor ring air gap excessive 	 <p>NOTE: Monitor description. Missing input signal detected from the camshaft position sensor. No rise or falling edge detected from the camshaft position sensor. Input signal from the camshaft position sensor is high</p>


			<p>Check camshaft position sensor is installed correctly</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check reluctor ring to sensor runout and air gap are within specification
P0346-00	Camshaft Position Sensor A Circuit Range/Performance (Bank 2) - No sub type information	<ul style="list-style-type: none"> Loose camshaft position sensor Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Camshaft position sensor reluctor ring air gap excessive 	 NOTE: Monitor description. Disturbance detected on the camshaft input signal <ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check reluctor ring to sensor runout and air gap are within specification
P0347-00	Camshaft Position Sensor A Circuit Low (Bank 2) - No sub type information	 NOTE: Circuit reference I_P_CASIB <ul style="list-style-type: none"> Loose camshaft position sensor Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Camshaft position sensor reluctor ring air gap excessive 	 NOTE: Monitor description. Missing input signal detected from the camshaft position sensor. No rise or falling edge detected from the camshaft position sensor. Input signal from the camshaft position sensor is low <ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check reluctor ring to sensor runout and air gap are within specification
P0348-00	Camshaft Position Sensor A Circuit High (Bank 2) - No sub type information	 NOTE: Circuit reference I_P_CASIB <ul style="list-style-type: none"> Loose camshaft position sensor Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Camshaft position sensor reluctor ring air gap excessive 	 NOTE: Monitor description. Missing input signal detected from the camshaft position sensor. No rise or falling edge detected from the camshaft position sensor. Input signal from the camshaft position sensor is high <ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check reluctor ring to sensor runout and air gap are within




			specification
P0350-04	Ignition Coil Primary/Secondary Circuit - System Internal Failures	<ul style="list-style-type: none"> Power and ground connections to the engine control module open circuit Engine control module failure 	<ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Refer to the electrical circuit diagrams and check the power and ground connections to the module Check and install new engine control module as required Clear the DTC and retest
P0350-64	Ignition Coil Primary/Secondary Circuit - Signal plausibility failure	<ul style="list-style-type: none"> The engine control module detected plausibility failures Power and ground connections to the engine control module open circuit Engine control module failure 	<ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Refer to the electrical circuit diagrams and check the power and ground connections to the module Check and install new engine control module as required Clear the DTC and retest
P0350-85	Ignition Coil Primary/Secondary Circuit - Signal above allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Power and ground connections to the engine control module open circuit Engine control module failure 	<ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Refer to the electrical circuit diagrams and check the power and ground connections to the module Check and install new engine control module as required Clear the DTC and retest
P0351-13	Ignition Coil "A" Primary Control Circuit / Open - Circuit open	 <p>NOTE: Circuit reference IGN COIL 1</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Ignition coil connector is disconnected, connector pin is backed out, connector pin corrosion Ignition coil fuse supply failure Ignition coil circuit open circuit 	 <p>NOTE: Monitor description. Open circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is not disconnected, connector pin is not backed out Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for open circuit
P0352-13	Ignition Coil "B" Primary Control Circuit / Open - Circuit open	 <p>NOTE: Circuit reference IGN COIL 2</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Ignition coil connector is disconnected, connector pin is backed out, connector pin corrosion Ignition coil fuse supply failure Ignition coil circuit open circuit 	 <p>NOTE: Monitor description. Open circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is not disconnected, connector pin is not backed out Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for open circuit
P0353-13	Ignition Coil "C" Primary Control Circuit / Open - Circuit open	 <p>NOTE: Circuit reference IGN COIL 3</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of 	 <p>NOTE: Monitor description. Open circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is

		<p>an input in response to an output</p> <ul style="list-style-type: none"> Ignition coil connector is disconnected, connector pin is backed out, connector pin corrosion Ignition coil fuse supply failure Ignition coil circuit open circuit 	<p>not disconnected, connector pin is not backed out</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for open circuit
P0354-13	Ignition Coil "D" Primary Control Circuit / Open - Circuit open	 <p>NOTE: Circuit reference IGN COIL 4</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Ignition coil connector is disconnected, connector pin is backed out, connector pin corrosion Ignition coil fuse supply failure Ignition coil circuit open circuit 	 <p>NOTE: Monitor description. Open circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is not disconnected, connector pin is not backed out Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for open circuit
P0355-13	Ignition Coil "E" Primary Control Circuit / Open - Circuit open	 <p>NOTE: Circuit reference IGN COIL 5</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Ignition coil connector is disconnected, connector pin is backed out, connector pin corrosion Ignition coil fuse supply failure Ignition coil circuit open circuit 	 <p>NOTE: Monitor description. Open circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is not disconnected, connector pin is not backed out Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for open circuit
P0356-13	Ignition Coil "F" Primary Control Circuit / Open - Circuit open	 <p>NOTE: Circuit reference IGN COIL 6</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Ignition coil connector is disconnected, connector pin is backed out, connector pin corrosion Ignition coil fuse supply failure Ignition coil circuit open circuit 	 <p>NOTE: Monitor description. Open circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is not disconnected, connector pin is not backed out Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for open circuit
P0366-00	Camshaft Position Sensor B Circuit Range/Performance (Bank 1) - No sub type information	<ul style="list-style-type: none"> Loose camshaft position sensor Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Camshaft position sensor reluctor ring air gap excessive 	 <p>NOTE: Monitor description. Disturbance detected on the camshaft input signal</p> <ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check reluctor ring to sensor runout and air gap are within specification


P0367-00	Camshaft Position Sensor B Circuit Low (Bank 1) - No sub type information	 <p>NOTE: Circuit reference I_P_CASEA</p> <ul style="list-style-type: none"> Loose camshaft position sensor Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Camshaft position sensor reluctor ring air gap excessive 	 <p>NOTE: Monitor description. Missing input signal detected from the camshaft position sensor. No rise or falling edge detected from the camshaft position sensor. Input signal from the camshaft position sensor is low</p> <ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check reluctor ring to sensor runout and air gap are within specification
P0368-00	Camshaft Position Sensor B Circuit High (Bank 1) - No sub type information	 <p>NOTE: Circuit reference I_P_CASEA</p> <ul style="list-style-type: none"> Loose camshaft position sensor Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Camshaft position sensor reluctor ring air gap excessive 	 <p>NOTE: Monitor description. Missing input signal detected from the camshaft position sensor. No rise or falling edge detected from the camshaft position sensor. Input signal from the camshaft position sensor is high</p> <ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check reluctor ring to sensor runout and air gap are within specification
P0391-00	Camshaft Position Sensor B Circuit Range/Performance (Bank 2) - No sub type information	<ul style="list-style-type: none"> Loose camshaft position sensor Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Camshaft position sensor reluctor ring air gap excessive 	 <p>NOTE: Monitor description. Disturbance detected on the camshaft input signal</p> <ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check reluctor ring to sensor runout and air gap are within specification
P0392-00	Camshaft Position Sensor B Circuit Low (Bank 2) - No sub type information	 <p>NOTE: Circuit reference I_P_CASEB</p> <ul style="list-style-type: none"> Loose camshaft position sensor Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Camshaft position sensor reluctor ring air gap excessive 	 <p>NOTE: Monitor description. Missing input signal detected from the camshaft position sensor. No rise or falling edge detected from the camshaft position sensor. Input signal from the camshaft position sensor is low</p> <ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short






			<p>circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check reluctor ring to sensor runout and air gap are within specification
P0393-00	Camshaft Position Sensor B Circuit High (Bank 2) - No sub type information	 <p>NOTE: Circuit reference G_R_CAS2</p> <ul style="list-style-type: none"> Loose camshaft position sensor Camshaft position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Camshaft position sensor reluctor ring air gap excessive 	 <p>NOTE: Monitor description. Missing input signal detected from the camshaft position sensor. No rise or falling edge detected from the camshaft position sensor. Input signal from the camshaft position sensor is high</p> <ul style="list-style-type: none"> Check camshaft position sensor is installed correctly Refer to the electrical circuit diagrams and check camshaft position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check reluctor ring to sensor runout and air gap are within specification
P0420-00	Catalyst System Efficiency Below Threshold (Bank 1) - No sub type information	<ul style="list-style-type: none"> Exhaust system leakage Catalytic converter failed, caused by lean combustion Catalytic converter failed, caused by misfire Catalytic converter failed, caused by excessive oil consumption Catalytic converter failed, caused by contaminated fuel 	 <p>NOTE: Monitor description. Oxygen storage capacity of the catalyst too low</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check engine control module, for related DTCs and refer to the relevant DTC index Check exhaust system for leakage Refer to the relevant sections of the workshop manual and check the induction system for air leaks Refer to the relevant sections of the workshop manual and check the ignition system for causes of misfire Refer to the relevant sections of the workshop manual and carry out oil consumption checks Confirm with the customer that the correct fuel has been used
P0430-00	Catalyst System Efficiency Below Threshold (Bank 2) - No sub type information	<ul style="list-style-type: none"> Exhaust system leakage Catalytic converter failed, caused by lean combustion Catalytic converter failed, caused by misfire Catalytic converter failed, caused by excessive oil consumption Catalytic converter failed, caused by contaminated fuel 	 <p>NOTE: Monitor description. Oxygen storage capacity of the catalyst too low</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check engine control module, for related DTCs and refer to the relevant DTC index Check exhaust system for leakage Refer to the relevant sections of the workshop manual and check the induction system for air leaks Refer to the relevant sections of the workshop manual and check the ignition system for causes of misfire









			<p>Refer to the relevant sections of the workshop manual and carry out oil consumption checks</p> <ul style="list-style-type: none"> • Confirm with the customer that the correct fuel has been used
P043E-00	Evaporative Emission System Leak Detection Reference Orifice Low Flow - No sub type information	<ul style="list-style-type: none"> • Diagnostic module tank leakage failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system carry out large leak self test • Check and install new diagnostic module tank leakage as required
P043F-00	Evaporative Emission System Leak Detection Reference Orifice High Flow - No sub type information	<ul style="list-style-type: none"> • Diagnostic module tank leakage failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system carry out large leak self test • Check and install new diagnostic module tank leakage as required
P0442-00	Evaporative Emission System Leak Detected (small leak) - No sub type information	<ul style="list-style-type: none"> • Leak detected in evaporative emissions system • Fuel filler cap not sealing/missing • Purge valve stuck open • Harness failure - Purge valve circuit • Evaporative emissions canister pipework • Diagnostic module tank leakage pump failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system carry out purge valve self test • Check evaporative emission system for leak using appropriate smoke/leak tester • Check fuel filler cap is not missing • Check fuel filler cap is sealing correctly • Refer to the electrical circuit diagrams and check purge valve circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Visually inspect purge canister, purge pipes, fuel tank and filler neck for any obvious damage. Replace as required • Check and install new diagnostic module tank leakage pump as required
P0444-00	Evaporative Emission System Purge Control Valve "A" Circuit Open - No sub type information	 <p>NOTE: Circuit reference O_T_PCSV</p> <ul style="list-style-type: none"> • Purge control valve connector is disconnected, connector pin is backed out, connector pin corrosion • Purge control valve circuit open circuit • Purge control valve failure 	<ul style="list-style-type: none"> • Check connector is not disconnected, connector pin is not backed out • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check purge control valve circuit for open circuit • Check and install a new purge control valve as required
P0456-00	Evaporative Emission System Leak Detected (very small leak) - No sub type information	<ul style="list-style-type: none"> • Fuel filler cap not sealing/missing • Diagnostic module tank leakage connector not sealed • Diagnostic module tank leakage wiring connector not sealed • Evaporative emission system leak • Fuel tank, filler neck leak • Diagnostic module tank leakage module failure 	<ul style="list-style-type: none"> • Check fuel tank filler cap for sealing/missing. Check and install a new fuel tank filler cap as required • Check evaporative emission system for leak using appropriate smoke/leak tester • Carry out a purge valve self test to clean the purge valve • Check fuel tank and filler neck for leakage, replace as required • Check purge valve canister and pipes for leakage, replaced as required • Check and install a new diagnostic module tank leakage module as required
P0457-76	Evaporative Emission System Leak Detected (fuel cap loose/off) - Wrong mounting position	<ul style="list-style-type: none"> • The engine control module has detected incorrectly installed components • Fuel filler cap not fitted correctly • Fuel tank or fuel filler neck leak • Fuel filler cap failure 	<ul style="list-style-type: none"> • Check fuel filler cap is sealing correctly • Check fuel tank and fuel filler neck for leaks using appropriate smoke/leak tester • Using the manufacturer approved diagnostic system carry out small leak self test




			<ul style="list-style-type: none"> • Check and install new fuel filler cap as required
P0458-00	Evaporative Emission System Purge Control Valve Circuit Low - No subtype information	 <p>NOTE: Circuit reference O_T_PCSV</p> <ul style="list-style-type: none"> • Purge control valve connector is disconnected, connector pin is backed out, connector pin corrosion • Purge control valve circuit short circuit to ground • Purge control valve failure 	<ul style="list-style-type: none"> • Check connector is not disconnected, connector pin is not backed out • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check purge control valve circuit for short circuit to ground • Check and install a new purge control valve as required
P0459-00	Evaporative Emission System Purge Control Valve Circuit High - No subtype information	 <p>NOTE: Circuit reference O_T_PCSV</p> <ul style="list-style-type: none"> • Purge control valve connector is disconnected, connector pin is backed out, connector pin corrosion • Purge control valve circuit short circuit to power • Purge control valve failure 	<ul style="list-style-type: none"> • Check connector is not disconnected, connector pin is not backed out • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check purge control valve circuit for short circuit to power • Check and install a new purge control valve as required
P0460-29	Fuel Level Sensor A Circuit - Signal invalid	<ul style="list-style-type: none"> • The value of the signal measured by the engine control module is not plausible given the operating conditions • Connector is disconnected, connector pin is backed out, connector pin corrosion • Fuel level sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Fuel level sensor failure 	 <p>NOTE: Monitor description. Open circuit detected by the instrument cluster of the active fuel level sensor. The instrument cluster will transmit the failure over CAN to the engine control module. The engine control module sets the DTC</p> <ul style="list-style-type: none"> • Check connector is not disconnected, connector pin is not backed out • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check fuel level sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new fuel level sensor as required
P0480-11	Fan 1 Control Circuit - Circuit short to ground	<ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Engine cooling fan circuit short circuit to ground • Engine cooling fan failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check engine cooling fan circuit for short circuit to ground • Clear the DTC and retest • Check and install new engine cooling fan as required
P0480-12	Fan 1 Control Circuit - Circuit short to battery	<ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Engine cooling fan circuit short circuit to power • Engine cooling fan failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check engine cooling fan circuit for short circuit to power • Clear the DTC and retest • Check and install new engine cooling fan as required





P0480-13	Fan 1 Control Circuit - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector pin is backed out, connector pin corrosion Engine cooling fan circuit open circuit, high resistance Engine cooling fan failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check engine cooling fan circuit for open circuit, high resistance Clear the DTC and retest Check and install new engine cooling fan as required
P0481-11	Fan 2 Control Circuit - Circuit short to ground	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Engine cooling fan circuit short circuit to ground Engine cooling fan failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check engine cooling fan circuit for short circuit to ground Clear the DTC and retest Check and install new engine cooling fan as required
P0481-12	Fan 2 Control Circuit - Circuit short to battery	<ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Engine cooling fan circuit short circuit to power Engine cooling fan failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check engine cooling fan circuit for short circuit to power Clear the DTC and retest Check and install new engine cooling fan as required
P0481-13	Fan 2 Control Circuit - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector pin is backed out, connector pin corrosion Engine cooling fan circuit open circuit, high resistance Engine cooling fan failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check engine cooling fan circuit for open circuit, high resistance Clear the DTC and retest Check and install new engine cooling fan as required
P0483-36	Fan Performance - Signal frequency too low	<ul style="list-style-type: none"> Engine cooling fan partially stalled Engine cooling fan stalling caused by deep water wading Engine cooling fan stalling caused by obstruction in fan cowling Engine cooling fan circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Confirm if customer has been deep water wading Check for damage to or blockages in fan and fouling of fan cowling. Rectify as required Refer to the electrical circuit diagrams and check engine cooling fan circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest
P0483-37	Fan Performance - Signal frequency too high	<ul style="list-style-type: none"> The engine control module detected insufficient duration for one cycle of the output across a specified sample size Engine cooling fan failure 	<ul style="list-style-type: none"> Check and install new engine cooling fan as required Clear the DTC and retest
P0493-00	Fan Overspeed (clutch locked) - No sub type information	<ul style="list-style-type: none"> Engine cooling fan partially stalled Engine cooling fan stalling 	<ul style="list-style-type: none"> Confirm if customer has been deep water wading Check for damage to or


		<ul style="list-style-type: none"> caused by deep water wading Engine cooling fan stalling caused by obstruction in fan cowling Engine cooling fan circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> blockages in fan and fouling of fan cowling. Rectify as required Refer to the electrical circuit diagrams and check engine cooling fan circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest
P0496-00	Evaporative Emission System High Purge Flow - No sub type information	<ul style="list-style-type: none"> Purge valve stuck open Harness failure - Purge valve circuit Purge valve failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system carry out purge valve self test Refer to the electrical circuit diagrams and check purge valve circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check and install new purge valve as required
P0497-00	Evaporative Emission System Low Purge Flow - No sub type information	<ul style="list-style-type: none"> Purge valve stuck closed Harness failure - Purge valve circuit Purge valve failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system carry out purge valve self test Refer to the electrical circuit diagrams and check purge valve circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check and install new purge valve as required
P0501-00	Vehicle Speed Sensor A Range/Performance - No sub type information	<ul style="list-style-type: none"> Anti-lock brake system control module fault Crankshaft position sensor damaged Blocked or damaged air intake system and mass air flow sensors 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check anti-lock brake system control module, for related DTCs and refer to the relevant DTC index Inspect crankshaft position sensor for signs of damage and/or corrosion Check for damage to or blockages in air intake system and mass air flow sensors. Rectify as required Clear the DTC and retest
P0504-27	Brake Switch A / B Correlation - Signal rate of change above threshold	<ul style="list-style-type: none"> The signal transitions more quickly than is reasonably allowed Brake pedal switch plunger failure Brake pedal switch not fitted correctly Brake pedal switch failure 	<ul style="list-style-type: none"> Check for related brake pressure DTCs within the anti-lock braking control module Check brake pedal switch is fitted correctly. Clear DTC, start the engine and press the brake pedal, using maximum travel, for greater than 1 minute taking care not to press the accelerator pedal Check and install new brake pedal switch as required
P0505-00	Idle Control System - No sub type information	<ul style="list-style-type: none"> Intake air system blockage Front end accessory drive overload, failed or seized component Power steering pump overload, failed or seized component 	 NOTE: Monitor description. Engine idle oscillation greater than maximum deviation allowed during catalyst operation <ul style="list-style-type: none"> Check air filter is not blocked Check the intake air system is free from restrictions Check front end accessory drive belt and driven components for overload failure or seized Check power steering pump for overload, failed or seized component
P0505-	Idle Control System -	<ul style="list-style-type: none"> The signal transitions more 	




27	Signal rate of change above threshold	<p>quickly than is reasonably allowed</p> <ul style="list-style-type: none"> • Intake air system blockage • Front end accessory drive overload, failed or seized component • Power steering pump overload, failed or seized component 	 <p>NOTE: Monitor description. Engine idle oscillation greater than maximum deviation allowed during normal (warm) operation</p> <ul style="list-style-type: none"> • Check air filter is not blocked • Check the intake air system is free from restrictions • Check front end accessory drive belt and driven components for overload failure or seized • Check power steering pump for overload, failed or seized component
P0506-00	Idle Control System - RPM Lower Than Expected - No sub type information	<ul style="list-style-type: none"> • Intake air system blockage • Front end accessory drive overload, failed or seized component • Power steering pump overload, failed or seized component 	 <p>NOTE: Monitor description. Engine idle speed lower than minimum deviation allowed during normal (warm) operation</p> <ul style="list-style-type: none"> • Check air filter is not blocked • Check the intake air system is free from restrictions • Check front end accessory drive belt and driven components for overload failure or seized • Check power steering pump for overload, failed or seized component
P0506-24	Idle Control System - RPM Lower Than Expected - Signal stuck high	<ul style="list-style-type: none"> • The engine control module measures a signal that remains high when transitions are expected • Intake air system blockage • Front end accessory drive overload, failed or seized component • Power steering pump overload, failed or seized component 	 <p>NOTE: Monitor description. Engine idle speed lower than minimum deviation allowed during catalyst operation</p> <ul style="list-style-type: none"> • Check air filter is not blocked • Check the intake air system is free from restrictions • Check front end accessory drive belt and driven components for overload failure or seized • Check power steering pump for overload, failed or seized component
P0507-00	Idle Control System - RPM Higher Than Expected - No sub type information	<ul style="list-style-type: none"> • Intake air system leakage • Intake air system components incorrectly installed, loose or damaged pipework • Engine crankcase breather system leakage • Engine crankcase breather system components incorrectly installed 	 <p>NOTE: Monitor description. Engine idle speed greater than maximum deviation allowed during normal (warm) operation</p> <ul style="list-style-type: none"> • Using the manufacturer approved smoke test system check the intake air system is free from leakage, components are correctly installed, not loose or that damaged pipework is allowing leakage • Check Engine crankcase breather system is free from leakage, components are correctly installed, not loose or that damaged pipework is allowing leakage
P0507-23	Idle Control System - RPM Higher Than Expected - Signal stuck low	<ul style="list-style-type: none"> • The engine control module measures a signal that remains low when transitions are expected • Intake air system leakage • Intake air system components incorrectly installed, loose or damaged pipework • Engine crankcase breather system leakage • Engine crankcase breather 	 <p>NOTE: Monitor description. Engine idle speed greater than maximum deviation allowed during catalyst operation</p> <ul style="list-style-type: none"> • Using the manufacturer approved smoke test system check the intake air system is free from leakage, components are correctly installed, not loose




		system components incorrectly installed	<p>or that damaged pipework is allowing leakage</p> <ul style="list-style-type: none"> • Check Engine crankcase breather system is free from leakage, components are correctly installed, not loose or that damaged pipework is allowing leakage
P050B-92	Cold Start Ignition Timing Performance - Performance or incorrect operation	<ul style="list-style-type: none"> • The engine control module has detected that the component performance is outside its expected range or operating in an incorrect way • Engine control module failure 	 NOTE: Monitor description. Monitor ignition timing during catalyst heating while in drive <ul style="list-style-type: none"> • Check and install new engine control module as required
P050B-93	Cold Start Ignition Timing Performance - No operation	<ul style="list-style-type: none"> • Engine control module failure 	 NOTE: Monitor description. Actual ignition timing different to commanded ignition timing during catalyst heating <ul style="list-style-type: none"> • Check and install new engine control module as required
P050F-01	Brake Assist Vacuum Too Low - General Electrical Failure	 NOTE: Circuit reference I_S_BRKVAC <ul style="list-style-type: none"> • Brake vacuum sensor open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Brake vacuum pump air leakage • Brake vacuum pump failure 	 NOTE: Monitor description. The engine control module checks there is brake vacuum greater than 60kPa gauge pressure after 45 seconds. After engine is running, the atmospheric pressure is greater than 75kPa, the coolant is greater than 20'C, and the brake pedal is released <ul style="list-style-type: none"> • Check brake vacuum is available. Deplete vacuum with engine off until the brake pedal goes hard. With brake pedal still applied start engine, if the pedal drops then vacuum is available • Refer to the electrical circuit diagrams and check brake vacuum sensor circuit for open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • If the brake pedal does not drop check under bonnet for air leaks and brake vacuum pump operation • Check and install new brake vacuum pump as required • Clear the DTC and retest
P0512-12	Starter Request Circuit - Circuit short to battery	 NOTE: Circuit reference I_S_T50 <ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Connector is disconnected, connector pin is backed out, connector pin corrosion • Starter request circuit short circuit to power 	 NOTE: Monitor description. The engine control module checks that the hard wired crank request from the body control module matches the powermode CAN signal <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check starter request circuit for short circuit to power • Clear the DTC and retest
P0512-14	Starter Request Circuit - Circuit short to ground or open	 NOTE: Circuit reference I_S_T50 <ul style="list-style-type: none"> • The engine control module has detected a ground measurement or open circuit 	 NOTE: Monitor description. The engine control module checks that the hard wired crank request from the body control module matches the powermode CAN signal


		<p>for a period longer than expected or has detected a ground measurement or open circuit when another value was expected</p> <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Starter request circuit open circuit, short circuit to ground 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check starter request circuit for open circuit, short circuit to ground Clear the DTC and retest
P0512-72	Starter Request Circuit - Actuator stuck open	 <p>NOTE: Circuit reference I_S_T50R</p> <ul style="list-style-type: none"> Starter relay stuck open Connector is disconnected, connector pin is backed out, connector pin corrosion Starter request diagnostic circuit open circuit Starter relay failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion If engine starts turning, refer to the electrical circuit diagrams and check starter request circuit for open circuit Clear the DTC and retest Check and install new start relay as required
P0512-73	Starter Request Circuit - Actuator stuck closed	 <p>NOTE: Circuit reference I_S_T50R</p> <ul style="list-style-type: none"> Starter relay stuck closed Connector is disconnected, connector pin is backed out, connector pin corrosion Starter request diagnostic circuit short circuit to power Starter relay failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion If engine starts turning, refer to the electrical circuit diagrams and check starter request circuit for short circuit to power Clear the DTC and retest Check and install new start relay as required
P0513-00	Incorrect Immobilizer Key - No sub type information	<ul style="list-style-type: none"> Invalid signal from central junction box Immobilizer 	<ul style="list-style-type: none"> Check for CAN network and engine control module related DTCs and refer to the relevant DTC index. Check the central junction box for related DTCs and refer to the relevant DTC index. Re-configure the engine control module using the manufacturer approved diagnostic system Re-configure the central junction box using the manufacturer approved diagnostic system
P0528-00	Fan Speed Sensor Circuit No Signal - No sub type information	<ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Engine cooling fan stalling caused by obstruction in fan cowling Engine cooling fan circuit short circuit to ground, short circuit to power, open circuit, high resistance Engine cooling fan failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check for damage to or blockages in fan and fouling of fan cowling. Rectify as required Refer to the electrical circuit diagrams and check engine cooling fan circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check and install new engine cooling fan as required Clear the DTC and retest
P052A-00	Cold Start Intake (A) Camshaft Position Timing Over-Advanced (Bank 1) - No sub type information	<ul style="list-style-type: none"> Oil level is low Variable camshaft timing solenoid circuit intake and exhaust connectors swapped Variable camshaft timing solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance Oil pressure is low Variable camshaft timing actuator mechanical failure Excessive camshaft friction, restricted movement or stuck 	 <p>NOTE: Monitor description. Inlet camshaft target versus actual deviation exceeds allowable limit during catalyst heating phase</p> <ul style="list-style-type: none"> Check the oil level is correct Check variable camshaft timing solenoid circuit intake and exhaust connectors are not swapped Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance






			<ul style="list-style-type: none"> • Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to camshaft is correct and that oil gallery is free from debris • Clear the DTC and retest • Check and install new variable camshaft timing actuator as required • Refer to the relevant sections of the workshop manual and check the camshaft operation
P052C-00	Cold Start Intake (A) Camshaft Position Timing Over-Advanced (Bank 2) - No sub type information	<ul style="list-style-type: none"> • Oil level is low • Variable camshaft timing solenoid circuit intake and exhaust connectors swapped • Variable camshaft timing solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance • Oil pressure is low • Variable camshaft timing actuator mechanical failure • Excessive camshaft friction, restricted movement or stuck 	 NOTE: Monitor description. Inlet camshaft target versus actual deviation exceeds allowable limit during catalyst heating phase <ul style="list-style-type: none"> • Check the oil level is correct • Check variable camshaft timing solenoid circuit intake and exhaust connectors are not swapped • Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to camshaft is correct and that oil gallery is free from debris • Clear the DTC and retest • Check and install new variable camshaft timing actuator as required • Refer to the relevant sections of the workshop manual and check the camshaft operation
P053F-23	Cold Start Fuel Pressure Performance - Signal stuck low	<ul style="list-style-type: none"> • The engine control module measures a signal that remains low when transitions are expected • External fuel leak from high pressure fuel system • Internal fuel leak into low pressure fuel system 	 NOTE: Monitor description. The high pressure fuel pump signal is below a threshold during catalyst heating <ul style="list-style-type: none"> • Check for external fuel leaks from the high pressure fuel pump and fuel rail • Check for internal fuel leaks from high pressure fuel pump into the low pressure fuel system
P053F-24	Cold Start Fuel Pressure Performance - Signal stuck high	<ul style="list-style-type: none"> • The engine control module measures a signal that remains high when transitions are expected • External fuel leak from high pressure fuel system • Internal fuel leak into low pressure fuel system 	 NOTE: Monitor description. The high pressure fuel pump signal is above a threshold during catalyst heating <ul style="list-style-type: none"> • Check for external fuel leaks from the high pressure fuel pump and fuel rail • Check for internal fuel leaks from high pressure fuel pump into the low pressure fuel system
P054A-00	Cold Start Exhaust (B) Camshaft Position Timing Over-Advanced (Bank 1) - No sub type information	<ul style="list-style-type: none"> • Oil level is low • Variable camshaft timing solenoid circuit intake and exhaust connectors swapped • Variable camshaft timing solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance • Oil pressure is low 	 NOTE: Monitor description. Exhaust camshaft target versus actual deviation exceeds allowable limit during catalyst heating phase <ul style="list-style-type: none"> • Check the oil level is correct • Check variable camshaft timing solenoid circuit intake and

		<ul style="list-style-type: none"> • Variable camshaft timing actuator mechanical failure • Excessive camshaft friction, restricted movement or stuck 	<p>exhaust connectors are not swapped</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to camshaft is correct and that oil gallery is free from debris • Clear the DTC and retest • Check and install new variable camshaft timing actuator as required • Refer to the relevant sections of the workshop manual and check the camshaft operation
P054C-00	Cold Start Exhaust (B) Camshaft Position Timing Over-Advanced (Bank 2) - No sub type information	<ul style="list-style-type: none"> • Oil level is low • Variable camshaft timing solenoid circuit intake and exhaust connectors swapped • Variable camshaft timing solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance • Oil pressure is low • Variable camshaft timing actuator mechanical failure • Excessive camshaft friction, restricted movement or stuck 	 <p>NOTE: Monitor description. Exhaust camshaft target versus actual deviation exceeds allowable limit during catalyst heating phase</p> <ul style="list-style-type: none"> • Check the oil level is correct • Check variable camshaft timing solenoid circuit intake and exhaust connectors are not swapped • Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the relevant sections of the workshop manual and check the oil pressure is within specification. Check oil supply to camshaft is correct and that oil gallery is free from debris • Clear the DTC and retest • Check and install new variable camshaft timing actuator as required • Refer to the relevant sections of the workshop manual and check the camshaft operation
P0561-00	System Voltage Unstable - No sub type information	<ul style="list-style-type: none"> • Power and ground connections to the engine control module, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Engine control module failure 	<ul style="list-style-type: none"> • Refer to the workshop manual and the battery care manual, inspect the vehicle battery and ensure it is fully charged and serviceable before performing further tests • Refer to the electrical circuit diagrams and check the power and ground connections to the module • Check the vehicle charging system performance to ensure the voltage regulation is correct
P0562-00	System Voltage Low - No sub type information	<ul style="list-style-type: none"> • Vehicle battery under charged • Charging system fault - under charging 	<ul style="list-style-type: none"> • Refer to the workshop manual and the battery care manual, inspect the vehicle battery and ensure it is fully charged and serviceable before performing further tests • Refer to the electrical circuit diagrams and check the power and ground connections to the module • Check the vehicle charging system performance to ensure the voltage regulation is correct






P0562-16	System Voltage Low - Circuit voltage below threshold	<ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Power and ground connections to the engine control module, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Engine control module failure 	 <p>NOTE: Monitor description. Engine control module internal 5 Volt supply below the minimum hardcoded threshold value</p> <ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the power and ground connections to the module Clear the DTC and retest Check and install new engine control module as required
P0563-00	System Voltage High - No sub type information	<ul style="list-style-type: none"> Vehicle battery over charged Charging system fault - over charging 	<ul style="list-style-type: none"> Check the vehicle charging system performance to ensure the voltage regulation is correct
P0563-17	System Voltage High - Circuit voltage above threshold	<ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Charging system fault - over charging Engine control module failure 	 <p>NOTE: Monitor description. Engine control module internal 5 Volt supply above the upper hardcoded threshold value</p> <ul style="list-style-type: none"> Check the vehicle charging system performance to ensure the voltage regulation is correct Check and install new engine control module as required
P0571-62	Brake Switch A Circuit - Signal compare failure	<ul style="list-style-type: none"> The engine control module detected failure when comparing two or more input parameters for plausibility The brake pedal switch signal received over CAN is defective Brake pedal switch detached from pedal box whilst electrically connected Brake pedal switch adjustment incorrect Brake pedal switch harness failure Brake pedal switch failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system carry out network integrity test Check for related DTCs and refer to the relevant DTC index Inspect brake switch connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the brake pedal switch circuits for open circuit, short circuit to ground, short circuit to power Check and install new brake pedal switch as required
P0575-81	Cruise Control Input Circuit - Invalid serial data received	<ul style="list-style-type: none"> The DTC sets if the cancel, set minus, set plus, resume, headway increase and headway decrease speed control buttons have been pressed for longer than a calibrated period of time. The system then assumes a stuck/damaged button and will cancel and/or disable cruise. The failure will be healed in the next driving cycle if the failure is removed 	<ul style="list-style-type: none"> Check speed control buttons are not jammed/contaminated/damaged. Check speed control module for related DTCs and refer to the relevant DTC index Check steering wheel clock spring and connections to button pack for damage Check and install new cruise control button pack as required
P0597-13	Thermostat Heater Control Circuit / Open - Circuit open	 <p>NOTE: Circuit reference O_T_CTH</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector terminal is backed out, connector terminal 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check coolant thermostat heater circuit for short circuit to ground, short circuit to power, open circuit, high resistance Clear the DTC and retest Check and install new coolant thermostat heater as required




		<ul style="list-style-type: none"> corrosion Coolant thermostat heater circuit, open circuit, high resistance Coolant thermostat heater failure 	
P0598-11	Thermostat Heater Control Circuit Low - Circuit short to ground	 <p>NOTE: Circuit reference O_T_CTH</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Connector is disconnected, connector terminal is backed out, connector terminal corrosion Coolant thermostat heater circuit, short circuit to ground Coolant thermostat heater failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check coolant thermostat heater circuit for short circuit to ground Clear the DTC and retest Check and install new coolant thermostat heater as required
P0599-12	Thermostat Heater Control Circuit High - Circuit short to battery	 <p>NOTE: Circuit reference O_T_CTH</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Connector is disconnected, connector terminal is backed out, connector terminal corrosion Coolant thermostat heater circuit, short circuit to power Coolant thermostat heater failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check coolant thermostat heater circuit for short circuit to power Clear the DTC and retest Check and install new coolant thermostat heater as required
P0606-00	Control Module Processor - No sub type information	<ul style="list-style-type: none"> Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P0606-02	Control Module Processor - General signal failure	<ul style="list-style-type: none"> Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P0606-17	Control Module Processor - Circuit voltage above threshold	<ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P0606-48	Control Module Processor - Supervision software failure	<ul style="list-style-type: none"> Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P0606-86	Control Module Processor - Signal invalid	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is not plausible given the operating conditions Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P0606-92	Control Module Processor - Performance or incorrect operation	<ul style="list-style-type: none"> The engine control module has detected that the component performance is outside its expected range or operating in an incorrect way Software reset has occurred Low battery reset during start attempt 	 <p>NOTE: Monitor description. DTC is set if a software reset has occurred for an abnormal reason</p> <ul style="list-style-type: none"> Check battery is in fully charged and in a serviceable condition using a battery tester and battery care manual Refer to the electrical circuit diagrams and check the power and ground connections to the



			<ul style="list-style-type: none"> module Clear the DTC and test drive the vehicle including at least five ignition cycles. Check for DTCs. If DTC is not present return to customer. If DTC repeatedly returns check and install new engine control module as required
P0606-94	Control Module Processor - Unexpected operation	<ul style="list-style-type: none"> Software reset has occurred 	 <p>NOTE: Monitor description. DTC is set if a software reset has occurred for an abnormal reason</p> <ul style="list-style-type: none"> Check battery is in fully charged and in a serviceable condition using a battery tester and battery care manual Refer to the electrical circuit diagrams and check the power and ground connections to the module Clear the DTC and test drive the vehicle including at least five ignition cycles. Check for DTCs. If DTC is not present return to customer. If DTC repeatedly returns check and install new engine control module as required
P060A-00	Internal Control Module Monitoring Processor Performance - No sub type information	<ul style="list-style-type: none"> Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P060B-00	Internal Control Module A/D Processing Performance - No sub type information	<ul style="list-style-type: none"> Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P060B-02	Internal Control Module A/D Processing Performance - General signal failure	<ul style="list-style-type: none"> Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P060C-00	Internal Control Module Main Processor Performance - No sub type information	<ul style="list-style-type: none"> Engine speed calculation not plausible. Engine control module software error Engine control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power and ground connections to the module Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module Check and install new engine control module as required
P060D-00	Internal Control Module Accelerator Pedal Position Performance - No sub type information	<ul style="list-style-type: none"> Monitoring level 1 accelerator pedal diagnostics have not captured a synchronisation fault of the accelerator pedal. Engine control module software error Engine control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power and ground connections to the module Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module Check and install new engine control module as required
P0615-04	Starter Relay Circuit - System Internal Failures	<ul style="list-style-type: none"> Engine control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power and ground connections to the module Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module Clear the DTC and retest Check and install new engine control module as required



			control module as required
P0615-13	Starter Relay Circuit - Circuit open	 <p>NOTE: Circuit reference O_S_STRTL & O_S_STRTH</p> <ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Starter motor relay control circuit open circuit Starter motor relay disconnected/missing Starter motor relay failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check starter motor relay control circuit for open circuit Check and install new starter motor relay as required Clear the DTC and retest
P0615-72	Starter Relay Circuit - Actuator stuck open	 <p>NOTE: Circuit reference O_S_STRTL & O_S_STRTH</p> <ul style="list-style-type: none"> Starter motor fuse has blown Starter motor relay is stuck open Starter motor relay control circuit failure 	<ul style="list-style-type: none"> Check starter motor fuse Refer to the electrical circuit diagrams and check starter motor relay control circuit for open circuit, short circuit to ground, short circuit to power, high resistance Check and install new starter motor relay as required Clear the DTC and retest
P0615-81	Starter Relay Circuit - Invalid serial data received	<ul style="list-style-type: none"> Engine control module failure 	<ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Refer to the electrical circuit diagrams and check the power and ground connections to the module Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module Clear the DTC and retest Check and install new engine control module as required
P0616-00	Starter Relay Circuit Low - No sub type information	 <p>NOTE: Circuit reference O_S_STRTL & O_S_STRTH</p> <ul style="list-style-type: none"> Starter motor relay failure Starter motor relay circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check starter motor relay circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check and install new starter motor relay as required Clear the DTC and retest
P0616-11	Starter Relay Circuit Low - Circuit short to ground	 <p>NOTE: Circuit reference O_S_STRTL & O_S_STRTH</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Starter motor relay failure Starter motor relay circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check starter motor relay circuit for short circuit to ground Check and install new starter motor relay as required Clear the DTC and retest
P0617-00	Starter Relay Circuit High - No sub type information	 <p>NOTE: Circuit reference O_S_STRTL & O_S_STRTH</p> <ul style="list-style-type: none"> Starter motor relay failure Starter motor relay circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check starter motor relay circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check and install new starter motor relay as required Clear the DTC and retest




P0617-12	Starter Relay Circuit High - Circuit short to battery	 <p>NOTE: Circuit reference O_S_STRTL & O_S_STRTH</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Starter motor relay failure Starter motor relay circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check starter motor relay circuit for short circuit to power Check and install new starter motor relay as required Clear the DTC and retest
P061A-00	Internal Control Module Torque Performance - No sub type information	<ul style="list-style-type: none"> Delivered torque is calculated as being above requested torque within monitoring system. Engine control module software error Engine control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power and ground connections to the module Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module Check and install new engine control module as required
P061B-64	Internal Control Module Torque Calculation Performance - Signal plausibility failure	<ul style="list-style-type: none"> The engine control module detected plausibility failures Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P061C-00	Internal Control Module Engine RPM Performance - No sub type information	<ul style="list-style-type: none"> Desired ignition angle not plausible. Engine control module software error Engine control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power and ground connections to the module Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module Check and install new engine control module as required
P061D-00	Internal Control Module Engine Air Mass Performance - No sub type information	<ul style="list-style-type: none"> Fuel ethanol content correction factor applied by control system is not plausible to monitoring calculation. Engine control module software error Oil evaporation content of fuel mass is calculated erroneously low within control system when compared to rational check within monitoring system. Engine control module software error Engine control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power and ground connections to the module Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module Check and install new engine control module as required
P061D-42	Internal Control Module Engine Air Mass Performance - General memory failure	<ul style="list-style-type: none"> Injector cut off patterns found not plausible. Engine control module software error Engine control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power and ground connections to the module Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module Check and install new engine control module as required
P061D-43	Internal Control Module Engine Air Mass Performance - Special memory failure	<ul style="list-style-type: none"> Desired fuelling control limits implausible. Engine control module software error Engine control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power and ground connections to the module Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module Check and install new engine control module as required

			control module as required
P061D-62	Internal Control Module Engine Air Mass Performance - Signal compare failure	<ul style="list-style-type: none"> The engine control module detected failure when comparing two or more input parameters for plausibility Predicted air mass was found not plausible. Engine control module software error Engine control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power and ground connections to the module Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module Check and install new engine control module as required
P061F-00	Internal Control Module Throttle Actuator Controller Performance - No sub type information	 NOTE: Circuit reference O_T_TVAP0S <ul style="list-style-type: none"> Other throttle related DTCs Blockages/restriction preventing free motion of the throttle blade Throttle actuator failure 	 NOTE: Monitor description. Engine control module monitors the measured throttle position against the requested position and sets the DTC if they deviate excessively <ul style="list-style-type: none"> Check engine control module for related DTCs and refer to relevant DTC index. Rectify these first Inspect throttle for signs of blockage or restriction that prevent free motion of the throttle blade Clear the DTC and retest Check and install new engine control module as required
P0627-07	Fuel Pump A Control Circuit / Open - Mechanical Failures	<ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Harness failure between fuel pump driver module and low pressure fuel pump Low pressure fuel pump control circuit short circuit to ground, short circuit to power, open circuit, high resistance Low pressure fuel pump failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check low pressure fuel pump control circuit for short circuit to ground, short circuit to power, open circuit, high resistance Clear the DTC and retest Check and install new low pressure fuel pump as required
P062A-31	Fuel Pump A Control Circuit Range/Performance - No signal	 NOTE: Circuit reference O_T_FPMC <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel pump driver module signal circuit short circuit to ground, short circuit to power, open circuit, high resistance Fuel pump driver module failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel pump driver module signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance Clear the DTC and retest Check and install new fuel pump driver module as required
P062F-00	Internal Control Module EEPROM Error - No sub type information	<ul style="list-style-type: none"> Engine control module failure 	 NOTE: Monitor description. Engine control module monitors for hardware error of the EEPROM and sets the DTC when at least three blocks cannot be read <ul style="list-style-type: none"> Check and install new engine control module as required
P062F-43	Internal Control Module EEPROM Error - Special memory failure	<ul style="list-style-type: none"> Engine control module failure 	 NOTE: Monitor description. Engine control module monitors for hardware error of the EEPROM and sets the DTC when one block can not be written more than 3 times <ul style="list-style-type: none"> Check and install new engine control module as required
P062F-	Internal Control Module	<ul style="list-style-type: none"> Engine control module failure 	





96	EEPROM Error - Component internal failure		 NOTE: Monitor description. Engine control module monitors for hardware error of the EEPROM and sets the DTC if the sector erase cannot be performed or successfully completed <ul style="list-style-type: none"> • Check and install new engine control module as required
P0633-00	Immobilizer Key Not Programmed - ECM/PCM - No sub type information	<ul style="list-style-type: none"> • Power is lost from the engine control module or the central junction box during the immobilizer learn routine 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the power and ground connections to the engine control module and central junction box • Using the manufacturer approved diagnostic system, carry out the immobilisation procedure • Check for CAN network interference/engine control module related errors • Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module
P0633-42	Immobilizer Key Not Programmed - ECM/PCM - General memory failure	<ul style="list-style-type: none"> • Security key not programmed • Engine control module failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, carry out the immobilisation procedure • Check for CAN network interference/engine control module related errors. Re-configure the engine control module using the manufacturer approved diagnostic system. Re-configure the instrument panel control module using the manufacturer approved diagnostic system • Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module • Check and install new engine control module as required
P0634-00	Control Module Internal Temperature "A" Too High - No sub type information	<ul style="list-style-type: none"> • Engine control module internal temperature too high • Engine control module cooling fan failure • Engine control module failure 	 NOTE: Monitor description. The internal temperature of the engine control module is above the specified limit <ul style="list-style-type: none"> • Check engine control module for related DTCs and refer to relevant DTC index. Rectify these first • Check the engine control module cooling fan is operational • Check and install new engine control module cooling fan as required • Clear the DTC and retest • Check and install new engine control module as required
P0642-00	Sensor Reference Voltage A Circuit Low - No sub type information	<ul style="list-style-type: none"> • Power and ground connections to the engine control module, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Engine control module failure 	 NOTE: Monitor description. Engine control module internal 5 Volt supply below the minimum hardcoded threshold value <ul style="list-style-type: none"> • Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first • Inspect connectors for signs of




			<ul style="list-style-type: none"> water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the power and ground connections to the module Clear the DTC and retest Check and install new engine control module as required
P0643-00	Sensor Reference Voltage A Circuit High - No sub type information	<ul style="list-style-type: none"> Charging system fault - over charging Engine control module failure 	 NOTE: Monitor description. Engine control module internal 5 Volt supply above the upper hardcoded threshold value <ul style="list-style-type: none"> Check the vehicle charging system performance to ensure the voltage regulation is correct Check and install new engine control module as required
P064A-38	Fuel Pump Control Module - Signal frequency incorrect	 NOTE: Circuit reference I_T_FPMD <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel pump driver module diagnostic line circuit open circuit, short circuit to power, short circuit to ground Fuel pump driver module failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel pump driver module diagnostic circuit for open circuit, short circuit to power, short circuit to ground Clear the DTC and retest Check and install new fuel pump driver module as required
P064D-08	Internal Control Module O2 Sensor Processor Performance - Bank 1 - Bus Signal / Message Failures	<ul style="list-style-type: none"> Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P064D-16	Internal Control Module O2 Sensor Processor Performance - Bank 1 - Circuit voltage below threshold	<ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P064D-17	Internal Control Module O2 Sensor Processor Performance - Bank 1 - Circuit voltage above threshold	<ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P064D-86	Internal Control Module O2 Sensor Processor Performance - Bank 1 - Signal invalid	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is not plausible given the operating conditions Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P064E-08	Internal Control Module O2 Sensor Processor Performance - Bank 2 - Bus Signal / Message Failures	<ul style="list-style-type: none"> Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P064E-16	Internal Control Module O2 Sensor Processor Performance - Bank 2 - Circuit voltage below threshold	<ul style="list-style-type: none"> The engine control module measured a voltage below a specified range but not necessarily a short circuit to ground Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P064E-17	Internal Control Module O2 Sensor Processor Performance - Bank 2 - Circuit voltage above threshold	<ul style="list-style-type: none"> The engine control module measured a voltage above a specified range but not necessarily a short circuit to power Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required



P064E-86	Internal Control Module O2 Sensor Processor Performance - Bank 2 - Signal invalid	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is not plausible given the operating conditions Engine control module failure 	<ul style="list-style-type: none"> Check and install new engine control module as required
P0652-00	Sensor Reference Voltage B Circuit Low - No sub type information	<ul style="list-style-type: none"> Power and ground connections to the engine control module, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Engine control module failure 	 NOTE: Monitor description. Engine control module internal 5 Volt supply below the minimum hardcoded threshold value <ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the power and ground connections to the module Clear the DTC and retest Check and install new engine control module as required
P0653-00	Sensor Reference Voltage B Circuit High - No sub type information	<ul style="list-style-type: none"> Charging system fault - over charging Engine control module failure 	 NOTE: Monitor description. Engine control module internal 5 Volt supply above the upper hardcoded threshold value <ul style="list-style-type: none"> Check the vehicle charging system performance to ensure the voltage regulation is correct Check and install new engine control module as required
P0657-13	Actuator Supply Voltage A Circuit Open - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector pin is backed out, connector pin corrosion Harness failure - Wiring integrity Sound symposer failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Clear the DTC and retest Check and install new sound symposer as required
P0658-11	Actuator Supply Voltage A Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Harness failure - Wiring integrity Sound symposer failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Clear the DTC and retest Check and install new sound symposer as required
P0659-12	Actuator Supply Voltage A Circuit High - Circuit short to battery	<ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Connector is disconnected, connector pin is backed out, connector pin corrosion Harness failure - Wiring integrity Sound symposer failure 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Clear the DTC and retest Check and install new sound symposer as required



P0666-00	Control Module Internal Temperature Sensor "A" Circuit - No sub type information	<ul style="list-style-type: none"> Engine control module internal communication error Engine control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power and ground connections to the module Clear the DTC and retest Check and install new engine control module as required
P0667-85	Control Module Internal Temperature Sensor "A" Range/Performance - Signal above allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Engine control module internal temperature sensor greater than specified limit Engine control module failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power and ground connections to the module Clear the DTC and retest Check and install new engine control module as required
P0686-11	ECM/PCM Power Relay Control Circuit Low - Circuit short to ground	 NOTE: Circuit reference O_S_MRLY <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Engine control module power relay circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check engine control module power relay circuit for short circuit to ground Clear the DTC and retest
P0687-24	ECM/PCM Power Relay Control Circuit High - Signal stuck high	 NOTE: Circuit reference G_G_BAT1 / G_G_BAT2 / G_G_BAT3 <ul style="list-style-type: none"> The engine control module measures a signal that remains high when transitions are expected Engine control module power relay circuit short circuit to power, short circuit to another circuit 	<ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Refer to the electrical circuit diagrams and check engine control module power relay circuit for short circuit to power, short circuit to another circuit
P0688-00	ECM/PCM Power Relay Sense Circuit - No sub type information	<ul style="list-style-type: none"> Engine control module supply voltage greater than 16 volts Charging system fault - over charging Use of battery charger with boost setting producing greater than 16 volts Use of 24 volt charging or jump starting system 	<ul style="list-style-type: none"> Check the vehicle charging system performance to ensure the voltage regulation is correct Check battery is in fully charged and in a serviceable condition using a battery tester and battery care manual
P068A-00	ECM/PCM Power Relay De-Energized - Too Early - No sub type information	 NOTE: Circuit reference V_V_BAT_1R & V_V_BAT_2R & V_V_BAT_3R <ul style="list-style-type: none"> Engine control module main power relay de-energised before normal shutdown processes Power and ground connections to the engine control module, open circuit, high resistance Battery disconnection or relay control circuit intermittent harness failure Engine control module power relay failure 	<ul style="list-style-type: none"> This DTC is set when the engine management system high current relay contacts open early - Indicating a power hold failure. Check the vehicle battery has not been disconnected before the engine management system relay has powered down. Check the operation of the engine management system high current relay. Refer to the electrical circuit diagrams and check the engine management system high current relay supply and control circuits for open circuits, high resistance, short circuit to ground, short circuit to power, short circuit to other circuits. Repair harness as required Clear the DTC and retest Check and install new relay as required




P0691-11	Fan 1 Control Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Engine cooling fan circuit short circuit to ground Connector is disconnected, connector pin is backed out, connector pin corrosion Engine cooling fan failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check engine cooling fan circuit for short circuit to ground Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check and install new engine cooling fan as required Clear the DTC and retest
P0692-12	Fan 1 Control Circuit High - Circuit short to battery	<ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Engine cooling fan circuit short circuit to power Connector is disconnected, connector pin is backed out, connector pin corrosion Engine cooling fan failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check engine cooling fan circuit for short circuit to power Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check and install new engine cooling fan as required Clear the DTC and retest
P06A6-00	Sensor Reference Voltage A Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Engine control module sensor 5 volt supply circuit short circuit to ground, short circuit to power, open circuit Connector is disconnected, connector pin is backed out, connector pin corrosion 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the engine control module sensor 5 volt supply circuit for short circuit to ground, short circuit to power, open circuit Inspect connectors for signs of water ingress, and pins for damage and/or corrosion
P06A7-00	Sensor Reference Voltage B Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Engine control module sensor 5 volt supply circuit short circuit to ground, short circuit to power, open circuit Connector is disconnected, connector pin is backed out, connector pin corrosion 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the engine control module sensor 5 volt supply circuit for short circuit to ground, short circuit to power, open circuit Inspect connectors for signs of water ingress, and pins for damage and/or corrosion
P06A8-00	Sensor Reference Voltage C Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Engine control module sensor 5 volt supply circuit short circuit to ground, short circuit to power, open circuit Connector is disconnected, connector pin is backed out, connector pin corrosion 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the engine control module sensor 5 volt supply circuit for short circuit to ground, short circuit to power, open circuit Inspect connectors for signs of water ingress, and pins for damage and/or corrosion
P0700-00	Transmission Control System (MIL Request) - No sub type information	<ul style="list-style-type: none"> MIL request by automatic gearbox HS CAN network, short circuit to power, short circuit to ground, open circuit 	<ul style="list-style-type: none"> Check transmission control module for DTCs and refer to the relevant DTC index Clear the DTC and retest If this DTC is logged with other HS CAN related DTCs refer to the electrical circuit diagrams and check HS CAN network for short circuit to power, short circuit to ground, open circuit
P0703-62	Brake Switch B Circuit - Signal compare failure	<ul style="list-style-type: none"> The engine control module detected failure when comparing two or more input parameters for plausibility The brake pedal switch signal received over CAN is defective Brake pedal switch detached from pedal box whilst electrically connected Brake pedal switch adjustment 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system carry out network integrity test Check for related DTCs and refer to the relevant DTC index Inspect brake switch connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit




		<p>incorrect</p> <ul style="list-style-type: none"> • Brake pedal switch harness failure • Brake pedal switch failure 	<p>diagrams and check the brake pedal switch circuits for open circuit, short circuit to ground, short circuit to power</p> <ul style="list-style-type: none"> • Check and install new brake pedal switch as required
P0817-13	Starter Disable Circuit / Open - Circuit open	 <p>NOTE: Circuit reference O_S_STRPL & O_S_STRPH</p> <ul style="list-style-type: none"> • The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Starter motor pinion relay failure • Starter motor pinion relay circuit short circuit open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check starter motor pinion relay circuit for open circuit, high resistance • Check and install new starter motor pinion relay as required • Clear the DTC and retest
P081A-11	Starter Disable Circuit Low - Circuit short to ground	 <p>NOTE: Circuit reference O_S_STRPL & O_S_STRPH</p> <ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Starter motor pinion relay failure • Starter motor pinion relay circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check starter motor pinion relay circuit for short circuit to ground • Check and install new starter motor pinion relay as required • Clear the DTC and retest
P081A-12	Starter Disable Circuit Low - Circuit short to battery	 <p>NOTE: Circuit reference O_S_STRPL & O_S_STRPH</p> <ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Starter motor pinion relay failure • Starter motor pinion relay circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check starter motor pinion relay circuit for short circuit to power • Check and install new starter motor pinion relay as required • Clear the DTC and retest
P081A-4B	Starter Disable Circuit Low - Over temperature	<ul style="list-style-type: none"> • The engine control module detected an internal temperature above the expected range • Starter motor pinion relay failure • Starter motor pinion relay circuit short circuit to ground, short circuit to power, open circuit, high resistance • Engine control module failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check starter motor pinion relay circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check and install new starter motor pinion relay as required • Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module • Check and install new engine control module as required • Clear the DTC and retest
P081B-11	Starter Disable Circuit High - Circuit short to ground	 <p>NOTE: Circuit reference O_S_STRPL & O_S_STRPH</p> <ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check starter motor pinion relay circuit for short circuit to ground • Check and install new starter motor pinion relay as required • Clear the DTC and retest






		<p>detected a ground measurement when another value was expected</p> <ul style="list-style-type: none"> • Starter motor pinion relay failure • Starter motor pinion relay circuit short circuit to ground 	
P081B-12	Starter Disable Circuit High - Circuit short to battery	 <p>NOTE: Circuit reference O_S_STRPL & O_S_STRPH</p> <ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Starter motor pinion relay failure • Starter motor pinion relay circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check starter motor pinion relay circuit for short circuit to power • Check and install new starter motor pinion relay as required • Clear the DTC and retest
P081B-4B	Starter Disable Circuit High - Over temperature	<ul style="list-style-type: none"> • The engine control module detected an internal temperature above the expected range • Starter motor pinion relay failure • Starter motor pinion relay circuit short circuit to ground, short circuit to power, open circuit, high resistance • Engine control module failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check starter motor pinion relay circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check and install new starter motor pinion relay as required • Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module • Check and install new engine control module as required • Clear the DTC and retest
P0850-00	Park / Neutral Switch Input Circuit - No sub type information	 <p>NOTE: Circuit reference I_S_TNSW</p> <ul style="list-style-type: none"> • Hardwired park/neutral switch does not match the information within the CAN signal • Park/neutral switch circuit, short circuit to power, short circuit to ground, open circuit • HS CAN network failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the park/neutral switch circuit, for short circuit to power, short circuit to ground, open circuit • If this DTC is logged with other HS CAN related DTCs refer to the electrical circuit diagrams and check HS CAN network for short circuit to power, short circuit to ground, open circuit
POA0F-07	Engine Failed to Start - Mechanical failures	 <p>NOTE: Circuit reference O_S_STRPH</p> <ul style="list-style-type: none"> • Car configuration file incorrect for stop/start system • Harness failure - Wiring integrity starter motor circuit • Tandem solenoid starter motor failure • Tandem solenoid starter motor pinion not operating • Harness failure - Wiring integrity camshaft sensor circuit • Harness failure - Wiring integrity crankshaft sensor circuit 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check and up-date the car configuration file as required • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check connections are secure and wiring integrity • Clear the DTC and retest
POA1A-00	Generator Control Module - No sub type information	<ul style="list-style-type: none"> • Generator to engine control module LIN circuit, open circuit • Generator/engine control module failure 	<ul style="list-style-type: none"> • Check for good/clean contact at generator and engine control module LIN circuit connectors/pins. Refer to the electrical circuit diagrams and check generator to engine control module LIN circuit for open circuit. Check for engine control module hardware DTCs







			<p>and refer to relevant DTC index. Clear DTCs and repeat automated diagnostic procedure using the manufacturer approved diagnostic system</p> <ul style="list-style-type: none"> • Check and install new generator / engine control module as required
P115D-00	Mass Air Flow Circuit Offset - No sub type information	<ul style="list-style-type: none"> • Blocked air filter • Other related DTCs • Air induction system, incorrectly installed components, loose hose clips or air leakage • Mass air flow sensor contamination by oil or debris • Electric throttle blade contamination by oil or debris • Mass air flow sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Throttle adaption failure 	 <p>NOTE: Monitor description. Mass air flow sensor signal failure</p> <ul style="list-style-type: none"> • Check air filter is serviceable • Using the manufacturer approved diagnostic system check the engine control module for related DTCs and refer to the relevant DTC index • Refer to the relevant sections of the workshop manual and check the induction system for correctly installed components, loose hose clips or air leakage • Check mass air flow sensor for contamination by oil or debris clean as required • Check electric throttle blade for contamination by oil or debris clean as required • Refer to the electrical circuit diagrams and check mass air flow sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system carry out throttle adaption routine • Clear the DTC and retest
P115D-21	Mass Air Flow Circuit Offset - Signal amplitude < minimum	<ul style="list-style-type: none"> • The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low • Blocked air filter • Other related DTCs • Air induction system, incorrectly installed components, loose hose clips or air leakage • Mass air flow sensor contamination by oil or debris • Electric throttle blade contamination by oil or debris • Mass air flow sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Throttle adaption failure 	 <p>NOTE: Monitor description. Mass air flow sensors left/right flow to low</p> <ul style="list-style-type: none"> • Check air filter is serviceable • Using the manufacturer approved diagnostic system check the engine control module for related DTCs and refer to the relevant DTC index • Refer to the relevant sections of the workshop manual and check the induction system for correctly installed components, loose hose clips or air leakage • Check mass air flow sensor for contamination by oil or debris clean as required • Check electric throttle blade for contamination by oil or debris clean as required • Refer to the electrical circuit diagrams and check mass air flow sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Using the manufacturer approved diagnostic system carry out throttle adaption

			<p>routine</p> <ul style="list-style-type: none"> Clear the DTC and retest
P115D-22	Mass Air Flow Circuit Offset - Signal amplitude > maximum	<ul style="list-style-type: none"> The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high Blocked air filter Other related DTCs Air induction system, incorrectly installed components, loose hose clips or air leakage Mass air flow sensor contamination by oil or debris Electric throttle blade contamination by oil or debris Mass air flow sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Throttle adaption failure 	<p> NOTE: Monitor description. Mass air flow sensors left/right flow to high</p> <ul style="list-style-type: none"> Check air filter is serviceable Using the manufacturer approved diagnostic system check the engine control module for related DTCs and refer to the relevant DTC index Refer to the relevant sections of the workshop manual and check the induction system for correctly installed components, loose hose clips or air leakage Check mass air flow sensor for contamination by oil or debris clean as required Check electric throttle blade for contamination by oil or debris clean as required Refer to the electrical circuit diagrams and check mass air flow sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Using the manufacturer approved diagnostic system carry out throttle adaption routine Clear the DTC and retest
P115D-64	Mass Air Flow Circuit Offset - Signal plausibility failure	<ul style="list-style-type: none"> The engine control module detected plausibility failures Blocked air filter Other related DTCs Air induction system, incorrectly installed components, loose hose clips or air leakage Mass air flow sensor contamination by oil or debris Electric throttle blade contamination by oil or debris Mass air flow sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Throttle adaption failure 	<p> NOTE: Monitor description. Mass air flow sensor plausibility failure</p> <ul style="list-style-type: none"> Check air filter is serviceable Using the manufacturer approved diagnostic system check the engine control module for related DTCs and refer to the relevant DTC index Refer to the relevant sections of the workshop manual and check the induction system for correctly installed components, loose hose clips or air leakage Check mass air flow sensor for contamination by oil or debris clean as required Check electric throttle blade for contamination by oil or debris clean as required Refer to the electrical circuit diagrams and check mass air flow sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Using the manufacturer approved diagnostic system carry out throttle adaption routine Clear the DTC and retest
P1315-00	Persistent Misfire - No sub type information	<ul style="list-style-type: none"> Other related DTCs Fuel level, poor fuel quality/incorrect grade, fuel contaminated 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check the engine control module for related DTCs and refer to the




		<ul style="list-style-type: none"> Spark plugs damaged/worn Incorrect position or damaged crank shaft position sensor. Reluctor ring/toothed wheel damaged Excessive engine wear Catalyst blocked/restriction in exhaust system Driveline imbalance 	<p>relevant DTC index. Rectify these first</p> <ul style="list-style-type: none"> Check the fuel level, add fuel if required Check for poor quality or contaminated fuel Check spark plugs for poor condition and replace as necessary Check for damaged or incorrectly positioned crank shaft position sensor, reluctor ring/toothed wheel Check for poor cylinder compression, incorrect valve clearance and excessive engine wear Check for driveline imbalances, front end ancillary drives and transmission mounts
P131A-00	Low Fuel Level Detection - No sub type information	<ul style="list-style-type: none"> Other fuel related DTCs are set Low level fuel condition 	 <p>NOTE: Monitor description. The engine control module sets the DTC when other DTCs are set and when the fuel level is low</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check for related DTCs and refer to the relevant DTC index Check the fuel level, add fuel if required Clear the DTC and retest
P132B-36	Turbocharger/Supercharger Boost Control A Performance - Signal frequency too low	 <p>NOTE: Circuit reference O_T_CBPPPOS</p> <ul style="list-style-type: none"> Restriction of bypass blade due to debris, fouling or incorrect assembly Bypass blade actuator failure Bypass blade failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check for related DTCs and refer to the relevant DTC index Check for unrestricted movement of the bypass blade Check for correct assembly of bypass blade and end stop mechanism Check and install new bypass blade actuator as required Check and install new bypass blade as required
P132B-77	Turbocharger/Supercharger Boost Control A Performance - Commanded position not reachable	<ul style="list-style-type: none"> Restriction of bypass blade due to debris, fouling or incorrect assembly Bypass blade actuator failure Bypass blade failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check for related DTCs and refer to the relevant DTC index Check for unrestricted movement of the bypass blade Check for correct assembly of bypass blade and end stop mechanism Check and install new bypass blade actuator as required Check and install new bypass blade as required
P1500-31	Vehicle Speed Sensor -No signal	<ul style="list-style-type: none"> Signal error for vehicle speed over CAN 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check anti-lock brake system control module for DTCs and refer to the relevant DTC index
P1592-42	Vehicle Data Recorder Data Available - General memory failure	<ul style="list-style-type: none"> Battery disconnected during flight recorder data write sequence Power and ground connections to the engine control module, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Engine control module failure 	 <p>NOTE: Monitor description. Engine control module fails to write flight recorder data to internal memory</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the power and ground connections to the





			<ul style="list-style-type: none"> module Clear the DTC and retest Check and install new engine control module as required
P1592-81	Vehicle Data Recorder Data Available - Invalid serial data received	<ul style="list-style-type: none"> Battery disconnected during flight recorder data write sequence Power and ground connections to the engine control module, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Engine control module failure 	 NOTE: Monitor description. Engine control module fails to write flight recorder data to internal memory <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the power and ground connections to the module Clear the DTC and retest Check and install new engine control module as required
P162F-00	Starter Motor Disabled - Engine Crank Time Too Long - No sub type information	<ul style="list-style-type: none"> Vehicle battery failure Other starting related failures 	<ul style="list-style-type: none"> Refer to the workshop manual and the battery care manual, inspect the vehicle battery and ensure it is fully charged and serviceable before performing further tests Using the manufacturer approved diagnostic system, check the engine control module, for related DTCs and refer to the relevant DTC index
P1655-04	Starter Disable Circuit - System Internal Failures	<ul style="list-style-type: none"> Engine control module failure 	<ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module Clear the DTC and retest Check and install new engine control module as required
P1655-49	Starter Disable Circuit - Internal electronic failure	<ul style="list-style-type: none"> Engine control module failure 	<ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Using the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control module Clear the DTC and retest Check and install new engine control module as required
P167F-00	Non-OEM Calibration Detected - No sub type information	<ul style="list-style-type: none"> Non-OEM calibration has been flashed into the engine control module 	<ul style="list-style-type: none"> No dealer action required - DTC sets when an unauthorised calibration has been flashed into the engine control module
P168F-00	Cold Start Injection System Performance - No sub type information	<ul style="list-style-type: none"> Other related DTCs Fuel injector failure Engine control module failure 	NOTES:  Monitor description. Split injection during cold start emissions reduction not achieved  Operational requirements needed to allow the monitor to be fully tested. Allow an overnight soak and carry out a cold start, let vehicle idle until catalyst heating has finished (idle speed drops to below 1000rpm) <ul style="list-style-type: none"> Check engine control module for





			<p>additional DTCs and refer to relevant DTC index. Rectify these first</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel injector connections are secure and wiring integrity Clear the DTC and retest Allow an overnight soak and carry out a cold start. Check engine control module for this DTC Check and install new engine control module as required if the DTC has reset post the cold start
P2065-29	Fuel Level Sensor B Circuit - Signal invalid	<ul style="list-style-type: none"> The value of the signal measured by the engine control module is not plausible given the operating conditions Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel level sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance Fuel level sensor failure 	 NOTE: Monitor description. Open circuit detected by the instrument cluster of the passive fuel level sensor. The instrument cluster will transmit the failure over CAN to the engine control module. The engine control module sets the DTC <ul style="list-style-type: none"> Check connector is not disconnected, connector pin is not backed out Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel level sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Clear the DTC and retest Check and install new fuel level sensor as required
P2088-00	A Camshaft Position Actuator Control Circuit Low Bank 1 - No sub type information	 NOTE: Circuit reference O_T_CASICA <ul style="list-style-type: none"> Variable camshaft timing solenoid circuit short circuit to ground Variable camshaft timing solenoid failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground Clear the DTC and retest Check and install new variable camshaft timing solenoid as required
P2089-00	A Camshaft Position Actuator Control Circuit High Bank 1 - No sub type information	 NOTE: Circuit reference O_T_CASICA <ul style="list-style-type: none"> Variable camshaft timing solenoid circuit short circuit to power Variable camshaft timing solenoid failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to power Clear the DTC and retest Check and install new variable camshaft timing solenoid as required
P2090-00	B Camshaft Position Actuator Control Circuit Low Bank 1 - No sub type information	 NOTE: Circuit reference O_T_CASECA <ul style="list-style-type: none"> Variable camshaft timing solenoid circuit short circuit to ground Variable camshaft timing solenoid failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground Clear the DTC and retest Check and install new variable camshaft timing solenoid as required
P2091-85	B Camshaft Position Actuator Control Circuit High Bank 1 - Signal above allowable range	 NOTE: Circuit reference O_T_CASECA <ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to power Clear the DTC and retest Check and install new variable camshaft timing solenoid as required


		<p>Variable camshaft timing solenoid circuit short circuit to power</p> <ul style="list-style-type: none"> Variable camshaft timing solenoid failure 	
P2092-00	A Camshaft Position Actuator Control Circuit Low Bank 2 - No sub type information	 <p>NOTE: Circuit reference O_T_CASICB</p> <ul style="list-style-type: none"> Variable camshaft timing solenoid circuit short circuit to ground Variable camshaft timing solenoid failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground Clear the DTC and retest Check and install new variable camshaft timing solenoid as required
P2093-00	A Camshaft Position Actuator Control Circuit High Bank 2 - No sub type information	 <p>NOTE: Circuit reference O_T_CASICB</p> <ul style="list-style-type: none"> Variable camshaft timing solenoid circuit short circuit to power Variable camshaft timing solenoid failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to power Clear the DTC and retest Check and install new variable camshaft timing solenoid as required
P2094-00	B Camshaft Position Actuator Control Circuit Low Bank 2 - No sub type information	 <p>NOTE: Circuit reference O_T_CASECB</p> <ul style="list-style-type: none"> Variable camshaft timing solenoid circuit short circuit to ground Variable camshaft timing solenoid failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to ground Clear the DTC and retest Check and install new variable camshaft timing solenoid as required
P2095-85	B Camshaft Position Actuator Control Circuit High Bank 2 - Signal above allowable range	 <p>NOTE: Circuit reference O_T_CASECB</p> <ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Variable camshaft timing solenoid circuit short circuit to power Variable camshaft timing solenoid failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check variable camshaft timing solenoid circuit for short circuit to power Clear the DTC and retest Check and install new variable camshaft timing solenoid as required
P2100-00	Throttle Actuator A Control Motor Circuit /Open - No sub type information	 <p>NOTE: Circuit reference O_T_TVAPOS & O_T_TVANEG</p> <ul style="list-style-type: none"> Electric throttle actuator control circuit open circuit Electric throttle actuator failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check electric throttle actuator power and ground circuits for open circuit Refer to the electrical circuit diagrams and check for open circuit across electric throttle power and ground connections with harness disconnected Clear the DTC and retest Check and install new electric throttle actuator as required
P2101-00	Throttle Actuator A Control Motor Circuit Range/Performance - No sub type information	 <p>NOTE: Circuit reference O_T_TVAPOS & O_T_TVANEG</p> <ul style="list-style-type: none"> Electric throttle actuator control power and ground circuits short circuit to each other Electric throttle actuator failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check electric throttle actuator power and ground circuits for short circuit to each other Refer to the electrical circuit diagrams and check for short circuit across electric throttle power and ground connections with harness disconnected Clear the DTC and retest Check and install new electric throttle actuator as required
P2103-85	Throttle Actuator A Control Motor Circuit High - Signal	<ul style="list-style-type: none"> The engine control module has determined failures where some 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check electric


	above allowable range	<p>circuit quantity, reported via serial data, is above a specified range</p> <ul style="list-style-type: none"> • Electric throttle control circuits short circuit to power, short circuit to ground • Electric throttle actuator control power and ground circuits short circuit to each another • Electric throttle actuator failure 	<p>throttle actuator circuits for short circuit to power, short circuit to ground</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check electric throttle actuator power and ground circuits for short circuit to each other • Refer to the electrical circuit diagrams and check for short circuit across electric throttle power and ground connections with harness disconnected • Clear the DTC and retest • Check and install new electric throttle actuator as required
P2108-00	Throttle Actuator, A, Control Module Performance - No sub type information	<ul style="list-style-type: none"> • Electric throttle control circuits short circuit to power, short circuit to ground • Electric throttle actuator control power and ground circuits short circuit to each another • Electric throttle actuator failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check electric throttle actuator circuits for short circuit to power, short circuit to ground • Refer to the electrical circuit diagrams and check electric throttle actuator power and ground circuits for short circuit to each other • Refer to the electrical circuit diagrams and check for short circuit across electric throttle power and ground connections with harness disconnected • Clear the DTC and retest • Check and install new electric throttle actuator as required
P2111-00	Throttle Actuator "A" Control System - Stuck Open - No sub type information	<ul style="list-style-type: none"> • Electric throttle blocked or restricted • Electric throttle control circuits short circuit to power, short circuit to ground • Electric throttle actuator control power and ground circuits short circuit to each another • Electric throttle actuator failure 	<ul style="list-style-type: none"> • Check electric throttle for blockages or obstruction that prevent correct movement • Refer to the electrical circuit diagrams and check electric throttle actuator circuits for short circuit to power, short circuit to ground • Refer to the electrical circuit diagrams and check electric throttle actuator power and ground circuits for short circuit to each other • Refer to the electrical circuit diagrams and check for short circuit across electric throttle power and ground connections with harness disconnected • Clear the DTC and retest • Check and install new electric throttle actuator as required
P2112-85	Throttle Actuator "A" Control System - Stuck Closed - Signal above allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Electric throttle blocked or restricted • Electric throttle control circuits short circuit to power, short circuit to ground • Electric throttle actuator control power and ground circuits short circuit to each another • Electric throttle actuator failure 	<ul style="list-style-type: none"> • Check electric throttle for blockages or obstruction that prevent correct movement • Refer to the electrical circuit diagrams and check electric throttle actuator circuits for short circuit to power, short circuit to ground • Refer to the electrical circuit diagrams and check electric throttle actuator power and ground circuits for short circuit to each other • Refer to the electrical circuit diagrams and check for short circuit across electric throttle power and ground connections with harness disconnected • Clear the DTC and retest • Check and install new electric throttle actuator as required





P2119-00	Throttle Actuator "A" Control Throttle Body Range/Performance - No sub type information	<ul style="list-style-type: none"> • Other related DTCs • Electric throttle return spring failure • Electric throttle blocked or restricted • Electric throttle actuator failure 	<ul style="list-style-type: none"> • Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first • Check electric throttle return spring for correct operation • Check electric throttle for blockages or obstruction that prevent correct movement • Clear the DTC and retest • Check and install new electric throttle actuator as required
P2119-92	Throttle Actuator "A" Control Throttle Body Range/Performance - Performance or incorrect operation	<ul style="list-style-type: none"> • The engine control module has detected that the component performance is outside its expected range or operating in an incorrect way • Other related DTCs • Electric throttle blocked or restricted • Electric throttle actuator failure 	<ul style="list-style-type: none"> • Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first • Check electric throttle for blockages or obstruction that prevent correct movement • Clear the DTC and retest • Check and install new electric throttle actuator as required
P2119-97	Throttle Actuator "A" Control Throttle Body Range/Performance - Component or system operation obstructed or blocked	<ul style="list-style-type: none"> • Other related DTCs • Electric throttle blocked or restricted • Electric throttle actuator failure 	<ul style="list-style-type: none"> • Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first • Check electric throttle for blockages or obstruction that prevent correct movement • Clear the DTC and retest • Check and install new electric throttle actuator as required
P2122-00	Throttle/Pedal Position Sensor/Switch D Circuit Low - No sub type information	 <p>NOTE: Circuit reference I_A_APP1</p> <ul style="list-style-type: none"> • Harness failure - Accelerator pedal position sensor circuit • Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects the pedal demand 1 signal range is low. Refer to the electrical circuit diagrams and check the reference voltage and ground connections to the accelerator pedal position sensor. Check signal circuits for high resistance, open circuit, short circuit to power, short circuit to ground. Repair harness as required. Clear the DTC and retest • Check and install new accelerator pedal position sensor as required
P2123-00	Throttle/Pedal Position Sensor/Switch D Circuit High - No sub type information	 <p>NOTE: Circuit reference I_A_APP1</p> <ul style="list-style-type: none"> • Harness failure - Accelerator pedal position sensor circuit • Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects the pedal demand 1 signal range is high. Refer to the electrical circuit diagrams and check the reference voltage and ground connections to the accelerator pedal position sensor. Check signal circuits for high resistance, open circuit, short circuit to power, short circuit to ground. Repair harness as required. Clear the DTC and retest • Check and install new accelerator pedal position sensor as required
P2127-00	Throttle/Pedal Position Sensor/Switch E Circuit Low - No sub type information	 <p>NOTE: Circuit reference I_A_APP2</p> <ul style="list-style-type: none"> • Harness failure - Accelerator pedal position sensor circuit • Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects the pedal demand 2 signal range is low. Refer to the electrical circuit diagrams and check the reference voltage and ground connections to the accelerator pedal position sensor. Check signal circuits for high

			<p>resistance, open circuits, short circuit to power, short circuit to ground. Repair harness as required. Clear the DTC and retest</p> <ul style="list-style-type: none"> • Check and install new accelerator pedal position sensor as required
P2128-00	Throttle/Pedal Position Sensor/Switch E Circuit High - No sub type information	 <p>NOTE: Circuit reference I_A_APP2</p> <ul style="list-style-type: none"> • Harness failure - Accelerator pedal position sensor circuit • Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects the pedal demand 2 signal range is high. Refer to the electrical circuit diagrams and check the reference voltage and ground connections to the accelerator pedal position sensor. Check signal circuits for high resistance, open circuits, short circuit to power, short circuit to ground. Repair harness as required. Clear the DTC and retest • Check and install new accelerator pedal position sensor as required
P2135-00	Throttle/Pedal Position Sensor/Switch A / B Voltage Correlation - No sub type information	 <p>NOTE: Circuit reference O_V_5VTVA</p> <ul style="list-style-type: none"> • Harness failure - Electric throttle position sensor circuit • Electric throttle position sensor failure 	<ul style="list-style-type: none"> • Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first • Check and install new electric throttle as required
P2138-00	Throttle/Pedal Position Sensor/Switch D / E Voltage Correlation - No sub type information	 <p>NOTE: Circuit reference I_A_APP2 & I_A_APP1</p> <ul style="list-style-type: none"> • Harness failure - Accelerator pedal position sensor circuit • Accelerator pedal position sensor failure 	<ul style="list-style-type: none"> • This DTC is set when the engine control module detects an excessive difference between the pedal demand signal 1 and signal 2. Refer to the electrical circuit diagrams and check the reference voltage and ground connections to the accelerator pedal position sensors. Check signal circuits for high resistance, open circuit, short circuit to power, short circuit to ground. Repair harness as required. Clear the DTC and retest • Check and install new accelerator pedal position sensor as required
P2146-04	Fuel Injector Group A Supply Voltage Circuit / Open - System Internal Failures	<ul style="list-style-type: none"> • Engine control module failure 	 <p>NOTE: Monitor description. To diagnose an internal serial peripheral interface communication failure between the main central processing unit and the injector control module</p> <ul style="list-style-type: none"> • Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first • Clear the DTC and retest • Check and install new engine control module as required
P2146-13	Fuel Injector Group A Supply Voltage Circuit Open - Circuit open	<ul style="list-style-type: none"> • The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output • Connector is disconnected, connector terminal is backed out, connector terminal corrosion 	<ul style="list-style-type: none"> • Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check the power and ground connections to the



		<ul style="list-style-type: none"> Power and ground connections to the engine control module open circuit Engine control module failure 	<ul style="list-style-type: none"> module Clear the DTC and retest Check and install new engine control module as required
P2147-04	Fuel Injector Group A Supply Voltage Circuit Low - System Internal Failures	<ul style="list-style-type: none"> Engine control module failure 	 <p>NOTE: Monitor description. To diagnose an internal serial peripheral interface communication failure between the main central processing unit and the injector control module</p> <ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Clear the DTC and retest Check and install new engine control module as required
P2149-04	Fuel Injector Group B Supply Voltage Circuit / Open - System Internal Failures	<ul style="list-style-type: none"> Engine control module failure 	 <p>NOTE: Monitor description. To diagnose an internal serial peripheral interface communication failure between the main central processing unit and the injector control module</p> <ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Clear the DTC and retest Check and install new engine control module as required
P2149-13	Fuel Injector Group B Supply Voltage Circuit Open - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector terminal is backed out, connector terminal corrosion Power and ground connections to the engine control module open circuit Engine control module failure 	<ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the power and ground connections to the module Clear the DTC and retest Check and install new engine control module as required
P2150-04	Fuel Injector Group B Supply Voltage Circuit Low - System Internal Failures	<ul style="list-style-type: none"> Engine control module failure 	 <p>NOTE: Monitor description. To diagnose an internal serial peripheral interface communication failure between the main central processing unit and the injector control module</p> <ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Clear the DTC and retest Check and install new engine control module as required
P2152-04	Fuel Injector Group C Supply Voltage Circuit / Open - System Internal Failures	<ul style="list-style-type: none"> Engine control module failure 	 <p>NOTE: Monitor description. To diagnose an internal serial peripheral interface communication failure between the main central processing unit and the injector control module</p> <ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Clear the DTC and retest Check and install new engine control module as required




P2152-13	Fuel Injector Group C Supply Voltage Circuit Open - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector terminal is backed out, connector terminal corrosion Power and ground connections to the engine control module open circuit Engine control module failure 	<ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the power and ground connections to the module Clear the DTC and retest Check and install new engine control module as required
P2155-04	Fuel Injector Group D Supply Voltage Circuit / Open - System Internal Failures	<ul style="list-style-type: none"> Engine control module failure 	 NOTE: Monitor description. To diagnose an internal serial peripheral interface communication failure between the main central processing unit and the injector control module <ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Clear the DTC and retest Check and install new engine control module as required
P2155-13	Fuel Injector Group D Supply Voltage Circuit Open - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Connector is disconnected, connector terminal is backed out, connector terminal corrosion Power and ground connections to the engine control module open circuit Engine control module failure 	<ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the power and ground connections to the module Clear the DTC and retest Check and install new engine control module as required
P2169-13	Exhaust Pressure Regulator Vent Solenoid Control Circuit / Open - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Active exhaust solenoid valve circuit open circuit Active exhaust solenoid failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check active exhaust solenoid valve circuit for open circuit Check and install new active exhaust solenoid as required
P2170-11	Exhaust Pressure Regulator Vent Solenoid Control Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Active exhaust solenoid valve circuit short circuit to ground Active exhaust solenoid failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check active exhaust solenoid valve circuit for short circuit to ground Check and install new active exhaust solenoid as required
P2170-4B	Exhaust Pressure Regulator Vent Solenoid Control Circuit Low - Over temperature	<ul style="list-style-type: none"> The engine control module detected an internal temperature above the expected range Active exhaust solenoid valve circuit short circuit to power, short circuit to ground Active exhaust solenoid failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check active exhaust solenoid valve circuit for open circuit Check and install new active exhaust solenoid as required
P2171-12	Exhaust Pressure Regulator Vent Solenoid Control Circuit high - Circuit short to battery	<ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check active exhaust solenoid valve circuit for short circuit to power Check and install new active




		<p>measurement when another value was expected</p> <ul style="list-style-type: none"> Active exhaust solenoid valve circuit short circuit to power Active exhaust solenoid failure 	<p>exhaust solenoid as required</p>
P2176-00	Throttle Actuator "A" Control System - Idle Position Not Learned - No sub type information	<ul style="list-style-type: none"> Electric throttle actuator adaption routine not completed Replacement throttle fitted but adaption routine not completed 	<ul style="list-style-type: none"> Allow engine control module to power down. Turn on ignition and wait for 60 seconds. Start engine, this will allow new throttle adaption data to be stored Clear the DTC and retest
P2176-51	Throttle Actuator "A" Control System - Idle Position Not Learned - Not programmed	<ul style="list-style-type: none"> Voltage too low to perform electric throttle actuator adaption routine Electric throttle actuator adaption routine not completed 	<ul style="list-style-type: none"> Check battery is in fully charged and in a serviceable condition using a battery tester and battery care manual Allow engine control module to power down. Turn on ignition and wait for 60 seconds. Start engine, this will allow new throttle adaption data to be stored Clear the DTC and retest
P2176-52	Throttle Actuator "A" Control System - Idle Position Not Learned - Not activated	<ul style="list-style-type: none"> Electric throttle actuator adaption routine entry conditions are not met Electric throttle actuator adaption routine not completed Replacement throttle fitted but adaption routine not completed 	<ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Check battery is in fully charged and in a serviceable condition using a battery tester and battery care manual Allow engine control module to power down. Turn on ignition and wait for 60 seconds. Start engine, this will allow new throttle adaption data to be stored Clear the DTC and retest
P2176-54	Throttle Actuator "A" Control System - Idle Position Not Learned - Missing calibration	<ul style="list-style-type: none"> Electric throttle actuator adaption routine entry conditions are not met Electric throttle actuator adaption routine not completed Replacement throttle fitted but adaption routine not completed Electric throttle actuator failure 	<ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Check battery is in fully charged and in a serviceable condition using a battery tester and battery care manual Allow engine control module to power down. Turn on ignition and wait for 60 seconds. Start engine, this will allow new throttle adaption data to be stored Clear the DTC and retest Check and install new electric throttle actuator as required
P2177-00	System Too Lean Off Idle - Bank 1 - No sub type information	<ul style="list-style-type: none"> Air intake system leakage Mass air flow sensor contamination Exhaust system leakage Incorrect fuel pressure 	<p> NOTE: Operational requirements needed to allow the monitor to be fully tested. Fully warmed-up engine, drive off-idle for a minimum of 10 minutes with several periods of steady operation for more than 20 seconds (no gear shifts, steady accelerator position)</p> <ul style="list-style-type: none"> Check for air intake system leakage Check for mass air flow sensor contamination Check for exhaust system leakage Refer to the relevant section of the workshop manual and check fuel pressure is to specification Clear the DTC and retest





P2178-00	System Too Rich Off Idle - Bank 1 - No sub type information	<ul style="list-style-type: none"> Blocked air filter Air intake system restriction Mass air flow sensor contamination Exhaust system restriction Incorrect fuel pressure 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Fully warmed-up engine, drive off-idle for a minimum of 10 minutes with several periods of steady operation for more than 20 seconds (no gear shifts, steady accelerator position)</p> <ul style="list-style-type: none"> Check for blocked air filter Check for air intake system restriction Check for mass air flow sensor contamination Check for exhaust system restriction Refer to the relevant section of the workshop manual and check fuel pressure is to specification Clear the DTC and retest
P2179-00	System Too Lean Off Idle - Bank 2 - No sub type information	<ul style="list-style-type: none"> Air intake system leakage Mass air flow sensor contamination Exhaust system leakage Incorrect fuel pressure 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Fully warmed-up engine, drive off-idle for a minimum of 10 minutes with several periods of steady operation for more than 20 seconds (no gear shifts, steady accelerator position)</p> <ul style="list-style-type: none"> Check for air intake system leakage Check for mass air flow sensor contamination Check for exhaust system leakage Refer to the relevant section of the workshop manual and check fuel pressure is to specification Clear the DTC and retest
P2180-00	System Too Rich Off Idle - Bank 2 - No sub type information	<ul style="list-style-type: none"> Blocked air filter Air intake system restriction Mass air flow sensor contamination Exhaust system restriction Incorrect fuel pressure 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Fully warmed-up engine, drive off-idle for a minimum of 10 minutes with several periods of steady operation for more than 20 seconds (no gear shifts, steady accelerator position)</p> <ul style="list-style-type: none"> Check for blocked air filter Check for air intake system restriction Check for mass air flow sensor contamination Check for exhaust system restriction Refer to the relevant section of the workshop manual and check fuel pressure is to specification Clear the DTC and retest
P2183-00	Engine Coolant Temperature Sensor 2 Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Blockage in coolant system Insufficient mixture of antifreeze creating possibility of icing in coolant system Connector is disconnected, connector pin is backed out, connector pin corrosion Engine coolant temperature sensor circuit short circuit to power, short circuit to ground, open circuit, high resistance Engine coolant temperature sensor failure 	 <p>NOTE: Monitor description. Engine coolant sensor 2 long term average stuck. No movement in sensor value during drive cycle</p> <ul style="list-style-type: none"> Check coolant system for blockages or restrictions that prevent coolant flow Check for the correct level of antifreeze within the coolant Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check engine coolant temperature sensor for





			<p>short circuit to power, short circuit to ground, open circuit, high resistance</p> <ul style="list-style-type: none"> • Check and install new engine coolant temperature sensor as required
P2183-21	Engine Coolant Temperature Sensor 2 Circuit Range/Performance - Signal amplitude < minimum	<ul style="list-style-type: none"> • The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low • Blockage in coolant system • Insufficient mixture of antifreeze creating possibility of icing in coolant system • Connector is disconnected, connector pin is backed out, connector pin corrosion • Engine coolant temperature sensor circuit short circuit to power, short circuit to ground, open circuit, high resistance • Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> • Check coolant system for blockages or restrictions that prevent coolant flow • Check for the correct level of antifreeze within the coolant • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check engine coolant temperature sensor for short circuit to power, short circuit to ground, open circuit, high resistance • Check and install new engine coolant temperature sensor as required
P2183-22	Engine Coolant Temperature Sensor 2 Circuit Range/Performance - Signal amplitude > maximum	<ul style="list-style-type: none"> • The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high • Blockage in coolant system • Insufficient mixture of antifreeze creating possibility of icing in coolant system • Connector is disconnected, connector pin is backed out, connector pin corrosion • Engine coolant temperature sensor circuit short circuit to power, short circuit to ground, open circuit, high resistance • Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> • Check coolant system for blockages or restrictions that prevent coolant flow • Check for the correct level of antifreeze within the coolant • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check engine coolant temperature sensor for short circuit to power, short circuit to ground, open circuit, high resistance • Check and install new engine coolant temperature sensor as required
P2184-00	Engine Coolant Temperature Sensor 2 Circuit Low - No sub type information	<ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Engine coolant temperature sensor circuit short circuit to ground, open circuit • Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check engine coolant temperature sensor for short circuit to ground, open circuit • Check and install new engine coolant temperature sensor as required
P2185-00	Engine Coolant Temperature Sensor 2 Circuit High - No sub type information	<ul style="list-style-type: none"> • Connector is disconnected, connector pin is backed out, connector pin corrosion • Engine coolant temperature sensor circuit short circuit to power, open circuit • Engine coolant temperature sensor failure 	<ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check engine coolant temperature sensor for short circuit to power, open circuit • Check and install new engine coolant temperature sensor as required
P2187-00	System Too Lean at Idle - Bank 1 - No sub type information	<ul style="list-style-type: none"> • Air intake system leakage • Pipe detached/union leakage between intake manifold and cylinder head • Fuel pressure too low • Mass air flow sensor contaminated • Exhaust system leakage 	<ul style="list-style-type: none"> • Check for air intake system leakage • Check intake manifold to cylinder head union for air leaks or pipe disconnected • Refer to the relevant section of the workshop manual and check fuel pressure is to specification • Check for mass air flow sensor contamination • Check for exhaust system




			<ul style="list-style-type: none"> leakage Check all heated oxygen sensors are installed correctly Clear the DTC and retest
P2188-00	System Too Rich at Idle - Bank 1 - No sub type information	<ul style="list-style-type: none"> Air filter blocked Air intake system restriction Fuel pressure too high Mass air flow sensor contaminated Exhaust system blocked 	<ul style="list-style-type: none"> Check air filter is not blocked Check the intake air system is free from restrictions Refer to the relevant section of the workshop manual and check fuel pressure is to specification Check for mass air flow sensor contamination Check for exhaust system blockage Clear the DTC and retest
P2189-00	System Too Lean at Idle - Bank 2 - No sub type information	<ul style="list-style-type: none"> Air intake system leakage Pipe detached/union leakage between intake manifold and cylinder head Fuel pressure too low Mass air flow sensor contaminated Exhaust system leakage 	<ul style="list-style-type: none"> Check for air intake system leakage Check intake manifold to cylinder head union for air leaks or pipe disconnected Refer to the relevant section of the workshop manual and check fuel pressure is to specification Check for mass air flow sensor contamination Check for exhaust system leakage Check all heated oxygen sensors are installed correctly Clear the DTC and retest
P2190-00	System Too Rich at Idle - Bank 2 - No sub type information	<ul style="list-style-type: none"> Air filter blocked Air intake system restriction Fuel pressure too high Mass air flow sensor contaminated Exhaust system blocked 	<ul style="list-style-type: none"> Check air filter is not blocked Check the intake air system is free from restrictions Refer to the relevant section of the workshop manual and check fuel pressure is to specification Check for mass air flow sensor contamination Check for exhaust system blockage Clear the DTC and retest
P2195-00	O2 Sensor Signal Biased/Stuck Lean - Bank 1, Sensor 1 - No sub type information	<ul style="list-style-type: none"> Exhaust system leakage Post catalyst heated oxygen sensor incorrectly installed Pre catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Post catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Pre catalyst heated oxygen sensor contamination or failure Post catalyst heated oxygen sensor contamination or failure 	<p>NOTES:</p> <p> Monitor description. Detects when secondary fuelling adaptation offset is too large for fuel mixture control to be maintained</p> <p> Operational requirements needed to allow the monitor to be fully tested. Drive vehicle under steady state conditions for up to 20 minutes</p> <ul style="list-style-type: none"> Check exhaust system for leakage. Rectify as required Check post catalyst heated oxygen sensor is correctly installed Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check pre catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check post catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Clear the DTC and retest




			<ul style="list-style-type: none"> • Check and install new pre catalyst heated oxygen sensor as required • Check and install new post catalyst heated oxygen sensor as required
P2196-00	O2 Sensor Signal Biased/Stuck Rich - Bank 1, Sensor 1 - No sub type information	<ul style="list-style-type: none"> • Exhaust system leakage • Post catalyst heated oxygen sensor incorrectly installed • Pre catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Post catalyst heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Pre catalyst heated oxygen sensor contamination or failure • Post catalyst heated oxygen sensor contamination or failure 	<p>NOTES:</p> <p> Monitor description. Detects when secondary fuelling adaptation offset is too small for fuel mixture control to be maintained</p> <p> Operational requirements needed to allow the monitor to be fully tested. Drive vehicle under steady state conditions for up to 20 minutes</p> <ul style="list-style-type: none"> • Check exhaust system for leakage. Rectify as required • Check post catalyst heated oxygen sensor is correctly installed • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check pre catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check post catalyst heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Clear the DTC and retest • Check and install new pre catalyst heated oxygen sensor as required • Check and install new post catalyst heated oxygen sensor as required
P2197-00	O2 Sensor Signal Biased/Stuck Lean - Bank 2, Sensor 1 - No sub type information	<ul style="list-style-type: none"> • Exhaust system leak • Post catalyst oxygen sensor incorrectly installed or harness failure • Pre catalyst oxygen sensor incorrectly installed or harness failure • Post catalyst oxygen sensor damaged or contaminated internally • Post catalyst oxygen sensor failure • Pre catalyst oxygen sensor failure 	<p> NOTE: Monitor description. Detects when secondary fuelling adaptation offset is too large for fuel mixture control to be maintained</p> <ul style="list-style-type: none"> • Check the exhaust system for leaks. Repair as necessary • Check pre and post catalyst oxygen sensors for damaged and correct installation • Refer to the electrical circuit diagrams and check post catalyst oxygen sensor circuits for open circuit short circuit to power, short circuit to ground, high resistance • Refer to the electrical circuit diagrams and check pre catalyst oxygen sensor circuits for open circuit short circuit to power, short circuit to ground, high resistance • Clear the DTC and retest • Check and install new pre catalyst oxygen sensor as required • Check and install new post catalyst oxygen sensor as required





P2198-00	O2 Sensor Signal Biased/Stuck Rich - Bank 2, Sensor 1 - No sub type information	<ul style="list-style-type: none"> Exhaust system leak Post catalyst oxygen sensor incorrectly installed or harness failure Pre catalyst oxygen sensor incorrectly installed or harness failure Post catalyst oxygen sensor damaged or contaminated internally Post catalyst oxygen sensor failure Pre catalyst oxygen sensor failure 	 NOTE: Monitor description. Detects when secondary fuelling adaptation offset is too small for fuel mixture control to be maintained <ul style="list-style-type: none"> Check the exhaust system for leaks. Repair as necessary Check pre and post catalyst oxygen sensors for damaged and correct installation Refer to the electrical circuit diagrams and check post catalyst oxygen sensor circuits for open circuit short circuit to power, short circuit to ground, high resistance Refer to the electrical circuit diagrams and check pre catalyst oxygen sensor circuits for open circuit short circuit to power, short circuit to ground, high resistance Clear the DTC and retest Check and install new pre catalyst oxygen sensor as required Check and install new post catalyst oxygen sensor as required
P219A-84	Bank 1 Air-Fuel Ratio Imbalance - Signal below allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range Intake air system blockage, restricting air from entering cylinders Specified cylinder, localised damage/restriction of fuel rail Specified cylinder, localised blockage/restriction within exhaust manifold Fuel injector failure Damage/friction in valve train components Camshaft profile switching system failure 	<p>NOTES:</p>  Monitor description. Inferred mixture strength (lambda) below threshold, (richer mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor  Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise) <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first Check condition of airpath from throttle to cylinder. Check for intake air system blockage, restricting air from entering cylinders Check for damage/restriction of fuel rail Check for blockage/restriction within exhaust manifold Check and install new fuel injector as required Using the manufacturer approved diagnostic system check engine control module for related camshaft profile switching system DTCs and refer to this DTC index Clear the DTC and retest
P219A-85	Bank 1 Air-Fuel Ratio Imbalance - Signal above allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via 	<p>NOTES:</p>





		<p>serial data, is above a specified range</p> <ul style="list-style-type: none"> • Fuel injector connector is disconnected, connector pin is backed out, connector pin corrosion • Specified cylinder, localised air leak on intake manifold to cylinder head connection • External fuel leak at fuel injector • Fuel restriction within fuel injector • Specified cylinder, localised damage/restriction of fuel rail • Air leak around spark plug • Air leak around fuel injector • Fuel injector failure • Ignition coil failure 	<p> Monitor description. Inferred mixture strength (lambda) above threshold, (leaner mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p> <p> Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check for air leak on intake manifold to cylinder head connection • Check for external fuel leak at fuel injector • Check for fuel restriction within fuel injector • Check for damage/restriction of fuel rail • Check for air leak around spark plug • Check for air leak around fuel injector • Check and install new fuel injector as required • Check and install new ignition coil as required • Clear the DTC and retest
P219B-84	Bank 2 Air-Fuel Ratio Imbalance - Signal below allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Intake air system blockage, restricting air from entering cylinders • Specified cylinder, localised damage/restriction of fuel rail • Specified cylinder, localised blockage/restriction within exhaust manifold • Fuel injector failure • Damage/friction in valve train components • Camshaft profile switching system failure 	<p>NOTES:</p> <p> Monitor description. Inferred mixture strength (lambda) below threshold, (richer mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p> <p> Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Check condition of airpath from throttle to cylinder. Check for intake air system blockage, restricting air from entering cylinders • Check for damage/restriction of fuel rail



			<ul style="list-style-type: none"> • Check for blockage/restriction within exhaust manifold • Check and install new fuel injector as required • Using the manufacturer approved diagnostic system check engine control module for related camshaft profile switching system DTCs and refer to this DTC index • Clear the DTC and retest
P219B-85	Bank 2 Air-Fuel Ratio Imbalance - Signal above allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Fuel injector connector is disconnected, connector pin is backed out, connector pin corrosion • Specified cylinder, localised air leak on intake manifold to cylinder head connection • External fuel leak at fuel injector • Fuel restriction within fuel injector • Specified cylinder, localised damage/restriction of fuel rail • Air leak around spark plug • Air leak around fuel injector • Fuel injector failure • Ignition coil failure 	<p>NOTES:</p> <p> Monitor description. Inferred mixture strength (lambda) above threshold, (leaner mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p> <p> Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check for air leak on intake manifold to cylinder head connection • Check for external fuel leak at fuel injector • Check for fuel restriction within fuel injector • Check for damage/restriction of fuel rail • Check for air leak around spark plug • Check for air leak around fuel injector • Check and install new fuel injector as required • Check and install new ignition coil as required • Clear the DTC and retest
P219C-84	Cylinder 1 Air-Fuel Ratio Imbalance - Signal below allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Intake air system blockage, restricting air from entering cylinders • Specified cylinder, localised damage/restriction of fuel rail • Specified cylinder, localised blockage/restriction within exhaust manifold • Fuel injector failure • Damage/friction in valve train components • Camshaft profile switching system failure 	<p>NOTES:</p> <p> Monitor description. Inferred mixture strength (lambda) below threshold, (richer mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p> <p> Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p>





			<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first Check condition of airpath from throttle to cylinder. Check for intake air system blockage, restricting air from entering cylinders Check for damage/restriction of fuel rail Check for blockage/restriction within exhaust manifold Check and install new fuel injector as required Using the manufacturer approved diagnostic system check engine control module for related camshaft profile switching system DTCs and refer to this DTC index Clear the DTC and retest
P219C-85	Cylinder 1 Air-Fuel Ratio Imbalance - Signal above allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Fuel injector connector is disconnected, connector pin is backed out, connector pin corrosion Specified cylinder, localised air leak on intake manifold to cylinder head connection External fuel leak at fuel injector Fuel restriction within fuel injector Specified cylinder, localised damage/restriction of fuel rail Air leak around spark plug Air leak around fuel injector Fuel injector failure Ignition coil failure 	<p>NOTES:</p> <p> Monitor description. Inferred mixture strength (lambda) above threshold, (leaner mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p> <p> Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check for air leak on intake manifold to cylinder head connection Check for external fuel leak at fuel injector Check for fuel restriction within fuel injector Check for damage/restriction of fuel rail Check for air leak around spark plug Check for air leak around fuel injector Check and install new fuel injector as required Check and install new ignition coil as required Clear the DTC and retest
P219D-84	Cylinder 2 Air-Fuel Ratio Imbalance - Signal below allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range Intake air system blockage, 	<p>NOTES:</p> <p> Monitor description. Inferred mixture strength (lambda) below threshold, (richer mixture). Monitors</p>





		<p>restricting air from entering cylinders</p> <ul style="list-style-type: none"> • Specified cylinder, localised damage/restriction of fuel rail • Specified cylinder, localised blockage/restriction within exhaust manifold • Fuel injector failure • Damage/friction in valve train components • Camshaft profile switching system failure 	<p>cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p>  <p>Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Check condition of airpath from throttle to cylinder. Check for intake air system blockage, restricting air from entering cylinders • Check for damage/restriction of fuel rail • Check for blockage/restriction within exhaust manifold • Check and install new fuel injector as required • Using the manufacturer approved diagnostic system check engine control module for related camshaft profile switching system DTCs and refer to this DTC index • Clear the DTC and retest
P219D-85	Cylinder 2 Air-Fuel Ratio Imbalance - Signal above allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Fuel injector connector is disconnected, connector pin is backed out, connector pin corrosion • Specified cylinder, localised air leak on intake manifold to cylinder head connection • External fuel leak at fuel injector • Fuel restriction within fuel injector • Specified cylinder, localised damage/restriction of fuel rail • Air leak around spark plug • Air leak around fuel injector • Fuel injector failure • Ignition coil failure 	<p>NOTES:</p>  <p>Monitor description. Inferred mixture strength (lambda) above threshold, (leaner mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p>  <p>Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check for air leak on intake manifold to cylinder head connection • Check for external fuel leak at fuel injector • Check for fuel restriction within fuel injector • Check for damage/restriction of fuel rail • Check for air leak around spark plug



			<ul style="list-style-type: none"> • Check for air leak around fuel injector • Check and install new fuel injector as required • Check and install new ignition coil as required • Clear the DTC and retest
P219E-84	Cylinder 3 Air-Fuel Ratio Imbalance - Signal below allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Intake air system blockage, restricting air from entering cylinders • Specified cylinder, localised damage/restriction of fuel rail • Specified cylinder, localised blockage/restriction within exhaust manifold • Fuel injector failure • Damage/friction in valve train components • Camshaft profile switching system failure 	<p>NOTES:</p> <p> Monitor description. Inferred mixture strength (lambda) below threshold, (richer mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p> <p> Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Check condition of airpath from throttle to cylinder. Check for intake air system blockage, restricting air from entering cylinders • Check for damage/restriction of fuel rail • Check for blockage/restriction within exhaust manifold • Check and install new fuel injector as required • Using the manufacturer approved diagnostic system check engine control module for related camshaft profile switching system DTCs and refer to this DTC index • Clear the DTC and retest
P219E-85	Cylinder 3 Air-Fuel Ratio Imbalance - Signal above allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Fuel injector connector is disconnected, connector pin is backed out, connector pin corrosion • Specified cylinder, localised air leak on intake manifold to cylinder head connection • External fuel leak at fuel injector • Fuel restriction within fuel injector • Specified cylinder, localised damage/restriction of fuel rail • Air leak around spark plug • Air leak around fuel injector • Fuel injector failure • Ignition coil failure 	<p>NOTES:</p> <p> Monitor description. Inferred mixture strength (lambda) above threshold, (leaner mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p> <p> Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first





			<p>Inspect connectors for signs of water ingress, and pins for damage and/or corrosion</p> <ul style="list-style-type: none"> • Check for air leak on intake manifold to cylinder head connection • Check for external fuel leak at fuel injector • Check for fuel restriction within fuel injector • Check for damage/restriction of fuel rail • Check for air leak around spark plug • Check for air leak around fuel injector • Check and install new fuel injector as required • Check and install new ignition coil as required • Clear the DTC and retest
P219F-84	Cylinder 4 Air-Fuel Ratio Imbalance - Signal below allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Intake air system blockage, restricting air from entering cylinders • Specified cylinder, localised damage/restriction of fuel rail • Specified cylinder, localised blockage/restriction within exhaust manifold • Fuel injector failure • Damage/friction in valve train components • Camshaft profile switching system failure 	<p>NOTES:</p> <p> Monitor description. Inferred mixture strength (lambda) below threshold, (richer mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p> <p> Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Check condition of airpath from throttle to cylinder. Check for intake air system blockage, restricting air from entering cylinders • Check for damage/restriction of fuel rail • Check for blockage/restriction within exhaust manifold • Check and install new fuel injector as required • Using the manufacturer approved diagnostic system check engine control module for related camshaft profile switching system DTCs and refer to this DTC index • Clear the DTC and retest
P219F-85	Cylinder 4 Air-Fuel Ratio Imbalance - Signal above allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Fuel injector connector is disconnected, connector pin is backed out, connector pin corrosion • Specified cylinder, localised air leak on intake manifold to cylinder head connection 	<p>NOTES:</p> <p> Monitor description. Inferred mixture strength (lambda) above threshold, (leaner mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p> <p> Operational requirements needed</p>

		<p>External fuel leak at fuel injector</p> <ul style="list-style-type: none"> • Fuel restriction within fuel injector • Specified cylinder, localised damage/restriction of fuel rail • Air leak around spark plug • Fuel injector failure • Ignition coil failure 	<p>to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check for air leak on intake manifold to cylinder head connection • Check for external fuel leak at fuel injector • Check for fuel restriction within fuel injector • Check for damage/restriction of fuel rail • Check for air leak around spark plug • Check for air leak around fuel injector • Check and install new fuel injector as required • Check and install new ignition coil as required • Clear the DTC and retest
P21A0-84	Cylinder 5 Air-Fuel Ratio Imbalance - Signal below allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Intake air system blockage, restricting air from entering cylinders • Specified cylinder, localised damage/restriction of fuel rail • Specified cylinder, localised blockage/restriction within exhaust manifold • Fuel injector failure • Damage/friction in valve train components • Camshaft profile switching system failure 	<p>NOTES:</p> <p> Monitor description. Inferred mixture strength (lambda) below threshold, (richer mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p> <p> Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Check condition of airpath from throttle to cylinder. Check for intake air system blockage, restricting air from entering cylinders • Check for damage/restriction of fuel rail • Check for blockage/restriction within exhaust manifold • Check and install new fuel injector as required • Using the manufacturer approved diagnostic system check engine control module for related camshaft profile switching system DTCs and refer to this DTC index

		<ul style="list-style-type: none"> • Clear the DTC and retest 	
P21A0-85	Cylinder 5 Air-Fuel Ratio Imbalance - Signal above allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Fuel injector connector is disconnected, connector pin is backed out, connector pin corrosion • Specified cylinder, localised air leak on intake manifold to cylinder head connection • External fuel leak at fuel injector • Fuel restriction within fuel injector • Specified cylinder, localised damage/restriction of fuel rail • Air leak around spark plug • Air leak around fuel injector • Fuel injector failure • Ignition coil failure 	<p>NOTES:</p> <p> Monitor description. Inferred mixture strength (lambda) above threshold, (leaner mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p> <p> Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check for air leak on intake manifold to cylinder head connection • Check for external fuel leak at fuel injector • Check for fuel restriction within fuel injector • Check for damage/restriction of fuel rail • Check for air leak around spark plug • Check for air leak around fuel injector • Check and install new fuel injector as required • Check and install new ignition coil as required • Clear the DTC and retest
P21A1-84	Cylinder 6 Air-Fuel Ratio Imbalance - Signal below allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range • Intake air system blockage, restricting air from entering cylinders • Specified cylinder, localised damage/restriction of fuel rail • Specified cylinder, localised blockage/restriction within exhaust manifold • Fuel injector failure • Damage/friction in valve train components • Camshaft profile switching system failure 	<p>NOTES:</p> <p> Monitor description. Inferred mixture strength (lambda) below threshold, (richer mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p> <p> Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Check condition of airpath from throttle to cylinder. Check for intake air system blockage,

			<ul style="list-style-type: none"> restricting air from entering cylinders • Check for damage/restriction of fuel rail • Check for blockage/restriction within exhaust manifold • Check and install new fuel injector as required • Using the manufacturer approved diagnostic system check engine control module for related camshaft profile switching system DTCs and refer to this DTC index • Clear the DTC and retest
P21A1-85	Cylinder 6 Air-Fuel Ratio Imbalance - Signal above allowable range	<ul style="list-style-type: none"> • The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range • Fuel injector connector is disconnected, connector pin is backed out, connector pin corrosion • Specified cylinder, localised air leak on intake manifold to cylinder head connection • External fuel leak at fuel injector • Fuel restriction within fuel injector • Specified cylinder, localised damage/restriction of fuel rail • Air leak around spark plug • Air leak around fuel injector • Fuel injector failure • Ignition coil failure 	<p>NOTES:</p> <p> Monitor description. Inferred mixture strength (lambda) above threshold, (leaner mixture). Monitors cylinder specific fuelling errors which may not be detected by the overall fuel system monitor</p> <p> Operational requirements needed to allow the monitor to be fully tested. Engine coolant temperature greater than 50°C, drive vehicle at steady load in 6th gear to achieve an engine speed of 1200-2400rpm, maintain these conditions for 10 minutes (highway cruise)</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check engine control module for related misfire DTCs and refer to this DTC index. Rectify these first • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Check for air leak on intake manifold to cylinder head connection • Check for external fuel leak at fuel injector • Check for fuel restriction within fuel injector • Check for damage/restriction of fuel rail • Check for air leak around spark plug • Check for air leak around fuel injector • Check and install new fuel injector as required • Check and install new ignition coil as required • Clear the DTC and retest
P2227-00	Barometric Pressure Sensor A Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> • Engine control module failure 	<p> NOTE: The sensor is installed within the engine control module and is not serviceable</p> <ul style="list-style-type: none"> • Check and install new engine control module as required
P2228-00	Barometric Pressure Sensor A Circuit Low - No sub type information	<ul style="list-style-type: none"> • Engine control module failure 	<p> NOTE: The sensor is installed within the engine control module and is not serviceable</p> <ul style="list-style-type: none"> • Check and install new engine control module as required




P2229-00	Barometric Pressure Sensor A Circuit High - No sub type information	<ul style="list-style-type: none"> Engine control module failure 	 <p>NOTE: The sensor is installed within the engine control module and is not serviceable</p> <ul style="list-style-type: none"> Check and install new engine control module as required
P2231-00	O2 Sensor Signal Circuit Shorted to Heater Circuit - Bank 1, Sensor 1 - No sub type information	<ul style="list-style-type: none"> Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P2234-00	O2 Sensor Signal Circuit Shorted to Heater Circuit - Bank 2, Sensor 1 - No sub type information	<ul style="list-style-type: none"> Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P2237-13	O2 Sensor Positive Current Control Circuit / Open - Bank 1, Sensor 1 - Circuit open	<ul style="list-style-type: none"> The engine control module has determined an open circuit via lack of bias voltage, low current flow, no change in the state of an input in response to an output Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P2237-64	O2 Sensor Positive Current Control Circuit / Open - Bank 1, Sensor 1 - Signal plausibility failure	<ul style="list-style-type: none"> The engine control module detected plausibility failures Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required
P2237-85	O2 Sensor Positive Current Control Circuit / Open - Bank 1, Sensor 1 - Signal above allowable range	 <p>NOTE: Circuit reference I_A_LSCP1</p> <ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Connector is disconnected, connector pin is backed out, connector pin corrosion Heated oxygen sensor failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new heated oxygen sensor as required








P2240-00	O2 Sensor Positive Current Control Circuit / Open - Bank 2, Sensor 1 - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P2240-19	O2 Sensor Positive Current Control Circuit / Open - Bank 2, Sensor 1 - Circuit current above threshold	 <p>NOTE: Circuit reference I_A_LSCP2</p> <ul style="list-style-type: none"> • The engine control module has measured current flow above a specified range • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P2240-64	O2 Sensor Positive Current Control Circuit / Open - Bank 2, Sensor 1 - Signal plausibility failure	<ul style="list-style-type: none"> • The engine control module detected plausibility failures • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P2243-00	O2 Sensor Reference Voltage Circuit / Open - Bank 1, Sensor 1 - No sub type information	 <p>NOTE: Circuit reference I_A_LSVN1</p> <ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P2247-00	O2 Sensor Reference Voltage Circuit / Open - Bank 2, Sensor 1 - No sub type information	 <p>NOTE: Circuit reference I_A_LSVN2</p> <ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P2251-00	O2 Sensor Negative Current Control Circuit / Open - Bank 1, Sensor 1 - No sub type information	 <p>NOTE: Circuit reference O_R_LSVG1</p> <ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required











P2254-00	O2 Sensor Negative Current Control Circuit / Open - Bank 2, Sensor 1 - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P2270-00	O2 Sensor Signal Stuck Lean - Bank 1, Sensor 2 - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Air leakage between heated oxygen sensor and catalyst • Heated oxygen sensor tip damaged • Heated oxygen sensor tip blocked • Heated oxygen sensor tip contaminated by excessive oil consumption • Heated oxygen sensor tip contaminated by poor or incorrect fuel 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Oxygen Sensor (O2S) Voltage Bank 1 Sensor 2 - (0x035F) - Heated oxygen sensor signal for correct operation • Refer to electrical circuit diagrams and check the heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check heated oxygen sensor is correctly installed • Check heated oxygen sensor for tip damage • Check heated oxygen sensor for tip blocked • Check heated oxygen sensor for tip contamination by excessive oil consumption. Carry out oil consumption check • Check heated oxygen sensor for tip contamination by poor or incorrect fuel. Check customer is using correct grade of fuel
P2271-00	O2 Sensor Signal Stuck Rich - Bank 1, Sensor 2 - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Air leakage between heated oxygen sensor and catalyst • Heated oxygen sensor tip damaged • Heated oxygen sensor tip blocked • Heated oxygen sensor tip contaminated by excessive oil consumption • Heated oxygen sensor tip contaminated by poor or incorrect fuel 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Oxygen Sensor (O2S) Voltage Bank 1 Sensor 2 - (0x035F) - Heated oxygen sensor signal for correct operation • Refer to electrical circuit diagrams and check the heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check heated oxygen sensor is correctly installed • Check heated oxygen sensor for tip damage • Check heated oxygen sensor for tip blocked • Check heated oxygen sensor for tip contamination by excessive oil consumption. Carry out oil consumption check • Check heated oxygen sensor for tip contamination by poor or incorrect fuel. Check customer is using correct grade of fuel
P2272-00	O2 Sensor Signal Stuck Lean - Bank 2, Sensor 2 - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Air leakage between heated oxygen sensor and catalyst • Heated oxygen sensor tip damaged 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Oxygen Sensor (O2S) Voltage Bank 2 Sensor 2 - (0x0362) - Heated oxygen sensor signal for correct operation











		<ul style="list-style-type: none"> • Heated oxygen sensor tip blocked • Heated oxygen sensor tip contaminated by excessive oil consumption • Heated oxygen sensor tip contaminated by poor or incorrect fuel 	<ul style="list-style-type: none"> • Refer to electrical circuit diagrams and check the heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check heated oxygen sensor is correctly installed • Check heated oxygen sensor for tip damage • Check heated oxygen sensor for tip blocked • Check heated oxygen sensor for tip contamination by excessive oil consumption. Carry out oil consumption check • Check heated oxygen sensor for tip contamination by poor or incorrect fuel. Check customer is using correct grade of fuel
P2273-00	O2 Sensor Signal Stuck Rich - Bank 2, Sensor 2 - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Air leakage between heated oxygen sensor and catalyst • Heated oxygen sensor tip damaged • Heated oxygen sensor tip blocked • Heated oxygen sensor tip contaminated by excessive oil consumption • Heated oxygen sensor tip contaminated by poor or incorrect fuel 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Oxygen Sensor (O2S) Voltage Bank 2 Sensor 2 - (0x0362) - Heated oxygen sensor signal for correct operation • Refer to electrical circuit diagrams and check the heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check heated oxygen sensor is correctly installed • Check heated oxygen sensor for tip damage • Check heated oxygen sensor for tip blocked • Check heated oxygen sensor for tip contamination by excessive oil consumption. Carry out oil consumption check • Check heated oxygen sensor for tip contamination by poor or incorrect fuel. Check customer is using correct grade of fuel
P2274-00	O2 Sensor Signal Stuck Lean - Bank 1, Sensor 3 - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Air leakage between heated oxygen sensor and catalyst • Heated oxygen sensor tip damaged • Heated oxygen sensor tip blocked • Heated oxygen sensor tip contaminated by excessive oil consumption • Heated oxygen sensor tip contaminated by poor or incorrect fuel 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Oxygen Sensor (O2S) Voltage Bank 1 Sensor 3 - (0x0360) - Heated oxygen sensor signal for correct operation • Refer to electrical circuit diagrams and check the heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check heated oxygen sensor is correctly installed • Check heated oxygen sensor for tip damage • Check heated oxygen sensor for tip blocked • Check heated oxygen sensor for tip contamination by excessive oil consumption. Carry out oil consumption check • Check heated oxygen sensor for tip contamination by poor or incorrect fuel. Check customer is using correct grade of fuel
P2275-	O2 Sensor Signal Stuck	<ul style="list-style-type: none"> • Heated oxygen sensor circuit, 	<ul style="list-style-type: none"> • Using the manufacturer






00	Rich - Bank 1, Sensor 3 - No sub type information	<p>short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Air leakage between heated oxygen sensor and catalyst • Heated oxygen sensor tip damaged • Heated oxygen sensor tip blocked • Heated oxygen sensor tip contaminated by excessive oil consumption • Heated oxygen sensor tip contaminated by poor or incorrect fuel 	<p>approved diagnostic system check datalogger signal - Oxygen Sensor (O2S) Voltage Bank 1 Sensor 3 - (0x0360)</p> <ul style="list-style-type: none"> - Heated oxygen sensor signal for correct operation • Refer to electrical circuit diagrams and check the heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check heated oxygen sensor is correctly installed • Check heated oxygen sensor for tip damage • Check heated oxygen sensor for tip blocked • Check heated oxygen sensor for tip contamination by excessive oil consumption. Carry out oil consumption check • Check heated oxygen sensor for tip contamination by poor or incorrect fuel. Check customer is using correct grade of fuel
P2276-00	O2 Sensor Signal Stuck Lean - Bank 2, Sensor 3 - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Air leakage between heated oxygen sensor and catalyst • Heated oxygen sensor tip damaged • Heated oxygen sensor tip blocked • Heated oxygen sensor tip contaminated by excessive oil consumption • Heated oxygen sensor tip contaminated by poor or incorrect fuel 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Oxygen Sensor (O2S) Voltage Bank 2 Sensor 3 - (0x0363) - Heated oxygen sensor signal for correct operation • Refer to electrical circuit diagrams and check the heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check heated oxygen sensor is correctly installed • Check heated oxygen sensor for tip damage • Check heated oxygen sensor for tip blocked • Check heated oxygen sensor for tip contamination by excessive oil consumption. Carry out oil consumption check • Check heated oxygen sensor for tip contamination by poor or incorrect fuel. Check customer is using correct grade of fuel
P2277-00	O2 Sensor Signal Stuck Rich - Bank 2, Sensor 3 - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit, short circuit to ground, short circuit to power, open circuit, high resistance • Air leakage between heated oxygen sensor and catalyst • Heated oxygen sensor tip damaged • Heated oxygen sensor tip blocked • Heated oxygen sensor tip contaminated by excessive oil consumption • Heated oxygen sensor tip contaminated by poor or incorrect fuel 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signal - Oxygen Sensor (O2S) Voltage Bank 2 Sensor 3 - (0x0363) - Heated oxygen sensor signal for correct operation • Refer to electrical circuit diagrams and check the heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check heated oxygen sensor is correctly installed • Check heated oxygen sensor for tip damage • Check heated oxygen sensor for tip blocked • Check heated oxygen sensor for tip contamination by excessive oil consumption. Carry out oil





			<ul style="list-style-type: none"> consumption check Check heated oxygen sensor for tip contamination by poor or incorrect fuel. Check customer is using correct grade of fuel
P2281-21	Air Leak Between MAF and Throttle Body - Signal amplitude < minimum	<ul style="list-style-type: none"> The engine control module measured a signal voltage below a specified range but not necessarily a short circuit to ground, gain low Air intake system leakage between the mass air flow sensor and the electric throttle 	 NOTE: Monitor description. Air leak between mass air flow sensor and electric throttle <ul style="list-style-type: none"> Check for air intake system leakage between the mass air flow sensor and the electric throttle, left bank and right bank
P2281-22	Air Leak Between MAF and Throttle Body - Signal amplitude > maximum	<ul style="list-style-type: none"> The engine control module measured a signal voltage above a specified range but not necessarily a short circuit to power, gain too high Air intake system blockage between the mass air flow sensor and the electric throttle 	 NOTE: Monitor description. Air leak between mass air flow sensor and electric throttle <ul style="list-style-type: none"> Check for air intake system blockage between the mass air flow sensor and the electric throttle, left bank and right bank
P228E-84	"Fuel Pressure Regulator 1 Exceeded Learning Limits - Too Low" - Signal below allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range Damaged/worn high pressure fuel pump Fuel pump incorrect assembly/timing High pressure fuel pump failure 	<ul style="list-style-type: none"> Check engine control module for related DTCs and refer to relevant DTC index Check for a damaged or worn high pressure fuel pump Check timing and condition of the fuel pump drive chain Check and install new high pressure fuel pump as required
P228F-85	Fuel Pressure Regulator 1 Exceeded Learning Limits - Too High - Signal above allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Damaged/worn high pressure fuel pump Fuel pump incorrect assembly/timing High pressure fuel pump failure 	<ul style="list-style-type: none"> Check engine control module for related DTCs and refer to relevant DTC index Check for damaged or worn high pressure fuel pump Check timing and condition of the fuel pump drive chain Check and install new high pressure fuel pump as required
P2299-23	Brake Pedal Position/Accelerator Pedal Position Incompatible - Signal stuck low	<ul style="list-style-type: none"> The engine control module measures a signal that remains low when transitions are expected Brake pedal switch detached from mounting bracket/pedal box whilst electrically connected Brake pedal switch mounting position incorrectly adjusted Brake pedal switch plunger partially stuck in Brake pedal switch 1 circuit open circuit, short circuit to power, short circuit to ground Brake pedal switch 2 circuit open circuit, short circuit to power, short circuit to ground 	 NOTE: Monitor description. If the driver is braking and producing a high brake line pressure whilst not pressing the accelerator pedal then both brake pedal switches should be on/active. If the brake pedal switches are off/inactive in this condition then the switches have failed and the DTC is set <ul style="list-style-type: none"> Check engine control module for related DTCs and refer to relevant DTC index Check that the brake pedal switch is mounted and correctly positioned on the mounting bracket/pedal box Check for smooth operation of the brake pedal switch plunger Refer to the electrical circuit diagrams and check brake pedal switch 1 circuit for open circuit, short circuit to power, short circuit to ground Refer to the electrical circuit diagrams and check brake pedal switch 2 circuit for open circuit, short circuit to power, short circuit to ground
P2299-	Brake Pedal	<ul style="list-style-type: none"> The engine control module 	






24	Position/Accelerator Pedal Position Incompatible - Signal stuck high	<p>measures a signal that remains high when transitions are expected</p> <ul style="list-style-type: none"> • Brake pedal switch detached from mounting bracket/pedal box whilst electrically connected • Brake pedal switch mounting position incorrectly adjusted • Brake pedal switch plunger partially stuck out • Brake pedal switch 1 circuit open circuit, short circuit to power, short circuit to ground • Brake pedal switch 2 circuit open circuit, short circuit to power, short circuit to ground 	 NOTE: Monitor description. If the driver is pressing the accelerator pedal and the vehicle is accelerating and the brake pressure is low both brake pedal switches should be off/inactive. If the switches are on/active in this condition then the brake pedal switches have failed and the DTC is set <ul style="list-style-type: none"> • Check engine control module for related DTCs and refer to relevant DTC index • Check that the brake pedal switch is mounted and correctly positioned on the mounting bracket/pedal box • Check for smooth operation of the brake pedal switch plunger • Refer to the electrical circuit diagrams and check brake pedal switch 1 circuit for open circuit, short circuit to power, short circuit to ground • Refer to the electrical circuit diagrams and check brake pedal switch 2 circuit for open circuit, short circuit to power, short circuit to ground
P2300-11	Ignition Coil A Primary Control Circuit Low - Circuit short to ground	 NOTE: Circuit reference IGN COIL 1 <ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Ignition coil circuit, short circuit to ground, open circuit 	 NOTE: Monitor description. Short circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC <ul style="list-style-type: none"> • Check ignition coil connector is correctly installed • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check ignition coil circuit for short circuit to ground, open circuit
P2301-12	Ignition Coil A Primary Control Circuit High - Circuit short to battery	 NOTE: Circuit reference IGN COIL 1 <ul style="list-style-type: none"> • The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected • Ignition coil circuit, short circuit to power, open circuit 	 NOTE: Monitor description. Short circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC <ul style="list-style-type: none"> • Check ignition coil connector is correctly installed • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check ignition coil circuit for short circuit to power
P2303-11	Ignition Coil B Primary Control Circuit Low - Circuit short to ground	 NOTE: Circuit reference IGN COIL 2 <ul style="list-style-type: none"> • The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Ignition coil circuit, short circuit to ground, open circuit 	 NOTE: Monitor description. Short circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC <ul style="list-style-type: none"> • Check ignition coil connector is correctly installed • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Refer to the electrical circuit diagrams and check ignition coil circuit for short circuit to






			ground, open circuit
P2304-12	Ignition Coil B Primary Control Circuit High - Circuit short to battery	 <p>NOTE: Circuit reference IGN COIL 2</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Ignition coil circuit, short circuit to power, open circuit 	 <p>NOTE: Monitor description. Short circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is correctly installed Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for short circuit to power
P2306-11	Ignition Coil C Primary Control Circuit Low - Circuit short to ground	 <p>NOTE: Circuit reference IGN COIL 3</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Ignition coil circuit, short circuit to ground, open circuit 	 <p>NOTE: Monitor description. Short circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is correctly installed Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for short circuit to ground, open circuit
P2307-12	Ignition Coil C Primary Control Circuit High - Circuit short to battery	 <p>NOTE: Circuit reference IGN COIL 3</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Ignition coil circuit, short circuit to power, open circuit 	 <p>NOTE: Monitor description. Short circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is correctly installed Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for short circuit to power
P2309-11	Ignition Coil D Primary Control Circuit Low - Circuit short to ground	 <p>NOTE: Circuit reference IGN COIL 4</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Ignition coil circuit, short circuit to ground, open circuit 	 <p>NOTE: Monitor description. Short circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is correctly installed Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for short circuit to ground, open circuit
P2310-12	Ignition Coil D Primary Control Circuit High - Circuit short to battery	 <p>NOTE: Circuit reference IGN COIL 4</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected 	 <p>NOTE: Monitor description. Short circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is correctly installed Inspect connectors for signs of water ingress, and pins for





		Ignition coil circuit, short circuit to power, open circuit	<ul style="list-style-type: none"> damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for short circuit to power
P2312-11	Ignition Coil E Primary Control Circuit Low - Circuit short to ground	 <p>NOTE: Circuit reference IGN COIL 5</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Ignition coil circuit, short circuit to ground, open circuit 	 <p>NOTE: Monitor description. Short circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is correctly installed Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for short circuit to ground, open circuit
P2313-12	Ignition Coil E Primary Control Circuit High - Circuit short to battery	 <p>NOTE: Circuit reference IGN COIL 5</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Ignition coil circuit, short circuit to power, open circuit 	 <p>NOTE: Monitor description. Short circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is correctly installed Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for short circuit to power
P2315-11	Ignition Coil F Primary Control Circuit Low - Circuit short to ground	 <p>NOTE: Circuit reference IGN COIL 6</p> <ul style="list-style-type: none"> The engine control module has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected Ignition coil circuit, short circuit to ground, open circuit 	 <p>NOTE: Monitor description. Short circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is correctly installed Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for short circuit to ground, open circuit
P2316-12	Ignition Coil F Primary Control Circuit High - Circuit short to battery	 <p>NOTE: Circuit reference IGN COIL 6</p> <ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Ignition coil circuit, short circuit to power, open circuit 	 <p>NOTE: Monitor description. Short circuit detected by the ignition control module, passed to main CPU within engine control module and sets the DTC</p> <ul style="list-style-type: none"> Check ignition coil connector is correctly installed Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check ignition coil circuit for short circuit to power
P2400-00	Evaporative Emission System Leak Detection Pump Control Circuit / Open - No sub type information	 <p>NOTE: Circuit reference O_S_TDMP</p> <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Diagnostic monitoring tank 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Ignition on and engine running</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion





		<p>leakage pump circuit, open circuit, high resistance</p> <ul style="list-style-type: none"> Diagnostic monitoring tank leakage pump failure 	<p>Refer to electrical circuit diagrams and check the diagnostic monitoring tank leakage pump circuit for open circuit, high resistance</p> <ul style="list-style-type: none"> Clear the DTC and retest Check and install a new diagnostic monitoring tank leakage pump as required
P2401-00	Evaporative Emission System Leak Detection Pump Control Circuit Low - No sub type information	 <p>NOTE: Circuit reference O_S_TDMP</p> <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Diagnostic monitoring tank leakage pump circuit, short circuit to ground Diagnostic monitoring tank leakage pump failure 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Ignition on and engine running</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to electrical circuit diagrams and check the diagnostic monitoring tank leakage pump circuit for short circuit to ground Clear the DTC and retest Check and install a new diagnostic monitoring tank leakage pump as required
P2402-85	Evaporative Emission System Leak Detection Pump Control Circuit High - Signal above allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Connector is disconnected, connector pin is backed out, connector pin corrosion Diagnostic monitoring tank leakage pump circuit, short circuit to power Diagnostic monitoring tank leakage pump failure 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Ignition on and engine running</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to electrical circuit diagrams and check the diagnostic monitoring tank leakage pump circuit for short circuit to power Clear the DTC and retest Check and install a new diagnostic monitoring tank leakage pump as required
P2404-00	Evaporative Emission System Leak Detection Pump Sense Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Diagnostic monitoring tank leakage module circuit, short circuit to ground, short circuit to power, open circuit, high resistance Diagnostic monitoring tank leakage module failure 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Ensure that the vehicle has a fuel level between 15 and 85%, ambient temperature is between 32°F and 95°F, Ignition is on. Using the manufacturer approved diagnostic system carry out a "large leak test". Allow the diagnostic monitoring tank leakage test to complete, refer to diagnostic monitoring tank leakage test results</p> <ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the diagnostic monitoring tank leakage module circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check and install a new diagnostic monitoring tank leakage module as required
P2405-00	Evaporative Emission System Leak Detection Pump Sense Circuit Low - No sub type information	<ul style="list-style-type: none"> Diagnostic monitoring tank leakage module circuit, short circuit to ground, short circuit to power, open circuit, high resistance Diagnostic monitoring tank leakage module failure 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Ensure that the vehicle has a fuel level between 15 and 85%, ambient temperature is between 32°F and 95°F, Ignition is on. Using the manufacturer approved diagnostic</p>




			<p>system carry out a "large leak test". Allow the diagnostic monitoring tank leakage test to complete, refer to diagnostic monitoring tank leakage test results</p> <ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the diagnostic monitoring tank leakage module circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check and install a new diagnostic monitoring tank leakage module as required
P2406-00	Evaporative Emission System Leak Detection Pump Sense Circuit High - No sub type information	<ul style="list-style-type: none"> Diagnostic monitoring tank leakage module circuit, short circuit to ground, short circuit to power, open circuit, high resistance Blocked pipework Diagnostic monitoring tank leakage module failure 	<p> NOTE: Operational requirements needed to allow the monitor to be fully tested. Ensure that the vehicle has a fuel level between 15 and 85%, ambient temperature is between 32°F and 95°F, Ignition is on. Using the manufacturer approved diagnostic system carry out a "large leak test". Allow the diagnostic monitoring tank leakage test to complete, refer to diagnostic monitoring tank leakage test results</p> <ul style="list-style-type: none"> Refer to electrical circuit diagrams and check the diagnostic monitoring tank leakage module circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check for blocked pipework Check and install a new diagnostic monitoring tank leakage module as required
P2407-00	Evaporative Emission System Leak Detection Pump Sense Circuit Intermittent/Erratic - No sub type information	<ul style="list-style-type: none"> Water or fuel moisture detected in the diagnostic monitoring tank leakage module Diagnostic monitoring tank leakage module circuit, short circuit to ground, short circuit to power, open circuit, high resistance Diagnostic monitoring tank leakage module failure 	<p> NOTE: Operational requirements needed to allow the monitor to be fully tested. Ensure that the vehicle has a fuel level between 15 and 85%, ambient temperature is between 32°F and 95°F, Ignition is on. Using the manufacturer approved diagnostic system carry out a "large leak test". Allow the diagnostic monitoring tank leakage test to complete, refer to diagnostic monitoring tank leakage test results</p> <ul style="list-style-type: none"> Check for water or fuel moisture in the diagnostic monitoring tank leakage module Refer to electrical circuit diagrams and check the diagnostic monitoring tank leakage module circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check and install a new diagnostic monitoring tank leakage module as required
P240A-00	Evaporative Emission System Leak Detection Pump Heater Circuit / Open - No sub type information	<p> NOTE: Circuit reference O_S_TDMH</p> <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Diagnostic monitoring tank leakage pump circuit, open 	<p> NOTE: Operational requirements needed to allow the monitor to be fully tested. Ignition on and engine running</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to electrical circuit


		<ul style="list-style-type: none"> circuit, high resistance Diagnostic monitoring tank leakage pump failure 	<ul style="list-style-type: none"> diagrams and check the diagnostic monitoring tank leakage pump circuit for open circuit, high resistance Clear the DTC and retest Check and install a new diagnostic monitoring tank leakage pump as required
P240B-00	Evaporative Emission System Leak Detection Pump Heater Circuit Low - No sub type information	<ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Diagnostic monitoring tank leakage pump circuit, short circuit to ground Diagnostic monitoring tank leakage pump failure 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Ignition on and engine running</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to electrical circuit diagrams and check the diagnostic monitoring tank leakage pump circuit for short circuit to ground Clear the DTC and retest Check and install a new diagnostic monitoring tank leakage pump as required
P240C-85	Evaporative Emission System Leak Detection Pump Heater Circuit High - Signal above allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Connector is disconnected, connector pin is backed out, connector pin corrosion Diagnostic monitoring tank leakage pump circuit, short circuit to power Diagnostic monitoring tank leakage pump failure 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Ignition on and engine running</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to electrical circuit diagrams and check the diagnostic monitoring tank leakage pump circuit for short circuit to power Clear the DTC and retest Check and install a new diagnostic monitoring tank leakage pump as required
P2418-00	Evaporative Emission Control System Switching Valve Control Circuit / Open - No sub type information	 <p>NOTE: Circuit reference O_S_TDMV</p> <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Diagnostic monitoring tank leakage pump circuit, open circuit, high resistance Diagnostic monitoring tank leakage pump failure 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Ignition on and engine running</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to electrical circuit diagrams and check the diagnostic monitoring tank leakage pump circuit for open circuit, high resistance Clear the DTC and retest Check and install a new diagnostic monitoring tank leakage pump as required
P2419-00	Evaporative Emission Control System Switching Valve Control Circuit Low - No sub type information	<ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Diagnostic monitoring tank leakage pump circuit, short circuit to ground Diagnostic monitoring tank leakage pump failure 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Ignition on and engine running</p> <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to electrical circuit diagrams and check the diagnostic monitoring tank leakage pump circuit for short circuit to ground Clear the DTC and retest Check and install a new diagnostic monitoring tank

			leakage pump as required
P2420-85	Evaporative Emission Control System Switching Valve Control Circuit High - Signal above allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified range Connector is disconnected, connector pin is backed out, connector pin corrosion Diagnostic monitoring tank leakage pump circuit, short circuit to power Diagnostic monitoring tank leakage pump failure 	 NOTE: Operational requirements needed to allow the monitor to be fully tested. Ignition on and engine running <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to electrical circuit diagrams and check the diagnostic monitoring tank leakage pump circuit for short circuit to power Clear the DTC and retest Check and install a new diagnostic monitoring tank leakage pump as required
P250A-12	Engine Oil Level Sensor Circuit - Circuit short to battery	<ul style="list-style-type: none"> The engine control module has detected a vehicle power measurement for a period longer than expected or has detected a vehicle power measurement when another value was expected Oil level sensor circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check oil level sensor circuit for short circuit power Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest
P250B-00	Engine Oil Level Sensor Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Oil level sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Oil level sensor failure 	 NOTE: Monitor description. Engine control module monitors the oil temperature from the sensor and sets the DTC if the temperature is not plausible <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check oil level sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new oil level sensor as required
P250B-25	Engine Oil Level Sensor Circuit Range/Performance - Signal shape/waveform failure	 NOTE: Circuit reference I_T_OCS <ul style="list-style-type: none"> Oil level sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Oil level sensor failure 	 NOTE: Monitor description. Engine control module monitors the PWM signal from the sensor and sets the DTC if an out of range signal is detected <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check oil level sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new oil level sensor as required
P250B-41	Engine Oil Level Sensor Circuit Range/Performance - General checksum failure	<ul style="list-style-type: none"> Oil level sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Oil level sensor failure 	 NOTE: Monitor description. Engine control module monitors the PWM signal from the sensor and sets the DTC if a checksum or watchdog error is detected <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check oil level sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance

			<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new oil level sensor as required
P250C-23	Engine Oil Level Sensor Circuit Low - Signal stuck low	<ul style="list-style-type: none"> The engine control module measures a signal that remains low when transitions are expected Oil level sensor circuit short circuit to ground, high resistance 	 NOTE: Monitor description. Engine control module monitors the input pin from the oil level sensor and sets the DTC if the input is low <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check oil level sensor circuit for short circuit to ground, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest
P250D-24	Engine Oil Level Sensor Circuit High - Signal stuck high	 NOTE: Circuit reference I_T_OCS <ul style="list-style-type: none"> The engine control module measures a signal that remains high when transitions are expected Oil level sensor circuit short circuit to power 	 NOTE: Monitor description. Engine control module monitors the input pin from the oil level sensor and sets the DTC if the input is high <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check oil level sensor circuit for short circuit to power Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest
P252B-00	Engine Oil Quality Sensor Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Oil level sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check oil level sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest
P252B-62	Engine Oil Quality Sensor Circuit Range/Performance - Signal compare failure	<ul style="list-style-type: none"> The engine control module detected failure when comparing two or more input parameters for plausibility Oil level sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check oil level sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest
P2541-84	Low Pressure Fuel System Sensor Circuit Low - Signal below allowable range	 NOTE: Circuit reference I_A_FLPS & O_V_5VFLPS <ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel low pressure sensor circuit, short circuit to ground Fuel low pressure sensor 5 volt power supply circuit, open circuit, high resistance Fuel low pressure sensor failure 	<ul style="list-style-type: none"> Check connector is not disconnected, connector pin is not backed out Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check fuel low pressure sensor circuit for short circuit to ground Check fuel low pressure sensor 5 volt power supply circuit for open circuit, high resistance Clear the DTC and retest Check and install new fuel low pressure sensor as required
P2542-85	Low Pressure Fuel System Sensor Circuit High - Signal above allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is above a specified 	<ul style="list-style-type: none"> Check connector is not disconnected, connector pin is not backed out Inspect connectors for signs of



		<p>range</p> <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Fuel low pressure sensor circuit, short circuit to power Fuel low pressure sensor ground supply circuit, open circuit, high resistance Fuel low pressure sensor failure 	<p>water ingress, and pins for damage and/or corrosion</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check fuel low pressure sensor circuit for short circuit to power Check fuel low pressure sensor ground supply circuit for open circuit, high resistance Clear the DTC and retest Check and install new fuel low pressure sensor as required
P2564-00	Turbocharger Boost Control Position Sensor A Circuit Low - No sub type information	 <p>NOTE: Circuit reference G_R_CBPP & I_A_CBPP & O_V_5VCBPP</p> <ul style="list-style-type: none"> Supercharger bypass valve actuator circuit short circuit to ground, short circuit to power, open circuit, high resistance Supercharger bypass valve actuator failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check supercharger bypass valve actuator circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new supercharger bypass valve actuator as required
P2565-00	Turbocharger Boost Control Position Sensor A Circuit High - No sub type information	 <p>NOTE: Circuit reference G_R_CBPP & I_A_CBPP & O_V_5VCBPP</p> <ul style="list-style-type: none"> Supercharger bypass valve actuator circuit short circuit to ground, short circuit to power, open circuit, high resistance Supercharger bypass valve actuator failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check supercharger bypass valve actuator circuit for short circuit to ground, short circuit to power, open circuit, high resistance Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Clear the DTC and retest Check and install new supercharger bypass valve actuator as required
P25A2-00	Brake System Control Module Requested MIL Illumination - No sub type information	<ul style="list-style-type: none"> Anti-lock brake system failure High speed CAN bus failure Fuse failure High speed CAN bus circuit, short circuit to ground, short circuit to power, open circuit Anti-lock brake system control module power circuit failure Anti-lock brake system control module ground circuit failure 	 <p>NOTE: Monitor description. Anti-lock brake system control module is indicating a fault to the engine control module that could have emission failure conditions therefore requests the MIL</p> <ul style="list-style-type: none"> Check anti-lock brake system control module for additional DTCs and refer to relevant DTC index. Rectify these first Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and check high speed CAN network for short circuit to ground, short circuit to power, open circuit Refer to the electrical circuit diagrams and check anti-lock brake system control module power and ground circuits for open circuit Clear the DTC and retest
P2601-00	Coolant Pump "A" Control Circuit performance / Stuck Off - No sub type information	 <p>NOTE: Circuit reference O_S_CACWPR</p> <ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Air charge coolant pump relay circuit short circuit to ground, 	<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check air charge coolant pump relay circuit for short circuit to ground, short circuit to power, open circuit, high resistance




		<ul style="list-style-type: none"> short circuit to power, open circuit, high resistance Air charge coolant pump relay failure 	<ul style="list-style-type: none"> Clear the DTC and retest Check and install new air charge coolant pump relay as required
P2610-00	ECM/PCM Engine Off Timer Performance - No sub type information	<ul style="list-style-type: none"> CAN network failure Invalid CAN data received from central junction box 	 <p>NOTE: Monitor description. Engine control module monitors the global time and checks if it plausible</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required Refer to the electrical circuit diagrams and check the power and ground connections to the central junction box Check central junction box for related DTCs and refer to relevant DTC index Clear the DTC and retest
P2610-84	ECM/PCM Engine Off Timer Performance - Signal below allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range Vehicle battery has been isolated and the global time does not increment. Warm coolant has been replaced with cold coolant Rapid engine temperature cooling with rapid ambient temperature rise 	 <p>NOTE: Monitor description. The engine control module will set a DTC if the engine off time calculated from the global time in the instrument cluster/central junction box is less than 1hr, when the shutdown temperature was fully warm, and the coolant 1 temperature at start is significantly cooled down to ambient temp</p> <ul style="list-style-type: none"> Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the power and ground connections to the module Refer to the electrical circuit diagrams and check connections are secure and wiring integrity for coolant temperature sensor and ambient temperature sensor Clear the DTC and retest
P2610-87	ECM/PCM Engine Off Timer Performance - Missing message	<ul style="list-style-type: none"> CAN network failure Central junction box not transmitting CAN data 	 <p>NOTE: Monitor description. Engine control module monitors the global time on CAN. If global time is not received then this DTC is set</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required Refer to the electrical circuit diagrams and check the power and ground connections to the central junction box Check central junction box for related DTCs and refer to relevant DTC index Clear the DTC and retest
P2626-13	O2 Sensor Positive Current Trim Circuit / Open Bank 1	<ul style="list-style-type: none"> The engine control module has determined an open circuit via 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check heated




	Sensor 1 - Circuit open	<p>lack of bias voltage, low current flow, no change in the state of an input in response to an output</p> <ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<p>oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
P2629-00	O2 Sensor Positive Current Trim Circuit / Open Bank 2 Sensor 1 - No sub type information	<ul style="list-style-type: none"> • Heated oxygen sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Connector is disconnected, connector pin is backed out, connector pin corrosion • Heated oxygen sensor failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check heated oxygen sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Inspect connectors for signs of water ingress, and pins for damage and/or corrosion • Clear the DTC and retest • Check and install new heated oxygen sensor as required
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> • The engine control module has determined failures where a data bus is not available • High speed CAN bus failure • High speed CAN bus circuit, short circuit to ground, short circuit to power, open circuit • The engine control module has not received the expected CAN signal from the terrain response switchpack within the specified time interval • CAN harness link between engine control module and terrain response switchpack network malfunction 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system carry out network integrity test • Refer to the electrical circuit diagrams and check high speed CAN network for short circuit to ground, short circuit to power, open circuit • Using the manufacturer approved diagnostic system, check terrain response switchpack for DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check terrain response switchpack power and ground circuits for open circuit. Check CAN harness between engine control module and terrain response switchpack, repair as necessary
U0002-00	High Speed CAN Communication Bus Performance - No sub type information	<ul style="list-style-type: none"> • High speed CAN short circuit to ground • High speed CAN short circuit to power 	<p> NOTE: Engine control module will use default CAN signal values</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check high speed CAN for short circuit to ground • Refer to the electrical circuit diagrams and check high speed CAN for short circuit to power
U0010-88	Medium Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> • The engine control module has determined failures where a data bus is not available • Medium speed CAN bus failure • Medium speed CAN bus circuit, short circuit to ground, short circuit to power, open circuit 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system carry out network integrity test • Refer to the electrical circuit diagrams and check medium speed CAN network for short circuit to ground, short circuit to power, open circuit
U0101-00	Lost Communication with TCM - No sub type information	<ul style="list-style-type: none"> • The engine control module has not received the expected CAN signal from the transmission control module within the specified time interval • CAN harness link between engine control module and transmission control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check transmission control module for DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system, complete a CAN network

		network malfunction	integrity test. Refer to the electrical circuit diagrams and check transmission control module power and ground circuits for open circuit. Check CAN harness between engine control module and transmission control module, repair as necessary
U0102-00	Lost Communication with Transfer Case Control Module - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the transfer case control module within the specified time interval CAN harness link between engine control module and transfer case control module network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check transfer case control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check transfer case control module power and ground circuits for open circuit. Check CAN harness between engine control module and transfer case control module, repair as necessary
U0103-00	Lost Communication With Gear Shift Control Module A - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the transmission control switch within the specified time interval CAN harness link between engine control module and transmission control switch network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check transmission control switch for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check transmission control switch power and ground circuits for open circuit. Check CAN harness between engine control module and transmission control switch, repair as necessary
U0104-00	Lost Communication With Cruise Control Module - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the speed control module within the specified time interval CAN harness link between engine control module and speed control module network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check speed control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check speed control module power and ground circuits for open circuit. Check CAN harness between engine control module and speed control module, repair as necessary
U0121-00	Lost Communication With Anti-Lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the anti-lock brake system control module within the specified time interval CAN harness link between engine control module and anti-lock brake system control module network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check anti-lock brake system control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check anti-lock brake system control module power and ground circuits for open circuit. Check CAN harness between engine control module and anti-lock brake system control module, repair as necessary


U0128-00	Lost Communication With Park Brake Control Module - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the parking brake control module within the specified time interval CAN harness link between engine control module and parking brake control module network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check parking brake control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check parking brake control module power and ground circuits for open circuit. Check CAN harness between engine control module and parking brake control module, repair as necessary
U012A-00	Lost Communication with Chassis Control Module "A" - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the integrated suspension control module within the specified time interval CAN harness link between engine control module and integrated suspension control module network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check integrated suspension control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and check integrated suspension control module power and ground circuits for open circuit Check CAN harness between engine control module and integrated suspension control module, repair as necessary
U012B-00	Lost Communication with Chassis Control Module "B" - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the integrated suspension control module within the specified time interval CAN harness link between engine control module and integrated suspension control module network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check integrated suspension control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and check integrated suspension control module power and ground circuits for open circuit Check CAN harness between engine control module and integrated suspension control module, repair as necessary
U0140-00	Lost Communication With Body Control Module - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the central junction box within the specified time interval CAN harness link between engine control module and central junction box network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check central junction box for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check central junction box power and ground circuits for open circuit. Check CAN harness between engine control module and central junction box, repair as necessary
U0146-00	Lost Communication With Gateway "A" - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the gateway control module within the specified time interval CAN harness link between engine control module and 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check gateway control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system,





		gateway control module network malfunction	<p>complete a CAN network integrity test</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check gateway control module power and ground circuits for open circuit Check CAN harness between engine control module and gateway control module, repair as necessary
U0151-00	Lost Communication With Restraints Control Module - No sub type information	 <p>NOTE: Circuit reference I_F_CRASH</p> <ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the restraints control module within the specified time interval CAN harness link between engine control module and restraints control module network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check restraints control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check restraints control module power and ground circuits for open circuit. Check CAN harness between engine control module and restraints control module, repair as necessary
U0151-08	Lost Communication With Restraints Control Module - Bus Signal / Message Failures	 <p>NOTE: Circuit reference I_F_CRASH</p> <ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the restraints control module within the specified time interval CAN harness link between engine control module and restraints control module network malfunction 	<ul style="list-style-type: none"> If this DTC is logged with U0151-00 & B10A2-32, check for fuse failure, restraints control module power and ground circuits for open circuit. Refer to the electrical circuit diagrams and check CAN harness If this DTC is logged with B10A2-32, or on its own refer to the electrical circuit diagrams and check restraints control module crash signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check restraints control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check restraints control module power and ground circuits for open circuit. Check CAN harness between engine control module and restraints control module, repair as necessary
U0155-00	Lost Communication With Instrument Panel Cluster (IPC) Control Module - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected CAN signal from the instrument cluster within the specified time interval CAN harness link between engine control module and instrument cluster network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check instrument cluster for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and check instrument cluster power and ground circuits for open circuit. Check CAN harness between engine control module and instrument cluster, repair as necessary
U0167-00	Lost Communication With Vehicle Immobilizer	<ul style="list-style-type: none"> Power is lost from the engine control module or the central 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the power


	Control Module - No sub type information	junction box during the Immobilizer learn routine	<p>and ground connections to the engine control module and central junction box</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, carry out the immobilisation procedure Check for CAN network interference/engine control module related errors
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> The engine control module has not received the expected master configuration data transmitted from the vehicle Engine control module hardware part incorrect for application Engine control module software part incorrect for application 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check CAN network circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check engine control module hardware part is correct for application Check engine control module software part is correct for application
U0402-00	Invalid Data Received from TCM - No sub type information	<ul style="list-style-type: none"> Engine control module relay circuit short circuit to ground, short circuit to power, open circuit, high resistance Stop/ start failure indicated to the engine control module by the transmission control module 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check engine control module relay circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check transmission control module for related DTCs and refer to relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required
U0402-29	Invalid Data Received from TCM - Signal invalid	<ul style="list-style-type: none"> The value of the signal measured by the engine control module is not plausible given the operating conditions CAN network failure Implausible CAN data received from transmission control module 	<p> NOTE: Monitor description. Integrity check of transmission control module CAN signal</p> <ul style="list-style-type: none"> Check transmission control module for related DTCs and refer to relevant DTC index Check transmission control switch for related DTCs and refer to relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required
U0402-41	Invalid Data Received from TCM - General checksum failure	<ul style="list-style-type: none"> CAN network failure Implausible CAN data received from transmission control module 	<p> NOTE: Monitor description. Monitors transmission control module CAN data for erroneous alive counter, checksum, complement information</p> <ul style="list-style-type: none"> Check transmission control module for related DTCs and refer to relevant DTC index Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required
U0402-62	Invalid Data Received from TCM - Signal compare failure	<ul style="list-style-type: none"> The engine control module detected failure when comparing two or more input 	<p> NOTE: Monitor description.</p>




		<p>parameters for plausibility</p> <ul style="list-style-type: none"> • CAN network failure • Implausible CAN data received from transmission control module 	<p>Integrity check of transmission control module CAN signal</p> <ul style="list-style-type: none"> • Check transmission control module for related DTCs and refer to relevant DTC index • Check transmission control switch for related DTCs and refer to relevant DTC index • Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required
U0402-67	Invalid Data Received from TCM - Signal incorrect after event	<ul style="list-style-type: none"> • CAN network failure • Implausible CAN data received from transmission control module 	<p> NOTE: Monitor description. Integrity check of transmission control module CAN signal</p> <ul style="list-style-type: none"> • Check transmission control module for related DTCs and refer to relevant DTC index • Check transmission control switch for related DTCs and refer to relevant DTC index • Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required
U0402-82	Invalid Data Received from TCM - Alive / sequence counter incorrect / not updated	<ul style="list-style-type: none"> • CAN network failure • Implausible CAN data received from transmission control module 	<p> NOTE: Monitor description. Integrity check of transmission control module CAN signal</p> <ul style="list-style-type: none"> • Check transmission control module for related DTCs and refer to relevant DTC index • Check transmission control switch for related DTCs and refer to relevant DTC index • Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required
U0402-83	Invalid Data Received from TCM - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> • CAN network failure • Implausible CAN data received from transmission control module 	<p> NOTE: Monitor description. Integrity check of transmission control module CAN signal</p> <ul style="list-style-type: none"> • Check transmission control module for related DTCs and refer to relevant DTC index • Check transmission control switch for related DTCs and refer to relevant DTC index • Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required
U0404-00	Invalid Data Received from Gear Shift Control Module A - No sub type information	<ul style="list-style-type: none"> • CAN network failure • Invalid CAN data received from transmission control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair




			<p>harness as required</p> <ul style="list-style-type: none"> • Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first • Check transmission control switch for related DTCs and refer to relevant DTC index • Refer to the electrical circuit diagrams and check the power and ground connections to the transmission control switch • Clear the DTC and retest
U0404-41	Invalid Data Received from Gear Shift Control Module A - General checksum failure	<ul style="list-style-type: none"> • CAN network failure • Invalid CAN data received from transmission control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required • Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first • Check transmission control switch for related DTCs and refer to relevant DTC index • Refer to the electrical circuit diagrams and check the power and ground connections to the transmission control switch • Clear the DTC and retest
U0404-82	Invalid Data Received from Gear Shift Control Module A - Alive / sequence counter incorrect / not updated	<ul style="list-style-type: none"> • CAN network failure • Invalid CAN data received from transmission control switch 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required • Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first • Check transmission control switch for related DTCs and refer to relevant DTC index • Refer to the electrical circuit diagrams and check the power and ground connections to the transmission control switch • Clear the DTC and retest
U0404-83	Invalid Data Received from Gear Shift Control Module A - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> • CAN network failure • Invalid CAN data received from transmission control switch 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required • Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first • Check transmission control switch for related DTCs and refer to relevant DTC index • Refer to the electrical circuit diagrams and check the power and ground connections to the transmission control switch • Clear the DTC and retest
U0405-68	Invalid Data Received From Cruise Control Module - Event information	<ul style="list-style-type: none"> • Speed control system failure • Speed control buttons jammed/contaminated/damaged • Clock spring failure 	<ul style="list-style-type: none"> • Check speed control module for additional DTCs and refer to relevant DTC index • Check speed control buttons and clock spring are not jammed/contaminated/damaged

			<ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the power supply and ground connections to the speed control module Clear the DTC and retest
U0405-82	Invalid Data Received From Cruise Control Module - Alive / sequence counter incorrect / not updated	<ul style="list-style-type: none"> Speed control system failure Speed control buttons jammed/contaminated/damaged Clock spring failure 	<ul style="list-style-type: none"> Check speed control module for additional DTCs and refer to relevant DTC index Check speed control buttons and clock spring are not jammed/contaminated/damaged Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the power supply and ground connections to the speed control module Clear the DTC and retest
U0405-84	Invalid Data Received From Cruise Control Module - Signal below allowable range	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is below a specified range Speed control system failure Speed control buttons jammed/contaminated/damaged Clock spring failure 	<ul style="list-style-type: none"> Check speed control module for additional DTCs and refer to relevant DTC index Check speed control buttons and clock spring are not jammed/contaminated/damaged Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the power supply and ground connections to the speed control module Clear the DTC and retest
U0405-86	Invalid Data Received From Cruise Control Module - Signal invalid	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is not plausible given the operating conditions Speed control system failure Speed control buttons jammed/contaminated/damaged Clock spring failure 	<ul style="list-style-type: none"> Check speed control module for additional DTCs and refer to relevant DTC index Check speed control buttons and clock spring are not jammed/contaminated/damaged Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check the power supply and ground connections to the speed control module Clear the DTC and retest
U0415-02	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - General signal failure	<ul style="list-style-type: none"> Other anti-lock brake system control module DTCs are set High speed CAN bus failure Fuse failure High speed CAN bus circuit, short circuit to ground, short circuit to power, open circuit Anti-lock brake system control module power circuit failure Anti-lock brake system control module ground circuit failure 	 NOTE: Monitor description. The anti-lock brake system control module CAN messages are being updated on the CAN bus. If the data is not updated and correctly formatted periodically a DTC is set. The monitor is operational when the ignition is ON <ul style="list-style-type: none"> Check anti-lock brake system control module for additional DTCs and refer to relevant DTC index. Rectify these first Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and check high speed CAN network for short circuit to ground, short circuit to power, open circuit Refer to the electrical circuit diagrams and check anti-lock brake system control module power and ground circuits for

			open circuit
U0415-29	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - Signal invalid	<ul style="list-style-type: none"> The value of the signal measured by the engine control module is not plausible given the operating conditions High speed CAN bus failure Fuse failure High speed CAN bus circuit, short circuit to ground, short circuit to power, open circuit Anti-lock brake system control module power circuit failure Anti-lock brake system control module ground circuit failure 	 <p>NOTE: Monitor description. The anti-lock brake system control module CAN messages are being updated on the CAN bus. If the data is not updated and correctly formatted periodically a DTC is set. The monitor is operational when the ignition is ON</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and check high speed CAN network for short circuit to ground, short circuit to power, open circuit Refer to the electrical circuit diagrams and check anti-lock brake system control module power and ground circuits for open circuit
U0415-41	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - General checksum failure	<ul style="list-style-type: none"> Other anti-lock brake system control module DTCs are set High speed CAN bus failure Fuse failure High speed CAN bus circuit, short circuit to ground, short circuit to power, open circuit Anti-lock brake system control module power circuit failure Anti-lock brake system control module ground circuit failure 	 <p>NOTE: Monitor description. The anti-lock brake system control module CAN messages are being updated on the CAN bus. If the data is not updated and correctly formatted periodically a DTC is set. The monitor is operational when the ignition is ON</p> <ul style="list-style-type: none"> Check anti-lock brake system control module for additional DTCs and refer to relevant DTC index. Rectify these first Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and check high speed CAN network for short circuit to ground, short circuit to power, open circuit Refer to the electrical circuit diagrams and check anti-lock brake system control module power and ground circuits for open circuit
U0415-62	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - Signal compare failure	<ul style="list-style-type: none"> The engine control module detected failure when comparing two or more input parameters for plausibility Stop/ start system failure Harness failure - Wiring integrity anti-lock brake system control module 	 <p>NOTE: Monitor description. Monitors the compliment of the anti-lock brake system control module CAN signal engine running request</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check anti-lock brake system control module for DTCs and refer to the relevant DTC index Refer to the electrical circuit diagrams and check connections are secure and wiring integrity
U0415-82	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - Alive / sequence counter incorrect / not updated	<ul style="list-style-type: none"> High speed CAN bus failure Fuse failure High speed CAN bus circuit, short circuit to ground, short circuit to power, open circuit Anti-lock brake system control module power circuit failure Anti-lock brake system control module ground circuit failure 	 <p>NOTE: Monitor description. The anti-lock brake system control module CAN messages are being updated on the CAN bus. If the data is not updated and correctly formatted periodically a DTC is set. The monitor is operational when the ignition is ON</p> <ul style="list-style-type: none"> Using the manufacturer

			<p>approved diagnostic system, complete a CAN network integrity test</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check high speed CAN network for short circuit to ground, short circuit to power, open circuit Refer to the electrical circuit diagrams and check anti-lock brake system control module power and ground circuits for open circuit
U0415-83	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> High speed CAN bus failure Fuse failure High speed CAN bus circuit, short circuit to ground, short circuit to power, open circuit Anti-lock brake system control module power circuit failure Anti-lock brake system control module ground circuit failure 	 NOTE: Monitor description. The anti-lock brake system control module CAN messages are being updated on the CAN bus. If the data is not updated and correctly formatted periodically a DTC is set. The monitor is operational when the ignition is ON <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and check high speed CAN network for short circuit to ground, short circuit to power, open circuit Refer to the electrical circuit diagrams and check anti-lock brake system control module power and ground circuits for open circuit
U0416-46	Invalid Data Received From Vehicle Dynamics Control Module - Calibration / parameter memory failure	<ul style="list-style-type: none"> CAN network failure Invalid CAN data received from anti-lock brake system control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Check anti-lock brake system control module for related DTCs and refer to relevant DTC index Refer to the electrical circuit diagrams and check the power and ground connections to the anti-lock brake system control module Clear the DTC and retest
U0416-68	Invalid Data Received From Vehicle Dynamics Control Module - Event information	<ul style="list-style-type: none"> The engine control module has received the default brake pressure signal value over CAN from the anti-lock brake system control module for a specified time interval Anti-lock brake system failure CAN harness link between engine control module and anti-lock brake system control module network malfunction 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check anti-lock brake system control module for DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system carry out network integrity test. Refer to the electrical circuit diagrams and check anti-lock brake system control module power and ground circuits for open circuit. Check CAN harness between engine control module and anti-lock brake system control module, repair as necessary
U0426-00	Invalid Data Received From Vehicle Immobilizer Control Module - No sub	<ul style="list-style-type: none"> Electric steering column lock has received an invalid identity response 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network

	type information	<ul style="list-style-type: none"> Module substituted 	<p>integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required. Using the manufacturer approved diagnostic system check and update the car configuration file as required</p> <ul style="list-style-type: none"> Ensure all modules installed in the vehicle which store vehicle identity are valid for this vehicle and are not substitutes from a donor vehicle
U042B-29	Invalid Data Received from Chassis Control Module, A - Signal invalid	<ul style="list-style-type: none"> The value of the signal measured by the engine control module is not plausible given the operating conditions Fuse failure High speed CAN bus failure High speed CAN bus circuit, short circuit to ground, short circuit to power, open circuit Integrated suspension control module failure 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Ignition on</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check integrated suspension control module power and ground circuits for open circuit Check integrated suspension control module for additional DTCs and refer to relevant DTC index. Rectify these first Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and check high speed CAN network for short circuit to ground, short circuit to power, open circuit Clear the DTC and retest
U042B-68	Invalid Data Received from Chassis Control Module, A - Event information	<ul style="list-style-type: none"> Fuse failure High speed CAN bus failure High speed CAN bus circuit, short circuit to ground, short circuit to power, open circuit 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Ignition on</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check integrated suspension control module power and ground circuits for open circuit Check integrated suspension control module for additional DTCs and refer to relevant DTC index. Rectify these first Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and check high speed CAN network for short circuit to ground, short circuit to power, open circuit Clear the DTC and retest
U042B-82	Invalid Data Received from Chassis Control Module, A - Alive/sequence counter incorrect/not updated	<ul style="list-style-type: none"> Fuse failure High speed CAN bus failure High speed CAN bus circuit, short circuit to ground, short circuit to power, open circuit Integrated suspension control module failure 	 <p>NOTE: Operational requirements needed to allow the monitor to be fully tested. Ignition on</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check integrated suspension control module power and ground circuits for open circuit Check integrated suspension control module for additional DTCs and refer to relevant DTC index. Rectify these first Using the manufacturer

			<p>approved diagnostic system, complete a CAN network integrity test</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check high speed CAN network for short circuit to ground, short circuit to power, open circuit Clear the DTC and retest
U0447-00	Invalid Data Received From Gateway "A" - No sub type information	<ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Harness failure - Wiring integrity dual battery system Harness failure - Wiring integrity gateway module 	 NOTE: Monitor description. Engine control module has been informed of a failure within the dual battery system <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Clear the DTC and retest
U0452-00	Invalid Data Received From Restraints Control Module - No sub type information	<ul style="list-style-type: none"> Connector is disconnected, connector pin is backed out, connector pin corrosion Harness failure - Wiring integrity seat belt sensor Harness failure - Wiring integrity gateway module 	 NOTE: Monitor description. Engine control module has been informed of a failure within the seat belt sensor <ul style="list-style-type: none"> Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Refer to the electrical circuit diagrams and check connections are secure and wiring integrity Clear the DTC and retest
U0592-00	Invalid Data Received From Gear Shift Control Module B - No sub type information	<ul style="list-style-type: none"> CAN network failure Invalid CAN data received from transmission control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair harness as required Check engine control module for additional DTCs and refer to relevant DTC index. Rectify these first Check transmission control switch for related DTCs and refer to relevant DTC index Refer to the electrical circuit diagrams and check the power and ground connections to the transmission control switch Clear the DTC and retest
U1A14-00	CAN Initialisation Failure - No sub type information	<ul style="list-style-type: none"> Harness fault - CAN circuit Engine control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and check CAN circuits. Repair wiring harness as required Inspect connectors for signs of water ingress, and pins for damage and/or corrosion Check and install a new engine control module as required
U2012-00	Car Configuration Parameter(s) - No sub type information	<ul style="list-style-type: none"> Car configuration signal not received Car configuration file incorrect Harness fault - CAN circuit Central junction box not transmitting some or all of the car configuration CAN data 	 NOTE: Monitor description. Car configuration parameter received from central junction box is outside the designated limits allowed <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system

			<p>check and up-date the car configuration file as required</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check CAN circuits. Repair wiring harness as required Check the central junction box for related DTCs and refer to the relevant DTC index Clear the DTC and re-test
U2108-00	Adaptive Cruise Control - No sub type information	<ul style="list-style-type: none"> Adaptive speed control system failure - Error indicating adaptive speed control failure flag set 	<ul style="list-style-type: none"> Check adaptive speed control module for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required
U2108-24	Adaptive Cruise Control - Signal stuck high	<ul style="list-style-type: none"> The engine control module measures a signal that remains high when transitions are expected Adaptive speed control system failure - Adaptive speed control follow speed error 	<ul style="list-style-type: none"> Check adaptive speed control module for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required
U2108-64	Adaptive Cruise Control - Signal plausibility failure	<ul style="list-style-type: none"> The engine control module detected plausibility failures Adaptive speed control system failure - Adaptive speed control follow speed range error 	<ul style="list-style-type: none"> Check adaptive speed control module for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required
U2108-68	Adaptive Cruise Control - Event information	<ul style="list-style-type: none"> Adaptive speed control system failure - Error indicating adaptive speed control follow speed check when stationary 	<ul style="list-style-type: none"> Check adaptive speed control module for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required
U2108-86	Adaptive Cruise Control - Signal invalid	<ul style="list-style-type: none"> The engine control module has determined failures where some circuit quantity, reported via serial data, is not plausible given the operating conditions Adaptive speed control system failure - Error when invalid adaptive speed control resume requests are present 	<ul style="list-style-type: none"> Check adaptive speed control module for DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required

General Information - Diagnostic Trouble Code (DTC) Index DTC: Fuel Fired Booster Heater Control Module (FFBH)

Description and Operation

Fuel Fired Booster Heater (FFBH)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.






Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.


The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Fuel Fired Booster Heater (FFBH). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: Fuel Fired Booster Heater (412-02B, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1206-53	Crash Occurred - Deactivated	<ul style="list-style-type: none"> Crash signal received from restraints control module 	<p>NOTE: Fuel fired booster heater operation is inhibited when this DTC is set.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the restraints control module for related DTCs and refer to the relevant DTC index
B1D22-11	Coolant Temperature Sensor - Circuit short to ground	<ul style="list-style-type: none"> Fuel fired booster heater coolant temperature sensor circuit short circuit to ground 	<ul style="list-style-type: none"> Install a new fuel fired booster heater coolant temperature sensor as necessary. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013)
B1D22-15	Coolant Temperature Sensor - Circuit short to battery or open	<ul style="list-style-type: none"> Fuel fired booster heater coolant temperature sensor circuit short circuit to 	<ul style="list-style-type: none"> Install a new fuel fired booster heater coolant temperature sensor as necessary. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013)

		power, open circuit, high resistance	
B1D23-13	Overheat Sensor - Circuit open	<ul style="list-style-type: none"> Fuel fired booster heater coolant temperature sensor circuit open circuit, high resistance 	<ul style="list-style-type: none"> Install a new fuel fired booster heater coolant temperature sensor as necessary. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013)
B1D24-11	Glow Plug - Circuit short to ground	<ul style="list-style-type: none"> Fuel fired booster heater glow plug circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel fired booster heater glow plug circuit for short circuit to ground. Install a new fuel fired booster heater glow plug as necessary. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013)
B1D24-15	Glow Plug - Circuit short to battery or open	<ul style="list-style-type: none"> Fuel fired booster heater glow plug circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel fired booster heater glow plug circuit for short circuit to power, open circuit, high resistance. Install a new fuel fired booster heater glow plug as necessary. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013)
B1D25-11	Heater Fuel Pump - Circuit short to ground	<ul style="list-style-type: none"> Fuel fired booster heater fuel pump circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel fired booster heater fuel pump circuit for short circuit to ground
B1D25-15	Heater Fuel Pump - Circuit short to battery or open	<ul style="list-style-type: none"> Fuel fired booster heater fuel pump circuit short circuit to battery, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel fired booster heater fuel pump circuit for short circuit to power, open circuit, high resistance
B1D26-11	Combustion Air Blower - Circuit short to ground	<ul style="list-style-type: none"> Fuel fired booster heater internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013). If the fault persists, install a new fuel fired booster heater
B1D26-15	Combustion Air Blower - Circuit short to battery or open	<ul style="list-style-type: none"> Fuel fired booster heater internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013). If the fault persists, install a new fuel fired booster heater
B1D26-92	Combustion Air Blower - Performance or incorrect operation	<ul style="list-style-type: none"> Fuel fired booster heater internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013). If the fault persists, install a new fuel fired booster heater
B1D26-93	Combustion Air Blower - No operation	<ul style="list-style-type: none"> Fuel fired booster heater internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013). If the fault persists, install a new fuel fired booster heater
B1D27-11	Heater Coolant Pump - Circuit short to ground	 NOTE: Circuit reference + <ul style="list-style-type: none"> Fuel fired booster heater coolant pump circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel fired booster heater coolant pump circuit for short circuit to ground
B1D27-15	Heater Coolant Pump - Circuit short to battery or open	 NOTE: Circuit reference + <ul style="list-style-type: none"> Fuel fired booster heater coolant pump 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel fired booster heater coolant pump circuit for short circuit to power, open circuit, high resistance

		<p>circuit short circuit to power, open circuit, high resistance</p>	
B1D28-11	Fuel Pre-heater - Circuit short to ground	<ul style="list-style-type: none"> Fuel fired booster heater glow plug circuit short circuit to ground 	 <p>NOTE: The pre heat is performed by the ignition glow plug</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel fired booster heater glow plug circuit for short circuit to ground. Install a new fuel fired booster heater glow plug as necessary. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013). If the fault persists, install a new fuel fired booster heater
B1D28-15	Fuel Pre-heater - Circuit short to battery or open	<ul style="list-style-type: none"> Fuel fired booster heater glow plug circuit short circuit to power, open circuit, high resistance 	 <p>NOTE: The pre heat is performed by the ignition glow plug</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel fired booster heater glow plug circuit for short circuit to power, open circuit, high resistance. Install a new fuel fired booster heater glow plug as necessary. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013). If the fault persists, install a new fuel fired booster heater
B1D29-93	No Start, Even After Restart Attempt - No operation	<ul style="list-style-type: none"> No fuel present at fuel fired booster heater module Fuel fired booster heater air intake blocked Fuel fired booster heater exhaust system blocked 	<ul style="list-style-type: none"> Check vehicle fuel level. Check fuel lines to fuel fired booster heater module for blockage, kinking or damage. Check fuel for aeration and correct fuel delivery. Check that the vehicle is not parked on an incline when the fuel fired booster heater is operated. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013) Check the fuel fired booster heater air intake for blockage, kinking or damage. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013) Check the fuel fired booster heater exhaust system for blockage, kinking or damage. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013)
B1D30-93	No Start In Test Mode - No operation	<ul style="list-style-type: none"> No fuel present at fuel fired booster heater module Fuel fired booster heater air intake blocked Fuel fired booster heater exhaust system blocked 	<ul style="list-style-type: none"> Check vehicle fuel level. Check fuel lines to fuel fired booster heater module for blockage, kinking or damage. Check fuel for aeration and correct fuel delivery. Check that the vehicle is not parked on an incline when the fuel fired booster heater is operated. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013) Check the fuel fired booster heater air intake for blockage, kinking or damage. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013) Check the fuel fired booster heater exhaust system for blockage, kinking or damage. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013)
B1D31-94	Flame Detected Prior to Normal Operation - Unexpected operation	<ul style="list-style-type: none"> Fuel fired booster heater glow plug circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: The glow plug and flame sensor are a combined unit</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the fuel fired booster heater glow plug circuit for short circuit to ground, short circuit to power, open circuit, high resistance. Install a new fuel fired booster heater glow plug as necessary. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013)
B1D32-92	Multiple Flame Interruption During Heating Cycle - Performance or incorrect operation	<ul style="list-style-type: none"> No fuel present at fuel fired booster heater module Fuel fired booster heater air intake blocked Fuel fired 	<ul style="list-style-type: none"> Check vehicle fuel level. Check fuel lines to fuel fired booster heater module for blockage, kinking or damage. Check fuel for aeration and correct fuel delivery. Check that the vehicle is not parked on an incline when the fuel fired booster heater is operated. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013) Check the fuel fired booster heater air intake for blockage, kinking or damage. Using the manufacturer

		booster heater exhaust system blocked	<p>approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013)</p> <ul style="list-style-type: none"> Check the fuel fired booster heater exhaust system for blockage, kinking or damage. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013)
B1D33-92	Flame Interruption During Normal Operation - Performance or incorrect operation	<ul style="list-style-type: none"> No fuel present at fuel fired booster heater module Fuel fired booster heater air intake blocked Fuel fired booster heater exhaust system blocked 	<ul style="list-style-type: none"> Check vehicle fuel level. Check fuel lines to fuel fired booster heater module for blockage, kinking or damage. Check fuel for aeration and correct fuel delivery. Check that the vehicle is not parked on an incline when the fuel fired booster heater is operated. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013) Check the fuel fired booster heater air intake for blockage, kinking or damage. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013) Check the fuel fired booster heater exhaust system for blockage, kinking or damage. Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013)
B1D34-68	Heater In Lock Out Mode - Event information	<ul style="list-style-type: none"> Fuel fired booster heater system fault 	<p> NOTE: This DTC is for information only. Diagnose and rectify other fuel fired booster heater DTCs first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013)
B1D63-11	External Control Relay - Circuit short to ground	<ul style="list-style-type: none"> Fuel fired booster heater internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013). If the fault persists, install a new fuel fired booster heater
B1D63-15	External Control Relay - Circuit short to battery or open	<ul style="list-style-type: none"> Fuel fired booster heater internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013). If the fault persists, install a new fuel fired booster heater
U0010-00	Medium Speed CAN Communication Bus - No sub type information	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0028-08	Vehicle Communication Bus A - Bus signal/message failures	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> Fuel fired booster heater is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the fuel fired booster heater with the latest level software
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U3000-16	Control Module - Circuit voltage below threshold	<ul style="list-style-type: none"> Fuel fired booster heater power or ground circuit open circuit, high resistance Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the electrical circuit diagrams and check the fuel fired booster heater power and ground circuits for open circuit, high resistance Refer to the relevant section of the workshop manual and test the battery and charging system
U3000-	Control Module	<ul style="list-style-type: none"> Battery/charging 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system,

17	- Circuit voltage above threshold	system fault	check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the relevant section of the workshop manual and test the battery and charging system
U3000-43	Control Module - Special memory failure	<ul style="list-style-type: none"> Fuel fired booster heater internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013). If the fault persists, install a new fuel fired booster heater
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> Fuel fired booster heater internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - AHCM Operation Check (0x9013). If the fault persists, install a new fuel fired booster heater
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> Mismatch between the voltage at the fuel fired booster heater and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02) - and compare it to battery voltage. Refer to the electrical circuit diagrams and check the fuel fired booster heater power and ground circuits for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Gateway Module (GWM)

Description and Operation

Gateway Module (GWM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.











Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.








The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Gateway Module (GWM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.



For additional information, refer to: [Charging System](#) (414-00 Battery and Charging System - General Information, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B11DB-49	Battery Monitoring Module "A" - Internal electronic failure	<ul style="list-style-type: none"> Battery monitoring system control module - Internal failure 	<p>NOTE: Disconnect the primary battery for 60 seconds before continuing</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new battery monitoring system control module as required
B11DB-87	Battery Monitoring Module "A" - Missing message	<p>NOTE: Circuit reference LIN 1</p> <ul style="list-style-type: none"> LIN bus circuit fault 	<ul style="list-style-type: none"> Check the integrity of the battery monitoring system control module connector and rectify as required. Refer to the electrical circuit diagrams and check the power supply circuit between the battery positive terminal and the battery monitoring system control module for short circuit to ground, open circuit, high resistance. Repair circuit as required. Clear DTC and retest If fault persists, refer to the electrical circuit diagrams and check the LIN bus circuit between the gateway module and the battery monitoring

			<p>system control module for short circuit to ground, short circuit to power, open circuit, high resistance. Repair circuit as required. Clear DTC and retest</p> <ul style="list-style-type: none"> • If the fault persists, install a new battery monitoring system control module as required
B13C5-92	Secondary Battery - Performance or incorrect operation	 <p>NOTE: Circuit reference V BATT 2</p> <ul style="list-style-type: none"> • Secondary battery connectors insecure • Power supply distribution box circuit - Open circuit, high resistance • Secondary battery system fault • Charging system fault 	<ul style="list-style-type: none"> • Check the integrity of the secondary battery circuit connections at the battery terminals and at the power supply distribution box. Rectify as required • Refer to the electrical circuit diagrams and check the power supply distribution box circuit for open circuit, high resistance. Repair circuit as required. Clear DTC and retest • Refer to the relevant section of the workshop manual and test the secondary battery with the manufacturer approved battery health testing tool. Charge the secondary battery if necessary and retest. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new power supply distribution box as required
B1404-13	Charging System - Circuit open	<ul style="list-style-type: none"> • Battery/charging system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - Power Supply System Service Mode (0x2027). If the fault persists, install a new generator
B1412-09	Quiescent Relay Box - Component failures	 <p>NOTE: Circuit reference LIN 1</p> <ul style="list-style-type: none"> • Quiescent current control module power or ground circuit(s) - Open circuit, high resistance • LIN bus circuit - Short circuit to ground, short circuit to power, open circuit, high resistance • Quiescent current control module - Internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the quiescent current control module power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new quiescent current control module
B1412-87	Quiescent Relay Box - Missing message	 <p>NOTE: Circuit reference LIN 1</p> <ul style="list-style-type: none"> • LIN bus circuit - Short circuit to ground, short circuit to power, open circuit, high resistance • Quiescent current control module - Internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the LIN bus circuit between the gateway module and the quiescent current control module for short circuit to ground, short circuit to power, open circuit, high resistance. Repair circuit as required. Clear DTC and retest • If the fault persists, install a new quiescent current control module as required
B1412-96	Quiescent Relay Box - Component internal failure	<ul style="list-style-type: none"> • Quiescent current control module - Internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, carry out the guided diagnostic routine - Special applications/Battery/Quiescent relay box internal check diagnostic (0x2054) - Clear the DTC and retest • If the fault persists, install a new quiescent current control module as required
B1479-08	Power Supply Distribution Box - Bus signal/message failures	 <p>NOTE: Circuit reference LIN 2</p>	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the LIN bus circuit between the gateway module and the power supply distribution box for short circuit to ground, short circuit to power, open

		<ul style="list-style-type: none"> • LIN bus circuit - Short circuit to ground, short circuit to power, open circuit, high resistance • Power supply distribution box - Internal failure 	<ul style="list-style-type: none"> • circuit, high resistance. Repair circuit as required • Using the manufacturer approved diagnostic system, clear the DTCs, lock the vehicle and wait 2 minutes. Unlock the vehicle and retest. If the fault persists, install a new power supply distribution box as required
B1479-14	Power Supply Distribution Box - Circuit short to ground or open	 <p>NOTE: Circuit reference V BATT 2</p> <ul style="list-style-type: none"> • Power supply distribution box circuit - Short circuit to ground, open circuit, high resistance • Power supply distribution box - Internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the power supply distribution box circuit for short circuit to ground, open circuit, high resistance. Repair circuit as required • Using the manufacturer approved diagnostic system, clear the DTCs, lock the vehicle and wait 2 minutes. Unlock the vehicle and retest. If the fault persists, install a new power supply distribution box as required
B1479-72	Power Supply Distribution Box - Actuator stuck open	 <p>NOTE: Circuit reference V BATT 2</p> <ul style="list-style-type: none"> • Power supply distribution box circuit - Short circuit to ground, open circuit, high resistance • Power supply distribution box - Internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the power supply distribution box circuit for short circuit to ground, open circuit, high resistance. Repair circuit as required • Using the manufacturer approved diagnostic system, clear the DTCs, lock the vehicle and wait 2 minutes. Unlock the vehicle and retest. If the fault persists, install a new power supply distribution box as required
B1479-73	Power Supply Distribution Box - Actuator stuck closed	 <p>NOTE: Circuit reference V BATT 2</p> <ul style="list-style-type: none"> • Power supply distribution box circuit - Short circuit to ground, open circuit, high resistance • Power supply distribution box - Internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the power supply distribution box circuit for short circuit to ground, open circuit, high resistance. Repair circuit as required • Using the manufacturer approved diagnostic system, clear the DTCs, lock the vehicle and wait 2 minutes. Unlock the vehicle and retest. If the fault persists, install a new power supply distribution box as required
B1479-96	Power Supply Distribution Box - Component internal failure	 <p>NOTE: Circuit reference V BATT 2</p> <ul style="list-style-type: none"> • Power supply distribution box circuit - Short circuit to ground, open circuit, high resistance • Power supply distribution box - Internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the power supply distribution box circuit for short circuit to ground, open circuit, high resistance. Repair circuit as required • Using the manufacturer approved diagnostic system, clear the DTCs, lock the vehicle and wait 2 minutes. Unlock the vehicle and retest. If the fault persists, install a new power supply distribution box as required
B1479-98	Power Supply Distribution Box - Component or system over temperature	<ul style="list-style-type: none"> • Power supply distribution box - Over temperature event 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the power supply distribution box circuit for short circuit to ground, open circuit, high resistance. Repair circuit as required • Allow the vehicle to cool. Using the manufacturer approved diagnostic system, clear the DTCs, lock the vehicle and wait 2 minutes. Unlock the vehicle and run the engine for 5 minutes with all electrical loads on. If the fault persists, install a new power

			supply distribution box as required
P0620-00	Generator Control Circuit - No Sub Type Information	 <p>NOTE: Circuit reference LIN 3</p> <ul style="list-style-type: none"> Primary drive belt - Incorrect tension LIN bus circuit - Short circuit to ground, short circuit to power, open circuit, high resistance Generator - Internal failure 	<ul style="list-style-type: none"> Check the primary drive belt tension and rectify as required Refer to the electrical circuit diagrams and check the LIN bus circuit between the gateway module and the generator for short circuit to ground, short circuit to power, open circuit, high resistance. Repair circuit as required Using the manufacturer approved diagnostic system, perform routine - Power Supply System Service Mode (0x2027). Clear the DTCs and retest. If the fault persists, install a new generator as required
P065B-16	Generator Control Circuit Range/Performance - Circuit Voltage Below Threshold	 <p>NOTE: Circuit reference LIN 3</p> <ul style="list-style-type: none"> Primary battery fault LIN bus circuit - Short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: If P0620-00, P065C-01, POA1A-87 or POA3B-68 is/are also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and test the primary battery Refer to the electrical circuit diagrams and check the LIN bus circuit between the gateway module and the generator for short circuit to ground, short circuit to power, open circuit, high resistance. Repair circuit as required. Clear DTC and retest
P065B-17	Generator Control Circuit Range/Performance - Circuit Voltage Above Threshold	 <p>NOTE: Circuit reference LIN 3</p> <ul style="list-style-type: none"> Primary battery connectors insecure Generator connectors insecure LIN bus circuit - Short circuit to ground, short circuit to power, open circuit, high resistance 	<p>NOTES:</p>  <p>If P0620-00, P065C-01, POA1A-87 or POA3B-68 is/are also set, perform the relevant corrective action(s) first</p>  <p>This DTC may be set during jump starting and/or battery starting</p> <ul style="list-style-type: none"> Check the integrity of the primary battery connectors and rectify as required Check the integrity of the generator connectors and rectify as required Refer to the electrical circuit diagrams and check the LIN bus circuit between the gateway module and the generator for short circuit to ground, short circuit to power, open circuit, high resistance. Repair circuit as required. Clear DTC and retest
P065C-01	Generator Mechanical Performance - General Electrical Failure	<ul style="list-style-type: none"> Primary drive belt - Incorrect tension 	<ul style="list-style-type: none"> Check the primary drive belt tension and rectify as required
POA1A-87	Generator Control Module - Missing message	 <p>NOTE: Circuit reference LIN 3</p> <ul style="list-style-type: none"> Primary battery connectors insecure Generator connectors insecure LIN bus circuit - Short circuit to ground, short circuit to power, open circuit, high resistance Generator - Internal failure 	<ul style="list-style-type: none"> Check the integrity of the primary battery connectors and rectify as required Check the integrity of the generator connectors and rectify as required Refer to the electrical circuit diagrams and check the LIN bus circuit between the gateway module and the generator for short circuit to ground, short circuit to power, open circuit, high resistance. Repair circuit as required. Clear DTC and retest If the fault persists, install a new generator as required. Clear DTC and retest
POA3B-68	Generator Over Temperature - Event information	<ul style="list-style-type: none"> Generator - Over temperature event 	<ul style="list-style-type: none"> Check generator wiring and connectors for evidence of heat damage. Investigate the cause of generator over temperature event. Using the manufacturer approved diagnostic system, clear

			the DTCs and retest
U0001-88	High Speed Communication Bus - Bus off	 <p>NOTE: Circuit reference HS CAN H / HS CAN L</p> <ul style="list-style-type: none"> High speed CAN bus circuit - Short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance. Repair circuit as required. Clear DTC and retest
U0010-88	Medium Speed Communication Bus - Bus off	 <p>NOTE: Circuit reference MS CAN H / MS CAN L</p> <ul style="list-style-type: none"> Medium speed CAN bus circuit - Short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance. Repair circuit as required. Clear DTC and retest
U0300-46	Internal Control Module Software Incompatibility - Calibration/parameter memory failure	<ul style="list-style-type: none"> Gateway module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, reconfigure the gateway module with the latest level software. Clear the DTCs and retest. If the fault persists, clear the DTCs, lock the vehicle and wait 2 minutes. Unlock the vehicle and retest. If the fault persists, install a new gateway module as required
U1A14-00	CAN Initialisation Failure - No sub type information	<ul style="list-style-type: none"> Gateway module power or ground circuit(s) - Open circuit, high resistance High speed CAN bus circuit - Short circuit to ground, short circuit to power, open circuit, high resistance Medium speed CAN bus circuit - Short circuit to ground, short circuit to power, open circuit, high resistance Gateway module - Internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the gateway module power and ground circuits for open circuit, high resistance. Repair circuit as required. Clear DTC and retest Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance. Repair circuit as required Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance. Repair circuit as required Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new gateway module as required
U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> Central junction box is not configured correctly Gateway module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, reconfigure the central junction box with the latest level software Using the manufacturer approved diagnostic system, reconfigure the gateway module with the latest level software
U3000-04	Control Module - System internal failures	<ul style="list-style-type: none"> Gateway module - Internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, reconfigure the gateway module with the latest level software. Clear the DTCs, lock the vehicle and wait 2 minutes. Unlock the vehicle and retest. If the fault persists, install a new gateway module as required

General Information - Diagnostic Trouble Code (DTC) Index DTC: Headlamp Leveling Control Module (HLCM)

Description and Operation

Headlamp Leveling Control Module (HLCM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Headlamp Leveling Control Module (HLCM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Headlamp Leveling](#) (417-01 Exterior Lighting, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1041-04	Leveling Control - System internal failures	<ul style="list-style-type: none"> Headlamp leveling control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new headlamp leveling control module
B1087-83	LIN Bus "A" - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> Headlamp leveling control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new headlamp leveling control module
B1087-86	LIN Bus "A" - Signal invalid	<ul style="list-style-type: none"> Headlamp leveling control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new headlamp leveling control module
B1087-88	LIN Bus "A" - bus off	<ul style="list-style-type: none"> LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance

B10AE-11	Headlamp Leveling Motor - Circuit short to ground	<ul style="list-style-type: none"> Headlamp leveling motors control circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the headlamp leveling motors control circuit for short circuit to ground
B10AE-12	Headlamp Leveling Motor - Circuit short to battery	<ul style="list-style-type: none"> Headlamp leveling motors control circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the headlamp leveling motors control circuit for short circuit to power
B10AE-64	Headlamp Leveling Motor - Signal plausibility failure	<ul style="list-style-type: none"> Headlamp leveling circuits open circuit, high resistance 	<ul style="list-style-type: none"> Disconnect both headlamps. Using the manufacturer approved diagnostic system, clear the DTCs and retest. DTC B10AE-64 set: Refer to the electrical circuit diagrams and test the headlamp leveling control circuit for open circuit, high resistance. DTC B10AE-64 not set: Refer to the electrical circuit diagrams and test the headlamp leveling actuator power and ground circuits for open circuit, high resistance
B1D64-01	Left Headlamp Swivelling Motor - General electrical failure	<ul style="list-style-type: none"> Left headlamp swivelling motor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, temporarily swap the headlamps. Clear the DTCs and retest. If DTC B1D65-01 is now set, install a new left headlamp
B1D64-04	Left Headlamp Swivelling Motor - System internal failures	<ul style="list-style-type: none"> Left headlamp swivelling motor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, temporarily swap the headlamps. Clear the DTCs and retest. If DTC B1D65-04 is now set, install a new left headlamp
B1D64-87	Left Headlamp Swivelling Motor - Missing message	<ul style="list-style-type: none"> Left headlamp swivelling motor power or ground circuit open circuit, high resistance Left headlamp swivelling motor internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the left headlamp swivelling motor power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, temporarily swap the headlamps. Clear the DTCs and retest. If DTC B1D65-87 is now set, install a new left headlamp
B1D65-01	Right Headlamp Swivelling Motor - General electrical failure	<ul style="list-style-type: none"> Right headlamp swivelling motor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, temporarily swap the headlamps. Clear the DTCs and retest. If DTC B1D64-01 is now set, install a new right headlamp
B1D65-04	Right Headlamp Swivelling Motor - System internal failures	<ul style="list-style-type: none"> Right headlamp swivelling motor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, temporarily swap the headlamps. Clear the DTCs and retest. If DTC B1D64-04 is now set, install a new right headlamp
B1D65-87	Right Headlamp Swivelling Motor - Missing message	<ul style="list-style-type: none"> Right headlamp swivelling motor power or ground circuit open circuit, high resistance Right headlamp swivelling motor internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the right headlamp swivelling motor power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, temporarily swap the headlamps. Clear the DTCs and retest. If DTC B1D64-87 is now set, install a new right headlamp
B1D68-00	Left Headlamp Swivelling Feedback Sensor - No sub type information	<ul style="list-style-type: none"> Left headlamp swivelling motor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, temporarily swap the headlamps. Clear the DTCs and retest. If DTC B1D69-00 is now set, install a new left headlamp
B1D69-00	Right Headlamp Swivelling Feedback Sensor - No sub type information	<ul style="list-style-type: none"> Right headlamp swivelling motor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, temporarily swap the headlamps. Clear the DTCs and retest. If DTC B1D68-00 is now set, install a new right headlamp

U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0101-00	Lost Communication with Transmission Control Module - No sub type information	<ul style="list-style-type: none"> Transmission control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Transmission system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0102-00	Lost Communication with Transfer Case Control Module - No sub type information	<ul style="list-style-type: none"> Transfer case control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
U0121-00	Lost Communication With ABS Control Module - No sub type information	<ul style="list-style-type: none"> Anti-lock brake system control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Anti-lock brake system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0126-00	Lost Communication With Steering Angle Sensor Module - No sub type information	<ul style="list-style-type: none"> Steering angle sensor module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Steering angle sensor system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering angle sensor module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
U0132-00	Lost Communication With Suspension Control Module "A" - No sub	<ul style="list-style-type: none"> Air suspension control module power or ground circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the air suspension control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN

	type information	<p>High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Air suspension system fault 	<p>bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the air suspension control module for related DTCs and refer to the relevant DTC index
U0140-00	Lost Communication With Body Control Module - No sub type information	<ul style="list-style-type: none"> • Central junction box power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Central junction box system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification • Incorrect headlamp leveling control module installed • Headlamp leveling control module or central junction box is not configured correctly 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary • Install a new headlamp leveling control module as necessary • Using the manufacturer approved diagnostic system, re-configure the headlamp leveling control module and the central junction box with the latest level software. If the software levels are already correct, install a new headlamp leveling control module
U0402-00	Invalid Data Received From Transmission Control Module - No sub type information	<ul style="list-style-type: none"> • Missing/invalid data from the transmission control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0403-00	Invalid Data Received From Transfer Case Control Module - No sub type information	<ul style="list-style-type: none"> • Missing/invalid data from the transfer case control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
U0415-00	Invalid Data Received From Anti-Lock Braking System Control Module - No sub type information	<ul style="list-style-type: none"> • Missing/invalid data from the anti-lock brake system control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0421-00	Invalid Data Received from Suspension Control Module A - No sub type information	<ul style="list-style-type: none"> • Missing/invalid data from the air suspension control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the air suspension control module for related DTCs and refer to the relevant DTC index
U0422-00	Invalid Data Received From Body Control Module - No sub type information	<ul style="list-style-type: none"> • Missing/invalid data from the central junction box 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0428-00	Invalid Data Received From Steering Angle	<ul style="list-style-type: none"> • Missing/invalid data from the steering angle 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index

	Sensor Module - No sub type information	sensor module	
U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> Car configuration file information not received completely 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Car configuration file information incompatible with the headlamp leveling control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U3002-81	Vehicle Identification Number - Invalid serial data received	<ul style="list-style-type: none"> Stored vehicle identification number does not match most recent vehicle identification number 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U3003-16	Battery Voltage - Circuit voltage below threshold	<ul style="list-style-type: none"> Headlamp leveling control module power or ground circuit open circuit, high resistance Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111). Refer to the electrical circuit diagrams and test the headlamp leveling control module power and ground circuits for open circuit, high resistance Refer to the relevant section of the workshop manual and test the battery and charging system
U3003-17	Battery Voltage - Circuit voltage above threshold	<ul style="list-style-type: none"> Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111). Refer to the relevant section of the workshop manual and test the battery and charging system
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> Mismatch between the voltage at the headlamp leveling control module and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111) - and compare it to battery voltage. Refer to the electrical circuit diagrams and check the headlamp leveling control module power and ground circuits for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Instrument Cluster (IC)

Description and Operation

Instrument Cluster (IC)



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Instrument Cluster (IC). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Instrument Cluster](#) (413-01 Instrument Cluster, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1009-51	Ignition Authorisation - Not programmed	<ul style="list-style-type: none"> Instrument cluster is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the instrument cluster with the latest level software
B1009-87	Ignition Authorisation - Missing message	<ul style="list-style-type: none"> Instrument cluster is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the instrument cluster with the latest level software
B100D-64	Column Lock Authorisation - Signal plausibility failure	<ul style="list-style-type: none"> Request to lock or unlock electric steering column lock has failed due to engine speed or vehicle speed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
B1026-12	Steering Column Lock - Circuit short to battery	<ul style="list-style-type: none"> Electric steering column lock ground circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the electric steering column lock ground circuit for short circuit to power
B1026-63	Steering Column Lock - Circuit/component protection time-out	<ul style="list-style-type: none"> Electric steering column lock ground circuit short circuit to 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the electric steering column lock ground circuit for short circuit to power

		power	
B1A14-96	RCM Warning Lamp - Component internal failure	<ul style="list-style-type: none"> Instrument cluster internal failure - Supplementary restraint system light emitting diode circuit failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new instrument cluster
B1A68-86	Ambient Temperature Sensor - Signal invalid	<ul style="list-style-type: none"> Instrument cluster internal failure - Internal temperature sensor signal is out of range/invalid 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new instrument cluster
B1A85-96	Ambient Light Sensor - Component internal failure	<ul style="list-style-type: none"> Instrument cluster internal failure - Internal light sensor failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new instrument cluster
P0610-55	Control Module Vehicle Options Error - Not configured	<ul style="list-style-type: none"> Instrument cluster is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the instrument cluster with the latest level software
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0010-88	Medium Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0100-00	Lost Communication With ECM/PCM "A" - No sub type information	<ul style="list-style-type: none"> Engine control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Engine system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the engine control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0101-00	Lost Communication with TCM - No sub type information	<ul style="list-style-type: none"> Transmission control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Transmission system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0102-00	Lost Communication with Transfer Case Control Module - No	<ul style="list-style-type: none"> Transfer case control module power or ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance

	sub type information	<p>circuit open circuit, high resistance</p> <ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
U0104-00	Lost Communication With Cruise Control Module - No sub type information	<ul style="list-style-type: none"> Speed control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Speed control system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the speed control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the speed control module for related DTCs and refer to the relevant DTC index
U0121-00	Lost Communication With Anti-Lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> Anti-lock brake system control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Anti-lock brake system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0126-00	Lost Communication With Steering Angle Sensor Module - No sub type information	<ul style="list-style-type: none"> Steering angle sensor module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Steering angle sensor system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering angle sensor module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
U0128-00	Lost Communication With Park Brake Control Module - No sub type information	<ul style="list-style-type: none"> Electric park brake control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Electric park brake system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the electric park brake control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the electric park brake control module for related DTCs and refer to the relevant DTC index
U0132-	Lost Communication	<ul style="list-style-type: none"> Air suspension 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check

00	With Suspension Control Module "A" - No sub type information	<p>control module power or ground circuit open circuit, high resistance</p> <ul style="list-style-type: none"> • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Air suspension system fault 	<p>the air suspension control module power and ground circuits for open circuit, high resistance</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the air suspension control module for related DTCs and refer to the relevant DTC index
U0133-00	Lost Communication With Active Roll Control Module - No sub type information	<ul style="list-style-type: none"> • Dynamic response control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Dynamic response system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the dynamic response control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the dynamic response control module for related DTCs and refer to the relevant DTC index
U0136-00	Lost Communication With Differential Control Module - Rear - No sub type information	<ul style="list-style-type: none"> • Rear differential control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Rear differential system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear differential control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the rear differential control module for related DTCs and refer to the relevant DTC index
U0138-00	Lost Communication with All Terrain Control Module - No sub type information	<ul style="list-style-type: none"> • Terrain response switchpack power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Terrain response system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the terrain response switchpack power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the terrain response switchpack for related DTCs and refer to the relevant DTC index
U0139-08	Lost Communication With Suspension Control Module "B" - Bus signal/message failures	<ul style="list-style-type: none"> • Adaptive damping system control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Adaptive 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the adaptive damping system control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the adaptive damping system control module for related DTCs and refer to the relevant DTC index

		damping system fault	
U0140-00	Lost Communication With Body Control Module - No sub type information	<ul style="list-style-type: none"> Central junction box power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Central junction box system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0141-00	Lost Communication With Body Control Module "A" - No sub type information	<ul style="list-style-type: none"> Central junction box power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Central junction box system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0151-00	Lost Communication With Restraints Control Module - No sub type information	<ul style="list-style-type: none"> Restraints control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Restraints system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the restraints control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the restraints control module for related DTCs and refer to the relevant DTC index
U0159-00	Lost Communication With Parking Assist Control Module "A" - No sub type information	<ul style="list-style-type: none"> Parking aid control module power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Parking aid system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the parking aid control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the parking aid control module for related DTCs and refer to the relevant DTC index
U0164-00	Lost Communication With HVAC Control Module - No sub type information	<ul style="list-style-type: none"> Automatic temperature control module power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the automatic temperature control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the automatic temperature control module for related DTCs and refer to the relevant DTC index

		Automatic temperature control system fault	
U0184-00	Lost Communication With Radio - No sub type information	<ul style="list-style-type: none"> Integrated audio module / audio head unit power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Integrated audio module / audio head unit system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the integrated audio module / audio head unit power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the integrated audio module / audio head unit for related DTCs and refer to the relevant DTC index
U0208-00	Lost Communication With "Seat Control Module A" - No sub type information	<ul style="list-style-type: none"> Driver seat control module power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Driver seat system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seat control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the driver seat control module for related DTCs and refer to the relevant DTC index
U0214-00	Lost Communication With Remote Function Actuation - No sub type information	<ul style="list-style-type: none"> Keyless vehicle module power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Keyless vehicle system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the keyless vehicle module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the keyless vehicle module for related DTCs and refer to the relevant DTC index
U0241-00	Lost Communication With Headlamp Control Module "A" - No sub type information	<ul style="list-style-type: none"> Headlamp leveling control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Headlamp leveling system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the headlamp leveling control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the headlamp leveling control module for related DTCs and refer to the relevant DTC index
U0242-00	Lost Communication With Headlamp Control Module "B" - No sub type information	<ul style="list-style-type: none"> Rear view mirror power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear view mirror power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high

		<ul style="list-style-type: none"> ground, short circuit to power, open circuit, high resistance Rear view mirror fault 	<ul style="list-style-type: none"> resistance Using the manufacturer approved diagnostic system, check the rear view mirror for related DTCs and refer to the relevant DTC index
U025D-00	Lost Communication With Front Controls Interface Module "B" - No sub type information	<ul style="list-style-type: none"> Integrated control panel power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Integrated control panel fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the integrated control panel power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the integrated control panel for related DTCs and refer to the relevant DTC index
U0264-00	Lost Communication With Camera Module-Rear - No sub type information	<ul style="list-style-type: none"> Proximity camera control module power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Proximity camera system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the proximity camera control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the proximity camera control module for related DTCs and refer to the relevant DTC index
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> Instrument cluster expulsion from network management 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check for other modules reporting CAN bus off or lost communication faults. If other modules report problems, check the software version in the central junction box. If no other modules report problems, re-configure the instrument cluster with the latest level software
U0402-68	Invalid Data Received from TCM - Event information	<ul style="list-style-type: none"> Missing/invalid data from the transmission control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U2013-02	Switch Pack - General signal failure	<ul style="list-style-type: none"> Steering wheel left switchpack internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new steering wheel left switchpack
U2013-08	Switch Pack - Bus signal/message failures	<ul style="list-style-type: none"> Steering wheel left switchpack power or ground circuit open circuit, high resistance LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the steering wheel left switchpack power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U3000-46	Control Module - Calibration/parameter memory failure	<ul style="list-style-type: none"> Instrument cluster internal failure - Odometer storage corrupted 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new instrument cluster
U3000-	Control Module -	<ul style="list-style-type: none"> Instrument 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic

49	Internal electronic failure	cluster internal failure - Internal memory corrupted	system, clear the DTCs and retest. If the fault persists, install a new instrument cluster
U3000-55	Control Module - Not configured	<ul style="list-style-type: none"> • Incorrect wheels/tires installed • Tire size compensation is incorrectly configured 	<ul style="list-style-type: none"> • Install the correct wheels and tires • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U3000-87	Control Module - Missing message	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U3002-81	Vehicle Identification Number - Invalid serial data received	<ul style="list-style-type: none"> • Instrument cluster previously installed on another vehicle • New instrument cluster installed and VIN not yet programmed 	<ul style="list-style-type: none"> • Install the original or a new instrument cluster as necessary • Using the manufacturer approved diagnostic system, perform routine - Learn VIN (0x0404)
U3003-16	Control Module - Circuit voltage below threshold	<ul style="list-style-type: none"> • Instrument cluster power or ground circuit open circuit, high resistance • Battery/charging system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the electrical circuit diagrams and check the instrument cluster power and ground circuits for open circuit, high resistance • Refer to the relevant section of the workshop manual and test the battery and charging system
U3003-17	Control Module - Circuit voltage above threshold	<ul style="list-style-type: none"> • Battery/charging system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the relevant section of the workshop manual and test the battery and charging system
U3003-62	Control Module - Signal compare failure	<ul style="list-style-type: none"> • Mismatch between the voltage at the instrument cluster and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02) - and compare it to battery voltage. Refer to the electrical circuit diagrams and check the instrument cluster power and ground circuits for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Integrated Audio Module (IAM) - High Line

Description and Operation

Integrated Audio Module (IAM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.














Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.








The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Integrated Audio Module (IAM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.



For additional information, refer to: Information and Entertainment System (415-00, Diagnosis and Testing).



DTC	Description	Possible Causes	Action
B119F-11	GPS Antenna - Circuit short to ground	<p>NOTE: Circuit reference GPS_SIGNAL</p> <ul style="list-style-type: none"> Navigation antenna not connected to the integrated audio module Navigation antenna circuit short circuit to ground 	<ul style="list-style-type: none"> Confirm that the navigation antenna is connected to the integrated audio module Refer to the electrical circuit diagrams and check the navigation antenna circuit for short circuit to ground
B119F-13	GPS Antenna - Circuit open	<p>NOTE: Circuit reference GPS_SIGNAL</p> <ul style="list-style-type: none"> Navigation 	<p>NOTE: This DTC may be set even though no fault condition is present and should be ignored unless the customer has reported a navigation system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p>

		<p>antenna not connected to the integrated audio module</p> <ul style="list-style-type: none"> Navigation antenna circuit open circuit, high resistance 	<ul style="list-style-type: none"> Confirm that the navigation antenna is connected to the integrated audio module Refer to the electrical circuit diagrams and check the navigation antenna circuit for open circuit, high resistance
B11A3-49	Gyroscope - Internal electronic failures	<ul style="list-style-type: none"> Integrated audio module internal gyroscope failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
B121C-13	Hard Drive - Circuit open	<ul style="list-style-type: none"> Integrated audio module internal hard drive communication failure 	<p> NOTE: This DTC may be set even though no fault condition is present and should be ignored unless the customer has reported a navigation system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, re-configure the integrated audio module with the latest level software. Insert a CD and copy one track to the hard drive to confirm correct operation. Return vehicle to standard settings and delete the file. If the fault persists, install a new integrated audio module
B121C-49	Hard Drive - Internal electronic failures	<ul style="list-style-type: none"> Integrated audio module internal hard drive failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, re-configure the integrated audio module with the latest level software. Insert a CD and copy one track to the hard drive to confirm correct operation. Return vehicle to standard settings and delete the file. If the fault persists, install a new integrated audio module
B1252-09	USB Port - Component failures	<p> NOTE: Circuit reference USB_5B / USB_DATA_POS / USB_DATA_NEG / USB_DATA_GND / USB_SCR</p> <ul style="list-style-type: none"> No USB function 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the USB circuits for short circuit to ground, short circuit to power, open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
B1252-19	USB Port - Circuit current above threshold	<ul style="list-style-type: none"> Excessive current drawn by a universal serial bus device 	<ul style="list-style-type: none"> Disconnect all universal serial bus devices. Connect a test universal serial bus memory stick. Using the manufacturer approved diagnostic system, perform routine - USB Connector Test (0x6018). If the fault persists, install a new integrated audio module
B1296-4A	Navigation Map Data - Incorrect component installed	<ul style="list-style-type: none"> Navigation map does not match the market of the vehicle 	<p> NOTE: This DTC may be set even though no fault condition is present and should be ignored unless the customer has reported a navigation system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p> <ul style="list-style-type: none"> Update the map data as necessary. Using the manufacturer approved diagnostic system, re-configure the integrated audio module with the latest level software. Check and up-date the car configuration file as necessary. Clear the DTCs and retest. If the fault persists, install a new integrated audio module
B1A56-11	Antenna - Circuit short to ground	<p> NOTE: Circuit reference AM_FM</p> <ul style="list-style-type: none"> AM/FM antenna amplifier 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the AM/FM antenna amplifier circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module

		circuit short circuit to ground	
B1A56-13	Antenna - Circuit open	 <p>NOTE: Circuit reference AM_FM</p> <ul style="list-style-type: none"> AM/FM antenna amplifier circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the AM/FM antenna amplifier circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
B1D50-07	Digital Disk Player - Mechanical failures	<ul style="list-style-type: none"> Integrated audio module internal failure 	 <p>NOTE: This DTC may be set even though no fault condition is present and should be ignored unless the customer has reported a navigation system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p> <ul style="list-style-type: none"> Perform basic visual inspection for foreign matter inside disk player. Remove foreign matter if possible. Using the manufacturer approved diagnostic system, clear the DTCs and retest with multiple disks. If the fault persists, install a new integrated audio module
B1D55-11	Antenna#2 - Circuit short to ground	 <p>NOTE: Circuit reference FM2</p> <ul style="list-style-type: none"> FM/TMC antenna amplifier circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the FM/TMC antenna amplifier circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
B1D55-13	Antenna#2 - Circuit open	 <p>NOTE: Circuit reference FM2</p> <ul style="list-style-type: none"> FM/TMC antenna amplifier circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the FM/TMC antenna amplifier circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
B1D57-11	Antenna#4 Circuit - Circuit short to ground	<ul style="list-style-type: none"> VICS antenna circuit short circuit to ground 	 <p>NOTE: Vehicle Information and Communication System (VICS) is a type of Traffic Message Channel system used in the Japan market only</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the VICS antenna circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
B1D57-13	Antenna#4 Circuit - Circuit open	<ul style="list-style-type: none"> VICS antenna circuit open circuit, high resistance 	 <p>NOTE: Vehicle Information and Communication System (VICS) is a type of Traffic Message Channel system used in the Japan market only</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the VICS antenna circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
B1D78-11	Auxiliary Input - Circuit short to ground	 <p>NOTE: Circuit reference AUX1 L+ / AUX1 R+ / AUX1 LR-</p> <ul style="list-style-type: none"> Auxiliary input 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the auxiliary input 1 circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module

		1 circuit short circuit to ground	
B1D78-13	Auxiliary Input - Circuit open	 <p>NOTE: Circuit reference AUX1 L+ / AUX1 R+ / AUX1 LR-</p> <ul style="list-style-type: none"> Auxiliary input 1 circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the auxiliary input 1 circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
B1D79-11	Microphone Input - Circuit short to ground	 <p>NOTE: Circuit reference MIC_1_POS / MIC_1_NEG</p> <ul style="list-style-type: none"> Microphone 1 circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the microphone 1 circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
B1D79-13	Microphone Input - Circuit open	 <p>NOTE: Circuit reference MIC_1_POS / MIC_1_NEG</p> <ul style="list-style-type: none"> Microphone 1 circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the microphone 1 circuit for open circuit, high resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
P150E-00	Electronic Control Module Cooling Fan Circuit - No sub type information	<ul style="list-style-type: none"> Integrated audio module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
U2005-62	Vehicle Speed - Signal compare failure	<ul style="list-style-type: none"> Anti-lock brake system control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance MOST network failure - Speed signal broadcast is not received by the integrated audio module Anti-lock brake system fault 	<p>NOTES:</p> <p> This DTC may be set when the vehicle is being transported</p> <p> This DTC may be set even though no fault condition is present and should be ignored unless the customer has reported a navigation system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuits for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the relevant section of the workshop manual and test the MOST network Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index. Clear the DTCs and retest
U200D-11	Control Module Output Power A - Circuit short to ground	 <p>NOTE: Circuit reference ANTENNA_AMP</p> <ul style="list-style-type: none"> AM/FM antenna amplifier circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the AM/FM antenna amplifier circuit for short circuit to ground. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
U200D-13	Control Module Output Power A -		<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the AM/FM antenna amplifier circuit for open circuit, high

	Circuit open	<p>NOTE: Circuit reference ANTENNA_AMP</p> <ul style="list-style-type: none"> AM/FM antenna amplifier circuit open circuit, high resistance 	resistance. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Touch screen internal failure MOST network failure Integrated audio module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the touch screen for related DTCs and refer to the relevant DTC index Refer to the relevant section of the workshop manual and test the MOST network Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Touch screen internal failure MOST network failure Integrated audio module is not configured correctly 	<p>NOTES:</p> <p> Only applicable to the Japanese market</p> <p> This DTC may be set even though no fault condition is present and should be ignored unless the customer has reported a navigation system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the touch screen for related DTCs and refer to the relevant DTC index Refer to the relevant section of the workshop manual and test the MOST network Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U2200-41	Control Module Configuration Memory Corrupt - General checksum failure	<ul style="list-style-type: none"> Integrated audio module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, re-configure the integrated audio module with the latest level software. If the fault persists, install a new integrated audio module
U2200-44	Control Module Configuration Memory Corrupt - Data memory failure	<ul style="list-style-type: none"> Integrated audio module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, re-configure the integrated audio module with the latest level software. If the fault persists, install a new integrated audio module
U3000-41	Control Module - General checksum failure	<ul style="list-style-type: none"> Integrated audio module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, re-configure the integrated audio module with the latest level software. If the fault persists, install a new integrated audio module
U3000-45	Control Module - Program memory failure	<ul style="list-style-type: none"> Integrated audio module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, re-configure the integrated audio module with the latest level software. If the fault persists, install a new integrated audio module
U3000-	Control Module -	<ul style="list-style-type: none"> Integrated 	

46	Calibration/parameter memory failure	audio module internal failure	 <p>NOTE: This DTC may be set even though no fault condition is present and should be ignored unless the customer has reported a navigation system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, re-configure the integrated audio module with the latest level software. If the fault persists, install a new integrated audio module
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> Integrated audio module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, re-configure the integrated audio module with the latest level software. If the fault persists, install a new integrated audio module
U3000-4A	Control Module - Incorrect component installed	<ul style="list-style-type: none"> Incorrect hardware or software detected Integrated audio module internal failure 	<ul style="list-style-type: none"> Check that the installed hardware is correct Using the manufacturer approved diagnostic system, re-configure the integrated audio module with the latest level software. Clear the DTCs and retest. If the fault persists, install a new integrated audio module
U3000-98	Control Module - Component or system over temperature	<ul style="list-style-type: none"> Ventilation ducts obstructed Integrated audio module internal failure 	 <p>NOTE: Allow vehicle to cool before performing any diagnostic steps. Move vehicle into shade and operate climate control on a cool setting</p> <ul style="list-style-type: none"> Check the ventilation ducts for obstructions Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated audio module
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> Mismatch between the voltage at the integrated audio module and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the integrated audio module power and ground circuits for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Integrated Control Panel (ICP)

Description and Operation

Integrated Control Panel (ICP)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Integrated Control Panel (ICP). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
U0010-88	Medium Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0140-00	Lost Communication With Body Control Module - No sub type information	<ul style="list-style-type: none"> Central junction box power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Central junction 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index

		box system fault	
U0155-00	Lost Communication With Instrument Panel Cluster (IPC) Control Module - No sub type information	<ul style="list-style-type: none"> Instrument cluster power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Instrument cluster system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the instrument cluster power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the instrument cluster for related DTCs and refer to the relevant DTC index
U0164-00	Lost Communication With HVAC Control Module - No sub type information	<ul style="list-style-type: none"> Automatic temperature control module power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Automatic temperature control system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the automatic temperature control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the automatic temperature control module for related DTCs and refer to the relevant DTC index
U0166-00	Lost Communication With Auxiliary Heater Control Module - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification Fuel fired booster heater power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Fuel fired booster heater system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary Refer to the electrical circuit diagrams and check the fuel fired booster heater power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the fuel fired booster heater for related DTCs and refer to the relevant DTC index
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification Incorrect integrated control panel installed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary Install a new integrated control panel as necessary
U0424-68	Invalid Data Received From HVAC Control Module - Event information	<ul style="list-style-type: none"> Missing/invalid data from the automatic temperature control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the automatic temperature control module for related DTCs and refer to the relevant DTC index
U2002-24	Switch - Signal stuck high	<ul style="list-style-type: none"> Integrated control panel switch stuck active 	<ul style="list-style-type: none"> Test the operation of the integrated control panel switches Install a new integrated control panel as necessary

		Integrated control panel internal failure	
U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> Integrated control panel is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the integrated control panel with the latest level software
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification Incorrect integrated control panel installed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary Install a new integrated control panel as necessary
U3000-41	Control Module - General checksum failure	<ul style="list-style-type: none"> Integrated control panel internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated control panel
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> Mismatch between the voltage at the integrated control panel and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02) - and compare it to battery voltage. Refer to the electrical circuit diagrams and check the integrated control panel power and ground circuits for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Rear Integrated Control Panel (RICP)

Description and Operation

Integrated Control Panel B (ICPB)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.





If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.




Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Integrated Control Panel B (ICPB). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1A85-11	Ambient Light Sensor - Circuit short to ground	<ul style="list-style-type: none"> Ambient light sensor failure 	 NOTE: The ambient light sensor and circuits are integral to the integrated control panel B <ul style="list-style-type: none"> Clear the DTC and re-test. Using the manufacturer approved diagnostic system, check datalogger signal - Ambient Sensor Voltage (0x721C). Check that the voltage decreases when the sensor is covered and increases when a light source is directed into the sensor. If the sensor voltage does not change with varying light intensity install a new integrated control panel B as necessary
B1A85-12	Ambient Light Sensor - Circuit short to battery	<ul style="list-style-type: none"> Ambient light sensor failure 	 NOTE: The ambient light sensor and circuits are integral to the integrated control panel B <ul style="list-style-type: none"> Clear the DTC and re-test. Using the manufacturer approved diagnostic system, check datalogger signal - Ambient Sensor Voltage (0x721C). Check that the voltage decreases when the sensor is covered and increases when a light source is

			directed into the sensor. If the sensor voltage does not change with varying light intensity install a new integrated control panel B as necessary
U0010-88	Medium Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0140-00	Lost communication with body control module - No sub type information	<ul style="list-style-type: none"> • Central junction box power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Central junction box system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0256-00	Lost Communication With Front Controls Interface Module "A" - No sub type information	<ul style="list-style-type: none"> • Integrated control panel power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Integrated control panel system fault 	 <p>NOTE: This DTC relates to the compact disc eject switch</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the integrated control panel power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the integrated control panel for related DTCs and refer to the relevant DTC index
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> • Incorrect integrated control panel B installed 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated control panel B
U2002-24	Switch - Signal stuck high	<ul style="list-style-type: none"> • Integrated control panel B switch stuck active 	<ul style="list-style-type: none"> • Test operation of all integrated control panel B switches. Clear the DTCs and retest. If the fault persists, install a new integrated control panel B
U3000-41	Control Module - General checksum failure	<ul style="list-style-type: none"> • Integrated control panel B internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new integrated control panel B
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> • Mismatch between the voltage at the integrated control panel 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the integrated control panel B power and ground circuits for open circuit, high resistance

		B and the voltage value broadcast on the CAN bus	
--	--	--	--

General Information - Diagnostic Trouble Code (DTC) Index DTC: Keyless Vehicle Module (KVM)

Description and Operation

Keyless Vehicle Module (KVM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.







Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.






The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Keyless Vehicle Module (KVM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.






For additional information, refer to: Locks, Latches and Entry Systems (501-14 Handles, Locks, Latches and Entry Systems, Diagnosis and Testing).






DTC	Description	Possible Causes	Action
B102B-00	Passive Key - No sub type information	<ul style="list-style-type: none"> Smart key is not configured correctly 	<p>NOTE: This DTC is set if an invalid smart key is detected when the stop/start switch is operated</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, re-configure the smart key with the latest level software
B10A9-00	Remote Keyless Entry Less Than 2 Keys Programmed - No sub type information	<ul style="list-style-type: none"> Secret key has been programmed to the vehicle but less than 2 key fobs have been programmed 	<ul style="list-style-type: none"> Clear DTC and retest. If the fault persists, configure the key fobs using the manufacturers approved diagnostic system
B10C1-15	Left Front Unlock Pull Switch - Short circuit to battery or open	<ul style="list-style-type: none"> Front left exterior door handle power or ground circuit open circuit, 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left exterior door handle power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the front left exterior door handle unlock switch circuit for



		<ul style="list-style-type: none"> high resistance Front left exterior door handle unlock switch circuit short circuit to power, open circuit, high resistance Front left exterior door handle internal failure 	<ul style="list-style-type: none"> short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left exterior door handle
B10C1-23	Left Front Unlock Pull Switch - Signal stuck low	<ul style="list-style-type: none"> Front left exterior door handle unlock switch circuit short circuit to ground Front left exterior door handle internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left exterior door handle unlock switch circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left exterior door handle
B10C2-15	Left Rear Unlock Pull Switch - Short circuit to battery or open	<ul style="list-style-type: none"> Rear left exterior door handle power or ground circuit open circuit, high resistance Rear left exterior door handle unlock switch circuit short circuit to power, open circuit, high resistance Rear left exterior door handle internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left exterior door handle power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the rear left exterior door handle unlock switch circuit for short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left exterior door handle
B10C2-23	Left Rear Unlock Pull Switch - Signal stuck low	<ul style="list-style-type: none"> Rear left exterior door handle unlock switch circuit short circuit to ground Rear left exterior door handle internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left exterior door handle unlock switch circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear left exterior door handle
B10C3-15	Right Front Unlock Pull Switch - Short circuit to battery or open	<ul style="list-style-type: none"> Front right exterior door handle power or ground circuit open circuit, high resistance Front right exterior door handle unlock switch circuit short circuit to power, open circuit, high resistance Front right exterior door handle internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right exterior door handle power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the front right exterior door handle unlock switch circuit for short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right exterior door handle
B10C3-23	Right Front Unlock Pull Switch - Signal stuck low	<ul style="list-style-type: none"> Front right exterior door handle unlock switch circuit short circuit to ground Front right exterior door handle internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right exterior door handle unlock switch circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right exterior door handle







		failure	
B10C4-15	Right Rear Unlock Pull Switch - Short circuit to battery or open	<ul style="list-style-type: none"> Rear right exterior door handle power or ground circuit open circuit, high resistance Rear right exterior door handle unlock switch circuit short circuit to power, open circuit, high resistance Rear right exterior door handle internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right exterior door handle power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the rear right exterior door handle unlock switch circuit for short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right exterior door handle
B10C4-23	Right Rear Unlock Pull Switch - Signal stuck low	<ul style="list-style-type: none"> Rear right exterior door handle unlock switch circuit short circuit to ground Rear right exterior door handle internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right exterior door handle unlock switch circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear right exterior door handle
B10C5-23	Trunk Unlock Pull Switch - Signal stuck low	 <p>NOTE: Circuit reference EXT BOOT RELEASE SW</p> <ul style="list-style-type: none"> Upper tailgate exterior switch circuit short circuit to ground Upper tailgate exterior switch internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the upper tailgate exterior switch circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new upper tailgate exterior switch
B10C6-00	Exterior Trunk Antenna - No sub type information	<ul style="list-style-type: none"> Tailgate exterior low frequency antenna circuit short circuit to ground, short circuit to power 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the tailgate exterior low frequency antenna circuit for short circuit to ground, short circuit to power
B10C6-11	Exterior Trunk Antenna - Circuit short to ground	<ul style="list-style-type: none"> Tailgate exterior low frequency antenna circuit short circuit to ground, short circuit between positive and negative 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the tailgate exterior low frequency antenna circuit for short circuit to ground, short circuit between positive and negative
B10C6-12	Exterior Trunk Antenna - Circuit short to battery	<ul style="list-style-type: none"> Tailgate exterior low frequency antenna circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the tailgate exterior low frequency antenna circuit for short circuit to power
B10C6-13	Exterior Trunk Antenna - Circuit	<ul style="list-style-type: none"> Tailgate exterior low frequency 	 <p>NOTE: If any other low frequency antenna short circuit</p>







	open	antenna circuit open circuit, high resistance	<p>to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the tailgate exterior low frequency antenna circuit for open circuit, high resistance
B10C7-00	Interior Trunk Antenna - No sub type information	<ul style="list-style-type: none"> Passenger compartment left low frequency antenna circuit short circuit to ground, short circuit to power 	<p> NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the passenger compartment left low frequency antenna circuit for short circuit to ground, short circuit to power
B10C7-11	Interior Trunk Antenna - Circuit short to ground	<ul style="list-style-type: none"> Passenger compartment left low frequency antenna circuit short circuit to ground, short circuit between positive and negative 	<p> NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the passenger compartment left low frequency antenna circuit for short circuit to ground, short circuit between positive and negative
B10C7-12	Interior Trunk Antenna - Circuit short to battery	<ul style="list-style-type: none"> Passenger compartment left low frequency antenna circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the passenger compartment left low frequency antenna circuit for short circuit to power
B10C7-13	Interior Trunk Antenna - Circuit open	<ul style="list-style-type: none"> Passenger compartment left low frequency antenna circuit open circuit, high resistance 	<p> NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the passenger compartment left low frequency antenna circuit for open circuit, high resistance
B10C8-00	Interior Center Antenna - No sub type information	<ul style="list-style-type: none"> Passenger compartment right low frequency antenna circuit short circuit to ground, short circuit to power 	<p> NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the passenger compartment right low frequency antenna circuit for short circuit to ground, short circuit to power
B10C8-11	Interior Center Antenna - Circuit short to ground	<ul style="list-style-type: none"> Passenger compartment right low frequency antenna circuit short circuit to ground, short circuit between positive and negative 	<p> NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the passenger compartment right low frequency antenna





			<p>circuit for short circuit to ground, short circuit between positive and negative</p>
B10C8-12	Interior Center Antenna - Circuit short to battery	<ul style="list-style-type: none"> Passenger compartment right low frequency antenna circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the passenger compartment right low frequency antenna circuit for short circuit to power
B10C8-13	Interior Center Antenna - Circuit open	<ul style="list-style-type: none"> Passenger compartment right low frequency antenna circuit open circuit, high resistance 	<p> NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the passenger compartment right low frequency antenna circuit for open circuit, high resistance
B10C9-00	Interior Front Antenna - No sub type information	<ul style="list-style-type: none"> Passenger compartment front low frequency antenna circuit short circuit to ground, short circuit to power 	<p> NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the passenger compartment front low frequency antenna circuit for short circuit to ground, short circuit to power
B10C9-11	Interior Front Antenna - Circuit short to ground	<ul style="list-style-type: none"> Passenger compartment front low frequency antenna circuit short circuit to ground, short circuit between positive and negative 	<p> NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the passenger compartment front low frequency antenna circuit for short circuit to ground, short circuit between positive and negative
B10C9-12	Interior Front Antenna - Circuit short to battery	<ul style="list-style-type: none"> Passenger compartment front low frequency antenna circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the passenger compartment front low frequency antenna circuit for short circuit to power
B10C9-13	Interior Front Antenna - Circuit open	<ul style="list-style-type: none"> Passenger compartment front low frequency antenna circuit open circuit, high resistance 	<p> NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the passenger compartment front low frequency antenna circuit for open circuit, high resistance
B10CA-00	Left rear door handle Antenna - No sub type information	<ul style="list-style-type: none"> Rear left door exterior handle low frequency antenna circuit short circuit to ground, short circuit to power 	<p> NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the rear left door exterior handle low frequency antenna circuit

			for short circuit to ground, short circuit to power
B10CA-11	Left rear door handle Antenna - Circuit short to ground	<ul style="list-style-type: none"> Rear left door exterior handle low frequency antenna circuit short circuit to ground, short circuit between positive and negative 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the rear left door exterior handle low frequency antenna circuit for short circuit to ground, short circuit between positive and negative
B10CA-12	Left rear door handle Antenna - Circuit short to battery	<ul style="list-style-type: none"> Rear left door exterior handle low frequency antenna circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the rear left door exterior handle low frequency antenna circuit for short circuit to power
B10CA-13	Left rear door handle Antenna - Circuit open	<ul style="list-style-type: none"> Rear left door exterior handle low frequency antenna circuit open circuit, high resistance 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the rear left door exterior handle low frequency antenna circuit for open circuit, high resistance
B10CB-00	Right rear door handle Antenna - No sub type information	<ul style="list-style-type: none"> Rear right door exterior handle low frequency antenna circuit short circuit to ground, short circuit to power 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the rear right door exterior handle low frequency antenna circuit for short circuit to ground, short circuit to power
B10CB-11	Right rear door handle Antenna - Circuit short to ground	<ul style="list-style-type: none"> Rear right door exterior handle low frequency antenna circuit short circuit to ground, short circuit between positive and negative 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the rear right door exterior handle low frequency antenna circuit for short circuit to ground, short circuit between positive and negative
B10CB-12	Right rear door handle Antenna - Circuit short to battery	<ul style="list-style-type: none"> Rear right door exterior handle low frequency antenna circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the rear right door exterior handle low frequency antenna circuit for short circuit to power
B10CB-13	Right rear door handle Antenna - Circuit open	<ul style="list-style-type: none"> Rear right door exterior handle low frequency antenna circuit open circuit, high resistance 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the rear right door exterior handle low frequency antenna circuit for open circuit, high resistance

B10CC-23	Left Front Latch Clutch Switch - Signal stuck low	<ul style="list-style-type: none"> Front left door latch clutch switch circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left door latch clutch switch circuit for short circuit to ground
B10CD-23	Left Rear Latch Clutch Switch - Signal stuck low	<ul style="list-style-type: none"> Rear left door latch clutch switch circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left door latch clutch switch circuit for short circuit to ground
B10CE-23	Right Front Latch Clutch Switch - Signal stuck low	<ul style="list-style-type: none"> Front right door latch clutch switch circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right door latch clutch switch circuit for short circuit to ground
B10CF-23	Right Rear Latch Clutch Switch - Signal stuck low	<ul style="list-style-type: none"> Rear right door latch clutch switch circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right door latch clutch switch circuit for short circuit to ground
B10D1-23	Left Front Lock Button - Signal stuck low	<ul style="list-style-type: none"> Front left door exterior handle lock switch circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left door exterior handle lock switch circuit for short circuit to ground
B10D2-23	Left Rear Lock Button - Signal stuck low	<ul style="list-style-type: none"> Rear left door exterior handle lock switch circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear left door exterior handle lock switch circuit for short circuit to ground
B10D3-23	Right Front Lock Button - Signal stuck low	<ul style="list-style-type: none"> Front right door exterior handle lock switch circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right door exterior handle lock switch circuit for short circuit to ground
B10D4-23	Right Rear Lock Button - Signal stuck low	<ul style="list-style-type: none"> Rear right door exterior handle lock switch circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear right door exterior handle lock switch circuit for short circuit to ground
B12D5-16	Door Handle Proximity Sensor - Circuit voltage below threshold	<ul style="list-style-type: none"> Door handle proximity sensor circuit short circuit to ground Keyless vehicle module power or ground circuit open circuit, high resistance Keyless vehicle module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the door handle proximity sensor circuit for short circuit to ground Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111). Refer to the electrical circuit diagrams and check the keyless vehicle module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new keyless vehicle module
B12D6-11	Fast Door Unlock/Open Actuator - Circuit short to ground	<ul style="list-style-type: none"> Door E latch circuit(s) short circuit to ground 	 NOTE: Faults on individual terminals/circuits cannot be detected <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the door E latch circuits for short circuit to ground
B12D6-12	Fast Door Unlock/Open Actuator - Circuit short to battery	<ul style="list-style-type: none"> Door E latch circuit(s) short circuit to power 	 NOTE: Faults on individual terminals/circuits cannot be detected <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the door E latch circuits for short circuit to power
B12EA-96	Radio Frequency (RF) Receiver - Component internal failure	<ul style="list-style-type: none"> RF receiver internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new RF receiver

B1334-23	Tailgate Glass Release Switch - Signal stuck low	<p>Tailgate glass switch circuit short circuit to ground</p> <ul style="list-style-type: none"> Tailgate glass switch stuck active 	 <p>NOTE: This circuit/switch is available as an option</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the tailgate glass switch circuit for short circuit to ground Test the operation of the tailgate glass switch
B1335-00	Front Triangulation / Loadspace Antenna - No sub type information	<ul style="list-style-type: none"> Luggage compartment right low frequency antenna circuit short circuit to ground, short circuit to power 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the luggage compartment right low frequency antenna circuit for short circuit to ground, short circuit to power
B1335-11	Front Triangulation / Loadspace Antenna - Circuit short to ground	<ul style="list-style-type: none"> Luggage compartment right low frequency antenna circuit short circuit to ground, short circuit between positive and negative 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the luggage compartment right low frequency antenna circuit for short circuit to ground, short circuit between positive and negative
B1335-12	Front Triangulation / Loadspace Antenna - Circuit short to battery	<ul style="list-style-type: none"> Luggage compartment right low frequency antenna circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the luggage compartment right low frequency antenna circuit for short circuit to power
B1335-13	Front Triangulation / Loadspace Antenna - Circuit open	<ul style="list-style-type: none"> Luggage compartment right low frequency antenna circuit open circuit, high resistance 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the luggage compartment right low frequency antenna circuit for open circuit, high resistance
B1336-00	Left Front Door External Antenna - No sub type information	<ul style="list-style-type: none"> Front left door exterior handle low frequency antenna circuit short circuit to ground, short circuit to power 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the front left door exterior handle low frequency antenna circuit for short circuit to ground, short circuit to power
B1336-11	Left Front Door External Antenna - Circuit short to ground	<ul style="list-style-type: none"> Front left door exterior handle low frequency antenna circuit short circuit to ground, short circuit between positive and negative 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the front left door exterior handle low frequency antenna circuit for short circuit to ground, short circuit between positive and negative

B1336-12	Left Front Door External Antenna - Circuit short to battery	<ul style="list-style-type: none"> Front left door exterior handle low frequency antenna circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the front left door exterior handle low frequency antenna circuit for short circuit to power
B1336-13	Left Front Door External Antenna - Circuit open	<ul style="list-style-type: none"> Front left door exterior handle low frequency antenna circuit open circuit, high resistance 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the front left door exterior handle low frequency antenna circuit for open circuit, high resistance
B1337-00	Right Front Door External Antenna - No sub type information	<ul style="list-style-type: none"> Front right door exterior handle low frequency antenna circuit short circuit to ground, short circuit to power 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the front right door exterior handle low frequency antenna circuit for short circuit to ground, short circuit to power
B1337-11	Right Front Door External Antenna - Circuit short to ground	<ul style="list-style-type: none"> Front right door exterior handle low frequency antenna circuit short circuit to ground, short circuit between positive and negative 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the front right door exterior handle low frequency antenna circuit for short circuit to ground, short circuit between positive and negative
B1337-12	Right Front Door External Antenna - Circuit short to battery	<ul style="list-style-type: none"> Front right door exterior handle low frequency antenna circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the front right door exterior handle low frequency antenna circuit for short circuit to power
B1337-13	Right Front Door External Antenna - Circuit open	<ul style="list-style-type: none"> Front right door exterior handle low frequency antenna circuit open circuit, high resistance 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the front right door exterior handle low frequency antenna circuit for open circuit, high resistance
B133D-00	Loadspace/Interior Boot Antenna - No sub type information	<ul style="list-style-type: none"> Luggage compartment left low frequency antenna circuit short circuit to ground, short circuit to power 	 <p>NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the luggage compartment left low frequency antenna circuit for short circuit to ground, short circuit to power
B133D-11	Loadspace/Interior Boot Antenna -	<ul style="list-style-type: none"> Luggage compartment 	 <p>NOTE: If any other low frequency antenna short circuit</p>

	Circuit short to ground	left low frequency antenna circuit short circuit to ground, short circuit between positive and negative	<p>to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the luggage compartment left low frequency antenna circuit for short circuit to ground, short circuit between positive and negative
B133D-12	Loadspace/Interior Boot Antenna - Circuit short to battery	<ul style="list-style-type: none"> Luggage compartment left low frequency antenna circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the luggage compartment left low frequency antenna circuit for short circuit to power
B133D-13	Loadspace/Interior Boot Antenna - Circuit open	<ul style="list-style-type: none"> Luggage compartment left low frequency antenna circuit open circuit, high resistance 	<p> NOTE: If any other low frequency antenna short circuit to power DTC is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Perform routine - On Demand Self Test (0x0202). If the fault persists, refer to the electrical circuit diagrams and check the luggage compartment left low frequency antenna circuit for open circuit, high resistance
C1017-23	Boot/Trunk Primary Switch - Signal stuck low	<ul style="list-style-type: none"> Tailgate lock switch circuit short circuit to ground 	<p> NOTE: This circuit/switch is available as an option</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the tailgate lock switch circuit for short circuit to ground
U0010-88	Medium Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U201F-00	External Receiver - No sub type information	<p> NOTE: Circuit reference RX SERIAL DATA</p> <ul style="list-style-type: none"> RF receiver power or ground circuit open circuit, high resistance LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance RF receiver internal failure Keyless vehicle module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the RF receiver power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new RF receiver Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new keyless vehicle module
U201F-31	External Receiver - No signal	<p> NOTE: Circuit reference RX SERIAL DATA</p> <ul style="list-style-type: none"> RF receiver power or ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the RF receiver power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system,

		<p>circuit open circuit, high resistance</p> <ul style="list-style-type: none"> • LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • RF receiver internal failure • Keyless vehicle module internal failure 	<p>clear the DTCs and retest. If the fault persists, install a new RF receiver</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new keyless vehicle module
U201F-95	External Receiver - Incorrect assembly	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification - RF receiver frequency • Incorrect RF receiver installed 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary • Install a new RF receiver as necessary
U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> • Keyless vehicle module is not configured correctly 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the keyless vehicle module with the latest level software
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> • Keyless vehicle module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new keyless vehicle module
U3000-95	Control Module - Incorrect assembly	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification - Passive entry / passive start or passive start only • Incorrect keyless vehicle module installed 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary • Install a new keyless vehicle module as necessary
U3002-81	Vehicle Identification Number - Invalid serial data received	<ul style="list-style-type: none"> • Keyless vehicle module previously installed on another vehicle • New keyless vehicle module installed and VIN not yet programmed 	<ul style="list-style-type: none"> • Install the original or a new keyless vehicle module as necessary • Using the manufacturer approved diagnostic system, perform routine - Learn VIN (0x0404)

General Information - Diagnostic Trouble Code (DTC) Index DTC: Multi-Function Display (MFD)

Description and Operation

Multi-Function Display (MFD)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle



When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the warranty policy and procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system)



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the digital multimeter leads into account



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion



If diagnostic trouble codes are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals






Where an 'on demand self-test' is referred to, this can be accessed via the 'diagnostic trouble code monitor' tab on the manufacturers approved diagnostic system



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required

The table below lists all diagnostic trouble codes (DTCs) that could be logged in the multi-function display module, for additional diagnosis and testing information refer to the relevant diagnosis and testing section. For additional information, refer to: [Information and Entertainment System](#) (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B108E-01	Display - General electrical failure	<ul style="list-style-type: none"> Internal multi-function display connection failure 	<ul style="list-style-type: none"> Install new multi-function display as necessary
B10BD-11	Multifunctional Switch - Circuit short to ground	<ul style="list-style-type: none"> Steering wheel left switchpack circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the steering wheel left switchpack circuit for short circuit to ground
B10BD-13	Multifunctional Switch - Circuit open	<ul style="list-style-type: none"> Steering wheel left switchpack circuit open circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the steering wheel left switchpack circuit for open circuit

B10BD-23	Multifunctional Switch - Activation too long - Signal stuck low	<ul style="list-style-type: none"> Steering wheel left switchpack input active continuously for more than two minutes 	<ul style="list-style-type: none"> Clear the DTC and retest. If the problem persists, install a new steering wheel left switchpack
U0010-88	Medium Speed CAN Communication Bus - BMS Bus Off - Bus off	 <p>NOTE: Circuit reference MS CAN H / MS CAN L</p> <ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and test the medium speed CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0074-88	Control Module Communication Bus "B" Off - Bus off	 <p>NOTE: Circuit reference CAN H / CAN L</p> <ul style="list-style-type: none"> CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and test the CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0184-00	Lost communication with Radio - No sub type information	 <p>NOTE: Circuit reference CAN H / CAN L</p> <ul style="list-style-type: none"> Audio head unit power or ground circuit open circuit, high resistance CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the audio head unit power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and test the CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0195-00	Lost Communication With Subscription Entertainment Receiver Module - No sub type information	<ul style="list-style-type: none"> Audio head unit power or ground circuit open circuit, high resistance CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the audio head unit power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, complete a CAN network integrity test. Refer to the electrical circuit diagrams and test the CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0422-68	Invalid Data Received From Body Control Module (BCM) - Event information	<ul style="list-style-type: none"> Invalid data received from the central junction box - Clock data 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index

U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> Multi-function display configuration not complete Multi-function display internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the multi-function display with the latest level software Clear the DTC and retest. If the problem persists, install a new multi-function display
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Invalid car configuration received from central junction box 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U3000-00	Control Module - No sub type information	<ul style="list-style-type: none"> Multi-function display software corrupted Multi-function display internal failure 	<ul style="list-style-type: none"> Clear the DTC and retest. If the problem persists, install a new multi-function display
U3006-16	Control Module Input Power "A" - Circuit voltage below threshold	<ul style="list-style-type: none"> The power supply to the multi-function display has been below 9 Volts for more than 1000 milliseconds 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and test the battery. Refer to the relevant section of the workshop manual and test the charging system. Clear the DTC and retest. Refer to the electrical circuit diagrams and test the multi-function display power and ground circuits for open circuit, high resistance
U3006-17	Control Module Input Power "A" - Circuit voltage above threshold	<ul style="list-style-type: none"> The power supply to the multi-function display has been above 16 Volts for more than 1000 milliseconds 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and test the battery. Refer to the relevant section of the workshop manual and test the charging system

General Information - Diagnostic Trouble Code (DTC) Index DTC: Navigation Control Module (NCM) - India & Israel

Description and Operation

Navigation Control Module (NCM) - India & Israel

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all diagnostic trouble codes (DTCs) that could be logged in the Navigation Control Module (NCM) - India & Israel, for additional diagnosis and testing information refer to the relevant diagnosis and testing section.

For additional information, refer to: [Navigation System](#) (419-07 Navigation System, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B119F-31	GPS Antenna - No Signal	<ul style="list-style-type: none"> GPS Antenna circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the GPS Antenna circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1A89-11	Satellite Antenna - Circuit short to ground	<ul style="list-style-type: none"> Roof pod circuit to GPS satellite antenna - Short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the roof pod circuits from the navigation control module to the GPS satellite antenna for short circuit to ground. Repair circuit as required, clear DTC and retest
B1A89-13	Satellite Antenna - Circuit open	<ul style="list-style-type: none"> Roof pod circuit to GPS satellite antenna - Open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the roof pod circuits from the navigation control module to the GPS satellite antenna for open circuit, high resistance. Repair circuit as required, clear DTC and retest
B1296-4A	Navigation Map Data Mismatch With	<ul style="list-style-type: none"> SD memory card map data 	<ul style="list-style-type: none"> Install the correct SD memory card

	Market - Incorrect component installed	incorrect to market	
B1A81-4B	Internal Trip Switch - Over temperature	<ul style="list-style-type: none"> Navigation control module internal temperature above threshold 	<ul style="list-style-type: none"> Allow the navigation control module to cool, clear the DTC and retest if the fault persists install a new navigation control module as required
U0010-88	Medium Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0011-82	Medium Speed CAN Communication Bus Performance - Alive/sequence counter incorrect/not updated	<ul style="list-style-type: none"> Invalid data received from another control module via the medium speed CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine the invalid data source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index
U0011-87	Medium Speed CAN Communication Bus Performance - Missing message	<ul style="list-style-type: none"> Missing message from another control module via the medium speed CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine the missing message source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index

General Information - Diagnostic Trouble Code (DTC) Index DTC: Navigation Control Module (NCM) - Extended Markets

Description and Operation

Navigation Control Module (NCM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.





Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Navigation Control Module (NCM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Navigation System](#) (419-07 Navigation System, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B119F-11	GPS Antenna - Circuit short to ground	<p>NOTE: Circuit reference GPS-SIGNAL</p> <ul style="list-style-type: none"> GPS antenna circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the GPS antenna circuit for short circuit to ground
B119F-13	GPS Antenna - Circuit open	<p>NOTE: Circuit reference GPS-SIGNAL</p> <ul style="list-style-type: none"> GPS antenna circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the GPS antenna circuit for open circuit, high resistance
B1296-4A	Navigation Map Data Mismatch With Market - Incorrect component installed	<ul style="list-style-type: none"> SD memory card map data incorrect to market 	<ul style="list-style-type: none"> Install the correct SD memory card Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary

		Incorrect market set in car configuration file	
B12A0-11	Auxiliary Input 2 - Circuit short to ground	 <p>NOTE: Circuit reference AUDIO POS / AUDIO NEG</p> <ul style="list-style-type: none"> • Audio positive circuit short circuit to ground • Audio negative circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the audio positive circuit for short circuit to ground • Refer to the electrical circuit diagrams and check the audio negative circuit for short circuit to ground
B1300-11	Video Output "A" - Circuit short to ground	 <p>NOTE: Circuit reference LVDS IN1 / LVDS IN2</p> <ul style="list-style-type: none"> • Low voltage differential signalling positive circuit short circuit to ground • Low voltage differential signalling negative circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the low voltage differential signalling positive circuit for short circuit to ground • Refer to the electrical circuit diagrams and check the low voltage differential signalling negative circuit for short circuit to ground
B1A81-4B	Internal Trip Switch - Over temperature	<ul style="list-style-type: none"> • Navigation control module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new navigation control module
B1A84-56	Car Configuration Data - Invalid/incomplete configuration	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U0010-88	Medium Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0011-82	Medium Speed CAN Communication Bus Performance - Alive/sequence counter incorrect / not updated	<ul style="list-style-type: none"> • Invalid data received from another control module via the medium speed CAN bus 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the snapshot data to determine the invalid data source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index
U0011-87	Medium Speed CAN Communication Bus Performance - Missing message	<ul style="list-style-type: none"> • Missing message from another control module via the medium speed CAN bus 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the snapshot data to determine the missing message source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification • Incorrect navigation control module installed 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary • Install a new navigation control module as necessary
U0400-92	Invalid Data Received - Performance or incorrect operation	<ul style="list-style-type: none"> • Touch screen private CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the touch screen private CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Occupant Classification Sensor Control Module (OCSCM)

Description and Operation

Occupant Classification Sensor Control Module (OCSCM)



WARNING: TO AVOID ACCIDENTAL DEPLOYMENT AND POSSIBLE PERSONAL INJURY, THE BACKUP POWER SUPPLY MUST BE DEPLETED BEFORE REPAIRING OR REPLACING ANY AIR BAG SUPPLEMENTAL RESTRAINT SYSTEM (SRS) COMPONENTS. TO DEplete THE BACKUP POWER SUPPLY ENERGY, DISCONNECT THE BATTERY GROUND CABLE AND WAIT ONE MINUTE. FAILURE TO FOLLOW THIS INSTRUCTION MAY RESULT IN PERSONAL INJURY.

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Occupant Classification Sensor Control Module (OCSCM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Air Bag Supplemental Restraint System \(SRS\)](#) (501-20B Supplemental Restraint System, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1193-53	Crash Event Storage Full and Locked - Deactivated	<ul style="list-style-type: none"> Crash event occurred 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - On Demand Self Test (0x0202)
B1A54-01	Occupant Belt Tension Sensor - General electrical failure	<ul style="list-style-type: none"> Seatbelt tension sensor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - On Demand Self Test (0x0202). If the problem persists, install a new seatbelt tension sensor as necessary
B1A54-02	Occupant Belt Tension Sensor - General	<ul style="list-style-type: none"> Seatbelt tension sensor signal circuit short circuit to ground, short circuit to 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the seatbelt tension sensor signal circuit for short circuit to ground, short circuit to

	signal failure	power, open circuit, high resistance	power, open circuit, high resistance
B1A54-11	Occupant Belt Tension Sensor - Circuit short to ground	<ul style="list-style-type: none"> Seatbelt tension sensor signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the seatbelt tension sensor signal circuit for short circuit to ground
B1A54-12	Occupant Belt Tension Sensor - Circuit short to battery	<ul style="list-style-type: none"> Seatbelt tension sensor signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the seatbelt tension sensor signal circuit for short circuit to power
B1A54-13	Occupant Belt Tension Sensor - Circuit open	<ul style="list-style-type: none"> Seatbelt tension sensor signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the seatbelt tension sensor signal circuit for open circuit, high resistance
B1A62-02	Pressure Sensor - General signal failure	<ul style="list-style-type: none"> Occupant detection sensor signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the occupant detection sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1A62-11	Pressure Sensor - Circuit short to ground	<ul style="list-style-type: none"> Occupant detection sensor signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the occupant detection sensor signal circuit for short circuit to ground
B1A62-12	Pressure Sensor - Circuit short to battery	<ul style="list-style-type: none"> Occupant detection sensor signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the occupant detection sensor signal circuit for short circuit to power
B1A62-13	Pressure Sensor - Circuit open	<ul style="list-style-type: none"> Occupant detection sensor signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the occupant detection sensor signal circuit for open circuit, high resistance
B1A62-7B	Pressure Sensor - Low fluid level	<ul style="list-style-type: none"> Occupant classification sensor control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new occupant classification sensor control module
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0151-00	Lost Communication With Restraints Control Module - No sub type information	<ul style="list-style-type: none"> Restraints control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Restraints system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the restraints control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the restraints control module for related DTCs and refer to the relevant DTC index
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> Master car configuration file ID does not correspond 	<ul style="list-style-type: none"> Check that the correct the occupant classification sensor control module is installed for vehicle specification. Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U2016-51	Control Module Main Software - Not programmed	<ul style="list-style-type: none"> Occupant classification sensor control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new occupant classification sensor control module
U201A-51	Control Module Main Calibration Data - Not programmed	<ul style="list-style-type: none"> Occupant classification sensor control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new occupant classification sensor control module
U3000-04	Control Module - System internal	<ul style="list-style-type: none"> Occupant classification sensor control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new occupant classification

	failures		sensor control module
U3000-54	Control Module - Missing calibration	<ul style="list-style-type: none"> This diagnostic trouble code is set if routine - Calibrate OCS Empty Seat Offset (0x5000) - is requested and fails due to one of the pre-conditions to execute the routine 	<ul style="list-style-type: none"> Check the following criteria have all been achieved: <ul style="list-style-type: none"> Ignition status set to RUN/START Verify seat is always empty after power-up before re-zero is requested The occupant classification sensor control module has gone through the seat assembly plant calibration No collision event received from the restraints control module during the current ignition cycle No faults present in the current ignition cycle The trigger message for calibrate empty seat offset has been received from the diagnostic tool Occupant classification sensor control module has enough time to begin classification Temperature is between 6°C (42°F) and 36°C (97°F)
U3003-16	Battery Voltage - Circuit voltage below threshold	<ul style="list-style-type: none"> Occupant classification sensor control module power or ground circuit open circuit, high resistance Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111). Refer to the electrical circuit diagrams and check the occupant classification sensor control module power and ground circuits for open circuit, high resistance Refer to the relevant section of the workshop manual and test the battery and charging system
U3003-17	Battery Voltage - Circuit voltage above threshold	<ul style="list-style-type: none"> Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111). Refer to the relevant section of the workshop manual and test the battery and charging system

General Information - Diagnostic Trouble Code (DTC) Index DTC: Parking Aid Control Module (PACM)

Description and Operation

Parking Aid Control Module (PACM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.






Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.



The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Parking Aid Control Module (PACM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.


For additional information, refer to: [Parking Aid](#) (413-13 Parking Aid, Diagnosis and Testing).


DTC	Description	Possible Causes	Action
B1B36-12	Front Right Outer Sensor - Circuit short to battery	<ul style="list-style-type: none"> Wiring harness fault Front right outer parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the front bumper harness for damage. Check sensor circuit for short circuit to power. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B36-14	Front Right Outer Sensor - Circuit short to ground or open	<ul style="list-style-type: none"> Wiring harness fault Front right outer parking aid sensor - 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the front bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, open circuit. Repair or replace any wiring harness as required Check the connector for integrity and damage, then


		Component internal failure	<ul style="list-style-type: none"> re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B36-96	Front Right Outer Sensor - Component internal failure	<ul style="list-style-type: none"> Wiring harness fault Front right outer parking aid sensor - Component internal failure 	 <p>NOTE: This DTC will log if the local ground of the sensor is open circuit</p> <ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the front bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, open circuit. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B38-12	Front Right Inner Sensor - Circuit short to battery	<ul style="list-style-type: none"> Wiring harness fault Front right inner parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the front bumper harness for damage. Check sensor circuit for short circuit to power. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B38-14	Front Right Inner Sensor - Circuit short to ground or open	<ul style="list-style-type: none"> Wiring harness fault Front right inner parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the front bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, open circuit. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B38-96	Front Right Inner Sensor - Component internal failure	<ul style="list-style-type: none"> Wiring harness fault Front right inner parking aid sensor - Component internal failure 	 <p>NOTE: This DTC will log if the local ground of the sensor is open circuit</p> <ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the front bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, open circuit. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test

			<ul style="list-style-type: none"> If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B40-12	Front Left Outer Sensor - Circuit short to battery	<ul style="list-style-type: none"> Wiring harness fault Front left outer parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the front bumper harness for damage. Check sensor circuit for short circuit to power. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B40-14	Front Left Outer Sensor - Circuit short to ground or open	<ul style="list-style-type: none"> Wiring harness fault Front left outer parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the front bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, open circuit. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B40-96	Front Left Outer Sensor - Component internal failure	<ul style="list-style-type: none"> Wiring harness fault Front left outer parking aid sensor - Component internal failure 	 <p>NOTE: This DTC will log if the local ground of the sensor is open circuit</p> <ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the front bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, open circuit. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B42-12	Front Left Inner Sensor - Circuit short to battery	<ul style="list-style-type: none"> Wiring harness fault Front left inner parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the front bumper harness for damage. Check sensor circuit for short circuit to power. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the


			suspect sensor. Renew the faulty sensor
B1B42-14	Front Left Inner Sensor - Circuit short to ground or open	<ul style="list-style-type: none"> Wiring harness fault Front left inner parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the front bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, open circuit. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B42-96	Front Left Inner Sensor - Component internal failure	<ul style="list-style-type: none"> Wiring harness fault Front left inner parking aid sensor - Component internal failure 	 <p>NOTE: This DTC will log if the local ground of the sensor is open circuit</p> <ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the front bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, open circuit. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B44-12	Rear Right Outer Sensor - Circuit short to battery	<ul style="list-style-type: none"> Wiring harness fault Rear right outer parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the rear bumper harness for damage. Check sensor circuit for short circuit to power. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B44-14	Rear Right Outer Sensor - Circuit short to ground or open	<ul style="list-style-type: none"> Wiring harness fault Rear right outer parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the rear bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, open circuit. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B44-96	Rear Right Outer Sensor - Component internal failure	<ul style="list-style-type: none"> Wiring harness fault Rear right outer parking aid sensor - 	 <p>NOTE: This DTC will log if the local ground of the sensor is open circuit</p> <ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the rear

		Component internal failure	<p>bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, short circuit to power, open circuit. Repair or replace any wiring harness as required</p> <ul style="list-style-type: none"> • Check the connector for integrity and damage, then re-connect sensor to confirm connection • Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test • If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B46-12	Rear Right Inner Sensor - Circuit short to battery	<ul style="list-style-type: none"> • Wiring harness fault • Rear right inner parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> • Refer to electrical wiring diagrams and check the rear bumper harness for damage. Check sensor circuit for short circuit to power. Repair or replace any wiring harness as required • Check the connector for integrity and damage, then re-connect sensor to confirm connection • Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test • If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B46-14	Rear Right Inner Sensor - Circuit short to ground or open	<ul style="list-style-type: none"> • Wiring harness fault • Rear right inner parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> • Refer to electrical wiring diagrams and check the rear bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, open circuit. Repair or replace any wiring harness as required • Check the connector for integrity and damage, then re-connect sensor to confirm connection • Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test • If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B46-96	Rear Right Inner Sensor - Component internal failure	<ul style="list-style-type: none"> • Wiring harness fault • Rear right inner parking aid sensor - Component internal failure 	<p> NOTE: This DTC will log if the local ground of the sensor is open circuit</p> <ul style="list-style-type: none"> • Refer to electrical wiring diagrams and check the rear bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, short circuit to power, open circuit. Repair or replace any wiring harness as required • Check the connector for integrity and damage, then re-connect sensor to confirm connection • Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test • If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B48-12	Rear Left Outer Sensor - Circuit short to battery	<ul style="list-style-type: none"> • Wiring harness fault • Rear left outer parking aid sensor - Component 	<ul style="list-style-type: none"> • Refer to electrical wiring diagrams and check the rear bumper harness for damage. Check sensor circuit for short circuit to power. Repair or replace any wiring harness as required • Check the connector for integrity and damage, then re-connect sensor to confirm connection

		internal failure	<ul style="list-style-type: none"> Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B48-14	Rear Left Outer Sensor - Circuit short to ground or open	<ul style="list-style-type: none"> Wiring harness fault Rear left outer parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the rear bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, open circuit. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B48-96	Rear Left Outer Sensor - Component internal failure	<ul style="list-style-type: none"> Wiring harness fault Rear left outer parking aid sensor - Component internal failure 	 <p>NOTE: This DTC will log if the local ground of the sensor is open circuit</p> <ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the rear bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, short circuit to power, open circuit. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B50-12	Rear Left Inner Sensor - Circuit short to battery	<ul style="list-style-type: none"> Wiring harness fault Rear left inner parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the rear bumper harness for damage. Check sensor circuit for short circuit to power. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B50-14	Rear Left Inner Sensor - Circuit short to ground or open	<ul style="list-style-type: none"> Wiring harness fault Rear left inner parking aid sensor - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the rear bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, open circuit. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the

			bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B50-96	Rear Left Inner Sensor - Component internal failure	<ul style="list-style-type: none"> Wiring harness fault Rear left inner parking aid sensor - Component internal failure 	 <p>NOTE: This DTC will log if the local ground of the sensor is open circuit</p> <ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the rear bumper harness for damage/corrosion. Check sensor circuit for short circuit to ground, short circuit to power, open circuit. Repair or replace any wiring harness as required Check the connector for integrity and damage, then re-connect sensor to confirm connection Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test If the problem persists remove the suspect sensor from the bumper. Inspect the sensor connector for signs of water ingress/corrosion. Exchange the suspect sensor with another sensor within the bumper that is not reporting a fault. Clear the DTC and run the on demand self test to confirm if the fault code now appears for the new position of the suspect sensor. Renew the faulty sensor
B1B54-11	Function LED - Park Aid - Circuit short to ground	<ul style="list-style-type: none"> Wiring harness fault Switch/LED - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the parking aid LED circuit for short circuit to ground. Repair or replace any wiring harness as required Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test. If the problem persists, suspect the switch/LED
B1B54-12	Function LED - Park Aid - Circuit short to battery	<ul style="list-style-type: none"> Wiring harness fault Switch/LED - Component internal failure Control module - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the parking aid LED circuit for short circuit to power. Repair or replace any wiring harness as required Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test. If the problem persists, suspect the switch/LED
B1B54-13	Function LED - Park Aid - Circuit open	<ul style="list-style-type: none"> Wiring harness fault Switch/LED - Component internal failure Control module - Component internal failure 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the parking aid LED circuit for open circuit, high resistance. Repair or replace any wiring harness as required Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test. If the problem persists, suspect the switch/LED
B1B57-11	Front Sensors Power Circuit - Circuit short to ground	<ul style="list-style-type: none"> Wiring harness fault Control module - Component internal failure 	<ul style="list-style-type: none"> Check front and rear bumper harness for signs of damage and security of connections Refer to electrical wiring diagrams and check the parking assist front sensor power circuit and rear sensor power circuit for short circuit to ground. Repair or replace any wiring harness as required Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test. If the problem persists, suspect the control module Cycle the ignition off, then on, to power up parking aid system and check corrective action
B1B58-11	Rear Sensors Power Circuit - Circuit short to ground	<ul style="list-style-type: none"> Wiring harness fault Control module - Component internal failure 	<ul style="list-style-type: none"> Check rear and front (if front PDC fitted) bumper harness for signs of damage and security of connections Refer to electrical wiring diagrams and check the parking assist rear sensor power circuit and front sensor power circuit (if front PDC fitted) for short circuit to ground. Repair or replace any wiring harness as required Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test. If the problem persists, suspect the control module Cycle the ignition off, then on, to power up parking aid system and check corrective action
B1C30-	Disable Switch -	<ul style="list-style-type: none"> Wiring harness 	<ul style="list-style-type: none"> Refer to electrical wiring diagrams and check the

73	Actuator stuck closed	<ul style="list-style-type: none"> fault Control switch - Component internal failure 	<ul style="list-style-type: none"> parking assist switch and switch circuit. Repair or replace any wiring harness as required Using the manufacturers approved diagnostic system clear the DTC and run the on demand self test. If the problem persists, suspect the control switch Check the switch function
U0001-81	High speed CAN Communication Bus - Invalid serial data received	<ul style="list-style-type: none"> Invalid data received from another control module via the high speed CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine the invalid data source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index. Clear DTC and retest
U0001-82	High speed CAN Communication Bus - Alive/sequence counter incorrect / not updated	<ul style="list-style-type: none"> Invalid data received from another control module via the high speed CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine the invalid data source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index. Clear DTC and retest
U0001-83	High speed CAN Communication Bus - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> Invalid data received from another control module via the high speed CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine the invalid data source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index. Clear DTC and retest
U0001-87	High speed CAN Communication Bus - Missing message	<ul style="list-style-type: none"> Missing message from another control module via the high speed CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine the missing message source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index. Clear DTC and retest
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0300-57	Internal Control Module Software Incompatibility - Invalid/incomplete software component	<ul style="list-style-type: none"> Car configuration file stored in parking aid control module does not match the master car configuration file Master car configuration file not being transmitted by master control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine car configuration details Check the components installed on the vehicle were installed by the factory or a dealer Install the original component or a new one as required
U2100-56	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> Parking aid control module not configured 	<ul style="list-style-type: none"> Check car configuration file master node to ensure that the car configuration data blocks that the parking aid control module subscribes to have been transmitted at least once within 3 full CCF transmission cycles Using the manufacturer approved diagnostic system check and update the car configuration file as required. Clear the DTC and retest
U2101-56	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Parking aid control module - Configuration error 	<ul style="list-style-type: none"> Check local snapshot data (DID 0xE103) to determine the non-valid CCF values If all values in 0xE103 are set to zero then all parameter values are valid but the combination of parameter values is invalid Using the manufacturer approved diagnostic system check and update the car configuration file as required. Clear the DTC and retest
U3000-47	Control Module - Watchdog/safety Micro-Controller failure	<ul style="list-style-type: none"> Parking aid control module - Internal failure 	<ul style="list-style-type: none"> Using the manufacturers approved diagnostic system clear the DTC, cycle the ignition off, then on, and check if the DTC is still logged If the DTC is still logged suspect the parking aid control module

U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> • Parking aid control module - Internal failure 	<ul style="list-style-type: none"> • Using the manufacturers approved diagnostic system clear the DTC, cycle the ignition off, then on, and check if the DTC is still logged • If the DTC is still logged suspect the parking aid control module
U3000-55	Control Module - Not configured	<ul style="list-style-type: none"> • Parking aid control module - Configuration error • No calibration file loaded 	<ul style="list-style-type: none"> • Using the manufacturers approved diagnostic system download and install the latest released calibration file for the hardware and software part numbers installed to the vehicle. Clear DTC and retest • If the DTC is still logged suspect the parking aid control module
U3000-56	Control Module - Invalid / incomplete configuration	<ul style="list-style-type: none"> • Parking aid control module - Configuration error • No calibration file loaded 	<ul style="list-style-type: none"> • Using the manufacturers approved diagnostic system download and install the latest released calibration file for the vehicle. Clear DTC and retest • If the DTC is still logged suspect the parking aid control module
U3000-63	Control Module - Circuit/component protection time-out	<ul style="list-style-type: none"> • Parking aid control module internal circuit protection routine has deactivated the module following detection of repeated parking aid sensor short circuit faults 	 <p>NOTE: This DTC is only logged if the control module has detected persistent parking aid sensor short circuit faults. Ensure that all circuit faults have been resolved before proceeding with the reset short protection routine</p> <ul style="list-style-type: none"> • Check for related parking aid sensor circuit fault DTCs and ensure all parking aid sensor faults are resolved • Using the manufacturer approved diagnostic system, clear the DTCs and perform routine - Reset/Clear Specified Function (Reset Short Protection) (0x040E)

General Information - Diagnostic Trouble Code (DTC) Index DTC: Proximity Camera Control Module (PCCM)

Description and Operation

Proximity Camera Control Module (PCCM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.














Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.




The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Proximity Camera Control Module (PCCM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Parking Aid](#) (413-13 Parking Aid, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B100E-29	Video Input "A" signal - Signal invalid	<ul style="list-style-type: none"> Video out circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the video out circuit for short circuit to ground, open circuit, high resistance
B1087-00	LIN Bus "A" - No sub type information	<ul style="list-style-type: none"> LIN bus circuit(s) short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the LIN bus circuits for short circuit to ground, short circuit to power, open circuit, high resistance
B12BD-19	Rear Camera - Circuit current above threshold	<p>NOTE: Circuit reference V+ / SHIELD</p> <ul style="list-style-type: none"> Rear proximity camera circuit short circuit to ground, short 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear proximity camera circuit for short circuit to ground, short circuit to power, open circuit, high resistance

		circuit to power, open circuit, high resistance	
B12BD-31	Rear Camera - No signal	 <p>NOTE: Circuit reference LVDS+ / LVDS-</p> <ul style="list-style-type: none"> Rear proximity camera LVDS circuit(s) open circuit, high resistance Rear proximity camera internal failure 	 <p>NOTE: When checking LVDS circuits, DO NOT probe the LVDS cables. Visual checks ONLY should be performed at the cable inter-connect points</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear proximity camera LVDS circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear proximity camera
B12BD-49	Rear Camera - Internal electronic failure	<ul style="list-style-type: none"> Rear proximity camera internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear proximity camera
B12BD-54	Rear Camera - Missing calibration	<ul style="list-style-type: none"> Rear proximity camera not calibrated Rear proximity camera not installed correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system calibrate the rear proximity camera Check the rear proximity camera is fitted and aligned correctly
B12BE-19	Left Front Camera - Circuit current above threshold	 <p>NOTE: Circuit reference V+ / SHIELD</p> <ul style="list-style-type: none"> Front left proximity camera circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left proximity camera circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B12BE-31	Left Front Camera - No signal	 <p>NOTE: Circuit reference LVDS+ / LVDS-</p> <ul style="list-style-type: none"> Front left proximity camera LVDS circuit(s) open circuit, high resistance Front left proximity camera internal failure 	 <p>NOTE: When checking LVDS circuits, DO NOT probe the LVDS cables. Visual checks ONLY should be performed at the cable inter-connect points</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front left proximity camera LVDS circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left proximity camera
B12BE-49	Left Front Camera - Internal electronic failure	<ul style="list-style-type: none"> Front left proximity camera internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front left proximity camera
B12BE-54	Left Front Camera - Missing calibration	<ul style="list-style-type: none"> Front left proximity camera not calibrated Front left proximity camera not installed correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system calibrate the front left proximity camera Check the front left proximity camera is fitted and aligned correctly
B12BF-19	Right Front Camera - Circuit current above threshold	 <p>NOTE: Circuit reference V+ / SHIELD</p> <ul style="list-style-type: none"> Front right 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the front right proximity camera circuit for short circuit to ground, short circuit to power, open circuit, high resistance

		proximity camera circuit short circuit to ground, short circuit to power, open circuit, high resistance	
B12BF-31	Right Front Camera - No signal	 <p>NOTE: Circuit reference LVDS+ / LVDS-</p> <ul style="list-style-type: none"> • Front right proximity camera LVDS circuit(s) open circuit, high resistance • Front right proximity camera internal failure 	 <p>NOTE: When checking LVDS circuits, DO NOT probe the LVDS cables. Visual checks ONLY should be performed at the cable inter-connect points</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the front right proximity camera LVDS circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right proximity camera
B12BF-49	Right Front Camera - Internal electronic failure	<ul style="list-style-type: none"> • Front right proximity camera internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new front right proximity camera
B12BF-54	Right Front Camera - Missing calibration	<ul style="list-style-type: none"> • Front right proximity camera not calibrated • Front right proximity camera not installed correctly 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system calibrate the front right proximity camera • Check the front right proximity camera is fitted and aligned correctly
B12CO-19	Left Mirror Camera - Circuit current above threshold	 <p>NOTE: Circuit reference V+ / SHIELD</p> <ul style="list-style-type: none"> • Left mirror proximity camera circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the left mirror proximity camera circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B12CO-31	Left Mirror Camera - No signal	 <p>NOTE: Circuit reference LVDS+ / LVDS-</p> <ul style="list-style-type: none"> • Left mirror proximity camera LVDS circuit(s) open circuit, high resistance • Left mirror proximity camera internal failure 	 <p>NOTE: When checking LVDS circuits, DO NOT probe the LVDS cables. Visual checks ONLY should be performed at the cable inter-connect points</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the left mirror proximity camera LVDS circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new left mirror proximity camera
B12CO-49	Left Mirror Camera - Internal electronic failure	<ul style="list-style-type: none"> • Left mirror proximity camera internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new left mirror proximity camera
B12CO-54	Left Mirror Camera - Missing calibration	<ul style="list-style-type: none"> • Left mirror proximity camera not calibrated • Left mirror proximity 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system calibrate the left mirror proximity camera • Check the left mirror proximity camera is fitted and aligned correctly

		camera not installed correctly	
B12C1-19	Right Mirror Camera - Circuit current above threshold	 <p>NOTE: Circuit reference V+ / SHIELD</p> <ul style="list-style-type: none"> Right mirror proximity camera circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right mirror proximity camera circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B12C1-31	Right Mirror Camera - No signal	 <p>NOTE: Circuit reference LVDS+ / LVDS-</p> <ul style="list-style-type: none"> Right mirror proximity camera LVDS circuit(s) open circuit, high resistance Right mirror proximity camera internal failure 	 <p>NOTE: When checking LVDS circuits, DO NOT probe the LVDS cables. Visual checks ONLY should be performed at the cable inter-connect points</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right mirror proximity camera LVDS circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new right mirror proximity camera
B12C1-49	Right Mirror Camera - Internal electronic failure	<ul style="list-style-type: none"> Right mirror proximity camera internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new right mirror proximity camera
B12C1-54	Right Mirror Camera - Missing calibration	<ul style="list-style-type: none"> Right mirror proximity camera not calibrated Right mirror proximity camera not installed correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system calibrate the right mirror proximity camera Check the right mirror proximity camera is fitted and aligned correctly
P1603-00	EEPROM Malfunction - No sub type information	<ul style="list-style-type: none"> Proximity camera control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new proximity camera control module
U0010-88	Medium Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> Incorrect software loaded Lost CAN signal 	<ul style="list-style-type: none"> Check for other modules reporting CAN bus off or lost communication faults. If other modules report problems, check the software version in the central junction box using the manufacturers approved diagnostic system. If no other modules report problems, check the software version in the park distance control module. Update as necessary
U1A4B-49	Control Module Processor B - Internal electronic failure	<ul style="list-style-type: none"> Proximity camera control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new proximity camera control module
U201A-51	Control Module Main Calibration Data - Not programmed	<ul style="list-style-type: none"> Proximity camera control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the proximity camera control module with the latest level software

U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U3000-46	Control Module - Calibration / parameter memory failure	<ul style="list-style-type: none"> Proximity camera control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new proximity camera control module
U3000-47	Control Module - Watchdog / safety MicroController failure	<ul style="list-style-type: none"> Proximity camera control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new proximity camera control module
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> Proximity camera control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new proximity camera control module
U3000-98	Control Module - Component or system over temperature	<ul style="list-style-type: none"> Component or system over temperature 	<ul style="list-style-type: none"> Consider the environmental conditions before suspecting the proximity camera control module. Allow the proximity camera control module to cool, clear DTC, wait for a minimum of 2 minutes, then retest
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> Mismatch between the voltage at the proximity camera control module and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02) - and compare it to battery voltage. Refer to the electrical circuit diagrams and check the proximity camera control module power and ground circuits for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Rear Differential Control Module (RDCM)

Description and Operation

Rear Differential Control Module (RDCM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.














Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.









The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Rear Differential Control Module (RDCM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.





For additional information, refer to: [Rear Drive Axle and Differential](#) (205-02 Rear Drive Axle/Differential, Diagnosis and Testing).





DTC	Description	Possible Causes	Action
P0562-16	System Voltage Low - Circuit voltage below threshold	<ul style="list-style-type: none"> Rear differential control module power or ground circuit open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xD018). Refer to the electrical circuit diagrams and test the rear differential control module power and ground circuits for open circuit, high resistance
P0563-17	System Voltage High - Circuit voltage above threshold	<ul style="list-style-type: none"> Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xD018). Refer to the relevant section of the workshop manual and test the battery and charging system
P0604-00	Internal Control Module Random Access Memory (RAM) Error - No sub type information	<ul style="list-style-type: none"> Rear differential control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the rear differential control module with the latest level software. Clear the DTCs and retest. If the fault persists, install a new rear differential control module
P0605-00	Internal Control Module Read	<ul style="list-style-type: none"> Rear differential control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the rear differential control module with the

	Only Memory (ROM) Error - No sub type information	internal failure	latest level software. Clear the DTCs and retest. If the fault persists, install a new rear differential control module
P0606-47	Control Module Processor - Watchdog/safety MicroController failure	<ul style="list-style-type: none"> Rear differential control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear differential control module
P0607-49	Control Module Performance - Internal electronic failure	<ul style="list-style-type: none"> Rear differential control module power or ground circuit open circuit, high resistance Rear differential control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xD018). Refer to the electrical circuit diagrams and test the rear differential control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear differential control module
P062F-00	Internal Control Module EEPROM Error - No sub type information	<ul style="list-style-type: none"> Rear differential control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear differential control module
P0652-16	Sensor Reference Voltage B Circuit Low - Circuit voltage below threshold	 <p>NOTE: Circuit reference HALL_Vsupp</p> <ul style="list-style-type: none"> Rear differential actuator position sensor supply circuit short circuit to ground Rear differential control module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator position sensor supply circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear differential control module
P0653-17	Sensor Reference Voltage B Circuit High - Circuit voltage above threshold	 <p>NOTE: Circuit reference HALL_Vsupp</p> <ul style="list-style-type: none"> Rear differential actuator position sensor supply circuit short circuit to power Rear differential control module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator position sensor supply circuit for short circuit to power Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear differential control module
P0657-13	Actuator Supply Voltage A Circuit / Open - Open circuit	 <p>NOTE: Circuit reference MOT+ / MOT-</p> <ul style="list-style-type: none"> Rear differential actuator power or ground circuit open circuit, high resistance 	 <p>NOTE: Ignore P0657-13 if P0605-00 is also set (perform the corrective action for P0605-00)</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator power and ground circuits for open circuit, high resistance
P0658-11	Actuator Supply Voltage A Circuit / Low - Circuit short to ground	 <p>NOTE: Circuit reference MOT+ / MOT-</p> <ul style="list-style-type: none"> Rear differential actuator power or ground circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator power and ground circuits for short circuit to ground
P0659-12	Actuator Supply Voltage A Circuit / High - Circuit short to battery	 <p>NOTE: Circuit reference MOT+ / MOT-</p> <ul style="list-style-type: none"> Rear differential actuator power or ground circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator power and ground circuits for short circuit to power

P080A-54	Clutch Position Not Learned - Missing calibration	<ul style="list-style-type: none"> Rear differential control module internal failure 	 <p>NOTE: The rear differential control module performs a calibration routine every 500km. If any rear differential control module faults are present this routine will not run and P080A will set. Investigate other rear differential control module related DTCs first. P080A will also set if the rear differential control module connector has been removed and reconnected</p> <ul style="list-style-type: none"> Investigate other rear differential control module related DTCs first. Using the manufacturer approved diagnostic system, perform routine - Control Module Calibration. Clear the DTCs and retest. If the fault persists, install a new rear differential control module
P0810-62	Clutch Position Control Error - Signal compare failure	<ul style="list-style-type: none"> Rear differential actuator circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear differential actuator position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear differential actuator mechanical failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and test the rear differential actuator position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, perform routine - Control Module Calibration. Clear the DTCs and retest. If the fault persists, install a new rear differential actuator
POCBC-11	Drive Motor "A" Temperature Sensor Circuit - Circuit short to ground	 <p>NOTE: Circuit reference TEMP1+</p> <ul style="list-style-type: none"> Rear differential actuator temperature sensor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator temperature sensor circuit for short circuit to ground
POCBC-15	Drive Motor "A" Temperature Sensor Circuit - Circuit short to battery or open	 <p>NOTE: Circuit reference TEMP1+ / TEMP-</p> <ul style="list-style-type: none"> Rear differential actuator temperature sensor circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator temperature sensor circuit for short circuit to power, open circuit, high resistance
P186A-13	Differential Lock-up Actuator Brake Control Circuit / Open - Circuit open	 <p>NOTE: Circuit reference MAG+ / MAG-</p> <ul style="list-style-type: none"> Rear differential actuator brake circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator brake circuit for open circuit, high resistance
P186B-11	Differential Lock-up Actuator Brake Control Circuit Low - Circuit short to ground	 <p>NOTE: Circuit reference MAG+ / MAG-</p> <ul style="list-style-type: none"> Rear differential actuator brake circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator brake circuit for short circuit to ground

P186C-12	Differential Lock-up Actuator Brake Control Circuit High - Circuit short to battery	 <p>NOTE: Circuit reference MAG+ / MAG-</p> <ul style="list-style-type: none"> Rear differential actuator brake circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator brake circuit for short circuit to power
P186D-97	Clutch Actuator Stuck - Component or system operation obstructed or blocked	 <p>NOTE: Circuit reference MOT+ / MOT-</p> <ul style="list-style-type: none"> Rear differential actuator circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear differential actuator mechanical failure 	 <p>NOTE: If additional rear differential related DTCs are also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator circuit for short circuit to ground, short circuit to power, open circuit, high resistance (>1.8 Ohms) Using the manufacturer approved diagnostic system, perform the guided diagnostic routine. Clear the DTCs and retest. If fault persists, install a new rear differential actuator
P1888-11	Differential Oil Temperature Sensor Circuit Failure - Circuit short to ground	 <p>NOTE: Circuit reference TEMP2+</p> <ul style="list-style-type: none"> Rear differential oil temperature sensor signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential oil temperature sensor signal circuit for short circuit to ground
P1888-15	Differential Oil Temperature Sensor Circuit Failure - Circuit short to battery or open	 <p>NOTE: Circuit reference TEMP2+ / TEMP2-</p> <ul style="list-style-type: none"> Rear differential oil temperature sensor signal or earth circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential oil temperature sensor signal and earth circuits for short circuit to power, open circuit, high resistance
P188A-98	Differential Oil Temperature Too High/Too Low - Component or system over temperature	<ul style="list-style-type: none"> Insufficient rear differential oil Incorrect rear differential oil specification Rear differential oil temperature sensor signal circuit short circuit to ground 	<p>NOTES:</p>  <p>This DTC is set when the rear differential oil temperature exceeds 160°C</p>  <p>If P0605-00 is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the rear differential oil quantity Refer to the relevant section of the workshop manual and check the rear differential oil specification Refer to the electrical circuit diagrams and test the rear differential oil temperature sensor signal circuit for short circuit to ground
P18A5-12	Motion Position Sensor "A" Signal Circuit - Circuit short to battery	 <p>NOTE: Circuit reference HALL_in1 / HALL_in2</p> <ul style="list-style-type: none"> Rear differential actuator position sensor signal 1 circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator position sensor signal 1 circuit for short circuit to power Refer to the electrical circuit diagrams and test the rear differential actuator position sensor signal 2 circuit for short circuit to power

		<ul style="list-style-type: none"> Rear differential actuator position sensor signal 2 circuit short circuit to power 	
P18A5-14	Motion Position Sensor "A" Signal Circuit - Circuit short to ground or open	 <p>NOTE: Circuit reference HALL_in1 / HALL_in2</p> <ul style="list-style-type: none"> Rear differential actuator position sensor signal 1 circuit short circuit to ground, open circuit, high resistance Rear differential actuator position sensor signal 2 circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator position sensor signal 1 circuit for short circuit to ground, open circuit, high resistance Refer to the electrical circuit diagrams and test the rear differential actuator position sensor signal 2 circuit for short circuit to ground, open circuit, high resistance
P18A8-74	Differential Actuator Brake Control - Actuator slipping	<ul style="list-style-type: none"> Rear differential actuator brake mechanical failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform the guided diagnostic routine. Clear the DTCs and retest. If fault persists, install a new rear differential actuator
P2787-4B	Clutch Temperature Too High - Over temperature	<ul style="list-style-type: none"> Rear differential actuator active for prolonged duration due to driving style or terrain 	<p>NOTES:</p> <p> This DTC is set when the rear differential clutch pack calculated temperature exceeds 200°C</p> <p> If P0605-00 is also set, perform the relevant corrective action(s) first</p> <p> If additional rear differential temperature related DTCs are also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Allow the rear differential to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest
U0001-81	High Speed CAN Communication Bus - Invalid serial data received	<ul style="list-style-type: none"> Invalid data received from another control module via the high speed CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine the invalid data source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index
U0001-87	High Speed CAN Communication Bus - Missing message	<ul style="list-style-type: none"> Missing message from another control module via the high speed CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine the missing message source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index
U0001-88	High Speed CAN Communication - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and test the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> Rear differential control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the rear differential control module with the latest level software
U1A14-49	CAN Initialization	<ul style="list-style-type: none"> Rear differential control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a

	Failure - Internal electronic failure	internal failure	new rear differential control module
U2000-4B	Motor Temperature - Over temperature	<ul style="list-style-type: none"> Rear differential actuator temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear differential control module internal failure 	<p>NOTES:</p> <p> This DTC is set when the rear differential actuator temperature exceeds 150°C</p> <p> If P0605-00 is also set, perform the relevant corrective action(s) first</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear differential control module
U2011-1C	Motor - Circuit voltage out of range	<p> NOTE: Circuit reference MOT+ / MOT-</p> <ul style="list-style-type: none"> Rear differential actuator positive circuit short circuit to actuator negative circuit Rear differential control module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the rear differential actuator positive circuit for short circuit to the actuator negative circuit Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear differential control module
U210A-62	Temperature Sensor - Signal compare failure	<ul style="list-style-type: none"> Mismatch between rear differential oil temperature sensor signal and rear differential actuator temperature sensor signal Insufficient rear differential oil Incorrect rear differential oil specification Rear differential oil temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear differential actuator temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Allow the rear differential to cool (1 hour minimum). Using the manufacturer approved diagnostic system, check datalogger signals - Motor Temperature (0xD11C) - Rear Differential Sump Oil Temperature (0x1E8A). Difference should be <25°C Refer to the relevant section of the workshop manual and check the rear differential oil quantity Refer to the relevant section of the workshop manual and check the rear differential oil specification Refer to the electrical circuit diagrams and test the rear differential oil temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and test the rear differential actuator temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U3000-4B	Control Module - Over temperature	<ul style="list-style-type: none"> Rear differential control module insecurely installed Rear differential control module internal failure 	<p> NOTE: This DTC is set when the rear differential control module internal temperature exceeds 105°C</p> <ul style="list-style-type: none"> Check the security and integrity of the rear differential control module fixings Allow the rear differential control module to cool (1 hour minimum). Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear differential control module

General Information - Diagnostic Trouble Code (DTC) Index DTC: Rear Seat Entertainment Control Module (RSECM)

Description and Operation

Rear Seat Entertainment Control Module (RSECM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

















Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.









The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Rear Seat Entertainment Control Module (RSECM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.






For additional information, refer to: [Information and Entertainment System](#) (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).









DTC	Description	Possible Causes	Action
B100F-29	Video Input "B" - Signal invalid	<p>NOTE: Circuit reference AUX PANEL VIDEO IN / AUX PANEL VIDEO GND</p> <ul style="list-style-type: none"> Auxiliary video in circuit short circuit to ground, short circuit to power, open circuit, high resistance Auxiliary device internal failure Rear seat entertainment control module internal failure 	<p>NOTE: This DTC can only set when routine - Test Composite Video Blanking and Synchronisation Input (0x6015) - is run and fails</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the auxiliary video in circuit for short circuit to ground, short circuit to power, open circuit, high resistance Connect a known functional video signal source to the audio video input/output panel and select this source using the rear seat entertainment remote control. Check the left/right rear seat entertainment screen for a valid signal Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment control module


B1010-29	Video Input "C" - Signal invalid	 <p>NOTE: Circuit reference HLDF_CVBS_VIDEO_IN / HLDF_CVBS_VIDEO_GND</p> <ul style="list-style-type: none"> • Touch screen video in circuit short circuit to ground, short circuit to power, open circuit, high resistance • Touch screen internal failure • Rear seat entertainment control module internal failure 	 <p>NOTE: This DTC can only set when routine - Test Composite Video Blanking and Synchronisation Input (0x6015) - is run and fails</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the touch screen video in circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the touch screen for related DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment control module
B1252-57	USB Port - Invalid/incomplete software component	<ul style="list-style-type: none"> • A USB device is detected but the content format of the USB device is not supported 	 <p>NOTE: This DTC can only set when routine - USB Interface Self Test (0x602E) - is run and fails</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs, remove and reconnect the USB device, and retest. If fault persists, replace the content of the USB device with content that is correctly formatted
B1252-93	USB Port - No operation	 <p>NOTE: Circuit reference AUX PANEL USB DATA POS / AUX PANEL USB DATA NEG</p> <ul style="list-style-type: none"> • USB device circuit short circuit to ground, short circuit to power, open circuit, high resistance • USB device internal failure • Rear seat entertainment control module internal failure 	 <p>NOTE: This DTC can only set when routine - USB Interface Self Test (0x602E) - is run and fails</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the USB circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Connect a known functional USB device to the audio video input/output panel and select this source using the rear seat entertainment remote control. Check the left/right rear seat entertainment screen for a valid signal • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment control module
B125E-4A	Left Rear Display - Incorrect component installed	 <p>NOTE: Circuit reference SUPPLY_HLDR_L_R / HLDR_MS_CAN_POS / HLDR_MS_CAN_NEG / HLDR_GND</p> <ul style="list-style-type: none"> • Rear seat entertainment left screen power or ground circuit open circuit, high resistance • Rear seat entertainment CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Incorrect rear seat entertainment left screen installed 	 <p>NOTE: This DTC is set when the rear seat entertainment control module has not read a valid serial number from the left rear seat entertainment screen within 25 seconds</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear seat entertainment left screen power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and check the rear seat entertainment CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check that the rear seat entertainment left screen has not been substituted
B125E-96	Left Rear Display - Component internal failure	<ul style="list-style-type: none"> • Rear seat entertainment left screen internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment left screen
B125E-98	Left Rear Display - Component or system over temperature	<ul style="list-style-type: none"> • Rear seat entertainment left screen over temperature condition 	<ul style="list-style-type: none"> • Allow the system to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment left screen
B125F-4A	Right Rear Display -	 <p>NOTE: Circuit reference</p>	 <p>NOTE: This DTC is set when the rear seat</p>

	Incorrect component installed	<p>SUPPLY_HLDR_L_R / HLDR_MS_CAN_POS / HLDR_MS_CAN_NEG / HLDR_GND</p> <ul style="list-style-type: none"> Rear seat entertainment right screen power or ground circuit open circuit, high resistance Rear seat entertainment CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Incorrect rear seat entertainment right screen installed 	<p>entertainment control module has not read a valid serial number from the right rear seat entertainment screen within 25 seconds</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear seat entertainment right screen power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the rear seat entertainment CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Check that the rear seat entertainment right screen has not been substituted
B125F-96	Right Rear Display - Component internal failure	<ul style="list-style-type: none"> Rear seat entertainment right screen internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment right screen
B125F-98	Right Rear Display - Component or system over temperature	<ul style="list-style-type: none"> Rear seat entertainment right screen over temperature condition 	<ul style="list-style-type: none"> Allow the system to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment right screen
B1285-88	Video Input "D" - Bus off	<p> NOTE: Circuit reference TV_LVDS_POS / TV_LVDS_NEG</p> <ul style="list-style-type: none"> TV control module low-voltage differential signalling circuit short circuit to ground, short circuit to power, open circuit, high resistance Television system fault Rear seat entertainment control module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the TV control module low-voltage differential signalling circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the TV control module for related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment control module
B12A0-11	Auxiliary Input 2 - Circuit short to ground	<p> NOTE: Circuit reference AUX PANEL AUDIO IN RIGHT</p> <ul style="list-style-type: none"> Right auxiliary audio in circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right auxiliary audio in circuit for short circuit to ground
B12A0-12	Auxiliary Input 2 - Circuit short to battery	<p> NOTE: Circuit reference AUX PANEL AUDIO IN RIGHT</p> <ul style="list-style-type: none"> Right auxiliary audio in circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right auxiliary audio in circuit for short circuit to power
B12ED-88	Video Input "F" - Bus off	<p> NOTE: Circuit reference L_HLDR_LVDS_VIDEO_OUT_POS / L_HLDR_LVDS_VIDEO_OUT_NEG</p> <ul style="list-style-type: none"> Rear seat entertainment left screen low-voltage differential signalling circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear seat entertainment left screen low-voltage differential signalling circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B12F8-88	Video Input "G" - Bus off	<p> NOTE: Circuit reference R_HLDR_LVDS_VIDEO_OUT_POS / R_HLDR_LVDS_VIDEO_OUT_NEG</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear seat entertainment right screen low-voltage differential signalling circuit for short circuit to ground, short circuit to power, open circuit, high resistance

		<ul style="list-style-type: none"> Rear seat entertainment right screen low-voltage differential signalling circuit short circuit to ground, short circuit to power, open circuit, high resistance 	
B1D21-02	Remote Control Switch - General signal failure	 <p>NOTE: Circuit reference SUPPLY_REMOTE / REMOTE_DATA_IN / REMOTE_DATA_OUT / REMOTE_GND</p> <ul style="list-style-type: none"> Rear seat entertainment remote control docking station power or ground circuit open circuit, high resistance Rear seat entertainment remote control data bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear seat entertainment remote control internal failure 	 <p>NOTE: This DTC can only set when routine - TSRC (Touch Screen Remote Control Interface Self Test (0x602F) - is run and fails</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear seat entertainment remote control docking station power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the rear seat entertainment remote control data bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Place the rear seat entertainment remote control in the docking station. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment remote control
B1D21-08	Remote Control Switch - Bus signal/message failures	<ul style="list-style-type: none"> Rear seat entertainment remote control fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the rear seat entertainment remote control with the latest level software
B1D21-1C	Remote Control Switch - Circuit voltage out of range	<ul style="list-style-type: none"> Rear seat entertainment remote control fault 	 <p>NOTE: This DTC can only set when routine - TSRC (Touch Screen Remote Control Interface Self Test (0x602F) - is run and fails</p> <ul style="list-style-type: none"> Install a new rear seat entertainment remote control battery
B1D21-57	Remote Control Switch - Invalid/incomplete software component	<ul style="list-style-type: none"> Rear seat entertainment remote control fault 	 <p>NOTE: This DTC can only set when routine - TSRC (Touch Screen Remote Control Interface Self Test (0x602F) - is run and fails</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the rear seat entertainment remote control with the latest level software
B1D21-71	Remote Control Switch - Actuator stuck	<ul style="list-style-type: none"> Rear seat entertainment remote control fault 	 <p>NOTE: This DTC can only set when routine - TSRC (Touch Screen Remote Control Interface Self Test (0x602F) - is run and fails</p> <ul style="list-style-type: none"> Test the operation of the rear seat entertainment remote control switches
B1D78-11	Auxiliary Input - Circuit short to ground	 <p>NOTE: Circuit reference AUX PANEL AUDIO IN LEFT</p> <ul style="list-style-type: none"> Left auxiliary audio in circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left auxiliary audio in circuit for short circuit to ground
B1D78-12	Auxiliary Input - Circuit short to battery	 <p>NOTE: Circuit reference AUX PANEL AUDIO IN LEFT</p> <ul style="list-style-type: none"> Left auxiliary audio in circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left auxiliary audio in circuit for short circuit to power
U0196-31	Lost Communication	 <p>NOTE: Circuit reference</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear seat entertainment left

	With Entertainment Control Module - Rear "A" - No signal	<p>SUPPLY_HLDR_L_R / HLDR_MS_CAN_POS / HLDR_MS_CAN_NEG / HLDR_GND</p> <ul style="list-style-type: none"> Rear seat entertainment left screen power or ground circuit open circuit, high resistance Rear seat entertainment CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<p>screen power and ground circuits for open circuit, high resistance</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear seat entertainment CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0249-31	Lost Communication With Entertainment Control Module - Rear "B" - No signal	<p> NOTE: Circuit reference SUPPLY_HLDR_L_R / HLDR_MS_CAN_POS / HLDR_MS_CAN_NEG / HLDR_GND</p> <ul style="list-style-type: none"> Rear seat entertainment right screen power or ground circuit open circuit, high resistance Rear seat entertainment CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear seat entertainment right screen power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the rear seat entertainment CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U1009-00	Invalid Data Received From Right Rear Display Module - No sub type information	<p> NOTE: Circuit reference SUPPLY_HLDR_L_R / HLDR_MS_CAN_POS / HLDR_MS_CAN_NEG / R_HLDR_LVDS_VIDEO_OUT_POS / R_HLDR_LVDS_VIDEO_OUT_NEG / HLDR_GND</p> <ul style="list-style-type: none"> Rear seat entertainment CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear seat entertainment right screen low-voltage differential signalling circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear seat entertainment right screen power or ground circuit open circuit, high resistance Rear seat entertainment right screen internal failure 	<p> NOTE: This DTC indicates that unexpected data was received from the rear seat entertainment right screen. This could be due to a reset, harness fault, incorrect programming or random corruption</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear seat entertainment CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the rear seat entertainment right screen low-voltage differential signalling circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the rear seat entertainment right screen power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment right screen
U100A-00	Invalid Data Received From Left Rear Display Module - No sub type information	<p> NOTE: Circuit reference SUPPLY_HLDR_L_R / HLDR_MS_CAN_POS / HLDR_MS_CAN_NEG / L_HLDR_LVDS_VIDEO_OUT_POS / L_HLDR_LVDS_VIDEO_OUT_NEG / HLDR_GND</p> <ul style="list-style-type: none"> Rear seat entertainment CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear seat entertainment left screen low-voltage differential signalling circuit short circuit to 	<p> NOTE: This DTC indicates that unexpected data was received from the rear seat entertainment left screen. This could be due to a reset, harness fault, incorrect programming or random corruption</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear seat entertainment CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the rear seat entertainment left screen low-voltage differential signalling circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the rear seat entertainment left

		<p>ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Rear seat entertainment left screen power or ground circuit open circuit, high resistance • Rear seat entertainment left screen internal failure 	<p>screen power and ground circuits for open circuit, high resistance</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment left screen
U200D-11	Control Module Output Power A - Circuit short to ground	 <p>NOTE: Circuit reference SUPPLY_HLDR_L_R</p> <ul style="list-style-type: none"> • Rear seat entertainment left/right screen circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear seat entertainment left/right screen circuit for short circuit to ground
U200D-12	Control Module Output Power A - Circuit short to battery	 <p>NOTE: Circuit reference SUPPLY_HLDR_L_R</p> <ul style="list-style-type: none"> • Rear seat entertainment left/right screen circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear seat entertainment left/right screen circuit for short circuit to power
U200D-19	Control Module Output Power A - Circuit current above threshold	 <p>NOTE: Circuit reference SUPPLY_HLDR_L_R / HLDR_GND</p> <ul style="list-style-type: none"> • Rear seat entertainment left/right screen circuit short circuit to ground, short circuit to power • Rear seat entertainment control module internal failure 	 <p>NOTE: This DTC is logged when the combined total current consumption of the rear screens exceeds 1.35 amps</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear seat entertainment left/right screen circuit for short circuit to ground, short circuit to power • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment control module
U200E-11	Control Module Output Power B - Circuit short to ground	 <p>NOTE: Circuit reference SUPPLY_REMOTE</p> <ul style="list-style-type: none"> • Rear seat entertainment remote control docking station supply circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear seat entertainment remote control docking station supply circuit for short circuit to ground
U200E-12	Control Module Output Power B - Circuit short to battery	 <p>NOTE: Circuit reference SUPPLY_REMOTE</p> <ul style="list-style-type: none"> • Rear seat entertainment remote control docking station supply circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear seat entertainment remote control docking station supply circuit for short circuit to power
U200E-19	Control Module Output Power B - Circuit current above threshold	 <p>NOTE: Circuit reference SUPPLY_REMOTE/ REMOTE_GND</p> <ul style="list-style-type: none"> • Rear seat entertainment remote control docking station circuit short circuit to ground, short circuit to power • Rear seat entertainment control module internal failure 	 <p>NOTE: If this DTC is set, install a new rear seat entertainment control module even if a circuit fault has been found and rectified</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the rear seat entertainment remote control docking station circuit for short circuit to ground, short circuit to power • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment control module
U2014-56	Control Module Hardware - Invalid/incomplete configuration	<ul style="list-style-type: none"> • Rear seat entertainment control module is not configured correctly 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the rear seat entertainment control module with the latest level software
U2100-00	Initial Configuration Not	<ul style="list-style-type: none"> • Rear seat entertainment control module is not 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the rear seat

	Complete - No sub type information	configured correctly	entertainment control module with the latest level software
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification Incorrect rear seat entertainment control module installed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary Install a new rear seat entertainment control module as necessary
U3000-19	Control Module - Circuit current above threshold	<ul style="list-style-type: none"> Rear seat entertainment control module internal failure 	 <p>NOTE: If this DTC is set, install a new rear seat entertainment control module even if a circuit fault has been found and rectified</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment control module
U3000-55	Control Module - Not configured	<ul style="list-style-type: none"> Rear seat entertainment control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the rear seat entertainment control module with the latest level software
U3000-98	Control Module - Component or system over temperature	<ul style="list-style-type: none"> Rear seat entertainment control module over temperature 	<ul style="list-style-type: none"> Allow the vehicle to cool. Check the rear seat entertainment control module ventilation ducts for obstructions. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear seat entertainment control module
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> Mismatch between the voltage at the rear seat entertainment control module and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear seat entertainment control module power and ground circuits for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Rear View Camera (RVC)

Description and Operation

Rear View Camera (RVC)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Rear View Camera (RVC). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Parking Aid](#) (413-13 Parking Aid, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
U0010-88	Medium Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0012-13	Medium Speed CAN Communication Bus (+) Open - Circuit open	<ul style="list-style-type: none"> Medium speed CAN bus high circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the medium speed CAN bus high circuit for open circuit, high resistance
U0013-11	Medium Speed CAN Communication Bus (+) Low - Circuit short to ground	<ul style="list-style-type: none"> Medium speed CAN bus high circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the medium speed CAN bus high circuit for short circuit to ground
U0014-	Medium Speed	<ul style="list-style-type: none"> Medium speed 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the

12	CAN Communication Bus (+) High - Circuit short to battery	CAN bus high circuit short circuit to power	medium speed CAN bus high circuit for short circuit to power
U0015-13	Medium Speed CAN Communication Bus (-) Open - Circuit open	<ul style="list-style-type: none"> Medium speed CAN bus low circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the medium speed CAN bus low circuit for open circuit, high resistance
U0016-11	Medium Speed CAN Communication Bus (-) Low - Circuit short to ground	<ul style="list-style-type: none"> Medium speed CAN bus low circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the medium speed CAN bus low circuit for short circuit to ground
U0017-12	Medium Speed CAN Communication Bus (-) High - Circuit short to battery	<ul style="list-style-type: none"> Medium speed CAN bus low circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the medium speed CAN bus low circuit for short circuit to power
U0018-88	Medium Speed CAN Communication Bus (-) shorted to Bus (+) - Bus off	<ul style="list-style-type: none"> Medium speed CAN bus high circuit short circuit to medium speed CAN bus low circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the medium speed CAN bus high circuit for short circuit to the medium speed CAN bus low circuit
U0140-08	Lost Communication With Body Control Module - Bus signal/message failures	<ul style="list-style-type: none"> Central junction box power or ground circuit open circuit, high resistance Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Central junction box system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U3000-96	Control Module - Component internal failure	<ul style="list-style-type: none"> Rear view camera internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear view camera

General Information - Diagnostic Trouble Code (DTC) Index DTC: Rear View Mirror

Description and Operation

Rear View Mirror



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.




Check DDW for open campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Rear View Mirror. For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Autolamps](#) (417-01 Exterior Lighting, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1286-16	Interior mirror - Circuit voltage below threshold	<ul style="list-style-type: none"> Auto high beam control module power or ground circuit open circuit, high resistance Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the electrical circuit diagrams and check the auto high beam control module power and ground circuits for open circuit, high resistance Refer to the relevant section of the workshop manual and test the battery and charging system
B1286-17	Interior mirror - Circuit voltage above threshold	<ul style="list-style-type: none"> Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the relevant section of the workshop manual and test the battery and charging system
B1286-44	Interior mirror - Data memory failure	<ul style="list-style-type: none"> Auto high beam control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear view mirror
B1286-47	Interior mirror - Watchdog/safety micro controller failure	<ul style="list-style-type: none"> Auto high beam control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear view mirror
B1286-49	Interior mirror - Internal electronic failure	<ul style="list-style-type: none"> Auto high beam control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear view mirror

B1286-60	Interior mirror – Reserved by document	<ul style="list-style-type: none"> Auto high beam control module temperature below lower operating threshold (-20°C) 	<ul style="list-style-type: none"> Allow the vehicle interior temperature to increase
B1286-78	Interior mirror - Alignment or adjustment incorrect	<ul style="list-style-type: none"> Auto high beam sensitivity has been reduced using the instrument cluster service menu settings 	 <p>NOTE: This DTC is for event information only.</p> <ul style="list-style-type: none"> Increased sensitivity mode is cancelled when the ignition is cycled
B1286-96	Interior mirror - Component internal failure	<ul style="list-style-type: none"> Auto high beam control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear view mirror
B1286-97	Interior mirror - Component or system operation obstructed or blocked	<ul style="list-style-type: none"> Auto high beam camera view blocked 	<ul style="list-style-type: none"> Check for obstructions in front of the auto high beam camera
B1286-98	Interior mirror - Component or system over temperature	<ul style="list-style-type: none"> Auto high beam control module temperature above upper operating threshold (65°C) 	<ul style="list-style-type: none"> Allow the vehicle interior temperature to decrease
B12AC-11	Electrochromic door mirror - Circuit short to ground	<ul style="list-style-type: none"> Electrochromic door mirror output circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check both door mirrors circuit for short circuit to ground
B12AC-12	Electrochromic door mirror - Circuit short to battery	<ul style="list-style-type: none"> Electrochromic door mirror output circuit short circuit to power 	<ul style="list-style-type: none"> Refer to electrical circuit diagrams and check both door mirrors circuit for short circuit to power
B12EB-78	Camera horizontal alignment - Alignment or adjustment incorrect	<ul style="list-style-type: none"> Auto high beam control module camera misaligned in the horizontal direction. Windscreen button and mirror attachment alignment incorrect Auto high beam control module internal failure 	<ul style="list-style-type: none"> Check accuracy of mirror attachment and windscreen button Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear view mirror
B12EC-78	Camera vertical alignment - Alignment or adjustment incorrect	<ul style="list-style-type: none"> Rear view mirror camera misaligned in the horizontal direction. Windscreen button and mirror attachment alignment incorrect Auto high beam control module internal failure 	<ul style="list-style-type: none"> Check accuracy of mirror attachment and windscreen button Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear view mirror
B134A-78	Target aim verification - camera horizontal alignment - Alignment or adjustment incorrect	<ul style="list-style-type: none"> Rear view mirror camera misaligned in the horizontal direction. Windscreen button and mirror attachment alignment incorrect Auto high beam control module internal failure 	<ul style="list-style-type: none"> Check accuracy of mirror attachment and windscreen button Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear view mirror
B134B-78	Target aim vertical - camera horizontal alignment - Alignment or adjustment incorrect	<ul style="list-style-type: none"> Rear view mirror camera misaligned in the horizontal direction. Windscreen button and mirror attachment alignment incorrect Auto high beam control module internal failure 	<ul style="list-style-type: none"> Check accuracy of mirror attachment and windscreen button Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new rear view mirror
U0010-88	Medium speed CAN communication bus - Bus off	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance

U0140-00	Lost communication with body control module - No sub type information	<ul style="list-style-type: none"> • Central junction box power or ground circuit open circuit, high resistance • Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Central junction box system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0300-00	Internal control module software incompatibility - No sub type information	<ul style="list-style-type: none"> • Auto high beam control module is not configured correctly 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the rear view mirror with the latest level software
U201A-57	Control module main calibration data - Invalid/incomplete software component	<ul style="list-style-type: none"> • Auto high beam control module is not configured correctly • Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the rear view mirror with the latest level software • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U2100-00	Initial configuration not complete - No sub type information	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U2101-00	Control module configuration incompatible - No sub type information	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary

General Information - Diagnostic Trouble Code (DTC) Index DTC: Restraints Control Module (RCM)

Description and Operation

Restraints Control Module (RCM)



WARNING: TO AVOID ACCIDENTAL DEPLOYMENT AND POSSIBLE PERSONAL INJURY, THE BACKUP POWER SUPPLY MUST BE DEPLETED BEFORE REPAIRING OR REPLACING ANY AIR BAG SUPPLEMENTAL RESTRAINT SYSTEM (SRS) COMPONENTS. TO DEplete THE BACKUP POWER SUPPLY ENERGY, DISCONNECT THE BATTERY GROUND CABLE AND WAIT ONE MINUTE. FAILURE TO FOLLOW THIS INSTRUCTION MAY RESULT IN PERSONAL INJURY.



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

NOTES:



Given the legal implications of a restraints system failure, harness repairs to the restraints control module circuits are not acceptable. Where the text refers to "REPAIR the circuit", this will normally mean the replacement of a harness.



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



















Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.










The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Restraints Control Module (RCM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.









For additional information, refer to: [Air Bag Supplemental Restraint System \(SRS\)](#) (501-20B Supplemental Restraint System, Diagnosis and Testing).











DTC	Description	Possible Causes	Action
B0001-11	Driver Frontal Stage 1 Deployment Control - Circuit short to ground	<p>NOTE: Circuit reference DR AIRBAG F1 / DR AIRBAG R1</p> <ul style="list-style-type: none"> Driver airbag (stage 1) circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver airbag (stage 1) circuit for short circuit to ground. Rotate the steering wheel during the tests to check for intermittent circuit faults within the clockspring
B0001-12	Driver Frontal Stage 1 Deployment Control - Circuit short to battery	<p>NOTE: Circuit reference DR AIRBAG F1 / DR AIRBAG R1</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver airbag (stage 1) circuit for short circuit to power. Rotate the steering wheel during the tests to check for intermittent circuit faults within the clockspring









		<ul style="list-style-type: none"> Driver airbag (stage 1) circuit short circuit to power 	
B0001-1A	Driver Frontal Stage 1 Deployment Control - Circuit resistance below threshold	 <p>NOTE: Circuit reference DR AIRBAG F1 / DR AIRBAG R1</p> <ul style="list-style-type: none"> Driver airbag (stage 1) circuit short circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver airbag (stage 1) circuit for short circuit. Test connector security at clockspring and airbag. Rotate the steering wheel during the tests to check for intermittent circuit faults within the clockspring
B0001-1B	Driver Frontal Stage 1 Deployment Control - Circuit resistance above threshold	 <p>NOTE: Circuit reference DR AIRBAG F1 / DR AIRBAG R1</p> <ul style="list-style-type: none"> Driver airbag (stage 1) circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver airbag (stage 1) circuit for open circuit, high resistance. Rotate the steering wheel during the tests to check for intermittent circuit faults within the clockspring
B0001-64	Driver Frontal Stage 1 Deployment Control - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 <p>NOTE: This DTC is set when the output is switched off but the airbag is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0001-95	Driver Frontal Stage 1 Deployment Control - Incorrect assembly	 <p>NOTE: Circuit reference DR AIRBAG F1 / DR AIRBAG R1</p> <ul style="list-style-type: none"> Driver airbag (stage 1) incorrect assembly. Short circuit between two different circuits (at least two faults) 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver airbag (stage 1) circuit for faults. Rotate the steering wheel during the tests to check for intermittent circuit faults within the clockspring
B0002-11	Driver Frontal Stage 2 Deployment Control - Circuit short to ground	 <p>NOTE: Circuit reference DR AIRBAG F2 / DR AIRBAG R2</p> <ul style="list-style-type: none"> Driver airbag (stage 2) circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver airbag (stage 2) circuit for short circuit to ground. Rotate the steering wheel during the tests to check for intermittent circuit faults within the clockspring
B0002-12	Driver Frontal Stage 2 Deployment Control - Circuit short to battery	 <p>NOTE: Circuit reference DR AIRBAG F2 / DR AIRBAG R2</p> <ul style="list-style-type: none"> Driver airbag (stage 2) circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver airbag (stage 2) circuit for short circuit to power. Rotate the steering wheel during the tests to check for intermittent circuit faults within the clockspring
B0002-1A	Driver Frontal Stage 2 Deployment Control - Circuit resistance below threshold	 <p>NOTE: Circuit reference DR AIRBAG F2 / DR AIRBAG R2</p> <ul style="list-style-type: none"> Driver airbag (stage 2) circuit short circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver airbag (stage 2) circuit for short circuit. Test connector security at clockspring and airbag. Rotate the steering wheel during the tests to check for intermittent circuit faults within the clockspring
B0002-1B	Driver Frontal Stage 2 Deployment Control - Circuit resistance above threshold	 <p>NOTE: Circuit reference DR AIRBAG F2 / DR AIRBAG R2</p> <ul style="list-style-type: none"> Driver airbag (stage 2) circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver airbag (stage 2) circuit for open circuit, high resistance. Rotate the steering wheel during the tests to check for intermittent circuit faults within the clockspring











B0002-64	Driver Frontal Stage 2 Deployment Control - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 <p>NOTE: This DTC is set when the output is switched off but the airbag is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0002-95	Driver Frontal Stage 2 Deployment Control - Incorrect assembly	 <p>NOTE: Circuit reference DR AIRBAG F2 / DR AIRBAG R2</p> <ul style="list-style-type: none"> Driver airbag (stage 2) incorrect assembly. Short circuit between two different circuits (at least two faults) 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver airbag (stage 2) circuit for faults. Rotate the steering wheel during the tests to check for intermittent circuit faults within the clockspring
B0010-11	Passenger Frontal Stage 1 Deployment Control - Circuit short to ground	 <p>NOTE: Circuit reference PASS AIRBAG F1 / PASS AIRBAG R1</p> <ul style="list-style-type: none"> Passenger airbag (stage 1) circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag (stage 1) circuit for short circuit to ground
B0010-12	Passenger Frontal Stage 1 Deployment Control - Circuit short to battery	 <p>NOTE: Circuit reference PASS AIRBAG F1 / PASS AIRBAG R1</p> <ul style="list-style-type: none"> Passenger airbag (stage 1) circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag (stage 1) circuit for short circuit to power
B0010-1A	Passenger Frontal Stage 1 Deployment Control - Circuit resistance below threshold	 <p>NOTE: Circuit reference PASS AIRBAG F1 / PASS AIRBAG R1</p> <ul style="list-style-type: none"> Passenger airbag (stage 1) circuit short circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag (stage 1) circuit for short circuit. Test connectors for security
B0010-1B	Passenger Frontal Stage 1 Deployment Control - Circuit resistance above threshold	 <p>NOTE: Circuit reference PASS AIRBAG F1 / PASS AIRBAG R1</p> <ul style="list-style-type: none"> Passenger airbag (stage 1) circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag (stage 1) circuit for open circuit, high resistance
B0010-64	Passenger Frontal Stage 1 Deployment Control - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 <p>NOTE: This DTC is set when the output is switched off but the airbag is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0010-95	Passenger Frontal Stage 1 Deployment Control - Incorrect assembly	 <p>NOTE: Circuit reference PASS AIRBAG F1 / PASS AIRBAG R1</p> <ul style="list-style-type: none"> Passenger airbag (stage 1) incorrect assembly. Short circuit between two different circuits (at least two faults) 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag (stage 1) circuit for faults









B0011-11	Passenger Frontal Stage 2 Deployment Control - Circuit short to ground	 <p>NOTE: Circuit reference PASS AIRBAG F2 / PASS AIRBAG R2</p> <ul style="list-style-type: none"> Passenger airbag (stage 2) circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag (stage 2) circuit for short circuit to ground
B0011-12	Passenger Frontal Stage 2 Deployment Control - Circuit short to battery	 <p>NOTE: Circuit reference PASS AIRBAG F2 / PASS AIRBAG R2</p> <ul style="list-style-type: none"> Passenger airbag (stage 2) circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag (stage 2) circuit for short circuit to power
B0011-1A	Passenger Frontal Stage 2 Deployment Control - Circuit resistance below threshold	 <p>NOTE: Circuit reference PASS AIRBAG F2 / PASS AIRBAG R2</p> <ul style="list-style-type: none"> Passenger airbag (stage 2) circuit short circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag (stage 2) circuit for short circuit. Test connectors for security
B0011-1B	Passenger Frontal Stage 2 Deployment Control - Circuit resistance above threshold	 <p>NOTE: Circuit reference PASS AIRBAG F2 / PASS AIRBAG R2</p> <ul style="list-style-type: none"> Passenger airbag (stage 2) circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag (stage 2) circuit for open circuit, high resistance
B0011-64	Passenger Frontal Stage 2 Deployment Control - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 <p>NOTE: This DTC is set when the output is switched off but the airbag is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0011-95	Passenger Frontal Stage 2 Deployment Control - Incorrect assembly	 <p>NOTE: Circuit reference PASS AIRBAG F2 / PASS AIRBAG R2</p> <ul style="list-style-type: none"> Passenger airbag (stage 2) incorrect assembly. Short circuit between two different circuits (at least two faults) 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag (stage 2) circuit for faults
B0020-11	Left Side Air Bag Deployment Control - Circuit short to ground	 <p>NOTE: Circuit reference LH SIDE A/BAG F1 / LH SIDE A/BAG R1</p> <ul style="list-style-type: none"> Left side airbag (seat) circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side airbag (seat) circuit for short circuit to ground
B0020-12	Left Side Air Bag Deployment Control - Circuit short to battery	 <p>NOTE: Circuit reference LH SIDE A/BAG F1 / LH SIDE A/BAG R1</p> <ul style="list-style-type: none"> Left side airbag (seat) circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side airbag (seat) circuit for short circuit to power
B0020-1A	Left Side Air Bag Deployment Control		<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side airbag (seat) circuit for short circuit.









	- Circuit resistance below threshold	<p>NOTE: Circuit reference LH SIDE A/BAG F1 / LH SIDE A/BAG R1</p> <ul style="list-style-type: none"> Left side airbag (seat) circuit short circuit 	Test connectors for security
B0020-1B	Left Side Air Bag Deployment Control - Circuit resistance above threshold	 <p>NOTE: Circuit reference LH SIDE A/BAG F1 / LH SIDE A/BAG R1</p> <ul style="list-style-type: none"> Left side airbag (seat) circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side airbag (seat) circuit for open circuit, high resistance
B0020-64	Left Side Air Bag Deployment Control - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 <p>NOTE: This DTC is set when the output is switched off but the airbag is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0020-95	Left Side Airbag Deployment Control - Incorrect assembly	 <p>NOTE: Circuit reference LH SIDE A/BAG F1 / LH SIDE A/BAG R1</p> <ul style="list-style-type: none"> Left side airbag (seat) incorrect assembly. Short circuit between two different circuits (at least two faults) 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side airbag (seat) circuit for faults
B0021-11	Left Curtain Deployment Control 1 - Circuit short to ground	 <p>NOTE: Circuit reference LH SIDE CUR F1 / LH SIDE CUR R1</p> <ul style="list-style-type: none"> Left side air curtain (rows 1 and 2) circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side air curtain (rows 1 and 2) circuit for short circuit to ground
B0021-12	Left Curtain Deployment Control 1 - Circuit short to battery	 <p>NOTE: Circuit reference LH SIDE CUR F1 / LH SIDE CUR R1</p> <ul style="list-style-type: none"> Left side air curtain (rows 1 and 2) circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side air curtain (rows 1 and 2) circuit for short circuit to power
B0021-1A	Left Curtain Deployment Control 1 - Circuit resistance below threshold	 <p>NOTE: Circuit reference LH SIDE CUR F1 / LH SIDE CUR R1</p> <ul style="list-style-type: none"> Left side air curtain (rows 1 and 2) circuit short circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side air curtain (rows 1 and 2) circuit for short circuit. Test connectors for security
B0021-1B	Left Curtain Deployment Control 1 - Circuit resistance above threshold	 <p>NOTE: Circuit reference LH SIDE CUR F1 / LH SIDE CUR R1</p> <ul style="list-style-type: none"> Left side air curtain (rows 1 and 2) circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side air curtain (rows 1 and 2) circuit for open circuit, high resistance
B0021-64	Left Curtain Deployment Control	<ul style="list-style-type: none"> Restraints control module is not 	 <p>NOTE: This DTC is set when the output is switched</p>








	1 - Signal plausibility failure	configured correctly	off but the airbag is actually installed.
B0021-95	Left Curtain Deployment Control 1 - Incorrect assembly	 <p>NOTE: Circuit reference LH SIDE CUR F1 / LH SIDE CUR R1</p> <ul style="list-style-type: none"> Left side air curtain (rows 1 and 2) incorrect assembly. Short circuit between two different circuits (at least two faults) 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software Refer to the electrical circuit diagrams and check the left side air curtain (rows 1 and 2) circuit for faults
B0022-11	Left Curtain Deployment Control 2 - Circuit short to ground	<ul style="list-style-type: none"> Left side air curtain 2 (row 3) circuit short circuit to ground 	 <p>NOTE: Applicable to seven seat vehicles.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side air curtain 2 (row 3) circuit for short circuit to ground
B0022-12	Left Curtain Deployment Control 2 - Circuit short to battery	<ul style="list-style-type: none"> Left side air curtain 2 (row 3) circuit short circuit to power 	 <p>NOTE: Applicable to seven seat vehicles.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side air curtain 2 (row 3) circuit for short circuit to power
B0022-1A	Left Curtain Deployment Control 2 - Circuit resistance below threshold	<ul style="list-style-type: none"> Left side air curtain 2 (row 3) circuit short circuit 	 <p>NOTE: Applicable to seven seat vehicles.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side air curtain 2 (row 3) circuit for short circuit. Test connectors for security
B0022-1B	Left Curtain Deployment Control 2 - Circuit resistance above threshold	<ul style="list-style-type: none"> Left side air curtain 2 (row 3) circuit open circuit, high resistance 	 <p>NOTE: Applicable to seven seat vehicles.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side air curtain 2 (row 3) circuit for open circuit, high resistance
B0022-64	Left Curtain Deployment Control 2 - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<p>NOTES:</p>  <p>Applicable to seven seat vehicles.</p>  <p>This DTC is set when the output is switched off but the airbag is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0022-95	Left Curtain Deployment Control 2 - Incorrect assembly	<ul style="list-style-type: none"> Left side air curtain 2 (row 3) incorrect assembly. Short circuit between two different circuits (at least two faults) 	 <p>NOTE: Applicable to seven seat vehicles.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side air curtain 2 (row 3) circuit for faults
B0028-11	Right Side Air Bag Deployment Control - Circuit short to ground	 <p>NOTE: Circuit reference RH SIDE A/BAG F1 / RH SIDE A/BAG R1</p> <ul style="list-style-type: none"> Right side airbag (seat) circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side airbag (seat) circuit for short circuit to ground
B0028-12	Right Side Air Bag Deployment Control - Circuit short to	 <p>NOTE: Circuit reference RH SIDE A/BAG</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side airbag (seat) circuit for short circuit to power









	battery	F1 / RH SIDE A/BAG R1		<ul style="list-style-type: none"> Right side airbag (seat) circuit short circuit to power
B0028-1A	Right Side Air Bag Deployment Control - Circuit resistance below threshold	 NOTE: Circuit reference RH SIDE A/BAG F1 / RH SIDE A/BAG R1		<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side airbag (seat) circuit for short circuit. Test connectors for security
B0028-1B	Right Side Air Bag Deployment Control - Circuit resistance above threshold	 NOTE: Circuit reference RH SIDE A/BAG F1 / RH SIDE A/BAG R1		<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side airbag (seat) circuit for open circuit, high resistance
B0028-64	Right Side Air Bag Deployment Control - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 NOTE: This DTC is set when the output is switched off but the airbag is actually installed.	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0028-95	Right Side Airbag Deployment Control - Incorrect assembly	 NOTE: Circuit reference RH SIDE A/BAG F1 / RH SIDE A/BAG R1		<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side airbag (seat) circuit for faults
B0029-11	Right Curtain Deployment Control 1 - Circuit short to ground	 NOTE: Circuit reference RH SIDE CUR F1 / RH SIDE CUR R1		<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side air curtain (rows 1 and 2) circuit for short circuit to ground
B0029-12	Right Curtain Deployment Control 1 - Circuit short to battery	 NOTE: Circuit reference RH SIDE CUR F1 / RH SIDE CUR R1		<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side air curtain (rows 1 and 2) circuit for short circuit to power
B0029-1A	Right Curtain Deployment Control 1 - Circuit resistance below threshold	 NOTE: Circuit reference RH SIDE CUR F1 / RH SIDE CUR R1		<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side air curtain (rows 1 and 2) circuit for short circuit. Test connectors for security
B0029-1B	Right Curtain Deployment Control 1 - Circuit resistance above	 NOTE: Circuit reference RH SIDE CUR F1 / RH SIDE CUR R1		<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side air curtain (rows 1 and 2) circuit for open circuit, high resistance









	threshold	<ul style="list-style-type: none"> Right side air curtain (rows 1 and 2) circuit open circuit, high resistance 	
B0029-64	Right Curtain Deployment Control 1 - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 <p>NOTE: This DTC is set when the output is switched off but the airbag is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0029-95	Right Curtain Deployment Control 1 - Incorrect assembly	 <p>NOTE: Circuit reference RH SIDE CUR F1 / RH SIDE CUR R1</p> <ul style="list-style-type: none"> Right side air curtain (rows 1 and 2) incorrect assembly. Short circuit between two different circuits (at least two faults) 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side air curtain (rows 1 and 2) circuit for faults
B002A-11	Right Curtain Deployment Control 2 - Circuit short to ground	<ul style="list-style-type: none"> Right side air curtain 2 (row 3) circuit short circuit to ground 	 <p>NOTE: Applicable to seven seat vehicles.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side air curtain 2 (row 3) circuit for short circuit to ground
B002A-12	Right Curtain Deployment Control 2 - Circuit short to battery	<ul style="list-style-type: none"> Right side air curtain 2 (row 3) circuit short circuit to power 	 <p>NOTE: Applicable to seven seat vehicles.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side air curtain 2 (row 3) circuit for short circuit to power
B002A-1A	Right Curtain Deployment Control 2 - Circuit resistance below threshold	<ul style="list-style-type: none"> Right side air curtain 2 (row 3) circuit short circuit 	 <p>NOTE: Applicable to seven seat vehicles.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side air curtain 2 (row 3) circuit for short circuit. Test connectors for security
B002A-1B	Right Curtain Deployment Control 2 - Circuit resistance above threshold	<ul style="list-style-type: none"> Right side air curtain 2 (row 3) circuit open circuit, high resistance 	 <p>NOTE: Applicable to seven seat vehicles.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side air curtain 2 (row 3) circuit for open circuit, high resistance
B002A-64	Right Curtain Deployment Control 2 - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<p>NOTES:</p>  <p>Applicable to seven seat vehicles.</p>  <p>This DTC is set when the output is switched off but the airbag is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B002A-95	Right Curtain Deployment Control 2 - Incorrect assembly	<ul style="list-style-type: none"> Right side air curtain 2 (row 3) incorrect assembly. Short circuit between two different circuits (at least two faults) 	 <p>NOTE: Applicable to seven seat vehicles.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side air curtain 2 (row 3) circuit for faults
B0050-11	Driver Seatbelt Sensor - Circuit	 <p>NOTE: Circuit</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seatbelt buckle switch circuit for short









	short to ground	<p>reference BUCKLE SWITCH-DR</p> <ul style="list-style-type: none"> • Driver seatbelt buckle switch circuit short circuit to ground 	circuit to ground
B0050-12	Driver Seatbelt Sensor - Circuit short to battery	<p> NOTE: Circuit reference BUCKLE SWITCH-DR</p> <ul style="list-style-type: none"> • Driver seatbelt buckle switch circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver seatbelt buckle switch circuit for short circuit to power
B0050-1D	Driver Seatbelt Sensor - Circuit current out of range	<p> NOTE: Circuit reference BUCKLE SWITCH-DR</p> <ul style="list-style-type: none"> • Driver seatbelt buckle switch circuit current out of range 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver seatbelt buckle switch circuit for fault
B0050-64	Driver Seatbelt Sensor - Signal plausibility failure	<ul style="list-style-type: none"> • Restraints control module is not configured correctly 	<p> NOTE: This DTC is set when the input is switched off but the sensor is actually installed.</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0090-11	Left Frontal Restraints Sensor - Circuit short to ground	<p> NOTE: Circuit reference LH CRASH SENS F / LH CRASH SENS R</p> <ul style="list-style-type: none"> • Left front impact sensor circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the left front impact sensor circuit for short circuit to ground
B0090-12	Left Frontal Restraints Sensor - Circuit short to battery	<p> NOTE: Circuit reference LH CRASH SENS F / LH CRASH SENS R</p> <ul style="list-style-type: none"> • Left front impact sensor circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the left front impact sensor circuit for short circuit to power
B0090-64	Left Frontal Restraints Sensor - Signal plausibility failure	<ul style="list-style-type: none"> • Restraints control module is not configured correctly 	<p> NOTE: This DTC is set when the input is switched off but the sensor is actually installed.</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0090-81	Left Frontal Restraints Sensor - Invalid serial data received	<p> NOTE: Circuit reference LH CRASH SENS F / LH CRASH SENS R</p> <ul style="list-style-type: none"> • Left front impact sensor circuit open circuit • Left front impact sensor internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the left front impact sensor circuit for open circuit • Install a new left front impact sensor as necessary
B0090-92	Left Frontal Restraints Sensor - Performance or incorrect operation	<p> NOTE: Circuit reference LH CRASH SENS F / LH CRASH SENS R</p> <ul style="list-style-type: none"> • Left front impact 	<ul style="list-style-type: none"> • Check left front impact sensor fixings for security • Install a new left front impact sensor as necessary







		<p>sensor fixings insecure</p> <ul style="list-style-type: none"> Left front impact sensor internal failure 	
B0090-96	Left Frontal Restraints Sensor - Component internal failure	 <p>NOTE: Circuit reference LH CRASH SENS F / LH CRASH SENS R</p> <ul style="list-style-type: none"> Left front impact sensor internal failure 	<ul style="list-style-type: none"> Install a new left front impact sensor as necessary
B0091-11	Left Side Restraints Sensor 1 - Circuit short to ground	 <p>NOTE: Circuit reference LH SIDE SENS F1 / LH SIDE SENS R1</p> <ul style="list-style-type: none"> Left side impact sensor 1 (door) circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side impact sensor 1 (door) circuit for short circuit to ground
B0091-12	Left Side Restraints Sensor 1 - Circuit short to battery	 <p>NOTE: Circuit reference LH SIDE SENS F1 / LH SIDE SENS R1</p> <ul style="list-style-type: none"> Left side impact sensor 1 (door) circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side impact sensor 1 (door) circuit for short circuit to power
B0091-64	Left Side Restraints Sensor 1 - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 <p>NOTE: This DTC is set when the input is switched off but the sensor is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0091-81	Left Side Restraints Sensor 1 - Invalid serial data received	 <p>NOTE: Circuit reference LH SIDE SENS F1 / LH SIDE SENS R1</p> <ul style="list-style-type: none"> Left side impact sensor 1 (door) circuit open circuit Left side impact sensor 1 (door) internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side impact sensor 1 (door) circuit for open circuit Install a new left side impact sensor 1 (door) as necessary
B0091-92	Left Side Restraints Sensor 1 - Performance or incorrect operation	 <p>NOTE: Circuit reference LH SIDE SENS F1 / LH SIDE SENS R1</p> <ul style="list-style-type: none"> Left side impact sensor 1 (door) fixings insecure Left side impact sensor 1 (door) internal failure 	<ul style="list-style-type: none"> Check left side impact sensor 1 (door) fixings for security Install a new left side impact sensor 1 (door) as necessary
B0091-96	Left Side Restraints Sensor 1 - Component internal failure	 <p>NOTE: Circuit reference LH SIDE SENS F1 / LH SIDE SENS R1</p> <ul style="list-style-type: none"> Left side impact sensor 1 (door) internal failure 	<ul style="list-style-type: none"> Install a new left side impact sensor 1 (door) as necessary
B0092-11	Left Side Restraints Sensor 2 - Circuit short to ground	 <p>NOTE: Circuit reference LH SIDE SENS</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side impact sensor 2 (B pillar) circuit for short circuit to ground



		F1 / LH SIDE SENS R1	
		<ul style="list-style-type: none"> Left side impact sensor 2 (B pillar) circuit short circuit to ground 	
B0092-12	Left Side Restraints Sensor 2 - Circuit short to battery	 <p>NOTE: Circuit reference LH SIDE SENS F1 / LH SIDE SENS R1</p> <ul style="list-style-type: none"> Left side impact sensor 2 (B pillar) circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side impact sensor 2 (B pillar) circuit for short circuit to power
B0092-64	Left Side Restraints Sensor 2 - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 <p>NOTE: This DTC is set when the input is switched off but the sensor is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0092-81	Left Side Restraints Sensor 2 - Invalid serial data received	 <p>NOTE: Circuit reference LH SIDE SENS F1 / LH SIDE SENS R1</p> <ul style="list-style-type: none"> Left side impact sensor 2 (B pillar) circuit open circuit Left side impact sensor 2 (B pillar) internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side impact sensor 2 (B pillar) circuit for open circuit Install a new left side impact sensor 2 (B pillar) as necessary
B0092-92	Left Side Restraints Sensor 2 - Performance or incorrect operation	 <p>NOTE: Circuit reference LH SIDE SENS F1 / LH SIDE SENS R1</p> <ul style="list-style-type: none"> Left side impact sensor 2 (B pillar) fixings insecure Left side impact sensor 2 (B pillar) internal failure 	<ul style="list-style-type: none"> Check left side impact sensor 2 (B pillar) fixings for security Install a new left side impact sensor 2 (B pillar) as necessary
B0092-96	Left Side Restraints Sensor 2 - Component internal failure	 <p>NOTE: Circuit reference LH SIDE SENS F1 / LH SIDE SENS R1</p> <ul style="list-style-type: none"> Left side impact sensor 2 (B pillar) internal failure 	<ul style="list-style-type: none"> Install a new left side impact sensor 2 (B pillar) as necessary
B0093-11	Left Side Restraints Sensor 3 - Circuit short to ground	 <p>NOTE: Circuit reference LH SIDE SENS F2 / LH SIDE SENS R2</p> <ul style="list-style-type: none"> Left side impact sensor 3 (C pillar) circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side impact sensor 3 (C pillar) circuit for short circuit to ground
B0093-12	Left Side Restraints Sensor 3 - Circuit short to battery	 <p>NOTE: Circuit reference LH SIDE SENS F2 / LH SIDE SENS R2</p> <ul style="list-style-type: none"> Left side impact sensor 3 (C pillar) circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side impact sensor 3 (C pillar) circuit for short circuit to power
B0093-	Left Side Restraints	<ul style="list-style-type: none"> Restraints control 	





64	Sensor 3 - Signal plausibility failure	module is not configured correctly	 <p>NOTE: This DTC is set when the input is switched off but the sensor is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0093-81	Left Side Restraints Sensor 3 - Invalid serial data received	 <p>NOTE: Circuit reference LH SIDE SENS F2 / LH SIDE SENS R2</p> <ul style="list-style-type: none"> Left side impact sensor 3 (C pillar) circuit open circuit Left side impact sensor 3 (C pillar) internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side impact sensor 3 (C pillar) circuit for open circuit Install a new left side impact sensor 3 (C pillar) as necessary
B0093-92	Left Side Restraints Sensor 3 - Performance or incorrect operation	 <p>NOTE: Circuit reference LH SIDE SENS F2 / LH SIDE SENS R2</p> <ul style="list-style-type: none"> Left side impact sensor 3 (C pillar) fixings insecure Left side impact sensor 3 (C pillar) internal failure 	<ul style="list-style-type: none"> Check left side impact sensor 3 (C pillar) fixings for security Install a new left side impact sensor 3 (C pillar) as necessary
B0093-96	Left Side Restraints Sensor 3 - Component internal failure	 <p>NOTE: Circuit reference LH SIDE SENS F2 / LH SIDE SENS R2</p> <ul style="list-style-type: none"> Left side impact sensor 3 (C pillar) internal failure 	<ul style="list-style-type: none"> Install a new left side impact sensor 3 (C pillar) as necessary
B0095-11	Right Frontal Restraints Sensor - Circuit short to ground	 <p>NOTE: Circuit reference RH CRASH SENS F / RH CRASH SENS R</p> <ul style="list-style-type: none"> Right front impact sensor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right front impact sensor circuit for short circuit to ground
B0095-12	Right Frontal Restraints Sensor - Circuit short to battery	 <p>NOTE: Circuit reference RH CRASH SENS F / RH CRASH SENS R</p> <ul style="list-style-type: none"> Right front impact sensor circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right front impact sensor circuit for short circuit to power
B0095-64	Right Frontal Restraints Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 <p>NOTE: This DTC is set when the input is switched off but the sensor is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0095-81	Right Frontal Restraints Sensor - Invalid serial data received	 <p>NOTE: Circuit reference RH CRASH SENS F / RH CRASH SENS R</p> <ul style="list-style-type: none"> Right front impact sensor circuit open circuit Right front impact sensor internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right front impact sensor circuit for open circuit Install a new right front impact sensor as necessary







B0095-92	Right Frontal Restraints Sensor - Performance or incorrect operation	 <p>NOTE: Circuit reference RH CRASH SENS F / RH CRASH SENS R</p> <ul style="list-style-type: none"> Right front impact sensor fixings insecure Right front impact sensor internal failure 	<ul style="list-style-type: none"> Check right front impact sensor fixings for security Install a new right front impact sensor as necessary
B0095-96	Right Frontal Restraints Sensor - Component internal failure	 <p>NOTE: Circuit reference RH CRASH SENS F / RH CRASH SENS R</p> <ul style="list-style-type: none"> Right front impact sensor internal failure 	<ul style="list-style-type: none"> Install a new right front impact sensor as necessary
B0096-11	Right Side Restraints Sensor 1 - Circuit short to ground	 <p>NOTE: Circuit reference RH SIDE SENS F1 / RH SIDE SENS R1</p> <ul style="list-style-type: none"> Right side impact sensor 1 (door) circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side impact sensor 1 (door) circuit for short circuit to ground
B0096-12	Right Side Restraints Sensor 1 - Circuit short to battery	 <p>NOTE: Circuit reference RH SIDE SENS F1 / RH SIDE SENS R1</p> <ul style="list-style-type: none"> Right side impact sensor 1 (door) circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side impact sensor 1 (door) circuit for short circuit to power
B0096-64	Right Side Restraints Sensor 1 - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 <p>NOTE: This DTC is set when the input is switched off but the sensor is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0096-81	Right Side Restraints Sensor 1 - Invalid serial data received	 <p>NOTE: Circuit reference RH SIDE SENS F1 / RH SIDE SENS R1</p> <ul style="list-style-type: none"> Right side impact sensor 1 (door) circuit open circuit Right side impact sensor 1 (door) internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side impact sensor 1 (door) circuit for open circuit Install a new right side impact sensor 1 (door) as necessary
B0096-92	Right Side Restraints Sensor 1 - Performance or incorrect operation	 <p>NOTE: Circuit reference RH SIDE SENS F1 / RH SIDE SENS R1</p> <ul style="list-style-type: none"> Right side impact sensor 1 (door) fixings insecure Right side impact sensor 1 (door) internal failure 	<ul style="list-style-type: none"> Check right side impact sensor 1 (door) fixings for security Install a new right side impact sensor 1 (door) as necessary
B0096-96	Right Side Restraints Sensor 1 - Component internal failure	 <p>NOTE: Circuit reference RH SIDE SENS F1 / RH SIDE SENS R1</p> <ul style="list-style-type: none"> Right side impact 	<ul style="list-style-type: none"> Install a new right side impact sensor 1 (door) as necessary









		sensor 1 (door) internal failure	
B0097-11	Right Side Restraints Sensor 2 - Circuit short to ground	 <p>NOTE: Circuit reference RH SIDE SENS F1 / RH SIDE SENS R1</p> <ul style="list-style-type: none"> Right side impact sensor 2 (B pillar) circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side impact sensor 2 (B pillar) circuit for short circuit to ground
B0097-12	Right Side Restraints Sensor 2 - Circuit short to battery	 <p>NOTE: Circuit reference RH SIDE SENS F1 / RH SIDE SENS R1</p> <ul style="list-style-type: none"> Right side impact sensor 2 (B pillar) circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side impact sensor 2 (B pillar) circuit for short circuit to power
B0097-64	Right Side Restraints Sensor 2 - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 <p>NOTE: This DTC is set when the input is switched off but the sensor is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0097-81	Right Side Restraints Sensor 2 - Invalid serial data received	 <p>NOTE: Circuit reference RH SIDE SENS F1 / RH SIDE SENS R1</p> <ul style="list-style-type: none"> Right side impact sensor 2 (B pillar) circuit open circuit Right side impact sensor 2 (B pillar) internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side impact sensor 2 (B pillar) circuit for open circuit Install a new right side impact sensor 2 (B pillar) as necessary
B0097-92	Right Side Restraints Sensor 2 - Performance or incorrect operation	 <p>NOTE: Circuit reference RH SIDE SENS F1 / RH SIDE SENS R1</p> <ul style="list-style-type: none"> Right side impact sensor 2 (B pillar) fixings insecure Right side impact sensor 2 (B pillar) internal failure 	<ul style="list-style-type: none"> Check right side impact sensor 2 (B pillar) fixings for security Install a new right side impact sensor 2 (B pillar) as necessary
B0097-96	Right Side Restraints Sensor 2 - Component internal failure	 <p>NOTE: Circuit reference RH SIDE SENS F1 / RH SIDE SENS R1</p> <ul style="list-style-type: none"> Right side impact sensor 2 (B pillar) internal failure 	<ul style="list-style-type: none"> Install a new right side impact sensor 2 (B pillar) as necessary
B0098-11	Right Side Restraints Sensor 3 - Circuit short to ground	 <p>NOTE: Circuit reference RH SIDE SENS F2 / RH SIDE SENS R2</p> <ul style="list-style-type: none"> Right side impact sensor 3 (C pillar) circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side impact sensor 3 (C pillar) circuit for short circuit to ground
B0098-12	Right Side Restraints Sensor 3 - Circuit short to battery	 <p>NOTE: Circuit reference RH SIDE SENS F2 / RH SIDE SENS R2</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side impact sensor 3 (C pillar) circuit for short circuit to power





		<ul style="list-style-type: none"> Right side impact sensor 3 (C pillar) circuit short circuit to power 	
B0098-64	Right Side Restraints Sensor 3 - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 <p>NOTE: This DTC is set when the input is switched off but the sensor is actually installed.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B0098-81	Right Side Restraints Sensor 3 - Invalid serial data received	 <p>NOTE: Circuit reference RH SIDE SENS F2 / RH SIDE SENS R2</p> <ul style="list-style-type: none"> Right side impact sensor 3 (C pillar) circuit open circuit Right side impact sensor 3 (C pillar) internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side impact sensor 3 (C pillar) circuit for open circuit Install a new right side impact sensor 3 (C pillar) as necessary
B0098-92	Right Side Restraints Sensor 3 - Performance or incorrect operation	 <p>NOTE: Circuit reference RH SIDE SENS F2 / RH SIDE SENS R2</p> <ul style="list-style-type: none"> Right side impact sensor 3 (C pillar) fixings insecure Right side impact sensor 3 (C pillar) internal failure 	<ul style="list-style-type: none"> Check right side impact sensor 3 (C pillar) fixings for security Install a new right side impact sensor 3 (C pillar) as necessary
B0098-96	Right Side Restraints Sensor 3 - Component internal failure	 <p>NOTE: Circuit reference RH SIDE SENS F2 / RH SIDE SENS R2</p> <ul style="list-style-type: none"> Right side impact sensor 3 (C pillar) internal failure 	<ul style="list-style-type: none"> Install a new right side impact sensor 3 (C pillar) as necessary
B00A0-49	Occupant Classification System - Internal electronic failure	<ul style="list-style-type: none"> Occupant classification sensor system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the occupant classification sensor control module for related DTCs and refer to the relevant DTC index
B00A0-64	Occupant Classification System - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B00A0-88	Occupant Classification System - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B00A0-92	Occupant Classification System - Performance or incorrect operation	<ul style="list-style-type: none"> Occupant classification sensor system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the occupant classification sensor control module for related DTCs and refer to the relevant DTC index
B00B5-11	Driver Seat Track Position Restraints Sensor - Circuit short to ground	 <p>NOTE: Circuit reference DR SEAT TRACK POS F</p> <ul style="list-style-type: none"> Driver seat track position sensor circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seat track position sensor circuit for short circuit to ground
B00B5-15	Driver Seat Track Position Restraints	 <p>NOTE: Circuit</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seat track position sensor circuit for

	Sensor - Circuit short to battery or open	reference DR SEAT TRACK POS F <ul style="list-style-type: none"> Driver seat track position sensor circuit short circuit to power, open circuit, high resistance 	short circuit to power, open circuit, high resistance
B00B5-1D	Driver Seat Track Position Restraints Sensor - Circuit current out of range	 NOTE: Circuit reference DR SEAT TRACK POS F <ul style="list-style-type: none"> Driver seat track position sensor circuit short circuit to ground, short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seat track position sensor circuit for short circuit to ground, short circuit to power
B00B5-64	Driver Seat Track Position Restraints Sensor - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	 NOTE: This DTC is set when the input is switched off but the sensor is actually installed. <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B00C0-96	Passenger Seat Occupant Classification Sensor "A" - Component internal failure	<ul style="list-style-type: none"> Occupant classification system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the occupant classification sensor control module for related DTCs and refer to the relevant DTC index
B00D2-68	Restraint System Malfunction Indicator 1 - Event information	<ul style="list-style-type: none"> Instrument cluster fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the instrument cluster for related DTCs and refer to the relevant DTC index
B00D2-87	Restraint System Malfunction Indicator 1 - Missing message	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B00D5-14	Restraint System Passenger Disable Indicator - Circuit short to ground or open	<ul style="list-style-type: none"> Passenger airbag deactivation warning indicator circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag deactivation warning indicator circuit for short circuit to ground, open circuit, high resistance
B00D5-55	Restraint System Passenger Disable Indicator - Not configured	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B00DF-00	Passenger Restraints Disable Switch - No sub type information	<ul style="list-style-type: none"> Passenger airbag deactivation switch stuck mid-way between 'enabled' and 'disabled' Passenger airbag deactivation switch circuit open circuit, high resistance 	<ul style="list-style-type: none"> Test the operation of the passenger airbag deactivation switch Refer to the electrical circuit diagrams and check the passenger airbag deactivation switch circuit for open circuit, high resistance
B00DF-54	Passenger Restraints Disable Switch - Missing calibration	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B00DF-64	Passenger Restraints Disable Switch - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1211-11	Driver Seatbelt Retractor Pretensioner	<ul style="list-style-type: none"> Driver seatbelt retractor and pretensioner circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seatbelt retractor and pretensioner circuit for short circuit to ground

	Deployment Control - Circuit short to ground	short circuit to ground	
B1211-12	Driver Seatbelt Retractor Pretensioner Deployment Control - Circuit short to battery	<ul style="list-style-type: none"> Driver seatbelt retractor and pretensioner circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seatbelt retractor and pretensioner circuit for short circuit to power
B1211-1A	Driver Seatbelt Retractor Pretensioner Deployment Control - Circuit resistance below threshold	<ul style="list-style-type: none"> Driver seatbelt retractor and pretensioner circuit short circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seatbelt retractor and pretensioner circuit for short circuit
B1211-1B	Driver Seatbelt Retractor Pretensioner Deployment Control - Circuit resistance above threshold	<ul style="list-style-type: none"> Driver seatbelt retractor and pretensioner circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seatbelt retractor and pretensioner circuit for open circuit, high resistance
B1211-64	Driver Seatbelt Retractor Pretensioner Deployment Control - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1211-95	Driver Seatbelt Retractor Pretensioner Deployment Control - Incorrect assembly	<ul style="list-style-type: none"> Driver seatbelt retractor and pretensioner short circuit between two different circuits (at least two faults) 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seatbelt retractor and pretensioner circuit for faults
B1212-11	Driver Seatbelt Buckle Pretensioner Deployment Control - Circuit short to ground	 <p>NOTE: Circuit reference DR PRETEN F1 / DR PRETEN R1</p> <ul style="list-style-type: none"> Driver seatbelt pretensioner circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seatbelt pretensioner circuit for short circuit to ground
B1212-12	Driver Seatbelt Buckle Pretensioner Deployment Control - Circuit short to battery	 <p>NOTE: Circuit reference DR PRETEN F1 / DR PRETEN R1</p> <ul style="list-style-type: none"> Driver seatbelt pretensioner circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seatbelt pretensioner circuit for short circuit to power
B1212-1A	Driver Seatbelt Buckle Pretensioner Deployment Control - Circuit resistance below threshold	 <p>NOTE: Circuit reference DR PRETEN F1 / DR PRETEN R1</p> <ul style="list-style-type: none"> Driver seatbelt pretensioner circuit short circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seatbelt pretensioner circuit for short circuit
B1212-1B	Driver Seatbelt Buckle Pretensioner Deployment Control - Circuit resistance above threshold	 <p>NOTE: Circuit reference DR PRETEN F1 / DR PRETEN R1</p> <ul style="list-style-type: none"> Driver seatbelt pretensioner circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver seatbelt pretensioner circuit for open circuit, high resistance
B1212-64	Driver Seatbelt Buckle Pretensioner Deployment Control - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software

B1212-95	Driver Seatbelt Buckle Pretensioner Deployment Control - Incorrect assembly	 <p>NOTE: Circuit reference DR PRETEN F1 / DR PRETEN R1</p> <ul style="list-style-type: none"> • Driver seatbelt pretensioner short circuit between two different circuits (at least two faults) 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the driver seatbelt pretensioner circuit for faults
B1213-11	Passenger Seatbelt Buckle Pretensioner Deployment Control - Circuit short to ground	 <p>NOTE: Circuit reference PASS PRETEN F1 / PASS PRETEN R1</p> <ul style="list-style-type: none"> • Passenger seatbelt pretensioner circuit short circuit to ground 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passenger seatbelt pretensioner circuit for short circuit to ground
B1213-12	Passenger Seatbelt Buckle Pretensioner Deployment Control - Circuit short to battery	 <p>NOTE: Circuit reference PASS PRETEN F1 / PASS PRETEN R1</p> <ul style="list-style-type: none"> • Passenger seatbelt pretensioner circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passenger seatbelt pretensioner circuit for short circuit to power
B1213-1A	Passenger Seatbelt Buckle Pretensioner Deployment Control - Circuit resistance below threshold	 <p>NOTE: Circuit reference PASS PRETEN F1 / PASS PRETEN R1</p> <ul style="list-style-type: none"> • Passenger seatbelt pretensioner circuit short circuit 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passenger seatbelt pretensioner circuit for short circuit
B1213-1B	Passenger Seatbelt Buckle Pretensioner Deployment Control - Circuit resistance above threshold	 <p>NOTE: Circuit reference PASS PRETEN F1 / PASS PRETEN R1</p> <ul style="list-style-type: none"> • Passenger seatbelt pretensioner circuit open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passenger seatbelt pretensioner circuit for open circuit, high resistance
B1213-64	Passenger Seatbelt Buckle Pretensioner Deployment Control - Signal plausibility failure	<ul style="list-style-type: none"> • Restraints control module is not configured correctly 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1213-95	Passenger Seatbelt Buckle Pretensioner Deployment Control - Incorrect assembly	 <p>NOTE: Circuit reference PASS PRETEN F1 / PASS PRETEN R1</p> <ul style="list-style-type: none"> • Passenger seatbelt pretensioner short circuit between two different circuits (at least two faults) 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the passenger seatbelt pretensioner circuit for faults
B1A00-16	Control Module - Circuit voltage below threshold	<ul style="list-style-type: none"> • Restraints control module power or ground circuit open circuit, high resistance • Battery/charging system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111). Refer to the electrical circuit diagrams and check the restraints control module power and ground circuits for open circuit, high resistance • Refer to the relevant section of the workshop manual and test the battery and charging system
B1A00-17	Control Module - Circuit voltage above threshold	<ul style="list-style-type: none"> • Battery/charging system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111). Refer to the relevant section of the workshop manual and test the

			battery and charging system
B1A00-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> Restraints control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new restraints control module
B1A17-95	Driver Stage 1 Airbag Squib Short Circuit To Ignition Loop - Incorrect assembly	 <p>NOTE: Circuit reference DR AIRBAG F1 / DR AIRBAG R1</p> <ul style="list-style-type: none"> Driver airbag (stage 1) circuit short circuit to another circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver airbag (stage 1) circuit for short circuit to another circuit
B1A19-95	Driver Stage 2 Airbag Squib Short Circuit To Ignition Loop - Incorrect assembly	 <p>NOTE: Circuit reference DR AIRBAG F2 / DR AIRBAG R2</p> <ul style="list-style-type: none"> Driver airbag (stage 2) circuit short circuit to another circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the driver airbag (stage 2) circuit for short circuit to another circuit
B1A21-95	Passenger Stage 1 Airbag Squib Short Circuit To Ignition Loop - Incorrect assembly	 <p>NOTE: Circuit reference PASS AIRBAG F1 / PASS AIRBAG R1</p> <ul style="list-style-type: none"> Passenger airbag (stage 1) circuit short circuit to another circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag (stage 1) circuit for short circuit to another circuit
B1A23-95	Passenger Stage 2 Airbag Squib Short Circuit To Ignition Loop - Incorrect assembly	 <p>NOTE: Circuit reference PASS AIRBAG F2 / PASS AIRBAG R2</p> <ul style="list-style-type: none"> Passenger airbag (stage 2) circuit short circuit to another circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag (stage 2) circuit for short circuit to another circuit
B1A29-95	Left Side Airbag Squib Short Circuit To Ignition Loop - Incorrect assembly	 <p>NOTE: Circuit reference LH SIDE A/BAG F1 / LH SIDE A/BAG R1</p> <ul style="list-style-type: none"> Left side airbag (seat) circuit short circuit to another circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side airbag (seat) circuit for short circuit to another circuit
B1A31-95	Right Side Airbag Squib Short Circuit To Ignition Loop - Incorrect assembly	 <p>NOTE: Circuit reference RH SIDE A/BAG F1 / RH SIDE A/BAG R1</p> <ul style="list-style-type: none"> Right side airbag (seat) circuit short circuit to another circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side airbag (seat) circuit for short circuit to another circuit
B1A33-95	Left Curtain Airbag Squib Short Circuit To Ignition Loop - Incorrect assembly	 <p>NOTE: Circuit reference LH SIDE CUR F1 / LH SIDE CUR R1</p> <ul style="list-style-type: none"> Left side air curtain (rows 1 and 2) circuit short circuit to another circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side air curtain (rows 1 and 2) circuit for short circuit to another circuit
B1A35-95	Right Curtain Airbag Squib Short Circuit To Ignition Loop -	 <p>NOTE: Circuit reference RH SIDE CUR F1</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side air curtain (rows 1 and 2) circuit for short circuit to another circuit

	Incorrect assembly	/ RH SIDE CUR R1		
		<ul style="list-style-type: none"> Right side air curtain (rows 1 and 2) circuit short circuit to another circuit 		
B1A37-95	Left Curtain #2 Airbag Squib Short Circuit To Ignition Loop - Incorrect assembly	<ul style="list-style-type: none"> Left side air curtain 2 (row 3) circuit short circuit to another circuit 		<p>NOTE: Applicable to seven seat vehicles.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left side air curtain 2 (row 3) circuit for short circuit to another circuit
B1A39-95	Right Curtain #2 Airbag Squib Short Circuit To Ignition Loop - Incorrect assembly	<ul style="list-style-type: none"> Right side air curtain 2 (row 3) circuit short circuit to another circuit 		<p>NOTE: Applicable to seven seat vehicles.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right side air curtain 2 (row 3) circuit for short circuit to another circuit
B1A40-11	Left Side (pelvic) 2 - Circuit short to ground	<ul style="list-style-type: none"> Restraints control module is not configured correctly 		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1A40-12	Left Side (pelvic) 2 - Circuit short to battery	<ul style="list-style-type: none"> Restraints control module is not configured correctly 		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1A40-1A	Left Side (pelvic) 2 - Circuit resistance below threshold	<ul style="list-style-type: none"> Restraints control module is not configured correctly 		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1A40-1B	Left Side (pelvic) 2 - Circuit resistance above threshold	<ul style="list-style-type: none"> Restraints control module is not configured correctly 		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1A40-64	Left Side (pelvic) 2 - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1A40-95	Left Side (pelvic) 2 - Incorrect assembly	<ul style="list-style-type: none"> Restraints control module is not configured correctly 		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1A41-95	Left Side (pelvic) 2 Short circuit To Ignition Loop – Incorrect assembly	<ul style="list-style-type: none"> Restraints control module is not configured correctly 		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1A55-14	Crash Record Output - Circuit short to ground or open	 <p>NOTE: Circuit reference CRASH OUTPUT</p> <ul style="list-style-type: none"> Crash signal circuit short circuit to ground, open circuit, high resistance 		<p>NOTE: If this DTC is set after re-configuring the restraints control module, disconnect the battery for 1 minute and retest.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the crash signal circuit for short circuit to ground, open circuit, high resistance
B1A55-64	Crash Record Output - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1D60-11	Right Side (pelvic) 2 - Circuit short to ground	<ul style="list-style-type: none"> Restraints control module is not configured correctly 		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1D60-12	Right Side (pelvic) 2 - Circuit short to battery	<ul style="list-style-type: none"> Restraints control module is not configured correctly 		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1D60-1A	Right Side (pelvic) 2 - Circuit resistance below threshold	<ul style="list-style-type: none"> Restraints control module is not configured correctly 		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1D60-1B	Right Side (pelvic) 2 - Circuit resistance above threshold	<ul style="list-style-type: none"> Restraints control module is not configured correctly 		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software

B1D60-64	Right Side (pelvic) 2 - Signal plausibility failure	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1D60-95	Right Side (pelvic) 2 - Incorrect assembly	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
B1D74-11	Passenger Airbag Cutoff Enable Switch - Circuit short to ground	<ul style="list-style-type: none"> Passenger airbag deactivation switch enable circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag deactivation switch enable circuit for short circuit to ground
B1D74-12	Passenger Airbag Cutoff Enable Switch - Circuit short to battery	<ul style="list-style-type: none"> Passenger airbag deactivation switch enable circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag deactivation switch enable circuit for short circuit to power
B1D74-13	Passenger Airbag Cutoff Enable Switch - Circuit open	<ul style="list-style-type: none"> Passenger airbag deactivation switch enable circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag deactivation switch enable circuit for open circuit, high resistance
B1D75-11	Passenger Airbag Cutoff Disable Switch - Circuit short to ground	<ul style="list-style-type: none"> Passenger airbag deactivation switch disable circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag deactivation switch disable circuit for short circuit to ground
B1D75-12	Passenger Airbag Cutoff Disable Switch - Circuit short to battery	<ul style="list-style-type: none"> Passenger airbag deactivation switch disable circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag deactivation switch disable circuit for short circuit to power
B1D75-13	Passenger Airbag Cutoff Disable Switch - Circuit open	<ul style="list-style-type: none"> Passenger airbag deactivation switch disable circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the passenger airbag deactivation switch disable circuit for open circuit, high resistance
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0122-87	Lost Communication With Vehicle Dynamics Control Module - Missing message	<ul style="list-style-type: none"> Anti-lock brake system control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Anti-lock brake system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0300-55	Internal Control Module Software Incompatibility - Not configured	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
U1A02-66	Permanent Memory Store Full – Signal has too many transitions/events	<ul style="list-style-type: none"> Restraints control module memory full 	<ul style="list-style-type: none"> Install a new restraints control module (not warrantable)
U1A03-87	Car Configuration Parameter – Missing message	<ul style="list-style-type: none"> Central junction box power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance

		<ul style="list-style-type: none"> high resistance Central junction box system fault 	Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U1A14-55	CAN Initialization Failure - Not configured	<ul style="list-style-type: none"> Restraints control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new restraints control module
U201A-4A	Control Module Main Calibration Data - Incorrect component installed	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software. Clear the DTCs and retest. If the fault persists, install a new restraints control module
U201A-51	Control Module Main Calibration Data - Not programmed	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software
U201B-4A	Control Module Calibration Data #2 - Incorrect component installed	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software. Clear the DTCs and retest. If the fault persists, install a new restraints control module
U201B-51	Control Module Calibration Data #2 - Not programmed	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software. Clear the DTCs and retest. If the fault persists, install a new restraints control module
U201C-4A	Control Module Calibration Data #3 - Incorrect component installed	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software. Clear the DTCs and retest. If the fault persists, install a new restraints control module
U201C-51	Control Module Calibration Data #3 - Not programmed	<ul style="list-style-type: none"> Restraints control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the restraints control module with the latest level software. Clear the DTCs and retest. If the fault persists, install a new restraints control module
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> Restraints control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new restraints control module
U3002-81	Vehicle Identification Number - Invalid serial data received	<ul style="list-style-type: none"> Restraints control module previously installed on another vehicle New restraints control module installed and VIN not yet programmed 	<ul style="list-style-type: none"> Install the original or a new restraints control module as necessary Using the manufacturer approved diagnostic system, perform routine - Learn VIN (0x0404)

General Information - Diagnostic Trouble Code (DTC) Index DTC: Satellite Radio Control Module (SRCM)

Description and Operation

Satellite Radio Control Module (SRCM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Satellite Radio Control Module (SRCM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1A89-01	Satellite Antenna - General electrical failure	<ul style="list-style-type: none"> Digital radio antenna circuit short circuit to ground, short circuit to power, open circuit, high resistance Satellite radio control module internal failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the digital radio antenna circuit for short circuit to ground, short circuit to power, open circuit, high resistance If fault persists, install a new satellite radio control module
U3000-4A	Control Module - Incorrect component installed	<ul style="list-style-type: none"> Car configuration file mismatch 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary. Clear the diagnostic trouble code and re-test
U3000-55	Control Module - Not configured	<ul style="list-style-type: none"> Satellite radio control module not configured 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the satellite radio control module with the latest level software
U3000-	Control	<ul style="list-style-type: none"> Satellite radio 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system,

87	Module - Missing message	control module configuration incomplete/corrupted	re-configure the satellite radio control module with the latest level software
U3000-98	Control Module - Component or system over temperature	<ul style="list-style-type: none"> • Satellite radio control module cooling vents obstructed • Satellite radio control module internal failure 	<ul style="list-style-type: none"> • Check that the satellite radio control module cooling vents / air circulation are not obstructed. Cool the vehicle interior down by ensuring it is in the shade and have the A/C on cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new satellite radio control module

General Information - Diagnostic Trouble Code (DTC) Index DTC: Steering Angle Sensor Module (SASM)

Description and Operation

Steering Angle Sensor Module (SASM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Steering Angle Sensor Module (SASM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Steering System](#) (211-00 Steering System - General Information, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
C0051-04	Steering Wheel Position Sensor - System internal failures	<ul style="list-style-type: none"> Steering angle sensor module not calibrated correctly Steering angle sensor module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform routine - Calibrate Steering Angle Centre Position (0x200E) Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new steering angle sensor module
C0051-62	Steering Wheel Position Sensor - Signal compare failure	<ul style="list-style-type: none"> Steering angle sensor module not calibrated correctly Steering geometry incorrect Steering angle sensor module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform routine - Calibrate Steering Angle Centre Position (0x200E) Refer to the relevant section of the workshop manual and check and adjust the steering geometry Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new steering angle sensor module
C0051-64	Steering Wheel Position Sensor -	<ul style="list-style-type: none"> Steering angle sensor module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform routine - Calibrate Steering Angle Centre

	Signal plausibility failure	<ul style="list-style-type: none"> not calibrated correctly Steering geometry incorrect Steering angle sensor module internal failure 	<ul style="list-style-type: none"> Position (0x200E) Refer to the relevant section of the workshop manual and check and adjust the steering geometry Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new steering angle sensor module
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0122-00	Lost Communication With Vehicle Dynamics Control Module - No subtype information	<ul style="list-style-type: none"> Anti-lock brake system control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Anti-lock brake system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0140-00	Lost Communication With Body Control Module - No subtype information	<ul style="list-style-type: none"> Central junction box power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Central junction box system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0300-55	Internal Control Module Software Incompatibility - Not configured	<ul style="list-style-type: none"> Mismatch between vehicle and steering angle sensor module software levels 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the steering angle sensor module with the latest level software. If the fault persists, re-configure the central junction box with the latest level software
U1A14-49	CAN Initialization failure- Internal electronic failure	<ul style="list-style-type: none"> Steering angle sensor module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new steering angle sensor module
U3002-62	Vehicle Identification Number - Signal compare failure	<ul style="list-style-type: none"> Steering angle sensor module previously installed on another vehicle 	<ul style="list-style-type: none"> Install the original or a new steering angle sensor module as necessary

General Information - Diagnostic Trouble Code (DTC) Index DTC: Terrain Response Switchpack (TR)

Description and Operation

Terrain Response Switchpack (TR)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint and carry out the recommendations as required.





There are references to "power latch" within the DTC index. This is where the module must be reset by means of a complete power down and power up.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Terrain Response Switchpack (TR). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Ride and Handling Optimization](#) (204-06 Ride and Handling Optimization, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
C1A00-46	Control Module - Calibration/parameter memory failure	<ul style="list-style-type: none"> The terrain response switchpack has indicated a calibration/parameter memory failure for embedded systems using FLASH memory. This is equivalent to EEPROM in RAM/ROM/EEPROM embedded systems Corruption in the non-volatile memory storage system (EEPROM) in the 	<ul style="list-style-type: none"> Rectify this DTC before attempting to rectify others. Record all DTCs logged and clear them. With ignition on select a terrain response special program, turn off the ignition, then turn back on the ignition and verify the selected special program is still active. If the selected terrain response special program is still not active and has returned to the general program, confirm if DTC has returned. Repeat procedure again once more. If DTC is still present install a new terrain response switchpack

		terrain response switchpack	
C1A01-96	LED - Component internal failure	<ul style="list-style-type: none"> • Terrain response switchpack internal failure 	 <p>NOTE: If the system is in 'failsafe default' mode due to another issue, no LEDs will illuminate. This fault does not cause the system to go to 'failsafe default' mode.</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs. Operate the terrain response switchpack to select each special programme. Check each LED illuminates as appropriate. If the fault persists, install a new terrain response switchpack
C1A02-94	Rotary Encoder Stuck In Intermediate Position - Unexpected operation	<ul style="list-style-type: none"> • The terrain response switchpack is held in an intermediate position (between the special programmes) for more than 60 seconds • Foreign object preventing correct operation of terrain response switchpack • Mechanical damage to the terrain response switchpack 	 <p>NOTE: Suspect driver error do not replace the terrain response switchpack</p> <ul style="list-style-type: none"> • Check for foreign object preventing correct operation of terrain response switchpack. Start the vehicle engine, rotate the terrain response switchpack until it has located a genuine detent, wait 60 seconds. Stop the vehicle engine, clear the DTC and retest
U0001-88	High Speed CAN Communication Bus Off - Bus off	<ul style="list-style-type: none"> • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0100-00	Lost Communication With The ECM/PCM 'A' - No sub type information	<ul style="list-style-type: none"> • Engine control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Engine system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the engine control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0101-00	Lost Communication With The TCM - No sub type information	<ul style="list-style-type: none"> • Transmission control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transmission system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0102-00	Lost Communication With The Transfer Case Control Module - No sub type information	<ul style="list-style-type: none"> • Transfer case control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic

		Transfer case system fault	system, check the transfer case control module for related DTCs and refer to the relevant DTC index
U0121-00	Lost Communication With Anti-Lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> • Anti-lock brake system control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Anti-lock brake system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0132-00	Lost Communication With Suspension Control Module 'A' - No sub type information	<ul style="list-style-type: none"> • Air suspension control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Air suspension system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the air suspension control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the air suspension control module for related DTCs and refer to the relevant DTC index
U0139-00	Lost Communication With Suspension Control Module 'B' - No sub type information	<ul style="list-style-type: none"> • Adaptive damping system control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Adaptive damping system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the adaptive damping system control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the adaptive damping system control module for related DTCs and refer to the relevant DTC index
U0140-00	Lost Communication With Body Control Module - No sub type information	<ul style="list-style-type: none"> • Central junction box power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Central junction box system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> • Terrain response switchpack is not configured correctly 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the terrain response switchpack with the latest level software
U0401-68	Invalid Data Received From The ECM/PCM 'A' - Event information	<ul style="list-style-type: none"> • Missing/invalid data from the engine control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0402-68	Invalid Data Received from TCM - Event information	<ul style="list-style-type: none"> • Missing/invalid data from the transmission control module 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0403-68	Invalid Data Received From The Transfer	<ul style="list-style-type: none"> • Missing/invalid data from the transfer 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the transfer case control

	Case Control Module - Event information	case control module	module for related DTCs and refer to the relevant DTC index
U0415-68	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - Event information	<ul style="list-style-type: none"> Missing/invalid data from the anti-lock brake system control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0421-68	Invalid Data Received From Suspension Control Module 'A' - Event information	<ul style="list-style-type: none"> Missing/invalid data from the air suspension control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the air suspension control module for related DTCs and refer to the relevant DTC index
U0422-68	Invalid Data Received From Body Control Module - Event information	<ul style="list-style-type: none"> Missing/invalid data from the central junction box 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U043A-68	Invalid Data Received From Suspension Control Module "B" - Event information	<ul style="list-style-type: none"> Missing/invalid data from the adaptive damping system control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the adaptive damping system control module for related DTCs and refer to the relevant DTC index
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification Incorrect terrain response switchpack installed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary Install a new terrain response switchpack as necessary

General Information - Diagnostic Trouble Code Index: Touch Screen DTC: Touch Screen (TS)

Description and Operation

Touch Screen (TS)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle



When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the warranty policy and procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system)



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places and with a current calibration certificate. When testing resistance, always take the resistance of the digital multimeter leads into account



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion



If diagnostic trouble codes are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals






Where an 'on demand self-test' is referred to, this can be accessed via the 'diagnostic trouble code monitor' tab on the manufacturers approved diagnostic system




The table below lists all diagnostic trouble codes (DTCs) that could be logged in the touch screen, for additional diagnosis and testing information refer to the relevant diagnosis and testing section.

For additional information, refer to: Information and Entertainment System (415-00, Diagnosis and Testing).

DTC	Description	Possible Cause	Action
B1087-83	LIN Bus "A" - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> LIN bus to the rear view camera circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the LIN bus circuit to the rear view camera for short circuit to ground, short circuit to power, open circuit, high resistance
B1087-86	LIN Bus "A" - Signal invalid	<ul style="list-style-type: none"> LIN bus to the rear view camera circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the LIN bus circuit to the rear view camera for short circuit to ground, short circuit to power, open circuit, high resistance
B1087-87	LIN Bus "A" - Missing message	<ul style="list-style-type: none"> LIN bus to the rear view camera circuit 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the LIN bus circuit to the rear view camera for short circuit to ground, short circuit to power, open circuit, high

		short circuit to ground, short circuit to power, open circuit, high resistance	resistance
B1087-88	LIN Bus "A" - Bus off	<ul style="list-style-type: none"> LIN bus to the rear view camera circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the LIN bus circuit to the rear view camera for short circuit to ground, short circuit to power, open circuit, high resistance
B1D21-13	Remote control switch - Circuit open	<ul style="list-style-type: none"> Steering wheel switchpack fault Clockspring fault Wiring harness fault 	<ul style="list-style-type: none"> No steering wheel remote in-car entertainment switchpack functionality. This DTC is logged if the module detects an open circuit on the steering wheel audio switch signal line. Refer to the electrical circuit diagrams and test the signal line running from the steering wheel audio switchpack through the clockspring to the touch screen for insecure connectors, open circuits, including intermittent faults (rotate steering wheel during checks). Also test ground connections to the control module for open circuits. Repair or replace wiring harness as required
U0010-00	Medium speed CAN communication bus - No sub type information	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the medium speed CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0010-48	Medium speed CAN communication bus - Supervised software failure	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the medium speed CAN circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0140-00	Lost communication with central junction box - No sub type information	<ul style="list-style-type: none"> Lost communication with the central junction box 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the central junction box Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the central junction box for short circuit to ground, short circuit to power, open circuit, high resistance
U0142-00	Lost communication with body control module "B" - No sub type information	<ul style="list-style-type: none"> Lost communication with the central junction box 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the central junction box Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the central junction box for short circuit to ground, short circuit to power, open circuit, high resistance
U0155-00	Lost communication with instrument panel cluster - No sub type information	<ul style="list-style-type: none"> Lost communication with the instrument cluster 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the instrument cluster Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the instrument cluster for short circuit to ground, short circuit to power, open circuit, high resistance
U0159-00	Lost communication with parking assist control module A - No	<ul style="list-style-type: none"> Lost communication with the park distance control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the park distance control module

	sub type information		<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the park distance control module for short circuit to ground, short circuit to power, open circuit, high resistance
U0164-00	Lost communications with HVAC control module - No sub type information	<ul style="list-style-type: none"> Lost communication with the automatic temperature control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the automatic temperature control module Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the automatic temperature control module for short circuit to ground, short circuit to power, open circuit, high resistance
U0166-00	Lost Communication With Auxiliary Heater Control Module - No sub type information	<ul style="list-style-type: none"> Lost communication with the fuel fired booster heater 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the fuel fired booster heater Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the fuel fired booster heater for short circuit to ground, short circuit to power, open circuit, high resistance
U0184-00	Lost communications with radio - No sub type information	<ul style="list-style-type: none"> Lost communication with the integrated audio module 	 <p>NOTE: This DTC may be stored even though no fault condition is present and should be ignored unless the customer has reported an information and entertainment system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a MOST network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the integrated audio module Refer to the electrical circuit diagrams and test the MOST circuit between the touch screen and the integrated audio module
U0184-4A	Lost communications with radio - Incorrect component installed	<ul style="list-style-type: none"> The serial number of the component does not match the serial number stored in the master module 	<ul style="list-style-type: none"> Check the serial number of the part is valid (as installed at the factory). If the part has been installed by a dealer the installation routine has not been performed correctly, install the component using the manufacturer approved diagnostic system. Clear the DTC and retest the system
U0186-00	Lost communication with audio amplifier A - No sub type information	<ul style="list-style-type: none"> Lost communication with the audio amplifier module 	 <p>NOTE: This DTC may be stored even though no fault condition is present and should be ignored unless the customer has reported an information and entertainment system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the audio amplifier module Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the audio amplifier module for short circuit to ground, short circuit to power, open circuit, high resistance
U0186-4A	Lost communication with audio amplifier A - Incorrect component installed	<ul style="list-style-type: none"> The serial number of the component does not match the serial number stored in the master module 	<ul style="list-style-type: none"> Check the serial number of the part is valid (as installed at the factory). If the part has been installed by a dealer the installation routine has not been performed correctly, install the component using the manufacturer approved diagnostic system. Clear the DTC and retest the system
U0191-00	Lost communication with television - No sub type information	<ul style="list-style-type: none"> Lost communication with the TV control module 	 <p>NOTE: This DTC may be stored even though no fault condition is present and should be ignored unless the customer has reported an information and entertainment system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p>

			<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the TV control module Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the TV control module for short circuit to ground, short circuit to power, open circuit, high resistance
U0191-4A	Lost communication with television - Incorrect component installed	<ul style="list-style-type: none"> The serial number of the component does not match the serial number stored in the master module 	<ul style="list-style-type: none"> Check the serial number of the part is valid (as installed at the factory). If the part has been installed by a dealer the installation routine has not been performed correctly, install the component using the manufacturer approved diagnostic system. Clear the DTC and retest the system
U0193-00	Lost communication with digital audio control module A - No sub type information	<ul style="list-style-type: none"> Lost communication with the satellite radio control module 	 <p>NOTE: This DTC may be stored even though no fault condition is present and should be ignored unless the customer has reported an information and entertainment system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the satellite radio control module Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the satellite radio control module for short circuit to ground, short circuit to power, open circuit, high resistance
U0193-4A	Lost communication with digital audio control module A - Incorrect component installed	<ul style="list-style-type: none"> The serial number of the component does not match the serial number stored in the master module 	<ul style="list-style-type: none"> Check the serial number of the part is valid (as installed at the factory). If the part has been installed by a dealer the installation routine has not been performed correctly, install the component using the manufacturer approved diagnostic system. Clear the DTC and retest the system
U0194-00	Lost communication with digital audio control module B - No sub type information	<ul style="list-style-type: none"> Lost communication with the digital radio control module 	 <p>NOTE: This DTC may be stored even though no fault condition is present and should be ignored unless the customer has reported an information and entertainment system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the digital radio control module Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the digital radio control module for short circuit to ground, short circuit to power, open circuit, high resistance
U0194-4A	Lost communication with digital audio control module B - Incorrect component installed	<ul style="list-style-type: none"> The serial number of the component does not match the serial number stored in the master module 	<ul style="list-style-type: none"> Check the serial number of the part is valid (as installed at the factory). If the part has been installed by a dealer the installation routine has not been performed correctly, install the component using the manufacturer approved diagnostic system. Clear the DTC and retest the system
U0196-00	Lost communication with entertainment control module - Rear A - No sub type information	<ul style="list-style-type: none"> Lost communication with the rear seat entertainment control module 	 <p>NOTE: This DTC may be stored even though no fault condition is present and should be ignored unless the customer has reported an information and entertainment system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power

			<p>and ground connections to the rear seat entertainment control module</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the rear seat entertainment control module for short circuit to ground, short circuit to power, open circuit, high resistance
U0196-4A	Lost communication with entertainment control module - Rear A - Incorrect component installed	<ul style="list-style-type: none"> The serial number of the component does not match the serial number stored in the master module 	<ul style="list-style-type: none"> Check the serial number of the part is valid (as installed at the factory). If the part has been installed by a dealer the installation routine has not been performed correctly, install the component using the manufacturer approved diagnostic system. Clear the DTC and retest the system
U0208-00	Lost Communication With "Seat Control Module A" - No sub type information	<ul style="list-style-type: none"> Lost communication with the driver seat module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the driver seat module Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the driver seat module for short circuit to ground, short circuit to power, open circuit, high resistance
U0209-00	Lost Communication With "Seat Control Module B" - No sub type information	<ul style="list-style-type: none"> Lost communication with the passenger seat module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the passenger seat module Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the passenger seat module for short circuit to ground, short circuit to power, open circuit, high resistance
U023B-00	Lost communication with image processing module B - No sub type information	<ul style="list-style-type: none"> Lost communication with the rear view camera 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the rear view camera Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the rear view camera for short circuit to ground, short circuit to power, open circuit, high resistance
U025D-00	Lost communication with front controls interface module - No sub type information	<ul style="list-style-type: none"> Lost communication with the integrated control panel 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, complete a CAN network integrity test Refer to the electrical circuit diagrams and test the power and ground connections to the integrated control panel Refer to the electrical circuit diagrams and test the CAN circuit between the touch screen and the integrated control panel for short circuit to ground, short circuit to power, open circuit, high resistance
U0300-00	Internal control module software incapability - No sub type information	<ul style="list-style-type: none"> Touch screen is not compatible with the vehicle 	<ul style="list-style-type: none"> Check the touch screen part number. Install the correct part as necessary. Check that the correct software is installed
U0300-51	Internal control module software incapability - Not programmed	<ul style="list-style-type: none"> Touch screen software incorrect or missing 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the part numbers of the software installed. Re-configure the touch screen with the latest level software as necessary
U1A24-87	MOST ring complete. No Communication - Missing message	<ul style="list-style-type: none"> MOST ring complete MOST ring node internal fault 	<p> NOTE: This DTC may be stored even though no fault condition is present and should be ignored unless the customer has reported an information and entertainment system concern. Clear the DTC and retest. Verify the customer concern prior to diagnosis</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the MOST ring for fault, bypass each MOST module in turn to isolate faulty node
U2003-87	Fibre optic communication bus - Missing message	<ul style="list-style-type: none"> MOST ring incomplete 	<ul style="list-style-type: none"> Check MOST ring for disconnected modules or fibreoptic cable concerns

U3000-4B	Control module - Over temperature	<ul style="list-style-type: none"> • Touch screen panel backlight - High temperature detected 	<ul style="list-style-type: none"> • Allow the system to cool, clear the diagnostic trouble code and check/monitor system for re-occurrence, if DTC re-occurs, check and install a new touch screen as necessary
U3000-98	Control module - Component or system over temperature	<ul style="list-style-type: none"> • System shut down request from another module on MOST ring • MOST module - Internal temperature over limit 	<ul style="list-style-type: none"> • This DTC is logged if the touch screen display control module receives a system shut down request from another MOST module that is registering as over temperature. Allow the system to cool, clear the diagnostic trouble code and check/monitor system for re-occurrence • If DTC re-occurs, refer to the electrical circuit diagrams and check each MOST module for signs of overheating and related DTCs and refer to the relevant DTC index
U3003-62	Battery voltage - Signal compare failure	<ul style="list-style-type: none"> • Mis-match between the supply voltage to the touch screen and the battery voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the power and ground circuits to the touch screen compared to battery voltage

General Information - Diagnostic Trouble Code (DTC) Index DTC: Transfer Case Control Module (TCCM)

Description and Operation

Transfer Case Control Module (TCCM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.













Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.






The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Transfer Case Control Module (TCCM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual






For additional information, refer to: [Transfer Case](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Diagnosis and Testing).






DTC	Description	Possible Causes	Action
P0560-00	System Voltage - No sub type information	<ul style="list-style-type: none"> Transfer case control module power or ground circuit open circuit, high resistance Battery/charging system fault Transfer case control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111). Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance Refer to the relevant section of the workshop manual and test the battery and charging system Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0561-00	System Voltage Unstable - No sub type information	<ul style="list-style-type: none"> Transfer case control module power or ground circuit open circuit, high resistance Battery/charging 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111). Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance







		<ul style="list-style-type: none"> system fault Transfer case control module internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and test the battery and charging system Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0562-00	System Voltage Low - No sub type information	<ul style="list-style-type: none"> Transfer case control module power or ground circuit open circuit, high resistance Battery/charging system fault Transfer case control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111). Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance Refer to the relevant section of the workshop manual and test the battery and charging system Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0563-00	System Voltage High - No sub type information	<ul style="list-style-type: none"> Battery/charging system fault 	 NOTE: This DTC may be set when the vehicle is jump started. <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111). Refer to the relevant section of the workshop manual and test the battery and charging system
P0607-00	Control Module Performance - No sub type information	<ul style="list-style-type: none"> Transfer case control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0634-00	PCM / ECM / TCM Internal Temperature A Too High - No sub type information	<ul style="list-style-type: none"> Transfer case motor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case control module internal failure 	<p>NOTES:</p>  Transfer case motor resistance should be 0.2 ohms to 10.0 ohms.
			 This DTC may be induced by excessive high/low range changes.
			 This DTC may be induced by prolonged off-road driving. <ul style="list-style-type: none"> Allow the vehicle to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, refer to the electrical circuit diagrams and check the transfer case motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0641-00	Sensor Reference Voltage A Circuit - No sub type information	<ul style="list-style-type: none"> Transfer case motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case control module internal failure 	 NOTE: Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms. <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance







			<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0642-00	Sensor Reference Voltage A Circuit Low - No sub type information	<ul style="list-style-type: none"> Transfer case motor position sensor circuit short circuit to ground Transfer case control module internal failure 	 <p>NOTE: Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0643-00	Sensor Reference Voltage A Circuit High - No sub type information	<ul style="list-style-type: none"> Transfer case motor position sensor circuit short circuit to power Transfer case control module internal failure 	 <p>NOTE: Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to power Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0652-00	Sensor Reference Voltage B Circuit Low - No sub type information	<ul style="list-style-type: none"> Transfer case selector fork position sensor circuit short circuit to ground Manual transmission gear position sensor circuit short circuit to ground Transfer case control module internal failure 	 <p>NOTE: Transfer case selector fork position sensor voltage (supply circuit to ground circuit) should be 4.0V to 6.0V.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case selector fork position sensor circuit for short circuit to ground Refer to the electrical circuit diagrams and check the manual transmission gear position sensor circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0653-00	Sensor Reference Voltage B Circuit High - No sub type information	<ul style="list-style-type: none"> Transfer case selector fork position sensor circuit short circuit to power Manual transmission gear position sensor circuit short circuit to power Transfer case control module internal failure 	 <p>NOTE: Transfer case selector fork position sensor voltage (supply circuit to ground circuit) should be 4.0V to 6.0V.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case selector fork position sensor circuit for short circuit to power Refer to the electrical circuit diagrams and check the manual transmission gear position sensor circuit for short circuit to power Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0666-00	PCM/ECM/TCM Internal Temperature Sensor 'A' Circuit - No sub type	<ul style="list-style-type: none"> Transfer case solenoid circuit short circuit to ground Transfer case control module internal 	 <p>NOTE: Transfer case solenoid resistance should be 0.2 ohms to 10.0 ohms.</p> <ul style="list-style-type: none"> Allow the vehicle to cool. Using the







	information	failure	<p>manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, refer to the electrical circuit diagrams and check the transfer case solenoid circuit for short circuit to ground</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0698-00	Sensor Reference Voltage C Circuit Low - No sub type information	<ul style="list-style-type: none"> Manual transmission output speed sensor circuit short circuit to ground 	 <p>NOTE: Manual transmission output speed sensor voltage (supply circuit to ground circuit) should be 8.0V to 11.0V, signal should be approximately 5 times engine speed in 1st gear when the clutch is fully engaged.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Manual Transmission Output Shaft Speed (0x11B5). Refer to the electrical circuit diagrams and check the manual transmission output speed sensor circuit for short circuit to ground
P0699-00	Sensor Reference Voltage C Circuit High - No sub type information	<ul style="list-style-type: none"> Manual transmission output speed sensor circuit short circuit to power, open circuit, high resistance 	 <p>NOTE: Manual transmission output speed sensor voltage (supply circuit to ground circuit) should be 8.0V to 11.0V, signal should be approximately 5 times engine speed in 1st gear when the clutch is fully engaged.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Manual Transmission Output Shaft Speed (0x11B5). Refer to the electrical circuit diagrams and check the manual transmission output speed sensor circuit for short circuit to power, open circuit, high resistance
P0702-00	Transmission Control System Electrical - No sub type information	<ul style="list-style-type: none"> Transfer case control module power or ground circuit open circuit, high resistance Battery/charging system fault 	 <p>NOTE: This DTC may be set during a forced reset by the manufacturer approved diagnostic system.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111). Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance Refer to the relevant section of the workshop manual and test the battery and charging system
P0712-00	Transmission Fluid Temperature Sensor A Circuit Low - No sub type information	<ul style="list-style-type: none"> Transfer case motor temperature sensor circuit short circuit to ground Transfer case control module internal failure 	 <p>NOTE: Transfer case motor temperature sensor (temperature signal circuit to motor position sensor ground circuit) resistance should be 1.0k ohms to 30.0k ohms.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor temperature sensor circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0713-00	Transmission Fluid Temperature Sensor A Circuit High - No sub type information	<ul style="list-style-type: none"> Transfer case motor temperature sensor circuit short circuit to power Transfer case control module internal failure 	 <p>NOTE: Transfer case motor temperature sensor (temperature signal circuit to motor position sensor ground circuit) resistance should be 1.0k ohms to 30.0k ohms.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor temperature sensor circuit for short circuit to power Using the manufacturer approved diagnostic


			system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0715-00	Turbine/Input Shaft Speed Sensor A Circuit - No sub type information	<ul style="list-style-type: none"> Manual transmission output speed sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: Manual transmission output speed sensor voltage (supply circuit to ground circuit) should be 8.0V to 11.0V, signal should be approximately 5 times engine speed in 1st gear when the clutch is fully engaged.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Manual Transmission Output Shaft Speed (0x11B5). Refer to the electrical circuit diagrams and check the manual transmission output speed sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
P0716-00	Turbine/Input Shaft Speed Sensor A Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Manual transmission output speed sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: Manual transmission output speed sensor voltage (supply circuit to ground circuit) should be 8.0V to 11.0V, signal should be approximately 5 times engine speed in 1st gear when the clutch is fully engaged.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Manual Transmission Output Shaft Speed (0x11B5). Refer to the electrical circuit diagrams and check the manual transmission output speed sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
P0717-00	Turbine/Input Shaft Speed Sensor A Circuit No Signal - No sub type information	<ul style="list-style-type: none"> Manual transmission output speed sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	 <p>NOTE: Manual transmission output speed sensor voltage (supply circuit to ground circuit) should be 8.0V to 11.0V, signal should be approximately 5 times engine speed in 1st gear when the clutch is fully engaged.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Manual Transmission Output Shaft Speed (0x11B5). Refer to the electrical circuit diagrams and check the manual transmission output speed sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
P0780-00	Shift Malfunction - No sub type information	<ul style="list-style-type: none"> Transfer case motor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case control module internal failure Transfer case internal failure 	<p>NOTES:</p>  <p>Transfer case motor resistance should be 0.2 ohms to 10.0 ohms.</p>  <p>Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault







			persists, install a new transfer case and perform routine - Transfer Case Replacement
P0806-00	Clutch Position Sensor Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Transfer case selector fork position sensor not calibrated Transfer case motor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case selector fork position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Manual transmission output speed sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Manual transmission gear position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case motor failure Transfer case selector fork position sensor failure Transfer case control module internal failure Transfer case internal failure 	<p>NOTES:</p> <p> If additional transfer case circuit fault related DTCs are also set, perform the relevant corrective action(s) first and retest.</p> <p> Transfer case motor resistance should be 0.2 ohms to 10.0 ohms.</p> <p> Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <p> Transfer case selector fork position sensor voltage (supply circuit to ground circuit) should be 4.0V to 6.0V.</p> <p> Manual transmission output speed sensor voltage (supply circuit to ground circuit) should be 8.0V to 11.0V, signal should be approximately 5 times engine speed in 1st gear when the clutch is fully engaged.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform routine - Transfer Case Replacement. Clear the DTCs and retest Refer to the electrical circuit diagrams and check the transfer case motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the transfer case selector fork position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check datalogger signal - Manual Transmission Output Shaft Speed (0x11B5). Refer to the electrical circuit diagrams and check the manual transmission output speed sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check datalogger signal - Manual Gearshift Position (0x1985) - and select gears. Refer to the electrical circuit diagrams and check the manual transmission gear position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case motor and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case selector fork position sensor and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case and perform








			routine - Transfer Case Replacement
P0807-00	Clutch Position Sensor Circuit Low - No sub type information	<ul style="list-style-type: none"> Transfer case motor position sensor circuit short circuit to ground Transfer case control module internal failure 	 <p>NOTE: Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0808-00	Clutch Position Sensor Circuit High - No sub type information	<ul style="list-style-type: none"> Transfer case motor position sensor circuit short circuit to ground Transfer case control module internal failure 	 <p>NOTE: Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0820-00	Gear Lever X-Y Position Sensor Circuit - No sub type information	<ul style="list-style-type: none"> Manual transmission gear position sensor calibration lost due to driver riding the clutch - Transmission input and output speeds incorrect for selected gear ratio Clutch slip due to wear - Transmission input and output speeds incorrect for selected gear ratio Manual transmission output speed sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<p>NOTES:</p>  <p>Manual transmission output speed sensor voltage (supply circuit to ground circuit) should be 8.0V to 11.0V, signal should be approximately 5 times engine speed in 1st gear when the clutch is fully engaged.</p>  <p>This DTC may be induced by the driver.</p> <ul style="list-style-type: none"> Calibrate the manual transmission gear position sensor Check the clutch for slipping Using the manufacturer approved diagnostic system, check datalogger signal - Manual Transmission Output Shaft Speed (0x11B5). Refer to the electrical circuit diagrams and check the manual transmission output speed sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
P0826-00	Up and Down Switch Circuit - No sub type information	<ul style="list-style-type: none"> Transfer case high/low range switch stuck active Transfer case high/low range switch signal circuit short circuit to power Transfer case control module internal failure 	<p>NOTES:</p>  <p>This DTC will be set if the switch signal is active for > 255 seconds.</p>  <p>This DTC may be induced by the driver.</p> <ul style="list-style-type: none"> Check the operation of the transfer case high/low range switch Using the manufacturer approved diagnostic system, check datalogger signal - TCCM Input Status (0x1983). Refer to the electrical circuit diagrams and check the transfer case high/low range switch signal circuits for short circuit to power Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case







			Replacement
P0900-00	Clutch Actuator Circuit/Open - No sub type information	<ul style="list-style-type: none"> Transfer case motor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case control module internal failure 	 NOTE: Transfer case motor resistance should be 0.2 ohms to 10.0 ohms. <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0902-00	Clutch Actuator Circuit - No sub type information	<ul style="list-style-type: none"> Transfer case motor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case control module internal failure 	 NOTE: Transfer case motor resistance should be 0.2 ohms to 10.0 ohms. <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0903-00	Clutch Actuator Circuit - No sub type information	<ul style="list-style-type: none"> Transfer case motor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case control module internal failure 	 NOTE: Transfer case motor resistance should be 0.2 ohms to 10.0 ohms. <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0915-00	Gear Shift Position Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Transfer case motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case selector fork position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case selector fork position sensor failure Transfer case motor failure Transfer case control module internal failure 	NOTES:  If additional transfer case circuit fault related DTCs are also set, perform the relevant corrective action(s) first and retest.  Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.  Transfer case selector fork position sensor voltage (supply circuit to ground circuit) should be 4.0V to 6.0V. <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the transfer case selector fork position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case selector fork position sensor and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault







			<p>persists, install a new transfer case motor and perform routine - Transfer Case Replacement</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0916-00	Gear Shift Position Circuit Low - No sub type information	<ul style="list-style-type: none"> Transfer case selector fork position sensor circuit short circuit to ground Transfer case control module internal failure 	 <p>NOTE: Transfer case selector fork position sensor voltage (supply circuit to ground circuit) should be 4.0V to 6.0V.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case selector fork position sensor circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P0917-00	Gear Shift Position Circuit High - No sub type information	<ul style="list-style-type: none"> Transfer case selector fork position sensor circuit short circuit to power Transfer case control module internal failure 	 <p>NOTE: Transfer case selector fork position sensor voltage (supply circuit to ground circuit) should be 4.0V to 6.0V.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case selector fork position sensor circuit for short circuit to power Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P173A-00	Clutch Actuator Position Sensor Circuit Range/Performance - No sub type information	<ul style="list-style-type: none"> Transfer case motor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case motor failure Transfer case control module internal failure 	<p>NOTES:</p>  <p>If additional transfer case circuit fault related DTCs are also set, perform the relevant corrective action(s) first and retest.</p>  <p>Transfer case motor resistance should be 0.2 ohms to 10.0 ohms.</p>  <p>Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case motor and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P173B-00	Clutch Actuator Position Sensor Circuit Low - No sub type information	<ul style="list-style-type: none"> Transfer case motor position sensor circuit short circuit to ground Transfer case control module internal 	 <p>NOTE: Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to</p>







		failure	20.0k ohms. <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P173C-00	Clutch Actuator Position Sensor Circuit High - No sub type information	<ul style="list-style-type: none"> Transfer case motor position sensor circuit short circuit to power Transfer case control module internal failure 	 <p>NOTE: Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to power Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P174A-00	Gear Lever X Position Sensor Circuit Low - No sub type information	<ul style="list-style-type: none"> Manual transmission gear position sensor X axis signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the manual transmission gear position sensor X axis signal circuit for short circuit to ground
P174B-00	Gear Lever X Position Sensor Circuit High - No sub type information	<ul style="list-style-type: none"> Manual transmission gear position sensor X axis signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the manual transmission gear position sensor X axis signal circuit for short circuit to power
P174C-00	Gear Lever Y Position Sensor Circuit Low - No sub type information	<ul style="list-style-type: none"> Manual transmission gear position sensor Y axis signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the manual transmission gear position sensor Y axis signal circuit for short circuit to ground
P174D-00	Gear Lever Y Position Sensor Circuit High - No sub type information	<ul style="list-style-type: none"> Manual transmission gear position sensor Y axis signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the manual transmission gear position sensor Y axis signal circuit for short circuit to power
P1804-00	4-Wheel Drive High Indicator Circuit Failure - No sub type information	<ul style="list-style-type: none"> Transfer case high range LED circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case high range LED circuit for short circuit to ground, open circuit, high resistance
P1806-00	4-Wheel Drive High Indicator Short Circuit To Battery - No sub type information	<ul style="list-style-type: none"> Transfer case high range LED circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case high range LED circuit for short circuit to power
P1807-00	4-Wheel Drive High Indicator Short Circuit To Ground - No sub type information	<ul style="list-style-type: none"> Transfer case high range LED circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case high range LED circuit for short circuit to ground
P1808-00	4-Wheel Drive Low Indicator Circuit Failure - No sub type information	<ul style="list-style-type: none"> Transfer case low range LED circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case low range LED circuit for short circuit to ground, open circuit, high resistance
P1810-00	4-Wheel Drive Low Indicator Short Circuit To Battery - No sub type information	<ul style="list-style-type: none"> Transfer case low range LED circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case low range LED circuit for short circuit to power
P181B-	Clutch Actuator	<ul style="list-style-type: none"> Transfer case 	

00	Changeover Solenoid Low - No sub type information	<p>solenoid circuit short circuit to ground</p> <ul style="list-style-type: none"> Transfer case control module internal failure 	<p> NOTE: Transfer case solenoid resistance should be 0.2 ohms to 10.0 ohms.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case solenoid circuit for short circuit to ground Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P181C-00	Clutch Actuator Changeover Solenoid High - No sub type information	<ul style="list-style-type: none"> Transfer case solenoid circuit short circuit to power Transfer case control module internal failure 	<p> NOTE: Transfer case solenoid resistance should be 0.2 ohms to 10.0 ohms.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case solenoid circuit for short circuit to power Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P181D-00	Clutch Actuator Changeover Solenoid Range/Performance - No sub type information	<ul style="list-style-type: none"> Transfer case motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case motor failure Transfer case solenoid failure Transfer case control module internal failure Transfer case internal failure 	<p>NOTES:</p> <p> If additional transfer case circuit fault related DTCs are also set, perform the relevant corrective action(s) first and retest.</p> <p> Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <p> Transfer case solenoid resistance should be 0.2 ohms to 10.0 ohms.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the transfer case solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case motor and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case solenoid and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case and perform routine - Transfer Case Replacement
P181E-00	Clutch Actuator Range/Performance - No sub type information	<ul style="list-style-type: none"> Transfer case motor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case motor position sensor 	<p>NOTES:</p> <p> If additional transfer case circuit fault related DTCs are also set, perform the relevant corrective action(s) first and retest.</p>

		<p>circuit short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Transfer case solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transfer case motor failure • Transfer case solenoid failure • Transfer case control module internal failure • Transfer case internal failure 	<p> Transfer case motor resistance should be 0.2 ohms to 10.0 ohms.</p> <p> Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <p> Transfer case solenoid resistance should be 0.2 ohms to 10.0 ohms.</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transfer case motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the transfer case solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case motor and perform routine - Transfer Case Replacement • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case solenoid and perform routine - Transfer Case Replacement • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case and perform routine - Transfer Case Replacement
P181F-00	Clutch Control System Performance - No sub type information	<ul style="list-style-type: none"> • Transfer case motor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transfer case motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transfer case solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transfer case control module internal failure • Transfer case motor failure • Transfer case solenoid failure • Transfer case internal failure 	<p>NOTES:</p> <p> If additional transfer case circuit fault related DTCs are also set, perform the relevant corrective action(s) first and retest.</p> <p> Transfer case motor resistance should be 0.2 ohms to 10.0 ohms.</p> <p> Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <p> Transfer case solenoid resistance should be 0.2 ohms to 10.0 ohms.</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transfer case motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check

			<p>the transfer case solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case motor and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case solenoid and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case and perform routine - Transfer Case Replacement
P183A-00	Range Change Mechanism Failure - No sub type information	<ul style="list-style-type: none"> Transfer case motor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case motor failure Transfer case control module internal failure Transfer case internal failure Transmission fault - High drag torque in Neutral 	<p>NOTES:</p> <p> If additional transfer case circuit fault related DTCs are also set, perform the relevant corrective action(s) first and retest.</p> <p> If any transmission control module DTCs are also set, perform the relevant corrective action(s) first and retest.</p> <p> Transfer case motor resistance should be 0.2 ohms to 10.0 ohms.</p> <p> Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case motor and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case and perform routine - Transfer Case Replacement Refer to the relevant section of the workshop manual and test the transmission
P186D-00	Clutch Actuator Stuck - No sub type information	<ul style="list-style-type: none"> Transfer case motor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case motor position sensor circuit short circuit to ground, short circuit 	<p>NOTES:</p> <p> If additional transfer case circuit fault related DTCs are also set, perform the relevant corrective action(s) first and retest.</p> <p> Transfer case motor resistance should be 0.2</p>

		<p>to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Transfer case solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transfer case motor failure • Transfer case control module internal failure • Transfer case internal failure 	<p>ohms to 10.0 ohms.</p> <p> Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <p> Transfer case solenoid resistance should be 0.2 ohms to 10.0 ohms.</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transfer case motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the transfer case solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case motor and perform routine - Transfer Case Replacement • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case and perform routine - Transfer Case Replacement
P2711-00	Unexpected Mechanical Gear Disengagement - No sub type information	<ul style="list-style-type: none"> • Transfer case motor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transfer case motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transfer case motor failure • Transfer case control module internal failure • Transfer case internal failure • Transmission fault - High drag torque in Neutral 	<p>NOTES:</p> <p> If additional transfer case circuit fault related DTCs are also set, perform the relevant corrective action(s) first and retest.</p> <p> If any transmission control module DTCs are also set, perform the relevant corrective action(s) first and retest.</p> <p> Transfer case motor resistance should be 0.2 ohms to 10.0 ohms.</p> <p> Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transfer case motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case motor and perform routine - Transfer Case Replacement • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control

			<p>module and perform routine - Transfer Case Replacement</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case and perform routine - Transfer Case Replacement Refer to the relevant section of the workshop manual and test the transmission
P2785-00	Clutch Actuator Temperature Too High - No sub type information	<ul style="list-style-type: none"> Transfer case motor temperature too high (> 150°C) Transfer case motor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case control module internal failure 	<p>NOTES:</p> <p> Transfer case motor resistance should be 0.2 ohms to 10.0 ohms.</p> <p> This DTC may be induced by prolonged off-road driving.</p> <ul style="list-style-type: none"> Allow the vehicle to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest Refer to the electrical circuit diagrams and check the transfer case motor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P2787-00	Clutch Temperature Too High - No sub type information	<ul style="list-style-type: none"> Transfer case clutch temperature too high Incorrect specification wheels/tires installed - Mismatch between axle speeds Front/rear driveshaft failure Front/rear differential failure Front/rear left/right halfshaft failure 	<p> NOTE: This DTC may be induced by prolonged off-road driving.</p> <ul style="list-style-type: none"> Allow the vehicle to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest Check the wheel and tire specifications Check the integrity of the front and rear driveshafts Check the integrity of the front and rear differentials Check the integrity of the halfshafts
P2789-00	Clutch Adaptive Learning at Limit - No sub type information	<ul style="list-style-type: none"> Transfer case clutch not calibrated Transfer case motor position sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case solenoid circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case fluid contaminated with water Transfer case clutch worn/burnt Transfer case control module internal failure 	<p>NOTES:</p> <p> If additional transfer case circuit fault related DTCs are also set, perform the relevant corrective action(s) first and retest.</p> <p> Transfer case motor position sensor voltage (sensor supply to sensor ground) should be 8V to 11V, resistance (signal A circuit to ground circuit) should be 16.0k ohms to 20.0k ohms and resistance (signal B circuit to ground circuit) should be 16.0k ohms to 20.0k ohms.</p> <p> Transfer case solenoid resistance should be 0.2 ohms to 10.0 ohms.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform routine - Transfer Case Replacement Refer to the electrical circuit diagrams and check the transfer case motor position sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the transfer case solenoid circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the relevant section of the workshop manual and check the transfer case fluid level/condition. If water is present in the fluid,

			<p>check the integrity of the transfer case breather and install a new transfer case and perform routine - Transfer Case Replacement</p> <ul style="list-style-type: none"> • Check the integrity of the driveshafts, differentials and half shafts. Rectify as necessary and install a new transfer case and perform routine - Transfer Case Replacement • Using the manufacturer approved diagnostic system, perform routine - Transfer Case Replacement. Clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
P2806-00	Transmission Range Sensor Alignment - No sub type information	<ul style="list-style-type: none"> • Manual transmission gear position sensor not calibrated 	<ul style="list-style-type: none"> • Calibrate the manual transmission gear position sensor
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0100-00	Lost Communication With ECM/PCM "A" - No sub type information	<ul style="list-style-type: none"> • Engine control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Engine system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the engine control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0101-00	Lost Communication with TCM - No sub type information	<ul style="list-style-type: none"> • Transmission control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transmission system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0121-00	Lost Communication With Anti-Lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> • Anti-lock brake system control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Anti-lock brake system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0126-00	Lost Communication With Steering Angle Sensor Module - No sub type information	<ul style="list-style-type: none"> • Steering angle sensor module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Steering angle sensor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the steering angle sensor module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC

		system fault	index
U0128-00	Lost Communication With Park Brake Control Module - No sub type information	<ul style="list-style-type: none"> Electric park brake control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Electric park brake system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the electric park brake control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the electric park brake control module for related DTCs and refer to the relevant DTC index
U0132-00	Lost Communication With Suspension Control Module "A" - No sub type information	<ul style="list-style-type: none"> Air suspension control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Air suspension system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the air suspension control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the air suspension control module for related DTCs and refer to the relevant DTC index
U0136-00	Lost Communication With Differential Control Module - Rear - No sub type information	<ul style="list-style-type: none"> Rear differential control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Rear differential system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the rear differential control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the rear differential control module for related DTCs and refer to the relevant DTC index
U0138-00	Lost Communication with All Terrain Control Module - No sub type information	<ul style="list-style-type: none"> Terrain response switchpack power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Terrain response system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the terrain response switchpack power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the terrain response switchpack for related DTCs and refer to the relevant DTC index
U0140-00	Lost Communication With Body Control Module - No sub type information	<ul style="list-style-type: none"> Central junction box power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Central junction box system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> Transfer case control module is not configured correctly Incorrect transfer case control module installed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the transfer case control module with the latest level software Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case

			Replacement
U0401-00	Invalid Data Received From ECM/PCM A - No sub type information	<ul style="list-style-type: none"> Missing/invalid data from the engine control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0402-00	Invalid Data Received from TCM - No sub type information	<ul style="list-style-type: none"> Missing/invalid data from the transmission control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0415-00	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> Missing/invalid data from the anti-lock brake system control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0417-00	Invalid Data Received From Park Brake Control Module - No sub type information	<ul style="list-style-type: none"> Missing/invalid data from the electric park brake control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the electric park brake control module for related DTCs and refer to the relevant DTC index
U0428-00	Invalid Data Received From Steering Angle Sensor Module - No sub type information	<ul style="list-style-type: none"> Missing/invalid data from the steering angle sensor module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
U3000-55	Control Module - Not configured	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification Incorrect transfer case control module installed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transfer case control module and perform routine - Transfer Case Replacement
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> Mismatch between the voltage at the transfer case control module and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111) - and compare it to battery voltage. Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Transmission Control Module (TCM)

Description and Operation

Transmission Control Module (TCM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



If a failure condition is reported indicating the need to renew the transmission assembly on a vehicle that remains under manufacturer warranty, an authorisation request must first go through the warranty prior approval programme before any work is begun



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.









The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Transmission Control Module (TCM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.





For additional information, refer to: Diagnostics (307-01A, Diagnosis and Testing).


DTC	Description	Possible Causes	Action
B1087-41	LIN Bus "A" - General checksum failure	<ul style="list-style-type: none"> LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1087-63	LIN Bus "A" - Circuit / component protection time-out	<ul style="list-style-type: none"> LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1087-64	LIN Bus "A" - Signal plausibility failure	<ul style="list-style-type: none"> Missing/invalid data from the transmission 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control switch for related DTCs and refer to the relevant DTC index

		control switch	
B1087-82	LIN Bus "A" - Alive / sequence counter incorrect / not updated	<ul style="list-style-type: none"> LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1087-83	LIN Bus "A" - Signal plausibility failure - value of signal protection calculation incorrect	<ul style="list-style-type: none"> Missing/invalid data from the transmission control switch 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control switch for related DTCs and refer to the relevant DTC index
B1087-88	LIN Bus "A" - Bus off	<ul style="list-style-type: none"> LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B108E-02	Display - General signal failure	<ul style="list-style-type: none"> Gear display signal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs. Road test the vehicle and check that the displayed gear matches the engaged gear. If the fault persists, install a new transmission control module
C1A88-64	High Pressure Switching Valve #1 - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0121-86	Throttle/Pedal Position Sensor A Circuit Range/Performance - Signal invalid	<ul style="list-style-type: none"> Invalid data received from the engine control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
P0219-64	Engine Overspeed Condition - Signal plausibility failure	<ul style="list-style-type: none"> Invalid data received from the engine control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
P0560-21	System Voltage - Signal amplitude < minimum	<ul style="list-style-type: none"> Battery/charging system fault Transmission control module power or ground circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and test the battery and charging system Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance
P0562-1C	System Voltage Low - Circuit voltage out of range	<ul style="list-style-type: none"> Battery/charging system fault Transmission control module power or ground circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and test the battery and charging system Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance
P0562-21	System Voltage Low - Signal amplitude < minimum	<ul style="list-style-type: none"> Battery/charging system fault Transmission control module power or ground circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and test the battery and charging system Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance
P0563-22	System Voltage High - Signal amplitude > maximum	<ul style="list-style-type: none"> Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the relevant section of the workshop manual and test the battery and charging system
P0601-41	Internal Control Module Memory Checksum Error- General checksum failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module

P0606-04	Control Module Processor - System Internal Failures	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0606-11	Control Module Processor - Circuit short to ground	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0606-62	Control Module Processor - Signal compare failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0606-64	Control Module Processor - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0613-04	TCM Processor - System internal failures	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0613-06	TCM Processor - Algorithm based failures	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0613-11	TCM Processor - Circuit short to ground	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0613-12	TCM Processor - Circuit short to battery	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0613-13	TCM Processor - Circuit open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0613-15	TCM Processor - Circuit short to battery or open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0613-18	TCM Processor - Circuit current below threshold	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P061B-02	Internal Control Module Torque Calculation Performance - General signal failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P061B-64	Internal Control Module Torque Calculation Performance - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P062F-04	Internal Control Module EEPROM Error - System internal failures	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0641-64	Sensor Reference Voltage A Circuit/Open - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0642-21	Sensor Reference Voltage A Circuit Low - Signal amplitude < minimum	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0643-22	Sensor Reference Voltage A Circuit High - Signal amplitude > maximum	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0657-13	Actuator Supply Voltage A Circuit / Open - Circuit open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0657-64	Actuator Supply Voltage A Circuit / Open - Signal	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module

	plausibility failure		
P0658-11	Actuator Supply Voltage A Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0659-12	Actuator Supply Voltage A Circuit High - Circuit short to battery	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0666-64	Control Module Internal Temperature Sensor "A" Circuit - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control module internal failure 	 <p>NOTE: Consider environmental conditions before condemning the transmission control module</p> <ul style="list-style-type: none"> Allow the transmission control module to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0667-01	PCM / ECM / TCM Internal Temperature Sensor A Range/Performance - General electrical failure	<ul style="list-style-type: none"> Transmission control module internal failure 	 <p>NOTE: Consider environmental conditions before condemning the transmission control module</p> <ul style="list-style-type: none"> Allow the transmission control module to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0668-21	PCM / ECM / TCM Internal Temperature Sensor A Circuit Low - Signal amplitude < minimum	<ul style="list-style-type: none"> Transmission control module internal failure 	 <p>NOTE: Consider environmental conditions before condemning the transmission control module</p> <ul style="list-style-type: none"> Allow the transmission control module to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0669-22	PCM / ECM / TCM Internal Temperature Sensor A Circuit High - Signal amplitude > maximum	<ul style="list-style-type: none"> Transmission control module internal failure 	 <p>NOTE: Consider environmental conditions before condemning the transmission control module</p> <ul style="list-style-type: none"> Allow the transmission control module to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P06AC-01	PCM / ECM / TCM Internal Temperature Sensor B Range/Performance - General electrical failure	<ul style="list-style-type: none"> Transmission control module internal failure 	 <p>NOTE: Consider environmental conditions before condemning the transmission control module</p> <ul style="list-style-type: none"> Allow the transmission control module to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P06AC-64	PCM / ECM / TCM Internal Temperature Sensor B Range/Performance - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control module internal failure 	 <p>NOTE: Consider environmental conditions before condemning the transmission control module</p> <ul style="list-style-type: none"> Allow the transmission control module to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P06AD-22	PCM / ECM / TCM Internal Temperature Sensor B Circuit Low - Signal amplitude > maximum	<ul style="list-style-type: none"> Transmission control module internal failure 	 <p>NOTE: Consider environmental conditions before condemning the transmission control module</p> <ul style="list-style-type: none"> Allow the transmission control module to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P06AE-21	PCM / ECM / TCM Internal Temperature Sensor B Circuit High - Signal amplitude < minimum	<ul style="list-style-type: none"> Transmission control module internal failure 	 <p>NOTE: Consider environmental conditions before condemning the transmission control module</p> <ul style="list-style-type: none"> Allow the transmission control module to cool. Using the manufacturer approved diagnostic

			system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0700-02	Transmission Control System (MIL Request) - General signal failure	<ul style="list-style-type: none"> Transmission system fault 	<ul style="list-style-type: none"> Investigate other DTCs first. Clear the DTCs and road test the vehicle. Re-read DTCs
P0700-83	Transmission Control System (MIL Request) - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0702-98	Transmission Control System Electrical - Component or system over temperature	<ul style="list-style-type: none"> Insufficient transmission cooling 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Check the automatic transmission cooling system
P0710-04	Transmission Fluid Temperature Sensor A Circuit - System internal failures	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0710-13	Transmission Fluid Temperature Sensor A Circuit - Circuit open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0710-27	Transmission Fluid Temperature Sensor A Circuit - Signal rate of change above threshold	<ul style="list-style-type: none"> Transmission control module internal failure 	 <p>NOTE: Consider environmental conditions before condemning the transmission control module</p> <ul style="list-style-type: none"> Allow the transmission control module to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0710-64	Transmission Fluid Temperature Sensor A Circuit - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control module internal failure 	 <p>NOTE: Consider environmental conditions before condemning the transmission control module</p> <ul style="list-style-type: none"> Allow the transmission control module to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0712-11	Transmission Fluid Temperature Sensor A Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> Transmission control module internal failure 	 <p>NOTE: Consider environmental conditions before condemning the transmission control module</p> <ul style="list-style-type: none"> Allow the transmission control module to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0713-12	Transmission Fluid Temperature Sensor A Circuit High - Circuit short to battery	<ul style="list-style-type: none"> Transmission control module internal failure 	 <p>NOTE: Consider environmental conditions before condemning the transmission control module</p> <ul style="list-style-type: none"> Allow the transmission control module to cool. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0715-12	Turbine/Input Shaft Speed Sensor A Circuit - Circuit short to battery	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0715-64	Turbine/Input Shaft Speed Sensor A Circuit - Signal plausibility failure	<ul style="list-style-type: none"> Turbine sensor signal plausibility failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Check datalogger signals - Turbine Speed (0x1E72) - Transmission Output Shaft Speed (0x1E68) - for plausibility. If the fault persists, install a new transmission control module
P0716-14	Turbine/Input Shaft Speed Sensor A Circuit Range/Performance - Circuit short to ground or open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module

P0716-27	Turbine/Input Shaft Speed Sensor A Circuit Range/Performance - Signal rate of change above threshold	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0720-12	Output Shaft Speed Sensor Circuit - Circuit short to battery	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0720-14	Output Shaft Speed Sensor Circuit - Circuit short to ground or open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0721-02	Output Shaft Speed Sensor Circuit Range/Performance - General signal failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0721-27	Output Shaft Speed Sensor Circuit Range/Performance - Signal rate of change above threshold	<ul style="list-style-type: none"> Signal rate of change above threshold 	 <p>NOTE: This DTC may be set by an anti-lock braking system fault allowing the brakes to lock during braking</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0721-62	Output Shaft Speed Sensor Circuit Range/Performance - Signal compare failure	<ul style="list-style-type: none"> Anti-lock brake system fault Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new transmission control module
P0721-64	Output Shaft Speed Sensor Circuit Range/Performance - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new transmission control module
P0725-83	Engine Speed Input Circuit - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> Missing/invalid data from the engine control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
P0729-07	Gear 6 Incorrect Ratio - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P0730-00	Incorrect Gear Ratio - No sub type information	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P0731-07	Gear 1 Incorrect Ratio - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P0732-07	Gear 2 Incorrect Ratio - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P0733-	Gear 3 Incorrect	<ul style="list-style-type: none"> Automatic 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop

07	Ratio - Mechanical failures	transmission internal failure	manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P0734-07	Gear 4 Incorrect Ratio - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P0735-07	Gear 5 Incorrect Ratio - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P0736-07	Reverse Incorrect Ratio - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P0736-64	Reverse Incorrect Ratio - Signal plausibility failure	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P0741-07	Torque Converter Clutch Solenoid Circuit Performance/Stuck Off - Mechanical failures	<ul style="list-style-type: none"> Torque converter or automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new torque converter. Clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P0745-11	Pressure Control Solenoid A - Circuit short to ground	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0745-12	Pressure Control Solenoid A - Circuit short to battery	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0745-13	Pressure Control Solenoid A - Circuit open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0745-14	Pressure Control Solenoid A - Circuit short to ground or open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0745-64	Pressure Control Solenoid A - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0745-93	Pressure Control Solenoid A - No operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0745-94	Pressure Control Solenoid A - Unexpected operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0748-11	Pressure Control Solenoid A Electrical - Circuit short to ground	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0748-12	Pressure Control Solenoid A Electrical - Circuit short to battery	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module

P0748-13	Pressure Control Solenoid A Electrical - Circuit open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P076F-07	Gear 7 Ratio Incorrect - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P077E-02	Transmission Fluid Temperature Measurement System - Multiple Sensor Correlation - General signal failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0780-62	Shift Malfunction - Signal compare failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0780-93	Shift Malfunction - No operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0780-94	Shift Malfunction - Unexpected operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0795-04	Pressure Control Solenoid C - System Internal Failures	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P07AD-07	Transmission Friction Element "F" Stuck On - Mechanical failures	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P07D9-07	Gear 8 Incorrect Ratio - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P07DC-07	Incorrect Shift from Gear 1 - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P07DD-07	Incorrect Shift from Gear 2 - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P07DE-07	Incorrect Shift from Gear 3 - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P07DF-07	Incorrect Shift from Gear 4 - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P07E0-07	Incorrect Shift from Gear 5 - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P07E1-	Incorrect Shift from	<ul style="list-style-type: none"> Automatic 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop

07	Gear 6 - Mechanical failures	transmission internal failure	manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P07E2-07	Incorrect Shift from Gear 7 - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P07E3-07	Incorrect Shift from Gear 8 - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P0801-94	Reverse Inhibit Control Circuit - Unexpected operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0810-04	Clutch Position Control Error - System Internal Failures	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. Ensure the displayed gear matches the engaged gear. If the fault persists, install a new transmission control module
P0826-01	Up and Down Switch Circuit - General Electrical Failure	<ul style="list-style-type: none"> Upshift/downshift paddle switch stuck active Upshift/downshift paddle switch circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Test the operation of the upshift/downshift paddle switches Refer to the electrical circuit diagrams and check the upshift/downshift paddle switch circuits for short circuit to ground, short circuit to power, open circuit, high resistance
P0826-2A	Up and Down Switch Circuit - Signal stuck in range	<ul style="list-style-type: none"> Upshift/downshift paddle switch stuck active Upshift/downshift paddle switch circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Test the operation of the upshift/downshift paddle switches Refer to the electrical circuit diagrams and check the upshift/downshift paddle switch circuits for short circuit to ground, short circuit to power, open circuit, high resistance
P0826-64	Up and Down Switch Circuit - Signal plausibility failure	<ul style="list-style-type: none"> Upshift/downshift paddle switch stuck active Upshift/downshift paddle switch circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Test the operation of the upshift/downshift paddle switches Refer to the electrical circuit diagrams and check the upshift/downshift paddle switch circuits for short circuit to ground, short circuit to power, open circuit, high resistance
P084F-11	Park / neutral Switch Output Circuit - Circuit short to ground	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P084F-12	Park / neutral Switch Output Circuit - Circuit short to battery	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P084F-13	Park / neutral Switch Output Circuit - Circuit open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P084F-	Park / neutral Switch	<ul style="list-style-type: none"> Transmission 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic

14	Output Circuit - Circuit short to ground or open	control module internal failure	system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P084F-29	Park / neutral Switch Output Circuit - Signal invalid	<ul style="list-style-type: none"> • Park/neutral switch output circuit signal invalid 	<ul style="list-style-type: none"> • Check for correct output signal at transmission control module pin 1 to transmission plug (check in all positions). If the signal appears normal, then check wiring and connectors to the module. If no signal present, renew the transmission control module as required
P0850-02	Park / neutral Switch Input Circuit - General signal failure	<ul style="list-style-type: none"> • Park/neutral switch output circuit failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. Test the parklock mechanism by engaging and disengaging the parking lock several times. If fault persists, renew parklock components as necessary. If the fault persists, install a new transmission control module
P0850-29	Park / neutral Switch Input Circuit - Signal invalid	<ul style="list-style-type: none"> • Starter inhibit signal invalid 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. Test the parklock mechanism by engaging and disengaging the parking lock several times. If fault persists, renew parklock components as necessary. If the fault persists, install a new transmission control module
P0851-01	Park / neutral Switch Input Circuit Low - General electrical failure	<ul style="list-style-type: none"> • Switch input circuit general signal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. Test the parklock mechanism by engaging and disengaging the parking lock several times. If fault persists, renew parklock components as necessary. If the fault persists, install a new transmission control module
P0852-01	Park / neutral Switch Input Circuit High - General electrical failure	<ul style="list-style-type: none"> • Switch input circuit general signal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. Test the parklock mechanism by engaging and disengaging the parking lock several times. If fault persists, renew parklock components as necessary. If the fault persists, install a new transmission control module
P0942-07	Hydraulic Pressure Unit - Mechanical failures	<ul style="list-style-type: none"> • Automatic transmission internal failure 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P0942-62	Hydraulic Pressure Unit - Signal compare failure	<ul style="list-style-type: none"> • Hydraulic pressure unit signal compare failure 	<ul style="list-style-type: none"> • Perform ECO-start and monitor engine speed and engine/transmission start stop and position signals. Clear the DTC and retest. If the problem persists, renew the transmission control module as required
P0965-64	Pressure Control Solenoid B Control Circuit Range/Performance - Signal plausibility failure	<ul style="list-style-type: none"> • Transmission control module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0965-93	Pressure Control Solenoid B Control Circuit Range/Performance - No operation	<ul style="list-style-type: none"> • Transmission control module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0965-94	Pressure Control Solenoid B Control Circuit Range/Performance - Unexpected operation	<ul style="list-style-type: none"> • Transmission control module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0966-11	Pressure Control Solenoid B Control Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> • Transmission control module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0966-12	Pressure Control Solenoid B Control Circuit Low - Circuit short to battery	<ul style="list-style-type: none"> • Transmission control module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module

	Signal amplitude < minimum		
P0978-64	Shift Solenoid C Control Circuit Range/Performance - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0978-93	Shift Solenoid C Control Circuit Range/Performance - No operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0978-94	Shift Solenoid C Control Circuit Range/Performance - Unexpected operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0979-11	Shift Solenoid C Control Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0979-14	Shift Solenoid C Control Circuit Low - Circuit short to ground or open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0980-12	Shift Solenoid C Control Circuit High - Circuit short to battery	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0980-19	Shift Solenoid C Control Circuit High - Circuit current above threshold	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0981-64	Shift Solenoid D Control Circuit Range/Performance - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0981-93	Shift Solenoid D Control Circuit Range/Performance - No operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0981-94	Shift Solenoid D Control Circuit Range/Performance - Unexpected operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0982-11	Shift Solenoid D Control Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0982-14	Shift Solenoid D Control Circuit Low - Circuit short to ground or open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0982-18	Shift Solenoid D Control Circuit Low - Circuit current below threshold	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0983-12	Shift Solenoid D Control Circuit High - Circuit short to battery	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0983-19	Shift Solenoid D Control Circuit High - Circuit current above threshold	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0984-64	Shift Solenoid E Control Circuit Range/Performance - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0984-93	Shift Solenoid E Control Circuit Range/Performance - No operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0984-	Shift Solenoid E	<ul style="list-style-type: none"> Transmission 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic

94	Control Circuit Range/Performance - Unexpected operation	control module internal failure	system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0985-11	Shift Solenoid E Control Circuit Low - Circuit short to ground	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0985-14	Shift Solenoid E Control Circuit Low - Circuit short to ground or open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0985-18	Shift Solenoid E Control Circuit Low - Circuit current below threshold	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0986-12	Shift Solenoid E Control Circuit High - Circuit short to battery	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P0986-19	Shift Solenoid E Control Circuit High - Circuit current above threshold	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P164C-62	Internal Control Module Start-Stop Performance - Signal compare failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Perform ECO-start and monitor engine speed and engine/transmission start stop and position signals. Clear the DTC and retest. If the problem persists, renew the transmission control module as required
P1706-94	High Vehicle Speed Observed in Park - Unexpected operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P1707-72	Transfer Case Neutral or Park/Neutral Indication Circuit - Actuator stuck open	<ul style="list-style-type: none"> Emergency park release has been operated / is sticking Parking lock mechanical failure 	<ul style="list-style-type: none"> Test the operation of the emergency park release Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P1707-77	Transfer Case Neutral or Park/Neutral Indication Circuit - Commanded position not reachable	<ul style="list-style-type: none"> Emergency park release has been operated / is sticking Parking lock mechanical failure 	<ul style="list-style-type: none"> Test the operation of the emergency park release Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P177A-07	Transmission Friction Element A or B - Mechanical Failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P177B-07	Transmission Friction Element A or C - Mechanical Failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P177C-07	Transmission Friction Element A or D - Mechanical Failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P177D-07	Transmission Friction Element A or E - Mechanical Failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P177E-	Transmission Friction	<ul style="list-style-type: none"> Automatic 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop

07	Element B or C - Mechanical Failures	transmission internal failure	manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P177F-07	Transmission Friction Element B or D - Mechanical Failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P178A-07	Transmission Friction Element B or E - Mechanical Failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P178B-07	Transmission Friction Element C or D - Mechanical Failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P178C-07	Transmission Friction Element C or E - Mechanical Failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P178D-07	Transmission Friction Element D or E - Mechanical Failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P2159-02	Vehicle Speed Sensor B Range/Performance - General signal failure	<ul style="list-style-type: none"> Missing/invalid data from the anti-lock brake system control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
P215B-62	Vehicle Speed / Output Shaft Speed Correlation - Signal compare failure	<ul style="list-style-type: none"> Missing/invalid data from the anti-lock brake system control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
P258F-02	Torque Management Request Output Signal - General signal failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P2700-07	Transmission Friction Element A Apply Time Range/Performance - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P2701-07	Transmission Friction Element B Apply Time Range/Performance - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P2702-07	Transmission Friction Element C Apply Time Range/Performance - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P2703-07	Transmission Friction Element D Apply	<ul style="list-style-type: none"> Automatic transmission 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid

	Time Range/Performance - Mechanical failures	internal failure	level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P2704-07	Transmission Friction Element E Apply Time Range/Performance - Mechanical failures	<ul style="list-style-type: none"> Automatic transmission internal failure 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and check the automatic transmission fluid level and quality. Using the manufacturer approved diagnostic system, clear the DTCs and road test the vehicle. If the fault persists, install a new automatic transmission
P2711-94	Unexpected Mechanical Gear Disengagement - Unexpected operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P2713-04	Pressure Control Solenoid D - System Internal Failures	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P2722-04	Pressure Control Solenoid E - System Internal Failures	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P2757-93	Torque Converter Clutch Pressure Control Solenoid Control Circuit Perf or Stuck Off - No operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P2757-94	Torque Converter Clutch Pressure Control Solenoid Control Circuit Perf or Stuck Off - Unexpected operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P2759-11	Torque Converter Clutch Pressure Control Solenoid Electrical - Circuit short to ground	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P2759-12	Torque Converter Clutch Pressure Control Solenoid Electrical - Circuit short to battery	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P2761-13	Torque Converter Clutch Pressure Control Solenoid Control Circuit / Open - Circuit open	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P2762-64	Torque Converter Clutch Pressure Control Solenoid Control Circuit Range / Perf - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P2784-02	Input / Turbine Speed Sensor A / B Correlation - General signal failure	<ul style="list-style-type: none"> Sensor general signal failure, multiple input speed signal faults 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
P2787-4B	Clutch Temperature Too High - Over temperature	<ul style="list-style-type: none"> Clutch over temperature 	<ul style="list-style-type: none"> Allow the transmission to cool, clear the DTC and retest. Check transmission oil level and check for excessive gear changes during normal driving. Check paddle switch for intermittent operation and renew as required
P2787-98	Clutch Temperature Too High - Component or system over temperature	<ul style="list-style-type: none"> Component or system over temperature 	<ul style="list-style-type: none"> Allow the transmission to cool, clear the DTC and retest. Check transmission oil level and check for excessive gear changes during normal driving. Check paddle switch for intermittent operation Check the transmission oil level and quality, refer

			to the relevant section of the workshop manual. Clear the DTC and test drive the vehicle using all gears in drive and reverse. Clear the DTC and retest. If the problem persists, or if any other gear ratio related DTCs are logged, renew the transmission
P2793-92	Gear Shift Direction Circuit - Performance or incorrect operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P2793-94	Gear Shift Direction Circuit - Unexpected operation	<ul style="list-style-type: none"> Transmission control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
P279D-02	Four Wheel Drive (4WD) Range Signal Circuit - General signal failure	<ul style="list-style-type: none"> Transfer case control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
P279D-64	Four Wheel Drive (4WD) Range Signal Circuit - Signal plausibility failure	<ul style="list-style-type: none"> Transfer case control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Transfer case system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
U0001-88	High Speed CAN Communication CAN Bus - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0100-63	Lost Communication With ECM/PCM "A" - Circuit / component protection time-out	<ul style="list-style-type: none"> Engine control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Engine system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the engine control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0102-63	Lost Communication with transfer box control module - Circuit / component protection time-out	<ul style="list-style-type: none"> Transfer case control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transfer case control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance

		<p>short circuit to power, open circuit, high resistance</p> <ul style="list-style-type: none"> • Transfer case system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
U0103-63	Lost Communication With Gear Shift Control Module A - Circuit / component protection time-out	<ul style="list-style-type: none"> • Transmission control switch power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transmission control switch system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the transmission control switch power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transmission control switch for related DTCs and refer to the relevant DTC index
U0121-63	Lost Communication With Anti-Lock Brake System (ABS) Control Module - Circuit / component protection time-out	<ul style="list-style-type: none"> • Anti-lock brake system control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Anti-lock brake system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0126-63	Lost Communication With Steering Angle Sensor Module - Circuit / component protection time-out	<ul style="list-style-type: none"> • Steering angle sensor module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Steering angle sensor system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the steering angle sensor module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the steering angle sensor module for related DTCs and refer to the relevant DTC index
U0128-63	Lost Communication With Park Brake Control Module - Circuit / component protection time-out	<ul style="list-style-type: none"> • Electric park brake control module power or ground circuit open circuit, high resistance • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Electric park brake system fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the electric park brake control module power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the electric park brake control module for related DTCs and refer to the relevant DTC index
U0138-63	Lost Communication with All Terrain Control Module - Circuit / component protection time-out	<ul style="list-style-type: none"> • Terrain response switchpack power or ground circuit open circuit, high 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the terrain response switchpack power and ground circuits for open circuit, high resistance • Using the manufacturer approved diagnostic system, perform a CAN network integrity test.

		<ul style="list-style-type: none"> resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Terrain response system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the terrain response switchpack for related DTCs and refer to the relevant DTC index
U0140-63	Lost Communication With Body Control Module - Circuit / component protection time-out	<ul style="list-style-type: none"> Central junction box power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Central junction box system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0300-57	Internal Control Module Software Incompatibility - Invalid / incomplete software component	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U0401-02	Invalid Data Received from ECM/PCM A - General signal failure	<ul style="list-style-type: none"> Missing/invalid data from the engine control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0401-29	Invalid Data Received from ECM/PCM A - Signal invalid	<ul style="list-style-type: none"> Missing/invalid data from the engine control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0401-41	Invalid Data Received from ECM/PCM A - General checksum failure	<ul style="list-style-type: none"> Missing/invalid data from the engine control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0401-64	Invalid Data Received from ECM/PCM A - Signal plausibility failure	<ul style="list-style-type: none"> Missing/invalid data from the engine control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0401-82	Invalid Data Received from ECM/PCM A - Alive / sequence counter incorrect / not updated	<ul style="list-style-type: none"> Missing/invalid data from the engine control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0401-83	Invalid Data Received from ECM/PCM A - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> Missing/invalid data from the engine control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0404-41	Invalid Data Received from Gear Shift Control Module A - General checksum failure	<ul style="list-style-type: none"> Missing/invalid data from the transmission control switch 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control switch for related DTCs and refer to the relevant DTC index
U0404-64	Invalid Data Received from Gear Shift Control Module A - Signal plausibility failure	<ul style="list-style-type: none"> Missing/invalid data from the transmission control switch 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control switch for related DTCs and refer to the relevant DTC index
U0404-82	Invalid Data Received from Gear Shift Control Module A - Alive / sequence counter incorrect / not updated	<ul style="list-style-type: none"> Missing/invalid data from the transmission control switch 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control switch for related DTCs and refer to the relevant DTC index

U0404-83	Invalid Data Received from Gear Shift Control Module A - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> Missing/invalid data from the transmission control switch 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control switch for related DTCs and refer to the relevant DTC index
U0415-29	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - Signal invalid	<ul style="list-style-type: none"> Missing/invalid data from the anti-lock brake system control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0415-41	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - General checksum failure	<ul style="list-style-type: none"> Missing/invalid data from the anti-lock brake system control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0415-82	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - Alive / sequence counter incorrect / not updated	<ul style="list-style-type: none"> Missing/invalid data from the anti-lock brake system control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0416-98	Invalid Data Received From Vehicle Dynamics Control Module - Component or system over temperature	<ul style="list-style-type: none"> Missing/invalid data from the anti-lock brake system control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0422-41	Invalid Data Received From Body Control Module - General checksum failure	<ul style="list-style-type: none"> Missing/invalid data from the central junction box 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0422-82	Invalid Data Received From Body Control Module - Alive / sequence counter incorrect / not updated	<ul style="list-style-type: none"> Missing/invalid data from the central junction box 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0422-83	Invalid Data Received From Body Control Module - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> Missing/invalid data from the central junction box 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U101B-87	Lost Communication With GSM - Multiple Bus - Missing message	<ul style="list-style-type: none"> Transmission control switch power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Transmission control switch system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transmission control switch power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the transmission control switch for related DTCs and refer to the relevant DTC index
U2101-56	Control Module Configuration Incompatible - Invalid / incomplete configuration	<ul style="list-style-type: none"> Transmission control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the transmission control module with the latest level software. Check and up-date the car configuration file as necessary. Clear the DTC and re-test

U3000-56	Control Module - Invalid / incomplete configuration	<ul style="list-style-type: none"> • Transmission control module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control module
U3001-94	Control Module Improper Shutdown - Unexpected operation	<ul style="list-style-type: none"> • Transmission control module power or ground circuit open circuit, high resistance • Battery/charging system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance • Refer to the relevant section of the workshop manual and test the battery and charging system

General Information - Diagnostic Trouble Code (DTC) Index DTC: Transmission Control Switch (TCS)

Description and Operation

Transmission Control Switch (TCS)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.





Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.




The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Transmission Control Switch (TCS). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: External Controls (307-05 Automatic Transmission/Transaxle External Controls - TDV6 3.0L Diesel/V8 5.0L Petrol, Vehicles With: 6HP28 6-Speed Automatic Transmission, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1087-08	LIN Bus "A" - Bus signal/message failures	NOTE: Circuit reference LIN <ul style="list-style-type: none"> Transmission control module power or ground circuit open circuit, high resistance LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Transmission system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
B1087-81	LIN Bus "A" - Invalid serial data received	<ul style="list-style-type: none"> Transmission system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control module

			for related DTCs and refer to the relevant DTC index
B1087-82	LIN Bus "A" - Alive/sequence counter incorrect / not updated	<ul style="list-style-type: none"> Transmission system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
B1087-83	LIN Bus "A" - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> Transmission system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
B1087-87	LIN Bus "A" - Missing message	 <p>NOTE: Circuit reference LIN</p> <ul style="list-style-type: none"> Transmission control module power or ground circuit open circuit, high resistance LIN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Transmission system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the transmission control module power and ground circuits for open circuit, high resistance Refer to the electrical circuit diagrams and check the LIN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
B1142-62	Ignition Status 1 - Signal compare failure	 <p>NOTE: Circuit reference IGN</p> <ul style="list-style-type: none"> Ignition sense circuit short circuit to ground, short circuit to power, open circuit, high resistance - Power mode differs to that broadcast on high speed CAN 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the ignition sense circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B123C-01	Dynamic Stability Control Status Indicator - General electrical failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
B123D-64	Dynamic Stability Control Button - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
B123F-01	Adaptive Speed Limiter Mode Indicator - General electrical failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
B1241-64	Adaptive Speed Limiter Button - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
B1242-64	Winter Button - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
B1243-01	Winter Button Mode Indicator - General electrical failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
B1244-64	Dynamic / Sport Button - Signal plausibility failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
B1245-	Dynamic / Sport	<ul style="list-style-type: none"> Transmission control 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic

01	Button Mode Indicator - General electrical failure	switch internal failure	system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
C113A-62	Wakeup Control - Signal compare failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P0603-44	Internal Control Module Keep Alive Memory (KAM) Error - Data memory failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P0604-44	Internal Control Module Random Access Memory (RAM) Error - Data memory failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P0605-45	Internal Control Module Read Only Memory (ROM) Error - Program memory failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P0606-2F	ECM / PCM Processor - Signal erratic	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P0606-47	ECM / PCM Processor - Watchdog/safety microcontroller failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P0705-09	Transmission Range Sensor A Circuit (PRNDL Input) - Component failures	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P0705-46	Transmission Range Sensor A Circuit (PRNDL Input) - Calibration/parameter memory failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P0705-86	Transmission Range Sensor A Circuit (PRNDL Input) - Signal invalid	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P0814-01	Transmission Range Display Circuit - General electrical failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P081C-64	Park Input Circuit - Signal plausibility failure	<ul style="list-style-type: none"> Hardwired park and transmission control switch position display signals are not consistent 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the park signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance. Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
P084F-11	Park / Neutral Switch Output Circuit - Circuit short to ground	<ul style="list-style-type: none"> Park/neutral signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the park/neutral signal circuit for short circuit to ground
P084F-15	Park / Neutral Switch Output Circuit - Circuit short to battery or open	<ul style="list-style-type: none"> Park/neutral signal circuit short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the park/neutral signal circuit for short circuit to battery, open circuit, high resistance
P176A-01	Transmission Range Selector Up and Down Position Circuit - General electrical failure	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P176A-13	Transmission Range Selector Up and Down Position Circuit	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control

	- Circuit open		switch
P176A-19	Transmission Range Selector Up and Down Position Circuit - Circuit current above threshold	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P176A-94	Transmission Range Selector Up and Down Position Circuit - Unexpected operation	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P176B-71	Transmission Range Selector Up and Down Position Control Error - Actuator stuck	<ul style="list-style-type: none"> Transmission control switch internal failure - Raise/lower failure 	 <p>NOTE: This DTC may be set by resisting the raising/lowering of the transmission control switch</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P176C-07	Transmission Range Selector Lock Control Error - Mechanical failures	<ul style="list-style-type: none"> Transmission control switch internal failure - Rotation detected while locked 	 <p>NOTE: This DTC may be set by releasing the brake pedal whilst rotating the transmission control switch</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P176C-11	Transmission Range Selector Lock Control Error - Circuit short to ground	<ul style="list-style-type: none"> Transmission control switch internal failure - Lock solenoid circuit short circuit to ground 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P176C-12	Transmission Range Selector Lock Control Error - Circuit short to battery	<ul style="list-style-type: none"> Transmission control switch internal failure - Lock solenoid circuit short circuit to power 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
P176C-73	Transmission Range Selector Lock Control Error - Actuator stuck closed	<ul style="list-style-type: none"> Transmission control switch internal failure - Lock solenoid circuit failure 	 <p>NOTE: This DTC may be set by attempting to rotate the transmission control switch as it unlocks</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0100-00	Lost Communication With ECM/PCM "A" - No sub type information	<ul style="list-style-type: none"> Engine control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Engine system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the engine control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0100-87	Lost Communication With ECM/PCM "A" - Missing message	<ul style="list-style-type: none"> Missing/invalid data from the engine control module - Engine speed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index
U0101-	Lost Communication	<ul style="list-style-type: none"> Transmission control 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and

00	with TCM - No sub type information	<ul style="list-style-type: none"> module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Transmission system fault 	<ul style="list-style-type: none"> check the transmission control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0101-87	Lost Communication with TCM - Missing message	<ul style="list-style-type: none"> Missing/invalid data from the transmission control module - TCM_PosDisp 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0121-00	Lost Communication With Anti-Lock Brake System (ABS) Control Module - No sub type information	<ul style="list-style-type: none"> Anti-lock brake system control module power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Anti-lock brake system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the anti-lock brake system control module power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0121-87	Lost Communication With Anti-Lock Brake System (ABS) Control Module - Missing message	<ul style="list-style-type: none"> Missing/invalid data from the anti-lock brake system control module - Steering angle 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0140-00	Lost Communication With Body Control Module - No sub type information	<ul style="list-style-type: none"> Central junction box power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Central junction box system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the central junction box power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0155-00	Lost Communication With Instrument Panel Cluster (IPC) Control Module - Missing message	<ul style="list-style-type: none"> Instrument cluster power or ground circuit open circuit, high resistance High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance Instrument cluster system fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the instrument cluster power and ground circuits for open circuit, high resistance Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the instrument cluster for related DTCs and refer to the relevant DTC index
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> Invalid master configuration ID received 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the central junction box with the latest level software. Clear the DTCs and retest. If the fault persists, install a new transmission control switch
U0401-92	Invalid Data Received From ECM/PCM - Performance or incorrect operation	<ul style="list-style-type: none"> Missing/invalid data from the engine control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the engine control module for related DTCs and refer to the relevant DTC index

U0402-64	Invalid Data Received from Transmission control module - Signal plausibility failure	<ul style="list-style-type: none"> Missing/invalid data from the transmission control module - Implausible lock request received 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0402-81	Invalid Data Received from Transmission control module - Invalid serial data received	<ul style="list-style-type: none"> Missing/invalid data from the transmission control module - TCM_PosDisp / TCM_LockReq 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0402-82	Invalid Data Received from Transmission control module - Alive/sequence counter incorrect / not updated	<ul style="list-style-type: none"> Missing/invalid data from the transmission control module - Alive counter 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0402-83	Invalid Data Received from Transmission control module - Value of signal protection calculation incorrect	<ul style="list-style-type: none"> Missing/invalid data from the transmission control module - Checksum 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0402-92	Invalid Data Received from Transmission control module - Performance or incorrect operation	<ul style="list-style-type: none"> Missing/invalid data from the transmission control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U0415-92	Invalid Data Received From Anti-Lock Brake System (ABS) Control Module - Performance or incorrect operation	<ul style="list-style-type: none"> Missing/invalid data from the anti-lock brake system control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U0422-08	Invalid Data Received From Body Control Module - Bus signal/message failures	<ul style="list-style-type: none"> Missing/invalid data from the central junction box 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0422-81	Invalid Data Received From Body Control Module - Invalid serial data received	<ul style="list-style-type: none"> Missing/invalid data from the central junction box - Invalid power mode 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0422-92	Invalid Data Received From Body Control Module - Performance or incorrect operation	<ul style="list-style-type: none"> Missing/invalid data from the central junction box 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the central junction box for related DTCs and refer to the relevant DTC index
U0423-92	Invalid Data Received From Instrument Panel Control Module - Performance or incorrect operation	<ul style="list-style-type: none"> Missing/invalid data from the instrument cluster 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the instrument cluster for related DTCs and refer to the relevant DTC index
U043A-92	Invalid Data Received From Suspension Control Module "B" - Performance or incorrect operation	<ul style="list-style-type: none"> Missing/invalid data from the adaptive damping control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the adaptive damping control module for related DTCs and refer to the relevant DTC index
U101A-86	Lost Communication With Transmission Control Module (Multiple Bus) - Signal invalid	<ul style="list-style-type: none"> CAN and LIN bus failure 	 NOTE: Ignore this DTC if no other CAN or LIN DTCs are set <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the transmission control module for related DTCs and refer to the relevant DTC index
U1A14-04	CAN Initialization Failure - System internal failures	<ul style="list-style-type: none"> Transmission control switch internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
U2012-4A	Car Configuration Parameter(s) - Incorrect component	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary

	installed	<ul style="list-style-type: none"> • Incorrect transmission control switch installed 	<ul style="list-style-type: none"> • Install a new transmission control switch as necessary
U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> • Transmission control switch internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new transmission control switch
U3003-16	Battery Voltage - Circuit voltage below threshold	<ul style="list-style-type: none"> • Transmission control switch power or ground circuit open circuit, high resistance • Battery/charging system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the electrical circuit diagrams and check the transmission control switch power and ground circuits for open circuit, high resistance • Refer to the relevant section of the workshop manual and test the battery and charging system
U3003-17	Battery Voltage - Circuit voltage above threshold	<ul style="list-style-type: none"> • Battery/charging system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the relevant section of the workshop manual and test the battery and charging system
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> • Mismatch between the voltage at the transmission control switch and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02) - and compare it to battery voltage. Refer to the electrical circuit diagrams and check the transmission control switch power and ground circuits for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: TV Control Module (TVCM) - Digital

Description and Operation

Television Control Module (TVCM) - Digital

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.















Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Television Control Module (TVCM) - Digital. For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Information and Entertainment System](#) (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1A56-11	Antenna - Circuit short to ground	NOTE: Circuit reference - TV1 SIG <ul style="list-style-type: none"> Antenna 1 signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 1 signal circuit for short circuit to ground
B1A56-12	Antenna - Circuit short to battery	NOTE: Circuit reference - TV1 SIG <ul style="list-style-type: none"> Antenna 1 signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 1 signal circuit for short circuit to power
B1A56-13	Antenna - Circuit open	NOTE: Circuit reference - TV1 SIG	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 1 signal circuit for open circuit, high resistance

		Antenna 1 signal circuit open circuit, high resistance	
B1D55-11	Antenna #2 - Circuit short to ground	 <p>NOTE: Circuit reference - TV2 SIG</p> <ul style="list-style-type: none"> Antenna 2 signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 2 signal circuit for short circuit to ground
B1D55-12	Antenna #2 - Circuit short to battery	 <p>NOTE: Circuit reference - TV2 SIG</p> <ul style="list-style-type: none"> Antenna 2 signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 2 signal circuit for short circuit to power
B1D55-13	Antenna #2 - Circuit open	 <p>NOTE: Circuit reference - TV2 SIG</p> <ul style="list-style-type: none"> Antenna 2 signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 2 signal circuit for open circuit, high resistance
B1D56-11	Antenna #3 Circuit - Circuit short to ground	 <p>NOTE: Circuit reference - TV3 SIG</p> <ul style="list-style-type: none"> Antenna 3 signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 3 signal circuit for short circuit to ground
B1D56-12	Antenna #3 Circuit - Circuit short to battery	 <p>NOTE: Circuit reference - TV3 SIG</p> <ul style="list-style-type: none"> Antenna 3 signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 3 signal circuit for short circuit to power
B1D56-13	Antenna #3 Circuit - Circuit open	 <p>NOTE: Circuit reference - TV3 SIG</p> <ul style="list-style-type: none"> Antenna 3 signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 3 signal circuit for open circuit, high resistance
B1D57-11	Antenna #4 Circuit - Circuit short to ground	 <p>NOTE: Circuit reference - TV4 SIG</p> <ul style="list-style-type: none"> Antenna 4 signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 4 signal circuit for short circuit to ground
B1D57-12	Antenna #4 Circuit - Circuit short to battery	 <p>NOTE: Circuit reference - TV4 SIG</p> <ul style="list-style-type: none"> Antenna 4 signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 4 signal circuit for short circuit to power
B1D57-13	Antenna #4 Circuit - Circuit open	 <p>NOTE: Circuit reference - TV4 SIG</p> <ul style="list-style-type: none"> Antenna 4 signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 4 signal circuit for open circuit, high resistance

B1D58-11	Television Output - Circuit short to ground	 <p>NOTE: Circuit reference - CVBS OUT</p> <ul style="list-style-type: none"> CVBS signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the CVBS signal circuit for short circuit to ground
B1D58-12	Television Output - Circuit short to battery	 <p>NOTE: Circuit reference - CVBS OUT</p> <ul style="list-style-type: none"> CVBS signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the CVBS circuit for short circuit to power
B1D58-13	Television Output - Circuit open	 <p>NOTE: Circuit reference - CVBS OUT</p> <ul style="list-style-type: none"> CVBS signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the CVBS circuit for open circuit, high resistance
U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification Incorrect TV control module installed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary Install a new TV control module as necessary
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification Incorrect TV control module installed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary Install a new TV control module as necessary
U3000-46	Control Module - Calibration / parameter memory failure	<ul style="list-style-type: none"> TV control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the TV control module with the latest level software
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> TV control module failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check and install the latest relevant level of software to the TV control module Clear the DTCs and retest. If fault persists, check and install new TV control module as required
U3000-98	Control Module - Component or system over temperature	<ul style="list-style-type: none"> TV control module over temperature 	<ul style="list-style-type: none"> Check airflow to the TV control module. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new TV control module
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> Mismatch between the voltage at the TV control module and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111) - and compare it to battery voltage. Refer to the electrical circuit diagrams and check the TV control module power and ground circuits for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: Telephone Interface Module (TIM)

Description and Operation

Telephone Interface Module (TIM)

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adaptor kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the Telephone Interface Module (TIM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Information and Entertainment System](#) (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B100E-25	Video Input "A" - Signal shape/waveform failure	<ul style="list-style-type: none"> Navigation video signal circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the navigation video signal circuit for short circuit to ground, short circuit to power, open circuit, high resistance
B1183-96	Video Encoder - Component internal failure	<ul style="list-style-type: none"> Telephone interface module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new telephone interface module
U0001-81	High Speed CAN Communication Bus - Invalid serial data received	<ul style="list-style-type: none"> Invalid data received from the touch screen Invalid data received from the navigation control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the touch screen for related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, check the navigation control module for related DTCs and refer to the relevant DTC index
U0001-	High Speed CAN	<ul style="list-style-type: none"> Invalid data 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic

82	Communication Bus - Alive/sequence counter incorrect / not updated	<ul style="list-style-type: none"> received from the touch screen Invalid data received from the navigation control module 	<ul style="list-style-type: none"> system, check the touch screen for related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, check the navigation control module for related DTCs and refer to the relevant DTC index
U0001-87	High Speed CAN Communication Bus - Missing message	<ul style="list-style-type: none"> Missing message from the touch screen Missing message from the navigation control module 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data for details of the missing message. Check the touch screen for related DTCs and refer to the relevant DTC index Using the manufacturer approved diagnostic system, check the snapshot data for details of the missing message. Check the navigation control module for related DTCs and refer to the relevant DTC index
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> Private high speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the private high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0010-88	Medium Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0011-82	Medium Speed CAN Communication Bus Performance - Alive/sequence counter incorrect / not updated	<ul style="list-style-type: none"> Invalid data received from another control module via the medium speed CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine the invalid data source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index
U0011-87	Medium Speed CAN Communication Bus Performance - Missing message	<ul style="list-style-type: none"> Missing message from another control module via the medium speed CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine the missing message source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index
U0300-00	Internal Control Module Software Incompatibility - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U0400-92	Invalid Data Received - Performance or incorrect operation	<ul style="list-style-type: none"> Invalid road speed signal received 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the anti-lock brake system control module for related DTCs and refer to the relevant DTC index
U1A01-82	Communication Link - Alive/sequence counter incorrect / not updated	<ul style="list-style-type: none"> Telephone interface module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new telephone interface module
U1A01-88	Communication Link - Bus off	<ul style="list-style-type: none"> Telephone interface module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new telephone interface module
U1A4B-47	Control Module Processor B - Watchdog/safety MicroController failure	<ul style="list-style-type: none"> Telephone interface module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new telephone interface module
U2015-57	Control Module Boot Software - Invalid/incomplete software component	<ul style="list-style-type: none"> Telephone interface module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the telephone interface module with the latest level software
U2017-57	Control Module Software #2 - Invalid/incomplete software component	<ul style="list-style-type: none"> Telephone interface module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the telephone interface module with the latest level software

U201A-54	Control Module Main Calibration Data - Missing calibration	Telephone interface module is not configured correctly	Using the manufacturer approved diagnostic system, re-configure the telephone interface module with the latest level software
U2020-14	Phone Holder Baseplate Detection - Circuit short to ground or open	<ul style="list-style-type: none"> • Audio video input/output panel circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the audio video input/output panel circuits for short circuit to ground, short circuit to power, open circuit, high resistance
U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> • Telephone interface module is not configured correctly 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, re-configure the telephone interface module with the latest level software
U2100-56	Initial Configuration Not Complete - Invalid/incomplete configuration	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> • Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary

General Information - Diagnostic Trouble Code (DTC) Index DTC: TV Control Module (TVCM) - Hybrid

Description and Operation

TV Control Module (TVCM) - Hybrid

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.













Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the TV Control Module (TVCM) - Hybrid. For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Information and Entertainment System](#) (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B1A56-11	Antenna - Circuit short to ground	<p>NOTE: Circuit reference ANTENNA_1_SIG</p> <ul style="list-style-type: none"> Antenna 1 signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 1 signal circuit for short circuit to ground
B1A56-12	Antenna - Circuit short to battery	<p>NOTE: Circuit reference ANTENNA_1_SIG</p> <ul style="list-style-type: none"> Antenna 1 signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 1 signal circuit for short circuit to power
B1A56-13	Antenna - Circuit open	<p>NOTE: Circuit reference ANTENNA_1_SIG</p> <ul style="list-style-type: none"> Antenna 1 signal circuit open circuit, high 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 1 signal circuit for open circuit, high resistance

		resistance	
B1D55-11	Antenna #2 - Circuit short to ground	 <p>NOTE: Circuit reference ANTENNA_2_SIG</p> <ul style="list-style-type: none"> Antenna 2 signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 2 signal circuit for short circuit to ground
B1D55-12	Antenna #2 - Circuit short to battery	 <p>NOTE: Circuit reference ANTENNA_2_SIG</p> <ul style="list-style-type: none"> Antenna 2 signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 2 signal circuit for short circuit to power
B1D55-13	Antenna #2 - Circuit open	 <p>NOTE: Circuit reference ANTENNA_2_SIG</p> <ul style="list-style-type: none"> Antenna 2 signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 2 signal circuit for open circuit, high resistance
B1D56-11	Antenna #3 Circuit - Circuit short to ground	 <p>NOTE: Circuit reference ANTENNA_3_SIG</p> <ul style="list-style-type: none"> Antenna 3 signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 3 signal circuit for short circuit to ground
B1D56-12	Antenna #3 Circuit - Circuit short to battery	 <p>NOTE: Circuit reference ANTENNA_3_SIG</p> <ul style="list-style-type: none"> Antenna 3 signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 3 signal circuit for short circuit to power
B1D56-13	Antenna #3 Circuit - Circuit open	 <p>NOTE: Circuit reference ANTENNA_3_SIG</p> <ul style="list-style-type: none"> Antenna 3 signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 3 signal circuit for open circuit, high resistance
B1D57-11	Antenna #4 Circuit - Circuit short to ground	 <p>NOTE: Circuit reference ANTENNA_4_SIG</p> <ul style="list-style-type: none"> Antenna 4 signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 4 signal circuit for short circuit to ground
B1D57-12	Antenna #4 Circuit - Circuit short to battery	 <p>NOTE: Circuit reference ANTENNA_4_SIG</p> <ul style="list-style-type: none"> Antenna 4 signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 4 signal circuit for short circuit to power
B1D57-13	Antenna #4 Circuit - Circuit open	 <p>NOTE: Circuit reference ANTENNA_4_SIG</p> <ul style="list-style-type: none"> Antenna 4 signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 4 signal circuit for open circuit, high resistance
B1D58-11	Television Output - Circuit short to ground	 <p>NOTE: Circuit reference CVBS OUT / CVBS GND</p> <ul style="list-style-type: none"> CVBS signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the CVBS signal circuit for short circuit to ground
B1D58-12	Television Output - Circuit short to battery	<ul style="list-style-type: none"> CVBS signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the CVBS circuit for short circuit to power

B1D58-13	Television Output - Circuit open	<ul style="list-style-type: none"> CVBS signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the CVBS circuit for open circuit, high resistance
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> TV control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new TV control module
U3000-4B	Control Module - Over temperature	<ul style="list-style-type: none"> TV control module over temperature 	<ul style="list-style-type: none"> Check airflow to the TV control module. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new TV control module
U3000-51	Control Module - Not programmed	<ul style="list-style-type: none"> TV control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the TV control module with the latest level software
U3000-54	Control Module - Missing calibration	<ul style="list-style-type: none"> TV control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the TV control module with the latest level software
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> Mismatch between the voltage at the TV control module and the voltage value broadcast on the CAN bus 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the TV control module power and ground circuits for open circuit, high resistance

General Information - Diagnostic Trouble Code (DTC) Index DTC: TV Control Module (TVCM) - Conditional Access System

Description and Operation

TV Control Module (TVCM) - Conditional Access System

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



When probing connectors to take measurements in the course of the pinpoint tests, use the adapter kit, part number 3548-1358-00.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.
















Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the TV Control Module (TVCM) - Conditional Access System. For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

For additional information, refer to: [Information and Entertainment System](#) (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).

DTC	Description	Possible Causes	Action
B147C-00	Conditional Access System (Video Encryption) - No subtype information	<ul style="list-style-type: none"> Conditional access system card not authorised or expired Conditional access system card fault 	NOTE: This DTC is applicable to Japan market vehicles only <ul style="list-style-type: none"> Subscription required Install a new conditional access system card
B1A56-11	Antenna - Circuit short to ground	NOTE: Circuit reference TV1 SIG <ul style="list-style-type: none"> Antenna 1 signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 1 signal circuit for short circuit to ground
B1A56-12	Antenna - Circuit short to battery	NOTE: Circuit <ul style="list-style-type: none"> Antenna 1 signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 1 signal circuit for short circuit to power

		<p>reference TV1 SIG</p> <ul style="list-style-type: none"> Antenna 1 signal circuit short circuit to power 	
B1A56-13	Antenna - Circuit open	 <p>NOTE: Circuit reference TV1 SIG</p> <ul style="list-style-type: none"> Antenna 1 signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 1 signal circuit for open circuit, high resistance
B1D55-11	Antenna #2 - Circuit short to ground	 <p>NOTE: Circuit reference TV2 SIG</p> <ul style="list-style-type: none"> Antenna 2 signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 2 signal circuit for short circuit to ground
B1D55-12	Antenna #2 - Circuit short to battery	 <p>NOTE: Circuit reference TV2 SIG</p> <ul style="list-style-type: none"> Antenna 2 signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 2 signal circuit for short circuit to power
B1D55-13	Antenna #2 - Circuit open	 <p>NOTE: Circuit reference TV2 SIG</p> <ul style="list-style-type: none"> Antenna 2 signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 2 signal circuit for open circuit, high resistance
B1D56-11	Antenna #3 Circuit - Circuit short to ground	 <p>NOTE: Circuit reference TV3 SIG</p> <ul style="list-style-type: none"> Antenna 3 signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 3 signal circuit for short circuit to ground
B1D56-12	Antenna #3 Circuit - Circuit short to battery	 <p>NOTE: Circuit reference TV3 SIG</p> <ul style="list-style-type: none"> Antenna 3 signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 3 signal circuit for short circuit to power
B1D56-13	Antenna #3 Circuit - Circuit open	 <p>NOTE: Circuit reference TV3 SIG</p> <ul style="list-style-type: none"> Antenna 3 signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 3 signal circuit for open circuit, high resistance
B1D57-11	Antenna #4 Circuit - Circuit short to ground	 <p>NOTE: Circuit reference TV4 SIG</p> <ul style="list-style-type: none"> Antenna 4 signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 4 signal circuit for short circuit to ground

B1D57-12	Antenna #4 Circuit - Circuit short to battery	 <p>NOTE: Circuit reference TV4 SIG</p> <ul style="list-style-type: none"> Antenna 4 signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 4 signal circuit for short circuit to power
B1D57-13	Antenna #4 Circuit - Circuit open	 <p>NOTE: Circuit reference TV4 SIG</p> <ul style="list-style-type: none"> Antenna 4 signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the antenna 4 signal circuit for open circuit, high resistance
B1D58-11	Television Output - Circuit short to ground	 <p>NOTE: Circuit reference CVBS OUT</p> <ul style="list-style-type: none"> CVBS signal circuit short circuit to ground 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the CVBS signal circuit for short circuit to ground
B1D58-12	Television Output - Circuit short to battery	 <p>NOTE: Circuit reference CVBS OUT</p> <ul style="list-style-type: none"> CVBS signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the CVBS circuit for short circuit to power
B1D58-13	Television Output - Circuit open	 <p>NOTE: Circuit reference CVBS OUT</p> <ul style="list-style-type: none"> CVBS signal circuit open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the CVBS circuit for open circuit, high resistance
U2100-00	Initial Configuration Not Complete - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification Incorrect TV control module installed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary Install a new TV control module as necessary
U2101-00	Control Module Configuration Incompatible - No sub type information	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification Incorrect TV control module installed 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary Install a new TV control module as necessary
U3000-46	Control Module - Calibration/parameter memory failure	<ul style="list-style-type: none"> TV control module is not configured correctly 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, re-configure the TV control module with the latest level software
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> TV control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new TV control module
U3000-98	Control Module - Component or system over temperature	<ul style="list-style-type: none"> TV control module over temperature 	<ul style="list-style-type: none"> Check airflow to the TV control module. Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new TV control module
U3003-62	Battery Voltage - Signal compare failure	<ul style="list-style-type: none"> Mismatch between the voltage at the 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - ECU Power Supply Voltage (0xD111) - and compare it to battery voltage. Refer

		TV control module and the voltage value broadcast on the CAN bus	to the electrical circuit diagrams and check the TV control module power and ground circuits for open circuit, high resistance
--	--	--	--

General Information - Diagnostic Trouble Code (DTC) Index DTC: Wade Aid Control Module (WACM)

Description and Operation

General Proximity Sensor Module (GPSM)



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer-approved diagnostic system).



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion.








If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.



Check DDW for open campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint and carry out the recommendations as required.

The table below lists all Diagnostic Trouble Codes (DTCs) that could be logged in the General Proximity Sensor Module (GPSM). For additional diagnosis and testing information, refer to the relevant Diagnosis and Testing section in the workshop manual.

DTC	Description	Possible Causes	Action
B143A-12	Proximity Sensor #1 - Circuit short to battery	<p>NOTE: Circuit reference SIG LEFT</p> <ul style="list-style-type: none"> Left proximity sensor signal circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left proximity sensor signal circuit for short circuit to power
B143A-14	Proximity Sensor #1 - Circuit short to ground or open	<p>NOTE: Circuit reference SIG LEFT</p> <ul style="list-style-type: none"> Left proximity sensor signal circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left proximity sensor signal circuit for short circuit to ground, open circuit, high resistance
B143A-96	Proximity Sensor #1 - Component internal failure	<ul style="list-style-type: none"> Left proximity sensor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new left proximity sensor
B143B-12	Proximity Sensor #2 - Circuit short to battery	<p>NOTE: Circuit reference SIG RIGHT</p>	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right proximity sensor signal circuit for short circuit to power

		<ul style="list-style-type: none"> Right proximity sensor signal circuit short circuit to power 	
B143B-14	Proximity Sensor #2 - Circuit short to ground or open	 <p>NOTE: Circuit reference SIG RIGHT</p> <ul style="list-style-type: none"> Right proximity sensor signal circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right proximity sensor signal circuit for short circuit to ground, open circuit, high resistance
B143B-96	Proximity Sensor #2 - Component internal failure	<ul style="list-style-type: none"> Right proximity sensor internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new right proximity sensor
B145D-12	Proximity Sensor Supply - Circuit #1 - Circuit short to battery	 <p>NOTE: Circuit reference GND LEFT</p> <ul style="list-style-type: none"> Left proximity sensor ground circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left proximity sensor ground circuit for short circuit to power
B145D-14	Proximity Sensor Supply - Circuit #1 - Circuit short to ground or open	 <p>NOTE: Circuit reference IGN LEFT</p> <ul style="list-style-type: none"> Left proximity sensor power supply circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the left proximity sensor power supply circuit for short circuit to ground, open circuit, high resistance
B145E-12	Proximity Sensor Supply - Circuit #2 - Circuit short to battery	 <p>NOTE: Circuit reference GND RIGHT</p> <ul style="list-style-type: none"> Right proximity sensor ground circuit short circuit to power 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right proximity sensor ground circuit for short circuit to power
B145E-14	Proximity Sensor Supply - Circuit #2 - Circuit short to ground or open	 <p>NOTE: Circuit reference IGN RIGHT</p> <ul style="list-style-type: none"> Right proximity sensor power supply circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the right proximity sensor power supply circuit for short circuit to ground, open circuit, high resistance
U0001-81	High Speed CAN Communication Bus - Invalid serial data received	<ul style="list-style-type: none"> Invalid data received from another control module via the medium speed CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine the invalid data source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index
U0001-82	High Speed CAN Communication Bus - Alive/sequence counter incorrect / not updated	<ul style="list-style-type: none"> Invalid data received from another control module via the high speed CAN bus 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine the invalid data source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index
U0001-87	High Speed CAN Communication	<ul style="list-style-type: none"> Missing message from another 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the snapshot data to determine the missing

	Bus - Missing message	control module via the high speed CAN bus	message source control module. Check the relevant control module for related DTCs and refer to the relevant DTC index
U0001-88	High Speed CAN Communication Bus - Bus off	<ul style="list-style-type: none"> High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
U0300-57	Internal Control Module Software Incompatibility - Invalid/incomplete software component	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. Check DTCs in all control modules. U0300-57 set in multiple control modules on the high speed CAN bus: Re-configure the central junction box with the latest level software. U0300-57 set in general proximity sensor module only: Re-configure the general proximity sensor module with the latest level software. If the fault persists, install a new general proximity sensor module
U2100-56	Initial Configuration Not Complete - Invalid/incomplete configuration	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
U2101-56	Control Module Configuration Incompatible - Invalid/incomplete configuration	<ul style="list-style-type: none"> Car configuration file mismatch with vehicle specification 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Number of Invalid Car Configuration Parameter Values Received (0xE103) - to determine invalid parameters. Check and up-date the car configuration file as necessary
U3000-47	Control Module - Watchdog/safety MicroController failure	<ul style="list-style-type: none"> General proximity sensor module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new general proximity sensor module
U3000-49	Control Module - Internal electronic failure	<ul style="list-style-type: none"> General proximity sensor module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, clear the DTCs and retest. If the fault persists, install a new general proximity sensor module
U3000-55	Control Module - Not configured	<ul style="list-style-type: none"> General proximity sensor module power or ground circuit open circuit, high resistance Battery/charging system fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check datalogger signal - Main ECU Supply Voltage (0xDD02). Refer to the electrical circuit diagrams and check the general proximity sensor module power and ground circuits for open circuit, high resistance Refer to the relevant section of the workshop manual and test the battery and charging system

Identification Codes - Identification Codes

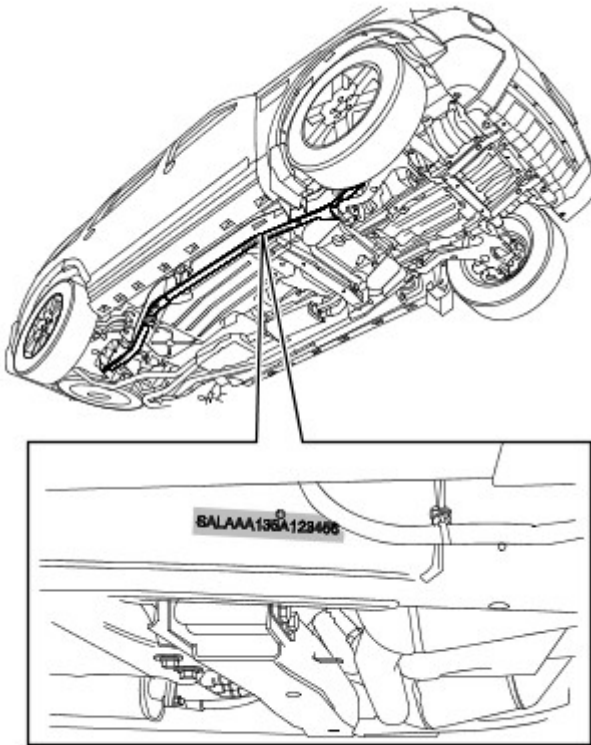
Description and Operation

VIN Number

The VIN number will be found in three locations:

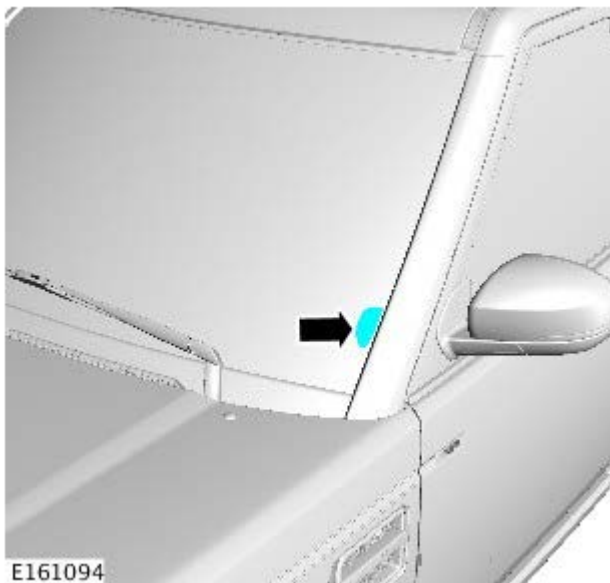
- **1.** Stamped on the side of the RH longitudinal member, rearward of the body front mounting.
- **2.** At the bottom of the windshield glass on the LH side of the vehicle and visible from the outside.
- **3. UK, Europe and ROW - Not NAS/Canada** - On the VIN plate attached to the bonnet locking platform.
- **4. NAS/Canada** - On the Tire Data/Specification label attached to the front of the LH B-pillar.

Longitudinal Member VIN

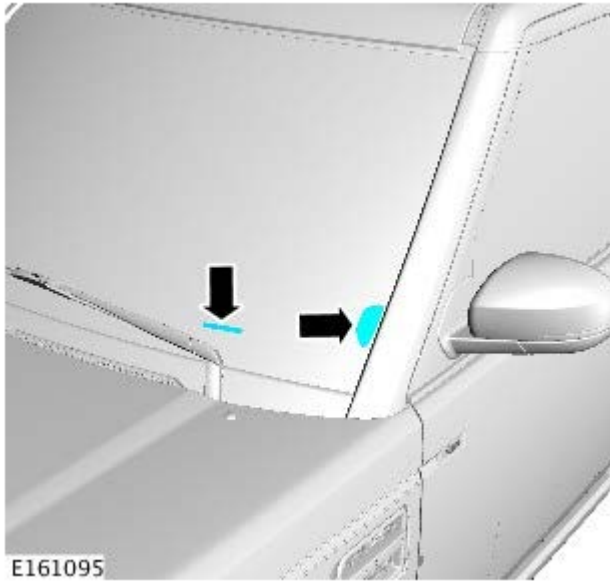


E54942

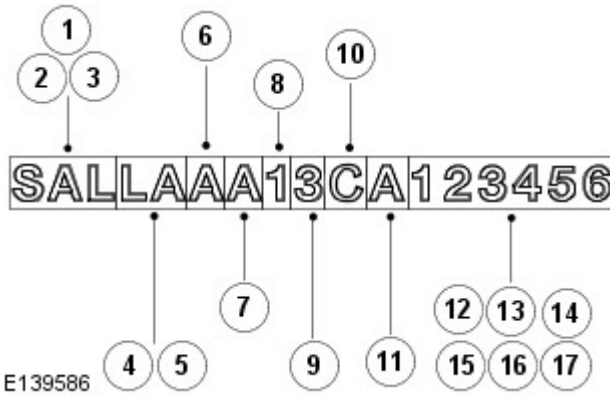
Windscreen VIN - ROW



Windscreen VIN - China

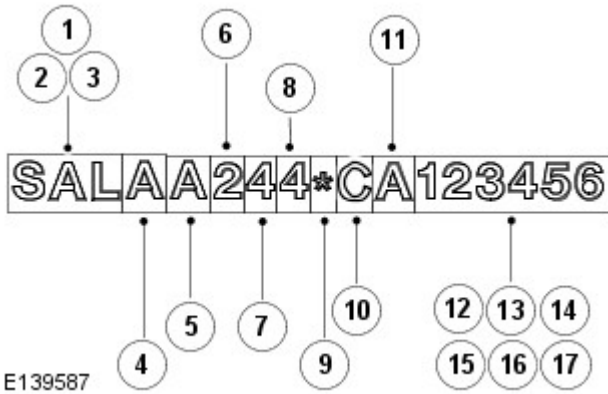


VIN number - UK, EU and ROW



VIN Position	Character	Identifies
1 - 3 - World identifier	SAL	Jaguar Land Rover Limited
4,5 - Vehicle type	LA	Land Rover - Discovery
6 - Class	A	Standard
6 - Class	J	Japan
7 - Body style	A	4 Door
7 - Body style	D	Commercial 2 seat
7 - Body style	E	Commercial 5 seat
7 - Body style	K	Armoured
8 - Engine	1	276DT - V6 2.7 Diesel
8 - Engine	D	508PN - V8 5.0 NA Petrol
8 - Engine	F	306DT - V6 3.0 High power diesel without cDPF
8 - Engine	G	306DT - V6 3.0 High power diesel with cDPF
8 - Engine	M	306DT - V6 3.0 Low power diesel with cDPF
8 - Engine	N	306DT - V6 3.0 Low power diesel without cDPF
8 - Engine	V	306PS - V6 3.0 SC Petrol
9- Steering and transmission	3	RHD - 6 Speed automatic
9- Steering and transmission	4	LHD - 6 Speed automatic
9- Steering and transmission	5	RHD - 8 Speed automatic
9- Steering and transmission	6	LHD - 8 Speed automatic
10- Model year	C	2012
10- Model year	D	2013
10- Model year	E	2014
11 - Plant	A	Solihull
11 - Plant	G	CKD Russia
12 - 17 - Serial number	1 2 3 4 5 6	Unique six digit serial number

VIN number - NAS, Canada, Mexico, China & Korea (gasoline).



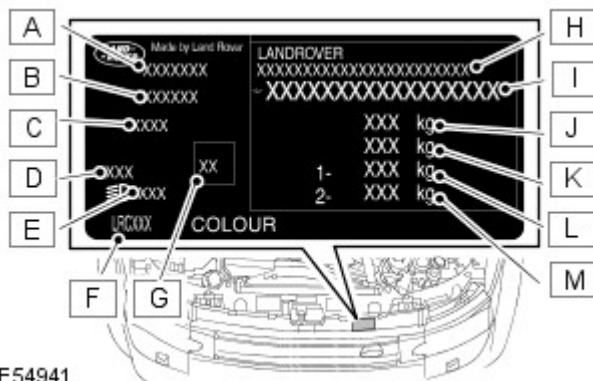
E139587



NOTE: # Manual belts with driver and passenger frontal air bags and side inflatable restraint (1st,2nd (& 3rd) row when fitted).

VIN Position	Character	Identifies
1 - 3 - World identifier	SAL	Jaguar Land Rover Limited
4 - Make / Model	A	Land Rover - LR4
5 - Class / Nas restraint type	B	TL "S" / LR4 Base 5 Seats #
5 - Class / Nas restraint type	C	TL "S" / LR4 Base 7 Seats #
5 - Class / Nas restraint type	D	TL "SE" 5 Seats #
5 - Class / Nas restraint type	E	TL "SE" 7 Seats #
5 - Class / Nas restraint type	F	TL "HSE" 5 Seats #
5 - Class / Nas restraint type	G	TL "HSE" 7 Seats #
5 - Class / Nas restraint type	K	TL "HSE" Lux 7 Seats #
5 - Class / Nas restraint type	N	China
6 - Body style	2	4 Door Station Wagon
7 - Engine	1	276DT - V6 2.7 Diesel
7 - Engine	D	508PN - V8 5.0 NA
7 - Engine	F	306DT - V6 3.0 High power diesel without cDPF
7 - Engine	N	306DT - V6 3.0 Low power diesel without cDPF
7 - Engine	V	306PS - V6 3.0 SC Petrol
8- Steering and transmission	4	LHD - 6 Speed automatic
8- Steering and transmission	6	LHD - 8 Speed automatic
9 - Check digit	*	Derived by calculation
10- Model year	C	2012
10- Model year	D	2013
10- Model year	E	2014
11 - Plant	A	Solihull
12 -17 - Serial number	1 2 3 4 5 6	Unique six digit serial number

Bonnet locking platform VIN plate - Not NAS/Canada



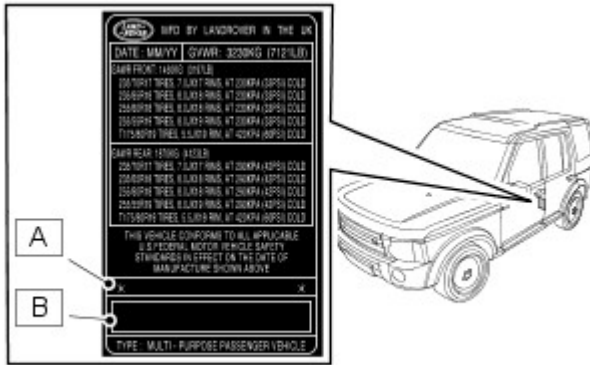
E54941

The VIN plate contains the following information:

- A - Reserved
- B - Engine Description
- C - Country
- D - Diesel Indicator
- E - Reserved
- F - Headlamp Code/initial aim value - If shown
- G - Colour code/group
- H - Type/Approval Number - If shown

- **I** - VIN Number
- **J** - Gross Vehicle Weight
- **K** - Gross Train Weight
- **L** - Front Axle Weight
- **M** - Rear Axle Weight

VIN/Certification/Tire Data Label - NAS only

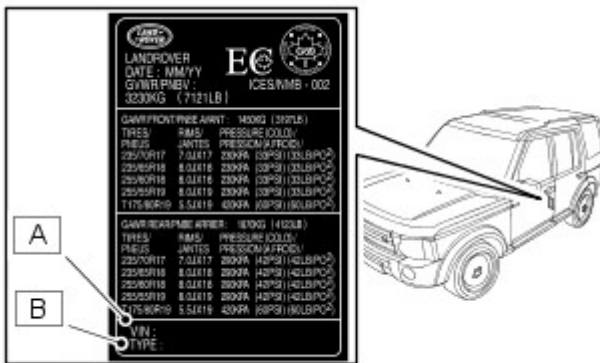


E54951

The Certification Label contains the following VIN information:

- **A** - * Vehicle VIN Number
- **B** - Bar code identification

VIN/Tire Pressure Specification Label - Canada only



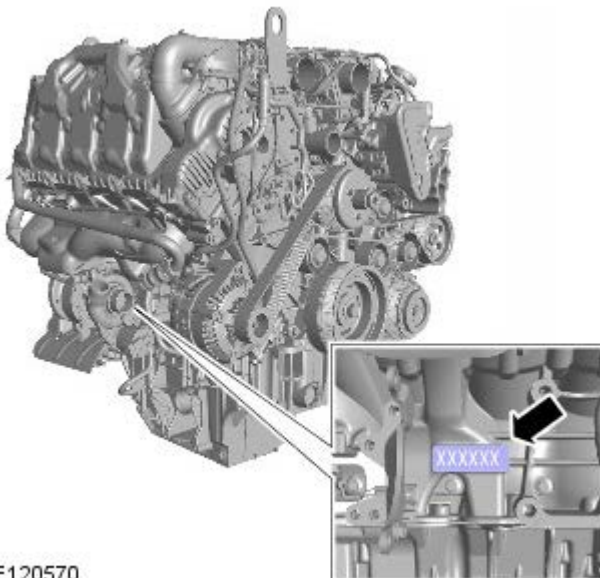
E54950

The Tire Pressure Certification Label contains the following VIN information:

- **A** - Vehicle VIN Number
- **B** - Vehicle Type

Unit/Assembly Serial Number Locations

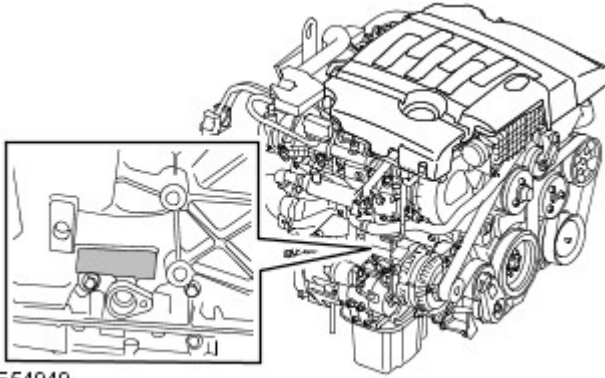
3.0 litre V6 Diesel Engine Serial Number



E120570

3.0 Litre V6 Diesel Engine Serial Number is stamped on the RH side of the cylinder block.

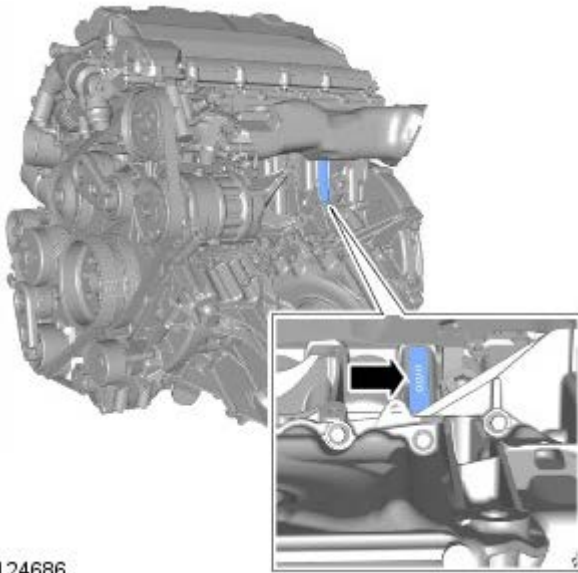
2.7 Litre V6 Diesel Engine Serial Number



E54949

The 2.7 Litre V6 Diesel Engine Serial Number is stamped on the RH side of the cylinder block.

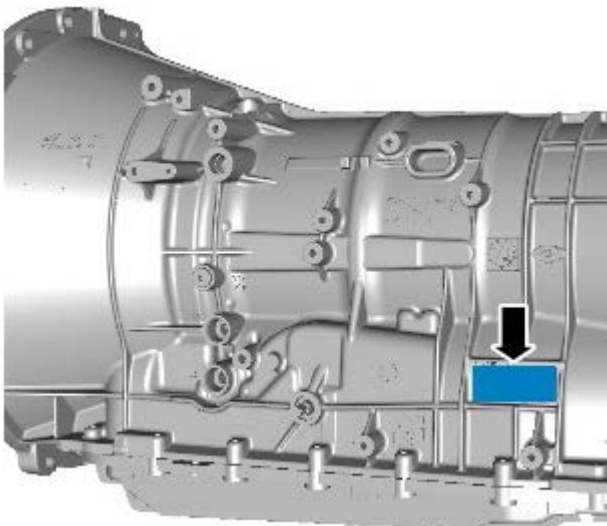
5.0 Litre NA V8 and 3.0 Litre SC Petrol Engine Serial Number



E124686

The 5.0 Litre NA V8 and 3.0 Litre SC Petrol Engine Serial Number is stamped on the LH side of the cylinder block.

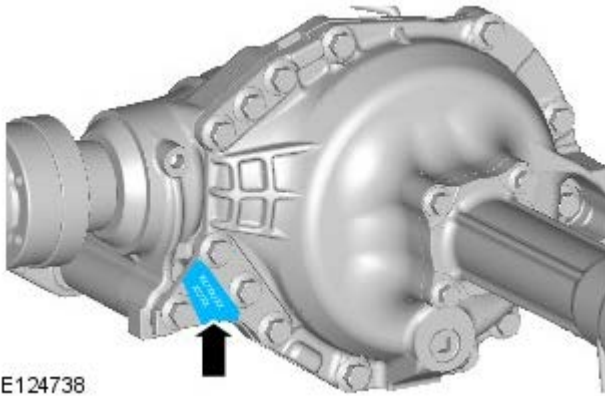
Automatic Gearbox Serial Number



E120916

The Automatic Gearbox Serial Number is stamped on the rear LH side of the gearbox casing.

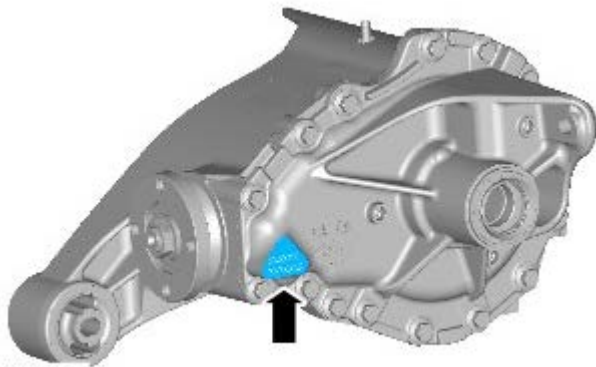
Front Differential Serial Number



E124738

The Front Differential Serial Number is stamped on the underside of the differential casing and is located above the removable cross member.

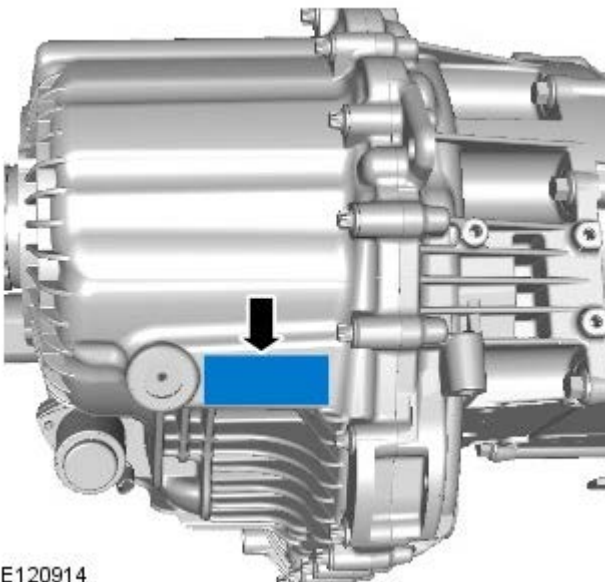
Rear Differential Serial Number



E124739

The Rear Differential Serial Number is stamped on the underside of the differential casing adjacent to the front mounting.

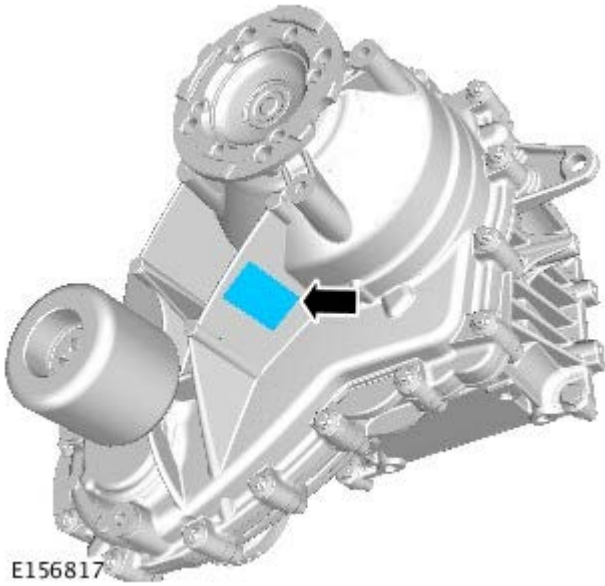
Twin Speed Transfer Case Serial Number



E120914

The twin speed transfer case serial number is stamped on the right side of the transfer case and may also be on a bar coded self-adhesive label attached to the case.

Single Speed Transfer Case Serial Number

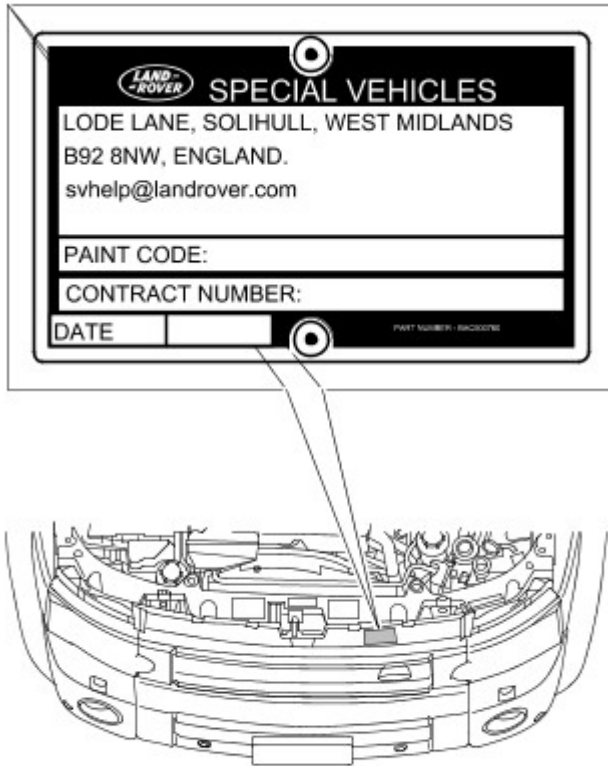


The Single Speed Transfer Case serial number is stamped on the lower right side of the transfer case and may also be on a bar coded self-adhesive label attached to the case.

Identification Codes - Identification Codes

Description and Operation

Commission plate



E102702

The commission plate is mounted on the locking platform of the engine compartment lid.

The plate contains the:

- contact details for Land Rover Special Vehicles
- paint code
- contract number
- commission date of the vehicle.

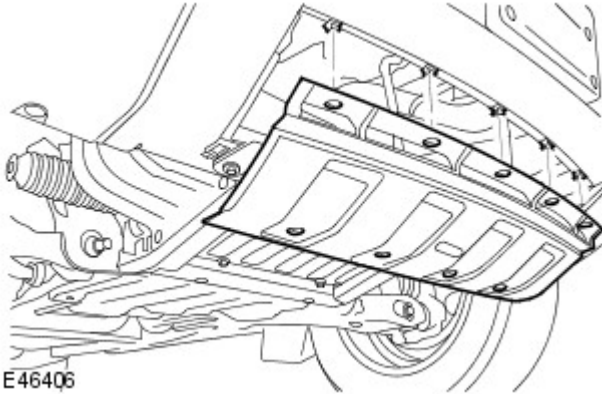
Jacking and Lifting - Vehicle Recovery

Description and Operation

Towing/Lashing eyes



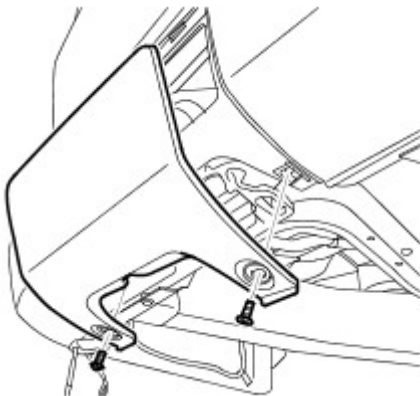
CAUTION: The single towing/lashing eyes at the front and rear of the vehicle are designed for vehicle recovery purposes only and **MUST** not be used to tow a trailer or caravan.



The front towing/lashing eye is accessible after releasing the 9 toggle fasteners securing the towing eye access panel and removing the panel.



CAUTION: Ensure that during towing, the towing attachment does not contact the bumper.



The rear towing/lashing eye 'A' is accessible after releasing the 2 fasteners securing the access panel to the bumper and removing the panel.



CAUTION: This towing/lashing eye should only be used for towing another vehicle or for recovery purposes to enable this vehicle to be positioned in order that the front towing eye may be used for recovery/towing.

4 Wheel Towing

CAUTIONS:



Suspended towing of this vehicle **MUST NOT** be attempted, if 4 wheel towing is not possible, vehicle must be recovered on a suitable trailer.



The vehicle may be towed for a maximum of 3 hours or 90 miles (150 km) at a maximum speed of 30 mph (50 km/h), these limits **MUST NOT** be exceeded.



The following procedures must be followed to ensure that the vehicle is towed in a safe condition and damage to the vehicle transmission system is prevented.

1. Remove the front towing/lashing eye access panel.
2. Secure the towing attachment from the recovery vehicle to the towing/lashing eye.



CAUTION: Ensure that the towing attachment will not contact the front bumper during towing.

3. Apply the parking brake.
4. Insert ignition key and turn the ignition switch to position 'II'.
5. **Manual gearbox:** Apply the footbrake and position the gear lever in 'N' - Neutral.



CAUTION: If 'N' - Neutral cannot be selected, front and rear propeller shafts must be removed before vehicle is towed.

6. **Automatic gearbox:** Apply the footbrake and move the selector lever to the 'N' Neutral position.



NOTE: If electrical power is not available, use the manual interlock release tab on the selector lever to move the selector lever to the Neutral position.

All vehicles

7. Select 'H' - HIGH on the transfer box.

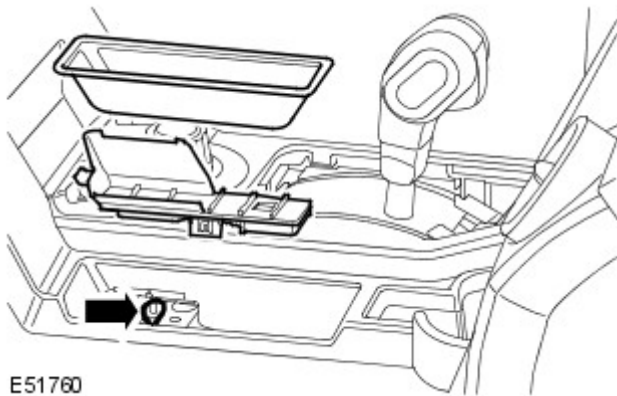


CAUTION: If electrical power is not available, and 'H' - HIGH cannot be selected, the vehicle may not be towed but must be recovered on a suitable trailer. If, however, transfer box was in 'H' - HIGH when electrical power was lost, vehicle may still be towed.

8. Release the parking brake.



NOTE: If electrical power is not available, it will be necessary to release the parking brake manually using the following procedures:



NOTE: Left hand drive illustrated, right hand drive on opposite side of centre console.

9. Lift out the coin tray from the centre console
10. Remove the access panel from the centre console.
11. Locate the electric parking brake release cable, insert a suitable tool through the cable eye and pull the cable upwards to release the parking brake.



CAUTION: The electric parking brake will not function until electrical power is restored it will, therefore, be necessary to chock the wheels when vehicle is at a standstill.



WARNING: Do not release the parking brake until towing is about to commence. Whilst towing, do not attempt to remove the ignition key and do not turn the key to any position other than 'II'. With the engine switched off, the power assisted steering system and brake booster will be inoperative thereby resulting in an increase in the effort required to turn the steering wheel and apply the brakes.



CAUTION: The vehicle tow connections should only be used in normal road conditions, 'snatch' recovery must be avoided.

On completion of 4 wheel towing

1. Apply the parking brake or if electrical power is not available, securely chock the wheels.
2. Detach towing equipment from towing/lashing eyes.
3. Fit the towing eye access panel and secure the toggle fasteners.

Transporting by trailer



CAUTION: Use the towing/lashing eyes at the front and rear of the vehicle, DO NOT secure lashing hooks or restraints to any other part of the vehicle.

Position the vehicle, apply the parking brake and select 'N' - Neutral on the manual or automatic gearbox selector lever



CAUTION: If electrical power is not available and the parking brake is released, it will not be possible to re-apply the parking brake. It will, therefore be necessary to select 1st gear - manual gearbox or 'P' Park - automatic gearbox and ensure that the vehicle wheels are adequately chocked to prevent vehicle movement.

Jacking and Lifting - Jacking

Description and Operation

General



WARNING: The following instructions must be adhered to before raising the vehicle off the ground:

- Position vehicle on a solid, level surface.
- Apply the parking brake.
- Select 'P' - PARK on automatic transmission selector or 1st gear on manual transmission and 'H' High on transfer case.



WARNING: If the drive shaft(s) are to be disconnected, it will be necessary to raise all four wheels off the ground in order that the shaft(s) can be rotated. DO NOT use the customer jack and ensure that the vehicle is adequately supported on axle stands. With the vehicle raised, it will be necessary to release the park brake and select Neutral - 'N' in the main transmission to enable the drive shaft(s) to be rotated

CAUTIONS:



To avoid damage to the underbody components of the vehicle, the following instructions must be adhered to:



Do not position jacks or axle stands under the following components:

- Body structure other than any approved jacking or lifting points
- Bumpers
- Fuel lines
- Fuel tank
- Brake lines
- Front or rear suspension arms
- Steering linkage
- Transfer case
- Front or rear differential units
- Transmission
- Engine oil pan - See note below



NOTE: For certain repair operations, it may be necessary to support the engine under the oil pan. In this case, a block of hardwood or a rubber pad must be positioned on the jack lifting pad to protect the oil pan.

Vehicle jack

The jack provided with the vehicle is only intended for use in an emergency such as changing a tire. DO NOT use the jack for any other purpose. Refer to the Owner's Handbook for the vehicle jack location points and jacking procedures.



WARNING: Never work under a vehicle supported solely by the vehicle jack.

Hydraulic jack

A hydraulic jack with a minimum lifting capacity of 1500 kg, (3,300 lbs) must be used.

WARNINGS:



Do not commence work on the underside of the vehicle until suitable axle stands have been placed in the correct position.



Always chock the wheels when jacking. The parking brake may be ineffective when the wheel(s) are off the ground.

Raising and Supporting the Vehicle

To assist in raising the vehicle, jacking points are provided as shown in the following illustrations.

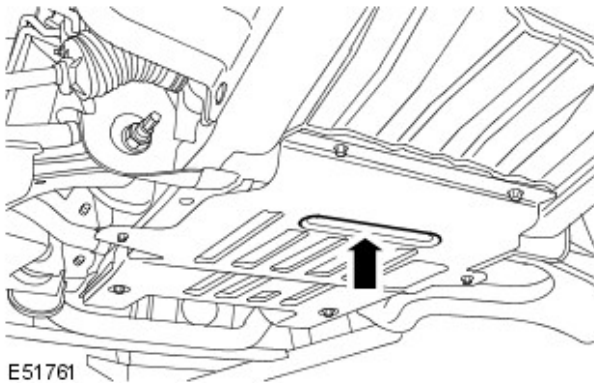
Raising the Front of the Vehicle

Apply the parking brake.

Select 'P' - PARK on automatic transmission selector.



WARNING: Always chock the rear wheels when jacking the front of the vehicle.

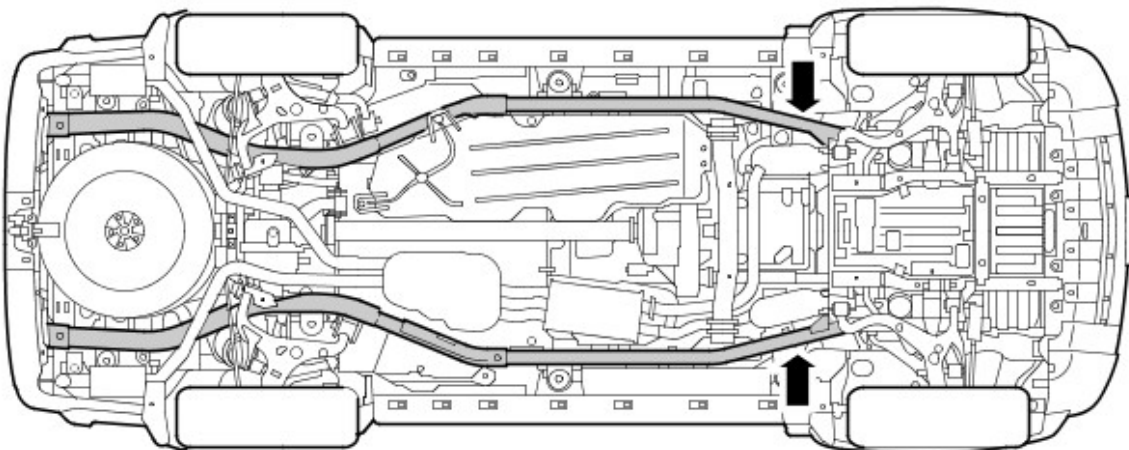


Position the lifting pad of the hydraulic jack in the centre of the recess in the engine undershield.



NOTE: If the engine undershield has been removed, position the jack lifting pad in the centre of the front cross beam.

With the vehicle raised to the desired height, position axle stands at positions shown.



E53784



CAUTION: Position suitable material between axle stands and longitudinal members to prevent damage to the longitudinal members.

Carefully lower jack until vehicle rests on axle stands.



WARNING: Before commencing work on the underside of the vehicle, ensure that axle stands are correctly positioned and vehicle is securely supported.

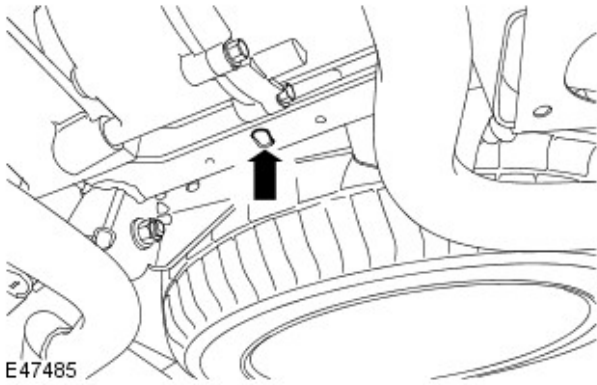
Reverse procedure when removing vehicle from stands.

Raising the Rear of the Vehicle

Select 'P' - PARK on automatic transmission selector.

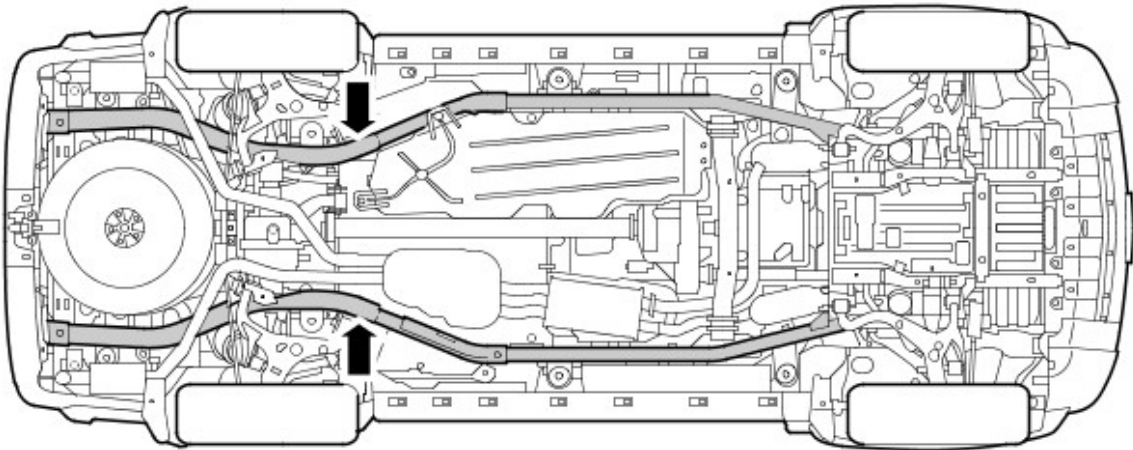


WARNING: Always chock the front wheels when jacking the rear of the vehicle.



Position the lifting pad of the hydraulic jack under the centre of the rear cross member as shown.

! CAUTION: Take care that the lifting pad of the jack is of a suitable size to avoid damaging the heat shield. It is not advisable to use a spacer block between the lifting pad and the rear cross member as this may result in some vehicle instability.



E47486

With vehicle raised to desired height, position axle stands at positions shown.

! CAUTION: Position suitable material between axle stands and longitudinal members to prevent damage to the longitudinal members.

Carefully lower jack until vehicle rests on axle stands.

! WARNING: Before commencing work on underside of vehicle, ensure that axle stands are correctly positioned and vehicle is securely supported.

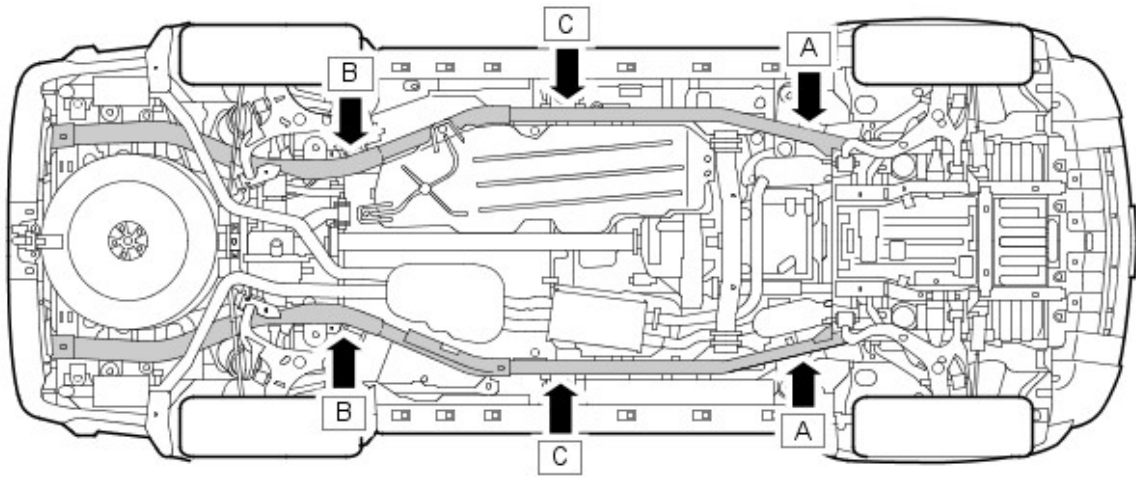
Reverse procedure when removing vehicle from stands.

Raising Vehicle - One Wheel/side

Apply the parking brake.

Select 'P' - PARK on automatic transmission selector.

! WARNING: Always chock the wheels which are not to be raised.

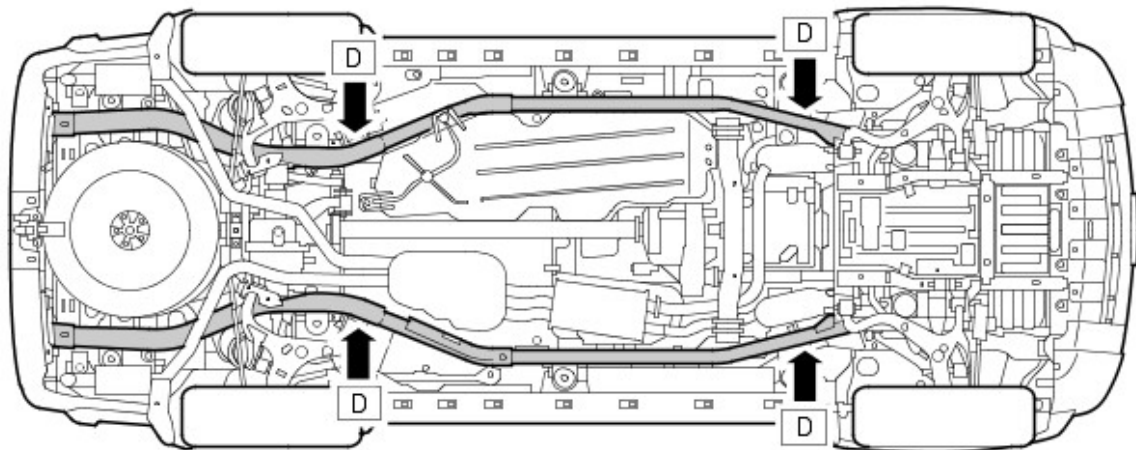


E47487

- **One front wheel** - position lifting pad of hydraulic jack beneath longitudinal member on the side to be raised at Point 'A'
- **One rear wheel** - position lifting pad of jack beneath longitudinal member on the side to be raised at Point 'B'
- **Front and rear wheels - ONE SIDE** - position lifting pad of jack beneath longitudinal member on the side to be raised at Point 'C'



NOTE: Point 'C' is in line with number 3 body mounting.



E47488

With vehicle at desired height, position axle stand(s) beneath longitudinal members and adjacent to the lifting pad of the jack at appropriate point(s) D.



CAUTION: Position suitable material between axle stands and longitudinal members to prevent damage to the longitudinal members.

Carefully lower jack until vehicle rests on axle stands.



WARNING: Before commencing work on underside of vehicle, ensure that axle stands are correctly positioned and vehicle is securely supported.

Reverse procedure when removing vehicle from stands.

Jacking and Lifting - Lifting

Description and Operation

Vehicle on Wheels - Four Post Ramp



WARNING: If the drive shaft(s) are to be disconnected, it will be necessary to raise all four wheels off the ramp in order that the shaft(s) can be rotated. If the wheel free facility is not to be used, raise the vehicle off the ramp using suitable equipment. With the vehicle raised, position axle stands in the positions shown for the front and rear support blocks - see illustration in Jacking. With the axle stands positioned, release the parking brake and select NEUTRAL 'N' in the transmission.



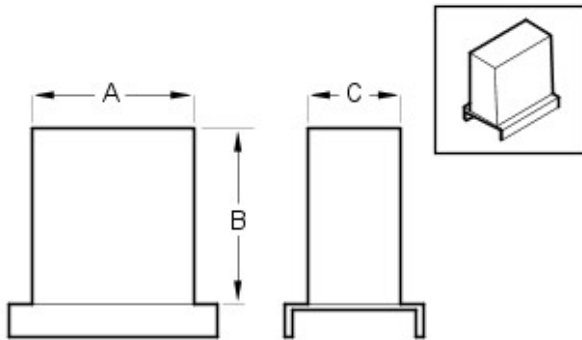
WARNING: Do not push the vehicle backwards and forwards along the ramp in order to gain access to the drive shaft fixings.

Position the vehicle on the ramp with the front and rear of the vehicle equidistant from the ends of the ramp. Chock the wheels, select NEUTRAL in the transmission and where practicable, apply the parking brake.

Wheel Free Lift - Four Post Ramp



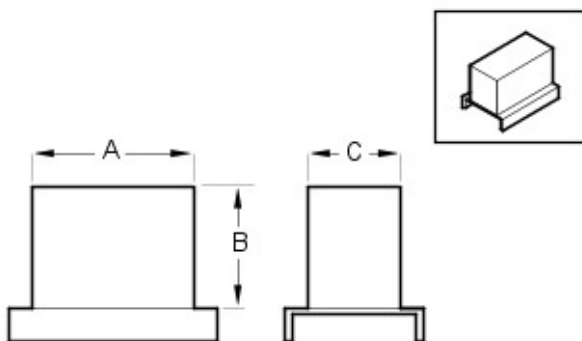
NOTE: To enable the vehicle to be supported correctly on the wheel free longitudinals, it will be necessary to produce 2 off each of the support blocks to the dimensions given in the accompanying illustrations. The supporting part of each block must be manufactured from suitable hardwood or metal and the 'U' shaped base of each block must be manufactured from metal. Note that it is essential to ensure that the 'U' shaped base of each block is wide enough to fit over the wheel free longitudinals.



E48763

Front Support Block Dimensions

- 'A' = 127.0 mm (5.0 in)
- 'B' = 146.0 mm (5.75 in)
- 'C' = 89.0 mm (3.5 in)



E48764

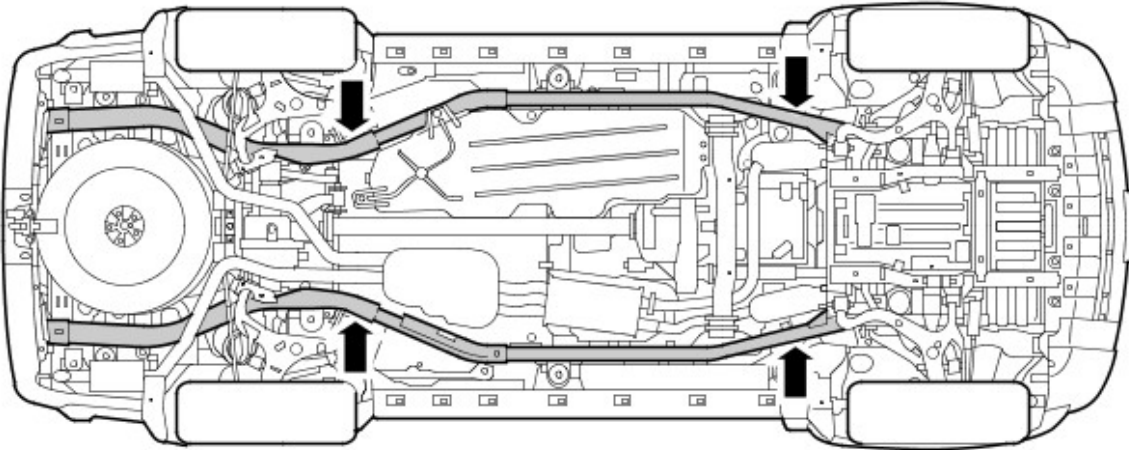
Rear support block dimensions

- 'A' = 152.0 mm (6.0 in)
- 'B' = 101.0 mm (4.0 in)
- 'C' = 76.0 mm (3.0 in)

Raising and Supporting the Vehicle

1. Position vehicle on ramp.
2. Position suspension in 'off-road' height.
3. Apply parking brake.

4. Raise ramp to desired height.



E47489

5. Align the wheel free longitudinals beneath the body frame longitudinals and position the support blocks beneath the longitudinals in the positions shown.



CAUTION: Ensure that the front and rear support blocks are correctly oriented to front and rear of vehicle.

6. Engage wheel free and lower ramp slowly until weight of vehicle rests on support blocks and road wheels are just clear of ramp.

7. Ensure that the vehicle is correctly supported on all four support blocks, that blocks are still correctly positioned and are in full contact with the body frame longitudinals.

8. Lower the ramp.



WARNING: Make sure that the vehicle is stable before commencing work.



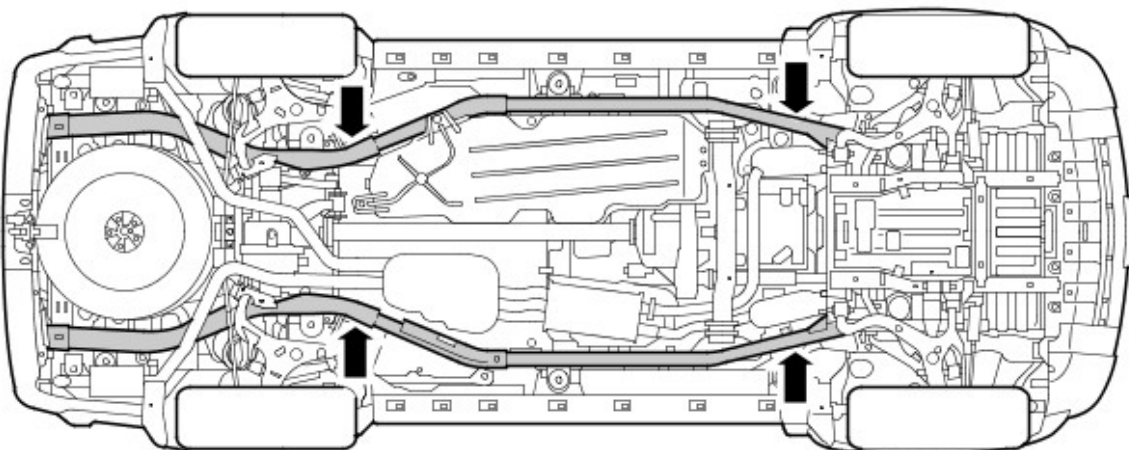
NOTE: Return the suspension to 'normal ride height' when the vehicle is removed from the ramp.

Two Post Lift



CAUTION: If the drive shaft(s) are to be removed, release the parking brake and select NEUTRAL 'N' in the transmission in order that the shaft(s) can be rotated when the vehicle is raised to the desired height.

1. Position the vehicle with the centre of the lift pillars aligned approximately with the front of the driver/passenger seat cushions.



E47489

2. Extend the lifting arms and position the pad of each lifting arm beneath the body frame longitudinal lifting points.

3. Raise the vehicle until the wheels are just clear of the ground and check that the pads of each lifting arm are still correctly positioned.

4. Raise the vehicle to the desired height.

5. Ensure that vehicle is correctly supported on all four lifting pads, that pads are still correctly positioned and are in full contact with the body frame longitudinals.



WARNING: Make sure that the vehicle is stable before commencing work.

Maintenance Schedules - Maintenance Schedules - Gasoline Engines

Description and Operation

CAUTIONS:



Always refer to the correct market Maintenance check sheet for the correct service scheduling.



Unless stated otherwise, the following operations must be carried out at every service interval. Note that the 'A' and 'B' Service Intervals listed on the 'Maintenance Check Sheet' for vehicles operating under arduous conditions, vary from those specified for vehicles operating under normal conditions. Reference must therefore, always be made to the 'Arduous Conditions Maintenance Check Sheet' for vehicles operating under these conditions.

NOTES:



Note that the A and B Services listed on the Maintenance Check Sheet, applicable to vehicles operating under arduous conditions, vary both in period and mileage (kilometres) to the intervals specified for those vehicles operating under normal conditions. Reference must therefore, always be made to the 'Arduous Conditions section' for vehicles operating under these conditions.

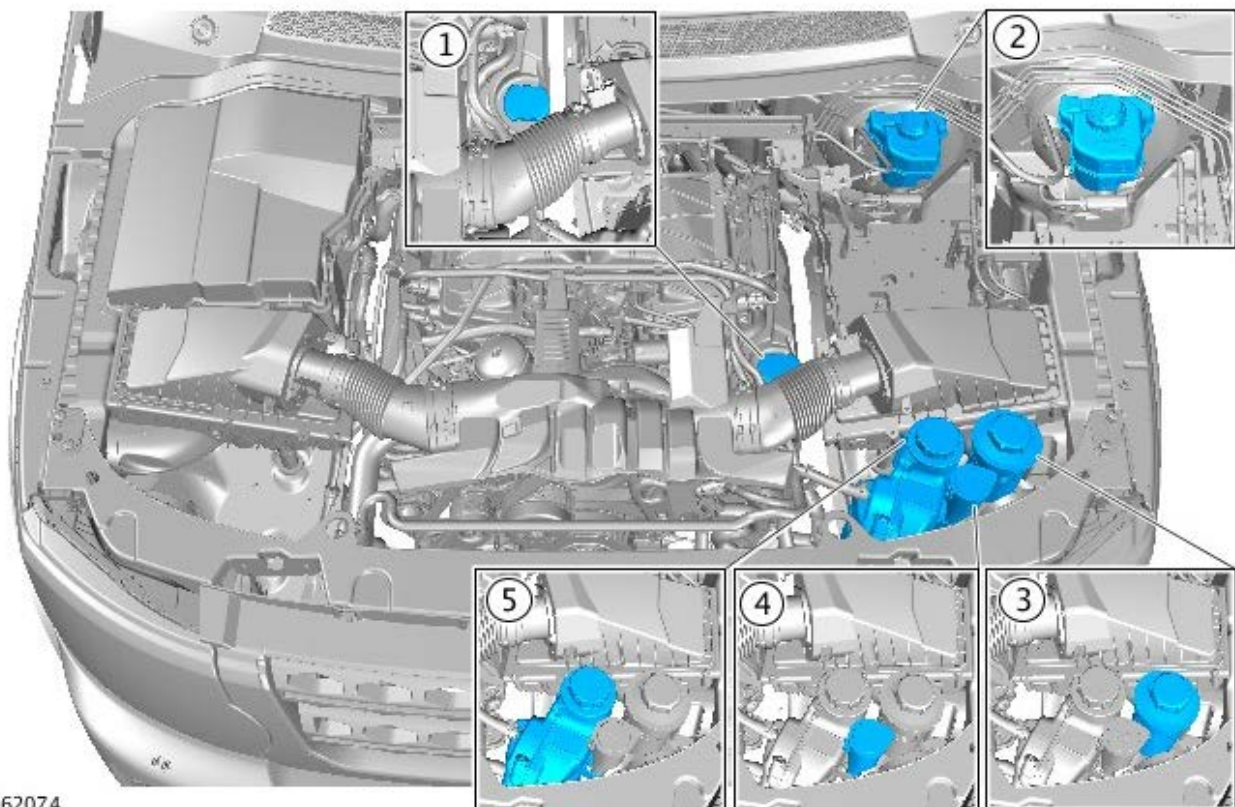


Some variation in the illustrations may occur, but the essential information is always correct.

Torque Specifications

Description	Nm	lb-ft
Seat frame fixing Torx screws	40	30
Seat belt fixing Torx screws	40	30
Road wheel nuts	140	103

Underbonnet View - 3.0 Litre

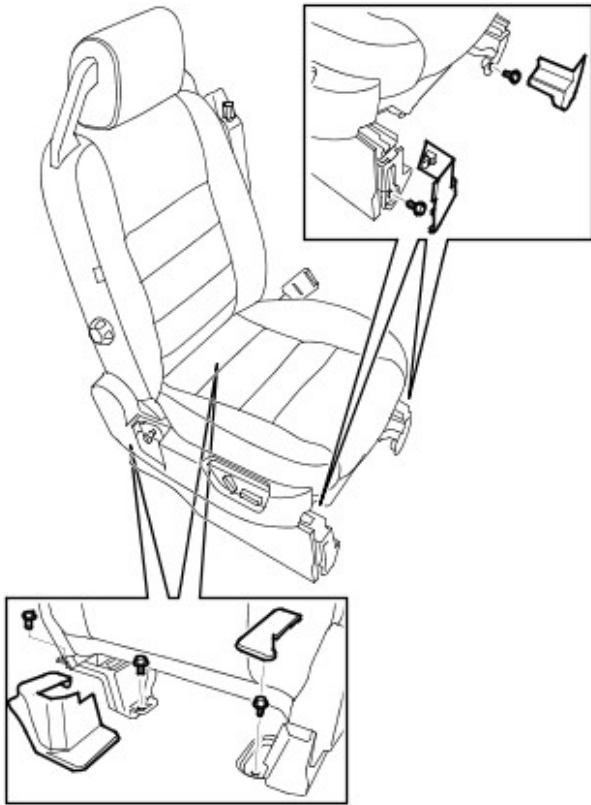


E162074

- 1. Engine oil filler cap
- 2. Brake fluid reservoir (LH drive illustrated - RH drive on opposite side)
- 3. Power steering fluid reservoir
- 4. Windshield washer reservoir
- 5. Coolant expansion tank

Maintenance Operations

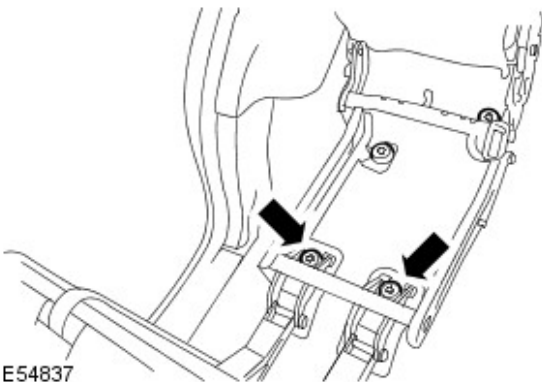
Seats and Safety Belts



E45101

Front seat frame fixings

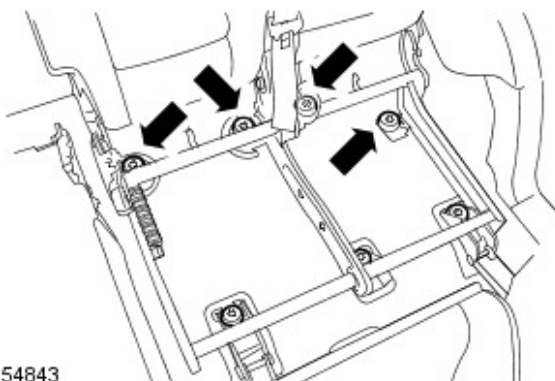
1. Carefully remove the trim panels covering the seat frame fixing Torx screws.
2. Check that the front seat frame fixing Torx screws are secure and that the seat frames show no signs of movement.
3. Reinstall the trim panels on completion.



E54837

Front seat frame fixings

4. Check that the rear seat frame front fixings are secure and that the seat frames show no signs of movement.

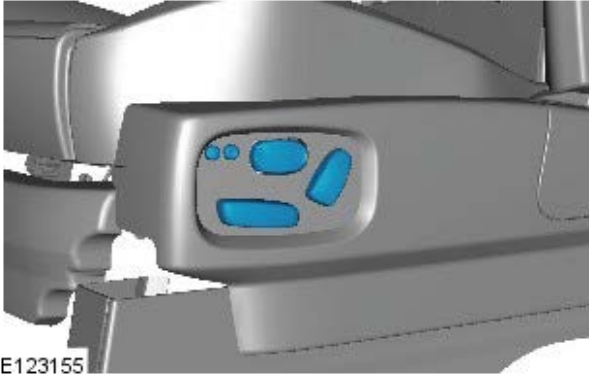


E54843

Front seat frame fixings

5. Fold the seat cushions forwards and check that the rear seat frame rear fixings are secure and that the seat frames show no signs of movement.

6. Fold the seat cushions back on completion.



Front seat controls

7. Check operation of all seat controls.

Safety belts

8. Fully extend each safety belt and check that it returns unassisted; repeat for all belts.

9. Check entire length of safety belt webbing for signs of fraying or damage; repeat for all belts.

10. Connect each safety belt to the correct buckle, check safety belt buckle and tongue are secure; check that buckle releases tongue correctly.

11. Check all safety belt and buckle mountings and fixings for security.



12. Check front safety belt height adjusters for correct operation.

Lamps, Horns and Warning Indicators

1. Check side, head, fog, reversing and tail lamps for correct operation.

2. Check operation of headlamp automatic levelling system - if installed.

3. Check turn signals and hazard warning lamps for correct operation.

4. Check brake (stop) lamps for correct operation.

5. Check all exterior lamp lenses for clarity and condition; pay particular attention to headlamp and fog lamp lenses for stone chips or damage.

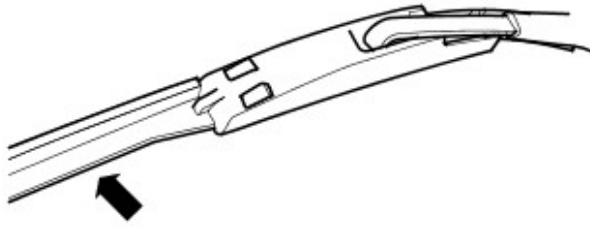
6. Check horn for loud, clear sound.

7. Switch on headlamps and check that side/headlamp reminder warning sounds when door is opened.

8. Check operation of interior courtesy lamps.

9. Check operation of all instrument pack warning and indicator lamps.

Washers and Wipers



E54838

1. Check all wiper blades for condition and signs of splits or damage.
2. Check security of wiper arms.
3. Operate front and rear windshield washers, check that jets are clear and correctly aimed.
4. Operate front and rear wipers at all speeds and check for smooth, smear free operation.

Check High/Low Gear Engagement

1. Select LOW range gear, drive vehicle forwards 3 to 4 vehicle lengths, stop vehicle and select HIGH range gear - gears must engage smoothly.

Pollen Filter

1. Replace pollen filter.
For additional information, refer to: [Pollen Filter](#) (412-01 Air Distribution and Filtering, Removal and Installation).

Corrosion/Cosmetic Inspection

1. Carry out the annual corrosion/cosmetic inspection using the Annual Corrosion Inspection Sheet.

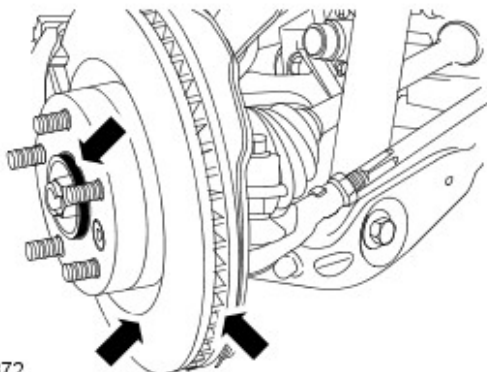
Wheels and Tires

1. Check that tires comply with manufacturer's specification.
For additional information, refer to: [Wheels and Tires](#) (204-04 Wheels and Tires, Description and Operation).
2. Check/adjust tire pressures including spare.
For additional information, refer to: [Wheels and Tires](#) (204-04 Wheels and Tires, Description and Operation).
3. **Vehicles with Uni-directional tires installed:** Mark the wheel to stud relationship of each road wheel and note location of each road wheel to its respective hub.
4. Loosen road wheel nuts. Raise vehicle to a wheel free condition.
For additional information, refer to: [Lifting](#) (100-02 Jacking and Lifting, Description and Operation).
5. Remove the road wheels.
6. Visually check tires for condition, lumps or bulges. Check tread depth across the width of the tire and around the circumference; make sure that remaining tread depth does not contravene local legislative requirements.



NOTE: Do not install wheels at this stage.

Braking System



E54872

1. Inspect front brake pads for wear.
For additional information, refer to: [Specifications](#) (206-03 Front Disc Brake, Specifications).
2. Inspect rear brake pads for wear.

For additional information, refer to: [Specifications](#) (206-04 Rear Disc Brake, Specifications).

3. Check brake calipers for signs of fluid leaks.
4. Check brake discs for condition.
5. Check all brake booster and brake system pipes and hoses for condition, chafing and leaks.
6. Clean road wheel hub spigots and apply grease, Land Rover Part Number RYL 105020 to the wheel mating surface of each spigot.
7. **Vehicles with Uni-directional tires installed:** Install road wheels to their respective hubs ensuring that stud to wheel relationship is maintained.
8. **Vehicles with NON uni-directional tires installed:** Install wheels on the opposite side of the vehicle but make sure that they on the same axle as they were originally installed.
9. Install road wheel nuts and tighten to 140 Nm (103 lb-ft).
10. Replace brake fluid.
For additional information, refer to: [Brake System Pressure Bleeding](#) (206-00 Brake System - General Information, General Procedures).

11. Replace all flexible brake hoses.

Electric Parking Brake

1. Check the adjustment of the electric parking brake.
For additional information, refer to: [Parking Brake Shoe and Lining Adjustment](#) (206-05 Parking Brake and Actuation, General Procedures).
2. **Vehicles operating under arduous conditions:** Check the condition of the electric parking brake system.

Road Wheel Speed Sensors

1. Inspect the road wheel speed sensor harnesses for damage.

Door Locks and Hinges

1. Check operation of all door locks, bonnet lock and fuel filler flap.
2. Lubricate all door check straps, bonnet catch and fuel filler flap catch.

Radiator and Cooling Fan

1. **Vehicles operating under arduous conditions:** Visually check radiator for external obstructions, check cooling fan blades for damage.

Cooling System

1. Check specific gravity of coolant using a hydrometer.



NOTE: A suitable hydrometer is available from the Equipment Programme under Part Number 511 3302 001 00.

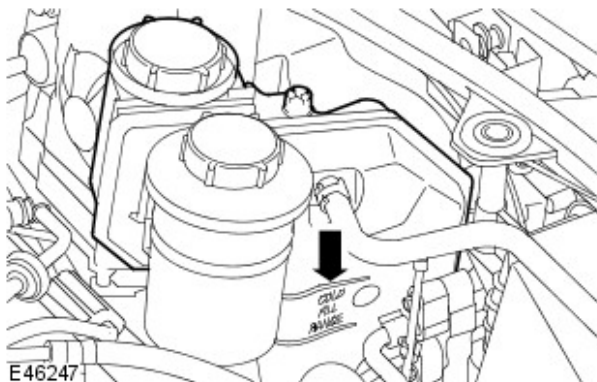
2. Top-up cooling system if necessary.

For additional information, refer to: [Specifications](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Specifications).



CAUTION: Anti-freeze concentration must be maintained at 50%.

Cooling system - Check/Top-up



WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank whilst the system is hot.



CAUTION: Engine coolant will damage the paint finished surfaces. If coolant is spilled, immediately remove the coolant and wash the area with water.

1. Check the level of coolant in the expansion tank. With the engine cold, the coolant level must be to the '**UPPER LEVEL**' indicator mark above the '**COLD FILL RANGE**' text on the side of the expansion tank. Ignore any coolant which may be visible in the top section of the tank.

2. If topping-up is required, remove expansion tank filler cap and top-up coolant level to the '**UPPER LEVEL**' indicator mark.

For additional information, refer to: [Specifications](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Specifications).



CAUTION: Always top-up with a 50% mixture of anti-freeze and water.

3. Install expansion tank filler cap, tighten cap until ratchet is heard to 'click'.

Coolant - Replace

1. Replace the coolant.

For additional information, refer to: [Cooling System Partial Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).

Ignition System

1. Replace spark plugs.

For additional information, refer to: [Spark Plugs](#) (303-07B Engine Ignition - V6 S/C 3.0L Petrol, Removal and Installation).

Air Filtering

1. Replace the air filter element.

For additional information, refer to: [Air Cleaner Element](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

Ancillary Drive Belt

1. Check the condition of the ancillary drive belt.

2. Remove all traces of mud and dirt from the drive belt and pulleys.

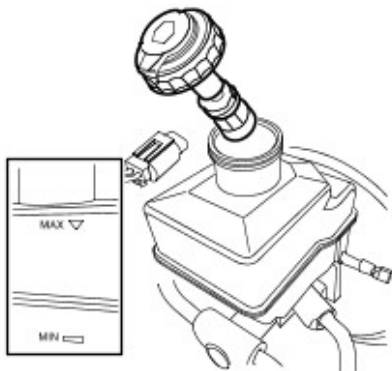
3. Check the drive belt for signs of splitting and wear.

4. Replace the ancillary drive belt.

For additional information, refer to: [Accessory Drive Belt](#) (303-05B Accessory Drive - V6 S/C 3.0L Petrol, Removal and Installation).

Fluid Levels

Brake fluid reservoir



E54845

1. Remove the auxiliary battery box cover.

2. Check the fluid level in the brake fluid reservoir, the level must be to the '**MAX**' mark on the reservoir; top-up if necessary.

3. Clean the area around the reservoir filler cap, remove cap.

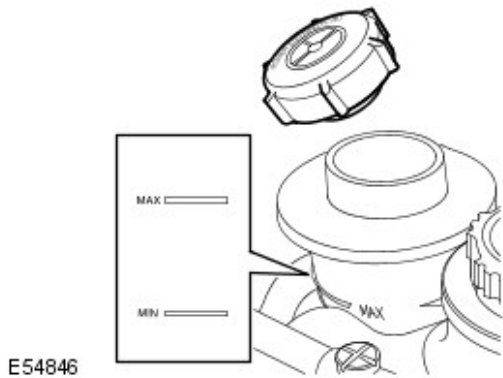
4. If necessary, top-up using the recommended fluid to the '**MAX**' mark on the reservoir.

For additional information, refer to: [Specifications](#) (206-00 Brake System - General Information, Specifications).

5. Install the reservoir filler cap.

6. Install the auxiliary battery box cover.

Power steering fluid reservoir



E54846

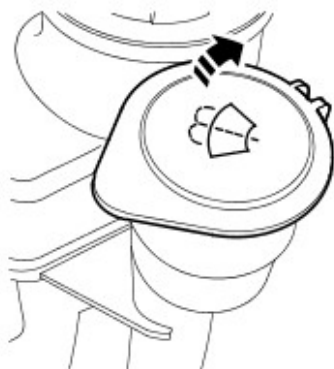
! CAUTION: To prevent over filling, check/top-up the system with the engine switched off and the system cold. Make sure that the steering wheel is in the straight ahead position, do not turn the steering wheel prior to checking the fluid level.

1. Check that the fluid level is to the mid-way mark between the '**MAX**' and '**MIN**' marks on the fluid reservoir, top-up if necessary.
2. Clean the area around the reservoir filler cap, remove cap.
3. If necessary, top-up using the recommended fluid to the mid-way mark on the reservoir. For additional information, refer to: [Specifications](#) (211-02 Power Steering, Specifications).

! CAUTION: Do not fill reservoir above the '**MAX**' mark.

4. Install the reservoir filler cap.

Windshield washer reservoir



E54847

1. Remove the windshield washer reservoir filler cap.
2. Top-up the reservoir using a mixture of an approved windshield washer fluid and water until the level is to the bottom of the gauze filter in the reservoir filler neck.
3. Install the reservoir filler cap.

Engine Oil and Filter

1. Renew engine oil and filter - 3.0 litre engine.

For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01B Engine - V6 S/C 3.0L Petrol, General Procedures) / [Specifications](#) (303-01B Engine - V6 S/C 3.0L Petrol, Specifications).

Automatic Transmission

1. Renew automatic transmission fluid.

For additional information, refer to: [Transmission Fluid Drain and Refill](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, General Procedures).

Transfer Case

1. Renew transfer case fluid.

For additional information, refer to: [Transfer Case Draining and Filling](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, General Procedures) / [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).

Differential Assemblies

1. Renew front differential oil.

For additional information, refer to: [Differential Draining and Filling](#) (205-03 Front Drive Axle/Differential, General Procedures) / [Specifications](#) (205-03 Front Drive Axle/Differential, Specifications).

2. Renew rear differential oil.

For additional information, refer to: [Differential Draining and Filling](#) (205-02 Rear Drive Axle/Differential, General Procedures) / [Specifications](#) (205-02 Rear Drive Axle/Differential, Specifications).

Suspension and Body Mountings

1. Check for free play in all suspension and body mounting rubbers.

2. Check condition of suspension rubber boots and gaiters.

3. Lift the vehicle so that front wheels are clear of ground/ramp to enable insertion of a suitable lever (e.g. a 1200mm long steel tube). Check the lower ball joints for free play by placing the lever between the ground/ramp and the tire, and lifting the wheel assembly with the lever. A second person will be required to check simultaneously for any ball joint lift. If free play (knock) is noted in the ball joint, replacement is required.

Removable Tow Bar

1. Check condition of removable tow bar.

For additional information, refer to: [Tow Bar Mounting Check](#) (502-02 Full Frame and Body Mounting, General Procedures).

Fuel System

1. Check fuel system pipes, hoses and unions for chafing, leaks and corrosion.

Electrical Harnesses

1. Check all electrical harnesses for chafing.

Oil/Fluid Leaks

1. Check for oil/fluid leaks.

Exhaust System

1. Check exhaust system for leaks, security and damage.

Power Steering

1. Check power steering rod ball joint fixings, gaiters and condition of ball joints and dust covers.

2. Check power steering pipes, hoses and unions for chafing, leaks and corrosion.

Fault Lamp(s)

1. If fault lamp(s) are illuminated, test the associated system using approved Land Rover diagnostic equipment and report findings.

Road Test

1. Carry out road test of vehicle.

For additional information, refer to: [Road/Roller Testing](#) (100-00 General Information, Description and Operation).

General

1. Endorse Service Record.

2. Report any unusual features of vehicle condition and any additional work required.

Additional Items That May Require Attention

It is recommended that:

1. All brake fluid hydraulic seals are replaced.



NOTE: This is in addition to the maintenance requirement that flexible brake hoses **MUST** be replaced at this service interval.

2. After 50 miles (80 km) continuous use in severe off-road conditions i.e. wading, deep mud and abrasive grit/slurry: The electric parking brake should be cleaned and inspected.

3. After 50 miles (80 km) continuous use in severe off-road conditions i.e. wading, deep mud and abrasive grit/slurry: The ancillary drive belt should be cleaned and inspected.

4. Vehicles used in dusty or field conditions or deep wading: More frequent attention to the air cleaner will be required.

Maintenance Schedules - Maintenance Schedules - Diesel Engines

Description and Operation

CAUTIONS:



Always refer to the correct market Maintenance check sheet for the correct service scheduling.



Unless stated otherwise, the following operations must be carried out at every service interval. Note that the 'A' and 'B' Service Intervals listed on the 'Maintenance Check Sheet' for vehicles operating under arduous conditions, vary from those specified for vehicles operating under normal conditions. Reference must therefore, always be made to the 'Arduous Conditions Maintenance Check Sheet' for vehicles operating under these conditions.

NOTES:



Note that the A and B Services listed on the Maintenance Check Sheet, applicable to vehicles operating under arduous conditions, vary both in period and mileage (kilometres) to the intervals specified for those vehicles operating under normal conditions. Reference must therefore, always be made to the 'Arduous Conditions section' for vehicles operating under these conditions.

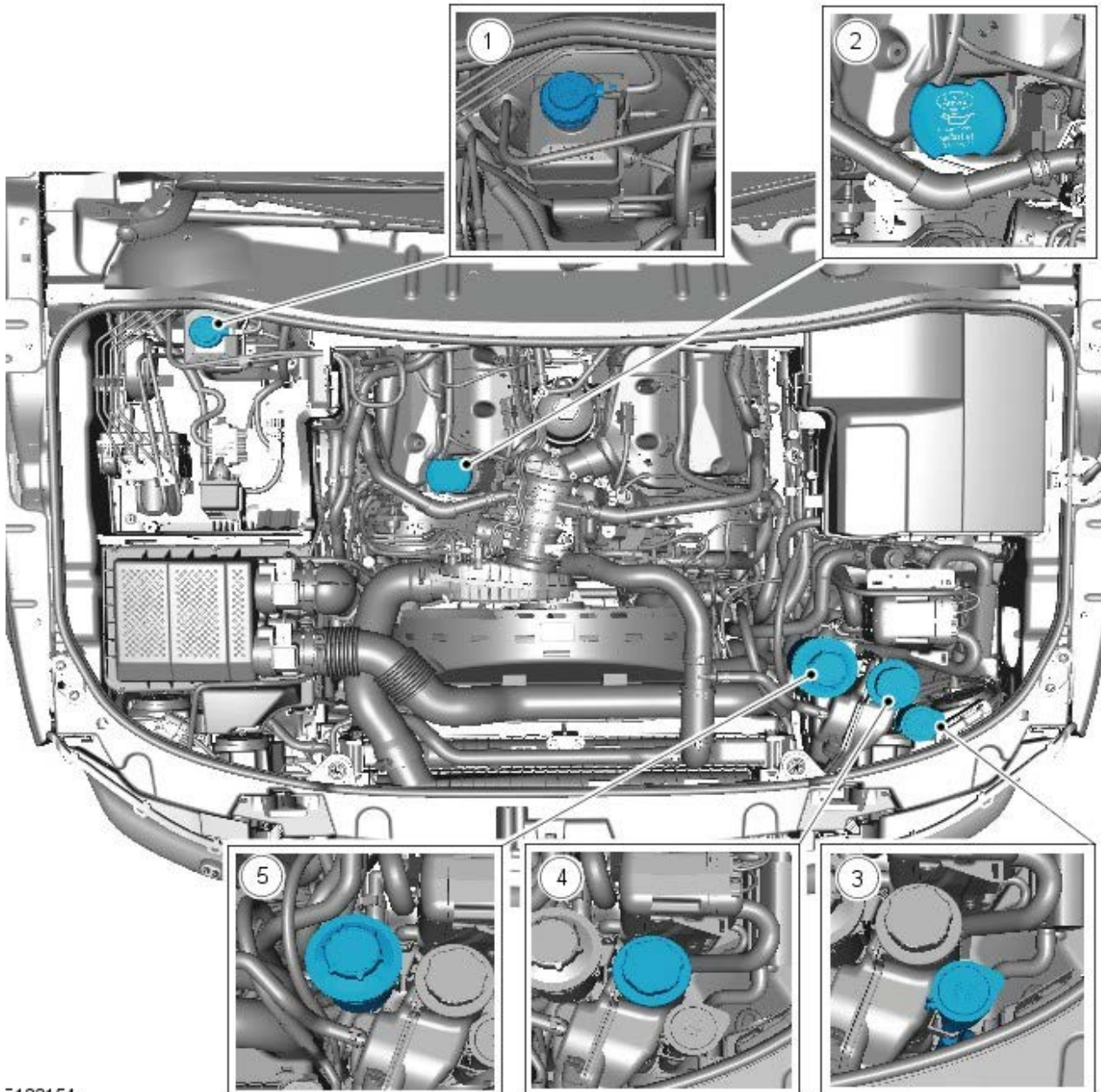


Some variation in the illustrations may occur, but the essential information is always correct.

Torque Specifications

Description	Nm	lb-ft
Seat frame fixing Torx screws	40	30
Seat belt fixing Torx screws	40	30
Road wheel nuts	140	103

Underbonnet View - 3.0 Litre

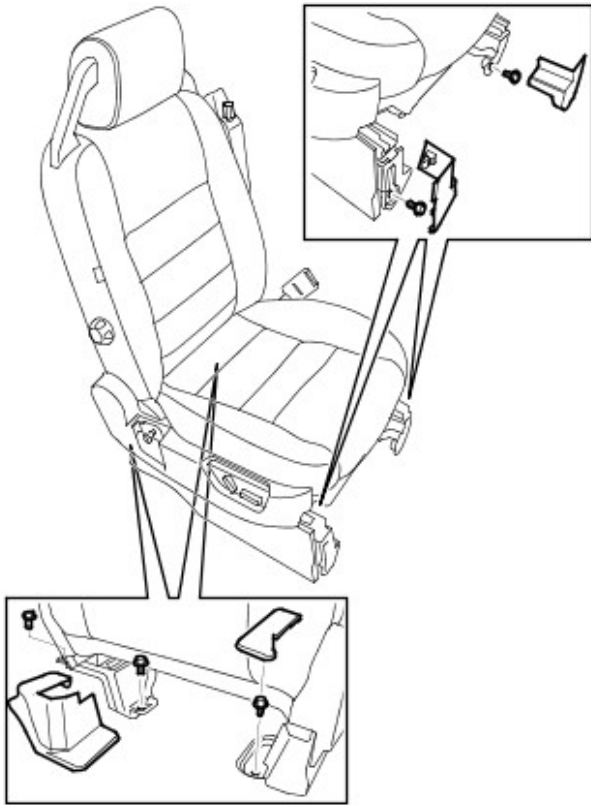


E123154

- 1. Brake/clutch fluid reservoir (RH drive illustrated - LH drive on opposite side)
- 2. Engine oil filler cap
- 3. Windshield washer reservoir
- 4. Coolant expansion tank
- 5. Power steering fluid reservoir

Maintenance Operations

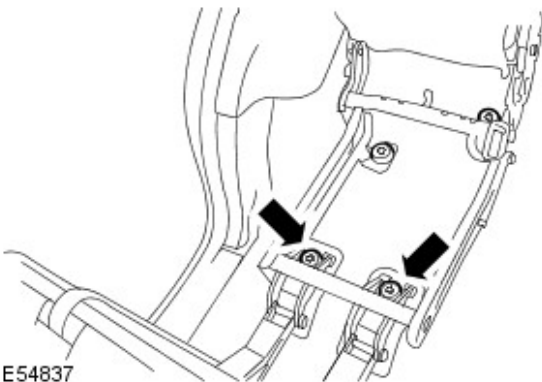
Seats and Safety Belts



E45101

Front seat frame fixings

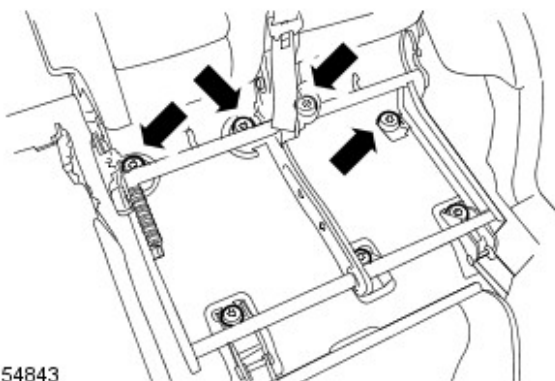
1. Carefully remove the trim panels covering the seat frame fixing Torx screws.
2. Check that the front seat frame fixing Torx screws are secure and that the seat frames show no signs of movement.
3. Reinstall the trim panels on completion.



E54837

Front seat frame fixings

4. Check that the rear seat frame front fixings are secure and that the seat frames show no signs of movement.

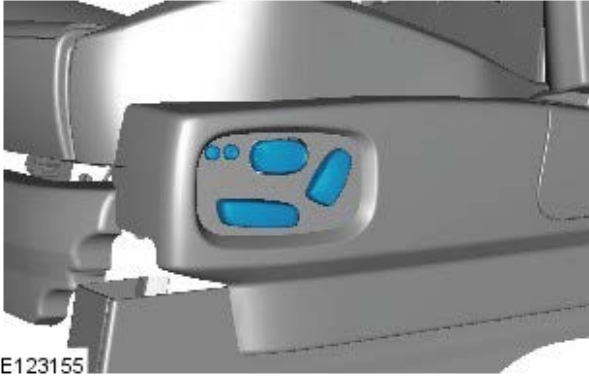


E54843

Front seat frame fixings

5. Fold the seat cushions forwards and check that the rear seat frame rear fixings are secure and that the seat frames show no signs of movement.

6. Fold the seat cushions back on completion.



Front seat controls

7. Check operation of all seat controls.

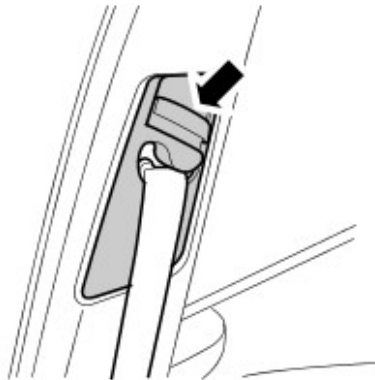
Safety belts

8. Fully extend each safety belt and check that it returns unassisted; repeat for all belts.

9. Check entire length of safety belt webbing for signs of fraying or damage; repeat for all belts.

10. Connect each safety belt to the correct buckle, check safety belt buckle and tongue are secure; check that buckle releases tongue correctly.

11. Check all safety belt and buckle mountings and fixings for security.



12. Check front safety belt height adjusters for correct operation.

Lamps, Horns and Warning Indicators

1. Check side, head, fog, reversing and tail lamps for correct operation.

2. Check operation of headlamp automatic levelling system - if installed.

3. Check turn signals and hazard warning lamps for correct operation.

4. Check brake (stop) lamps for correct operation.

5. Check all exterior lamp lenses for clarity and condition; pay particular attention to headlamp and fog lamp lenses for stone chips or damage.

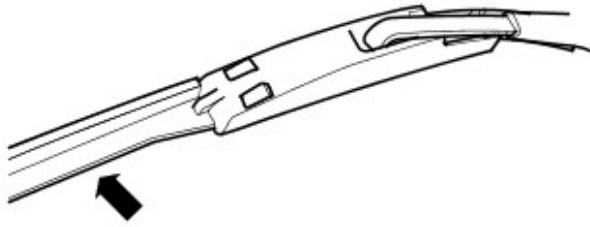
6. Check horn for loud, clear sound.

7. Switch on headlamps and check that side/headlamp reminder warning sounds when door is opened.

8. Check operation of interior courtesy lamps.

9. Check operation of all instrument pack warning and indicator lamps.

Washers and Wipers



E54838

1. Check all wiper blades for condition and signs of splits or damage.
2. Check security of wiper arms.
3. Operate front and rear windshield washers, check that jets are clear and correctly aimed.
4. Operate front and rear wipers at all speeds and check for smooth, smear free operation.

Check High/Low Gear Engagement

1. Select LOW range gear, drive vehicle forwards 3 to 4 vehicle lengths, stop vehicle and select HIGH range gear - gears must engage smoothly.

Pollen Filter

1. Replace pollen filter.
For additional information, refer to: [Pollen Filter](#) (412-01 Air Distribution and Filtering, Removal and Installation).

Corrosion/Cosmetic Inspection

1. Carry out the annual corrosion/cosmetic inspection using the Annual Corrosion Inspection Sheet.

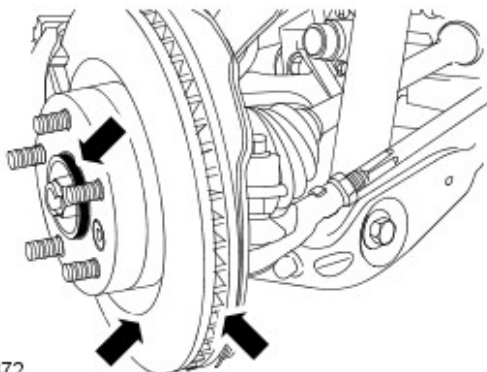
Wheels and Tires

1. Check that tires comply with manufacturer's specification.
For additional information, refer to: [Wheels and Tires](#) (204-04 Wheels and Tires, Description and Operation).
2. Check/adjust tire pressures including spare.
For additional information, refer to: [Wheels and Tires](#) (204-04 Wheels and Tires, Description and Operation).
3. **Vehicles with Uni-directional tires installed:** Mark the wheel to stud relationship of each road wheel and note location of each road wheel to its respective hub.
4. Loosen road wheel nuts. Raise vehicle to a wheel free condition.
For additional information, refer to: [Lifting](#) (100-02 Jacking and Lifting, Description and Operation).
5. Remove the road wheels.
6. Visually check tires for condition, lumps or bulges. Check tread depth across the width of the tire and around the circumference; make sure that remaining tread depth does not contravene local legislative requirements.



NOTE: Do not install wheels at this stage.

Braking System



E54872

1. Inspect front brake pads for wear.
For additional information, refer to: [Specifications](#) (206-03 Front Disc Brake, Specifications).
2. Inspect rear brake pads for wear.

For additional information, refer to: [Specifications](#) (206-04 Rear Disc Brake, Specifications).

3. Check brake calipers for signs of fluid leaks.
4. Check brake discs for condition.
5. Check all brake booster and brake system pipes and hoses for condition, chafing and leaks.
6. Clean road wheel hub spigots and apply grease, Land Rover Part Number RYL 105020 to the wheel mating surface of each spigot.
7. **Vehicles with Uni-directional tires installed:** Install road wheels to their respective hubs ensuring that stud to wheel relationship is maintained.
8. **Vehicles with NON uni-directional tires installed:** Install wheels on the opposite side of the vehicle but make sure that they are on the same axle as they were originally installed.
9. Install road wheel nuts and tighten to 140 Nm (103 lb-ft).
10. Replace brake fluid.
For additional information, refer to: [Brake System Pressure Bleeding](#) (206-00 Brake System - General Information, General Procedures).

11. Replace all flexible brake hoses.

Electric Parking Brake

1. Check the adjustment of the electric parking brake.
For additional information, refer to: [Parking Brake Shoe and Lining Adjustment](#) (206-05 Parking Brake and Actuation, General Procedures).
2. **Vehicles operating under arduous conditions:** Check the condition of the electric parking brake system.

Road Wheel Speed Sensors

1. Inspect the road wheel speed sensor harnesses for damage.

Fuel Filter Element

1. Replace fuel filter element. For additional information, refer to: [Fuel Filter Element](#) (310-01A Fuel Tank and Lines - TDV6 3.0L Diesel, Removal and Installation).

Fuel Sedimentor

1. Drain the fuel sedimentor.
For additional information, refer to: [Diesel Filter Water Drain-Off](#) (310-00 Fuel System - General Information, General Procedures).

Radiator/intercooler and Cooling Fan

1. Visually check the radiator/intercooler for external obstructions, check cooling fan blades for damage.
2. Remove any debris from the intercooler using a low pressure hose.

Door Locks and Hinges

1. Check operation of all door locks, bonnet lock and fuel filler flap.
2. Lubricate all door check straps, bonnet catch and fuel filler flap catch.

Cooling System

1. Check specific gravity of coolant using a hydrometer.

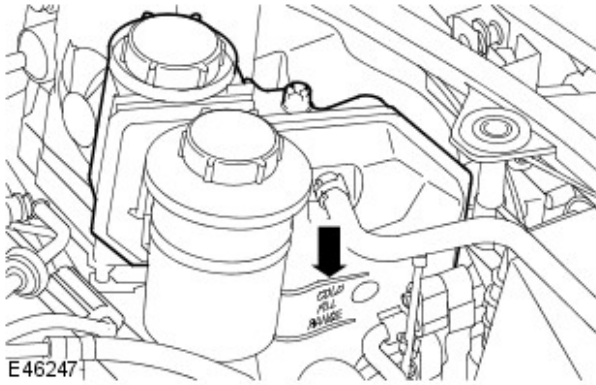


NOTE: A suitable hydrometer is available from the Equipment Programme under Part Number 511 3302 001 00.

2. Top-up cooling system if necessary.
For additional information, refer to: [Specifications](#) (303-03A Engine Cooling - TDV6 3.0L Diesel, Specifications).



CAUTION: Anti-freeze concentration must be maintained at 50%.



Cooling system - Check/Top-up



WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank whilst the system is hot.



CAUTION: Engine coolant will damage the paint finished surfaces. If coolant is spilled, immediately remove the coolant and wash the area with water.

1. Check the level of coolant in the expansion tank. With the engine cold, the coolant level must be to the **'UPPER LEVEL'** indicator mark above the **'COLD FILL RANGE'** text on the side of the expansion tank. Ignore any coolant which may be visible in the top section of the tank.

2. If topping-up is required, remove expansion tank filler cap and top-up coolant level to the **'UPPER LEVEL'** indicator mark.

For additional information, refer to: [Specifications](#) (303-03A Engine Cooling - TDV6 3.0L Diesel, Specifications).



CAUTION: Always top-up with a 50% mixture of anti-freeze and water.

3. Fit expansion tank filler cap, tighten cap until ratchet is heard to 'click'.

Coolant - Replace

1. Replace the coolant.

For additional information, refer to: [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures).

Air Filtering

1. Replace the air filter element.

For additional information, refer to: [Air Cleaner Element](#) (303-12A Intake Air Distribution and Filtering - TDV6 3.0L Diesel, Removal and Installation).

Ancillary Drive Belt

1. Check the condition of the ancillary drive belt.

2. Remove all traces of mud and dirt from the drive belt and pulleys.

3. Check the drive belt for signs of splitting and wear.

4. Replace the ancillary drive belt.

For additional information, refer to: [Accessory Drive Belt](#) (303-05A Accessory Drive - TDV6 3.0L Diesel, Removal and Installation).

Camshaft Timing Belt and High Pressure Fuel Pump Drive Belt/Rear End Accessory Drive (READ) Belt

1. Replace camshaft timing belt.

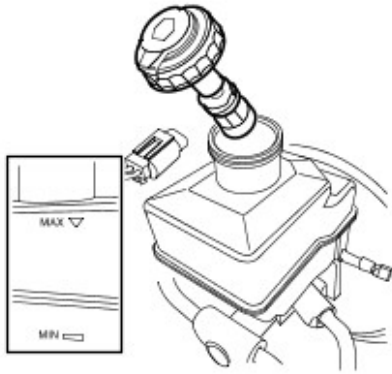
For additional information, refer to: [Timing Belt](#) (303-01A Engine - TDV6 3.0L Diesel, Removal and Installation).

Replace the High pressure fuel pump drive belt.

For additional information, refer to: [Rear End Accessory Drive \(READ\)](#) (303-05A Accessory Drive - TDV6 3.0L Diesel, Removal and Installation).

Fluid Levels

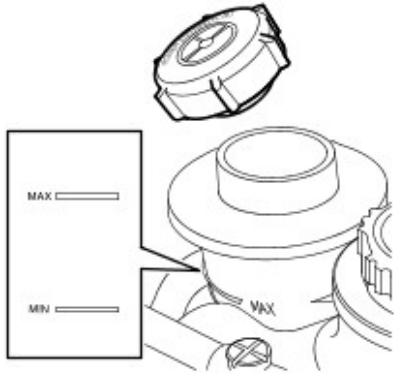
Brake/clutch fluid reservoir



E54845

1. Remove the auxiliary battery box cover.
2. Check the fluid level in the brake/clutch fluid reservoir, the level must be to the '**MAX**' mark on the reservoir; top-up if necessary.
3. Clean the area around the reservoir filler cap, remove the cap.
4. If necessary, top-up using the recommended fluid to the '**MAX**' mark on the reservoir.
For additional information, refer to: [Specifications](#) (206-00 Brake System - General Information, Specifications).
5. Reinstall the reservoir filler cap.
6. Install the auxiliary battery box cover.

Power steering fluid reservoir



E54846



CAUTION: To prevent over filling, check/top-up the system with the engine switched off and the system cold. Make sure that the steering wheel is in the straight ahead position, do not turn the steering wheel prior to checking the fluid level.

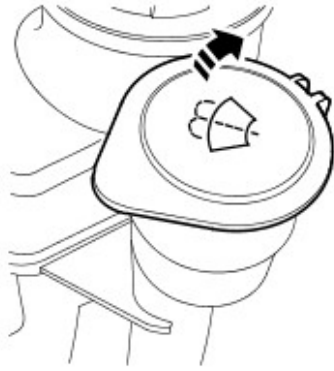
1. Check that the fluid level is to the mid-way mark between the '**MAX**' and '**MIN**' marks on the fluid reservoir, top-up if necessary.
2. Clean the area around the reservoir filler cap, remove the cap.
3. If necessary, top-up using the recommended fluid to the mid-way mark on the reservoir.
For additional information, refer to: [Specifications](#) (211-02 Power Steering, Specifications).



CAUTION: Do not fill reservoir above the '**MAX**' mark.

4. Reinstall the reservoir filler cap.

Windshield washer reservoir



E54847

1. Remove the windshield washer reservoir filler cap.
2. Top-up the reservoir using a mixture of an approved windshield washer fluid and water until the level is to the bottom of the gauze filter in the reservoir filler neck.
3. Reinstall the reservoir filler cap.

Engine Oil and Filter

1. Renew engine oil and filter.

For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01A Engine - TDV6 3.0L Diesel, General Procedures).

Automatic Transmission

1. Renew automatic transmission fluid.

For additional information, refer to: [Transmission Fluid Drain and Refill](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, General Procedures).

Transfer Case

1. Renew transfer case fluid.

For additional information, refer to: [Transfer Case Draining and Filling](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, General Procedures) / [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).

Differential Assemblies

1. Renew front differential oil.

For additional information, refer to: [Differential Draining and Filling](#) (205-03 Front Drive Axle/Differential, General Procedures) / [Specifications](#) (205-03 Front Drive Axle/Differential, Specifications).

2. Renew rear differential oil.

For additional information, refer to: [Differential Draining and Filling](#) (205-02 Rear Drive Axle/Differential, General Procedures) / [Specifications](#) (205-02 Rear Drive Axle/Differential, Specifications).

Suspension and Body Mountings

1. Check for free play in all suspension and body mounting rubbers.
2. Check condition of suspension rubber boots and gaiters.
3. Lift the vehicle so that front wheels are clear of ground/ramp to enable insertion of a suitable lever (e.g. a 1200mm long steel tube). Check the lower ball joints for free play by placing the lever between the ground/ramp and the tire, and lifting the wheel assembly with the lever. A second person will be required to check simultaneously for any ball joint lift. If free play (knock) is noted in the ball joint, replacement is required.

Removable Tow Bar

1. Check condition of removable tow bar.

For additional information, refer to: [Tow Bar Mounting Check](#) (502-02 Full Frame and Body Mounting, General Procedures).

Fuel System

1. Check fuel system pipes, hoses and unions for chafing, leaks and corrosion.

Electrical Harnesses

1. Check all electrical harnesses for chafing.

Oil/Fluid Leaks

1. Check for oil/fluid leaks.

Exhaust System

1. Check exhaust system for leaks, security and damage.

Power Steering

1. Check power steering rod ball joint fixings, gaiters and condition of ball joints and dust covers.
2. Check power steering pipes, hoses and unions for chafing, leaks and corrosion.

Clutch

1. Check clutch pipes and unions for chafing, leaks and corrosion.

Fault Lamp(s)

1. If fault lamp(s) are illuminated, test the associated system using approved Land Rover diagnostic equipment and report findings.

Road Test

1. Carry out road test of vehicle.

For additional information, refer to: [Road/Roller Testing](#) (100-00 General Information, Description and Operation).

General

1. Endorse Service Record.
2. Report any unusual features of vehicle condition and any additional work required.

Additional Items That May Require Attention

It is recommended that:

1. All brake fluid hydraulic seals are replaced.



NOTE: This is in addition to the maintenance requirement that flexible brake hoses **MUST** be replaced at this service interval.

2. After 50 miles (80 km) continuous use in severe off-road conditions i.e. wading, deep mud and abrasive grit/slurry: The electric parking brake should be cleaned and inspected.

3. After 50 miles (80 km) continuous use in severe off-road conditions i.e. wading, deep mud and abrasive grit/slurry: The ancillary drive belt should be cleaned and inspected.

4. Vehicles used in dusty or field conditions or deep wading: More frequent attention to the air cleaner will be required.

5. Vehicles used in areas where fuel quality is poor: Where vehicles are used in these areas, the fuel sedimentor may require draining at more frequent intervals.

Vehicle Transportation Aids and Vehicle Storage - New Vehicle Storage

Description and Operation

INTRODUCTION

Standards

Vehicles may require storage for varying periods of time before the customer takes delivery. It is essential that a new Land Rover vehicle is stored correctly, in order to ensure total customer satisfaction after the car is removed from storage and prepared for sale.

This document establishes the MINIMUM STANDARDS required of franchise holders and appointed vehicle storage companies by Land Rover for the storage of new vehicles, and may only be deviated from with the Company's agreement. Any concerns should be discussed with your Franchise Regional Manager.

This information should be used in conjunction with the relevant Pre-Delivery Inspection (PDI) information.

AREAS OF RESPONSIBILITY

Preventative Measures

Adequate preventative measures must be taken to ensure that each vehicle in stock is maintained in peak condition.

ARRIVAL

It is your responsibility to notify delivery companies immediately of any losses and/or transit damage identified on receipt of the vehicle.

Where applicable, Vehicle Condition Reports (VCR's) must be endorsed accordingly, otherwise it is unlikely that the transit insurance company will accept any claims for missing items or damage rectification.

STORAGE

Correct preparation of vehicles for storage is essential. The majority of new vehicles leaving Land Rover are provided with the appropriate protection for transit. It is your responsibility to ensure that a vehicle storage department, or specialist company, is sufficiently equipped to undertake the storage requirements endorsed in this publication.

Whilst vehicles are in storage, any deterioration or damage sustained is the sole responsibility of the storage operator and must NOT be made the subject of a warranty claim.

DISPATCH

When removing vehicles from storage, you are responsible for procedures that ensure they are in a safe and roadworthy condition.

VEHICLE STORAGE

VEHICLE IDENTIFICATION UPON ARRIVAL

1. **A New Vehicle Storage History Sheet must be raised for every new vehicle upon arrival and should remain inside the vehicle until despatch. This must contain a record of the vehicle condition and any rectification work carried out during the storage period (see Storage History Sheet).**
2. Vehicles must be checked for correct specification and/or shortages. Where this is incorrect the required parts should be procured through normal channels and costs claimed back via the DDW system using the appropriate shortage or misbuild program code.
 - Claims for rectifying incorrect specification items and/or shortages must be made in accordance with the conditions detailed in Section C of the Warranty Policy and Procedures Manual.
 - **NOTE:** All missing items should be recorded on the New Vehicle Storage History Sheet and countersigned by an authorized person.
3. Vehicles must be inspected for transit damage.
 - Delivery damage is not the responsibility of Land Rover and must not be made the subject of a warranty claim. It is the responsibility of the Dealer/Retailer or vehicle storage company to identify any such damage at the time of the new vehicle receipt and to ensure that the full details are recorded on the Delivery Receipt. Claims for rectification of such damage must be directed to the Delivery Company.
 - Failure to notify the Delivery Company of damage details at the time of vehicle delivery will result in claims for subsequent rectification being rejected.
 - Warranty claims for damage repairs may only be submitted where Land Rover's responsibility is clearly indicated. Examples falling into this category are paintwork damage during the fitment of trim or outward facing dents on the door skin.
 - Warranty claims will not be accepted for any transit damage repaired or identified after the vehicle has been placed into service.
4. A label should be suitably affixed to the inside of the windshield indicating the date of vehicle arrival. Labels must not be stuck directly to the windshield but placed in a transparent licence holder, or alternatively stuck to a piece of cling film and attached to the inside of the windshield. This will avoid damage to the windshield when removing labels.
5. Ignition and door keys must be suitably labelled and when the vehicle is locked, they must be held in a suitably identified and secure office. All key numbers must be recorded on the New Vehicle Storage History Sheet. All keys, including spares, must be removed from the vehicle during storage for security reasons.

VEHICLE INSPECTION

The entire vehicle exterior must be inspected and, if necessary, washed thoroughly, including the underside and

wheel arches, to remove all dirt and mud deposits.

Any defects found during inspection must be rectified before the vehicle is stored.

Ensure that bumper and body side protectors are correctly located.

There are two main methods of vehicle storage:

1. Collective storage of several vehicles in an open compound.
2. Collective storage of a small number of vehicles, normally at the dealership/retailer and possibly under cover.

IDEALLY ALL VEHICLES SHOULD BE STORED IN A WELL VENTILATED AND TEMPERATURE-CONTROLLED BUILDING.

However, it is recognised that the majority of all vehicle storage is done in an open compound. Therefore, the following site requirements must be observed and should be authorised with your Regional Manager.

1. The site should have a well-drained hard standing surface, preferably concrete or tarmac, which is free from undergrowth.
2. The site and driveways must be kept clean and clear of any obstruction at all times.
3. The site must be enclosed by a secure intruder-proof perimeter fence and the gates securely locked. The site should be under daily surveillance, with unauthorised access prevented at all times.
4. The site should be located away from areas subject to industrial fallout, sea spray or wind-blown dust and sand. Where fallout conditions are unavoidable it will be necessary to monitor the exterior condition of all cars and wash as necessary. Heavy contamination may require vehicles to have the transit protection coating removed and problems arising from the contamination rectified. Once the transit coating has been removed, the vehicle must not be returned to outdoor storage unless it is fully covered to provide the necessary protection against deterioration.
5. Mains water, tyre inflation and battery charging facilities must be available on site.
6. Hedges, shrubs and trees adjacent to the site should be kept trimmed and clear of parked vehicles.
7. Vehicles must not be parked under trees, overhead cables or other overhanging structures as bird droppings or other types of contamination could occur.

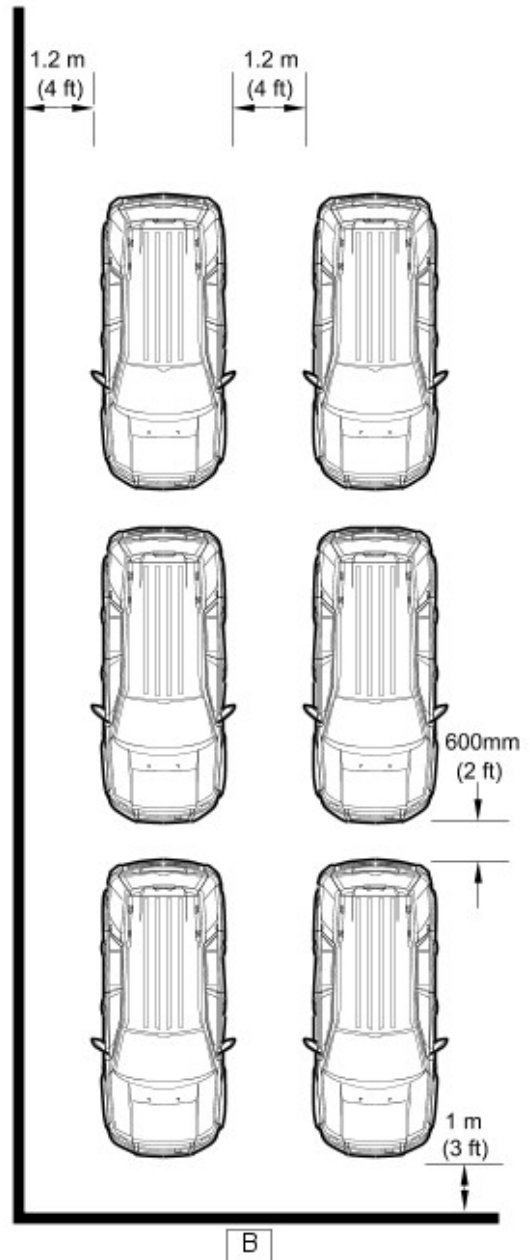
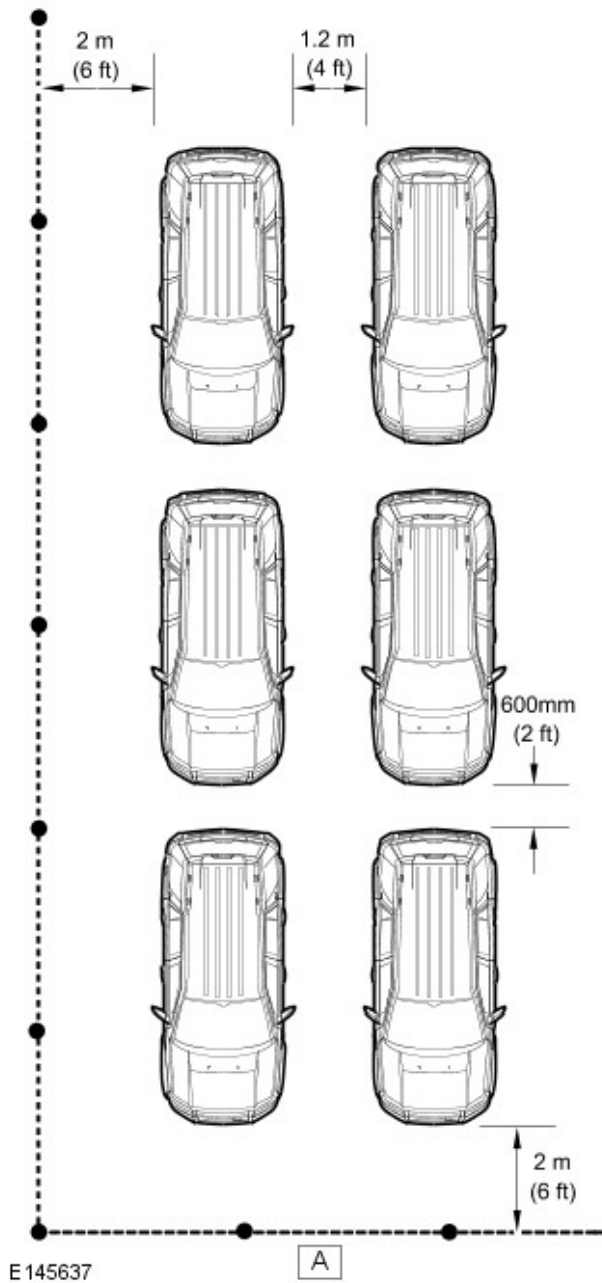
VEHICLE PARKING

Vehicles must be parked tidily with a minimum of 600 mm (2 feet) between bumpers, front and rear.

There must be a full doors width clearance between the driver's door and any adjacent vehicle or obstruction.

Vehicles must be parked at least 1.2 metres (4 feet) away from any interior wall or, for outside storage, at least 2 metres (6 feet) away from any perimeter fence.

Vehicles must be moved on a first-in-first-out basis, subject to specification.



Item	Part Number	Description
A	-	Storage Outside
B	-	Storage Inside

FACILITIES AND EQUIPMENT

Car wash facilities.

Tyre inflation equipment with calibrated gauge 0 - 4.05 bar (0 - 60lb/in²).

All equipment used must be functionally capable of meeting the compliance requirements. Please refer to the approved equipment document.

Jacking equipment.

Wheel brace.

The following materials must be available and must meet Land Rover specifications:

- Engine oil.
- Transmission fluid.
- Brake fluid.
- Distilled water.
- Windscreen washer fluid.
- Anti-freeze.

Access to trailer/recovery vehicle (Vehicles should not be towed).

Comprehensive filing system for vehicle records.



NOTE: Tools supplied with the vehicle must not be used for any rectification work prior to the prospective purchaser.

OPERATIONS REQUIRED DURING STORAGE PERIOD

REFERENCE CHART

The following chart gives a quick reference to the requirements necessary during the time a vehicle is in storage. A detailed explanation of each operation is provided on subsequent pages.

If a vehicle remains in storage after 150 days from receipt of vehicle, a new form must be started.

OPERATION	UPON RECEIPT	30 days from receipt	60 days from receipt	90 days from receipt	120 days from receipt	150 days from receipt
1. IDENTIFICATION	X	.	.	.	.	.
2. INSPECTION	X	X	X	X	X	X
3. BATTERIES	X	X	X	X	X	X
4. COOLING SYSTEM	X	X	X	X	X	X
5. ENGINE	X	X	X	X	X	X
6. AIR CONDITIONING	X	X	X	X	X	X
7. TIRES	X	X	X	X	X	X
8. PARKING BRAKE	X	X	X	X	X	X
9. DOORS, WINDOWS AND VEHICLE INTERIOR	X	.	.	X	.	.
10. WINDSHIELD WIPER BLADES	X	.	.	X	.	.
11. PAINTWORK	.	.	.	.	.	.
All markets	REMOVE 'WRAPGUARD' AFTER 180 DAYS					

STORAGE OPERATIONS

BATTERIES

To make sure the correct standard of battery care, please see the 'Battery Care Requirements for New Vehicles (Dealer and Retailer).

For requirements for receipt of a new vehicle, new vehicle storage and replacement batteries please see the battery care requirements for new vehicles (dealer and service)

Place a label on the vehicle (or on New Vehicle Storage History Sheet) to indicate when a recharge will be required. The battery condition should be checked prior to starting and/or moving the vehicle.

For additional information, refer to: [Battery Care Requirements](#) (414-00 Battery and Charging System - General Information, Description and Operation).

The storage, handling and charging of batteries is not dangerous provided that the relevant battery manufacturers' recommendations are followed. However, a suitable storage and charging facility must be available and should be in accordance with local legal requirements.

HYBRID ELECTRIC VEHICLE (HEV) BATTERY PACK



CAUTION: Always keep the high voltage battery charged, failure to do so may cause damage to the battery.

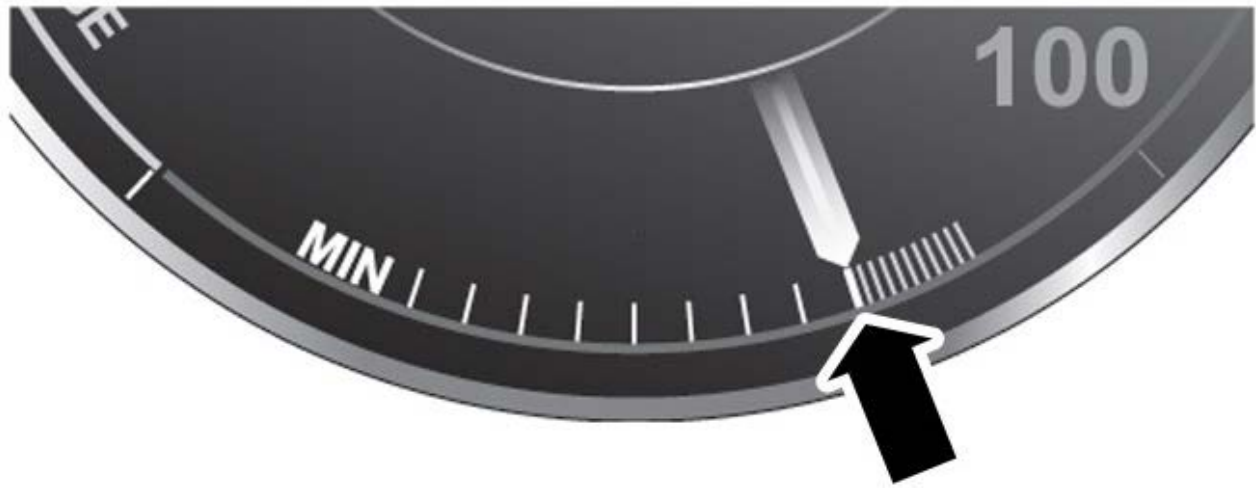


NOTE: In extreme cold climate conditions (circa -30°C), store the vehicle in a warmer area to protect it from the environment.

If the vehicle is not used for 30 days or more, it is essential that the high voltage battery is charged. For longer storage periods, charge the high voltage battery every 30 days.

Charge the HEV battery pack as follows:

- Start the vehicle (using the engine Start/Stop button and brake pedal sequence).
- To view the Tachometer, open the instrument cluster menu, then select Instrument Display, Hybrid Content and Reduced Hybrid Display.
- Raise the engine to approximately 1500 rpm.
- When the battery charge level has reached the position indicated in the following graphic, the vehicle may be switched off.



E161503

COOLING SYSTEM

It is ESSENTIAL to maintain the concentration of anti-freeze at the factory-fill condition. Failure to do so may cause oxidation of the cooling system leading to corrosion of the engine and heater.

The coolant mixture specification is 50% plain water and 50% Land Rover anti-freeze, Coolant and Corrosion Inhibitor for frost protection down to -36°C (-33°F).

Coolant specific gravity must be checked monthly using a high quality hydrometer with an appropriate range. At a coolant temperature of 15°C (60°F), the correct specific gravity reading is 1.074. If the coolant is above or below this temperature, the following corrections will enable accurate specific gravity readings to be taken:

- For higher temperatures: add 0.004 to the specific gravity for each 5°C (10°F).
- For lower temperatures: deduct 0.004 from the specific gravity for each 5°C (10°F).

If the specific gravity is correct but the cooling system requires additional coolant, mix anti-freeze and water to the correct proportions and to the correct volume, then add to the system. Examine for leaks from the radiator and hoses and rectify as necessary.

If the check shows that the coolant contains less than the required anti-freeze content, proceed as follows:

1. Carefully examine the radiator and all hoses for leaks and security of hose clamps.
2. Remove the header tank pressure cap and drain the cooling system as instructed in the relevant service manual.
3. Mix anti-freeze and water in the correct proportions and to the correct volume.
4. Close the drain plug and add the coolant until the level in the header tank is steady at 'MAX'.



WARNING: DO NOT REMOVE THE HEADER TANK PRESSURE CAP WHILE THE ENGINE IS HOT.



CAUTION: DO NOT use radiator anti-freeze solution in the windshield washer equipment or paint work will be damaged.

ENGINE OIL LEVEL

Where fitted, remove the dipstick and check the engine oil level. If necessary, top up with the approved grade of engine oil.

On vehicles with an electronic oil level and temperature sensor, check the engine oil level using the procedures described in the applicable Workshop Manual.

ENGINE AND AIR CONDITIONING SYSTEM

If the vehicle is stored for 30 days or more, the engine and air conditioning system should be operated using the following process:

- Set the ignition to power mode 6
- Ensure the air conditioning system is switched off
- Start the engine and run for 1 minutes at idle
- Raise the engine speed to 2000 RPM for 5 minutes
- Return the engine speed to idle
- Set the air conditioning temperature to 22° and the fan blower speed to 75% of the maximum blower speed
- Switch on the air conditioning system
- Ensure all the instrument panel air ducts are open
- Run the air conditioning system for minimum of 5 continuous minutes with the engine at idle

TIRES

For storage purposes, tires on fitted wheels must be inflated to and maintained at a maximum pressure of 3.60 bar

(52 lbf/in²).



NOTE: Wheels must be rotated through 90 degrees in the forward direction monthly, to ensure that the tread is rotated evenly during the storage period.

The spare wheel tire pressure must be maintained at the appropriate pressure specified in the Owners Handbook.

Tire condition should be inspected and defective tires replaced prior to removal from storage.

Guidance for Rotation of Tires

To ensure tires are rotated through a minimum of 90 degrees, apply a chalk mark on a front wheel tire wall at the current centre contact point with the road surface. Move the car forwards until the chalk mark is at the horizontal position. This process can be applied to a single car or to a row of vehicles and should ensure that all four wheels on each vehicle is rotated by 90 degrees.

PARKING BRAKE

Vehicles with Manual Park Brake

The parking brake must NOT remain 'on' during storage.

After parking:

- Manual transmission vehicles: select first or reverse gear and release the parking brake
- Automatic transmission vehicles: select 'P' and release the parking brake.

Vehicles with Electric Park Brake (EPB)

For vehicles with EPB, the park brake will remain locked onto the brake disc during storage. Refer to the Workshop Manual, General Procedures, Parking Brake and Actuation for EPB release procedure.



NOTE: For all vehicles with an Electronic Parking Brake (EPB), on manual transmission vehicles, first or reverse gear must be selected before releasing the EPB. On automatic transmission vehicles 'Park' (P) must be selected before releasing the EPB.

Where possible the EPB must not remain on during storage. If, for any reason, it is not possible to perform the release procedure, the operation of the EPB must be checked/monitored monthly during the road wheel rotation procedure.

AIR SUSPENSION (IF FITTED)

During storage the air suspension system should be left in the transit mode. No other checks are necessary during storage for this system.

DOORS, WINDOWS AND VEHICLE INTERIOR

Doors, windows, bonnet, boot lid and fuel filler flap must be closed and locked to prevent water and moisture ingress. A check should be done each month for any signs of water ingress into the cars interior and luggage compartment. Any water ingress points should be rectified immediately.

WINDSHIELD WIPER BLADES

Depending on the model, where possible move the wiper arms and blades away from the windshield and leave in the extended position.

PAINTWORK

Paintwork can be damaged if the protective coating remains on the vehicle for an extended period of time. In markets with high levels of ultraviolet light (tropical or semi-tropical conditions), the protective coating **MUST** be removed after six months. For all other markets the protective coating **MUST** be removed after nine months.

If storage is subsequently continued, the vehicle must be kept under cover and should be washed regularly (at least every month).

REMOVAL FROM STORAGE

PROCEDURES

Before removal from storage area, all fluid levels including coolant, hydraulic fluids and lubricating oils must be checked and replenished where necessary. Where a substantial loss has occurred the cause must be traced prior to moving the vehicle.

The New Vehicle Storage History Sheet must be checked and safety related faults rectified before the vehicle is moved from the storage site. These checks are essential to ensure that the vehicle is safe to drive.

Tires must be adjusted to the pressures recommended in the relevant service manual or owners handbook.

Reconnect the battery negative terminal (when applicable).

Check the operation of the lighting and signalling equipment.

TRANSIT PROTECTION COATING (WHERE FITTED)

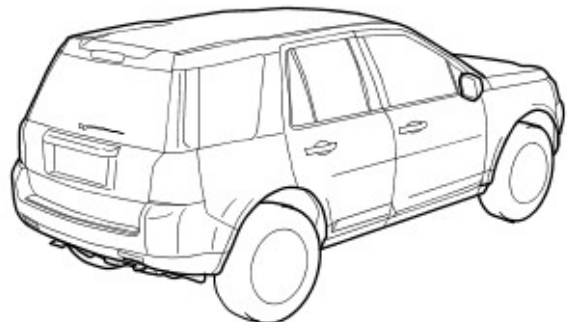
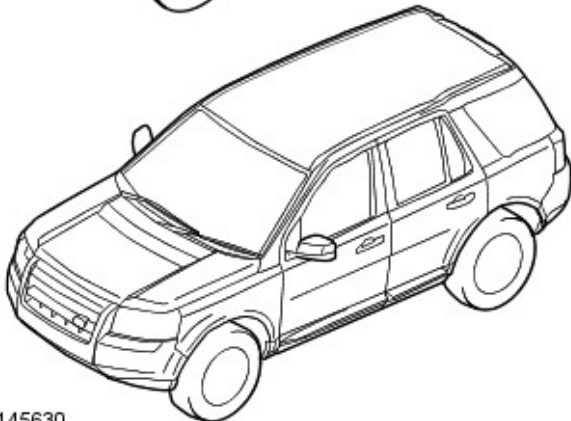
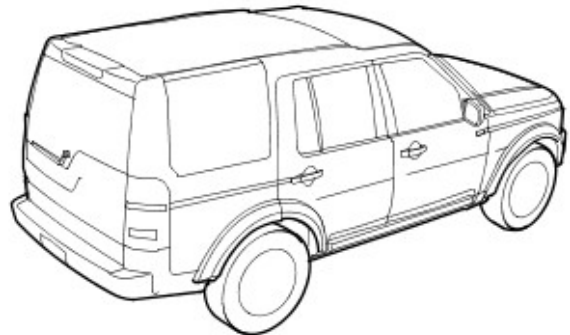
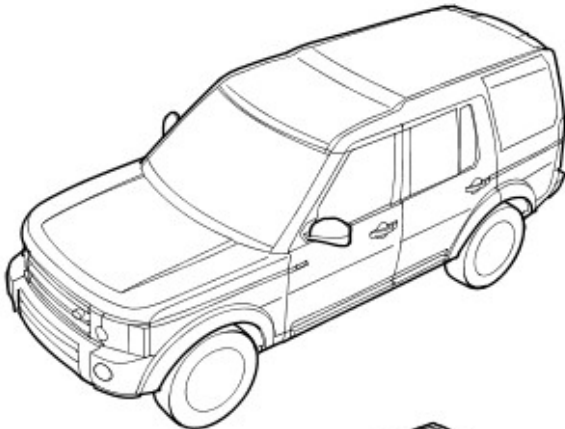
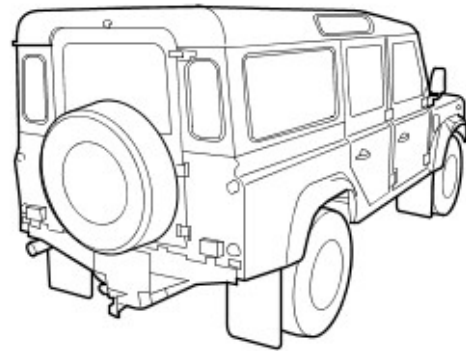
REMOVAL OF TRANSIT PROTECTION COATING

During storage, the protective coating will collect airborne dirt and grit. Great care must be taken when removing the transit coating so that damage to the paint film and exterior trim is avoided.

Removal of the transit protection coating should be carried out in accordance with the procedure detailed in the Pre-Delivery Inspection (PDI) information.

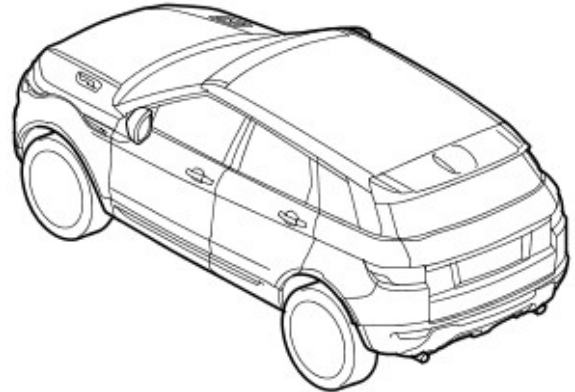
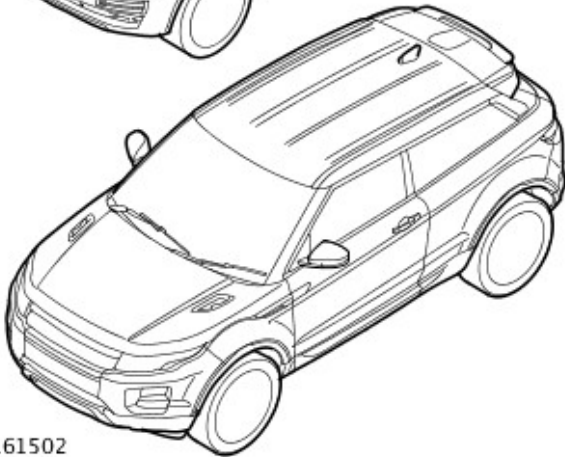
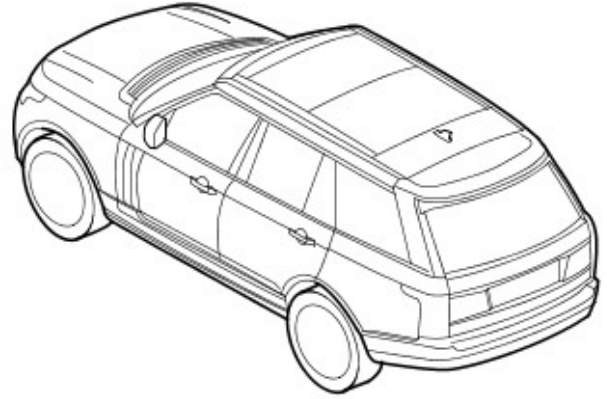
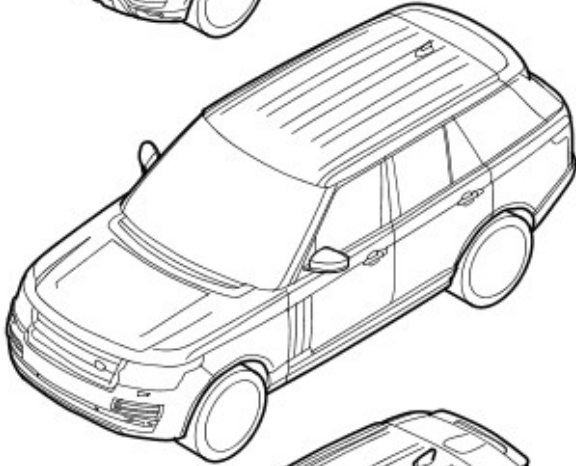
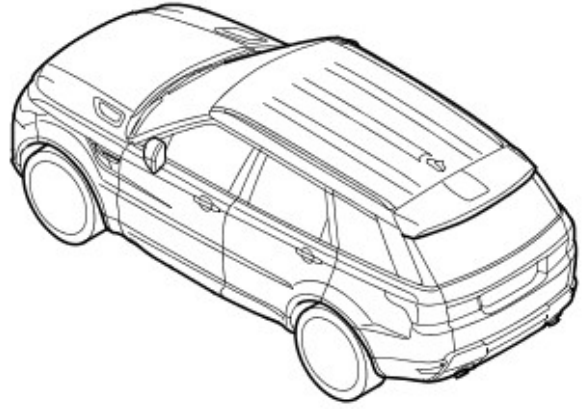
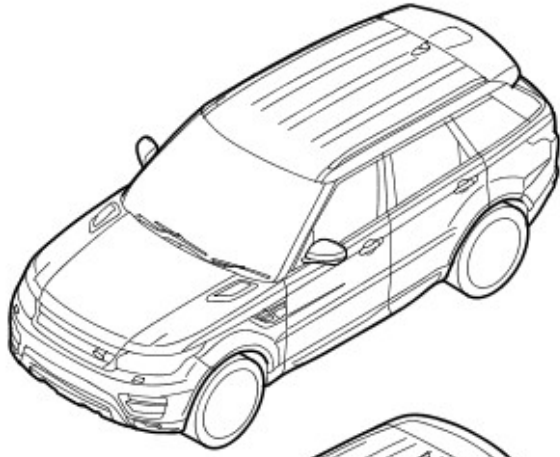
When the vehicle is dispatched from the storage area, remove the New Vehicle Storage History Sheet and file in the vehicle records.

STORAGE HISTORY SHEET



E145630

STORAGE HISTORY SHEET (Continued)



E161502

Vehicle Transportation Aids and Vehicle Storage - New Vehicle Storage Form

Description and Operation

Before carrying out any battery assessments, refer to the battery care requirements.

For additional information, refer to: [Battery Care Requirements](#) (414-00 Battery and Charging System - General Information, Description and Operation).



NOTE: If the vehicle has been started within the previous 24 hours the surface charge must be removed prior to any battery assessment

This form is to be used to record the battery condition for vehicles and parts by the dealer / retailer prior to handover to the customer. If the vehicle is kept in storage longer than 150 days, a new form must be started.

For AGM batteries Midtronics EXP 1080 / GR1 tester must be used.

Follow the instructions on the Midtronics EXP 1080 / GR1 tester to assess battery condition.

TESTER RESULTS	ACTION
GOOD BATTERY	Return to service.
GOOD RE-CHARGE	Fully charge battery and return to service.
CHARGE AND RE-TEST	Fully charge battery. Remove surface charge. Re-test battery. If same result replace battery.
REPLACE BATTERY OR BAD CELL BATTERY	Verify surface charge removed. Disconnect battery from vehicle and re-test. If result repeats after surface charge removal, replace battery. DO NOT RECHARGE.
UNABLE TO DO TEST	Disconnect battery from vehicle and re-test.

		Voltage	Date	Signature
Vehicle Arrival				
Initial battery voltage and date of reading taken	Midtronics Code			
	Battery Voltage			
	Recharge Details (if any)			
	Post Charge Voltage			
30 days from initial battery reading	Midtronics Code			
	Battery Voltage			
	Recharge Details (if any)			
	Post Charge Voltage			
60 days from initial battery reading	Midtronics Code			
	Battery Voltage			
	Recharge Details (if any)			
	Post Charge Voltage			
90 days from initial battery reading	Midtronics Code			
	Battery Voltage			
	Recharge Details (if any)			
	Post Charge Voltage			
120 days from initial battery reading	Midtronics Code			
	Battery Voltage			
	Recharge Details (if any)			
	Post Charge Voltage			
150 days from initial battery reading	Midtronics Code			
	Battery Voltage			
	Recharge Details (if any)			
	Post Charge Voltage			
Pre Delivery Inspection (PDI)	Midtronics Code			
	Battery Voltage			
	Recharge Details (if any)			
	Post Charge Voltage			
Customer Handover	The battery voltage MUST be 12.55 volts or above			

Please make sure that any transit relays are refitted and / or the vehicle is put into transportation mode if the vehicle is stored

Transit relay removal / vehicle placed in normal mode should only be completed a maximum of 72 hours prior to handover to customer

STORAGE HISTORY SHEET

--	--	--

MODEL:		COLOR:	ARRIVAL DATE:
KEY NUMBER:			
VIN:			

OPERATIONS	IDENTIFICATION	INSPECTION	COOLING SYSTEM	ENGINE	TIRES	PARKING BRAKE - OFF	DOORS, WINDOWS AND VEHICLE INTERIOR
UPON RECEIPT
30 DAYS
60 DAYS
90 DAYS
120 DAYS
150 DAYS
OPERATIONS	WINDSHIELD WIPER BLADES	PAINTWORK	COMMENTS ON VEHICLE CONDITION	INSPECTORS SIGNATURE AND DATE			
UPON RECEIPT	.	.	NOTE: RECORD ANY VEHICLE BODY DAMAGE ON SILHOUETTES THAT FOLLOW				
30 DAYS	.	.	.				
60 DAYS	.	.	.				
90 DAYS	.	.	.				
120 DAYS	.	.	.				
150 DAYS	.	.	.				

Pre-Delivery Inspection Manual - Preliminary

Description and Operation

1. Transportation: Make sure that the vehicle has arrived with the transportation seals intact. Remove and discard the transportation seals.

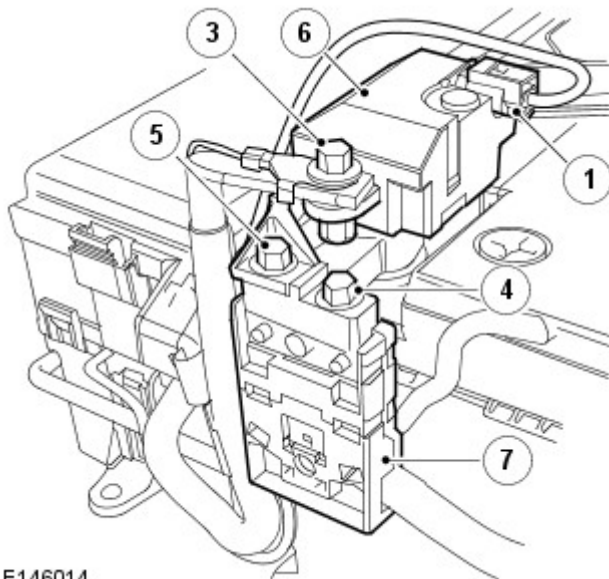
1.1 During production of the vehicle, a transportation relay is fitted to the battery positive terminal. This is to minimize battery drain during vehicle storage and delivery. To start the vehicle when a transit relay is fitted, press the hazard warning switch. This activates the transit relay to power-up and allow the engine to be started. If the ignition is turned on but the engine is not started the vehicle will return to transport mode after 15 seconds. After parking the vehicle in a work bay, remove the keys.

1.2 Check the integrity of factory fitted door and tailgate closure seals. Should a seal be broken or missing, make sure the tool kit and spare wheel are present. Also check that no internal damage to trim has occurred.

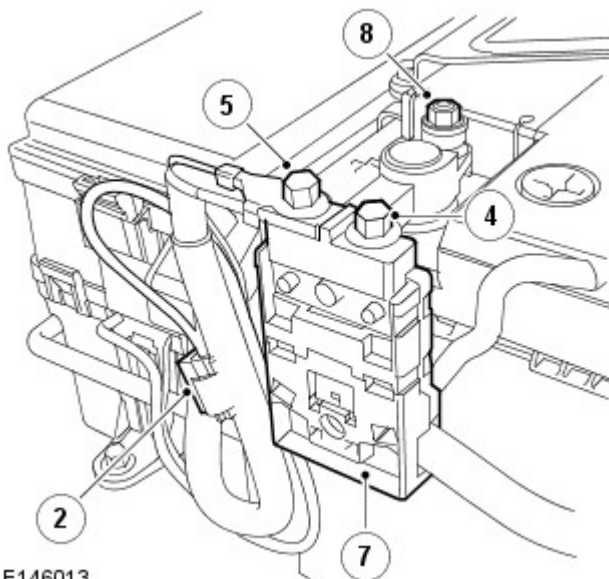
1.3 Remove door and tailgate closure seals.

1.4 Open bonnet for access.

2. Vehicle Transportation Relay: A transit relay is fitted to the battery. This allows the vehicle to be driven when necessary, but isolates the vehicle during transit and storage to prevent the battery becoming discharged.



E146014



E146013

2.1 To remove the transit relay:

2.1.1 Disconnect the battery negative lead from the battery negative terminal.

2.1.2 Disconnect the electrical connector (1) from the transit relay. Secure the electrical connector to the stowage position (2) provided on the main wiring harness.

2.1.3 Remove the bolt (3), that secures the battery positive cables to the top of the transit relay. Discard this

bolt.

2.1.4 Remove the two bolts (4), and (5), that secure the transit relay to the mega-fuse assembly (7). Discard the transit relay (6).

2.1.5 Replace the bolts (4), and (5), to the mega-fuse (7). Make sure that all the positive leads removed from the top of the transit relay (6), are reconnected to the top of the mega-fuse (7). Tighten the bolts finger tight at this point.

2.1.6 Loosen the battery positive terminal pinch bolt (8), twist the mega-fuse clockwise until it stops hard against the battery.

2.1.7 Torque the bolts (4), and (5), to 12 Nm (9 lb.ft).

2.1.8 Twist the mega-fuse back to the straight position, and torque the battery positive terminal pinch bolt (8), to 6 Nm (4 lb.ft).

2.1.9 Reconnect the battery negative terminal, and torque to 6 Nm (4 lb.ft). Make sure this is carried out in one clean connection, this will avoid creating electrical 'spikes' in the system.

2.1.10 After the transit relay has been removed and the battery re-connected, a Battery Monitor System (BMS), reset will need to be carried out using SDD.



NOTE: Information regarding the BMS reset can be found in the Battery Care Manual on GTR.

CAUTIONS:



Damage to battery. The battery terminal posts have a rotational torque threshold of 9 Nm (6 lb.ft). Extreme care MUST be observed when torquing the bolts (4), and (5), to 12 Nm (9 lb.ft).



Damage to equipment. Failure to remove the transit relay before carrying out the PDI checks may result in damage to the SDD equipment.



Damage to vehicle. Do not disconnect the battery while the ignition is switched on:

- Electrical modules will not be allowed to shut down correctly and will result in fault codes being stored and spurious faults being induced.
- Permanent damage to the instrument cluster may also result if the battery is disconnected with the ignition switched on.

3. Battery Care Requirements

Make sure the correct standard of battery care is applied to the battery, For additional information, refer to: [Battery Care Requirements](#) (414-00 Battery and Charging System - General Information, Description and Operation).

NOTES:



All equipment used must be functionally capable of meeting the compliance requirements.



The vehicle may need to be taken out of transit mode to carry out the preconditions.

3.1. Carry out the battery test process shown below.

It is recommended that this test is conducted at least 24 hours after the vehicle engine has been run or the battery charged to avoid the need of surface charge removal. If time constraints make this unacceptable then the surface charge must be removed.

Surface Charge Removal

A vehicle which has had its battery charged or been driven in a 24 hour period before the test, must have its surface charge removed.

- Turn on the ignition but do not start the vehicle
- Switch on the headlamps on high beam for a minimum 3 minutes
- Switch off the headlamps
- Wait a minimum of 5 minutes before recording test results for any battery measurements

Battery Test

The battery may be tested either on a bench or on the vehicle.

The battery condition must be checked in accordance with the battery test process utilizing an appropriate tester as outlined in **the equipment section (Section 5)**

For additional information, refer to: [Battery Care Requirements](#) (414-00 Battery and Charging System - General Information, Description and Operation).



NOTE: The midtronics code must be recorded on the form.

Any actions must be carried out in accordance with the table shown in the **determining battery condition section (Section 6)**

For additional information, refer to: [Battery Care Requirements](#) (414-00 Battery and Charging System - General Information, Description and Operation).

The details must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.

For additional information, refer to: [New Vehicle Storage Form](#) (100-11 Vehicle Transportation Aids and Vehicle Storage, Description and Operation).



CAUTION: DO NOT connect the tester to any other circuit or chassis point other than the battery negative terminal.

3.2. If the battery is disconnected again after conducting the PDI, certain vehicle electrical systems that are calibrated during the PDI will lose the calibration and will require resetting again once the battery is reconnected. This may include the PDI application and Market configurations shown in section 11.

3.3. The battery must be tested to determine that the battery is in good condition, and there is sufficient charge to carry out the PDI. Certain electrical systems require a precise voltage to operate correctly.

- Check the battery positive terminal cable and BMS clamp pinch bolts are tightened to 6 Nm.



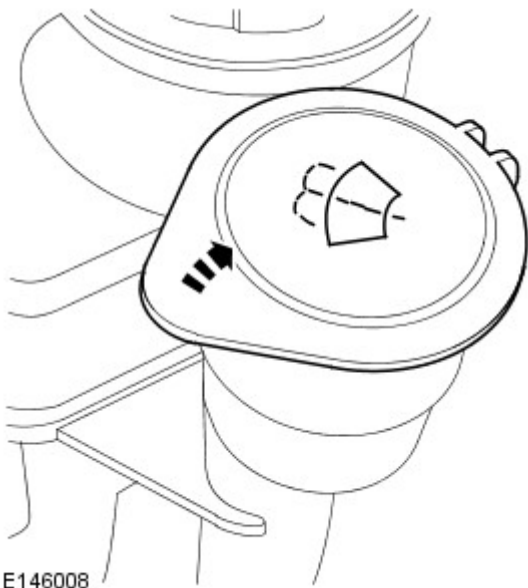
NOTE: It is imperative, to make sure correct vehicle functionality, that the battery terminal is pushed fully home and is tightened to the specified torque figure.

- Connect the Land Rover recommended battery tester to the battery.
- Check and record on the PDI check sheet, the battery condition as indicated by the Land Rover recommended battery tester.



NOTE: The voltage check must be carried out before connecting the diagnostic equipment. Failure to do this may result in vehicle configuration failure.

3.4. Check security of battery carrier clamp and that it is tightened to a torque of 5 Nm (4 lb.ft).



4. Check/top-up the level in the windscreen washer reservoir. Top-up the reservoir using a mixture of an approved windscreen washer fluid and water until the level is to the bottom of the gauze filter in the reservoir filler neck.

5. Check/top-up all under-hood fluid levels. Investigate cause of any low level readings.

5.1 The engine must be switched off and allowed to stand for a period of at least 10 minutes for petrol engines, and 20 minutes for diesel engines, before checking the oil level. Checking the oil level soon after the engine has been run will provide a false low level reading, which may result in overfilling. To allow for the actual oil level to be verified, a service mode exists to give access to live oil readings. In order to have a correct reading, the following conditions must be met:

- The vehicle **MUST** be parked on a level area of ground. The sensor installation is very sensitive to vehicle tilt in the fore-aft direction: 0.5 degree vehicle tilt corresponds to an up to 0.5 liter measurement error.
- The gear selector must be in the 'PARK' (P) position and the hood must be open.
- A minimum time of **10 minutes for petrol engines**, and **20 minutes for diesel engines**, **MUST** be allowed to pass after running the engine. This drain-down time is to allow the oil to return to the sump.



NOTE: If the Oil Level Display on the Message Center displays: 'not available', not enough time has elapsed to allow the oil to drain back into the sump.

To access service mode, the following procedure should be followed:

- 1 With the ignition 'ON', engine not running, use the controls on the steering wheel, select on the Message Center: Service Menu > Oil Level Display
- 2 Press the cruise control CANCEL button twice within 2 seconds.
- 3 The instrument pack display will revert back to the normal display in the trip computer.
- 4 Using the controls on the steering wheel, access the Oil Level Display again.

Messages to the right of the gauge will advise of any action that may need to be taken. If the oil level is below the required operating range, a message advising how much oil to add will be displayed; i.e., 'Add 0.5 liters'. If necessary, add the recommended quantity of oil then re-check the level.



CAUTION: Serious damage to the engine and components will result from overfilling engine with oil. When filling the engine with oil, make sure any spilt oil is immediately cleaned from the engine, components or bodywork.

- 5 With the ignition 'ON', engine not running, remove the oil filler cap.



NOTE: Petrol Engines: SAE 5W-20 meeting Land Rover specification WSS M2C925-A (Castrol SLX Professional OE 5W-20).

Diesel Engines: SAE 5W-30 meeting Land Rover specification WSS M2C934-B (Castrol SLX Professional OE 5W-20).

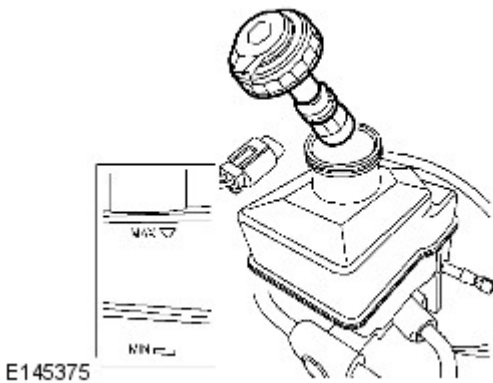
- 6 If the oil level is within the required operating range, the message 'Level OK' will be displayed.
- 7 If indicated by the Message Center oil level display, add the appropriate quantity of oil (as advised). Wait 5 minutes to let the oil level stabilise and re-check the level.
- 8 Clean up any oil spilt during the top-up process.
- 9 Install the oil filler cap.



CAUTION: The ignition must be left on during the top-up, so that the electronic dipstick can register and display the new oil level. This enables an accurate level recheck.



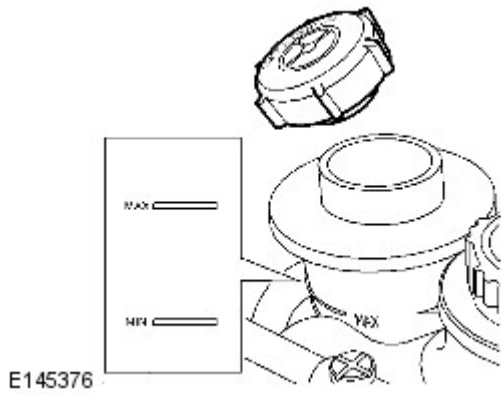
NOTE: Investigate the cause of any low fluid levels.



5.2 Remove the auxiliary battery box cover. Check the fluid level in the brake/clutch fluid reservoir. The level must be to the 'MAX' mark on the reservoir, top-up if necessary. Top-up the fluid level using Shell Donax YB DOT4 ESL brake/ clutch fluid to the 'MAX' mark on the reservoir. Install the auxiliary battery box cover.



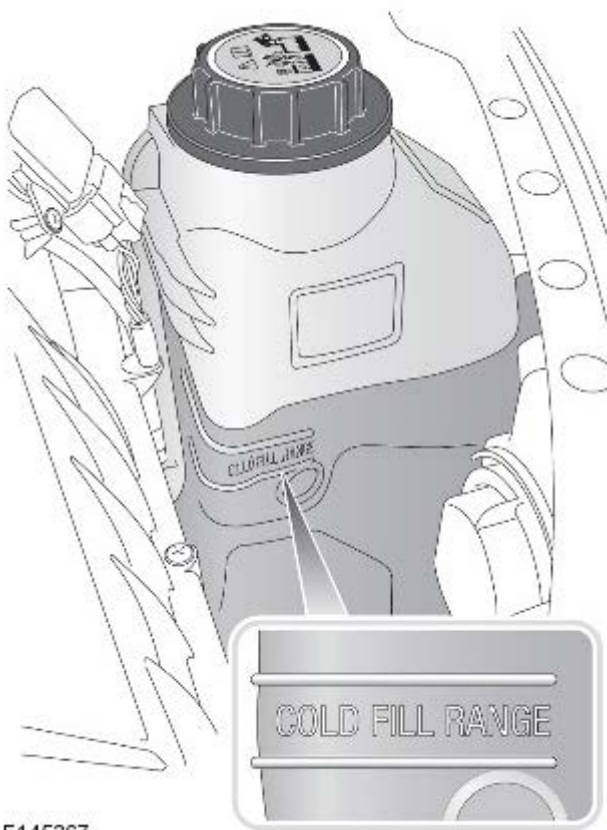
NOTE: Investigate the cause of any low fluid levels.



5.3 Check that the power steering fluid level is midway between the 'MAX' and 'MIN' marks on the fluid reservoir, top-up if necessary. Top-up the fluid level using Texaco cold climate fluid 14315.



NOTE: Investigate the cause of any low fluid levels.



5.4 Check the coolant level in the expansion tank. With the engine cold, the coolant level must be to the upper level of the cold fill range indicator mark, above the text on the side of the expansion tank. Ignore any coolant which may be visible in the top section of the tank.

5.5 Top-up the coolant to the upper level mark on the tank using a 50% mixture of water and Havoline Extended Life Coolant (XLC) or any ethylene glycol based anti-freeze containing no methanol with only Organic Acid Technology (OAT) corrosion inhibitors. Install the expansion tank filler cap, tighten the cap until the ratchet is heard to 'click'.

NOTES:



Anti-freeze concentration MUST be maintained at 50%.



Investigate the cause of any low fluid levels.

5.6 Check/record the specific gravity of the coolant using a hydrometer. The specific gravity of the coolant at 20oC (68oF) must be 1.068:

- Loosen the expansion tank filler cap to relieve pressure in the cooling system.
- Tighten the expansion tank filler cap.

- Remove the expansion tank bleed screw.
- Extract enough coolant to enable the gravity to be checked.
- Install the expansion tank bleed screw.
- Top-up the coolant.

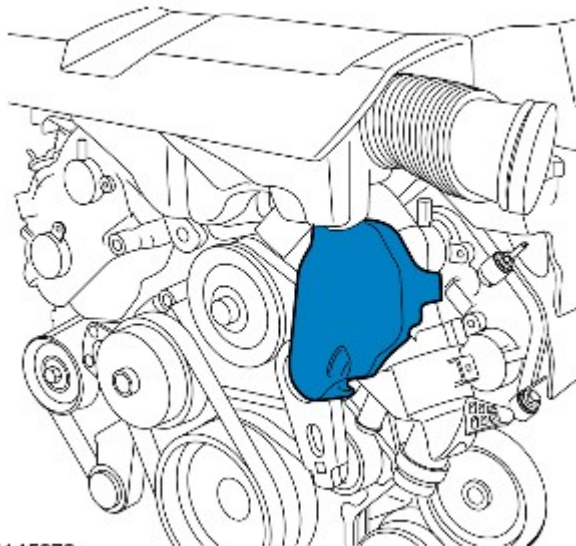


WARNING: Risk of injury. Since injury such as scalding could be caused by escaping steam or coolant, do not remove, or loosen, the filler cap from the coolant expansion tank while the system is hot.



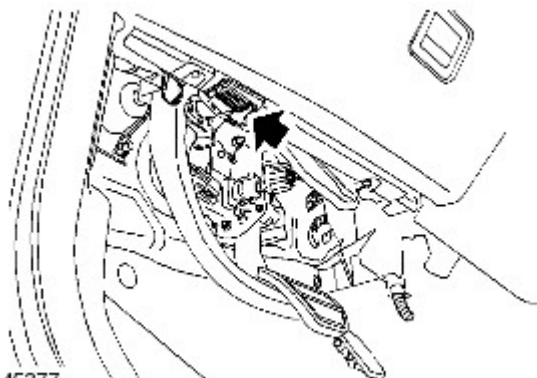
NOTE: A suitable hydrometer is available from the Equipment Program, Part Number FT 2030.

6. Make sure that the cold air deflector has been fitted on vehicles with the 3.0L supercharged engines, that operate in severe cold markets: **(Russia and Nordic countries)**.



E145378

6.1 The cold air deflector should be secured to both of the multi-stage thermostat (MST) hoses and visually flat to the front of the engine. If necessary, push on the center of the deflector to firmly seat between both MST hoses. Make sure the deflector is retained, and is flat to the front of the engine.



E145377

7. Connect the approved Land Rover battery power supply, then connect the Land Rover approved diagnostic equipment to the vehicle diagnostic socket. Use the latest version of SDD available.



NOTE: To charge the battery, connect the positive booster cable to the positive terminal on the battery. The negative booster cable **MUST** be connected to a suitable earth point on the vehicle. The earth point should be at least 0.5 meters, (20 inches) away from the battery and as far away as possible from any fuel pipes, brake pipes and moving parts.



CAUTION: Damage to vehicle. Failure to charge the battery in this manner will cause the BMS, to NOT register the charge increase. This can cause certain systems to be inhibited during the first few days of driving while the BMS recalibrates.

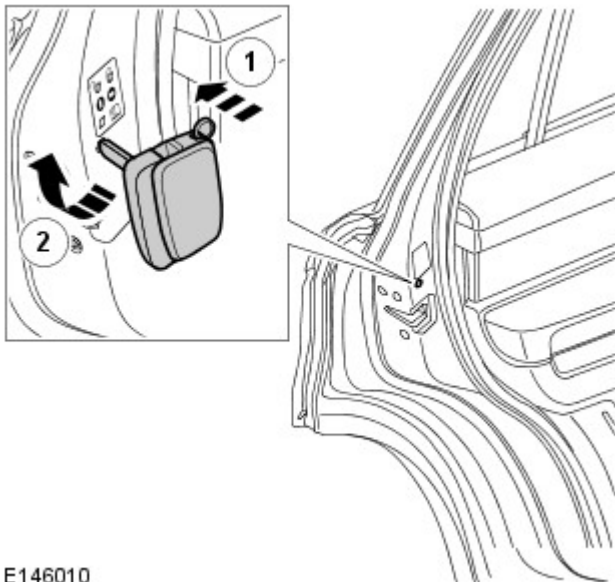
8. Using the diagnostic equipment, run the PDI application:

- Switch the ignition ON.
- Enter VIN and vehicle details into diagnostic equipment.
- Select the correct model year.
- Select 'Vehicle Configuration' icon.

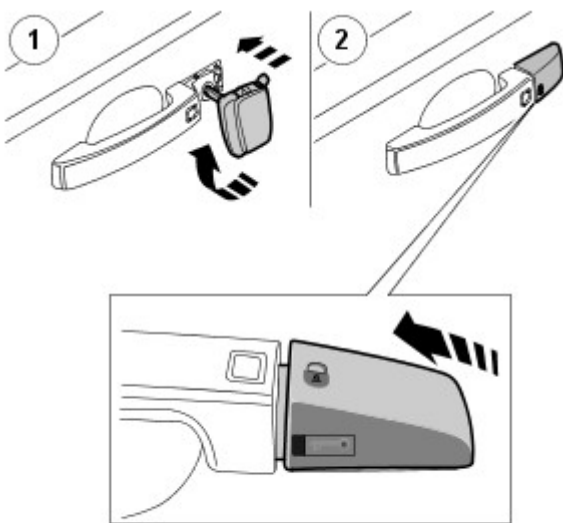
- Select 'Special Applications'.
- Select the 'Pre-delivery Inspection' Application.
- Follow the on-screen instructions. This will take the vehicle out of transit mode, sets the Service Interval Announcer (SIA), on petrol models 'flight recorder' data, and the EMS adaption values.

9. Using the diagnostic equipment, clear any fault codes:

- Select 'Diagnostic Trouble Code Monitor' icon.
- Confirm vehicle features.
- Select 'Diagnostic Trouble Code Monitor' icon.
- Select 'Complete Vehicle' to clear fault codes.



E146010



E146012

10. Check the doors, door locks and child safety locks for correct operation. Install the door lock cover.

10.1 Check operation of the internal 'master lock' and 'unlock switch' on the door pad.

10.2 Check the hood release and safety catch for correct operation.

10.3 Check the operation of every button on both the supplied key fobs, to make sure the expected functionality is carried out as indicated by each buttons legend.

To check the Passive Entry system, perform the following additional tests:

- Make sure both Smart Keys are taken at least 3 meters away from the vehicle.
- Lock the vehicle by pressing the lock button on one of the Smart Keys. Make sure that the locking process has been completed as evidenced by the door mirrors folding in.
- Wait 5 seconds.
- Take one Smart Key and bring it within close proximity (1 meter), of the drivers door, pull the door handle and make sure the vehicle unlocks.
- Close the drivers door and press the exterior lock button on the drivers door handle, whilst keeping the Smart Key in close proximity of the drivers door.
- Make sure the locking process has been completed as evidenced by the door mirrors folding in.

- Remove the Smart Key to at least 3 meters from the vehicle.
- Take the second Smart Key and bring it within close proximity (1 meter), of the drivers door, pull the door handle and make sure the vehicle unlocks.
- Enter the vehicle, place the first Smart Key on the center console and press both the start button and the brake pedal simultaneously. Repeat this process for the second Smart Key.
- If the vehicle starts with both Smart Keys, the Passive Entry and both Smart Keys are operating correctly.



E146009

10.4 Check for correct operation of the vehicle alarm system:

- Make sure all doors, windows and sunroofs are closed.
- Press the lock button on the Smart Key once. This will 'superlock' the vehicle (interior and exterior vehicle protection). Check that the indicator triple flashes for 10 seconds then continues to single flash.
- Press the unlock button and make sure the alarm has been disarmed.
- Press the lock button twice within three seconds. This will activate the perimetric alarm but **NOT** the interior space protection.
- Check that the indicator double flashes for 10 seconds, then continues to single flash.
- Press the unlock button and make sure the alarm has been disarmed.



NOTE: To carry out this procedure in the correct manner the battery charger should be removed.

Pre-Delivery Inspection Manual - Vehicle Interior

Description and Operation



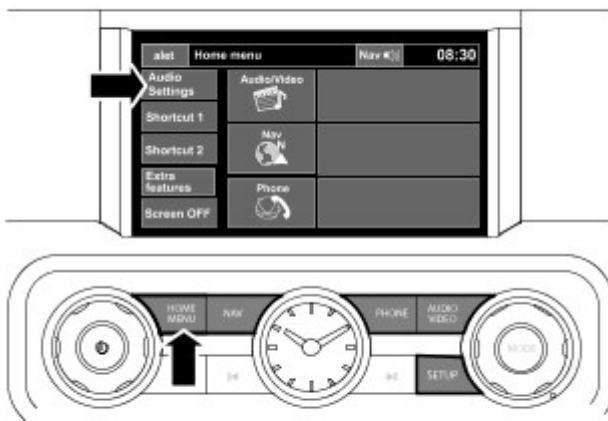
NOTE: The battery charger should be reconnected whilst carrying out the sections 11- 23 of this PDI manual.

To charge the battery, connect the positive booster cable to the positive terminal on the battery. The negative booster cable **MUST** be connected to a suitable earth point on the vehicle. The earth point should be at least 0.5 meters, (20 inches) away from the battery and as far away as possible from any fuel pipes, brake pipes and moving parts.



CAUTION: Damage to vehicle. Failure to charge the battery in this manner will cause the BMS, to NOT register the charge increase. This can cause certain systems to be inhibited during the first few days of driving while the BMS recalibrates.

11. Touchscreen Audio System: Using the Touch Screen Display (TSD), set the clock, date, voice language and the Satellite Navigation, specific to the Market unless otherwise instructed on the Customer Configurations Sheet.



E146002

11.1 Clock Setting - With the vehicle ignition system switched on in convenience mode and the TSD switched on, select the HOME MENU by pressing the hard button on the left side of the audio controls:

1. Touch the **Audio settings** soft-button.
2. At the settings menu, touch the **Clock adjust** soft-button.
3. Touch the arrow up or arrow down softbuttons to adjust the hours or minutes.
4. Touch the **12/24** soft-buttons to set the hours for the 12 or 24 hour clock display. With the 12 hour display selected, am/pm is also displayed as appropriate.
5. Touch the **Set** soft-button to confirm the clock settings.
6. Return to the **Home menu** screen by touching the arrow soft-button at the top left of the screen, or press the **HOME MENU** hard-button on the audio controls.



NOTE: The displayed clock time will not be set and displayed correctly until the Set soft-button is touched. If the Set soft-button is not touched the clock will not be reset on exiting the Clock adjust screen.

11.2 Date Setting - With the vehicle ignition system switched on in convenience mode and the TSD switched on, select the HOME MENU by pressing the hard button on the left side of the audio controls:

1. Touch the **Audio settings** soft-button.
2. At the settings menu, touch the **Clock adjust** soft-button.
3. Touch the **Date** soft-button then touch the **arrow up** or **arrow down** soft-buttons to adjust the days or months.
4. Touch the **dd/mm** or **mm/dd** soft-buttons to set the date format setting.
5. Touch **Set** to confirm the date settings.
6. Return to the **Home menu** screen by touching the arrow soft-button at the top left of the screen, or press the **HOME MENU** hard-button on the audio controls.



NOTE: The displayed date will not be set and displayed correctly until the Set soft-button is touched. If the Set soft-button is not touched the date will not be reset on exiting the Clock Adjust screen.

11.3 Language Setting - With the vehicle ignition system switched on in convenience mode and the TSD switched on, select the HOME MENU by pressing the hard button on the left side of the audio controls:

1. Touch the **Audio settings** soft-button.
2. At the settings menu, touch the **Language** softbutton. Select and change the specified language on the customer configurations sheet.
3. Set the voice language (if option is available).
4. Set the system voice feedback, Male or Female (if option is available).
5. Return to the **Home menu** screen by touching the arrow soft-button at the top left of the screen, or press the **HOME MENU** hard-button on the audio controls.

12. Navigation system - Check the Navigation screen, make sure that the correct country map has been uploaded onto the Navigation hard drive. To set the Navigation search area the following must be done:

- Select 'Navigation'.
- Select 'Enter destination'.
- Select 'More'.
- Select 'Search area'.
- Then select the local country or state specific to the Market unless otherwise instructed on the Customer Configurations Sheet.

13. Bluetooth® - Using a Bluetooth® capable phone:

1 Switch the ignition ON and make sure that the Touch Screen is active.

2 From the **Home menu**, select **Phone**.

3 A menu will appear. If no phone is connected, select **Search new**, otherwise select **Change phone** and then select **Search new**.

4



NOTE: There are two ways of pairing the Bluetooth® device and the vehicle. Detailed below is pairing to the vehicle, the other method is using the vehicle 'Vehicle to device' to pair to the device. If you use the 'Vehicle to device' method, follow the instructions on screen. Select Device to vehicle option. The vehicles Bluetooth® system is discoverable for only 3 minutes.

5 Using the mobile phone, search for Bluetooth® devices. On some phones, this is referred to as new paired device. See your phone's operating instructions for further information.

6 When the vehicle's Bluetooth® system is discovered, begin the pairing process and follow the on-screen instructions.

7 When requested, enter the Land Rover Bluetooth® access pin (2121) into the phone and vehicle system.

8 Once your phone is paired it may automatically connect to the vehicle system. If not, use the device list shown on the touch screen or use the mobile phone.



NOTE: Make sure that the device is enabled for Bluetooth®

When the customer configures a Bluetooth® phone, this will overwrite the last configured phone.

14. Rear Seat Entertainment - The Rear Seat Entertainment headphones will be in the transit items bag and the Touchscreen Remote Control (TsRC) will be in the docking station. The following **MUST** be carried out:

- Fit the AAA batteries to both sets of headphones. Each set of headphones requires 2 AAA batteries.
- Place the headphones in the rear door cards - one in each side.
- Fit and connect the TsRC battery into the remote by removing the rear battery cover, and connecting the battery.
- Replace and re-secure the battery cover. Put the 2 black rubber bung screw head covers supplied directly over the screw heads on the battery cover.
- Dock the TsRC unit back into the docking station, observe until at least 2 charge segments are illuminated.



NOTE: The TsRC is docked by locating its bottom edge onto the locating pins in the docking station, then pushing down on the 'raised blip' on the top centre of the TsRC. A positive lock will be denoted by a 'click' from the TsRC and docking connector.

15. Satellite navigation

If prompted, insert the Navigation SD card into the Navigation unit.

For additional information, refer to: [SD Memory Card](#) (101-01 Pre-Delivery Inspection Manual, Removal and Installation).

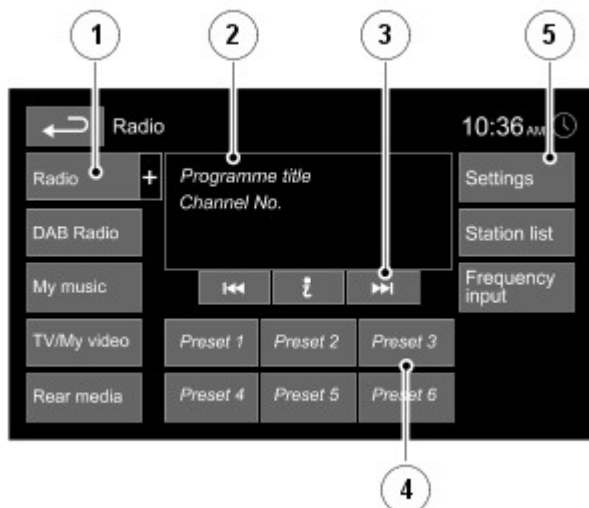
Place the SD card instructions into the literature pack.

Check operation of the system:

- Driving the vehicle will automatically establish global position.
- If global position has not been established, the navigation screen will display a 'GPS' icon with a line through it. Make sure no obstructions, such as tall buildings or trees, are close-by.

16. Set the Radio and DAB, specific to the Market unless otherwise instructed on the Customer Configurations

Sheet.



E145990

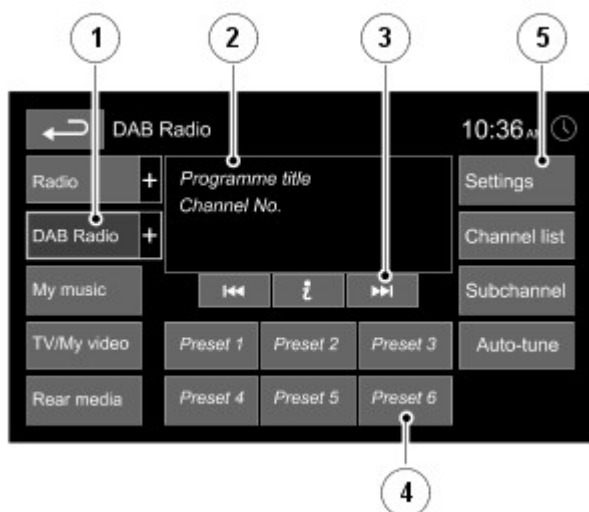
17. Radio system - With the vehicle ignition system switched on in convenience mode and the TSD switched on, select the **HOME MENU** by pressing the hard button on the left side of the audio controls:

1. Touch the **Audio settings** soft-button.
2. At the **Radio** menu, set 6 radio stations for each wavelength as specified on the customer configuration sheet. Touch the **Radio** (1) soft button to select a waveband.
3. Short touch the **Auto Seek** soft-button (3) to search for the next chosen radio station (Shown in the display (2)).
4. Touch and hold the **Preset** soft button (4) to store the current station on the chosen preset (the radio will mute while the station is stored then beep to confirm).
5. Repeat these steps until all wavelengths have 6 preset radio stations.
6. Touch the **Settings** soft-button (5) to activate/ deactivate the RDS, Traffic, News, AF and Reg functions; according to the Market unless otherwise specified on the 'New Vehicle Configurations Options' sheet.
7. Return to the **Home menu** screen by pressing the arrow soft-button at the top left of the screen, or, press the **HOME MENU** hard-button on the audio controls.



CAUTION: Due to radio reception constrains, it may be necessary to set the radio presets outside of the workshop.

18. DAB Radio system - With the vehicle ignition system switched on in convenience mode and the TSD switched on, select the **HOME MENU** by pressing the hard button on the left side of the audio controls:



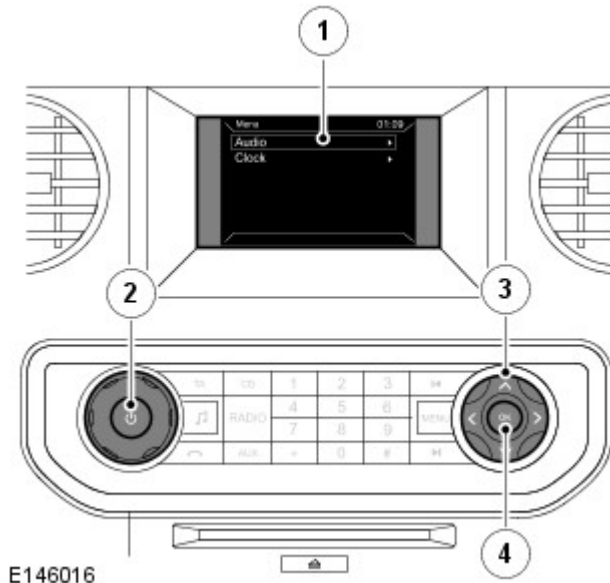
E145991

1. Touch the **Audio settings** soft-button.
2. At the **DAB Radio** menu, set 6 radio stations for each DAB band (DAB 1, 2, or 3) as specified on the customer configuration sheet. Touch the **DAB Radio** (1) soft button to select a DAB band.
3. Short touch the **Auto Seek** soft-button (3) to search for the next chosen DAB radio station (Shown in the display (2)).
4. Touch and hold the **Preset** soft button (4) to store the current station on the chosen preset (the DAB

- radio will mute while the station is stored).
5. Repeat these steps until all DAB bands have 6 preset radio stations.
 6. Touch the **Settings** soft-button (5) to activate/ deactivate the FM Traffic, Announcements, Link DAB (auto search when signal strength drops), DAB format (DAB regions) and DAB country functions; according to the Market unless otherwise specified on the 'New Vehicle Configurations Options' sheet.
 7. Return to the **Home menu** screen by pressing the arrow soft-button at the top left of the screen, or, press the **HOME MENU** hard-button on the audio controls.



CAUTION: Due to radio reception constrains, it may be necessary to set the radio presets outside of the workshop.



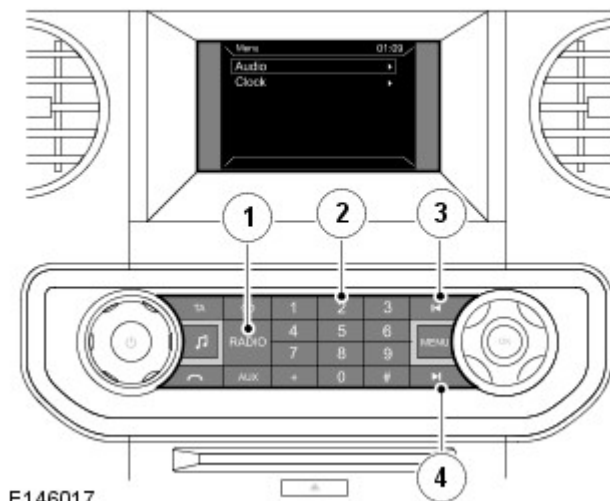
19. For vehicles with the Standard Audio System: To set/change the time and date, turn ON the audio system using the ON/OFF button (2).

20. Time:

- Using the navigation up and down arrow buttons (3), navigate to 'Clock' on the menu display (1). Navigate to Set Time to set the time.
- Use the navigation buttons to increase or decrease the hours and minutes. Once the correct time has been set, press the 'OK' button (4), to confirm.
- Navigate to the '24h Mode' to select the time format, press the 'OK' button (4), to confirm the change.

21. Date:

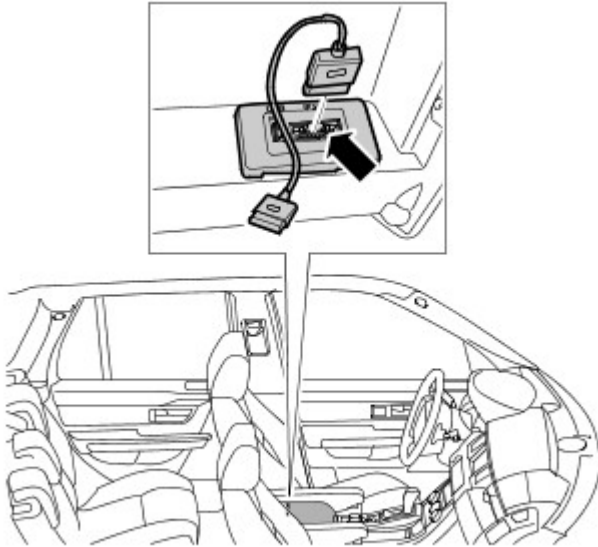
- Using the navigation up and down arrow buttons (3), navigate to 'Clock' on the menu display (1). Navigate to Set Date to set the date.
- Use the navigation buttons to increase or decrease the year, month and date. Once the correct date has been set, press the 'OK' button (4), to confirm.
- Navigate to 'Set Date Format' to select the date format, press the 'OK' button (4), to confirm the change.



22. For vehicles with the Standard Audio System: The radio seek up/down buttons (3) or (4), are used to

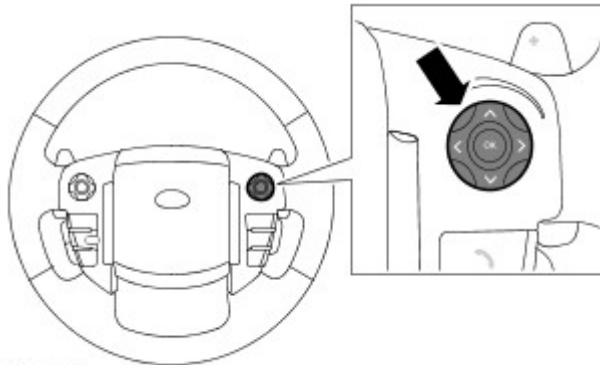
search for radio stations, and these can be stored as pre-sets.

- Select a waveband (1) and briefly press one of the seek buttons (3) or (4). The search will stop at the first radio station it finds in the direction chosen.
- Save the radio stations as pre-sets by holding down a numbered button (2), for approximately three seconds. After a short delay the station name will be displayed at that pre-set location.
- Manual tuning can be done if necessary by holding the seek up/down button (3) or (4), for more than 4 seconds. Manual tuning mode exits after a 10 second timeout period.
- Repeat this process for all the pre-set radio stations.



E146003

23. If requested on the 'New Vehicles Configurations Options' sheet, place the iPod™ lead into the glovebox.



E146005

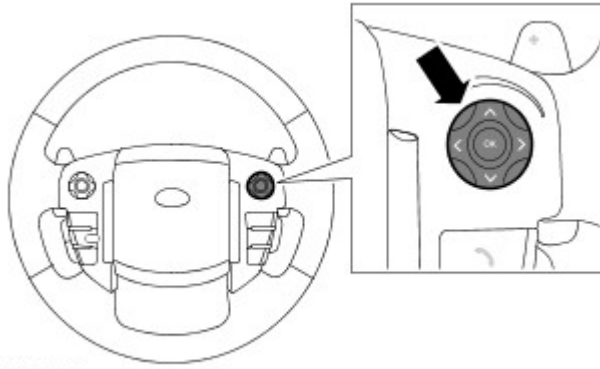
24. The automatic headlamp system has an additional feature called HBA (High Beam Assist). The 'Hand of Traffic' must be set in the Message Center and the feature enabled to make sure of correct operation of the system. To set the HBA the following steps must be followed in order:

- With the ignition 'ON', engine not running, use the controls on the steering wheel to select on the instrument cluster menu:
- Main Menu > Vehicle Set-up > High Beam Assist.
- Configure the 'Hand of Traffic' setting by selecting the appropriate Drive on Left (of road) or Drive on Right (of road) to Market condition.
- 'Enable' the feature by setting Activate Assist.
- Carry out a visual check to make sure that there are no stickers, or labels, directly in view of the HBA camera sensor.

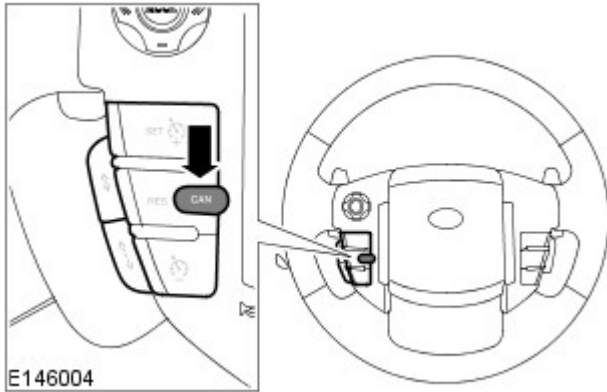


NOTE: The HBA feature can be enabled (or disabled) by selecting (or de-selecting) Activate Assist.

Enabling or disabling HBA will not affect previous 'Hand of Traffic' settings.



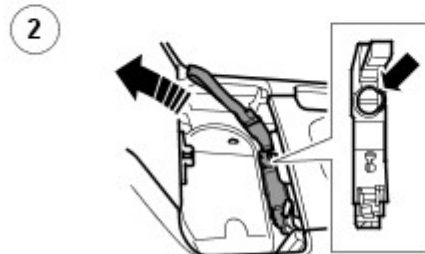
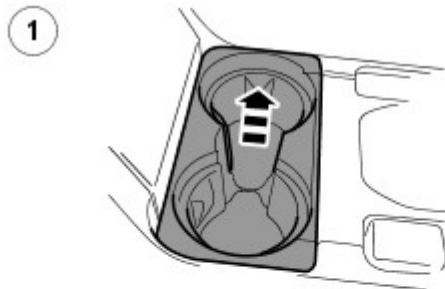
E146005



E146004

25. Reset the oil level indicator. To reset the oil level indicator the following steps must be followed in order:

- With the ignition 'ON', engine not running, use the controls on the steering wheel to select on the instrument cluster menu: Service Menu > Oil Level Display.
- Press the cruise control CANCEL button twice within 2 seconds.
- The instrument pack display will revert to the normal display in the trip computer.
- Using the controls on the steering wheel, access the Oil Level Display again.
- Press and hold the cruise control CANCEL button for 10 seconds to reset the oil level indicator.
- The trip menu display will revert to the normal display mode on the Message Center.
- Turn the ignition OFF.



E146018

26. Emergency Park Release System.

- In the event of a vehicle transmission failure, a mechanical means of selecting neutral is now available. An Emergency Park Release (EPR) provides this functionality.
- In an emergency, the EPR hand lever can be operated to release the park pawl within the transmission. The park pawl will not be allowed to re-engage until the hand lever is locked down in the closed position.
- The EPR lever is exposed while in transit. Actuation of the EPR requires the operator to be seated in the driver's seat with the foot brake applied. Turn the locking device 90 degrees anti-clockwise and lift using the pull strap.
- Ensure that the EPR lever locking device is locked down securely, then fit the finisher panel and cup

holders. The cup holders are despatched in the glovebox.

27. Remove battery charger: Disconnect the approved battery charger/power supply from the vehicle.

28. Make sure that the interior of the vehicle is undamaged. Refer to the **Cosmetic Standards Manual** on **Topix**.

Pre-Delivery Inspection Manual - Vehicle Exterior

Description and Operation

29. Check operation of fuel flap and lock.

30. Inspect the road wheels and tires for damage. Check the wheel retaining nuts for correct torque, 140 Nm (103 lb.ft).

31. The vehicle is delivered with the tire pressures set higher than the normal operating pressures. Set the tire pressures to 2.0 bar (29psi) for the road test.



CAUTION: When the tire pressures are reduced from the high transit / storage pressure to the road test pressures, the final pressure will rise. The initial high drop in pressure from transit / storage pressure to normal pressure will cause the tire pressure to rise after 2 minutes, giving incorrect tire pressures by up to 0.4 bar (6psi).

Initially drop each tire pressure to approximately 0.1-0.3 bar (2-4psi) below the recommended pressure and then inflate the tires to the desired pressure.



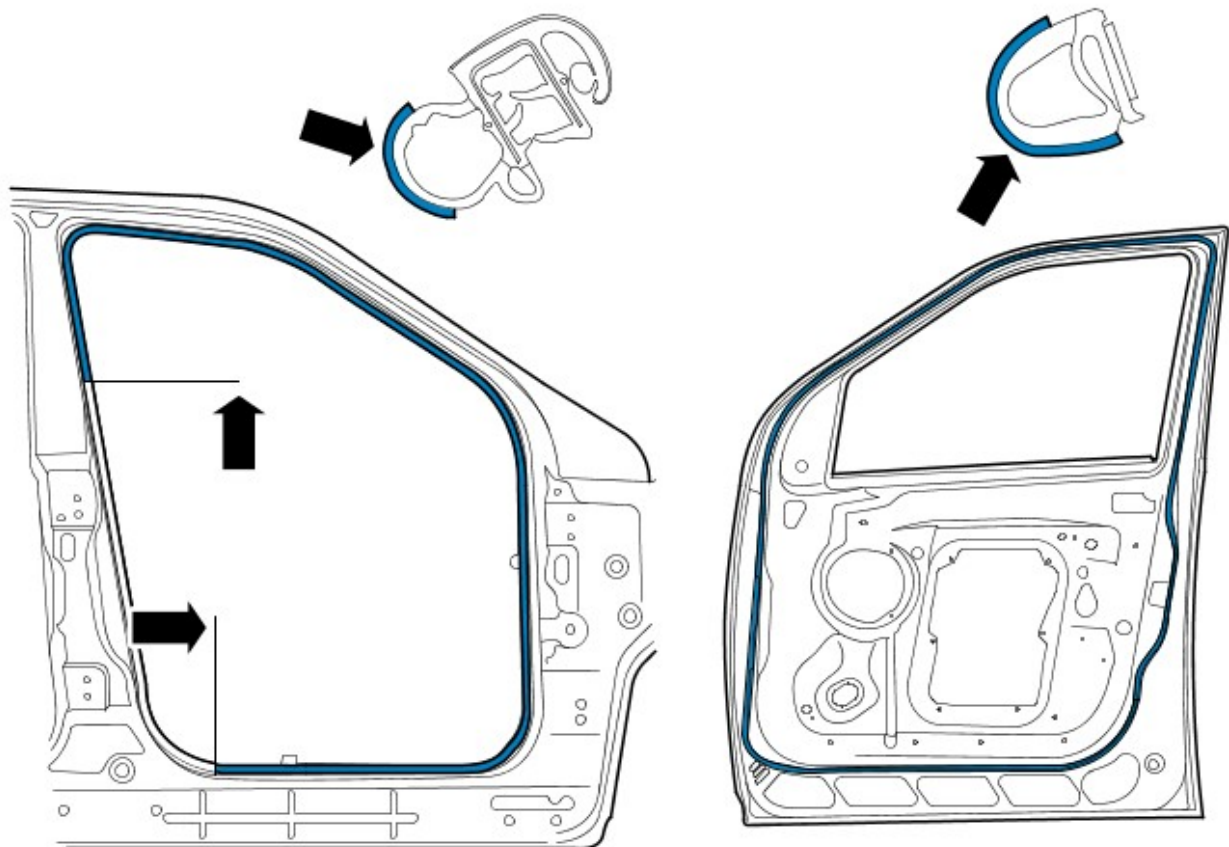
CAUTION: If the vehicle is returned to storage after the PDI, the tire pressures must be raised to 3.60 bar (52psi).

32. Remove all internal and external transit protection. Stow the rear outer seat belts in the stowage clips.

33. Check that the vehicle exterior is clean and undamaged. Refer to the 'Cosmetics Standards Manual' on TOPIx, for further details.

34. Apply lubricant to the door seals on vehicles that operate in severe cold markets: **(Russia and Nordic countries)**.

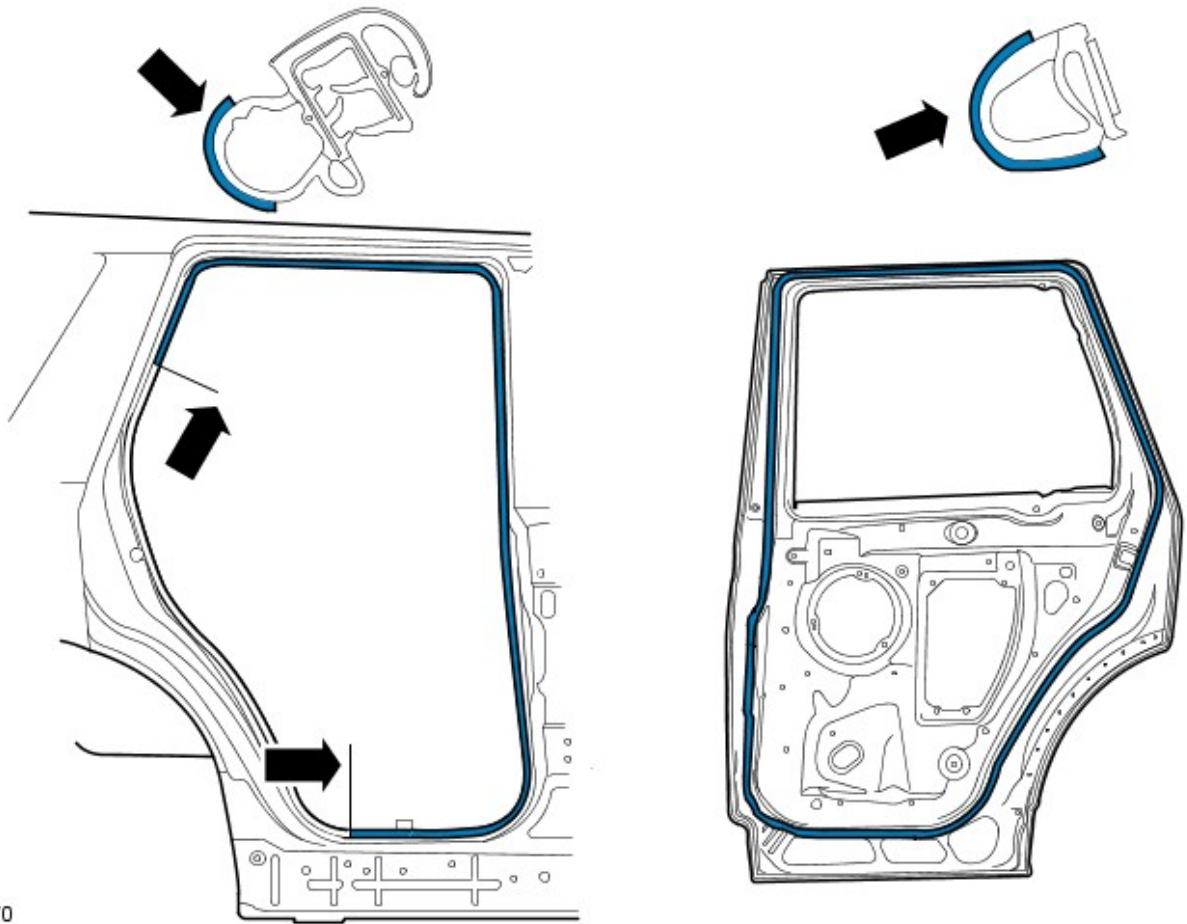
Front door seals



E92669

34.1 Vehicles operated in severe cold markets (Russia and Nordic countries): Apply the Carboflo pen, Land Rover Part No. CYK500010 to the primary and secondary front door seals as illustrated above.

Rear door seals



E92670

34.2 Vehicles operated in severe cold markets (Russia and Nordic countries): Apply the Carboflo pen, Land Rover Part No. CYK500010 to the primary and secondary rear door seals as illustrated above

Pre-Delivery Inspection Manual - Road Test

Description and Operation



NOTE: Before driving the vehicle, check the operation of:

- Lights, indicators, wipers, wash/wipe and hazard warning.
- Seats and seat belts.
- Fascia switches.
- Electric park brake.

35. Make sure that the automatic transmission starter isolator, operates in all gears with the exception of 'P' - Park and 'N' - Neutral.

36. Check for the correct operation of all the driver controls and systems. Including the Terrain Response indicators, wheel direction/ differential locking indicators and the low tire pressure monitoring system, if fitted.

36.1 Start vehicle and check operation of:



CAUTION: Make sure the climate control is set in the off position.

- Starter/Inhibitor switch.
- Electric mirrors, including power fold.

36.2 During the road test, make sure the transfer box range change functionality is tested by using the following method.

- With engine running and parking brake applied, select neutral on automatic gearbox.
- Request range change for low gear with switch - wait until change is complete.
- Request range change into high gear with switch - wait until change is complete.
- Repeat 5 times.
- Make sure high range is left selected.

36.3 Make sure the correct operation of the shift interlock (where applicable).



CAUTION: Risk of injury. Apply the parking brake, chock the wheels and make sure that all personnel are clear of the vehicle before carrying out the above procedure.



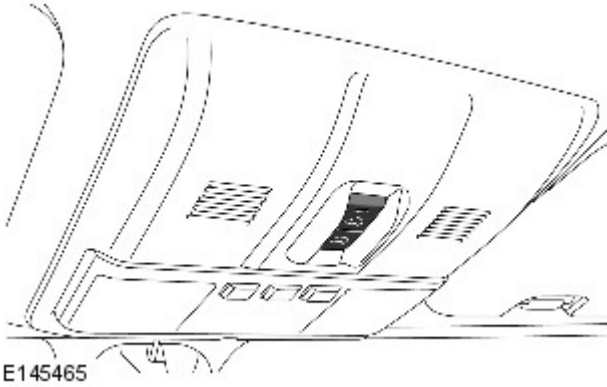
E145464

36.4 Check the electric windows for correct operation. Open and close all the windows fully. Check that the rear window isolation switch is operational.

36.5 If the battery is disconnected, becomes discharged or the power supply is interrupted, the one-touch 'window up' operation is disabled until the window position is reset.

To reset the window position:

- Close the window fully.
- Release the switch, the pull up and hold for one second.
- Repeat the procedure on each window.



36.6 Check the sunroof for correct operation. Make sure both sunroof open/close and sunroof tilt are fully operational.

36.7 Check operation of the air conditioning (A/C) system.

- When the vehicle is at operating temperature, set the heater control to 22°C and run the fan speed at 75%.
- Switch on the A/C system and run for 5 minutes.

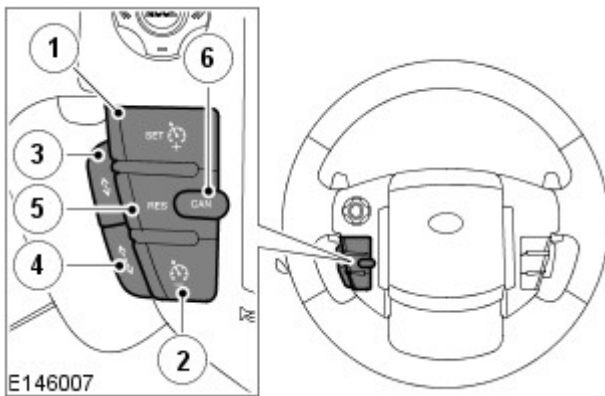
36.8 Check for correct operation of the cruise control or adaptive cruise control (ACC) system.

 **WARNING:** Damage to vehicle. Adaptive cruise control is not a collision warning or avoidance system.

Risk of injury. It is the driver's responsibility to stay alert, drive safely and be in control of the vehicle at all times.

Only use cruise control when conditions are favourable, e.g. on straight, dry, open roads with light traffic.

36.9 The cruise control and ACC system are operated by switches mounted on the steering wheel. The driver can also intervene at any time by use of the brake or accelerator pedals. The Forward Alert function can be manually turned on or off in the Message Centre. Using the Message Centre steering wheel controls select: **Vehicle Set-up** and then **Forward Alert** from the menu; using the **OK** button will turn the function on or off.



36.10 Controls - all cruise control switches are located on the steering wheel switch-pack:

1. SET + : Set the speed (+) or increase.
2. SET - : Set the speed (-) or decrease.
3. GAP: Gap decrease (ACC only).
4. GAP: Gap increase (ACC only).
5. RESUME: Resume set speed.
6. CANCEL: Cancels without erasing memorised speed.

36.11 Setting a speed:

- Accelerate as normal until required speed is reached.
- Press the 'SET' button (1). The vehicle speed will be stored in the memory and cruise control should be engaged.
- The message centre will display the selected speed - 'SETSPEED 80KM/H 50MPH'.



36.12 Checking the ACC gap: After the ignition is switched on a default gap will be automatically selected (setting No 3). There are 4 gaps available to select.

- After selecting cruise control, check that the vehicle slows when a vehicle ahead is detected by the system.

! WARNING: If the adaptive cruise control system predicts that its maximum braking level will not be sufficient, then an audible warning will sound while the system continues to brake. 'DRIVER INTERVENE' will also be displayed on the message centre.

- When a vehicle ahead is detected the vehicle will be in 'follow mode'.

! WARNING: When in 'follow mode' the vehicle will not decelerate automatically to a stop, nor will the vehicle always decelerate quickly enough to avoid a collision without driver intervention.

- Check that when in 'follow mode' a warning light in the instrument pack is illuminated and the message centre displays 'CRUISE GAP'.

36.13 Altering the cruise gap to the vehicle ahead:

- Press, the top part of the switch (3) to decrease the gap, and the bottom part of the switch (4) to increase the gap.
- Check 'follow mode' functions correctly.

36.14 Check the operation of the 'Forward Alert' system. Make sure that the ACC system is disengaged: this will allow the GAP buttons to be used to adjust the Forward Alert.

Switch on 'Forward Alert'

- Set the 'Forward Alert' gap.
- Using the GAP increase button (4), on the steering wheel switch-pack, select the largest gap available.

Check that when a vehicle is detected close ahead, an audible warning sounds and the message centre displays: 'FORWARD ALERT'.

This is easiest to achieve by following a lead vehicle as it slows down.

! WARNING: The 'Forward Alert' system DOES NOT provide vehicle braking.

△ NOTE: The 'Forward Alert' system provides warnings if a vehicle is detected close ahead.



36.15 Set the 'Forward Alert' gap:

- Using the GAP decrease button (3), on the steering wheel switch-pack, select the smallest gap available.

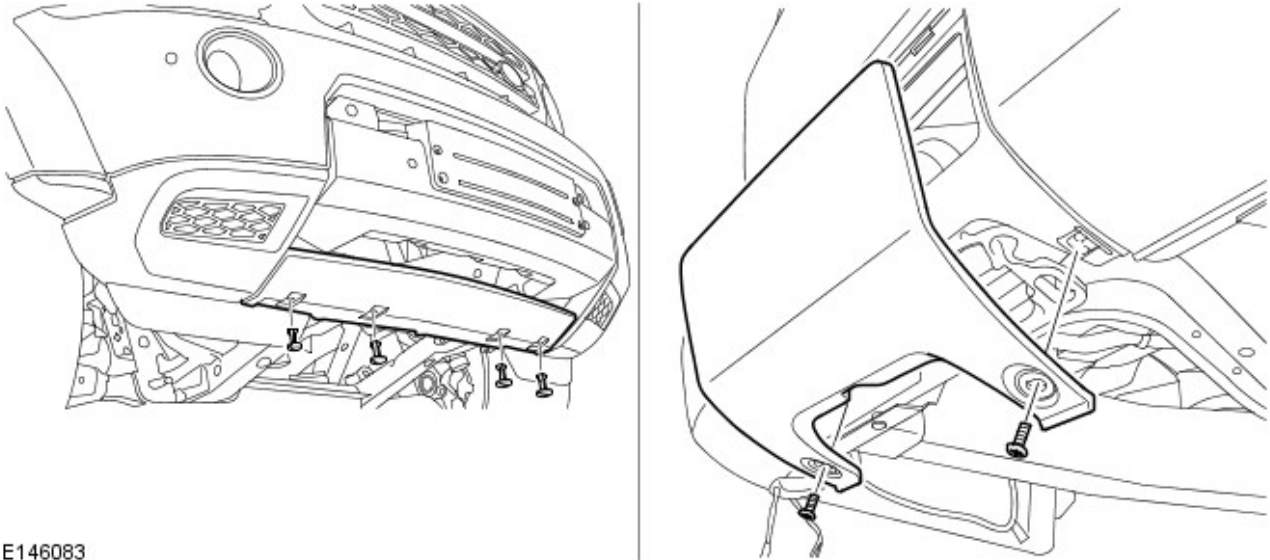
- 36.16** Switch OFF the Forward Alert system so that the customer receives the vehicle set in this condition.
- 37.** Check for any unusual noises from the power train, suspension or braking systems.
- 38.** Check for any squeaks or rattles from the vehicle interior.
- 39.** Check the operation of the satellite navigation system (if fitted).

Pre-Delivery Inspection Manual - Quality Assurance Checks

Description and Operation

40. On completion of road test:

- Position the vehicle on lift.
- Raise the vehicle on lift.
- Visually check beneath the vehicle for leaks from the powertrain components.
- Lower the vehicle.



E146083

41. Install the front towing eye cover, secure with the 4 toggle fasteners. Install the rear towing eye cover, tighten the fixings.

42. Reconnect the approved Land Rover battery power supply and IDS, use SDD to read fault codes, rectify any logged faults.

43. Check the register of Service Action Bulletins - make sure a fault free delivery to the customer.

44. If fault lamp(s) are illuminated, interrogate that system using IDS, report findings and clear faults.

44.1 Disconnect IDS and the approved Land Rover battery power supply.

45. Retain copy of this schedule in the Customer/ Vehicle History file.

46. Make sure the vehicle details are included in the Service Portfolio and endorse with the dealer stamp.

47. Record locking wheel nut code and place in Customer/Vehicle History file, (If applicable).

48. Record the Bluetooth code and place in Customer/Vehicle History file, (If applicable).

49. Make sure vehicle literature pack and security item contents are correct.

50. Place vehicle literature pack, mats and security items in the vehicle, (If applicable).

51. Make sure the tire pressures are set to the correct pressure.

51.1 For vehicles that will be delivered to the customer: Set all tire pressures (including spare) with the tires cold to the recommended tire pressures for 'normal' conditions (up to 100mph [160kph]). The recommended tire pressures are provided on a label attached to the 'B' pillar.

51.2 For vehicles being returned to storage: Set all tire pressures with the tires cold to 3.6 bar (52psi).

52. Valet vehicle prior to customer release.

53. Attach correct type approval labels to the handsets (where applicable).



NOTE: A vehicle must not be left without a transportation switch/relay installed for longer than two days, prior to customer handover.

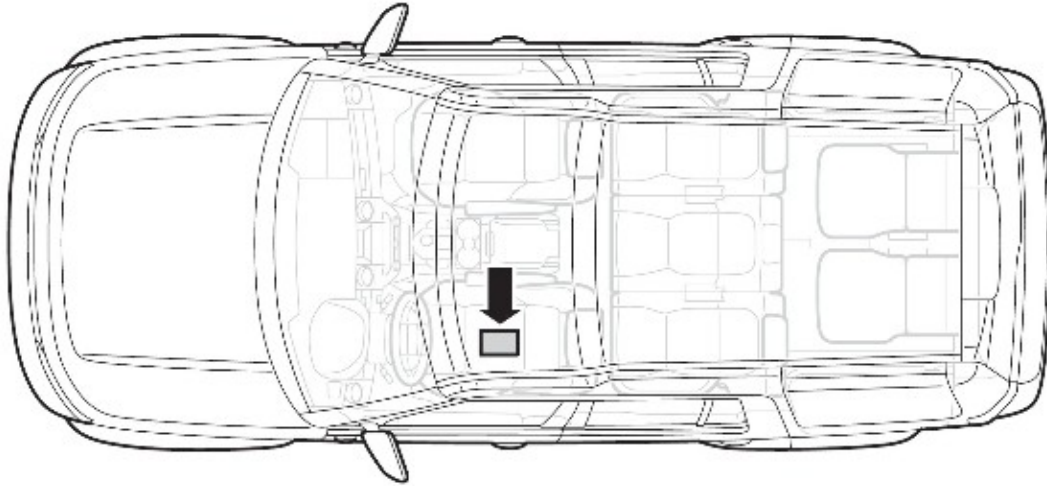
If the transit relay has been refitted prior to release to customer; step 2 will need to be repeated, to remove the transit relay. Step 9 will need to be repeated, using the necessary diagnostic equipment, to clear DTC's.

Pre-Delivery Inspection Manual - SD Memory Card

Removal and Installation

Removal

1.

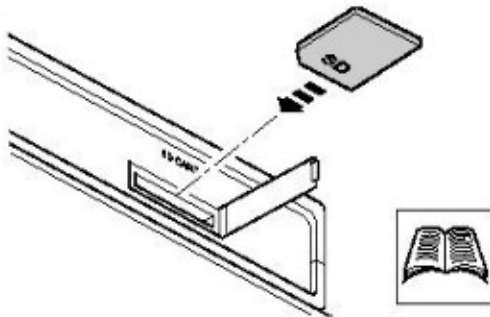


E159881

2. Position the LH front seat fully forwards.

Installation

1.



E159871

Showroom Preparation - Showroom Preparation

Description and Operation



NOTE: The information given in this document is subject to change for different model years.

Prior to the vehicle being placed into the showroom, the following components must be removed.

Function	Fuse	Rating	Location
Starter motor (All variants)	14E	40amp	Engine junction box (EJB)
Horn	FE31	15amp	EJB
Wipers	29E	30amp	EJB
Washers	43P & 38P	15amp	Central junction box (CJB)
Power washers	7E	30amp	EJB

Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards - Introduction

Description and Operation

General

This document describes the processes and methodology that must be applied to carry out a quality inspection of the exterior body and paint on all Jaguar and Land Rover vehicles, except Defender, at Pre-Delivery Inspection (PDI). This quality inspection is required to determine if there are any defects (hereafter called exceptions) affecting the exterior finish of the vehicle. These exceptions can be attributed to factory related defects in materials or workmanship, damage in transit or damage in storage.

Defining exterior body and paint related exceptions requires a high level of technical expertise. This manual has been compiled so that an inspector can determine if an exception should be repaired or noted as Commercially/Customer Acceptable (CA).

Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards - Cosmetic Acceptance Standards

Description and Operation

General

This section defines the paint and body acceptance standards for each of the exterior surface zones.
For additional information, refer to: [Exterior Surface Zone Identification](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).

A Zone - Medium to High Visibility

Paint

Scratches

Characteristic	PDI
Scratch Not Down To Primer (Light Surface Scratch In Top Layer - Not Through To Color Coat)	
1 scratch greater than 20mm length	Not permissible
Cluster of scratches - more than 2 in an area of 10x10cm	Not permissible
Up to 2 scratches less than 20mm length	Acceptable if not easily visible from 1m viewing distance. Up to 2 per panel not greater than 20mm length
Scratch Down To Primer (Color Coat Visible)	
Any scratch where primer is visible	Unacceptable

Chips

Characteristic	PDI
Chip Not Down To Bare Metal But Primer (Color Coat Visible)	
Any chip where primer is visible	Not permissible

Dirt In Paint



NOTE: * Pieces of dirt that are less than 1mm in diameter that give a distinct tactile feedback should be classed as a repair.

Characteristic	PDI
Dirt Has same Color As Body Color	
2 or more small pieces of dirt less than 1mm, and less than 250mm apart	Unacceptable
1 or more pieces of dirt more than 1mm*	Unacceptable
Faint exceptions which are 250mm or greater apart. Exceptions must be 1mm or less diameter and not exceed four on any one panel	Acceptable

Flattening Marks

Characteristic	PDI
If easily visible from 1m viewing distance	Not permissible
If not easily visible from 1m viewing distance	Acceptable

Polishing Marks

Characteristic	PDI
If easily visible from 1m viewing distance	Not permissible
If not easily visible from 1m viewing distance	Acceptable

Polishing Compound

Characteristic	PDI
	Not permissible

Overspray - Color

Characteristic	PDI
	Not permissible

Overspray - Clear Coat

Characteristic	PDI
	Not permissible

Craters

Characteristic	PDI
	Not permissible

Runs and Sags

Characteristic	PDI
	Not permissible

Color Mismatch

Characteristic	PDI

	Not permissible
--	-----------------

Flaking/Peeling

Characteristic	PDI
	Not permissible

Poor Color/Poor Coverage/Thin Paint/Shady

Characteristic	PDI
	Not permissible

Body

Dent

Characteristic	PDI
	Not permissible

Ding

Characteristic	PDI
	Not permissible

Panel Profile, Gaps and Flushness

Characteristic	PDI
Under/over profile or flushness not greater than 1mm	Acceptable
Tapered gaps not greater than 1mm over a length of 1m	Acceptable

B Zone - Low to Hidden Visibility

Paint

Scratches

Characteristic	PDI
Scratch Not Down To Primer (Light Surface Scratch In Top Layer - Not Through To Color Coat)	
4 or more scratches greater than 60mm length	Not permissible
Cluster of scratches - more than 2 greater than 60mm length in an area of 100cm ² (10x10cm)	Not permissible
Up to 3 scratches less than 60mm length	Acceptable
Scratch Down To Primer (Color Coat Visible)	
Any scratch where primer is visible	Unacceptable

Chips

Characteristic	PDI
Chip Not Down To Bare Metal But Primer (Color Coat Visible)	
Any chip where primer is visible	Unacceptable

Dirt In Paint

Characteristic	PDI
Dirt Has same Color As Body Color	
1 or more large pieces of dirt 2mm to 4mm (diameter or length)	Unacceptable
6 or more small pieces of dirt 1 to 2mm	Unacceptable
High accumulation of clearly visible pieces of dirt less than 1mm in a square of 25cm ² (5cm x 5cm)	Unacceptable
Less than 5 small pieces of dirt 1 to 2mm in diameter more than 50mm apart	Acceptable

Flattening Marks

Characteristic	PDI
Any flattening mark greater than 50mm ² and not more than three in a 250mm radius. If easily visible from 1m viewing distance	Not permissible
Any flattening mark not greater than 50mm ² and not more than three in a 250mm radius. If not easily visible from 1m viewing distance	Acceptable

Polishing Marks

Characteristic	PDI
Any polishing mark greater than 50mm ² and not more than three in a 250mm radius. If easily visible from 1m viewing distance	Not permissible
Any polishing mark not greater than 50mm ² and not more than three in a 250mm radius. If not easily visible from 1m viewing distance	Acceptable

Polishing Compound

Characteristic	PDI
	Not permissible

Overspray - Color

Characteristic	PDI
	Not permissible

Overspray - Clear Coat

Characteristic	PDI

	Not permissible
--	-----------------

Craters

Characteristic	PDI
Any craters, not greater than 250mm apart, greater than 1.5mm in diameter and more than three in any panel	Not permissible
Any craters, greater than 250mm apart, not greater than 1.5mm in diameter and not more than three in any panel	Acceptable

Runs and Sags

Characteristic	PDI
A single run or sag more than 4mm long or wide	Not permissible
A single run or sag not more than 4mm long or wide	Acceptable

Color Mismatch

Characteristic	PDI
	Not permissible

Flaking/Peeling

Characteristic	PDI
	Not permissible

Poor Color/Poor Coverage/Thin Paint/Shady

Characteristic	PDI
If easily visible from 1m viewing distance	Not permissible
If not easily visible from 1m viewing distance	Acceptable

Body

Dent

Characteristic	PDI
	Not permissible

Ding

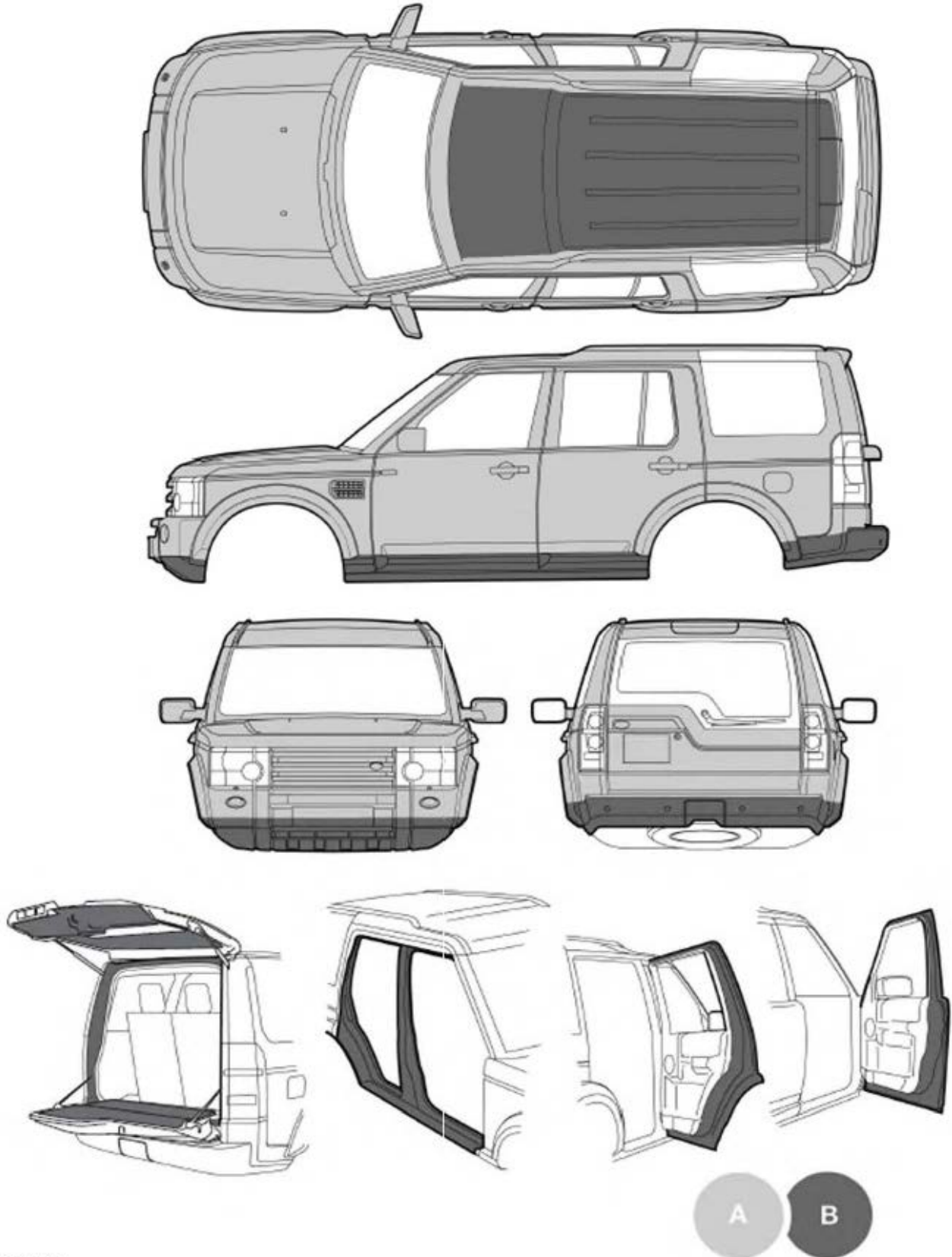
Characteristic	PDI
	Not permissible

Panel Profile, Gaps and Flushness

Characteristic	PDI
Under/over profile or flushness not greater than 1.5mm	Acceptable
Tapered gaps not greater than 1.5mm over a length of 1m	Acceptable

Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards - Exterior Surface Zone Identification

Description and Operation



E160640

A = Medium to High visibility; B = Low to Hidden visibility

Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards - Paint Exceptions And Associated Repair Procedures

Description and Operation

Fine Blistering



NOTE: Alternative Terminology: Micro-blisters, pimples, bubbles, pop-ups and snail trails.



Description

Fine blisters are from 0.5 to 1.0 mm (0.020 to 0.040 in.) in diameter and may appear in patches or cover large areas. Their disposition may resemble a ring formation, an irregular, wandering snail-like trail, or be presented in an unmistakable fingerprint outline.

Blisters may contain water and close inspection will reveal whether they are in the clear coat, color coats, intermediate coats or penetrate to bare metal. Color coat blisters are often very thin and more prominent than the flatter, larger to metal or to primer blisters. Recognition of depth or source is aided by breaking with a pin and viewing with a low-power magnifying lens.

Warranty Related Cause

- Fault(s) in vehicle manufacturer's or Original Equipment Manufacturer's (OEM) paint finish process or off-line repair process.

Non-warranty Related Cause(s)

- External contamination (for example: bird droppings, industrial fall-out, etc.)
- Contamination of the painted surfaces by airborne contaminants.

Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair not permissible exceptions as follows:
 - Fine blisters in clear coat only: Polish or flat and polish to remove concern.
 - Fine blisters extending down into color base coat, primer coats or bare metal: Flat to remove concern then re-paint as required.

Blowing



NOTE: Alternative Terminology: Bubbles and bridging.



E160645

Description

Large air bubbles or blisters formed by detachment of the surface paint film. This exception is generally associated with the application of paint across sealed seams, boxed-in corner panels, plastic substrates or where bridging has occurred.

Warranty Related Cause

- Surface contamination on bare metal panel or solvent retention in sealant prior to paint application.

Non-warranty Related Cause(s)

- None.

Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by flattening, to remove blow/bubble down to the substrate, then re-painting as required.

Chipped Paint/Scratches



NOTE: Alternative Terminology: Stone-bruising.



E160646

Description

Broken surface finish of varying size and shape. Extent and severity will depend upon cause.

Warranty Related Cause

- Damage caused during manufacturing build process or in factory transit.
- Only considered to be warranty when found on door or other opening panel edges where transit labels are intact.

Non-warranty Related Cause(s)

- Vehicle transit damage.
- Damage resulting from inadequate security of vehicle during transit or storage.
- Accidental damage during vehicle movement at Port of Entry.

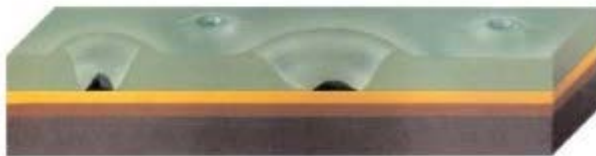
Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions as follows:
 - Most exceptions can be repaired using a brush touch up then polish.
 - For exceptions in high visibility areas, flat to remove evidence of exception and re-paint as required.

Cissing



NOTE: Alternative Terminology: Fish eyes, craters, pits, saucering, crackling and poor wetting.



E160647

Description

Cissing is identified by the presence of small crater-like depressions in the paint finish, which may vary in size and depth according to cause, from individual craters of **pin-hole** size in densely packed groups to isolated craters of up to 10 mm (0.4 in.) in diameter.

Craters will often reveal small impurities at base when inspected with a low-powered lens. The exception may be uniform and densely arrayed but in most cases occurs as individual **fish eye** type craters.

Warranty Related Cause

- Faults in vehicle manufacturer's original paint finish.

Non-warranty Related Cause(s)

- None.

Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by flattening, to remove evidence of crater and any residual contaminate, then re-paint as required.

Contamination



NOTE: Alternative Terminology: Rust specks, industrial fallout, cement dust, airborne contamination, spotting, spots, specks and splashes.



E160648

Description

Any foreign substance or chemicals which adhere to the surface or become embedded in the paint by chemical action. Excessive exposure to unfavorable atmospheric conditions. Contamination may appear as spots, speckles or splash-like deposits, this is often associated with stains, especially on metallic paint films.

Industrial Fallout/Acid Spotting/Rust Specks:

Airborne particles from industrial activities can contaminate paint film surfaces and may consist of various deposits. The paint surface is usually dusted with particles, tiny colored spots, minute stains, greasy or tacky spots and feels 'gritty'. When closely examined with a low-powered magnifying lens the particles may be seen embedded into or adhering to the paint, possibly with a stain surrounding it or rust, if it is ferrous, from the particle.

Cement Deposit/Dust

Easily recognizable by the deposit. Severe staining in the form of spots or streaks will result if the deposits are allowed to remain on the paint film.

Leaves/Berries

Wet leaves, tree sap and resins allowed to remain on the paint film and exposed to strong sunlight will cause discoloration and staining of the surface. Berries or fruits will stain paints if they are allowed to decompose on the paint film.

Salt Deposits

Salt deposits from handling, water or other fluids allowed to remain on the paint surface can result in detachment of the paint film from the underlying surface.

Warranty Related Cause

- Not normally an exception arising from manufacturing process. This is not normally a warranty related exception, but should this exception be apparent at PDI report the exception through EPQR.

Non-warranty Related Cause(s)

- Poor storage of new vehicles.
- Failure to refinish vehicles properly.
- Refinished surfaces subjected to careless handling.
- Defective oven or drying room.

Prevention

- Store vehicles as detailed in the New Vehicle Storage Manual.
- Do not expose soft paint finishes to atmospheres likely to cause contamination

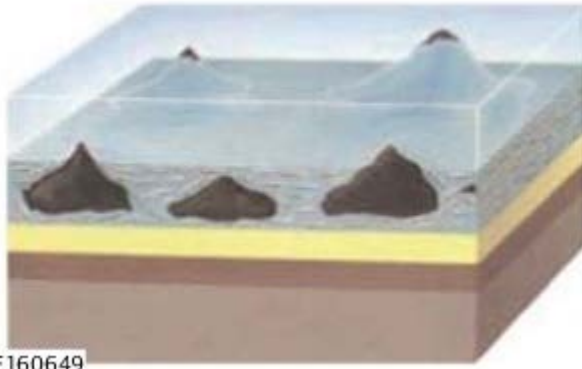
Rectification Process

1. Wash with a mild detergent solution.
2. Rinse with a 10% oxalic acid solution.
3. Remove any remaining stains by polishing, or by light compounding and polishing.

Dirt/Dust On Basecoat



NOTE: Alternative Terminology: Seediness, nibs, spikes, bits, specks, grains and dirt inclusions.



E160649

Description

Particles embedded below the clear coat at the surface of the basecoat color or in the basecoat become magnified or exaggerated. If the exception appears to be extensive, close examination will reveal whether it is dirt or dry-sprayed basecoat particles that have been re-dissolved into the clear coat resulting in a spiky effect.

Warranty Related Cause

- Condition arising during manufacture.

Non-warranty Related Cause(s)

- None.

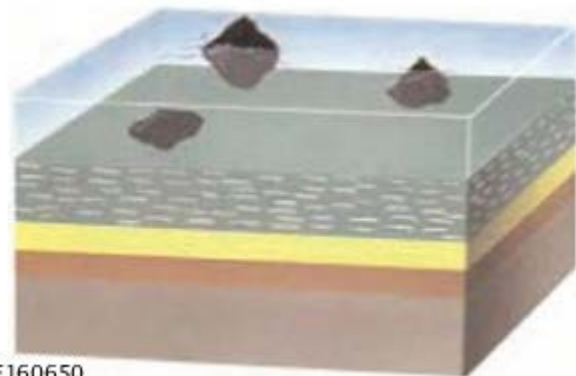
Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by flattening and polishing, or flattening and re-painting.

Dirt In Clear Coat



NOTE: Alternative Terminology: Grittiness, seediness, specks, nibs and dirt inclusions.



E160650

Description

Dirt embedded in the surface of the clear coat.

Warranty Related Cause

- Condition arising during manufacture.

Non-warranty Related Cause(s)

- None.

Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by polishing, or flattening and polishing. If more than 50% of the clear coat film thickness has to be removed to clear the exception, re-paint the clear coat as required.

Dirt Under Basecoat



NOTE: Alternative Terminology: Dirt nibs, nibs, knobs, hills, lumps, coarse blisters, bumps and basecoat imperfections.



Description

Dirt under basecoat is often mistaken as blisters: the effect is similar, appearing as hard lumps or bumps in the finish. The exception will not deteriorate neither will it result in film failure. The contamination is of no defined size. The exception is hard and will not give way when probed with a blunt object or fingernail, unlike **soft** blisters.

Warranty Related Cause

- Condition arising during manufacture.

Non-warranty Related Cause(s)

- None.

Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by polishing, or flattening and polishing. If dirt/inclusions are showing through the base color coat, re-paint as required.

Dull Finish/Abnormal Loss Of Gloss



NOTE: Alternative Terminology: dulling back, poor gloss, deadening, hazing, loss of gloss and low gloss.



Description

This exception relates to a paint surface which is smooth and evenly applied but lacks reflective ability. Unlike dry spray the surface will not be roughened. Close inspection may reveal whether it is the result of surface

contamination or a film defect. It may cover large or small areas. Small patches are often the result of contamination.



NOTE: Dulling will occur on exposure to strong sunlight over lengthy periods, resulting in **off-shading** of the color.

Warranty Related Cause

- Manufacturer's defect in paint material or process.

Non-warranty Related Cause(s)

- Airborne deposits such as water or salt staining.

Rectification Process

1. Polish only or clean and polish.

Etching



NOTE: Alternative Terminology: Bird droppings, acid attack, windshield-wash attack, strong detergent attack, industrial fallout, splashes and solvent attack.



Description

Small or large areas of the paint surface roughened and partly removed or disintegrated, often with traces of the cause and staining around the area. The severity of the exception will vary depending on the exposure and the nature of the attacking substance. In severe cases the paint film may exhibit signs of crazing.

Warranty Related Cause

- Not an exception arising from manufacturing process.

Non-warranty Related Cause(s)

- Incorrect or poor storage of new vehicles.
- Poor handling or carelessness with corrosive chemicals.
- Exposing soft or new paint finishes to strong chemicals or failure to protect from airborne contaminants.

Prevention

- Store vehicles as detailed in the New Vehicle Storage Manual.
- Take care with finishes and protect. Do not expose uncured or improperly hardened finishes to conditions likely to cause etching.
- Avoid washing recently finished areas or soft cellulose with detergents or allowing detergents to stay on the surface.

Rectification Process

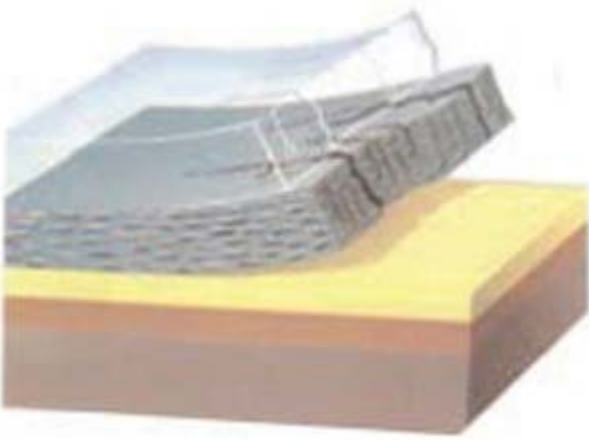
1. Check severity of exception.
2. If mild, exception can be fine flatted and compounded/polished out.
3. If severe, exception will require local refinish. Make sure all traces of the contaminant are removed.

Flaking/Delaminationg



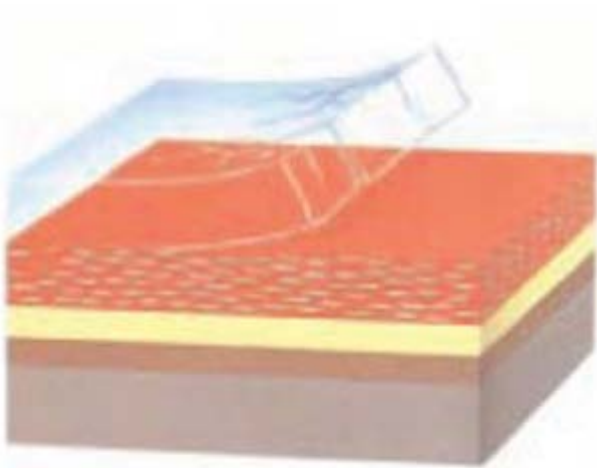
NOTE: Alternative Terminology: Peeling off, peel back, blowing off, shelling, poor bond, loss of adhesion, intercoat adhesion failure and poor adhesion.

Clear Coat and Basecoat Flaking From Surface



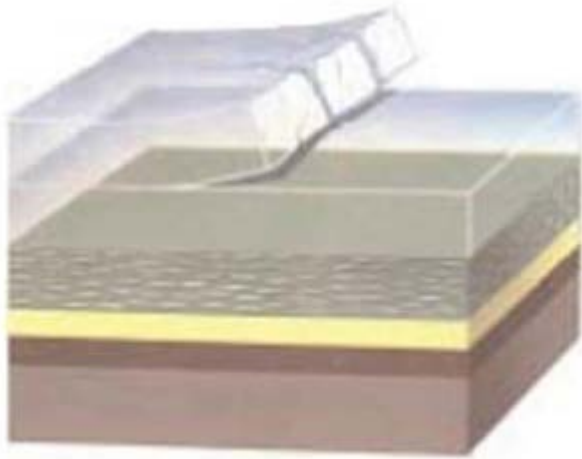
E160654

Clear Coat Flaking From Basecoat



E160655

Clear Coat Flaking From Clear Coat



E160656

Description

The clear coat or both basecoat and clear coat layers are partially or completely detached from the underlying surfaces over large or small areas depending on severity. The exception may exhibit flaking or may only be apparent from portions of the clear coat having previously been removed. The exception is confined to a clear coat only, or to both the clear coat and the basecoat layers.

Warranty Related Cause

- Defective original process or materials.

Non-warranty Related Cause(s)

- None.

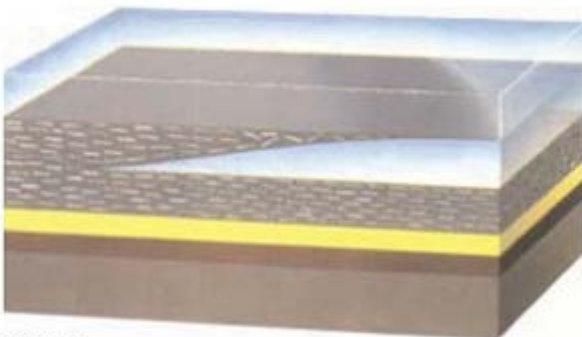
Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by flattening to the layer where the flaking has occurred, then re-painting as necessary.

Haloes



NOTE: Alternative Terminology: Contours, rings, edges, dry edges, peeling back, poor fade-out and poor wetting.



E160657

Description

Color transition of localized refinished area is not imperceptibly graduated into surrounding finish resulting in a dark edge, light shadow or difference in surface finish around the periphery of a repair.

Warranty Related Cause

- Manufacturer's defect in paint application process.

Non-warranty Related Cause(s)

- None.

Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by re-painting as required.

Off Shade



NOTE: Alternative Terminology: Discoloration, mismatch, off-color and fading.



Description

Color shade of adjacent panels does not match or areas with break lines appear to be off-color or differing in shade. This term normally applies to off-color of complete adjacent panels. Local off-shade areas are likely to be the result of contaminants.

Warranty Related Cause

- Manufacturer's process fault.

Non-warranty Related Cause(s)

- None.

Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by re-painting as required.

Opacity/Inadequate Color Coverage



NOTE: Alternative Terminology: Rub-through, grinning-through, poor hiding, poor coverage, thin paint, transparent film, undercoat showing through, undersprayed, lack of paint and poor build.



Description

This exception usually occurs in hard-to-spray areas, sharp contours/edges or lower panels and is evident as insufficient paint coverage and application. The exception will be more defined on dark colors and some metallic colors.

Warranty Related Cause

- Manufacturer's process defect, lack of paint application.

Non-warranty Related Cause(s)

- None.

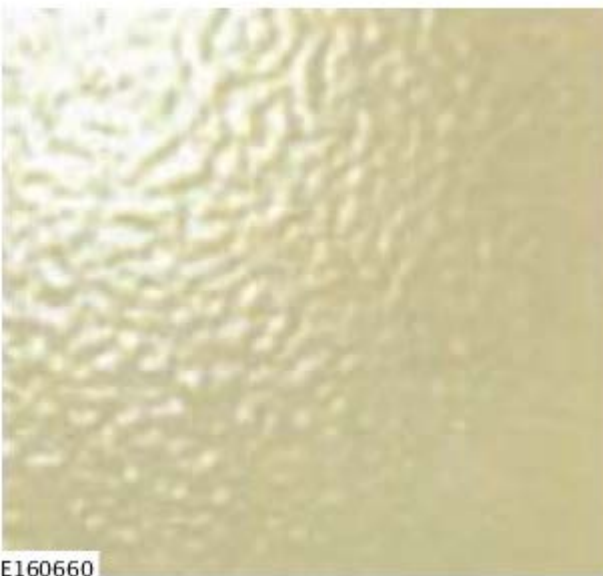
Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by re-painting as required.

Orange Peel



NOTE: Alternative Terminology: Pebbling, poor flow and poor leveling.



Description

A paint finish which has an undulated surface resembling an orange skin. Impaired reflective ability is characteristic of this defect.

Warranty Related Cause

- Manufacturer's paint application process.

Non-warranty Related Cause(s)

- None.

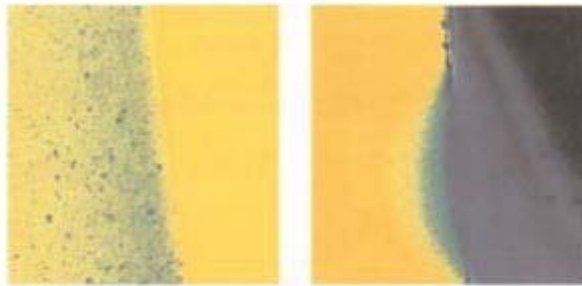
Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by polishing, or flatting and polishing.

Overspray



NOTE: Alternative Terminology: Masking lines, inconsistency and hazing.



E160661

Description

Overspray may appear as areas of dust-like paint particles adhering to the paint surface, or as paint particles only partially absorbed into the finish, reducing the gloss and hazing or misting the reflective ability of the surface.

Warranty Related Cause

- Defective application process by manufacturer.

Non-warranty Related Cause(s)

- None.

Rectification Process - Overspray Clear Coat

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by polishing, or flatting and polishing.

Rectification Process - Overspray Color Coat Plus Clear Coat

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Not permissible exceptions must be repaired as follows:
 - Attempt removal of concern by either polishing or flat and polishing.
 - If polishing does not remove concern, flat and re-paint affected area.

Polishing Compound



NOTE: Alternative Terminology: Residue and debris.

Description

Polishing compound will take the form of either small round specks or hazy patches on body panels or trim components.

Warranty Related Cause

- Polishing compound on vehicles is the result of factory polish repairs done to rectify minor paint defects.

Appropriate protection and subsequent cleaning after polishing not carried out satisfactorily.

Non-warranty Related Cause(s)

- None.

Rectification Process

1. Clean affected area by applying an alcohol based spirit wipe on a soft cloth.

Polishing Witness Marks (Circular Fine Scratches)



NOTE: Alternative Terminology: Swirls, dull finish, blooming and haloing.

Description

Localized areas of circular fine scratching which may have a dull hazy appearance. This effect is a result of inadequate fine flatting and polishing to remove small surface defects.

Warranty Related Cause

- Defective application process by manufacturer.
- Final polishing has not been done effectively, therefore the area shows a low gloss appearance with a bloom/hazy finish.

Non-warranty Related Cause(s)

- None.

Rectification Process

1. Polish area to remove scratches and restore gloss.
2. De-bloom panel to remove all evidence of polishing.

Poor Metal Finish



NOTE: Alternative Terminology: Disc marks, blue marks, weld spatter and weld splashes.



Description

The paint film has sunk into and repeated the outlines of scratches, grooves or lines in the metal. This exception will be characterized by a pattern of short curved grooves, criss-cross lines or very short deep grooves at the surface. The marks in the finish will be more pronounced and severe than flatting marks. When the exception arises from weld spatter or pieces of metal under the finish, it will be seen as jagged intrusions in the paint or globules located adjacent to a welded seam.

Warranty Related Cause

- Poor metal finish in production process.

Non-warranty Related Cause(s)

- None.

Rectification Process

1. Determine if exception is permissible or not permissible.

For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).

2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by polishing, or flatting and polishing. In severe cases re-paint as required.

Runs



NOTE: Alternative Terminology: Drips, gun spits and sags.



E160663

Description

An accumulation of paint which gathers to form a thickened fold, often accompanied by individual tear-like runs or a sagging drapery of runs.

Warranty Related Cause

- Incorrect paint application by manufacturer.

Non-warranty Related Cause(s)

- None.

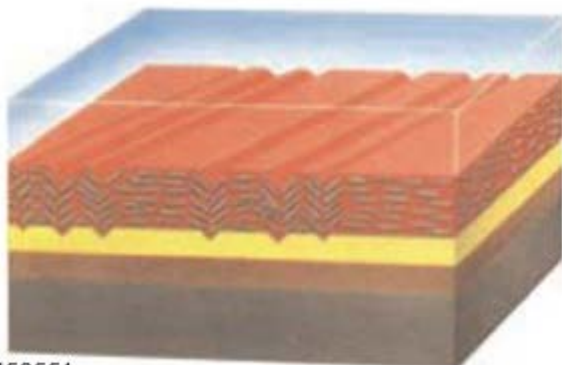
Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by polishing, or flatting and polishing.

Sanding Scratches



NOTE: Alternative Terminology: Sand scratches, scratches in basecoat, dark lines, flatting marks and lining up.



E160664

Description

Parallel scratch marks or fine dark lines apparent only in the basecoat color, following the direction and extent of the manual flattening operation. The severity and effect depends on the location and direction of view (i.e. the lines may not be apparent when viewed directly into the paint film).

Warranty Related Cause

- Defect occurring during manufacturer's process.

Non-warranty Related Cause(s)

- None.

Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by polishing, or flattening and polishing. In severe cases, re-paint as required.

Shadiness/Sheary



NOTE: Alternative Terminology: Shear, sheariness, flotation, mottle, banding, streaks, gun streaking, shadows and blotches.



Description

The paint color appears variegated or in patches of darker and/or lighter shades, arranged in a cloud-like manner. The cloudy pattern usually follows the direction of application according to the stroke of the spray gun.

Warranty Related Cause

- Defect arising from manufacturer's process.

Non-warranty Related Cause(s)

- None.

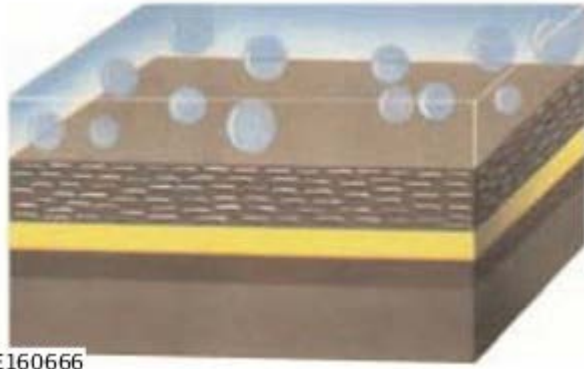
Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by re-painting as required.

Solvent Retention



NOTE: Alternative Terminology: Boil, pits, bubbles, pin-holes, boiling, solvent boil, solvent shock and air bubbles.



E160666

Description

Bubbles of solvent retained in the clear coat, usually close to the surface and in localized areas, of a size between 0.5 and 1 mm (0.020 and 0.040 in.) diameter. May initially be apparent as black dots, but close examination will reveal the depth at which they are held in the clear coat.

Warranty Related Cause

- Fault with manufacturing process.

Non-warranty Related Cause(s)

- None.

Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by re-painting as required.

Staining/Discoloration



NOTE: Alternative Terminology: Water spotting, tree sap/leaves/road tar/glue stains, bleeding, excess adhesive, darkening, rain spotting, brown spots and acid staining.



E160667

Description

Staining is a general term used to describe a condition where the paint surface is discolored or dyed. The stain may arise from under the film, i.e. bleeding, or penetrate into the film from external contamination. Traces of the contaminant will indicate the nature of the staining. Water spotting is recognized as a pattern of light colored spots or marks on the surface of the paint film. These may be accompanied by traces of salt or lime-like deposits. The exception is most common on horizontal surfaces and results from formation of water globules, which with subsequent evaporation leaves salt deposits to stain or attack the paint.

Warranty Related Cause

- Not a warranty related concern.

Non-warranty Related Cause(s)

- Poor storage conditions.
- Oil in air line.
- Contamination of surface by fumes from oven heating system.
- Alcohol or anti-freeze spillage.
- Road tar.
- Windshield-wash fluid attack.
- Acid attack.
- Water left to dry on surface.

Prevention

Store vehicles as detailed in the **New Vehicle Storage Manual**.

Rectification Process

1. Determine if exception is permissible or not permissible.
For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Permissible exception does not require a repair so should be passed as CA.
3. Repair any not permissible exceptions by polishing, or flatting and polishing.

Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards - General Requirements

Description and Operation

Facility Minimum Requirements (For PDI Centers)



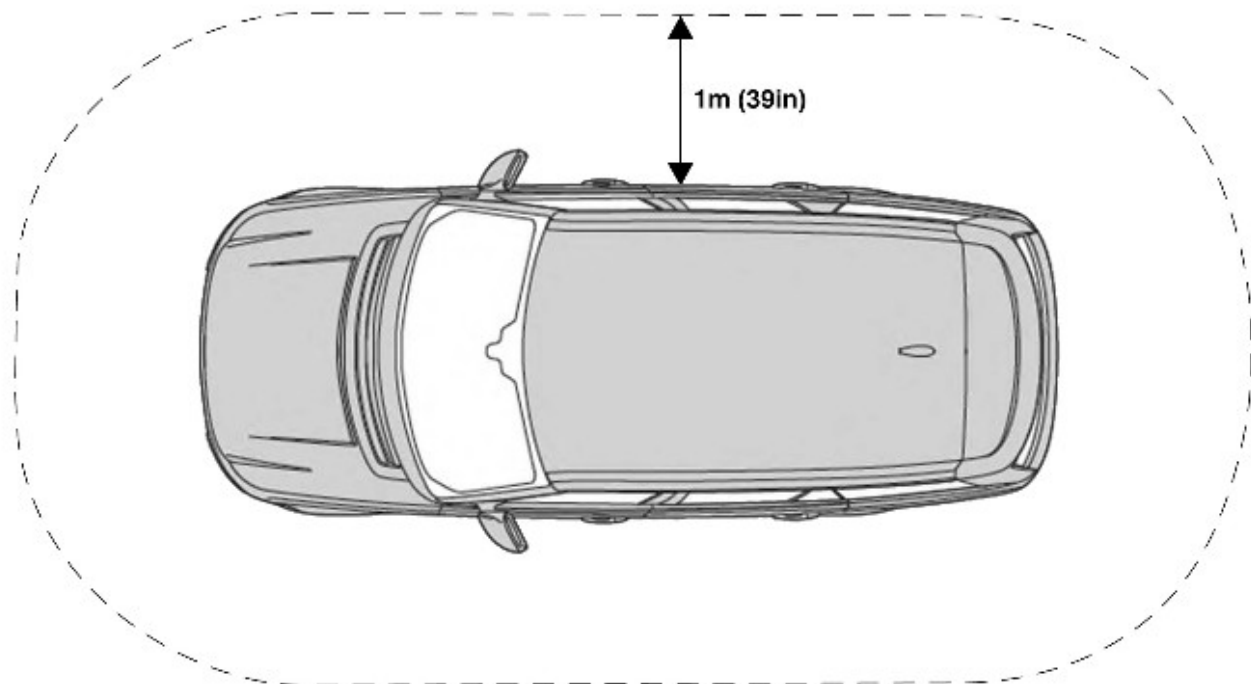
NOTE: The maximum time taken to inspect the vehicle should not normally exceed 5 minutes.

1. A covered well ventilated area providing ample room to drive vehicles into and out of without restrictions.
2. A separate vehicle wash/dry area should be available.
3. Vehicles should be processed down a single line **flow** process.
4. The flow line should be clearly marked using floor marking set to a minimum required width.
5. Sidewalk ways should be clearly marked and must incorporate the provision for doors fully open down the line.
6. All inspection areas should be clearly marked with adequate natural tone florescent lighting that illuminates the vehicle in a consistent way across all exterior surfaces. The lighting levels should be between 1000 and 2000 lux.
7. The inspection area should consist of a box, line marked on the floor, clearly defining the inspection viewing position 1 m (39 in.) from the vehicle. The floor surface where possible should be finished in a light gray to reflect light. Use suitable stable platforms to allow the roof inspection of high sided vehicles.
8. All possible contact points down the line should be protected using soft foam. This foam should be regularly checked and renewed if required.
9. Portable/Mobile units should have soft foam protection installed to all edges. These should be checked regularly and installed if required.
10. No electrical cables, airlines or pipes should be used across the vehicles.
11. All accessory fitting should be done in an off-line location.
12. Personnel should wear appropriate clothing, which removes any risk of damaging the vehicles.
13. Personnel should be devoid of the following items, which could potentially cause vehicle damage:
 - Exposed metal items such as belt buckles, jean rivets, buttons or zippers.
 - Exposed jewellery, watches, chains or rings. Fully covering these items with soft protection is advisable.
 - Tools or other objects sticking out of pockets.
 - Grease, oil or solvents.
14. The line should be kept clean at all times. All dirt, debris or fluid spillages should be cleaned up immediately.

Exterior Inspection Viewing Position



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



E160668

Conduct Of Personnel

1. There should be no smoking in the working area. Areas where smoking is allowed should be clearly marked

- and be the only locations where smoking is permitted.
2. There should be no eating or drinking in the working area. Locations for taking refreshments should be allocated.
 3. Do not lean on or sit in or on vehicles.
 4. Do not place objects on, by or in vehicles.
 5. Do not operate the vehicle in any unnecessary manner, e.g. listening to the radio, unauthorized driving/moving of the vehicle, etc.
 6. When the vehicle is not being worked on make sure all windows, doors and other openings are kept closed.
 7. Do not use clipboards or any other writing materials by or on the vehicle. All written work associated with processing the vehicle should be done in an off-line location.

Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards - Identification Of Exceptions

Description and Operation

Exception Types

Exceptions identified while carrying out a vehicle exterior surface inspection fall into three cause categories:

- Transportation.
- Warranty.
- Internal.

Transportation

Where applicable, all of the transportation exceptions will have been already identified during the Marine Survey, also known as the First Point of Rest Survey. This survey must be carried out immediately after the cars leave the ship in an area on the dockside. Vehicles should not be moved to a holding compound and then inspected for transportation exceptions. If for any reason vehicles cannot be inspected on the dockside and have to be moved to a compound, prior agreement must be obtained from the carrier that they will still accept liability for any transit related damage found.

Examples of transportation exceptions:

- Damage caused by physical impact, abrasion or forced entry.
- Damage or soiling of the drivers area to include seat and interior components, door inner and apertures and door trims. Obvious vandalism or abuse of the interior.
- Wheel rim damage - the rim has rotary cut or abrasion marks.
- Damage to undercarriage.
- Vehicle exterior glass surface, scratched, chipped or broken.
- Paint chips noted on driver's door rear edge or the drivers side rear door leading edge. Any paint damage or trim damage found on doors whereby the transit door seal is broken.

Undercarriage exceptions must be declared within seven workings days from receipt of the vehicle.

Water, tire, glass and exterior body fallout damage are managed risks subject to separate negotiations.

Warranty

Warranty related exceptions are those that relate to the fit, functionality and workmanship of parts or materials. Determining warranty related exceptions is done via the PDI process. Please refer to the applicable vehicle line Warranty Policy and Procedures Manual for a more comprehensive explanation of the warranty process requirements.

Examples of warranty related exceptions:

- Poor metal condition on body panels such as distorted, wavy or creased. Only acceptable if outside of factory quality build standard.
- Poor finish on body panels such as file, grinder or weld marks. Only acceptable if outside of factory quality build standard.
- Outwards facing dents in body panels.
- Poor paint finish due to the following:
 - Dirt/Inclusions.
 - Runs/Sags.
 - Blisters, including solvent popping.
 - Peeling/Flaking
 - Base color coat bruising/blemishes.
 - Mottle/Shading of color coat.
 - Over spray or dry spray.
 - Chipped paint - only allowed on panels covered by transit coatings or where transit labels are applied.
 - Any defect found under the transit coating, except where there is evidence that the transit coating has been breached.
- Tire damage caused by production related debris (e.g. screws, bolts, etc.).
- Cracks in glass or plastic panels deemed to be defective material.
- Improperly installed or mis-aligned panels, mouldings, badges, emblems or weather strips.
- Wheel rim damage found inboard of the rim or noted in or around the wheel nut location holes.
- Water ingress/leakage - damaged or contaminated components due to poor body seam sealing or incorrectly installed/damaged body weather seals.

Internal

Any damage related exceptions found subsequent to the Marine Survey will be considered as internal. It is therefore the responsibility of the port processor to repair any such damages and absorb all associated costs. The only deviation from this is the possibility of finding hidden transportation damage during the PDI inspection.

Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards - Exterior Pre-Delivery Inspection (PDI) Process

Description and Operation

General

All exterior PDI should be carried out inside the PDI facility.

For additional information, refer to: [General Requirements](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).

Conducting the Inspection

All inspections should be undertaken in a manner that minimizes contact with the vehicles, to avoid damaging them.

The vehicle's outer surfaces should be clean, if necessary having been washed and dried prior to the inspection process.

All inspections shall be entirely impartial and be based on the following instructions, developed to make sure all vehicle inspections are conducted in a consistent systematic manner:

- All exterior surfaces and components not covered by transit protection should be inspected.
- All exterior surfaces and components not covered by transit protection should be inspected.
- Start inspection at center front of vehicle, then move down the right side, across the rear and up the left side, finishing at your start point.
- All exceptions noted must be clearly visible at 1 m (39 in.) standing upright at right angles to the inspected surface/component or up to 30 degrees each side of center. Most surface defects are visible at right angles to the vehicle. Dents/Dings are most visible when the surface of the vehicle is viewed at the 30 degrees angle offset.
- Close inspection, viewing surfaces/components at less than 1 m (39 in.), is not permitted when carrying out this inspection. Close inspection must only be used to confirm an exception is present. Close inspection is a means of exception verification, not a detection technique.
- Determine the acceptability of any exceptions found on the vehicle in accordance with the criteria given in the acceptance standards tables.

For additional information, refer to: [Cosmetic Acceptance Standards](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).

Inspection Process - Description Of the Work Element

1. View each panel as described above. You may occasionally have to lightly touch the surface of the vehicle to confirm the presence of an exception. At the end of the inspection all exceptions should be recorded on a worksheet. Include a fault code description and a vehicle silhouette.
For additional information, refer to: [Exterior Surface Zone Identification](#) (101-03 Exterior Body & Paint Pre-Delivery Inspection (PDI) Standards, Description and Operation).
2. Inspect the front area of the hood, the radiator grille, header panel, headlamps, front body panels, bumper assy. View across front of vehicle to make sure gaps and alignments are acceptable.
3. Using the reflection from the overhead lights, scan the panel to detect any dents/dings.
4. At the right side of the vehicle inspect the front fender, hood, bumper side and wheel assy. Viewing down the vehicle from a 30 deg angle check for dents/dings.
5. Inspect right side of windscreen, A-pillar, roof above front door, front door, door handle, door glass and sill area. Look down the vehicle from 30 degrees angle and check for dents/dings.
6. Inspect the roof above the rear door, rear door, door handle, door glass, B/C-pillar trim and sill area. Look down the vehicle from 30 degrees angle and check for dents/dings.
7. Inspect the right hand rear fender, luggage compartment, D/E-pillar, side bumper assembly and wheel assembly.
8. Look along the right hand side of the vehicle and check that all of the panel gaps and alignments are acceptable.
9. At the rear of the vehicle inspect the luggage compartment lid/tailgate to make sure panel gaps and alignments are correct. Inspect tail lamps and rear fender around lamp assemblies. Inspect the complete rear bumper assembly including any finishers, badges, emblems or lamps. Make sure their alignment is correct.
10. 10. In reverse order fully inspect the left side of the vehicle.

Reporting Warranty Inspection Data

Each warranty exception must be recorded by using the Jaguar or Land Rover warranty code system. Refer to the appropriate Repair Time Searcher (RTS) to find the correct warranty code. Direct reporting of exceptions found on vehicles should be done via the Electronic Product Quality Reporting (EPQR) system.

Suspension System - General Information -

Coil Spring Suspension

Item	Specification
Type:	
Front	Independent with single rate coil spring, twin tube damper and high stress anti-roll bar
Rear	Independent with dual rated coil spring, twin tube damper and anti-roll bar

Air Spring Suspension

Item	Specification
Type	Independent with twin tube damper, anti-roll bars and air springs with multiple, driver selectable ride heights - Standard, off-road and access.

Wheel Alignment Specification (All Markets) - Front - LHD



CAUTION: When checking or adjusting front or rear steering geometry, the vehicle must either have a full fuel tank or have sufficient weight placed in the vehicle's load space to give the equivalent weight of a full fuel tank. The weight must be evenly distributed at the front and the right hand side of the load space. The fuel tank capacity is 86.3 litres (18.9 Imperial gallons) (22.7 US gallons). Depending on the amount of fuel in the tank, calculate the amount of weight which must be added:

- 1 litre of fuel weighs 0.8 kg (1.7 pounds)
- 1 Imperial gallon of fuel weighs 3.6 kg (8.0 pounds)
- 1 US gallon of fuel weighs 3.0 kg (6.7 pounds)



NOTE: All figures are with vehicle at 'Showroom' ride height - full fluids, full tank of fuel, no occupants/luggage, tires inflated to normal pressures

Item		Left-hand		Right-hand		Total/Balance	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
Camber	Decimal degrees	-0.15°	± 0.75°	-0.50°	± 0.75°	0.35°	± 0.75°
	Degrees/minutes	-9'	± 45'	-30'	± 45'	21'	± 45'
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
	Decimal degrees	-0.90°	0.60°	-1.25°	0.25°	-0.40°	1.10°
	Degrees/minutes	-54'	36'	-1°15'	15'	-24'	1°6'
Castor	Decimal degrees	3.86°	± 0.75°	4.17°	± 0.75°	-0.31°	± 0.75°
	Degrees/minutes	3°52'	± 45'	4°10'	± 45'	-19'	± 45'
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
	Decimal degrees	3.11°	4.61°	3.42°	4.92°	-1.06°	0.44°
	Degrees/minutes	3°7'	4°37'	3°25'	4°55'	-1°4'	26'
Toe	Decimal degrees	0.08°	±0.10°	0.08°	±0.10°	0.16°	± 0.20°
	Degrees/minutes	5'	±6'	5'	±6'	10'	± 12'
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
	Decimal degrees	-0.02°	0.18°	-0.02°	0.18°	-0.04°	0.36°
	Degrees/minutes	-1'	11'	-1'	11'	-2'	22'

Wheel Alignment Specification (All Markets) - Front - RHD



NOTE: All figures are with vehicle at 'Showroom' ride height - full fluids, full tank of fuel, no occupants/luggage, tires inflated to normal pressures

Item		Left-hand		Right-hand		Total/Balance	
		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
Camber	Decimal degrees	-0.50°	± 0.75°	-0.50°	± 0.75°	0.00°	± 0.75°
	Degrees/minutes	-30'	± 45'	-30'	± 45'	0'	± 45'
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
	Decimal degrees	-1.25°	0.25°	-1.25°	0.25°	-0.75°	0.75°
	Degrees/minutes	-1°15'	15'	-1°15'	15'	-45'	45'
Castor	Decimal degrees	4.02°	± 0.75°	4.02°	± 0.75°	0.00°	± 0.75°
	Degrees/minutes	4°1'	± 45'	4°1'	± 45'	0'	± 45'
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
	Decimal degrees	3.27°	4.77°	3.27°	4.77°	-0.75°	0.75°
	Degrees/minutes	3°16'	4°46'	3°16'	4°46'	-45'	45'
Toe		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance

	Decimal degrees	0.08°	±0.10°	0.08°	±0.10°	0.16°	± 0.20°
	Degrees/minutes	5'	±6'	5'	±6'	10'	± 12'
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
	Decimal degrees	-0.02°	0.18°	-0.02°	0.18°	-0.04°	0.36°
	Degrees/minutes	-1'	11'	-1'	11'	-2'	22'

Wheel Alignment Specification (All Markets) - Rear - vehicles with air suspension



NOTE: All figures are with vehicle at 'Showroom' ride height - full fluids, full tank of fuel, no occupants/luggage, tires inflated to normal pressures

Item		Left-hand		Right-hand		Total/Balance		Thrust Angle	
		Nominal	Tolerance	Nominal	Tolerance				
Camber	Decimal degrees	-0.75°	± 0.75°	-0.75°	± 0.75°				
	Degrees/minutes	-45'	± 45'	-45'	± 45'				
		Minimum	Maximum	Minimum	Maximum				
	Decimal degrees	-1.50°	0.00°	-1.50°	0.00°				
	Degrees/minutes	-1°30'	0'	-1°30'	0'				
Toe		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
	Decimal degrees	0.12°	± 0.10°	0.12°	± 0.10°	0.24°	± 0.14°	0°	± 0.14°
	Degrees/minutes	7'	± 6'	7'	± 6'	14'	± 8'	0'	± 8'
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
	Decimal degrees	0.02°	0.22°	0.02°	0.22°	0.10°	0.38°	-0.14°	0.14°
	Degrees/minutes	1'	13'	1'	13'	6'	23'	-8'	8'

Wheel Alignment Specification (All Markets) - Rear - vehicles without air suspension



NOTE: All figures are with vehicle at 'Showroom' ride height - full fluids, full tank of fuel, no occupants/luggage, tires inflated to normal pressures

Item		Left-hand		Right-hand		Total/Balance		Thrust Angle	
		Nominal	Tolerance	Nominal	Tolerance				
Camber	Decimal degrees	-0.50°	± 0.75°	-0.50°	± 0.75°				
	Degrees/minutes	-30'	± 45'	-30'	± 45'				
		Minimum	Maximum	Minimum	Maximum				
	Decimal degrees	-1.25°	0.25°	-1.25°	0.25°				
	Degrees/minutes	-1°15'	15'	-1°15'	15'				
Toe		Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
	Decimal degrees	0.12°	± 0.10°	0.12°	± 0.10°	0.24°	± 0.14°	0°	± 0.14°
	Degrees/minutes	7'	± 6'	7'	± 6'	14'	± 8'	0'	± 8'
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
	Decimal degrees	0.02°	0.22°	0.02°	0.22°	0.10°	0.38°	-0.14°	0.14°
	Degrees/minutes	1'	13'	1'	13'	6'	23'	-8'	8'

Suspension System - General Information - Suspension System

Diagnosis and Testing

Principle of Operation

For a detailed description of the Suspension System and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to:

- Front Suspension (204-01 Front Suspension, Description and Operation),
- Rear Suspension (204-02 Rear Suspension, Description and Operation).

Inspection and Verification



WARNING: Before carrying out a road test, make sure the vehicle is safe to do so. Failure to follow this instruction may result in personal injury.



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Gather as much information from the driver as possible and verify the customer concern by carrying out a road test, as closely as possible reproducing the conditions under which the fault occurs.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection

Mechanical
<ul style="list-style-type: none"> • Tire pressures • Damaged wheels or tires • Wheel bearing(s) • Loose or damaged front or rear suspension components • Loose, damaged or missing suspension fastener(s) • Damaged or leaking air suspension components • Worn or damaged suspension bushing(s) • Loose, worn or damaged steering system components • Damaged axle components • Damaged chassis

3. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the symptom chart.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Crabbing	<ul style="list-style-type: none"> • Incorrect rear thrust angle • Front or rear suspension components 	<ul style="list-style-type: none"> • Check the rear alignment • Check the front and rear suspension for signs of damage or wear
Drift/pull/wander	<ul style="list-style-type: none"> • Tire pressures • Uneven tire wear • Damaged steering components • Wheel alignment • Brake drag • Unevenly loaded or overloaded vehicle 	<ul style="list-style-type: none"> • Check and adjust the tire pressures (see visual inspection) • Check for uneven tire wear, investigate the cause and rectify as necessary • Check the steering for wear/damage • Check and adjust the wheel alignment as necessary • Check for binding brakes, rectify as necessary • Advise the driver of the load issues
Front bottoming or riding low	<ul style="list-style-type: none"> • Damaged suspension components • Air spring fault 	<ul style="list-style-type: none"> • Check the suspension components for damage • Check the dynamic suspension
Uneven tire wear	<ul style="list-style-type: none"> • Incorrect tire pressure (rapid centre rib or inner and outer edge wear) • Incorrect front or rear toe (rapid inner or outer edge wear) 	<ul style="list-style-type: none"> • Check and adjust the tire pressures (see visual inspection) • Check and adjust the wheel alignment as necessary • Balance the wheels and tires as necessary

	<ul style="list-style-type: none"> • Incorrect camber (rapid inner or outer edge wear) • Tires out of balance (tires cupped or dished) 	
Harsh ride	<ul style="list-style-type: none"> • Damaged suspension components • Air spring fault 	<ul style="list-style-type: none"> • Check the suspension components for damage • Check the dynamic suspension
Shimmy or wheel tramp	<ul style="list-style-type: none"> • Wheels/tires • Loose wheel nut(s) • Loose front suspension fasteners • Front wheel bearing(s) fault • Worn or damaged suspension component bushing • Loose, worn or damaged ball joint(s) • Loose, worn or damaged steering components • Front wheel alignment 	<ul style="list-style-type: none"> • Check the wheels and tires for condition and balance • Check and tighten the wheel nuts and suspension fasteners to specification • Check the front wheel bearings, suspension bushings, ball joints and steering components for wear or damage • Check and adjust the wheel alignment as necessary
Poor return ability of the steering (self-centering)	<ul style="list-style-type: none"> • Steering column • Ball joints • Steering components 	<ul style="list-style-type: none"> • Check the steering column universal joints, etc • Check the ball joints and other steering components
Sway or roll	<ul style="list-style-type: none"> • Loose front or rear stabilizer bar • Worn lower suspension arm stabilizer bar insulators • Air spring fault 	<ul style="list-style-type: none"> • Check the stabilizer bar security and condition. Rectify as necessary • Check the function of the active stabilization system (where installed) • Check the air springs
Vehicle leans to one side	<ul style="list-style-type: none"> • Front or rear suspension components • Air spring fault 	<ul style="list-style-type: none"> • Check the front and rear suspension • Check the air springs

DTC Index

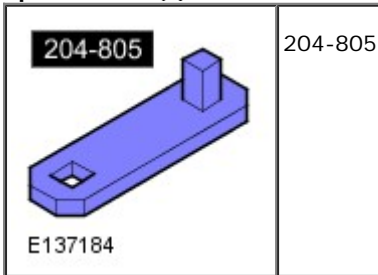
For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Air Suspension Control Module (100-00, Description and Operation).

Suspension System - General Information - Four-Wheel Alignment

General Procedures

Special Tool(s)



CAUTIONS:



Make sure the vehicle is on a flat level surface.



Make sure the tire pressures are within specification.



Make sure that only the manufacturers' recommended four wheel alignment equipment is used.



Make sure the vehicles fuel tank is full, if not distribute extra weight evenly over the fuel tank area to represent a full tank of fuel.



Make sure there are no heavy objects in the vehicle.



Make sure the air suspension is set to NORMAL ride height.



Make sure the steering is in the straight ahead position.



Make sure the slip plates (turntables) are free to move before adjusting the geometry.



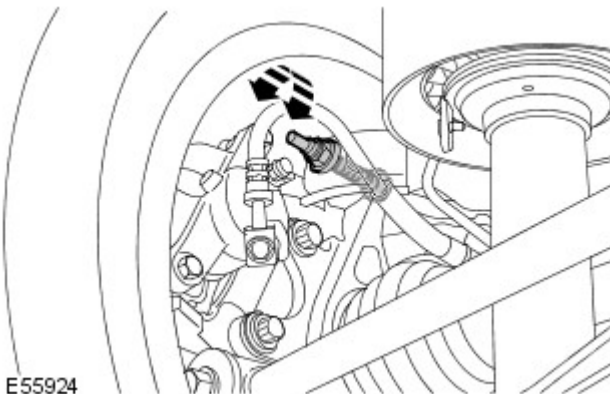
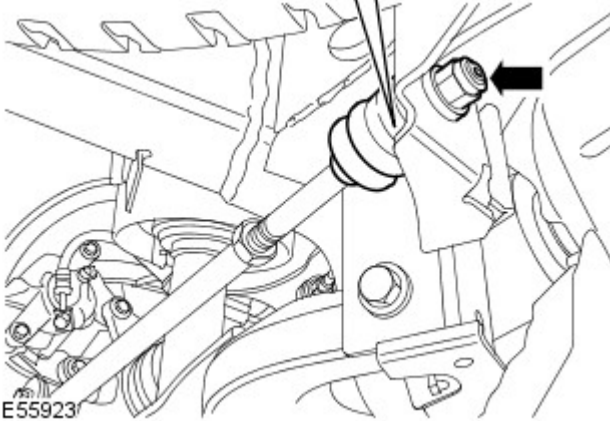
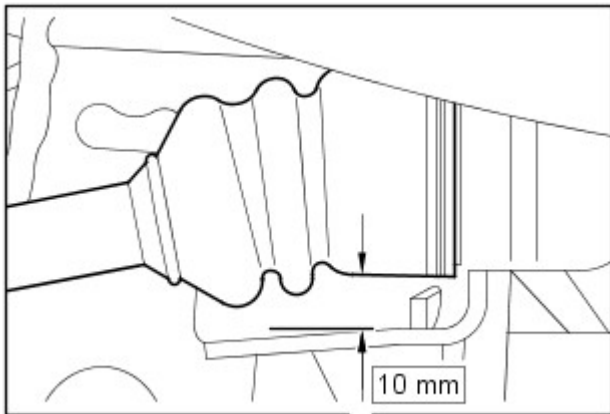
NOTE: This procedure can be used for vehicles with either air or coil spring suspension.


1. Check the tie rod ends, suspension joints, wheel bearings and wheels and tires for damage, wear and free play.
 - Adjust or repair any worn, damaged or incorrectly adjusted components.
2. Check and adjust tire pressures.
3. Position the vehicle on a calibrated, level, vehicle lift.
4. Release the vehicle parking brake.
5. Vehicles with dynamic suspension: Using the approved diagnostic tool, check the air suspension control module for fault codes and clear as required.
6. Vehicles with dynamic suspension: Using the diagnostic tool, set vehicle to 'Geometry Set Mode', using the instructions below. Putting the vehicle into this mode will make sure that the ride heights are controlled more accurately.
 1. Select the 'Configuration' tab
 2. Select 'Set up and Configure'.
 3. Select 'Air Suspension'.
 4. Select 'Suspension Geometry Set Up'.
 5. Select 'Tight Tolerance Mode'.
 6. Follow the on-screen instructions until the set up process has finished.


7.  NOTE: If rear camber adjustment is required, loosen

the rear camber adjustment bolts enough to allow adjustment before starting any other wheel alignment adjustments. Do not fully loosen the rear camber adjustment bolts.

Using only four wheel alignment equipment approved by Land Rover, check and adjust the wheel alignment.



8.  **CAUTION:** Make sure the toe link anti-rotation tang is fully seated in the integrated body frame before tightening the toe link retaining nut. Failure to follow this instruction will result in damage to the toe link or integrated body frame.

 **NOTE:** This step is only required if the toe links have been removed or replaced.

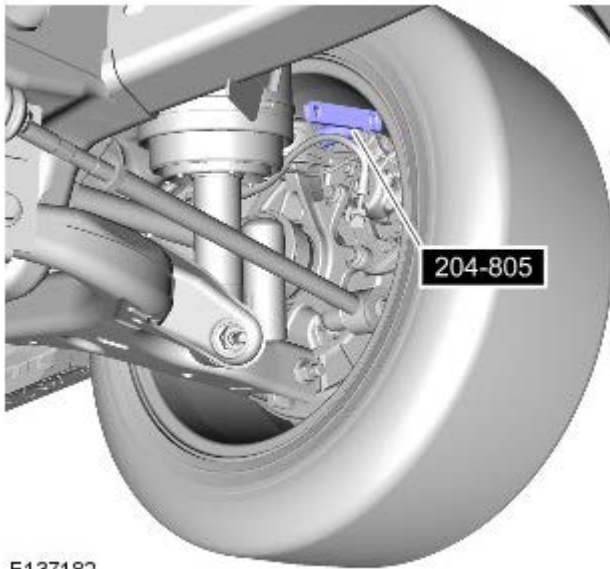
Adjust the rear bump steer.

- Loosen the toe link inner ball joint retaining nut.
- Set the gap, between the underside of the toe link rubber boot and the integrated body frame bracket, to 10 mm (0.473 in).
- Tighten the toe link inner ball joint retaining nut to 133 Nm (98 lb.ft)
- Repeat the above procedure for the other side.

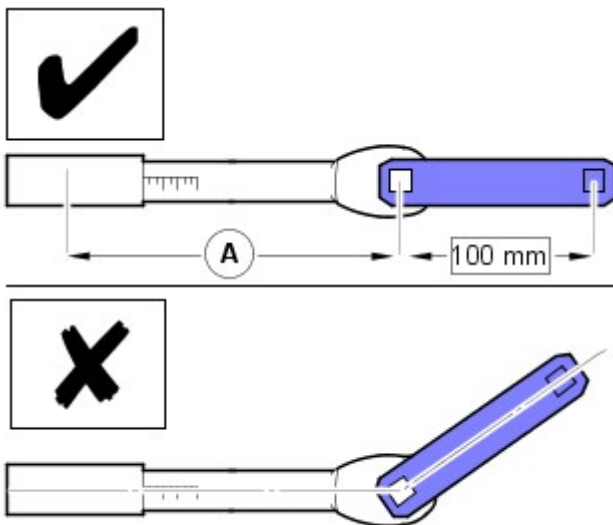
9. Adjust the rear camber.

- Loosen the rear camber adjusting bolts.
- Rotate the rear camber adjusting bolt until the correct value is obtained.
- Repeat the above procedure for the other side.
- Tighten the rear camber adjusting bolts.

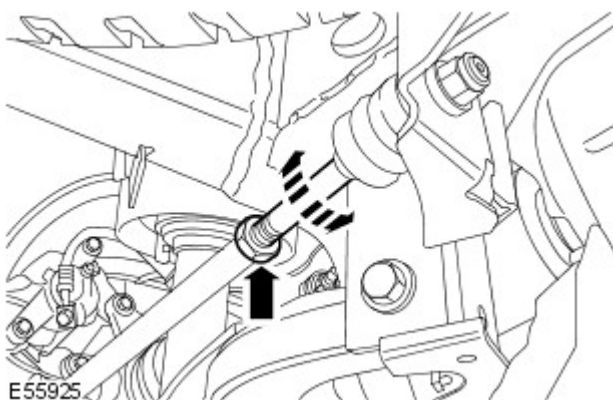
10. Install the special tool and a suitable socket to the rear camber adjusting bolt retaining nut.



E137182




E137185



E55925

11. NOTES:

 The torque wrench must be installed in a direct line with the special tool, as shown.

 Calculate the torque wrench setting using the formula below.

 Key to letters:

- **A** = Effective length of the torque wrench, measured in mm.

Formula:


- **Torque wrench setting (Nm) = $(133 \times A) / (A + 100)$**

Using the special tool, a suitable extension bar and a torque wrench, fully tighten the camber adjusting bolt retaining nut.

- Use the torque wrench setting calculated above.
- Repeat the above procedure for the other side.

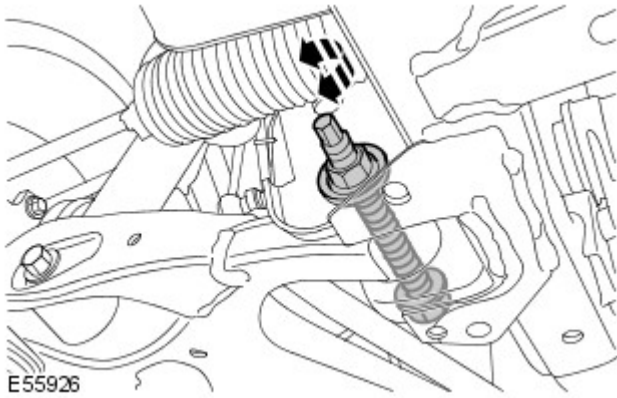
12. Adjust the rear toe.

- Loosen the toe link adjustment locking nut.
- Rotate the toe link inner ball joint until the correct rear toe value is obtained.
- Tighten the toe link adjustment locking nut to 130 Nm (96 lb.ft).
- Repeat the above procedure for the other side.
- Repeat the rear toe measurement.

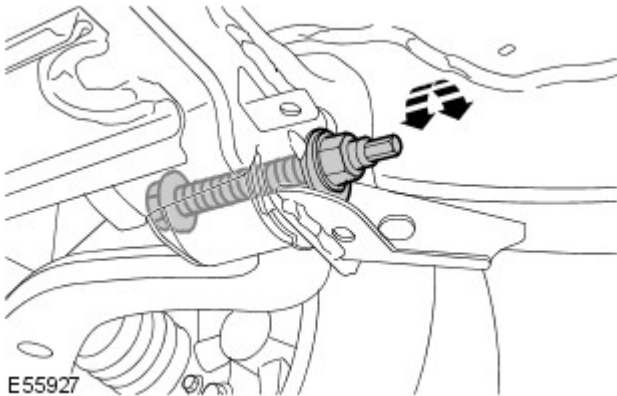
13.  CAUTION: Make sure the slip plates (turntables) are free to move before adjusting the geometry.

Adjust the front camber.

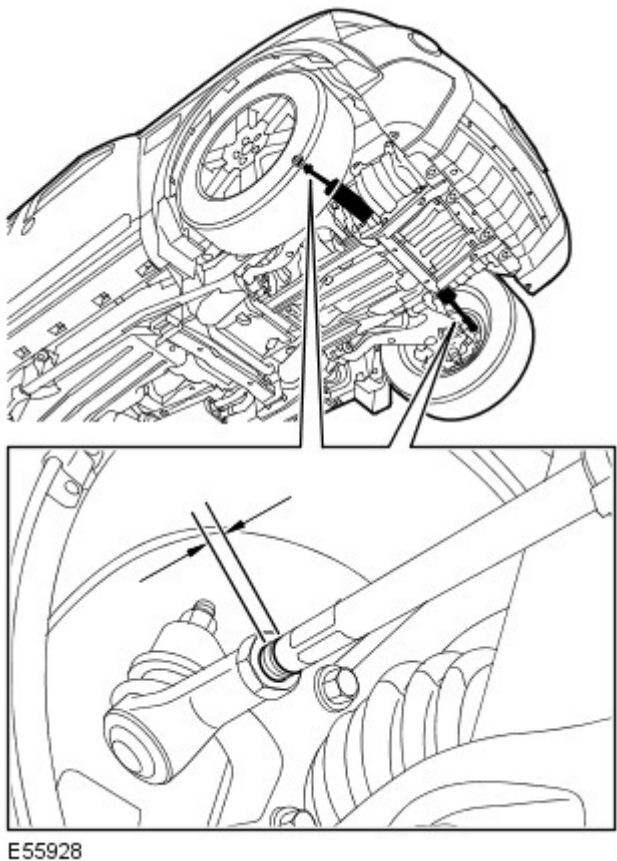
- Loosen the lower arm front camber adjusting bolt.
- Rotate the front camber adjusting bolt



- until the correct value is obtained.
- Tighten the lower arm front camber adjusting bolt to 275 Nm (203 lb.ft).
- Repeat the above procedure for the other side.

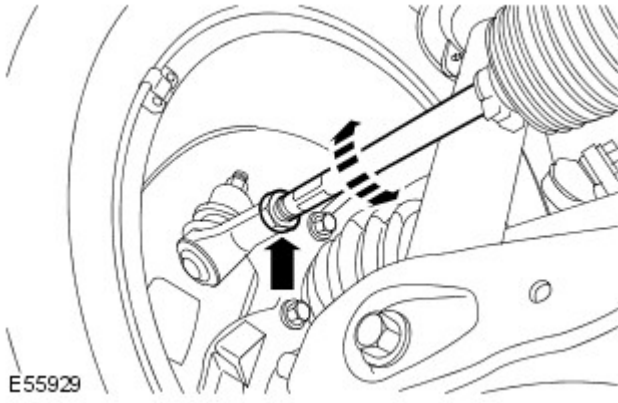


14. Adjust the front castor.
 - Loosen the lower arm rear castor adjusting bolt.
 - Rotate the castor adjusting bolt until the correct value is obtained.
 - Tighten the lower arm rear castor adjusting bolt.
 - Repeat the above procedure for the other side.
 - Repeat the castor measurement.
 - Repeat the above procedure until both castors achieve the correct value.
 - Tighten the lower arm rear castor adjusting bolts to 275 Nm (203 lb.ft).



15. Align the steering to straight ahead.
 - Measure the length of the exposed thread on each track rod.
 - If the exposed thread lengths differ by more than two millimetres:
 - Stage one: Loosen one track rod end locking nut.
 - Stage two: Rotate the track rod until the lengths of the exposed threads on both track rods are equal.
 - Stage three: Tighten the track rod end locking nut.
 - Stage four: Rotate the steering wheel until both front toe measurements are equal.

16. Adjust the front toe.
 - Loosen the track rod end locking nuts.
 - Rotate the track rods to adjust each individual front toe to the correct value.
 - Tighten the track rod end locking nuts to 53 Nm (39 lb.ft).



17. Vehicles with dynamic suspension: Using the diagnostic tool, return the vehicle to 'Normal Mode'.
 1. Select the 'Configuration' tab
 2. Select 'Set up and Configure'.
 3. Select 'Air Suspension'.
 4. Select 'Suspension Geometry Set Up'.
 5. Select 'Normal Mode'.
 6. Follow the on-screen instructions until the normal mode process has finished.

18. Calibrate the steering angle sensor using the diagnostic tool.

Suspension System - General Information - Front Wheel Bearing and Wheel Hub Runout Check

General Procedures

NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.

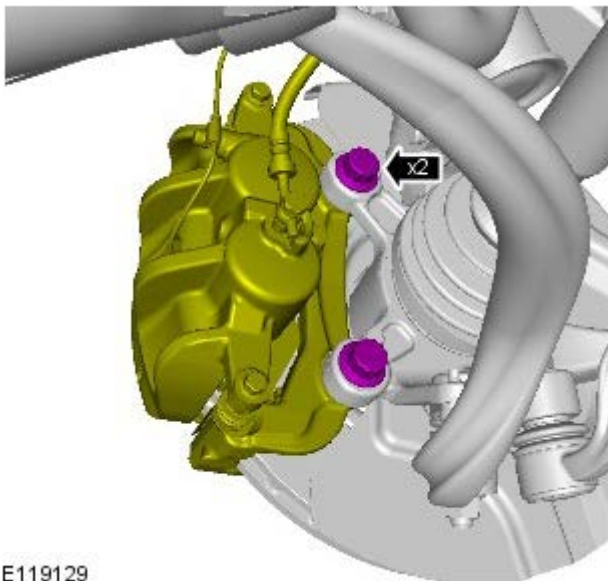


LH illustration shown, RH is similar.

-  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

- Remove the road wheel.



E119129

- CAUTIONS:**



Do not allow the brake caliper to hang on the brake hose.

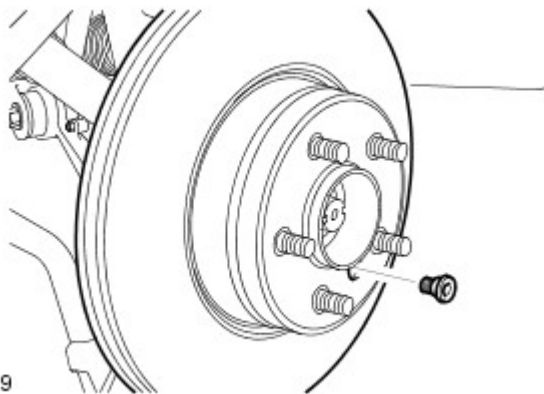


LH side: Do not allow the brake caliper to hang on the brake pad wear warning sensor lead.



NOTE: Models with standard brakes shown, models with high performance brakes similar.

Release the brake caliper and tie aside.

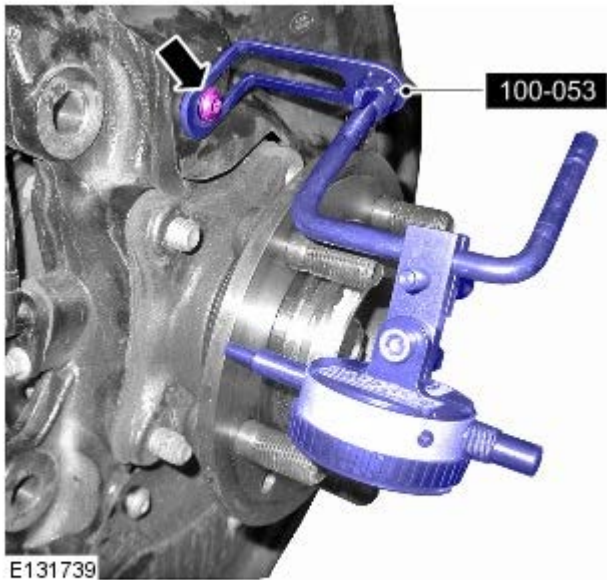


E61629

- Remove the front brake disc.
 - Remove the Allen screw.

- Thoroughly clean the hub mounting face.

- Using special tool (100-053) mount a Dial Test Indicator (DTI) to and secure to the backplate using the upper backplate fixing.



7.  **CAUTION:** Make sure the DTI is positioned clear of the wheel studs.

Position the DTI probe on the outer edge of the hub face.

8. Zero the DTI and rotate the hub one complete revolution to measure hub runout.
 - The hub runout limit is 0.0135 mm.

9.  **NOTE:** If the hub runout exceeds the limit replace the hub.

For additional information, refer to: Front Wheel Bearing and Wheel Hub (204-01, Removal and Installation).

10. Remove the DTI.
11. Install the brake disc.
 - Tighten the Torx screw to 35 Nm (26 lb.ft).
12. Install the brake caliper and tighten the bolts. TORQUE: 275 Nm
13. Install the road wheel and tighten nuts to 140Nm (103 lb-ft).
14. Repeat the above procedure on the opposite side.
15. Depress the brake pedal several times to set brake pads.
16. Lower the vehicle.

Front Suspension -

Coil Spring Suspension

Item	Specification
Road spring color coding:	
	YELLOW/BLUE
	YELLOW/GREY
	YELLOW

Note: The first color indicates the fitted position of the spring on the vehicle i.e. front. The secondary color identifies the thickness of the isolator which is fitted to a particular spring to ensure that the vehicle ride height is maintained within specified limits. Replacement springs will be supplied with the appropriate isolator fitted.

Torque Specifications

Description	Nm	lb-ft
* Stabilizer bar link nuts	115	85
Stabilizer bar clamp nuts	115	85
Front axle crossmember bolts	115	85
Shock absorber and spring assembly to lower arm bolt	300	221
Shock absorber top mounting nuts	70	52
* Shock absorber upper bush rebound plate nut	98	72
Heat shield bolts	10	7
* Upper arm and wheel knuckle nut	70	52
* Tie-rod end ball joint nut	76	56
Brake hose retaining bracket to wheel knuckle bolt	22	16
*+ Halfshaft retaining nut	230	169
Brake hose to upper arm bolt	22	16
Upper arm nuts and bolts	175	129
Radiator access panel bolts	10	7
Wheel hub bolts	115	85
Brake disc dust shield bolts	10	7
Lower arm bolts	275	203
Lower arm ball joint retaining nut	115	85
Lower arm front camber adjusting bolt	275	203
Lower arm rear castor adjusting bolts	275	203
Toe link inner ball joint retaining nut	133	98
Rear camber adjusting bolts	133	98
Track rod end locking nuts	53	39
Wheel speed sensor bolt	10	7
Axle carrier bushing bolt - M14	105	77
Axle carrier bracket bolts	80	59
Road wheel nuts	140	103

*** New nut/bolts must be fitted**

+ Stake nut on completion

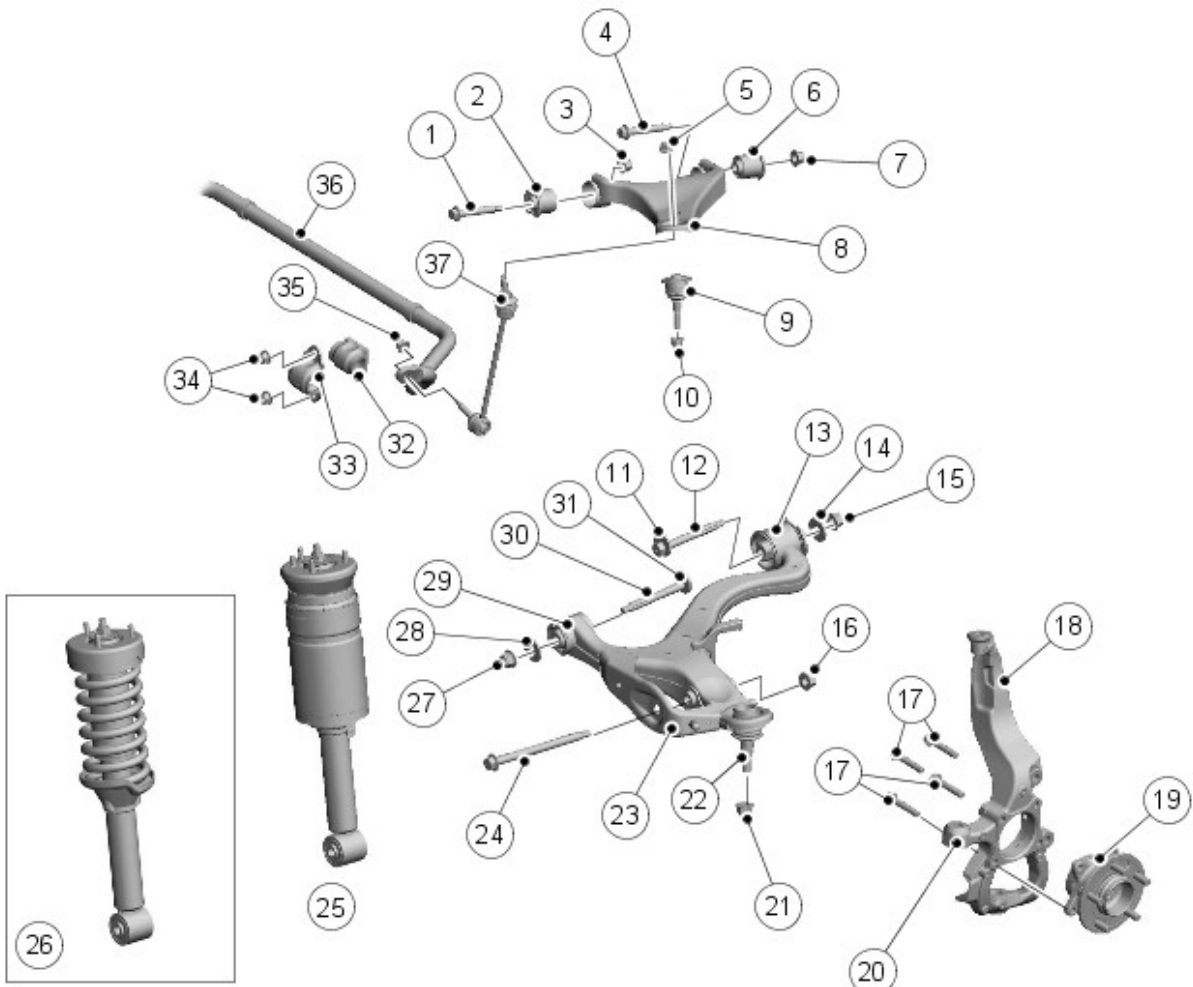
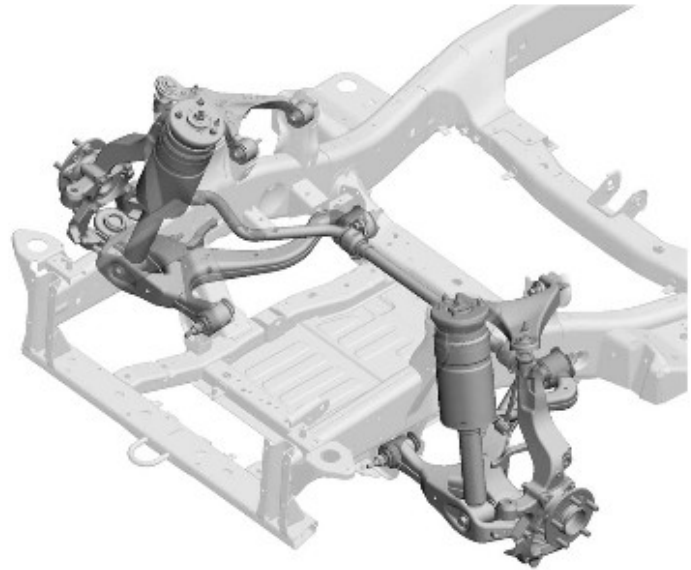
Front Suspension - Front Suspension

Description and Operation

COMPONENT LOCATION



NOTE: Air suspension version shown



E 150446

Item	Part Number	Description
1	-	Flanged bolt (Upper control arm forward bush)

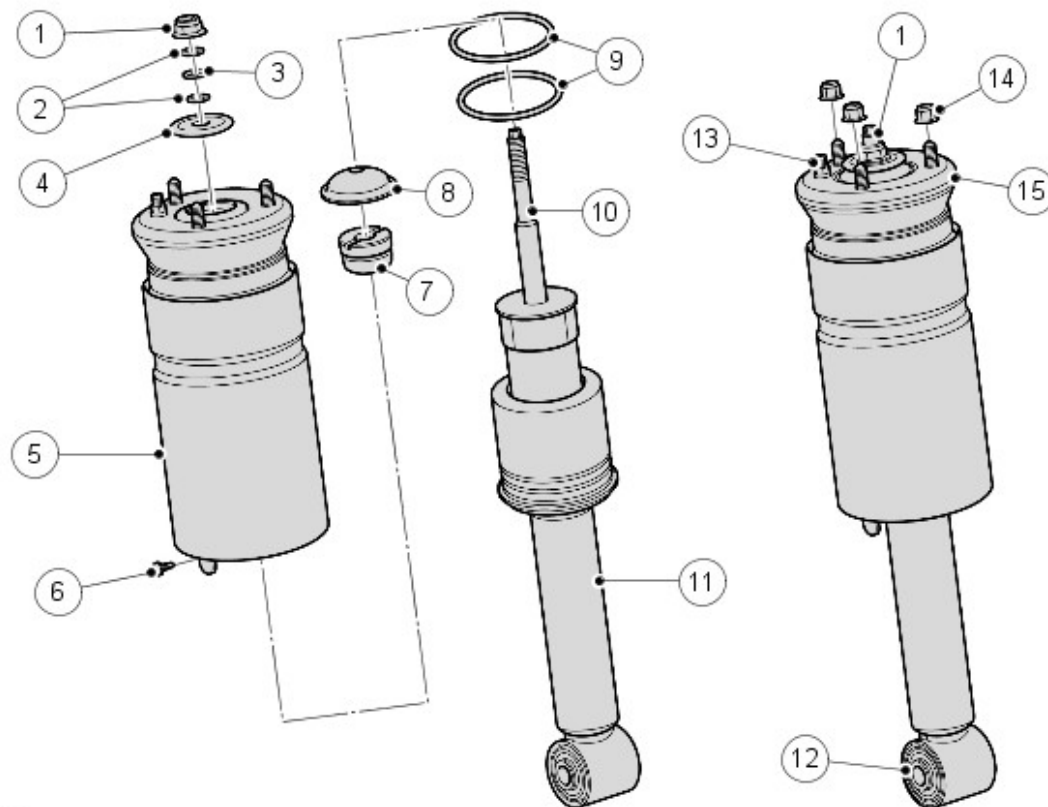
2	-	Bush - forward (Upper control arm)
3	-	Nut (Upper control arm forward bush)
4	-	Flanged bolt (Upper control arm rearward bush)
5	-	Nut (Stabilizer link to upper control arm)
6	-	Bush - rearward (Upper control arm)
7	-	Nut (Upper control arm rearward bush)
8	-	Upper control arm
9	-	Ball joint (Upper control arm to swivel hub)
10	-	Nut (Ball joint to swivel hub attachment)
11	-	Cam washer - integral to bolt (Lower control arm rearward bush)
12	-	Bolt (Lower control arm rearward bush)
13	-	Rearward hydrabush (Lower control arm)
14	-	Cam washer
15	-	Nut (Lower control arm rearward bush)
16	-	Nut (Shock absorber assembly lower attachment)
17	-	Wheel hub bolt (4 off)
18	-	Wheel knuckle
19	-	Wheel hub and bearing assembly
20	-	Steering gear attachment
21	-	Nut (Ball joint to swivel hub attachment)
22	-	Ball joint (Lower control arm to swivel hub)
23	-	Lower control arm (air suspension version shown)
24	-	Bolt (Shock absorber assembly lower attachment)
25	-	Shock absorber assembly (air suspension vehicles)
26	-	Shock absorber assembly (coil spring vehicles)
27	-	Nut (Lower control arm forward bush)
28	-	Cam washer
29	-	Lower control arm forward bush
30	-	Bolt (Lower control arm rearward bush)
31	-	Cam washer - integral to bolt (Lower control arm rearward bush)
32	-	Stabilizer bar bush
33	-	Stabilizer bar bracket
34	-	Nut (Stabilizer bar bracket)
35	-	Nut (Stabilizer link to Stabilizer bar)
36	-	Stabilizer bar
37	-	Stabilizer link

OVERVIEW

The front suspension is a fully independent design which offers a reduction in unsprung weight over the beam axle design fitted to previous Land Rover models. The front suspension comprises an upper control arm, a lower control arm, a wheel knuckle and hub, an stabilizer bar and links assembly and a shock absorber assembly. The shock absorber can have a coil spring or air spring, both shock absorber types use a similar design. The suspension components are common to both coil and air spring versions.

The suspension control arms have been designed for maximum ground clearance and also allow for adjustment of the camber and castor using cam adjusters.

Shock Absorber Assembly - Air Suspension



E150447

Item	Part Number	Description
1	-	Rebound washer*
2	-	O-ring - shock absorber rod (2 off)*
3	-	Self-locking nut*
4	-	Spacer - shock absorber rod*
5	-	Bump washer
6	-	Spring aid*
7	-	O-ring - air spring sleeve support (2 off)*
8	-	Shock absorber*
9	-	Voss air fitting
10	-	Shock absorber rod
11	-	Self-locking nut (3 off)
12	-	Top mount
13	-	Bush
14	-	Retaining pin - air spring assembly*
15	-	Air spring assembly*



NOTE: * shows service items

The shock absorber module comprises an air spring assembly, top mount and a shock absorber. The shock absorber and air spring are only serviceable as complete assemblies.

Shock Absorber

The shock absorber assembly is a twin tube design with the conventional coil spring replaced by the air spring. The lower end of the shock absorber is fitted with a bush and is attached to the lower control arm with a bolt and nut.

The shock absorber functions by restricting the flow of hydraulic fluid through internal galleries within the shock absorber. The shock absorber rod moves axially within the shock absorber, its movement limited by the flow of fluid through the galleries, providing damping of undulations in the terrain. The shock absorber rod is sealed at its exit point from the shock absorber body to maintain the fluid within the unit and to prevent the ingress of dirt and moisture. The seal also incorporates a wiper to keep the rod clean.

Air Spring

The air spring comprises an aluminium restraining cylinder, top mount, spring aid, air sleeve and an inner support sleeve.

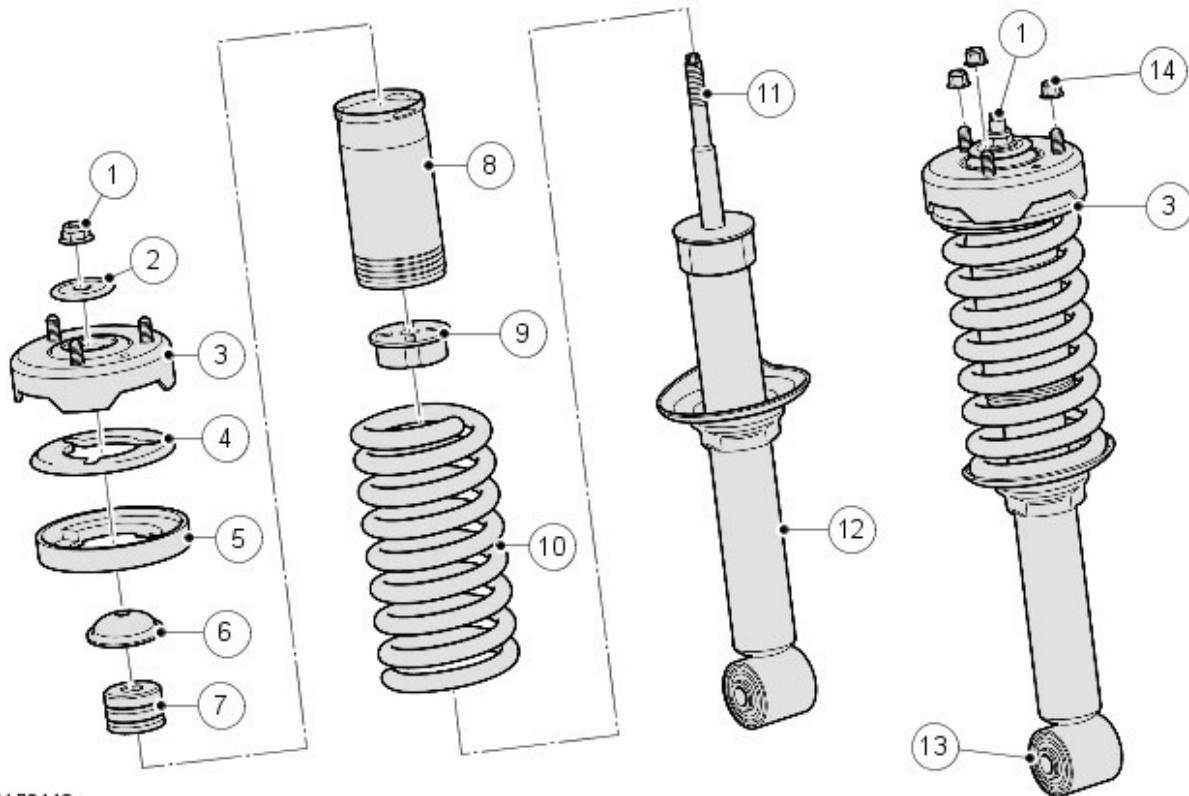
The air sleeve is made from a flexible rubber material which allows the sleeve to roll up and down the air spring piston as the vehicle changes height. The air sleeve is attached to the restraining cylinder and support sleeve by crimp rings which provide an air tight seal. The support sleeve contains a seal carrier which has two O-rings sealing the support sleeve and two O-rings sealing to the shock absorber body. The top of the air sleeve is crimped to the top mount which attaches to the chassis frame with 3 integral studs and self-locking nuts.

A spring aid is fitted to the shock absorber rod and prevents the top mount contacting the top of the shock absorber during full suspension compression and assists the suspension tune. The lower end of the air spring is located over the shock absorber body and seats on a fabricated seat on the shock absorber body. The air sleeve is positively attached to the seat with a retaining pin. The shock absorber rod is located through a central hole in the top mount. The rod is threaded at its outer end. A self-locking nut secures the air spring to the shock absorber rod.

The top mount is an integral part of the air spring and is fitted with a bush and rebound washer. A bump washer is located between the top mount plate and the shock absorber rod. The top mount is secured to the shock absorber rod with a self-locking nut. The top mount attaches to a housing on the chassis with 3 integral studs and self-locking nuts. The top mount also incorporates a 6 mm Voss air fitting which allows for the attachment of the air harness.

A gaitor is available as a dealer fit component. The gaitor is similar to the one fitted to the rear air shock absorber module and is available if a customer experiences dirt and debris becoming trapped between the air sleeve and the restraining cylinder under certain terrain conditions.

Shock Absorber Assembly - Coil Spring Suspension



E150448

Item	Part Number	Description
1	-	Self-locking nut
2	-	Rebound washer
3	-	Top mount assembly
4	-	Spring spacer (selective)
5	-	Spring isolator
6	-	Bump washer
7	-	Spring aid
8	-	Dust tube
9	-	Bump cup
10	-	Coil spring
11	-	Shock absorber
12	-	Shock absorber rod
13	-	Self-locking nut (3 off)
14	-	Bush

The coil spring shock absorber assembly comprises a shock absorber, coil spring and top mount.

Shock Absorber

The shock absorber assembly is a twin tube design with the conventional coil spring located on a welded spring seat on the shock absorber tube. The lower end of the shock absorber is fitted with a bush and is attached to the lower control arm with a bolt and nut.

The shock absorber functions by restricting the flow of hydraulic fluid through internal galleries within the shock absorber. The shock absorber rod moves axially within the shock absorber, its movement limited by the flow of fluid through the galleries, providing damping of undulations in the terrain. The shock absorber rod is sealed at its exit

point from the shock absorber body to maintain the fluid within the unit and to prevent the ingress of dirt and moisture. The seal also incorporates a wiper to keep the rod clean.

The shock absorber rod is located through a central hole in the top mount. The rod is threaded at its outer end. A self-locking nut secures the top mount to the shock absorber rod.

A spring aid is fitted to the shock absorber rod and prevents the top mount contacting the top of the shock absorber during full suspension compression and also assists the suspension tune.

Spring and Top Mount

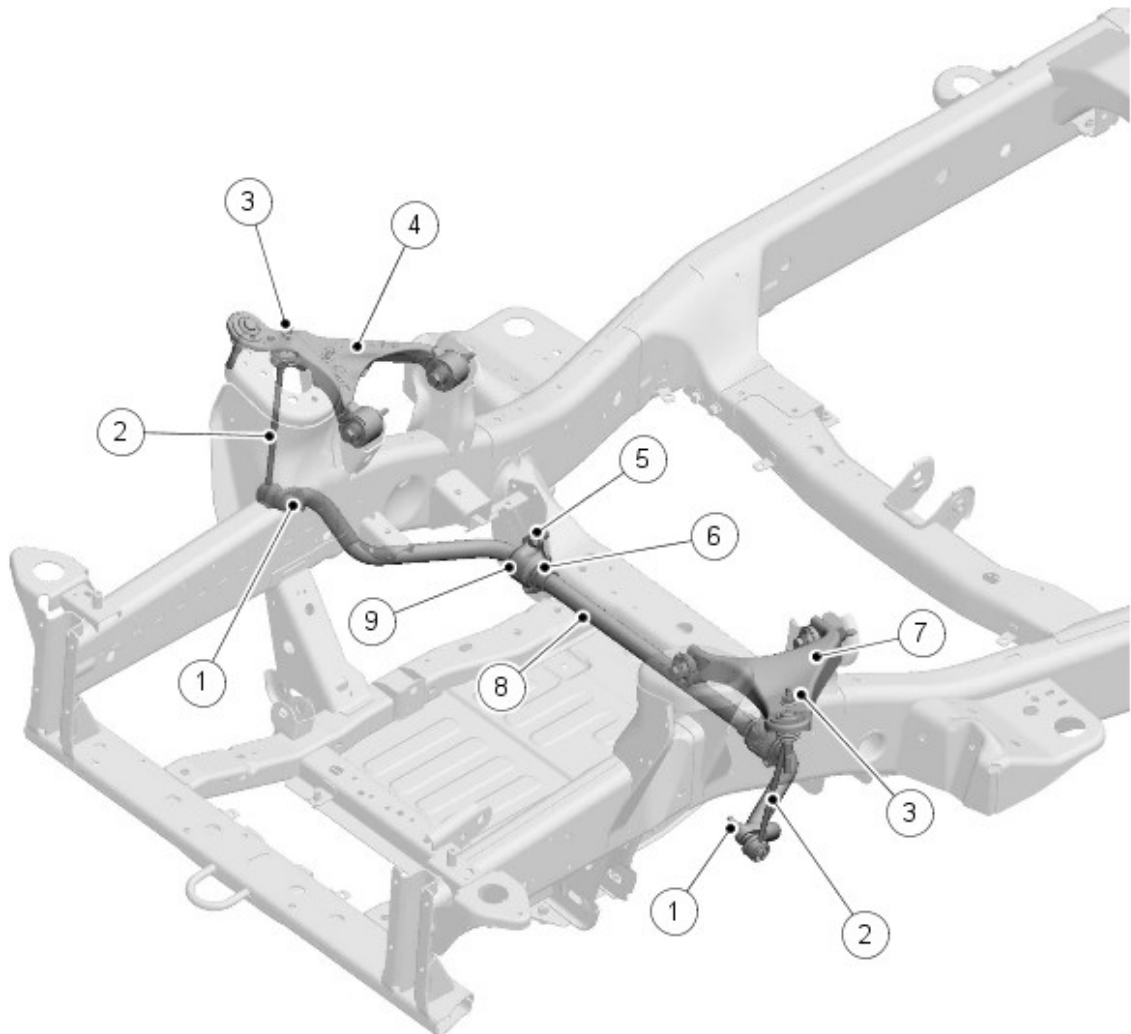
The coil spring fitted differs with vehicle specification. Each spring is color coded to identify its rating and fitment requirements.

The coil spring is located in a spring seat which is an integral part of the shock absorber body. The design of the spring seat prevents the spring rotating. The opposite end of the coil spring is located in a spring isolator which is fitted in the top mount. The spring isolator is made from rubber and prevents any noise produced during shock absorber and spring compression/extension from being transmitted to the vehicle body.

The top mount is fitted with a bush and rebound washer which are located between the top mount plate and the shock absorber rod, a self-locking nut secures the shock absorber rod to the top mount. The top mount attaches to a housing on the chassis with 3 integral studs and self-locking nuts.

The spring is fitted with spring spacers which are located between the spring isolator and the top mount. The spring spacers control the length of the spring to maintain the correct trim height. The spring spacers are color coded and are supplied with a replacement spring.

Stabilizer Bar



E150449

Item	Part Number	Description
------	-------------	-------------

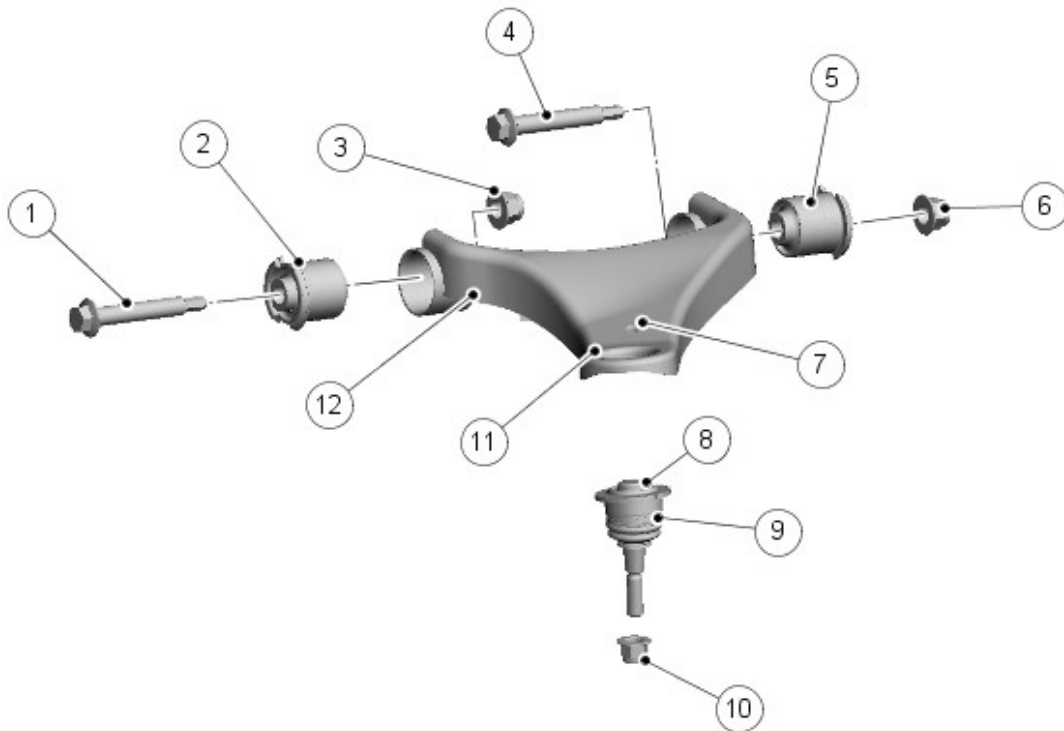
- 1 - Nut - link to stabilizer bar (2 off)
- 2 - Link (2 off)
- 3 - Nut - link to upper control arm (2 off)
- 4 - Right upper control arm
- 5 - Nut (4 off)
- 6 - Bush (2 off)
- 7 - Left upper control arm
- 8 - Stabilizer bar
- 9 - Bracket (2 off)

The stabilizer bar is fabricated from induction hardened, solid spring steel bar. The stabilizer bar operates, via a pair of links, from their attachment to the upper control arm.

The stabilizer bar is attached to the forward face of the chassis front cross member. The stabilizer bar is attached to the cross member with two, Teflon lined bushes. Brackets, which are pressed onto the bushes, are attached to the cross member with nuts, screwed onto studs in the cross member. The stabilizer bar has crimped, 'anti-shuffle' collars pressed in position on the inside edges of the bushes. The collars prevent sideways movement of the stabilizer bar.

The ends of the stabilizer bar are attached to the upper control arms via links. This allows the stabilizer bar to move with the wheel travel providing maximum effectiveness. Each link has a ball joint at each end. The top ball joint is attached to the link, parallel with the link axis. The ball joint is located in a hole in the upper control arm and secured with a self-locking nut. The bottom ball joint is attached to the link at 90 degrees to the link axis. The ball joint is located in a hole in the end of the stabilizer bar and secured with a self-locking nut. The links are not handed and therefore can be fitted to either side of the stabilizer bar.

Upper Control Arm



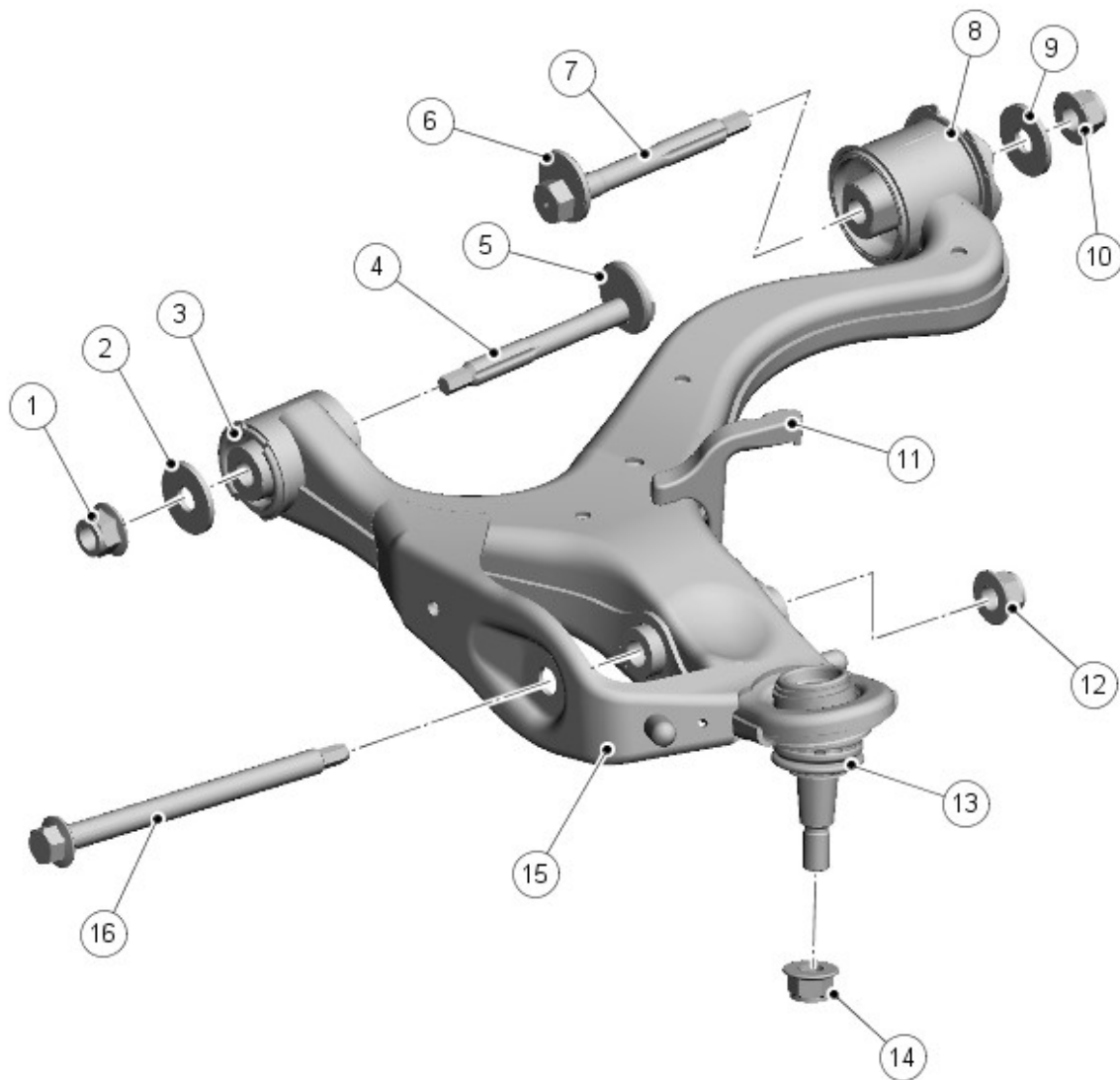
Item	Part Number	Description
1	-	Flanged bolt
2	-	Bush
3	-	Self-locking nut
4	-	Flanged bolt
5	-	Bush
6	-	Self-locking nut
7	-	Stabilizer link attachment hole
8	-	Ball joint
9	-	Ball joint circlip
10	-	Self-locking nut
11	-	Timing marks
12	-	Upper control arm

The upper control arm assembly comprises, the control arm, two bushes and a ball joint. The upper control arm is a pressed steel fabrication. Its outer end has a hole to accept the ball joint. A small indentation is located adjacent to the ball joint hole and is used to obtain the correct orientation of the ball joint. A smaller hole near the ball joint provides for the attachment of the stabilizer link. The underside of the upper control arm has a bracket for attachment of the height sensor link arm and two further brackets which secure the brake hose, pad wear sensor and wheel speed sensor cables.

The inner end of the arm has two fabricated bush housings which are welded to the arm pressing. A bush is pressed into each housing. The bushes are located between lugs on the chassis and are secured with bolts and self-locking nuts through metal inserts in the center of the bushes.

The ball joint is pressed into the upper control arm. The ball joint is an interference fit in the hole which prevents the ball joint from moving. A circlip is fitted to the ball joint to retain it in the hole. The top face of the ball joint has two semi-circular cut-outs. One of these cut-outs must be aligned with the small indentation in the upper control arm to ensure the correct operation of the ball joint.

Lower Control Arm



E150451

Item	Part Number	Description
1	-	Self-locking nut
2	-	Cam washer
3	-	Bush
4	-	Special bolt
5	-	Cam washer - integral to bolt
6	-	Cam washer - integral to bolt
7	-	Special bolt
8	-	hydrabush
9	-	Cam washer
10	-	Self-locking nut
11	-	Jacking bracket (vehicles with coil springs only)
12	-	Self-locking nut - shock absorber lower attachment
13	-	Ball joint
14	-	Self-locking nut
15	-	Lower control arm
16	-	Bolt - shock absorber lower attachment

The lower control arm assembly comprises, the control arm, two bushes and a ball joint. The lower control arm is a pressed steel fabrication with a hole at its outer end to accept the ball joint.

The inner end of the arm has two fabricated bush housings which are welded to the arm pressing. A bush is pressed into each housing. The rear bush is a hydrabush which provides a progressive increase in the hardness of the bush as the deflection of the wheel increases. The bushes are located between lugs on the chassis and are secured with bolts and self-locking nuts through metal inserts in the center of the bushes. The forward bush, self-locking nut, has

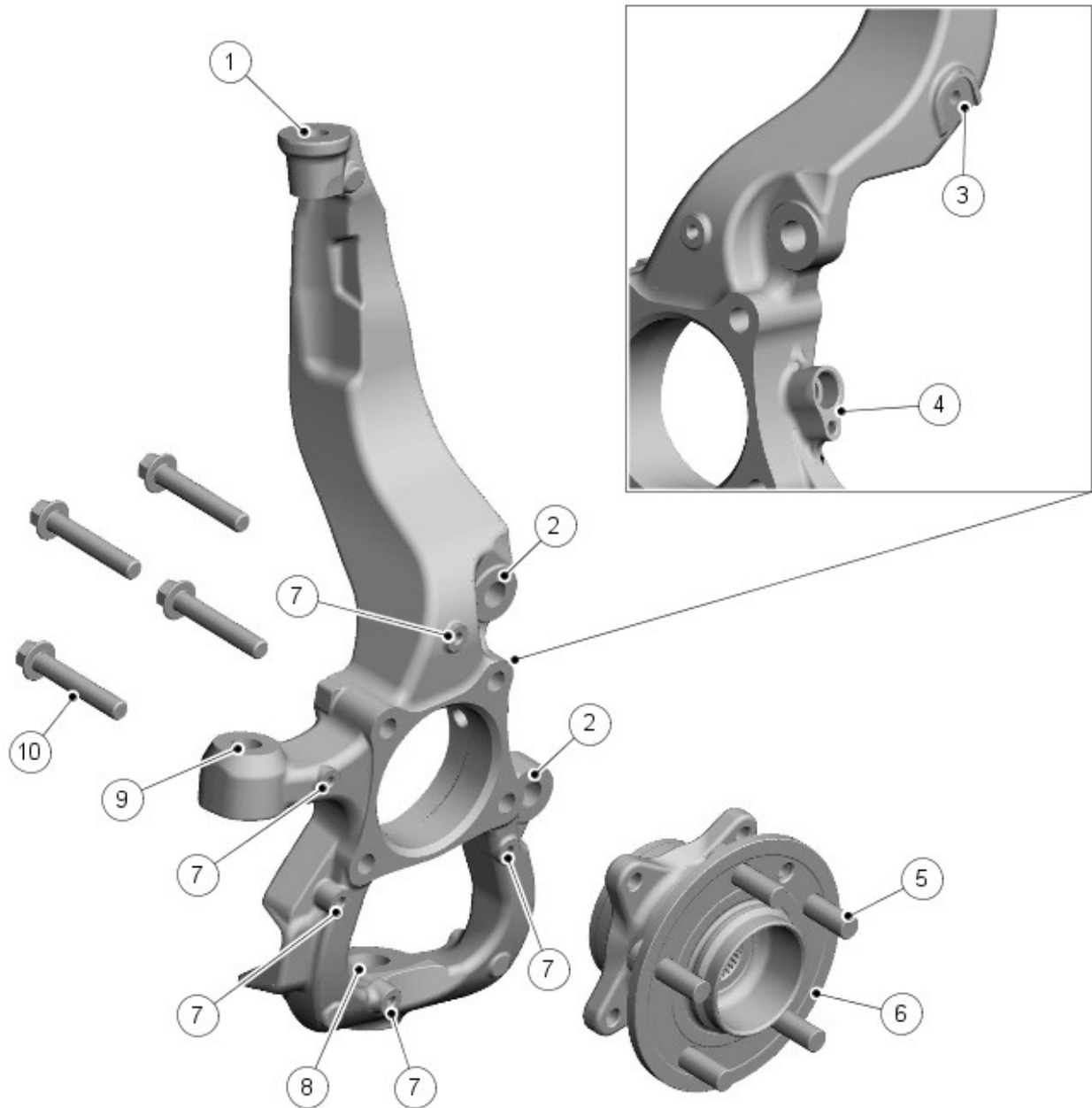
a cam washer located beneath it. The cam washer is located between lugs on the chassis bracket and its orientation can be adjusted to set the front camber. The rear bush, self-locking nut, also has a cam washer located beneath it. The cam washer is located between lugs on the chassis bracket and its orientation can be adjusted to set the front castor.

On vehicles fitted with coil springs only, a jacking bracket is located on the lower control arm.

A central aperture in the arm provides for the attachment of the shock absorber module lower bush. The shock absorber is secured with a long bolt which is positioned through holes in the arm and secured with a self-locking nut.

The ball joint is pressed into the lower control arm. The ball joint is an interference fit in the hole which prevents the ball joint from moving. A circlip is fitted to the ball joint to retain it in the hole.

Wheel Knuckle, Hub and Bearing Assembly



E150452

Item	Part Number	Description
1	-	Upper control arm attachment
2	-	Brake caliper attachment holes
3	-	Brake hose bracket attachment point
4	-	Wheel speed sensor location
5	-	Wheels studs
6	-	Wheel hub
7	-	Brake disc dust shield attachment holes
8	-	Lower control arm ball joint attachment
9	-	Steering gear ball joint attachment
10	-	Wheel hub bolts (4 off)

The wheel knuckle is a machined casting which is located between the ball joints of the upper and lower control arms. The knuckle has four clearance holes which allow for the fitment of four bolts which secure the wheel hub housing. A cast boss on the forward edge of the knuckle provides for attachment of the steering gear, tie rod ball joint.

The wheel hub and bearing assembly comprises the wheel hub housing, wheel hub and taper roller bearing. The wheel hub and bearing assembly is a non-serviceable component. Five M14 studs are pressed into the wheel hub and provide for the attachment of the road wheel with wheel nuts.

The wheel hub housing is a machined forging which houses a taper roller bearing. The housing has four threaded holes which provide for the attachment to the wheel knuckle with four bolts.

The wheel hub has a splined center bore which mates with corresponding splines on the halfshaft. Rotation of the halfshaft is passed, via the splines, to the wheel hub which rotates on the taper roller bearing.

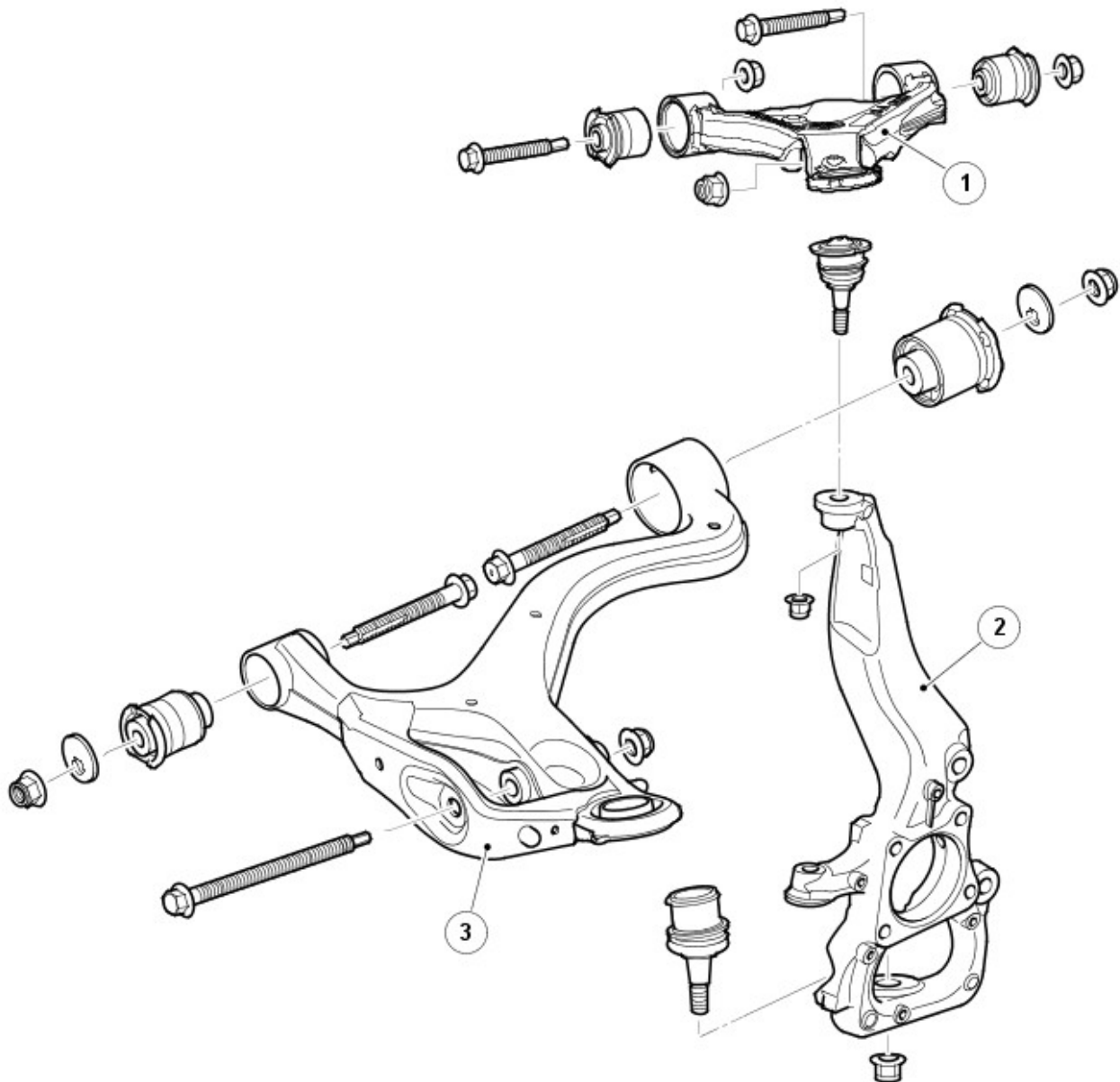
Front Suspension - Front Suspension

Description and Operation

In comparison with the standard vehicle, the additional weight of the armour and consequently the change in vehicle geometry has dictated the following changes to the front suspension of the armoured vehicle:

- new wheel knuckle
- new upper and lower control arms
- new stabilizer bar
- new stabilizer bar links
- modified air springs
- modified dampers.

New suspension components



E102745

Item	Part Number	Description
1	-	Upper control arm
2	-	Wheel knuckle
3	-	Lower control arm

Although visually similar to the standard vehicle, changes have been made internally to the air springs and dampers:

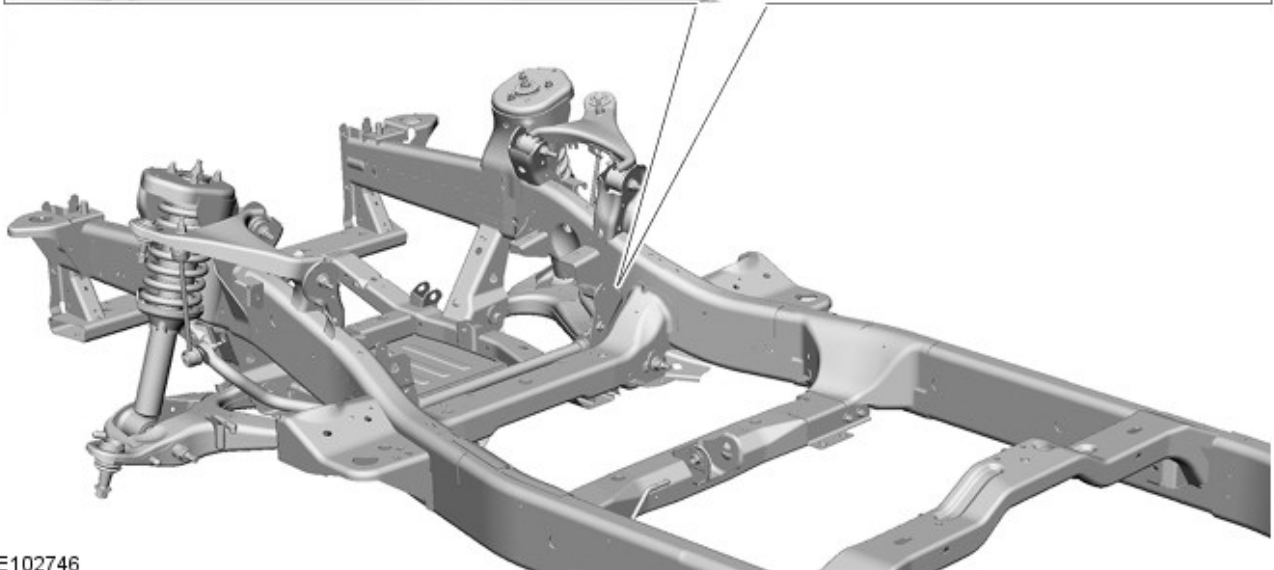
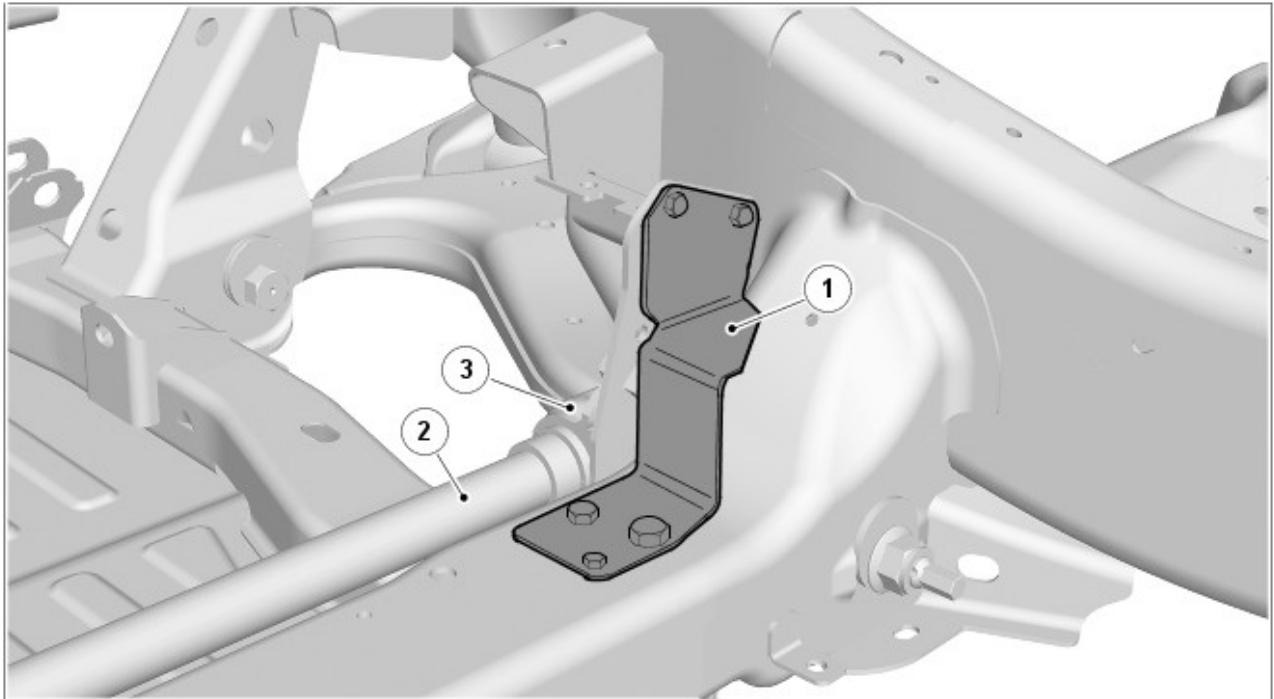
- The air springs incorporate a volume displacer which increases the spring rate in comparison to those fitted to the standard vehicle.
- The dampers feature revised internal valves to complement the revised spring rates and vehicle weight.

Software changes have also been made to the air suspension control module to restrict the 'Off-Road' height setting. For additional information, refer to: Vehicle Dynamic Suspension (204-05, Description and Operation).

The stabilizer bar features serviceable bushes, which are not bonded to the stabilizer bar. This allows the bushes to be replaced without removing the stabilizer bar from the vehicle. Clamp plates surrounding the bushes secure the stabilizer bar to the vehicle. Anti-shuffle collars are fitted to prevent lateral movement of the stabilizer bar.

Due to the additional weight of the armoured vehicle a reinforcement plate has been fitted to provide further rigid support to the right-hand-side clamp of the stabilizer bar.

Reinforcement plate for stabilizer bar right-hand clamp




E102746

Item	Part Number	Description
1	-	Reinforcement plate
2	-	Stabilizer bar
3	-	Right-hand clamp

Front Suspension - Front Stabilizer Bar

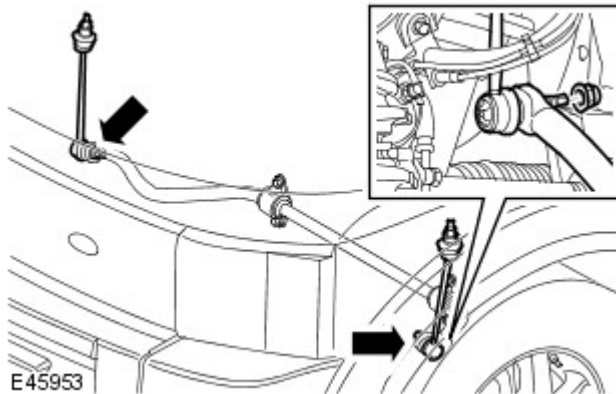
Removal and Installation

Removal

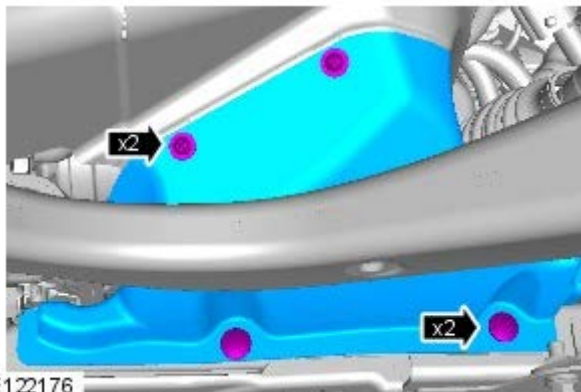
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the wheels and tires.



3. Disconnect both the stabilizer bar links from the stabilizer bar.
 - Remove and discard the 2 nuts.



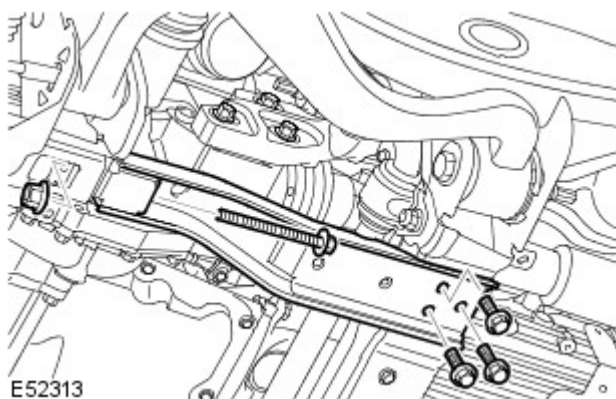
4.  **NOTE:** RH side only.

Remove the fender splash shield lower extension panel.

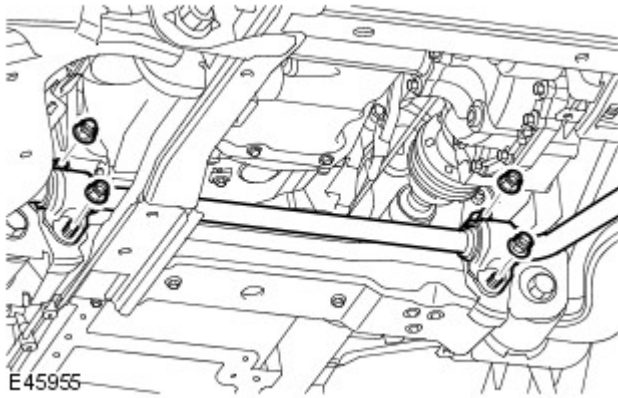
- Remove the 2 screws.
- Remove the 2 clips.

5. Remove the engine undershield.
For additional information, refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

6. Remove the front axle crossmember.
 - Remove the 4 bolts.



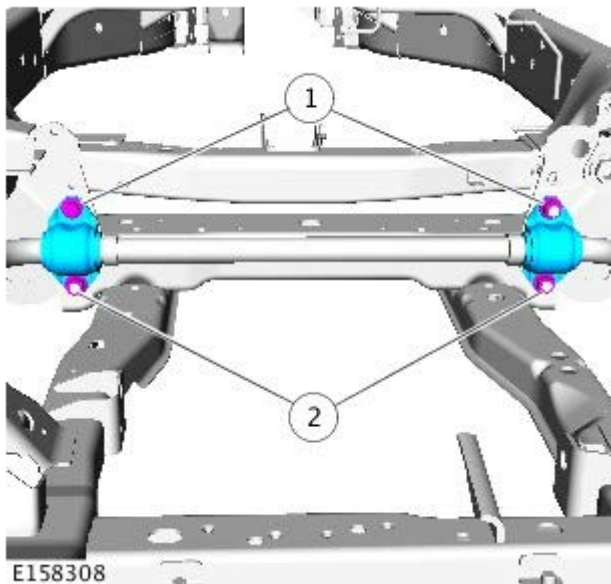
7. Remove the stabilizer bar bushing.
 - Remove the 4 nuts.
 - Remove the stabilizer bar clamps.



8. Remove the stabilizer bar.
 - Remove the stabilizer bar out through the LH side wheel arch.

Installation

1. Install the stabilizer bar.
 - Install the stabilizer bar through the LH side wheel arch.



2. Install the stabilizer bar bushing and clamps.
 - Tighten fixings 1 to 115 Nm (85 lb.ft).
 - Tighten fixings 2 to 115 Nm (85 lb.ft).
 - Tighten fixings 1 to 115 Nm (85 lb.ft).

3. Install the front axle crossmember.
 - Tighten the 4 bolts to 115 Nm (85 lb.ft).
4. Install the engine undershield.
For additional information, refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).

5.  **NOTE: RH side only.**

Install the fender splash shield lower extension panel.


- Install the 2 screws.
- Install the 2 clips.

6. Connect both stabilizer bar links to the stabilizer bar.
 - Install new nuts and tighten to 115 Nm (85 lb.ft).
7. Install the wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Front Suspension - Front Stabilizer Bar Link


Removal and Installation

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

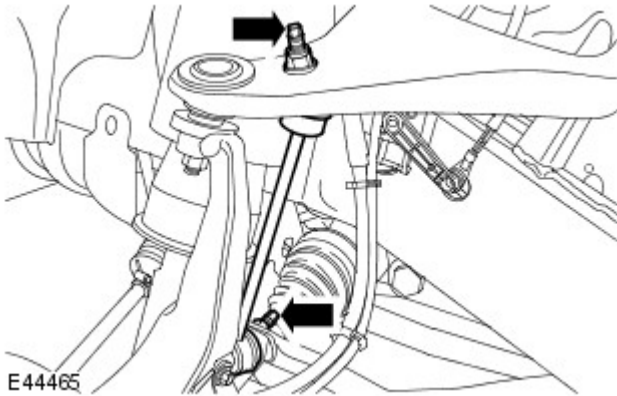
Raise and support the vehicle.

2. Remove the wheel and tire.

3.  **CAUTION:** Use a wrench on the hexagon provided to prevent the ball joint rotating.

Remove the stabilizer bar link.

- Remove and discard the 2 nuts.



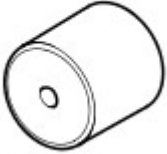



Installation

1. Install the stabilizer bar link.
 - Tighten the nuts to 115 Nm (85 lb.ft).
2. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Front Suspension - Upper Arm Ball Joint

Removal and Installation

Special Tool(s)

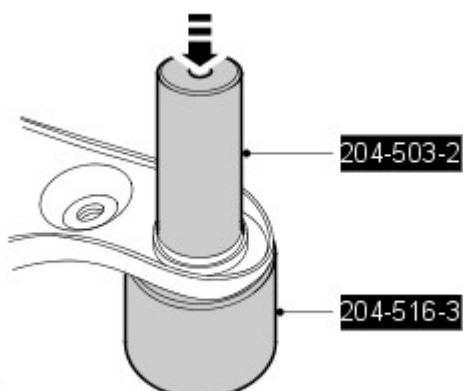
 <p>204-516/3 E50961</p>	<p>Ball joint remover 204-516/3 (LRT 64-026/3)</p>
 <p>204-530-2 E50156</p>	<p>Ball joint remover 204-530-2</p>
 <p>204-530-3 E50157</p>	<p>Ball joint installer 204-530-3</p>
 <p>204-530-1 E50155</p>	<p>Ball joint installer 204-530-1</p>

Removal



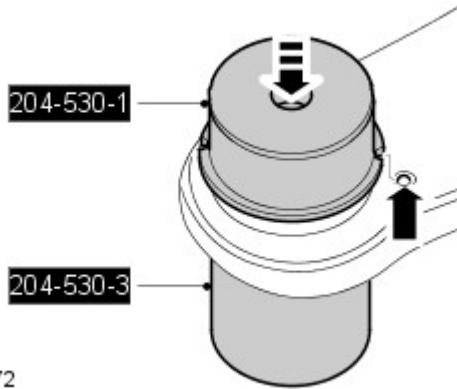
NOTE: This procedure shows removal and installation of the upper arm ball joint.

1. Remove the upper arm.
For additional information, refer to: Upper Arm (204-01 Front Suspension, Removal and Installation).
2. Remove the dust seal.
 - Remove the seal retainer.
 - Remove the circlip.
3. Using the special tools, remove the ball joint.



E50160

Installation



E50172

1.  CAUTION: Make sure the timing marks are aligned.

Using the special tools, install the ball joint.



E50173

2.  CAUTION: Circlip holes to be 90 degrees rotated from timing marks.






Install the circlip.

3. Install the upper arm.
For additional information, refer to: Upper Arm (204-01 Front Suspension, Removal and Installation).

Front Suspension - Lower Arm Ball Joint


Removal and Installation

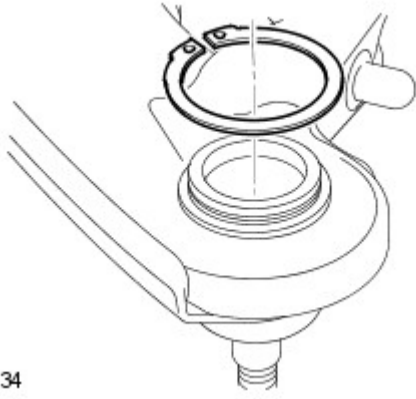
Special Tool(s)

 <p>204-531/3 E51733</p>	<p>Remover/installer front lower arm ball joint 204-531/3</p>
 <p>204-531/2 E51732</p>	<p>Remover/installer front lower arm ball joint 204-531/2</p>
 <p>204-531/1 E51731</p>	<p>Remover/installer front lower arm ball joint 204-531/1</p>
 <p>204-753 E104988</p>	<p>Remover/installer front lower arm ball joint 204-753</p>
 <p>204-754 E104989</p>	<p>Remover/installer front lower arm ball joint 204-754</p>

Removal

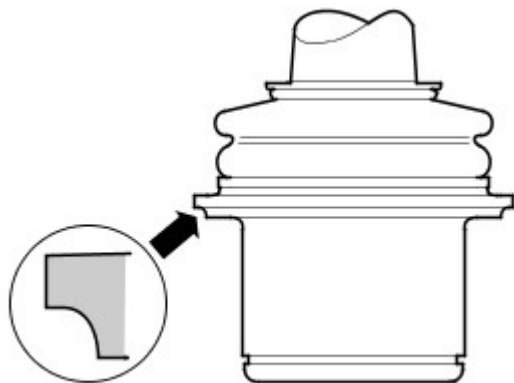
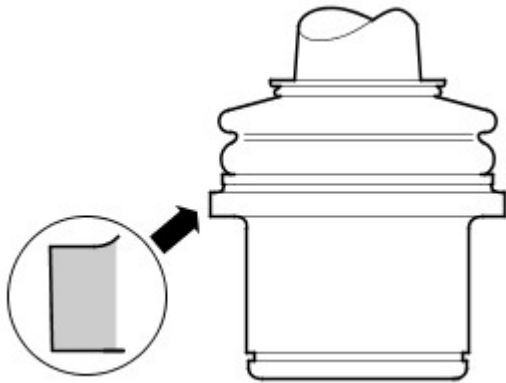
All vehicles

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
 Raise and support the vehicle.
- Remove the wheel and tire.
- Remove the lower arm.
 For additional information, refer to: Lower Arm (204-01, Removal and Installation).
- Remove the circlip.



E51734

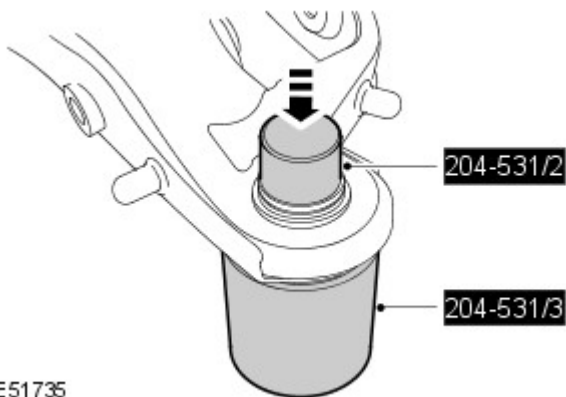
5. Inspect the installed ball joint to determine if a radius is present.



E104990

Ball joint without radius

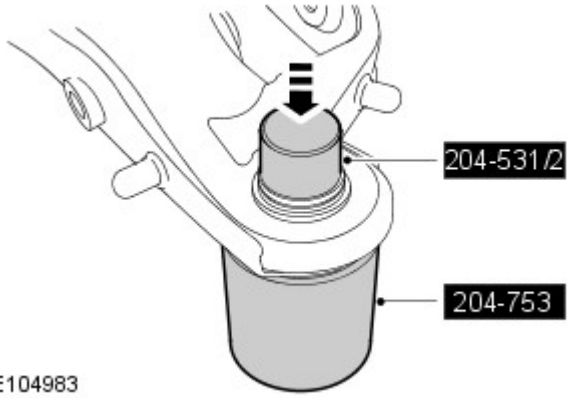
6. Using the special tools, remove the ball joint.



E51735

Ball joint with radius

7. Using the special tools, remove the ball joint.

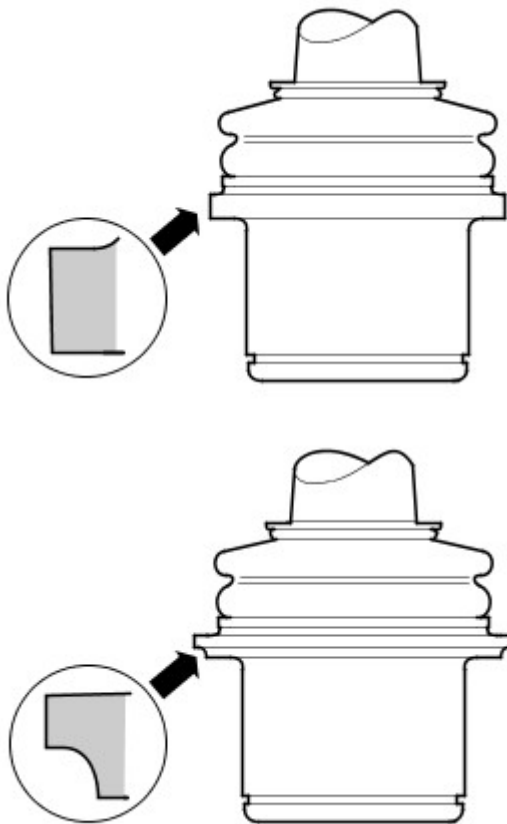


E104983

Installation

All vehicles

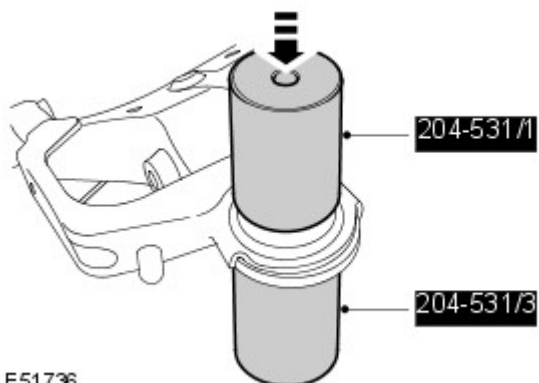
1. Clean the components.
2. Inspect the new ball joint to determine if a radius is present.



E104990

Ball joint without radius

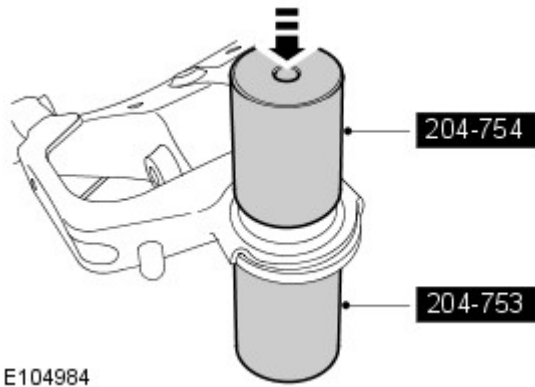
3. Using the special tools, install the ball joint.



E51736

Ball joint with radius

4. Using the special tools, install the ball joint.





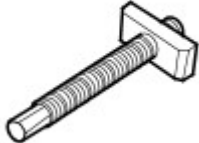
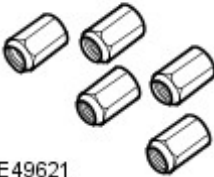

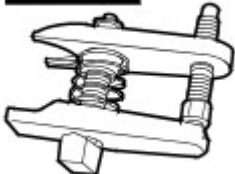
All vehicles

5. Install the circlip.
6. Install the lower arm.
For additional information, refer to: Lower Arm (204-01, Removal and Installation).
7. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Front Suspension - Wheel Knuckle

Removal and Installation


Special Tool(s)

 <p>204-506/1 E49618</p>	<p>Halfshaft remover/replacer 204-506/1(LRT-60-030/1)</p>
 <p>204-506/2 E49619</p>	<p>Halfshaft remover/replacer 204-506/2(LRT-60-030/2)</p>
 <p>204-506/3 E49620</p>	<p>Halfshaft remover/replacer 204-506/3(LRT-60-030/3)</p>
 <p>204-506/5 E49621</p>	<p>Retainers - halfshaft remover/replacer 204-506/5(LRT-60-030/5)</p>
 <p>204-506-01 E49622</p>	<p>Halfshaft installer adapter 204-506-01(LRT-60-030/4)</p>
 <p>205-754A E45276</p>	<p>Ball joint separator 205-754(LRT-54-027)</p>

Removal



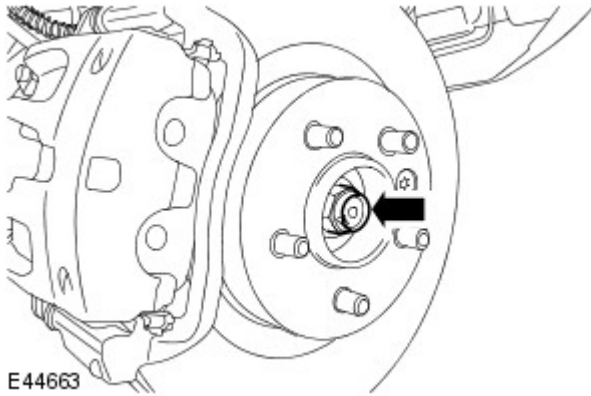
NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

- 
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

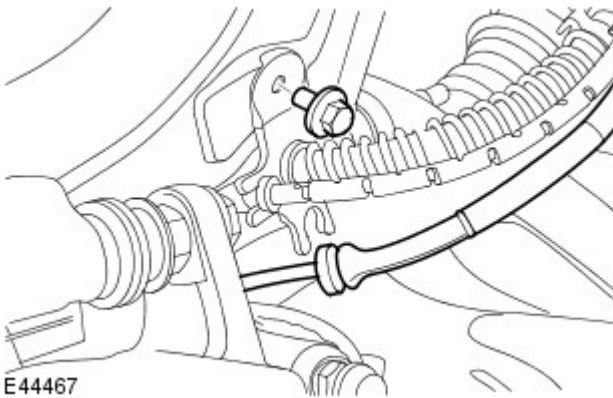
2. Remove the wheel and tire.

3. Loosen the halfshaft retaining nut.



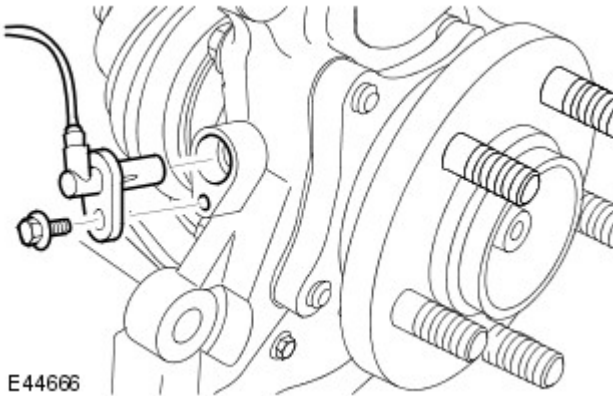
4. Release the brake hose bracket from the wheel knuckle.

- Remove the bolt.




5. Release the wheel speed sensor from the wheel knuckle.

- Remove the bolt.



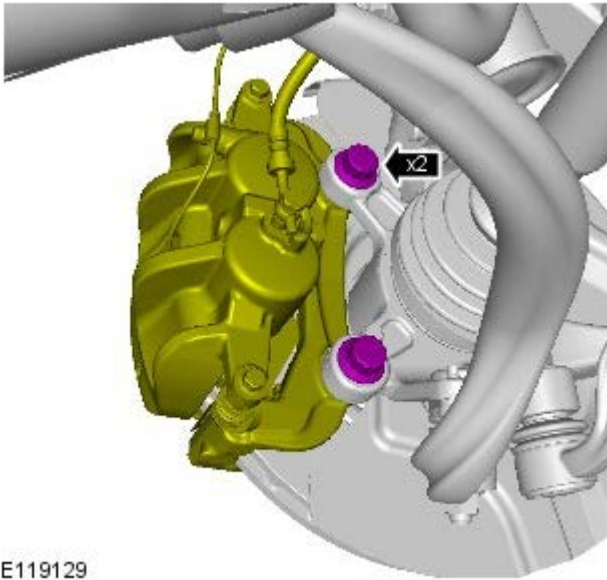
6. CAUTIONS:

 Do not allow the brake caliper to hang on the brake hose.

 LH side: Do not allow the brake caliper to hang on the brake pad wear warning sensor lead.

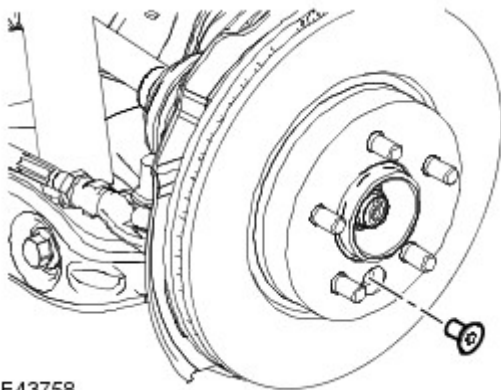
Remove the brake caliper and anchor plate.

- Remove the 2 bolts.
- Tie the brake caliper and brake caliper anchor plate assembly aside.



E119129

7. Remove the brake disc.
 - Remove the Torx screw.

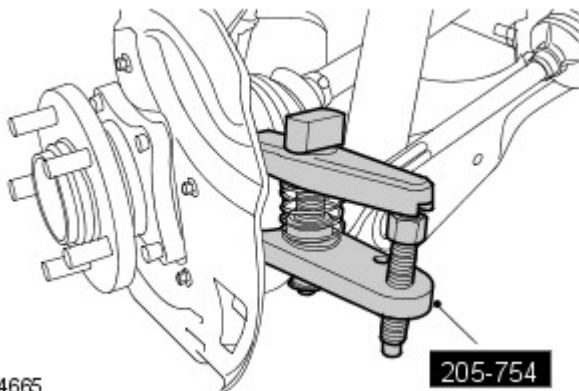


E43758


8. Remove the halfshaft retaining nut.
 - Discard the nut.

9. Loosen the tie-rod end ball joint retaining nut.

10. Using the special tool, release the tie-rod end ball joint from the wheel knuckle.
 - Discard the nut.



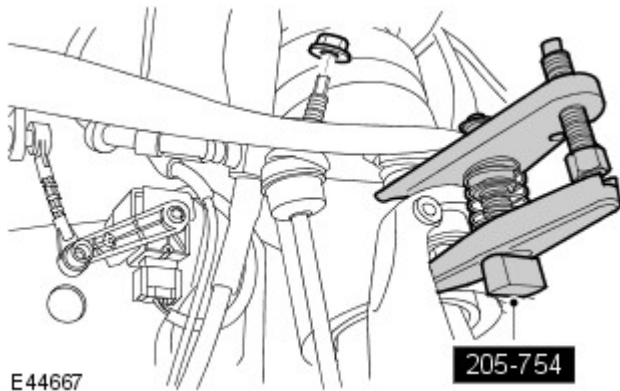
E44665

11.  **CAUTION:** Use a wrench on the hexagon provided to prevent the ball joint rotating.

Remove and discard the stabilizer bar link nut.

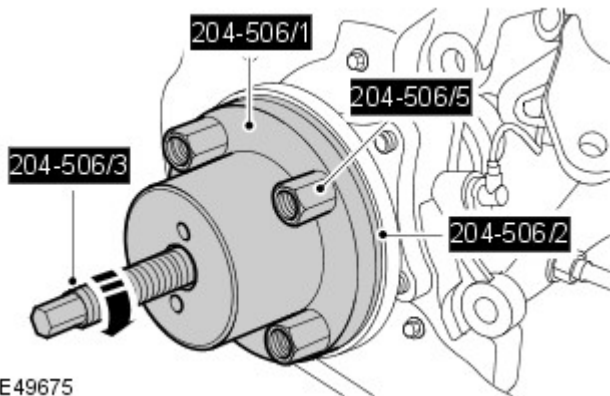
12. Loosen the upper arm retaining nut.

13. Using the special tool, release the upper arm ball joint.




E44667

205-754



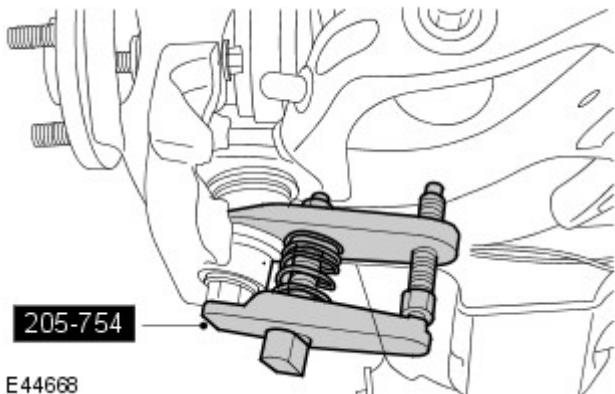
E49675

14.  **CAUTION:** Do not use a hammer to detach the halfshaft from the hub assembly, failure to follow this instruction may result in damage to the halfshaft.

Using the special tools, release the halfshaft from the drive flange.


15. Remove the lower ball joint retaining nut.

16. Using the special tool, release the lower ball joint from the steering knuckle.




E44668

205-754

17.  **CAUTION:** The lower arm ball joint can be damaged by excessive articulation. The wheel knuckle must be fully supported at all times. Do not allow the wheel knuckle to hang on the lower arm. Failure to follow this instruction will result in damage to vehicle.

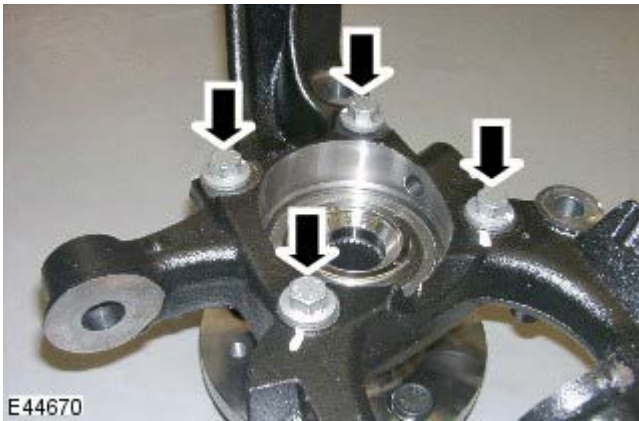
Remove the upper arm retaining nut.

- Discard the nut.

18.  **NOTE:** Do not disassemble further if the component is removed for access only.


Remove the wheel knuckle.

19. Remove the brake disc dust shield.
- Remove the four retaining bolts.

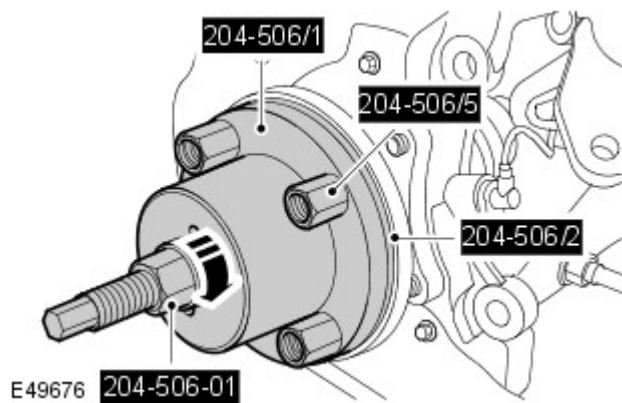


20. Remove the wheel hub.
 - Remove the 4 bolts.

Installation

1. Clean the components.
2. Install the wheel hub.
 - Tighten the 4 bolts to 115 Nm (85 lb.ft).
3. Install the brake disc dust shield.
 - Tighten the 4 bolts to 10 Nm (7 lb.ft).
4.  **CAUTION:** The lower arm ball joint can be damaged by excessive articulation. The wheel knuckle must be fully supported at all times. Do not allow the wheel knuckle to hang on the lower arm. Failure to follow this instruction will result in damage to vehicle.

With assistance, install the wheel knuckle.




5. Using the special tools, install the halfshaft in the wheel hub.

6. Connect the upper arm and wheel knuckle.
 - Install a new nut and tighten to 70 Nm (52 lb.ft).
7. Secure the stabilizer bar link.
 - Install a new nut and tighten to 115 Nm (85 lb.ft).
8. Tighten the lower arm ball joint retaining nut to 115 Nm (85

lb.ft).


9. Connect the tie-rod end ball joint.
 - Install a new nut and tighten to 76 Nm (56 lb.ft).

10.  **CAUTION: Install the halfshaft nut finger tight.**
Install a new halfshaft retaining nut and lightly tighten.

11. Make sure the brake disc and hub mating surfaces are clean.

12. Install the brake disc.
 - Tighten the Torx screw to 35 Nm (26 lb.ft).

13. Install the brake caliper and anchor plate.
 - Clean the brake caliper anchor plate using brake cleaning fluid.
 - Tighten the bolts to 275 Nm (203 lb.ft).

14.  **CAUTION: Do not use air tools to install the nut. Failure to follow this instruction may result in damage to the component.**



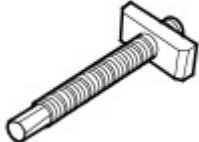
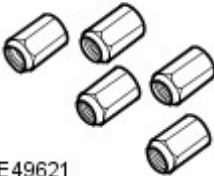

Tighten the new halfshaft retaining nut to 230 Nm (170 lb.ft).

- Stake the nut to the halfshaft.
15. Install the wheel speed sensor.
 - Tighten the bolt to 10 Nm (7 lb.ft).
 16. Secure the brake hose retaining bracket to the wheel knuckle.
 - Tighten the bolt to 22 Nm (16 lb.ft).
 17. Depress the brake pedal several times, check the fluid level in the brake fluid reservoir and top-up with brake fluid if necessary.
 18. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).


Front Suspension - Front Wheel Bearing and Wheel Hub

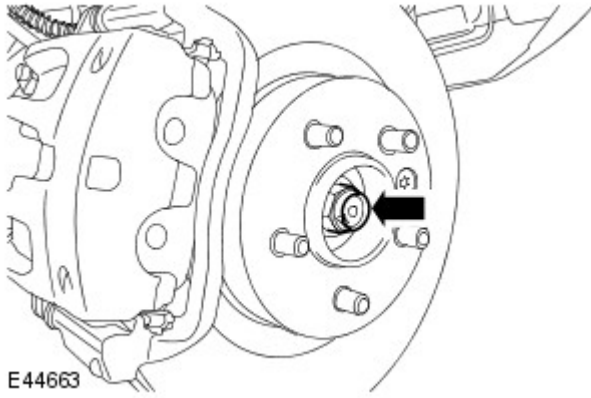
Removal and Installation

Special Tool(s)

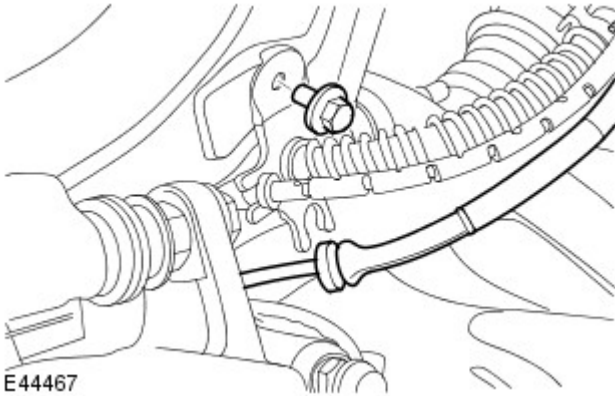
 <p>204-506/1 E49618</p>	<p>Halfshaft remover/replacer 204-506/1(LRT-60-030/1)</p>
 <p>204-506/2 E49619</p>	<p>Halfshaft remover/replacer 204-506/2(LRT-60-030/2)</p>
 <p>204-506/3 E49620</p>	<p>Halfshaft remover/replacer 204-506/3(LRT-60-030/3)</p>
 <p>204-506/5 E49621</p>	<p>Retainers - halfshaft remover/replacer 204-506/5(LRT-60-030/5)</p>
 <p>204-506-01 E49622</p>	<p>Halfshaft installer adapter 204-506-01(LRT-60-030/4)</p>

Removal


1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
2. Remove the wheel and tire.
3. Loosen the halfshaft retaining nut.



4. Release the brake hose bracket from the wheel knuckle.
 - Remove the bolt.



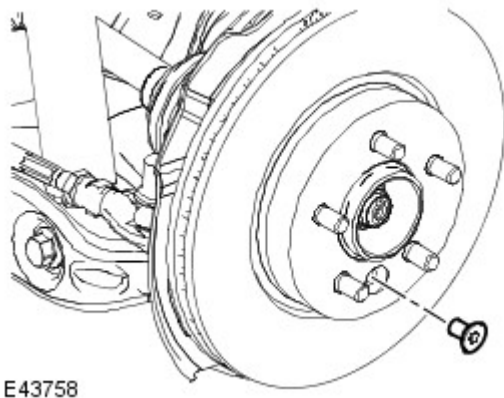
5. Remove the wheel speed sensor retaining bolt.

6.  **CAUTION:** Do not allow the brake caliper to hang on the brake hose.


Release the brake caliper anchor plate from the wheel knuckle and tie the caliper aside.

- Tie aside complete with the wheel speed sensor.

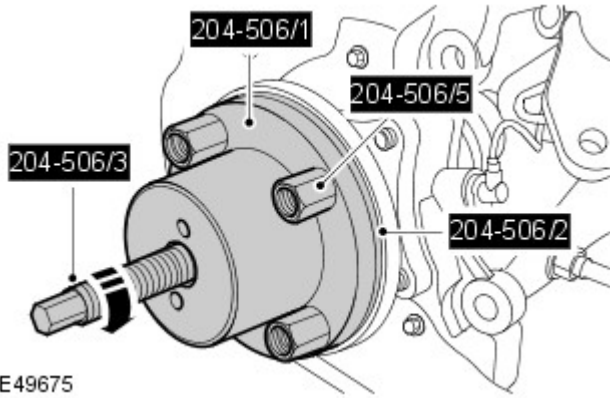
7. Remove the brake disc.
 - Remove the Torx screw.



8. Remove the halfshaft retaining nut.
 - Discard the nut.

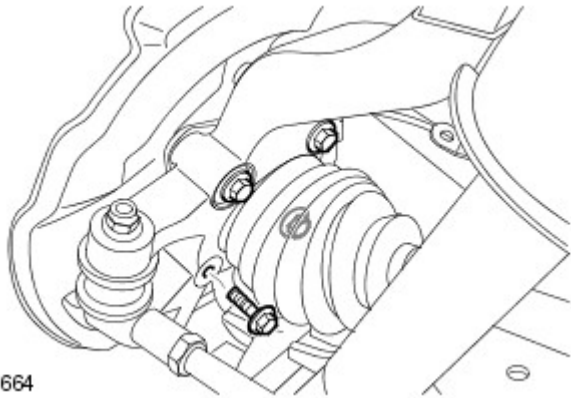
9.  **CAUTION:** Do not use a hammer to detach the halfshaft from the hub assembly, failure to follow this instruction may result in damage to the halfshaft.

Using the special tools, release the halfshaft from the wheel hub.



E49675

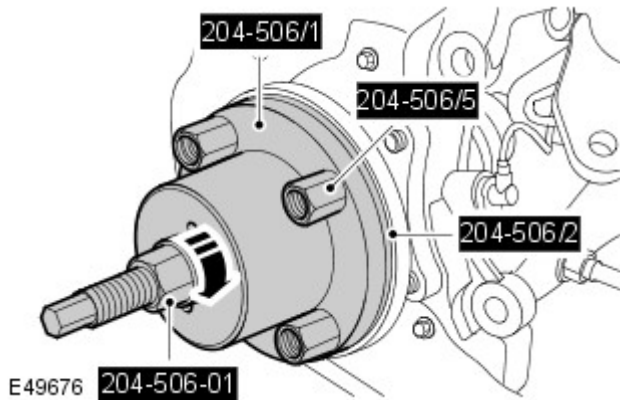
10. Remove the wheel hub.
 - Remove the 4 bolts.



E44664


Installation

1. Clean the components.
2. Install the wheel hub.
 - Using the special tools, install the halfshaft in the wheel hub.
 - Tighten the 4 bolts to 115 Nm (85 lb.ft).



E49676

3. Install a new halfshaft retaining nut and lightly tighten.
4. Make sure the brake disc and hub mating surfaces are clean.
5. Install the brake disc.
 - Tighten the Torx screw to 35 Nm (26 lb.ft).
6. Install the brake caliper and anchor plate.
 - Install the wheel speed sensor.
 - Tighten the bolts to 275 Nm (203 lb.ft).
7. Install the wheel speed sensor retaining bolt.
8. Secure the brake hose retaining bracket to the wheel knuckle.
 - Tighten the bolt to 22 Nm (16 lb.ft).

9.  **CAUTION:** Do not use air tools to install the nut. Failure to follow this instruction may result in damage to

the component.

Tighten the new halfshaft retaining nut to 230 Nm (170 lb.ft).


- Stake the nut to the halfshaft.
10. Depress the brake pedal several times, check the fluid level in the brake fluid reservoir and top-up with brake fluid if necessary.
 11. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Front Suspension - Shock Absorber and Spring Assembly

Removal and Installation

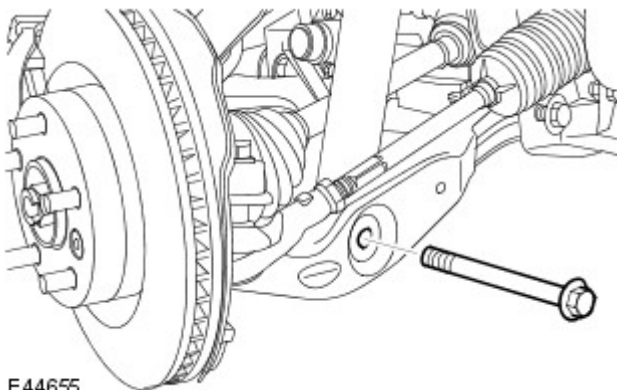
Removal

1. For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

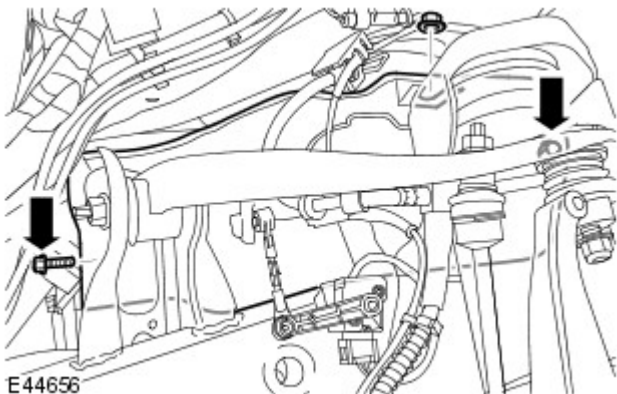
Raise and support the vehicle.

3. Remove the wheel and tire.
4. Remove the fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).



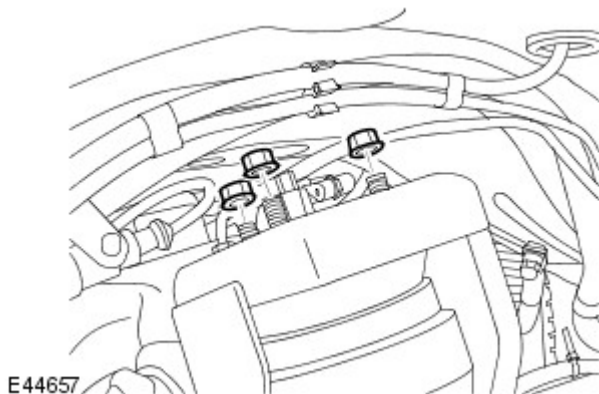
E44655

5. Disconnect the shock absorber and spring assembly from the lower arm.
 - Remove the nut and bolt.



E44656

6. Release the heat shield for access to the shock absorber and spring assembly upper mounting inner nut.
 - Remove the three retaining bolts.



E44657

7. Remove the shock absorber and spring assembly.
 - Remove the three retaining bolts.

Installation

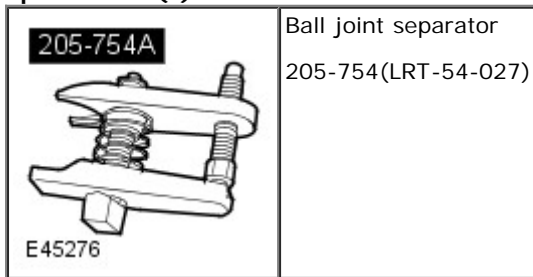
1. Install the shock absorber and spring assembly.

- Make sure the spring and shock absorber assembly top mounting to body mating faces are clean.
 - Fit the nuts and tighten to 63 Nm (46 lb.ft).
2. Secure the heat shield.
 - Install the three retaining bolts and tighten to 10 Nm (7 lb.ft).
 3. Connect the shock absorber and spring assembly to the lower arm.
 - Tighten the nut and bolt to 300 Nm (221 lb.ft).
 4. Install the fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).
 5. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
 6. For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).


Front Suspension - Upper Arm

Removal and Installation

Special Tool(s)

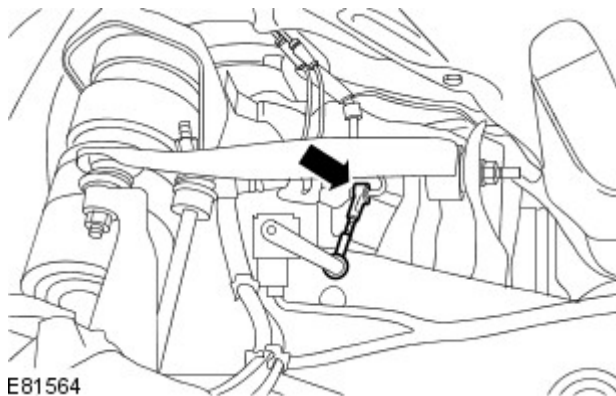



Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

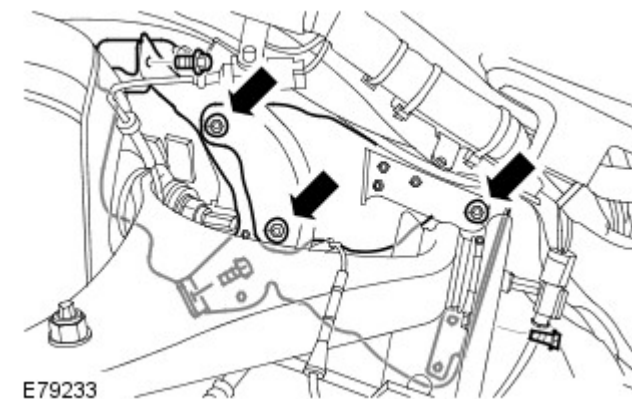
Raise and support the vehicle.

2. Remove the wheel and tire.

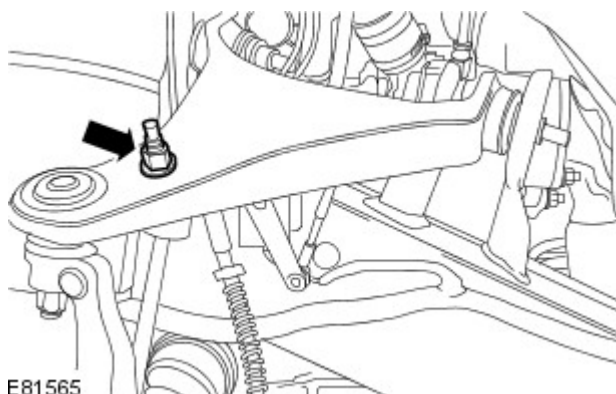



3.  **CAUTION:** Do not use excessive force to disconnect the height sensor link.

Disconnect the height sensor link arm.



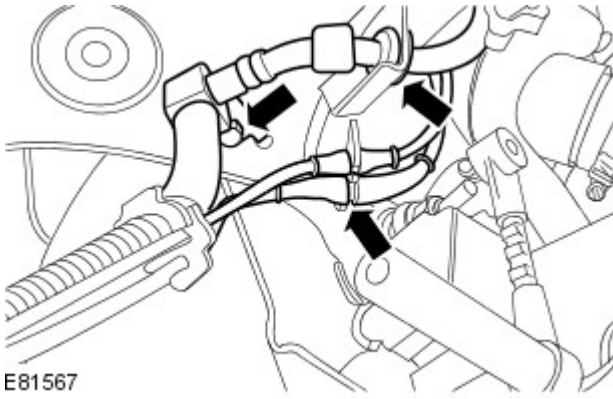
4. Remove the upper arm and brake line heat shields for access.
 - Remove the 3 nuts.
 - Remove the 3 bolts.



5.  **CAUTION:** Use a wrench on the hexagon provided to prevent the ball joint rotating.

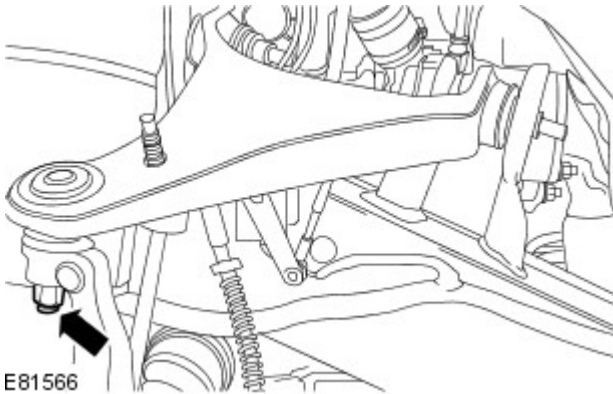
Remove the stabilizer bar link nut.

- Discard the nut.




E81567

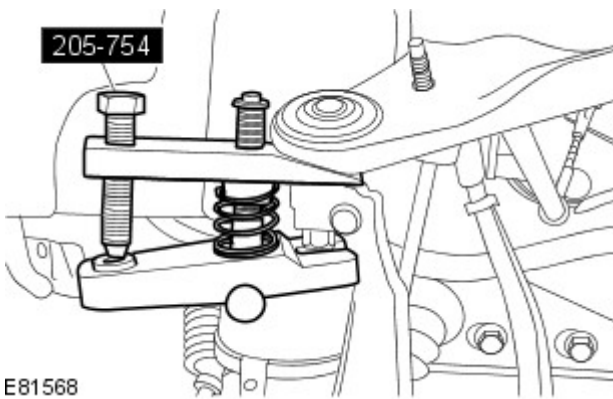
6. Release the brake hose and wheel speed sensor leads from the upper arm.
 - Remove the bolt.



E81566

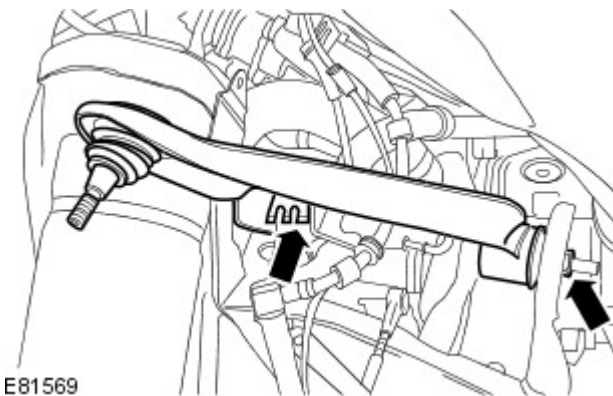
7.  **CAUTION:** To prevent the wheel knuckle falling outwards and disconnection of the halfshaft inner joint, support the wheel knuckle.

Loosen the upper arm retaining nut.



E81568

8. Using the special tool, release the upper arm ball joint.
 - Remove and discard the nut.



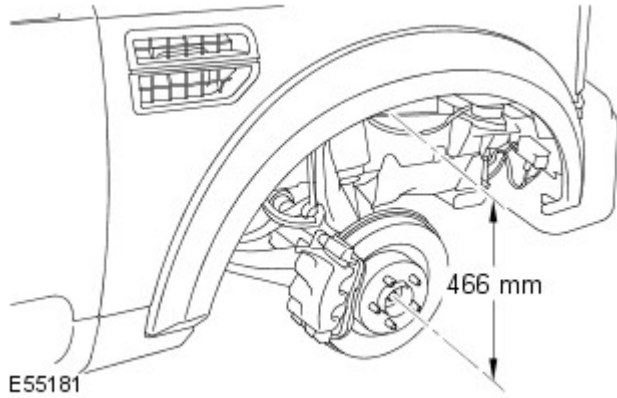
E81569

9. Remove the upper arm.
 - Remove and discard the 2 nuts.

Installation

1. Install the upper arm.
 - Fit the bolts but do not fully tighten at this stage.
 - Install new nuts.
2. Connect the upper arm and wheel knuckle.
 - Install a new nut and tighten to 70 Nm (52 lb.ft).
3. Secure the brake hose and wheel speed sensor leads to the upper arm.
 - Tighten the bolt to 23 Nm (17 lb.ft).

4. Secure the stabilizer bar link.
 - Install a new nut and tighten to 115 Nm (85 lb.ft).
5. Install the upper arm and brake line heat shields.
 - Install the 3 bolts.
 - Install the 3 nuts.
6. Connect the height sensor link.
7. Set the height distance between the centre of the halfshaft end and the edge of the fender trim to 466 mm (18.34").







8. Tighten the 2 upper arm nuts and bolts to 175 Nm (129 lb.ft).
9. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
10. Using the Land Rover approved diagnostic system, calibrate the suspension ride height.
For additional information, refer to: Ride Height Adjustments (204-05, General Procedures).

Front Suspension - Upper Arm Bushing

Removal and Installation


Special Tool(s)

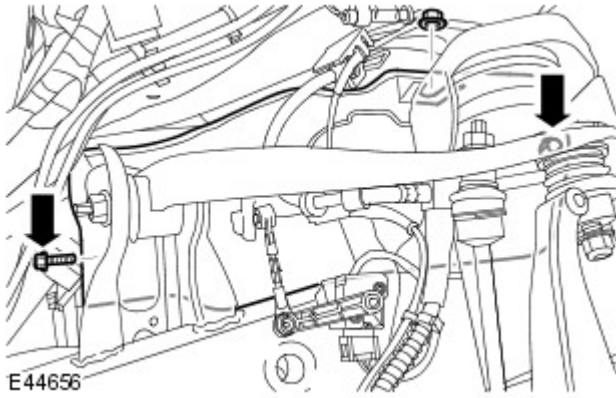
 <p>204-532/1 E55136</p>	<p>Receiver cup upper arm bushes 204-532/1</p>
 <p>204-532/2 E55137</p>	<p>Remover upper arm bushes 204-532/2</p>
 <p>204-532/3 E55138</p>	<p>Installer upper arm front bush 204-532/3</p>
 <p>204-532/4 E55139</p>	<p>Installer upper arm rear bush 204-532/4</p>

Removal

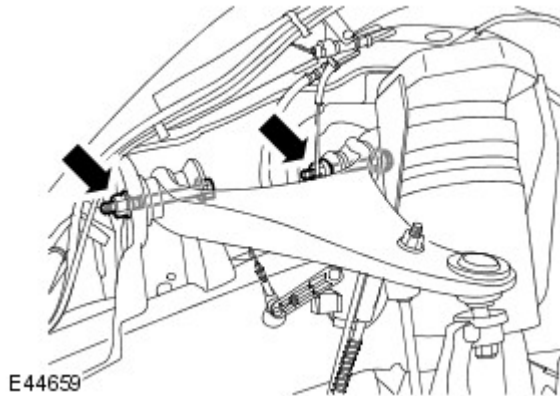


NOTE: The bushings must be replaced in pairs, LH and RH sides.


1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
2. Remove the front wheels and tires.
3. Remove the LH upper arm.
For additional information, refer to: Upper Arm (204-01, Removal and Installation).
4. Release the heat shield for access to the upper arm bolts.
 - Remove the nut.
 - Remove the forward bolt and loosen the rearward bolt.



5. Loosen the upper arm bolts.

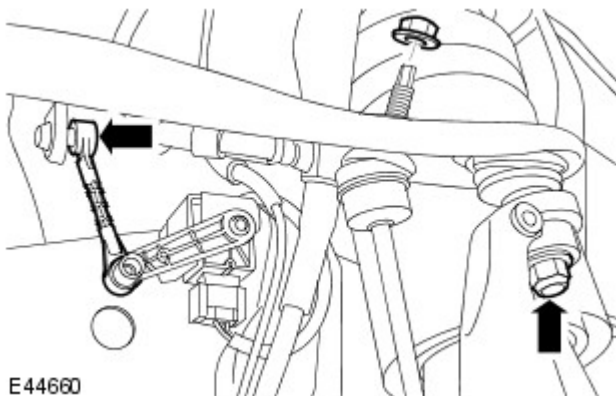



6. Disconnect the height sensor link arm.

7.  **CAUTION:** Use a wrench on the hexagon provided to prevent the ball joint rotating.

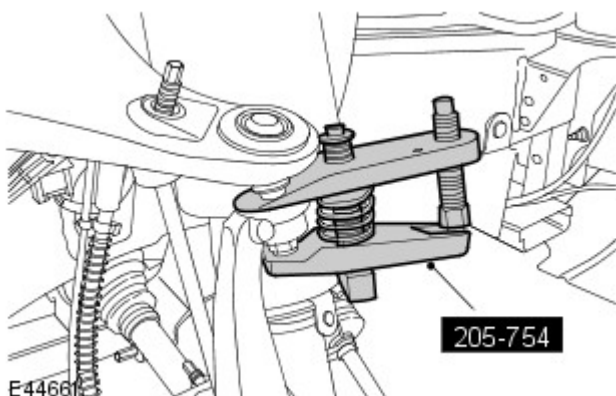
Remove the stabilizer bar link nut.

- Discard the nut.



8.  **CAUTION:** To prevent the wheel knuckle falling outwards and disconnection of the halfshaft inner joint, support the wheel knuckle.

Loosen the upper arm retaining nut.



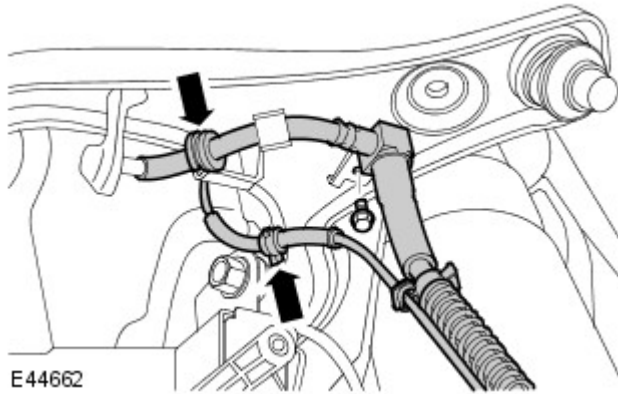
9. Using the special tool, release the upper arm ball joint.

- Remove and discard the retaining nut.

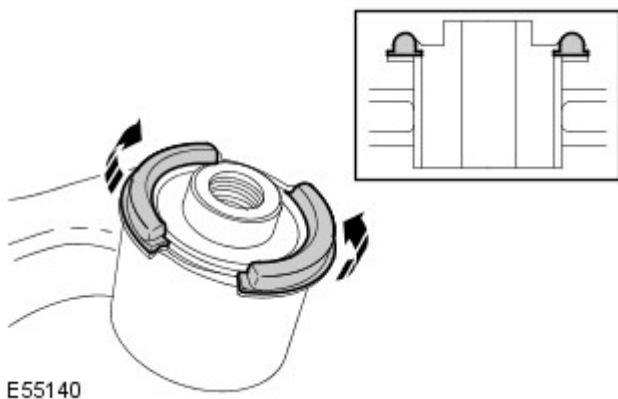
10. Release the brake hose from the upper arm.


11. Release the wheel speed sensor lead from the upper arm.

12. Remove the RH upper arm.



13. Note the position of the bushing in relation to the upper arm.

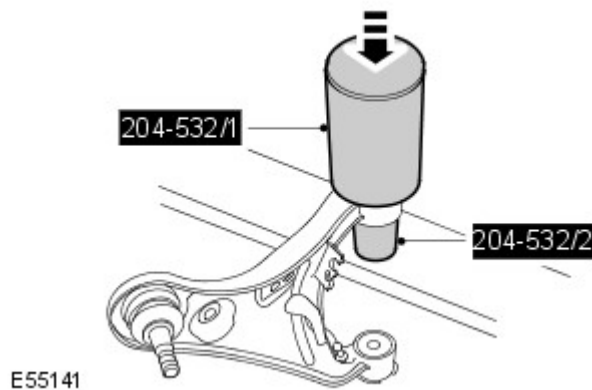


14.  **CAUTION:** The bush flanges need to be removed to allow bush removal.


Using a suitable tool, bend over the bush flanges.

15. Using a hacksaw, remove the flange from the bushing, making sure the upper arm is not damaged.

16. Using the special tools, remove and discard the upper arm bushings.

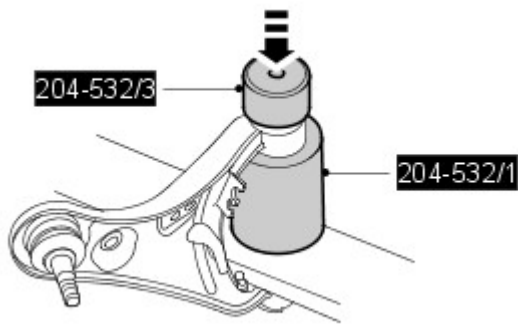


Installation

1.  **CAUTION:** Make sure the correct special tool is used to install the bushings to the correct depth.

Using the special tools, install the upper arm rear bushings.

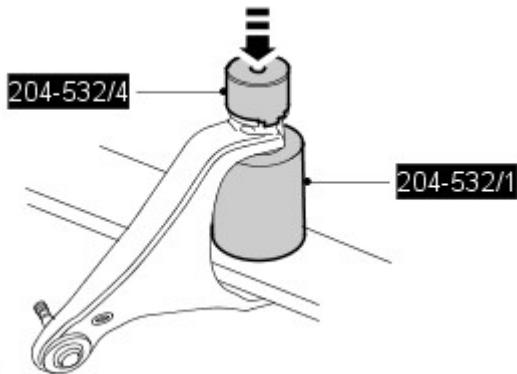
- Align the arrow on the bush with the mark, previously made on the upper arm.



E55142

2. Using the special tools, install the upper arm front bushings.

- Align the arrow on the bush with the mark, previously made on the upper arm.



E55143

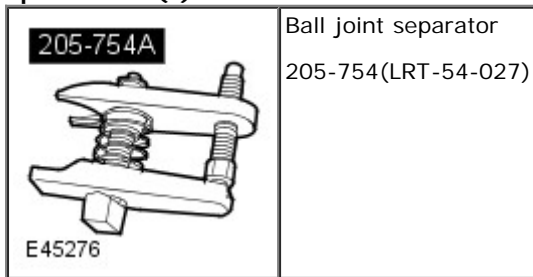
3. Install the RH upper arm.
 - Fit the bolts but do not fully tighten at this stage.
4. Secure the brake hose to the upper arm.
 - Tighten the bolt to 23 Nm (17 lb.ft).
5. Secure the wheel speed sensor lead to the upper arm.
6. Connect the upper arm and wheel knuckle.
 - Install a new nut and tighten to 70 Nm (52 lb.ft).
7. Secure the stabilizer bar link.
 - Install a new nut and tighten to 115 Nm (85 lb.ft).
8. Connect the height sensor link arm.
9. Set the height distance between the centre of the halfshaft end and the edge of the fender trim to 466 mm (18.34").
10. Tighten the 2 upper arm nuts and bolts to 175 Nm (129 lb.ft).
11. Secure the heat shield.
12. Install the LH upper arm.

For additional information, refer to: Upper Arm (204-01, Removal and Installation).
13. Install the front wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Front Suspension - Lower Arm

Removal and Installation

Special Tool(s)




Removal

1. Place vehicle into access mode.

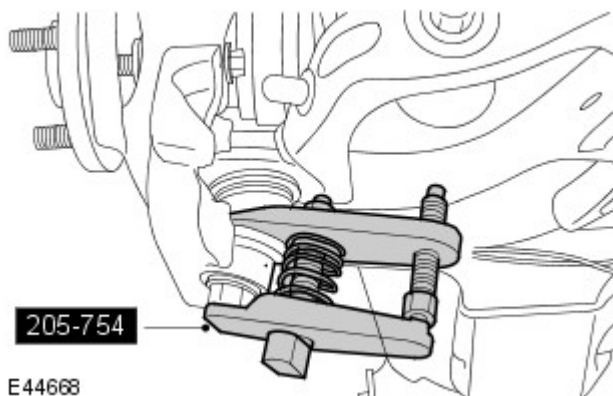


E99855

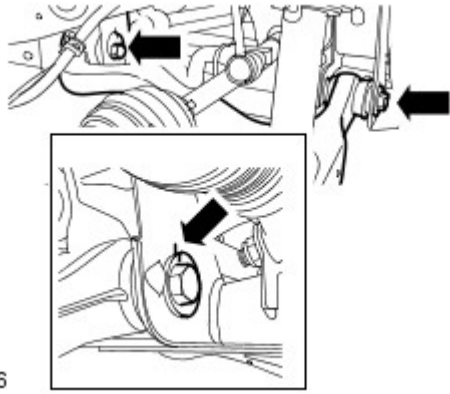
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

3. Remove the wheel and tire.
4. Remove the lower ball joint retaining nut.
5. Using the special tool, release the lower ball joint from the steering knuckle.

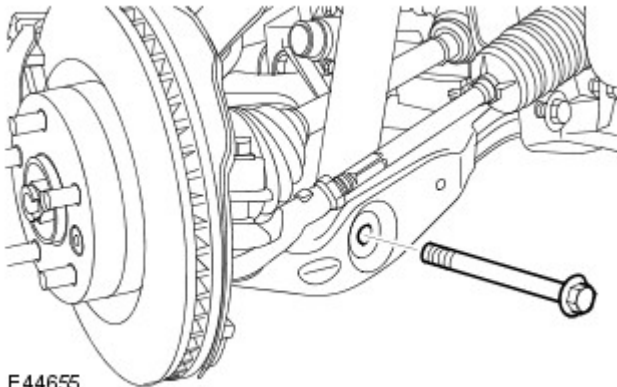


6. Mark the position of the bolts in relation to the chassis brackets.
 - Remove the 2 bolts.




E99856

7. Disconnect the shock absorber and spring assembly from the lower arm.
 - Remove the nut and bolt.



E44655

8.  **CAUTION:** Only displace the wheel knuckle sufficiently outboard to release the lower arm past the undertray. This will prevent the inboard driveshaft joint from separating. Failure to follow this instruction may result in damage to the vehicle.




NOTE: Make sure the steering is in the straight ahead position.

Remove the lower arm.

- Release the lower arm from the subframe and reposition downwards.
- Rotate the lower arm and position forward to release from the wheel knuckle.

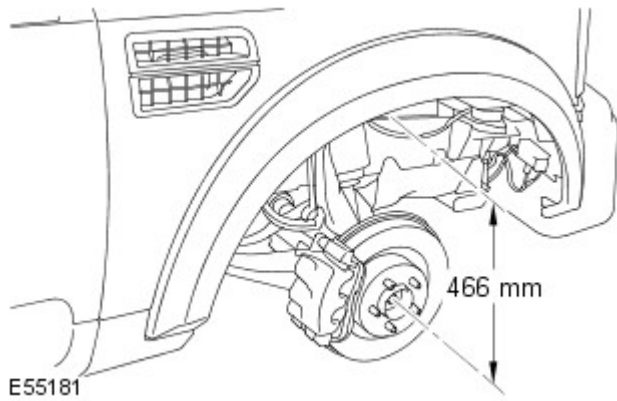
Installation

1. Install the lower arm.
 - Fit the bolts but do not fully tighten at this stage.
2.  **CAUTION:** The lower arm ball joint can be damaged by excessive articulation. Do not over articulate the ball joint. Failure to follow this instruction will result in damage to vehicle.

Connect the lower arm to the wheel knuckle.

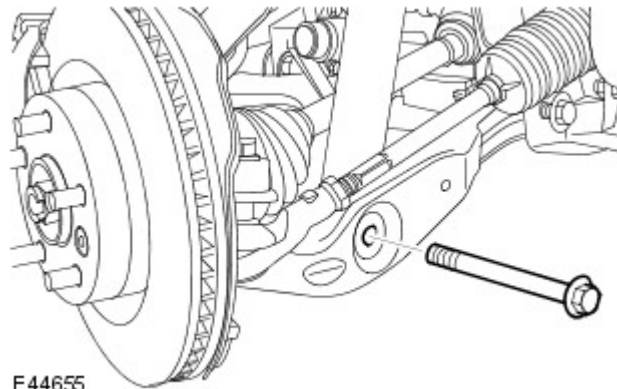
- Tighten the lower arm ball joint retaining nut to 115 Nm (85 lb.ft).

3. Set the height distance between the centre of the halfshaft end and the edge of the fender trim to 466 mm (18.34").



E55181

4. Tighten the lower arm bolts to 275 Nm (203 lb.ft).
 - Align the bolts to the marks made previously.



E44655

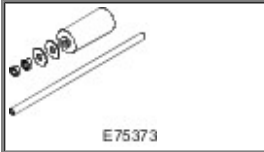
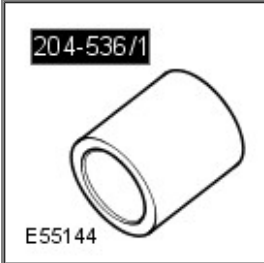
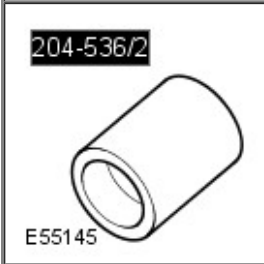


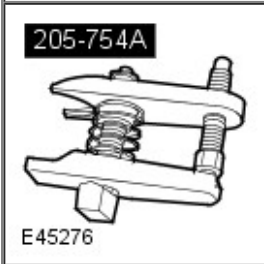
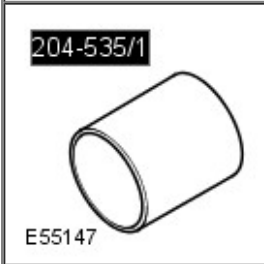
5. Connect the shock absorber and spring assembly to the lower arm.
 - Tighten the nut and bolt to 300 Nm (221 lb.ft).

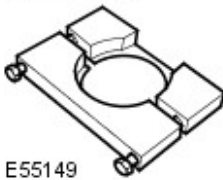

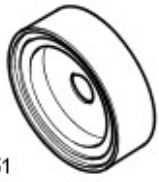
6. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
7. Carry out the wheel alignment procedure.

Front Suspension - Lower Arm Bushing

Removal and Installation





Special Tool(s)


 <p>E75373</p>	Hydraulic cylinder 10t 204-598
 <p>204-536/1 E55144</p>	Receiver front lower arm front bush 204-536/1
 <p>204-536/2 E55145</p>	Remover front lower arm front bush 204-536/2
 <p>204-535/2 E55148</p>	Remover front lower arm rear bush 204-535/2
 <p>204-536/3 E55146</p>	Installer front lower arm front bush 205-536/3
 <p>205-754A E45276</p>	Ball joint separator 205-754(LRT-54-027)
 <p>204-535/1 E55147</p>	Receiver lower arm rear bush 204-535/1
	Remover plate front lower arm rear bush 204-535/4

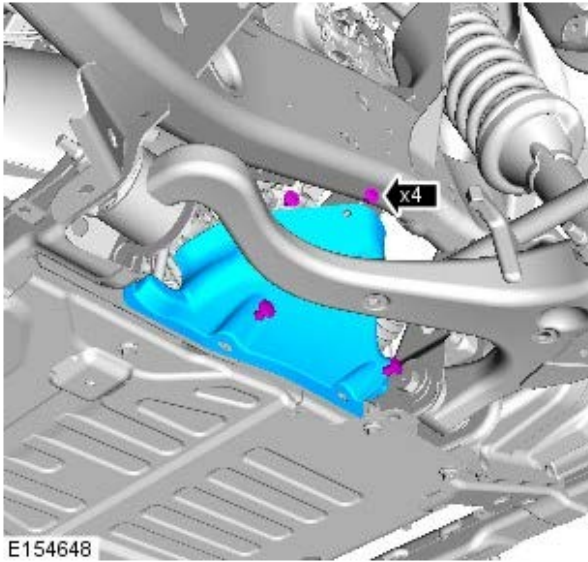
 <p>204-535/4 E55149</p>	
 <p>204-535/3 E55150</p>	<p>Installer lower arm rear bush 204-535/3</p>
 <p>204-535/5 E55151</p>	<p>Installer/depth setter front lower arm rear bush 204-535/5</p>

Removal

NOTES:

-  If installing the front bushes, both front bushes must be replaced.
-  If installing the rear bushes, both rear bushes must be replaced.
-  Note the orientation of the bush.
-  Removal steps in this procedure may contain installation details


1. Make sure that the tire pressures are correct and that the vehicle is at the correct ride height.
For additional information, refer to: [Ride Height Adjustments](#) (204-05 Vehicle Dynamic Suspension, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
3. Remove the clips and trim for access to the lower arm camber bolts

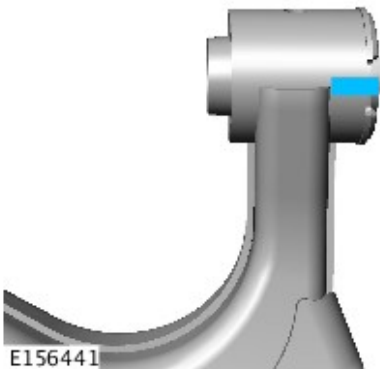


E154648


4. For additional information, refer to: [Lower Arm](#) (204-01 Front Suspension, Removal and Installation).
5. Secure lower arm in a suitable vice or similar to carry out the following steps.



6.  **NOTE:** Mark the new bush to aid correct orientation on installation.
Mark alignment of original bush prior to removal.



E156441

7.  **CAUTION:** The bush flanges need to be removed to allow bush removal.
Remove the lower arm front bushing flanges.

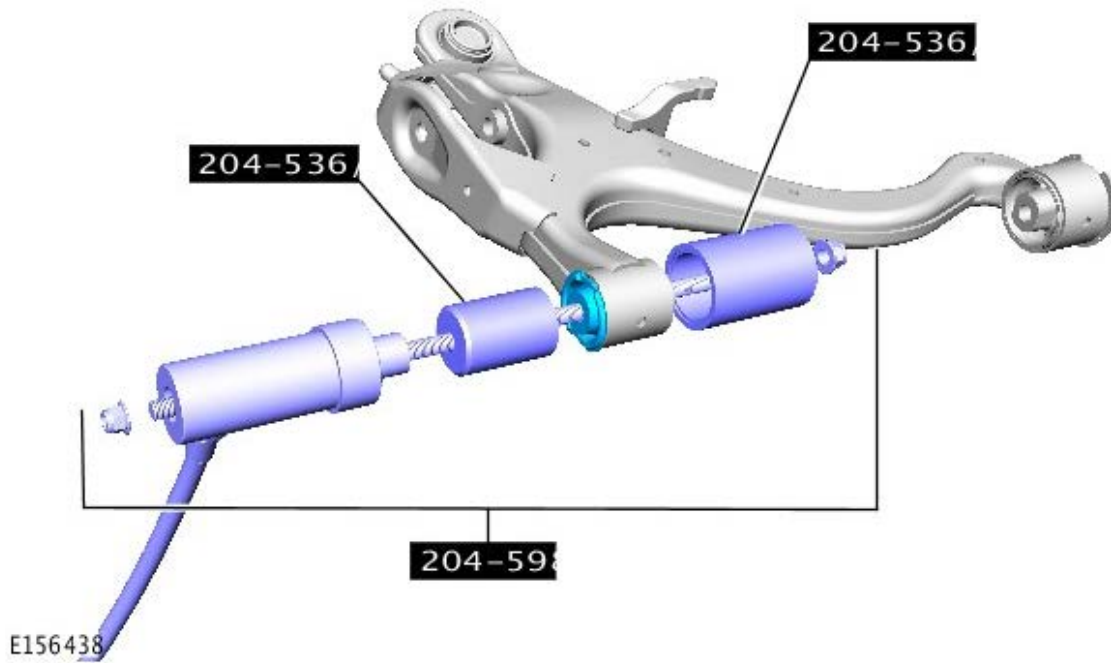


E156440

8.  **CAUTION:** Make sure correct alignment is maintained

whilst carrying out the step.

Using the special tools, remove the bush.

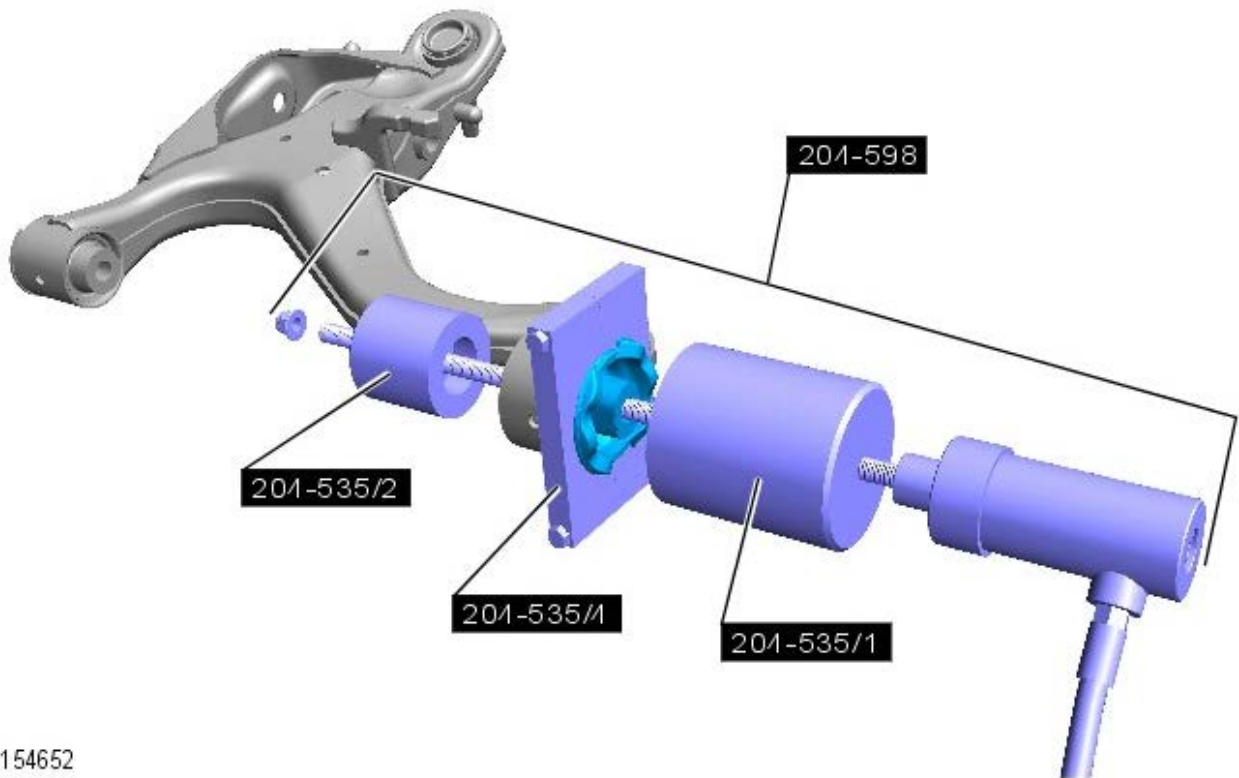


9. Mark alignment of original bush before removing, new bush to be installed with the same orientation




E154651

10.

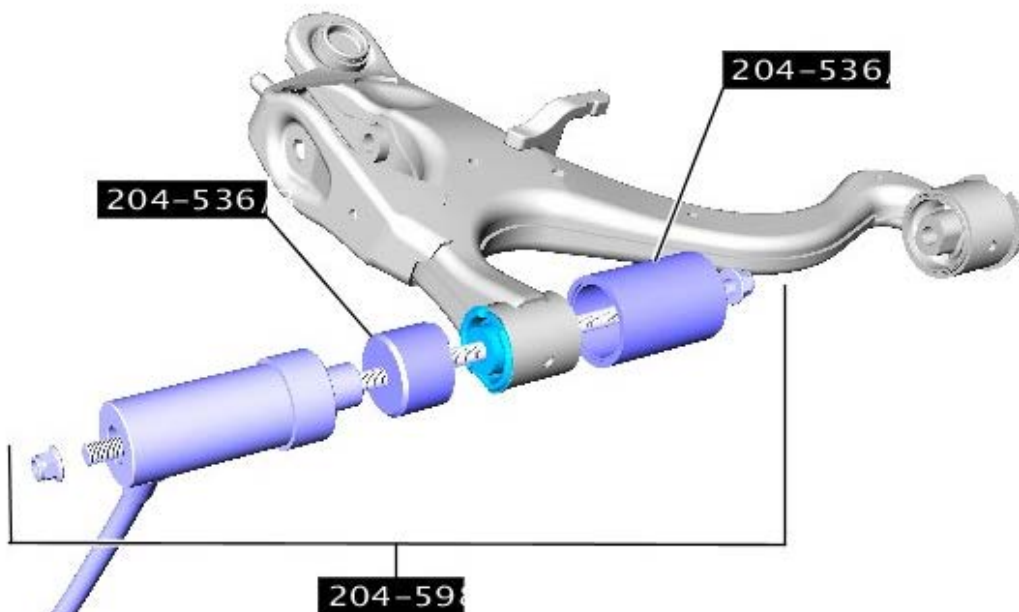


E154652

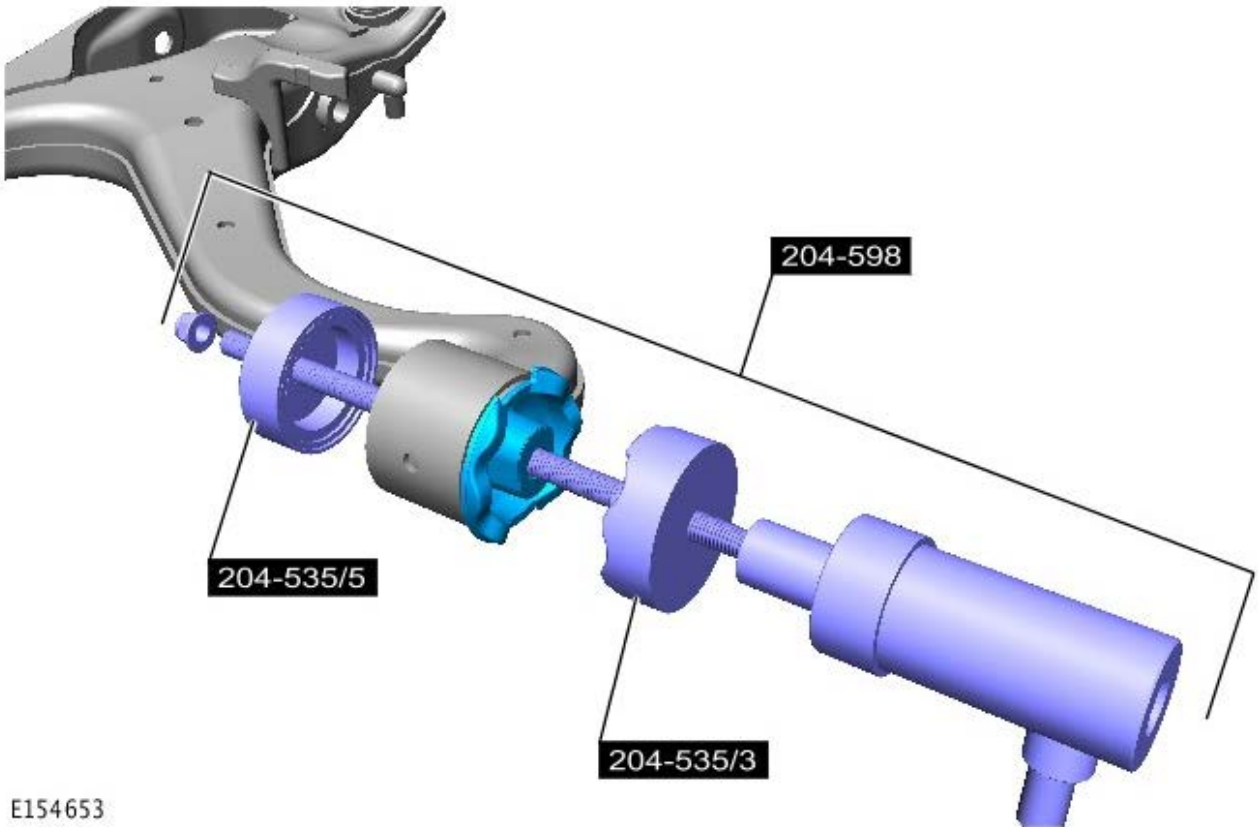
Installation

1.  CAUTION: Make sure correct alignment is maintained whilst carrying out the step.

Using the special tools install the bush.



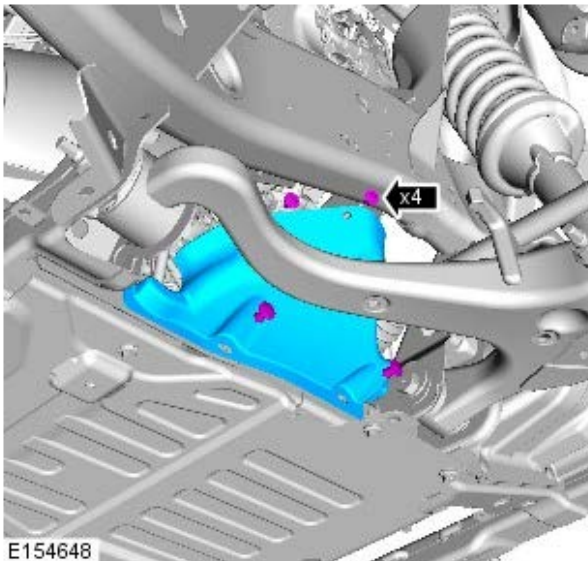
E156439



E154653

3. For additional information, refer to: [Lower Arm](#) (204-01 Front Suspension, Removal and Installation).

4. Refit the trim.






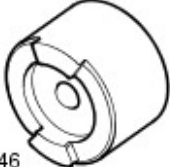
E154648

5. Carry out the wheel alignment procedure.

Front Suspension - Lower Arm Front Bushing

Removal and Installation

Special Tool(s)

 <p>E 75373</p>	Hydraulic cylinder 10t 204-598
 <p>204-536/1 E55144</p>	Receiver front lower arm front bush 204-536/1
 <p>204-536/2 E55145</p>	Remover front lower arm front bush 204-536/2
 <p>204-536/3 E55146</p>	Installer front lower arm front bush 204-536/3

Removal

NOTES:




If installing the front bushes, both front bushes must be installed.

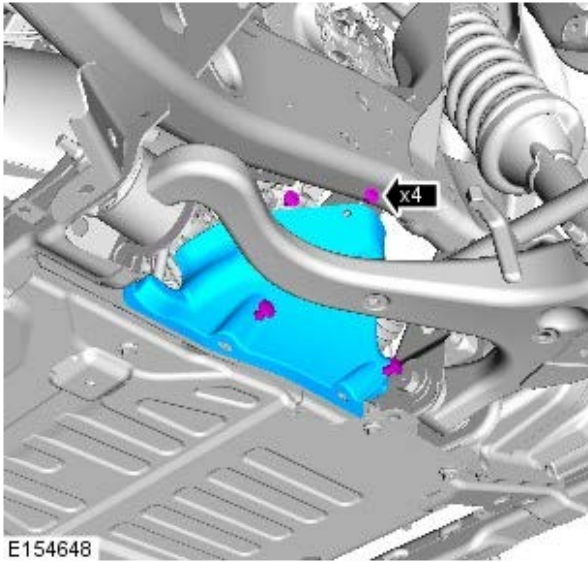


Note orientation of the bush.



Removal steps in this procedure may contain installation details


1. Make sure that the tire pressures are correct and that the vehicle is at the correct ride height.
For additional information, refer to: [Ride Height Adjustments](#) (204-05 Vehicle Dynamic Suspension, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
3. Remove the clips and trim for access to the lower arm camber bolts.

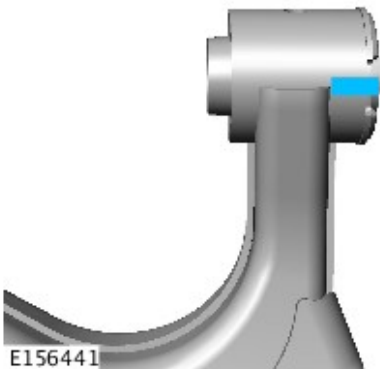


E154648


4. For additional information, refer to: [Lower Arm](#) (204-01 Front Suspension, Removal and Installation).
5. Secure lower arm in a suitable vice or similar to carry out the following steps.



6.  **NOTE:** Mark the new bush to aid correct orientation on installation.
Mark alignment of original bush prior to removal.



E156441

7.  **CAUTION:** The bush flanges need to be removed to allow bush removal.
Remove the lower arm front bushing flanges.

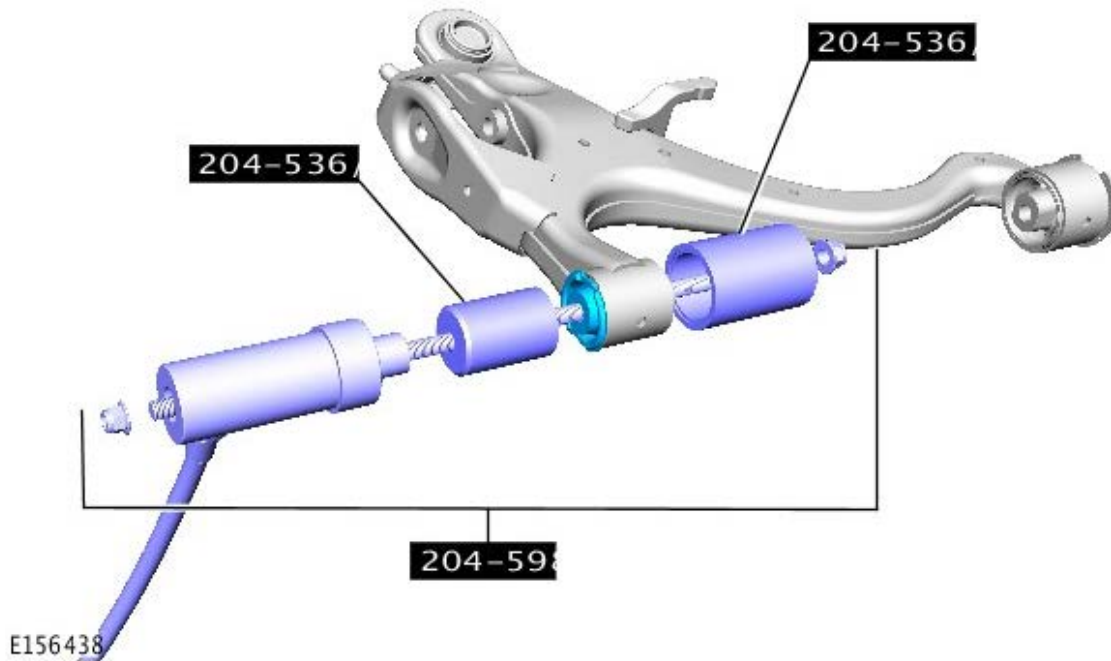


E156440


8.  **CAUTION:** Make sure correct alignment is maintained

whilst carrying out the step.

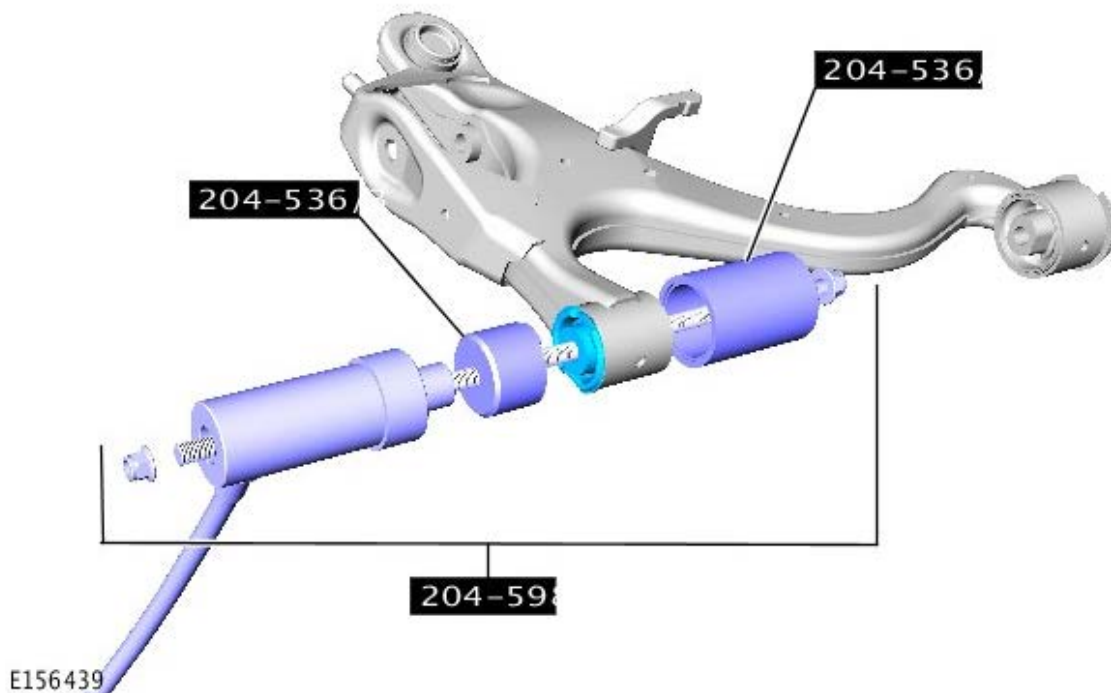
Using the special tools, remove the bush.



Installation

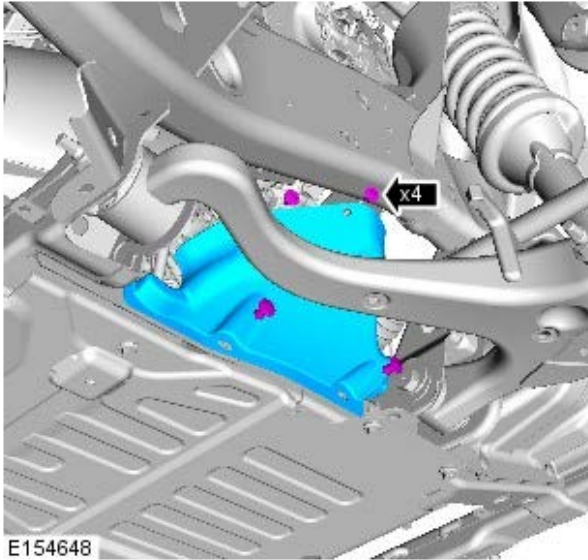
1.  CAUTION: Make sure correct alignment is maintained whilst carrying out the step.

Using the special tools install the bush.



2. For additional information, refer to: [Lower Arm](#) (204-01 Front Suspension, Removal and Installation).

3. Refit the trim.


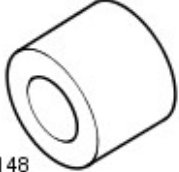

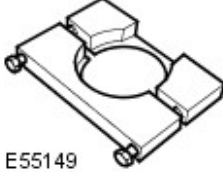

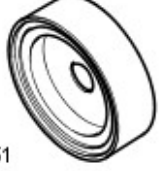


4. Carry out the wheel alignment procedure.

Front Suspension - Lower Arm Rear Bushing

Removal and Installation

Special Tool(s)

 <p>E75373</p>	<p>Hydraulic cylinder 10t 204-598</p>
 <p>204-535/2 E55148</p>	<p>Remover front lower arm rear bush 204-535/2</p>
 <p>204-536/1 E55144</p>	<p>Receiver front lower arm front bush 204-535/1</p>
 <p>204-535/4 E55149</p>	<p>Remover plate front lower arm rear bush 204-535/4</p>
 <p>204-535/3 E55150</p>	<p>Installer front lower arm rear bush 204-535/3</p>
 <p>204-535/5 E55151</p>	<p>Installer/depth setter front lower arm rear bush 204-535/5</p>

Removal

NOTES:



If installing the rear bushes, both rear bushes must be installed.




Take note of the fitted position of the bush.



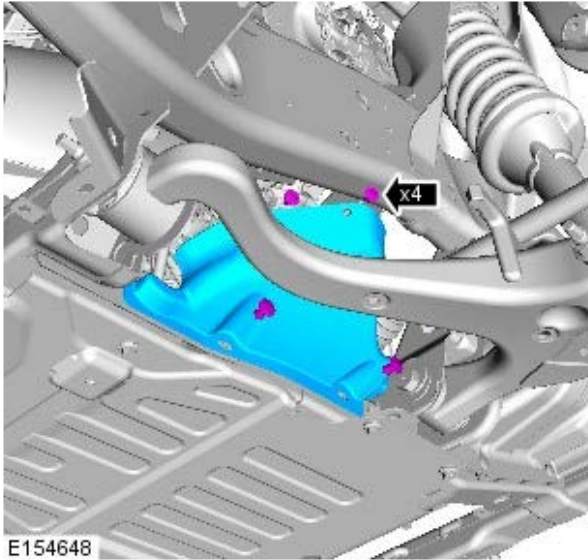
Removal steps in this procedure may contain installation details

1. Make sure that the tire pressures are correct and that the vehicle is at the correct ride height.
For additional information, refer to: Ride Height Adjustments (204-05 Vehicle Dynamic Suspension, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

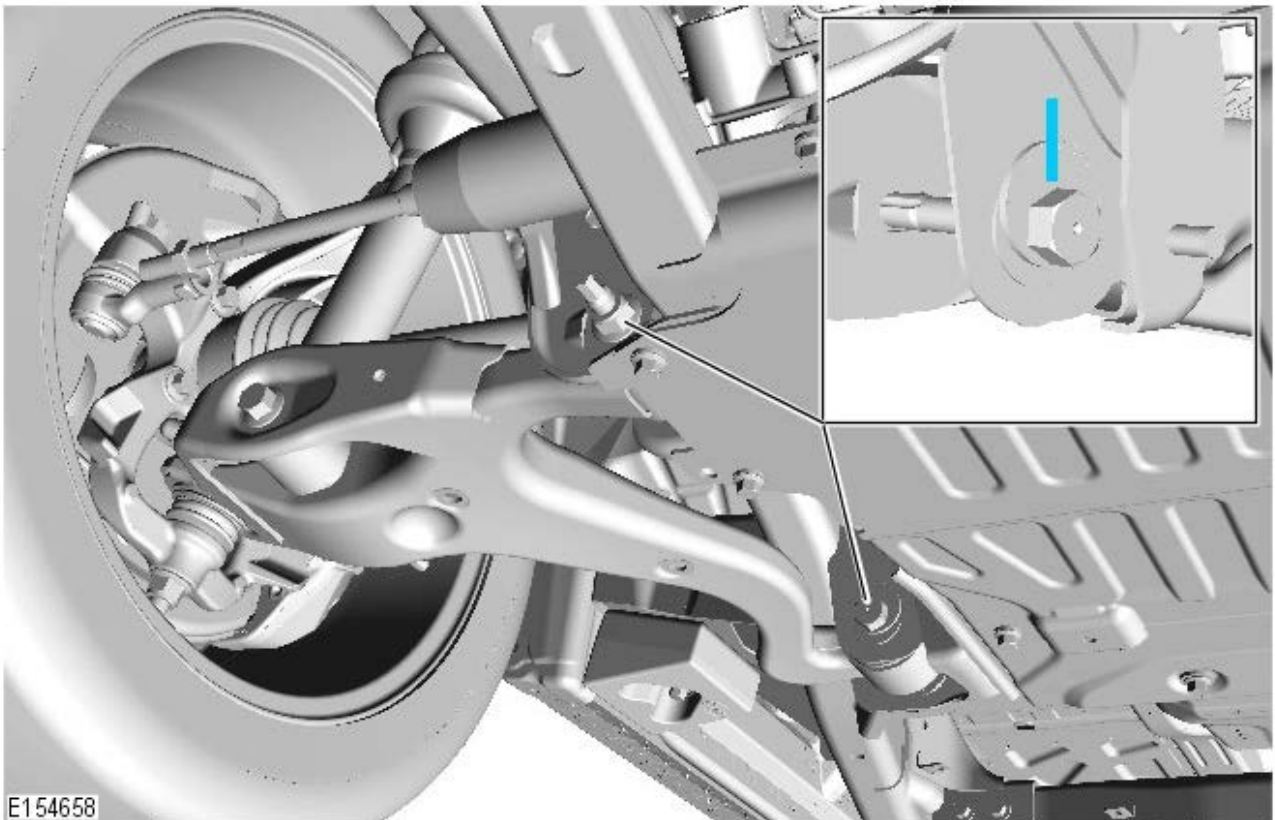
Raise and support the vehicle.

3. Remove the clips and trim for access to the lower arm camber bolts.




E154648

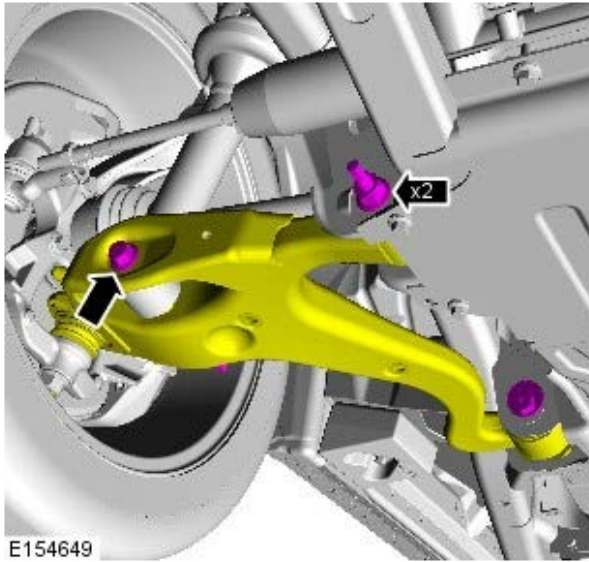
4. Mark the position of the bolts in relation to the chassis brackets making note of the original position.



E154658

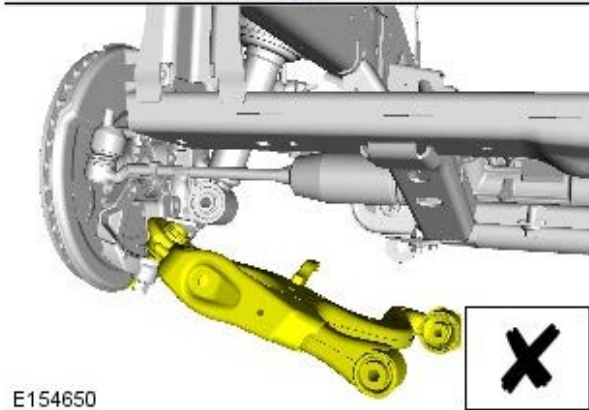
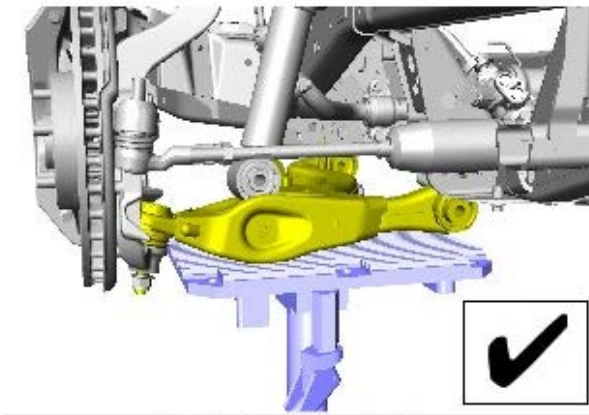
5.  **CAUTION:** Make sure the lower arm is supported. Failure to follow this instruction may result in damage to the ball joint.

Remove lower arm camber bolts and the lower damper bolt and rotate arm downwards for access.




E154649

6. Using a suitable transmission jack, support the lower arm in the position illustrated.




E154650

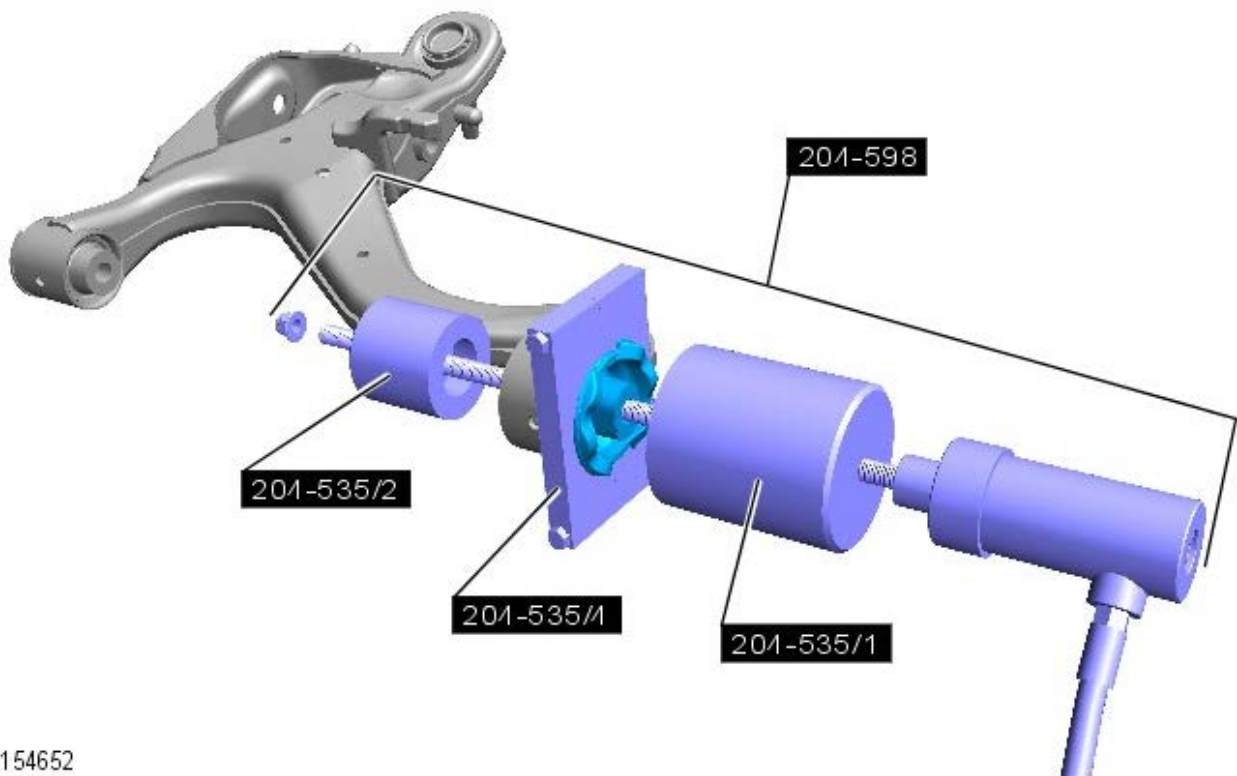
7.  NOTE: Mark the new bush to aid correct orientation on installation.
Mark alignment of original bush prior to removal.



E154651


8.  CAUTION: Make sure correct alignment is maintained whilst carrying out the step.

Using the special tools, remove the bush.

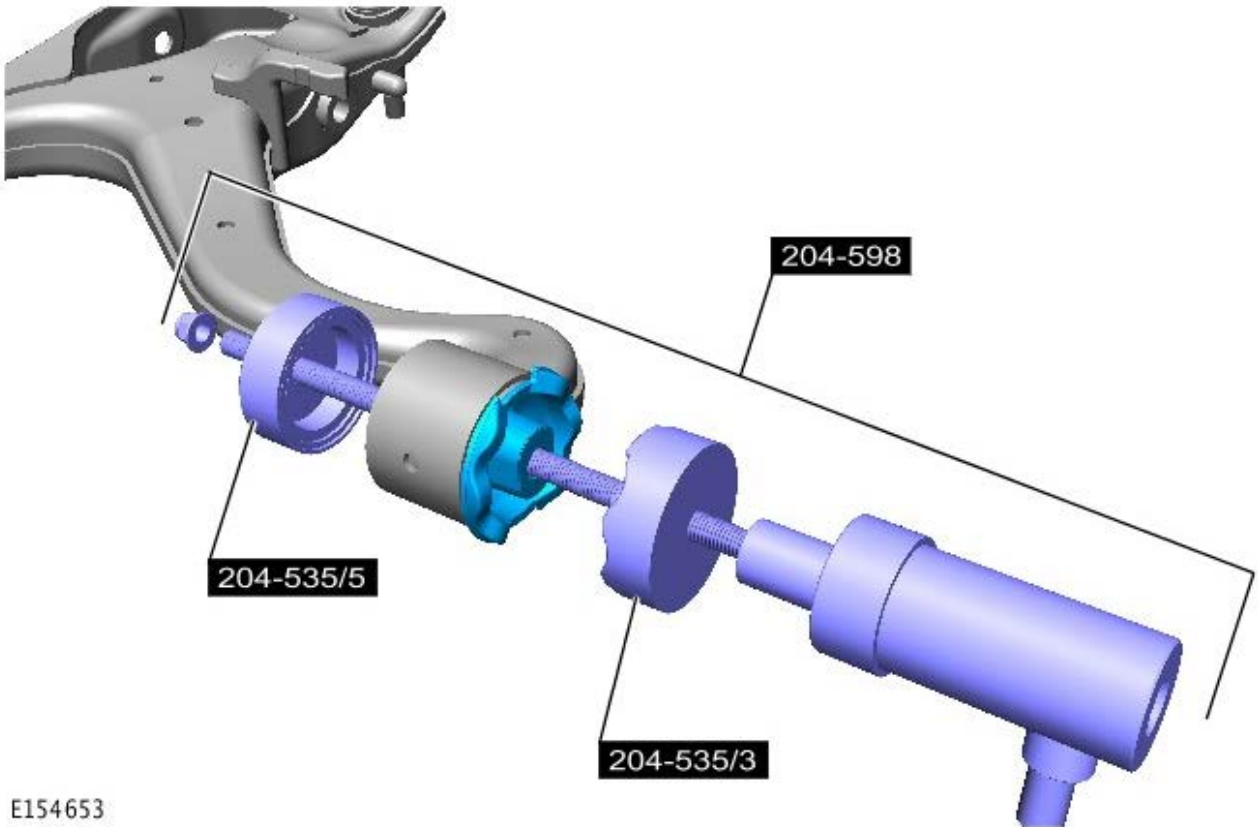


E154652

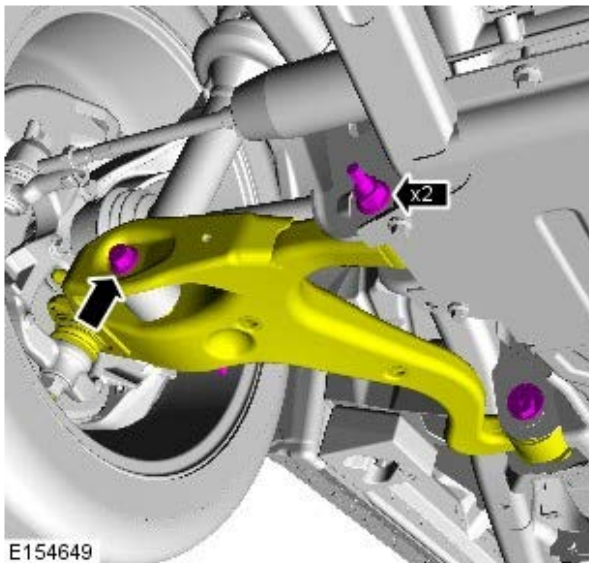
Installation

1.  CAUTION: Make sure correct alignment is maintained whilst carrying out the step.


Using the special tools install the bush.



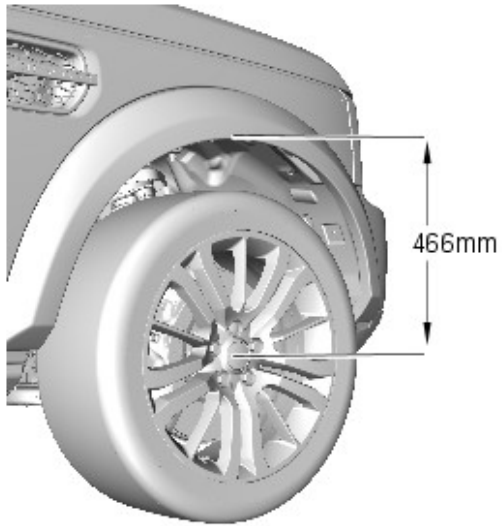
E154653



E154649

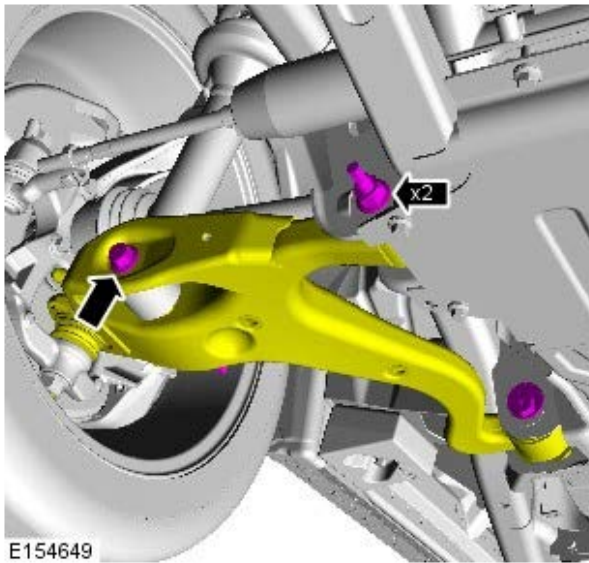
2.  **NOTE:** Do not tighten the bolts at this stage.
Install the lower front arm.

3. Set the height distance between the centre of the half shaft end and the edge of the fender trim to 466 mm (18.34") before tightening lower arm bolts.



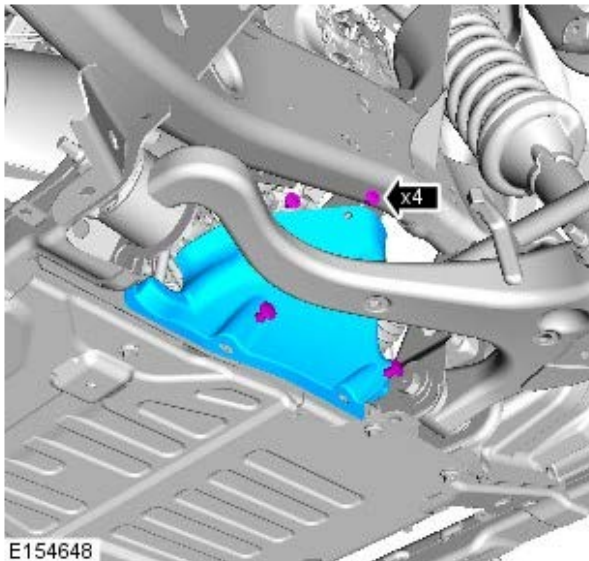
E155108

4. Attach the lower arm.
 - Align the bolts to the marks made previously.
 - Tighten the lower arm camber bolts to 275 Nm.
 - Tighten the shock absorber and spring assembly to lower arm bolt to 300 Nm.



E154649

5. Refit the trim.



E154648

6. Carry out the wheel alignment procedure.

Front Suspension - Shock Absorber and Spring Assembly TDV6 2.7L Diesel

Disassembly and Assembly

Disassembly

WARNINGS:




Ensure the spring compressor Safe Working Load (SWL) meets or exceeds the spring rating quoted in the Specifications section.

For additional information, refer to: Specifications (204-00, Specifications).

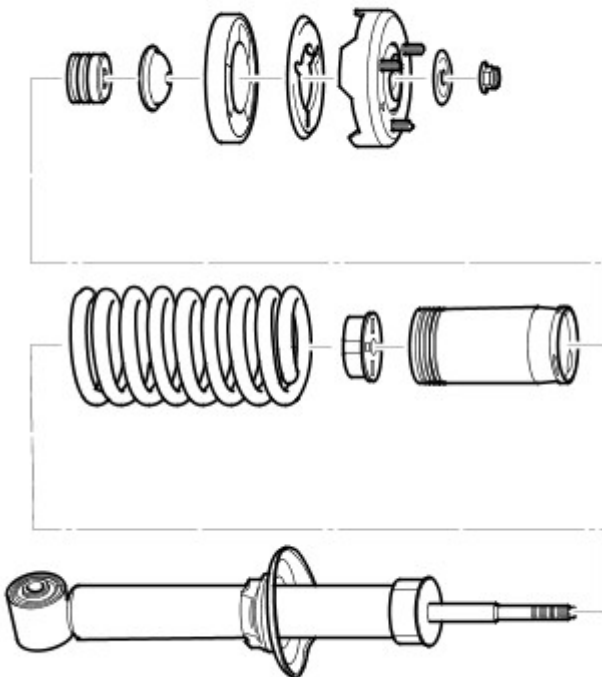


Always follow the spring compressor manufacturer's instructions.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

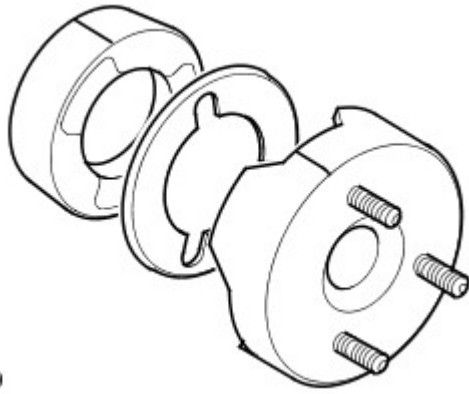
Raise and support the vehicle.

2. Remove the shock absorber and spring assembly.
For additional information, refer to: Shock Absorber and Spring Assembly (204-01, Removal and Installation).
3. Install a suitable spring compressor in a vise.
4. Install the shock absorber and spring assembly in the spring compressor.
 - Compress the spring just sufficiently to relieve the spring tension.
5. Remove the shock absorber.
 - Restrain the shock absorber spindle, remove and discard the nut.
 - Remove the upper bush rebound plate and upper bush.
 - Remove the upper mounting assembly.
 - Remove the dust tube and rebound plate assembly.
 - Remove the spring aid.



E51728

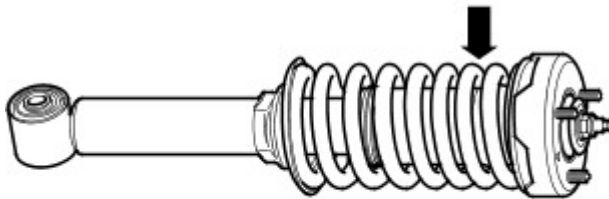
6. Remove the spring from the spring compressor.
7. Clean and inspect the components for deterioration.
 - To aid reassembly, mark the position of the rubber insulator in relation to the upper mounting plate.



E51729

- Remove the rubber insulator.
- Remove the spacer.
- Remove the rebound plate from the dust tube.

Assembly



1. Install the spring in the spring compressor.
 - Make sure the spring is installed with the close coils positioned towards the top of the shock absorber.

E51726

2. Install the spring aid.
3. Install the dust tube.
 - Install the rebound plate into the dust tube.
4. Install the shock absorber.
 - Make sure the spring is correctly located in the spring seat.
5. Install the upper mounting.
 - Install the spacer and rubber insulator, making sure the spacer drops over the stud heads and the insulator is aligned with the mark made previously.
 - Install the upper bush and upper bush rebound plate.
 - Install a new nut and tighten to 98 Nm (72 lb.ft).
6. Install the shock absorber and spring assembly.
For additional information, refer to: Shock Absorber and Spring Assembly (204-01, Removal and Installation).

Rear Suspension -

Coil Spring Suspension

Item	Specification
Road spring color coding - 5 Seat Model:	
	BROWN/WHITE
	BROWN/GREEN
	BROWN/ORANGE
	BROWN
Road spring color coding - 7 Seat Model:	
	RED/WHITE
	RED/GREEN
	RED/ORANGE
	RED

Note: The first color indicates the fitted position of the spring on the vehicle i.e. rear. The secondary color identifies the thickness of the isolator which is fitted to a particular spring to ensure that the vehicle ride height is maintained within specified limits. Replacement springs will be supplied with the appropriate isolator fitted.

General Specifications

Item	Specification
Gap between underside of the toe link rubber boot and the integrated body frame bracket	10.0 mm (0.394 in)
Height between the center of the halfshaft end and the edge of the fender trim	485 mm (19.10 in)

Torque Specifications

Description	Nm	lb-ft
Toe link bolt	175	129
* Toe link inner ball joint retaining nut	133	98
* Stabilizer bar link nuts	115	85
Stabilizer bar clamp bolts	62	46
Body mount retaining bolts	133	83
Shock absorber to the lower suspension arm nut and bolt	300	221
Shock absorber to suspension turret nuts	70	52
Lower arm to wheel knuckle bolt	175	129
Lower arm bolts	275	203
* + Halfshaft nut	420	311
Upper arm to wheel knuckle nut	133	98
Upper arm front bolt	175	129
Upper arm rear bolt	275	203
Brake tube unions	18	13
Rear camber adjusting bolts	133	98
Wheel speed sensor	9	7
Brake disc dust shield bolts	9	7
Parking brake cable coupling	8	6
Road wheel nuts	<ul style="list-style-type: none"> • Stage 1: 4 • Stage 2: 70 • Stage 3: 140 	<ul style="list-style-type: none"> • Stage 1: - • Stage 2: 52 • Stage 3: 103

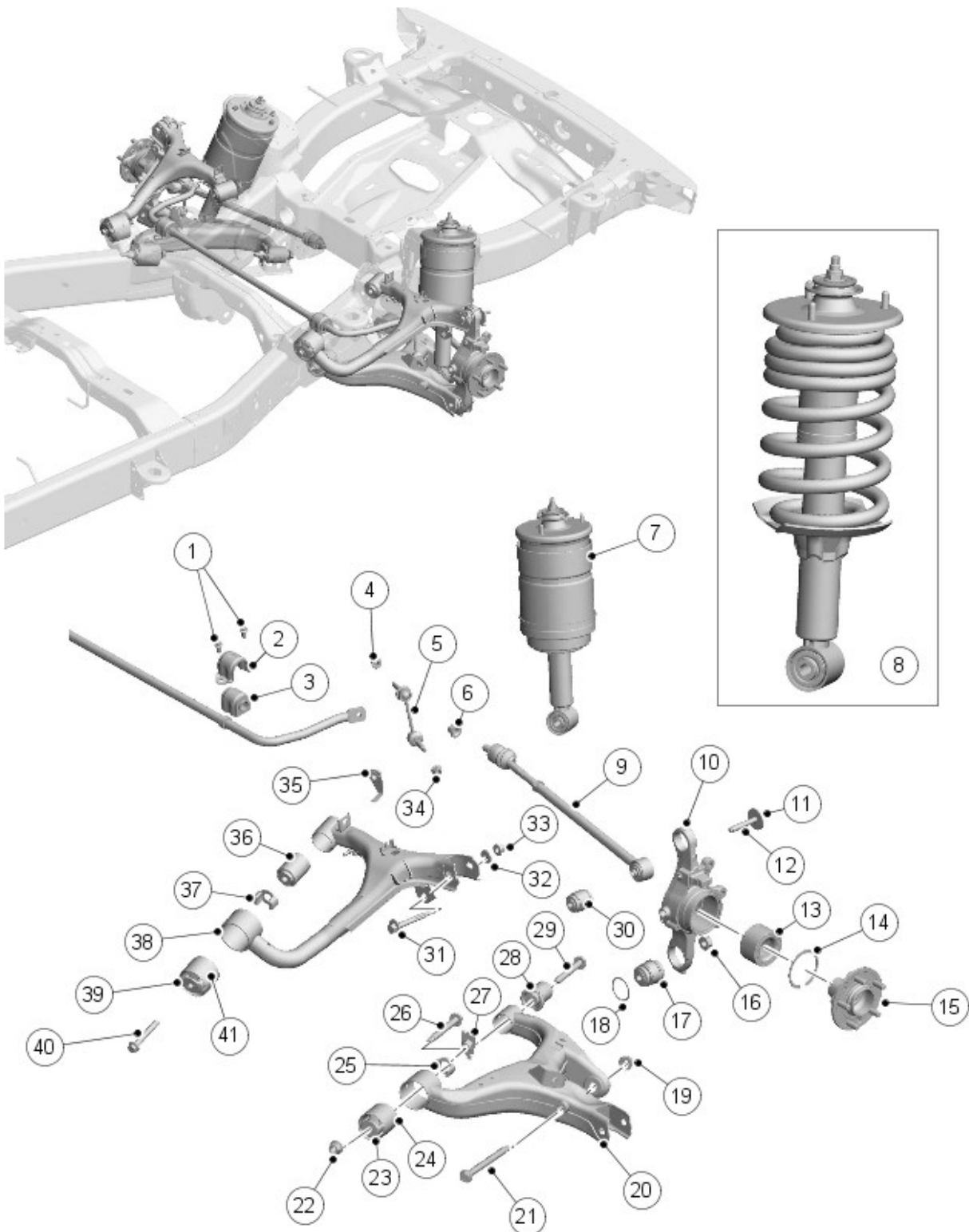
* New nut must be installed

+ Nut must be staked after tightening

Rear Suspension - Rear Suspension

Description and Operation

COMPONENT LOCATION



E 150574

Item	Part Number	Description
1	-	Bolt (Stabilizer bar bracket) (2 off)
2	-	Stabilizer bar bush
3	-	Stabilizer bar bracket
4	-	Self-locking nut (Stabilizer bar link to Stabilizer bar)

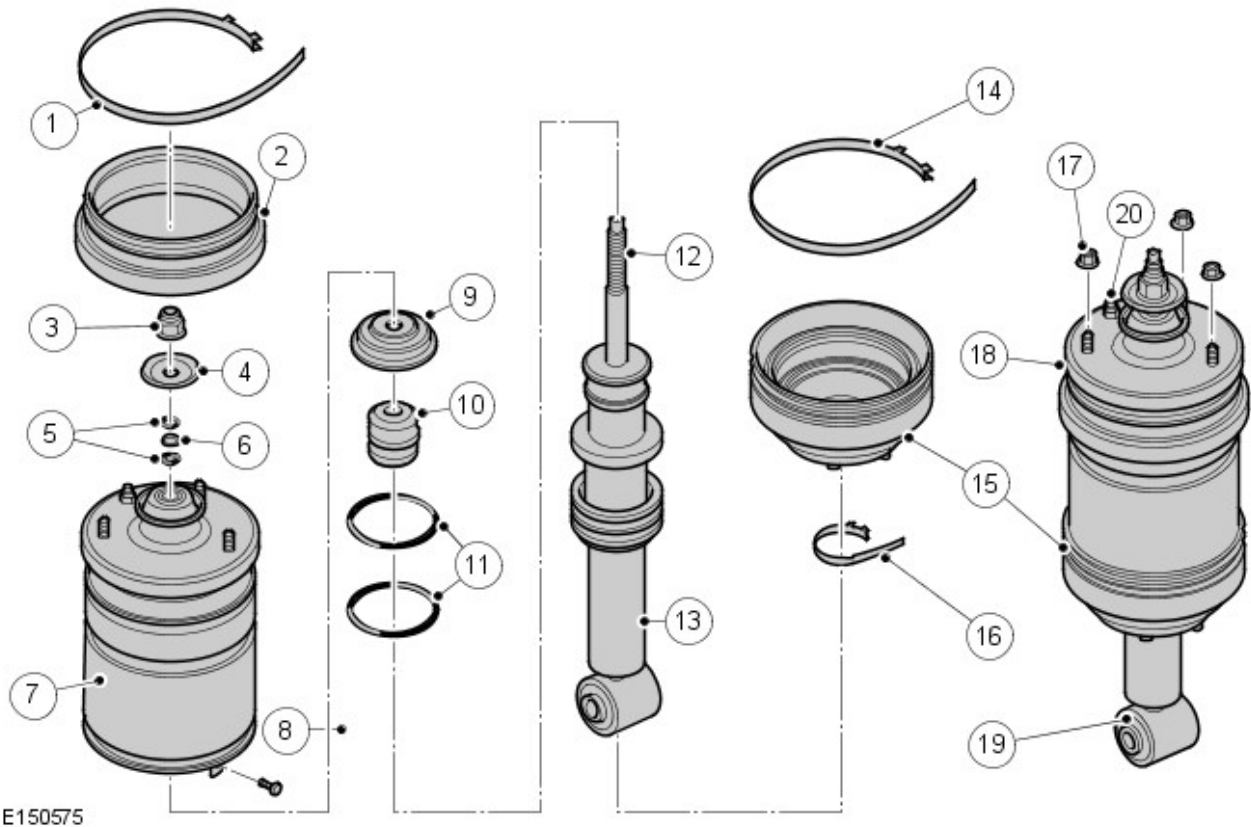
5	-	Stabilizer link
6	-	Special nut (Adjustable transverse toe link)
7	-	Shock absorber assembly (Air suspension)
8	-	Shock absorber assembly (Coil spring suspension)
9	-	Adjustable transverse toe link
10	-	Wheel knuckle and bearing assembly
11	-	Washer (Adjustable transverse toe link)
12	-	Bolt (Adjustable transverse toe link)
13	-	Wheel bearing
14	-	Circlip
15	-	Wheel hub
16	-	Self-locking nut (Wheel knuckle lower ball joint)
17	-	Ball joint (Wheel knuckle lower)
18	-	Circlip (Wheel knuckle lower ball joint)
19	-	Self-locking nut (Shock absorber)
20	-	Lower control arm
21	-	Bolt (Shock absorber)
22	-	Self-locking nut (Lower control arm forward bush)
23	-	Bumpstop clip
24	-	Bush - Forward (Lower control arm)
25	-	Bumpstop clip
26	-	Bolt (Lower control arm forward bush)
27	-	Nut and retainer (Lower control arm rearward bush)
28	-	Bush - Rearward (Lower control arm)
29	-	Bolt (Lower control arm rearward bush)
30	-	Ball joint (Wheel knuckle upper)
31	-	Cam bolt (Wheel knuckle upper ball joint)
32	-	Eccentric washer (Wheel knuckle upper ball joint)
33	-	Nut (Wheel knuckle upper ball joint)
34	-	Self-locking nut (Stabilizer bar link to lower control arm)
35	-	Caged nut (Upper control arm rearward bush)
36	-	Bush - Rearward (Upper control arm)
37	-	Bumpstop clip
38	-	Upper control arm
39	-	Bumpstop clip
40	-	Bolt (Upper control arm forward bush)
41	-	Bush - Forward (Upper control arm)

OVERVIEW

The independent rear suspension offers a reduction in unsprung weight over the beam axle design fitted to previous Land Rover models. The rear suspension comprises an upper control arm, a lower control arm, a wheel knuckle and wheel hub, two shock absorber assemblies and a stabilizer bar and links assembly. The shock absorber assemblies use a similar design of Shock absorber which can be fitted with either a coil spring or an air spring.

The rear suspension control arms have been designed to give maximum ground clearance and also allow for the adjustment of the camber using a cam bolt and adjustment of toe and bump steer via an adjustable transverse link.

SHOCK ABSORBER ASSEMBLY - AIR SUSPENSION



E150575

Item	Part Number	Description
1	-	Strap*
2	-	Upper gaitor*
3	-	Self-locking nut*
4	-	Rebound washer*
5	-	O-ring - Shock absorber rod*
6	-	Spacer - Shock absorber rod*
7	-	Air spring*
8	-	Retaining pin - Air spring sleeve support*
9	-	Bump washer*
10	-	Spring aid*
11	-	O-ring - Air sleeve support (2 off)*
12	-	Shock absorber rod
13	-	Shock absorber assembly
14	-	Strap*
15	-	Lower gaitor*
16	-	Strap*
17	-	Self-locking nut (3 off)
18	-	Top mount assembly
19	-	Bush
20	-	Voss connector



NOTE: * Shows service items

The shock absorber assembly comprises an air spring assembly, top mount and a shock absorber assembly. The shock absorber and air spring are only serviceable as complete assemblies.

Shock Absorber

The shock absorber assembly is a twin tube design with the conventional coil spring replaced by the air spring. The lower end of the shock absorber is fitted with a bush and is attached to the lower control arm with a bolt and nut.

The shock absorber functions by restricting the flow of hydraulic fluid through internal galleries within the shock absorber. The shock absorber rod moves axially within the shock absorber, its movement limited by the flow of fluid through the galleries, providing damping of undulations in the terrain. The shock absorber rod is sealed at its exit point from the shock absorber body to maintain the fluid within the unit and to prevent the ingress of dirt and moisture. The seal also incorporates a wiper to keep the rod clean.

Air Spring

The air spring is similar in design to the air spring used on the front suspension.

The air spring comprises an aluminium restraining cylinder, top mount, spring aid, air sleeve and an inner support sleeve.

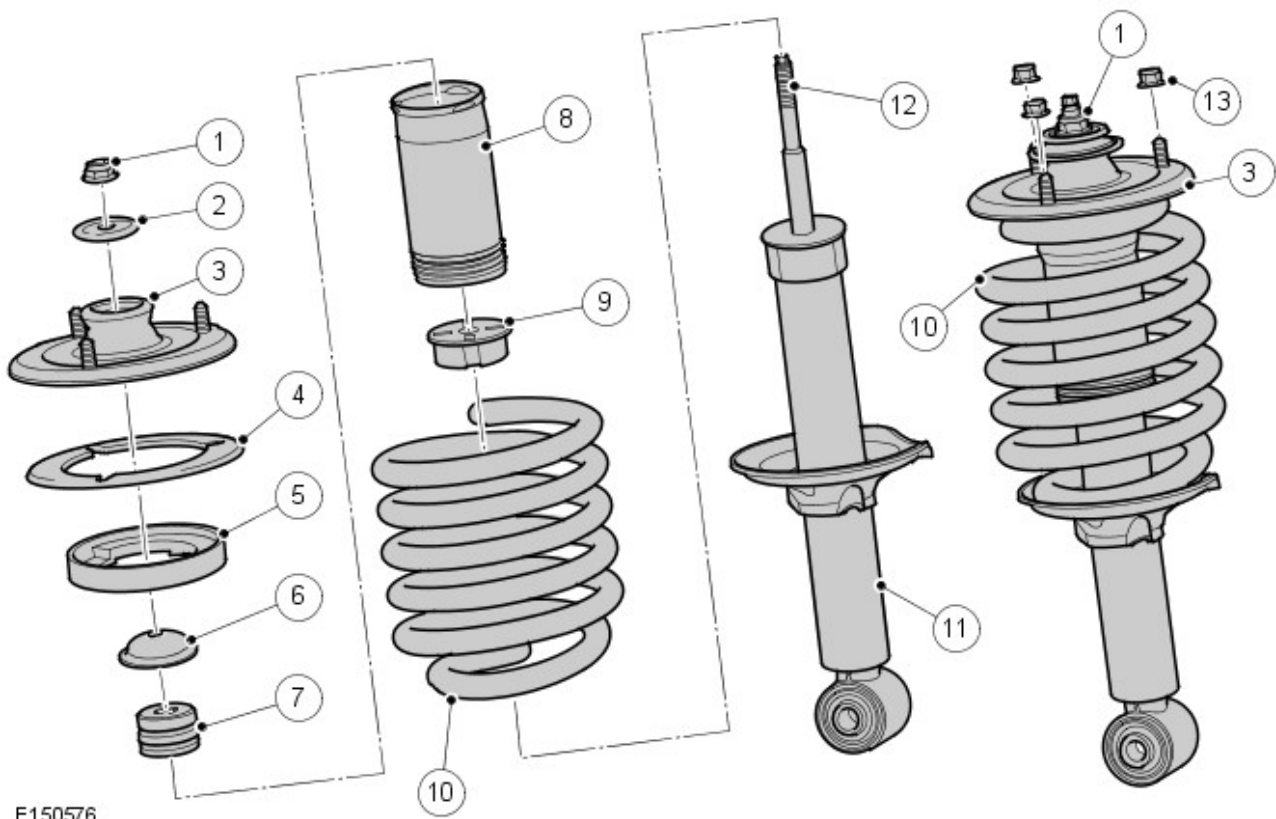
The air sleeve is made from a flexible rubber material which allows the sleeve to roll up and down the air spring piston as the vehicle changes height. The air sleeve is attached to the restraining cylinder and the support sleeve with crimp rings which provide an air tight seal. The support sleeve contains a seal carrier which has two O-rings sealing the support sleeve and two O-rings sealing to the Shock absorber body. The top of the air sleeve is crimped to the top mount which attaches to a mounting on the chassis with 3 integral studs and self-locking nuts.

A spring aid is fitted to the shock absorber rod and prevents the top mount contacting the top of the shock absorber during full suspension compression and assists the suspension tune. The lower end of the air spring is located over the shock absorber body and seats on a fabricated seat on the shock absorber body. The air sleeve is positively attached to the seat with a retaining pin. The shock absorber rod is located through a central hole in the top mount. The rod is threaded at its outer end and accepts a self-locking nut which secures the air spring to the shock absorber rod.

The top mount is an integral part of the air spring and is fitted with a bush and rebound washer which are located between the top mount plate and the shock absorber rod. A self-locking nut secures the Shock absorber rod to the top mount. The top mount attaches to a housing on the chassis with 3 integral studs and self-locking nuts. The top mount also incorporates a 6 mm Voss air fitting which allows for the attachment of the air harness.

The air spring is fitted with two gaitors. The upper gaitor is fitted between the top mount and the air spring restraining cylinder. The lower gaitor is secured to the lower end of the restraining cylinder and the Shock absorber body with metal straps. The gaitors prevent dirt and debris becoming trapped between the air sleeve and the restraining cylinder.

SHOCK ABSORBER ASSEMBLY - COIL SPRING SUSPENSION



E150576

Item	Part Number	Description
1	-	Self-locking nut
2	-	Rebound washer
3	-	Top mount assembly
4	-	Spring spacer (selective)
5	-	Spring isolator
6	-	Bump washer
7	-	Spring aid
8	-	Dust tube
9	-	Bump cup
10	-	Coil spring
11	-	Shock absorber
12	-	Shock absorber rod
13	-	Self-locking nut (3 off)
14	-	Bush

The coil spring shock absorber assembly comprises a shock absorber, a coil spring and a top mount.

Shock Absorber

The shock absorber assembly is a similar design to the front suspension shock absorber, with a twin tube design with a spring seat attached to the shock absorber body. The lower end of the shock absorber is fitted with a bush and is attached to the lower control arm with a bolt and self-locking nut. The shock absorber functions by restricting the flow of hydraulic fluid through internal galleries within the shock absorber.

The shock absorber rod moves axially within the Shock absorber, its movement limited by the flow of fluid through the galleries, providing damping of undulations in the terrain. The shock absorber rod is sealed at its exit point from the shock absorber body to maintain the fluid within the unit and to prevent the ingress of dirt and moisture. The seal also incorporates a wiper to keep the rod clean.

The shock absorber rod is located through a central hole in the top mount. The rod is threaded at its outer end and a self-locking nut secures the top mount to the Shock absorber rod.

A spring aid is fitted to the shock absorber rod and prevents the top mount contacting the top of the shock absorber during full suspension compression and assists the suspension tune.

Spring and Top Mount

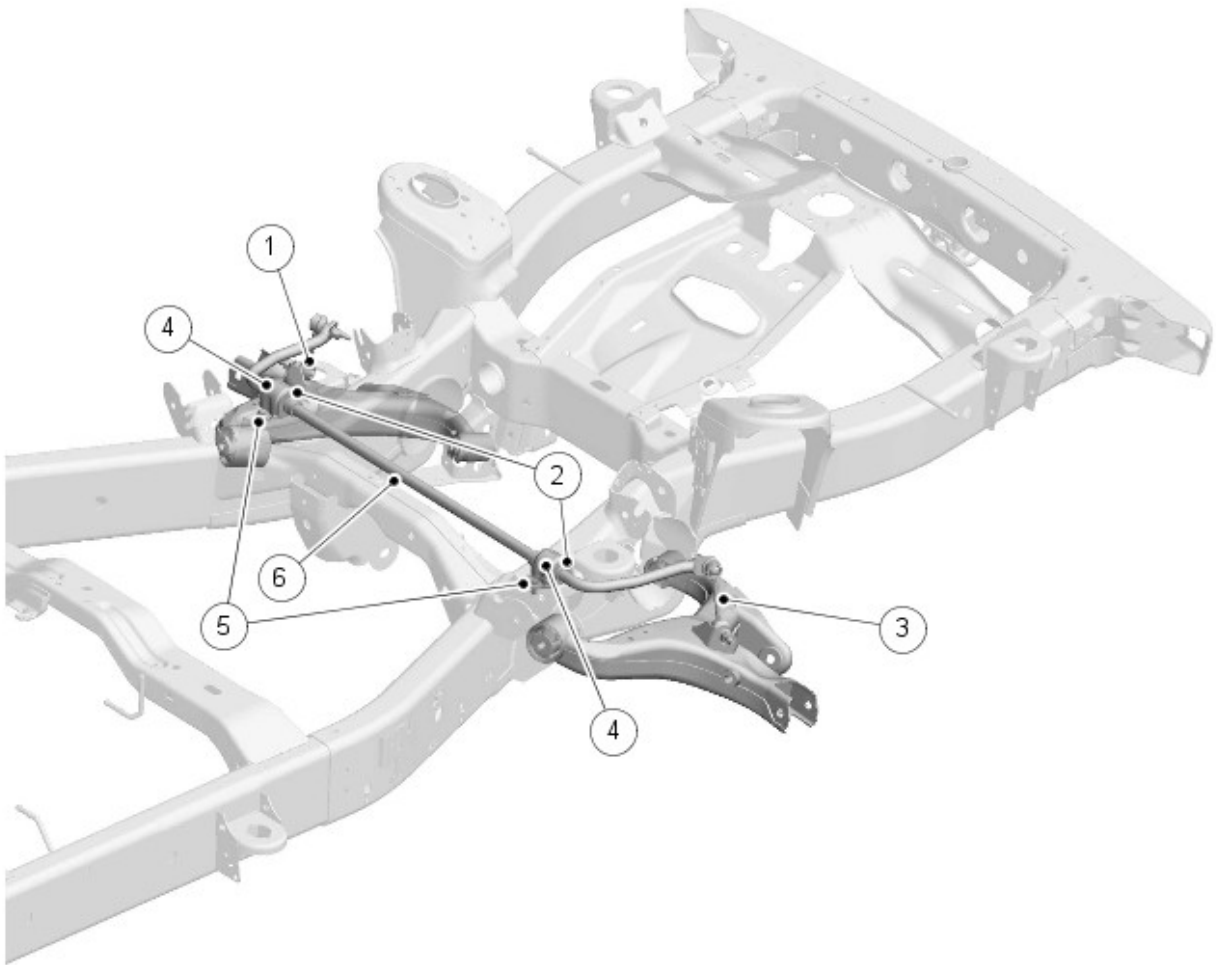
The coil spring fitted differs with vehicle specification. Each spring is color coded to identify its rating and fitment requirements.

The coil spring is located in a spring seat which is an integral part of the shock absorber body. The design of the spring seat prevents the spring rotating. The opposite end of the coil spring is located in a spring isolator which is fitted in the top mount. The spring isolator is made from rubber and prevents any noise produced during spring and Shock absorber compression/extension from being transmitted to the vehicle body. Three types of spring isolator are available which allow for differences in vehicle specification.

The top mount is fitted with a bush and a rebound washer which are located between the top mount plate and the shock absorber rod. The top mount is secured to the shock absorber rod with a self-locking nut. The top mount attaches to a housing on the vehicle chassis with three integral studs and self-locking nuts.

The spring is fitted with spring spacers which are located between the spring isolator and the top mount. The spring spacers control the length of the spring to maintain the correct trim height. The spring spacers are color coded and are supplied with a replacement spring.

STABILIZER BAR



E150577

Item	Part Number	Description
1	-	Right stabilizer link
2	-	Stabilizer bar bush (2 off)
3	-	Left stabilizer link
4	-	Stabilizer bar bracket (2 off)
5	-	Bolt (Stabilizer bar bracket) (2 off)
6	-	Stabilizer bar

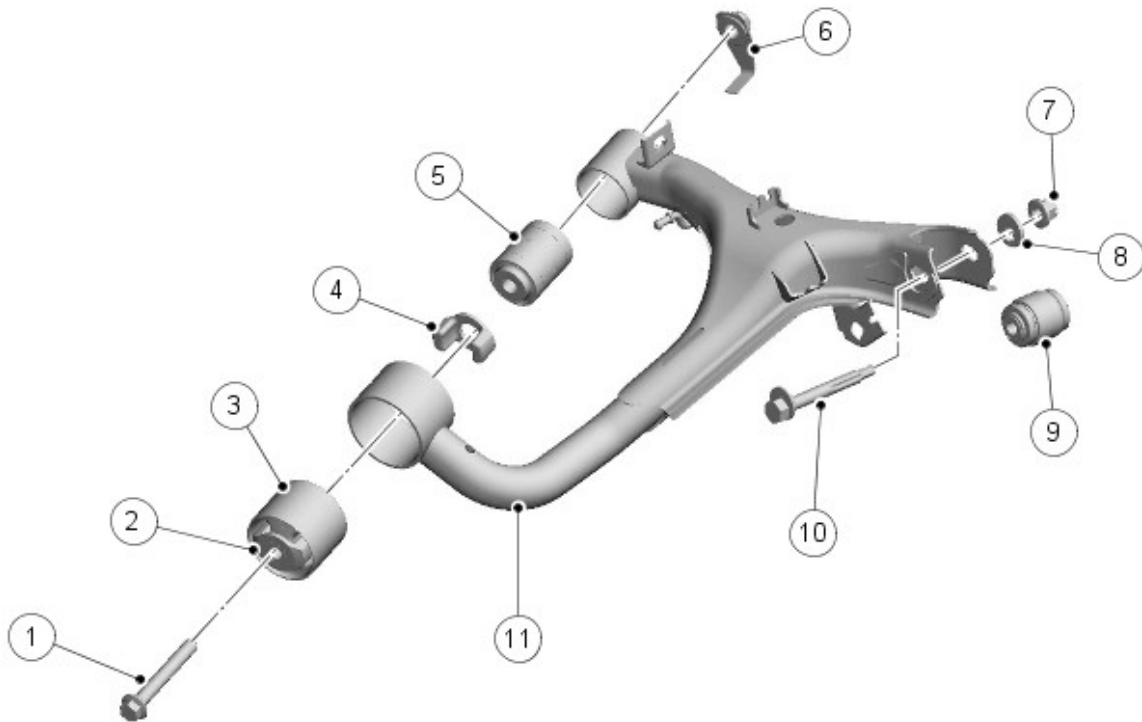
The stabilizer bar is fabricated from heat treated, solid, spring steel bar. The stabilizer bar operates, via a pair of links, from its attachment to the lower control arms.

The stabilizer bar is located on the upper face of a combined body mount and stabilizer bar bracket which is welded to each chassis side member. The stabilizer bar is attached to the brackets with two, Teflon lined bushes. The bushes are fitted with brackets, which are pressed onto the bushes and secured to the chassis brackets with bolts.

The stabilizer bar has crimped, 'anti-shuffle' collars pressed into position on the inside edges of the bushes. The collars prevent sideways movement of the stabilizer bar.

The ends of the stabilizer bar are attached to the lower control arms via links. This allows the stabilizer bar to move with the wheel travel providing maximum effectiveness. Each link has a ball joint at each end. The top ball joint is attached to the link at 90 degrees to the link axis and is located in a hole in the end of the stabilizer bar and secured with a self-locking nut. The bottom ball joint is also attached to the link at 90 degrees to the axis of the link and is located a hole in a bracket on the lower control and arm and secured with a self-locking nut. The links are not handed and therefore can be fitted to either side of the stabilizer bar.

UPPER CONTROL ARM



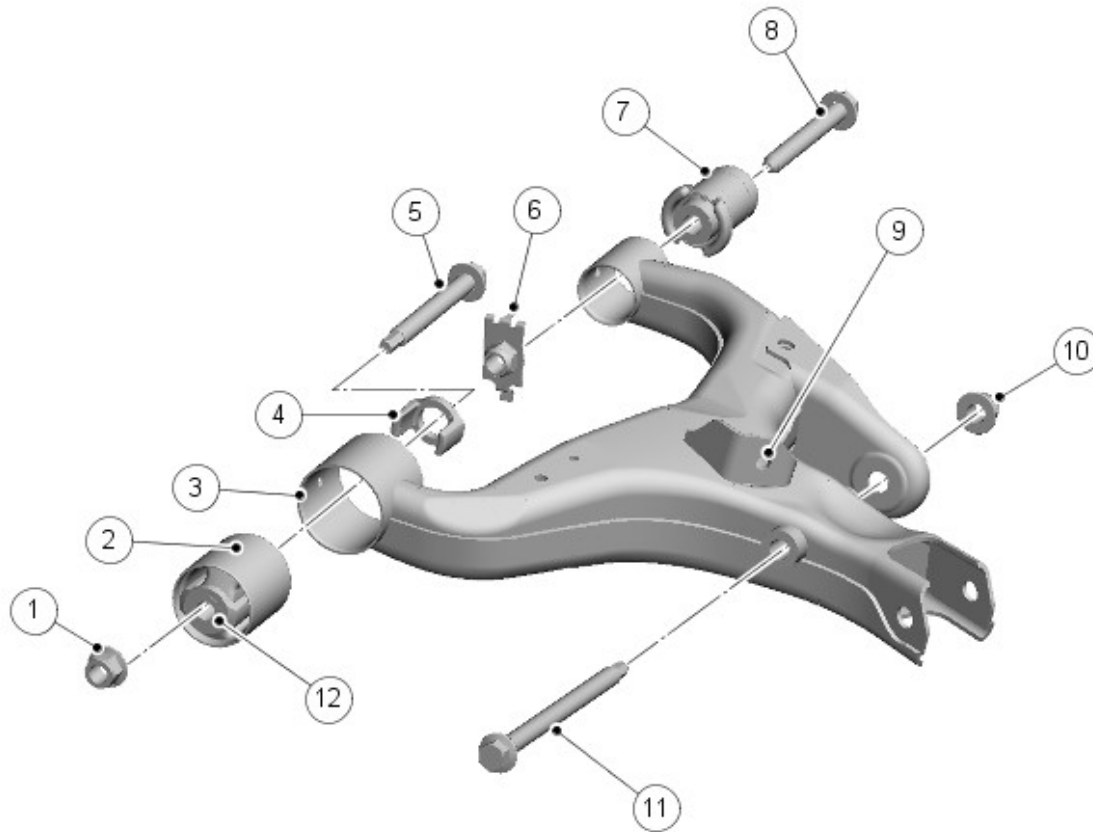
E150578

Item	Part Number	Description
1	-	Bolt
2	-	Bumpstop clip
3	-	Forward bush
4	-	Bumpstop clip
5	-	Rearward bush
6	-	Caged nut
7	-	Self-locking nut - upper wheel knuckle ball joint
8	-	Eccentric washer - upper wheel knuckle ball joint
9	-	Ball joint (Wheel knuckle upper)
10	-	Cam bolt - upper knuckle ball joint
11	-	Upper control arm

The upper control arm locates in brackets on the upper surface of each chassis side member. The upper control arm assembly comprises the control arm and two bushes. The upper control arm is a pressed and tubular steel fabrication. Its outer end has two brackets with slotted holes which locate the upper ball joint of the wheel knuckle. The ball joint is secured in the upper control arm with a cam bolt, eccentric washer and a self-locking nut. The cam bolt and the eccentric washer allow for the adjustment of the wheel camber.

Two fabricated tubular housings provide the location for the forward and rearward bushes. The bushes, which are pressed into the housings, locate between brackets on the chassis side members and are secured with bolts and caged nuts through metal inserts in the center of the bushes.

LOWER CONTROL ARM



E150579

Item	Part Number	Description
1	-	Self-locking nut
2	-	Forward bush
3	-	Lower control arm
4	-	Bumpstop clip
5	-	Bolt
6	-	Nut and retainer
7	-	Rearward bush
8	-	Bolt
9	-	Stabilizer link bracket
10	-	Self-locking nut - shock absorber assembly lower attachment
11	-	Bolt - shock absorber assembly lower attachment
12	-	Bumpstop clip

The lower control arm locates in brackets on the lower surface of each chassis side member. The lower control arm assembly comprises the control arm and two bushes. The lower control arm is a pressed steel fabrication. Its outer end has two brackets which locate the lower ball joint of the wheel knuckle. The ball joint is secured with a bolt and self-locking nut. The lower control arm also provides for the attachment of the shock absorber bush which is secured with a bolt and a self-locking nut.

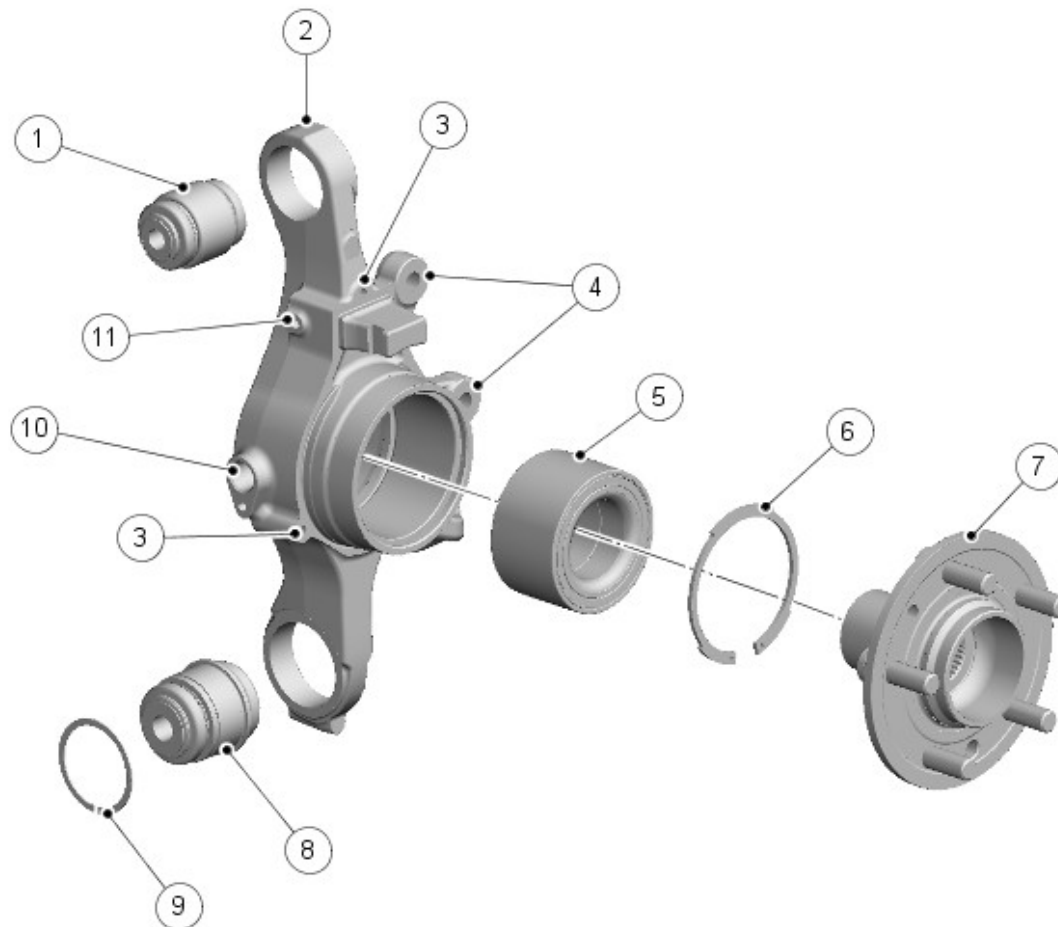
A bracket, welded to the upper surface of the lower control arm, allows for the attachment of the stabilizer bar link, bottom ball joint which is secured with a self-locking nut.

Two fabricated tubular housings provide the location for the forward and rearward bushes. The bushes, which are pressed into the housings, locate between brackets on the chassis side members. The forward bush is secured to the chassis bracket with a bolt and self-locking nut. The rearward bush is secured to the chassis bracket with a bolt and a nut and retainer. The nut and retainer allows for easy installation or removal of the bolt by removing the

requirement to hold the self-locking nut when installing or removing the bolt.

On vehicles fitted with coil springs only, a jacking bracket is located on the lower control arm.

WHEEL KNUCKLE, WHEEL HUB AND BEARING ASSEMBLY



E150580

Item	Part Number	Description
1	-	Ball joint - upper
2	-	Wheel knuckle
3	-	Park brake assembly attachment holes
4	-	Brake caliper attachment holes
5	-	Wheel bearing
6	-	Circlip - wheel bearing retention
7	-	Wheel hub
8	-	Ball joint - lower
9	-	Circlip - lower ball joint
10	-	Wheel speed sensor location
11	-	Wheel speed sensor cable bracket attachment

The wheel knuckle is a machined casting which is located between the upper and lower control arms. The wheel knuckle is fitted with two ball joints which are pressed into the wheel knuckle, with the lower ball joint being secured with a circlip. The ball joints are positioned between brackets on the upper and lower control arms and secured to the arms with a bolt and self-locking nut.

The wheel knuckle provides the location for the rear wheel taper roller bearing, which is pressed into a machined bore and retained with a circlip. The wheel bearing is a serviceable item. The wheel knuckle has a machined bore which provides the location for the wheel speed sensor. Three threaded holes allow for the attachment of the park

brake assembly. A cast boss on the wheel knuckle provides positive location for the park brake assembly. Two bosses on the wheel knuckle casting provide the attachment points for the rear brake caliper.

The wheel hub is a machined forging which is pressed into the wheel bearing in the wheel knuckle. The hub has a splined center bore which mates with corresponding splines on the halfshaft. Five M14 studs are pressed into the wheel hub and provide for the attachment of the road wheel with wheel nuts. Rotation of the halfshaft is passed, via the splines, to the wheel hub which rotates on the taper roller bearing.

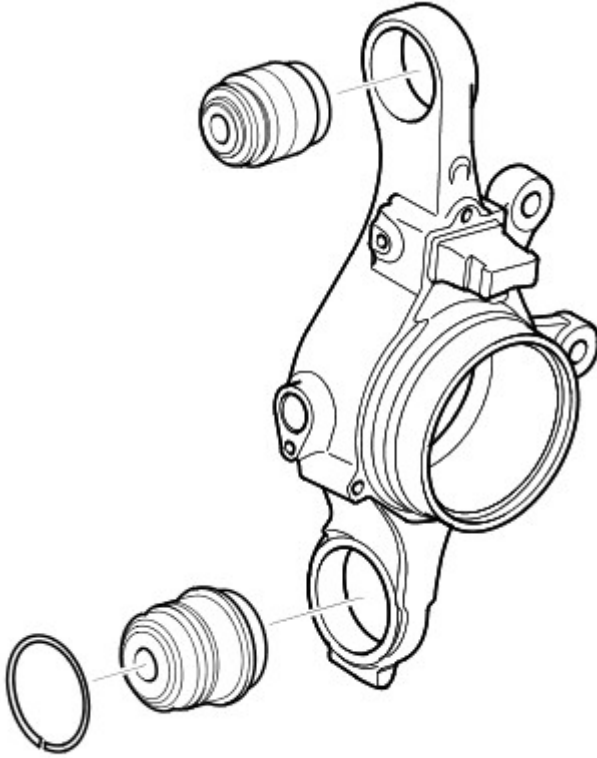
Rear Suspension - Rear Suspension

Description and Operation

In comparison with the standard vehicle, the additional weight of the armour and consequently change in vehicle geometry has dictated the following changes to the rear suspension:

- new wheel knuckle
- new stabilizer bar
- modified air springs
- modified dampers.

New wheel knuckle



E102785

Although visually similar to the standard vehicle, changes have been made internally to the air springs and dampers:

- The air springs incorporate a volume displacer which increases the spring rate in comparison to those fitted to the standard vehicle.
- The dampers feature revised internal valves to complement the revised spring rates and vehicle weight.

Software changes have also been made to the air suspension control module to restrict the 'Off-Road' height setting.




For additional information, refer to: Vehicle Dynamic Suspension (204-05, Description and Operation).

The stabilizer bar features serviceable bushes, which are not bonded to the stabilizer bar. This allows the bushes to be replaced without removing the stabilizer bar from the vehicle. Clamp plates surrounding the bushes secure the stabilizer bar to the vehicle. Anti-shuffle collars are fitted to prevent lateral movement of the stabilizer bar.


Rear Suspension - Upper Arm Ball Joint

Removal and Installation

Special Tool(s)

 <p>204-525-1 E49576</p>	Remover/installer rear upper arm ball joint 204-525/1
 <p>204-525-2 E49575</p>	Remover/installer rear upper arm ball joint 204-525/2
 <p>204-525-1 E49574</p>	Remover/installer rear upper arm ball joint 204-525/3

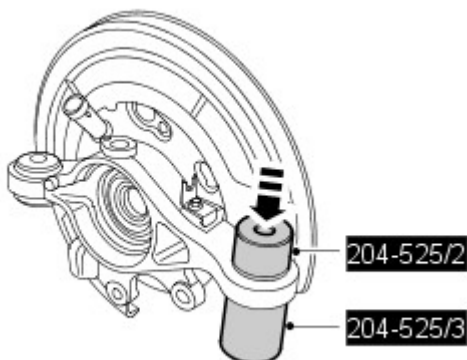
Removal

-  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

- Remove the wheel knuckle.
For additional information, refer to: Wheel Knuckle (204-02 Rear Suspension, Removal and Installation).

- Using the special tools, remove the ball joint.
 - Position machined face against the special tool.




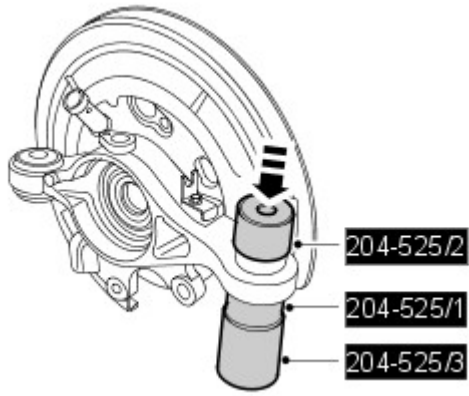
E49577

Installation


- Clean the components.

- CAUTIONS:**

 Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.



E49578

 If the push in force is less than 10 kN the wheel knuckle must be replaced.

Using the special tools, install the ball joint.



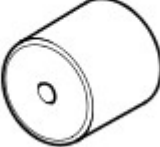

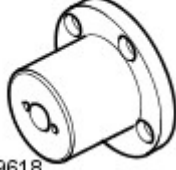
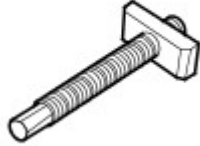

- Position machined face against the special tool.

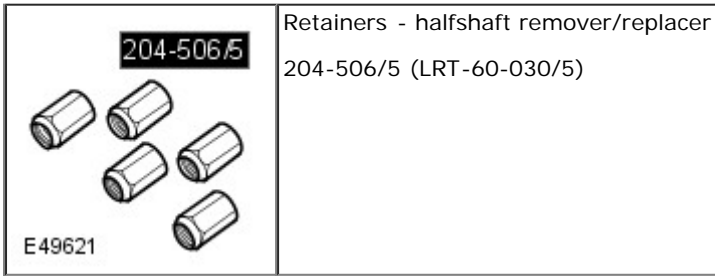
3. Install the wheel knuckle.
For additional information, refer to: Wheel Knuckle (204-02 Rear Suspension, Removal and Installation).
4. Install the wheel and tire.

Rear Suspension - Lower Arm Ball Joint

Removal and Installation

Special Tool(s)

<p>204-516/1</p>  <p>E46795</p>	<p>Ball joint remover/installer 204-516/1 (LRT-64-026/1)</p>
<p>204-516/2</p>  <p>E50960</p>	<p>Ball joint remover/installer 204-516/2 (LRT-64-026/2)</p>
<p>204-516/3</p>  <p>E50961</p>	<p>Ball joint remover/installer 204-516/3 (LRT-64-026/3)</p>
<p>204-516/4</p>  <p>E50962</p>	<p>Ball joint remover/installer 204-516/4 (LRT-64-026/4)</p>
<p>204-506/1</p>  <p>E49618</p>	<p>Halfshaft remover/replacer 204-506/1 (LRT-60-030/1)</p>
<p>204-506/3</p>  <p>E49620</p>	<p>Halfshaft remover/replacer 204-506/3 (LRT-60-030/3)</p>
<p>204-506-01</p>  <p>E49622</p>	<p>Halfshaft installer adapter 204-506-01</p>



Removal



CAUTION: The bolt securing the toe link to the wheel knuckle must not be used more than 5 times. Mark the bolt head with a suitable centre punch.

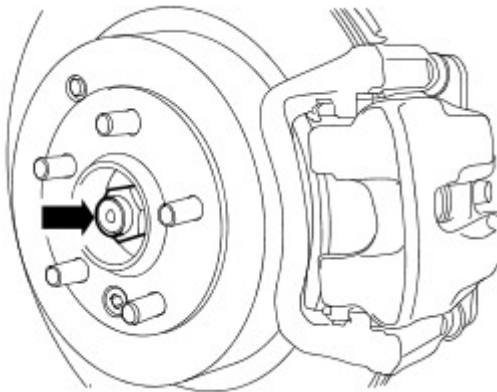


- WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

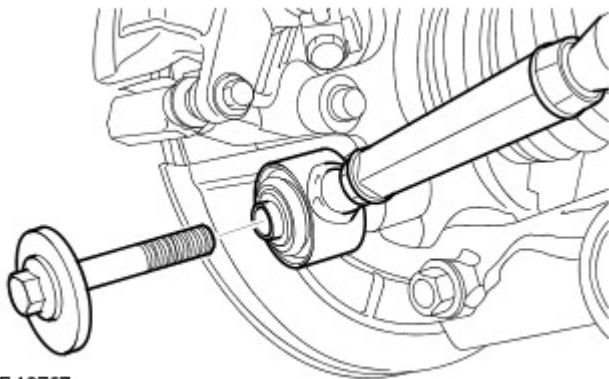
- Remove the wheel and tire.

- Loosen the halfshaft retaining nut.



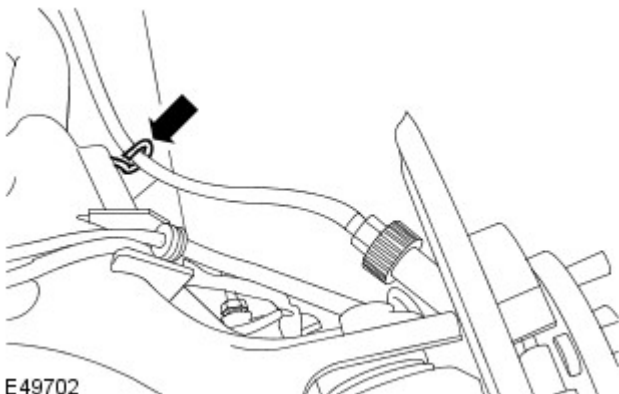
E46796

- Disconnect the toe link.
 - Remove the bolt.



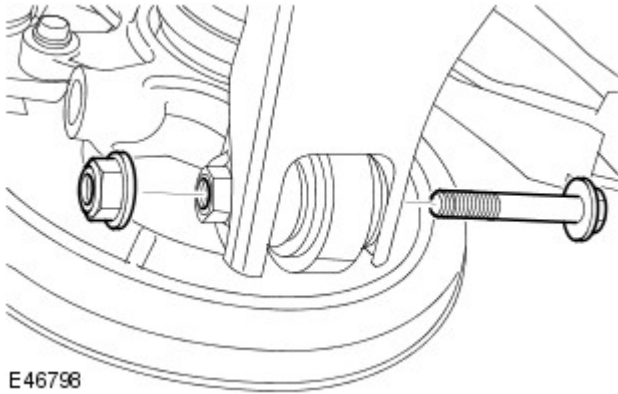
E46797

- Release the parking brake cable from the lower arm.



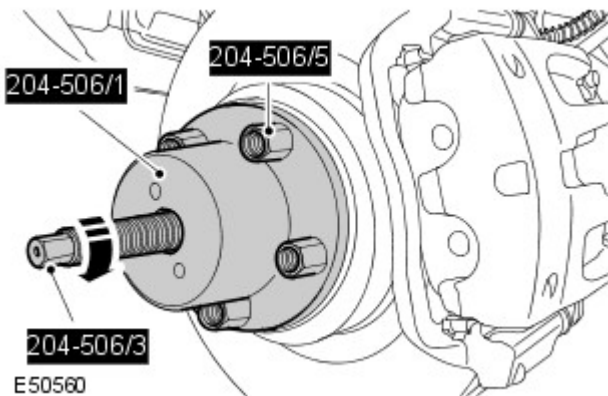
E49702

6. Remove the halfshaft retaining nut.



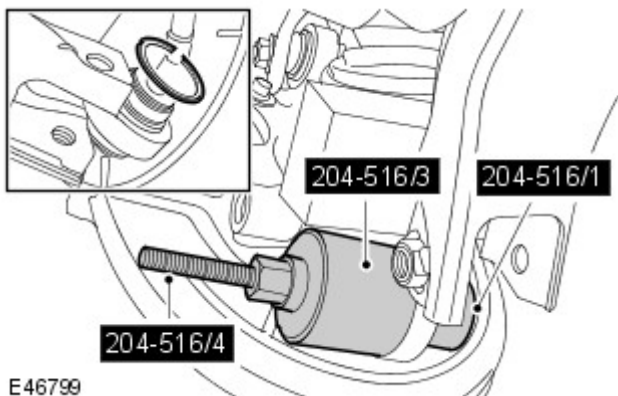
E46798

7. Release the knuckle from the lower arm.
• Remove the bolt.



E50560

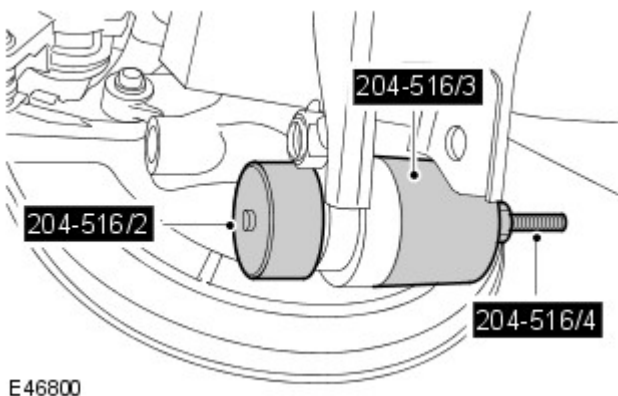
8. Using the special tools, release the halfshaft from the wheel hub.



E46799


9. Using the special tool, remove the lower arm ball joint.
• Support the wheel knuckle to give access to the lower ball joint.
• Remove and discard the snap ring.


Installation



E46800

1. CAUTIONS:

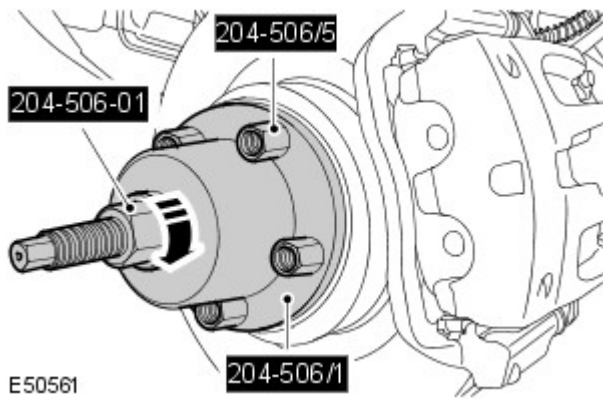
 If the push in force is less than 17 kN the wheel knuckle must be replaced.

 Make sure the ball joint is installed from the chamfered side of the wheel knuckle.


Using the special tool, install the lower arm ball joint.

- Install the snap ring.

2. Using the special tools, install the halfshaft in the wheel hub.




E50561

3.  **CAUTION:** Ensure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

Connect the lower arm to the wheel knuckle.

- Tighten the bolt to 175 Nm (129 lb.ft).

4. Install a new halfshaft retaining nut and lightly tighten.
5. Secure the parking brake cable.

6.  **CAUTION:** Do not use a bolt that has been installed more than 5 times. Check the bolt head for centre punch marks. A bolt head with 4 centre punch marks indicates the bolt has been installed 5 times and must be replaced.

Connect the toe link.







- Tighten the bolt to 175 Nm (129 lb.ft).
- Mark the bolt head with a centre punch, to indicate the number of times it has been used.

7. Tighten the halfshaft retaining nut to 350 Nm (258 lb.ft).
 - Stake the nut to the halfshaft.
8. Install the wheel and tire.
9. Carry out the wheel alignment procedure.


Rear Suspension - Wheel Bearing and Wheel Hub

Removal and Installation

Special Tool(s)

 <p>204-509/10 E49584</p>	Rear wheel bearing remover/installer 204-509/10(LRT-60-033/10)
 <p>205-802/1 E49579</p>	Rear wheel bearing remover/installer 205-802/1
 <p>205-802/2 E49580</p>	Rear wheel bearing remover/installer 205-802/2
 <p>205-802/3 E49581</p>	Rear wheel bearing remover/installer 205-802/3
 <p>205-802/4 E49582</p>	Rear wheel bearing remover/installer 205-802/4
 <p>205-802/5 E49583</p>	Rear wheel bearing remover/installer 205-802/5

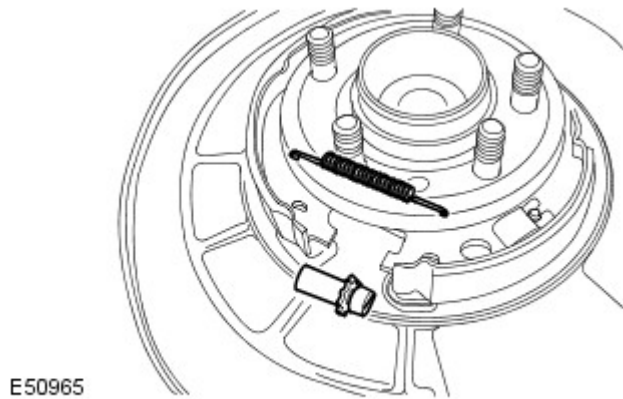
Removal

- 
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

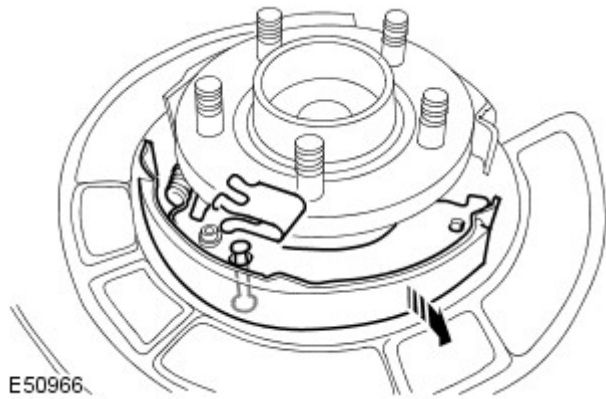
2. Remove the wheel knuckle.
For additional information, refer to: Wheel Knuckle (204-02 Rear Suspension, Removal and Installation).

3. Remove the adjuster and return spring.



E50965

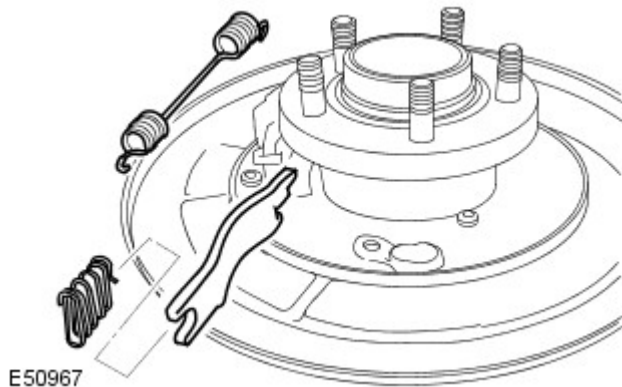
4. Remove the primary brake shoe.
 - Remove the hold-down spring and retaining pin.
 - Pivot the shoe to release it from the spreader plate and return spring.



E50966

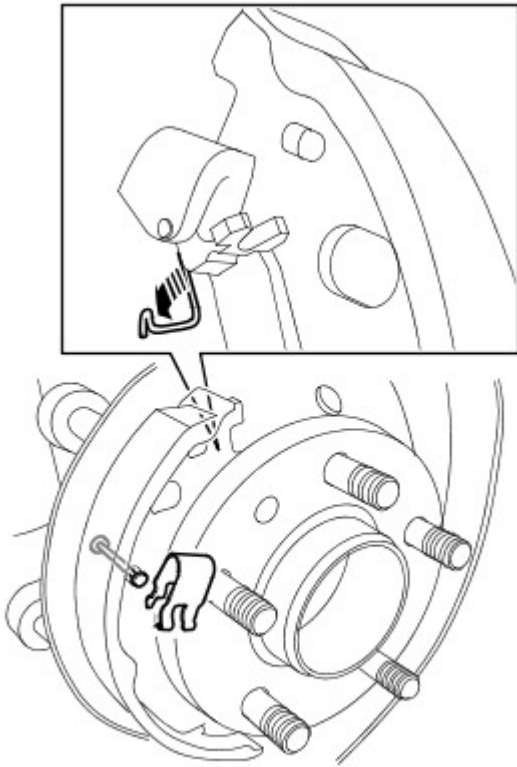
5. Remove the spreader plate and spring.

6. Remove the return spring.

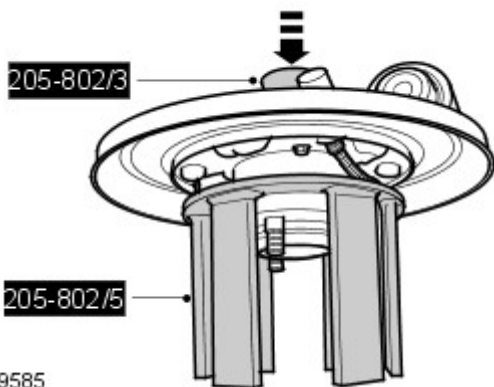


E50967

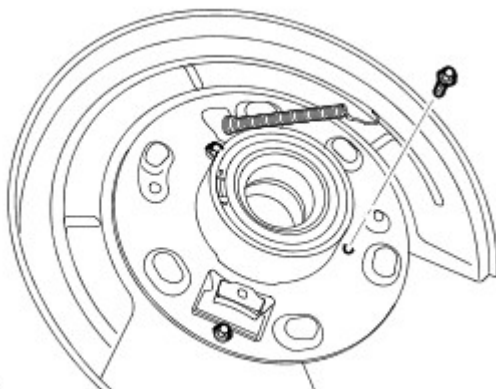
7. Remove the secondary brake shoe.
 - Remove the hold-down spring and retaining pin.
 - Disconnect the parking brake cable retaining spring from the brake shoe lever.



E50181



E49585



E49586

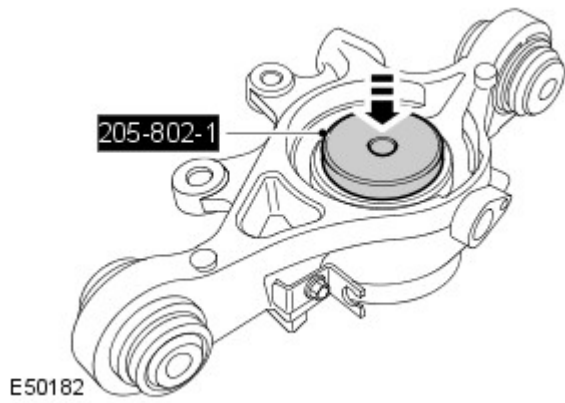
8. Using the special tools, remove the drive flange.

9. Remove the brake disc dust shield.

- Remove the 3 screws.

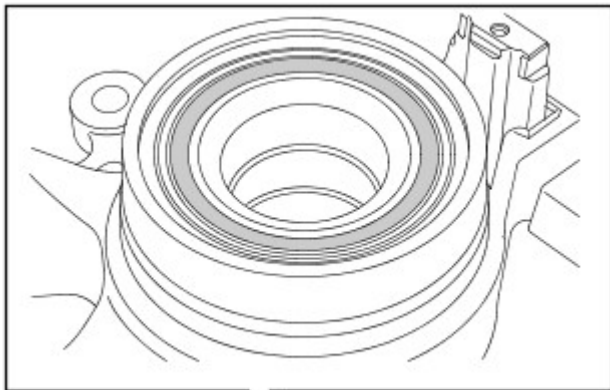
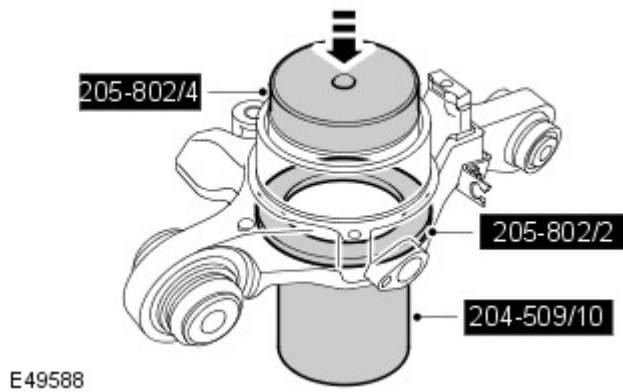
10. Using the special tools, remove the wheel bearing.


- Remove the circlip.



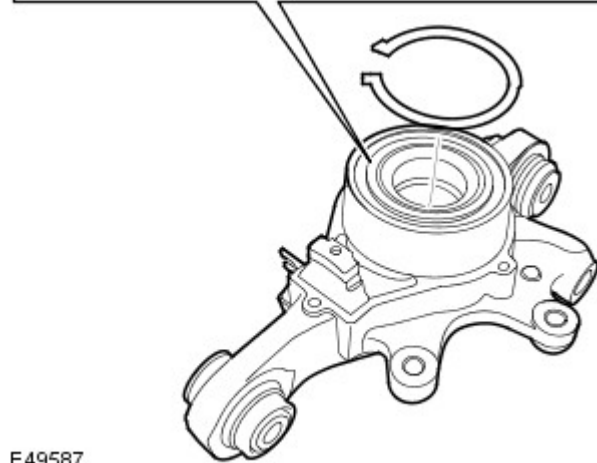
Installation

1. Clean the components.
2. Using the special tools, install the wheel bearing.



3.  **CAUTION:** Make sure that the bearing seal is not damaged when installing the circlip.

Install the circlip.



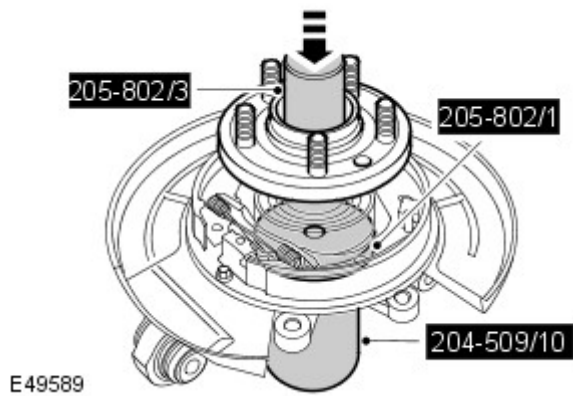
4. Install the brake disc dust shield.
 - Tighten the bolts to 9 Nm (7 lb.ft).

5.  **WARNING:** Do not use compressed air to clean brake

components. Dust from friction materials can be harmful if inhaled.

Clean the backing plate and apply grease to the brake shoe contacts.

6. Clean the adjuster and set it to its minimum extension.
7. Install the secondary brake shoe.
 - Connect the parking brake cable retaining spring to the brake shoe lever, making sure the spring is not twisted.
 - Install the hold-down spring and retaining pin.
8. Install the primary brake shoe.
 - Install the spreader plate and the spring.
 - Install the return spring.
 - Install the hold-down spring and retaining pin.
9. Install the return spring.
10. Install the brake shoe adjuster.
11. Using the special tools, install the drive flange.



12. Install the wheel knuckle.
For additional information, refer to: Wheel Knuckle (204-02 Rear Suspension, Removal and Installation).


Rear Suspension - Rear Stabilizer Bar

Removal and Installation

Removal

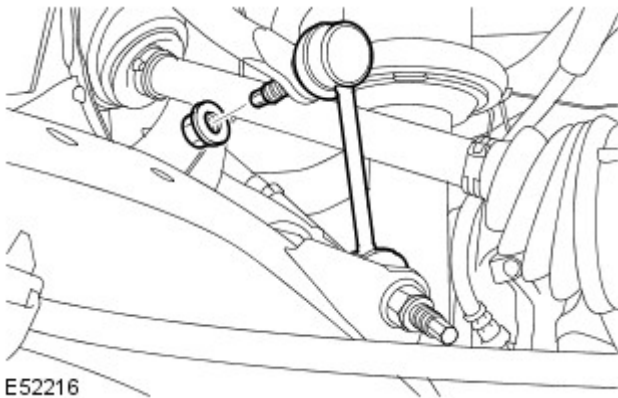


CAUTION: It is possible to install the stabilizer bar incorrectly. Note the position of the stabilizer bar before removal.


1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the wheel and tire.
3. Remove the rear bumper cover.
For additional information, refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).
4. Remove the spare wheel and tire.
5. Raise the vehicle.
6. Remove the rear wheels and tires.



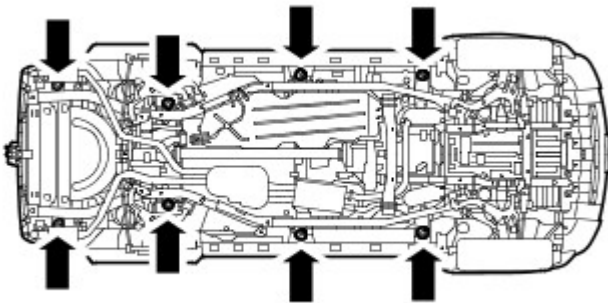
E52216

7.  **CAUTION:** Use a wrench on the hexagon provided to prevent the ball joint rotating.


Release both stabilizer bar links.

- Remove and discard the 2 nuts.

8. Remove the body mount retaining bolts.
 - Remove the 8 bolts.



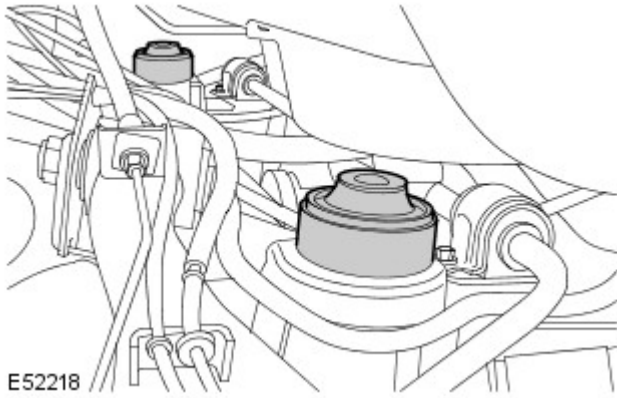
E52217

9.  **CAUTION:** Only raise the body sufficiently to remove the body mount.

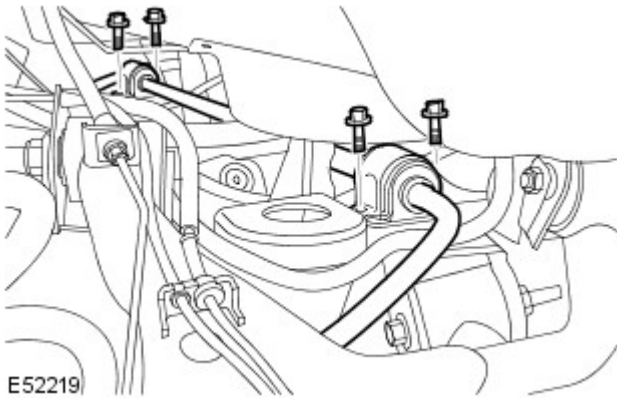
Carefully raise the body.

- Using suitable stands, raise the body to release the body mounts.

10. Remove the 2 rear body mounts.

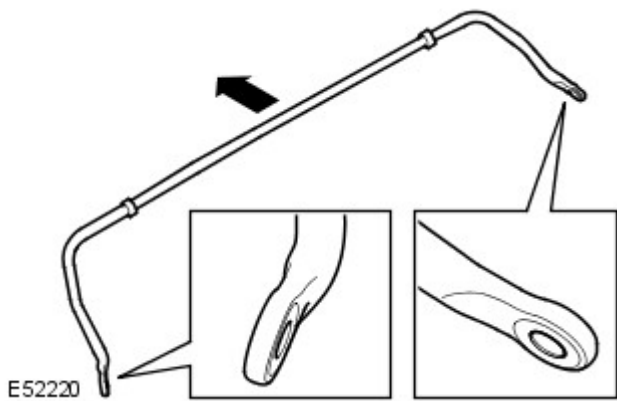


11. Remove the stabilizer bar bushing.
 - Remove the stabilizer bar clamps.
 - Remove the 4 bolts.




12.  CAUTION: Mark the position of the stabilizer bar.

Remove the stabilizer bar.



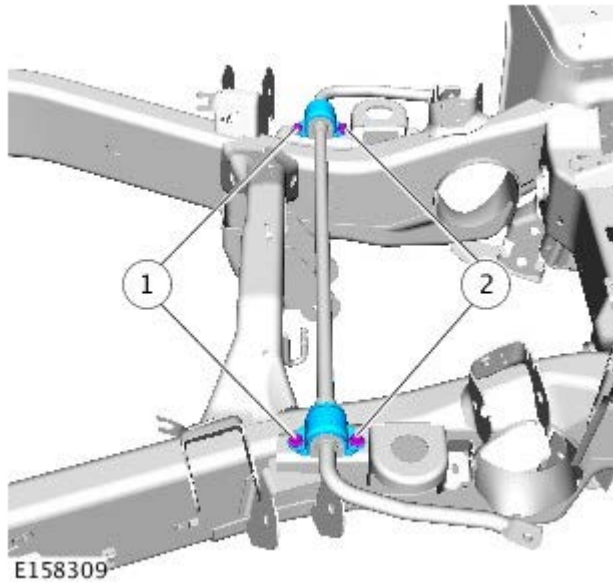
Installation

1.  CAUTION: Make sure the stabilizer bar is correctly installed.

Install the stabilizer bar.

2. Install the stabilizer bar bushing.

3. Install the stabilizer bar bushing and clamps.
 - Tighten fixings 1 to 62 Nm (46 lb.ft).
 - Tighten fixings 2 to 62 Nm (46 lb.ft).
 - Tighten fixings 1 to 62 Nm (46 lb.ft).









4. Install the body mounts.
5. Lower the body.
 - Remove the stands.
6. Install the body mount retaining bolts.
 - Tighten the 8 retaining bolts to 133 Nm (98 lb.ft).
7. Attach both stabilizer bar links.
 - Tighten the nuts to 115 Nm (85 lb.ft).
8. Install the wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
9. Lower the vehicle.
10. Install the spare wheel and tire.
11. Install the rear bumper cover.
For additional information, refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).

Rear Suspension - Upper Arm Bushing

Removal and Installation


Special Tool(s)

 <p>204-528-1</p> <p>E50585</p>	Remover/installer - rear suspension upper arm front bushing 204-528/1
 <p>204-528-2</p> <p>E50586</p>	Remover/installer - rear suspension upper arm front bushing 204-528/2
 <p>204-528-3</p> <p>E50587</p>	Remover/installer - rear suspension upper arm front bushing 204-528/3
 <p>204-527-1</p> <p>E50580</p>	Remover/installer rear suspension upper arm rear bushing 204-527/1
 <p>204-527-2</p> <p>E50581</p>	Remover/installer rear suspension upper arm rear bushing 204-527/2
 <p>204-527-3</p> <p>E50582</p>	Remover/installer rear suspension upper arm rear bushing 204-527/3

Removal



NOTE: The bushings must be replaced in pairs, LH and RH sides.

- 
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the wheels and tires.

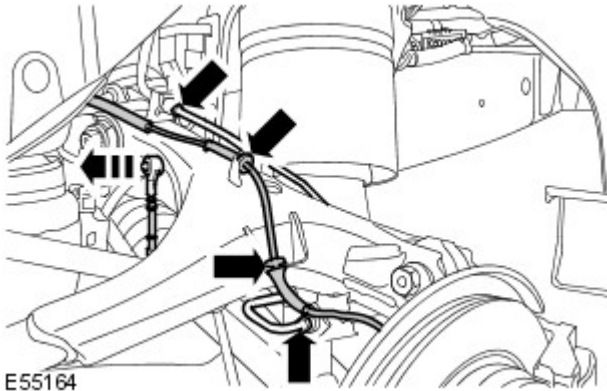
3.  **CAUTION:** Always plug any open connections to prevent contamination.

Remove the brake tube.

- Disconnect the 2 brake tube unions.
- Remove the brake hose clips and release the hoses.
- Release the brake tube from the clip.

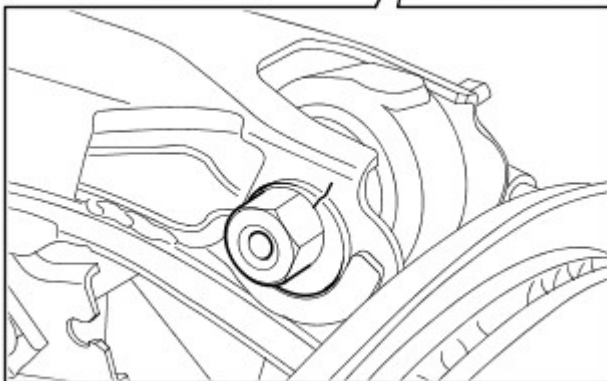
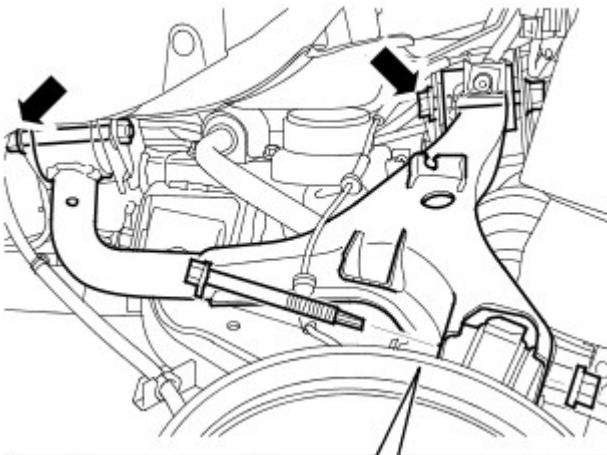
4. Disconnect the height sensor link.

5. Release the wheel speed sensor lead.



6. Remove the LH upper arm.

- Loosen the upper arm bolts.
- Mark the position of the bolt in relation to the upper arm.
- Disconnect the upper arm from the wheel knuckle.
- Remove the upper arm bolts.



7. Remove the RH upper arm.

For additional information, refer to: Upper Arm (204-02 Rear Suspension, Removal and Installation).

8. Mark the position of the bushing in relation to the upper arm.


9. Using the special tools, remove and discard the rear upper arm front bushing.

- Using the special tools, remove and discard the rear upper arm rear bushing.


Installation

- CAUTIONS:


 Make sure the bush is correctly aligned.


 Make sure the correct special tool is used to install the bushings to the correct depth.

Using the special tools, install the rear upper arm front bushing.

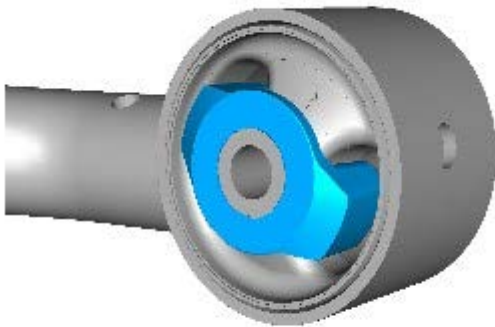
-  CAUTION: Make sure the bush is correctly aligned.

Using the special tools, install the rear upper arm rear bushing.

-  CAUTION: Make sure that bumpstop inserts are fitted on both sides of the front bushing prior to installation of the arm. Failure to follow this instruction may result in damage to the bushing.

 NOTE: Bumpstop inserts are installed to both sides of the bushing.

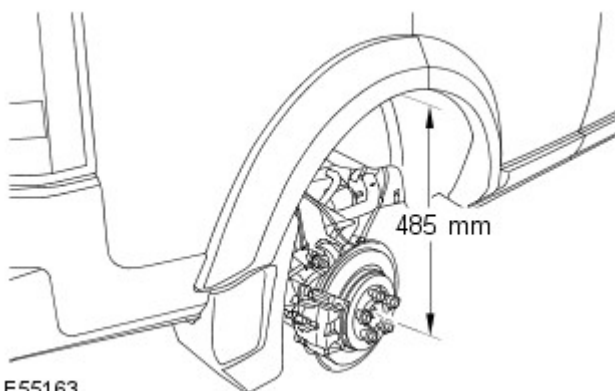
Check the bumpstop inserts are correctly installed.




E155405

- Install the LH upper arm.
 - Fit the bolts but do not fully tighten at this stage.

- Set the height between the center of the halfshaft end and the edge of the fender trim to 485 mm (19.10").
 - Support with an axle stand.



E55163

-  CAUTION: Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

Connect the upper arm and wheel knuckle.


- Align the bolt to the marks made previously.
- Tighten the bolt to 133 Nm (98 lb.ft).

7. Tighten the upper arm front bolt to 175 Nm (129 lb.ft).
8. Tighten the upper arm rear bolt to 275 Nm (203 lb.ft).
9. Secure the wheel speed sensor lead.
10. Secure the brake pad wear indicator sensor lead.
11. Connect the height sensor link.
12. Install the brake tube.
 - Tighten the brake tube unions to 18 Nm (13 lb.ft).
13. Install the RH upper arm.
For additional information, refer to: Upper Arm (204-02 Rear Suspension, Removal and Installation).
14. Install the wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Rear Suspension - Rear Stabilizer Bar Link

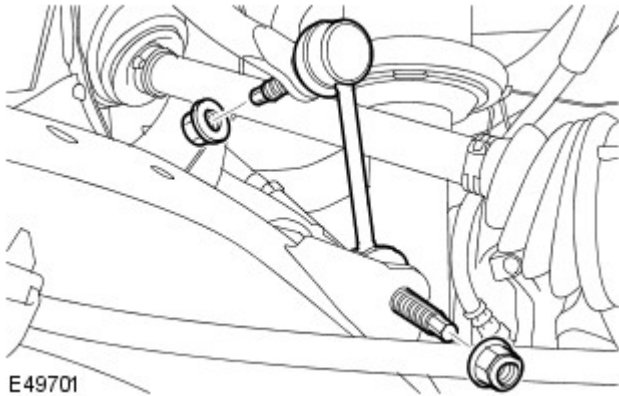
Removal and Installation


Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the wheel and tire.



3.  **CAUTION:** Use a wrench on the hexagon provided to prevent the ball joint rotating.

Remove the stabilizer bar link.

- Remove and discard the 2 nuts.


Installation

1. Install the stabilizer bar link.
 - Tighten the nuts to 115 Nm (85 lb.ft).
2. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Rear Suspension - Lower Arm


Removal and Installation

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

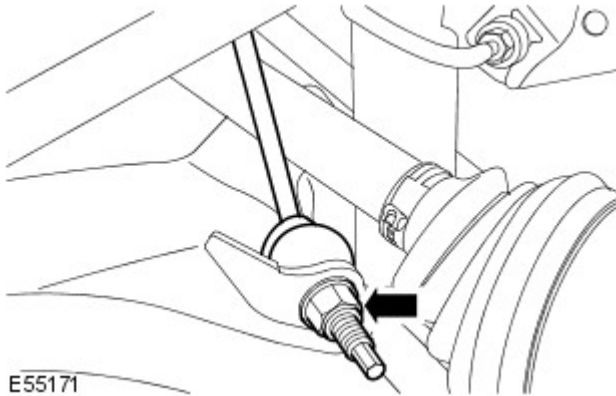
Raise and support the vehicle.

2. Remove the wheel and tire.

3.  **CAUTION:** Use a wrench on the hexagon provided to prevent the ball joint rotating.


Release the stabilizer bar link.

- Remove and discard the retaining nut.



E55171

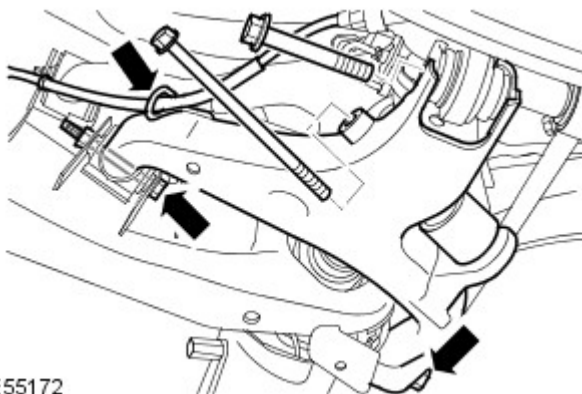
4. Loosen the 2 lower arm bolts.
5. Disconnect the shock absorber and spring assembly from the lower arm.
 - Remove the nut and bolt.
6. Release the parking brake cable.
7. Remove the 2 lower arm bolts.

8.  **CAUTION:** Ensure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

Release the knuckle from the lower arm.


- Remove the bolt.

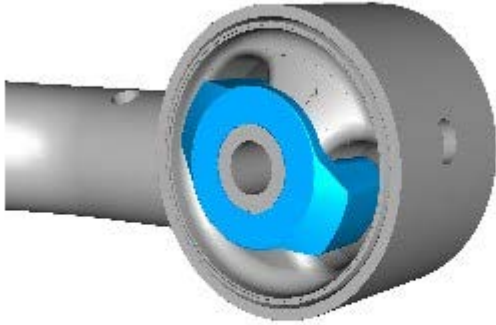
9. Remove the lower arm.



E55172

Installation

1.  **CAUTION:** Make sure that bumpstop inserts are fitted on both sides of the front bushing prior to installation of the arm. Failure to follow this instruction may result in damage to the bushing.




NOTE: Bumpstop inserts are installed to both sides of the bushing.

Check the bumpstop inserts are correctly installed.

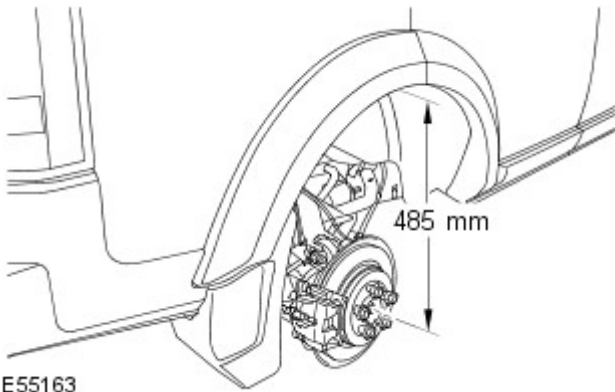
E155405

2. Install the lower arm.
 - Fit the bolts but do not fully tighten at this stage.

3.  **CAUTION:** Ensure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

Connect the lower arm to the wheel knuckle.

- Tighten the bolt to 175 Nm (129 lb.ft).
4. Connect the shock absorber and spring assembly to the lower arm.
 - Tighten the nut and bolt to 300 Nm (221 lb.ft).
 5. Set the height between the center of the halfshaft end and the edge of the fender trim to 485 mm (19.10").




E55163

6. Tighten the lower arm bolts to 275 Nm (203 lb.ft).
7. Secure the parking brake cable.
8. Connect the stabilizer link.
 - Install a new nut and tighten to 115 Nm (85 lb.ft).
9. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
10. Carry out the wheel alignment procedure.

Rear Suspension - Upper Arm

Removal and Installation

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the wheel and tire.

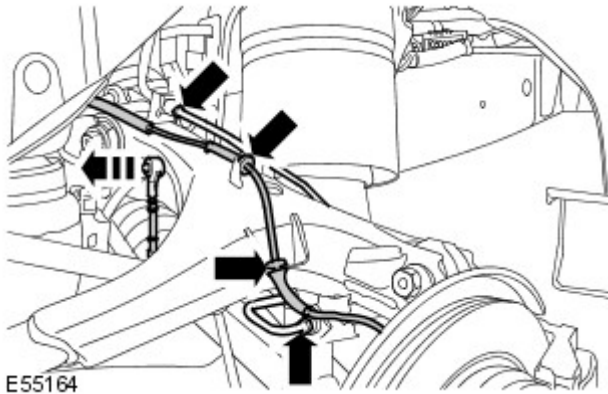
3.  **CAUTION:** Always plug any open connections to prevent contamination.

Remove the brake tube.

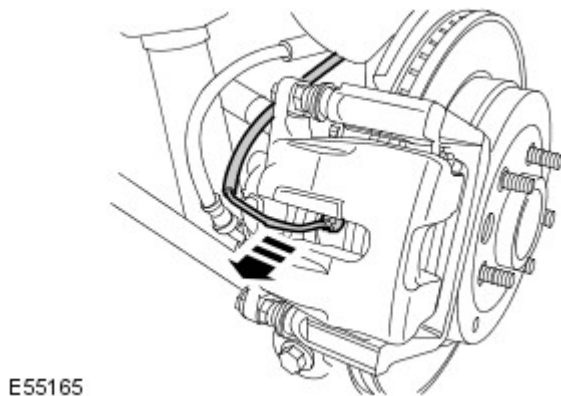
- Disconnect the 2 brake tube unions.
- Remove the brake hose clips and release the hoses.
- Release the brake tube from the clip.

4. Disconnect the height sensor link.

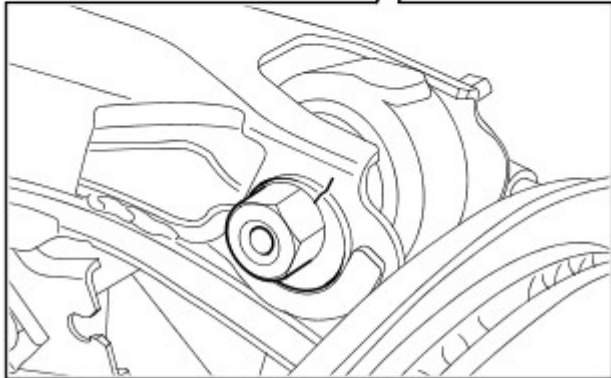
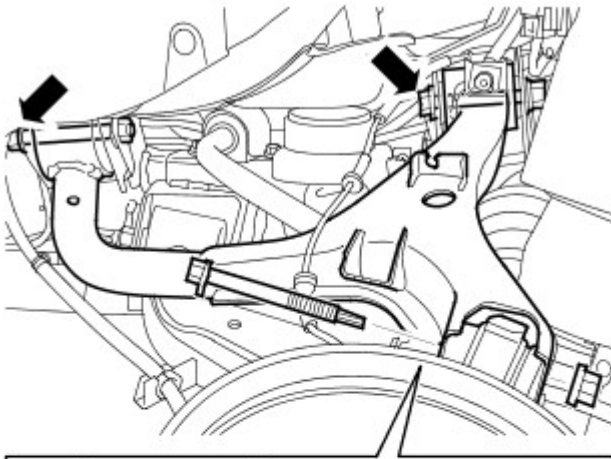
5. Release the wheel speed sensor lead.



6. RH side only: Release the brake pad wear indicator sensor lead.




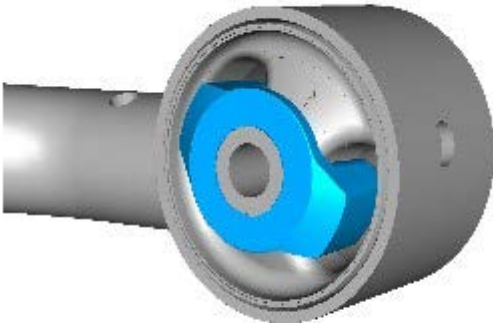
7. Remove the upper arm.
 - Loosen the upper arm bolts.
 - Mark the position of the bolt in relation to the upper arm.
 - Remove the nut and bolt, then release the upper arm from the wheel knuckle.
 - Remove the upper arm bolts.




E55166

Installation

1.  **CAUTION: Make sure that bumpstop inserts are fitted on both sides of the front bushing prior to installation of the arm. Failure to follow this instruction may result in damage to the bushing.**

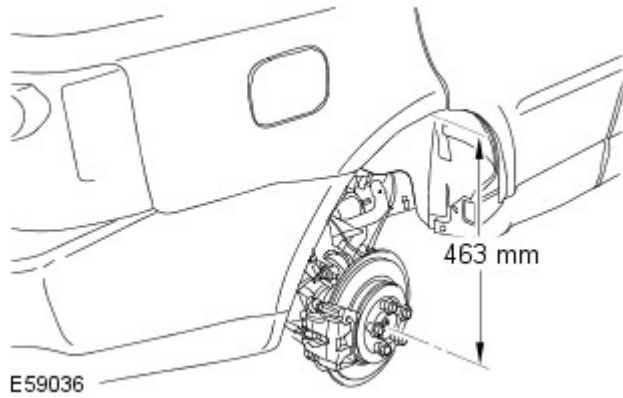



E155405

-  **NOTE:** Bumpstop inserts are installed to both sides of the bushing.

Check the bumpstop inserts are correctly installed.

2. Install the upper arm.
 - Fit the bolts but do not fully tighten at this stage.
3. Set the height, between the center of the halfshaft end and the edge of the fender trim, to 463 mm (18.23 inches).
 - Support with an axle stand.



4.  **CAUTION:** Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

Connect the upper arm and wheel knuckle.


- Align the bolt to the marks made previously.
- Tighten the bolt to 133 Nm (98 lb.ft).

5. Tighten the upper arm front bolt to 175 Nm (129 lb.ft).
6. Tighten the upper arm rear bolt to 275 Nm (203 lb.ft).
7. Secure the wheel speed sensor lead.
8. Secure the brake pad wear indicator sensor lead.
9. Connect the height sensor link.
10. Install the brake tube.
 - Tighten the brake tube unions to 18 Nm (13 lb.ft).
11. Bleed the brake system.
For additional information, refer to: Component Bleeding (206-00 Brake System - General Information, General Procedures).
12. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
13. Carry out the wheel alignment procedure.

Rear Suspension - Toe Link

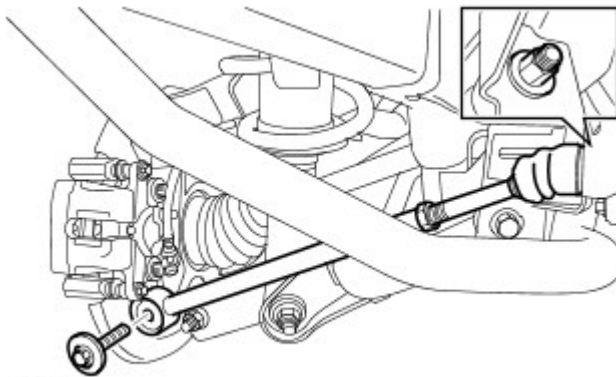
Removal and Installation

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the vehicle.

2. Remove the wheel and tire.
3. Disconnect the toe link.
 - Remove and discard the bolt.
4. Remove the toe link.
 - Remove and discard the nut.



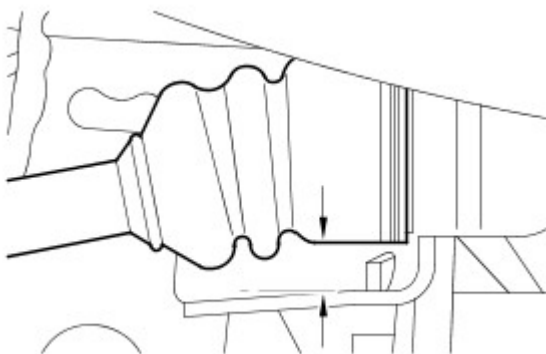
E47523

Installation

1.  **CAUTION:** Make sure the toe link anti-rotation tang is fully seated in the integrated body frame before tightening the toe link retaining nut. Failure to follow this instruction will result in damage to the toe link or integrated body frame.

Install the toe link.

- Install a new nut and lightly tighten.
2. Connect the toe link.
 - Using a M14 X 2 tap, clean the threads of the knuckle fixing hole. Blow out debris with an air-line.
 - Tighten the new bolt to 175 Nm (129 lb.ft).
 3. Set the gap, between the underside of the toe link rubber boot and the integrated body frame bracket, to 10 mm (0.473 in).
 - Tighten the toe link inner ball joint retaining nut to 133 Nm (98 lb.ft)




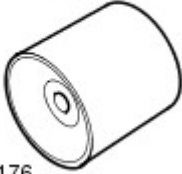




E47524

4. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
5. Carry out the wheel alignment procedure.

Rear Suspension - Lower Arm Bushing

Removal and Installation


Special Tool(s)

 <p>204-526/1 E55175</p>	<p>Receiver rear lower arm front bush 204-526/1</p>
 <p>204-526/2 E55176</p>	<p>Remover rear lower arm front bush 204-526/2</p>
 <p>204-526/3 E55177</p>	<p>Installer rear lower arm front bush 204-526/3</p>
 <p>204-532/1 E55178</p>	<p>Receiver rear lower arm rear bush 204-540/1</p>
 <p>204-540/2 E55179</p>	<p>Remover rear lower arm rear bush 204-540/2</p>
 <p>204-540/3 E55180</p>	<p>Installer rear lower arm rear bush 204-540/3</p>

Removal



NOTE: The bushings must be replaced in pairs, LH and RH sides.

- 
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the wheels and tires.
3. Remove the LH lower arm.
For additional information, refer to: Lower Arm (204-02 Rear Suspension, Removal and Installation).
4. Remove the RH lower arm.
5. Note the position of the bushing in relation to the lower arm.

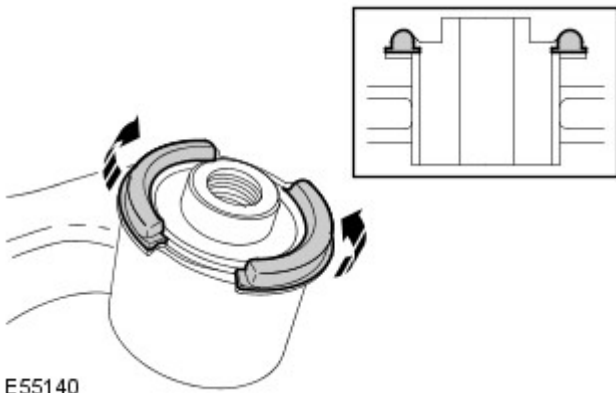
6.  **CAUTION:** The bush flanges need to be removed to allow bush removal.



NOTE: Take note of the fitted position of the bush.

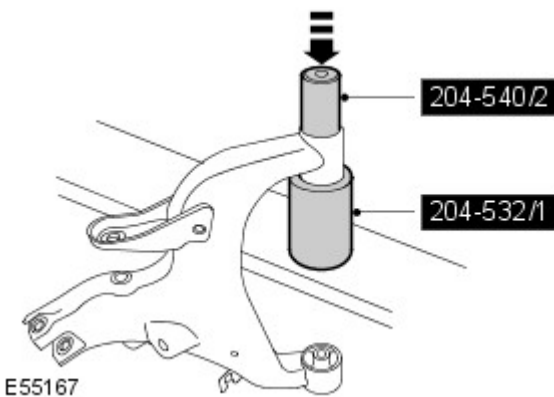
Using a suitable tool, bend over the bush flanges.

7. Using a hacksaw, remove the flange from the bushing, making sure the upper arm is not damaged.



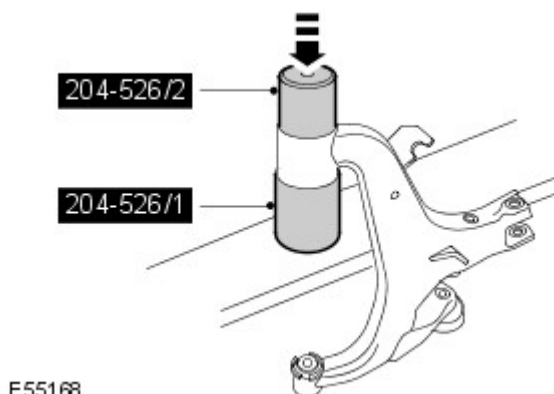
E55140

8. Using the special tools, remove and discard the lower arm rear bushings.



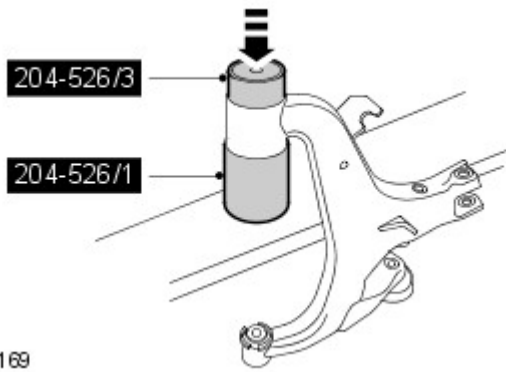
E55167

9. Using the special tools, remove and discard the lower arm front bushings.



E55168


Installation



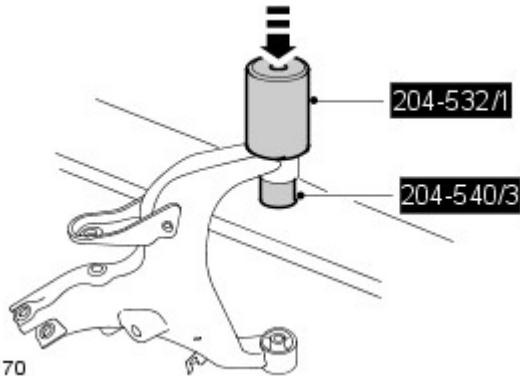
E55169

1. CAUTIONS:


 Make sure the bush is correctly aligned.

 Make sure the correct special tool is used to install the bushings to the correct depth.

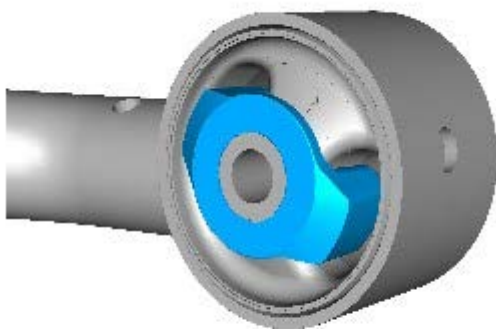
Using the special tools, install the lower arm front bushings




E55170


2.  CAUTION: Make sure the bush is correctly aligned.

Using the special tools, install the lower arm rear bushings.



E155405

3.  CAUTION: Make sure that bumpstop inserts are fitted on both sides of the front bushing prior to installation of the arm. Failure to follow this instruction may result in damage to the bushing.

 NOTE: Bumpstop inserts are installed to both sides of the bushing.

Check the bumpstop inserts are correctly installed.


4. Install the LH lower arm.
For additional information, refer to: Lower Arm (204-02 Rear Suspension, Removal and Installation).
5. Install the RH lower arm.
6. Install the wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
7. Carry out the wheel alignment procedure.

Rear Suspension - Shock Absorber and Spring Assembly TDV6 2.7L Diesel

Removal and Installation

Removal

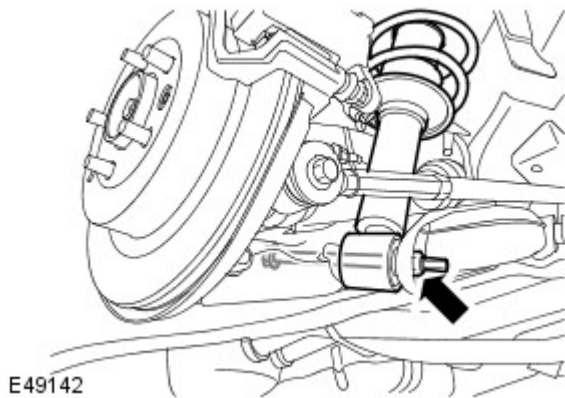
1. For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

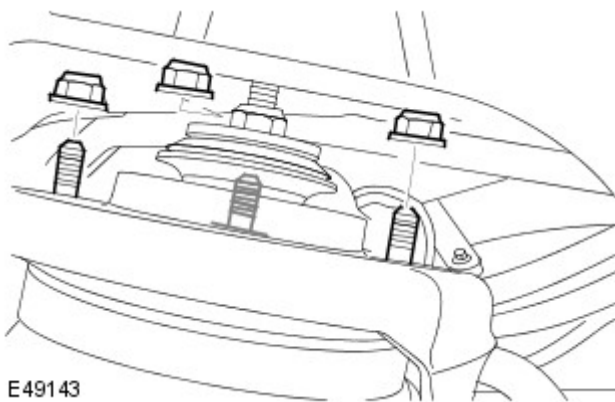
3. Remove the wheel and tire.

4. Disconnect the shock absorber and spring assembly from the lower arm.
 - Using a jack and a block of wood, support the base of the shock absorber.
 - Remove the nut and bolt.



E49142

5. Remove the shock absorber and spring assembly retaining nuts.



E49143

6. Remove the shock absorber and spring assembly.



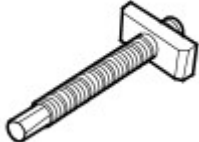
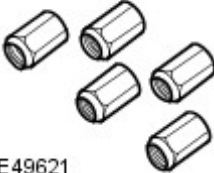

Installation

1. Install the shock absorber and spring assembly.
 - Make sure the spring and shock absorber assembly top mounting to body mating faces are clean.
 - Tighten the nuts to 63 Nm (46 lb.ft).
2. Connect the shock absorber and spring assembly to the lower arm.
 - Tighten the nut and bolt to 300 Nm (221 lb.ft).
3. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
4. For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).

Rear Suspension - Wheel Knuckle

Removal and Installation


Special Tool(s)

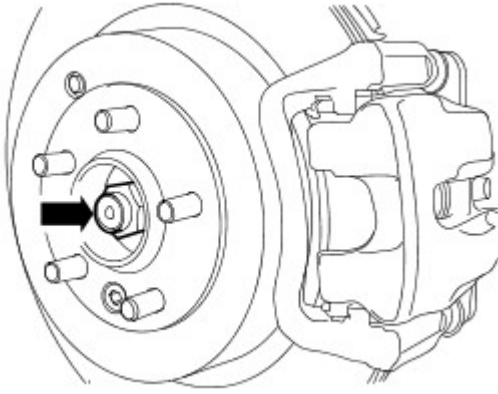
 <p>204-506/1 E49618</p>	<p>Halfshaft remover/replacer 204-506/1(LRT-60-030/1)</p>
 <p>204-506/2 E49619</p>	<p>Halfshaft remover/replacer 204-506/2(LRT-60-030/2)</p>
 <p>204-506/3 E49620</p>	<p>Halfshaft remover/replacer 204-506/3(LRT-60-030/3)</p>
 <p>204-506/5 E49621</p>	<p>Retainers - halfshaft remover/replacer 204-506/5(LRT-60-030/5)</p>
 <p>204-506-01 E49622</p>	<p>Halfshaft installer adapter 204-506-01(LRT-60-030/4)</p>

Removal



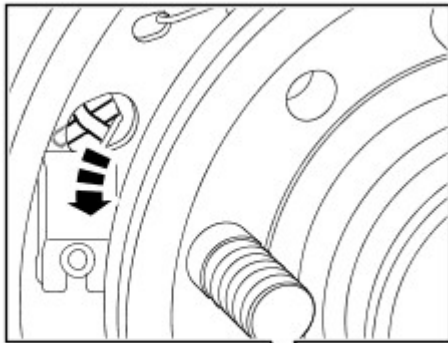
NOTE: If a new knuckle is installed a new wheel bearing must be installed.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
2. Remove the wheels and tires.
3. Loosen the halfshaft retaining nut.

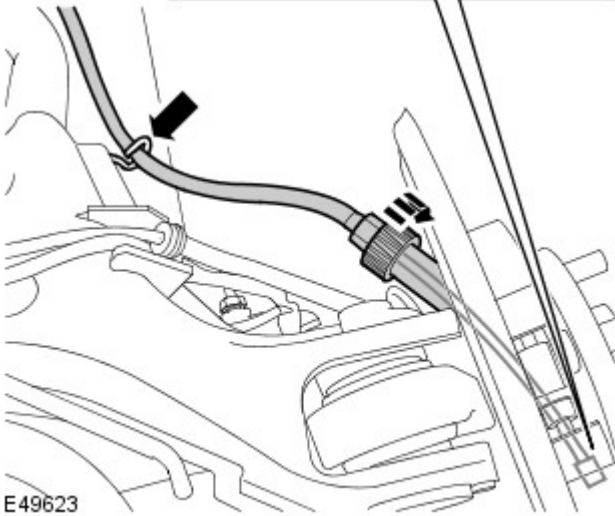


E46796

4. Remove the brake disc.
For additional information, refer to: Brake Disc (206-04 Rear Disc Brake, Removal and Installation).

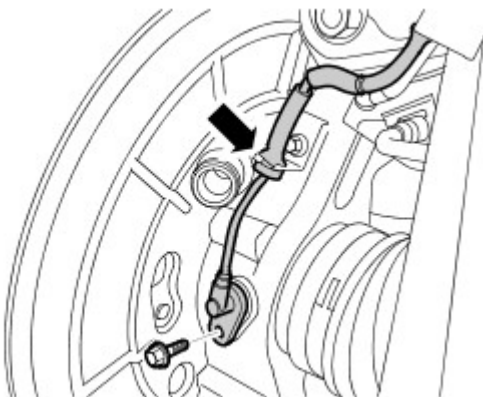


5. Release the parking brake cable.
 - Disconnect the parking brake cable from the brake shoe lever.
 - Disconnect the parking brake cable from the backplate.
 - Release the cable from the lower arm.



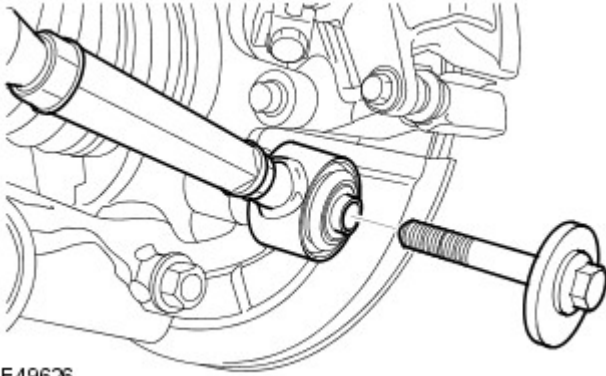
E49623

6. Release the wheel speed sensor from the wheel knuckle.



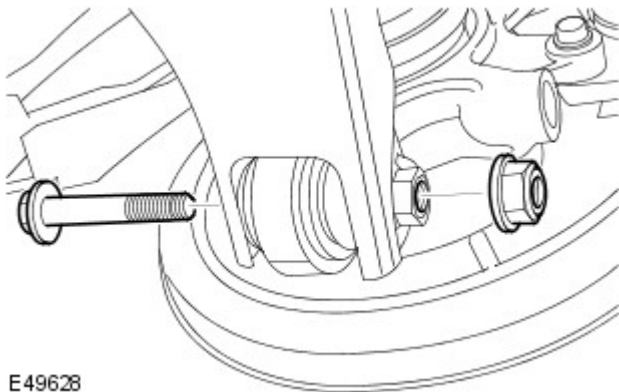
E49624

7. Disconnect the toe link.
 - Remove and discard the bolt.




E49626

8. Remove the halfshaft retaining nut.

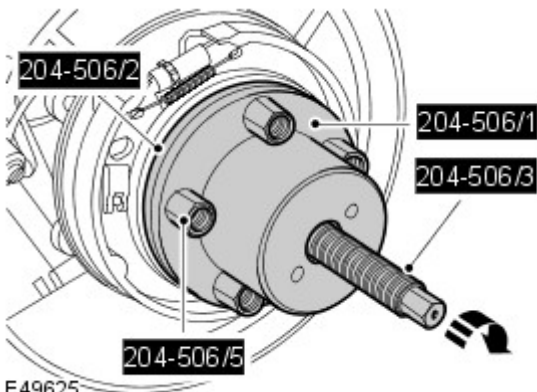


E49628


9.  **CAUTION:** Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

Release the knuckle from the lower arm.

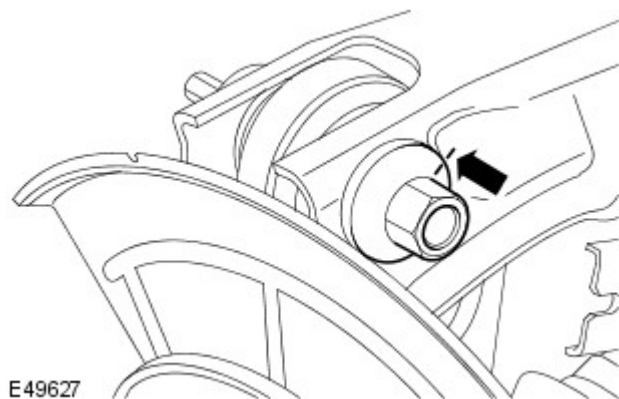
- Remove the bolt.




E49625

10.  **CAUTION:** Do not use a hammer to detach the halfshaft from the hub assembly, failure to follow this instruction may result in damage to the halfshaft.

Using the special tools, release the halfshaft from the wheel hub.




E49627

11.  **CAUTION:** Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.


Disconnect the upper arm from the wheel knuckle.

- Mark the position of the bolt in relation to the upper arm.
- Remove the nut and bolt.
- Discard the nut.

12.  **CAUTION:** Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

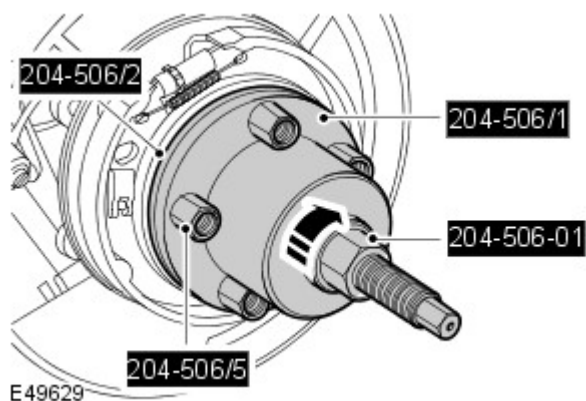
Remove the wheel knuckle.



Installation

1. Clean the components.
2.  **CAUTION:** Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

Install the wheel knuckle.


- Locate the halfshaft.
3. Connect the upper arm and wheel knuckle.
 - Align the bolt to the marks made previously.
 - Install a new nut and tighten to 133 Nm (98 lb.ft).
 4. Using the special tools, install the halfshaft in the wheel hub.



5.  **CAUTION:** Install the halfshaft nut finger tight.
Install a new halfshaft retaining nut and lightly tighten.
6.  **CAUTION:** Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

Connect the lower arm to the wheel knuckle.

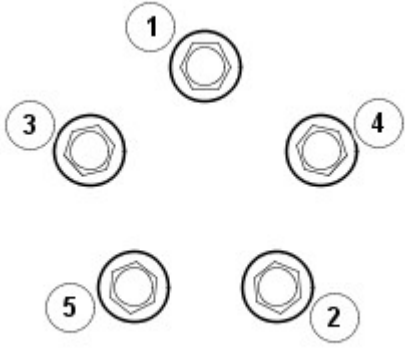
- Tighten the nut and bolt to 175 Nm (129 lb.ft).
7. Connect the toe link.
 - Tighten the new bolt to 175 Nm (129 lb.ft).
 8. Install the wheel speed sensor.
 - Tighten the bolt to 9 Nm (7 lb.ft).
 9. Locate the parking brake cable to the backplate.
 - Connect the cable to the brake shoe lever.
 - Tighten the coupling to 8 Nm (6 lb.ft).
 - Secure the parking brake cable to the lower arm.
 10. Install the brake disc.
For additional information, refer to: Brake Disc (206-04 Rear Disc Brake, Removal and Installation).

11.  **CAUTION:** Do not use air tools to install the nut. Failure to follow this instruction may result in damage to the component.

Tighten the new halfshaft retaining nut to 420 Nm (311 lb.ft).

- Stake the nut to the halfshaft.

12. Install the wheel and tire.
 - Tighten the wheel nuts in the sequence shown:
 1. Stage 1: 4 Nm
 2. Stage 2: 70 Nm
 3. Stage 3: 140 Nm



E74593

13. Carry out the wheel alignment procedure.

Rear Suspension - Shock Absorber and Spring Assembly TDV6 2.7L Diesel

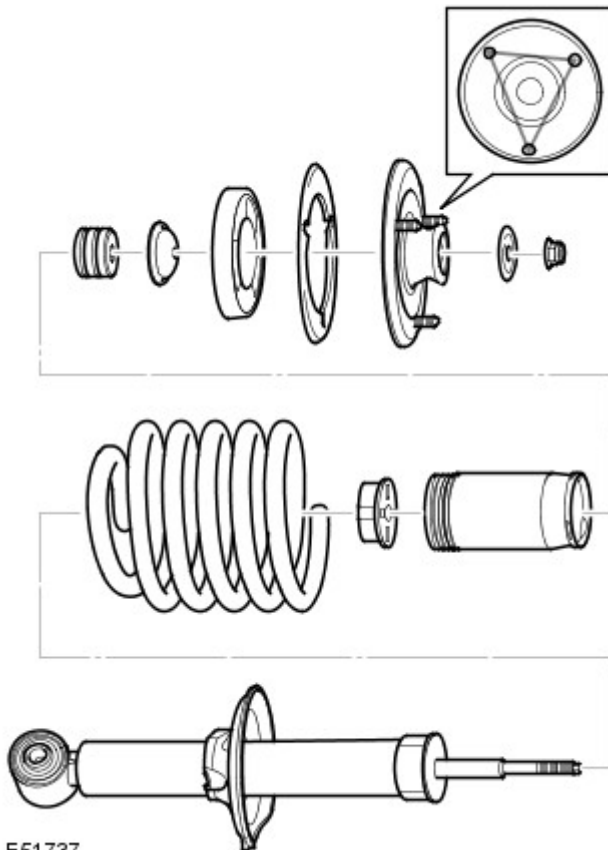
Disassembly and Assembly

Disassembly



WARNING: Ensure the spring compressor Safe Working Load (SWL) meets or exceeds the spring rating quoted in the Specifications section.

1. Raise and support the vehicle.
2. Remove the wheel and tire.
3. Remove the shock absorber and spring assembly.
For additional information, refer to: Shock Absorber and Spring Assembly (204-02, Removal and Installation).
4. Install a suitable spring compressor in a vise.
5. Install the shock absorber and spring assembly in the spring compressor.
 - Compress the spring just sufficiently to relieve the spring tension.
6. Remove the shock absorber.
 - Restrain the shock absorber spindle, remove and discard the nut.
 - Remove the upper bush rebound plate and upper bush.
 - Remove the upper mounting assembly.
 - Remove the dust tube and rebound plate assembly.
 - Remove the spring aid.

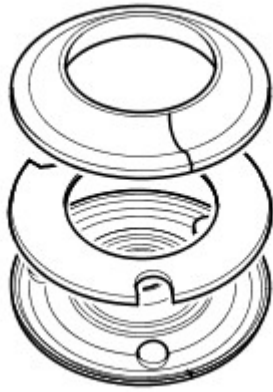


E51737

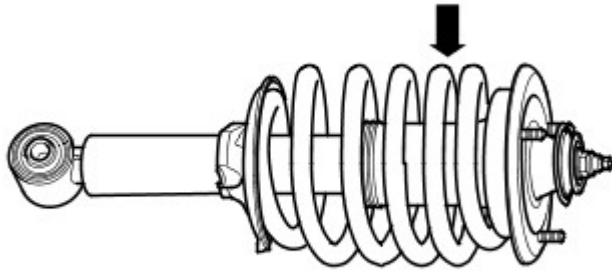
7. Remove the spring from the spring compressor.

Assembly

1. Clean and inspect the components for deterioration.
 - Remove the rubber insulator.
 - Remove the spacer.
 - Remove the rebound plate from the dust tube.



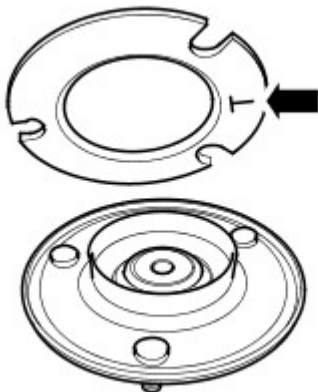
E51738



E51740

2. Install the spring in the spring compressor.
 - Make sure the spring is installed with the close coils positioned towards the top of the shock absorber.

3. Install the spring aid.
4. Install the dust tube.
 - Install the rebound plate into the dust tube.
5. Install the shock absorber.
 - Make sure the spring is correctly located in the spring seat.



E51739

6. Install the upper mounting.
 - Install the spacer and rubber insulator, making sure the spacer drops over the stud heads.
 - Install the upper bush and upper bush rebound plate.
 - Install a new nut and tighten to 98 Nm (72 lb.ft).

7. Install the shock absorber and spring assembly.
For additional information, refer to: Shock Absorber and Spring Assembly (204-02, Removal and Installation).
8. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Wheels and Tires -

Wheels

Wheel type	Wheel size
Alloy wheel	7J x 17
Alloy wheel	8J x 18
Alloy wheel	8J x 19
Alloy wheel	8.5J x 20
Reduced size spare wheel - Steel	5.5J x 19

CAUTIONS:



With reduced size spare wheel fitted, do not exceed 50 mph (80 kph) and replace with standard size wheel at earliest opportunity.



Do not use power tools when operating the spare wheel winch, raise and lower winch manually using hand tools only.

Tire Sizes - Standard Fit

Wheel size	Tire size	Tire load index
7J x 17 - Alloy	235/70 R17H - All terrain	111
8J x 18 - Alloy	255/60 R18V - All terrain	112
8J x 19 - Alloy	255/55 R19V - All terrain	111
8.5J x 20 - Alloy	255/50 R20Y - All terrain	109



CAUTION: Inner tubes must not be fitted with any of these tires.

Tire Sizes - Accessory Fit

Wheel size	Tire size	Tire load index
8J x 19 - Alloy	255/55 R19 - Mud terrain	111
8J x 19 - Alloy	255/55 R19 - Sand	111



CAUTION: Inner tubes must not be fitted with any of these tires.

Tire Pressures - Not NAS/Gulf/Brazil Vehicles

Loading condition	bars	lbf/in ²	kPa
Normal operating conditions - Up to 4 people:			
Front	2.3	33	230
Rear	2.5	36	250
Vehicle loaded to maximum gross vehicle weight:			
Front	2.5	36	250
Rear	2.9	42	290
Reduced size spare wheel	4.2	60	420
* Standard size spare wheel	2.9	42	290



CAUTION: * The standard size spare wheel tire should be inflated to the maximum gross vehicle weight pressure and the pressure for the front or rear wheel locations must be adjusted accordingly if the wheel is to be used under conditions other than with the vehicle loaded to maximum gross vehicle weight.

Tire Pressures - NAS/Gulf/Brazil Vehicles

Loading condition	bars	lbf/in ²	kPa
All conditions			
Front	2.5	36	250
Rear	2.9	42	290
Reduced size spare wheel	4.2	60	420
* Standard size spare wheel	2.9	42	290



CAUTION: The standard size spare tyre should be inflated to the highest recommended pressure when stored on the vehicle. The inflation pressure must be adjusted to suit the axle location when the spare is used to replace a punctured road tyre."

General Specification

Item	Make	Location
Tire low pressure sensor	Continental/Siemens	On inside of wheel rim
Tire pressure sensor initiator:		
Front	Continental/Siemens	Attached to the fender splash shield adjacent to the front bumper
Rear	Continental/Siemens	Attached to the fender splash shield adjacent to the rear bumper

Recommended Lubricant

Application	Land Rover Part No.
Wheel hub spigot	RYL 105020

Torque Specifications

Description	Nm	lb-ft
* Road wheel nuts	140	103
Tire low pressure sensor	8	6

* **Wheel nuts must be tightened by diagonal selection**

Wheels and Tires - Wheels and Tires

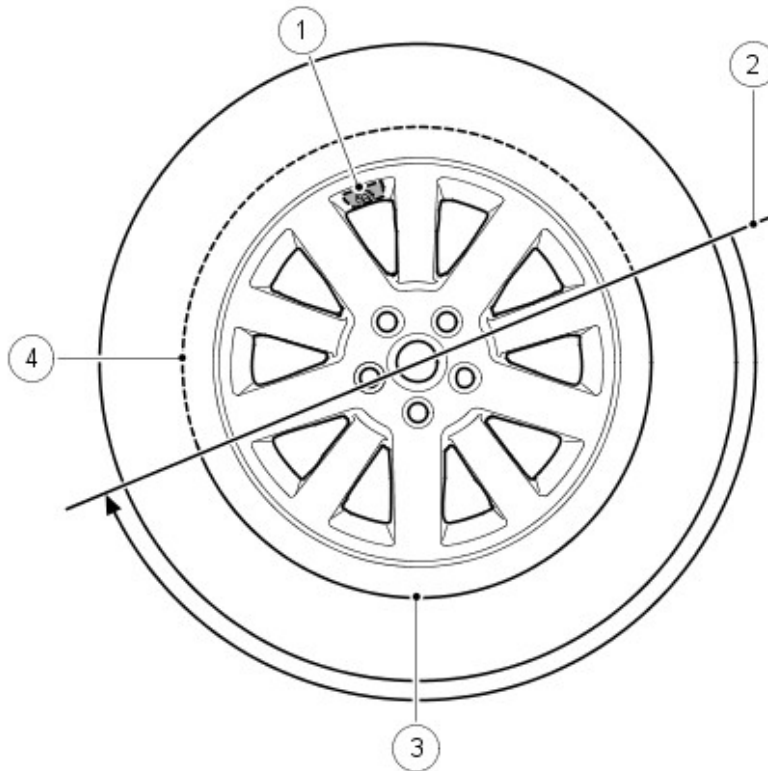
Description and Operation

TIRES



NOTE: The TPMS valve should be serviced using the suitable service kit, each time the tyre is dismantled, to ensure an air tight seal. Attention should be made to the detail of fitting this kit.

Care must be taken when removing and refitting tires to ensure that the tire pressure sensor is not damaged.



E45549

Item	Part Number	Description
1	-	Tire valve and pressure sensor
2	-	Tire fitting/removal tool initial start position
3	-	High tire and bead tension area
4	-	Low tire and bead tension area

When removing the tire, the bead breaker must not be used within 90 degrees of the tire valve in each direction.

When using the tire removal machine, the fitting arm start position must be positioned as shown in the tire changing illustration. The wheel can then be rotated through 180 degrees in a counterclockwise direction. This will relieve the high tension from the tire bead allowing the remaining 180 degrees of the tire to be manually pulled from the rim.

When refitting the tire, position the fitting arm as shown. Rotate the tire and take care that the bead on the low tension side of the tire does not damage the sensor.

Tread Act - NAS Only

Vehicles supplied to the North American markets must comply with the legislation of the Transport Recall Enhancement, Accountability and Documentation (TREAD) act. Part of the requirement of the TREAD act is for the vehicle to display a label, positioned on the driver's side B-pillar, which defines the recommended tire inflation pressure, load limits and maximum load of passengers and luggage weight the vehicle can safely carry. This label will be specific to each individual vehicle and will be installed on the production line.

This label must not be removed from the vehicle. The label information will only define the specification of the vehicle as it came off the production line. It will not include dealer or owner fitted accessory wheels and tires of differing size from the original fitment.

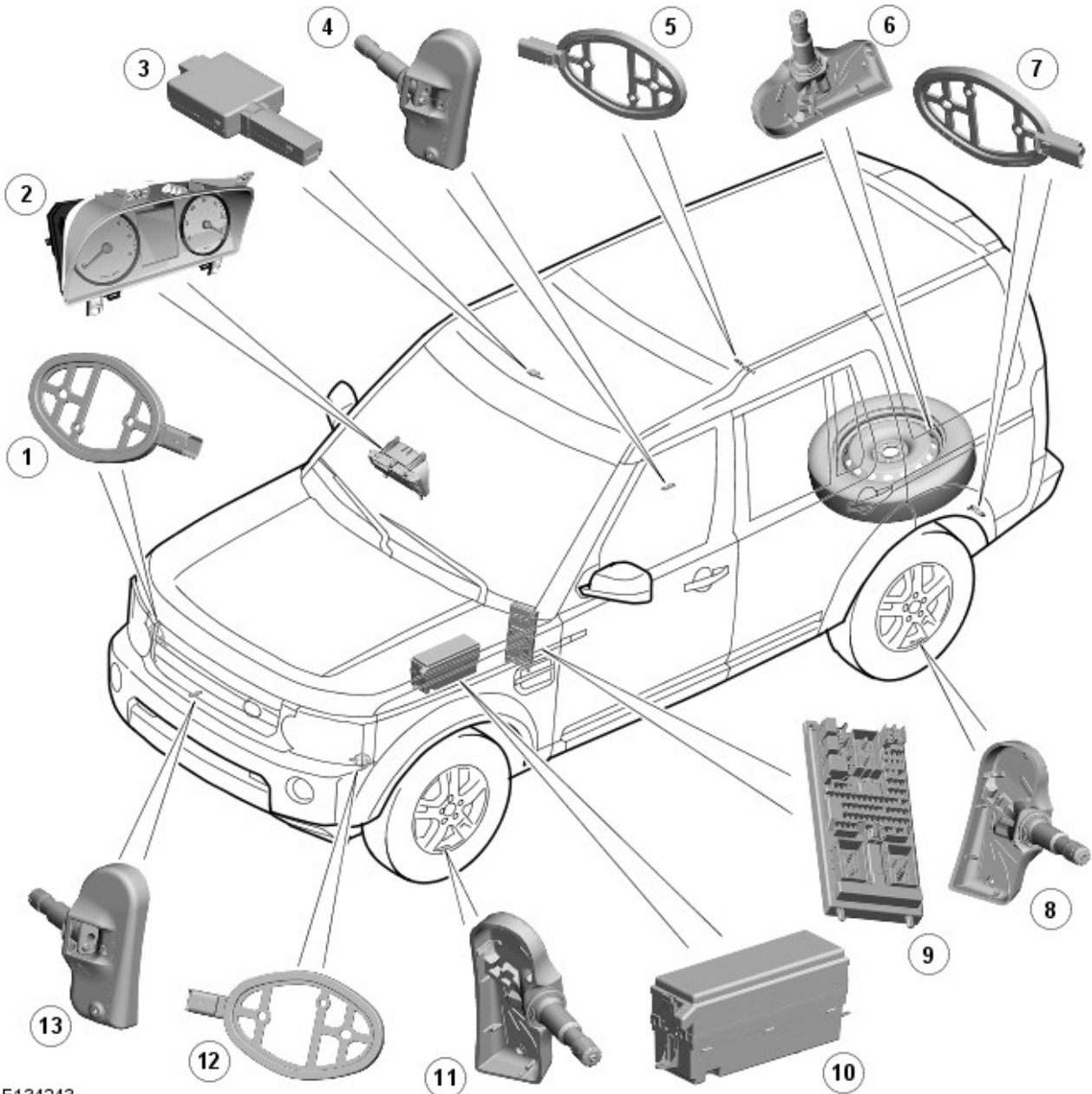


NOTE: If tires and wheels of a non-standard size are fitted to the vehicle, the car configuration file must be updated using a Land Rover approved diagnostic system.

If the label is damaged or removed for body repair, it must be replaced with a new label specific to that vehicle. A new label is requested from Land Rover parts and will be printed specifically for the supplied VIN of the vehicle.

TIRE PRESSURE MONITORING SYSTEM (TPMS)

Tire Pressure Monitoring System - Component Location



E134243

Item	Part Number	Description
1	-	RH (right-hand) front initiator
2	-	Instrument cluster
3	-	TPMS RF receiver
4	-	RH rear tire pressure sensor
5	-	RH rear initiator
6	-	Spare tire pressure sensor
7	-	LH (left-hand) rear initiator
8	-	LH rear tire pressure sensor
9	-	CJB (central junction box)
10	-	EJB (engine junction box)
11	-	LH front tire pressure sensor
12	-	LH front initiator
13	-	RH front tire pressure sensor

The purpose of the Tire Pressure Monitoring System (TPMS) is to assist the driver in maintaining the vehicle's tire pressures at the optimum level in order to:

- improve fuel consumption
- maintain ride and handling characteristics
- reduce the risk of rapid tire deflation – which may be caused by under inflated tires
- comply with legislation in relevant markets.

The TPMS measures the pressure in each of the tires on the vehicle (including the spare, if required) and issues warnings to the driver if any of the pressures deviate from defined tolerances.

NOTES:



During a 'blow out' a very rapid reduction in pressure is experienced. The system is not intended to warn the driver of a 'blow out', since it is not possible to give the driver sufficient warning that such an event is occurring, due to its short duration. The design of the TPMS is to assist the driver in keeping the tires at the correct pressure, which will tend to reduce the likelihood of a tire 'blow out' occurring.



TPMS is inhibited when the vehicle is in Delivery mode. For more details on Delivery mode refer to the PDI manual.

A single TPMS hardware configuration is used. TPMS status information is relayed to the driver with a message displayed in the instrument cluster message center and a amber warning indicator.

Tire Location

Because of the requirement for different pressure targets and thresholds for the front and rear tires, the **CJB** can identify the location of the tires on the vehicle, and assign a received tire pressure sensor identification to a specific position on the vehicle (i.e. FL (front left), FR (front right), RL (rear left) or RR (rear right)).

Tire location is performed automatically by the **CJB** using an auto-location function. This function requires no manual intervention by the driver. The **CJB** can automatically learn the position of tires on the vehicle if the tire pressure sensors or their positions are changed on the vehicle.

The tire learn and location process is ready to commence when the vehicle has been stationary or is traveling at less than 12 mph (20 km/h) for 15 minutes. This is known as 'parking mode'. The learn/locate process requires the vehicle to be driven at speeds of more than 12 mph (20 km/h) for 15 minutes. If the vehicle speed reduces to below 12 mph (20 km/h), the learn process timer is suspended until the vehicle speed increases to more than 12 mph (20 km/h), after which time the timer is resumed. If the vehicle speed remains below 12 mph (20 km/h) for more than 15 minutes, the timer is set to zero and process starts again.

The **CJB** can automatically detect, under all operating conditions, the following:

- one or more tire pressure sensors have been replaced
- one or more tire pressure sensor identifications are missing
- one or more 'alien' identifications are being received, i.e. the **CJB** can reject identifications from tire pressure sensors that do not belong to the vehicle
- the spare tire and one of the tires in use on the vehicle have exchanged position on the vehicle.

If the tire pressure sensors fitted to the running wheels (not the spare) are changed, the **CJB** can learn the new sensor identifications automatically. The learn function requires no manual intervention by the driver.

If a new sensor is fitted to the spare tire it must have its identification code programmed into the **CJB** using a Land Rover approved diagnostic system, or used on the vehicle as a 'running' wheel and the vehicle driven for 15 minutes at more than 12.5 mph (20 km/h).

Spare Tire Identification

Depending on the vehicle specification, the spare tire may or may not be fitted with a tire pressure sensor.



NOTE: Tire pressure sensors cannot be fitted to steel space saver spare wheels.

If the spare tire is fitted with a tire pressure sensor, the **CJB** can detect it, determine that it is the spare tire and monitor its pressure and issue warnings to the driver accordingly. If the **CJB** expects the spare tire to be fitted with a tire pressure sensor and it does not, the **CJB** will not show a fault to the driver, however a fault code will be stored in the **CJB**.

If the spare tire is being monitored and the driver replaces a flat 'running' tire with the spare tire, the **CJB** will not continually warn the driver that the original flat tire (now in the spare position) is flat. This prevents distraction of the driver by constant pressure warnings being issued. The driver is reminded by a message displayed for 20 seconds at each ignition on cycle that the spare tire is flat.

System Operation

Each time the vehicle is driven, the **CJB** transmits a Low Frequency (LF) (125 KHz) signal to each initiator in turn. This is received by the tire pressure sensor which transmits a Radio Frequency (RF) (315 or 433 MHz depending on market) signal to the RF receiver. This signal contains coded data which corresponds to sensor identification, air pressure, air temperature and acceleration data. This signal is communicated to the **CJB** via a K-bus line.

The system enters 'parking mode' after the vehicle speed has been less than 12.5 mph (20 km/h) for 12 minutes. In parking mode the tire pressure sensors transmit a coded signal to the **CJB** once every 13 hours. If the tire pressure decreases by more than 1 lbf/in² (0.6 bar) the sensor will transmit more often if pressure is being lost.

The spare tire sensor transmits a signal every 13 hours in the same manner as the road wheels when in parking mode. If the tire pressure decreases by more than 1 lbf/in² (0.6 bar) the sensor will transmit more often if pressure is being lost.

As each wheel responds to the LF signal from the **CJB**, it is assigned a position on the vehicle and is monitored for the remainder of that drive cycle in that position.

When the vehicle has been parked for more than 15 minutes and then driven at a speed of more than 12.5 mph (20 km/h), the initiators fire in turn for 18 seconds in the following order:

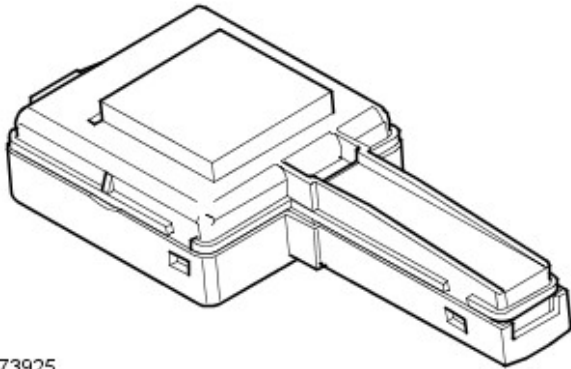
- Front left
- 6 second pause (for the to detect a response from the tire pressure sensor)
- Front right
- 6 second pause
- Rear right
- 6 second pause
- Rear left
- 6 second pause.

Each tire pressure sensor responds in turn so the **CJB** can establish the sensor positions at the start of the drive cycle. This process is repeated up to three times but less if the sensor positions are already known in the **CJB**. The process is known as 'Auto Location' and takes 7 to 8 minutes to complete. During this period the tire sensors transmit at regular intervals, once every 15 seconds. For the remainder of the drive cycle the tire sensors transmit once every 60 seconds or if a change in tire pressure is sensed until the vehicle stops and the system returns to parking mode.

Once the wheel position is established, the initiators stop firing a signal and do not fire again until the vehicle has been parked for more than 15 minutes. The signal transmissions from each wheel sensor continue at 1 minute intervals whilst the vehicle is being driven. This transmission is to monitor the tire pressure.

At 25% deflation the amber warning indicator in the instrument cluster is illuminated and an appropriate message displayed in the message center.

RF Receiver

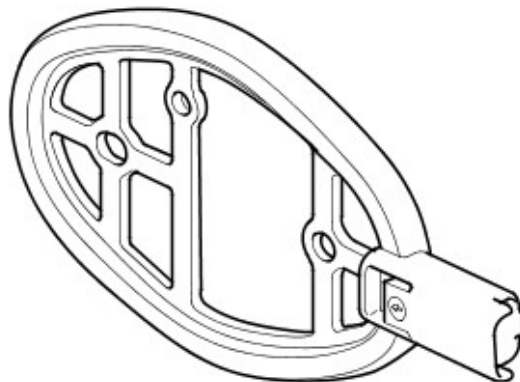


E73925

The RF receiver is mounted behind the overhead console and connects to the vehicle harness via a fly lead.

The RF receiver receives transmissions from each of the tire pressure sensors via an internal antenna. This information is then communicated to the **CJB** via a dedicated Local Interconnect Network (K-bus).

Initiator



E45552

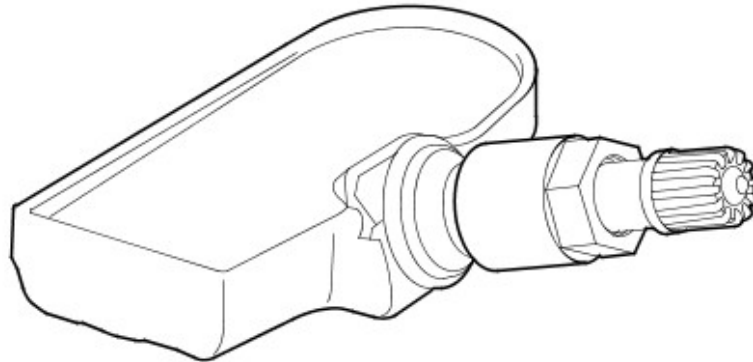
The initiators are located at the front of the front wheel arches and at the rear of the rear wheel arches and are secured with two scrivenets. The TPMS has four initiators and each has a connector which connects with the body harness.

The initiator is a passive, Low Frequency (LF) transmitter. Each initiator provides an auto-location feature to identify tire positions on the vehicle and transmit that data to the **CJB**.

The **CJB** energizes each initiator in turn using LF drivers. The corresponding tire pressure sensor detects the resulting

LF transmission and responds by initiating an RF transmission of its data. This data is received by the RF receiver and communicated to the **CJB** via a K-bus. The **CJB** can then determine which sensor is transmitting and its location on the vehicle.

Tire Pressure Sensor



E45553

The TPMS system uses 'active' tire pressure sensors which are mounted on each wheel, inside the tire cavity. The sensor is retained in position by the valve attachment to the wheel structure. The sensors transmit their RF signals at either 315 MHz or 433 MHz dependent on market requirements.

The sensors periodically measure the pressure and temperature of the air inside the tire plus the centripetal acceleration acting on the sensor. These measurements are transmitted periodically to the RF receiver located behind the overhead console.

The tire pressure sensors are self-contained units which have no electrical connections into or out of the sensor.

The care points detailed in the 'Tires' section of this chapter must be followed to avoid damage to the sensor. If the sensor is replaced, the nut, seal and washer must also be replaced and the sensor tightened to the correct torque value as given in the Service Repair manual.

The RF transmission from the sensor contains a unique identification code in its transmission data, so that the **CJB** can identify the tire on the vehicle. If the sensor is replaced on a 'running' wheel, the new sensor identification will be learnt when the vehicle is first driven at a speed of more than 12.5 mph (20 km/h) for 15 minutes. If a new sensor is fitted to the spare wheel, the identification for that sensor must be programmed into the **CJB** using a Land Rover approved diagnostic system or that wheel will not be monitored. The code is provided on a label with the complete wheel and tire assembly when new and is also printed on the casing of each sensor.

The replacement spare wheel may also be programmed to the vehicle by using it as a 'running' wheel for 15 minutes at more than 12.5 mph (20 km/h), then replacing it to the spare wheel position.

In order to conserve battery power, the tire sensor module uses different transmission rates when the wheel is stationary or moving. The wheel speed required to change between the stationary and moving transmission rates is very low to allow for the requirement for slow off-road driving.

Instrument Cluster Indications



E134246

Item	Part Number	Description
1	-	Message center
2	-	Amber warning indicator

The warning indications to the driver are common on all vehicles fitted with TPMS. Warnings are conveyed by an amber light emitting diode (LED) warning indicator and a text message displayed in the message center.

The warning indicator and message center are driven by CAN messages from the **CJB**. The warning indicator is illuminated by the cluster software for 3 seconds when the vehicle is in power mode 6 for a bulb check.

For additional information, refer to: Information and Message Center (413-08, Description and Operation).

Controller Area Network (CAN)

The **CJB** sends and receives a number of digital messages via the medium speed controller area network (CAN). The received messages are used for the operation of the TPMS. The transmitted messages comprise of TPMS status and requests to the instrument cluster to illuminate warnings indicators and/or display messages in the message center.

Transmitted Messages

The **CJB** transmits the messages shown in the following table.

Message	Received By
TPMS diagnostic response	A Land Rover approved diagnostic system.
TPMS amber warning indicator request at 25% tire deflation	Instrument cluster
TPMS message display request	Instrument cluster

Diagnostics

The **CJB** has a diagnostic connection via the medium speed CAN to enable system status and faults to be retrieved using a Land Rover approved diagnostic system.

Additionally, an on-board diagnostic routine within the **CJB** constantly monitors the system and alerts the driver to system faults by illuminating the amber warning indicator and/or displaying a message in the instrument cluster message center.

Fault Detection

If a sensor fails, the amber warning indicator in the instrument cluster will be illuminated. A message 'XX Tyre Not Monitored' will be displayed in the message center in addition to the amber warning indicator.



NOTE: 'XX' is the tire position on the vehicle, e.g. FL (front left), FR (front right), RL (rear left) or RR (rear right).

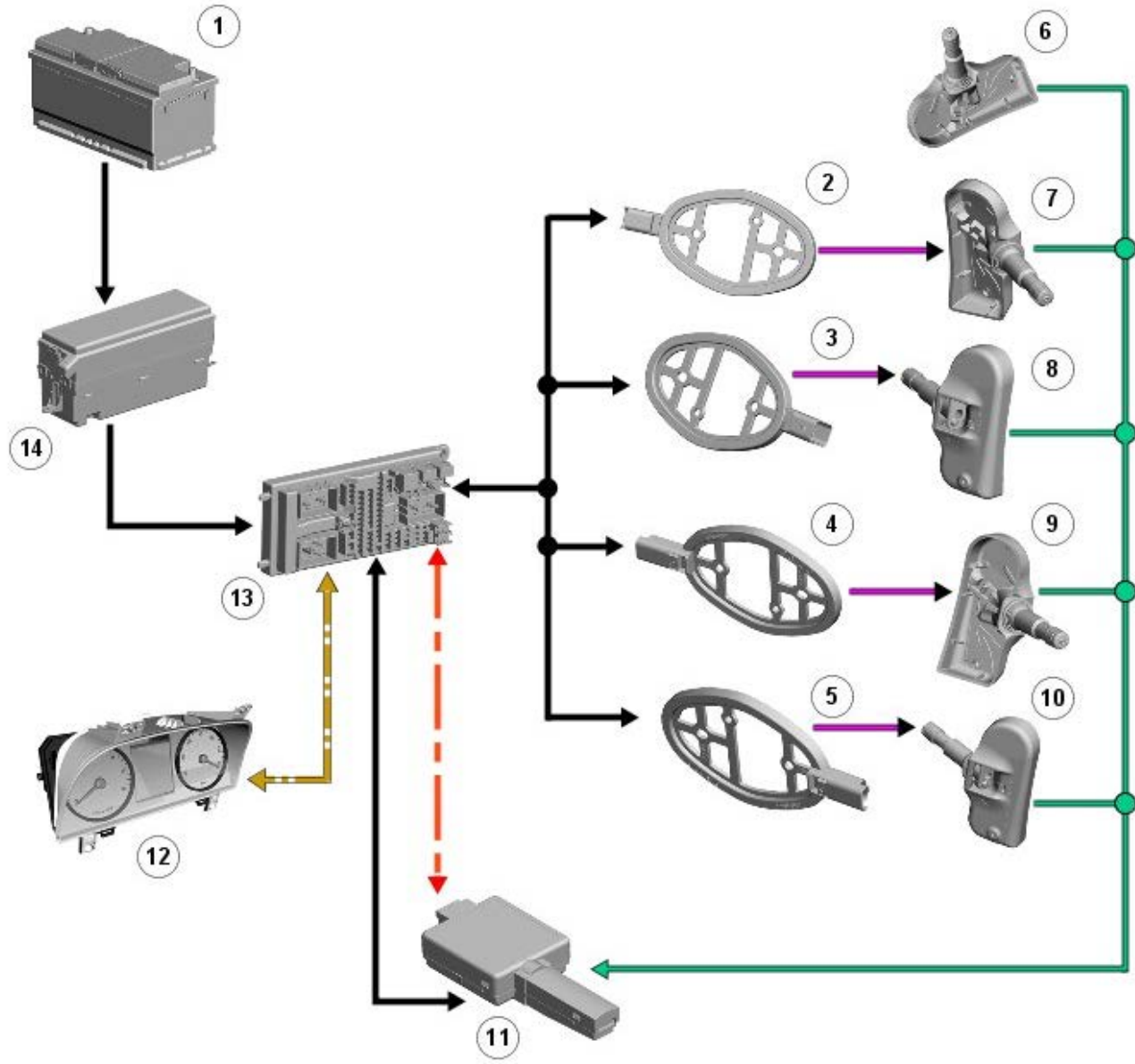
If more than one sensor fails or the **CJB** develops a fault, the amber warning indicator will be illuminated. A message 'Tyre Monitoring System Fault' will be displayed in the message center in addition to the amber warning indicator. This fault could also be caused if RF interference near the vehicle affects the system signal reception. When the

interference has ceased, the fault will be automatically cancelled and the TPMS will operate normally.

If a tire pressure sensor battery voltage becomes low, the sensor transmits a message to the **CJB**. The **CJB** stores the low battery condition as a fault flag in its memory with no other visual warnings displayed. If the battery fails, the sensor will stop transmitting and the **CJB** will transmit a message to display 'FL Tyre Not Monitored' for example in the message center. The dealer should interrogate the **CJB** for the fault flag using a Land Rover approved diagnostic system to determine the cause of the message. If the battery has failed, the sensor must be replaced and the stored fault flags removed using a Land Rover approved diagnostic system. The **CJB** will learn the identification of the new sensor when the vehicle is driven. If the replaced sensor is fitted to the spare wheel (if fitted), its identification must be manually programmed into the **CJB** using a Land Rover approved diagnostic system or by using it as a 'running' wheel for 15 minutes at more than 12.5 mph (20 km/h), then replacing it to the spare wheel position.

CONTROL DIAGRAM

 NOTE: **A** = Hardwired; **B** = K-Bus; **F** = RF Transmission; **N** = Medium Speed CAN Bus; **W** = LF Transmission



E134245



Item	Part Number	Description
1	-	Battery
2	-	RH rear initiator
3	-	LH rear initiator
4	-	RH front initiator
5	-	LH front initiator
6	-	Spare tire pressure sensor
7	-	RH rear tire pressure sensor
8	-	LH rear tire pressure sensor

- 9 - RH front tire pressure sensor
- 10 - LH front tire pressure sensor
- 11 - TPMS RF receiver
- 12 - Instrument Cluster
- 13 - CJB
- 14 - EJB

Wheels and Tires - Wheels and Tires

Diagnosis and Testing

Principles of Operation

For a detailed description of the wheels and tires, refer to the relevant Description and Operation section in the workshop manual.

REFER to: [Wheels and Tires](#) (204-04 Wheels and Tires, Description and Operation) / [Wheels and Tires](#) (204-04 Wheels and Tires, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer complaint. As much information as possible should be gathered from the driver to assist in diagnosing the cause(s). Confirm which of the following two warning types (A or B) exist for the Tire Pressure Monitoring System when the ignition status is switched from 'OFF' to 'ON'
 - **(A) Check Tire Pressure Warnings.** A low tire pressure warning will **continuously** illuminate the low tire pressure warning lamp. This warning may be accompanied by a text message such as CHECK TIRE PRESSURE (refer to owner literature). The manufacturer approved diagnostic system does NOT need to be used. Diagnostic Trouble Codes (DTCs) are not generated with this type of warning. To extinguish this warning it is essential that, with the ignition 'ON', all vehicle tires (including the spare) are to be set to the correct pressure as stated in the vehicle handbook or as indicated on the placard label in the passenger/driver door aperture. **It is not necessary to drive the vehicle to clear 'check tire pressure' warnings - just changing the tire pressure causes the tire low pressure sensor to transmit new data.**

NOTES:



The tire pressures should be set by:

- Using a calibrated tire pressure gauge
- With 'cold' tires (vehicle parked in the ambient temperature for at least one hour, not in a garage with an artificial ambient temperature)



If the tire pressure warning does not clear within two minutes, it is likely that the gauge is not correctly calibrated or the tires are 'warm'. Carry out the following steps until the warning has cleared:

- Rotate wheels approximately 180 degrees
- Increase the tire pressures by 3psi
- Wait a further two minutes
- When the tires are at ambient temperature and a **calibrated** gauge is available, reset the tire pressures to the correct pressure.



Tire pressure adjustments are part of routine owner maintenance. Tire pressure adjustments that are required due to a lack of owner maintenance are not to be claimed under vehicle warranty.

- **(B) System Fault Warnings.** When a system fault is detected, the low tire pressure warning lamp will flash for approximately 75 seconds prior to being continuously illuminated. Visually inspect wheel arch Tire Pressure Monitoring System Antennas and check for system DTCs. External visual damage to the tire low pressure sensors and air leaks will not cause system fault warnings (note: nut and seal system should be replaced at each tyre change using the available service kit). Check for the presence of tire low pressure sensors on all four wheels (note: a tire low pressure sensor has a metal valve stem rather than a rubber one).

2. Check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation).

Pinpoint Tests

PINPOINT TEST A : U201F11 TIRE PRESSURE MONITORING SYSTEM EXTERNAL RECEIVER DATA LINE CIRCUIT SHORT TO GROUND	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: U201F11 VERIFY EXTERNAL RECEIVER DATA LINE CIRCUIT SHORT TO GROUND	
1	Ignition OFF.

	2 Disconnect the Tire Pressure Monitoring System Receiver electrical connector, C2875.				
	3 Measure the resistance between				
	<table border="1"> <thead> <tr> <th>C2875, harness side</th> <th>Battery</th> </tr> </thead> <tbody> <tr> <td>Pin 1</td> <td>Negative terminal</td> </tr> </tbody> </table>	C2875, harness side	Battery	Pin 1	Negative terminal
C2875, harness side	Battery				
Pin 1	Negative terminal				
	Is the resistance less than 5 Ohms? Yes GO to A2. No GO to A3.				
A2: U201F11 CHECK THE EXTERNAL RECEIVER DATA LINE CIRCUIT FOR SHORT CIRCUIT TO GROUND					
	1 Disconnect the Body Control Module electrical connector, C0580.				
	2 Measure the resistance between				
	<table border="1"> <thead> <tr> <th>C2875, harness side</th> <th>Battery</th> </tr> </thead> <tbody> <tr> <td>Pin 1</td> <td>Negative terminal</td> </tr> </tbody> </table>	C2875, harness side	Battery	Pin 1	Negative terminal
C2875, harness side	Battery				
Pin 1	Negative terminal				
	Is the resistance less than 5 Ohms? Yes REPAIR the short circuit in wiring harness. No GO to A4.				
A3: U201F11 CHECK THE TIRE PRESSURE MONITORING SYSTEM EXTERNAL RECEIVER FOR SHORT CIRCUIT TO GROUND					
	1 Reconnect the Tire Pressure Monitoring System Receiver electrical connector, C2875.				
	2 Using manufacturer approved diagnostic system run On Demand Self Test (0x0202) .				
	Is the DTC U201F11 set? Yes Replace Tire Pressure Monitoring Receiver. No Investigate possible cause of intermittent failure.				
A4: U201F11 CHECK THE BODY CONTROL MODULE FOR SHORT CIRCUIT TO GROUND					
	1 Reconnect the Body Control Module electrical connector, C0580.				
	2 Reconnect the Tire Pressure Monitoring System Receiver electrical connector, C2875.				
	3 Using manufacturer approved diagnostic system run On Demand Self Test (0x0202) .				
	Is the DTC U201F11 set? Yes Replace Body Control Module. No Investigate possible cause of intermittent failure.				

PINPOINT TEST B : U201F12 TIRE PRESSURE MONITORING SYSTEM EXTERNAL RECEIVER DATA LINE CIRCUIT SHORT TO POWER					
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS				
B1: U201F12 VERIFY EXTERNAL RECEIVER DATA LINE CIRCUIT SHORT TO POWER					
	1 Ignition OFF.				
	2 Disconnect the Tire Pressure Monitoring System Receiver electrical connector, C2875.				
	3 Measure the resistance between				
	<table border="1"> <thead> <tr> <th>C2875, harness side</th> <th>Battery</th> </tr> </thead> <tbody> <tr> <td>Pin 1</td> <td>Positive terminal</td> </tr> </tbody> </table>	C2875, harness side	Battery	Pin 1	Positive terminal
C2875, harness side	Battery				
Pin 1	Positive terminal				
	Is the resistance less than 5 Ohms? Yes GO to B2. No GO to B3.				
B2: U201F12 CHECK THE EXTERNAL RECEIVER DATA LINE CIRCUIT FOR SHORT CIRCUIT TO POWER					
	1 Disconnect the Body Control Module electrical connector, C0580.				
	2 Measure the resistance between				
	<table border="1"> <thead> <tr> <th>C2875, harness side</th> <th>Battery</th> </tr> </thead> <tbody> <tr> <td>Pin 1</td> <td>Positive terminal</td> </tr> </tbody> </table>	C2875, harness side	Battery	Pin 1	Positive terminal
C2875, harness side	Battery				
Pin 1	Positive terminal				
	Is the resistance less than 5 Ohms? Yes REPAIR the short circuit in wiring harness. No GO to B4.				
B3: U201F12 CHECK THE TIRE PRESSURE MONITORING SYSTEM EXTERNAL RECEIVER FOR SHORT CIRCUIT TO POWER					
	1 Reconnect the Tire Pressure Monitoring System Receiver electrical connector, C2875.				
	2 Using manufacturer approved diagnostic system run On Demand Self Test (0x0202) .				
	Is the DTC U201F12 set?				


	Yes Replace Tire Pressure Monitoring Receiver.
	No Investigate possible cause of intermittent failure.
B4: U201F12 CHECK THE BODY CONTROL MODULE FOR SHORT CIRCUIT TO POWER	
	1 Reconnect the Body Control Module electrical connector, C0580.
	2 Reconnect the Tire Pressure Monitoring System Receiver electrical connector, C2875.
	3 Using manufacturer approved diagnostic system run On Demand Self Test (0x0202) .
	Is the DTC U201F12 set?
	Yes Replace Body Control Module.
	No Investigate possible cause of intermittent failure.

PINPOINT TEST C : U201F87 TIRE PRESSURE MONITORING SYSTEM EXTERNAL RECEIVER DATA LINE MISSING MESSAGE					
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS				
C1: U201F87 VERIFY EXTERNAL RECEIVER DATA LINE MISSING MESSAGE					
	1 Using manufacturer approved diagnostic system run On Demand Self Test (0x0202).				
	Is the DTC U201F87 set?				
	Yes GO to C2.				
	No Investigate possible cause of intermittent failure.				
C2: U201F87 CHECK EXTERNAL RECEIVER DATA LINE CIRCUIT					
	1 Ignition OFF.				
	2 Disconnect the Tire Pressure Monitoring System Receiver electrical connector, C2875.				
	3 Disconnect the Body Control Module electrical connector, C0580.				
	4 Measure the resistance between				
	<table border="1" style="width: 100%;"> <tr> <td style="text-align: center;">C2875, harness side</td> <td style="text-align: center;">C0580, harness side</td> </tr> <tr> <td>Pin 1</td> <td>Pin 25</td> </tr> </table>	C2875, harness side	C0580, harness side	Pin 1	Pin 25
C2875, harness side	C0580, harness side				
Pin 1	Pin 25				
	Is the resistance less than 5 ohms?				
	Yes GO to C3.				
	No REPAIR the high resistance/open circuit in wiring harness.				
C3: U201F87 CHECK EXTERNAL RECEIVER					
	1 Reconnect the Body Control Module electrical connector, C0580.				
	2 Reconnect the Tire Pressure Monitoring System Receiver electrical connector, C2875.				
	3 Using manufacturer approved diagnostic system run On Demand Self Test (0x0202) .				
	Is the DTC U201F87 set?				
	Yes Replace Tire Pressure Monitoring Receiver. GO to C4.				
	No Investigate possible cause of intermittent failure.				
C4: U201F87 CHECK BODY CONTROL MODULE.					
	1 Using manufacturer approved diagnostic system run On Demand Self Test (0x0202) .				
	Is the DTC U201F87 set?				
	Yes Replace Body Control Module.				
	No Test is complete. No further action is required.				


PINPOINT TEST D : C1A5693, C1A5893, C1A6093, C1A6293 DEFECTIVE RUNNING TIRE LOW PRESSURE SENSOR OR RECEIVER	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: C1A5693, C1A5893, C1A6093, C1A6293 CHECK FOR ADDITIONAL DTCS	
	1 Using manufacturer approved diagnostic system check for additional DTCs C1A5693, C1A5893, C1A6093, C1A6293, with identical time stamps.
	Have all four DTCs logged with identical time stamps in the Body Control module?
	Yes Diagnose and fix DTCs related to the tire pressure monitoring receiver.
	No Using manufacturer approved diagnostic system, perform diagnostic routine to verify reception of all tire low pressure sensors, by carrying out 'TPMS wheel unit & receiver reception test' from set up and configuration application and complete remedial actions.

PINPOINT TEST E : C1D1800 LOCALIZATION FAILURE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: C1D1800 ESTABLISH THE LOCATIONS OF THE TIRE LOW PRESSURE SENSOR LOCALIZATION	

FAILURES

	 <p>NOTE: To clear or reset information read in datalogger signal 'Unsuccessful wheel position triggering statistic' (0x4149) Use manufacturer approved diagnostic system and carry out 'Reset/Clear Specified Function' (0x040E) from Special Applications.</p> <p>1 Using manufacturer approved diagnostic system read datalogger signal 'Unsuccessful wheel position triggering statistic' (0x4149) to establish the locations of the tire low pressure sensor localization failures.</p>								
<p>Have the locations of the tire low pressure sensor localization failures been identified?</p> <p>Yes</p> <p>GO to E2.</p> <p>No</p> <p>Investigate possible cause of intermittent failure.</p>									
<p>E2: C1D1800 CHECK FOR ADDITIONAL LF INITIATOR CIRCUIT DTCS</p>									
<p>1 Using manufacturer approved diagnostic system check for additional DTCS C1A5712, C1A5714, C1A5912, C1A5914, C1A6112, C1A6114, C1A6312, C1A6314.</p>									
<p>Are any of the following DTCS logged C1A5712, C1A5714, C1A5912, C1A5914, C1A6112, C1A6114, C1A6312, C1A6314?</p> <p>Yes</p> <p>Refer to the DTC Index. Check for possible causes for each of the logged DTCS and carry out the repair operations specified.</p> <p>No</p> <p>GO to E3.</p>									
<p>E3: C1D1800 CHECK FOR ADDITIONAL TIRE LOW PRESSURE SENSOR DTCS</p>									
<p>1 Using manufacturer approved diagnostic system check for additional DTCS C1A5693, C1A5893, C1A6093, C1A6293, C1D2105.</p>									
<p>Are any of the following DTCS logged C1A5693, C1A5893, C1A6093, C1A6293, C1D2105?</p> <p>Yes</p> <p>Refer to the DTC Index. Check for possible causes for each of the logged DTCS and carry out the repair operations specified.</p> <p>No</p> <p>GO to E4.</p>									
<p>E4: C1D1800 CHECK INITIATORS ARE CORRECTLY INSTALLED</p>									
<p>1 Check for correct installation of Initiators for the locations identified. REFER to: (204-04 Wheels and Tires)</p> <p>Tire Pressure Monitoring System (TPMS) Front Antenna (Removal and Installation),</p> <p>Tire Pressure Monitoring System (TPMS) Rear Antenna (Removal and Installation).</p>									
<p>Are the Initiators correctly installed?</p> <p>Yes</p> <p>GO to E5.</p> <p>No</p> <p>Install Initiators to the correct locations.</p>									
<p>E5: C1D1800 CHECK FOR SHORT CIRCUIT IN INITIATOR HARNESS</p>									
<p>1 Ignition OFF.</p>									
<p>2 Disconnect the Body Control Module electrical connector, C0584 (Front LF Initiators).</p>									
<p>3 Disconnect the Body Control Module electrical connector, C0586 (Rear LF Initiators).</p>									
<p>4 Measure the resistance of Front Right Hand Initiator.</p>	<table border="1"> <tr> <td colspan="2" style="text-align: center;">C0584, harness side</td> <td colspan="2" style="text-align: center;">C0584, harness side</td> </tr> <tr> <td>Pin 1</td> <td></td> <td>Pin 2</td> <td></td> </tr> </table>	C0584, harness side		C0584, harness side		Pin 1		Pin 2	
C0584, harness side		C0584, harness side							
Pin 1		Pin 2							
<p>5 Measure the resistance of Front Left Hand Initiator.</p>	<table border="1"> <tr> <td colspan="2" style="text-align: center;">C0584, harness side</td> <td colspan="2" style="text-align: center;">C0584, harness side</td> </tr> <tr> <td>Pin 14</td> <td></td> <td>Pin 15</td> <td></td> </tr> </table>	C0584, harness side		C0584, harness side		Pin 14		Pin 15	
C0584, harness side		C0584, harness side							
Pin 14		Pin 15							
<p>6 Measure the resistance of Rear Right Hand Initiator.</p>	<table border="1"> <tr> <td colspan="2" style="text-align: center;">C0586, harness side</td> <td colspan="2" style="text-align: center;">C0586, harness side</td> </tr> <tr> <td>Pin 30</td> <td></td> <td>Pin 31</td> <td></td> </tr> </table>	C0586, harness side		C0586, harness side		Pin 30		Pin 31	
C0586, harness side		C0586, harness side							
Pin 30		Pin 31							
<p>7 Measure the resistance of Rear Left Hand Initiator.</p>	<table border="1"> <tr> <td colspan="2" style="text-align: center;">C0586, harness side</td> <td colspan="2" style="text-align: center;">C0586, harness side</td> </tr> <tr> <td>Pin 18</td> <td></td> <td>Pin 19</td> <td></td> </tr> </table>	C0586, harness side		C0586, harness side		Pin 18		Pin 19	
C0586, harness side		C0586, harness side							
Pin 18		Pin 19							
<p>Are any of the Initiator resistance measurements less than 1 Ohm?</p> <p>Yes</p> <p>REPAIR the short circuit as required.</p> <p>No</p> <p>Install the correct tire low pressure sensor, of correct frequency, in accordance with that defined in the manufacturer approved diagnostic system new tire low pressure sensor application, to the position(s) identified.</p> <p>REFER to: Tire Low Pressure Sensor (204-04 Wheels and Tires, Removal and Installation).</p>									

PINPOINT TEST F : C1D2105 MISSING, INCOMPATIBLE OR DEFECTIVE RUNNING TIRE LOW PRESSURE SENSOR(S) OR RECEIVER

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: C1D2105 CHECK FOR CORRECT WHEEL AND TIRE ASSEMBLY AND TIRE LOW PRESSURE SENSORS	
	 NOTE: As a visual check, a tire low pressure sensor has a metal valve stem rather than a rubber one and cannot be installed to a mini or space saver spare wheel. 1 Check that all full size running wheel and tire assemblies have tire low pressure sensors installed.
	Is a full size wheel and tire assembly with tire low pressure sensor installed to all running wheel positions? Yes Using manufacturer approved diagnostic system, perform diagnostic routine to verify reception of all tire low pressure sensors, by carrying out 'TPMS wheel unit & receiver reception test' from set up and configuration application and complete remedial actions. No If agreed with the customer, install the correct wheel and tire assembly or tire low pressure sensor(s), of correct frequency, in accordance with that defined in the manufacturer approved diagnostic system new tire low pressure sensor application. <small>(Note: If the datalogger signal 'Number Of Missing Tire Pressure Wheel Units' is 4 and the Instrument Panel Cluster displays text message 'Tire Pressure Monitoring Unavailable', the system has detected winter tire installation, as detailed in the owner's manual. Confirm why the vehicle has non-TPMS wheel & tire assemblies installed before installing tire low pressure sensors, which are not to be claimed under vehicle warranty.)</small>

Component Tests

Wheels and Tires

For wheel and tire specification information (pressures, torques, etc).
REFER to: [Specifications](#) (204-04 Wheels and Tires, Specifications).

When replacing wheels or tires, local legislation regarding health and safety must be complied with.

If the vehicle has a Tire Pressure Monitoring System installed, only manufacturer approved wheels and tires should be used. If the wheel and tire size is changed (for example from R18 to R20) the Tire Pressure Monitoring System module should be updated with the correct pressure information appropriate to the new wheel and tire set. Update the Tire Pressure Monitoring System module using the manufacturer approved diagnostic system.

As a general guideline, only replace tires in pairs or as a set, and only with tires of equivalent size and specification.

Confirm the symptoms of the customer complaint.

As much information as possible should be gathered from the driver to assist in diagnosing the cause(s).

1. Before a road test, carry out a basic inspection to make sure the vehicle is safe and legal to drive.

Basic inspection

- Correct tire inflation.
REFER to: [Specifications](#) (204-04 Wheels and Tires, Specifications).
- Legal tire tread depth
- Cuts/Bulges in tire sidewall(s)
- Tire ply separation
- Embedded objects
- Wheel rim damage
- Correct tire installation (specification, direction of rotation, etc)
- Any obvious distortion of the tire (flat/high spots)
- Worn/Damaged steering or suspension components

Road test

If the results of the basic inspection are acceptable, carry out a road test to confirm the symptoms.

To reproduce the symptoms, test the vehicle on similar roads to those on which the fault occurs and at similar speeds (provided it is legal to do so).

If the vibration or noise can be reproduced, note the speed at which it occurs and see if it is possible to drive through the symptom, meaning, is it possible to alter the fault by driving faster or slower than the speed at which it occurs?

If it **is** possible, it is likely that the fault is caused by an imbalance in the wheel or tire.

If the vibration or noise gets worse as the vehicle speed increases, it is likely that the fault is caused by distortion in the wheel or tire, or worn or damaged components.

Distortion checks

Check for distortion by raising the vehicle so that the wheels are free and placing an axle stand or similar fixed object next to each wheel in turn.

If the stand is placed at the tread of the tire, the tire can be checked for ovality by turning the wheel by hand and checking for high or low spots where the gap between the tread and the stand increases or reduces.

If the stand is placed next to the wheel rim or tire sidewall, the wheel and tire can be checked for run-out in a similar way.

Wheels and Tires - Tire Low Pressure Sensor

Removal and Installation

Removal



NOTE: It is strongly recommended that the valve seal and steel washer is replaced each time a tire is changed to avoid a seal failure. The seal and washer must be replaced if the sensor is removed. Removal of the sensor retaining nut must be regarded as sensor removal. The valve cap must always be in place except when inflating, releasing pressure or checking pressure.

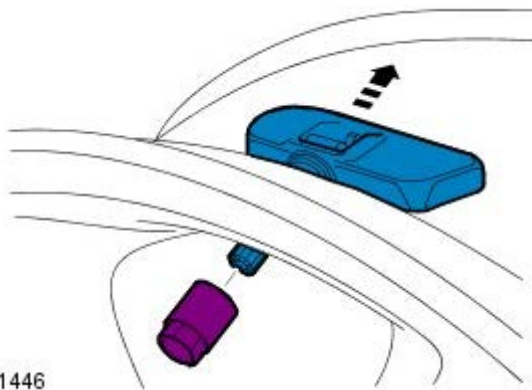
1. **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the wheel and tire.

3. **CAUTION:** To avoid damage to the tire low pressure sensor, release the tire bead from the rim, 180 degrees from the valve.

Remove the tire from the wheel.



E51446

4. **CAUTIONS:**

Do not push on the valve.

If the tire low pressure sensor is to be re-installed, a new washer, seal and nut must be installed.

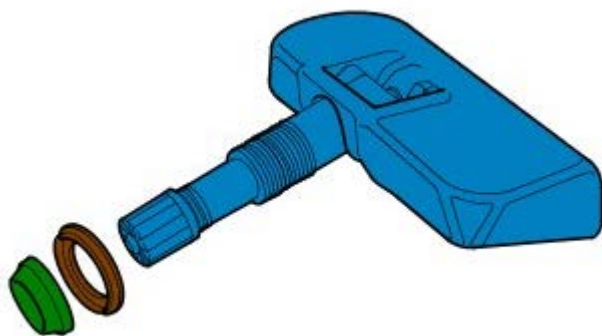
If the tire low pressure sensor is to be re-installed, a new washer, seal, nut and silver coloured nickel valve core must be installed.

Remove the tire low pressure sensor.

- Remove the nut.
- Release and withdraw the sensor along the valve axis.

5. If necessary, install a new seal and washer.

- Remove and discard the seal and washer.
- Install a new washer and seal, making sure the valve remains pressed fully onto its seat.



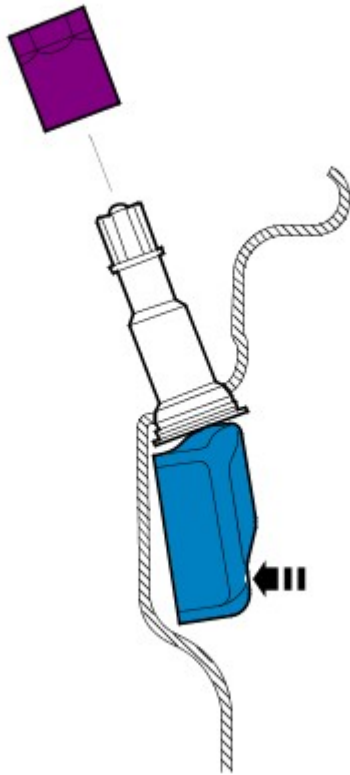
E51447

Installation

1. **CAUTION:** Do not use compressed air to clean the sensor. Do not clean the sensor with solvents or cleaning agents of any type, use a clean dry cloth.


Clean the component mating faces.

2. **CAUTION:** Do not apply any lubricant to



E51449

the new valve.

 **NOTE:** If the sensor is replaced on a 'running' wheel, the new sensor identification will be learnt when the vehicle is first driven. If a new sensor is fitted to the spare wheel the identification for that sensor must be programmed into the Tire Pressure Monitoring System (TPMS) module using T4. The identification code is provided on a label with the complete assembly and is also printed on the casing of each sensor.

Install the tire low pressure sensor.

- Install and hand tighten the nut whilst keeping the sensor in place.
- Tighten the nut to 6.5 Nm (4.8 lb.ft).

3. Install the tire and balance the wheel.


4. Install the wheel and tire.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

Wheels and Tires - Tire Pressure Monitoring System (TPMS) Front Antenna

Removal and Installation

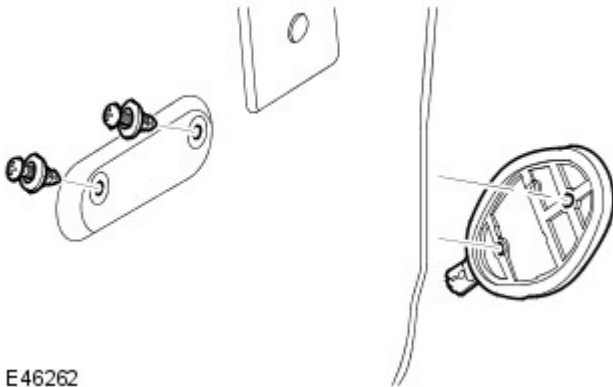
Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).

3. Remove the tire pressure antenna.
 - Remove the 2 retainers.



E46262

Installation

1. To install, reverse the removal procedure.
2. Initiate a new tire pressure antenna using T4.

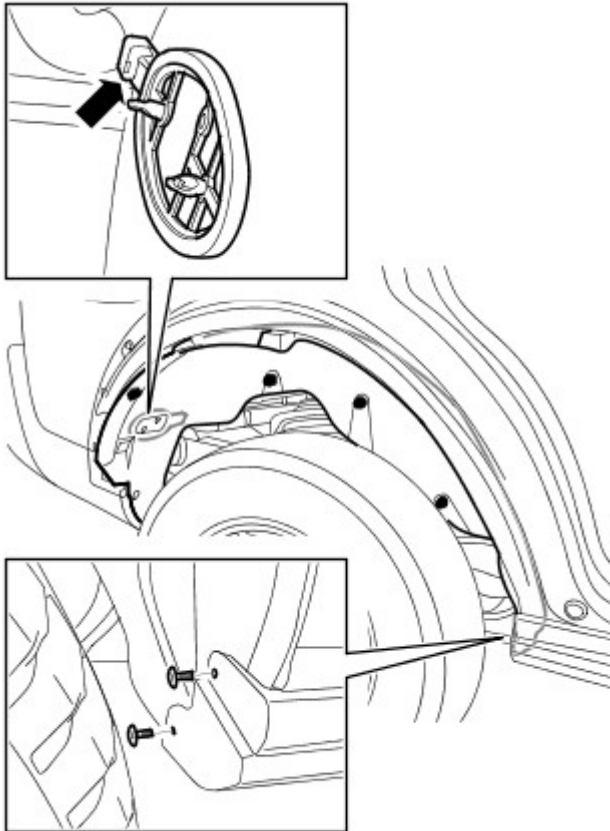
Wheels and Tires - Tire Pressure Monitoring System (TPMS) Rear Antenna

Removal and Installation

Removal

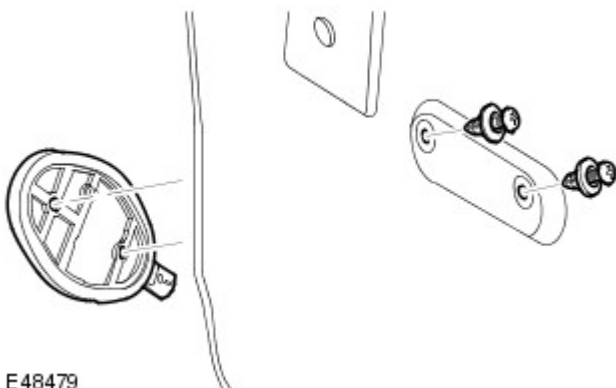
1. Remove the fender moulding.
For additional information, refer to: Rear Quarter Panel Moulding (501-08, Removal and Installation).

2. Remove the fender splash shield.
 - Remove the 2 screws.
 - Remove the 6 retainers.
 - Disconnect the electrical connector.



E48478

3. Remove the tire pressure antenna.
 - Remove the 2 retainers.



E48479

Installation

1. To install, reverse the removal procedure.
2. Initiate a new tire pressure antenna using T4.

Vehicle Dynamic Suspension -

Air Suspension - General Specification

Item	Specification
Ride height:	
Off road	55 mm (2.1 in) above standard
Access - reselectable whilst vehicle is moving	50 mm (1.9 in) below standard
Trim height	Configured using approved diagnostic equipment
Height sensors:	
Location	4 per vehicle - one sensor for each wheel
Height sensor arm colour coding:	
Left hand side, front and rear	WHITE
Right hand side, front and rear	BLACK
Height sensor operating voltages:	
Supply voltage	5 volts - supplied by air suspension ECU
Output voltage	Left hand front and right hand rear - Decreases to 0.5 volts with bump travel. Right hand front and left hand rear - Decreases to 4.5 volts with bump travel
Spring/damper modules:	
Type	Guided air spring surrounding twin tube damper
Pressures:	
Normal - Front	800 to 1000 kPa (8.0 to 10.0 bar) (116.0 to 145.0 lbf/in ²)
Normal - Rear	500 to 800 kPa (5.0 to 8.0 bar) (72.5 to 116.0 lbf/in ²)
Burst pressure	3500 kPa (35 bar) (507.5 lbf/in ²)
Maximum spring pressure - Full bump at gross vehicle weight	Approximately 2700 kPa (27 bar) (391.5 lbf/in ²)
Air compressors:	Supplied with air drier, electrically switched, pilot operated exhaust valve and double temperature sensors
Old type	Hitachi
*New type	AMK
Controlled by	Electronic Control Unit (ECU)
Maximum pressure	1680 kPa (16.8 bar) (243.6 lbf/in ²)
Air reservoir:	
Volume	9 litres (0.31 cu.ft)
Working pressure	1750 kPa (17.5 bar) (253.75 lbf/in ²)
Maximum operating pressure	2300 kPa (23 bar) (333.5 lbf/in ²)
Reservoir valve block	Incorporates pressure sensor to monitor spring and air reservoir pressures
Valve blocks:	
Front	2 corner valves, 1 cross link valve - all mounted on front bumper armature
Rear	2 corner valves, 1 cross link valve - all mounted on left hand rear spring tower

*** If an AMK air compressor is installed to replace an Hitachi air compressor then a new corresponding air compressor relay must also be installed.**

General Specifications

Item	Specification
Gap between underside of the toe link rubber boot and the chassis bracket	10.0 mm (0.393 in)

Torque Specifications

Description	Nm	lb-ft
Air suspension compressor bolts	10	7
Air suspension compressor lower cover bolts	10	7
Voss connector to the front solenoid valve block	2.5	1.7
Voss connector to the front and rear air springs	3.5	2.6
Voss connector to the rear solenoid valve block	2.5	1.7
Voss connector to the air suspension reservoir	5	4
Voss connector to the air suspension reservoir solenoid valve block	2.5	1.7
Air suspension control module bolt	10	7
Air suspension reservoir bolts	23	17
* Stabilizer bar link nuts	115	85
Toe link bolt	175	129
Toe link inner ball joint retaining nut	133	98
Toe link nut	103	76
Toe link adjustment locking nut	130	96
Lower front arm camber adjusting bolt	275	203
Lower arm rear castor adjusting bolts	275	203
Track rod end locking nuts	53	39

Rear camber adjusting bolts	133	98
Front and rear air spring/shock absorber to the suspension turret nuts	63	46
Front and rear air spring/shock absorber to the lower suspension arm nut and bolt	300	221
* Front and rear air spring/shock absorber top nut	98	72
Heat shield bolts	10	7
* + Halfshaft nut	350	258
Wheel speed sensor bolt	10	7
Brake disc dust shield bolts	10	7
Wheel hub bolts	115	85
* Lower arm ball joint retaining nut	115	85
* Tie-rod end ball joint	76	56
Suspension height sensor Torx bolts	2.2	1.5
Road wheel nuts	140	103

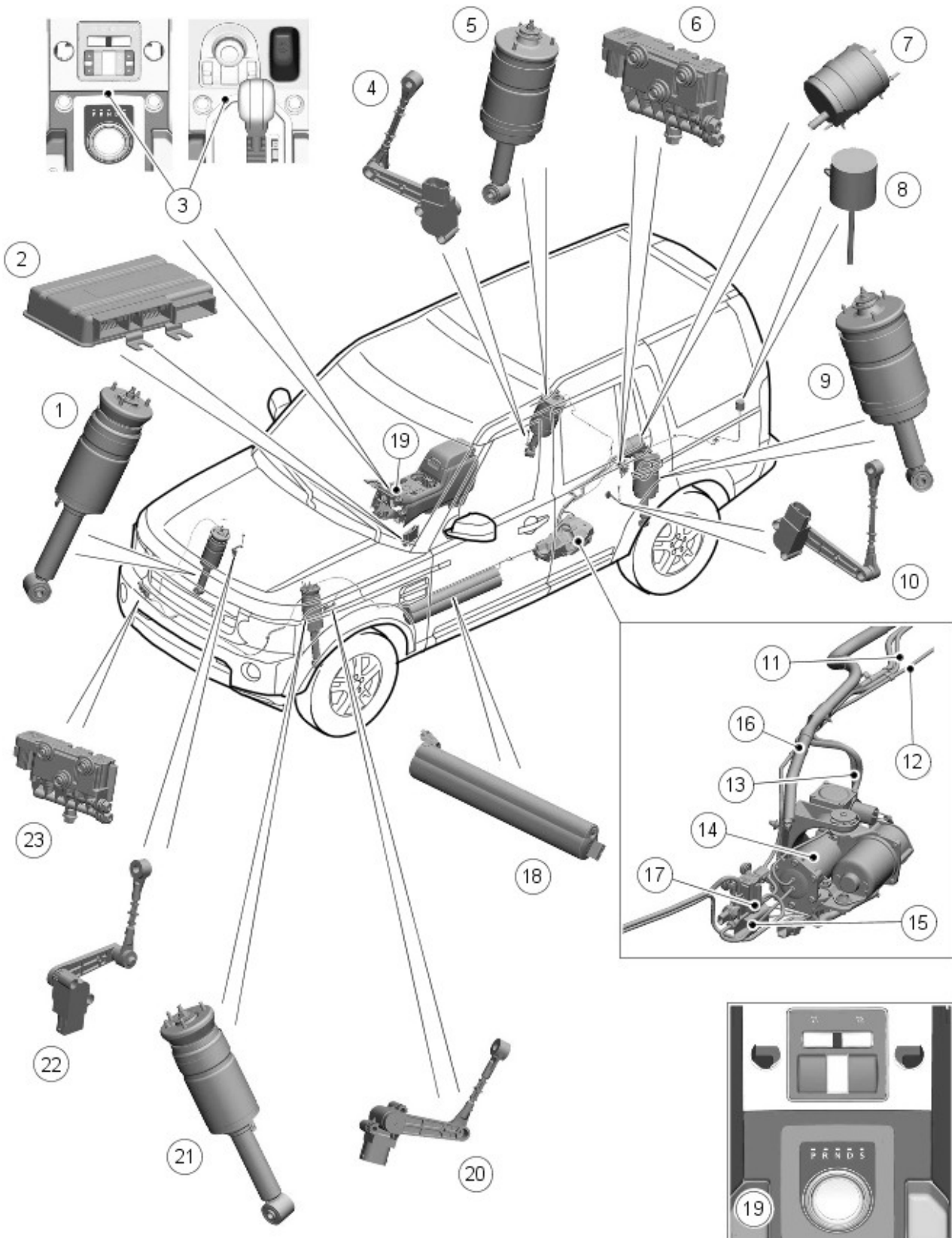
* **New nut must be installed**

+ **Stake nut on completion of tightening**

Vehicle Dynamic Suspension - Vehicle Dynamic Suspension

Description and Operation

Air Suspension - Component Location



E 150533

Item	Part Number	Description
1	-	Front right shock absorber assembly
2	-	Air suspension control module
3	-	Air suspension switchpack (air suspension vehicles only)
4	-	Rear right height sensor

5	-	Rear right shock absorber assembly
6	-	Rear axle valve block
7	-	Air supply unit silencer
8	-	Air supply unit filter
9	-	Rear left shock absorber assembly
10	-	Rear left height sensor
11	-	Pipe - Compressor inlet
12	-	Pipe - Reservoir valve block to rear axle valve block
13	-	Pipe - Compressor exhaust
14	-	Air supply unit
15	-	Pipe - Air supply unit to reservoir valve block
16	-	Pipe - exhaust
17	-	Reservoir valve block
18	-	Air reservoir
19	-	Hill Descent Control (HDC) and transfer case control switchpack
20	-	Front left height sensor
21	-	Front left shock absorber assembly
22	-	Front right height sensor
23	-	Front axle valve block

AIR SUSPENSION

General Information

The air suspension system is a four corner system which is fitted to all models.

The system is electronically controlled by an air suspension control module which controls the air supply unit, reacts to inputs from four height sensors and distributes air around the system via valve blocks.

The main air suspension system components are:

- Air suspension control module
- Air supply unit
- Four height sensors
- Three valve block assemblies
- Reservoir
- Air harness
- Two front shock absorber assemblies incorporating dampers
- Two rear shock absorber assemblies incorporating dampers
- Air suspension switch

The four corner air suspension system maintains the vehicle height under all operating conditions by controlling the mass of air in the air springs. The air suspension control module uses signals from the four height sensors to maintain the correct suspension height, irrespective of vehicle load. Additionally, the system allows the driver to request ride height changes to improve off-road performance or ease access or loading. The system automatically adjusts the ride height to improve the vehicle handling and dynamics when speed increases or decreases. This is achieved by operating pneumatic control valves to increase or decrease the mass of air in the air springs.

The air suspension system has three driver selectable, pre-determined ride heights and an automated high speed ride height. A driver interface indicates the selected ride height and height change movement. Additional information is also relayed to the driver via the Instrument Cluster (IC) message center and by audible warnings also transmitted by the IC.

Most height changes can only be made when the engine is running and the driver and passenger doors are closed.

The air suspension can be controlled manually by the driver using a switch on the floor console to select the required height change.

The system will temporarily inhibit height adjustments when the vehicle is subject to cornering, heavy acceleration or heavy braking. The inhibit function prevents unsettling of the vehicle.

Height changes are also restricted for safety reasons, when a door is opened and the vehicle is stationary for example.

The air suspension system is controlled by the air suspension control module which is located on the driver side 'A' pillar. The control module monitors the height of each corner of the vehicle via four height sensors, which are mounted in-board of each road wheel. The control module also performs an 'on-board diagnostic' function to perform 'health checks' on the system. If faults are detected, codes are stored in the control module and can be retrieved using the Land Rover approved diagnostic system.

Ride Height Tolerance Control

The air suspension control module has two ride height tolerance bands; normal tolerance and tight tolerance.

The control module considers the vehicle to be at target height if the current height is within the appropriate tolerance band. Height adjustments are not made until the vehicle height falls outside of the tolerance band for a pre-determined time. The time period is different depending on if the vehicle is moving or stationary. The tolerance bands are as follows:

- Normal \pm 10 mm
- Tight \pm 3 mm.

The tight tolerance band is only used if set by the Land Rover approved diagnostic system for diagnostic purposes or when the vehicle has been stationary for more than 5 minutes.

OPERATING MODES

The driver can manually select, using the air suspension switch, one of four ride states:

- ON-ROAD - this height is the normal operating height of the vehicle
- OFF-ROAD - this height is higher than the on-road height and provides improved ground clearance, approach, departure and breakover angles
- ACCESS - this height is lower than the on-road height and makes entering and exiting the vehicle easier for the occupants
- CRAWL (Locked at access) - this mode allows the vehicle to be driven at the access height at low speeds to provide increased roof clearance in low car parks etc.

HIGH SPEED - A non-selectable, automatic high speed mode is provided which lowers the vehicle height to improve vehicle handling.



NOTE: Vehicle height changes are restricted if the air suspension control module receives a 'Door Open' signal and the speed is less than 5 mph (8 km/h).

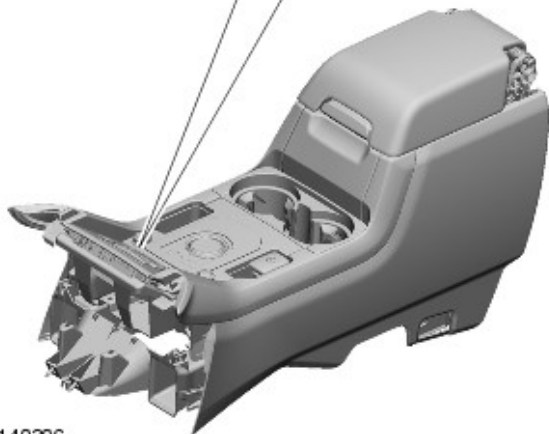
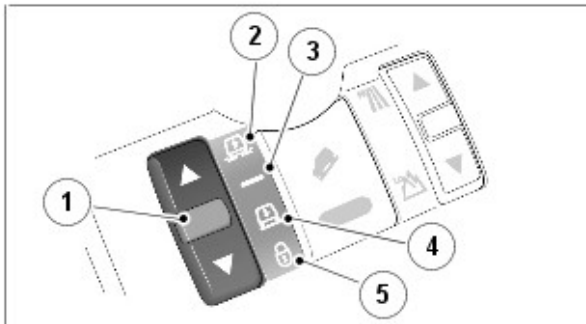
A complete vehicle delivery mode is available but is only selectable using the Land Rover approved diagnostic system. When this mode is active most vehicle systems, in addition to the air suspension, are inhibited or restricted to a minimal functionality. In this mode the air suspension is set to the Transit Mode.

If the air suspension control module senses that the vehicle has grounded and lost traction, the control module can temporarily increase and/or redistribute the volume of air supplied to the affected air spring(s) to maximize the available traction. This is known as extended mode and will be indicated to the driver by the lamps on the air suspension switch flashing and an 'EXTENDED MODE' message being displayed in the IC.

If a fault is detected by the air suspension control module, the control module will reduce the system functionality dependent on the type and severity of the fault. The control module will also store a fault code which can be retrieved using the Land Rover approved diagnostic system. If a severe fault occurs, the control module will attempt to put the vehicle in a safe condition. A fault is relayed to the driver by the IC message center and an audible warning emitted from the IC.

All information messages will be displayed for four seconds.

Air Suspension Switch Pack



E140306

Item	Part Number	Description
1	-	Raise/lower switch
2	-	Off-Road Mode
3	-	On-Road Mode

- 4 - Access Mode
- 5 - Crawl mode

The air suspension switchpack is located in the floor console, behind the transmission selector. The switch is a three position, non-latching switch which allows selection of the following driver selectable modes:

- Off-road mode
- On-road mode
- Access mode
- Crawl mode.

The air suspension switch can be rocked from its central position. The switch is non-latching and returns to the central position when released. The switch completes an earth path to the air suspension control module when operated. This earth path is completed on separate wires for the raise and lower switch positions, allowing the control module to determine which selection the driver has made.

The switch has six symbols which illuminate to show the current selected height and the direction of movement. The raise and lower symbols will flash and a warning tone will be emitted from the IC sounder when a requested height change is not allowed, i.e. vehicle speed too fast.

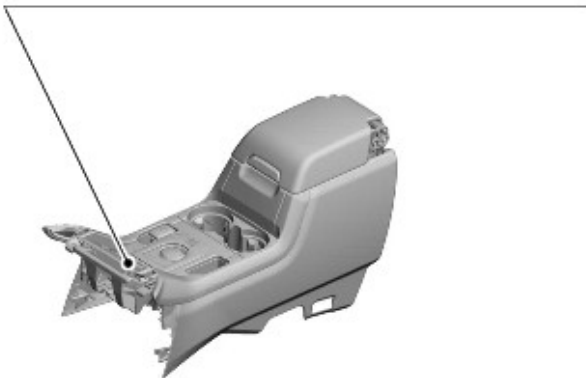
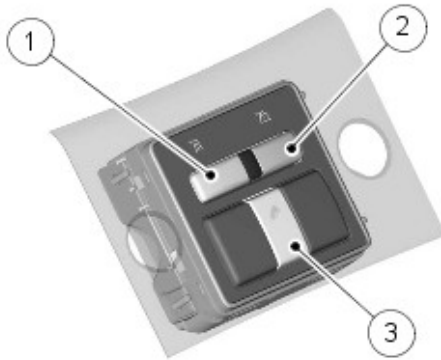
A flashing symbol indicates that the air suspension system is in a waiting state or that the system will override the driver selection because the speed threshold is too high.

The driver can also ignore the system's warnings signals and allow the height to change automatically. For example, increasing the vehicle speed to more than 25 mph (40 km/h) when locked to access height will cause the control module to automatically change the ride height from access mode to on-road mode.

Hill Descent Control and Transfer Case Control Switchpack



NOTE: Coil spring vehicles only.



E150641

Item	Part Number	Description
1	-	Hi range switch
2	-	Low range switch
3	-	HDC switch

On-Road Mode

This is the normal ride height for the vehicle.

Off-Road Mode

Off-road mode will only be selectable if the vehicle speed is less than 25 mph (40 km/h). The vehicle will be raised 55mm (2.2 inches) to provide additional body clearance and improved approach, departure and breakover angles. If the vehicle speed exceeds 31 mph (50 km/h), the air suspension control module will automatically lower the vehicle to the on-road mode height. At 25 to 28 mph (40 to 45 km/h) a message is displayed in the message center to warn the driver to slow down or the vehicle will lower.

Access Mode

Access mode lowers the vehicle body height and provides easier entry, exit and loading of the vehicle.

Access mode can be selected at any vehicle speed. When access mode is selected, the response of the air suspension system will depend on the vehicle speed:

- If the vehicle speed is more than 12.5 mph (20 km/h), the air suspension control module will wait for up to one minute for the vehicle speed to be reduced. The access mode light emitting diode (LED) and the lowering LED will flash while the air suspension control module waits for the vehicle speed to be reduced, the on-road mode lamp will remain illuminated. If the vehicle speed is not reduced sufficiently, the access mode request will be cancelled after 1 minute.
- If the vehicle speed is less than 12.5 mph (20 km/h), the air suspension control module will lower the suspension to a part lowered height and will remain at this height for up to one minute. The on-road mode lamp will extinguish as the air suspension control module lowers the suspension to the part lowered height. The access mode lamp and the lowering LED will illuminate. When part lowered is reached, the lowering LED will flash. If the vehicle speed is not reduced to less than 5 mph (8 km/h) in the one minute period, the access mode request will be cancelled.
- If the vehicle speed is less than 5 mph (8 km/h), the suspension will be lowered to access mode immediately. The access mode LED and the lowering LED will illuminate. When the access mode height is reached, the lowering LED will be extinguished.

Access height may be selected up to 40 seconds after the ignition is turned off, provided that the driver door has not been opened within this time.

The suspension will automatically rise from access mode when the vehicle speed exceeds 6.2 mph (10 km/h). If access mode was selected directly from off-road mode then the system will return to off-road mode when the vehicle speed exceeds 6.2 mph (10 km/h). Otherwise the system will lift the suspension to On-road height.

Selecting Access Mode Directly from Off-Road Mode

When the suspension is in off-road mode height, pressing the 'Access' height change switch once, or pressing the lowering switch twice before the lowering LED is extinguished, the control module will lower the suspension to access mode height. The control module will remember to return the suspension to off-road height automatically if the vehicle speed increases above 6.2 mph (10 km/h).

Crawl mode

Crawl mode allows the vehicle to be driven at low speeds with the suspension locked at the access mode height. This allows the vehicle to be driven in low car parks etc. with increased roof clearance.

Crawl mode can be selected up to 21.7 mph (35 km/h) with a long press of the switch in a down direction. The access mode lamp and the crawl mode lamp will be illuminated. When the control module is in crawl mode, on-road mode height will be selected automatically if the vehicle speed exceeds 24.8 mph (40 km/h). At 18.6 to 21.7 mph (30 to 35 km/h) a message is displayed in the message center to warn the driver to slow down or the vehicle will rise. Crawl mode can also be manually cancelled by moving the switch in the up direction for 1 second. The crawl mode lamp will now be extinguished.

High Speed Mode

High speed mode is a non-selectable, automatic mode which lowers the vehicle height to improve vehicle handling. This feature is fully automated and is 'invisible' to the driver.

If the vehicle speed exceeds 100 mph (160 km/h) for more than five seconds, the air suspension control module initiates the high speed mode. When the vehicle speed reduces to less than 80 mph (130 km/h) for more than 30 seconds, the vehicle returns to the On-Road height. This function is cancelled if a trailer is connected to the trailer socket.

Automatic Height Change Warnings

When the suspension is in off-road mode, access mode or crawl mode height, the air suspension control module will change the suspension height automatically when the vehicle speed exceeds a predetermined threshold.

When the suspension is at off-road mode or crawl mode height, the control module issues a warning to advise the driver that the vehicle is approaching the speed threshold. The IC sounder will emit a chime, a message will be displayed in the message center and the on-road mode LED and either the raising or lowering LED will flash.

The off-road mode or crawl mode height speed warning is removed when the vehicle speed is reduced.

SPECIAL MODES

Door Open Inhibit Mode

If one or more of the vehicle doors are opened during a height change when the vehicle is stationary, the air suspension control module will restrict further height change.

The LED on the air suspension LED display for the target mode height will remain illuminated and the raising or lowering LED will flash.

If all of the doors are closed within 90 seconds, the height change will resume. If the 90 second period is exceeded, the message 'CONFIRM REQUIRED SUSPENSION HEIGHT' will be displayed in the IC.

Extended Modes

Raise Inhibit Mode Raise inhibit mode is a reactive mode invoked when the following conditions are satisfied, vehicle speed below 10kph and vehicle raising very slowly. Raise inhibit mode is normally invoked when vehicle is

lifting against an obstacle, it can also be used when the vehicle is winching or is tethered down.

Jacking Mode Jacking mode is a reactive mode invoked when the following conditions are satisfied, vehicle stationary, system attempts to level the vehicle down and rate of vehicle lowering is below a predefined threshold for a predefined time. Jacking mode is normally invoked under the following conditions, vehicle jacking mode or vehicle grounded and stationary

Lower Inhibit Mode Lower inhibit mode is a reactive mode invoked when the following conditions are satisfied, vehicle stationary, rate of vehicle lowering is below a predefined threshold for a predefined time. Lower inhibit mode is normally invoked under the following conditions, vehicle lowered onto an obstacle during a height change.

Extended Mode Extended mode is a pro-active mode invoked when the following conditions are satisfied, vehicle moving and speed is below 50kph, traction activity is induced on axle pairs for fixed period of time and wheel heights above a predetermined threshold on coinciding axle pairs for the same fixed period of time. Extended mode is normally invoked under the following condition, vehicle is attempting to move and with low levels of traction and supported by an obstacle.

If the vehicle becomes grounded and the traction control becomes operational, the air suspension control module automatically increases the mass of air in the air springs to raise the vehicle clear of the obstruction. Extended mode is activated automatically and cannot be selected manually.

When the air suspension control module has activated the extended mode, the off-road mode lamp will flash if the suspension is above off-road mode height. The off-road mode and on-road mode lamps will flash if the suspension is between off-road mode and on-road mode heights. The on-road mode and access mode lamps will flash if the suspension is between on-road mode and access mode. A message will also be displayed in the message center.

To exit the extended mode, press the air suspension switch briefly in the up or down position or alternatively drive the vehicle at a speed of more than 2 mph (3 km/h) for 45 seconds.

Additional Lift in Extended Mode

When extended mode has been invoked and the automatic lifting of the vehicle is complete, the driver can request an additional lift of the vehicle. This can be particularly useful when extended mode has been activated on soft surfaces.

The additional lift can be requested once the height change LED has extinguished. Press and hold the air suspension switch in the up position for 3 seconds whilst simultaneously depressing the brake pedal. A chime from the IC will sound to confirm that the request has been accepted. The raising LED will be illuminated while the vehicle is being lifted.

Periodic Leveling Mode

When the vehicle is parked, the air suspension control module 'wakes up' two hours after the ignition was last switched off and then once every twenty four hours. The vehicle height is checked and if the vehicle is not level within a pre-set tolerance, small downwards height adjustments may be made automatically.

Transit Mode

Transit mode is a factory set mode which locks the suspension to enable the vehicle to be safely lashed to a transporter. The suspension transit mode is automatically set when the vehicle is configured for delivery mode using the Land Rover approved diagnostic system. Delivery mode also affects other vehicle systems which are inhibited or restricted to a minimal functionality.

When the ignition switch is switched off, the vehicle will be lowered to access mode. This ensures that the securing straps do not become loose should air leak from the air springs.

When transit mode is active, the air suspension switches are disabled. Periodic re-leveling is also disabled.

When the engine is started, the air suspension control module will cause the vehicle to rise allowing sufficient ground clearance for the vehicle to be loaded. While the height is changing, all the LED's in the air suspension switchpack will flash and a chime will be emitted by the IC. When the sufficient height reached, all the LED's will illuminate continuously and the chime will stop.

When the engine is switched off, the air suspension control module will cause the vehicle to lower allowing the vehicle to be strapped down. While the height is changing, all the LED's in the air suspension switchpack will flash. When the height of -50mm is reached, all the LED's will illuminate continuously.

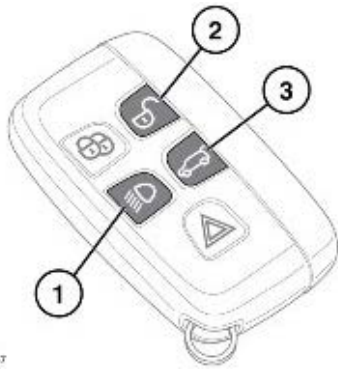
Calibration Mode

This mode is used when the air suspension control module has been replaced or a height sensor or suspension component has been dismantled or replaced.

The following conditions apply when the vehicle is in calibration mode:

- The ride height is set to tight tolerance
- Fault reaction to vehicle identification number (VIN) mis-match with the Car Configuration File (CCF) is disabled
- The raise, lower, access and hold switches are disabled
- Message "Air suspension not in customer mode" is displayed in the instrument pack.

Remote Operation



E124947

Item	Part Number	Description
1	-	Hold
2	-	Raise vehicle
3	-	Lower vehicle

The switches on the smart key may be used to operate the air suspension system, allowing the vehicle to be raised or lowered remotely. This may be useful in attaching a trailer or loading the vehicle.

To change the suspension height using the smart key, the vehicle must be stationary, all the doors closed and the hazard warning lamps switched on.

To raise the vehicle suspension switches 1 and 2 to are to be press simultaneously.

To lower the vehicle suspension switches 1 and 3 to are to be press simultaneously

Air Harness

The air harness comprises ten separate nylon pipes which are connected between the system components with Voss connectors. The pipes have the following diameters:

Pipe	Diameter
High pressure pipes	6 mm
Compressor inlet pipe	8 mm
Inlet filter to silencer	8 mm
Compressor exhaust pipe	10 mm
Silencer exhaust pipe	19 mm

If a pipe becomes damaged, an in-line connector is available for repair purposes. The pipes are secured to the body and chassis with a number of plastic clips.

LEAK DETECTION

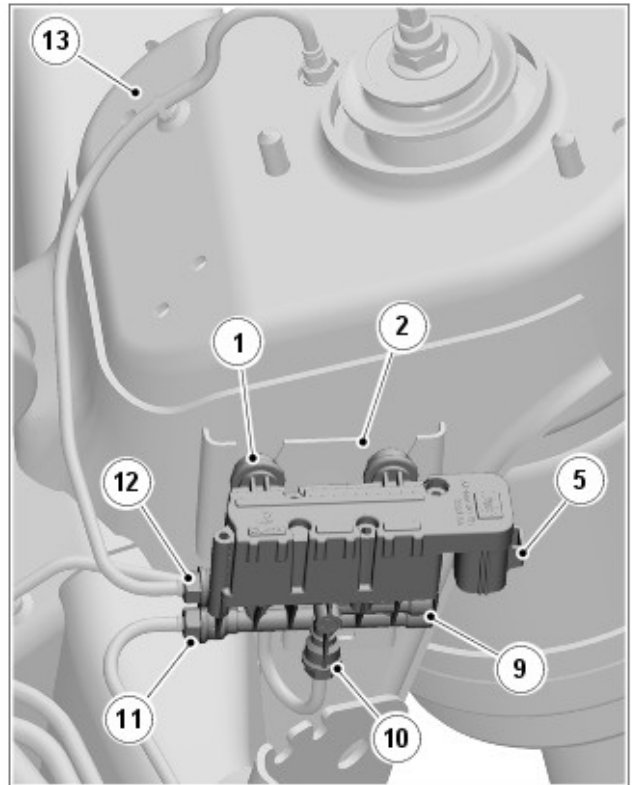
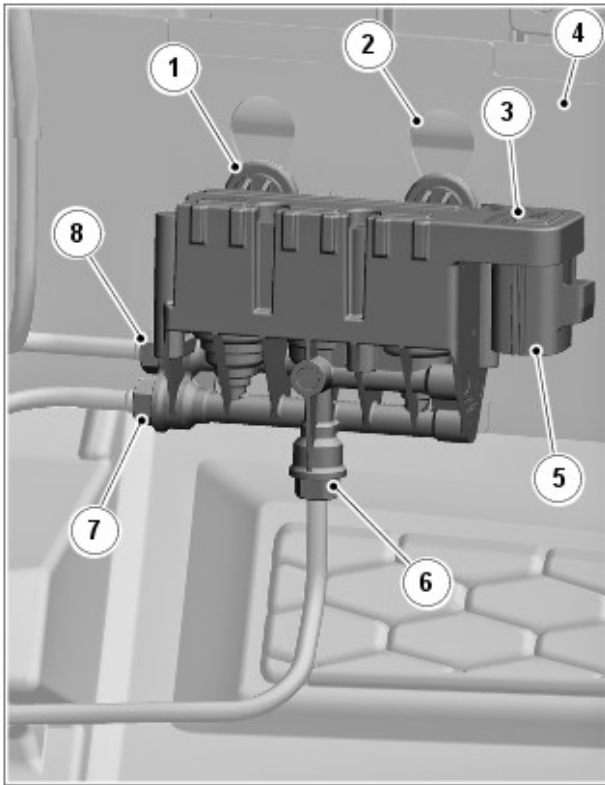
Leak detection can be carried out using a Land Rover approved leak detection spray.

If the vehicle appears to be leaking, perform a leak check on all aspects of the system, i.e.; air spring hose fittings and the associated connections on the valve blocks, air springs and reservoir. Failure to correctly diagnose leakage will result in unnecessary exchange of serviceable components and recurrence of original problem.

AIR SUSPENSION COMPONENTS

Valve Blocks

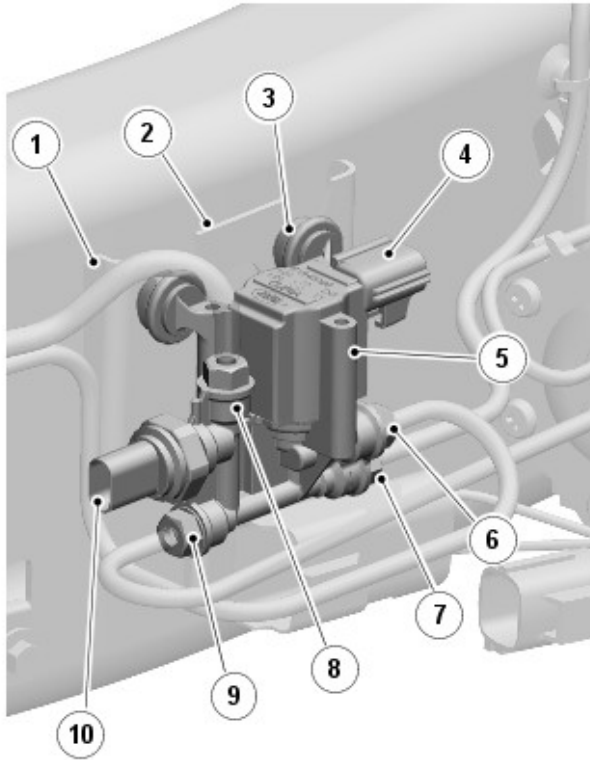
Front and Rear Valve Blocks



E140308

Item	Part Number	Description
1	-	Isolation rubber mounts (3 off)
2	-	Location slots
3	-	Front valve block, valves and solenoid assembly
4	-	Front bumper armature
5	-	Electrical connector
6	-	Left shock absorber assembly air harness connection
7	-	Air inlet/outlet connection
8	-	Right shock absorber assembly air harness connection
9	-	Rear valve block, valves and solenoid assembly
10	-	Right shock absorber assembly air harness connection
11	-	Air inlet/outlet connection
12	-	Left shock absorber assembly air harness connection
13	-	Rear suspension turret

Reservoir Valve Block



E140309

Item	Part Number	Description
1	-	Chassis mounting bracket
2	-	Location slot
3	-	Isolation rubber mounts (3 off)
4	-	Electrical connector
5	-	Reservoir valve block, valves and solenoid assembly
6	-	Reservoir connection
7	-	Rear valve block connection
8	-	Front valve block connection
9	-	Air supply unit connection
10	-	Pressure sensor

Front and Rear Valve Blocks

The front and rear axle valve blocks are similar in their design and construction and control the air supply and distribution to the front or rear pairs of shock absorber assemblies respectively. The difference between the two valves is the connections from the valve block to the left and right hand shock absorber assemblies and the valve size. It is important that the correct valve block is fitted to the correct axle. Fitting the incorrect valve block will not stop the air suspension system from functioning but will result in slow raise and lower times and uneven raising and lowering between the front and rear axles.

The front valve block is attached to the right end of the front bumper armature assembly. The valve block has three attachment lugs which are fitted with isolation rubber mounts. The rubber mounts locate in slots in the armature. The valve lugs locate in the holes above the slots and are pushed downwards into positive location in the slots.

The rear valve block is located on the forward face of the left hand rear suspension turret. The valve block has three attachment lugs which are fitted with isolation rubber mounts which locate in a bracket with three slotted holes. The bracket is attached to the left hand side of the chassis. The isolation rubber mounts locate in the 'V' shaped slots and are pushed downwards into positive location in the slots.

The front and rear valve blocks each have three air pipe connections which use 'Voss' type air fittings. One connection is an air pressure inlet/outlet from the reservoir valve block. The remaining two connections provide the pressure connections to the left and right hand air springs.

Each valve block contains three solenoid operated valves; two corner valves and one cross-link valve. Each of the valve solenoids is individually controlled by the air suspension control module. The solenoids have a resistance value of 2 Ohms at a temperature of 20°C (68°F).

Reservoir Valve Block

The reservoir valve block is attached to a bracket on the outside of the left hand chassis rail, between the reservoir and the air supply unit. The valve block is located within the air supply unit air supply housing to protect it from dirt ingress and damage from stones. The valve block has three attachment lugs which are fitted with isolation rubber mounts. The rubber mounts locate in the chassis bracket which has three corresponding 'V' shaped slots. The rubber mounts are pushed downwards into positive location in the slots.

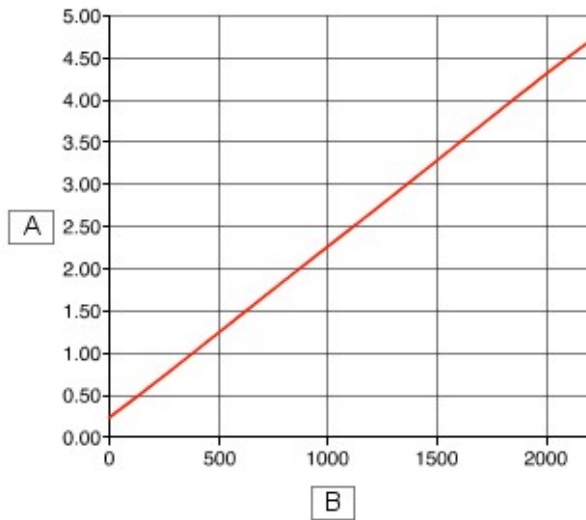
The reservoir valve block controls the storage and distribution of air from the reservoir. The reservoir valve block also contains the system's pressure sensor.

The valve block has four air pipe connections which use 'Voss' type air fittings. The connections provide for air supply from the air supply unit, air supply to and from the reservoir and air supply to and from the front and rear valve blocks. The connections from the air supply unit and the front and rear control valves are all connected via a common gallery within the valve and therefore are all subject to the same air pressures.

The valve block contains a solenoid operated valve which is controlled by the air suspension control module. The solenoid valve controls the pressure supply to and from the reservoir. The solenoid has a resistance value of 2 Ohms at a temperature of 20°C (68°F). When energized, the valve spool moves allowing air to pass to or from the reservoir.

The valve block also contains a pressure sensor which can be used to measure the system air pressure in the air springs and the reservoir. The pressure sensor is connected via a harness connector to the air suspension control module. The control module provides a 5V reference voltage to the pressure sensor and monitors the return signal voltage from the sensor.

Using this sensor, the control module controls the air supply unit operation and therefore limits the nominal system operating pressure to 244 lbf/in² (16.8 bar gage).

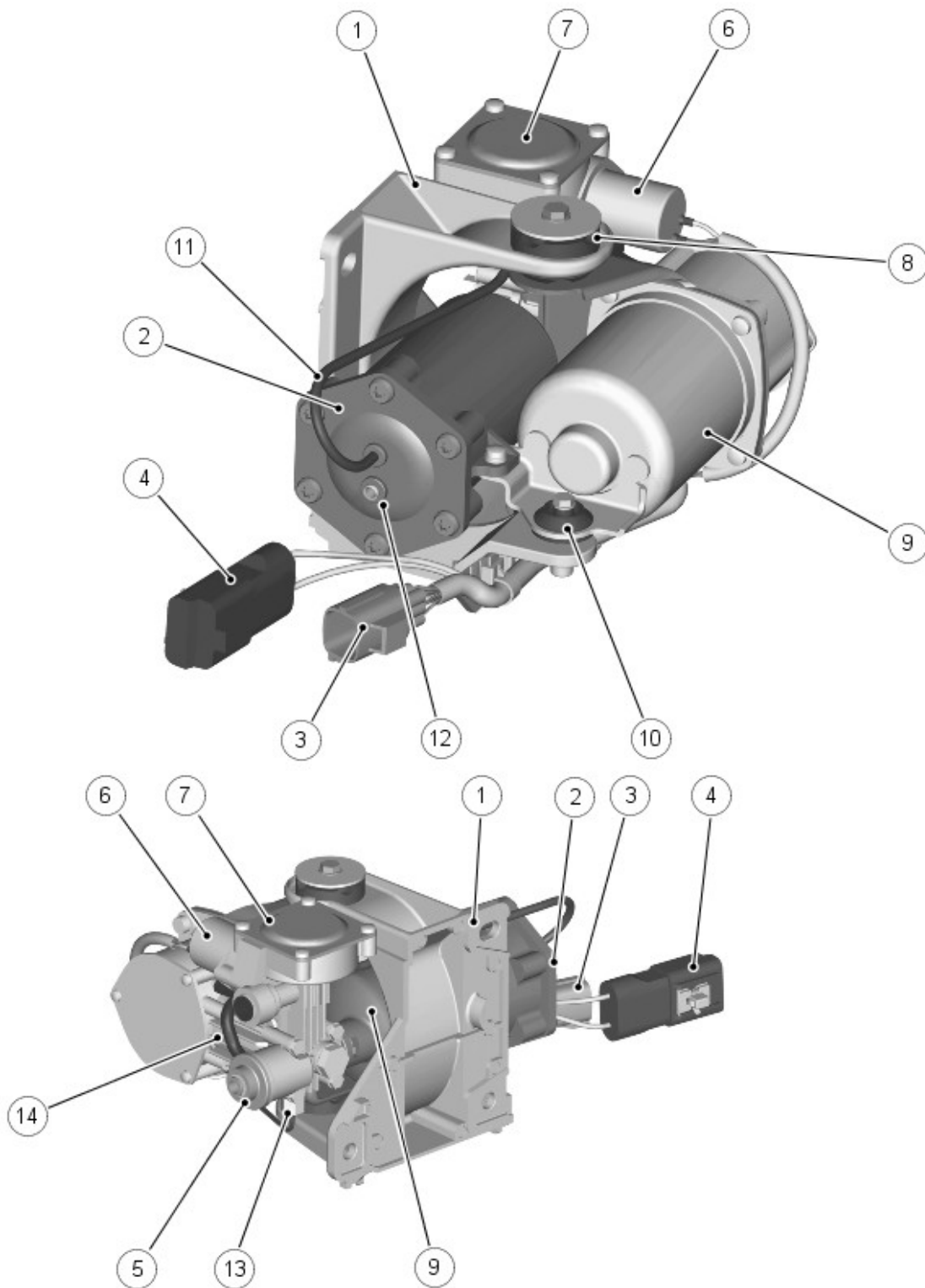


E61677

Item	Part Number	Description
A	-	Output voltage (V)
B	-	Pressure (kPa)

Removal of the reservoir valve block will require full depressurization of the reservoir. The valve block is a non-serviceable item and should not be disassembled other than for replacement of the pressure sensor.

Air Supply Unit



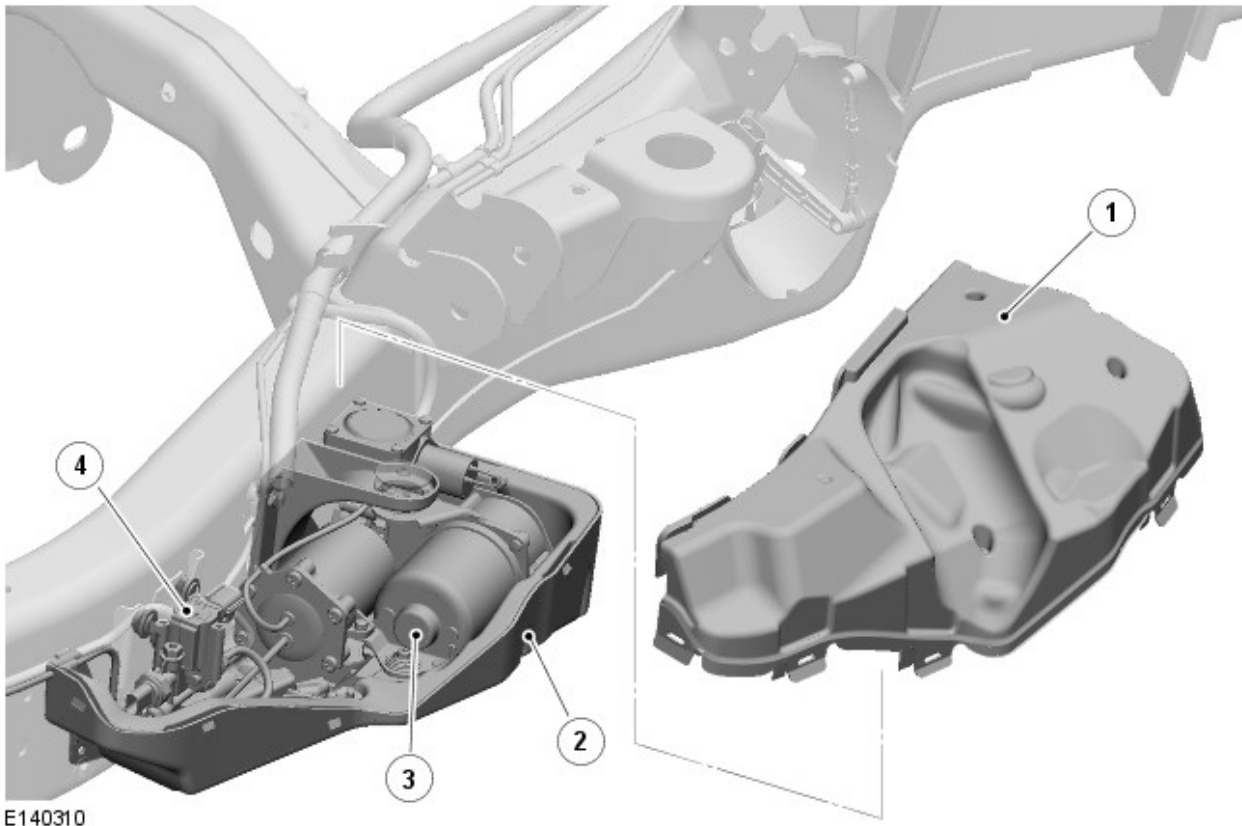
E45180

Item	Part Number	Description
1	-	Mounting bracket
2	-	Air dryer
3	-	Pilot exhaust valve solenoid and temperature sensors harness connector
4	-	Motor harness connector
5	-	Intake port
6	-	Pilot exhaust valve
7	-	Exhaust valve
8	-	Isolation mounting rubber (2 off)
9	-	Electric motor
10	-	Isolation mounting rubber (1 off)
11	-	Pilot air pipe

- 12 - High pressure supply to the air suspension system
- 13 - Compressor cylinder head temperature sensor
- 14 - Compressor

The air supply unit is located on the outside of the left hand chassis rail, forward of the upper control arm. The unit is attached to the chassis rail with three bolts and is protected by an air supply housing.

Air Supply Housing



Item	Part Number	Description
1	-	Upper cover
2	-	Lower cover
3	-	Air supply unit
4	-	Reservoir valve block

The air supply housing, which comprises of two parts; upper and lower, surrounds the air supply unit. The air supply housing is a plastic molding which is lined with an insulating foam which controls the operating noise of the air supply unit. The reservoir valve block is also located in the air supply housing, forward of the air supply unit.

The air supply unit comprises the following major components:

- A piston compressor
- A 12V electric motor
- A solenoid operated pilot valve
- An exhaust valve
- An air dryer unit

The air supply unit supplies dry, compressed air into the air suspension system where it is directed into the air springs or the reservoir by solenoid operated valves. Air can be exhausted from the system when required by the opening of an air spring or reservoir valve in addition to the exhaust valve which is part of the air supply unit.

The compressor operates to pressurize either the reservoir or to inflate one or more of the air springs. Height changes of less than 20 mm are achieved using the compressor alone. Height changes of more than 20 mm are achieved using the reservoir and the compressor. The compressor cannot operate without the engine running, with the following exceptions:

- During remote operation to raise the vehicle to allow for the attachment of a trailer
- When under control of a Land Rover approved diagnostic system.

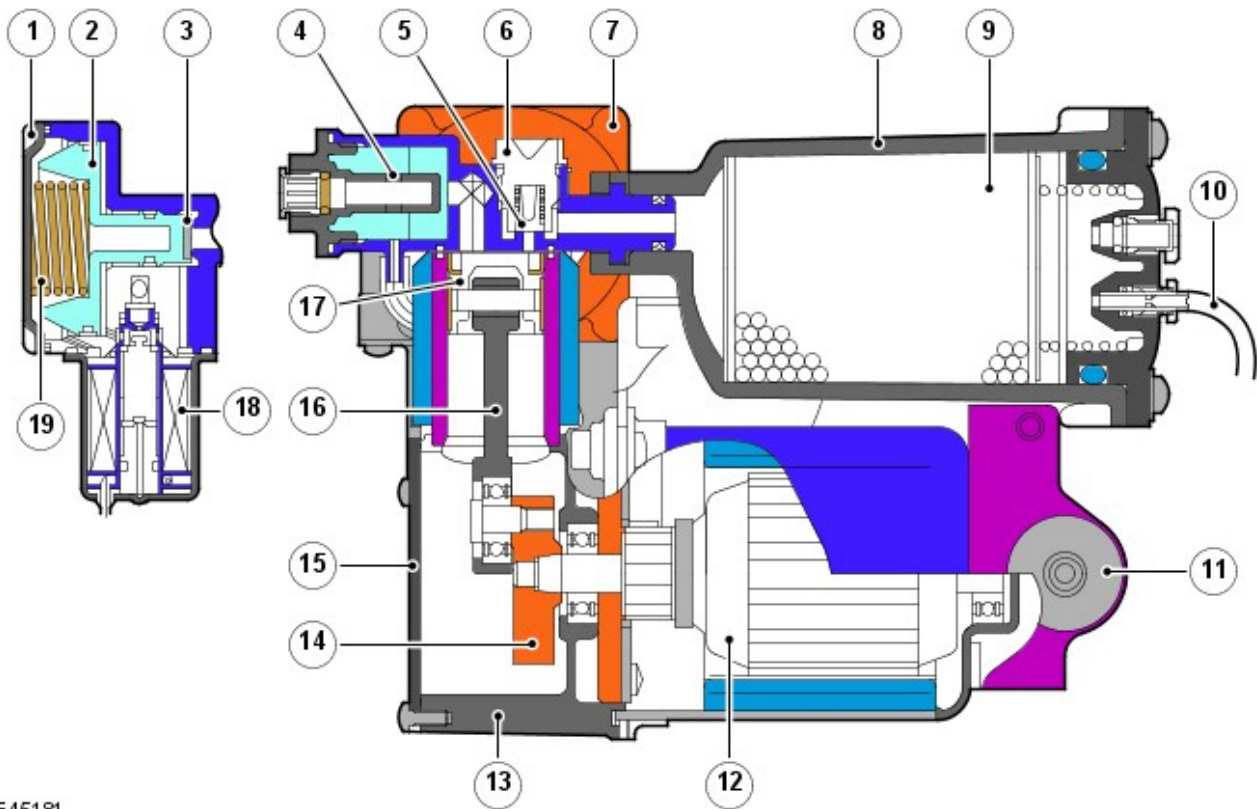
The air supply unit can be serviced in the event of component failure, but is limited to the following components; air dryer, pilot exhaust pipe and the rubber mounts.

The air supply unit is attached to a bracket which is bolted to the chassis. The unit is mounted to the bracket with flexible isolation mounting rubbers which assist with preventing operating noise being transmitted to the chassis.

Removal of the air supply unit does not require the whole air suspension system to be depressurized. The front and rear valve blocks and the reservoir valve block are normally closed when de-energized, preventing air pressure in the air springs and the reservoir escaping when the unit is disconnected.

There are a number of conditions that will inhibit operation of the air supply unit. It is vitally important that these system inhibits are not confused with a system malfunction. A full list of air supply unit inhibits are given in the compressor section of this document.

Air Supply Unit - Sectional View



E45181

Item	Part Number	Description
1	-	Exhaust valve cap
2	-	Plunger
3	-	Valve seat
4	-	Intake silencer port
5	-	Delivery valve
6	-	Valve guide
7	-	Cylinder head
8	-	Dryer case
9	-	Desiccant
10	-	Pilot exhaust line
11	-	Isolation rubber mount
12	-	Motor assembly
13	-	Crankcase
14	-	Crank
15	-	Crankcase cover
16	-	Connecting rod
17	-	Piston
18	-	Pilot exhaust valve
19	-	Spring - pressure relief

Electric Motor

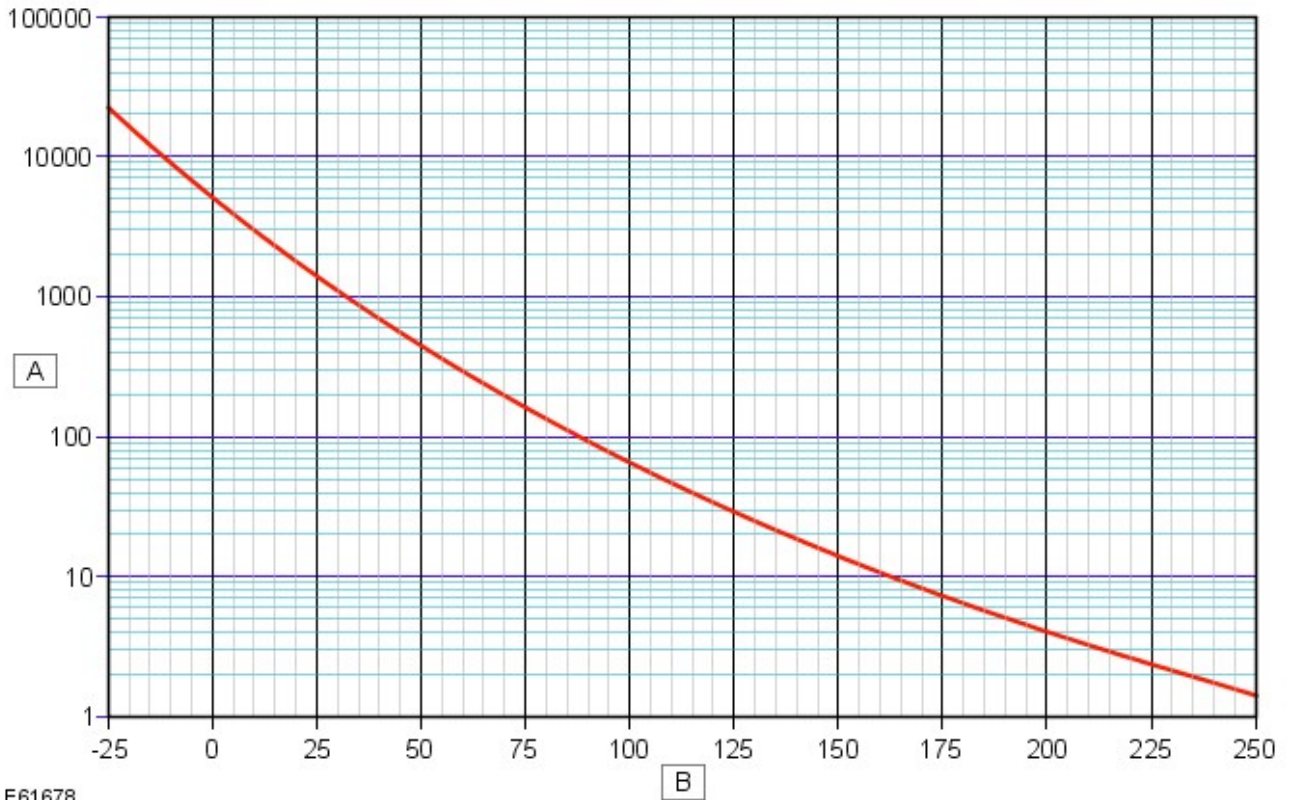
The electric motor is a 12V DC (direct current) motor with a nominal operating voltage of 13.5V. The motor drives a crank which has an eccentric pin to which the compressor connecting rod is attached.

The motor is fitted with a temperature sensor on the brush Printed Circuit Board (PCB) assembly. The sensor is connected to the air suspension control module which monitors the motor temperature and can suspend motor operation if the operating thresholds are exceeded.

The following graph shows motor temperature sensor resistance values against given temperatures.



NOTE: This graph is also applicable for the compressor cylinder head temperature sensor.



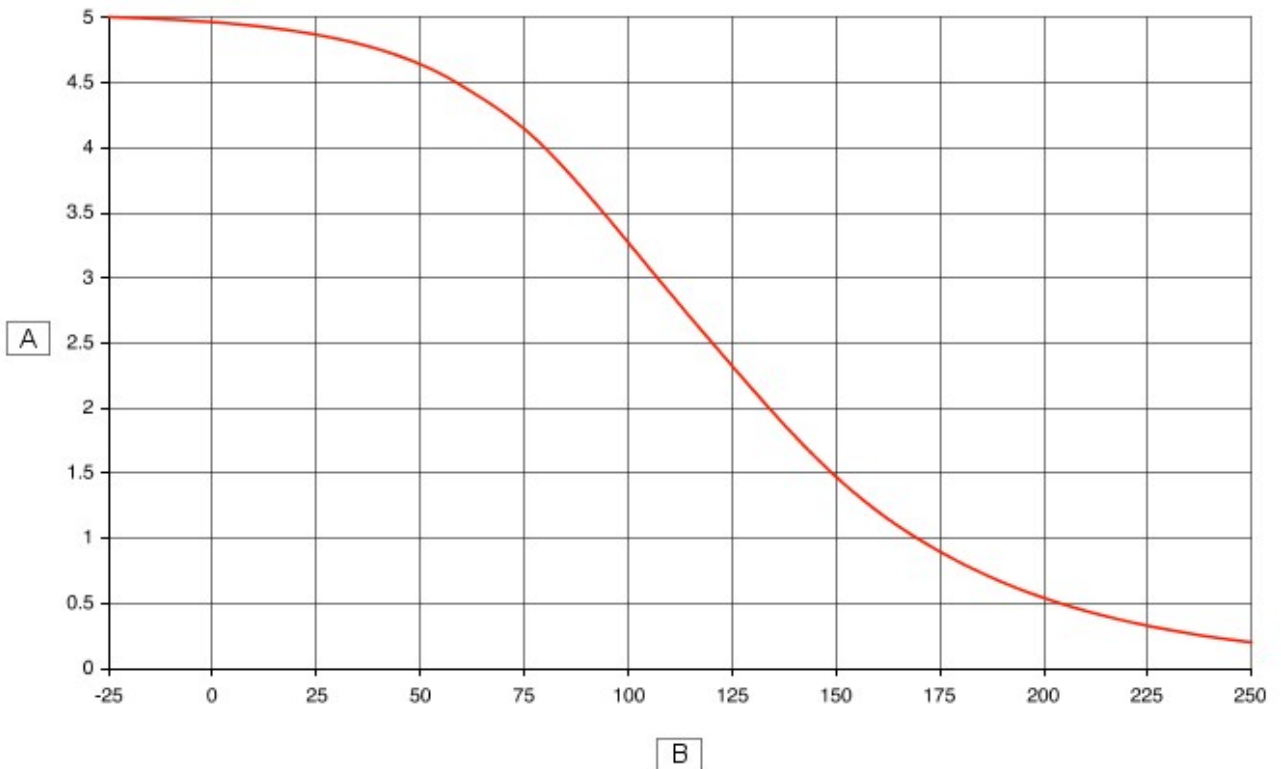
E61678

Item	Part Number	Description
A	-	Resistance (kOhms)
B	-	Temperature (°C)

The following graph shows air suspension control module output voltages against motor temperature sensor temperatures.



NOTE: This graph is also applicable for the compressor cylinder head temperature sensor.



E61679

Item	Part Number	Description
A	-	Control module input voltage (V)

B - Temperature sensor (°C)

Compressor

The compressor is used to supply air pressure to the air suspension reservoir. The air suspension control module monitors the pressure within the reservoir and, when the engine is running, maintains a pressure of 16.8 bar gage (244 lbf/in²).

The compressor comprises a motor driven connecting rod and piston which operate in a cylinder with a separate cylinder head. The motor rotates the crank moving the piston up and down in the cylinder bore. The air in the cylinder is compressed with the up stroke and is passed via the delivery valve through the air dryer and into the system.

The cylinder head is fitted with a temperature sensor. The sensor is connected to the air suspension control module which monitors the cylinder temperature and can suspend motor and compressor operation if an overheat condition occurs.

The compressor will not be allowed to start if the pressure sensor reads greater than 4 bar (absolute).

The following table shows the control module operating parameters for the differing air supply unit functions and the allowed compressor cylinder head operating temperatures.

Compressor Cylinder Head Operating Temperatures

	Leveling	Reservoir Filling
OFF	140°C (284°F)	130°C (266°C)
ON	120°C (248°F)	110°C (230°F)

Refer to the motor temperature sensor graph for compressor cylinder head temperature sensor resistance values and the air suspension control module output voltage / temperature sensor graph.

Air Dryer

Attached to the compressor is the air dryer which contains a Desiccant for removing moisture from the compressed air. Pressurized air is passed through the air dryer which removes any moisture in the compressed air before it is passed into the reservoir and/or the system.

When the air springs are deflated, the exhaust air also passes through the air dryer, removing the moisture from the unit and regenerating the Desiccant.

The air dryer is an essential component in the system ensuring that only dry air is present in the system. If moist air is present, freezing can occur resulting in poor system operation or component malfunction or failure.

Pilot Exhaust Valve

Attached to the cylinder head is a solenoid operated exhaust pilot valve. This valve is opened when the air springs are to be deflated or when the system pressure needs to be reduced.

The pilot exhaust valve is connected to the air delivery gallery, downstream of the air dryer. The pilot valve, when opened, operates the compressor exhaust valve allowing the air springs to be deflated.

When the solenoid is energized, pilot air moves the exhaust valve plunger, allowing pressurized air from the air springs and/or the reservoir to pass through the air dryer to atmosphere.

Exhaust Valve

The exhaust valve operates when the pilot exhaust valve is opened, allowing air returning from the air springs and/or the reservoir to be exhausted quickly.

The pilot exhaust valve also provides the system pressure relief function which protects the air springs from over inflation. The valve is pneumatically operated, responding to air pressure applied to it to overcome pressure from its internal spring. The valve is connected into the main pressure gallery which is always subject to the system pressure available in either the air springs or the reservoir. The valve is controlled by a spring which restricts the maximum operating pressure to between 22 to 27 bar gage (319 to 391 lbf/in²).

The minimum pressure in the system is also controlled by the exhaust valve to ensure that, even when deflated, the air springs contain a positive pressure with respect to atmosphere. This protects the air spring by ensuring it can still 'roll' over the piston without creasing.

Air Supply Unit Specifications

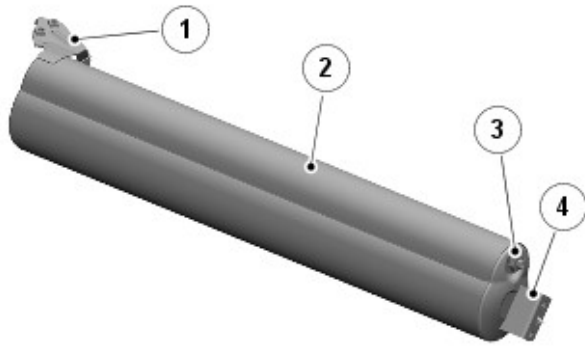
Description	Value
Working pressure	16.8 bar gage
Maximum pressure (stabilized)	22.0 to 27.0 bar gage
Operating voltage	10 to 16.5 Volts (13.5 Volts nominal)
Running current consumption	20-50 Amps depending on load
Maximum start-up current	120 Amps
Pilot Exhaust Valve - Solenoid valve resistance at 20°C (68°F)	4 Ohms ± 10%



NOTE: Resistance values will vary with coil temperature. Resistance of test leads must be measured before any readings are taken. Resistance value of the test leads must be subtracted from final solenoid resistance value.

There are a number of conditions that will inhibit operation of the air suspension compressor. It is vitally important that these inhibits are not confused with a system malfunction. A full list of compressor inhibits is contained in the compressor section of this document.

Reservoir



E140311

Item	Part Number	Description
1	-	Front bracket
2	-	Reservoir
3	-	Air hose connection to reservoir valve block
4	-	Rear bracket

The reservoir is an air storage vessel which provides fast air suspension lift times by the immediate availability of pressurized air into the system.

The reservoir is a steel fabrication and is located on the outside of the left hand chassis rail, in front of the air supply unit. The reservoir has a bracket at each end which attach to the body mounting brackets on the chassis.

The rearward end of the reservoir has a 'Voss' air fitting which provides for the connection of the air hose between the reservoir and the reservoir valve block.

The reservoir has a capacity of 9 liters (550 in³0). The nominal working pressure of the reservoir is 16.8 bar gage (243.6 lbf/in²), with a maximum pressure of 35 bar gage (507 lbf/in²).

Air Springs

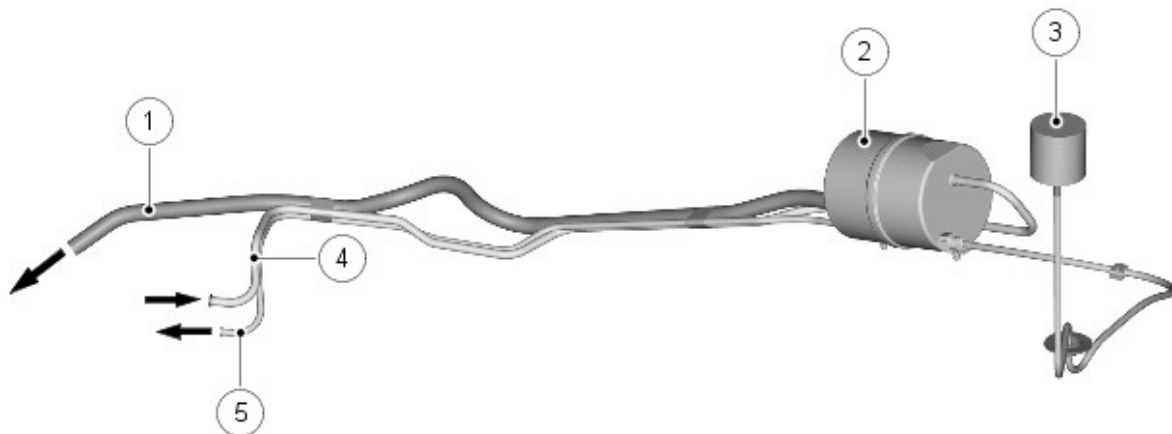
The air springs on the front and rear suspension are similar in construction. The air springs are manufactured from a flexible rubber and each air spring forms an air tight cavity which provides the required spring rate for each corner of the vehicle.

As the air spring is compressed, the rubber material compresses and rolls down the side of the vertical housing (piston) below the spring. An air connection port is located on the top of each spring and allows air to be added or removed from each spring. The port is connected via a Voss connector and a plastic tube to the axle valve block.

Replacement of an individual air spring does not require a full depressurization of the air suspension system. Only the corner concerned need be depressurized. This is achieved using a routine in the Land Rover approved diagnostic system.

When servicing of an air spring or a full system depressurization is required, the weight of the vehicle must be supported before the system is depressurized. On reassembly, the air spring must be fully pressurized before the weight of the vehicle is applied to it.

AIR SILENCER AND INLET AIR FILTER



E45185

Item	Part Number	Description
1	-	Exhaust (to atmosphere)
2	-	Inlet and exhaust silencer

- 3 - Air inlet filter
- 4 - Exhaust air from air supply unit
- 5 - Air inlet supply to air supply unit

The air silencer is required to limit any noise produced from the air supply unit during inflation or deflation of the air springs.

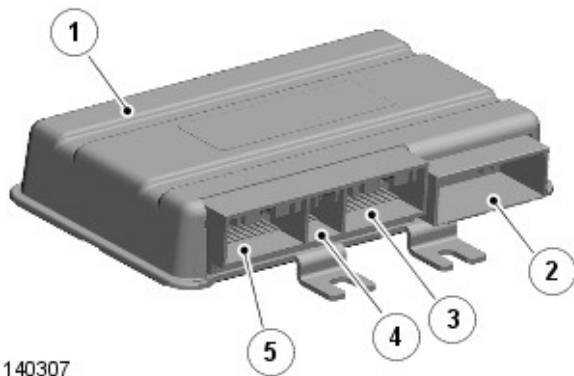
The silencer comprises two plastic molded cans, which are bonded together. A silencing foam in the large internal chamber forms the exhaust silencer. A pipe connection is molded onto each end of the silencer and provides for the attachment of the exhaust air to atmosphere pipe and the exhaust air pipe from the air supply unit.

A secondary chamber, located around the outside of the exhaust chamber forms the silencer for the inlet air. Pipe connections are molded onto each end of the intake silencer and provide for the attachment of the air inlet pipe from the inlet air filter and the air inlet pipe to the air supply unit. The intake air silencer is a hollow chamber with no noise reduction foam filling.

The air intake filter is connected via a pipe to the intake silencer chamber of the air silencer unit. The filter is located in the rear left corner of the body, away from possible sources of dirt and moisture.

The filter contains a foam element which removes particulate matter from the inlet air before it reaches the silencer or the air supply unit.

AIR SUSPENSION CONTROL MODULE



E 140307

Item	Part Number	Description
1	-	Air suspension control module
2	-	Connector C2321
3	-	Connector C2320
4	-	Connector C2030
5	-	Connector C0867

The air suspension system fitted is controlled by the air suspension control module which is located behind the instrument panel, on the driver side 'A' pillar.

The control module monitors the height of each corner of the vehicle via four height sensors, which are mounted in-board of each road wheel.

The control module has the following modes of operation:

- Calibration
- Normal
- Periodic Wake-Up.

When a new air suspension control module is fitted, the air suspension system will not function until the air suspension software is loaded and the system calibrated using the Land Rover approved diagnostic system.

Calibration

A calibration routine is performed using the Land Rover approved diagnostic system to access the position of each corner of the vehicle and record the settings in the control module memory. Once set, the calibration is not required to be performed unless the air suspension control module or adaptive damping module is removed or replaced, a height sensor or bracket is removed, replaced or disturbed or a suspension arm to which the sensor is connected is removed or replaced. If the removed height sensor is subsequently refitted, the calibration procedure will have to be performed to ensure the integrity of the system.

If the air supply unit, the reservoir, a valve block, a damper module or the air harness is removed or replaced, the system will not require recalibration.

Periodic Wake-Up Mode

When the vehicle is parked, the air suspension control module 'wakes up' two hours after the ignition was last switched off and once every twenty four hours thereafter. The vehicle height is checked and if the vehicle is not level within a pre-set tolerance, small downwards height adjustments may be made automatically.

SYSTEM OPERATION

Under normal operating conditions, the air suspension control module keeps the vehicle level at the 'current' ride

height. The incoming height signals from the sensors are passed through filters to remove irregular signals produced by road noise or other irregularities. When the vehicle is stationary or a height change is in progress, the signals are passed through a 'fast' filter, which tracks the true rate of change of height. When the vehicle is moving, the signals are passed through a 'slow' filter. The 'slow' filtered signals remove almost all road noise from the signals and output a true long term average for each corner height. The 'slow' filtered signals cannot be used to respond quickly during height changes.

The air suspension control module monitors each corner height signal using the fast filtered signals if the vehicle is stationary or the slow filtered signals if the vehicle is moving. If the height remains in a 'dead band' which is ± 10 mm from the target height, the control module does not implement any height adjustment changes. When the control module detects that a corner has moved outside of the 'dead band', the control module operates the compressor and/or the valves to raise or lower the corresponding corner(s) back into the target height.

SYSTEM INHIBITS

A number of conditions exist where a change in ride height is undesirable. To counter this, the air suspension control module is programmed with a number of system inhibits. If any of the conditions detailed below exist, the air suspension control module will suspend height changes and height corrections.

Compressor

System Pressure

The compressor will not start if the system pressure is greater than 4 bar (gauge)

Compressor Temperature

Two temperature sensors are located within the compressor to prevent overheating. If the temperature of the motor brush assembly or the compressor cylinder head rise above pre-set limits, the air suspension control module will inhibit the compressor operation. The limits are detailed in tables in the Air Supply Unit section of this manual.

Cornering

If the air suspension control module registers a cornering force greater than 0.2g it will inhibit all height changes and corrections. The system will remain inhibited until the cornering force falls to less than 0.15g. The air suspension control module receives a message from the lateral acceleration sensor (which is an integral part of the anti-lock brake system (ABS) yaw rate sensor) on the high speed controller area network (CAN) bus for the cornering force.

Rapid Acceleration

If the air suspension control module registers a rapid acceleration greater than 0.2g it will inhibit all height changes and corrections. The system will remain inhibited until the rapid acceleration falls to less than 0.15g. Acceleration is calculated by the control module from a vehicle speed signal received via the high speed CAN bus.

Rapid Deceleration

If the air suspension control module registers a rapid deceleration smaller than - 0.2g it will inhibit all height changes and corrections. The system will remain inhibited until the rapid deceleration rises above - 0.15g. Deceleration is calculated by the control module from a vehicle speed signal received via the high speed CAN bus.

Vehicle Jack

The air suspension control module will inhibit all height changes and corrections if it detects a corner lowering too slowly for more than 1.2 seconds. This is interpreted as the corner identified as moving too slowly being supported on a jack. In this situation, the corner height will not change when air is released from the air spring because the jack acts as a mechanical prop.

The system will remain inhibited until any of the following conditions exist:

- The air suspension rotary switch is moved to the up or down position
- The vehicle speed rises to more than 3 km/h (2 mph) for more than 45 seconds.

Door Open

The air suspension control module will stop all height change requests while any of the doors are open. Vehicle leveling continues with a door open by keeping the vehicle at the height when the door was opened if the vehicle load changes. Door open status is ignored when the vehicle speed is above 8 km/h (5 mph).

DIAGNOSTICS

The air suspension control module can store fault codes which can be retrieved using the Land Rover approved diagnostic system. The diagnostics information is obtained via the diagnostic socket which is located below the instrument panel, above the driver foot pedals. The socket is protected by a hinged cover.

The diagnostic socket allows the exchange of information between the various control modules on the bus systems and the Land Rover approved diagnostic system. This allows the fast retrieval of diagnostic information and programming of certain functions using the Land Rover approved diagnostic system.

Fault Messages

The air suspension has two methods which it can use to inform the driver of a fault in the air suspension system; the air suspension switchpack LED's and the IC message center.

If the air suspension control module suffers a major failure and there is no air suspension control, all the control switch LED's will remain unlit.

If a fault occurs and the control module can determine the ride height and the vehicle is not above on-road height, the driver will be notified via a message in the message center. If the control module cannot determine the height of the vehicle, or the vehicle is above on-road height and cannot be lowered, a message is displayed and accompanied with a maximum speed message.

If a fault is detected within the DSC (dynamic stability control) the message 'SUSPENSION LOWERED FOR SAFETY' and a chime will be emitted. This is not a fault with the air suspension system. The fault should be investigated and rectified as soon as possible.

For additional information, refer to: Information and Message Center (413-08, Description and Operation).

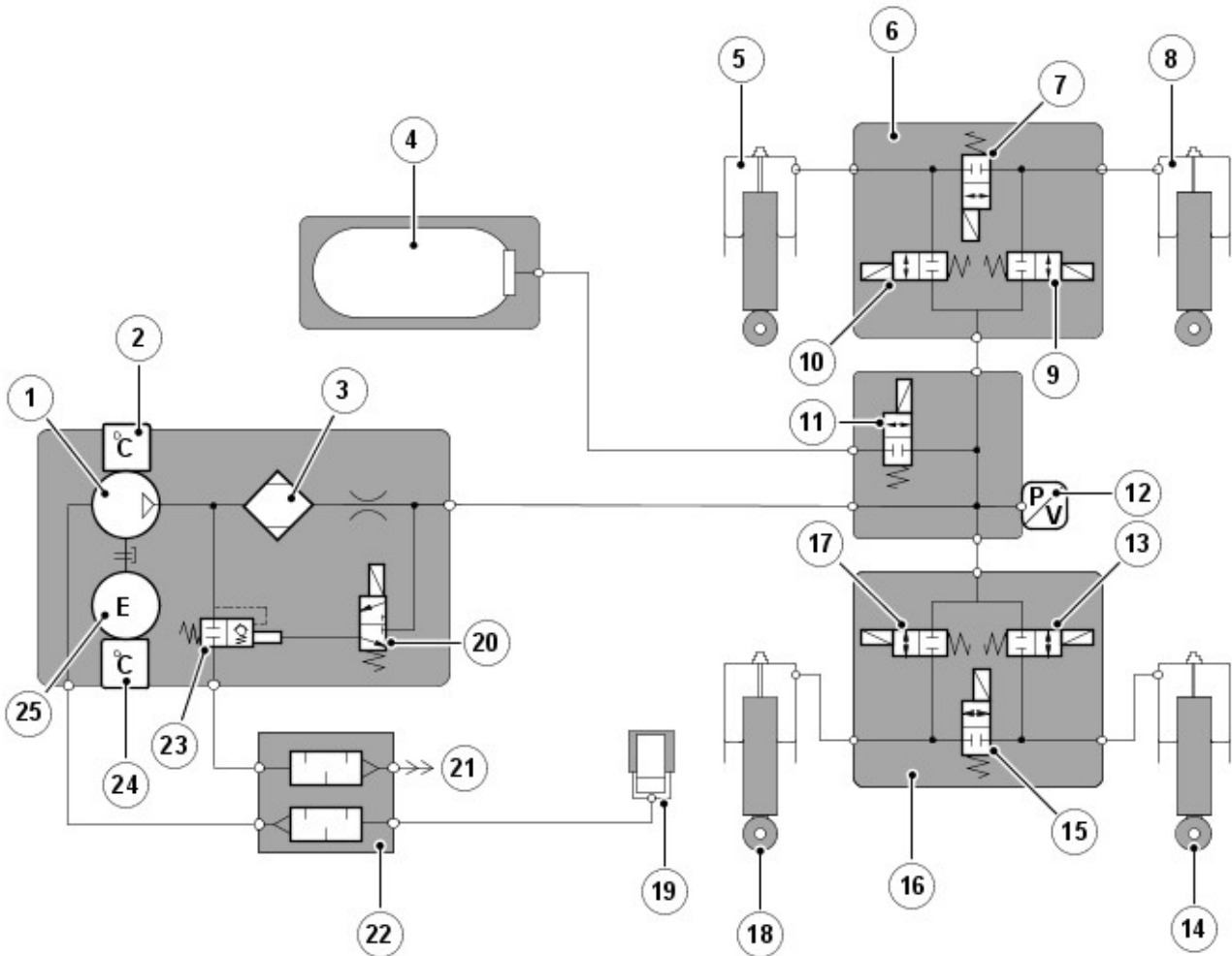
RESERVOIR

The air suspension control module assumes the reservoir has sufficient pressure, which is measured before a vehicle raise is started. The control module then uses a software model to operate the compressor as required.

SYSTEM PNEUMATIC CIRCUIT

The following schematic diagram shows the connection relationship between the air supply unit, the reservoir, the reservoir valve block, the cross-link valves and the air springs.

Schematic Pneumatic Circuit



E45175

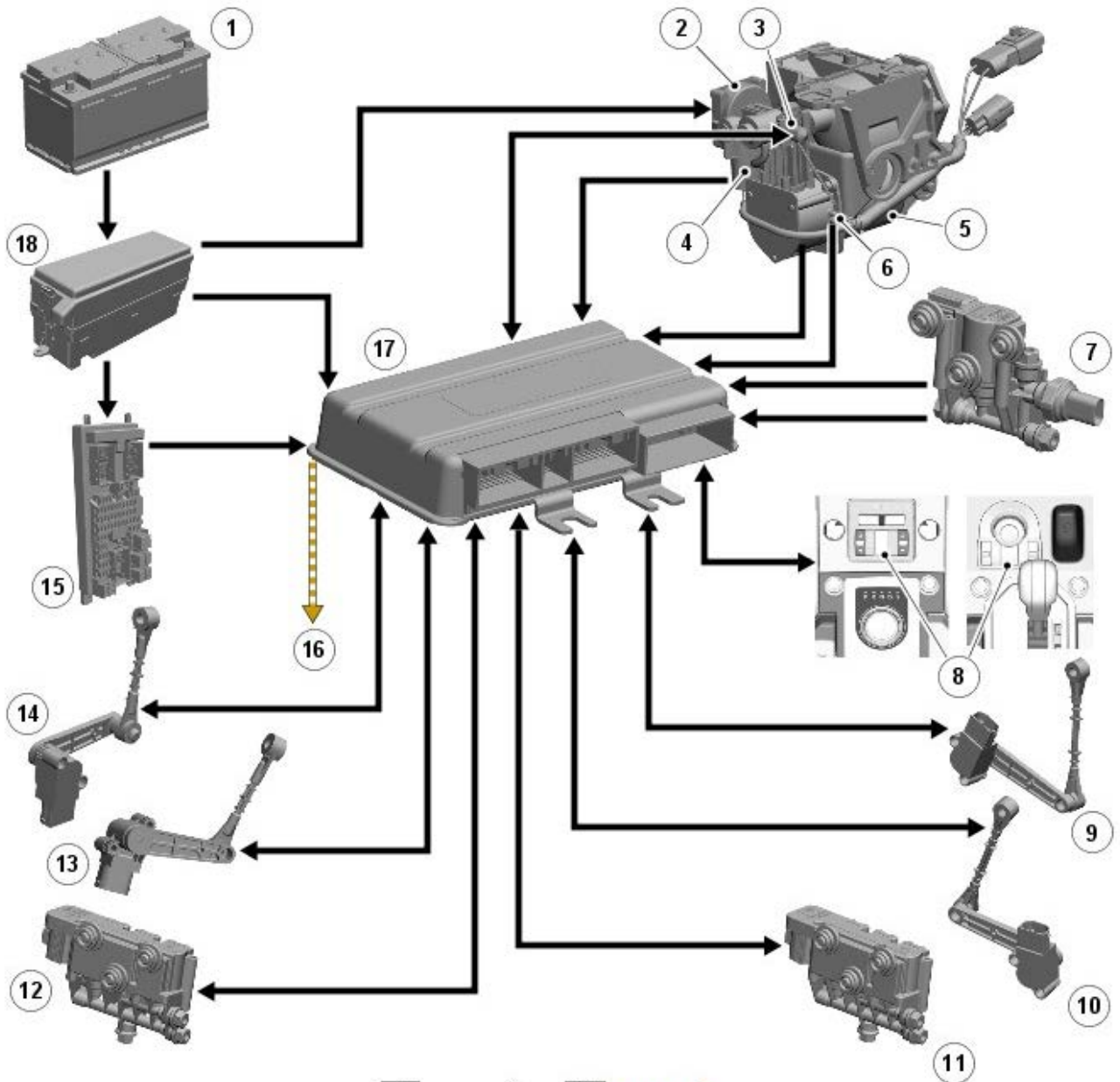
Item	Part Number	Description
1	-	Compressor
2	-	Compressor temperature sensor
3	-	Air dryer
4	-	Reservoir
5	-	Front left shock absorber assembly

6	-	Front valve block
7	-	Cross link valve
8	-	Front right shock absorber assembly
9	-	Front right corner valve
10	-	Front left corner valve
11	-	Reservoir control valve
12	-	Pressure sensor
13	-	Rear right corner valve
14	-	Rear right shock absorber assembly
15	-	Cross link valve
16	-	Rear valve block
17	-	Rear left corner valve
18	-	Rear left shock absorber assembly
19	-	Inlet air filter
20	-	Pilot exhaust valve
21	-	Exhaust
22	-	Air silencer
23	-	Pressure relief and exhaust valve
24	-	Motor temperature sensor
25	-	Electric motor

CONTROL DIAGRAM - AIR SUSPENSION



NOTE: **A** = Hardwired; **D** = High Speed CAN (controller area network) bus



E140315



Item	Part Number	Description
1	-	Battery
2	-	Air supply unit
3	-	Compressor temperature sensor
4	-	Motor temperature sensor
5	-	Motor
6	-	Exhaust valve solenoid
7	-	Reservoir control valve
8	-	Air suspension switch
9	-	Right front height sensor
10	-	Right rear height sensor
11	-	Rear control valve
12	-	CAN connection to other systems
13	-	Front control valve
14	-	Left rear height sensor
15	-	Left front height sensor
16	-	Central Junction Box (CJB)
17	-	Battery Junction Box (BJB)
18	-	Air suspension control module

Vehicle Dynamic Suspension - Vehicle Dynamic Suspension

Description and Operation

The increased weight of the armoured vehicle has necessitated changes to the air suspension system. These changes include an increase in the pressure within the air springs and a change to the 'off-road' height setting. These changes have impacted on the air suspension air supply unit and control module.

Off-road height can be selected at speeds up to 20 km/h (12 mile/h). When the system is at off-road height, the system selects on-road height if the vehicle speed exceeds 25 km/h (15mile/h).

If a new control module is fitted to the vehicle, the air suspension system will require re-calibrating. The calibration routine is carried out using the Land Rover approved diagnostic system.

Vehicle Dynamic Suspension - Vehicle Dynamic Suspension

Diagnosis and Testing

Principle of Operation

For a detailed description of the Vehicle Dynamic Suspension System and operation, refer to the relevant Description and Operation section of the workshop manual.

REFER to: Vehicle Dynamic Suspension (204-05 Vehicle Dynamic Suspension, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Air leakage • Air springs • Reservoir • Compressor • Compressor air filter • Pipework and unions • Sensor installation • Valve block(s) • Suspension components 	<ul style="list-style-type: none"> • Battery • Fuse(s) • Wiring harness physical damage or water ingress • Loose or corroded electrical connectors • Air suspension control switch • Controller Area Network (CAN) circuits • Sensors • Actuators • Valve block(s) • Air suspension control module

3. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the symptom chart.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Message	Possible Other Warnings	Possible Causes	Action
Vehicle on bump stops	<ul style="list-style-type: none"> • Suspension fault 	<ul style="list-style-type: none"> • Two chimes repeated regularly, red warning indicator permanently illuminated 	<ul style="list-style-type: none"> • Water ingress to wiring harness or connectors • Air leak(s) • Vehicle in transportation mode • System not calibrated or calibration corrupt • Implausible articulation symptoms detected • Failure of multiple height sensors • Air suspension control module failure 	<ul style="list-style-type: none"> • Visually inspect the wiring harness and connectors for water ingress • Visually inspect the system for air leakage • Check the system mode and calibration using the approved diagnostic system • Check for implausible articulation symptoms, i.e. height sensor or linkage fault, deflated air spring, under inflated tire etc • Note implausible articulation

				<p>symptoms may be caused by an un-calibrated height sensor</p> <ul style="list-style-type: none"> • Check for height sensor DTCs and refer to the DTC index
Vehicle does not sit level	<ul style="list-style-type: none"> • Suspension fault 	<ul style="list-style-type: none"> • Two chimes repeated regularly, red warning indicator permanently illuminated 	<ul style="list-style-type: none"> • Water ingress to wiring harness or connectors • Air leak(s) • Calibration corrupt • cross-link valve fault • Height sensor fault • Reservoir valve stuck open • Exhaust valve stuck closed • Corner valves stuck open • Air suspension control module failure 	<ul style="list-style-type: none"> • Visually inspect the wiring harness and connectors for water ingress • Visually inspect the system for air leakage and refer to the guided diagnostic routine on the approved diagnostic system • Check the system calibration using the approved diagnostic system • For front and rear cross link valve tests refer to the guided diagnostic routine on the approved diagnostic system • Check for height sensor DTCs and refer to the DTC index • For reservoir and exhaust valve tests refer to the guided diagnostic routine on the approved diagnostic system • Check for corner valve DTCs and refer to the DTC index
Vehicle sits too low	<ul style="list-style-type: none"> • Suspension fault • Hill descent control (HDC) fault, system not available • Dynamic stability control (DSC) 	<ul style="list-style-type: none"> • Two chimes, amber warning indicator permanently illuminated • One chime • DSC amber warning indicator permanently illuminated • Anti-lock 	<ul style="list-style-type: none"> • Water ingress to wiring harness or connectors • Air leak(s) • Air suspension compressor temperature sensor fault • Inlet air filter blockage/restriction • Air suspension compressor fault • Exhaust valve 	<ul style="list-style-type: none"> • Visually inspect the wiring harness and connectors for water ingress • Visually inspect the system for air leakage • For air compressor temperature

		brake system warning indicator permanently illuminated	<ul style="list-style-type: none"> stuck/sticking Air suspension control module lost communication with ABS module ABS fault. Air suspension control module failure 	<p>sensor, inlet air filter, exhaust valve and air compressor tests refer to the guided diagnostic routine on the approved diagnostic system</p> <ul style="list-style-type: none"> For air suspension control module lost communication with anti-lock brake system control module, refer to the lost communication codes statement at the end of this table Check for anti-lock brake system DTCs, refer to the relevant section of the workshop manual
Vehicle sits too high	<ul style="list-style-type: none"> Suspension fault 	<ul style="list-style-type: none"> Two chimes, amber warning indicator permanently illuminated 	<ul style="list-style-type: none"> Reservoir valve stuck open Exhaust valve stuck closed Corner valves stuck open Air suspension control module failure 	<ul style="list-style-type: none"> For reservoir valve and exhaust valve tests refer to the guided diagnostic routine on the approved diagnostic system Check for corner valve DTCs and refer to the DTC index
System detects extended mode unnecessarily when lowering	<ul style="list-style-type: none"> Suspension fault 	<ul style="list-style-type: none"> Two chimes, amber warning indicator permanently illuminated 	<ul style="list-style-type: none"> Crossed gallery and air spring pipes Incorrect valve block installed to front or rear Damage or blockage in air harness 	<ul style="list-style-type: none"> Refer to the guided diagnostic routine on the approved diagnostic system
Vehicle leans/tilts after being left over-night or for some days	<ul style="list-style-type: none"> - 	<ul style="list-style-type: none"> - 	<ul style="list-style-type: none"> Leaking air spring(s) Leak from corner valve to gallery Exhaust valve stuck open 	<ul style="list-style-type: none"> Refer to the guided diagnostic routine on the approved diagnostic system
After vehicle left over-night or for some days system regularly indicates "Suspension vehicle raising slowly" when first driving off	<ul style="list-style-type: none"> Suspension vehicle raising slowly 	<ul style="list-style-type: none"> - 	<ul style="list-style-type: none"> Leaking air spring(s) Leaking reservoir 	<ul style="list-style-type: none"> Refer to the guided diagnostic routine on the approved diagnostic system

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Air Suspension Control Module (100-00 General Information, Description and Operation).

Air Suspension Deflation Exit Routine

1. Key on, engine off.
2. Key off.
3. Press and release raise switch.
4. Press and release lower switch.
5. Key on, engine off.
6. Key on, engine running.
7. Press and release raise switch twice.
8. Press and release lower switch twice.
9. Press and release raise switch.

Vehicle Dynamic Suspension - Air Suspension System Depressurize and Pressurize

General Procedures

WARNINGS:



A small amount of air pressure will be left in the air suspension system.



Eye protection must be worn.



Wear protective gloves.


CAUTIONS:



Make sure tailgate, hood and all doors are closed.



Make sure the vehicle is in a clear working area.

1.  **WARNING:** The air suspension is pressurised. Make sure dirt or grease does not enter the system. Always wear hand, eye and ear safety standard protection when working on the system.

Using the Land Rover approved diagnostic system, depressurize the air suspension.


- Follow the on-screen prompts.

2. Using the Land Rover approved diagnostic system, pressurize the air suspension.
 - Start and run the engine.

Vehicle Dynamic Suspension - Ride Height Adjustments

General Procedures

Special Tool(s)

	Gauge, Ride height 204-557B
---	--------------------------------

CAUTIONS:



Make sure the wheels and tires, tie rod ends, suspension joints and wheel bearings are free from damage, wear and free play.



Make sure there are no heavy objects in the vehicle.



The ride height must be measured with the vehicle weight supported by the suspension.



With the engine running and all vehicle doors closed, make sure the air suspension is functioning and the vehicle height can be raised and lowered using the air suspension switch.




Drive the vehicle on to a flat, level surface.



Make sure the steering wheel is in the straight ahead position.




NOTE: This procedure must be carried out after replacement of the air suspension control module, removal or replacement of a height sensor, removal or replacement of the front or rear suspension arms, replacement of body panels incorporating suspension fixing points.

-  **CAUTION:** Make sure the vehicle is not moved once it has been positioned to take measurements.

Position the vehicle on a flat level surface.

- Connect the diagnostic tool to the vehicle data link connector (DLC).
 - Connect the vehicle data link cable into the vehicle communications module.
 - Connect the diagnostic tool USB Lead into the vehicle communications module.
 - Connect the data link cable to the data link connector.
 - Connect the diagnostic tool USB lead to the diagnostic tool USB port.

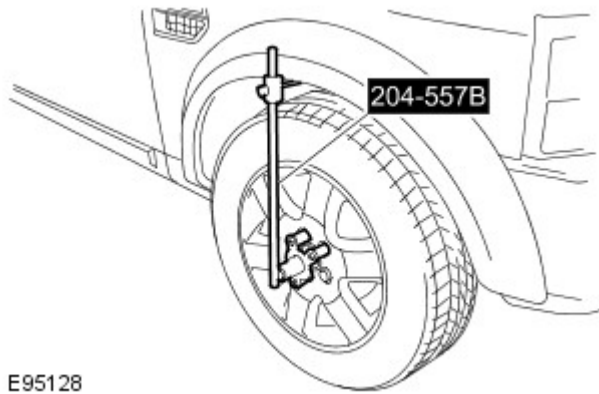
-  **CAUTION:** Make sure the ignition switch is turned off, the park brake is on and the selector lever is in park.




NOTE: IDS already loaded with the latest issue of software.

Switch IDS on and navigate to the vehicle identification number (VIN) input screen.

- Enter the vehicle identification number (VIN) and navigate to the vehicle configuration menu.
 - Select setup and configuration.
 - Select air suspension height calibration and read all warnings and cautions.
 - Follow the on-screen prompts.



E95128

5.  CAUTION: The diagnostic tool will cause the vehicle height to change during some parts of the calibration process.

NOTES:



Do not install the special tool over a locking wheel nut.



Make sure the special tool is square to the wheel face with the measuring rod in a vertical position.



Take the measurement from the top edge of the slider on the special tool.



Make sure the fender splash shields are correctly fitted.

Once in the suspension height measurement screen, use the special tool to measure and record the height setting from each wheel center to the wheel arch.


- Follow the on-screen prompts.


6. After successful calibration of the air suspension switch off the diagnostic tool and return to its original position.

Vehicle Dynamic Suspension - Air Leaks

General Procedures

Special Tool(s)

	<p>Hose Cutter 204-494 (LRT 60-002)</p>
---	---

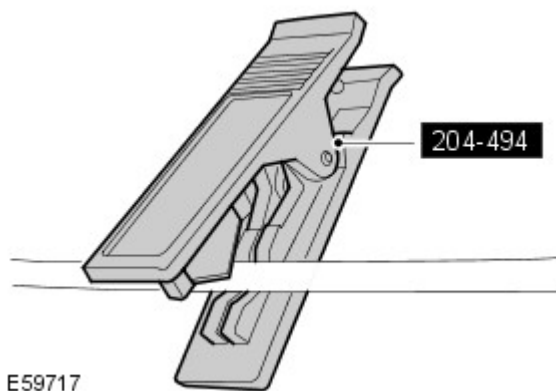
1.  **CAUTION:** Any leak detection spray used must have a corrosion inhibitor, and must not cause damage to paintwork, plastics, metals or plastic lines.



NOTE: The recommended leak detection spray is GOTEK LDS, Landrover part number STC 1090.

The recommended leak detection spray should be used to identify any suspected leaks. This procedure should also be used where any of the air suspension components have been disturbed.

2. Clean around the area of the suspected air leak.
3. Using the recommended leak detection spray, spray around all of the air suspension components, working systematically until the source of the air leak has been found.
4. If any of the air suspension components are found to be leaking e.g. air spring, compressor, reservoir or a solenoid valve block, repair is effected by replacement only.
5. Using T4, depressurize the air suspension system.
For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).



6. CAUTIONS:



Different air lines in the air suspension system have different material properties and wall thicknesses. It is important, in order to prevent subsequent air line failure, that the new air line material and wall thicknesses are identical to those of the air line being removed.



Replacement air line must be cut from a new air line with the equivalent Land Rover part number as the one being replaced. Do not use air line cut from a roll or coil.



Any existing heatsleeves and abrasion sleeves must be replaced as part of the repair.



Air line connectors should be positioned in areas away from heat sources such as the exhaust system, and away from any section of air line with a heat shield installed.



Do not trim air line ends. If the end of the air line is damaged, the air line must be cut and a new section added using a Land

Rover approved air line connector, or the air line must be renewed completely.

NOTES:



Air lines must only be cut using either Hose cutter 204-494 (LRT 60-002), available from SPX LTD or Hose cutter YA1000A, available from Snap-On Tools. Make sure the cut air line end is free from damage or burrs.



Only Land Rover approved air lines have been tested to the correct pressure and temperature specifications.



Only the Land Rover approved air line connector, RYC500210, has been tested to the correct pressure and temperature specifications.



If the markings or tape adjacent to the air line connections are removed when cutting air lines, the cut end of the air line must be clearly marked with a suitable colored tape or paint mark.

If the source of the air leak is found to be an air line connection, renew the Voss connector and, if required, the end of the air line. Using the special tool, cut off the damaged end of the air line and replace with new Land Rover approved air line and air line connectors as required.

7. If the source of the air leak is found to be in a section of air line, either; renew the air line, or, using the special tool, cut out the damaged section of air line and replace with new Land Rover approved air line, and air line connectors, as required.



8. **NOTE:** If the repair has been unsuccessful repeat the above steps until the air leak is rectified.

Using T4, pressurize the air suspension system.
For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).

Vehicle Dynamic Suspension - Suspension Height Sensor

Removal and Installation

Removal


NOTES:



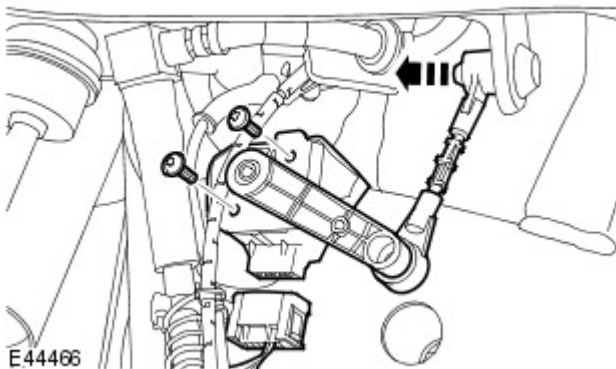
This procedure covers removal and installation of both the front and rear suspension height sensors.




The right hand sensor has a black colored lever and the left hand sensor has a white colored lever.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.




2.  **CAUTION:** Do not use excessive force to disconnect the height sensor link.

Remove the suspension height sensor.

- Disconnect the height sensor link.
- Disconnect the electrical connector.
- Remove the 2 Torx screws.

Installation

1.  **CAUTION:** Make sure the Torx screw is not over tightened. Failure to follow this instruction will result in damage to the vehicle.

To install, reverse the removal procedure.


- Tighten the screws to 3 Nm (2 lb.ft).

2. Using Land Rover approved diagnostic equipment, calibrate the ride height.

Vehicle Dynamic Suspension - Air Suspension Reservoir

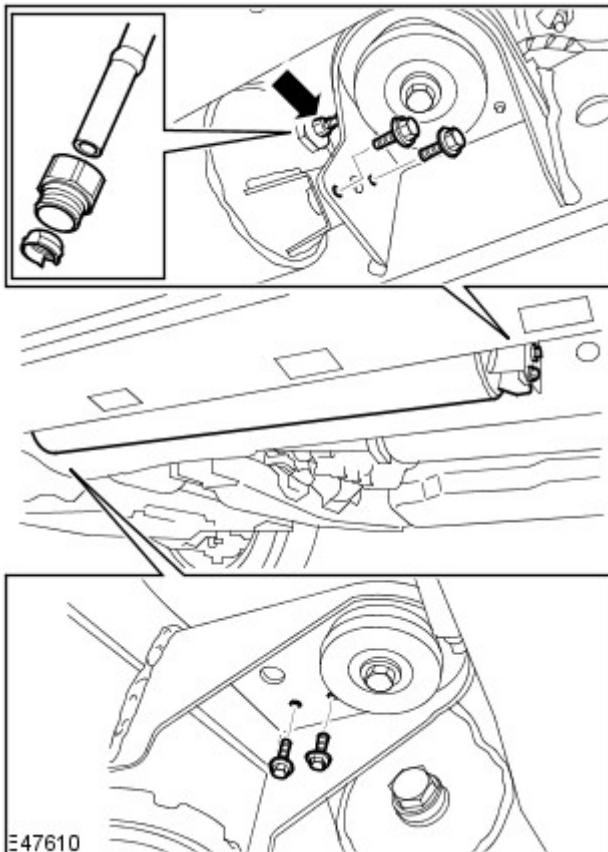
Removal and Installation

Removal


-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the vehicle.


- Using T4, depressurize the air suspension. For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05 Vehicle Dynamic Suspension, General Procedures).



- CAUTIONS:**

 Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.


 The air line must only be disconnected by removal of the Voss connector. Do not remove the air line retaining boss from the air suspension reservoir. Failure to follow this instruction may result in damage to the vehicle.

 Visually inspect the air line ends for damage or wear. Repair or replace the air line as necessary.

Disconnect the air line from the air suspension reservoir.

- Remove the air suspension reservoir.
 - Remove the 4 bolts.
- Remove the Voss connector from the air line.
 - Remove and discard the collet and the union.

Installation

-  **CAUTION:** Make sure the new Voss connector is installed and fully tightened with the alignment plug installed.

Install a new Voss connector to the air reservoir.

- Tighten the new Voss connector to 5 Nm (4 lb.ft).

- Install the air suspension reservoir.
 - Locate the air reservoir to the chassis brackets, fit the bolts and tighten to 23 Nm (17 lb.ft).
 - Fully seat the air line into the Voss connector.
 - Pull on the air line to make sure it is fully installed into the Voss connector.

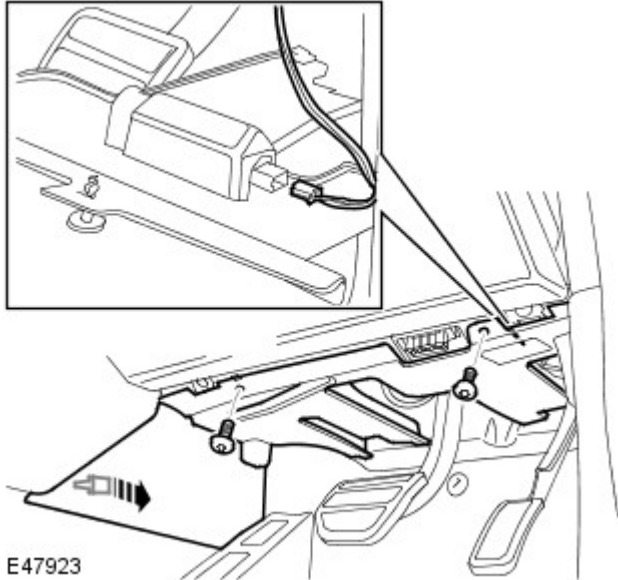
3. Using T4, pressurize the air suspension.
For additional information, refer to: Air Suspension System
Depressurize and Pressurize (204-05 Vehicle Dynamic
Suspension, General Procedures).

Vehicle Dynamic Suspension - Air Suspension Control Module

Removal and Installation

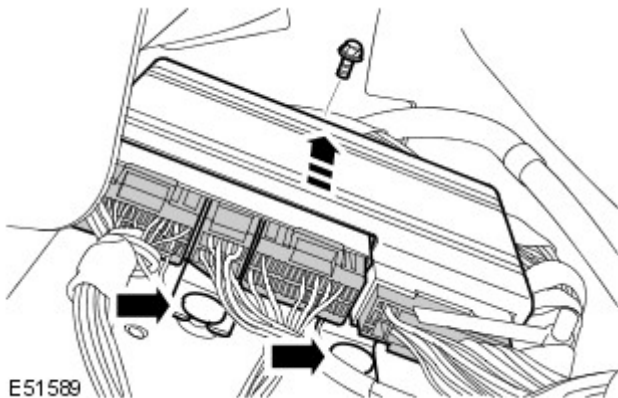
Removal

1. Driver side: Remove the cowl side trim panel.
For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).



E47923

2. Remove the closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.



E51589

3. Remove the air suspension control module.
 - Disconnect the 4 electrical connectors.
 - Remove the bolt.
 - Release from the 2 clips.


Installation

1. Install the air suspension control module.
 - Secure with the clips.
 - Connect the electrical connectors.
 - Tighten the bolt to 9 Nm (7 lb.ft).
2. Install the closing trim panel.
 - Connect the electrical connector.
 - Secure the clip.
 - Tighten the screws.
3. Install the cowl side trim panel.
For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).
4. Initiate a new control module using T4.

Vehicle Dynamic Suspension - Air Suspension Reservoir Solenoid Valve Block

Removal and Installation

Removal

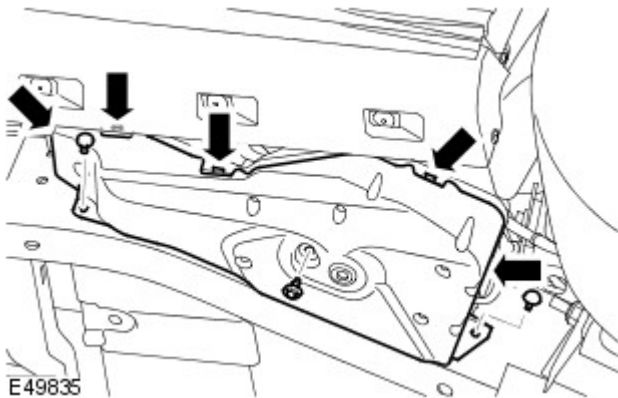
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Using T4, depressurize the air suspension. For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).

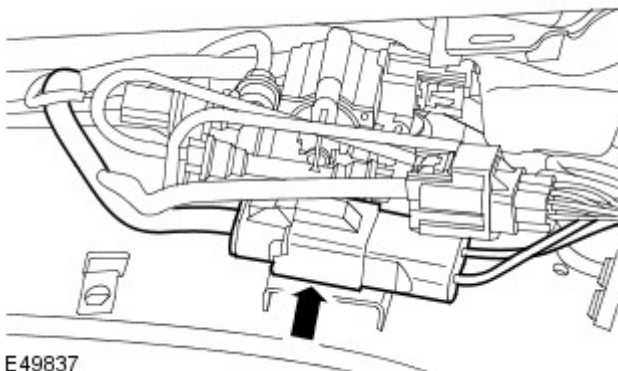
3. Remove the air suspension compressor lower cover.

- Remove the 3 bolts.
- Release the 5 clips.





4. Move the air compressor electrical connector aside.

- Release the 2 clips.



5. **CAUTIONS:**

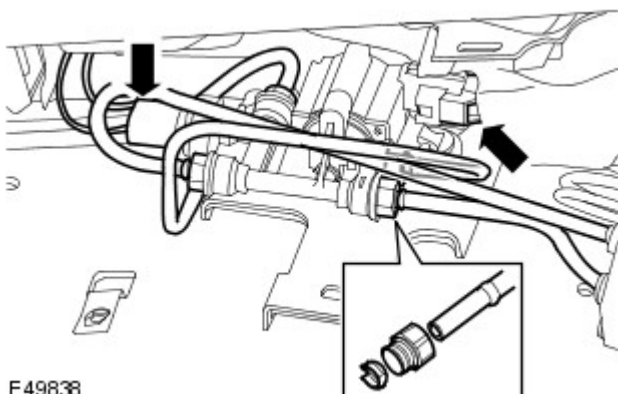
 Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

 Visually inspect the air line ends for damage or wear. Repair or replace the air line as necessary.

 **NOTE:** Note the air line fitted positions.

Remove the air suspension reservoir solenoid valve block.


- Disconnect the 4 air lines.
- Disconnect the 2 electrical connectors.
- Release the valve block 3 rubber insulators.



6. Remove the Voss connectors.

- Remove and discard the collets and the unions.

Installation


1.  CAUTION: Make sure the new Voss connector is installed and fully tightened with the alignment plug installed.



NOTE: New air suspension components are supplied with new Voss connectors tightened to the correct torque. Do not install new voss connectors if a new component is being installed.

Install new Voss connectors to the air suspension reservoir solenoid valve block.

- Tighten to 2.5 Nm (1.7 lb.ft).

2.  NOTE: Make sure the valve block does not become detached during connection of the air lines.

Install the air suspension reservoir solenoid valve block.

- Secure the 3 valve block rubber insulators.
- Connect the electrical connectors.
- Connect the air lines into the Voss connector.
- Pull on each air line to make sure it is fully installed into the Voss connector.

3. Secure the air compressor electrical connector.
4. Install the air suspension compressor lower cover.
 - Install the bolts and tighten to 10 Nm (7 lb.ft).
5. Using T4, pressurize the air suspension.
For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).


Vehicle Dynamic Suspension - Air Suspension Compressor Drier

Removal and Installation

Removal




CAUTION: If a new air suspension compressor, air compressor drier or air compressor delivery valve kit is installed due to failure, an air compressor relay must be installed. Failure to follow this instruction may result in damage to the air suspension system components.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

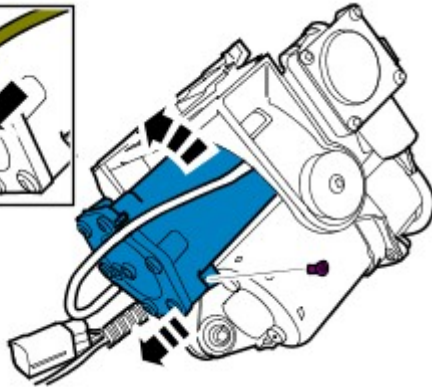
Raise and support the vehicle.


2. Remove the air suspension compressor.
For additional information, refer to: Air Suspension Compressor (204-05 Vehicle Dynamic Suspension, Removal and Installation).

3.  **CAUTION:** Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean and dry. Plug open connections to prevent contamination.

Disconnect the air line from the air suspension compressor drier.

- Release the air line from the retaining clip.



4.  **NOTE:** If equipped, note the position of the air suspension compressor retaining cable.


Remove the air suspension compressor drier.

- Remove the retaining screw.
- Remove and discard the O-ring seal.

E59815

Installation

1. Install a new O-ring seal.
 - Lubricate the O-ring with a lithium based grease.

2.  **NOTE:** If equipped, make sure the air suspension compressor retaining cable is correctly routed around the compressor cylinder head.

Install the air suspension compressor drier.

- Install the retaining screw and tighten to 3 Nm (2.2 lb.ft).

3. **CAUTIONS:**



Visually inspect the air line ends for damage or wear. Replace the air line as necessary.



Pull on the air line to make sure it is securely intalled in the connector.

Connect the air line to the air suspension compressor drier.


- Attach the air line to the retaining clip.

4. Install the air suspension compressor.
For additional information, refer to: Air Suspension Compressor (204-05 Vehicle Dynamic Suspension, Removal and Installation).

Vehicle Dynamic Suspension - Air Suspension Front Solenoid Valve Block


Removal and Installation


Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.
2. Remove the RH fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).
3. Using T4, depressurize the air suspension.
For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).

4. CAUTIONS:

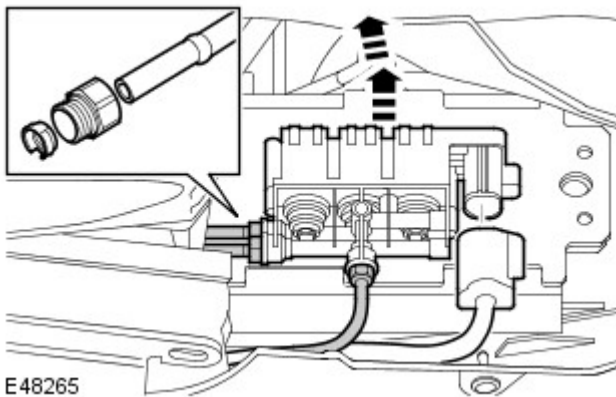
 Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

 Visually inspect the air line ends for damage or wear. Repair or replace the air line as necessary.

 **NOTE:** Note the air line fitted positions.


Disconnect the 3 air lines from the air suspension front solenoid valve block.

5. Remove the air suspension front solenoid valve block.
 - Disconnect the electrical connector.
 - Release the valve block 3 rubber insulators.



6. Remove the Voss connectors from the air lines.
 - Remove and discard the collet and the union.


Installation

1.  **CAUTION:** Make sure the new Voss connector is installed and fully tightened with the alignment plug installed.

 **NOTE:** New air suspension components are supplied with new Voss connectors tightened to the correct torque. Do not install new voss connectors if a new component is being installed.

Install new Voss connectors to the air suspension front solenoid valve block.

- Tighten to 2.5 Nm (1.7 lb.ft).

2.  NOTE: Make sure the valve block does not become detached during connection of the air lines.

Install the air suspension front solenoid valve block.

- Secure the 3 valve block rubber insulators.
- Connect the air lines into the Voss connector.
- Pull on each air line to make sure it is fully installed into the Voss connector.
- Connect the electrical connector.

3. Using T4, pressurize the air suspension.
For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).
4. Install the RH fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).


Vehicle Dynamic Suspension - Rear Air Spring

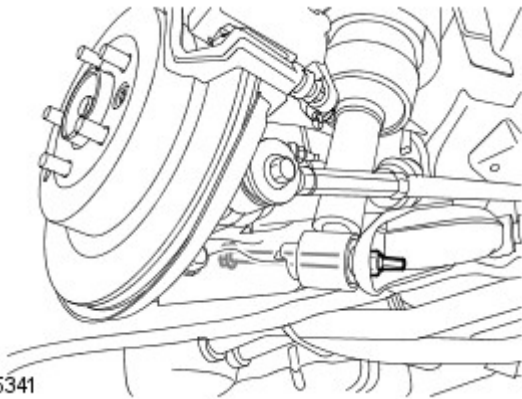
Removal and Installation

Removal




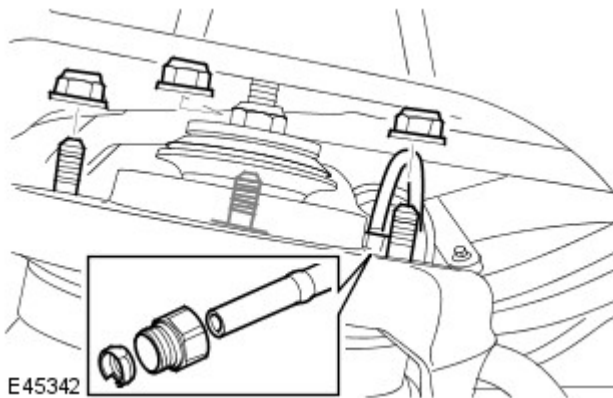
NOTE: Only the air spring being removed needs to be depressurised.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
2. Remove the wheel and tire.
3. Using T4, depressurise the air suspension.
For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).
4. Disconnect the rear air spring from the lower arm.
 - Remove the nut and bolt.



E45341

5.  **CAUTION:** Always plug any open connections to prevent contamination.
Disconnect the air line.
6. Using a trolley jack, support the rear air spring assembly.
7. Remove 3 rear air spring retaining nuts.
8. Remove the rear air spring.
9. Remove the Voss connector from the air line.
 - Remove the collet and the union.



E45342

Installation


1. Install a new Voss connector to the air spring.
 - Tighten to 3.5 Nm (2.6 lb.ft)
2. Install the rear air spring.
 - Make sure the spring and shock absorber assembly

- top mounting to body mating faces are clean.
- Connect the air line into the Voss connector.
 - Fit the nuts and tighten to 63 Nm (46 lb.ft).
3. Connect the shock absorber and spring assembly to the lower arm.
 - Tighten the nut and bolt to 300 Nm (221 lb.ft).
 4. Using T4, pressurise the air suspension.
For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).
 5. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Vehicle Dynamic Suspension - Air Suspension Muffler

Removal and Installation

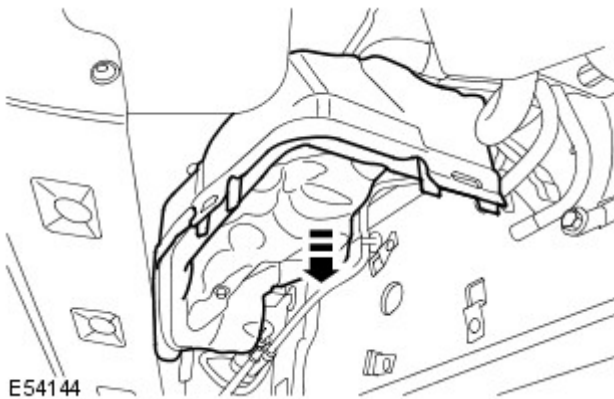
Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

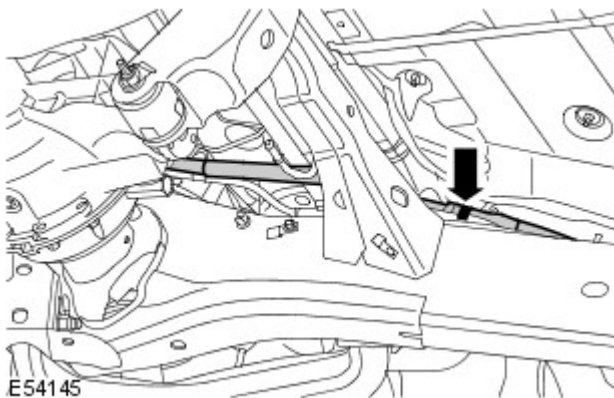
2. Remove the muffler assembly.
For additional information, refer to: Muffler (309-00B Exhaust System - 4.4L, Removal and Installation).
3. Remove the evaporative emissions canister.
For additional information, refer to: Evaporative Emission Canister (303-13B, Removal and Installation).
4. Remove the air suspension compressor.
For additional information, refer to: Air Suspension Compressor (204-05, Removal and Installation).

5. Remove the air suspension compressor upper cover.



E54144


6. Disconnect the air suspension intake filter pipe.



E54145

7. Remove the air suspension muffler.
 - Release clip from the air suspension muffler pipe.
 - Release the air suspension compressor to air suspension silencer pipes.

Installation

1. Install the air suspension muffler.
 - Locate the air suspension muffler pipes.
 - Secure the clip.
2. Connect the air suspension intake filter.
3.  **CAUTION:** Make sure the air suspension compressor upper cover is correctly positioned.


Install the air suspension compressor upper cover.

4. Install the air suspension compressor.
For additional information, refer to: Air Suspension Compressor (204-05, Removal and Installation).
5. Install the evaporative emissions canister.
For additional information, refer to: Evaporative Emission Canister (303-13B, Removal and Installation).
6. Install the muffler assembly.
For additional information, refer to: Muffler (309-00B Exhaust System - 4.4L, Removal and Installation).

Vehicle Dynamic Suspension - Air Suspension Rear Solenoid Valve Block


Removal and Installation


Removal

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.
- Remove the LH rear wheel and tire.
- Using T4, depressurize the air suspension.
For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).

4. CAUTIONS:

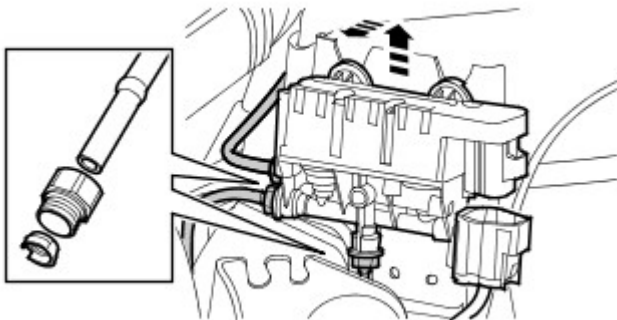
 Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

 Visually inspect the air line ends for damage or wear. Repair or replace the air line as necessary.

 **NOTE:** Note the air line fitted positions.


Disconnect 3 air lines from the rear valve block.

- Disconnect the electrical connector.
- Remove the rear valve block.
 - Release the valve block 3 rubber insulators.
- Remove the Voss connectors from the air lines.
 - Remove and discard the collets and the unions.



E48266

Installation

-  **NOTE:** New air suspension components are supplied with new Voss connectors tightened to the correct torque. Do not install new voss connectors if a new component is being installed.

Install new Voss connectors to the rear valve block.

- Tighten to 2.5 Nm (1.7 lb.ft).

- Install the rear valve block.
 - Secure the 3 valve block rubber insulators.
 - Connect the electrical connector.
 - Connect the air lines into the Voss connector.
 - Pull on each air line to make sure it is fully installed

into the Voss connector.

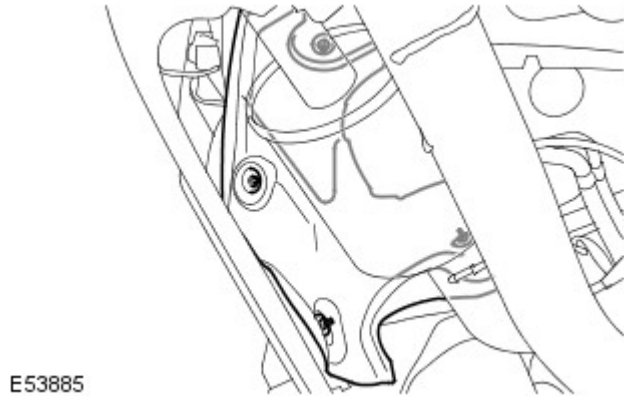
3. Using T4, pressurize the air suspension.
For additional information, refer to: Air Suspension System
Depressurize and Pressurize (204-05, General Procedures).
4. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Vehicle Dynamic Suspension - Air Suspension Air Filter

Removal and Installation

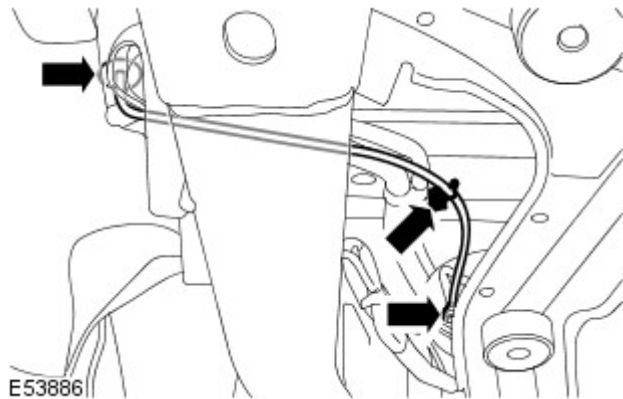
Removal

1. Open the liftgate and tailgate.
2. Remove the spare wheel and tire.
3. Remove the 4 nuts securing the LH rear tail pipe heat shield.



E53885

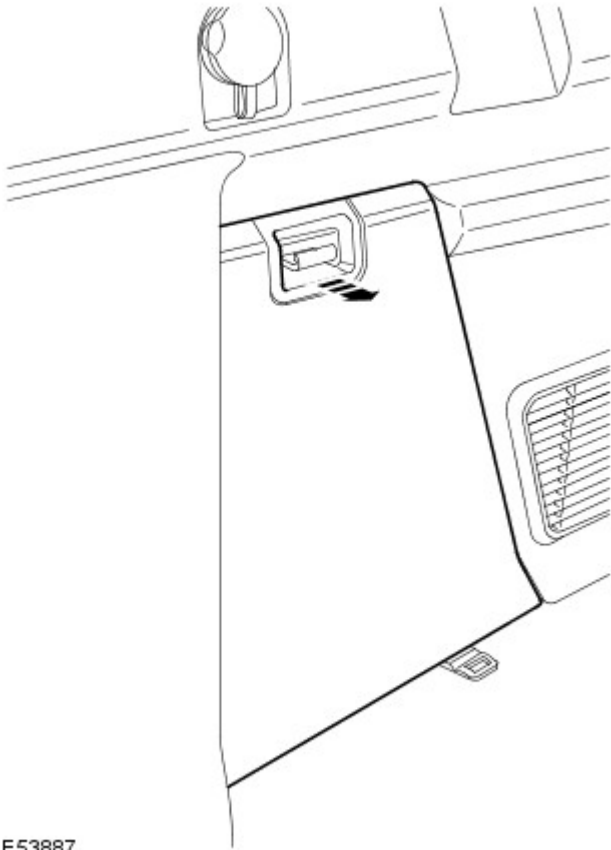
4. Reposition the LH rear tail pipe heat shield.
5. Disconnect the air suspension intake filter pipe.



E53886

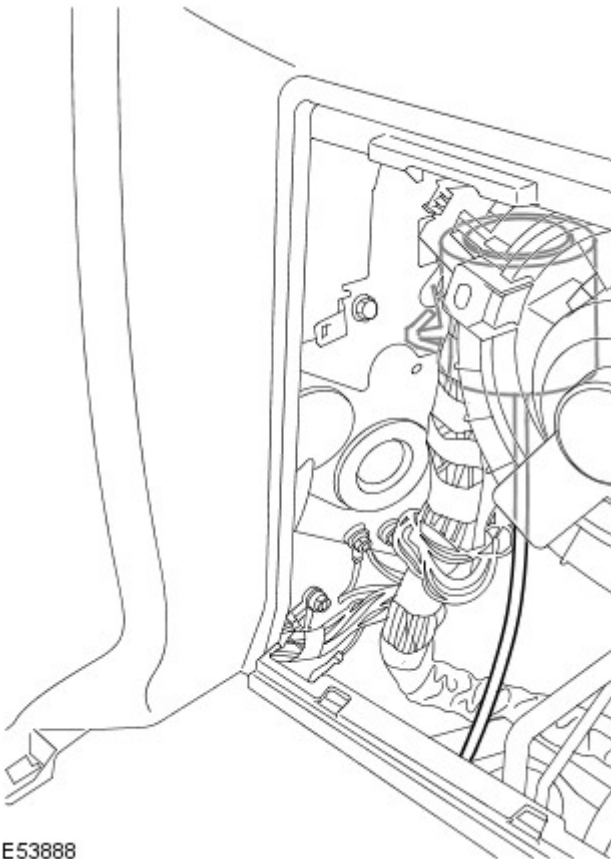
6. Detach the air suspension intake filter.
 - Release the grommet.
 - Release from the clip.

7. Remove the LH lower rear quarter trim access panel.



E53887

8. Remove the air suspension intake filter.



E53888

Installation



1. Install the air suspension intake filter.
 - Install the grommet.
2. Install the LH lower rear quarter trim access panel.
3. Attach the air suspension intake filter.

4. Connect the air suspension intake filter.
5. Reposition the LH rear tail pipe heat shield.
 - Install the nuts.
6. Install the spare wheel and tire.
7. Close the liftgate and tailgate.

Vehicle Dynamic Suspension - Front Air Shock Absorber

Removal and Installation

Special Tool(s)

 <p>204-538 E51385</p>	<p>Air spring tester 204-538</p>
 <p>204-700 E99789</p>	<p>Remover front air shocker absorber spindle nut 204-700</p>

Removal



NOTE: This procedure should also be used to remove the front air spring.

1. Remove the front shock absorber and air spring assembly. For additional information, refer to: Front Shock Absorber and Air Spring Assembly (204-05 Vehicle Dynamic Suspension, Removal and Installation).

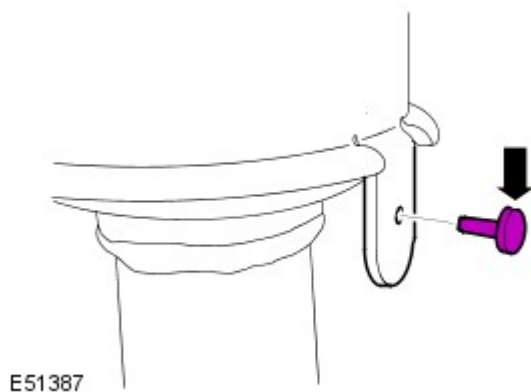


2. **NOTE:** If no leak is detected, investigate other areas of the air suspension for faults.

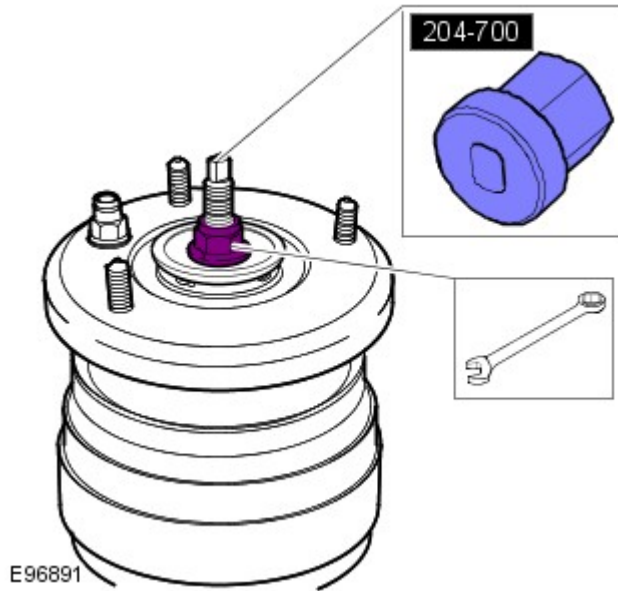
Check the assembly for leaks.

- Inflate the module to 4 bar and check for pressure loss using leak detector spray.
- If a leak is suspected, immerse the shock absorber and air spring assembly in a tank of water to locate the source of the leak and mark the area.

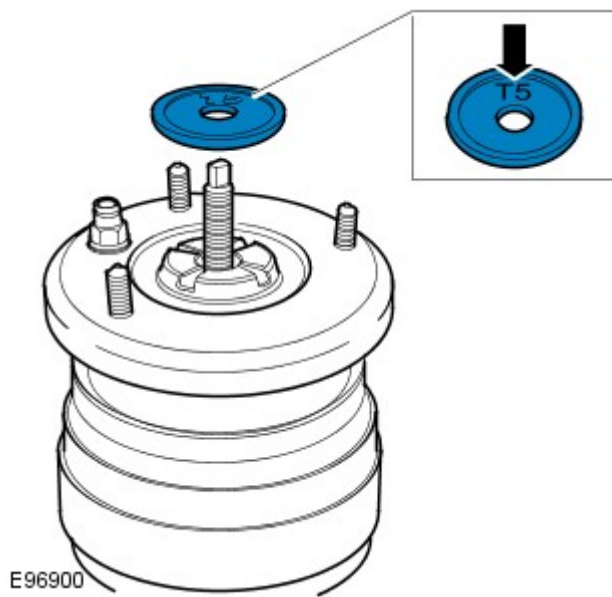
3. Remove the nylon retaining pin.




4. Using the special tool, remove the nut.




5. Remove the rebound washer.

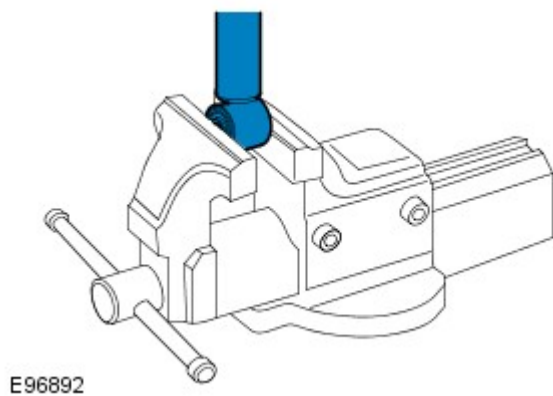


6. CAUTIONS:

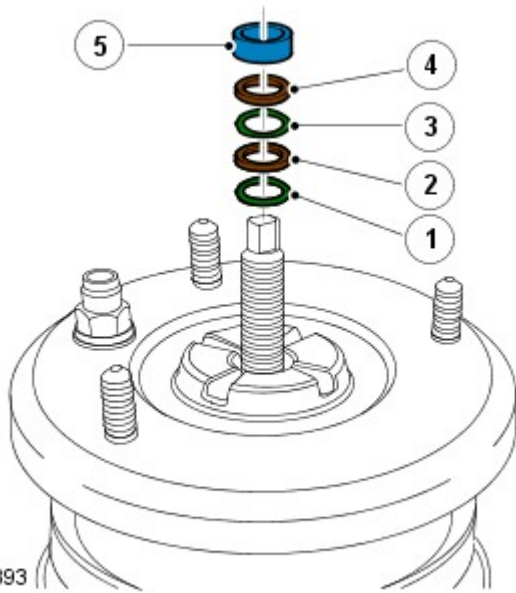
 Make sure protective jaws are installed to the vice. Failure to follow this instruction may result in damage to the component.

 Do not clamp the shock absorber tube. Failure to follow this instruction may result in damage to the component.

Position the front shock absorber and air spring assembly in a vice.

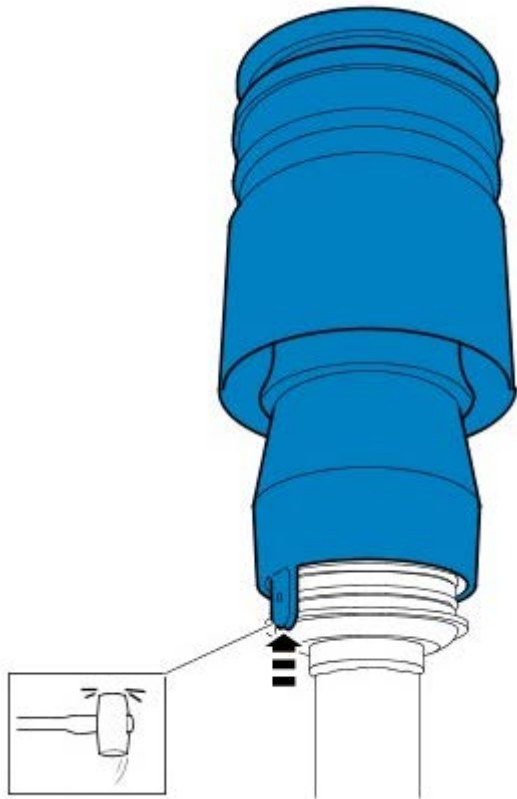


7. Remove and discard the 3 spacers and 2 O-ring seals.




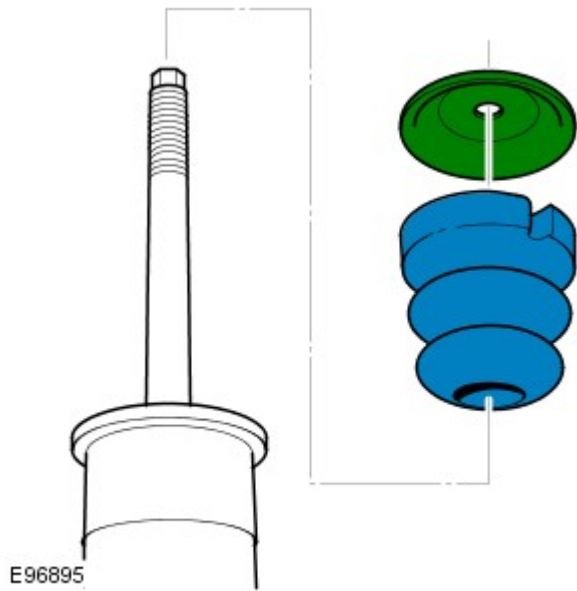
E96893

8. Remove the air spring.
 - Using a soft faced mallet, gently tap the sleeve support upwards to release it from the O-ring seals.

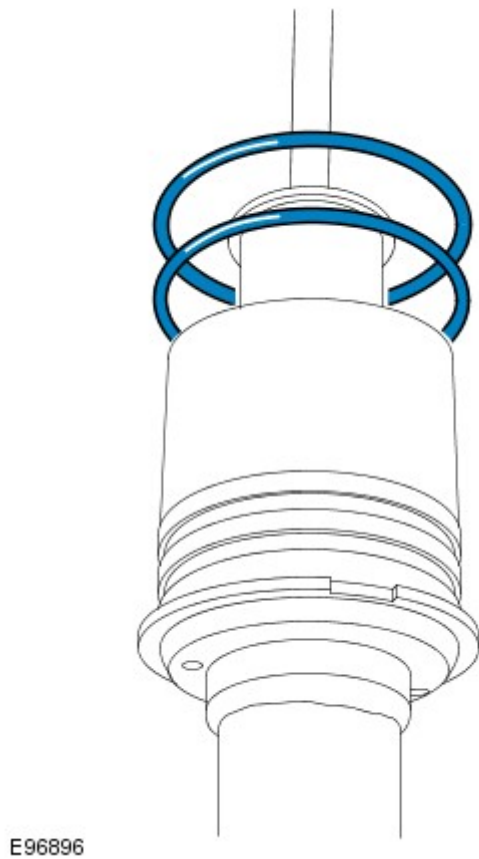


E96894

9.  NOTE: Note the fitted position.
Remove the bump plate and spring aid.




10. Remove and discard the 2 large black O-ring seals from the lower seal carrier.




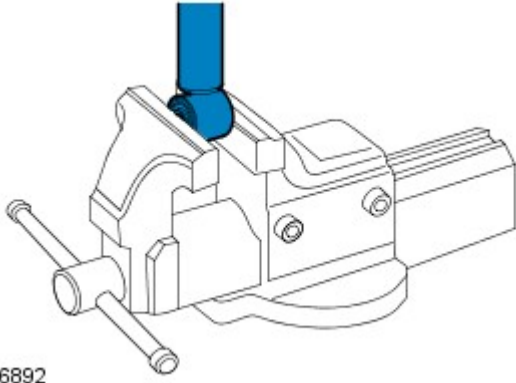
11. Remove the front shock absorber and air spring assembly from the vice.

Installation

1. CAUTIONS:

 Make sure protective jaws are installed to the vice. Failure to follow this instruction may result in damage to the component.

 Do not clamp the shock absorber tube. Failure to follow this instruction may result in damage to the component.

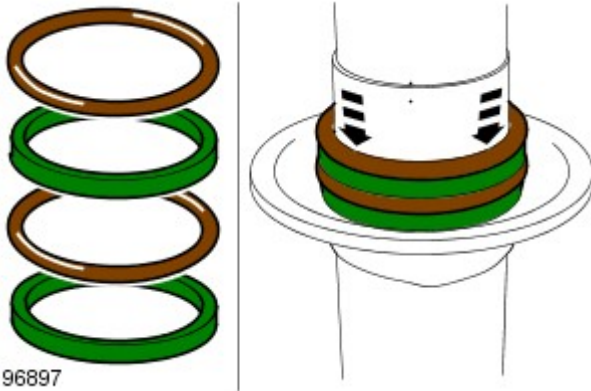


E96892

Position the front shock absorber and air spring assembly in a vice.

2.  **CAUTION:** Use compressed air and lint free non-flocking material.

Clean the components.



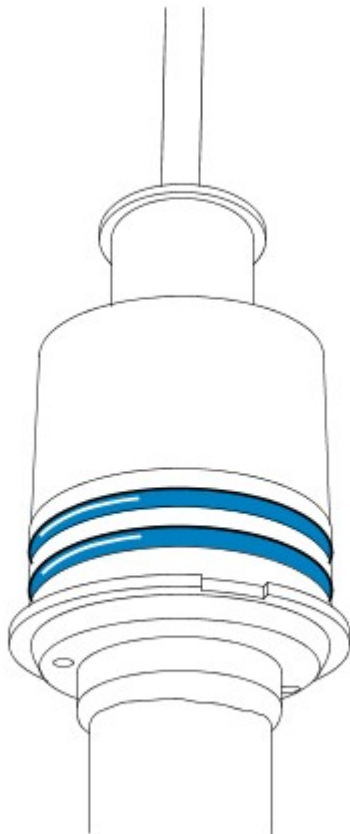
E96897

3. Lift the seal carrier to expose the O-ring seal stack.
- Make sure that the damper body O-ring seals and spacers are fully seated to the spring seat.


4.  **CAUTION:** Take care not to damage the O-ring seals during installation.

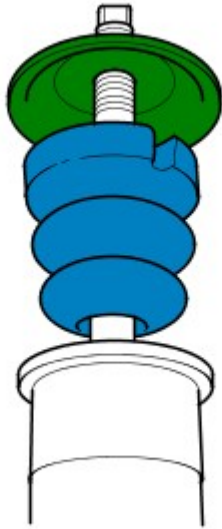
Install new O-ring seals to the seal carrier.

- Apply loctite 8021 (silicon-based oil) to the O-ring seals.



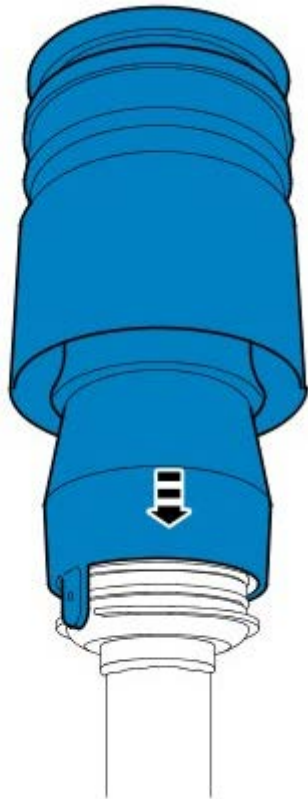
E96898

5.  **NOTE:** Make sure that these components are installed to the noted removal position.



E96899

Install the bump plate and spring aid.




E99908

6. Install the air spring.

- Align the sleeve support with the first O-ring seal making sure that the location tag is correctly aligned with the spring seat cut-out.

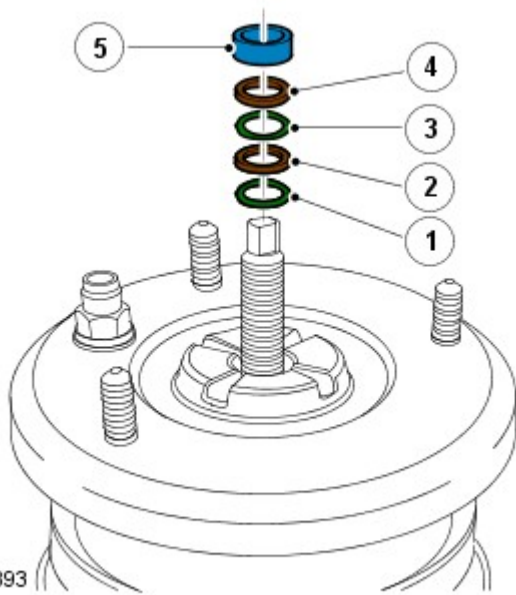
7. CAUTIONS:

 Make sure that the threads of the front air shock absorber are covered with protective tape.

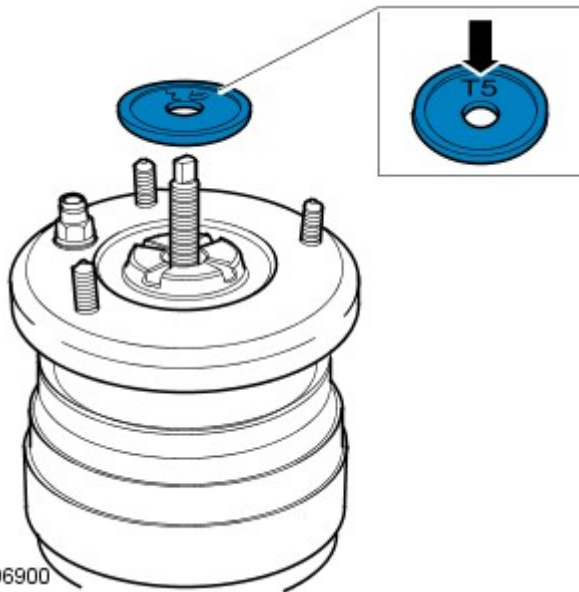
 Take care not to damage the O-ring seals during installation.

Install the components in the following order:


1. O-ring seal
2. Spacer
3. O-ring seal
4. Spacer
5. Spacer



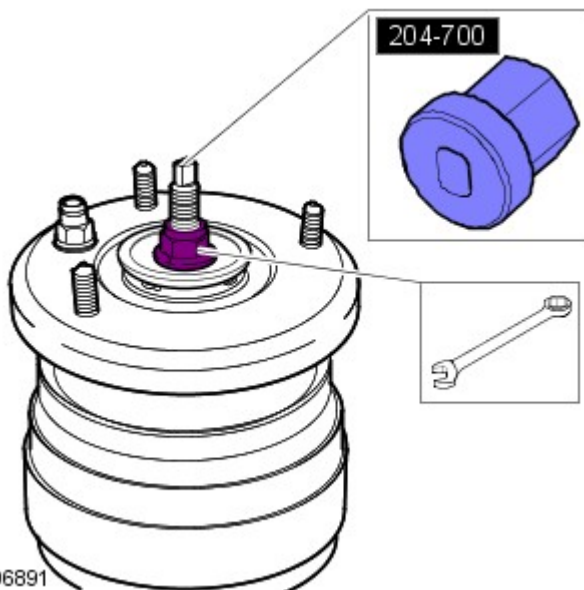
E96893



E96900

8.  **NOTE:** The "T5" stamp on the upper face of the rebound washer must be visible after assembly.

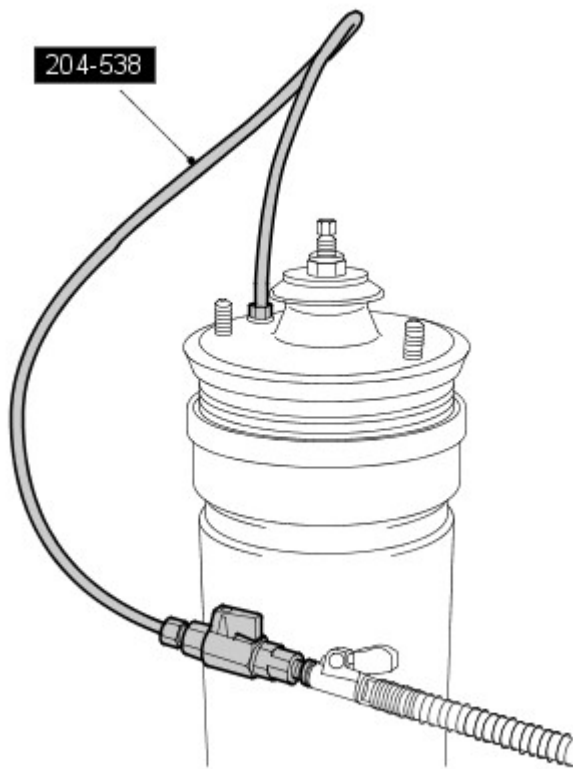
Install the rebound washer.



E96891


9. Install a new nut and using the special tool, and tighten to 98 Nm (72 lb.ft).


10. **CAUTIONS:**



E51445

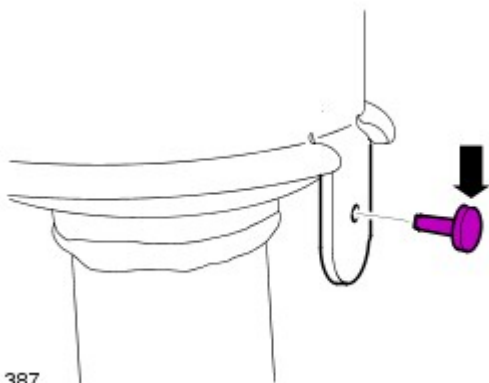
 The air supply must be free of any moisture.

 If during disassembly the air sleeve is unrolled, the air sleeve may inflate incorrectly (to one side). If this occurs, release the air pressure, and insert a suitable tool that will not damage the air sleeve or piston (a screw driver handle), into the side opposite the bulge. Inflate and deflate until the air sleeve inflates correctly (the air sleeve will be uniform inside the shroud).

 **NOTE:** To prevent damage when seating the sleeve support over the large black O-rings, compressed air should be used to inflate the air spring.

Using the special tool coupled to a tire inflator with a gauge, apply approximately 2 bar of air pressure to the air spring to fully seat the sleeve support over the O-ring seals.

11. Check the assembly for leaks.
 - Inflate the module to 4 bar and check for pressure loss using leak detector spray.
 - If a leak is suspected, immerse the shock absorber and air spring assembly in a tank of water to locate the source of the leak.
12. Depressurize and remove the special tool from the shock absorber and air spring assembly.
13. Install the nylon retaining pin.



E51387



14.  **NOTE:** Install a new air spring pipe connector.

Install the front shock absorber and air spring assembly. For additional information, refer to: Front Shock Absorber and Air Spring Assembly (204-05 Vehicle Dynamic Suspension, Removal and Installation).

Vehicle Dynamic Suspension - Rear Air Shock Absorber

Removal and Installation


Special Tool(s)

 <p>204-538 E51385</p>	<p>Air spring tester 204-538</p>
 <p>100-050 E57611</p>	<p>Band-it Thrift tool 100-050 (LRT-99-019)</p>

Removal



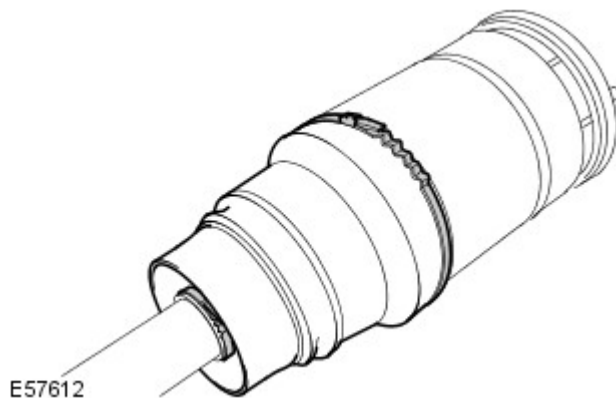
NOTE: This procedure should also be used to remove the rear air spring.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

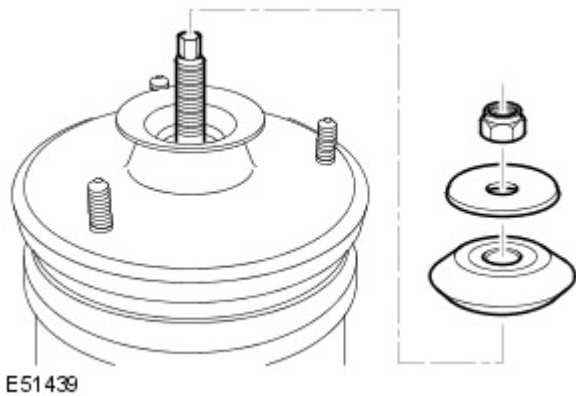
Raise and support the vehicle.

2. Remove the wheel and tire.
3. Remove the shock absorber and spring assembly.
For additional information, refer to: Rear Shock Absorber and Air Spring Assembly (204-05, Removal and Installation).

4. Remove the gaiter.
 - Remove and discard the 2 straps.

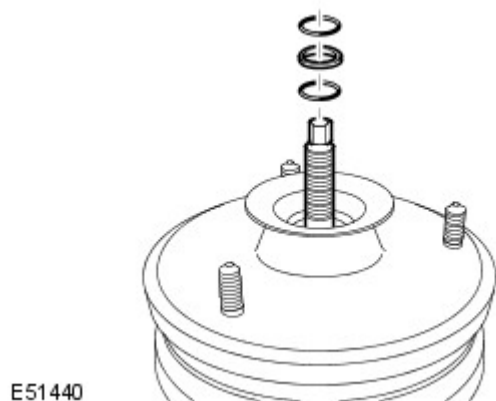


5. Remove the nut, rebound washer and rubber bushing.
 - Discard the nut.



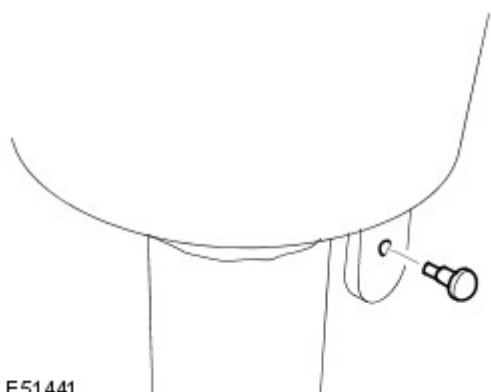
E51439

6. Remove and discard the O-ring seals and spacer.



E51440

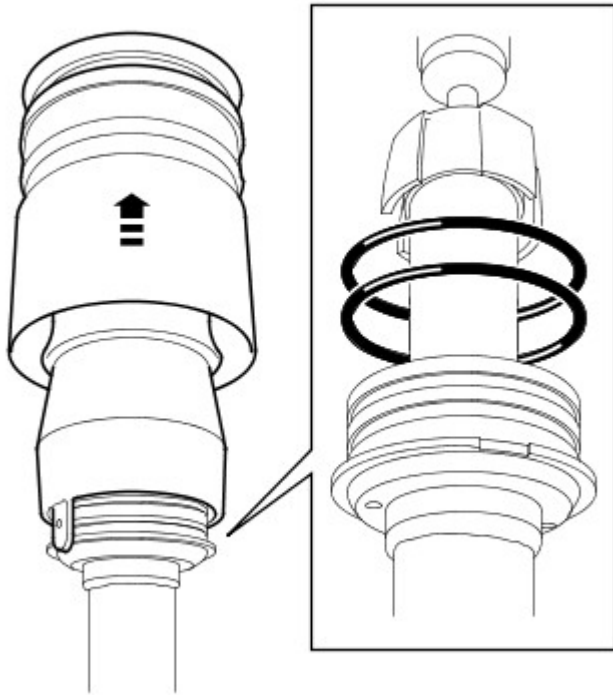
7. Remove the nylon retaining pin.



E51441

8. Remove the rebound plate and spring aid.

9. Remove the air spring.
 - Using a soft faced mallet, gently tap the sleeve support upwards to release it from the O-ring seals.
 - Remove and discard the 2 O-ring seals.

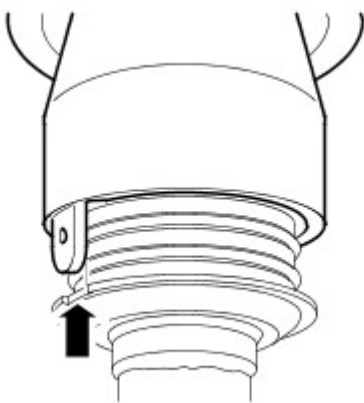


E51442

10. Remove the shock absorber from the vise.

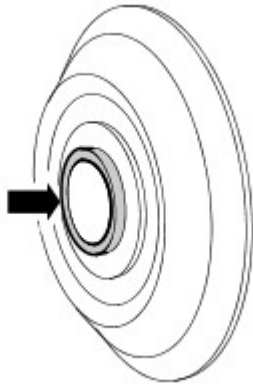
Installation

1. Install the shock absorber in the vise.
2. Clean the components.
3. Lubricate and install new O-rings to the seal carrier.
4. Install the spring aid and rebound plate.
5. Install the air spring.
 - Align the piston with the first O-ring seal, making sure the location tag is correctly aligned.



E51443

6. Install the new O-ring seals and spacer, taking care not to damage the seals.
7. Install the rubber bushing and rebound washer.
 - Make sure the formed insert on the bushing is located against the O-ring seal.



E51444

8. Install and lightly tighten the nut.

9. CAUTIONS:



The air supply must be free of any moisture.



If during disassembly the air sleeve is unrolled, the air sleeve may inflate incorrectly (to one side). If this occurs, release the air pressure, and insert a suitable tool that will not damage the air sleeve or piston (a screw driver handle), into the side opposite the bulge. Inflate and deflate until the air sleeve inflates correctly (the air sleeve will be uniform inside the shroud).

Install the air spring piston over the O-ring seals.

- Using the special tool coupled to a tire inflator with a gauge, apply approximately 2 bar of air pressure to the air spring to fully seat the piston over the O-ring seals.

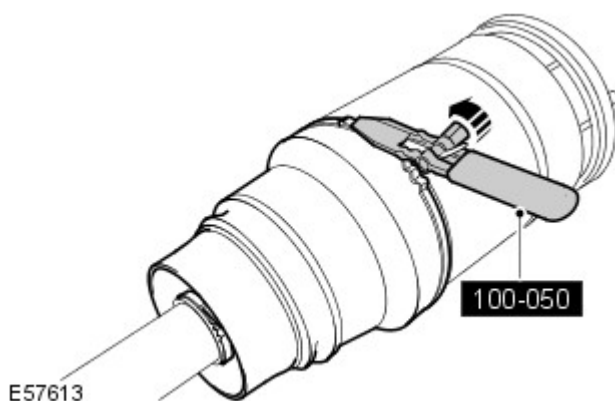
10. Tighten the top nut to 98 Nm (72 lb.ft).

11. Check the assembly for leaks.

- Inflate the module to 4 bar and check for pressure loss.
- If a leak is suspected, immerse the spring and shock absorber assembly in a tank of water to locate the source of the leak.

12. Install the gaiter.

- Using the special tool, install new straps.



13. Install the shock absorber and spring assembly. For additional information, refer to: Rear Shock Absorber and Air Spring Assembly (204-05, Removal and Installation).

Vehicle Dynamic Suspension - Front Shock Absorber and Air Spring Assembly

Removal and Installation

Removal

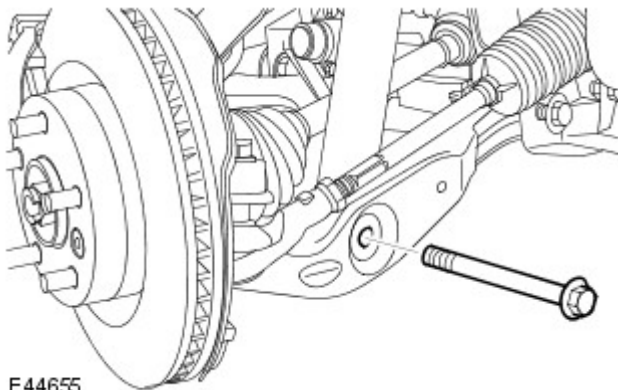


NOTE: Only the air spring being removed needs to be depressurized.

1. **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

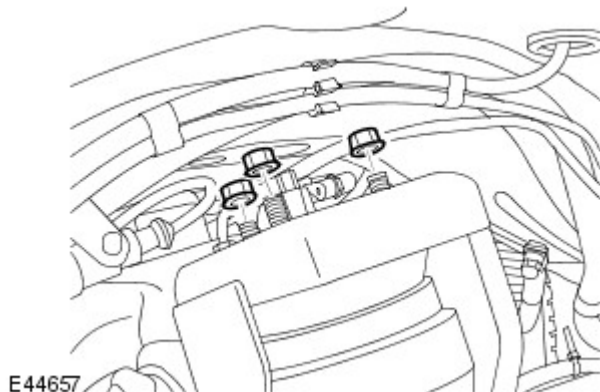
Raise and support the vehicle.

2. Remove the wheel and tire.
3. Using the Land Rover approved diagnostic system, depressurize the air suspension. For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).



E44655

4. Disconnect the shock absorber and air spring assembly from the lower arm.
 - Remove the nut and bolt.



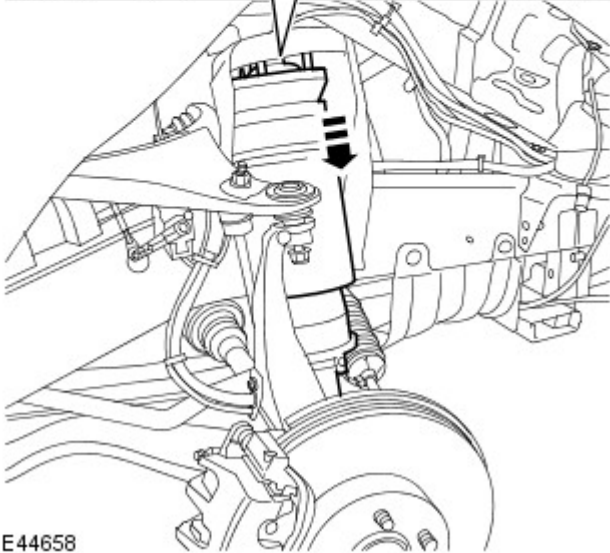
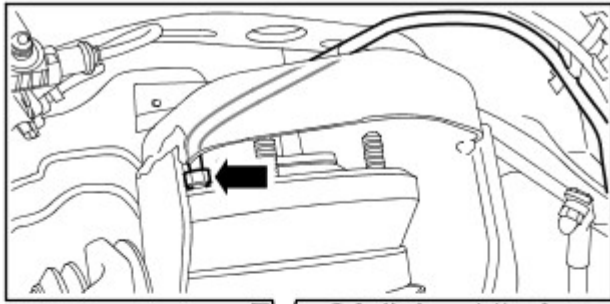
E44657

5. Release the shock absorber and air spring assembly.
 - Remove the 3 nuts.

6. **CAUTION:** Always plug any open connections to prevent contamination.

Reposition the shock absorber and air spring assembly.


- Disconnect the air line.



E44658

7. Remove the shock absorber and air spring assembly.
8. Remove the Voss connector from the air line.
 - Remove and discard the collet and the union.

Installation

1.  **CAUTION:** Make sure the new Voss connector is installed and fully tightened with the alignment plug installed.

Install a new Voss connector to the air spring.

- Tighten to 3.5 Nm (2.6 lb.ft)

2. **NOTES:**



Remove and discard the blanking caps.



Clean the component mating faces.

Install the shock absorber and air spring assembly.

- Connect the air line into the Voss connector.
 - Pull on the air line to make sure it is fully installed into the Voss connector.
 - Install the nuts and tighten to 63 Nm (46 lb.ft).
3. Connect the shock absorber and air spring assembly to the lower arm.
 - Tighten the nut and bolt to 300 Nm (221 lb.ft).
 4. Using the Land Rover approved diagnostic system, pressurize the air suspension.
For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).
 5. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Vehicle Dynamic Suspension - Rear Shock Absorber and Air Spring Assembly

Removal and Installation

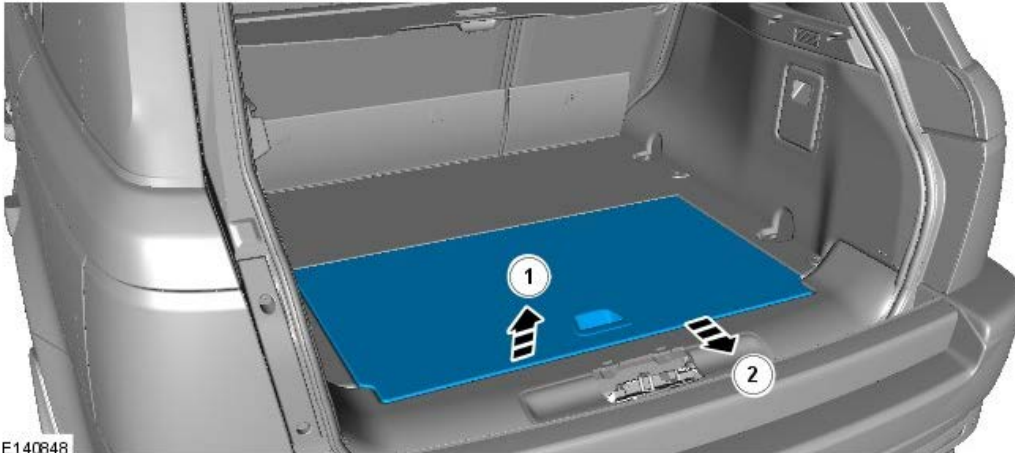
Removal



NOTE: RH illustration shown, LH is similar.

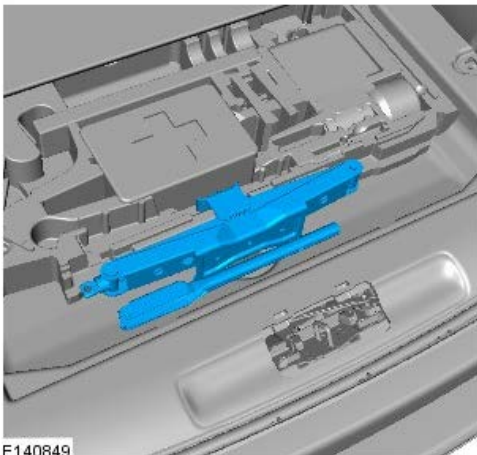
1. Using the Land Rover approved diagnostic system, depressurize the air suspension. For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05 Vehicle Dynamic Suspension, General Procedures).

2. Remove the loadspace floor panel.



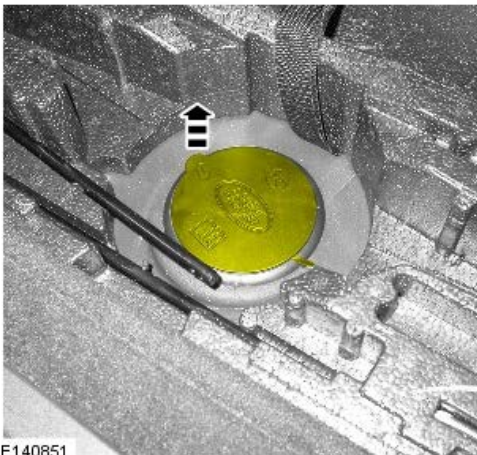
E140848

3. Remove the jack and wheel brace.



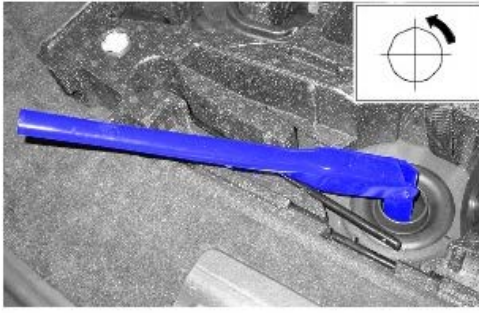
E140849

4. Remove the spare wheel/tool compartment cover.



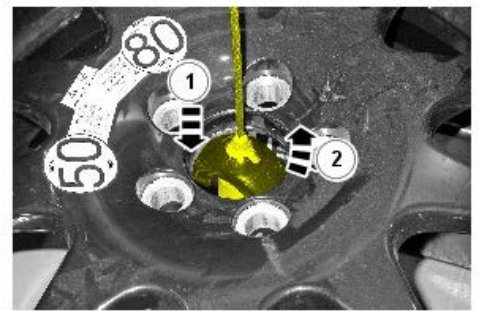
E140851

5. Lower the spare wheel and tire.



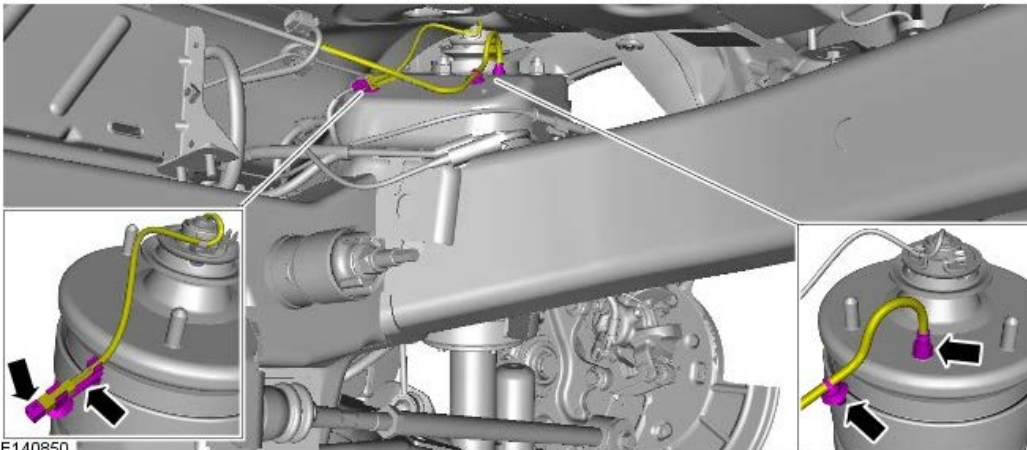
E140852

6. Remove the spare wheel.
 - Disconnect the spare wheel release strap and position aside.




E140853

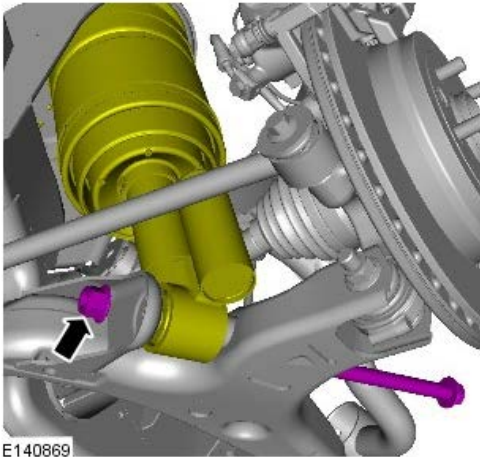
7.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.



E140850

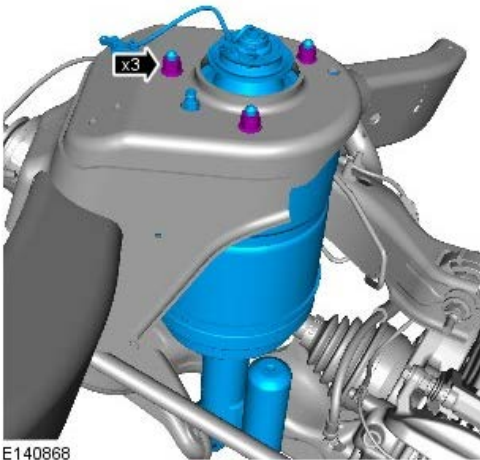
8.  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.
Remove the Voss connector from the air line.
 - Remove and discard the collet and the union.
 - Disconnect the active damping wiring.

9. Remove the wheel and tire.



E140869


10. Disconnect the shock absorber and air spring assembly from the lower arm.
- Remove the nut and bolt.



E140868

11. Remove the three shock absorber and air spring retaining nuts.
- Remove the shock absorber and air spring assembly.

Installation


1. Install the shock absorber and air spring assembly.
 - Make sure the shock absorber and air spring assembly top mounting to body mating faces are clean.
 - Fit the nuts and tighten to 63 Nm (46 lb.ft).
 - Connect the air line into the Voss connector.
 - Pull on the air line to make sure it is fully installed into the Voss connector.
2. Connect the shock absorber and air spring assembly to the lower arm.
 - Do not fully tighten at this stage.
3. Using the Land Rover approved diagnostic system, pressurize the air suspension. For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05 Vehicle Dynamic Suspension, General Procedures).
4. Tighten the shock absorber and air spring assembly to the lower arm.
 - Tighten the nut and bolt to 300 Nm (221 lb.ft).
5.  **CAUTION:** Make sure the new Voss connector is installed and fully tightened with the alignment plug installed.

Install a new Voss connector to the air spring.
 - Tighten to 3.5 Nm (2.6 lb.ft)
 - Attach the active damping wiring.
6. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
7. Lower the vehicle on the lift.
8. Connect the spare wheel release strap to the spare wheel and tire.
9. Install the spare wheel and tire.
 - Raise the spare wheel and tire.
10. Install the spare wheel/tool compartment cover.
11. Install the jack and wheel brace.
12. Install the loadspace floor panel.

Vehicle Dynamic Suspension - Air Suspension Pressure Sensor

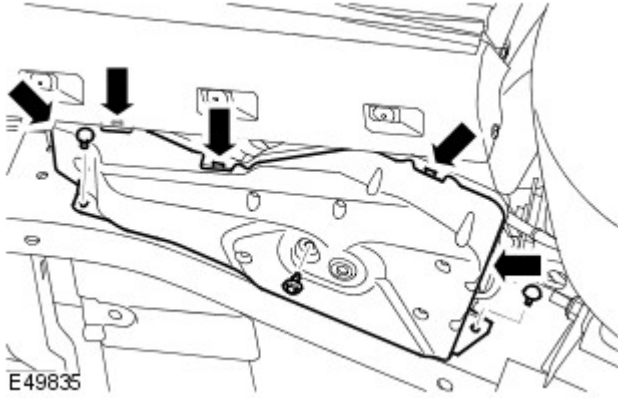
Removal and Installation

Removal


1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.


2. Remove the air compressor housing cover.
 - Remove the 3 bolts.
 - Release the 5 clips.



3. Using T4, depressurize the air suspension. For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).

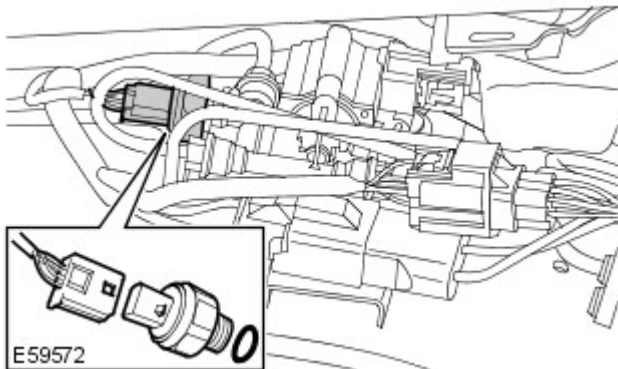
4.  **NOTE:** Make sure the valve block does not become detached during removal of the air pressure sensor.

Disconnect the electrical connector.


5.  **CAUTION:** Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

Remove the air pressure sensor.

- Remove and discard the O-ring seal.



Installation

1.  **NOTE:** Make sure the valve block does not become detached during installation of the air pressure sensor.

Install the air pressure sensor.

- Install a new O-ring seal.
- Tighten to 5 Nm (4 lb.ft).

2. Connect the electrical connector.

3. Using T4, pressurize the air suspension. For additional information, refer to: Air Suspension System Depressurize and Pressurize (204-05, General Procedures).

4. **CAUTIONS:**



Make sure the air suspension compressor upper cover is correctly positioned.



Make sure the air suspension exhaust pipe is correctly located in to the air suspension upper cover.

Install the air compressor housing cover.


- Install the bolts and tighten to 9 Nm (7 lb.ft).

Vehicle Dynamic Suspension - Air Suspension Compressor

Removal and Installation

Removal

 **WARNING:** Steps 1 and 2 must be carried out within 10 minutes of each other. Failure to follow this instruction may result in personal injury.

 **CAUTION:** Before disconnecting or removing components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

 **NOTE:** Removal steps in this procedure may contain installation details.

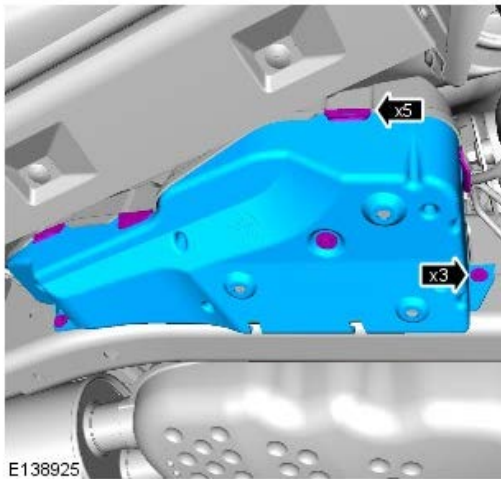
-  **CAUTION:** Make sure the ignition switch is turned off, the park brake is on and the selector lever is in park.

Open the front door.

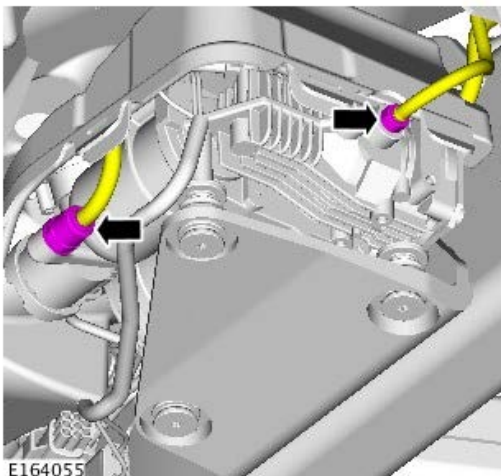
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle. Make sure at least one of the wheels is off the ground.

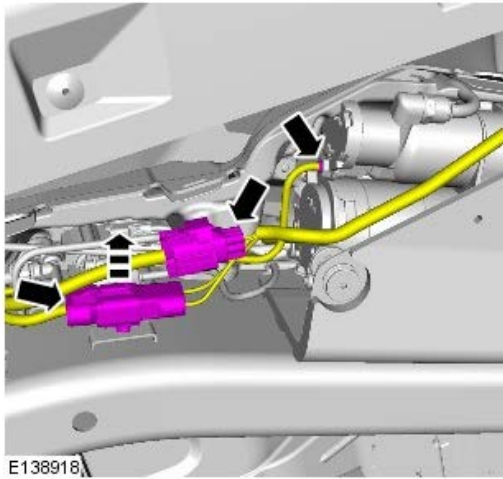
3.



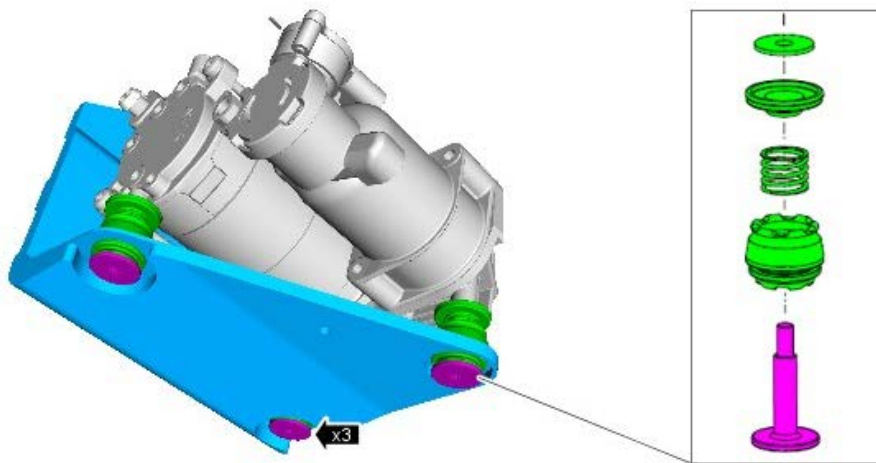
-  **CAUTION:** Always plug any open connections to prevent contamination.




-  **CAUTION:** Always plug any open connections to prevent contamination.




E138918



E139484

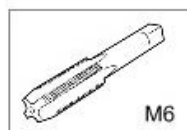
6.  NOTE: Note the orientation of the component prior to removal.

Installation

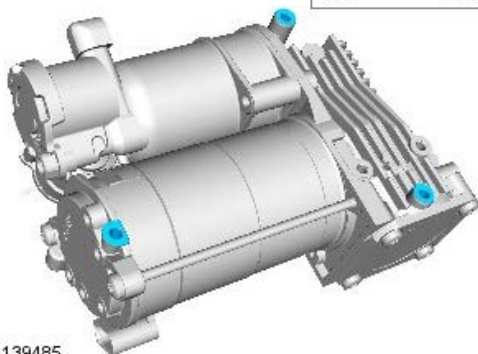
1.  NOTE: Check the air compressor type. If an AMK air compressor is installed to replace an Hitachi air compressor then a new corresponding relay must also be installed.

For additional information, refer to: [Specifications](#) (204-05 Vehicle Dynamic Suspension, Specifications).

2.  CAUTION: Using a suitable tap, cut a starting thread to align the self tapping bolts.




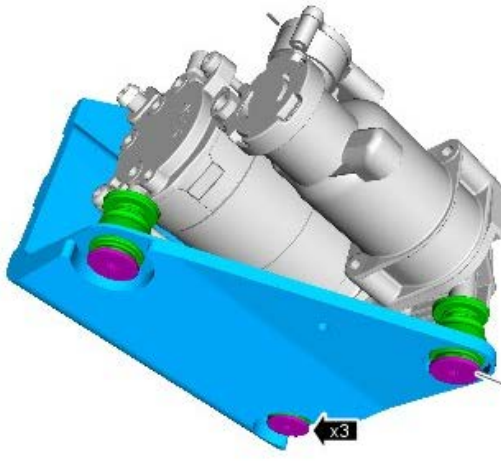
M6



E139485

3. CAUTIONS:

 Make sure that these components are installed to the noted removal

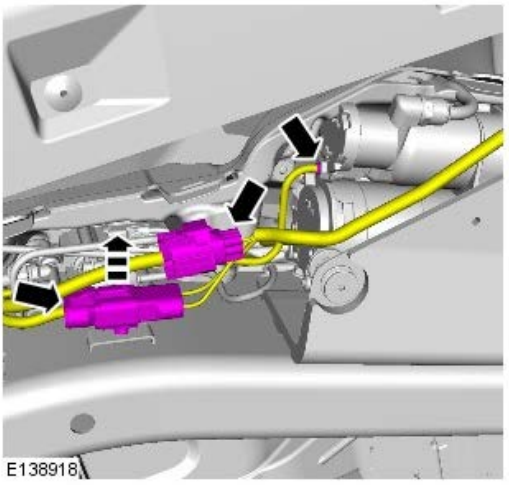


E139484

position.
 ⚠ Make sure that the self tapping bolts remains aligned during the tightening process.

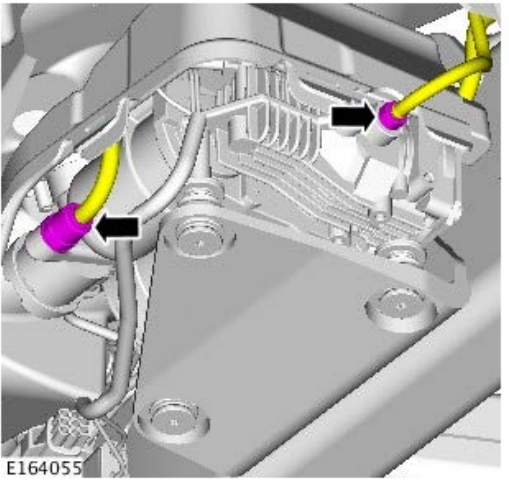
TORQUE:
 10 Nm

4.



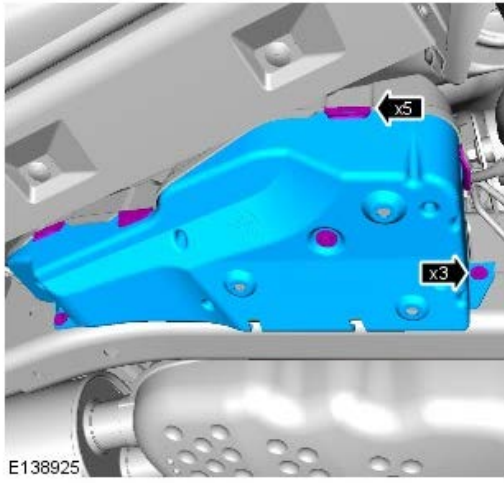
E138918

5.



E164055

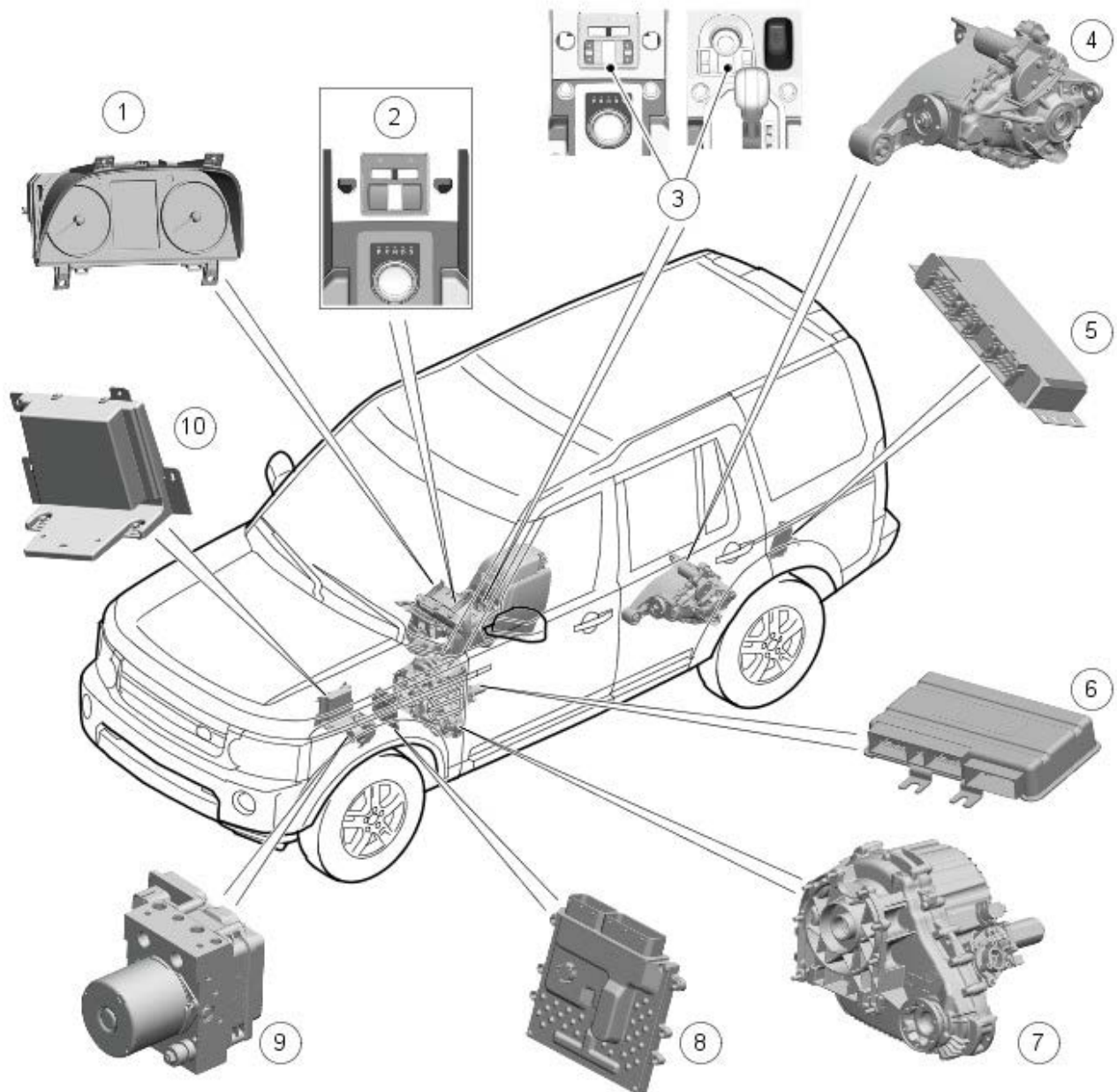
6. TORQUE: 9 Nm



Ride and Handling Optimization - Ride and Handling Optimization

Description and Operation

Component Location



E150708

Item	Part Number	Description
1	-	Instrument Cluster (IC)
2	-	Hill Descent Control (HDC) and Range Control switchpack (coil spring vehicles)
3	-	Terrain Response (TR) switchpack (air suspension vehicles)
4	-	Rear differential
5	-	Rear Differential Control Module (RDCM)
6	-	Air suspension control module
7	-	Transfer case (center differential and high/low range)
8	-	Engine Control Module (ECM)
9	-	Anti-Lock Brake System (ABS) control module
10	-	Transfer Case Control Module (TCCM)

GENERAL



NOTE: Coil spring vehicle are not equipped with TR system.

The TR system allows the driver to select a program which aims to provide the optimum settings for traction and performance for the prevailing terrain conditions. The system cannot be switched off. The 'special programs off' is

the default program and covers all general driving conditions. Four specific terrain programs are selectable to cover all terrain surfaces.

The system is controlled by a rotary control located on the center console, rearward of the selector lever (automatic transmission) or gearshift lever (manual transmission). The rotary control allows the selection of one of the following five programs:

- Special programs off
- Grass/Gravel/Snow
- Mud-Ruts
- Sand
- Rock crawl.

The rotary control can be rotated through 360 degrees or more in either direction and selects each program in turn. When TR is fitted to a vehicle, a hi-line IC will also be fitted which will display the selected program in the message center.

The TR system uses a combination of a number of vehicle subsystems to achieve the required vehicle characteristics for the terrain selected. The following subsystems make up the TR system:

- Engine management system
- Automatic transmission (if fitted)
- Transfer case (center differential)
- Rear differential (electronically controlled)
- Brake system (ABS/DSC/ETC/HDC functions)
- Air suspension.

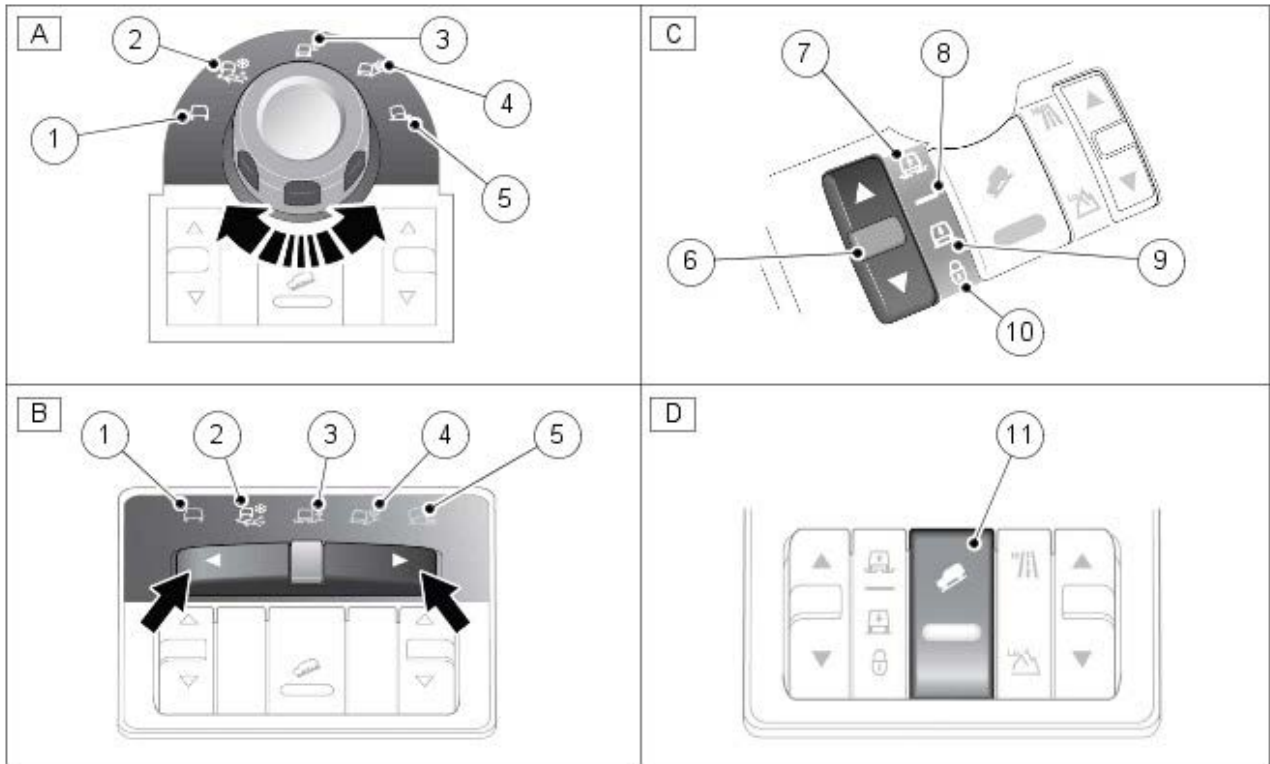
A TR control module is located below the rotary control. The control module detects the selection made on the rotary control and transmits a signal on the high speed [CAN \(controller area network\)](#) which is received by each of the subsystem control modules. Each of the affected control modules contain software which applies the correct operating parameters to their controlled system for the TR program selection made. Each control module also provides a feedback for the selected program so that the TR control module can check that all systems have changed to the correct operating parameters.

Information is displayed in the IC message center which informs the driver of improvements which can be made to the vehicle operating parameters to optimize the vehicle for the prevailing conditions. Inexperienced off-road drivers may benefit from the automatic assistance of the TR system and the driver information. Experienced off-road drivers can select the specific programs for extreme conditions to access control over the vehicle systems (e.g., throttle shift maps or traction settings) which are not accessible on vehicles without TR.

TERRAIN RESPONSE SWITCHPACK



NOTE: Air suspension vehicles.

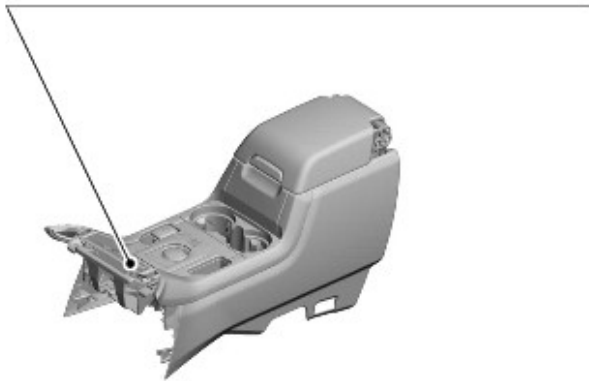
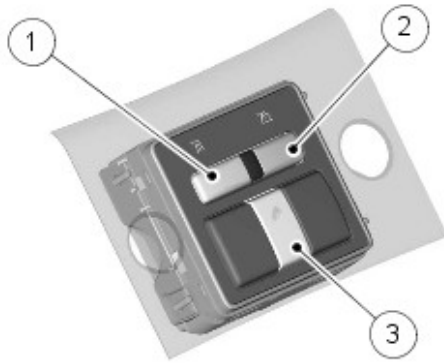


E150769

Item	Part Number	Description
A	-	TR switchpack - Transmission Selector Lever
B	-	TR switchpack - Transmission Control Switch (TCS)
C	-	Air suspension switch
D	-	Hill Descent Control (HDC) switch
1	-	General program (special programs off)
2	-	Grass/Gravel/Snow
3	-	Mud-Ruts
4	-	Sand
5	-	Rock crawl
6	-	Raise/lower switch
7	-	Off-Road Mode
8	-	On-Road Mode
9	-	Access Mode
10	-	Crawl (Locked at Access) Mode
11	-	HDC switch



NOTE: Coil spring vehicles only.



E150641

Item	Part Number	Description
1	-	Hi range switch
2	-	Low range switch
3	-	HDC switch

Each program is denoted by a symbol which represents the terrain encountered. The rotary control can be rotated to select the required program. The control will only select the last program in its direction of rotation. Further rotation of the control once the last program in either direction has been selected, will have no effect, e.g. once rock crawl has been selected, further rotation in a clockwise direction will have no effect.

The TR control module is located below the rotary control. The module is connected via a harness connector which also contains the wiring for the HDC switch, the Transfer case high/low range switch, the air suspension switch and the switch illumination circuits. The control module and switch uses four of these wires for a 12V battery supply when the ignition switch is in ignition position II, a ground and high speed CAN positive and negative.

TERRAIN RESPONSE OPERATION

The following vehicle subsystem control modules are used for the TR system:

- Engine management (engine control module)
- Transmission control (TCM - automatic transmission only)
- Transfer case control (TCCM)
- Rear differential control (RDCM - if fitted)
- Air suspension control (air suspension control module)
- Brake system (ABS/DSC/ETC/HDC functions) (ABS (anti-lock brake system) control module)

Each subsystem operates in different ways in relation to the selected TR program to achieve the optimum traction, stability and ease of control for the terrain encountered. The system has a safety factor built in which ensures that any program can be safely used on any surface, even when an inappropriate program selection has been made.

ENGINE CONTROL MODULE

The ECM (engine control module) varies the throttle pedal response to control the engine torque output. The ECM can change the throttle maps to change the amount of torque per percentage of pedal travel. The ECM can also change the throttle response to control the allowed torque change relative to the percentage pedal travel.

Each terrain program uses a combination of operating parameters for each subsystem. Changing between terrain programs initiates a different set of operating characteristics which will be noticeable to the driver. The driver will notice differences in engine and throttle response when, for example, the throttle pedal is held in a constant position and the terrain program is changed from grass/gravel/snow to sand, the driver will notice the torque and engine speed increase. If the terrain program is changed from sand to grass/gravel/snow the driver will notice a reduction in torque and engine speed.



NOTE: The change in torque and engine speed can take approximately 30 seconds and care must be taken not to confuse the TR system operation with an ECM fault.

Transmission Control

The Transmission Control Module (TCM) changes the shift maps for the TR program selected. This changes the shift points providing early or late upshifts and downshifts.

On slippery surfaces the transmission will select 2nd gear in high range or 3rd gear in low range for starting from a standstill to minimize wheel slip. In muddy conditions the transmission will provide maximum torque output from the transmission. In sand the transmission will provide an output which passes maximum engine power from the transmission.

In rock crawl special program (low range) the transmission will select 1st gear for driving off.

Sport mode is only available when the general program is selected and the transfer case is in high range. Sport mode is disabled in low range and all TR special programs. CommandShift™ is available in any program and also in high or low range.

If the transmission is in 'Sport' mode and a special program is subsequently selected, the transmission will automatically change to manual 'CommandShift™' mode. If a special program is already selected and the transmission selector lever is moved from drive 'D' to the 'Sport' mode position, the transmission will automatically change to 'CommandShift™' mode.

Transfer case and Rear Differential Control

The Transfer case electronically controlled differential and the rear electronically controlled differential (if fitted) are treated as one system. The electronic rear differential is an optional fitment on vehicles fitted with the TR system. The differential control has two operating strategies; pre-emptive and reactive.

The pre-emptive strategy anticipates and predicts the locking torque value required for each differential to minimize slip and maximize stability. Each TR program has a different threshold and input criteria for the pre-emptive strategy. The pre-emptive strategy improves vehicle traction and composure by avoiding wheel spin. This is achieved by anticipating the amount of differential lock required for the program selected. For example, a high locking torque would be applied for rock crawl or slippery surfaces.

The reactive strategy varies the amount of locking torque in response to the actual slip level and the dynamic behavior of the vehicle. Each TR program has a different threshold and input for the reactive strategy. The reactive strategy improves vehicle traction and composure by eliminating any wheel spin which has occurred after the pre-emptive strategy was applied. The locking response applied is applicable to the terrain program selected, for example, very sensitive on slippery surfaces to provide maximum traction and minimize surface damage.

The locking torque calculations use various signals from other subsystems, for example, engine torque, throttle position, selected gear, steering angle, vehicle speed, lateral acceleration, yaw behavior.

The Dynamic Stability Control function of the [ABS](#) system can override the TR differential control and reduce any applied locking torque during DSC action.

For additional information, refer to: Anti-Lock Control - Traction Control (206-09A, Description and Operation).

Air Suspension Control

The air suspension control module contains a strategy which provides automatic switching between normal and off-road heights. Changes in vehicle height settings will be relayed to the driver via the IC message center and [LED \(light emitting diode\)](#) illuminated icons on the switch. The automatic selection and deselection of the vehicle height provides automatic increase and decrease in ground clearance and aims to provide maximum benefit to the selected terrain program.

On a vehicle fitted with a correctly installed, Land Rover approved trailer socket, if an electrical load is sensed on the trailer socket, height changes are prohibited and the message center displays a message advising that a trailer is connected and off-road height is not automatically selected. The driver can raise the suspension manually using the air suspension switch.



NOTE: The prohibiting of the automatic ride height selection is only operational if a Land Rover approved trailer socket is fitted and an electrical load is sensed on the socket.

Anti-Lock Brake System Control

The [ABS](#) control module controls several vehicle functions and adjusts the operating parameters of these functions to optimize the selected TR program.

Traction control uses different slip/acceleration thresholds to improve traction and vehicle composure. For example, the system sensitivity is increased on slippery surfaces to reduce wheel spin.

If DSC is switched off (with the DSC switch on the instrument panel) when using a TR special program, if the special program is subsequently changed for a different program DSC is automatically switched back on.

The stability control uses different threshold values for the selected program to automatically reduce DSC intervention, removing the requirement for the driver to disable the DSC system in order to reduce engine intervention which is sometimes induced in extreme off-road conditions. In extreme sand conditions, there may be an additional benefit of disabling the DSC function using the DSC switch on the instrument panel in addition to selecting the sand program.

HDC is automatically switched on or off and target speeds are adjusted in response to the TR program selected. The responsiveness of the HDC function is also increased where required.

Automatic operation of HDC aims to assist the driver by switching the system on or off when it is of most benefit. Target speeds for HDC operation are also adjusted according the vehicle operating conditions.

Incorrect Program Usage

Selection of an inappropriate program is discouraged in the following ways:

- The active program icon is continually displayed in the IC message center
- The TR control module 'locks' out certain functions in some programs, e.g.
 - cruise control is only available with the special programs off or grass/gravel/snow program
 - transmission 'Sport' mode is deactivated in all special programs.
- In any special program, except the grass/gravel/snow program, when the ignition has been in the off position continually for more than 6 hours, the TR system defaults to the Special Programs Off
- When in the grass/gravel/snow program, the TR system will never default to the Special Programs Off. This is to allow for drivers in cold climates where continuous use of the grass/gravel/snow program would be beneficial.
- The rock crawl program is only available with the Transfer case in low range.

Selection of an inappropriate program for the terrain conditions will not endanger the driver or cause damage to the vehicle. Continued use of an inappropriate program may reduce the life of some components. The driver may notice reduced vehicle response, with the engine and transmission being less responsive than in the special programs off. Also, in some programs, HDC will remain on, signified by illumination of the HDC indicator in the IC. The driver may also notice torque 'wind-up' in the center and rear differentials causing a 'braking' effect when the vehicle is maneuvered in some special programs.

The use of the special programs in the TR system is monitored by the TR control module which records the mileage and time the vehicle has operated in a specific program in high and low range. This information can be retrieved using T4 and used by the dealer technician to check customer concerns, e.g. high fuel consumption which may be due to continued use of a certain program.

Driver Information

The high specification IC fitted to all vehicles with TR, contains a message center which displays vehicle information to the driver. The message center contains the TR program icons which display the currently selected program. If no symbol is displayed, no special program is selected and the system is in special programs off.

Any required changes to the subsystems are also passed to the driver in the form of indicator illumination in the IC or appropriate messages in the message center, HDC off or air suspension height change for example.

In certain operating conditions, the TR system also displays advice or warning messages to ensure the driver is using the vehicle to its full potential, e.g.:

- steering angle is displayed in the message center to avoid driving in deep ruts with steering lock applied
- gear information is displayed to recommend a gear for slippery conditions
- if the system automatically provided off road ride height, but the driver subsequently lowers the vehicle to normal height, then the system may advise that this will cause a risk of grounding.

The messages which can be displayed in the IC message center are detailed in the Information and Message Center section.

For additional information, refer to: Information and Message Center (413-08, Description and Operation).

DIAGNOSTICS

The TR control module stores information on detected TR faults and CAN errors which can be interrogated using T4. The TR sub-systems and the IC also store fault information relating to CAN errors from the TR control module.

The control module also stores the miles travelled and time elapsed in high range for the individual programs and in low range for use of all programs which can also be retrieved using T4. This information aids diagnosis of the TR system and also provides an indication of TR system abuse by the driver which can lead to premature component failure.

Terrain Response System Fault Diagnosis

TR relies on the correct functionality of the five sub-systems. If one of the sub-systems develops a fault, the TR system will not function, even though the fault is not in the TR system. The TR control module and rotary control should only be investigated if there are no apparent faults in any of the sub-systems. If a fault in a sub-system is subsequently corrected, the TR system will function normally after an ignition on and off cycle.

Terrain Response Sub-System Faults

If a fault occurs in a sub-system, the driver is alerted by the illumination of a warning indicator and/or an appropriate message for that sub-system in the IC message center. There will be no warning of a TR system fault.

When a sub-system fault is present and the driver attempts to select a different TR program using the rotary control or at the next ignition on cycle, a message 'SYSTEM FAULT SPECIAL PROGRAMS NOT AVAILABLE' will appear in the message center. This implies that the TR system has a fault, but only because a sub-system fault is preventing its operation. This message will be displayed for 5 seconds per ignition cycle, but is repeated if a further selection is made by the driver using the TR rotary control or at the next ignition on cycle.



NOTE: The message 'SYSTEM FAULT SPECIAL PROGRAMS NOT AVAILABLE' can also be generated by a fault in the TR rotary control or control module. See following section for details of rotary control or control module faults.

It is not possible for the TR control module to cause any fault behavior (warning indicator illumination or message generation) in any of the five sub-systems. Illumination of a sub-system warning indicator and/or a sub-system related message will never be associated with a TR control module or TR system fault.

The sub-system control modules can detect a fault with the CAN signal from the TR control module. If a fault in the TR system is detected, the sub-system control modules will operate in the 'special programs off' setting. The sub-system control modules will record a fault code for a failure of the TR CAN signal. These faults can be retrieved using

T4 and will provide useful information to indicate investigation of the TR control module or the CAN network.

Terrain Response Rotary Control or Control Module Fault

If a fault occurs in the TR rotary control, all rotary control icon amber LED's will be turned off (background illumination will remain on) and rotation of the rotary control is ignored. The IC message center will display a message 'SYSTEM FAULT SPECIAL PROGRAMS NOT AVAILABLE' when the fault occurs, if the fault is present and the driver attempts to select a special program (if the control module is able to do this) or at the next ignition on cycle.

If a failure of a rotary control icon amber LED occurs, the TR system will still function. Any selected special program will default to 'special programs off' at every ignition on cycle, with the exception of the grass/gravel/snow program.

The TR rotary control and the control module are an integral unit. If a fault occurs in either component, the whole unit will require replacement.

CAN Faults

If a CAN fault exists and prevents TR system operation, all of the TR rotary control icon LEDs will be illuminated and rotation of the rotary control is ignored.

If the IC does not receive a TR system CAN message from the TR Control module, the message 'SYSTEM FAULT SPECIAL PROGRAMS NOT AVAILABLE' will be displayed when the fault occurs and will be repeated at every ignition on cycle.

User Error

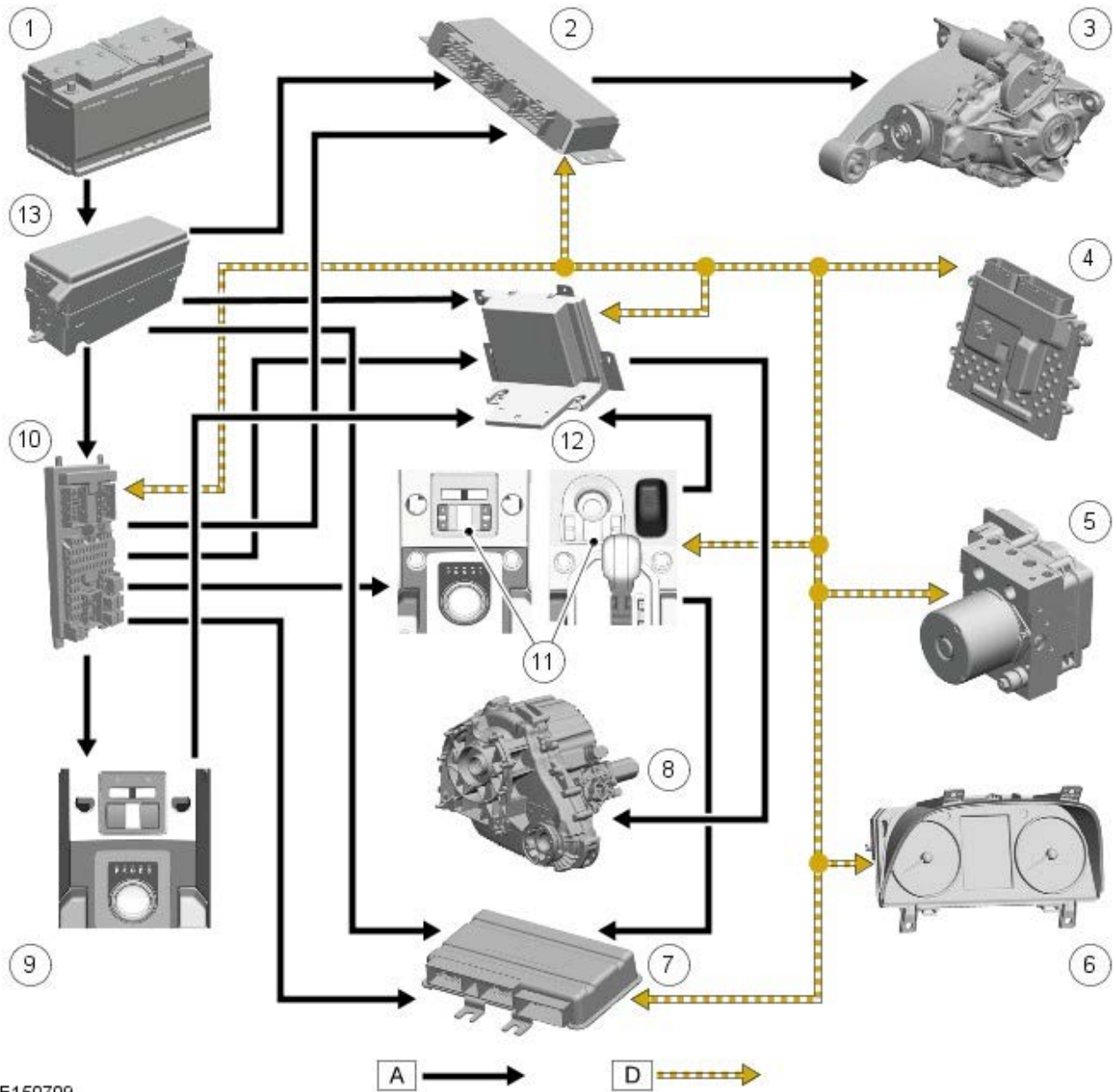
The following incorrect usage of the system may be misinterpreted as a system fault:

- Engine not running - Program changes and driver advisory messages are only available with the engine running
- Rock crawl program selected but transfer case in high range
- Special program change attempted with DSC or ABS active (this includes ABS cycling which is operational when HDC is being used on slippery or loose surfaces).
- Special program change attempted with overheat condition present on center or rear differential.

CONTROL DIAGRAM



NOTE: A = Hardwired; D = High Speed CAN bus



E150709

Item	Part Number	Description
1	-	Battery
2	-	RDCM
3	-	Rear differential
4	-	ECM
5	-	ABS control module
6	-	IC
7	-	Air suspension control module
8	-	Transfer case (center differential and high/low range)
9	-	Hill Descent Control (HDC) and Range Control Switchpack (coil spring vehicles)
10	-	Central Junction Box (CJB)
11	-	TR switchpack (air suspension vehicles)
12	-	TCCM
13	-	Battery Junction Box (BJB)

Ride and Handling Optimization - Ride and Handling Optimization

Description and Operation

Terrain Response allows the driver to select a program which provides the optimum settings for traction and performance for the prevailing terrain conditions. The Terrain Response system fitted to armoured vehicle has reduced functionality compared to that of the standard vehicle.

The system is controlled by a rotary control located on the floor console, rearward of the transmission selector lever. The rotary control allows the selection of one of the following special programs:

- Grass/ gravel /snow (also includes ice)
- Mud / ruts
- Sand

The 'Rock Crawl' option has been disabled on the armoured vehicle and the icon deleted.

Rotary control minus 'Rock Crawl' option



NOTE: Do not fit a standard rotary control to an armoured vehicle.

The principles of operation of the Terrain Response system are the same as that for the standard vehicle. For additional information, refer to: Ride and Handling Optimization (204-06, Description and Operation).

Ride and Handling Optimization - Ride and Handling Optimization

Diagnosis and Testing

Principles of Operation

Ride and handling optimization incorporates the terrain response system which links a number of modules around the vehicle to give the best combination of settings in the different systems.

For a detailed description of the Ride and Handling System and operation, refer to the relevant Description and Operation section of the workshop manual.

REFER to: Ride and Handling Optimization (204-06 Ride and Handling Optimization, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Tire condition, pressures, etc • Driveline components (correct installation, damage, etc) • Engine components (correct installation, damage, etc) • Transmission components (correct installation, damage, etc) • Suspension components (correct installation, damage, etc) 	<ul style="list-style-type: none"> • Fuses • Harnesses/connectors • Terrain response switchpack • Engine Control Module (ECM) • Transmission Control Module (TCM) • Transfer Case Control Module (TCCM) • Anti-lock Braking System control module (ABS) • Rear Differential Control Module (RDCM) • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Because the overall function of the system is dependent on sub-systems, it is possible to misinterpret displays in the message center as being terrain response faults when they are actually a result of a fault in one of the sub-systems.

Refer to the table below for help in deciding when to investigate terrain response faults and when the fault is likely to be in a sub-system.

Symptom	Description	Possible Causes	Action
Message centre display indicating a sub-system fault	The message centre indicates to the driver that a fault has occurred and in which sub-system	<ul style="list-style-type: none"> • Any sub-system fault supported by the message centre 	<ul style="list-style-type: none"> • For details of the available messages, refer to the relevant section of the workshop manual. Carry out a complete vehicle DTC read and follow the diagnostic routine(s) indicated
Message centre display: System fault special programs not available , terrain response switch operation normal	This message will display when a sub-system fault has occurred if the driver attempts to change the special program, and at each ignition on cycle for 5 seconds until the fault is rectified	<ul style="list-style-type: none"> • Any sub-system fault supported by the message centre 	<ul style="list-style-type: none"> • For details of the available messages, refer to the relevant section of the workshop manual. Carry out a complete vehicle DTC read and follow the diagnostic routine(s) indicated
Message centre display: System fault special	CAN circuit errors	<ul style="list-style-type: none"> • CAN circuit: short circuit to ground 	<ul style="list-style-type: none"> • Carry out a complete vehicle DTC read and follow the diagnostic

<p>programs not available, all terrain response switch LEDs illuminated</p>		<p>CAN circuit: short circuit to power</p> <ul style="list-style-type: none"> • CAN circuit: high resistance 	<p>routine(s) indicated</p>
<p>Special program changes not available</p>	<p>User error</p>	<ul style="list-style-type: none"> • Engine not running • Rock crawl selected with transfer box in high range • Special program change attempted with anti-lock brake system or dynamic stability control active <ul style="list-style-type: none"> - This includes anti-lock brake system cycling as part of hill descent control • Special program change attempted with an overheat condition present in the centre or rear differential 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual. Make sure that the driver is familiar with the correct operation of the system

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Terrain Response Switchpack (TR) (100-00 General Information, Description and Operation).

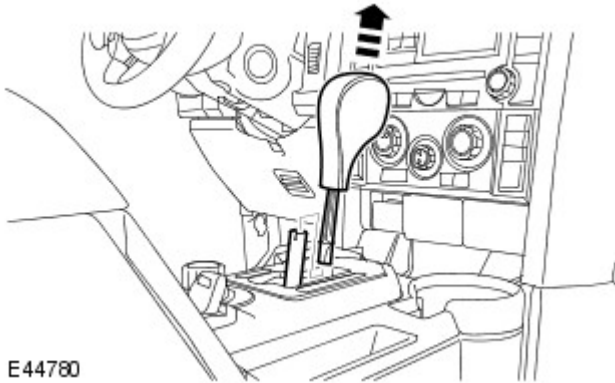
Ride and Handling Optimization - Ride and Handling Optimization Switch


Removal and Installation

Removal



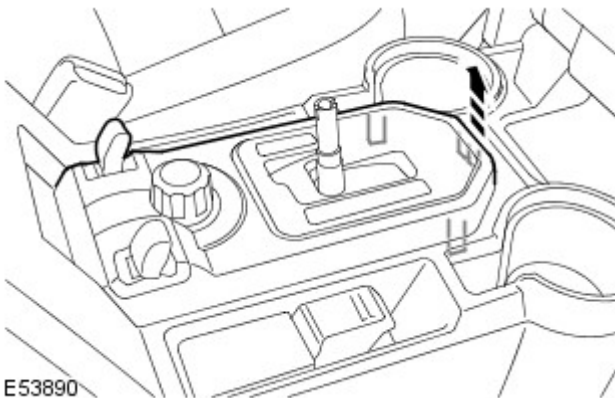
NOTE: Automatic transmission shown. Manual transmission is similar.



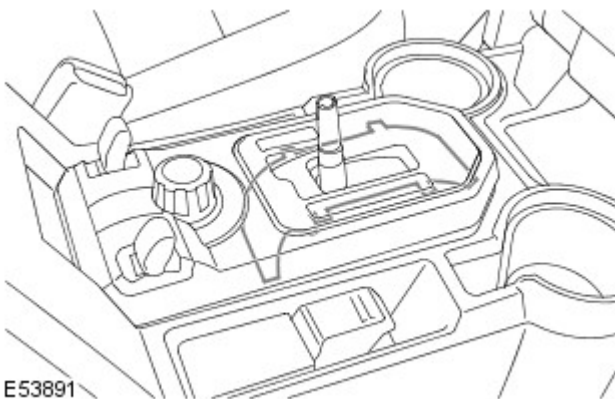
1.  **WARNING:** The gear lever knob will be released suddenly, keep face clear during removal.

Remove the selector lever knob.

- Pull the knob upwards.



2. Release the ride and handling optimization switch assembly.
 - Release the 4 clips.



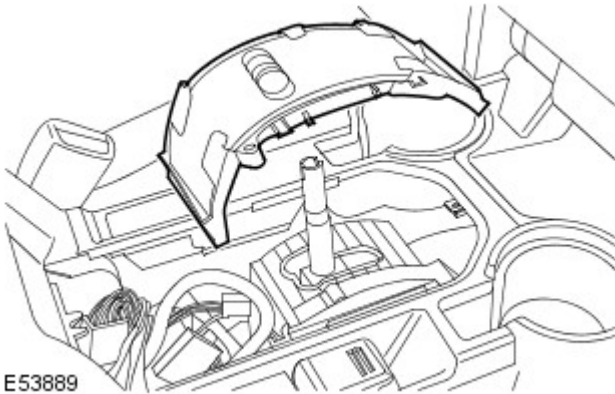
3. Release the selector lever panel.
 - Release the 4 clips.

4. Remove the ride and handling optimization switch assembly.
 - Disconnect the 2 electrical connectors.




E53892

5. Remove the selector lever panel.



E53889

Installation

1. Install the selector lever panel.
2. Install the ride and handling optimization switch assembly.
 - Connect the electrical connectors.
 - Secure the selector lever trim panel.
3.  **CAUTION:** Only fit the selector knob when the selector lever is in the 'P' position.

Install the selector lever knob.

- Engage the locating tang of the knob with the slot in the selector lever.
- Push the knob fully onto the selector lever.

Ride and Handling Optimization - Ride and Handling Optimization Switch

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.



Make sure that the gear selector lever is in position N before removing any components.

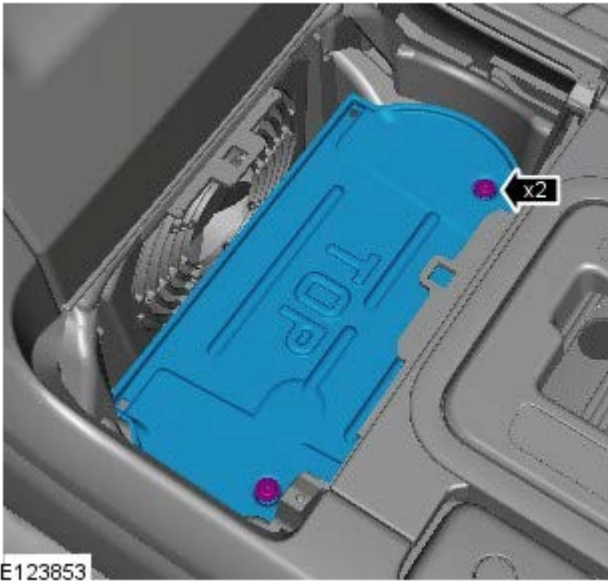
1.



2.



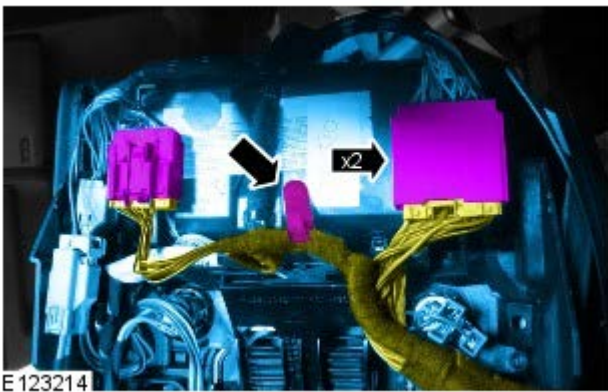
3.



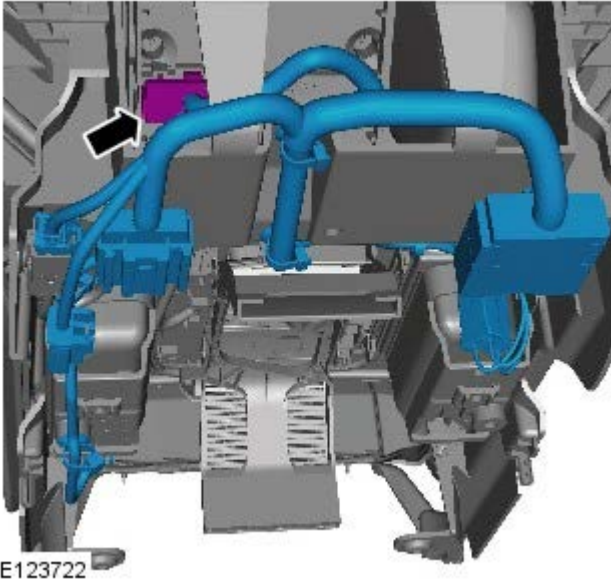
4.



5.

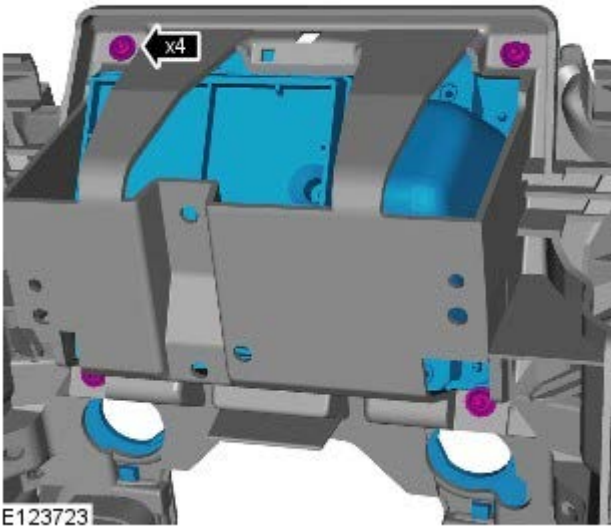


6.



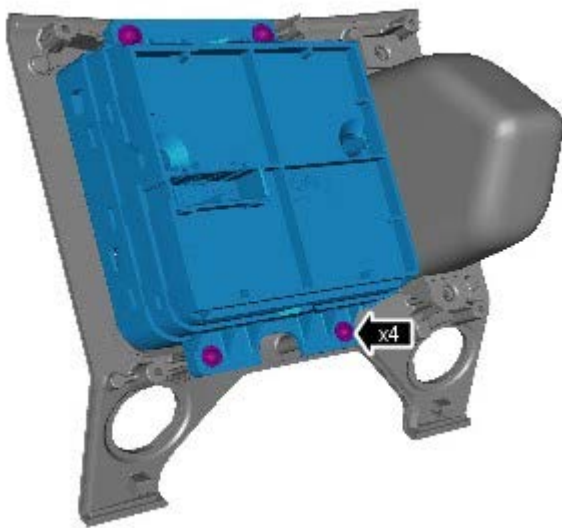
E123722

7.



E123723

8.



E124214

Installation

1. To install, reverse the removal procedure.

Driveshaft -

Front Drive (Propeller) Shaft

Item	Specification
Type	One piece, variable length steel tube.
Constant velocity joints	Plunging type, fitted at front and rear.

Rear Drive (Propeller) Shaft

Item	Specification
Type	Two piece, variable length steel tube with isolated centre bearing and swaged front section to provide controlled collapse of the shaft during a crash.
Constant velocity joints	Plunging constant velocity joints are positioned at the front and centre of the shaft with a fixed, Hookes type universal joint at the rear.

Torque Specifications

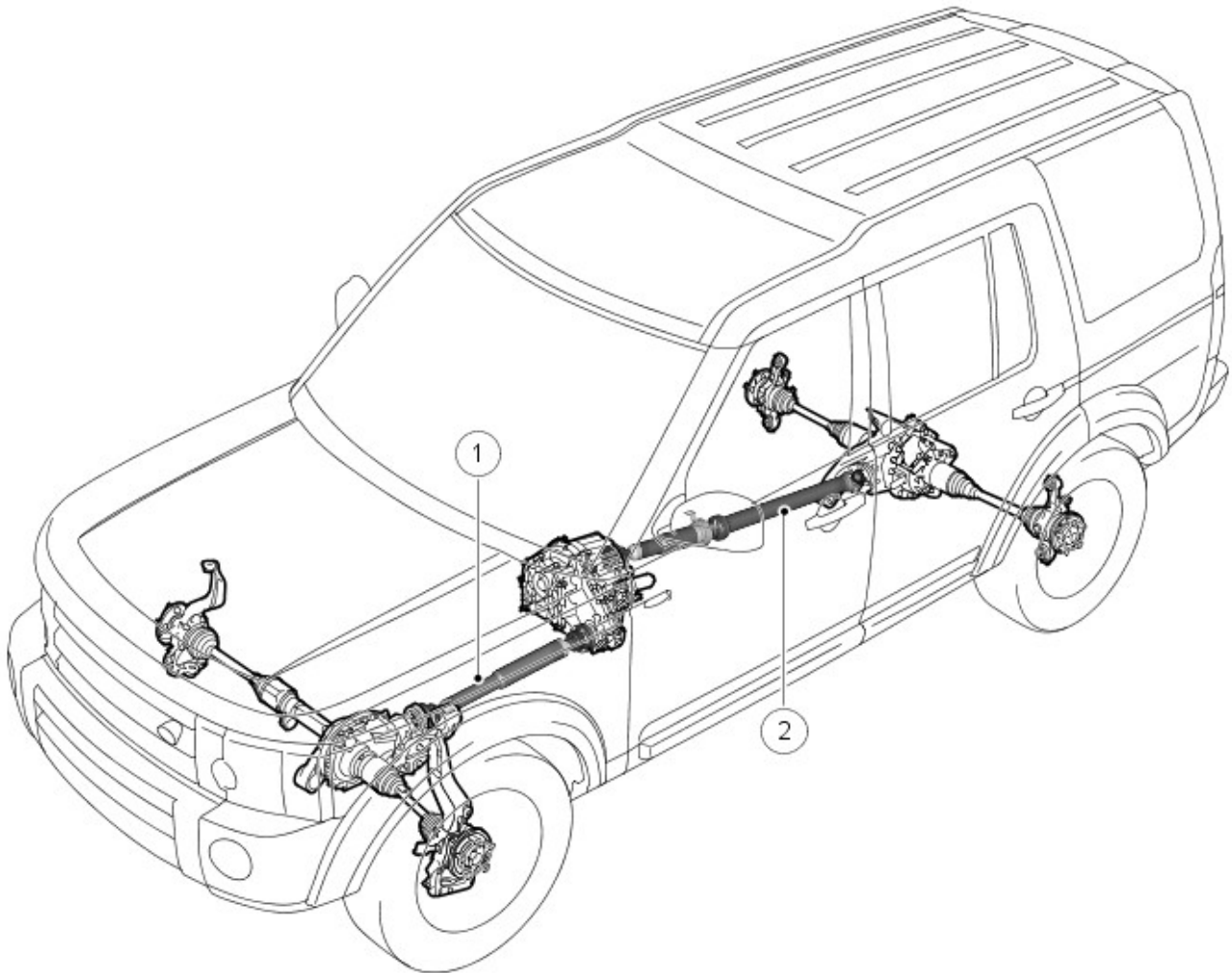
Description	Nm	lb-ft
* Front driveshaft to front axle drive flange Torx bolts:		
Stage 1	45	33
Stage 2	Further 90°	Further 90°
* Front driveshaft to transfer case drive flange Torx bolts:		
Stage 1	45	33
Stage 2	Further 90°	Further 90°
* Rear driveshaft to rear axle drive flange Torx bolts	150	110
Rear driveshaft to transfer case drive flange Torx bolts	73	54
Rear driveshaft center bearing bolts	30	22
Fuel tank heat shield bolts	5	4
Fuel tank heat shield nuts	3	2

*** New 'Patched' Torx bolts must be installed**

Driveshaft - Driveshaft

Description and Operation

Drive shaft Component Location



E46304

Item	Part Number	Description
1	-	Front drive shaft
2	-	Rear drive shaft

GENERAL

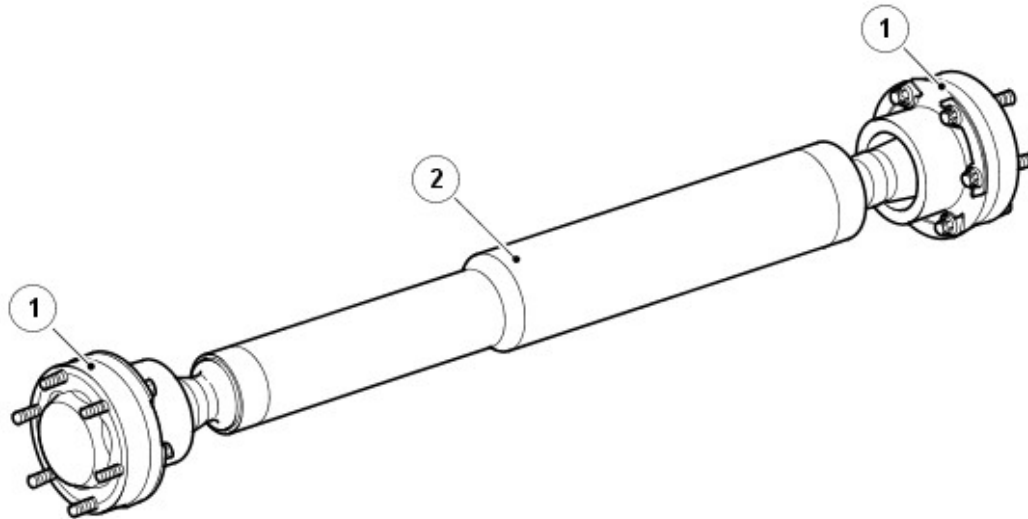
Drive shafts are used to transmit drive from the transfer box to the front and rear differentials.

The front drive shaft is a one-piece unit, connected to the transfer box and front differential unit via Constant Velocity (CV) joints.

The rear drive shaft is a two-piece unit, supported on a central bearing due to its increased length. The rear drive shaft is connected to the transfer box via a CV joint and the rear differential with a universal joint. These joints allow for angular deviations of the drive shaft due to acceleration and braking.

The front and rear drive shafts are not serviceable items and a failure will require the replacement of the complete drive shaft assembly.

FRONT DRIVE SHAFT



E46305

Item	Part Number	Description
1	-	CV joint
2	-	Front drive shaft

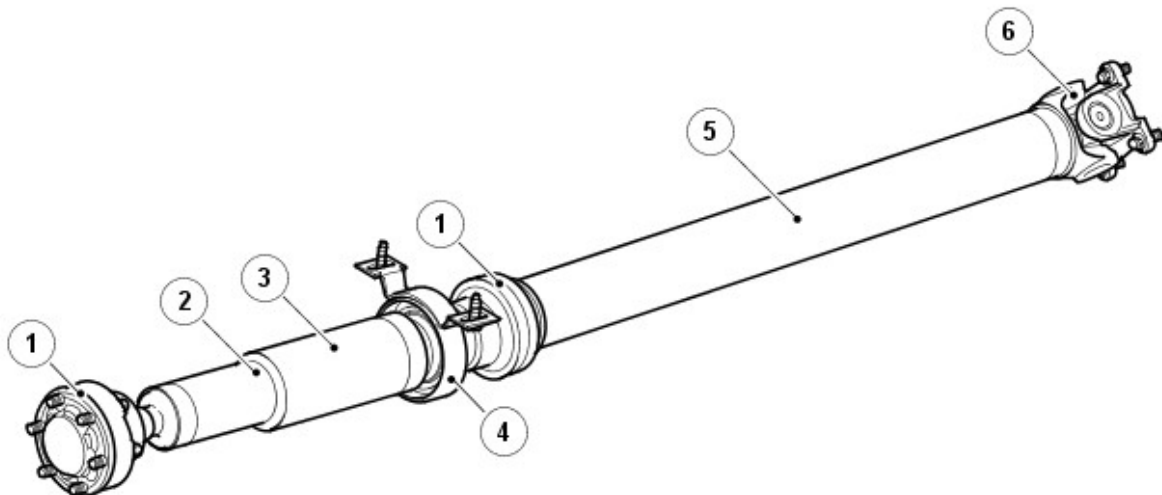
The front drive shaft is constructed from 1.7 mm wall tubular steel. A CV joint is attached to each end of the drive shaft (see 'Halfshaft Joint' section for more information on CV joints). The shaft has an overall nominal length of 713 mm.

Each CV joint has six holes, which allow for attachment to the input flange of the front differential and the front output flange of the transfer box. The CV joints are secured to the front differential and transfer box with six Torx head adhesive retained bolts.

Three compression link washers are fitted under each pair of bolts. The washers are required to prevent compression of the CV joints attachment flange.

A shroud is pressed over the CV joint. The shroud seals to the joint body using an internal gasket and to the front output flange of the transfer box using an end cap and internal gasket. This prevents the ingress of dirt and moisture. The CV joints allow for movement of the drive shaft caused by small movements in the transmission and transfer box mountings.

REAR DRIVE SHAFT ASSEMBLY



E46306

Item	Part Number	Description
1	-	CV joints
2	-	Collapsible crash section
3	-	Front shaft assembly
4	-	Support bearing
5	-	Rear shaft assembly
6	-	Universal joint

The rear drive shaft assembly comprises front and rear shaft assemblies and a centrally mounted shaft bearing. The rear drive shaft assembly has an overall nominal length of 1309 mm.

Front Shaft Assembly

The front shaft assembly incorporates a crash feature within the tube, which controls the collapse of the drive shaft during a crash.

The front shaft assembly comprises a CV joint at each end (see 'Halfshaft Joint' section for more information on CV joints).

The front CV joint (transfer box end) has six radial holes, which provide for the attachment to the transfer box rear output flange. The joint is secured to the output flange with six torx bolts, which screw into threaded holes in the flange. Three compression link washers are fitted under each pair of bolts. The rear splined shaft mates with splines in the rear shaft CV joint hub and is pressed in and fixed with Loctite. A machined surface on the shaft accepts the shaft bearing, which is a press fit.

Rear Shaft Assembly

The rear shaft assembly comprises a Hookes type universal joint at the rear (rear differential end).

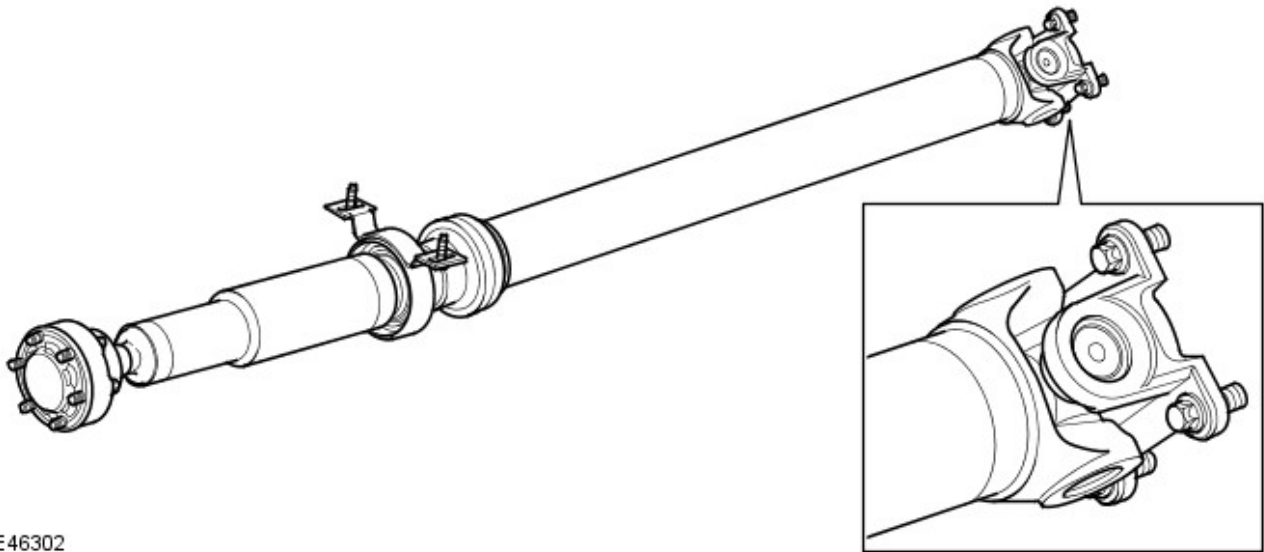
The universal joint is welded to the rear shaft tube and is secured to the input shaft of the rear differential with four flanged nuts. The opposite end of the rear shaft tube is welded directly to the CV joint body.

Shaft Bearing Assembly

The shaft bearing assembly comprises a pressed steel housing, a rubber diaphragm and a ball bearing. The diaphragm is bonded into the housing. An internal metal ring, bonded to the bush, allows for the bearing to be press fitted into it. The rubber bush allows for small deviations in alignment and also absorbs vibrational forces. The shaft bearing assembly is located by screws, which pass through plain holes in the bearing assembly and locate into nuts welded on the inside face of the chassis cross-member.

Driveshaft - Universal Joints

Description and Operation



E46302

A Hookes type universal joint is used to connect the rear drive shaft assembly to the rear differential, allowing for angular deviations of the drive shafts due to acceleration and braking.

The joint is bolted to the input shaft of the rear differential with four flanged adhesive screws and is lubricated during manufacture and sealed for life.

Driveshaft - Front Driveshaft V6 S/C 3.0L Petrol

Removal and Installation

Removal

NOTES:




Note the orientation of the driveshaft to aid installation



A small amount of oil may weep from the driveshaft joints during storage. The loss of this oil will not affect the operation or durability of the joint.



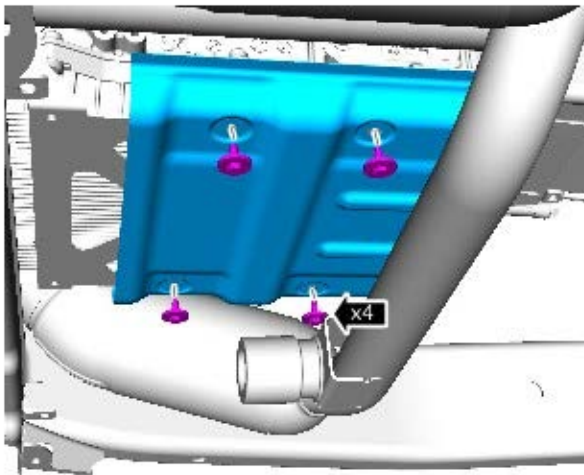
Some variation in the illustrations may occur, but the essential information is always correct.

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

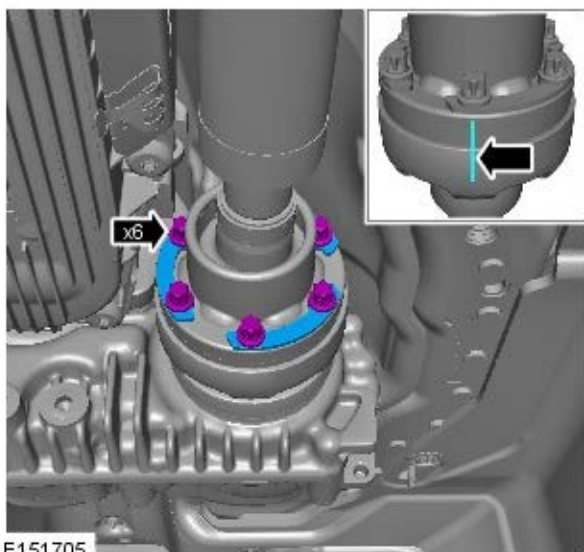
Raise and support the vehicle.

- Refer to: [Transmission Support Crossmember - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).

3.



E161234



E151705

- CAUTIONS:**



Mark the position of the driveshaft flange in relation to the drive pinion flange.



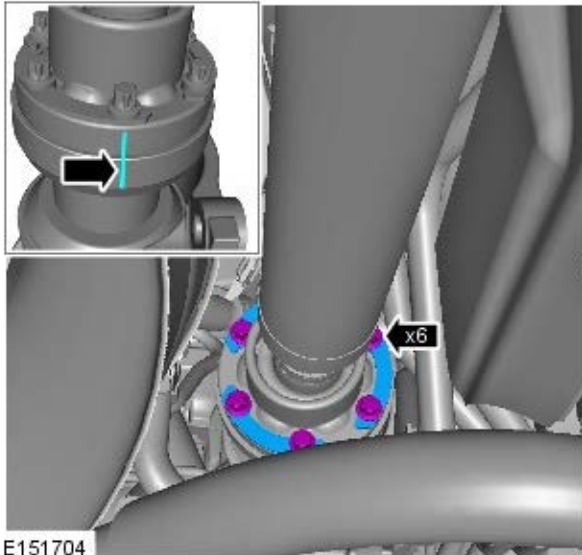
To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.





Make sure that the driveshaft is supported with suitable retaining straps.


- Remove the 6 Torx bolts and washers, discard the bolts.

- CAUTIONS:**



 Mark the position of the driveshaft flange in relation to the drive pinion flange.

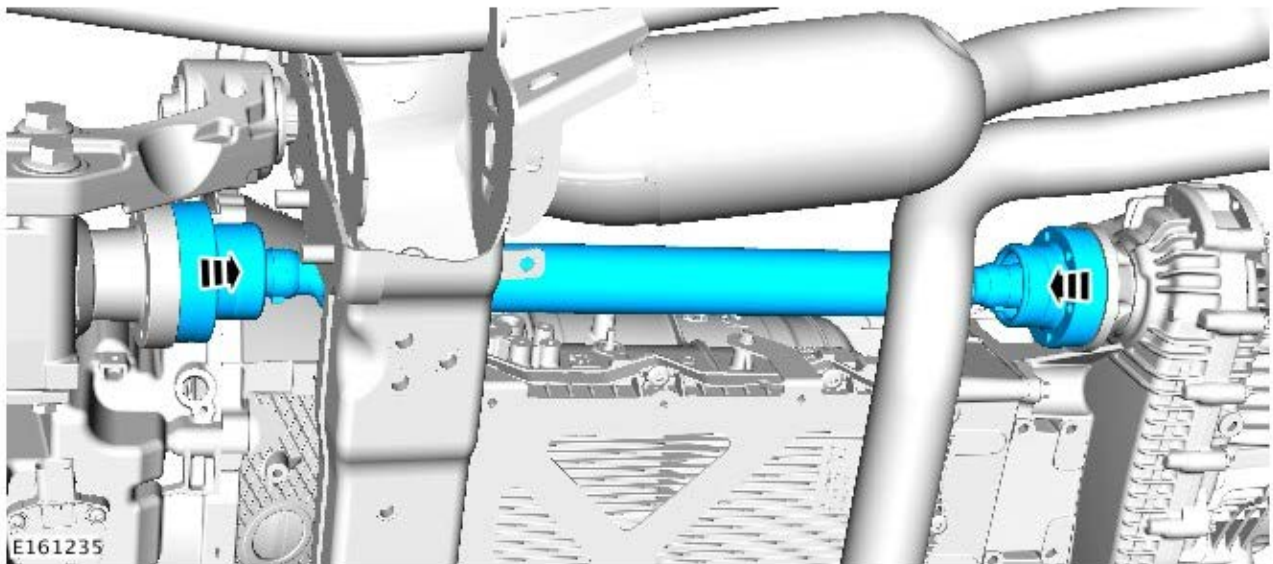
 To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

 Make sure that the driveshaft is supported with suitable retaining straps.

- Remove the 6 Torx bolts and washers, discard the bolts.


6.

- Compress the joints to disengage the drive flanges.

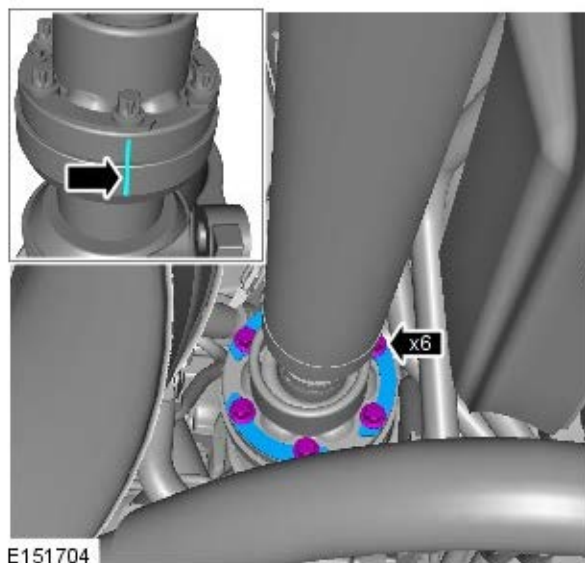
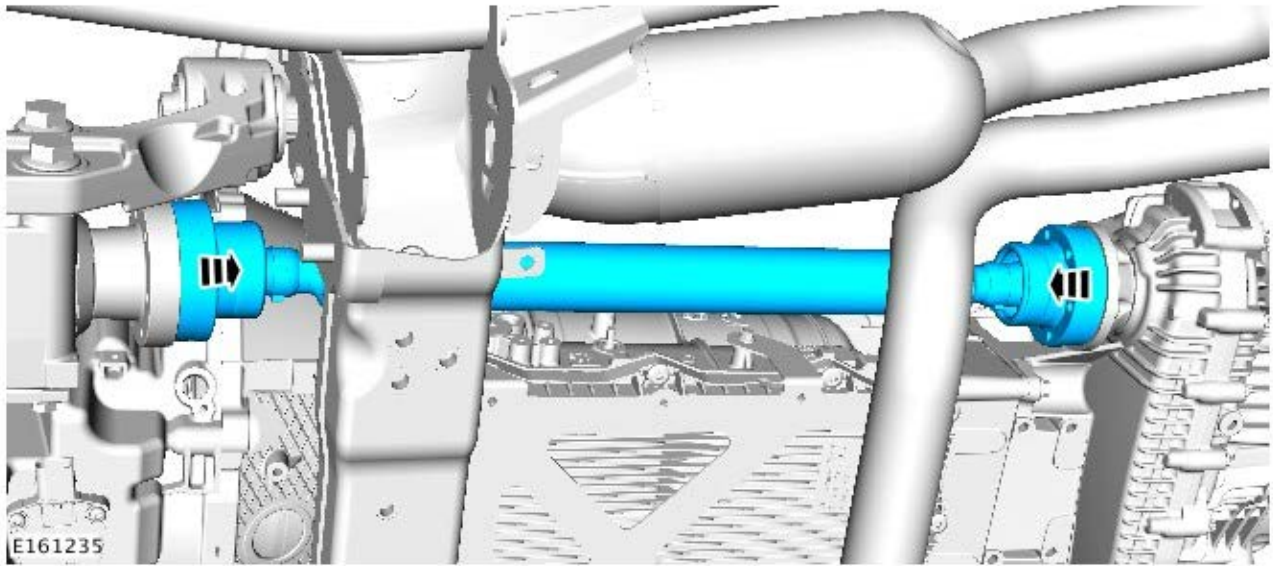


Installation

1. Clean all the mating faces and reusable parts thoroughly and check for damage.

2.  **NOTE:** A small amount of oil may weep from the driveshaft joints during storage. The loss of this oil will not affect the operation or durability of the joint.

- Compress the joints to engage the drive flanges.

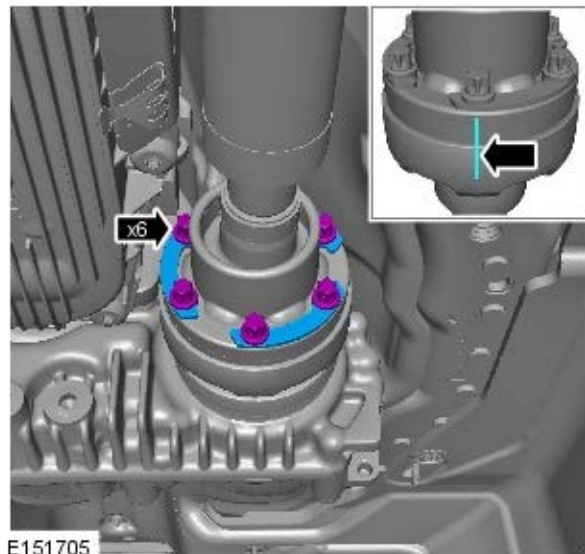


E151704

3. CAUTIONS:

- ⚠ Make sure that new bolts are installed.
- ⚠ The component must be aligned with the installation markings.
- ⚠ Tighten the bolts in a diagonal sequence.

Torque:
 Stage 1 45 Nm
 Stage 2 90°



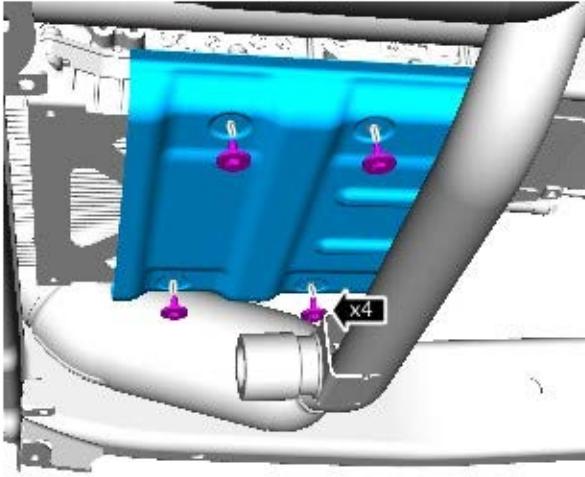
E151705

4. CAUTIONS:

- ⚠ Make sure that new bolts are installed.
- ⚠ The component must be aligned with the installation markings.
- ⚠ Tighten the bolts in a diagonal sequence.

Torque:
 Stage 1 45 Nm
 Stage 2 90°

5. Torque: 10 Nm



E161234

6. Refer to: [Transmission Support Crossmember - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).

Driveshaft - Front Driveshaft TDV6 3.0L Diesel

Removal and Installation


Removal



CAUTION: It is possible to fit the driveshaft incorrectly. Note the orientation before removal.



NOTE: A small amount of oil may weep from the driveshaft joints during storage. The loss of this oil will not affect the operation or durability of the joint.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

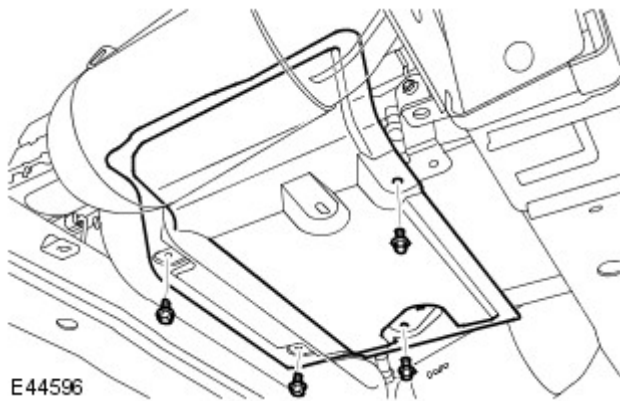
Raise and support the vehicle.

2. Remove the transmission crossmember.
For additional information, refer to: Transmission Support Crossmember - 3.0L Diesel (502-02, Removal and Installation).


3.  **NOTE:** If equipped.


Remove the transmission heat shield.

- Remove the 4 bolts.



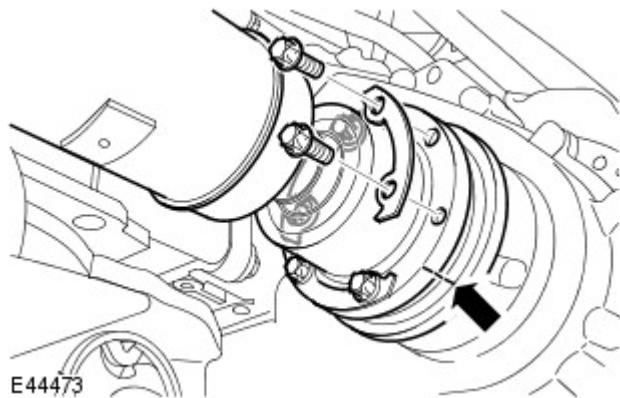
4. **CAUTIONS:**

 Mark the position of the driveshaft flange in relation to the drive pinion flange.


 To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.


Release the driveshaft from the transfer case drive flange.

- Remove the 6 Torx bolts and washers, discard the bolts.



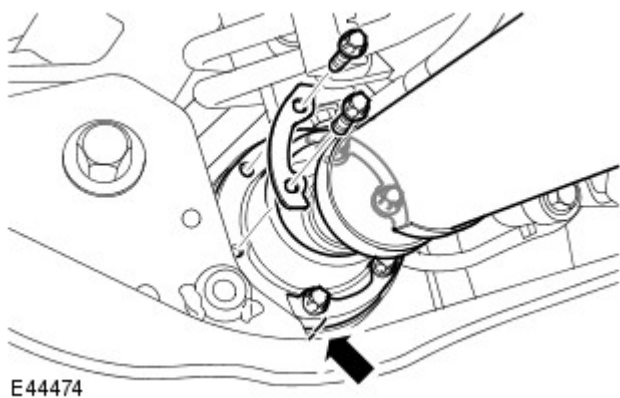
5. **CAUTIONS:**

 Mark the position of the driveshaft flange in relation to the drive pinion flange.

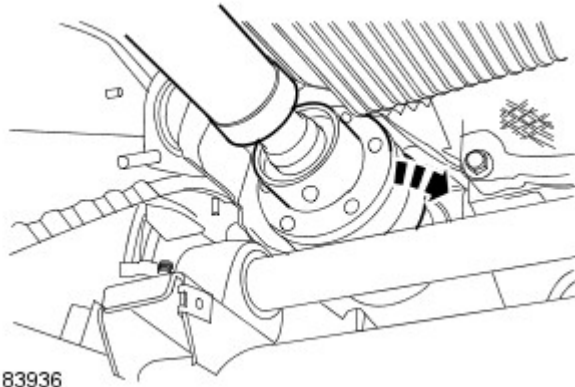
 To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

Release the driveshaft from the front axle drive flange.

- Remove the 6 Torx bolts and washers, discard the bolts.




6. Remove the front driveshaft.



E83936

- Compress the joints to disengage the drive flanges.

Installation

1.  **NOTE:** A small amount of oil may weep from the driveshaft joints during storage. The loss of this oil will not affect the operation or durability of the joint.


Install the driveshaft.

- Clean the components.
- Compress the joints to engage the drive flanges.

2.  **CAUTION:** Make sure that new bolts are installed.

Secure the driveshaft to the front axle drive flange.

- Stage 1: Tighten the bolts to 45 Nm (33 lb.ft).
- Stage 2: Tighten the bolts a further 90 degrees.

3.  **CAUTION:** Make sure that new bolts are installed.

Secure the driveshaft to the transfer case drive flange.

- Stage 1: Tighten the bolts to 45 Nm (33 lb.ft).
- Stage 2: Tighten the bolts a further 90 degrees.

4. Install the transmission heat shield.
 - Tighten the bolts to 10 Nm (7 lb.ft).

5. Install the transmission crossmember.
For additional information, refer to: Transmission Support Crossmember - 3.0L Diesel (502-02, Removal and Installation).


Driveshaft - Rear Driveshaft

Removal and Installation

Removal



NOTE: A small amount of oil may weep from the driveshaft joints during storage. The loss of this oil will not affect the operation or durability of the joint.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the fuel tank heat shield.
 - Remove the 3 bolts and 2 nuts.



3. **CAUTIONS:**



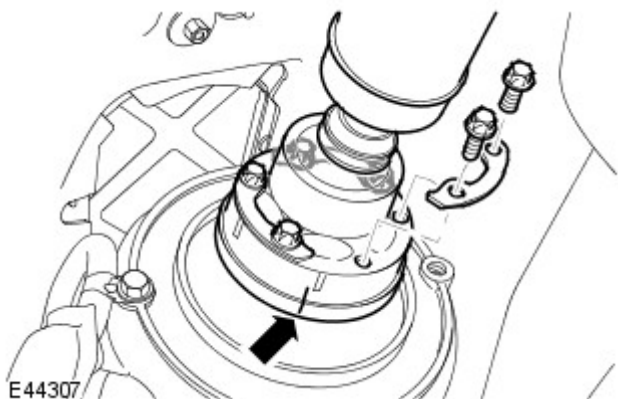
Mark the position of the driveshaft flange in relation to the drive pinion flange.



To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

Release the driveshaft from the transfer case drive flange.

- Remove the 6 Torx bolts and washers.



4. **CAUTIONS:**



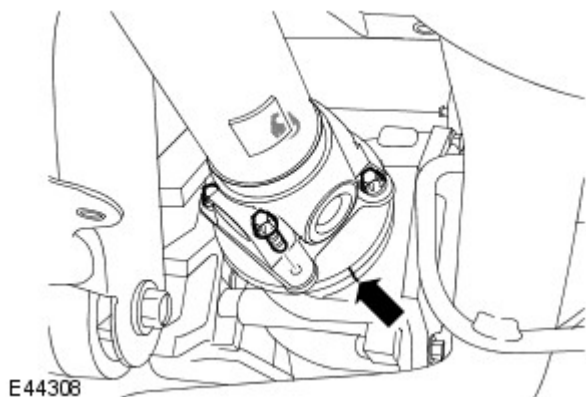
Mark the position of the driveshaft flange in relation to the drive pinion flange.



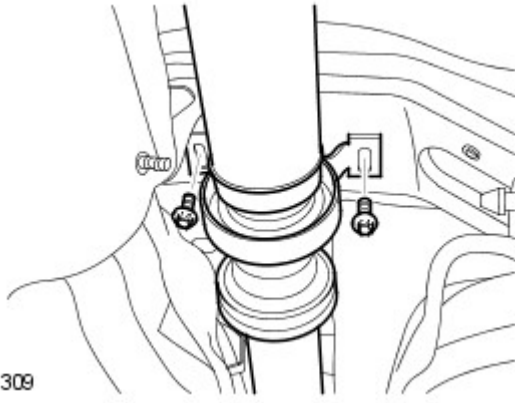
To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

Release the driveshaft from the rear axle drive flange.

- Remove and discard the 4 Torx bolts.




5. With assistance, remove the driveshaft.
 - Remove the 2 driveshaft center bearing mount bolts.




E44309

Installation

1.  NOTE: A small amount of oil may weep from the driveshaft joints during storage. The loss of this oil will not affect the operation or durability of the joint.

Attach the driveshaft to the rear axle drive flange.

- Clean the component mating faces.
- Attach the driveshaft to the rear axle drive flange.
- Tighten the new Torx bolts to 150 Nm (110 lb.ft).

2.  NOTE: A small amount of oil may weep from the driveshaft joints during storage. The loss of this oil will not affect the operation or durability of the joint.

Attach the driveshaft to the transfer case drive flange.

- Clean the component mating faces.
- Tighten the Torx bolts to 73 Nm (54 lb.ft).

3. CAUTIONS:



Align the driveshaft center bearing mount by moving the floating front section of the shaft backward or forwards until the bolt holes in the mount align with the holes in the chassis.



Make sure the center bearing mount is not under tension.

Install the driveshaft center bearing mount bolts.

- Align the center bearing mount.
- Tighten the driveshaft center bearing retaining bolts to 30 Nm (22 lb.ft).

4. Install the fuel tank heat shield.
 - Tighten the bolts to 6 Nm (4 lb.ft).
 - Tighten the nuts to 3 Nm (2 lb.ft).

Rear Drive Axle/Differential -

Lubricants



NOTE: Do not use any lubricant other than that specified

Item	Specification
Recommended lubricant:	
'Open' differential	Castrol SAF-XO - 75W/90
Differential with locking motor	Castrol SAF Carbon Mod Plus

Capacities

Unit	Capacity
'Open' differential	1.25 litres (1.32 US quarts)
Differential with locking motor	1.76 litres (1.86 US quarts)

Rear 'Open' Differential

Item	Specification
Reduction ratio:	
V6 Diesel engine - 8HP70 Automatic transmission	3.21:1
V6 Diesel engine - 6HP28 Automatic transmission	3.54:1
V8 Petrol engine - 6HP28 Automatic transmission	3.54:1

Rear Differential with Locking Motor

Item	Specification
Range	Up to 2500 Nm (98.5 lbf/ft)
Differential locking motor	Operates the ball/ramp mechanism and wet clutch. Motor incorporates a temperature sensor and is controlled by a module
Differential type	4 pin
Reduction ratio:	
V6 Diesel engine - 8HP70 Automatic transmission	3.21:1
V6 Diesel engine - 6HP28 Automatic transmission	3.54:1
V8 Petrol engine - 6HP28 Automatic transmission	3.54:1

Torque Specifications

Description	Nm	lb-ft
Oil drain plug	29	21
Oil filler plug	29	21
Oil temperature sensor	22	16
++ Differential locking motor bolts	10	7
Differential front mounting bolts	275	203
Differential rear mounting bolts	175	129
* Driveshaft to rear axle drive flange Torx bolts	150	110
Lower arm to wheel knuckle	275	203
Toe link bolt	175	129
Stabilizer bar link nuts	115	85
**+ Halfshaft retaining nut	350	258
Fuel tank heat shield nuts	3	2
Fuel tank heat shield bolts	5	4
Road wheel nuts	140	103

* New patchlok torx bolts must be installed

** New nut must be installed

+ Stake nut on completion of tightening operation

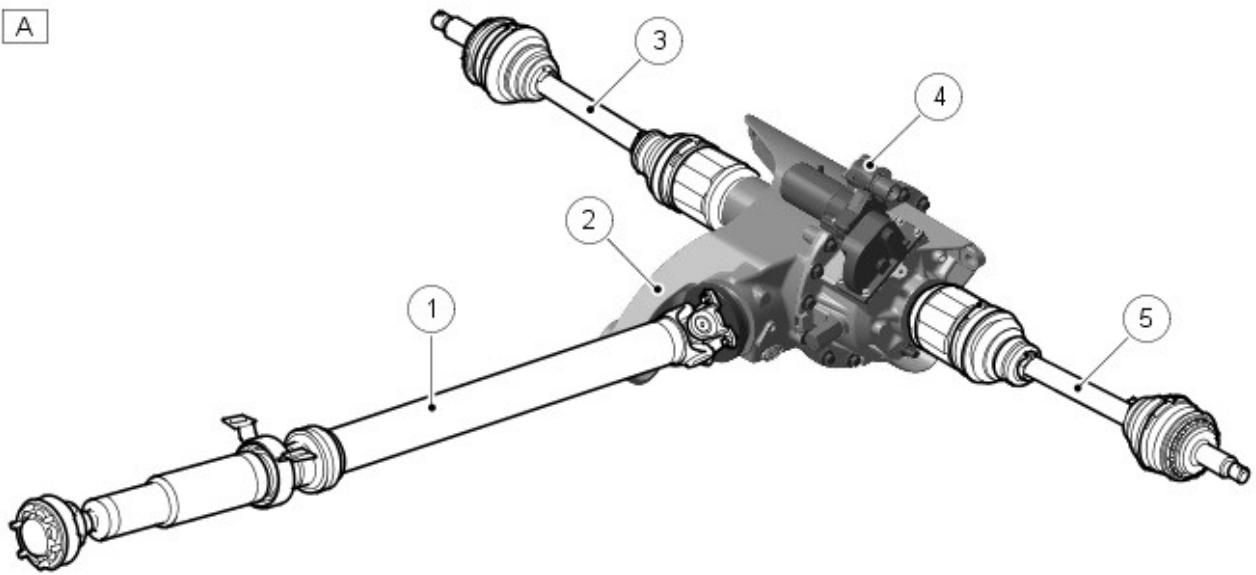
++ Apply sealant to flange of locking motor

Rear Drive Axle/Differential - Rear Drive Axle and Differential

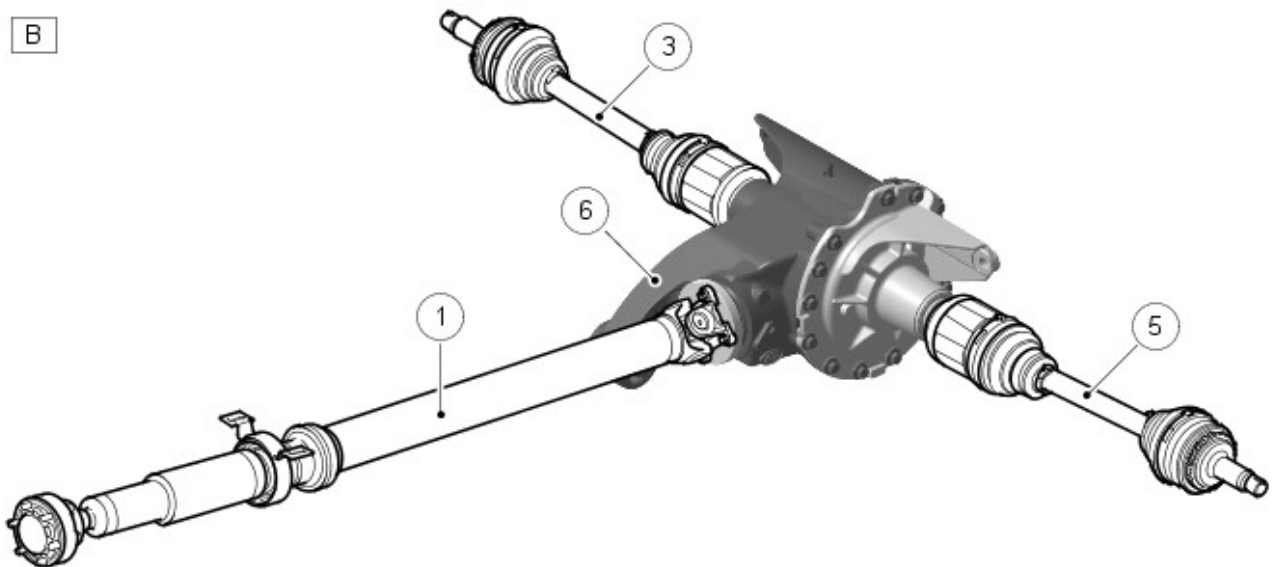
Description and Operation

GENERAL

A



B



E51166

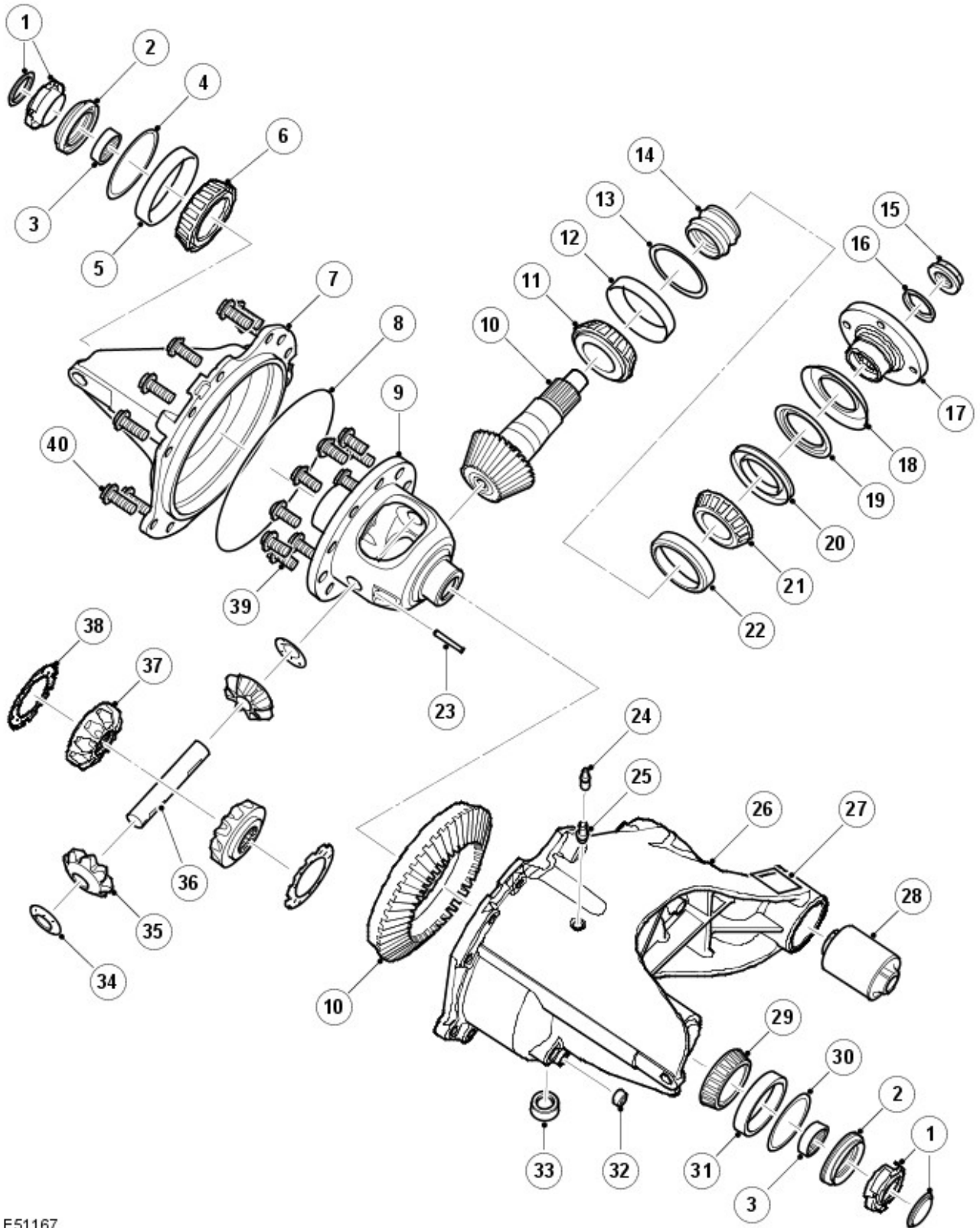
Item	Part Number	Description
A	-	Electronic rear differential
B	-	Open rear differential
1	-	Rear driveshaft
2	-	Electronic rear differential
3	-	RH rear drive halfshaft
4	-	Actuator (locking) motor assembly
5	-	LH rear drive halfshaft
6	-	Rear differential

The open rear differential converts the 'angle of drive' through 90° and distributes drive, via the rear drive halfshafts, to the rear wheels.

The differential unit is mounted to the chassis via rubber bushes and bolts; two mounting points at the rear of the unit and one at the front.

OPEN REAR DIFFERENTIAL ASSEMBLY

Open Rear Differential - Exploded View



E51167

Item	Part Number	Description
1	-	Cap
2	-	Seal
3	-	Bearing assembly, without race
4	-	Bearing pre-load spacer
5	-	Bearing
6	-	Roller bearing cup
7	-	Cover
8	-	Seal
9	-	Differential carrier
10	-	Gear and pinion assembly
11	-	Bearing

12	-	Roller bearing cup
13	-	Shim
14	-	Collapsible spacer
15	-	Pinion nut
16	-	Retainer
17	-	Flange
18	-	Outer deflector
19	-	Inner deflector
20	-	Oil seal
21	-	Bearing
22	-	Roller bearing cup
23	-	Roll pin
24	-	Breather cap
25	-	Breather
26	-	Case
27	-	Data location
28	-	Mounting bush
29	-	Bearing
30	-	Bearing pre-load spacer
31	-	Roller bearing cup
32	-	Plug
33	-	Drain plug
34	-	Thrust washer
35	-	Planet gears
36	-	Crosspin shaft
37	-	Sunwheel
38	-	Thrust washer
39	-	Bolt, 10 of
40	-	Bolt, 12 of

The cast iron casing comprises two parts; a cover and a carrier. The carrier provides locations for all the internal components. The carrier is sealed to the cover via an O-ring seal and secured with twelve bolts. The cover and carrier have cast fins, which assist mobility. A breather tube is fitted to the top of the carrier. This allows a plastic tube to be fitted and routed to a high point under the vehicle body, preventing the ingress of water when the vehicle is wading.

The carrier contains an oil drain plug. The differential unit contains a specified oil.
For additional information, refer to: Specifications (205-02, Specifications).

The differential is a conventional design using a hypoid gear layout, similar to the front differential. The open rear differential is available in various ratios depending on engine installation.

For additional information, refer to: Specifications (205-02, Specifications).

Changing the number of teeth between the crown wheel drive gear and pinion gear changes the ratio.

The differential comprises a pinion shaft and hypoid pinion-gear and a crown wheel drive-gear with an integral cage, which houses two planet gears. Two sun wheels are also located in the cage and pass the rotational drive to the drive shafts.

The pinion shaft is mounted on two opposed taper roller bearings, with a collapsible spacer located between them. The spacer is used to hold the bearings in alignment and also collapses under the pressure applied to the pinion flanged nut. This allows the flanged nut to be tightened to a predetermined torque, which collapses the spacer, setting the correct bearing preload.

The pinion shaft has an externally splined outer end, which accepts and locates the input flange, which is retained by the pinion nut and retainer. The input flange has four threaded holes and mates with the rear drive shaft. Four bolts secure the rear drive shaft to the input flange. An oil seal is pressed into the pinion housing and seals the input flange to the pinion housing. The pinion shaft has a hypoid gear at its inner end, which mates with the crown wheel drive gear.

The crown wheel drive gear is located on the differential case and secured with ten screws. The differential case is mounted on taper roller bearings located in machined bores on each side of the pinion housing. Shims are retained in the casing behind the bearing cups, the shim thickness is selected to apply the correct bearing preload and hypoid backlash.

The differential carrier has a through hole, which provides location for the shaft. The shaft is supported by a sun gear and a needle roller bearing. The shaft is fitted with a snap ring at one end, which locates in a machined groove in the sun gear, locking the shaft in position.

The sun gears are located in pockets in the carrier cage and mesh with the planet gears. Spacers are fitted between the sun wheels and the carrier and set the correct mesh contact between the planet gears and the sun wheels. Each sun wheel has a machined bore with internal splines and machined groove near the splined end. The groove provides positive location for a snap ring fitted to the end of each output flange.

Each output shaft has a spline, which locates in each sun wheel. A snap ring fitted to the splined shaft locates in the groove the sun wheel bore and positively locates the output shaft. Oil seals are pressed into each side of the pinion housing and seal the seal the output shaft.

Differential Operation

The operating principles of the front and rear differentials are the same. Rotational input from the drive shaft is passed via the input flange to the pinion shaft and pinion gear. The angles of the pinion gear to the crown wheel drive gear moves the rotational direction through 90°.

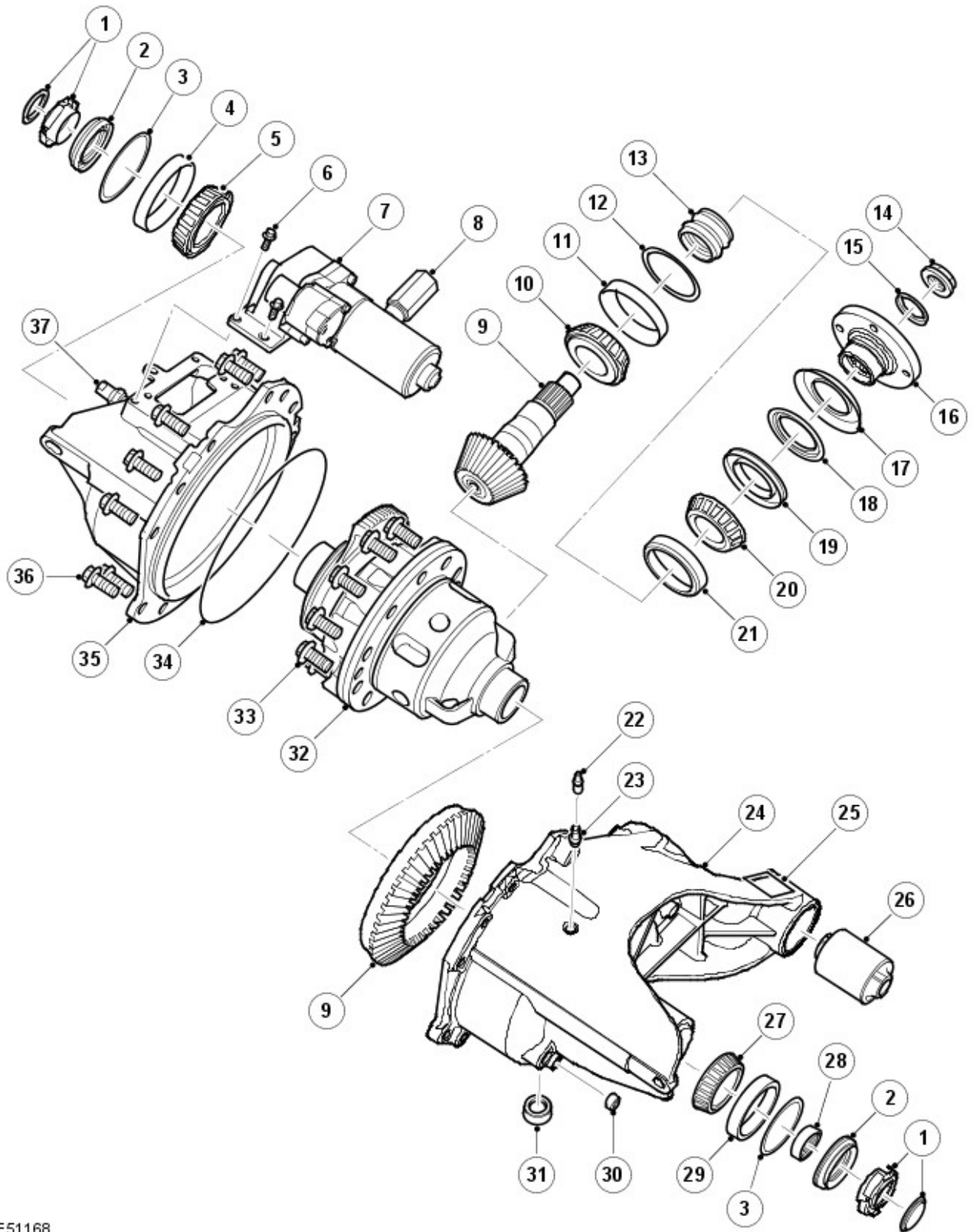
The transferred rotational motion is now passed to the crown wheel drive gear, which in turn rotates the differential casing. The shaft, which is secured to the casing, also rotates at the same speed as the casing. The planet gears, which are mounted on the shaft, also rotate with the casing. In turn, the planet gears transfer their rotational motion to the left and right hand sun wheels, rotating the drive halfshafts.

When the vehicle is moving in a forward direction, the torque applied through the differential to each sun wheel is equal. In this condition both drive halfshafts rotate at the same speed. The planet gears do not rotate and effectively lock the sun wheels to the differential casing.

If the vehicle is turning, the outer wheel will be forced to rotate faster than the inner wheel by having a greater distance to travel. The differential senses the torque difference between the sun wheels. The planet gears rotate on their axes to allow the outer wheel to rotate faster than the inner one.

ELECTRONIC REAR DIFFERENTIAL ASSEMBLY

Electronic Rear Differential - Exploded View



E51168

Item	Part Number	Description
1	-	Cap
2	-	O ring
3	-	Bearing pre-load spacer
4	-	Bearing
5	-	Bearing cup
6	-	Bolt, 4 of
7	-	Housing and motor assembly
8	-	Damper
9	-	Gear and pinion assembly
10	-	Bearing
11	-	Bearing cup

12	-	Shim
13	-	Collapsible spacer
14	-	Pinion nut
15	-	Retainer
16	-	Flange
17	-	Deflector, outer
18	-	Deflector, inner
19	-	Seal
20	-	Bearing
21	-	Bearing cup
22	-	Breather cap
23	-	Breather
24	-	Case
25	-	Data location
26	-	Mounting bush
27	-	Bearing
28	-	Bearing assembly without race
29	-	Bearing cup
30	-	Filler plug
31	-	Drain plug
32	-	Electronic differential assembly
33	-	Bolt, 10 of
34	-	O ring
35	-	Cover
36	-	Bolt, 12 of
37	-	Temperature sensor

The electronic rear differential has the same functionality as the open rear differential but incorporates a locking feature.

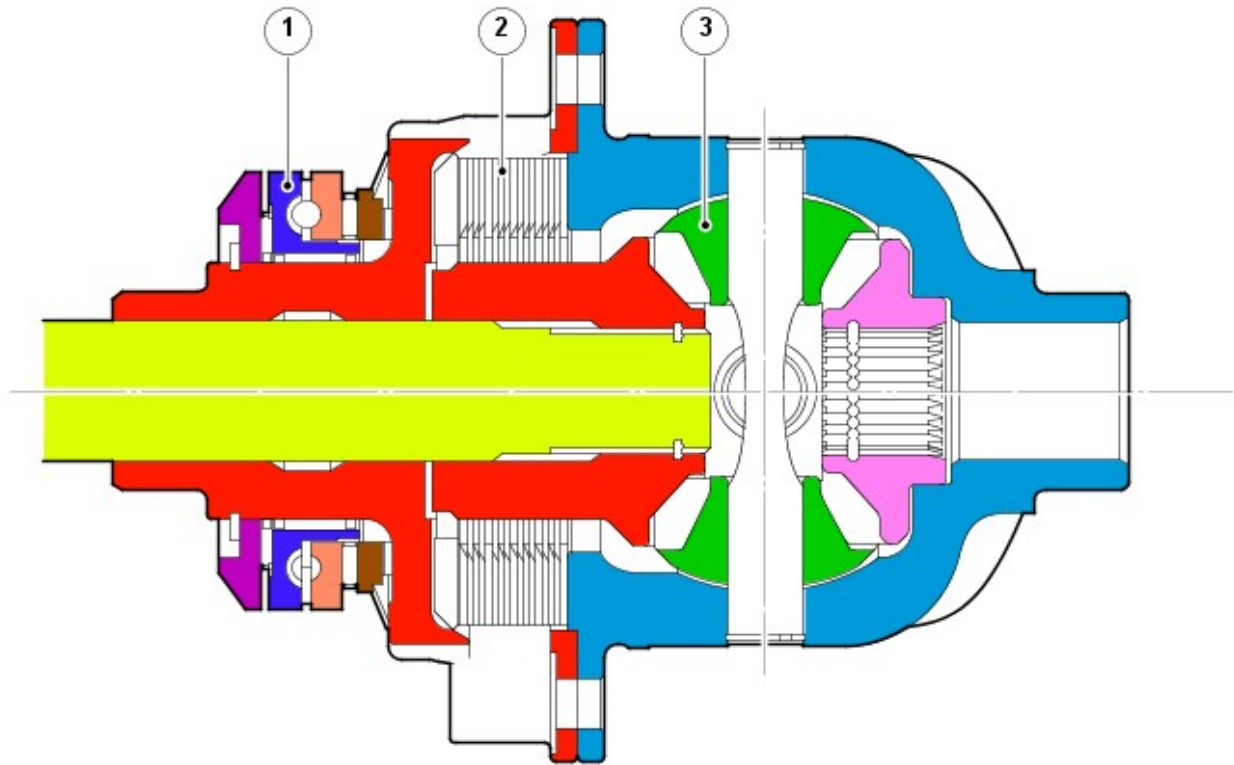
An electronically controlled multi-plate clutch provides a rear differential lock and torque biasing function to give improved traction performance and vehicle dynamic stability.

A strategy to electronically control the rear differential multi-plate clutch assembly, has been developed to provide:

- a pre-loading function, increasing locking torque with increased driving torque
- a slip controller to increase locking torque under off-road conditions and decrease locking-torque for optimum comfort, for example when parking the vehicle.

The unit receives a torque input from the transfer box output-shaft, which is passed through the unit to two outputs for the rear drive halfshafts.

The unit detects wheel-slip via various vehicle system inputs to the differential locking module and locks the differential accordingly.

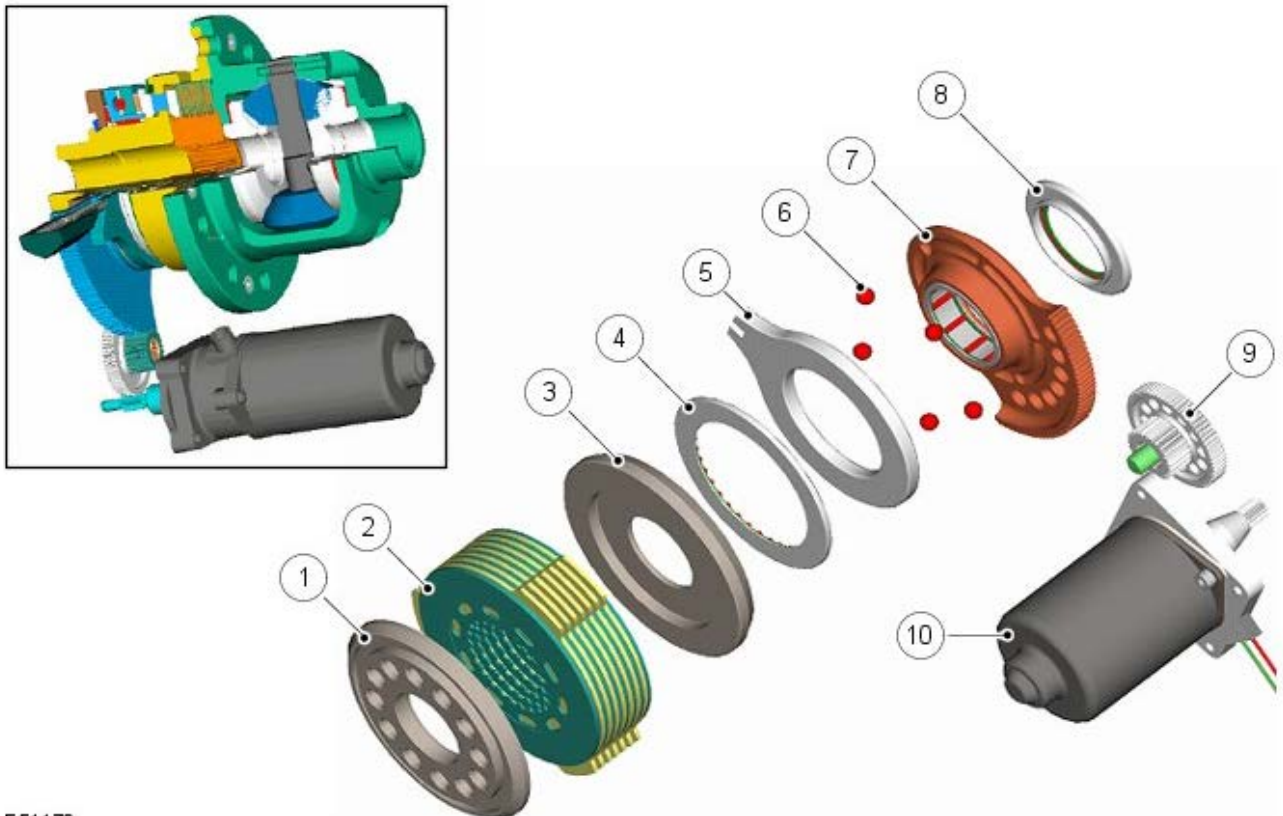


E51169

Item	Part Number	Description
1	-	Actuator
2	-	Clutch pack
3	-	Differential

The electronic rear differential locking and biasing feature is actuated via a DC motor, which is controlled by the differential locking module, via a [PWM \(pulse width modulation\)](#) signal.

Multi-plate Clutch Assembly



E51170

Item	Part Number	Description
1	-	Pressure disc

2	-	Clutch plate assembly
3	-	Pressure disc
4	-	Thrust race
5	-	Output actuator
6	-	Actuator balls
7	-	Input actuator
8	-	Bearing pre-load spacer
9	-	Reduction gearset
10	-	Actuator motor

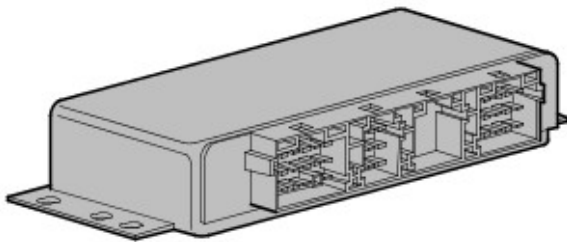
The multi-plate clutch assembly for both centre (transfer box) and electronic rear differentials act in a similar way. The aim of the multi-plate clutch assembly is to prevent excessive differential slip and therefore maximize the traction performance of the vehicle. This is fundamentally different from the 'braked' traction control, which can only counter act differential slip when it occurs.

A certain amount of differential slip is required to allow the vehicle to turn corners and to remain stable under control of the [ABS \(anti-lock brake system\)](#). The transfer box control module monitors the driver's demands through primary vehicle controls and automatically sets the slip torque at the rear differential via the differential locking module. The system is completely automatic and does not require any special driver input.

The multi-plate clutch assembly actively controls the torque flow through the rear differential and optimizes the torque distribution in the driveline. The clutch assembly biases the torque from the differential to the wheels with the higher grip and prevents the wheels with the lower grip from spinning.

By turning the input actuator disc, via the motor shaft, the output actuator is rotated. This movement acts on 5 balls in a ramp mechanism between the input and output actuators and gives a defined axial movement. The movement forces the pressure disc to induce friction between the sun gear and differential case via the clutch plates supported by the sun gear and the plates supported by the clutch basket on the differential case. This frictional force inhibits the differential rotation; the differential case and left hand differential side gear are locked together.

Differential Locking Module



E140538

The differential locking module controls the multi-plate clutch actuation. The locking module is mounted on a bracket located on the LH C-pillar, behind the trim.

The module is connected on the high-speed [CAN \(controller area network\)](#) bus and controls the differential operation using [CAN](#) messages from other control modules on the network.

The module uses three connectors for all inputs and outputs. It receives a permanent power supply from the [EJB \(engine junction box\)](#), and an ignition supply from the [CJB \(central junction box\)](#).

The module memorizes the position of the differential actuator motor when the engine is switched off.

The locking module controls the closed-loop position sensing system within the motor and regulates the power supply to the motor.

If any of following components are replaced:

- differential locking module
- differential actuator motor
- differential assembly.

An approved diagnostic system must be connected to the vehicle and the differential locking module self-calibration procedure performed.

If a fault occurs with the electronic differential, the locking module or one of the required input signals, for example; road speed signal, the locking module records an error code and a warning lamp, in the instrument cluster, illuminates permanently.

CAN Bus Messages

The high-speed [CAN](#) is a broadcast network connected between various vehicle control modules. It allows the fast exchange of data between control modules every few microseconds.

The differential locking module is connected on the high-speed [CAN](#) bus, via the transfer box control module, and controls differential operation using [CAN](#) messages from other control units on the network. Wheel speed, steering

angle, automatic transmission speed, temperature information, vehicle configuration, axle ratios and mode inputs, are some of the main signals received by the locking module.

The locking module also sends messages via the CAN bus to tell other control modules on the network, the status of the electronic rear differential. The clutch torque and default mode status are some of the main signals sent out by the locking module.

The following table shows the messages that can be displayed in the message centre of a high-line instrument cluster relating to the electronic rear differential:

Message	Description	Chime
'TRANSMISSION OVERHEAT' 'SLOW DOWN'	Rear differential temperature has reached or is approaching the overheat threshold.	None
'TRANSMISSION FAULT' 'TRACTION REDUCED'	Transfer box control module has stopped transmitting CAN bus messages. Defaults to open centre differential. Message also displayed when fault occurs with electronic rear differential.	None
'TRANSMISSION FAULT' 'STOP SAFELY'	Fault has occurred with electronic rear differential. Stop vehicle at earliest opportunity.	Single

On vehicles fitted with the low line instrument cluster, in place of the message centre there will be a status lamp, which has the following logic:

- Amber - Over temperature
- Red - Failure, stop vehicle

DIAGNOSTICS

The electronic rear differential locking module can store fault codes, which can be retrieved using an approved diagnostic system.

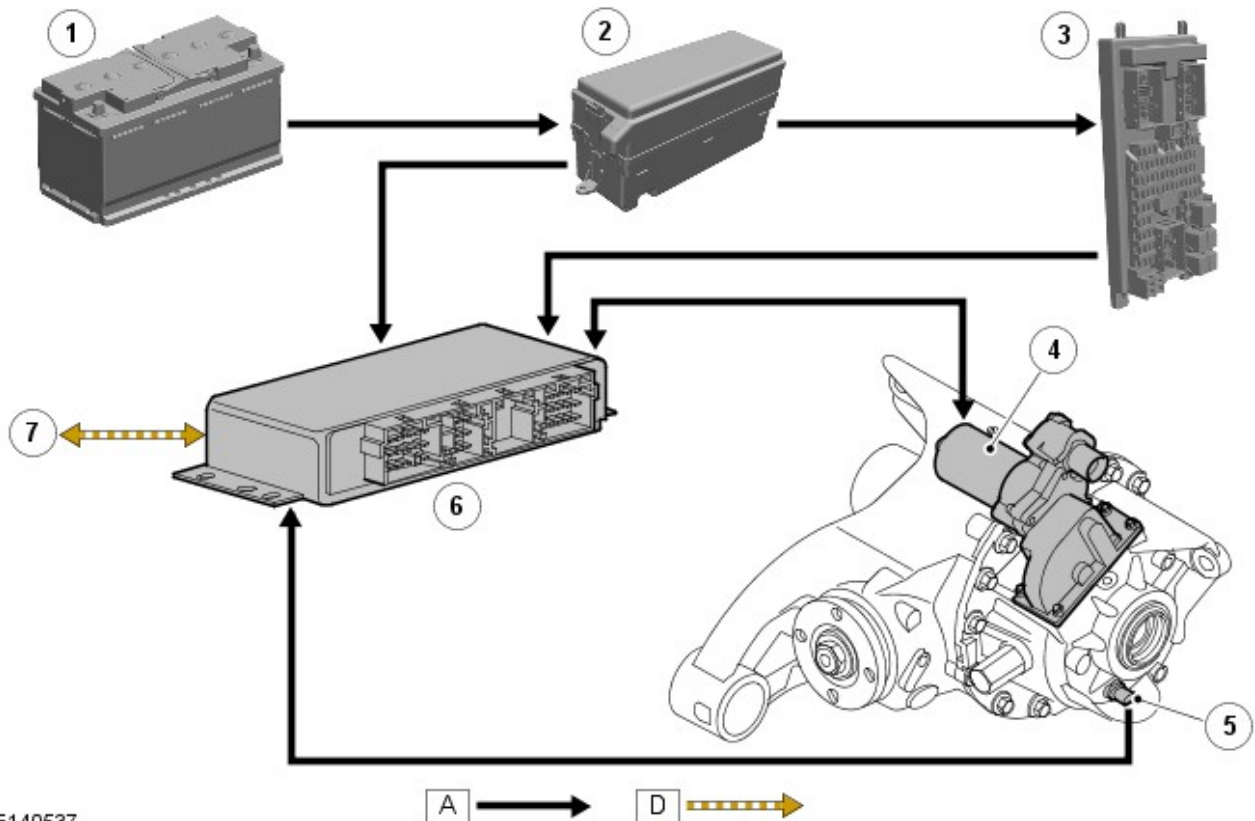
The information is communicated via a diagnostic socket. The diagnostic socket allows the exchange of information between the various control modules on the bus systems and the diagnostic equipment. The information is communicated to the socket via the CAN bus. This allows the retrieval of diagnostic information and programming of certain functions using the diagnostic equipment.

The electronic differential locking module uses **DTC (diagnostic trouble code)**, which relate to electronic rear differential electrical faults.

ELECTRONIC DIFFERENTIAL CONTROL DIAGRAM



NOTE: A = Hardwired; D = high-speed CAN bus.



E140537

Item	Part Number	Description
1	-	Battery

- 2 - EJB
- 3 - CJB
- 4 - Actuator motor
- 5 - Oil temperature sensor
- 6 - Differential locking module
- 7 - High- speed CAN to other vehicle systems

Rear Drive Axle/Differential - Rear Drive Axle and Differential

Diagnosis and Testing

Principles of Operation

For a detailed description of the Rear Drive Axle and Differential and operation, refer to the relevant Description and Operation section of the workshop manual.

REFER to: Rear Drive Axle and Differential (205-02 Rear Drive Axle/Differential, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Differential oil leakage • Sensor installation 	<ul style="list-style-type: none"> • Power • Fuse(s) • Wiring harness physical damage or water ingress • Loose or corroded electrical connectors • Controller Area Network (CAN) circuits • Sensors • Rear Differential Control Module (RDCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Message	Possible Other Warnings	Possible Causes	Action
Running at reduced capability with fault present	<ul style="list-style-type: none"> • Rear differential fault 	<ul style="list-style-type: none"> • Driveline overheat warning lamp illuminated • Rear differential/driveline fault warning lamp illuminated 	<ul style="list-style-type: none"> • Water ingress to wiring harness or connectors • Rear differential internal failure • Rear Differential Control Module (RDCM) internal failure 	<ul style="list-style-type: none"> • Visually inspect the wiring harness and connectors for water ingress • Install a new rear differential as necessary • Install a new Rear Differential Control Module (RDCM) as necessary
Rear differential overheat	<ul style="list-style-type: none"> • Rear differential overheat slow down 	<ul style="list-style-type: none"> • Driveline overheat warning lamp illuminated 	<ul style="list-style-type: none"> • Rear differential oil level incorrect • Rear differential oil incorrect specification • Rear differential temperature sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Rear Differential Control Module 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual and test the rear differential oil level • Refer to the relevant section of the workshop manual and test the rear differential oil specification • Refer to the electrical circuit diagrams and test the rear differential temperature sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Install a new Rear Differential Control Module (RDCM) as

			(RDCM) internal failure	necessary
--	--	--	----------------------------	-----------

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Rear Differential Control Module (RDCM) (100-00 General Information, Description and Operation).

Rear Drive Axle/Differential - Differential Draining and Filling

General Procedures



CAUTION: Do not fill the differential with lubricant up to the filler plug. The filler plug is only used to fill the differential with lubricant, and not to act as a level indicator.



NOTE: The only way to check the fluid level in the differential is to drain all the fluid out and refill with the correct quantity, shown in the specification section.

For additional information, refer to: Specifications (205-02, Specifications).

1. **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.



2. **CAUTION:** Do not undo or remove the large protruding hexagon on the differential casing.

Remove the differential case lubricant filler plug.

- Clean the area around the lubricant filler plug.
- Position container to collect fluid loss.



3. Drain the differential lubricant.
 - Clean the area around the drain plug.
 - Remove the fluid drain plug.

4. **CAUTION:** There has been 2 different types of fixings used for the drain plug. Note the type and make sure the correct torque is applied, see below.

Install the lubricant drain plug.

- Clean the drain plug.
- Up to differential serial number 254325: Tighten the hexagonal drive drain plug to 54 Nm (40 lb.ft).
- From differential serial number 254326: Tighten the 3/8" square drive drain plug to 28 Nm (21 lb.ft).

5. **CAUTIONS:**



There have been 2 different types of fixings used for the drain plug. Note the type and differential serial number, and make sure the correct torque is applied, see below.



Make sure the correct specification and quantity of oil is used.


Fill the differential with the correct amount of lubricant.
For additional information, refer to: Specifications (205-02
Rear Drive Axle/Differential, Specifications).

6. Install the differential filler plug.
 - Clean the filler plug.
 - Tighten the filler plug to 34 Nm (25 lb.ft).

Rear Drive Axle/Differential - Differential Locking Motor

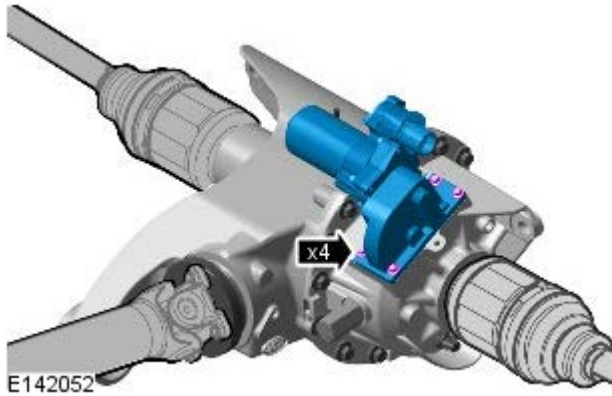
In-vehicle Repair

Removal

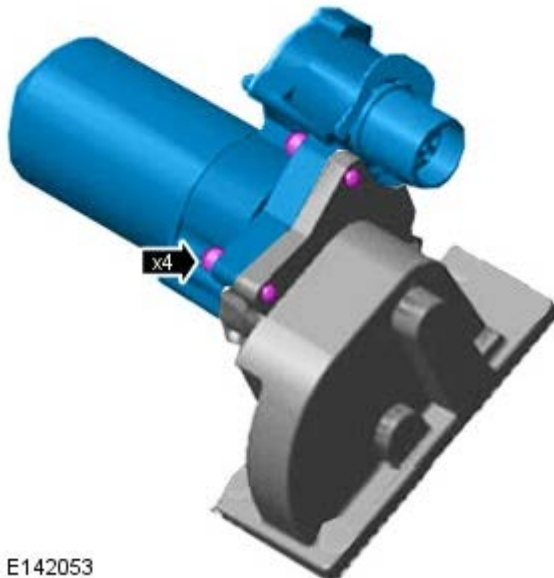
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the differential locking motor.
 - Disconnect the electrical connector.
 - Remove the 4 bolts.



3. Remove the 4 bolts.



4. Discard the motor.



E142054

5. Check the gear set for damage to the gears.

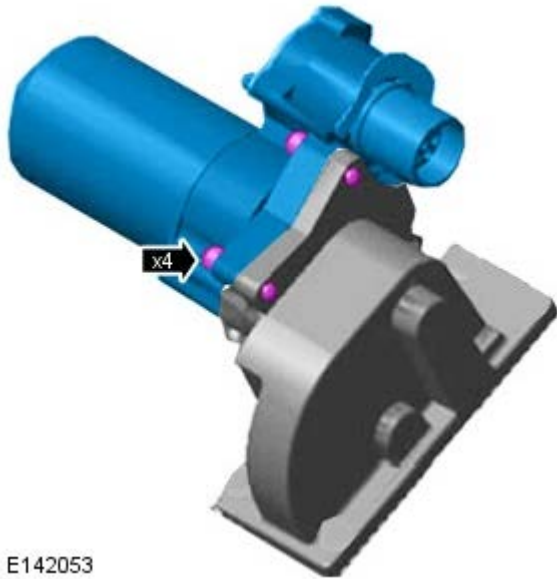
Installation

1. Clean the component mating faces.
 2. Install the new motor with new O ring seal.

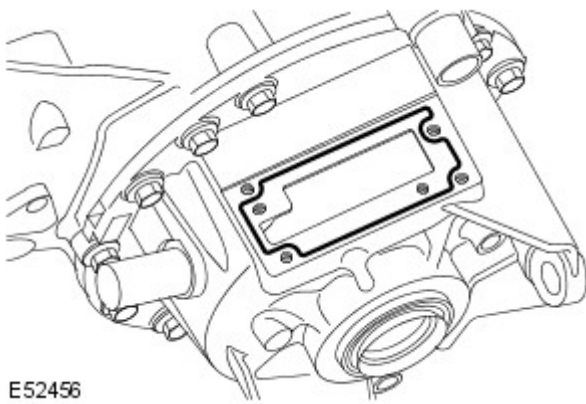


E142055

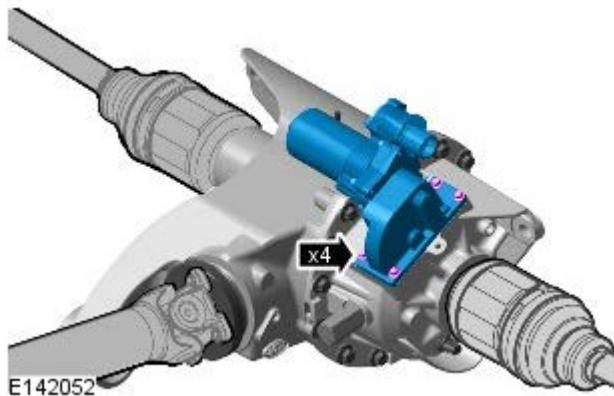
3. Install the 4 bolts 12 Nm.



E142053



E52456



E142052

4. Clean the component mating faces and apply continuous bead of sealant to the motor mating face on the differential.

5. Install the differential locking motor.

- Tighten the bolts to 10 Nm.
- Connect the electrical connector.


6. Lower the vehicle.

7. Calibrate the differential locking motor using the diagnostic tool.

Rear Drive Axle/Differential - Rear Axle Oil Temperature Sensor

In-vehicle Repair

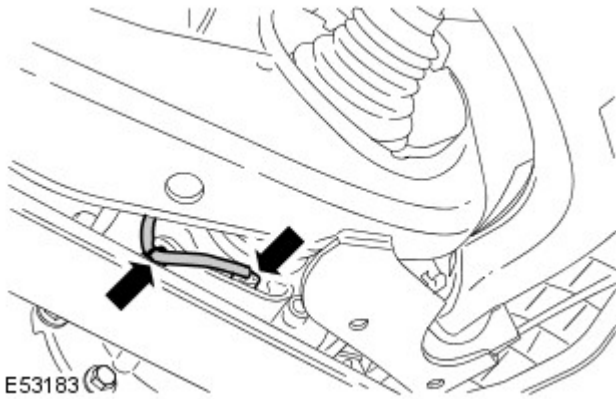
Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

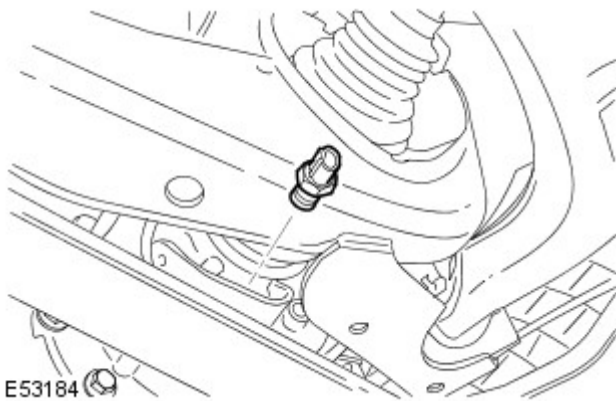
Raise and support the vehicle.

2. Drain the differential lubricant.
For additional information, refer to: Differential Draining and Filling (205-02, General Procedures).

3. Disconnect the electrical connector.
 - Release the wiring harness retaining clip.



4. Remove the oil temperature sensor.
 - Remove and discard the O-ring seal.



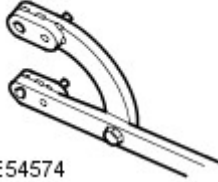






Installation

1. Clean the component mating faces.
2. Install the oil temperature sensor.
 - Tighten to 22 Nm (16 lb.ft).
3. Connect the electrical connector.
 - Secure the wiring harness clip.
4. Fill the differential with the correct amount of lubricant.
For additional information, refer to: Differential Draining and Filling (205-02, General Procedures).

Rear Drive Axle/Differential - Drive Pinion Seal


In-vehicle Repair

Special Tool(s)


<p>205-053</p>  <p>E54574</p>	<p>Flange holding tool 205-053</p>
<p>205-053</p>  <p>E54585</p>	<p>Adapter for 205-053</p>
<p>100-012</p>  <p>E54135</p>	<p>Impulse extractor 100-012(LRT-99-004)</p>
<p>205-821</p>  <p>E54586</p>	<p>Installer drive pinion oil seal 205-821</p>
<p>205-824</p>  <p>E54587</p>	<p>Remover drive flange 205-824</p>
<p>205-823</p>  <p>E54700</p>	<p>Remover drive pinion seal 205-823</p>
<p>205-821-01</p>  <p>E112195</p>	<p>Seal installer, adaptor 205-821-01</p>

Removal

CAUTIONS:

 The input flange must not be change for one from another unit.

 The drive pinion seal must only be renewed for 1 repair.


-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Drain the differential lubricant.
For additional information, refer to: Differential Draining and Filling (205-02, General Procedures).

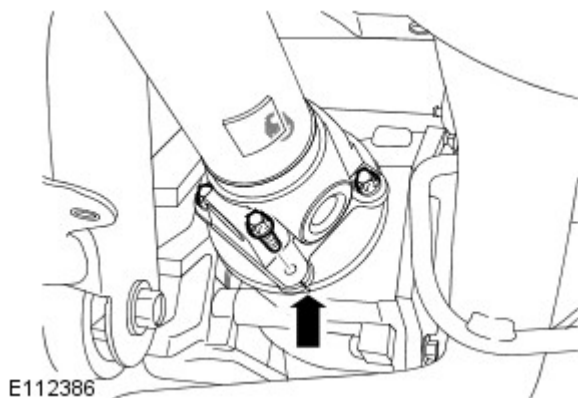
3. Remove the fuel tank heat shield.
 - Remove the 3 bolts and 2 nuts.



4.  **CAUTION:** Mark the position of the driveshaft flange in relation to the drive pinion flange.

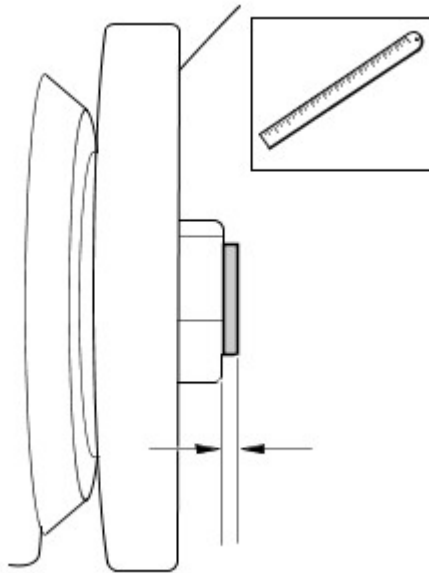
Release the driveshaft from the rear axle drive pinion flange.

- Remove and discard the 4 Torx bolts.

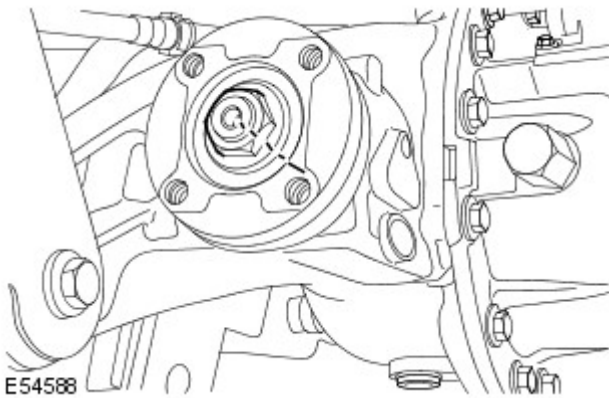


5. Measure the depth of the pinion nut on the pinion shaft.
 - Note measurement for installation.

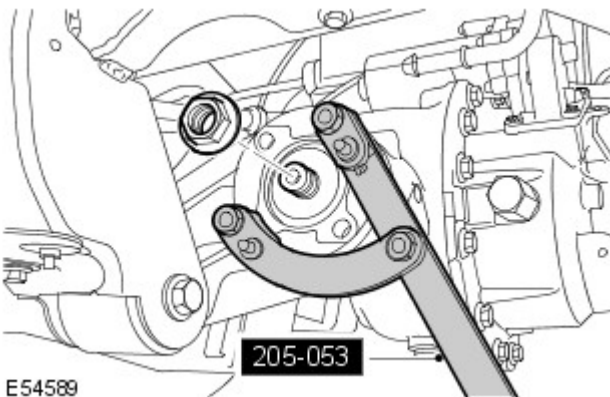
E112387



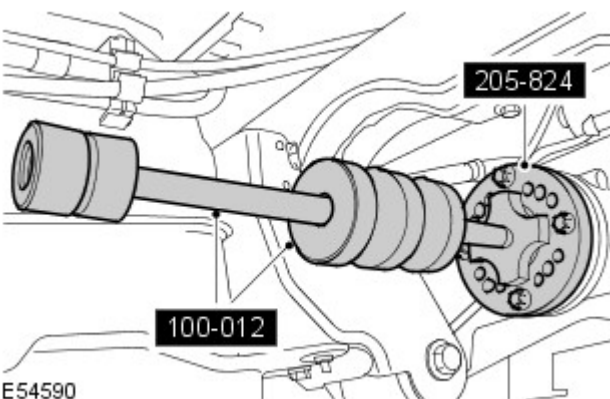
E54588




E54589



E54590



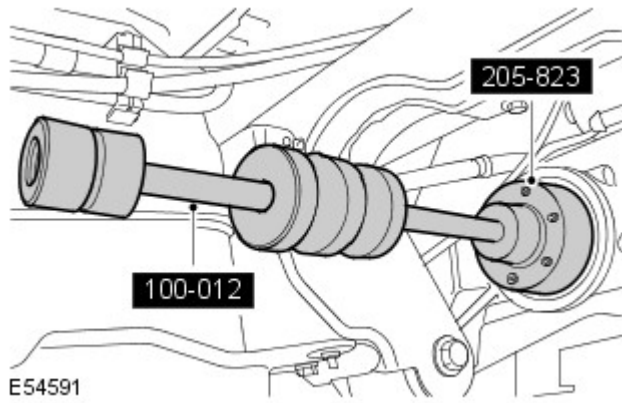
6.  **CAUTION:** This step must be carried out to make sure that the drive pinion nut is correctly tightened on assembly.

Accurately scribe a line to mark the drive pinion shaft to the drive pinion nut and pinion flange.

7. Remove the drive pinion flange retaining nut.
- Using the special tool, counter hold the drive pinion flange.
 - Note number of turns for installation.

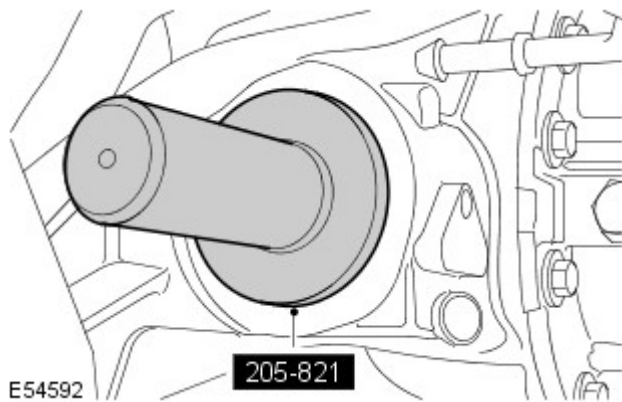
8. Using the special tool, remove the drive pinion flange.
- Check flange seal journal for any damage.

9. Using the special tool, remove the drive pinion seal.

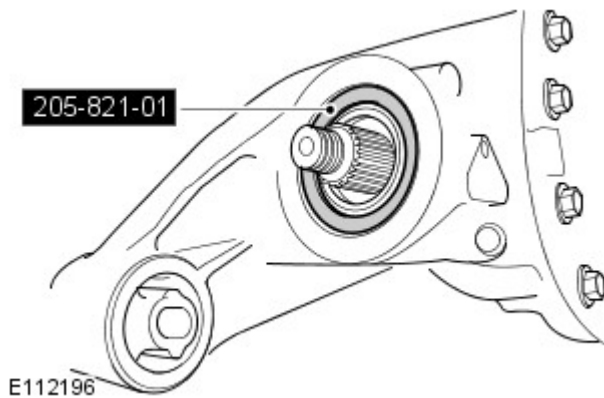



Installation

1. Clean the drive pinion flange.
2. Clean the drive pinion seal mating faces.
3. Using the special tool, install the new drive pinion seal.



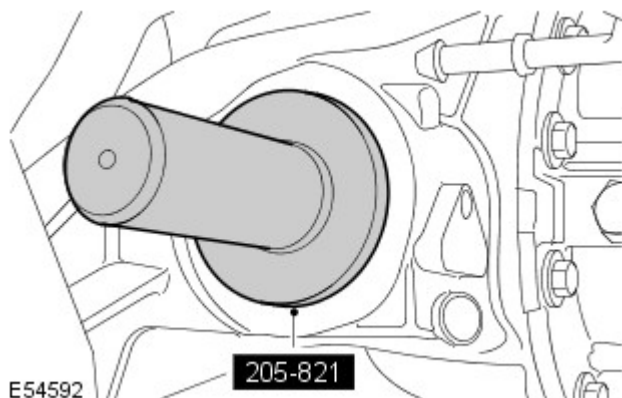
4. Remove the special tool.
 - Install special tool 205-821-01 to the seal face.




5.  **CAUTION:** Make sure adaptor is removed or damage to the vehicle may occur.

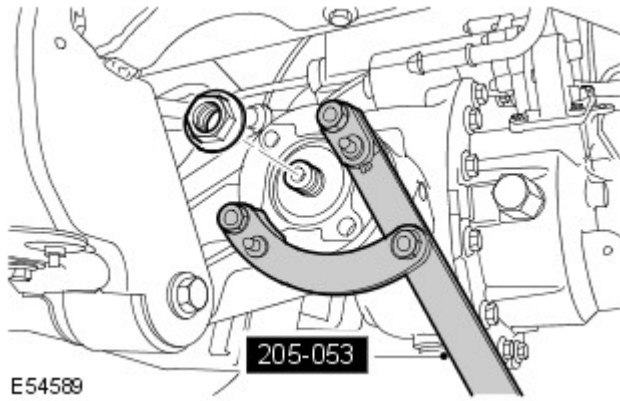
Using the special tool, install the new drive pinion seal.

- Remove the special tools.






6.  **CAUTION:** Make sure the drive pinion flange scribed marks are aligned.

Install the drive pinion flange.



7. CAUTIONS:


-  Make sure the mark on the drive pinion nut is never tightened short of the scribed mark on the drive pinion shaft.
-  Make sure the drive pinion flange has no end float and is free to rotate.
-  Make sure the scribed mark on the drive pinion nut is no more than a maximum of 5 degrees past the scribed mark on the drive pinion shaft.

Install the drive pinion flange retaining nut.

- Using the special tool, counter hold the drive pinion flange.
- Install nut to previously noted number of turns.
- Measure the depth of the pinion nut on the pinion shaft.

8. Attach the driveshaft to the rear axle drive flange.
- Clean the component mating faces.
 - Attach the driveshaft to the rear axle drive flange.
 - Tighten the new Torx bolts to 150 Nm (110 lb.ft).

9. Install the fuel tank heat shield.
- Tighten the bolts and nuts to 10 Nm (7 lb.ft).

10.  CAUTION: Make sure the correct specification and quantity of oil is used.

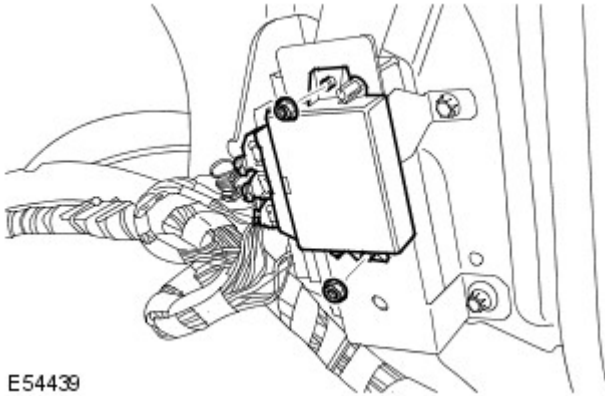
Fill the differential with the correct amount of lubricant. For additional information, refer to: Differential Draining and Filling (205-02, General Procedures).

Rear Drive Axle/Differential - Differential Locking Module

In-vehicle Repair

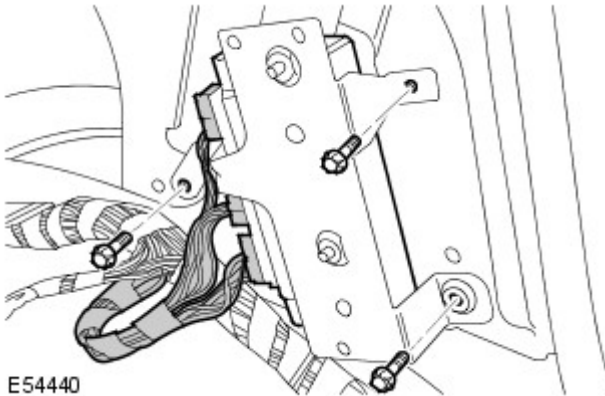
Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the rear quarter trim panel.
For additional information, refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).
3. Release the parking aid module.
 - Remove the 2 nuts.



E54439

4. Remove the differential locking module.
 - Disconnect the 3 electrical connectors.
 - Remove the 3 bolts.



E54440

Installation

1. Install the differential locking module.
 - Install the bolts and tighten to 10 Nm (7 lb.ft).
 - Connect and secure the electrical connectors.
2. Install the parking aid module.
 - Tighten the nuts to 10 Nm (7 lb.ft).
3. Install the rear quarter trim panel.
For additional information, refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).
4. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
5. Use T4 to calibrate a new differential locking module.

Rear Drive Axle/Differential - Axle Assembly

Removal and Installation


Removal



CAUTION: Do not undo or remove the large protruding hexagon on the differential casing.

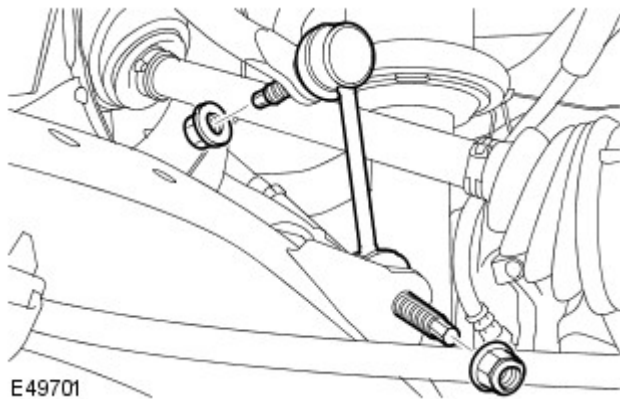



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

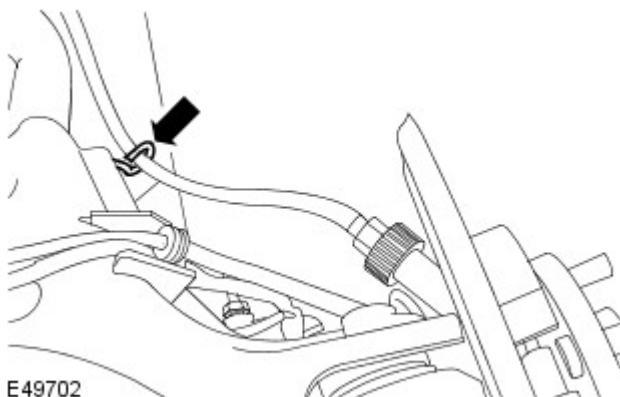
2. Remove the rear wheels and tires.
3. Remove the muffler assembly.
For additional information, refer to: [Front Muffler](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation) / [Front Muffler](#) (309-00A Exhaust System - TDV6 3.0L Diesel, Removal and Installation).
4. Remove the RH rear halfshaft.
For additional information, refer to: [Rear Halfshaft](#) (205-05 Rear Drive Halfshafts, Removal and Installation).



5.  **CAUTION:** Use a wrench on the hexagon provided to prevent the ball joint rotating.

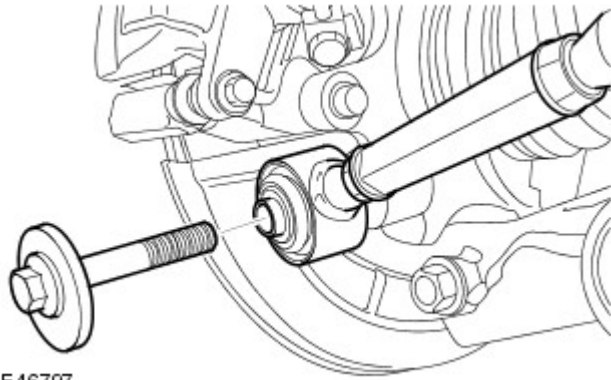
Remove the LH rear stabilizer bar link.

- Remove and discard the 2 nuts.

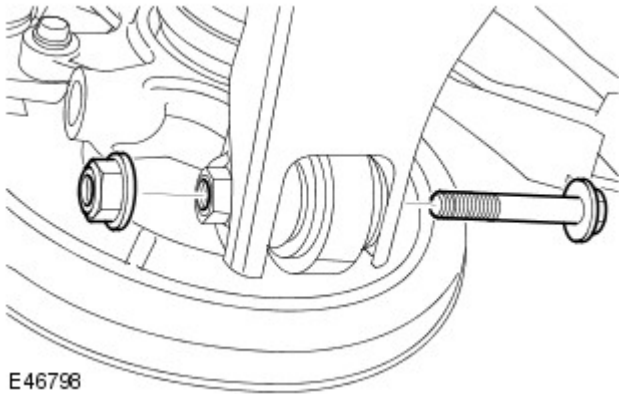


6. Release the parking brake cable from the lower arm.

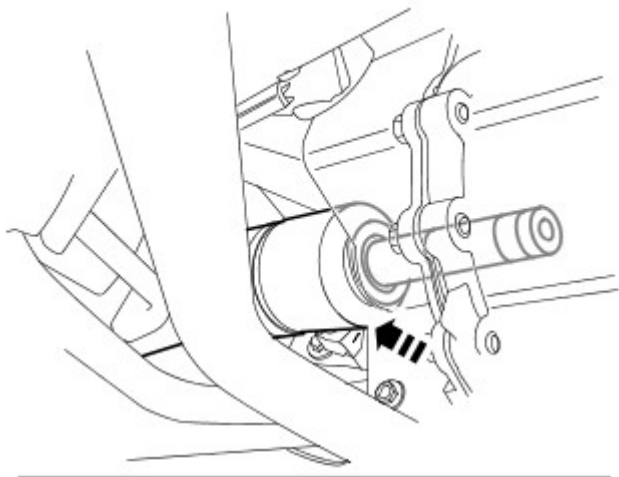
7. Disconnect the LH rear toe link.
 - Remove the bolt.



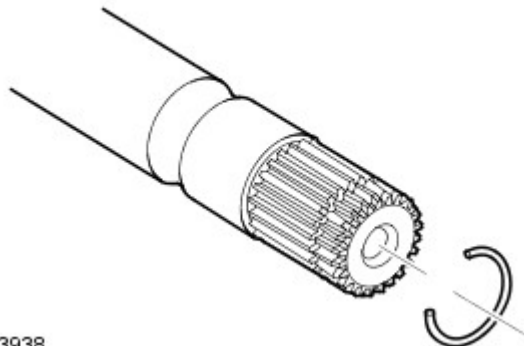
E46797




E46798



E63938



8.  **CAUTION:** Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.


Release the LH rear wheel knuckle from the lower arm.

- Remove the bolt.
- Using a suitable stand, support the LH rear wheel knuckle.

9.  **NOTE:** RH illustration shown, LH is similar.

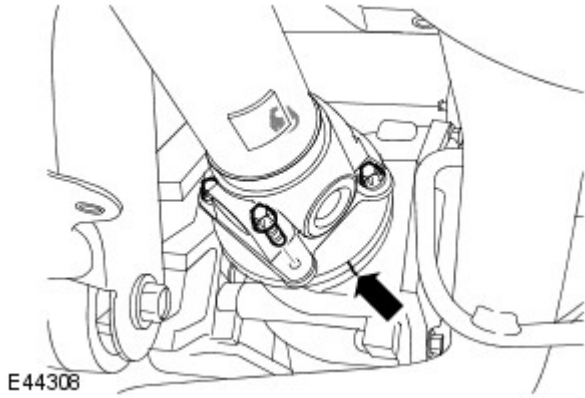
Release the LH rear halfshaft from the axle assembly.

- Remove and discard the snap ring.

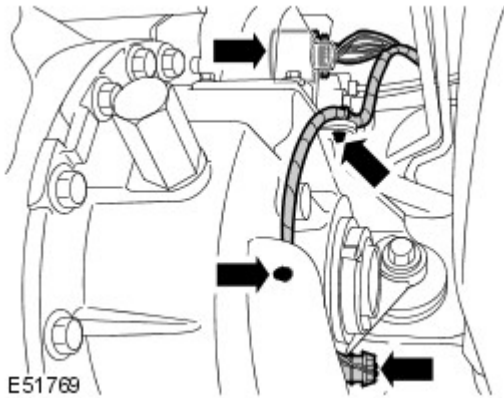
10.  **CAUTION:** Mark the position of the driveshaft flange in relation to the drive pinion flange.

Release the driveshaft from the rear axle drive flange.

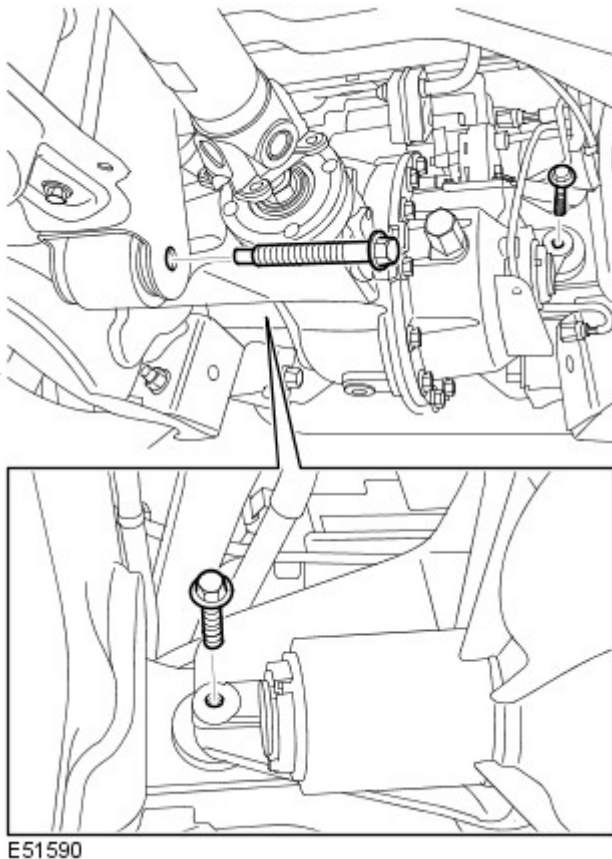
- Remove and discard the 4 bolts.
- Tie aside.




11. Vehicles with differential locking motor:
 - Disconnect the 2 electrical connectors.
 - Release the 2 wiring harness clips.



12. Using a transmission jack, support the rear axle assembly.



13.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

With assistance, remove the rear axle assembly.


- Remove the 3 bolts.
- Disconnect the breather line.

Installation

1. With assistance, install the rear axle assembly.
 - Connect the breather line.
 - Tighten the front mounting bolt to 275 Nm (203 lb.ft).
 - Tighten the rear mounting bolts to 175 Nm (129 lb.ft).

lb.ft).

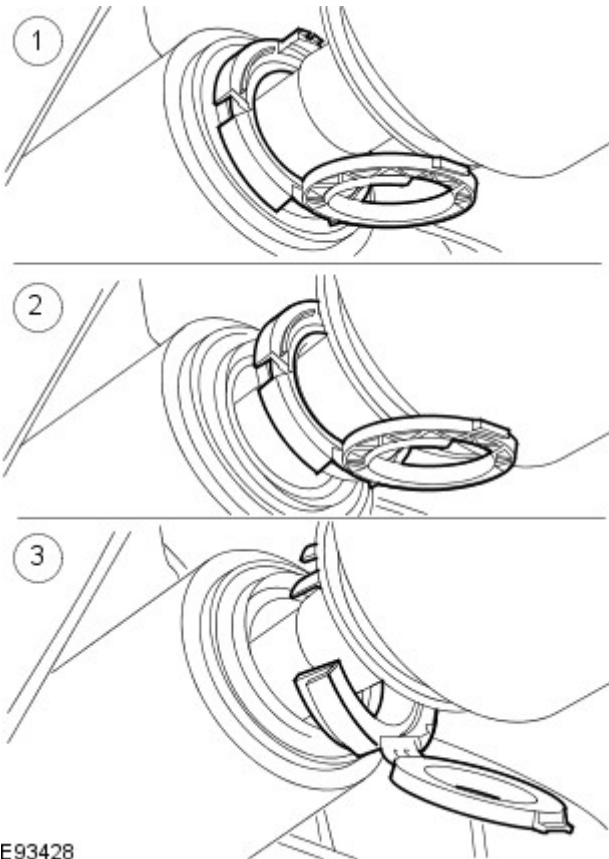
2. Vehicles with differential locking motor: Connect the electrical connectors.
 - Secure the wiring harness clips.

3.  **CAUTION:** Make sure that new bolts are installed.


Secure the driveshaft to the rear axle drive flange.

- Clean the component mating faces.
- Tighten the bolts to 150 Nm (110 lb.ft).

4. Install a new snap ring to the LH halfshaft.




E93428

5.  **NOTE:** Do not fully engage the halfshaft until the oil seal protector has been removed.

Secure the LH halfshaft in the axle assembly.

1. Open the halfshaft seal protector and install the halfshaft.
2. Release the halfshaft seal protector from the halfshaft seal.
3. Break the halfshaft seal protector in to two pieces and remove the halfshaft seal protector.
4. Fully install the halfshaft.

6.  **CAUTION:** Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

Connect the LH rear wheel knuckle to the lower arm.

- Tighten the nut and bolt to 275 Nm (203 lb.ft).

7. Connect the LH rear toe link.
 - Tighten the bolt to 175 Nm (129 lb.ft).
8. Secure the parking brake cable to the lower arm.
9. Install the LH rear stabilizer bar link.
 - Tighten the nuts to 115 Nm (85 lb.ft).
10. Install the RH halfshaft.

For additional information, refer to: [Rear Halfshaft](#) (205-05 Rear Drive Halfshafts, Removal and Installation).
11. Install the muffler assembly.








For additional information, refer to: [Front Muffler](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation) / [Front Muffler](#) (309-00A Exhaust System - TDV6 3.0L Diesel, Removal and Installation).



12. Install the wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Rear Drive Axle/Differential - Axle Housing Bushing

Removal and Installation

Special Tool(s)


<p>502-009/2</p>  <p>E54205</p>	<p>Remover rear differential rear bush 502-009/2</p>
<p>211-294</p>  <p>E54206</p>	<p>Hydraulic two legged puller 211-294</p>
<p>205-825/4</p>  <p>E54207</p>	<p>Adaptor/button 205-825/4</p>
<p>205-825/3</p>  <p>E54208</p>	<p>Installer rear differential front bush 205-825/3</p>
<p>205-825/5</p>  <p>E54209</p>	<p>Receiver cup rear differential front bush 205-825/5</p>
<p>205-825/6</p>  <p>E54210</p>	<p>Bearing Housing 205-825/6</p>
<p>51203</p>  <p>E54149</p>	<p>Bearing Set for 16mm Bolt 51203</p>

 <p>205-825/7 E54211</p>	<p>Remover/Installer long 16mm bolt 205-825/7</p>
 <p>205-825/8 E55277</p>	<p>Nut for long 16mm bolt 205-825/8</p>

Removal

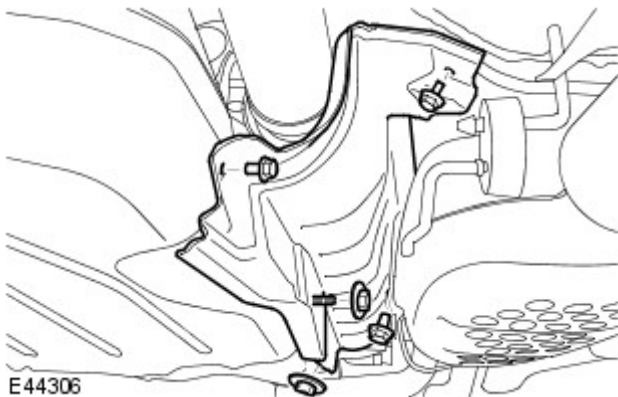


NOTE: Take note of the fitted position of the bush.


-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the vehicle.
- Remove the muffler assembly.
For additional information, refer to: Muffler (309-00, Removal and Installation).

- Remove the fuel tank heat shield.
 - Remove the 3 bolts and 2 nuts.



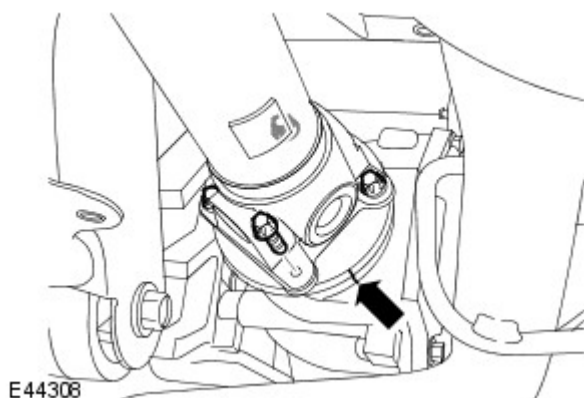
- CAUTIONS:

 Mark the position of the driveshaft flange in relation to the drive pinion flange.

 To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

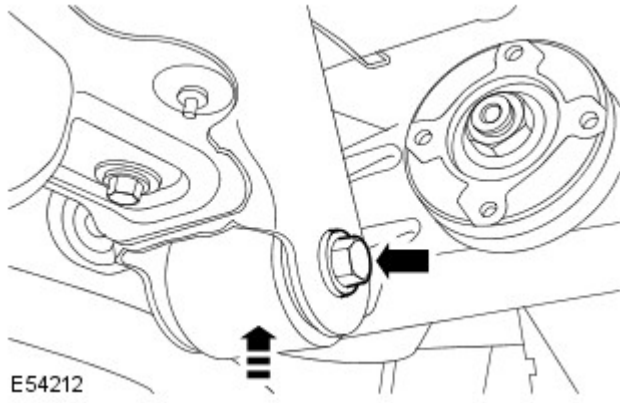
Release the driveshaft from the rear axle drive flange.

- Remove and discard the 4 Torx bolts.

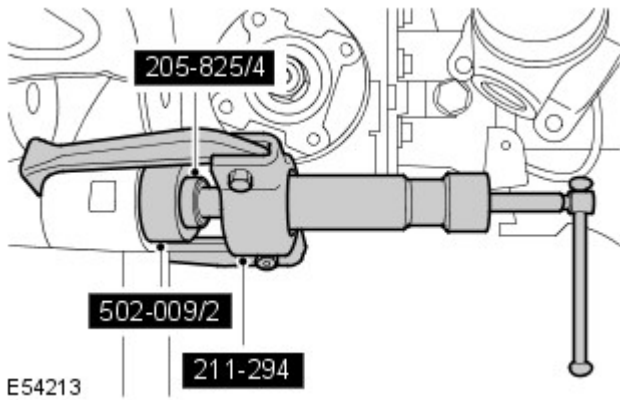


-  **CAUTION:** Make sure the weight of the axle is always supported.

Using a suitable jack, lower the front of the axle.



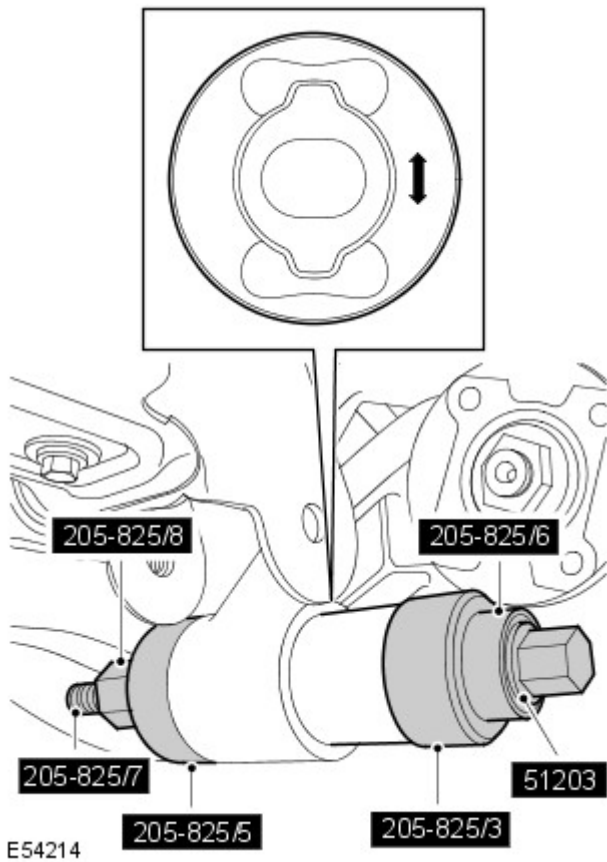
- Remove the axle front retaining bolt.




6. Using the special tools, remove the axle housing bushing.

Installation

1. Using the special tools, install the axle housing bushing.



2.  **CAUTION:** Make sure the weight of the axle is always supported.

Using a suitable jack, raise the front of the differential.



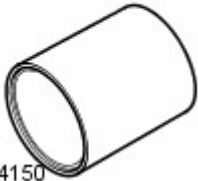


- Install the axle front retaining bolt.
- Tighten to 275 Nm (203 lb.ft).

3. Attach the driveshaft to the rear axle drive flange.
 - Clean the component mating faces.
 - Attach the driveshaft to the rear axle drive flange.
 - Tighten the new Torx bolts to 150 Nm (110 lb.ft).
4. Install the fuel tank heat shield.
 - Tighten the bolts and nuts to 10 Nm (7 lb.ft).
5. Install the muffler assembly.
For additional information, refer to: Muffler (309-00, Removal and Installation).

Rear Drive Axle/Differential - Rear Axle Housing Support Insulator

Removal and Installation


Special Tool(s)

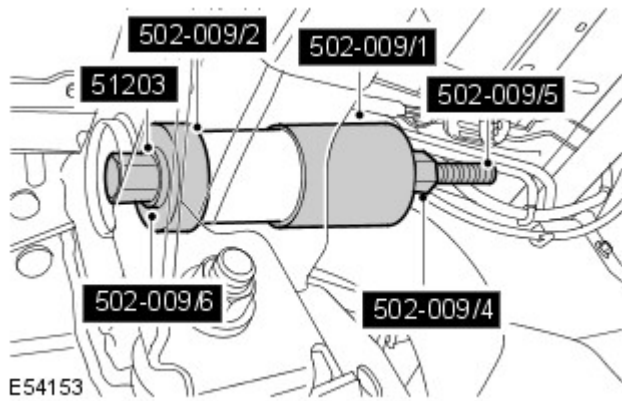
 <p>502-009/5 E54148</p>	<p>Remover/Installer long 14mm bolt 502-009/5</p>
 <p>51203 E54149</p>	<p>Bearing set for 14mm and 16mm bolt, 51203</p>
 <p>502-009/1 E54150</p>	<p>Receiver cup rear differential rear bush 502-009/1</p>
 <p>502-009/2 E54151</p>	<p>Remover rear differential rear bush 502-009/2</p>
 <p>502-009/3 E54152</p>	<p>Installer rear differential rear bush 502-009/3</p>

Removal



NOTE: Take note of the fitted position of the bush.

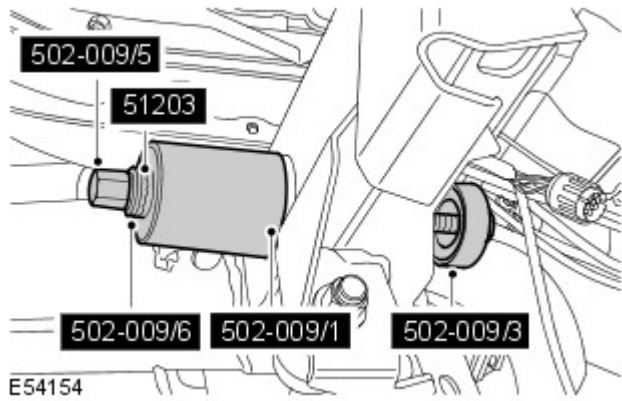
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
2. Remove the wheels and tires.
3. Remove the rear differential.
For additional information, refer to: Axle Assembly (205-02, Removal and Installation).



4.  **NOTE:** Take note of the fitted position of the bush.

Using the special tools, remove the rear axle housing support insulator.

Installation



1. Using the special tools, install the rear axle housing support insulator.

2. Install the rear differential.
For additional information, refer to: Axle Assembly (205-02, Removal and Installation).
3. Install the wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Front Drive Axle/Differential -

Lubricants



NOTE: Do not use any lubricant other than that specified

Item	Specification
Recommended lubricant	Castrol SAF-XO - 75W/90

Capacities

Item	Capacity
Front differential	0.61 litres (1.07 pints) (0.64 US quarts)

Front Differential

Item	Specification
Reduction ratio:	
V6 Diesel engine - 8HP70 Automatic transmission	3.21:1
V6 Diesel engine - 6HP28 Automatic transmission	3.54:1
V8 Petrol engine - 6HP28 Automatic transmission	3.54:1

Torque Specifications

Description	Nm	lb-ft
Oil drain plug	29	21
Oil filler plug	29	21
Differential case mounting bolts:		
Front mounting bolt	105	77
* Rear mounting bracket to differential casing bolts		
Stage 1	80	59
Stage 2	Further 60°	Further 60°
Front axle crossmember bolts	115	85
** Driveshaft to front axle drive flange Torx bolts:		
Stage 1	45	33
Stage 2	Further 90°	Further 90°
Road wheel nuts	140	103

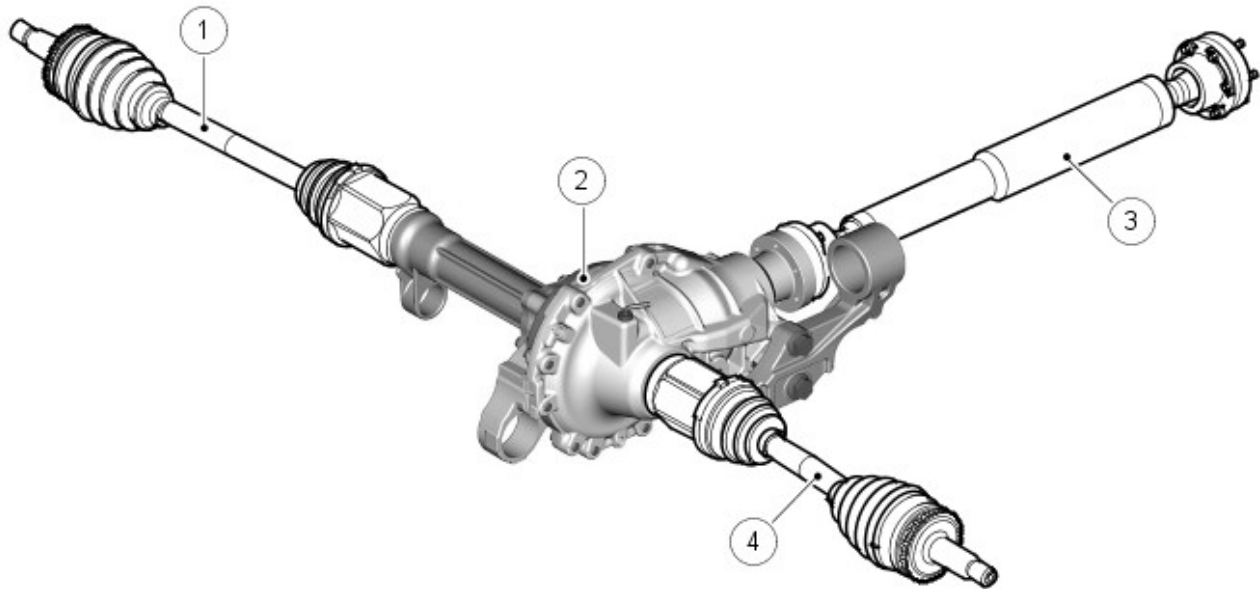
* New bolts must be installed

** New patchlok torx bolts must be installed

Front Drive Axle/Differential - Front Drive Axle and Differential

Description and Operation

GENERAL



E50981

Item	Part Number	Description
1	-	RH front drive halfshaft
2	-	Front differential assembly
3	-	Front driveshaft
4	-	LH front drive halfshaft

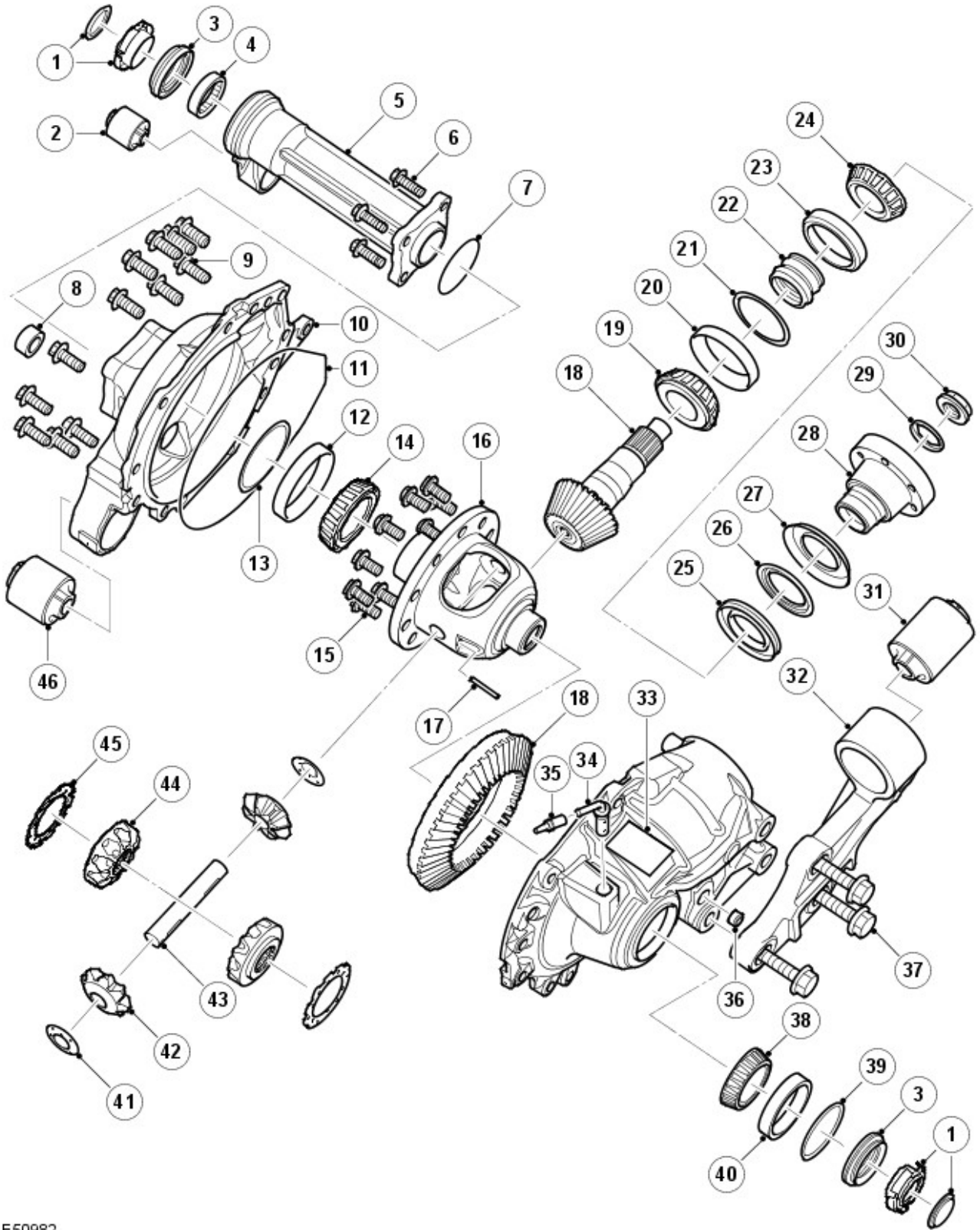
The front differential converts the 'angle of drive' through 90° and distributes drive, via the front drive halfshafts, to the front wheels.

The front differential for the V6 and V8 petrol variants have the same output ratio, but the output ratios for the TdV6 are different, depending on whether automatic or manual transmission is fitted.

The front differential is mounted on the LH side of the chassis.

FRONT DIFFERENTIAL ASSEMBLY

Front Differential - Exploded View



E50982

Item	Part Number	Description
1	-	Protection cap
2	-	Mounting bush assembly
3	-	Seal
4	-	Bearing assembly
5	-	Front tube
6	-	Bolt, 4 of
7	-	O-ring
8	-	Drain plug
9	-	Bolt, 14 of
10	-	Cover assembly
11	-	Cover seal

12	-	Roller bearing cup
13	-	Bearing preload spacer
14	-	Taper roller bearing
15	-	Bolt, 10 of
16	-	Differential case
17	-	Roll pin
18	-	Gear and pinion assembly
19	-	Taper roller bearing
20	-	Roller bearing cup
21	-	Shim
22	-	Collapsible spacer
23	-	Roller bearing cup
24	-	Taper roller bearing
25	-	Oil seal
26	-	Inner deflector
27	-	Outer deflector
28	-	Flange
29	-	Pinion nut retainer
30	-	Pinion nut
31	-	Mounting bush assembly
32	-	Axle mounting bracket
33	-	Data label
34	-	Breather tube
35	-	Cap
36	-	Fill plug
37	-	Bolt, 3 of
38	-	Taper roller bearing
39	-	Bearing preload spacer
40	-	Roller bearing cup
41	-	Thrust washer
42	-	Planet gear
43	-	Shaft
44	-	Sunwheel
45	-	Thrust washer
46	-	Mounting bush assembly

The casing comprises two halves with machined mating faces. When assembled, the cast iron casing halves are sealed with a thin film of Loctite 5999 sealant and secured together with fourteen bolts. A breather tube is fitted to the casings. This allows a plastic tube to be fitted and routed to a high point in the engine compartment, preventing the ingress of water when the vehicle is wading.

The RH casing is fitted with a drain plug. The front differential unit contains approximately 0.7 litre of oil for a dry fill.

The differential is a conventional design using a hypoid gear layout. This employs a hypoid bevel pinion gear and crown wheel, with the pinion offset above the centre line of the crown wheel. This design allows for a larger pinion gear to be used, which has the advantages of increased gear strength and reduced operating noise.

The front differential is available in three ratios. V8 and V6 petrol engine vehicles use a front differential with a final drive ratio of 3.73:1 and TdV6 diesel engine vehicles use a final drive ratio of 3.07:1, for vehicles with manual transmission, and 3.54:1 for vehicles with automatic transmission. Changing the number of teeth between the crown-wheel drive gear and pinion gear changes the ratio.

The differential comprises a pinion shaft and hypoid bevel gear, a crown wheel drive gear with an integral cage, which houses two planet gears. Two sun wheels are also located in the cage and pass the rotational drive to the drive shaft shafts.

The pinion shaft is mounted on two opposed taper roller bearings with a collapsible spacer located between them. The spacer is used to hold the bearings in alignment and also collapses under the pressure applied to the pinion nut. This allows the nut to be tightened to a predetermined torque, which collapses the spacer, setting the correct bearing preload.

The pinion shaft has an externally splined outer end which accepts and locates the input flange, which is retained by the pinion nut. The opposite end of the output flange has an internal spline which provides positive location for the front propeller shaft. The flange has an external O-ring seal which seals against the front propeller shaft shroud preventing the ingress of dirt and moisture into the splines. An oil seal is pressed into the LH casing and seals the input flange to the differential unit. The pinion shaft has a hypoid bevel gear at its inner end which mates with the crown wheel drive gear.

The crown wheel drive gear is located on the carrier and secured with ten screws. The carrier is mounted on taper roller bearings located in each casing half. The bearings are press fitted into the casing and a spacer is located on the outside face to set backlash and apply preload to the bearing.

The carrier is fitted with a shaft onto which the two planet gears are mounted. The shaft is secured in the carrier with a roll pin. The sun wheels are located in pockets within the carrier and mesh with the planet gears. Thrust washers

are located between the carrier and the sun wheels and hold the sun wheels in mesh with the planet gears. Each sun wheel has a machined, splined, bore to accept the drive shaft. A groove is machined in the bore to locate the snap ring fitted to the drive shaft, providing positive drive shaft location.

Differential Operation

The operating principles of the front and rear differentials are the same. Rotational input from the propeller shaft is passed via the input flange to the pinion shaft and pinion gear. The angles of the pinion gear to the crown wheel drive gear moves the rotational direction through 90°.

The transferred rotational motion is now passed to the crown wheel drive gear, which in turn rotates the carrier. The shaft, which is secured to the carrier, also rotates at the same speed as the carrier. The planet gears, which are mounted on the shaft, also rotate with the carrier. In turn, the planet gears transfer their rotational motion to the left and right hand sun wheels, rotating the drive shafts.

When the vehicle is moving in a forward direction, the torque applied through the differential to each sun wheel is equal. In this condition both drive shafts rotate at the same speed. The planet gears do not rotate and effectively lock the sun wheels to the carrier.

If the vehicle is turning, the outer wheel will be forced to rotate faster than the inner wheel by having a greater distance to travel. The differential senses the torque difference between the sun wheels. The planet gears rotate on their axes to allow the outer wheel to rotate faster than the inner one.

SERVICE

The oil used in the front differential is Castrol SAF-XO. The oil contains unique additives, which enhance the differentials operation. No other oil must be used in the front differential.

Front Differential Serviceable Components

- Halfshaft seals
- Needle roller bearing assemblies
- Chassis bush/fixings
- Lubricant.

Front Drive Axle/Differential - Differential Draining and Filling

General Procedures




CAUTION: Do not fill the differential with lubricant up to the filler plug. The filler plug is only used to fill the differential with lubricant, not to act as a level indicator.



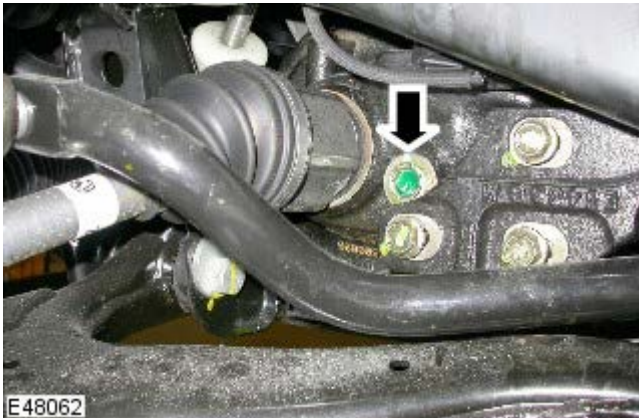
NOTE: The only way to check the fluid level in the differential is to drain all the fluid out and refill with the correct quantity, shown in the specification section.

For additional information, refer to: Specifications (205-03, Specifications).

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.


2. Remove the engine undershield.
For additional information, refer to: Engine Undershield (501-02 Front End Body Panels, Removal and Installation).



3. Remove the differential case lubricant filler plug.
 - Clean the area around the lubricant filler plug.
 - Position container to collect fluid loss.




4. Drain the differential lubricant.
 - Clean the area around the drain plug.
 - Remove the fluid drain plug.

5.  **CAUTION:** There have been 2 different types of fixings used for the drain plug. Note the type and differential serial number, and make sure the correct torque is applied, see below.

Install the lubricant drain plug.

- Clean the drain plug.
- Up to differential serial number 254845: Tighten the hexagonal drive drain plug to 54 Nm (40 lb.ft).
- From differential serial number 254846: Tighten the 3/8" square drive drain plug to 28 Nm (21 lb.ft).

6.  **CAUTION:** Do not fill the differential with lubricant up to the filler plug. The filler plug is only used to fill the differential with lubricant, not to act as a level indicator.





Fill the differential with the correct amount of lubricant.
For additional information, refer to: Specifications (205-03
Front Drive Axle/Differential, Specifications).

7. Install the differential filler plug.
 - Tighten the filler plug to 34 Nm (25 lb.ft).
8. Install the engine undershield.
For additional information, refer to: Engine Undershield
(501-02 Front End Body Panels, Removal and Installation).

Front Drive Axle/Differential - Drive Pinion Seal

In-vehicle Repair

Special Tool(s)

 <p>205-053</p> <p>E54574</p>	<p>Flange holding tool 205-053</p>
 <p>205-824</p> <p>E54587</p>	<p>Remover drive flange 205-824</p>
 <p>205-820</p> <p>E54703</p>	<p>Installer - drive pinion oil seal 205-820</p>
 <p>100-012</p> <p>E54135</p>	<p>Impulse extractor 100-012(LRT-99-004)</p>

Removal



CAUTION: The drive pinion seal must only be renewed once.



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

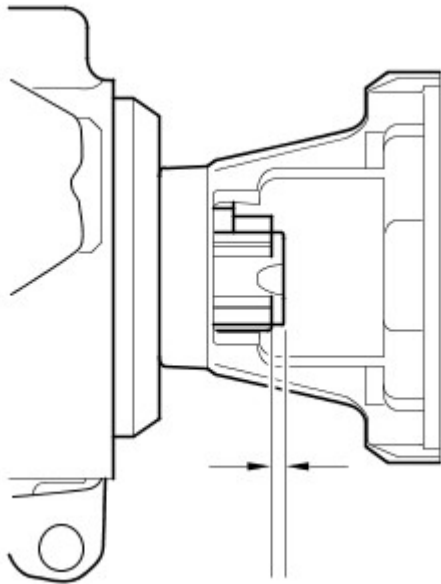


- WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the vehicle.

- Drain the differential lubricant.
For additional information, refer to: [Differential Draining and Filling](#) (205-03 Front Drive Axle/Differential, General Procedures).
- Remove the front driveshaft.
For additional information, refer to: [Front Driveshaft - V6 S/C 3.0L Petrol](#) (205-01 Driveshaft, Removal and Installation) / [Front Driveshaft - TDV6 3.0L Diesel](#) (205-01 Driveshaft, Removal and Installation).

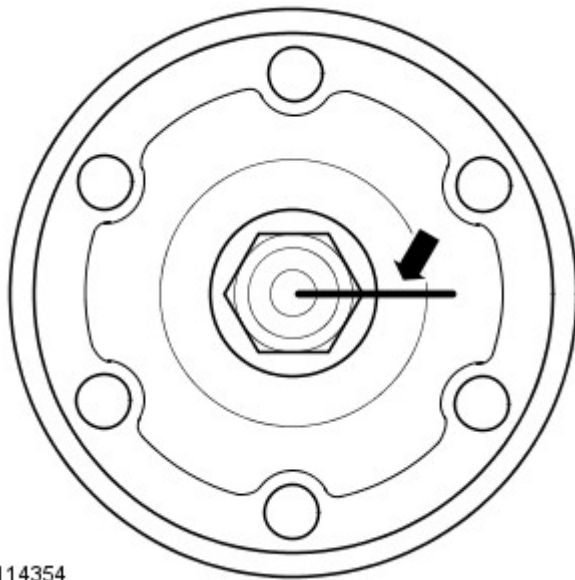
- Measure the depth of the pinion nut on the pinion shaft.
 - Note measurement for installation.



E114355

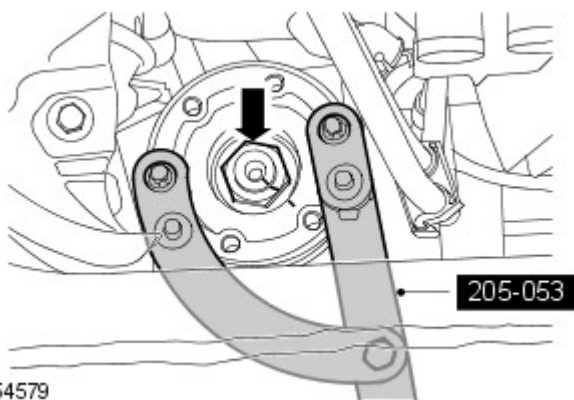
5.  **CAUTION:** This step must be carried out to make sure that the drive pinion nut is correctly tightened on assembly.

Accurately scribe a line to mark the drive pinion shaft to the drive pinion nut and pinion flange.




E114354

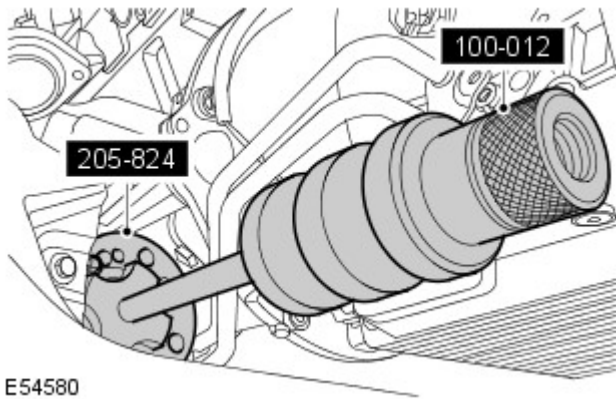
6. Remove the drive pinion flange retaining nut.
 - Using the special tool, counter hold the drive pinion flange.
 - Discard the drive pinion nut retainer.



E54579

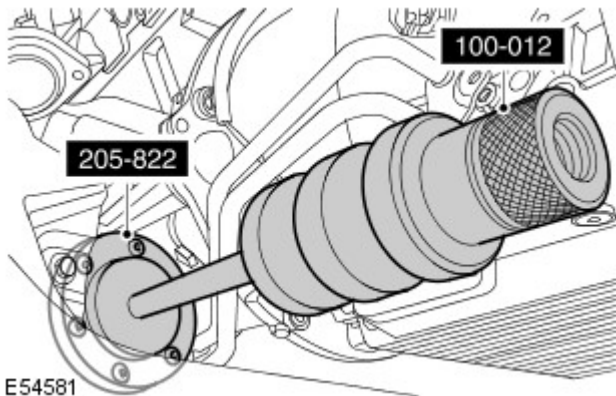
7.  **CAUTION:** Make sure only a bolt is used with the special tool, to draw the drive pinion flange off the drive pinion shaft.

Using the special tool, remove the drive pinion flange.



E54580

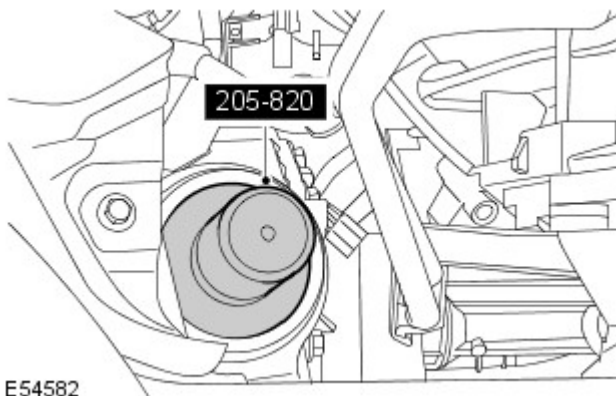
8. Using the special tool, remove the drive pinion seal.




E54581

Installation

1. Clean the drive pinion flange.
2. Clean the drive pinion seal mating faces.
3. Using the special tool, install the new drive pinion seal.





E54582


4.  **CAUTION:** Make sure the drive pinion flange scribed marks are aligned.

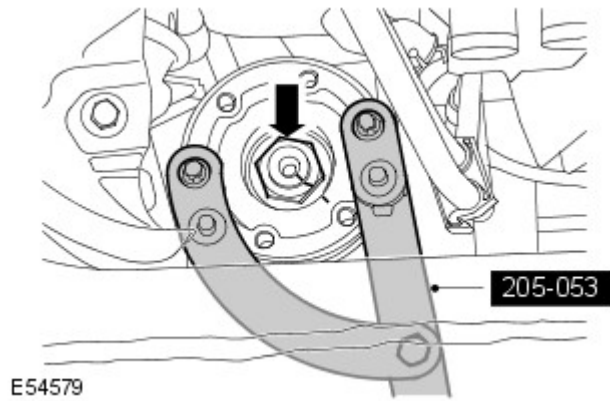
Install the drive pinion flange.

5. **CAUTIONS:**

 Make sure the mark on the drive pinion nut is never tightened short of the scribed mark on the drive pinion shaft.

 Make sure the drive pinion flange has no end float and is free to rotate.

 Make sure the scribed mark on the drive pinion nut is no more than a maximum of 5




degrees past the scribed mark on the drive pinion shaft.

Install the drive pinion flange retaining nut.

- Using the special tool, counter hold the drive pinion flange.
- Install nut to previously noted number of turns.
- Measure the depth of the pinion nut on the pinion shaft.

6. Install the front driveshaft.

For additional information, refer to: [Front Driveshaft - V6 S/C 3.0L Petrol](#) (205-01 Driveshaft, Removal and Installation) / [Front Driveshaft - TDV6 3.0L Diesel](#) (205-01 Driveshaft, Removal and Installation).



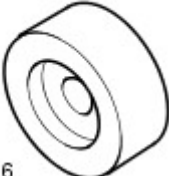




7.  **CAUTION:** Make sure the correct specification and quantity of oil is used.

Fill the differential with the correct amount of lubricant. For additional information, refer to: [Differential Draining and Filling](#) (205-03 Front Drive Axle/Differential, General Procedures).

Front Drive Axle/Differential - Front Axle Housing Support Insulator

In-vehicle Repair


Special Tool(s)

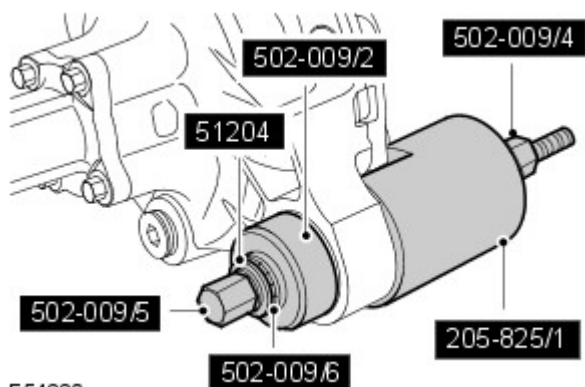
<p>502-009/6</p>  <p>E55285</p>	<p>Bearing Housing 502-009/6</p>
<p>51204</p>  <p>E55278</p>	<p>Bearing set for 14mm bolt 51204</p>
<p>205-825/3</p>  <p>E54216</p>	<p>Installer rear axle front bush 205-825/3</p>
<p>502-009/2</p>  <p>E54205</p>	<p>Remover rear differential rear bush 502-009/2</p>
<p>502-009/5</p>  <p>E54148</p>	<p>Remover/Installer long 14mm bolt 502-009/5</p>
<p>502-009/4</p>  <p>E55284</p>	<p>Nut for long 14mm bolt 502-009/4</p>
<p>205-825/1</p>  <p>E54219</p>	<p>Receiver cup front axle front bush 205-825/1</p>


Removal

 CAUTION: Make sure the bush is correctly aligned.

 NOTE: Take note of the fitted position of the bush.


-  WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
- Remove the front wheels and tires.
- Remove the front differential.
For additional information, refer to: Axle Assembly (205-03, Removal and Installation).



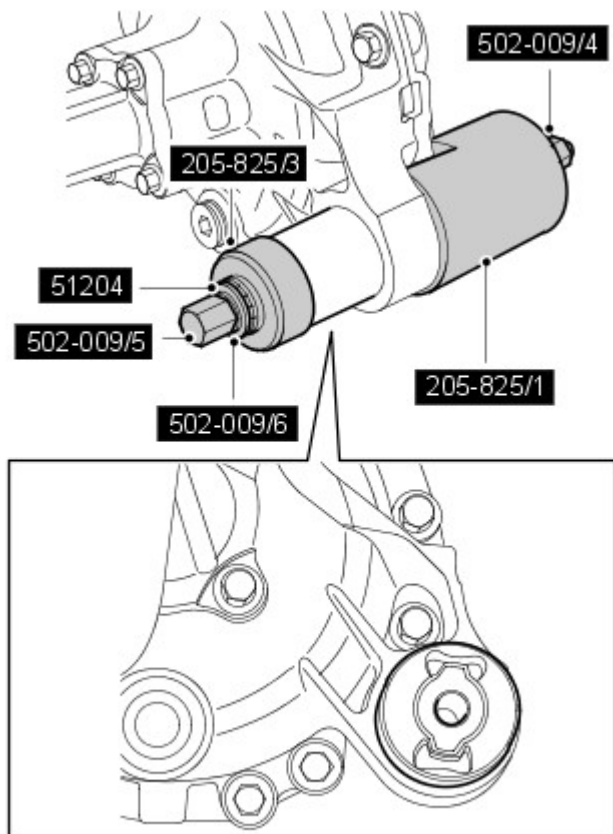
-  NOTE: Take note of the fitted position of the bush.

Using the special tools, remove the front axle housing support insulator.

Installation

-  CAUTION: Make sure the bush is correctly aligned.

Using the special tools, install the front axle housing support insulator.



- Install the front differential.
For additional information, refer to: Axle Assembly (205-03,

Removal and Installation).

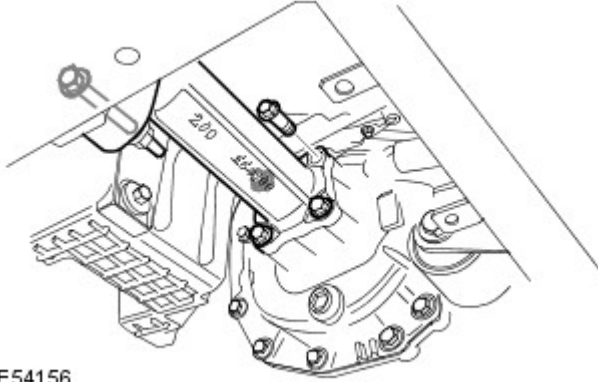
3. Install the front wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Front Drive Axle/Differential - Axle Tube

In-vehicle Repair

Removal

1. Remove the RH halfshaft.
For additional information, refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).
2. Remove the axle tube.
 - Remove the bolt from the bushing.
 - Remove the 4 bolts.
 - Rotate and remove the axle tube.
 - Early models: Remove and discard the O-ring seal.
 - Later models: Remove the sealant.



E54156

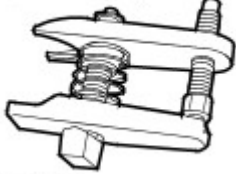


Installation

1. Install the axle tube.
 - Clean the component mating faces.
 - Early models: Install a new O-ring seal.
 - Later models: Apply sealant to the mating face.
For additional information, refer to: Specifications (205-03, Specifications).
 - Tighten the 4 axle tube bolts to 50 Nm (37 lb.ft).
 - Tighten the axle tube bushing bolt to 63 Nm (46 lb.ft).
2. Install the RH halfshaft.
For additional information, refer to: Front Halfshaft RH (205-04 Front Drive Halfshafts, Removal and Installation).

Front Drive Axle/Differential - Axle Assembly

Removal and Installation

Special Tool(s)

 <p>205-754A E45276</p>	<p>Ball joint separator 205-754(LRT-54-027)</p>
 <p>204-703 E99557</p>	<p>Front Stabilizer Bar Bushing Tightening Tool 204-703</p>
 <p>204-705 E99558</p>	<p>Front Stabilizer Bar Bushing Tightening Tool 204-705</p>

Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

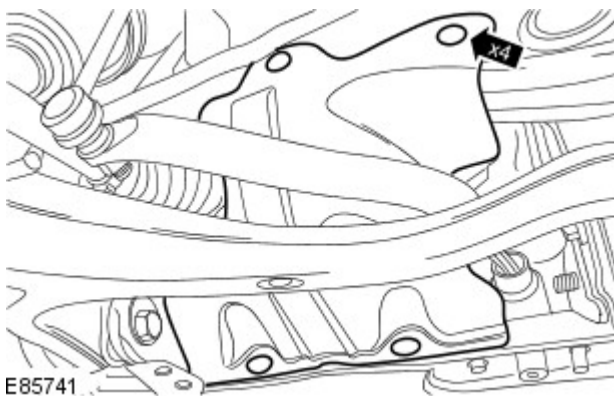
All vehicles

1.  **WARNING:** Make sure to support the vehicle with axle stands.

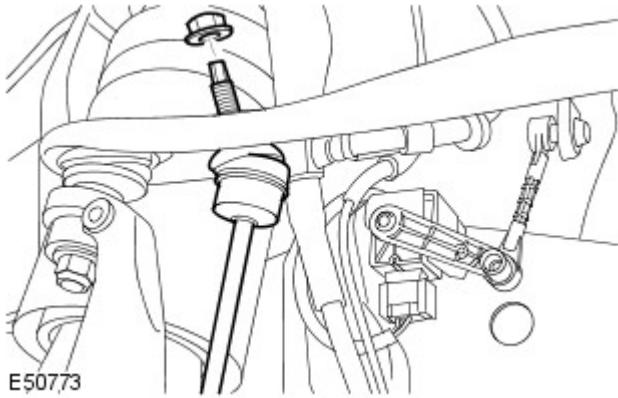
Raise and support the vehicle.

2. Remove the front wheels and tires.
3. Remove the axle tube.
For additional information, refer to: Axle Tube (205-03 Front Drive Axle/Differential, In-vehicle Repair).

4. Remove the LH splash shield.
 - Remove the 4 clips.

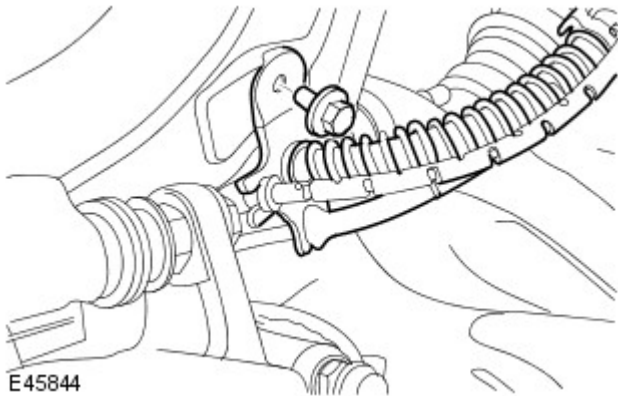


5. Release the LH stabilizer bar link.
 - Remove and discard the nut.




E50773

6. Release the LH brake hose bracket from the wheel knuckle.
 - Remove the bolt.

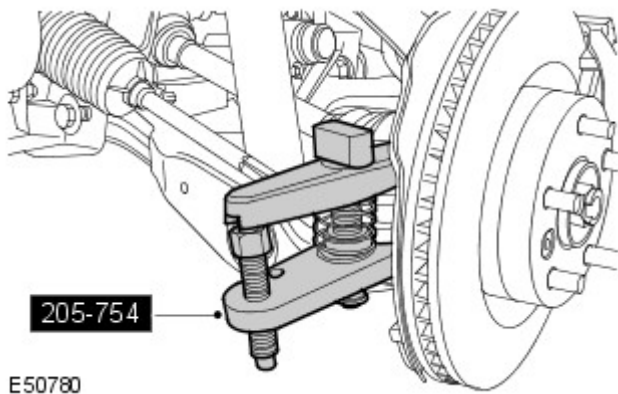


E45844

7.  **CAUTION:** Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.


Using the special tool, release the LH tie-rod end ball joint from the wheel knuckle.


- Remove and discard the nut.



E50780

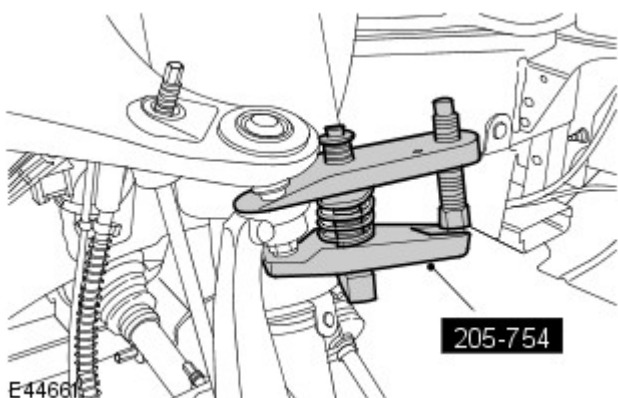
8. **CAUTIONS:**

 Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

 The lower arm ball joint can be damaged by excessive articulation. The wheel knuckle must be fully supported at all times. Do not allow the wheel knuckle to hang on the lower arm. Failure to follow this instruction will result in damage to vehicle.

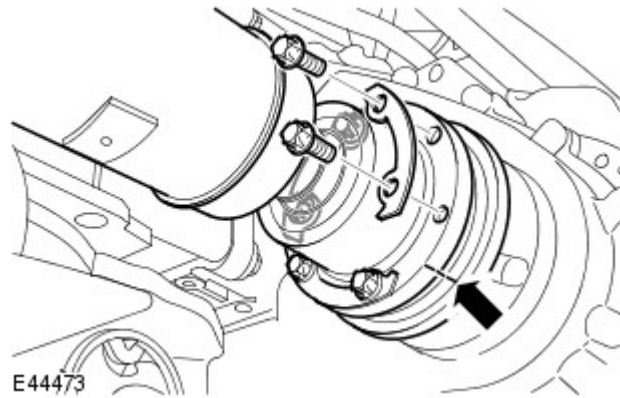
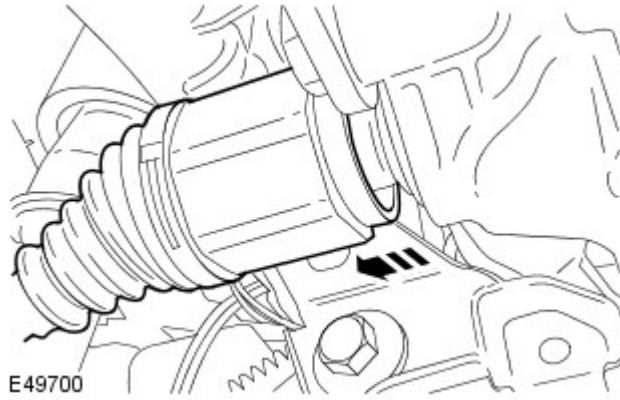
Using the special tool, release the LH upper arm ball joint.

- Remove and discard the nut.





E44661

9. Release the LH halfshaft from the axle assembly.
 - Remove and discard the snap ring.
 - Using a suitable tie strap, support the LH halfshaft.



10. CAUTIONS:

 Mark the position of the driveshaft flange in relation to the drive pinion flange.

 To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

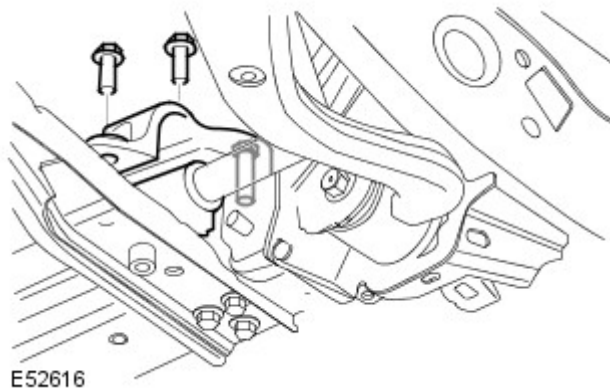
Release the driveshaft from the front axle drive flange.

- Remove the 6 Torx bolts and washers, discard the bolts.
- Using a suitable tie strap, secure the driveshaft end plate.

Vehicles with Active Stabilization

11. Remove the stabilizer bar bushing.

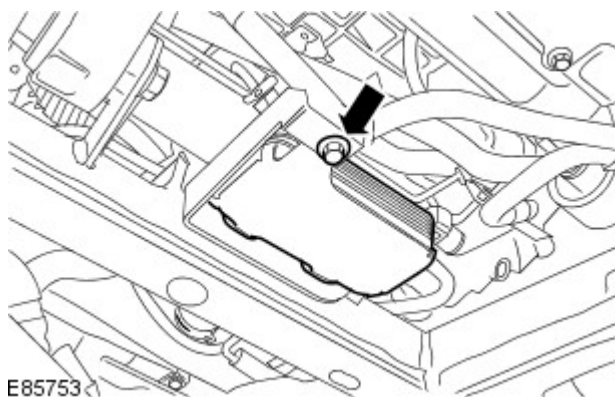
- Remove the 3 bolts.
- Remove the clamp.
- Remove the stabilizer bar bushing.



Vehicles with diesel engine

12. Release the fuel cooler.

- Remove the bolt.



Vehicles with 5.0L engine

13. Release the automatic transmission fluid cooler.

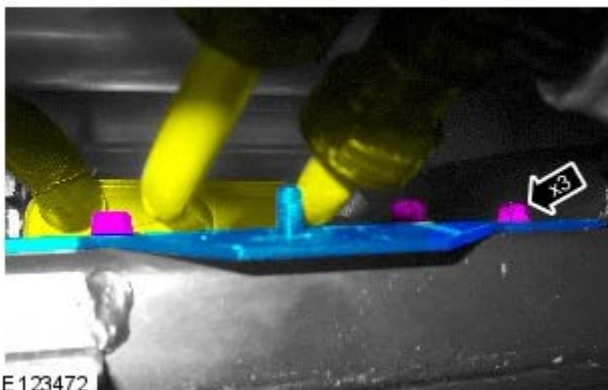
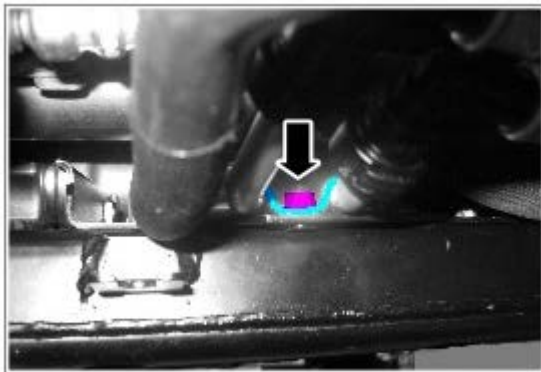
- Remove the 4 bolts.



E123471

14. Remove the transmission fluid cooler mounting bracket.

- Release the transmission fluid cooler pipe bracket.
- Remove the nut.
- Remove the 3 bolts.

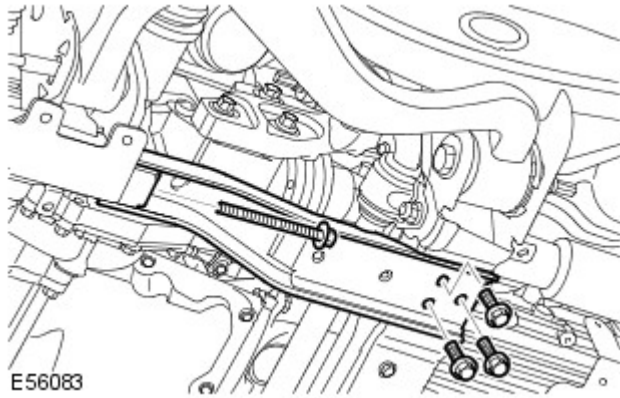


E123472

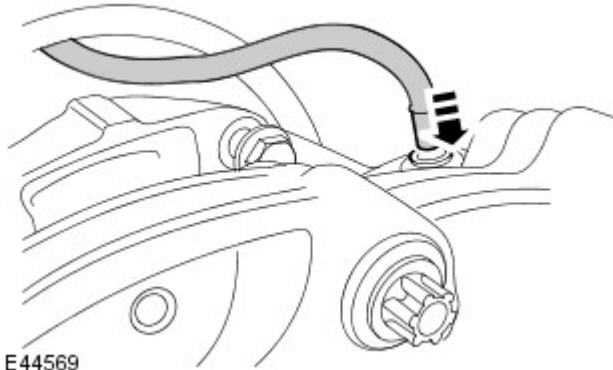
All vehicles

15. Remove the front axle crossmember.


- Remove the 4 bolts.



E56083



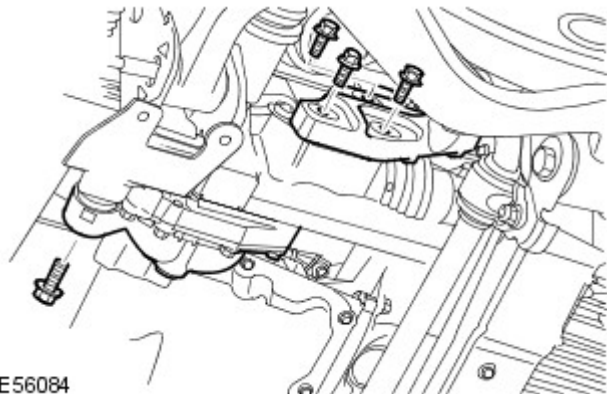
E44569

16.  **CAUTION:** Before the disconnection or removal of any components, make sure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

Disconnect the breather line.

- Release the clip.

17. Using a transmission jack, support the front axle assembly.



E56084

18. With assistance, remove the front axle assembly.
- Remove and discard the 3 axle assembly rear mounting bolts.
 - Remove the front axle assembly front mounting bolt.

Installation

All vehicles

1. With assistance, install the front axle assembly.
 - With assistance, raise and manoeuvre the front final drive unit.
 - Tighten the 3 new bolts in the front axle assembly to 80 Nm (59 lb.ft), then a further 60 degrees.
 - Tighten the front axle assembly front mounting bolt to 105 Nm (77 lb.ft).
2. Connect the breather line.
3. Install the front axle crossmember.
 - Tighten the 4 bolts to 115 Nm (85 lb.ft).

Vehicles with 5.0L engine

4. Install the transmission fluid cooler mounting bracket.
 - Tighten the 3 bolts to 25 Nm (18 lb.ft.).
 - Secure the transmission fluid cooler coolant pipe to the coolant hose bracket.
 - Tighten the nut to 15 Nm (11 lb.ft).

5. Install the automatic transmission fluid cooler.
 - Tighten the 4 bolts to 25 Nm (18 lb.ft.).


Vehicles with diesel engine

6. Secure the fuel cooler.
 - Tighten the bolt to 23 Nm (17 lb.ft).

Vehicles with Active Stabilization

7. Install the stabilizer bar bushing.
 - Install the clamp.
 - Install the bolts.
 - Tighten the bolts to 115 Nm (85 lb.ft).

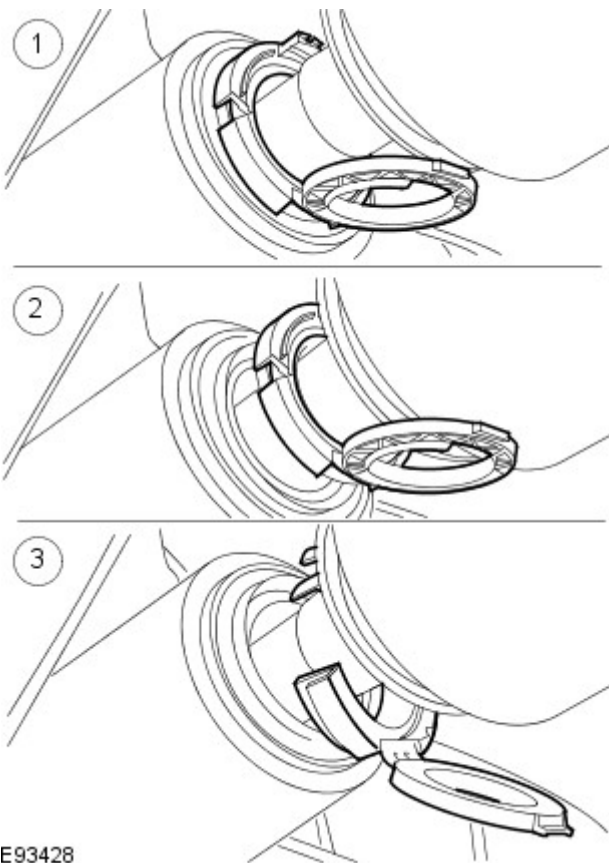
All vehicles

8.  **NOTE:** Make sure that new bolts are installed.


Secure the driveshaft to the front axle drive flange.

- Stage 1: Tighten the bolts to 45 Nm (33 lb.ft).
- Stage 2: Tighten the bolts a further 90 degrees.
- Remove and discard the tie strap.

9. Install a new snap ring to the LH halfshaft.
 - Remove and discard the tie strap.



E93428

10.  **NOTE:** Do not fully engage the halfshaft until the oil seal protector has been removed.

Secure the LH halfshaft in the axle assembly.

1. Open the halfshaft seal protector and install the halfshaft.
2. Release the halfshaft seal protector from the halfshaft seal.
3. Remove the halfshaft seal protector.
4. Fully install the halfshaft.

11.  **WARNING:** Make sure that a new nut is installed.

Secure the LH upper arm to the wheel knuckle.

- Install a new nut and tighten to 70 Nm (52 lb.ft).

12.  **WARNING:** Make sure that a new nut is installed.

Secure the LH tie-rod end ball joint to the wheel knuckle.

- Install a new nut and tighten to 70 Nm (52 lb.ft).

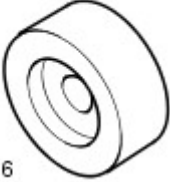


13. Secure the LH brake hose bracket to the wheel knuckle.
 - Tighten the bolt to 22 Nm (16 lb.ft).

14. Secure the LH stabilizer bar link.
 - Install a new nut and tighten to 115 Nm (85 lb.ft).
15. Install the LH splash shield.
 - Install the clips.
16. Install the axle tube.
For additional information, refer to: Axle Tube (205-03 Front Drive Axle/Differential, In-vehicle Repair).
17. If a new differential is installed, fill with the recommended fluid. For additional information, refer to: Differential Draining and Filling (205-03, General Procedures).
18. Install the wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Front Drive Axle/Differential - Axle Carrier Bushing

Removal and Installation

Special Tool(s)

 <p>205-825/3</p> <p>E54216</p>	<p>Installer rear axle front bush 205-825/3</p>
 <p>205-825/5</p> <p>E54209</p>	<p>Receiver cup rear differential front bush 205-825/5</p>
 <p>502-009/2</p> <p>E54205</p>	<p>Remover rear differential rear bush 502-009/2</p>

Removal



CAUTION: Make sure the bush is correctly aligned.


NOTES:



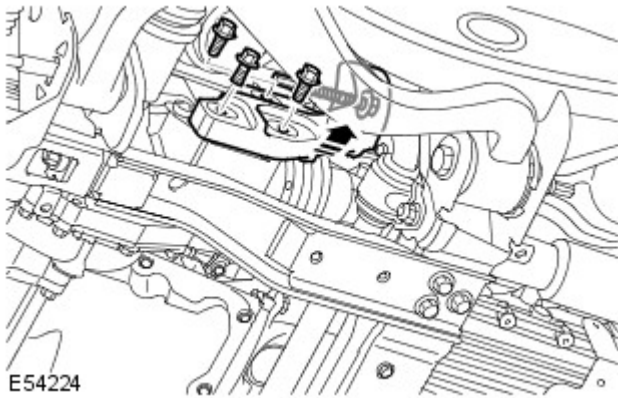
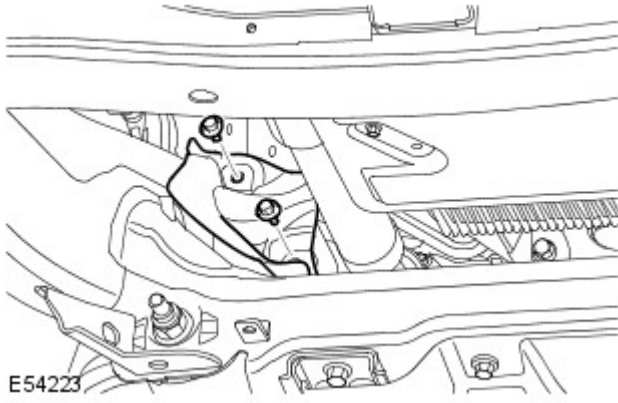
Take note of the fitted position of the bush.



Some variation in the illustrations may occur, but the essential information is always correct.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.
2. Remove the exhaust system.
For additional information, refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation) / [Exhaust System](#) (309-00A Exhaust System - TDV6 3.0L Diesel, Removal and Installation).
3. Using a jack, support the axle assembly.
4. Remove the axle carrier bushing heat shield.
 - Remove the two retaining bolts.



5.  **CAUTION:** The bolts must only be used once.

Remove the axle carrier.

- Remove and discard the three bolts retaining the axle carrier to the axle.
- Remove the axle carrier bushing bolt.

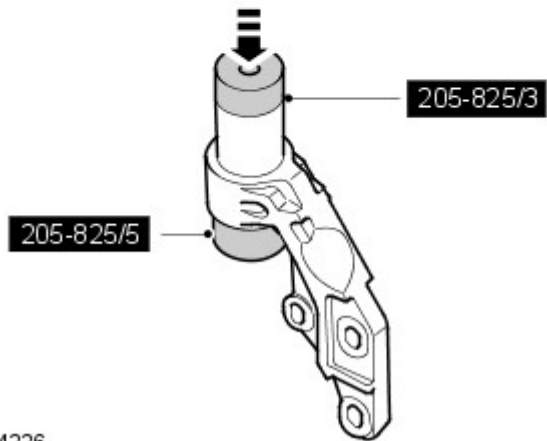
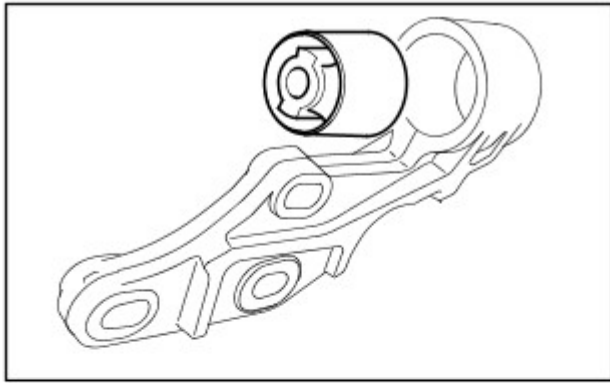
6.  **NOTE:** Take note of the fitted position of the bush.

Using the special tools, remove the axle carrier bushing.

Installation

1.  **CAUTION:** Make sure the bush is correctly aligned.

Using the special tools, install the axle carrier bushing.



E54226




2. Install the axle carrier.
 - Tighten the M14 bolt to 105 Nm (77 lb.ft).
 - Tighten the new axle carrier bracket bolts to 80 Nm (59 lb.ft), then a further 60 degrees.
3. Install the axle carrier bushing heat shield.
4. Remove the axle support.
5. Install the exhaust system.

For additional information, refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation) / [Exhaust System](#) (309-00A Exhaust System - TDV6 3.0L Diesel, Removal and Installation).

Front Drive Axle/Differential - Axle Tube Bushing

Removal and Installation

Special Tool(s)

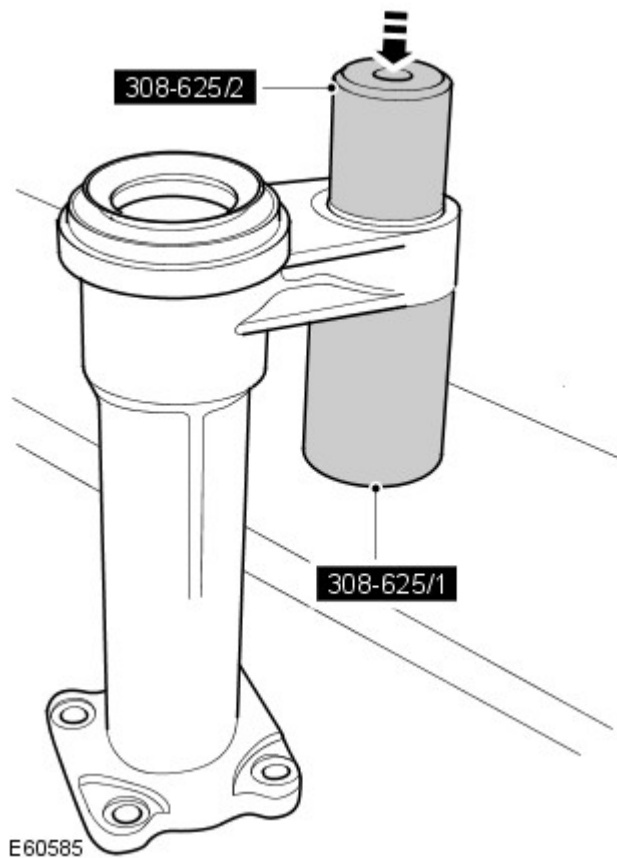
 <p>308-625/1 E60582</p>	<p>Remover/installer - Front axle extension support bush 308-625/1</p>
 <p>308-625/2 E60583</p>	<p>Remover/installer - Front axle extension support bush 308-625/2</p>
 <p>308-625/3 E60584</p>	<p>Remover/installer - Front axle extension support bush 308-625/3</p>

Removal


1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Raise and support the vehicle.
3. Remove the axle tube.
For additional information, refer to: Axle Tube (205-03, In-vehicle Repair).

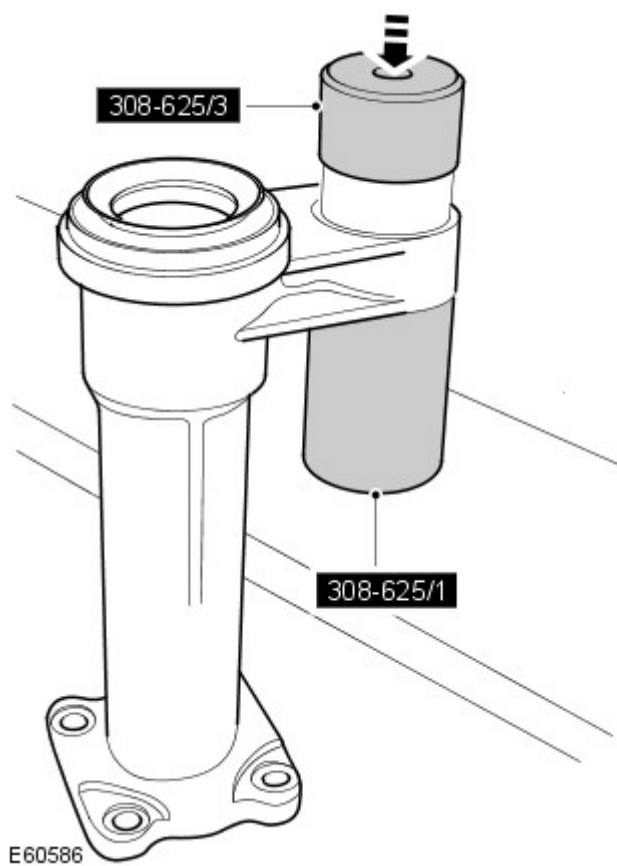
4.  **NOTE:** Note the fitted position.

Using the special tools, remove the bushing.



Installation

-  **NOTE:** Note the fitted position.
 Using the special tools, install the bushing.



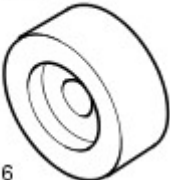
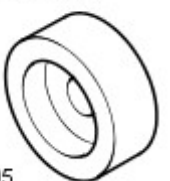





- Install the axle tube.
 For additional information, refer to: Axle Tube (205-03, In-vehicle Repair).
- Connect the battery ground cable.
 For additional information, refer to: Specifications (414-00, Specifications).

Front Drive Axle/Differential - Axle Cover Bushing

Removal and Installation


Special Tool(s)

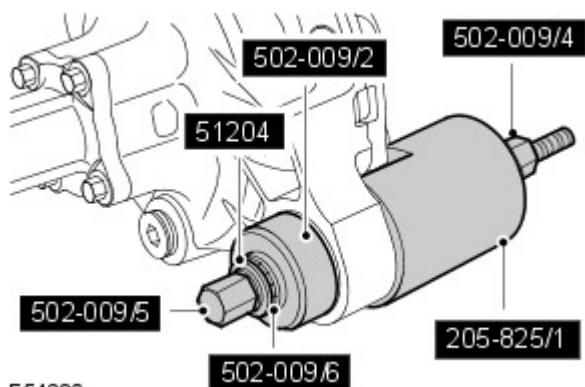
<p>502-009/6</p>  <p>E55285</p>	<p>Bearing Housing 502-009/6</p>
<p>51204</p>  <p>E55278</p>	<p>Bearing set for 14mm bolt 51204</p>
<p>205-825/3</p>  <p>E54216</p>	<p>Installer rear axle front bush 205-825/3</p>
<p>502-009/2</p>  <p>E54205</p>	<p>Remover rear differential rear bush 502-009/2</p>
<p>502-009/5</p>  <p>E54148</p>	<p>Remover/Installer long 14mm bolt 502-009/5</p>
<p>502-009/4</p>  <p>E55284</p>	<p>Nut for long 14mm bolt 502-009/4</p>
<p>205-825/1</p>  <p>E54219</p>	<p>Receiver cup front axle front bush 205-825/1</p>

Removal

 CAUTION: Make sure the bush is correctly aligned.

 NOTE: Take note of the fitted position of the bush.


-  WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
- Remove the front wheels and tires.
- Remove the front differential.
For additional information, refer to: Axle Assembly (205-03, Removal and Installation).



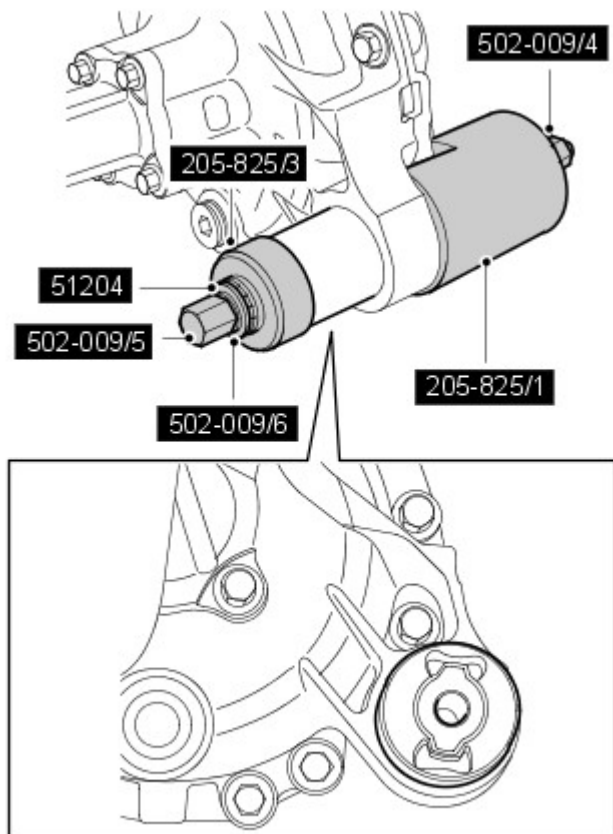
-  NOTE: Take note of the fitted position of the bush.

Using the special tools, remove the front axle housing support insulator.

Installation

-  CAUTION: Make sure the bush is correctly aligned.

Using the special tools, install the front axle housing support insulator.



- Install the front differential.
For additional information, refer to: Axle Assembly (205-03,

Removal and Installation).

3. Install the front wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Front Drive Halfshafts -

General Specification

Item	Specification
Type	Fully floating, fixed length, solid shafts incorporating constant velocity joints at each end of shaft

Lubricant

Item	Specification
Outboard joint	Use grease supplied with replacement boot kit (Optimol MS139G)
Inboard joint	Use grease supplied with replacement boot kit (1 Luber C MS132G)

General Specification

Item	Specification
Type	Fully floating, solid shafts incorporating 'plug-in' constant velocity joint at inboard end and fixed constant velocity joint at outboard end of shaft

Torque Specifications

Description	Nm	lb-ft
* Stabilizer bar link nut	115	85
* Stabilizer link nut	115	85
* Tie rod end ball joint nut	76	56
Brake hose retaining bracket to wheel knuckle bolt	25	18
* + Halfshaft retaining nut	230	169
Road wheel nuts	140	103

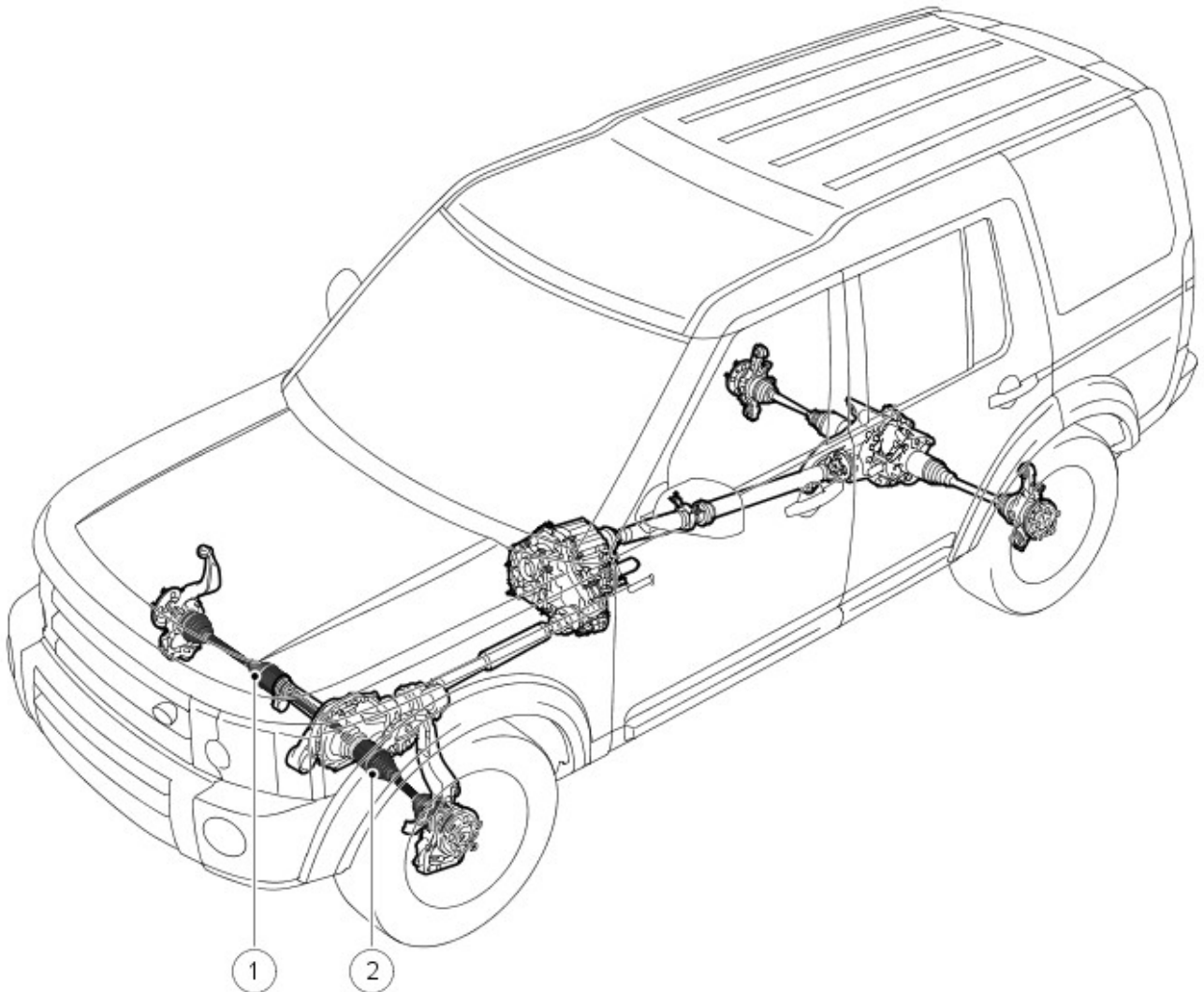
* **New nut must be fitted**

+ **Stake nut on completion**

Front Drive Halfshafts - Front Drive Halfshafts

Description and Operation

Front Drive Halfshaft Component Location



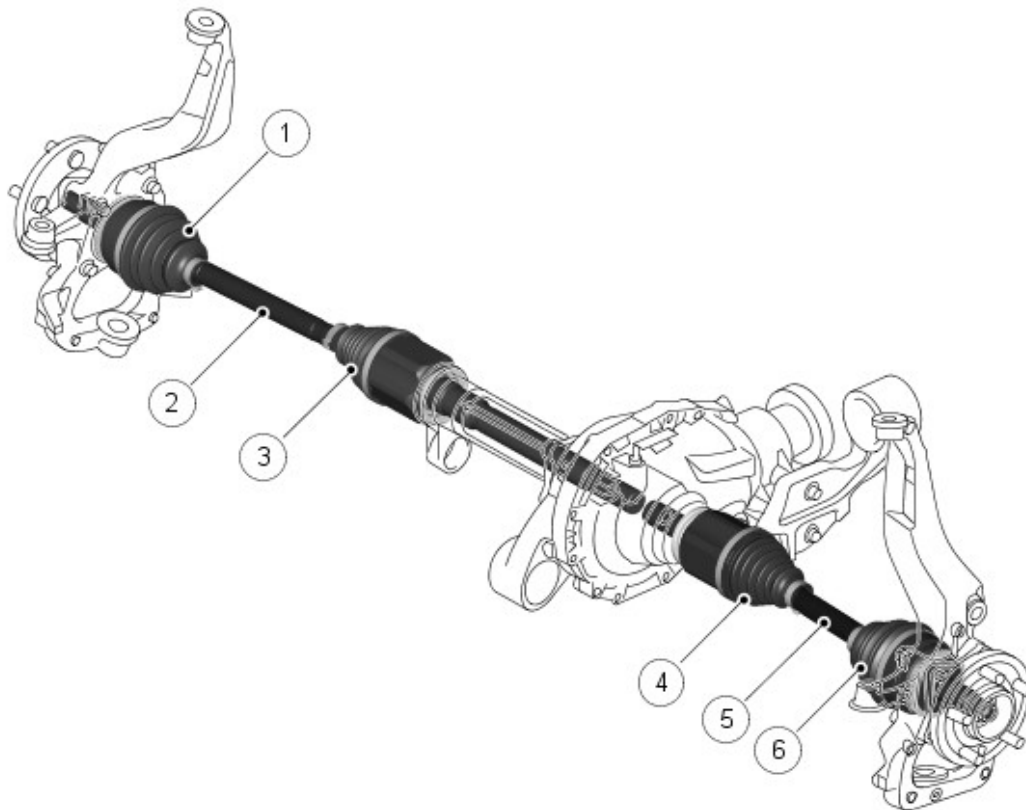
E46376

Item	Part Number	Description
1	-	RH front drive halfshaft
2	-	LH front drive halfshaft

GENERAL

The front drive shafts are handed components with the RH drive shaft being longer than the LH drive shaft. Both shafts are of similar construction with Constant Velocity (CV) joints at each end to allow for steering and suspension movement.

FRONT DRIVE HALFSHAFT ASSEMBLY



E46377

Item	Part Number	Description
1	-	RH outer CV joint
2	-	RH front drive halfshaft
3	-	RH inner CV joint
4	-	LH inner CV joint
5	-	LH front drive halfshaft
6	-	LH outer CV joint

The front drive shafts are similar in their construction. The only difference is the lengths of each shaft, the LH drive shaft is a longer shaft with an extended stem.

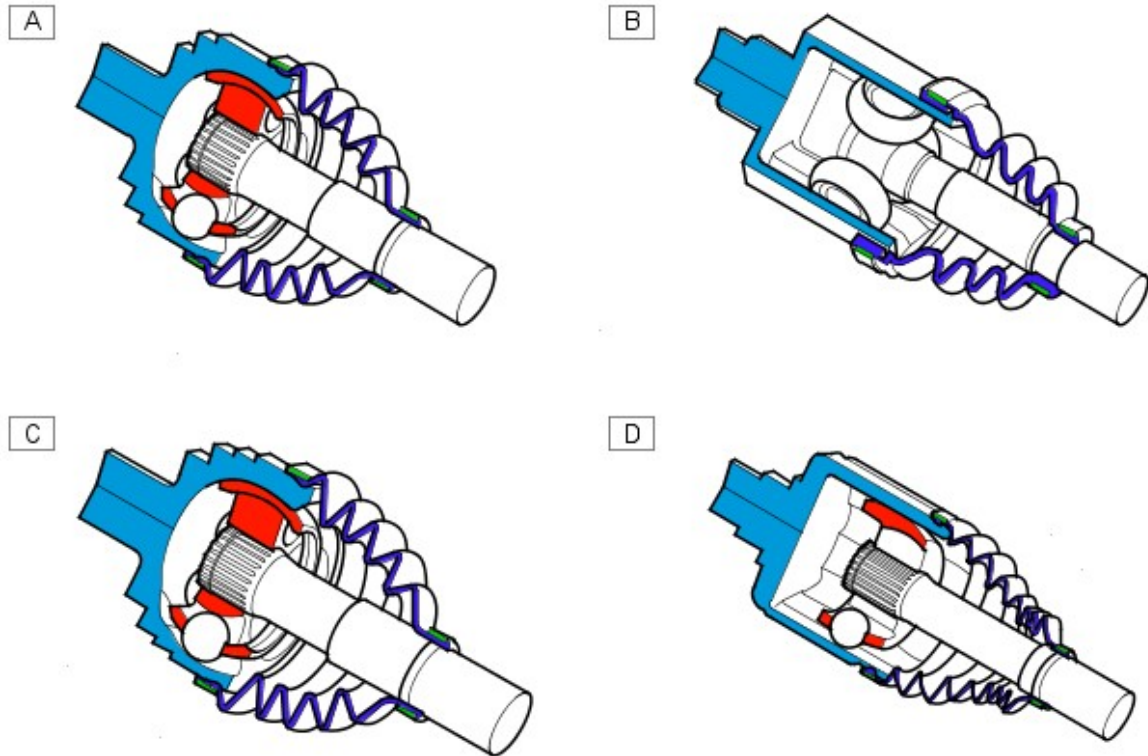
The outer CV joints have a target wheel on the outer diameter. This is used by the ABS wheel speed sensor for vehicle and wheel speed calculations.

Each drive shaft comprises two CV joints (inner and outer), boots, an outer tube and a solid barshaft, which is retained in the front differential by a circlip (see 'Halfshaft Joint' section for more information on CV joints).

Front Drive Halfshafts - Halfshaft Joint

Description and Operation

Front Drive HalfShaft – Sectional Views



E50637

Item	Part Number	Description
A	-	Front outboard halfshaft joint
B	-	Rear outboard halfshaft joint
C	-	Rear inboard halfshaft joint
D	-	Front inboard halfshaft joint

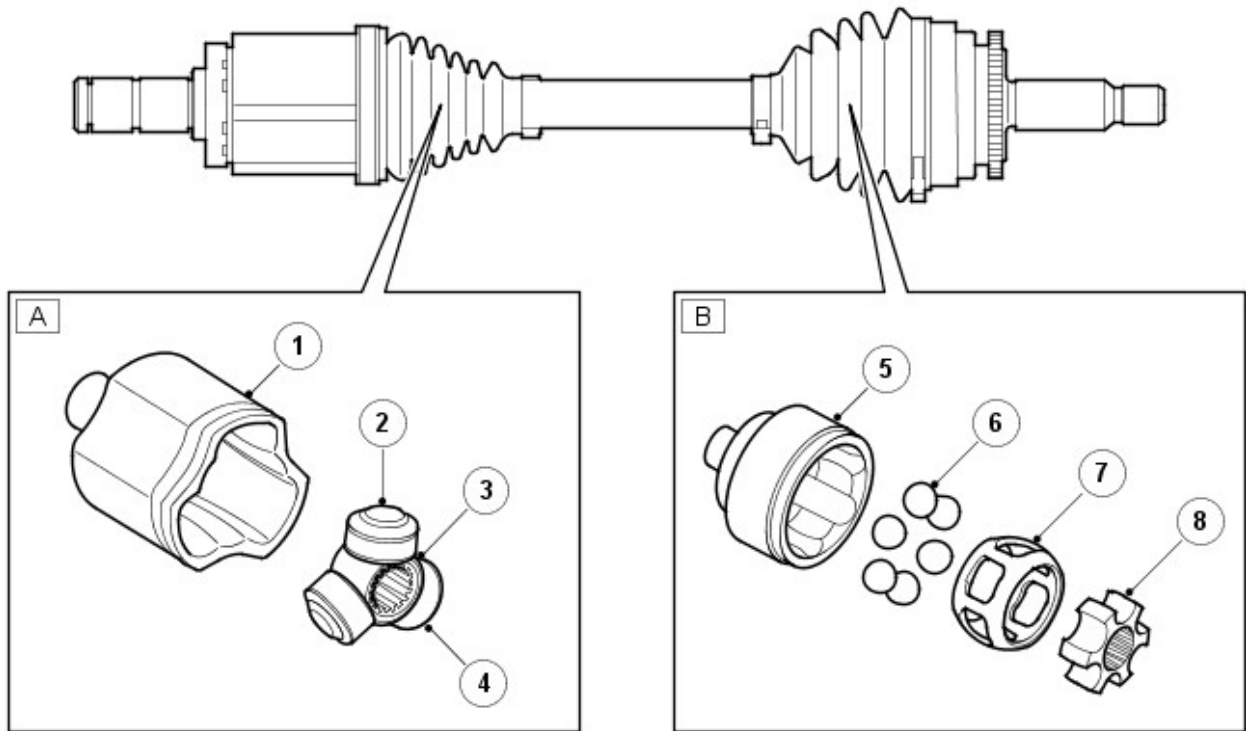
The outboard and rear inboard CV joints are of the Birfield design. This design uses longitudinal, elliptical grooves, which retain six steel balls. The balls are further retained by a cage. The constant velocity is achieved by the position of the steel balls. If a centre line is drawn through the balls and the driven hub or differential shaft, the two centre lines always bisect each other at the angle of drive. This condition allows the rotational speed of the driven shaft to be passed to the driven hub or differential shaft with no loss of rotational speed regardless of the shaft angle. The CV joints are packed with grease, which is retained in the joint by a synthetic rubber gaiter. The gaiter is retained at each end by a metal clamp, which provides a water tight seal to prevent the ingress of dirt and moisture. The CV joints are retained on their respective shaft or tube by an internal snap ring. The snap rings are located in a groove on each shaft or tube end and locate in a mating groove in the CV joint.



CAUTION: The inner hub is not retained in the joint body on this type of joint. The joint is held together in it's unfitted state only by the boot. Pulling on the barshaft can therefore pull the hub out of the joint body. For this reason care must be taken when handling and fitting the front driveshafts.

The shaft is a sliding fit inside the outer tube, which allows for the small length changes, which occur with articulation of the suspension. The shaft is located in a ball cage, which is retained inside the outer tube. The ball cage ensures that the shaft is held rigidly in the outer tube whilst allowing it to freely move in and out of the tube as necessary. A sealing plug is pressed into the outer tube and retains grease around the balls in the cage.

The inner CV joints are similar in design and operation to the outer joints except that the inner joints use rollers rather than balls to transmit the drive.



E46396

Item	Part Number	Description
A	-	Inner CV joint
B	-	Outer CV joint
1	-	Tulip outer race
2	-	Trunions (3 of)
3	-	Spider
4	-	Rollers (3 of)
5	-	Outer race
6	-	Steel balls (6 of)
7	-	Cage
8	-	Inner race

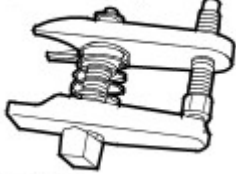
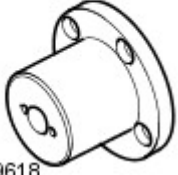





The front inboard joint is a 'tripode joint', having three 'feet' or 'podes'. The torque is transmitted from the outer race to the connecting shaft by means of rollers running on needle rollers around the trunions of the tripod spider. The roller tracks of the outer race enable the tripod assembly to move angularly and axially within the joint.




The inner CV joint shaft is splined and mates with splines in the front differential. There is no internal retaining mechanism for this type of joint so care must be taken during service as the shaft and CV joint can separate.

Front Drive Halfshafts - Front Halfshaft LH

Removal and Installation

Special Tool(s)

 <p>205-754A E45276</p>	<p>Ball joint separator 205-754(LRT-54-027)</p>
 <p>204-506/1 E49618</p>	<p>Halfshaft remover/replacer 204-506/1(LRT-60-030/1)</p>
 <p>204-506/3 E49620</p>	<p>Halfshaft remover/replacer 204-506/3(LRT-60-030/3)</p>
 <p>204-506-01 E49622</p>	<p>Halfshaft installer adapter (L319 up to VIN 671700, L320 up to VIN 810673) 204-506-01(LRT-60-030/4)</p>
 <p>204-506-01 E49622</p>	<p>Halfshaft installer adapter (L319 from VIN 671701, L320 from VIN 810674) JLR-204-506-01</p>
 <p>204-506/5 E49621</p>	<p>Retainers - halfshaft remover/replacer 204-506/5(LRT-60-030/5)</p>
 <p>308-005 E54134</p>	<p>Axle oil seal remover 308-005(LRT-37-004/2)</p>

 <p>100-012</p> <p>E54135</p>	<p>Impulse extractor 100-012(LRT-99-004)</p>
 <p>308-626/2</p> <p>E54137</p>	<p>Installer/Guide halfshaft oil seal 308-626/2</p>
 <p>308-626/1</p> <p>E54136</p>	<p>Installer halfshaft oil seal 308-626/1</p>

Removal

CAUTIONS:




Do not store or install halfshafts with joints at maximum articulation or damage may occur to the joint.

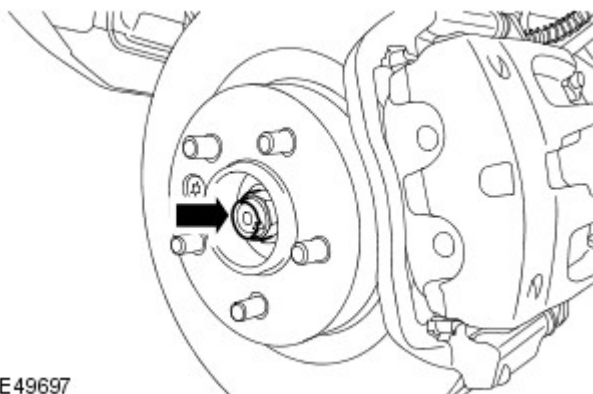


Do not allow halfshafts to hang unsupported at one end or joint damage will occur.

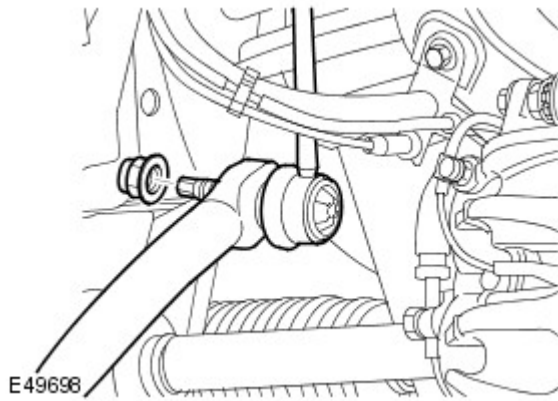



Angularly Adjusted Roller (AAR) joints, used at the inboard end of some halfshafts have no internal retaining mechanism and can separate.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
2. Drain the differential lubricant.
For additional information, refer to: [Differential Draining and Filling](#) (205-03 Front Drive Axle/Differential, General Procedures).
3. Remove the wheel and tire.
4. Remove the halfshaft retaining nut.
 - Discard the nut.



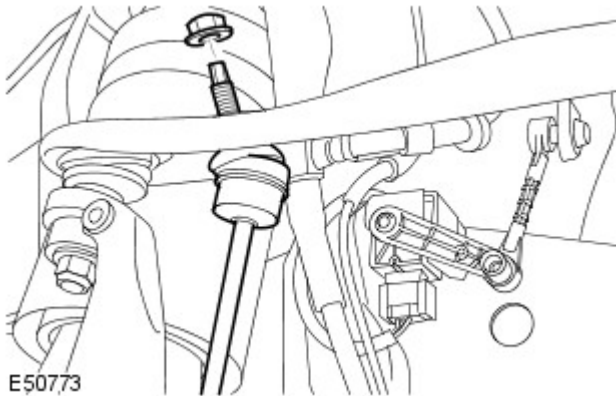
E49697




5.  CAUTION: Use a wrench on the hexagon provided to prevent the ball joint rotating.

Disconnect the RH stabilizer bar link.

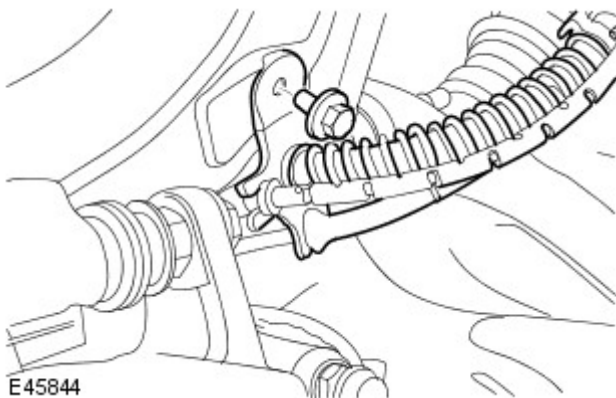
- Remove and discard the nut.



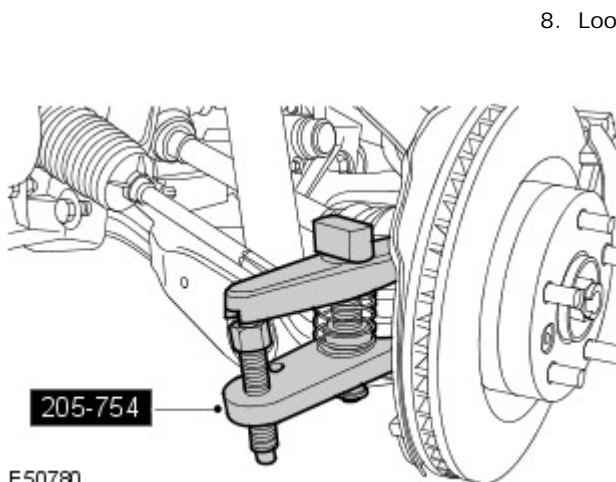
6.  CAUTION: Use a wrench on the hexagon provided to prevent the ball joint rotating.

Remove the stabilizer bar link nut.


- Remove and discard the nut.



7. Release the brake hose bracket from the wheel knuckle.
- Remove the bolt.




8. Loosen the tie-rod end ball joint retaining nut.

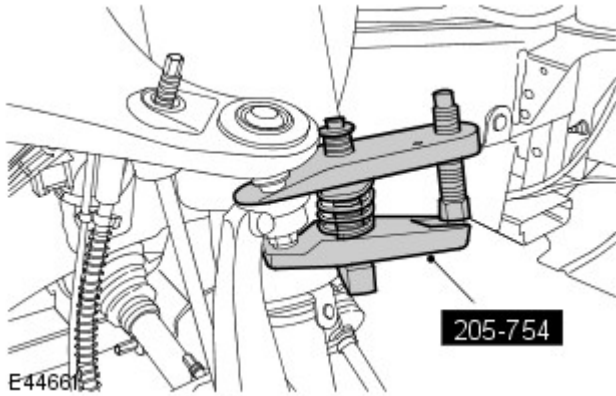
9.  CAUTION: Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.


Using the special tool, release the tie-rod end ball joint from the wheel knuckle.

- Discard the nut.

10.  CAUTION: To prevent the wheel knuckle falling outwards and disconnection of the halfshaft inner joint, support the wheel knuckle.

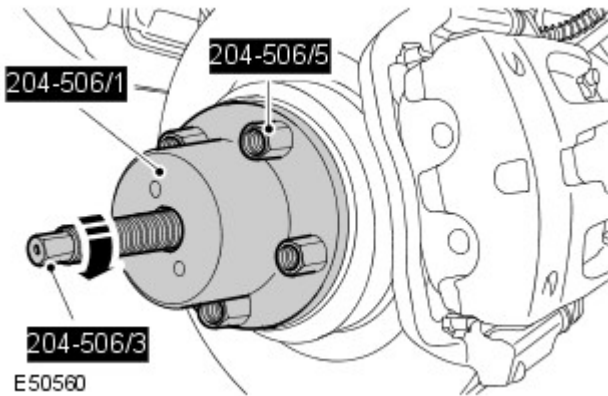
Loosen the upper arm retaining nut.




11.  **CAUTION:** Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.


Using the special tool, release the upper arm ball joint.

- Remove and discard the retaining nut.



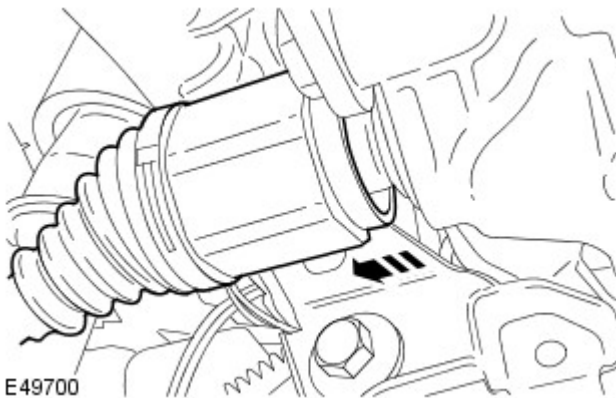
12. **CAUTIONS:**

 The lower arm ball joint can be damaged by excessive articulation. The wheel knuckle must be fully supported at all times. Do not allow the wheel knuckle to hang on the lower arm. Failure to follow this instruction will result in damage to vehicle.

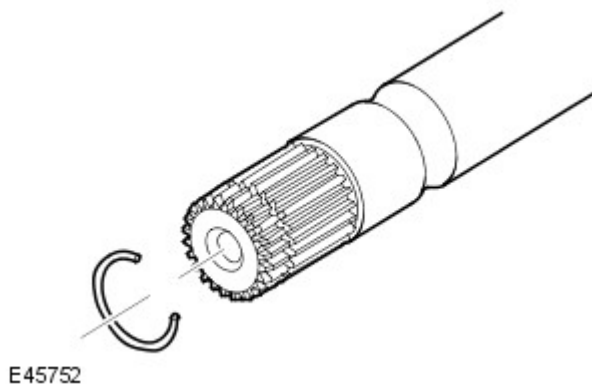
 Do not use a hammer to detach the halfshaft from the hub assembly, failure to follow this instruction may result in damage to the halfshaft.

Using the special tools, release the halfshaft from the wheel hub.

13. Release the halfshaft from the wheel knuckle.

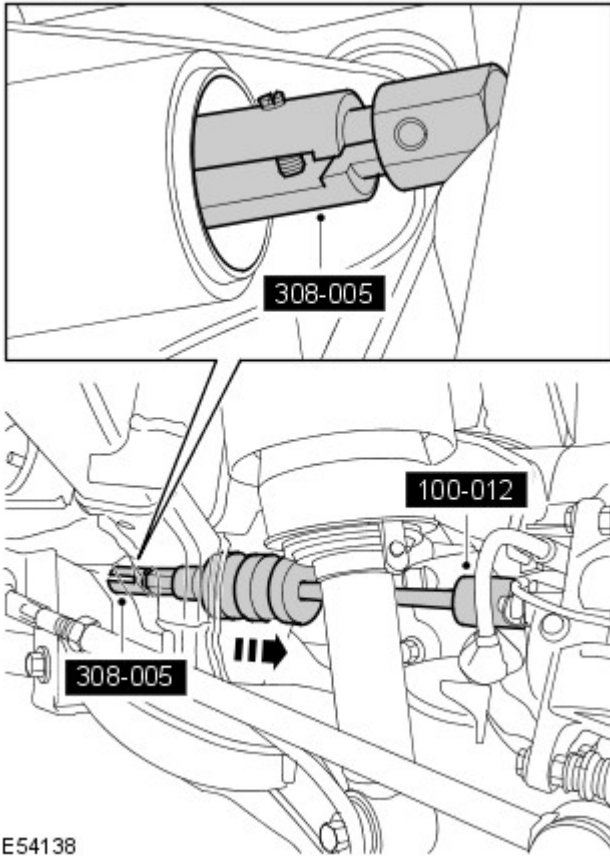


14. Release the halfshaft from the differential housing.



15. Remove the halfshaft.
- Raise the stabilizer bar to allow removal of the halfshaft.
 - Remove and discard the snap ring.

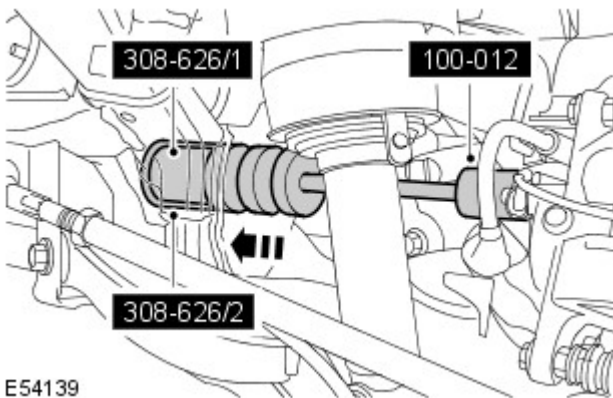
16. Using the special tools, remove and discard the halfshaft oil seal.



E54138

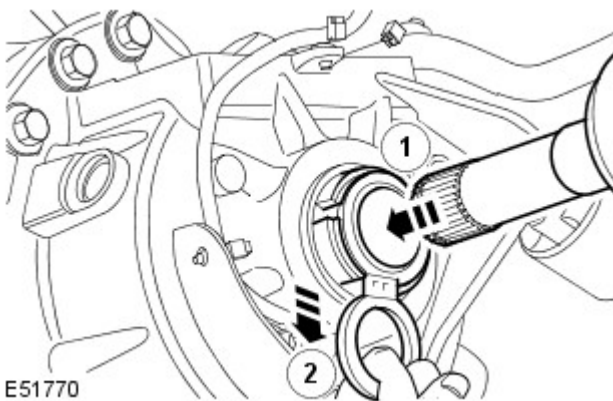
Installation

1. Clean the components.





E54139

2. Using the special tools, install a new halfshaft oil seal.
 - The halfshaft oil seal protector must be left in place, until the halfshaft is fully installed.



E51770

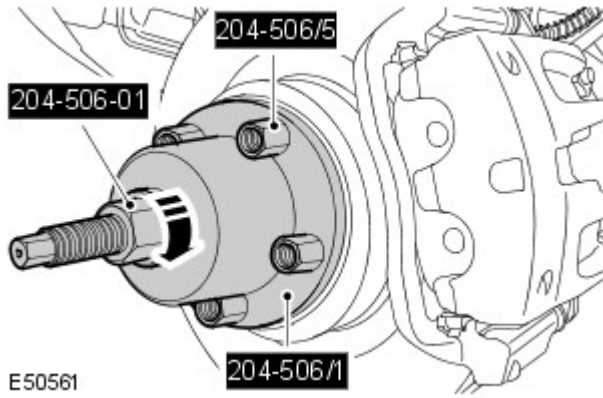
3.  **CAUTION:** Do not fully engage the halfshaft until the oil seal protector has been removed.


 **NOTE:** The oil seal protector is designed to break into two pieces.


Install the halfshaft.

- Install the snap ring.
- Lubricate the seal and the bearing running surfaces with clean axle oil.
- Open the halfshaft oil seal protector.
- Partially install the halfshaft.
- Remove and discard the halfshaft oil seal protector.
- Make sure the snap ring is fully engaged and retains the halfshaft.

4. **CAUTIONS:**




 The lower arm ball joint can be damaged by excessive articulation. The wheel knuckle must be fully supported at all times. Do not allow the wheel knuckle to hang on the lower arm. Failure to follow this instruction will result in damage to vehicle.


 Use tool 204-506-01 (LRT-60-030/4) for L319 up to VIN 671700, L320 up to VIN 810673. Use tool number JLR-204-506-01 for L319 from VIN 671701, L320 from VIN 810674. Failure to follow this instruction will result in damage to vehicle.

Using the special tools, install the halfshaft in the wheel hub.

5. Connect the upper arm and wheel knuckle.
 - Install a new nut and tighten to 70 Nm (52 lb.ft).
6. Secure the stabilizer bar link.
 - Install a new nut and tighten to 115 Nm (85 lb.ft).
7. Connect the tie-rod end ball joint.
 - Install a new nut and tighten to 76 Nm (56 lb.ft).


8.  **CAUTION:** Install the halfshaft nut finger tight.
Install a new halfshaft retaining nut and lightly tighten.

9. Secure the brake hose retaining bracket to the wheel knuckle.
 - Tighten the bolt to 22 Nm (16 lb.ft).
10. Secure the RH stabilizer link.
 - Install a new nut and tighten to 115 Nm (85 lb.ft).

11.  **CAUTION:** Do not use air tools to install the nut. Failure to follow this instruction may result in damage to the component.

Tighten the new halfshaft retaining nut to 230 Nm (170 lb.ft).

- Stake the nut to the halfshaft.
12. Install the wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

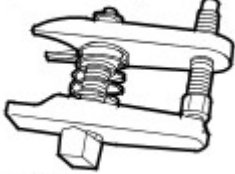
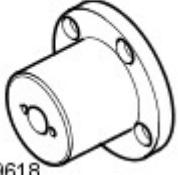


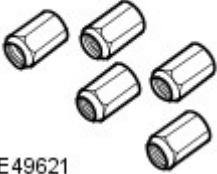


13.  **CAUTION:** Do not fill the differential with lubricant up to the filler plug. The filler plug is only used to fill the differential with lubricant, and not to act as a level indicator.




Fill the differential with the correct amount of lubricant. For additional information, refer to: [Differential Draining and Filling](#) (205-03 Front Drive Axle/Differential, General Procedures).

Front Drive Halfshafts - Front Halfshaft RH

Removal and Installation

Special Tool(s)

 <p>205-754A E45276</p>	<p>Ball joint separator 205-754(LRT-54-027)</p>
 <p>204-506/1 E49618</p>	<p>Halfshaft remover/replacer 204-506/1(LRT-60-030/1)</p>
 <p>204-506/3 E49620</p>	<p>Halfshaft remover/replacer 204-506/3(LRT-60-030/3)</p>
 <p>204-506-01 E49622</p>	<p>Halfshaft installer adapter 204-506-01(LRT-60-030/4)</p>
 <p>204-506/5 E49621</p>	<p>Retainers - halfshaft remover/replacer 204-506/5(LRT-60-030/5)</p>
 <p>308-005 E54134</p>	<p>Axle oil seal remover 308-005(LRT-37-004/2)</p>
 <p>100-012 E54135</p>	<p>Impulse extractor 100-012(LRT-99-004)</p>

 <p>308-626/2 E54137</p>	<p>Installer/Guide halfshaft oil seal 308-626/2</p>
 <p>308-626/1 E54136</p>	<p>Installer halfshaft oil seal 308-626/1</p>
 <p>205-819 E54141</p>	<p>Halfshaft bearing installer 205-819</p>

Removal

CAUTIONS:




Angularly Adjusted Roller (AAR) joints, used at the inboard end of some halfshafts have no internal retaining mechanism and can separate.

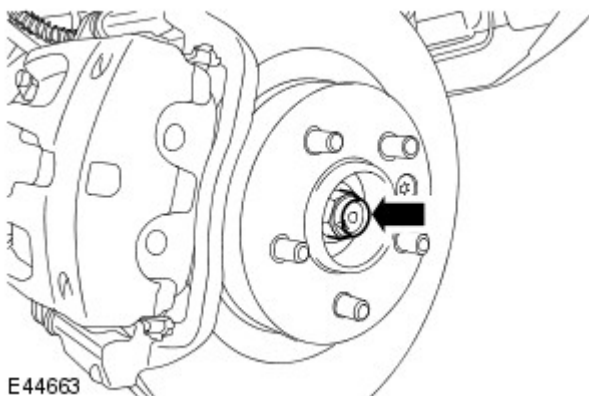


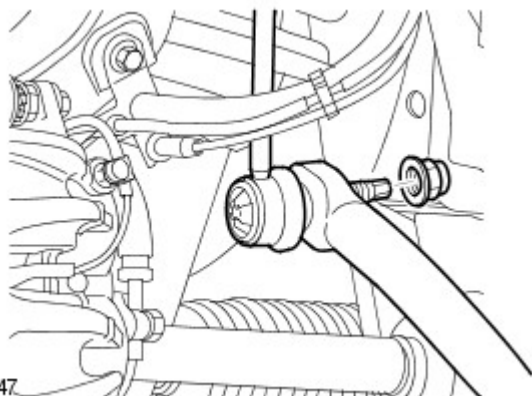
Do not allow halfshafts to hang unsupported at one end or joint damage will occur.




Do not store or install halfshafts with joints at maximum articulation or damage may occur to the joint.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
2. Drain the differential lubricant.
For additional information, refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).
3. Remove the wheels and tires.
4. Remove the halfshaft retaining nut.
 - Discard the nut.



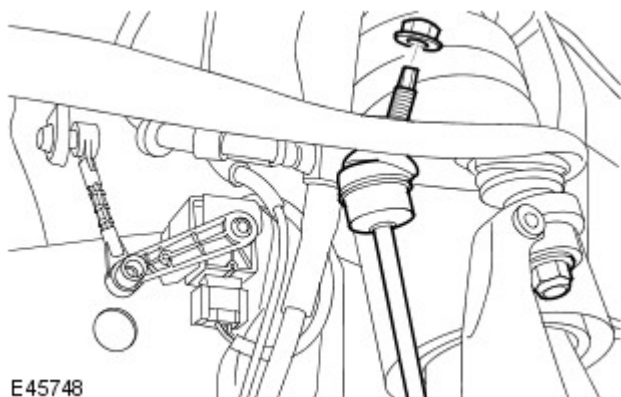


E45747


5.  CAUTION: Use a wrench on the hexagon provided to prevent the ball joint rotating.

Disconnect the stabilizer bar link.

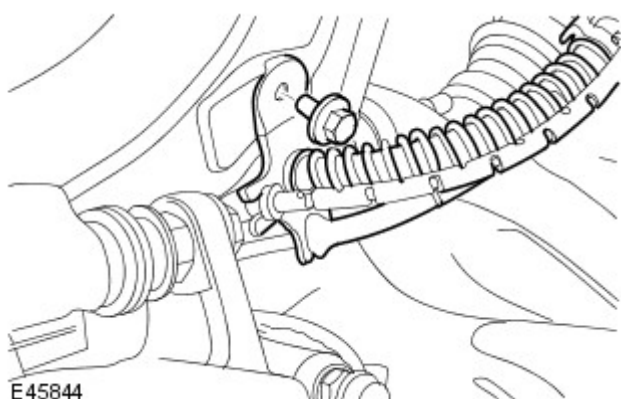
- Remove and discard the nut.



E45748

6.  CAUTION: Use a wrench on the hexagon provided to prevent the ball joint rotating.

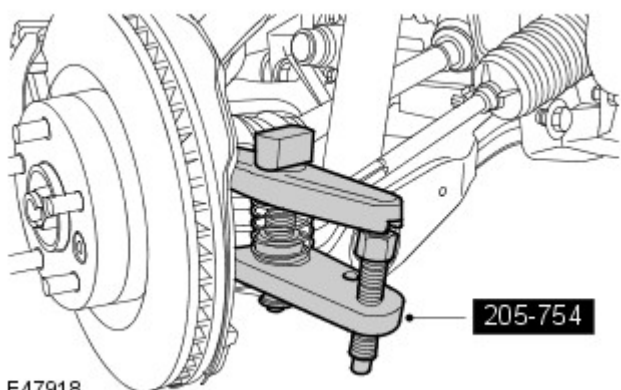
Remove the stabilizer bar link nut.



E45844


7. Release the brake hose bracket from the wheel knuckle.

- Remove the bolt.




E47918

8. Loosen the tie-rod end ball joint retaining nut.

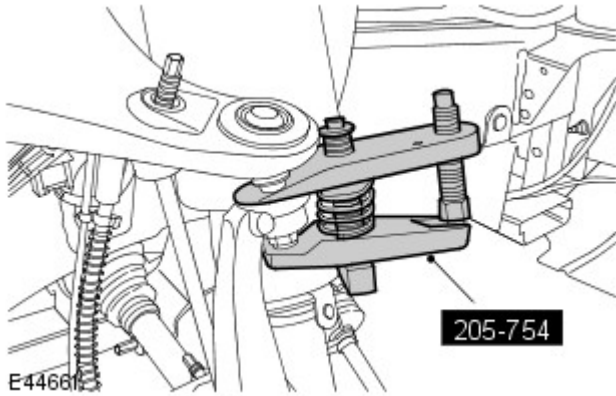
9.  CAUTION: Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.


Using the special tool, release the tie-rod end ball joint from the wheel knuckle.

- Discard the nut.

10.  CAUTION: To prevent the wheel knuckle falling outwards and disconnection of the halfshaft inner joint, support the wheel knuckle.

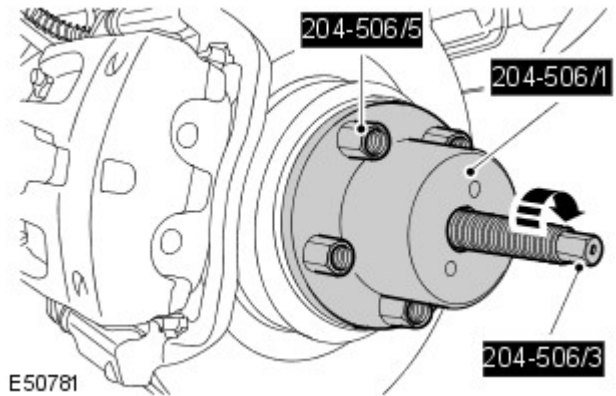
Loosen the upper arm retaining nut.




11.  **CAUTION:** Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.


Using the special tool, release the upper arm ball joint.

- Remove and discard the retaining nut.



12. **CAUTIONS:**

 The lower arm ball joint can be damaged by excessive articulation. The wheel knuckle must be fully supported at all times. Do not allow the wheel knuckle to hang on the lower arm. Failure to follow this instruction will result in damage to vehicle.

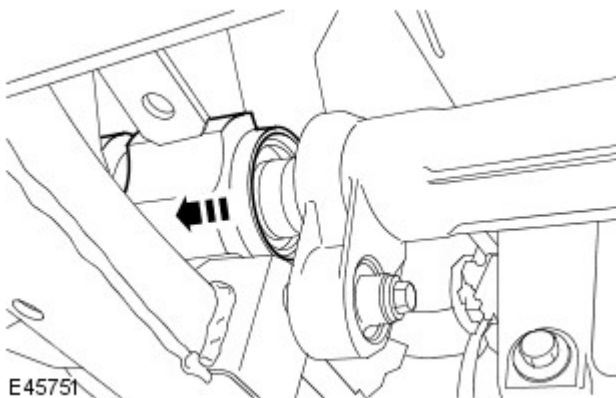
 Do not use a hammer to detach the halfshaft from the hub assembly, failure to follow this instruction may result in damage to the halfshaft.


Using the special tools, release the halfshaft from the wheel hub.

13. Release the halfshaft from the wheel knuckle.

14. Position a container to collect the oil spillage.

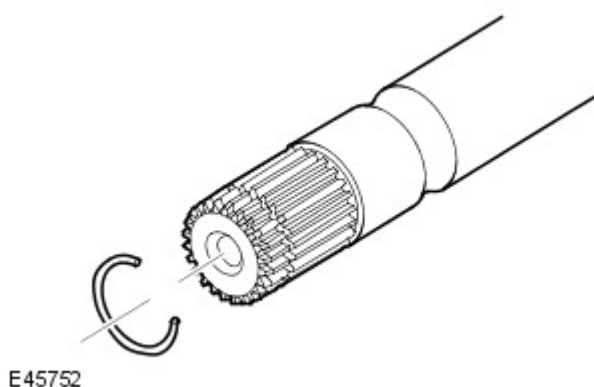
15. Release the halfshaft from the differential housing.



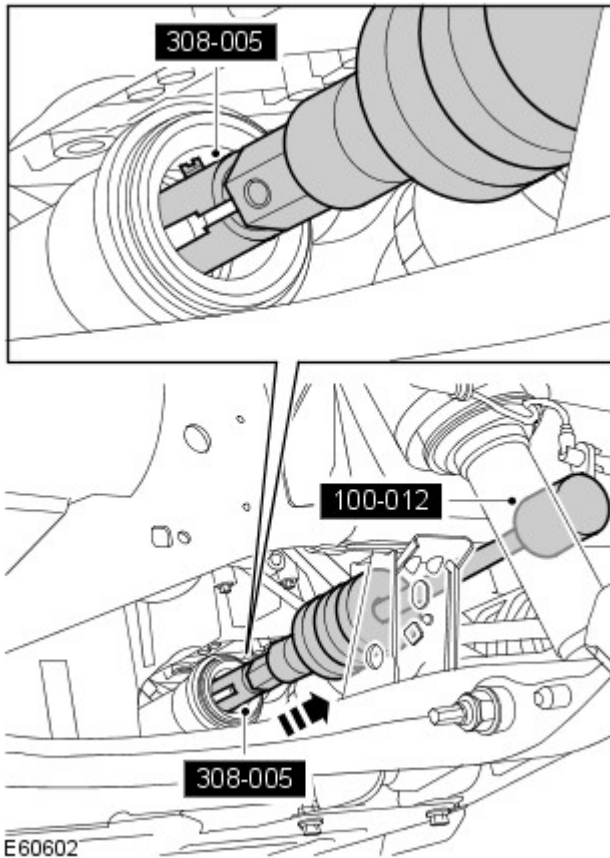
16.  **CAUTION:** Keep the halfshaft horizontal to avoid damaging the oil seal.

Remove the halfshaft.

- Raise the stabilizer bar to allow removal of the halfshaft.
- Remove and discard the snap ring.



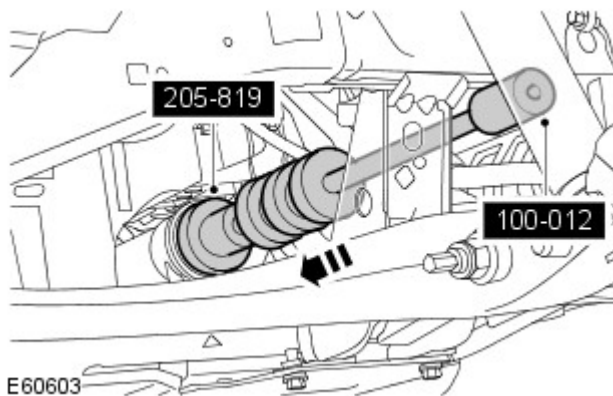
17. Using the special tools, remove and discard the halfshaft oil seal.




Installation

1. Clean the components.


2. Using the special tools, install a new halfshaft oil seal.
- The halfshaft oil seal protector must be left in place, until the halfshaft is fully installed.



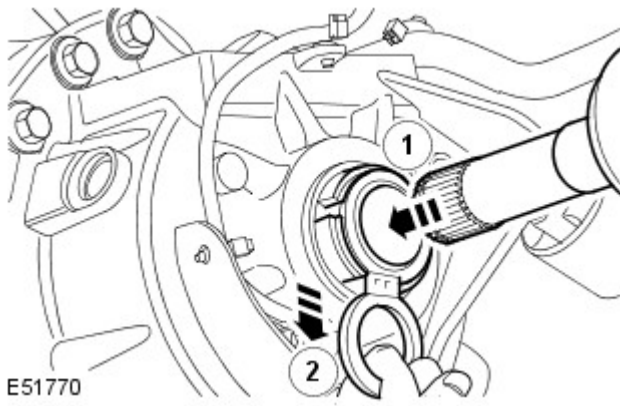
3.  **NOTE:** Do not fully engage the halfshaft until the oil seal protector has been removed.

Install the halfshaft.

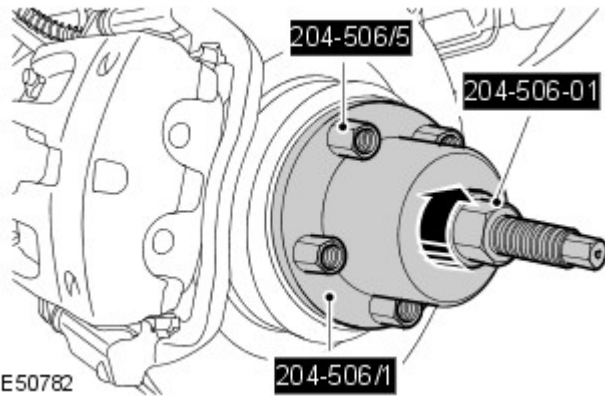
- Install the snap ring.
- Lubricate the seal and the bearing running surfaces with clean axle oil.
- Make sure the snap ring is fully engaged and retains the halfshaft.
- Open the halfshaft oil seal protector.

4.  **NOTE:** The oil seal protector is designed to break into two pieces.


Remove and discard the halfshaft oil seal protector.




E51770




E50782


5.  **CAUTION:** The lower arm ball joint can be damaged by excessive articulation. The wheel knuckle must be fully supported at all times. Do not allow the wheel knuckle to hang on the lower arm. Failure to follow this instruction will result in damage to vehicle.

Using the special tools, install the halfshaft in the wheel hub.

6. Connect the upper arm and wheel knuckle.
 - Install a new nut and tighten to 70 Nm (52 lb.ft).
7. Secure the stabilizer bar link.
 - Install a new nut and tighten to 115 Nm (85 lb.ft).
8. Connect the tie-rod end ball joint.
 - Install a new nut and tighten to 76 Nm (56 lb.ft).
9.  **CAUTION:** Install the halfshaft nut finger tight.

Install a new halfshaft retaining nut and lightly tighten.
10. Secure the brake hose retaining bracket to the wheel knuckle.
 - Tighten the bolt to 22 Nm (16 lb.ft).
11. Secure the LH stabilizer link.
 - Install a new nut and tighten to 115 Nm (85 lb.ft).
12.  **CAUTION:** Do not use air tools to install the nut. Failure to follow this instruction may result in damage to the component.

Tighten the new halfshaft retaining nut to 230 Nm (170 lb.ft).


 - Stake the nut to the halfshaft.
13. Install the wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
14.  **CAUTION:** Do not fill the differential with lubricant up to the filler plug. The filler plug is only used to fill the differential with lubricant, and not to act as a level indicator.

Fill the differential with the correct amount of lubricant. For additional information, refer to: Differential Draining and Filling (205-03 Front Drive Axle/Differential, General Procedures).

Front Drive Halfshafts - Outer Constant Velocity (CV) Joint Boot

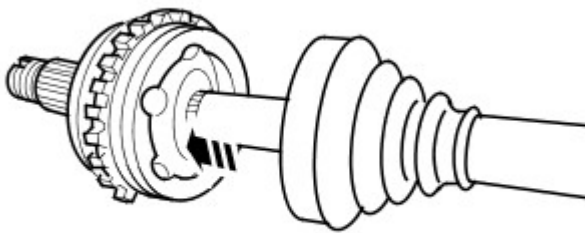
Removal and Installation

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
2. Remove the wheel and tire.
3. Remove the halfshaft.
For additional information, refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
4. Clamp the halfshaft in a vise.
5. Remove and discard the CV joint boot retaining clamps.



6. Slide the CV joint boot along the halfshaft to gain access to the joint.
7. Using a drift against the inner part of the CV joint, remove the CV joint from the halfshaft.
 - Remove and discard the snap ring.



E46875

8. Remove the outer CV joint boot.


Installation


1. Clean the components.
2. Install the CV joint boot.
3. Install the outer CV joint.
 - Install the snap ring.
 - Position the CV joint on the halfshaft, press the snap ring into its groove and push the CV joint fully on to the halfshaft.
 - Pull on the CV joint to ensure the snap ring has fully engaged.
4. Pack the CV joint with the grease supplied.



E137494

5. CAUTIONS:

 Make sure the CV boot is not pushed too far onto the drive shaft and the recess is exposed, failure to follow this instruction may result in damage to the component.

 After the clamps have been secured do not adjust them, failure to follow this instruction may result in damage to the component.

Install the CV joint boot to the CV joint.

- Using a suitable tool, secure the CV joint boot with the new clamps.

6. Install the halfshaft.

For additional information, refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).


7. Install the wheel and tire.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

Front Drive Halfshafts - Outer Constant Velocity (CV) Joint

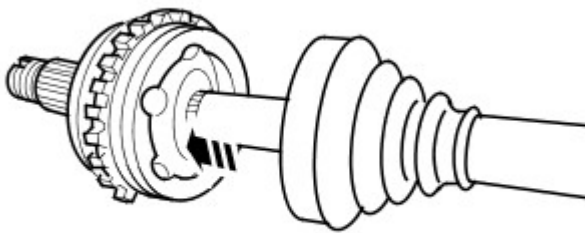
Removal and Installation

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
2. Remove the wheel and tire.
3. Remove the halfshaft.
For additional information, refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).
4. Clamp the halfshaft in a vise.
5. Remove and discard the CV joint boot retaining clamps.



6. Slide the CV joint boot along the halfshaft to gain access to the joint.
7. Using a drift against the inner part of the CV joint, remove the CV joint from the halfshaft.
 - Remove and discard the snap ring.



E46875

8. Remove the outer CV joint boot.


Installation


1. Clean the components.
2. Install the CV joint boot.
3. Install the outer CV joint.
 - Install the snap ring.
 - Position the CV joint on the halfshaft, press the snap ring into its groove and push the CV joint fully on to the halfshaft.
 - Pull on the CV joint to ensure the snap ring has fully engaged.
4. Pack the CV joint with the grease supplied.



E137494

5. CAUTIONS:

 Make sure the CV boot is not pushed too far onto the drive shaft and the recess is exposed, failure to follow this instruction may result in damage to the component.

 After the clamps have been secured do not adjust them, failure to follow this instruction may result in damage to the component.

Install the CV joint boot to the CV joint.

- Using a suitable tool, secure the CV joint boot with the new clamps.

6. Install the halfshaft.

For additional information, refer to: Front Halfshaft LH (205-04 Front Drive Halfshafts, Removal and Installation).


7. Install the wheel and tire.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

Front Drive Halfshafts - Inner Constant Velocity (CV) Joint Boot

Removal and Installation

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the wheel and tire.
3. Remove the halfshaft.
For additional information, refer to: Halfshaft LH (205-04, Removal and Installation).

4. Clamp the halfshaft in a vise.

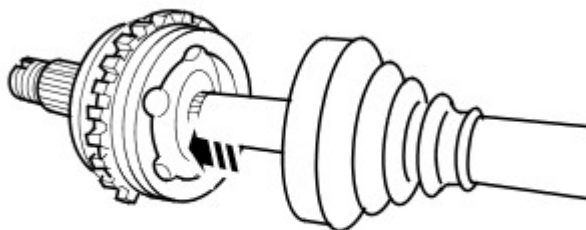
5. Remove and discard the CV joint boot retaining clamps.



6. Slide the CV joint boot along the halfshaft to gain access to the joint.



7. Using a drift against the inner part of the CV joint, remove the CV joint from the halfshaft.
 - Remove and discard the snap ring.



E46875

8. Remove the inner joint boot.

Installation

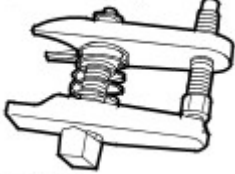
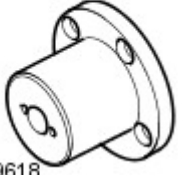


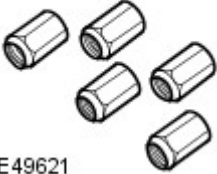


1. Clean the components.
2. Install the inner joint boot.
3. Install the inner joint.
 - Install a new snap ring.
 - Position the CV joint on the halfshaft, press the snap ring into its groove and push the CV joint fully on to the halfshaft.
 - Pull on the CV joint to ensure the snap ring has fully engaged.
4. Pack the joint with the grease supplied.
5. Install the CV joint boot to the CV joint.
 - Secure with the new clamps.
6. Install the halfshaft.



For additional information, refer to: Halfshaft LH (205-04, Removal and Installation).
7. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Front Drive Halfshafts - Halfshaft Seal LH

Removal and Installation

Special Tool(s)

 <p>205-754A E45276</p>	<p>Ball joint separator (LRT-54-027) 205-754</p>
 <p>204-506/1 E49618</p>	<p>Halfshaft remover/replacer (LRT-60-030/1) 204-506/1</p>
 <p>204-506/3 E49620</p>	<p>Halfshaft remover/replacer (LRT-60-030/3) 204-506/3</p>
 <p>204-506-01 E49622</p>	<p>Halfshaft installer adapter 204-506-01</p>
 <p>204-506/5 E49621</p>	<p>Retainers - halfshaft remover/replacer (LRT-60-030/5) 204-506/5</p>
 <p>308-005 E54134</p>	<p>Axle oil seal remover (LRT-37-004/2) 308-005</p>
 <p>100-012 E54135</p>	<p>Impulse extractor (LRT-99-004) 100-012</p>

<p>308-626/2</p>  <p>E54137</p>	<p>Installer/Guide halfshaft oil seal 308-626/2</p>
<p>308-626/1</p>  <p>E54136</p>	<p>Installer halfshaft oil seal 308-626/1</p>

Removal

CAUTIONS:



Do not store or install halfshafts with joints at maximum articulation or damage may occur to the joint



Do not allow halfshafts to hang unsupported at one end or joint damage will occur.



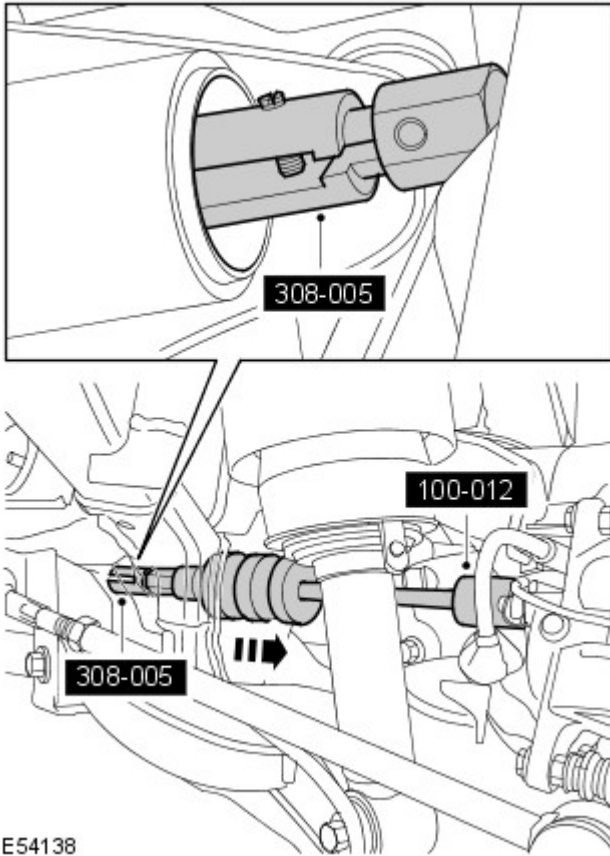
Angularly Adjusted Roller (AAR) joints, used at the inboard end of some halfshafts have no internal retaining mechanism and can separate.



1. **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

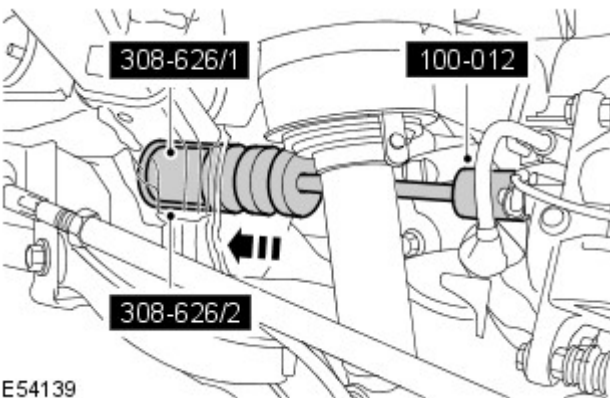
Raise and support the vehicle.

2. Remove the LH halfshaft.
For additional information, refer to: Halfshaft LH (205-04, Removal and Installation).
3. Using the special tools, remove and discard the halfshaft oil seal.



E54138

Installation



E54139

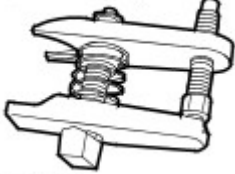
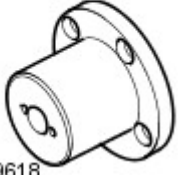


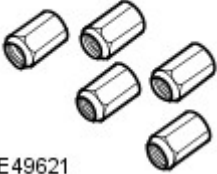


1. Using the special tools, install a new halfshaft oil seal.
 - The halfshaft oil seal protector must be left in place, until the halfshaft is fully installed.



2. Install the LH halfshaft.
For additional information, refer to: Halfshaft LH (205-04, Removal and Installation).

Front Drive Halfshafts - Halfshaft Seal RH

Removal and Installation

Special Tool(s)

 <p>205-754A E45276</p>	Ball joint separator (LRT-54-027) 205-754
 <p>204-506/1 E49618</p>	Halfshaft remover/replacer (LRT-60-030/1) 204-506/1
 <p>204-506/3 E49620</p>	Halfshaft remover/replacer (LRT-60-030/3) 204-506/3
 <p>204-506-01 E49622</p>	Halfshaft installer adapter 204-506-01
 <p>204-506/5 E49621</p>	Retainers - halfshaft remover/replacer (LRT-60-030/5) 204-506/5
 <p>308-005 E54134</p>	Axle oil seal remover (LRT-37-004/2) 308-005
 <p>100-012 E54135</p>	Impulse extractor (LRT-99-004) 100-012

<p>308-626/2</p>  <p>E54137</p>	<p>Installer/Guide halfshaft oil seal 308-626/2</p>
<p>308-626/1</p>  <p>E54136</p>	<p>Installer halfshaft oil seal 308-626/1</p>

Removal


CAUTIONS:



Angularly Adjusted Roller (AAR) joints, used at the inboard end of some halfshafts have no internal retaining mechanism and can separate.



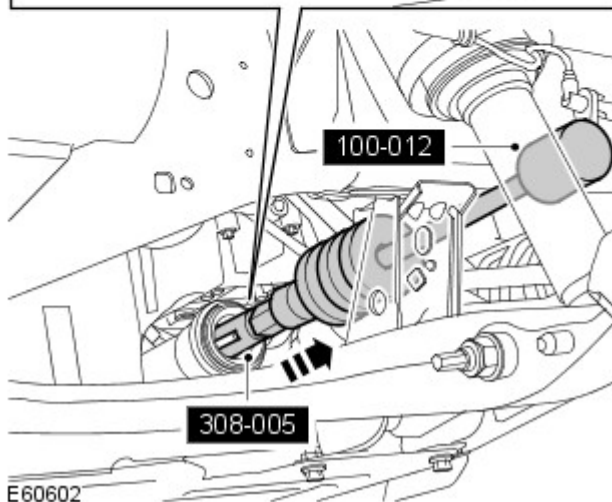
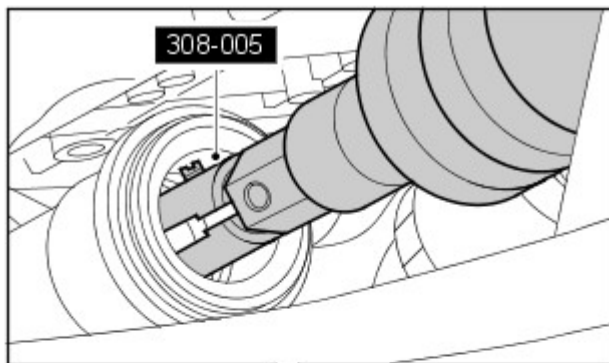
Do not allow halfshafts to hang unsupported at one end or joint damage will occur.

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

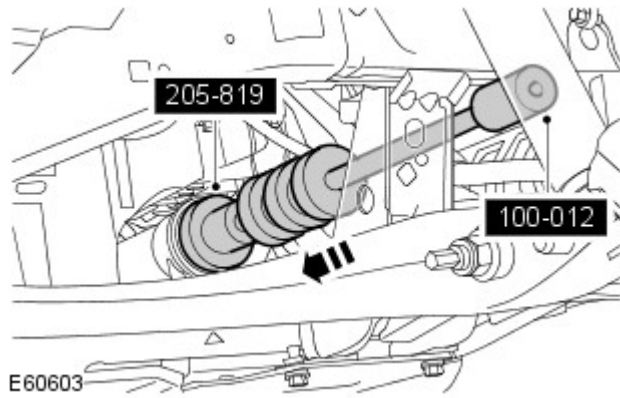
- Remove the RH halfshaft.
For additional information, refer to: Halfshaft RH (205-04, Removal and Installation).

- Using the special tools, remove and discard the halfshaft oil seal.



Installation

1. Using the special tools, install a new halfshaft oil seal.



2. Install the RH halfshaft.
For additional information, refer to: Halfshaft RH (205-04, Removal and Installation).

Rear Drive Halfshafts -

Recommended Lubricant

Item	Specification
Outboard joint	Use grease supplied with replacement boot kit (Optimol MS139G)
Inboard joint	Use grease supplied with replacement boot kit (Thermax MS141G)

General Specification

Item	Specification
Type	Fully floating, solid shafts incorporating plunging constant velocity joint at inboard end and fixed constant velocity joint at outboard end of shaft

Torque Specifications

Description	Nm	lb-ft
* Lower arm to wheel knuckle nut	275	203
Toe link bolt	175	129
* + Halfshaft nut	420	311
Road wheel nuts	<ul style="list-style-type: none"> • Stage 1: 4 • Stage 2: 70 • Stage 3: 140 	<ul style="list-style-type: none"> • Stage 1: - • Stage 2: 52 • Stage 3: 103

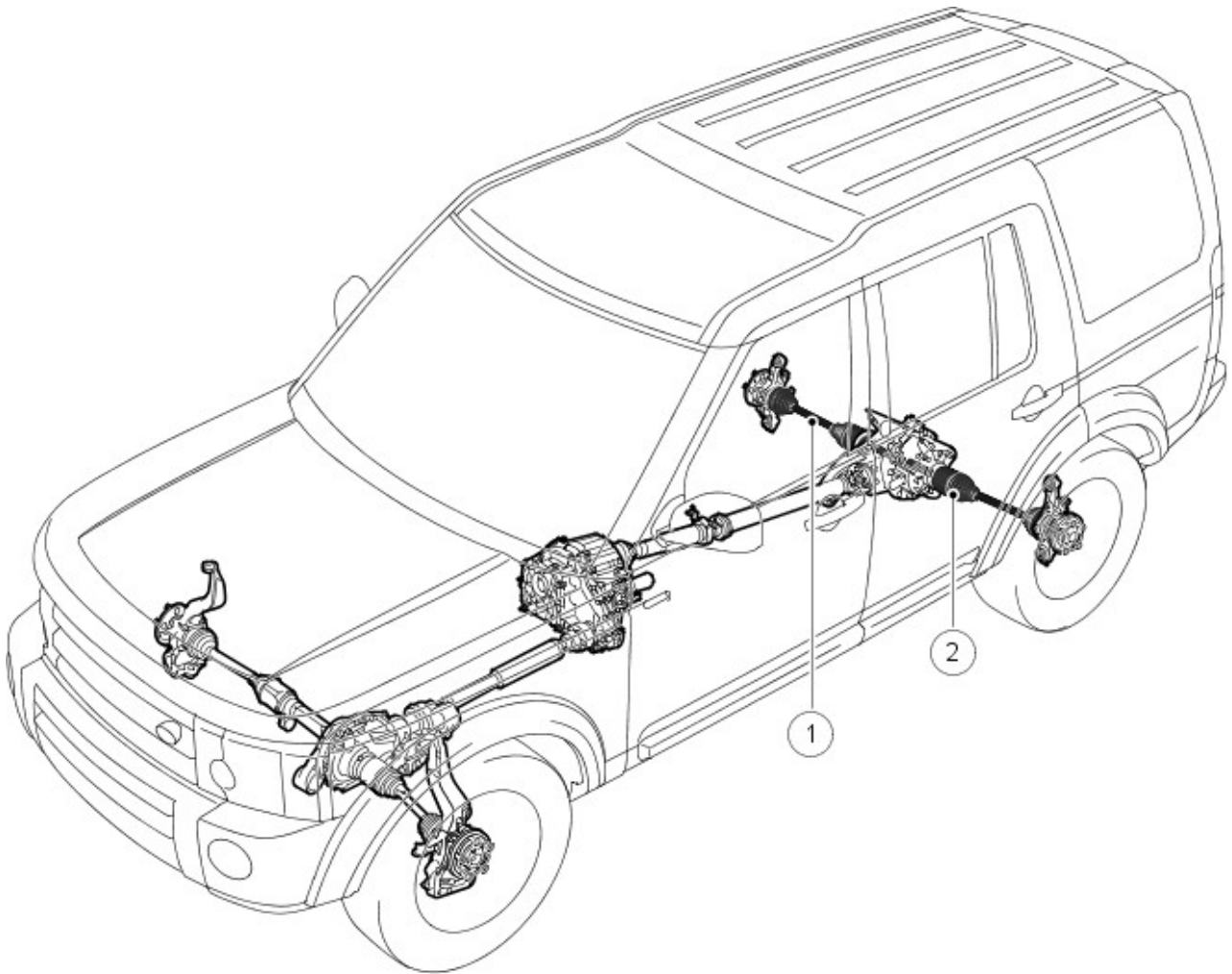
* **New nut must be installed**

+ **Stake nut on completion**

Rear Drive Halfshafts - Rear Drive Halfshafts

Description and Operation

Rear Drive Halfshaft Component Locations



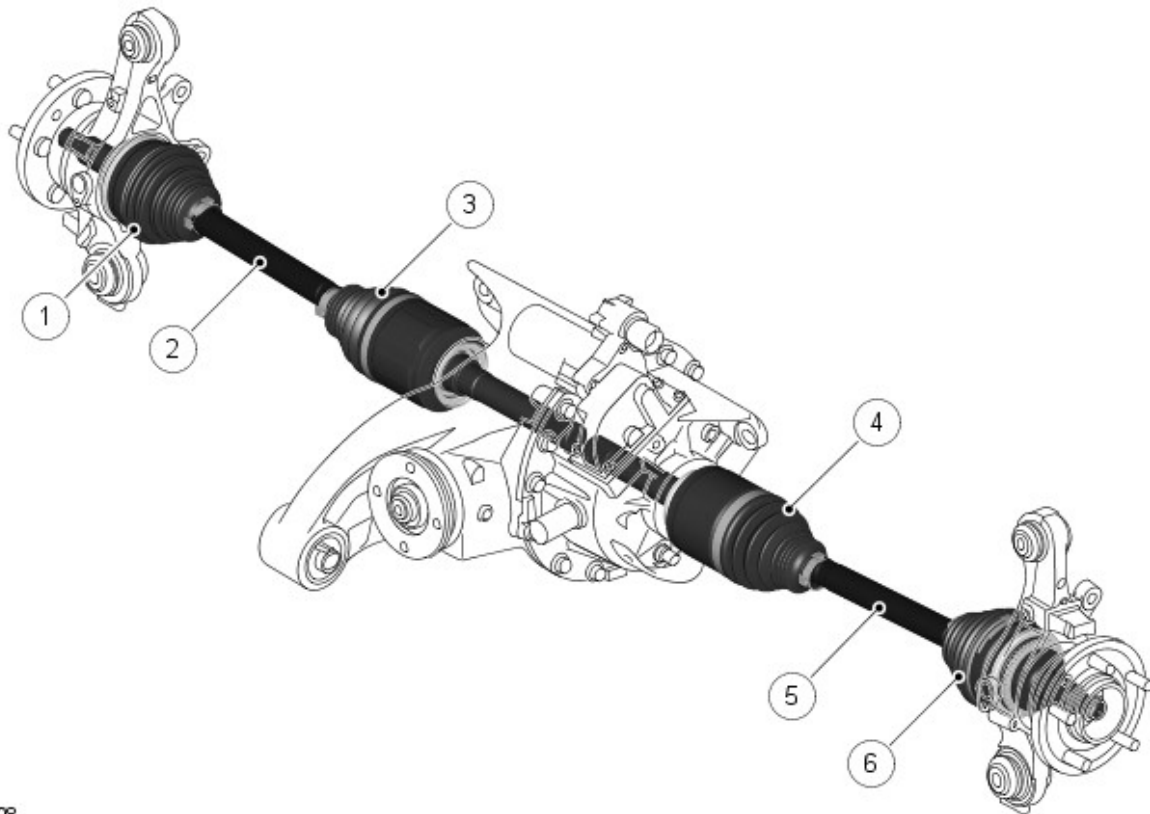
E46407

Item	Part Number	Description
1	-	RH rear drive halfshaft
2	-	LH rear drive halfshaft

GENERAL

The rear drive halfshafts are identical in their construction with a Constant Velocity (CV) joint at each end to allow for suspension movement.

REAR DRIVE SHAFT ASSEMBLY



E46408

Item	Part Number	Description
1	-	RH outer CV joint
2	-	RH rear drive halfshaft
3	-	RH inner CV joint
4	-	LH inner CV joint
5	-	LH rear drive halfshaft
6	-	LH outer CV joint

Each outer CV joint has a target wheel on the outer diameter. This target is used by the ABS wheel speed sensor for vehicle and wheel speed calculations.



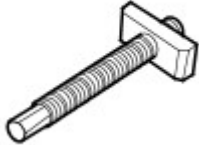




Each rear drive halfshaft comprises two CV joints (inner and outer), boots and a solid barshaft, which is retained in the rear differential by a circlip.


The CV joints used on the rear drive halfshafts share the same design and operating principles as the front drive halfshafts CV joints (see 'Halfshaft Joint' section for more information on CV joints). The rear drive halfshaft inner joint hubs are retained by peening over the lip of the joint body.

Rear Drive Halfshafts - Rear Halfshaft

Removal and Installation

Special Tool(s)

 <p>204-506/1</p> <p>E49618</p>	<p>Halfshaft remover/replacer 204-506/1(LRT-60-030/1)</p>
 <p>204-506/5</p> <p>E49621</p>	<p>Retainers - halfshaft remover/replacer 204-506/5(LRT-60-030/5)</p>
 <p>204-506/3</p> <p>E49620</p>	<p>Halfshaft remover/replacer 204-506/3(LRT-60-030/3)</p>
 <p>204-506-01</p> <p>E49622</p>	<p>Halfshaft installer adapter 204-506-01(LRT-60-030/4)</p>
 <p>308-005</p> <p>E54134</p>	<p>Axle oil seal remover 308-005(LRT-37-004/2)</p>
 <p>100-012</p> <p>E54135</p>	<p>Impulse extractor 100-012(LRT-99-004)</p>
 <p>308-626/1</p> <p>E54136</p>	<p>Installer halfshaft oil seal 308-626/1</p>

<p>308-626/2</p>  <p>E54137</p>	<p>Installer/Guide halfshaft oil seal 308-626/2</p>
---	---

Removal

CAUTIONS:



Do not allow halfshafts to hang unsupported at one end or joint damage will occur.




Do not store or install halfshafts with joints at maximum articulation or damage may occur to the joint.

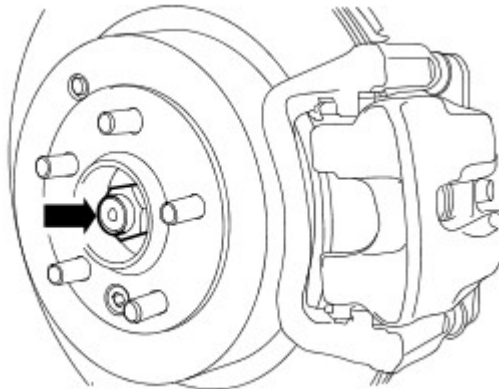


Angularly Adjusted Roller (AAR) joints, used at the inboard end of some halfshafts have no internal retaining mechanism and can separate.



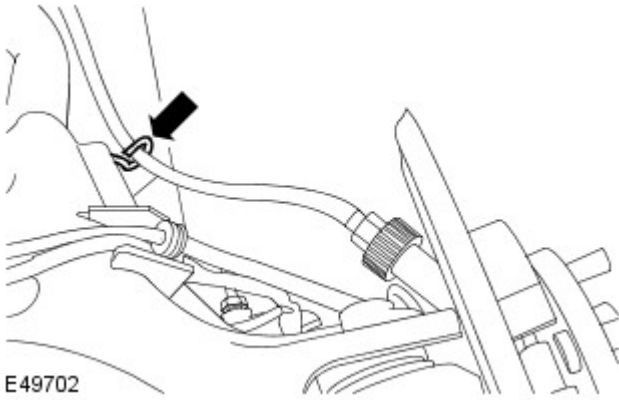
Do not undo or remove the large protruding hexagon on the differential casing.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
2. Drain the differential lubricant.
For additional information, refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).
3. Remove the wheel and tire.
4. Loosen the halfshaft retaining nut.
 - Discard the nut.



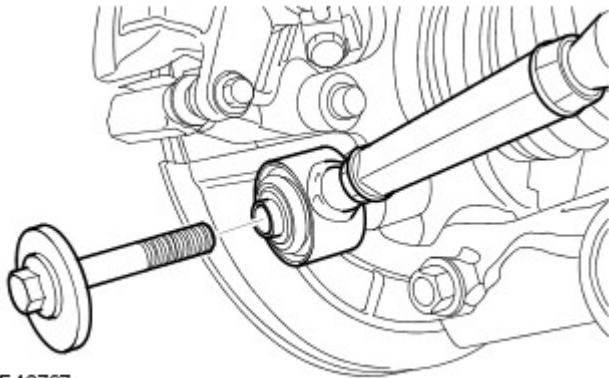
E46796

5. Remove the stabilizer bar link.
For additional information, refer to: Rear Stabilizer Bar Link (204-02 Rear Suspension, Removal and Installation).
6. Release the parking brake cable from the lower arm.



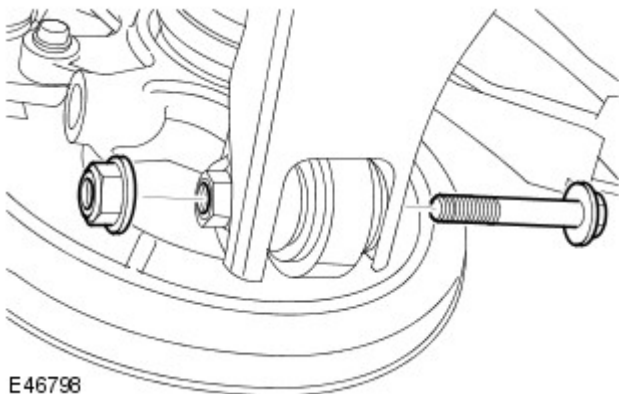
E49702

7. Disconnect the toe link.
 - Remove the bolt.




E46797

8. Remove and discard the halfshaft retaining nut.

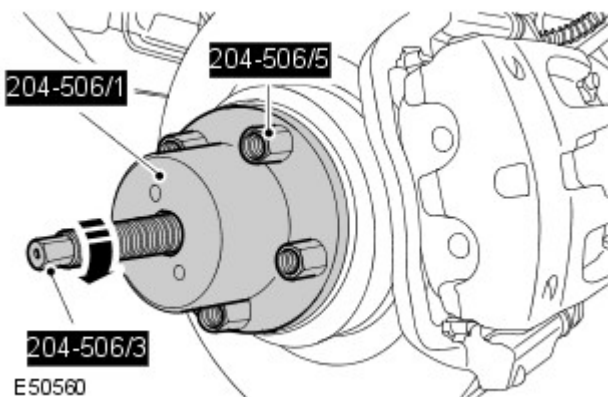


E46798


9.  **CAUTION:** Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.

Release the knuckle from the lower arm.

- Remove the bolt.

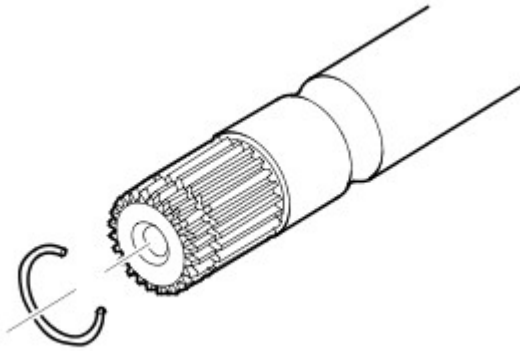


E50560

10.  **CAUTION:** Do not use a hammer to detach the halfshaft from the hub assembly, failure to follow this instruction may result in damage to the halfshaft.

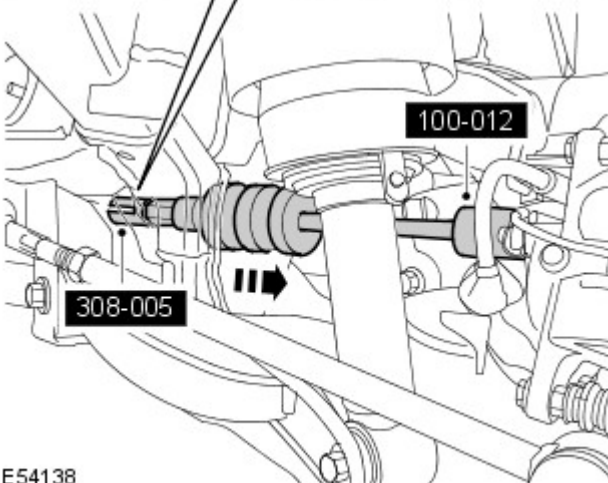
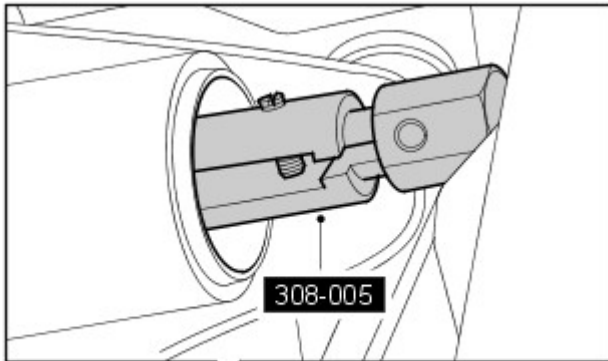
Using the special tools, release the halfshaft from the wheel hub.

11. Position a container to collect the oil spillage.
12. Release the halfshaft from the differential housing.
13. With assistance, remove the halfshaft.
 - Remove and discard the snap ring.



E45752

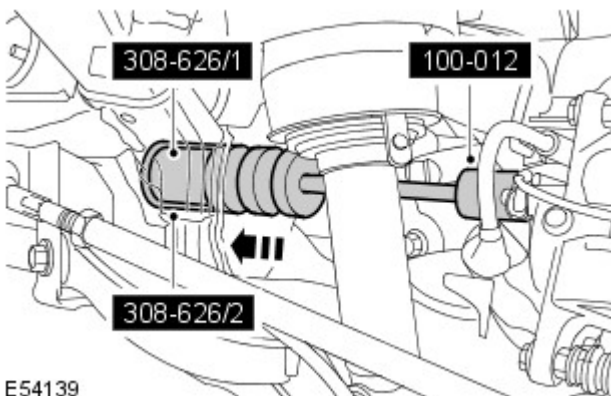
14. Using the special tools, remove and discard the halfshaft oil seal.



E54138

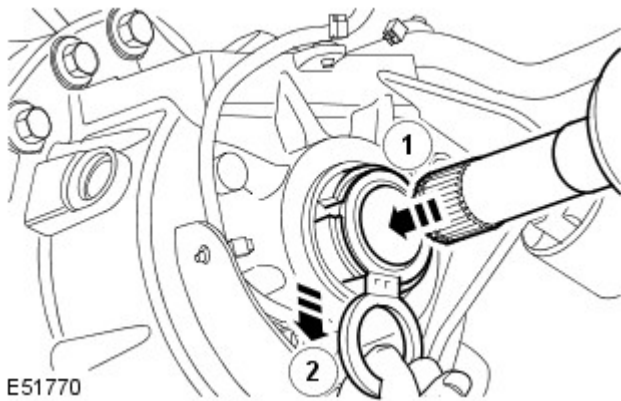
Installation

1. Clean the components.
2. Using the special tools, install a new halfshaft oil seal.
 - The halfshaft oil seal protector must be left in place, until the halfshaft is fully installed.




E54139

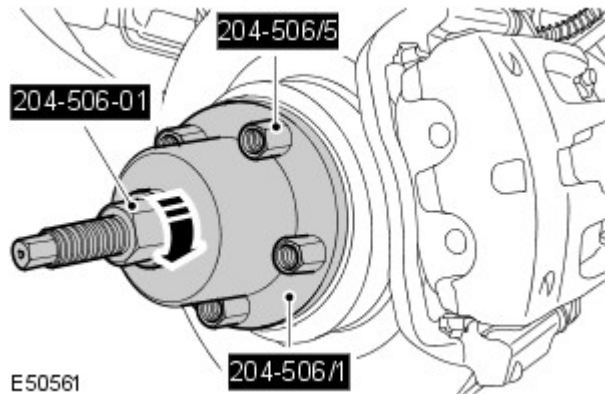
3. With assistance, install the halfshaft.
 - Install the snap ring.
 - Open the halfshaft oil seal protector.
 - Make sure the snap ring is fully engaged and retains the halfshaft.



E51770


4.  **NOTE:** The oil seal protector is designed to break into two pieces.

Remove and discard the halfshaft oil seal protector.




E50561

5. Using the special tools, install the halfshaft in the wheel hub.

6.  **CAUTION:** Make sure the ball joint seal is not damaged. A damaged seal will lead to the premature failure of the joint.


Connect the lower arm to the wheel knuckle.

- Tighten to 275 Nm (203 lb.ft).
- Tighten the new nut to 275 Nm (203 lb.ft).

7.  **CAUTION:** Install the halfshaft nut finger tight.

Install a new halfshaft retaining nut and lightly tighten.

8. Connect the toe link.
- Tighten the bolt to 175 Nm (129 lb.ft).
9. Secure the parking brake cable to the lower arm.
10. Install the stabilizer bar link.
For additional information, refer to: Rear Stabilizer Bar Link (204-02 Rear Suspension, Removal and Installation).

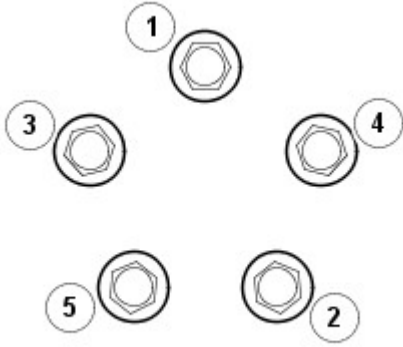
11.  **CAUTION:** Do not use air tools to install the nut. Failure to follow this instruction may result in damage to the component.

Tighten the new halfshaft retaining nut to 420 Nm (311 lb.ft).


- Stake the nut to the halfshaft.

12. Install the wheel and tire.
- Tighten the wheel nuts in the sequence shown:

1. Stage 1: 4 Nm
2. Stage 2: 70 Nm
3. Stage 3: 140 Nm



E74593


13.  **CAUTION:** Do not fill the differential with lubricant up to the filler plug. The filler plug is only used to fill the differential with lubricant, and not to act as a level indicator.

Fill the differential with the correct amount of lubricant. For additional information, refer to: Differential Draining and Filling (205-02 Rear Drive Axle/Differential, General Procedures).

Rear Drive Halfshafts - Outer Constant Velocity (CV) Joint Boot

Removal and Installation

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the wheel and tire.
3. Remove the halfshaft.
For additional information, refer to: Halfshaft (205-05, Removal and Installation).

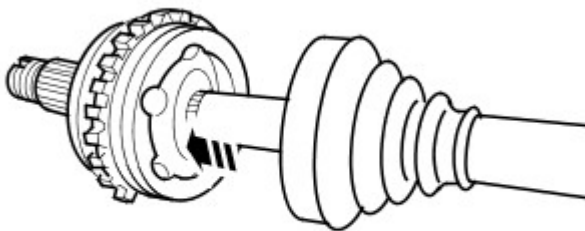
4. Clamp the halfshaft in a vise.

5. Remove and discard the CV joint boot retaining clamps.



6. Slide the CV joint boot along the halfshaft to gain access to the joint.

7. Using a drift against the inner part of the CV joint, remove the CV joint from the halfshaft.
 - Remove and discard the snap ring.



E46875

8. Remove the outer CV joint boot.

Installation


1. Clean the components.
2. Install the CV joint boot.
3. Install the outer CV joint.
 - Install the snap ring.
 - Position the CV joint on the halfshaft, press the snap ring into its groove and push the CV joint fully on to the halfshaft.
 - Pull on the CV joint to ensure the snap ring has fully engaged.
4. Pack the CV joint with the grease supplied.

5. Install the CV joint boot to the CV joint.
 - Secure with the new clamps.
6. Install the halfshaft.
For additional information, refer to: Halfshaft (205-05, Removal and Installation).
7. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Rear Drive Halfshafts - Inner Constant Velocity (CV) Joint Boot

Removal and Installation

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the wheel and tire.
3. Remove the halfshaft.
For additional information, refer to: Halfshaft (205-05, Removal and Installation).

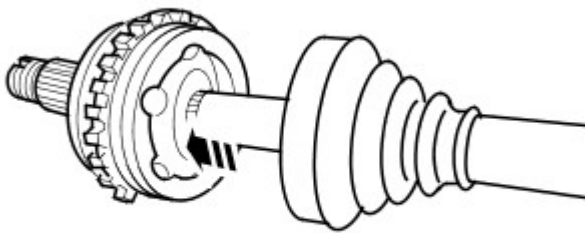
4. Clamp the halfshaft in a vise.

5. Remove and discard the CV joint boot retaining clamps.



6. Slide the CV joint boot along the halfshaft to gain access to the joint.

7. Using a drift against the inner part of the CV joint, remove the CV joint from the halfshaft.
 - Remove and discard the snap ring.



E46875

8. Remove the inner CV joint boot.

Installation



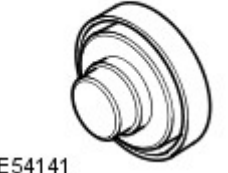
1. Clean the components.
2. Install the inner CV joint boot.
3. Install the inner joint.
 - Install a new snap ring.
 - Position the CV joint on the halfshaft, press the snap ring into its groove and push the CV joint fully on to the halfshaft.
 - Pull on the CV joint to ensure the snap ring has fully engaged.
4. Pack the joint with the grease supplied.

5. Install the boot to the joint.
 - Secure with the new clamps.
6. Install the halfshaft.
For additional information, refer to: Halfshaft (205-05, Removal and Installation).
7. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).


Rear Drive Halfshafts - Halfshaft Bearing

Removal and Installation

Special Tool(s)

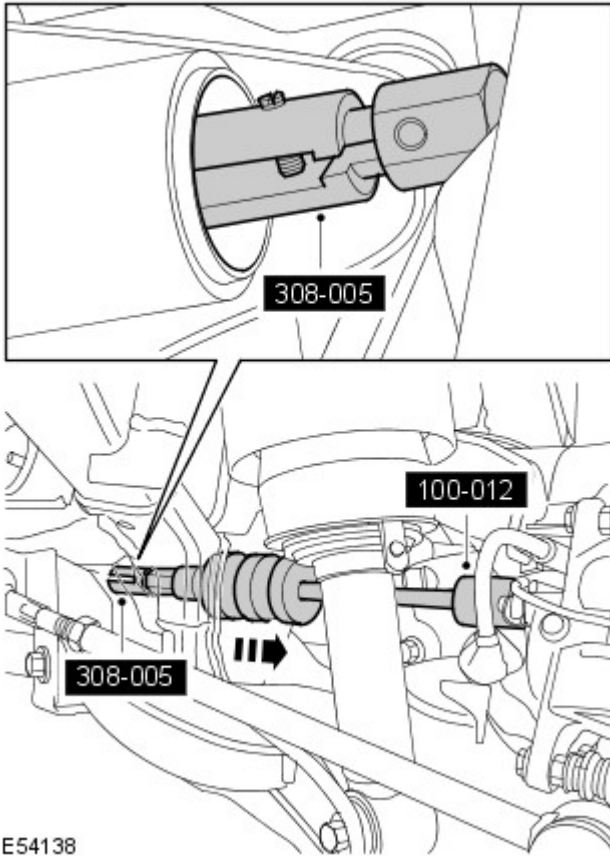
 <p>308-005</p> <p>E54134</p>	Axle oil seal remover 308-005 (LRT-37-004/2)
 <p>100-012</p> <p>E54135</p>	Impulse extractor 100-012 (LRT-99-004)
 <p>205-819</p> <p>E54141</p>	Halfshaft bearing installer 205-819

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

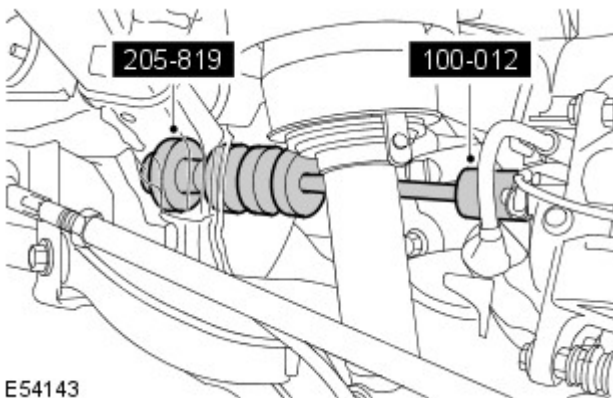
2. Remove the wheel and tire.
3. Remove and discard the halfshaft oil seal.
For additional information, refer to: Halfshaft (205-05, Removal and Installation).
4. Using the special tool, remove and discard the halfshaft bearing.



E54138

Installation

1. Using the special tools, install a new halfshaft bearing.



E54143

2. Install a new halfshaft oil seal.
For additional information, refer to: Halfshaft (205-05, Removal and Installation).
3. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Brake System - General Information -

Brake Hydraulic Fluid

Item	Specification
* Recommended hydraulic fluid	SHELL DONAX YB DOT4 ESL FLUID



CAUTION: * If the above fluid is not available, use a low viscosity DOT 4 brake fluid meeting ISO 4925 Class 6 and Land Rover LRES22BF03 requirements.

General Specification

Item	Specification
Footbrake type:	
Vehicles without Brembo brakes	Hydraulic, servo assisted, self-adjusting with front/rear split hydraulic system, twin piston sliding calipers to the front and single piston sliding calipers to the rear
Vehicles with Brembo brakes	Hydraulic, servo assisted, self-adjusting with front/rear split hydraulic system, opposed six piston calipers to the front and single piston sliding calipers to the rear
Parking brake type	Twin shoe (leading/trailing) operating on rear wheels and controlled from park brake lever in floor console via twin cables

Brake System - General Information - Brake System

Diagnosis and Testing

Principles of Operation

For a detailed description of the Brake System and operation, refer to the relevant Description and Operation section of the workshop manual.REFER to:

Front Disc Brake (206-03, Description and Operation),
 Front Disc Brake (206-03, Description and Operation),
 Rear Disc Brake (206-04, Description and Operation),
 Rear Disc Brake (206-04, Description and Operation),
 Parking Brake (206-05, Description and Operation),
 Parking Brake (206-05, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
 - If a road test is necessary make sure the vehicle is safe to do so.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection

Mechanical
<ul style="list-style-type: none"> • Brake pad(s) condition and installation • Brake caliper(s) condition and installation • Brake disc(s) condition and installation • Parking brake disc(s)/parking brake drum(s) condition and installation • Parking brake shoes condition and installation • Parking brake cable(s) condition and installation • Brake booster condition and installation • Brake booster vacuum hose condition and installation • Brake master cylinder condition and installation • Hydraulic Control Unit (HCU) • Brake fluid leaks • Brake warning indicator

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Brake noise	<ul style="list-style-type: none"> • Debris • Brake pads • Brake disc(s) 	<ul style="list-style-type: none"> • Remove the debris • Install new brake pads as necessary • Install new brake discs as necessary
Brake vibration	<ul style="list-style-type: none"> • Suspension components • Brake disc(s) 	<ul style="list-style-type: none"> • Check the installation of the suspension components • Refer to the relevant section of the workshop manual and test the brake disc runout
Excessive brake pedal travel/brake pedal spongy	<ul style="list-style-type: none"> • Brake pads <ul style="list-style-type: none"> - Worn brake pads may make the pedal travel excessive - New brake pads may make the pedal spongy • Air in the brake system <ul style="list-style-type: none"> - If the pedal "pumps-up", suspect air in the system • Brake master cylinder <ul style="list-style-type: none"> - If the pedal sinks to the floor when held under pressure when there are no external leaks, suspect 	<ul style="list-style-type: none"> • Install new brake pads as necessary. Road test to bed in the brake pads • Check for a cause for air ingress, rectify as necessary • Install a new brake master cylinder as necessary • Rectify the brake fluid leak as necessary

	<ul style="list-style-type: none"> • a master cylinder fault • Brake fluid leak (see visual inspection) 	
Excessive brake pedal effort/brake pedal hard	<ul style="list-style-type: none"> • Brake pipe(s) • Brake caliper slide(s) • Brake caliper piston(s) • Brake vacuum hose • Brake vacuum pump • Brake booster 	<ul style="list-style-type: none"> • Check for damaged brake pipes • Check the brake caliper slides • Check the brake caliper pistons • Check the brake vacuum hose for air leaks • Check the brake vacuum pump operation • Check the brake booster
Low foot brake efficiency / brakes pulling / sticking / binding	<ul style="list-style-type: none"> • Brake pipe(s) • Brake pads • Brake caliper piston(s) • Brake caliper slide(s) • Brake disc(s) 	<ul style="list-style-type: none"> • Check for damaged brake pipes • Check the brake pads • Check the brake caliper pistons • Check the brake caliper slides • Check the brake discs
Parking brake will not engage or release	<ul style="list-style-type: none"> • Electric park brake cables • Electric park brake shoes • Electric park brake adjusters • Rear brake disc(s)/drum(s) • Electric park brake actuator malfunction 	<ul style="list-style-type: none"> • Check the electric park brake cable(s) for operation/condition. Check that the cable end connector(s) are correctly installed to the operating lever(s) • Check the electric park brake shoes for wear • Check the electric park brake shoes for correct adjustment • Check the rear brake disc(s)/drum(s) • Check the electric park brake actuator for damage and/or excessive noise in normal operation
Low parking brake efficiency / parking brake sticking / binding		
Brake warning indicator staying illuminated	<ul style="list-style-type: none"> • Brake reservoir fluid level • Brake pads • Brake pad wear sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance • Brake fluid level sensor circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Check the brake fluid level, top up if required • Check the brake pads • Refer to the electrical circuit diagrams and test the brake pad wear sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and test the brake fluid level sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

Brake System - General Information - Front Brake Disc Runout Check

General Procedures

NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.

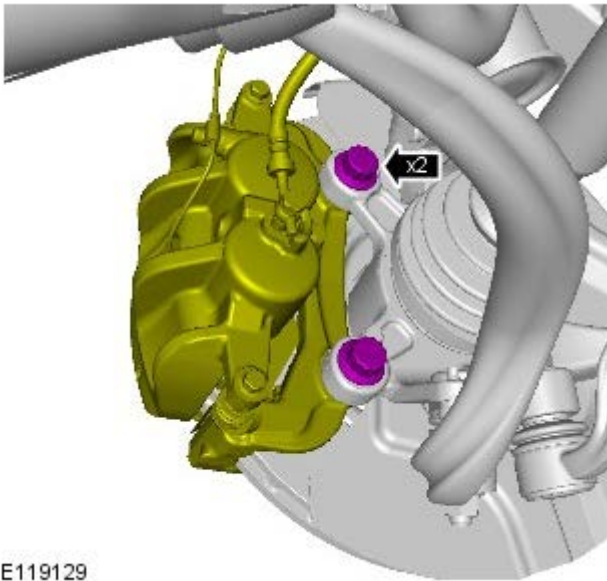


LH illustration shown, RH is similar.

1. **WARNING:** Make sure to support the vehicle with axle stands.

Raise the front of the vehicle.

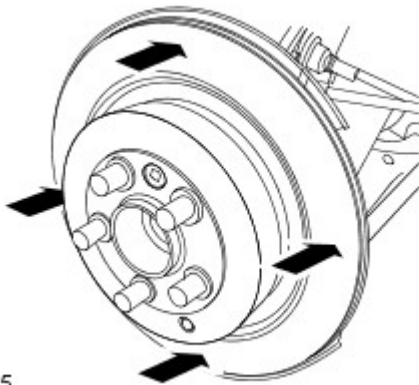
2. Remove the road wheel.



E119129

3. **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

Release the brake caliper and tie aside.

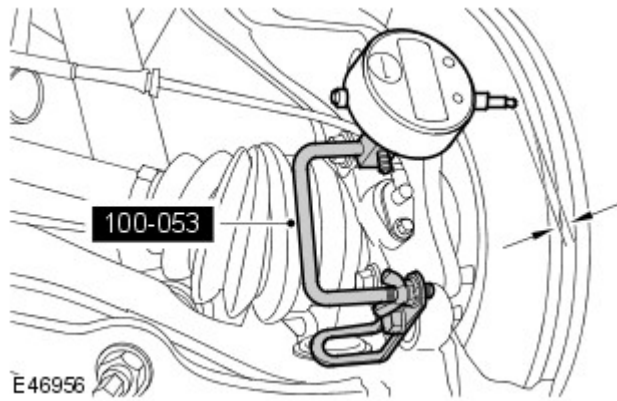


E46955

4. **CAUTION:** Brake discs must be renewed in pairs, unless one disc requires changing before 1000 miles (1600 kilometers) from new.

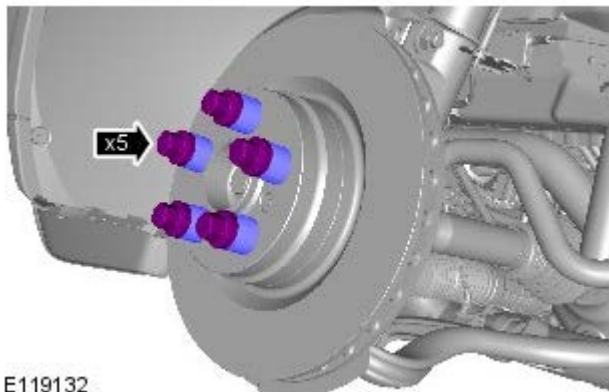
At 4 points around disc, measure disc thickness using a micrometer; renew disc if less than service limit or if variation is exceeded: Disc thickness, NEW 30 mm, Service limit = 27 mm. Thickness variation maximum = 0.01.

5. Mount a Dial Test Indicator (DTI) to and secure to inboard side of hub using caliper assembly upper bolt hole



6. Position DTI probe 5 mm in from outer edge of disc.

7. Install spacer washers under the wheel nuts.
- Tighten the road wheel nuts to 140 Nm (103 lb.ft).



8. Zero DTI and rotate road wheel one complete revolution to measure disc runout. Disc runout must not exceed 0.05 mm (0.002 in).

9. If disc runout is outside limits:

10. Remove the wheel hub nuts.

- Remove the spacers.

11. Remove Allen screw securing brake disc to drive flange.

12. Remove the brake disc.

13. Ensure mating surfaces of disc and drive flange are clean.

14. Install the brake disc.

- Tighten the Torx screw to 35 Nm (26 lb.ft).

15. Install spacer washers under the wheel nuts.

- Tighten the road wheel nuts to 140 Nm (103 lb.ft).

16. Check disc runout as detailed above.

17. If runout is still outside limits, renew disc and/or hub.

18. Remove the wheel hub nuts.

- Remove the spacers.

19. Remove the DTI.

20. Install the brake caliper and tighten the bolts. TORQUE: 275 Nm

21. Install the road wheel(s) and tighten nuts to 140Nm (103 lb-ft).

22. Depress brake pedal several times to set brake pads.

23. Lower the vehicle.

Brake System - General Information - Rear Brake Disc Runout Check

General Procedures

NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.



RH illustration shown, LH is similar.




It is not necessary to carry out the parking brake shoe 'bedding-in procedure' if the rear brake discs or parking brake shoes have been removed for access to other components.

-  **CAUTION:** Do not turn the ignition on when the parking brake service mode has been set, this will result in the parking brake being released from the service mode.

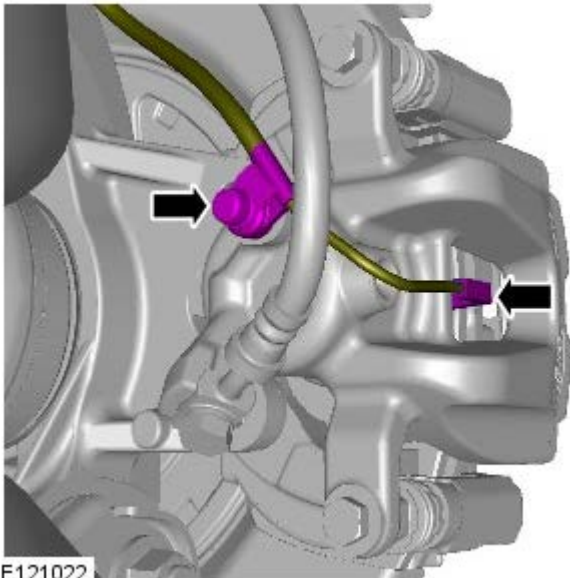
Enter the parking brake into the service mode.

- Turn the ignition on.
- Apply, and hold, the footbrake.
- Apply, and hold, the parking brake switch to the RELEASE position.
- Turn the ignition off.
- Release the footbrake.
- Release the parking brake switch.


-  **WARNING:** Make sure to support the vehicle with axle stands.

Raise rear of vehicle.

- Remove road wheel.

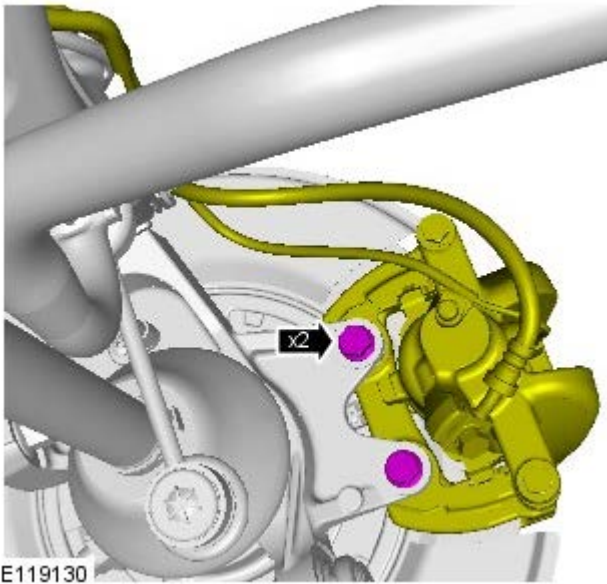


E121022

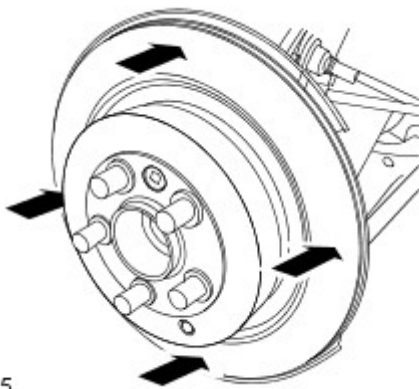
-  **CAUTION:** The brake pad wear indicator sensor is easily damaged. Do not use a lever to remove the sensor. Use fingers only.

RH side rear only: Disconnect the brake pad wear indicator sensor lead.

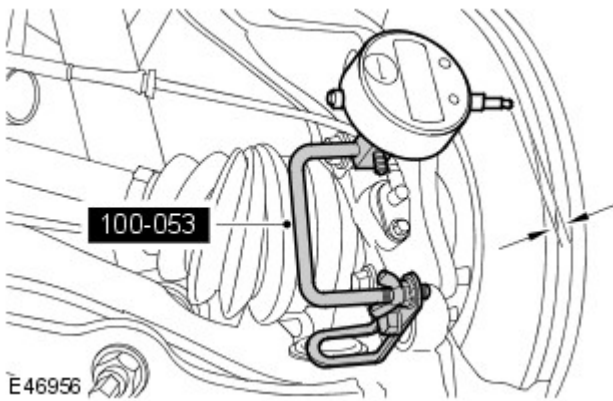
- Remove 2 bolts securing brake caliper to hub. Release caliper from hub and tie aside.




E119130




E46955



E46956

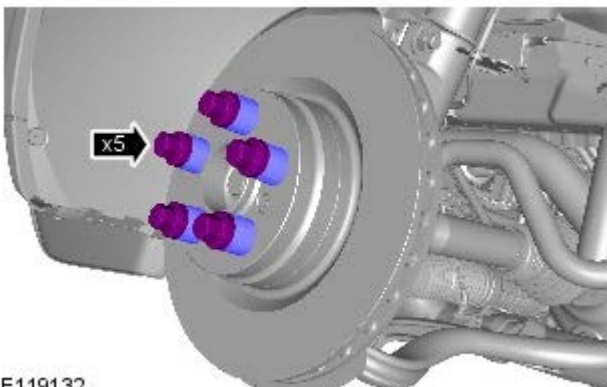
6.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

At 4 points around the disc, measure disc thickness using a micrometer; renew disc if less than service limit or if variation is exceeded: Disc thickness, NEW = 20 mm
Service limit = 18 mm. Thickness variation maximum = 0.01 mm.


7.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Mount a Dial Test Indicator (DTI) to and secure to inboard side of hub using caliper assembly upper bolt hole.

8. Position DTI probe 5 mm in from outer edge of disc.



E119132

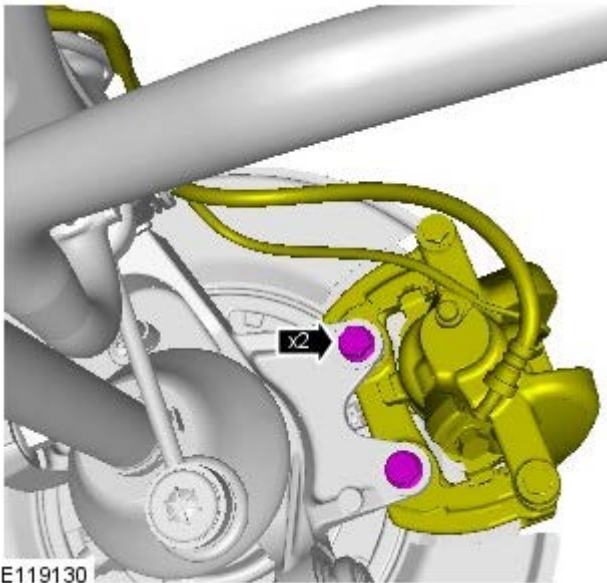
9.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Tighten the wheel nuts to 140 Nm (103 lb.ft).
• Install spacer washers under the wheel nuts.

10. Zero DTI and rotate wheel one complete revolution to

measure disc runout. Disc runout must not exceed 0.09 mm (0.003 in).

11. If disc runout is outside limits:
12. Remove the wheel hub nuts.
 - Remove the spacer washers.
13. Remove Allen screw securing brake disc to drive flange.
14. Remove brake disc.
15. Ensure mating surfaces of disc and drive flange are clean.
16. Install the brake disc.
 - Tighten the Torx screw to 35 Nm (26 lb.ft).
17. Tighten the wheel nuts to 140 Nm (103 lb.ft).
 - Install spacer washers under the wheel nuts.
18. Check disc runout as detailed above.
19. If runout is still outside limits, renew disc and/or hub.
20. Remove the wheel hub nuts.
 - Remove the spacer washers.
21. Remove the DTI.
22. Install the brake caliper anchor bolts
 - Tighten the bolts to 115 Nm (85 lb.ft).



23. Tighten the wheel nuts to 140 Nm (103 lb.ft).
24. Depress brake pedal several times to set brake pads.
25. Remove stands and lower vehicle.

Brake System - General Information - Brake System Bleeding

General Procedures



WARNING: If any components upstream of the Hydraulic Control Unit (HCU), including the HCU itself are replaced, the brake system must be bled using Land Rover approved diagnostic equipment. This will ensure that all air is expelled from the new component(s).

NOTES:



Bleeding of the complete brake system must be carried out using Land Rover approved diagnostic equipment. Where only the primary or secondary brake circuits have been disturbed in isolation, it should only be necessary to bleed that circuit. Partial bleeding of the hydraulic system is only permissible if a brake tube or hose has been disconnected with only minimal loss of fluid.

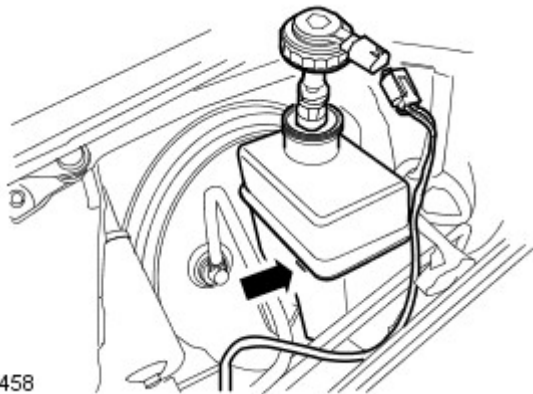


Some variation in the illustrations may occur, but the essential information is always correct.

- WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

- Check that the brake fluid lines are secure and that there are no signs of a brake fluid leak. If a brake fluid leak is detected, investigate and rectify the cause of the leak before bleeding the brakes.



E62458

- WARNING:** Do not allow dirt or foreign liquids to enter the reservoir. Use only new brake fluid of the correct specification from airtight containers. Do not mix brands of brake fluid as they may not be compatible.

CAUTIONS:



Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

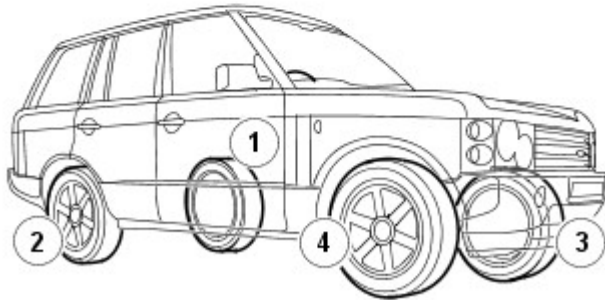
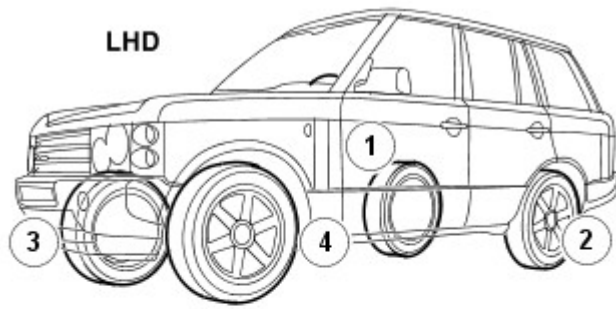


The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.

Fill the brake fluid reservoir to the MAX mark.


- Disconnect the brake fluid reservoir electrical connector.
- Remove the brake fluid reservoir cap.

- Conduct the bleed procedure with the engine running.
- Connect the diagnostic tool to the vehicle, select diagnostic and proceed as directed for bleeding the brake system.
- Starting at the brake caliper furthest away from the brake master cylinder, loosen the bleed screw by one-half to three-quarters of a turn.




E62462

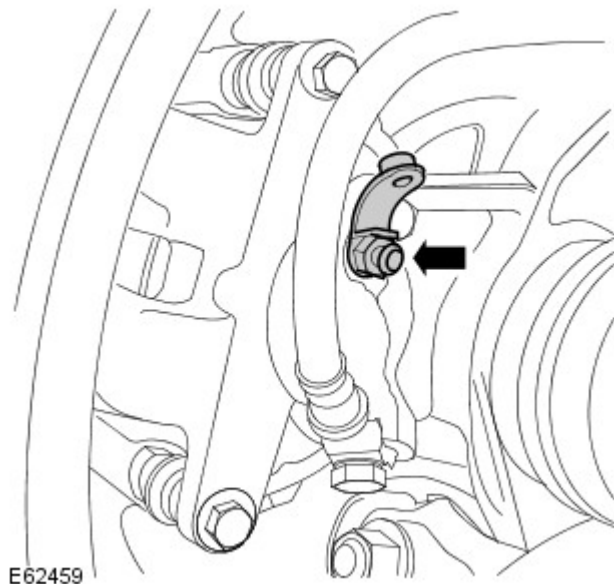
RHD

7. Install the bleed tube to the brake caliper bleed screw and immerse the free end of the bleed tube in a bleed jar containing a small quantity of approved brake fluid.
 - Hold the bleed container at least 300 mm above the Caliper that is being bled.
8.  **CAUTION:** The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.

With assistance, depress the brake pedal steadily through to 2/3 of its full stroke.

9. With the brake pedal held down, close bleed screw and then return the brake pedal to 1/3 of its full stroke and hold.
10. Repeat steps 8 and 9, 28 times for the rear brake and 10 times for the front brake.
11. At the end of the bleed process, depress and hold the brake pedal down.
12.  **CAUTION:** Make sure the bleed screw cap is installed after bleeding. This will prevent corrosion to the bleed screw.

With the brake pedal fully depressed, tighten the bleed screw to 10 Nm (7 lb.ft).



E62459

13. Fill the brake fluid reservoir to the MAX mark.

14.  **WARNING:** Braking efficiency may be seriously impaired if an incorrect bleed sequence is used.

Repeat the brake bleeding procedure for each brake caliper, following the above sequence.

15. Fill the brake fluid reservoir to the MAX mark.

16. Apply the brakes and check for leaks.

17. Install the brake fluid reservoir cap.

- Connect the brake fluid reservoir electrical connector.

18. On completion, road test the vehicle and check the brake pedal operation. The pedal travel should be short with a firm feel.

Brake System - General Information - Brake System Pressure Bleeding

General Procedures




NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Check that the brake fluid lines are secure and that there are no signs of a brake fluid leak. If a brake fluid leak is detected, investigate and rectify the cause of the leak before bleeding the brakes.

3.  **WARNING:** Do not allow dirt or foreign liquids to enter the reservoir. Use only new brake fluid of the correct specification from airtight containers. Do not mix brands of brake fluid as they may not be compatible.

CAUTIONS:



Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

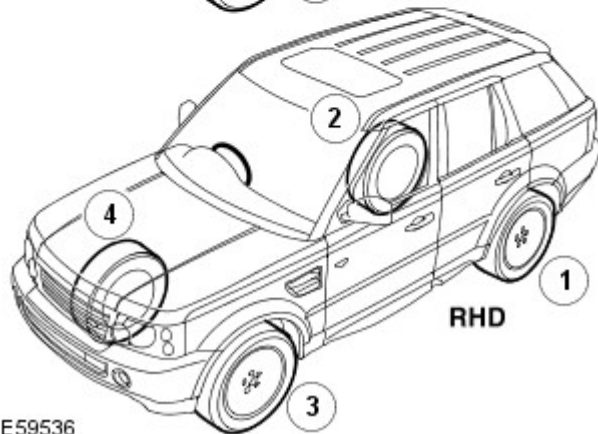
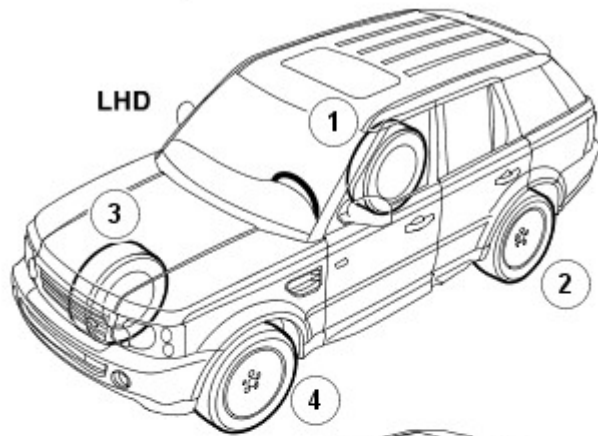


The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.

Fill the brake fluid reservoir to the MAX mark.


- Disconnect the brake fluid reservoir electrical connector.
- Remove the brake fluid reservoir cap.

4. Conduct the bleed procedure with the engine running.
5. Starting at the brake caliper furthest away from the brake master cylinder, loosen the bleed screw by one-half to three-quarters of a turn.




E59536

6.
 - Install the bleed tube to the brake caliper bleed screw and immerse the free end of the bleed tube in a bleed jar containing a small quantity of approved brake fluid.
 - Hold the bleed container at least 300 mm above the Caliper that is being bled.

7.  **CAUTION:** The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.

With assistance, depress the brake pedal steadily through to 2/3 of its full stroke.

8. With the brake pedal held down, close bleed screw and then return the brake pedal to 1/3 of its full stroke and hold.
9. Repeat steps 7 and 8, 28 times for the rear brake and 10 times for the front brake.
10. At the end of the bleed process, depress and hold the brake pedal down.

11.  **CAUTION:** Make sure the bleed screw cap is installed after bleeding. This will prevent corrosion to the bleed screw.

With the brake pedal fully depressed, tighten the bleed screw.

- On vehicles with high performance brakes, tighten the front caliper bleed screw to 19 Nm (14 lb.ft).
 - On vehicles with standard brakes, tighten the front caliper bleed screw to 10 Nm (7 lb.ft).
 - Tighten the rear caliper bleed screws to 10 Nm (7 lb.ft).
12. Fill the brake fluid reservoir to the MAX mark.

13.  **WARNING:** Braking efficiency may be seriously

impaired if an incorrect bleed sequence is used.

Repeat the brake bleeding procedure for each brake caliper, following the above sequence.

14. Fill the brake fluid reservoir to the MAX mark.
15. Apply the brakes and check for leaks.
16. Install the brake fluid reservoir cap.
 - Connect the brake fluid reservoir electrical connector.
17. On completion, road test the vehicle and check the brake pedal operation. The pedal travel should be short with a firm feel.

Brake System - General Information - Component Bleeding

General Procedures



WARNING: If any components upstream of the Hydraulic Control Unit (HCU), including the HCU itself are replaced, the brake system must be bled using Land Rover approved diagnostic equipment. This will ensure that all air is expelled from the new component(s).



CAUTION: LH illustration shown, RH is similar.

NOTES:



Bleeding of the complete brake system must be carried out using Land Rover approved diagnostic equipment. The following manual procedure covers bleeding the brake system for components down stream of the HCU, where only the primary or secondary brake circuits have been disturbed in isolation. Partial bleeding of the hydraulic system is only permissible if a brake tube or hose has been disconnected with only minimal loss of fluid.

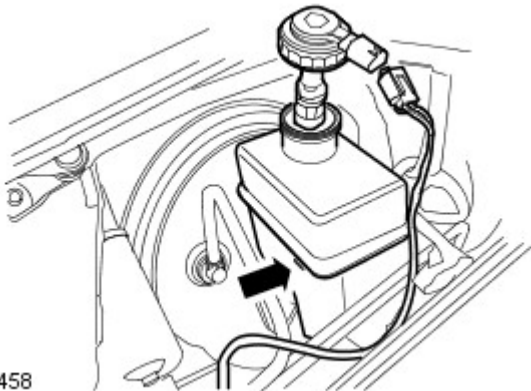


Some variation in the illustrations may occur, but the essential information is always correct.

- WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

- Check that the brake fluid lines are secure and that there are no signs of a brake fluid leak. If a brake fluid leak is detected, investigate and rectify the cause of the leak before bleeding the brakes.
- Pump the brake pedal until the brake vacuum assistance is exhausted.



E62458

- WARNING:** Do not allow dirt or foreign liquids to enter the reservoir. Use only new brake fluid of the correct specification from airtight containers. Do not mix brands of brake fluid as they may not be compatible.

CAUTIONS:



Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.



The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.

Remove the brake fluid reservoir cap.

- Disconnect the brake fluid reservoir electrical connector.
- Fill the brake fluid reservoir to the MAX mark.

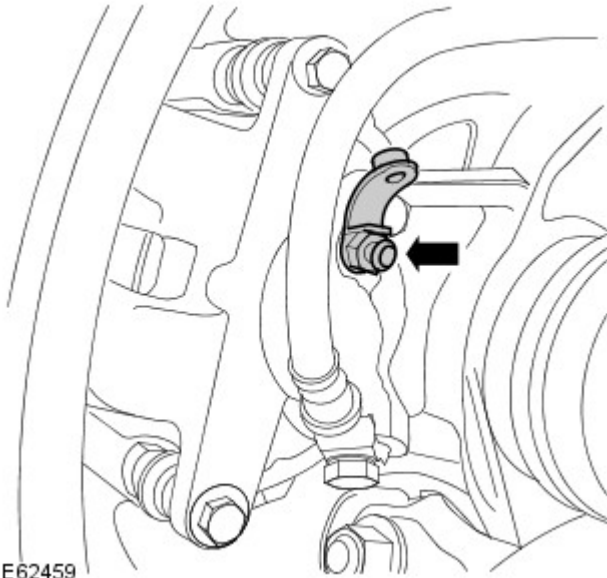
- Install the bleed tube to the brake caliper bleed screw and immerse the free end of the bleed tube in a bleed jar containing a small quantity of approved brake fluid.
 - Hold the bleed container at least 300 mm above the Caliper that is being bled.
- Loosen the bleed screw by one-half turn to three-quarters of a turn.

- CAUTION:** The brake fluid reservoir must remain full with new, clean brake fluid at all times during bleeding.


With assistance, depress the brake pedal steadily through

to 2/3 of its full stroke.

8. With the brake pedal held down, close bleed screw and then return the brake pedal to 1/3 of its full stroke and hold.
9. Repeat steps 7 and 8, 28 times for the rear brake and 10 times for the front brake.
10. At the end of the bleed process, depress and hold the brake pedal down.



E62459

11.  **CAUTION:** Make sure the bleed screw cap is installed after bleeding. This will prevent corrosion to the bleed screw.

With the brake pedal fully depressed, tighten the bleed screw.

- On vehicles with high performance brakes, tighten the front caliper bleed screw to 19 Nm (14 lb.ft).
- On vehicles with standard brakes, tighten the front caliper bleed screw to 10 Nm (7 lb.ft).
- Tighten the rear caliper bleed screws to 10 Nm (7 lb.ft).

12. Fill the brake fluid reservoir to the MAX mark.
13. Apply the brakes and check for leaks.
14. Install the brake fluid reservoir cap.
 - Connect the brake fluid reservoir electrical connector.
15. On completion, road test the vehicle and check the brake pedal operation. The pedal travel should be short with a firm feel.

Brake System - General Information - Front Brake Disc Runout Check - With Wheel On

General Procedures

NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.



LH illustration shown, RH is similar.

- WARNING:** Make sure to support the vehicle with axle stands.

Raise the front of the vehicle.



- NOTES:



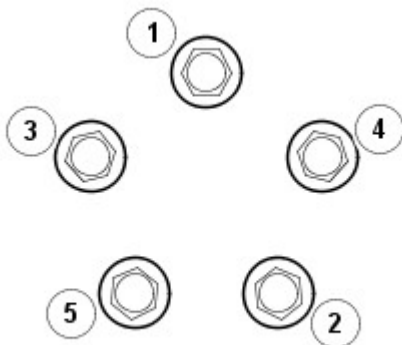
Take care not to contact back plate with DTI probe.



DTI probe extension maybe required.

Use magnetic base stand to mount [Dial Test Indicator \(DTI\) gauge](#) as shown 5 mm in from edge of disc.

- Zero DTI and rotate the wheel one full complete revolution to measure disc runout. Disc runout must not exceed 0.03 mm.



E74593

- NOTE:** The following steps must be followed if the runout exceeds 0.03 mm.

Remove and rotate the wheel 2 stud holes and install the wheel and tire in the new position.

- Tighten the road wheel nuts in sequence as shown above to the following:
 - Stage 1: 4 Nm.
 - Stage 2: 70 Nm.
 - Stage 3: 140 Nm.

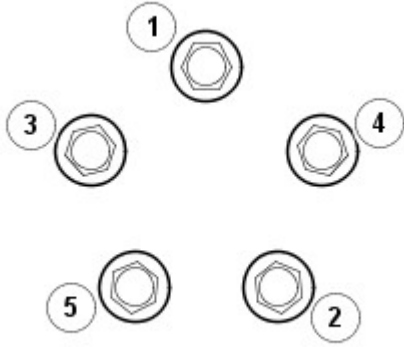
- Check runout as detailed above.



NOTE: If the runout still exceeds 0.03

- Check hub drive flange runout. For additional information, refer to: Front Wheel Bearing and Wheel Hub Runout Check (204-00, General Procedures).

- Install the wheel and tire.



- Tighten the road wheel nuts in sequence as shown above to the following:
- Stage 1: 4 Nm.
- Stage 2: 70 Nm.
- Stage 3: 140 Nm.

E74593

Brake System - General Information - Rear Brake Disc Runout Check - With Wheel On

General Procedures

NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.



RH illustration shown, LH is similar.



It is not necessary to carry out the parking brake shoe 'bedding-in procedure' if the rear brake discs or parking brake shoes have been removed for access to other components.

1.  **CAUTION:** Do not turn the ignition on when the parking brake service mode has been set, this will result in the parking brake being released from the service mode.

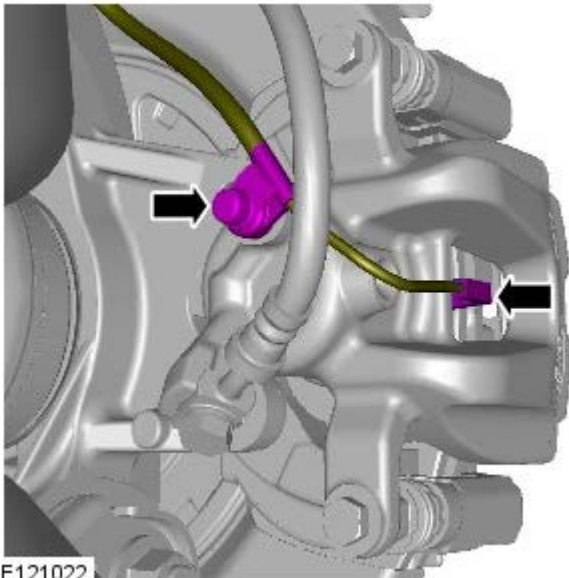
Enter the parking brake into the service mode.

- Turn the ignition on.
- Apply, and hold, the footbrake.
- Apply, and hold, the parking brake switch to the RELEASE position.
- Turn the ignition off.
- Release the footbrake.
- Release the parking brake switch.


2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise rear of vehicle.

3. Remove road wheel.

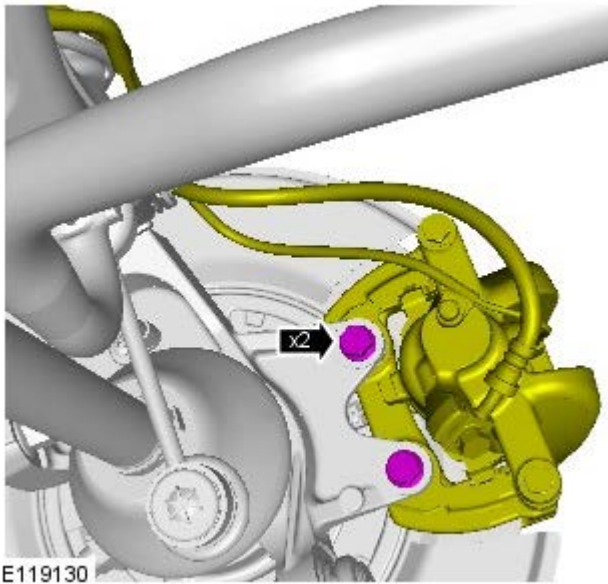


E121022

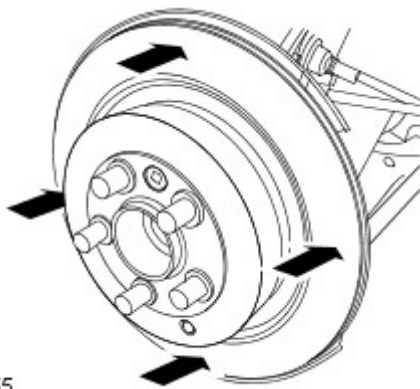
4.  **CAUTION:** The brake pad wear indicator sensor is easily damaged. Do not use a lever to remove the sensor. Use fingers only.

RH side rear only: Disconnect the brake pad wear indicator sensor lead.

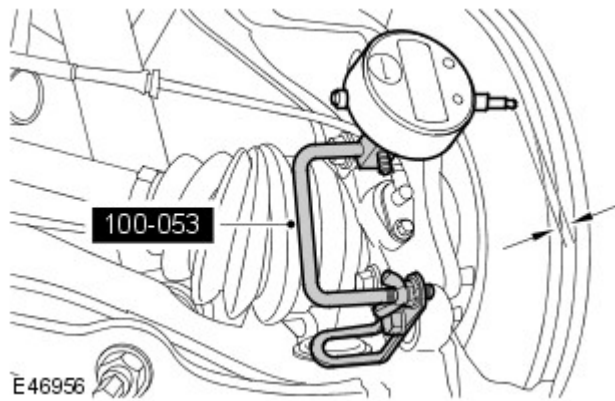
5. Remove 2 bolts securing brake caliper to hub. Release caliper from hub and tie aside.



E119130




E46955




E46956

6. NOTES:

 Some variation in the illustrations may occur, but the essential information is always correct.

 Wheel and tire shown removed for clarity

At 4 points around the disc, measure disc thickness using a micrometer; renew disc if less than service limit or if variation is exceeded: Disc thickness, NEW = 20 mm
Service limit = 18 mm. Thickness variation maximum = 0.01 mm.

7.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Mount a Dial Test Indicator (DTI) to and secure to inboard side of hub using caliper assembly upper bolt hole.

8. Position DTI probe 5 mm in from outer edge of disc.

9.  CAUTION: Take care not to trap the calliper.

Install the wheel.

- Tighten the road wheel nuts in sequence to the following
- Stage 1: 4 Nm.
- Stage 2: 70 Nm.
- Stage 3: 140 Nm.

10. Zero DTI and rotate wheel one complete revolution to measure disc runout. Disc runout must not exceed 0.09 mm (0.003 in).

11. **If disc runout is outside limits:**

12. Remove the wheel.

13. Remove Allen screw securing brake disc to drive flange.
14. Remove brake disc.
15. Make sure the mating surfaces of disc and drive flange are clean.
16. Install the brake disc.

17.  **CAUTION:** Take care not to trap the calliper.

Install the wheel.

- Tighten the road wheel nuts in sequence to the following
- Stage 1: 4 Nm.
- Stage 2: 70 Nm.
- Stage 3: 140 Nm.

18. Check disc runout as detailed above.
19. If runout is still outside limits.

20.  **NOTE:** Take care not to trap the calliper.

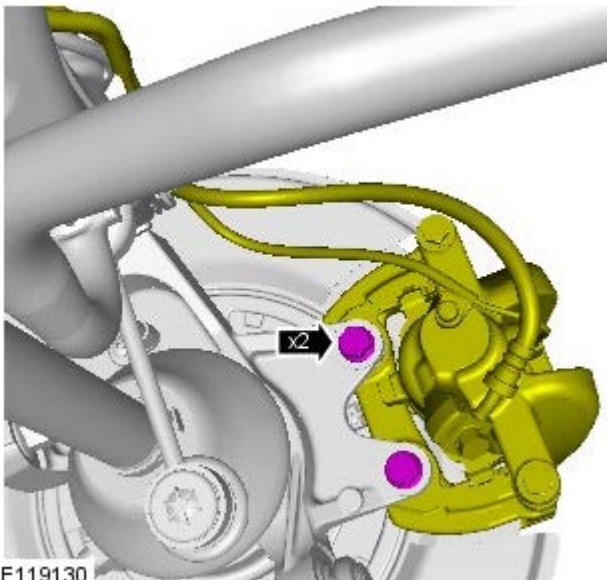
Remove and rotate the wheel 120 degrees and install the wheel in the new position

- Tighten the road wheel nuts in sequence to the following:
- Stage 1: 4 Nm.
- Stage 2: 70 Nm.
- Stage 3: 140 Nm.

21. Zero DTI and rotate wheel one complete revolution to measure disc runout. Disc runout must not exceed 0.09 mm (0.003 in).

22. Remove the DTI.

23. Install the brake caliper anchor bolts
 - Tighten the bolts to 115 Nm (85 lb.ft).



E119130

24. Install the wheel.
 - Tighten the road wheel nuts in sequence to the following:
 - Stage 1: 4 Nm.
 - Stage 2: 70 Nm.
 - Stage 3: 140 Nm.

25. Depress brake pedal several times to set brake pads.

26. Remove stands and lower vehicle.

Brake System - General Information - Brake Pad Bedding-In

General Procedures



NOTE: This procedure is to gradually increase the temperature in the braking components without inducing thermal shock and to mate the brake pad and disc friction surfaces.

1. With the vehicle stationary, pump the brake pedal until the pedal is firm.
2. Drive the vehicle and make sure that the braking system operates correctly.



3. NOTE: The following steps must be done without excessive traffic.

Using light to medium deceleration and varying speeds, leave at least 0.5 mile (0.8 Km) between each brake application.

4. Drive the vehicle, performing 30 brake applications, with a duration of 3 seconds for each application.

Front Disc Brake -

Item	Specification
Disc type	Ventilated
Disc diameter:	
Vehicles with 4.0L or 2.7L diesel engine	317 mm (12.6 in)
Vehicles with 5.0L or 3.0L diesel engine	360 mm (14.2 in)
Disc thickness:	
New	30.0 mm (1.18 in)
Service limit	27.0 mm (1.063 in)
Maximum disc run-out - disc installed	0.05 mm (0.002 in)
Caliper type	Sliding pin, twin piston
Piston diameter	48.0 mm (1.8 in)
Pad minimum thickness	3.0 mm (0.12 in)
Brake pad wear warning lead:	
Location	Front left hand brake pad
Activates at	75% of pad life utilised

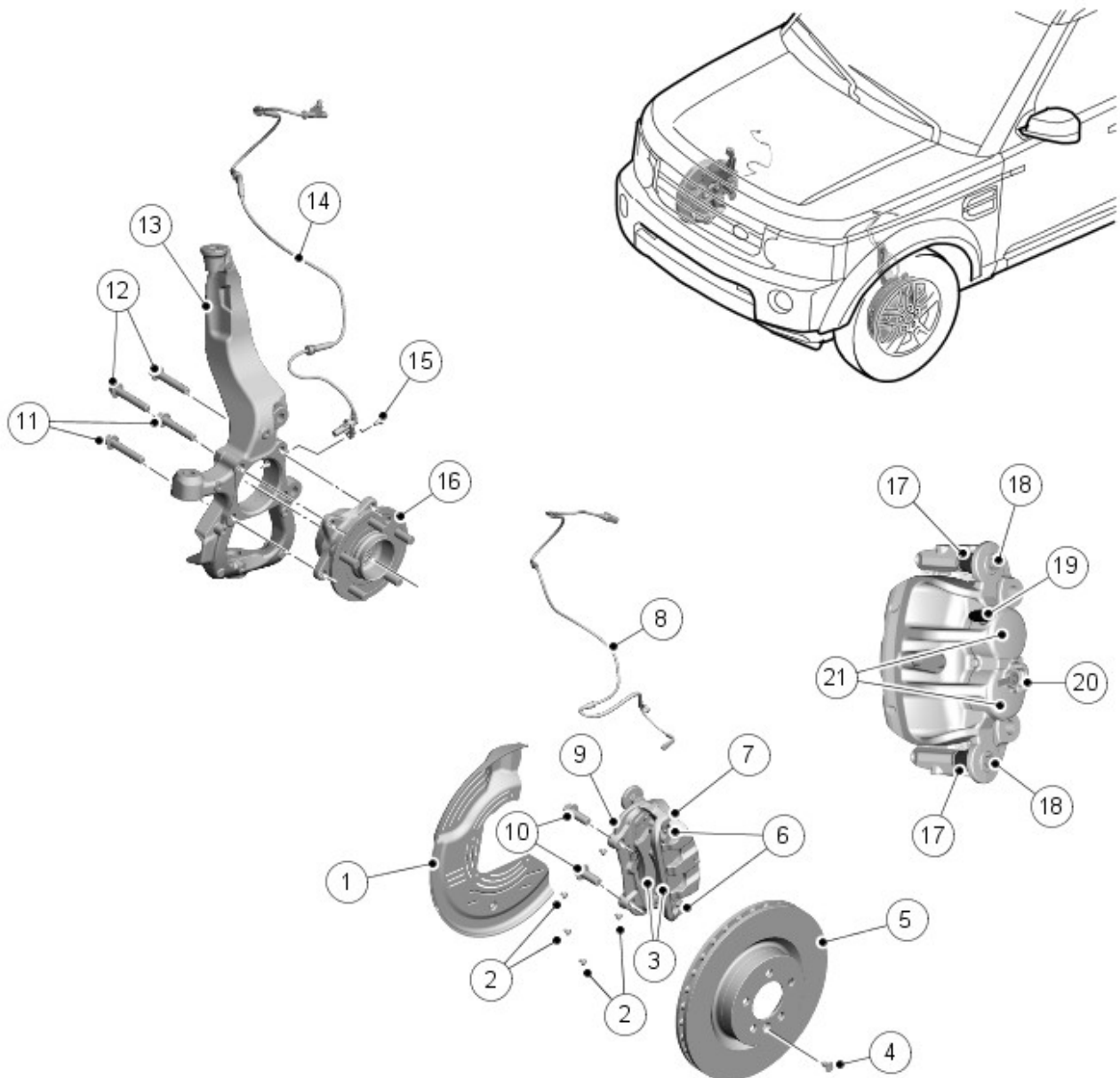
Torque Specifications

Description	Nm	lb-ft
Brake caliper bleed screw	10	7
Brake disc Torx screw	16	12
Brake caliper anchor plate bolts	275	202
Brake caliper housing bolts	35	26
Brake hose union	32	24
Brake hose retaining bracket to wheel knuckle bolt	22	16
Road wheel nuts	140	103

Front Disc Brake - Front Disc Brake

Description and Operation

COMPONENT LOCATION



E150854

Item	Part Number	Description
1	-	Dust shield
2	-	Dust shield screw (5 off)
3	-	Brake pad
4	-	Brake disc retaining bolt
5	-	Brake disc
6	-	Guide pin (2 off)
7	-	Caliper body
8	-	Brake pad wear sensor lead
9	-	Caliper carrier
10	-	Caliper bolt (2 off)
11	-	Wheel hub bolt
12	-	Wheel hub bolt
13	-	Wheel knuckle
14	-	Wheel speed sensor
15	-	Wheel speed sensor bolt
16	-	Wheel hub

17	-	Guide pin dust cover (2 off)
18	-	Guide pin (2 off)
19	-	Bleed screw
20	-	Dust cover
21	-	Piston (2 off)

OVERVIEW

Each front brake each consists of a twin piston brake brake caliper, a ventilated brake disc and a dust shield. All models the same brake caliper, disc and dust shield.

The brake brake caliper is attached to the rear of the wheel knuckle. The brake pads are made from an asbestos free material. The inboard brake pad of the left front brake incorporates a wear sensor.

When hydraulic pressure is supplied to the brake caliper, the pistons extend and force the inner pad against the disc. The brake caliper reacts and slides on the guide pins to bring the outer pad into contact with the disc.

The front brake pad wear sensor is connected in series with the rear brake pad wear sensor, between the Instrument Cluster (IC) and ground. When a brake pad incorporating a brake pad wear sensor is approximately 75% worn, the brake pad wear sensor goes open circuit. When the IC detects the open circuit, it illuminates the amber Light Emitting Diode (LED) in the brake warning indicator and displays an appropriate warning in the message center and sound a warning chime.

For additional information, refer to: Instrument Cluster (413-01, Description and Operation).

At the beginning of each ignition cycle, the IC performs a bulb check on the brake warning indicator: the indicator is illuminated amber for 1.5 seconds, red for 1.5 seconds, then goes off.

Front Disc Brake - Front Disc Brake

Description and Operation

The braking system has been modified to compensate for the additional weight of the armoured vehicle.

Heavy-duty calipers are mated to larger diameter discs. The discs are ventilated with directionally curved veins for increased airflow and consequently optimum cooling. The inboard side of the disc is protected by a one piece dust-shield.

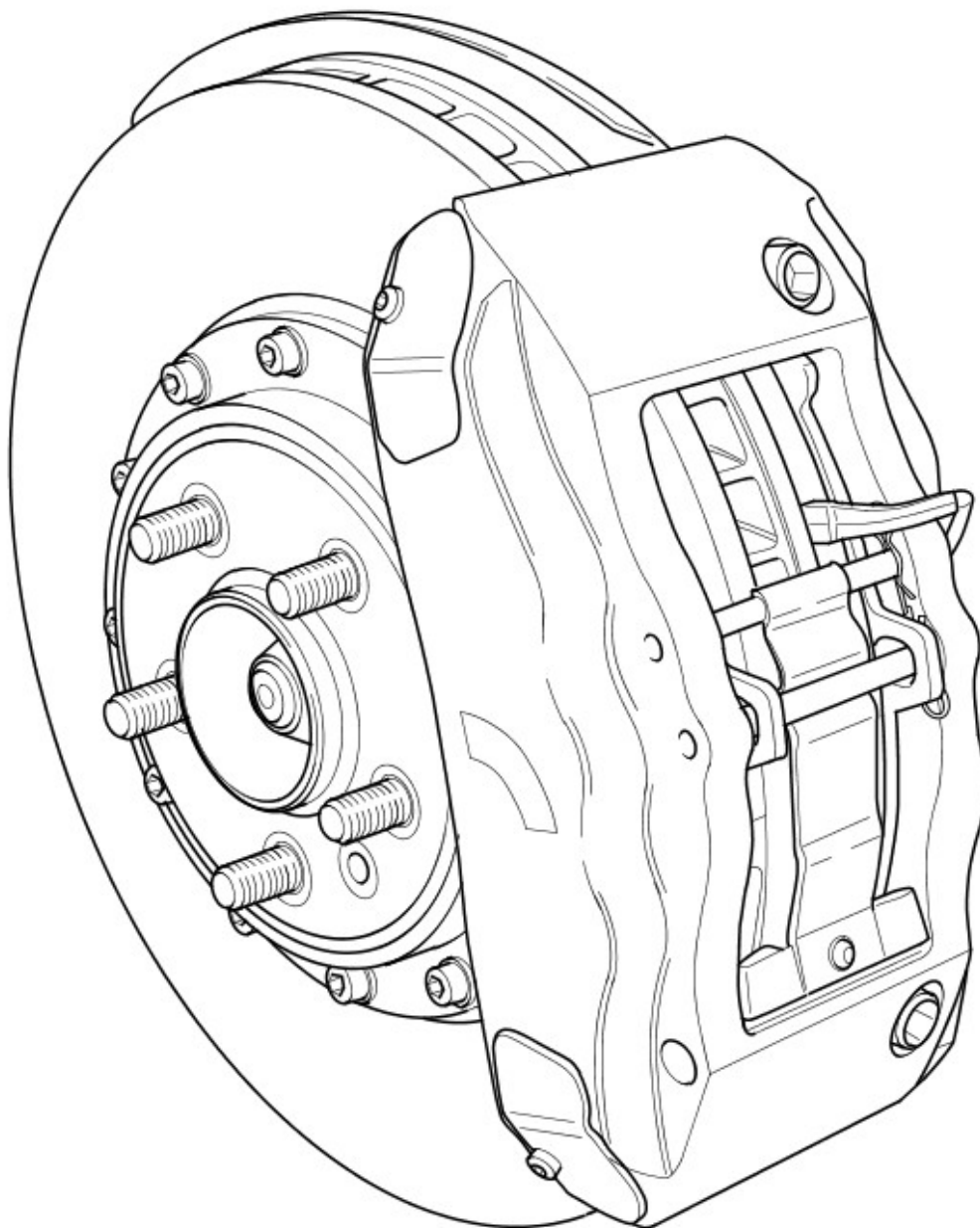
The front monobloc calipers are attached to the vehicle's wheel knuckles, and comprise three pairs of horizontally opposed pistons. With each pair of pistons being a different diameter to the other pairs of pistons:

- the smallest pair of pistons are at the leading edge of the pad, and
- the largest pair of pistons furthest from the leading edge.

This staggered piston arrangement provides a progressive braking force and even wear by reducing tapered wearing of the brake pads.

The brake pads also provide a firm consistent pedal with excellent cold performance for start-up and low-speed driving and are specially formulated for resistance to fade at high temperatures.

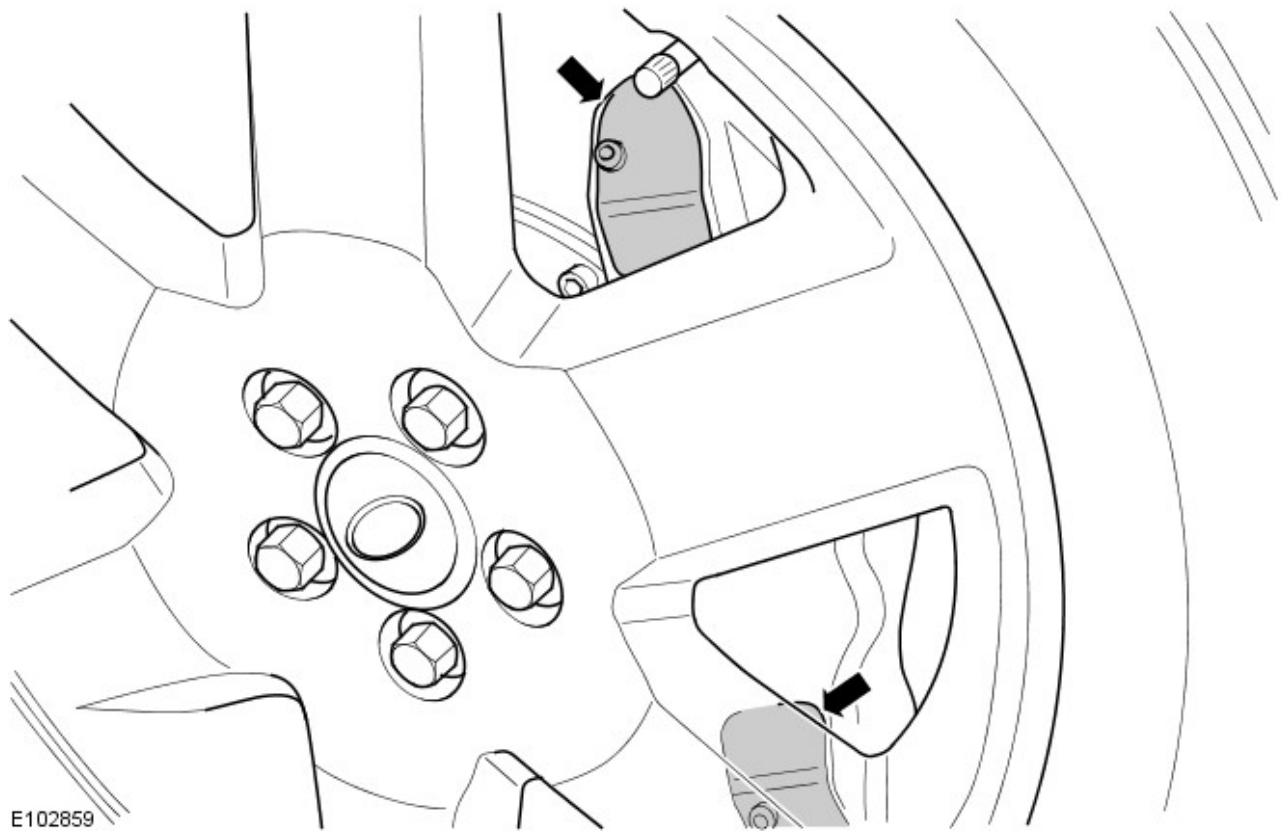
Heavy-duty caliper and large diameter brake disc



E102858

Each front brake caliper has two bleed screws fitted with tamper proof protective covers to prevent unauthorized access.

Bleed screw covers



E102859

Front Disc Brake - Brake Disc Vehicles With: Standard Brakes

Removal and Installation

Removal



WARNING: If installing a new brake disc, install new brake pads.



CAUTION: Brake discs must be renewed in pairs.

NOTES:

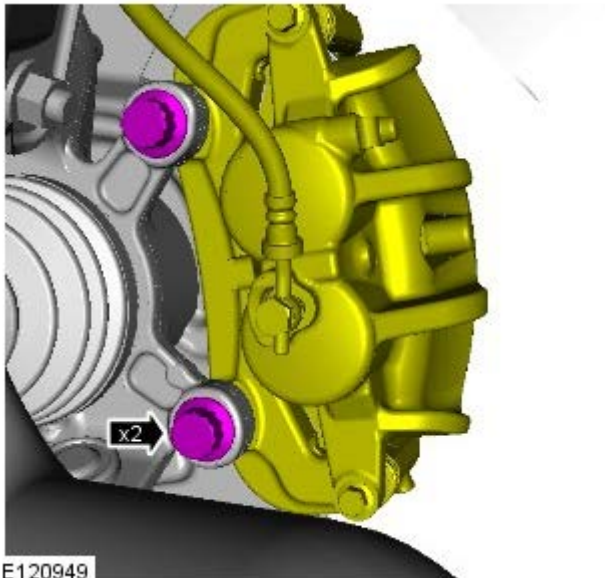


Some variation in the illustrations may occur, but the essential information is always correct.



The brake pad wear warning indicator sensor must be replaced each time the brake pads are serviced.

- WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
- Remove the front wheel and tire.



- CAUTIONS:**



Do not allow the brake caliper to hang on the brake hose.

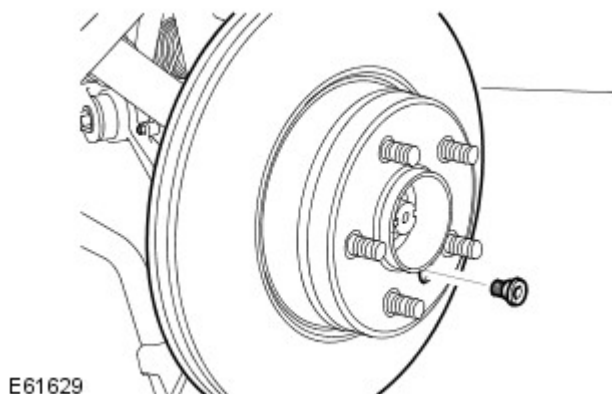


LH side: Do not allow the brake caliper to hang on the brake pad wear warning sensor lead.

Remove the brake caliper and anchor plate.

- Remove the brake caliper anchor bolts.
- Tie the brake caliper aside.

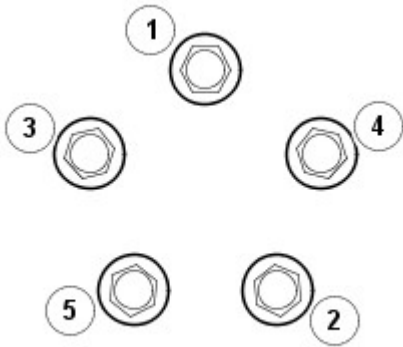
- Remove the front brake disc.
 - Remove the Allen screw.




Installation

- Make sure the brake disc and hub mating surfaces are clean.
- Install the brake disc.
 - Tighten the Torx screw to 35 Nm (26 lb.ft).

3. Install the brake caliper and anchor plate.
 - Clean the component mating faces.
 - Tighten the bolts to 275 Nm (203 lb.ft).



4.  **NOTE:** Tighten the wheel nuts in the sequence shown:

Install the wheels and tires.

- Stage 1 : 4Nm
- Stage 2 : 70Nm
- Stage 3 : 140Nm

E74593

5. Depress the brake pedal several times, check the fluid level in the brake fluid reservoir and top-up with brake fluid if necessary.
6. For additional information, refer to: Brake Pad Bedding-In (206-00 Brake System - General Information, General Procedures).

Front Disc Brake - Brake Pads Vehicles With: Standard Brakes

Removal and Installation

Removal

WARNINGS:



Brake pads must be renewed in axle sets only, otherwise braking efficiency may be impaired.



If the brake pad wear warning light has been activated, the pad wear sensor must be replaced.

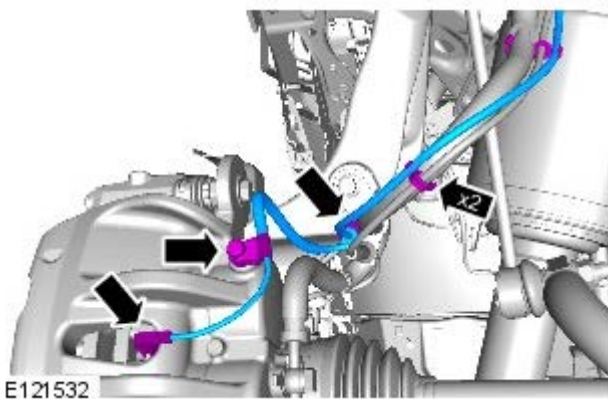


NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the wheels and tires.



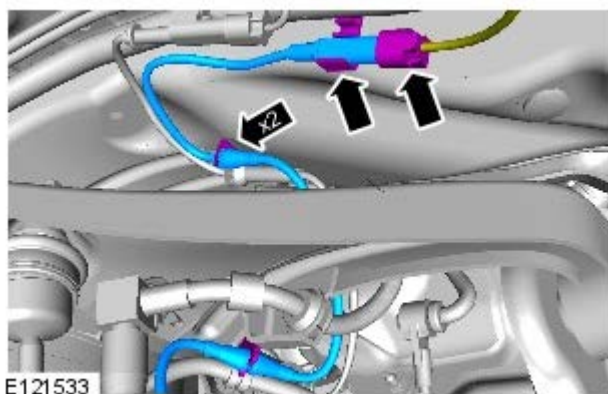
3. **CAUTION:** The brake pad wear indicator sensor is easily damaged. Do not use a lever to remove the sensor. Use fingers only.

LH side front: Disconnect the brake pad wear indicator sensor wiring harness.

4. **NOTE:** This step is only required if a new wear indicator harness is installed.

Remove the front LH fender splash shield.

For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).

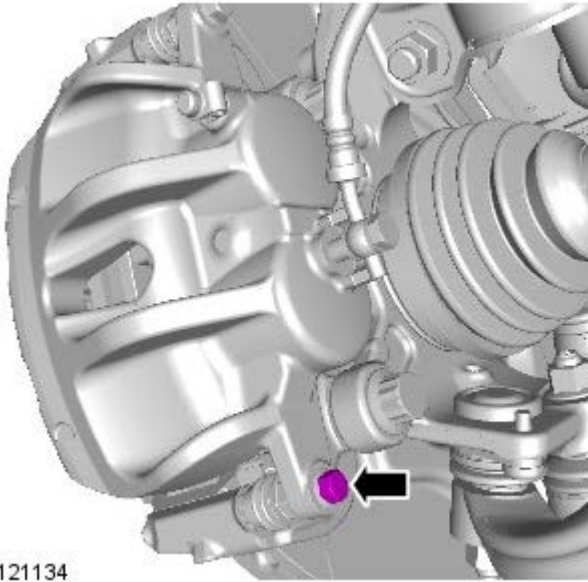


5. **NOTE:** This step is only required if a new wear indicator harness is installed.

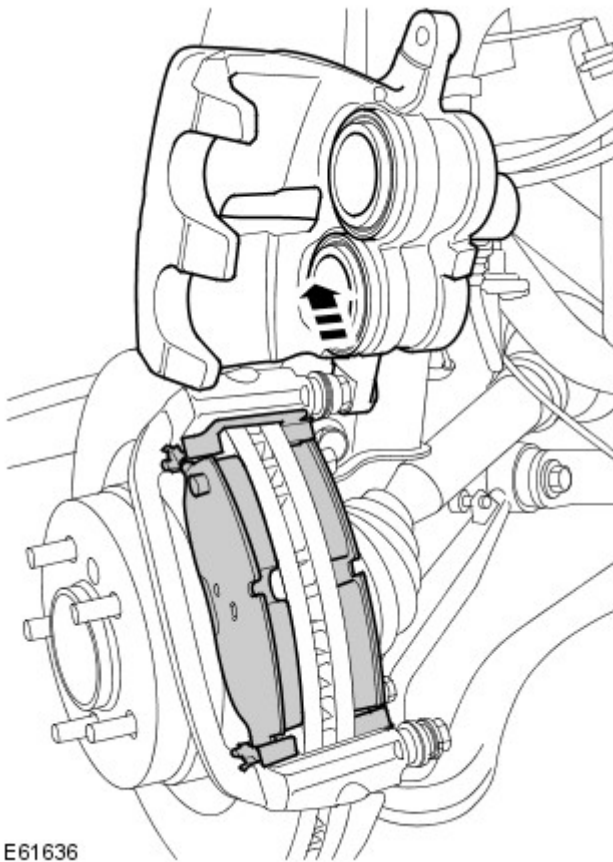
LH side front: Release and disconnect the brake pad wear indicator wiring harness.

6. **NOTE:** Use an additional wrench to prevent the component from rotating.


Remove the brake caliper lower bolt.



E121134



E61636


7.  **NOTE:** Note the orientation of the brake pads including the position of the small mass on the outer pad.

Remove the brake pads.

- Rotate the brake caliper upwards.
- Remove the 2 clips.

8. Repeat the above 2 steps for the other side.

Installation

1.  **WARNING:** Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

Clean the brake caliper housing and anchor plate using brake cleaning fluid.

2. Inspect the caliper piston and slide pin seals for damage.


3. **CAUTIONS:**




The brake caliper should move freely on both slide


pins.

 If necessary, renew the components.


 **Make sure that the plain slide pin is installed to the upper part of the caliper and the bushed slide pin is installed to the lower part.**

Check the slide pins for correct operation.

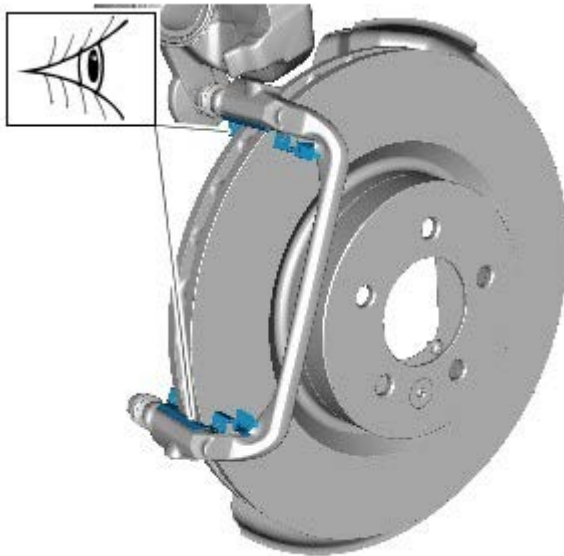
4.  **CAUTION:** Check the brake fluid reservoir level before pushing the piston back, failure to follow this instruction may result in damage to the vehicle.

 **NOTE:** As the piston is pushed back into the caliper housing, the brake fluid level in the reservoir will rise. Do not allow the reservoir to overflow.

Press the pistons into the caliper housing.

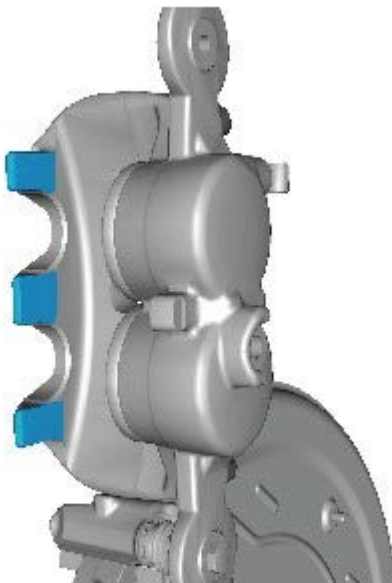
5.  **CAUTION:** **Make sure that the plain clip is installed to the bottom part of the caliper and the rubber coated clip is installed to the upper part.**

Install the 2 clips




E147727

6. Apply a suitable amount of the supplied grease to the caliper, as illustrated.



E147730

7.  **NOTE:** Make sure the brake pads are installed in the correct orientation.

Install the brake pads.

8. Rotate the brake caliper downwards.
 - Tighten the bolt to 35 Nm.
9. Repeat the above procedure for the other side.

10.  NOTE: This step is only required if a new wear indicator harness is installed.

LH side front: Connect the brake pad wear indicator wiring harness electrical connection.

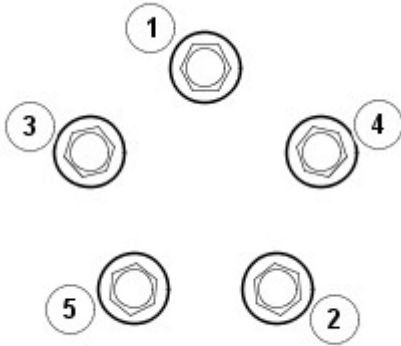
11.  NOTE: This step is only required if a new wear indicator harness is installed.

Install the front LH fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).

12. LH side front: Connect the brake pad wear indicator wiring harness.

13. Install the wheels and tires.
 - Tighten the wheel nuts in the sequence shown:

1. Stage 1: 4 Nm
2. Stage 2: 70 Nm
3. Stage 3: 140 Nm



E74593

14. Depress the brake pedal several times, check the fluid level in the brake fluid reservoir and top-up with brake fluid if necessary.
15. For additional information, refer to: Brake Pad Bedding-In (206-00 Brake System - General Information, General Procedures).

Front Disc Brake - Brake Caliper Vehicles With: Standard Brakes

Removal and Installation

Removal



CAUTION: LH illustration shown, RH is similar.

NOTES:



Removal steps in this procedure may contain installation details.

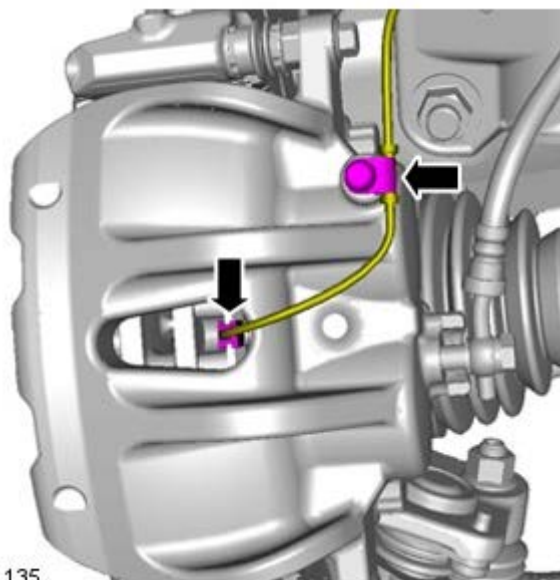


Some variation in the illustrations may occur, but the essential information is always correct.

- WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

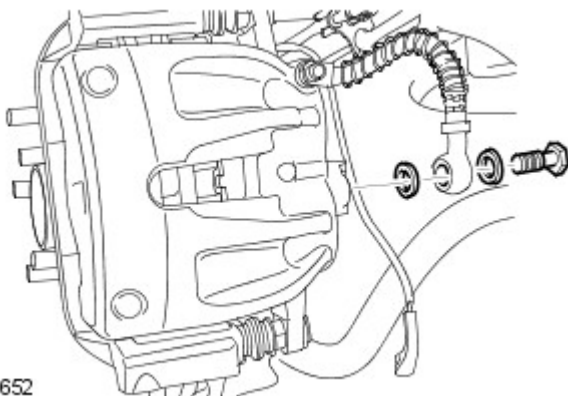
- Remove the wheel and tire.



E121135

- CAUTION:** The brake pad wear indicator sensor is easily damaged. Do not use a lever to remove the sensor. Use fingers only.

LH side only: Disconnect the brake pad wear indicator sensor.



E61652

- WARNING:** Be prepared to collect escaping fluid.



CAUTION: Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Disconnect the brake hose from the brake caliper.

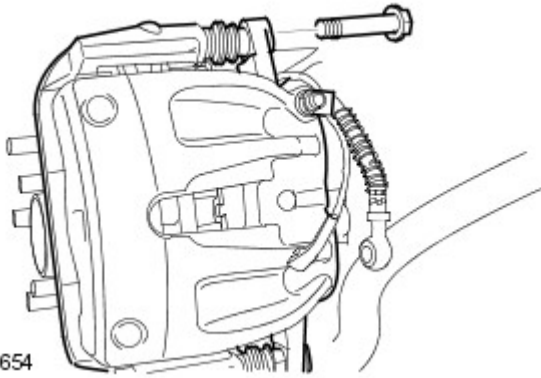
- Remove the union.
- Remove and discard the two sealing washers.
- Install blanking caps to the exposed ports.


- NOTE:** Note the orientation of the brake pads.

Remove the brake pads.

For additional information, refer to: Brake Pads - Vehicles With: Standard Brakes (206-03 Front Disc Brake, Removal and Installation).

E61654



6.  **NOTE:** Use an additional wrench to prevent the component from rotating.


Remove the brake caliper housing.

- Remove the brake caliper upper bolt.

Installation


1. **NOTES:**

 Use an additional wrench to prevent the component from rotating.

 Make sure the brake caliper guide pins are installed in the correct orientation.

Install the brake caliper.

- Tighten the brake caliper upper bolt to 35 Nm (26 lb.ft).


2.  **NOTE:** Make sure the brake pads are installed in the correct orientation.

Install the brake pads.

For additional information, refer to: Brake Pads - Vehicles With: Standard Brakes (206-03 Front Disc Brake, Removal and Installation).

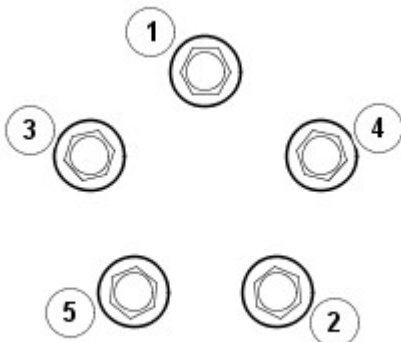
- Apply a suitable amount of the supplied grease to the mating faces of the brake pads and brake calipers.

3. Connect the brake hose to the brake caliper.
- Clean the component mating faces.
 - Remove the blanking caps from the ports.
 - Install new sealing washers.
 - Tighten the brake hose union to 32 Nm (24 lb.ft).
4. LH side only: Connect the brake pad wear indicator sensor.
5. Bleed the brake caliper.
For additional information, refer to: Component Bleeding (206-00 Brake System - General Information, General Procedures).

6.  **NOTE:** Tighten the wheel nuts in the sequence shown:

Install the wheels and tires.

- Stage 1 : 4Nm
- Stage 2 : 70Nm
- Stage 3 : 140Nm



E74593

Rear Disc Brake -

Item	Specification
Disc type	Ventilated
Disc diameter:	
Vehicles with 4.0L or 2.7L diesel engine	325 mm (12.7 in)
Vehicles with 5.0L or 3.0L diesel engine	354 mm (13.9 in)
Disc thickness - All engines:	
New	20.0 mm (0.78 in)
Service limit	18.0 mm (0.71 in)
Maximum disc run-out - disc installed	0.09 mm (0.003 in)
Caliper type	Sliding pin, single piston
Piston diameter	45.0 mm (1.7 in)
Pad minimum thickness	3.0 mm (0.12 in)
Brake pad wear warning lead:	
Location	Rear right hand brake pad
Activates at	75% of pad life utilised

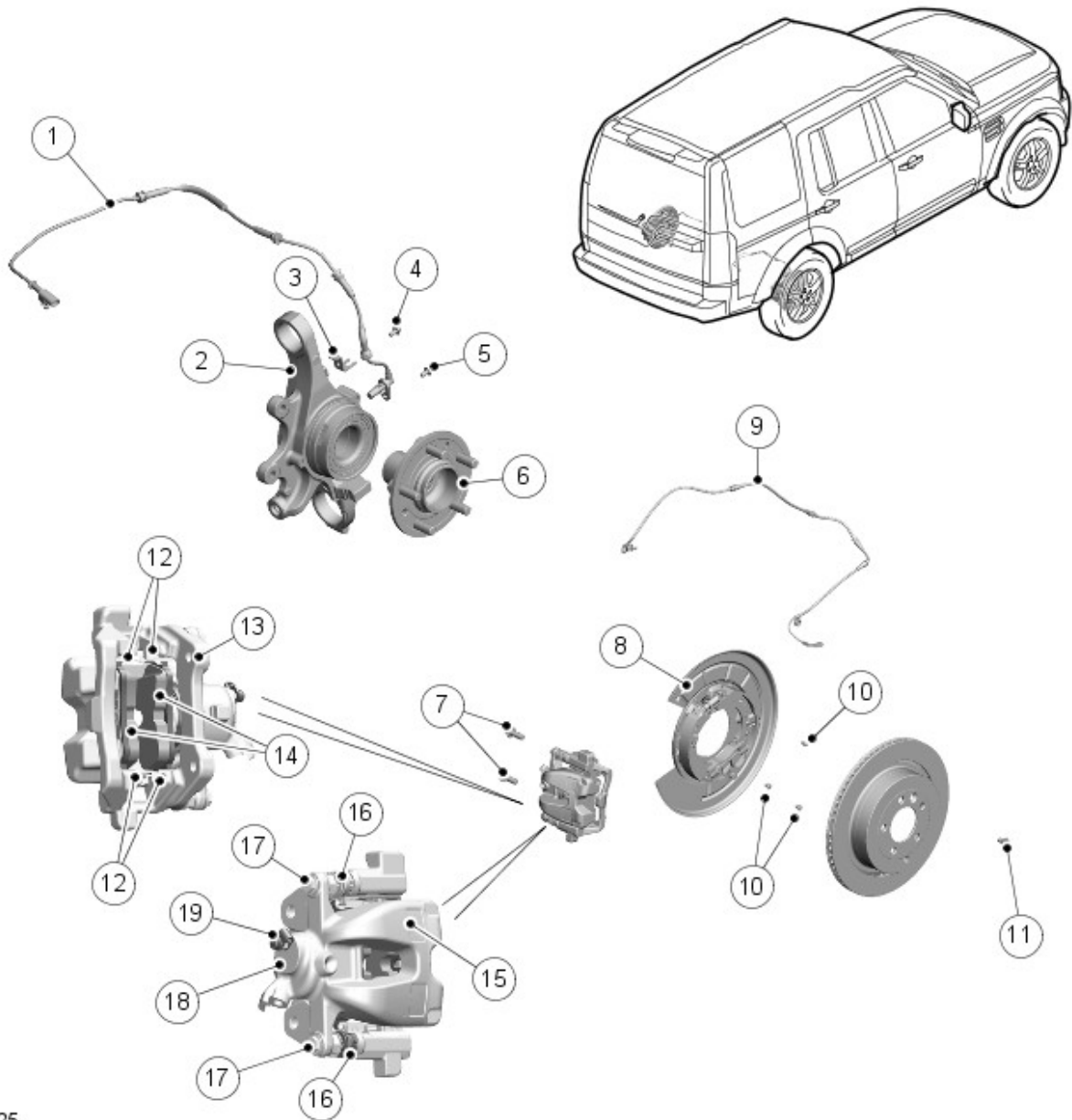
Torque Specifications

Description	Nm	lb-ft
Brake caliper bleed screw	10	7
Brake caliper housing to anchor plate bolts	35	26
Brake hose union	32	24
Brake disc Torx screw	16	12
Brake caliper anchor plate to wheel knuckle bolts	115	85
Road wheel nuts	140	103

Rear Disc Brake - Rear Disc Brake

Description and Operation

COMPONENT LOCATION



E150925

Item	Part Number	Description
1	-	Wheel speed sensor
2	-	Wheel knuckle
3	-	Wheel speed sensor holder
4	-	Wheel speed sensor holder bolt
5	-	Wheel knuckle
6	-	Wheel speed sensor bolt
7	-	Wheel hub
8	-	Dust shield
9	-	Brake pad wear sensor
10	-	Dust shield screw (3 off)
11	-	Brake disc retaining bolt
12	-	Brake pad retainers
13	-	Caliper body
14	-	Brake pad
15	-	Caliper carrier
16	-	Guide pin dust cover (2 off)

17	-	Guide pin (2 off)
18	-	Piston
19	-	Bleed screw and bleed screw dust cap

OVERVIEW

Each rear brake consists of a single piston brake caliper, a ventilated brake disc and a dust shield (integrated as part of the parking brake). TDV6 3.0L DIESEL models feature a different brake caliper and disc than the V6 3.0L S/C PETROL, TDV8 4.4L DIESEL and V8 S/C 5.0L PETROL models. The dust shield and parking brake are common on all derivatives.

The brake caliper is attached to the wheel knuckle. The brake pads are made from an asbestos free material. The inboard brake pad of the right rear brake incorporates a wear sensor.

When hydraulic pressure is supplied to the brake caliper, the piston extends and forces the inner pad against the disc. The brake caliper body reacts and slides on the guide pins to bring the outer pad into contact with the disc.

The rear brake pad wear sensor is connected in series with the front brake pad wear sensor, between the Instrument Cluster (IC) and ground. When a brake pad incorporating a brake pad wear sensor is approximately 75% worn, the brake pad wear sensor goes open circuit. When the IC detects the open circuit, it illuminates the amber Light Emitting Diode (LED) in the brake warning indicator and also displays an appropriate warning in the message center and sound a warning chime.

For additional information, refer to: Instrument Cluster (413-01, Description and Operation).

At the beginning of each ignition cycle, the IC performs a bulb check on the brake warning indicator: the indicator is illuminated amber for 1.5 seconds, then red for 1.5 seconds.

Rear Disc Brake - Rear Disc Brake

Description and Operation

The braking system has been modified to compensate for the additional weight of the armoured vehicle.

Heavy-duty calipers are mated to larger diameter discs. The discs are ventilated with directionally curved veins for increased airflow and consequently optimum cooling. The inboard side of the disc is protected by a one piece dust-shield.

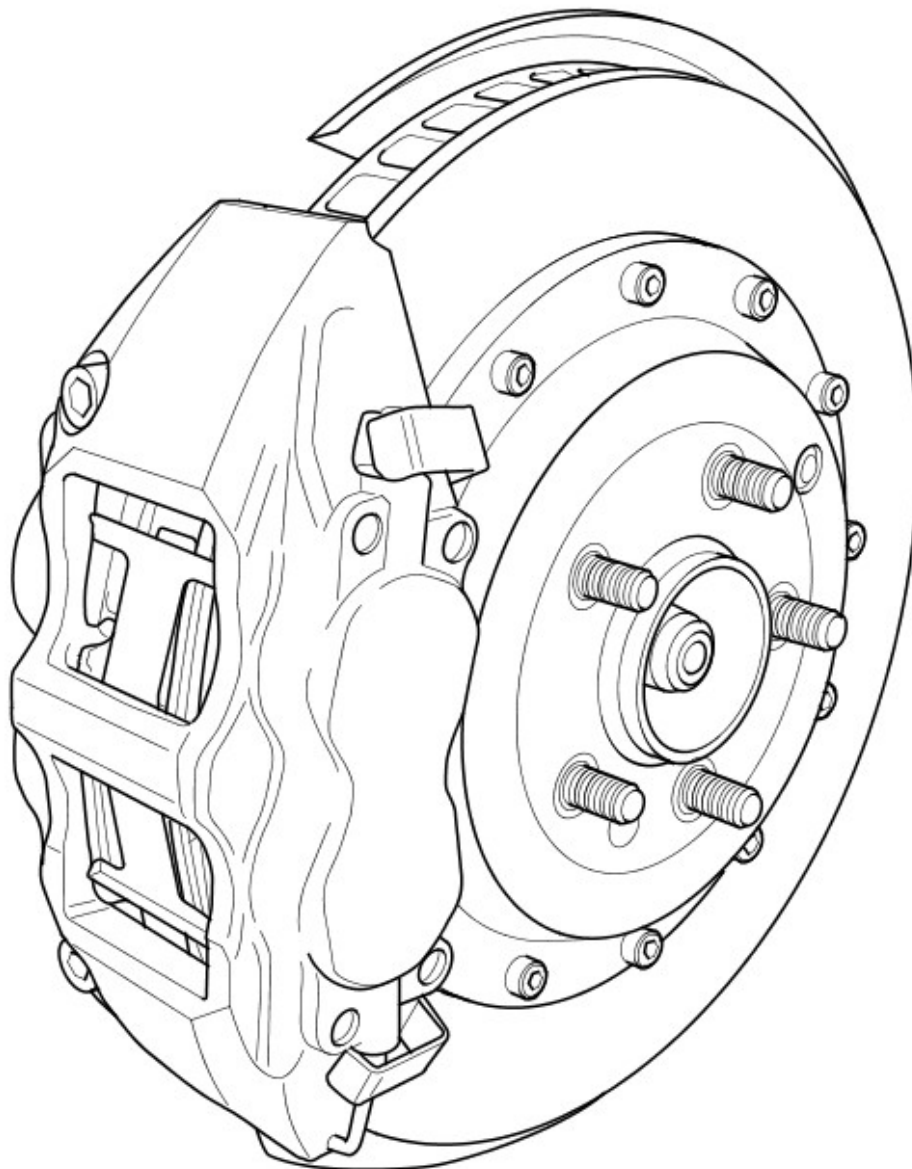
The rear monobloc calipers are attached to the vehicle's wheel knuckles, and comprise two pairs of horizontally opposed pistons. With each pair of pistons being a different diameter to the other pair of pistons:

- the smallest pair of pistons are at the leading edge of the pad, and
- the largest pair of pistons furthest from the leading edge.

This staggered piston arrangement provides a progressive braking force and even wear by reducing tapered wearing of the brake pads.

The brake pads also provide a firm consistent pedal with excellent cold performance for start-up and low-speed driving and are specially formulated for resistance to fade at high temperatures.

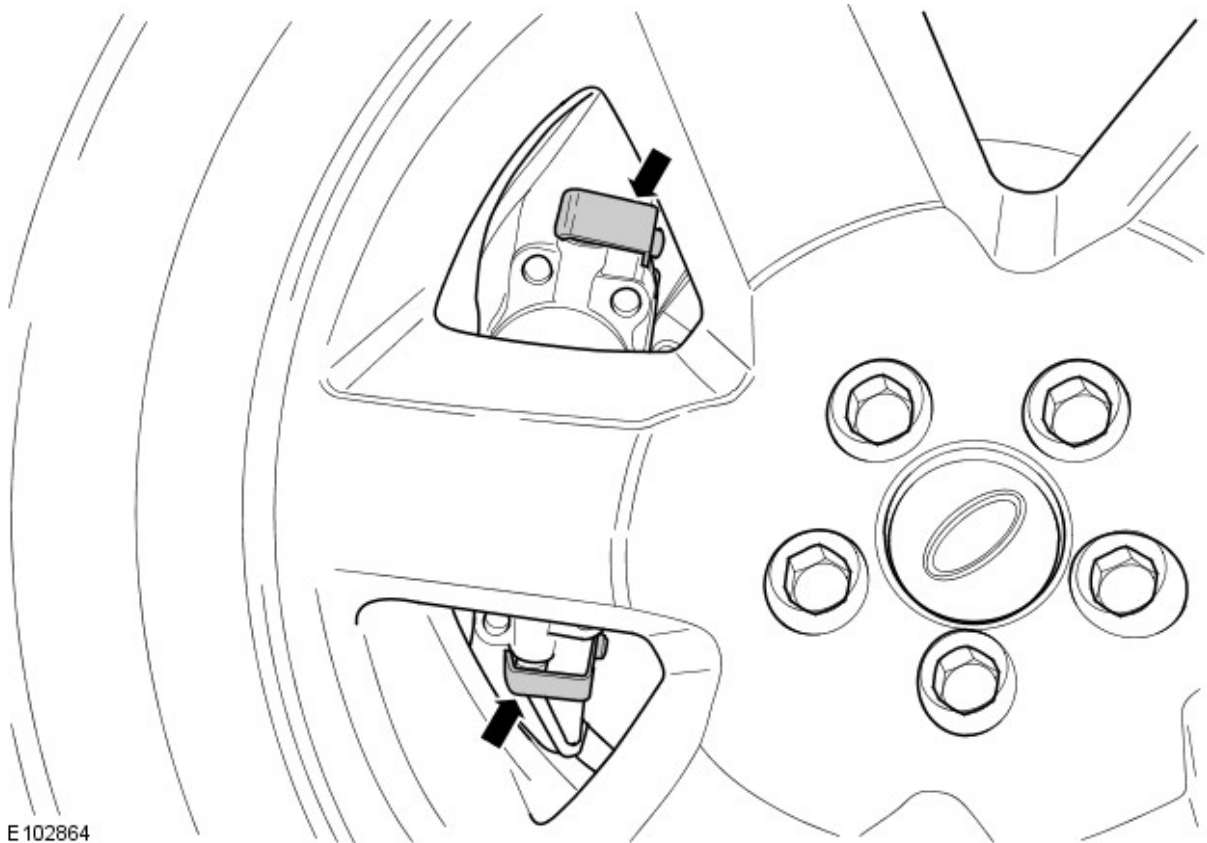
Heavy-duty caliper and large diameter brake disc



E102863

Each rear brake caliper has two bleed screws fitted with tamper proof protective covers to prevent unauthorized access.

Bleed screw covers



E 102864

Rear Disc Brake - Brake Disc

Removal and Installation

Removal



WARNING: If installing a new brake disc, install new brake pads.



CAUTION: Brake discs must be renewed in pairs.

NOTES:



If the parking brake shoes or the brake discs have been removed for access to other components then DO NOT carry out the bedding in procedure.



LH illustration shown, RH is similar.



The brake pad wear warning indicator sensor must be replaced each time the brake pads are serviced.

1. Using the Land Rover approved diagnostic system, drive the parking brake to the 'mounting position'.

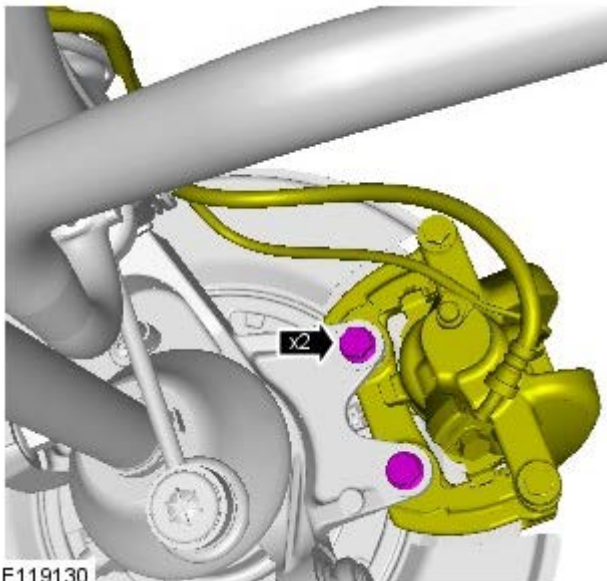


2. **WARNING:** Make sure to support the vehicle with axle stands.


Raise and support the vehicle.

3. Remove the rear wheel and tire.

4. Remove the brake caliper and anchor plate.

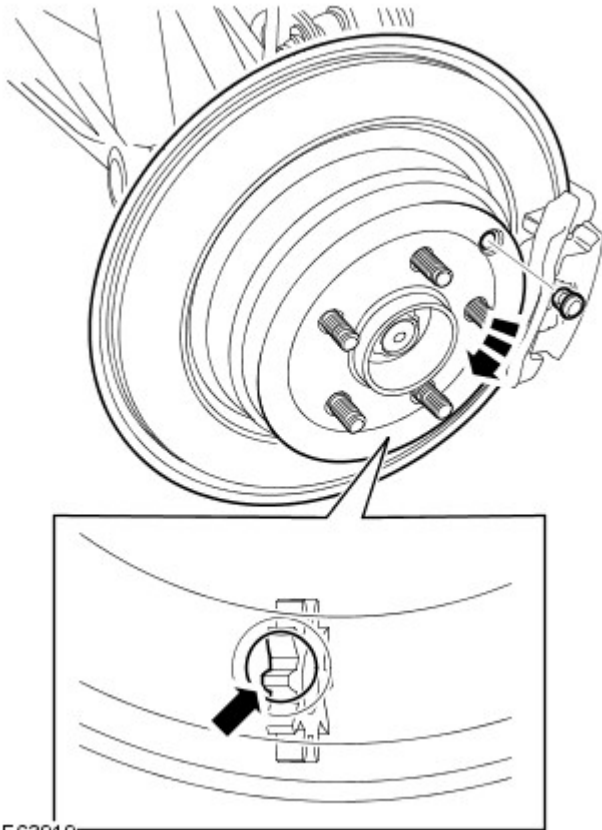


E119130

5.  **NOTE:** Rotate the rear brake disc to locate the parking brake shoe adjuster.

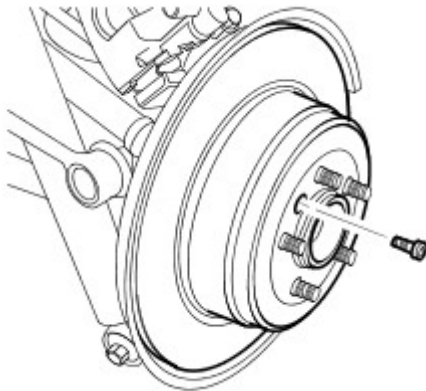
Release the parking brake shoe adjustment.

- Remove the parking brake shoe adjuster access plugs.
- Rotate the parking brake shoe adjuster.



E63919

6. Remove the rear brake disc.
 - Remove the Allen screw.



E63921

Installation

1. Make sure that the rear brake disc and hub mating surfaces are clean.
2. Install the rear brake disc.
 - Tighten the bolt to 35 Nm (26 lb.ft).
3. Install the brake caliper and anchor plate.
 - Tighten the bolts to 115 Nm (85 lb.ft).
4. Adjust the parking brake.

For additional information, refer to: Parking Brake Shoe and Lining Adjustment (206-05 Parking Brake and Actuation, General Procedures).
5. Install the rear wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
6. For additional information, refer to: Brake Pad Bedding-In (206-00, General Procedures).

Rear Disc Brake - Brake Pads

Removal and Installation

Removal



WARNING: Brake pads must be renewed in axle sets only, otherwise braking efficiency may be impaired.

NOTES:



RH illustration shown, LH is similar.



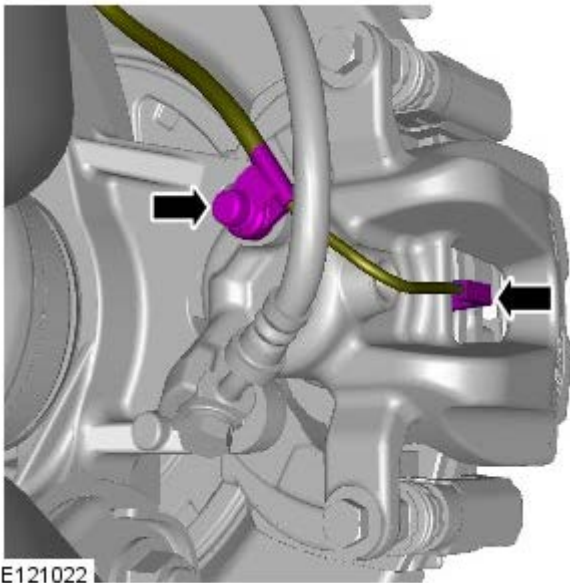
The brake pad wear warning indicator sensor must be replaced each time the brake pads are serviced.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

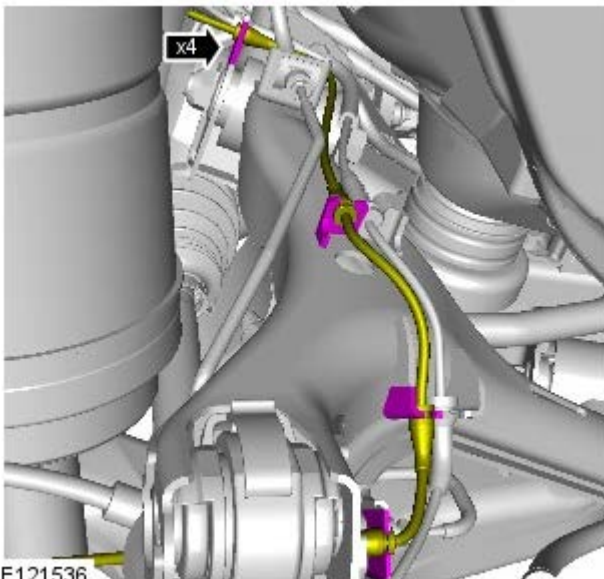
2. Remove the wheels and tires.

3. RH side rear: Disconnect the brake pad wear indicator sensor wiring harness.



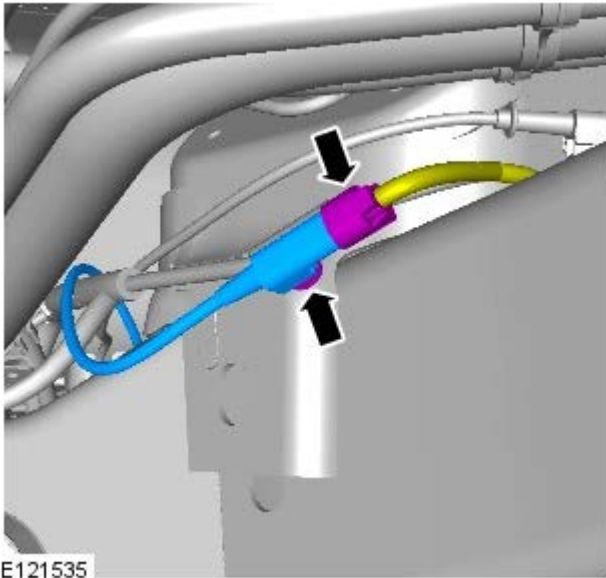
E121022

4. RH side rear: Disconnect the brake pad wear indicator sensor wiring harness.



E121536

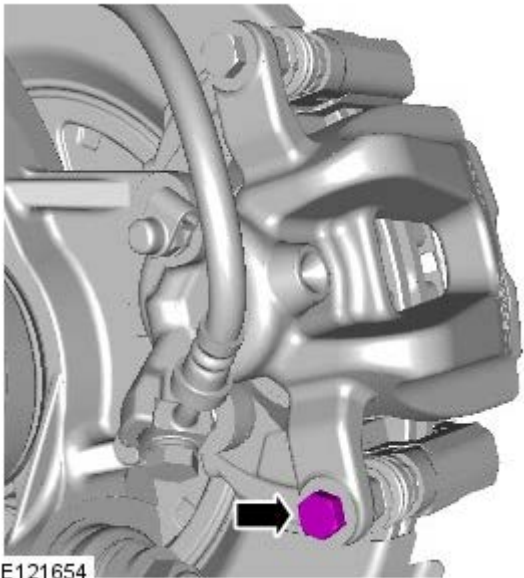
5. RH side rear: Release and disconnect the brake pad wear indicator wiring harness electrical connector.



E121535

6.  **NOTE:** Use an additional wrench to prevent the component from rotating.

Remove the brake caliper lower bolt.



E121654

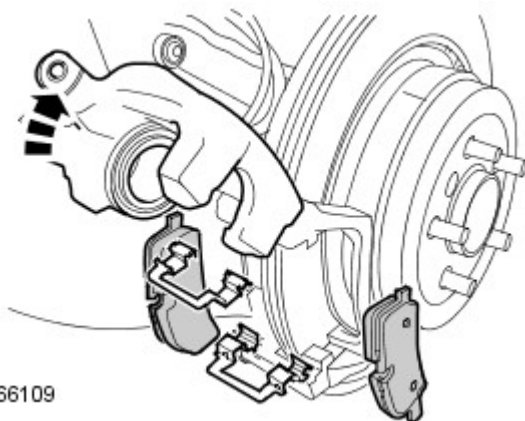
7. **NOTES:**

 **Note the orientation of the brake pads.**

 **Note the orientation of the clips.**

Remove the brake pads.


- Rotate the brake caliper upwards.
- Remove the 2 clips.



E66109

8. Repeat the above 2 steps for the other side.

Installation

1.  **WARNING:** Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

Clean the brake caliper housing and anchor plate using brake cleaning fluid.

2. Inspect the caliper piston and slide pin seals for damage.

3. CAUTIONS:




The brake caliper should move freely on both slide pins.



If necessary, renew the components.


Check the slide pins for correct operation.

4.  CAUTION: Check the brake fluid reservoir level before pushing the piston back, failure to follow this instruction may result in damage to the vehicle.



NOTE: As the piston is pushed back into the caliper housing, the brake fluid level in the reservoir will rise. Do not allow the reservoir to overflow.

Press the piston into the caliper housing.

5.  CAUTION: If installed, the adhesive strips covering the outer brake pads must be removed before installation. Failure to follow this instruction may result in damage to the vehicle.

If installed, remove the adhesive strips from the 2 outer brake pads.

6. NOTES:



Make sure the brake pads are installed in the correct orientation.



Make sure that the clips are installed in the correct orientation.

Install the brake pads.

- Install the 2 clips.

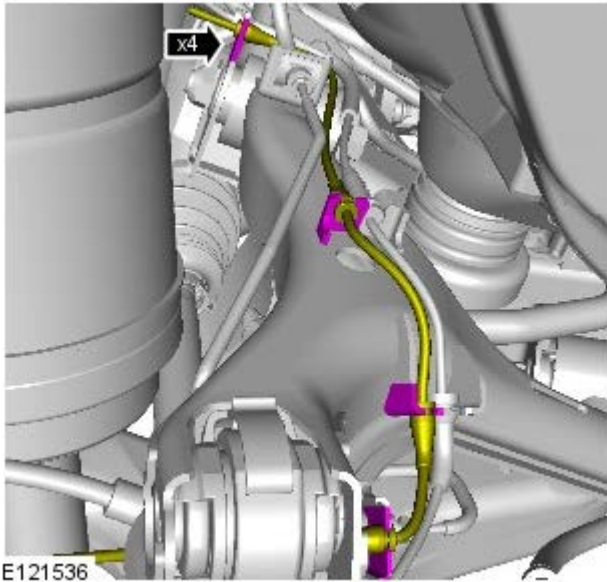
7. Rotate the brake caliper downwards.

- Tighten the brake caliper lower bolt to 35 Nm (26 lb.ft).

8. Repeat the above procedure for the other side.

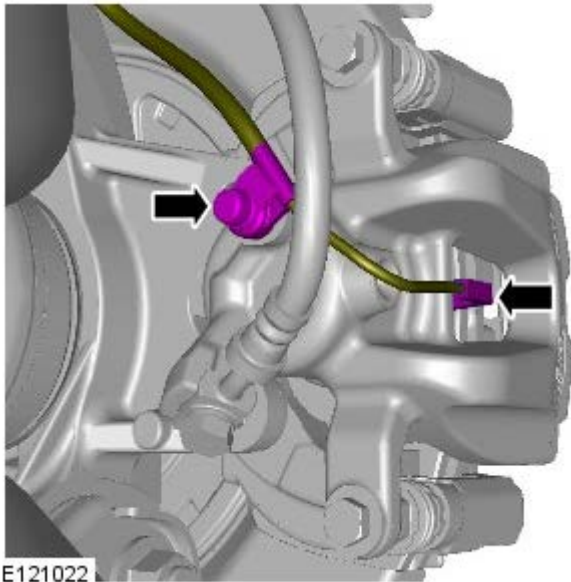
9. RH side rear: Connect the brake pad wear indicator wiring harness electrical connection.

10. RH side rear: Connect the brake pad wear indicator sensor wiring harness.




E121536

11. RH side rear: Connect the brake pad wear indicator sensor wiring harness.

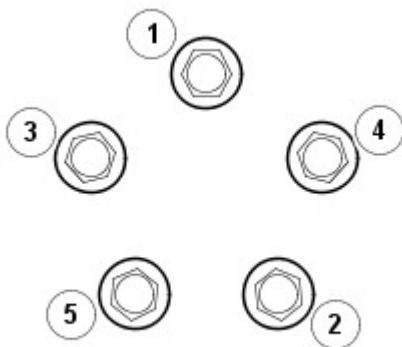


E121022

12.  **NOTE:** Tighten the wheel nuts in the sequence shown:

Install the wheels and tires.

- Stage 1 : 4Nm
- Stage 2 : 70Nm
- Stage 3 : 140Nm



E74593

13. Depress the brake pedal several times, check the fluid level in the brake fluid reservoir and top-up with brake fluid if necessary.
14. For additional information, refer to: Brake Pad Bedding-In (206-00 Brake System - General Information, General Procedures).

Rear Disc Brake - Brake Caliper

Removal and Installation



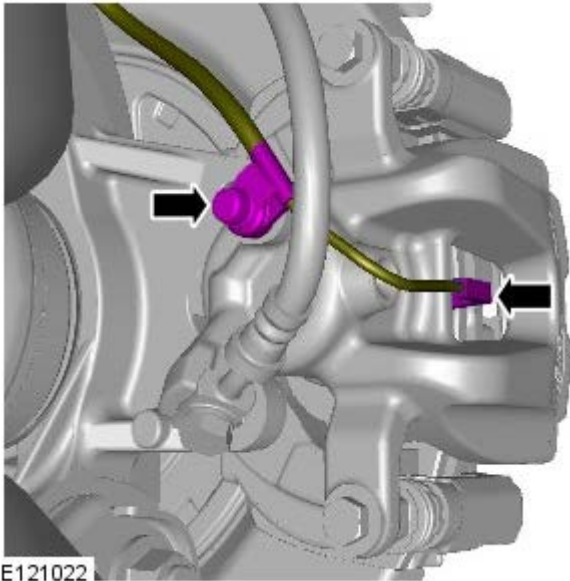
NOTE: RH illustration shown, LH is similar.

Removal

1. **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the wheel and tire.



E121022

3. **CAUTION:** The brake pad wear indicator sensor is easily damaged. Do not use a lever to remove the sensor. Use fingers only.

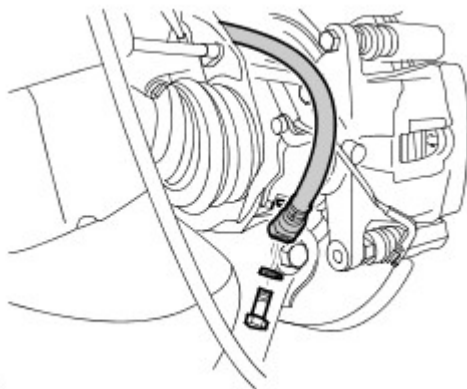
RH side only: Disconnect the brake pad wear indicator sensor.

- Release from the clip.

4. **NOTE:** Note the orientation of the brake pads.

Remove the brake pads.

For additional information, refer to: Brake Pads (206-04, Removal and Installation).



E66183

5. **CAUTION:** Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

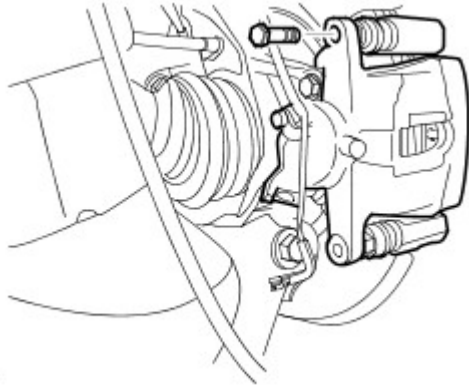
Disconnect the brake hose from the brake caliper.

- Remove the union.
- Remove and discard the two sealing washers.
- Install blanking caps to the exposed ports.

6. **NOTE:** Use an additional wrench to prevent the component from rotating.


Remove the brake caliper housing.

- Remove the brake caliper upper bolt.




E66184

Installation

1.  **NOTE:** Use an additional wrench to prevent the component from rotating.

Install the brake caliper.

- Tighten the brake caliper upper bolt to 35 Nm (26 lb.ft).

2.  **NOTE:** Make sure the brake pads are installed in the correct orientation.

Install the brake pads.

For additional information, refer to: Brake Pads (206-04, Removal and Installation).

3. Connect the brake hose to the brake caliper.
 - Clean the component mating faces.
 - Remove the blanking caps from the ports.
 - Install new sealing washers.
 - Tighten the brake hose union to 32 Nm (24 lb.ft).
4. Connect the brake pad wear indicator sensor.
5. Bleed the brake caliper.

For additional information, refer to: Component Bleeding - Vehicles With: Standard Brakes (206-00, General Procedures).
6. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

Rear Disc Brake - Brake Caliper Anchor Plate

Removal and Installation

Removal

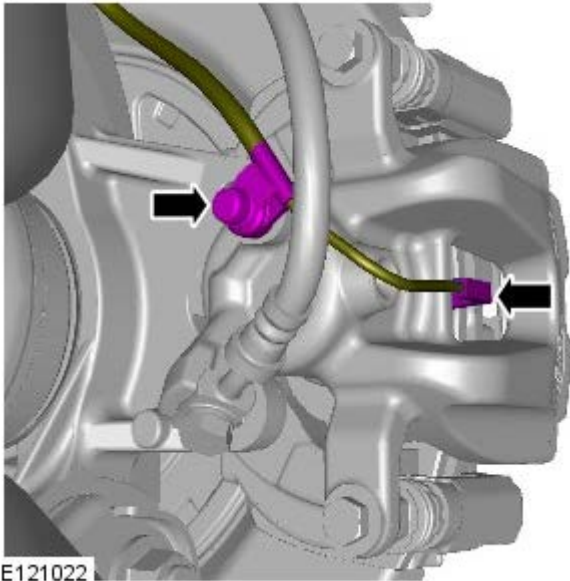


NOTE: RH illustration shown, LH is similar.

1. **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the wheel and tire.



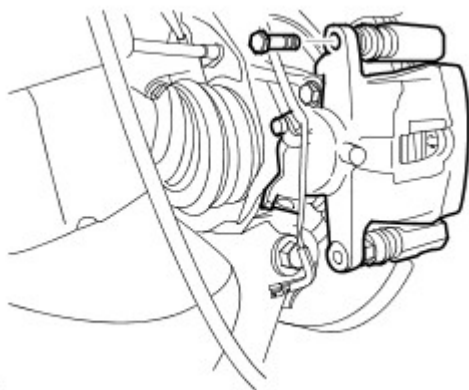
E121022

3. **CAUTION:** The brake pad wear indicator sensor is easily damaged. Do not use a lever to remove the sensor. Use fingers only.

RH side only: Disconnect the brake pad wear indicator sensor.

- Release from the clip.

4. Remove the rear brake pads.
For additional information, refer to: Brake Pads (206-04, Removal and Installation).



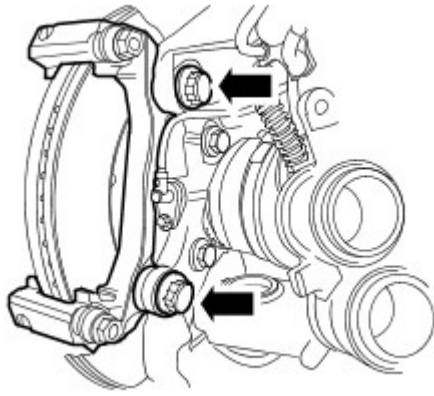
E66184

5. **NOTE:** Use an additional wrench to prevent the component from rotating.

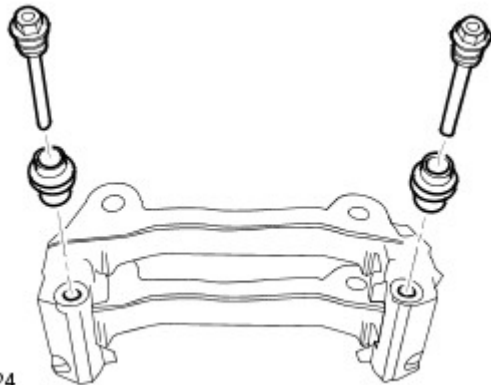
Remove the brake caliper housing.

- Remove the brake caliper upper bolt.


6. Remove the brake caliper anchor plate.



E52889



E53724

7.  **NOTE:** Note the orientation of the brake caliper guide pins.

Remove the guide pins and seals.

Installation

1. **CAUTIONS:**



The brake caliper should move freely on both slide pins.



If necessary, renew the components.



NOTE: Make sure the brake caliper guide pins are installed in the correct orientation.

Install the brake caliper guide pins.

- Check the condition of the caliper guide pin seals.
- Check for correct operation.

2. Install the brake caliper anchor plate.

- Tighten the bolts to 115 Nm (85 lb.ft).



3. **NOTE:** Use an additional wrench to prevent the component from rotating.

Install the brake caliper.

- Tighten the brake caliper upper bolt to 35 Nm (26 lb.ft).

4. Install the rear brake pads.

For additional information, refer to: Brake Pads (206-04, Removal and Installation).

5. Connect the brake pad wear indicator sensor.

6. Install the wheel and tire.

- Tighten the wheel nuts to 140 Nm (103 lb.ft).

Parking Brake and Actuation -

General Specification

Item	Specification
Make	Continental Teves
Model/type	N5528001
Operation	Twin cable operation to park brake with emergency cable release located in passenger compartment
Minimum brake lining material thickness	2.0 mm (0.078 in)

Torque Specifications

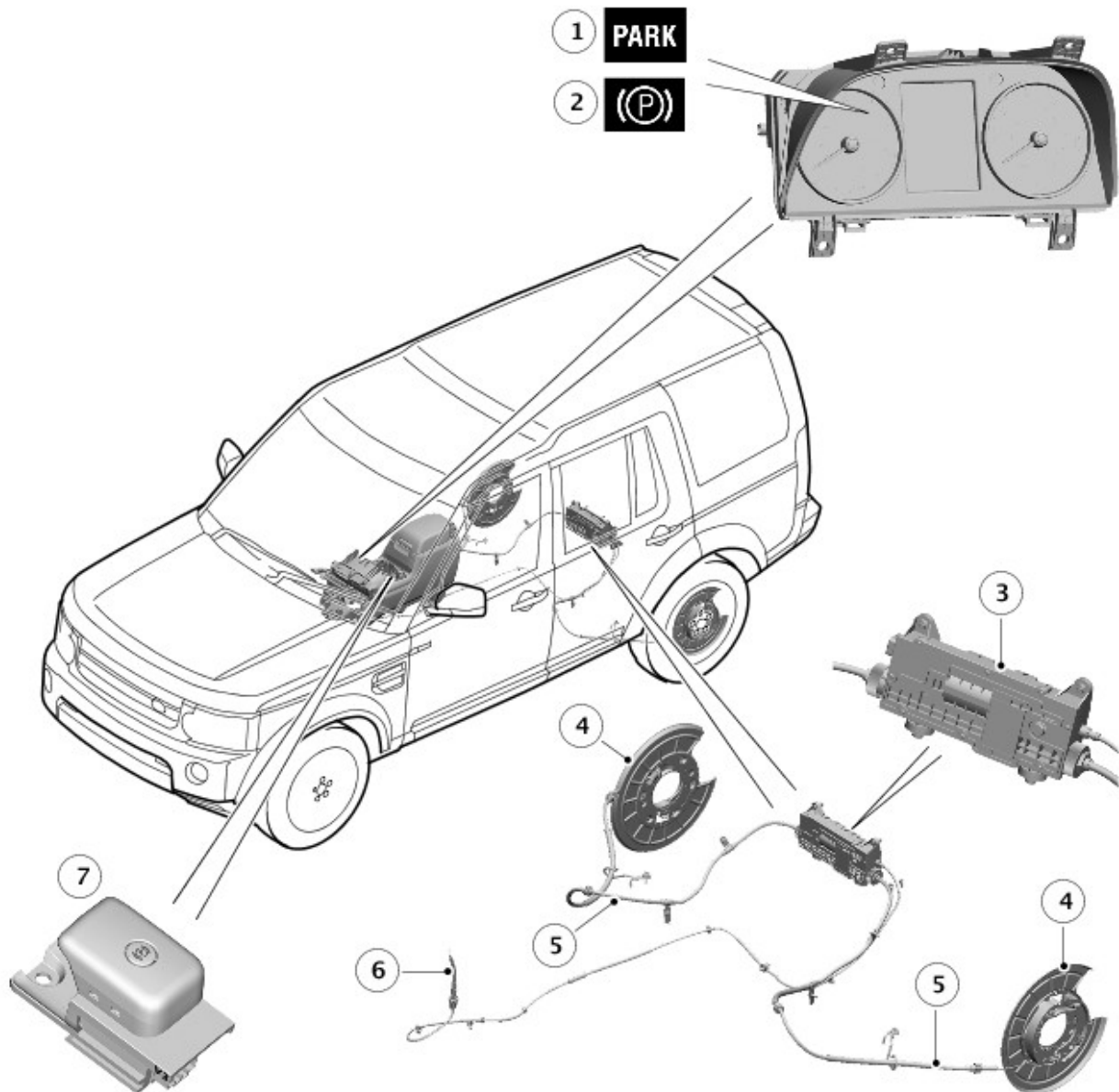
Description	Nm	lb-ft
Wedge adjuster Allen screw	7	5
Rear brake disc Torx screw	35	26
Brake caliper anchor plate to wheel knuckle bolts	115	85
Brake caliper to anchor plate bolts	35	26
Parking brake actuator and cable assembly nuts	5	4
Parking brake actuator mounting bracket bolts	22	16
Fuel tank heat shield nuts	3	2
Fuel tank heat shield bolts	6	4
* LH/RH parking brake cable bolts	22	16
Parking brake cable coupling	8	6
Road wheel nuts	140	103

* **New nuts/bolts must be installed**

Parking Brake and Actuation - Parking Brake

Description and Operation

COMPONENT LOCATION



E161667

Item	Part Number	Description
1	-	Parking brake indicators (NAS only)
2	-	Parking brake indicators (all except NAS (north American specification))
3	-	Parking brake module
4	-	Drum brake
5	-	Parking brake cable
6	-	Emergency release cable
7	-	Parking brake switch

GENERAL

The parking brake is an electrically actuated system that operates drum brakes integrated into the rear brake discs. The parking brake system consists of:

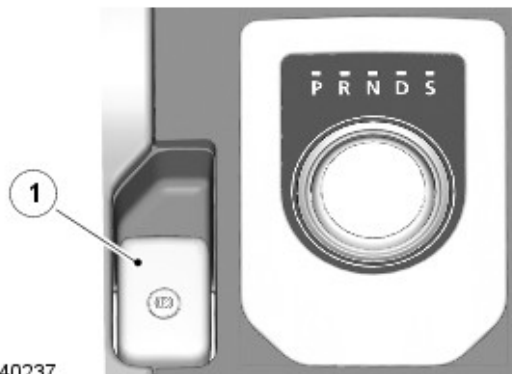
- A parking brake switch.
- Left and right drum brakes.
- Left and right brake cables.
- An emergency release cable.
- A clutch pedal position sensor (manual transmission models only).
- Two parking brake indicators.

A parking brake module.

The parking brake is operated by the parking brake module, which adjusts the tension of the brake cables to apply and release the drum brakes. Operation of the parking brake module is initiated by the parking brake switch.

PARKING BRAKE SWITCH

Parking Brake Switch - Electronic Transmission Shifter



E140237

The parking brake switch is used by the driver to apply and release the parking brake, and is installed in the center console adjacent to the gear lever.

Slots on the sides of the parking brake switch engage with the top panel of the center console, and a screw secures the parking brake switch in position. An electrical connector on the back of the switch provides the interface with the vehicle wiring. A brake symbol on the switch illuminates when the exterior lamps are selected on.

There are three states for the parking brake switch:

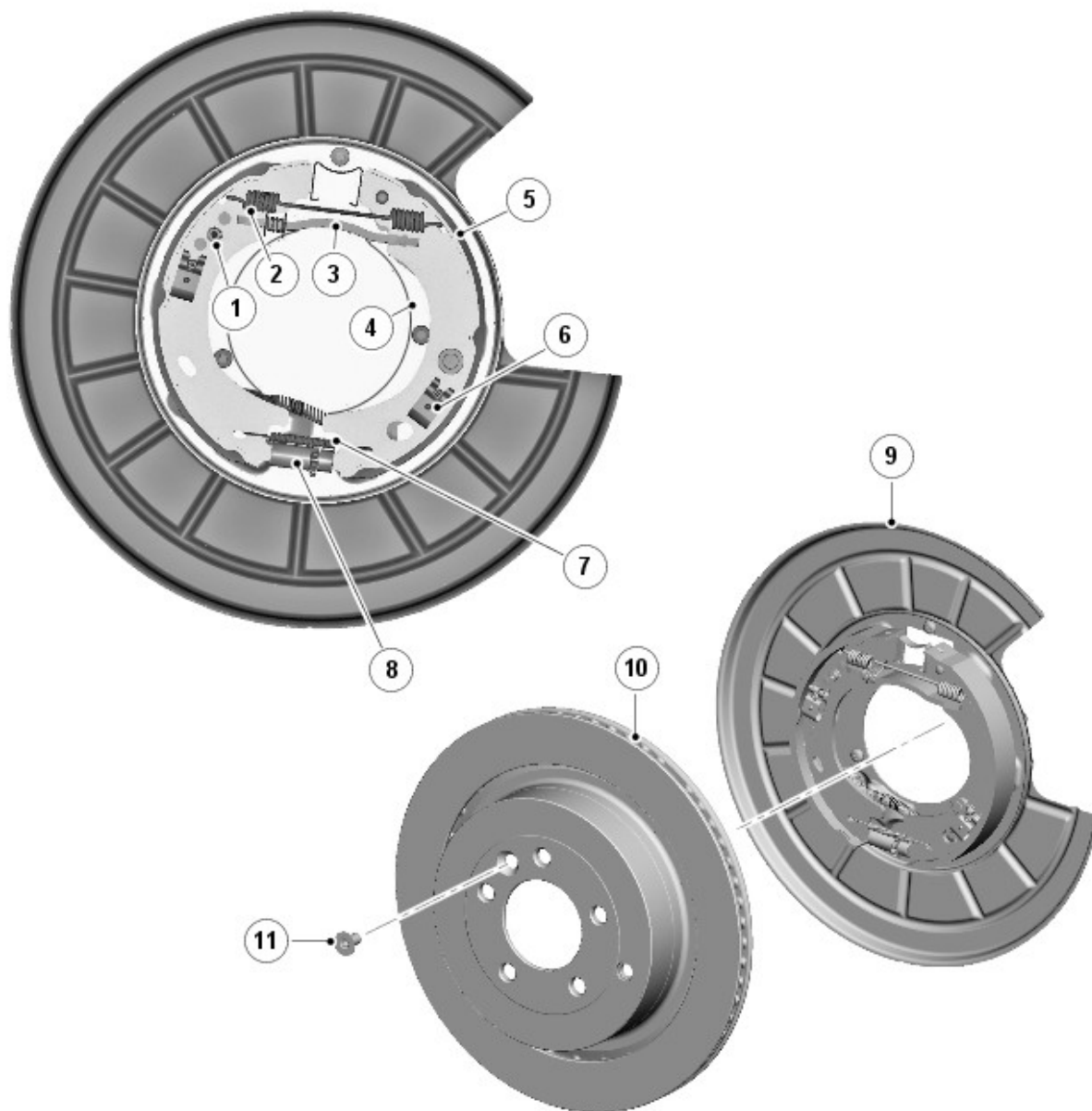
- Apply request, when the handle of the parking brake switch is pulled up.
- Release request, when the handle of the parking brake switch is pushed down.
- Idle, when the handle of the parking brake switch is in the central or rest position.

Microswitches, incorporated into the parking brake switch, are activated by the handle of the parking brake switch. To determine the operating state of the parking brake switch, the parking brake module scans the circuits containing the microswitches.

DRUM BRAKES



NOTE: LH (left-hand) brake shown, RH (right-hand) brake similar



E140238

Item	Part Number	Description
1	-	Wedge adjuster screw
2	-	Return spring
3	-	Cross strut
4	-	Backplate
5	-	Brake shoe
6	-	Shoe locating pin and clip
7	-	Adjuster spring
8	-	Toothed wheel adjuster
9	-	Dust shield
10	-	Rear brake disc
11	-	Adjuster access plug

Each drum brake consists of a pair of brake shoes installed on a backplate attached to the rear hub carrier. The brake shoes operate on the drum integrated into the rear brake disc. The orientation of the brake shoes differ by 180° between the LH and RH brakes.

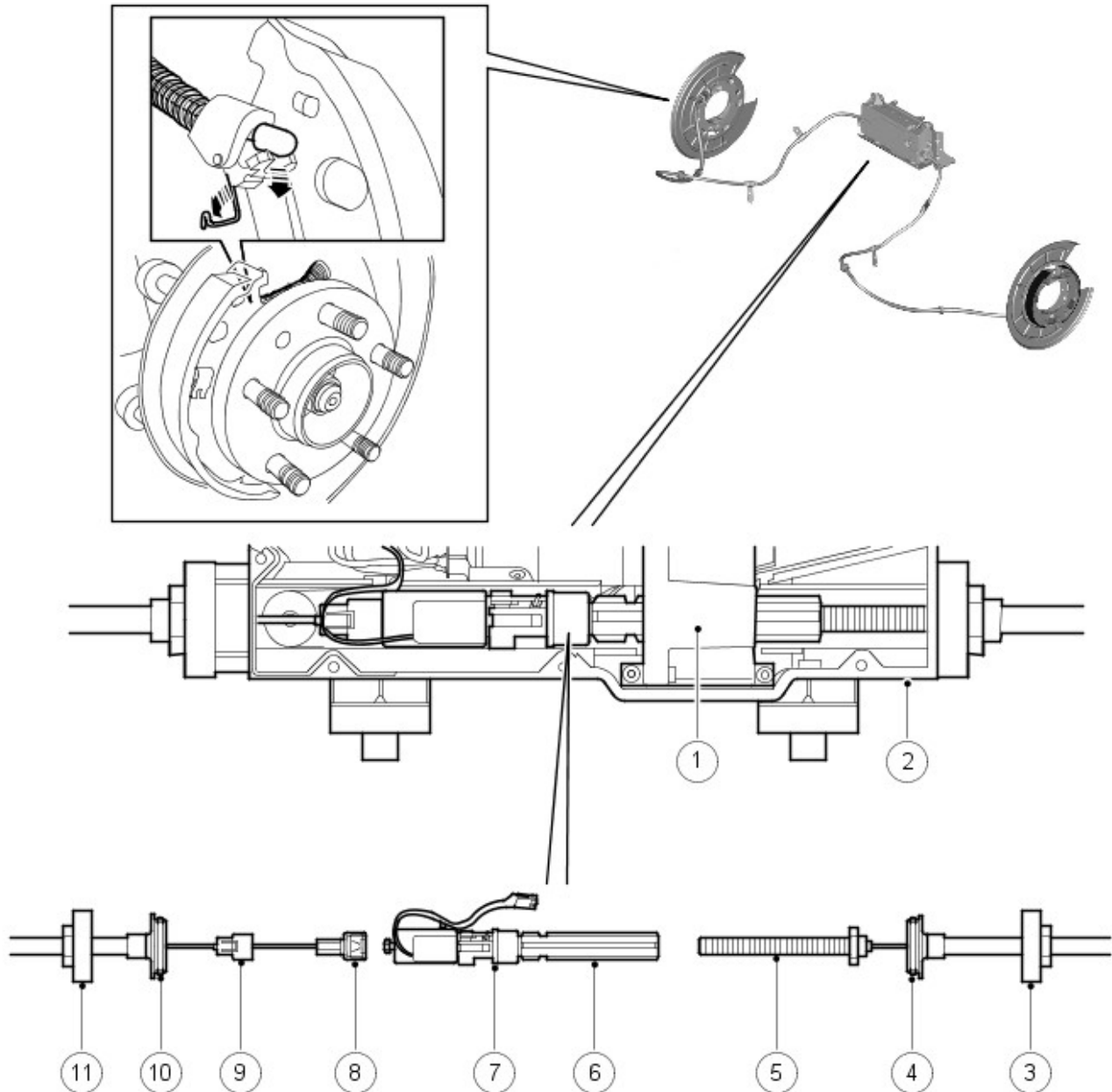
When the parking brake module tensions the brake cables, the movement is transmitted to an operating lever on one of the brake shoes. The operating lever pivots against a cross strut, which forces the brake shoes apart and into contact with the drum in the rear brake disc. Brake shoe to drum clearance is set with two manual adjusters, which are accessed through a hole in the brake disc. One of the adjusters is a conventional toothed wheel adjuster. The second adjuster is a wedge adjuster operated by an Allen screw.

After replacement of the brake shoes or brake discs, a bedding in procedure must be performed to ensure the drum brakes operate satisfactorily.

Prior to removing a brake disc from a vehicle, power should be disconnected from the parking brake module.

Operation of the parking brake switch while a brake disc is removed can cause the actuating mechanism in the parking brake module to seize.

BRAKE CABLES



E49845

Item	Part Number	Description
1	-	Gearbox
2	-	Parking brake module housing
3	-	Cable nut
4	-	Sealing collar
5	-	Threaded connector
6	-	Spline shaft
7	-	Force sensor
8	-	Shoe
9	-	Locking cover
10	-	Sealing collar
11	-	Cable nut

The brake cables consist of Bowden cables installed between the parking brake module and the drum brakes. Nuts, on the ends of the outer cables, secure the brake cables to the parking brake module and the backplate of the related drum brake. In each drum brake, the inner cable is located in the guide spring and connected to the brake shoe operating lever by a nipple on the end of the cable. In the parking brake module, the two inner cables are joined together via the force sensor and the spline shaft.

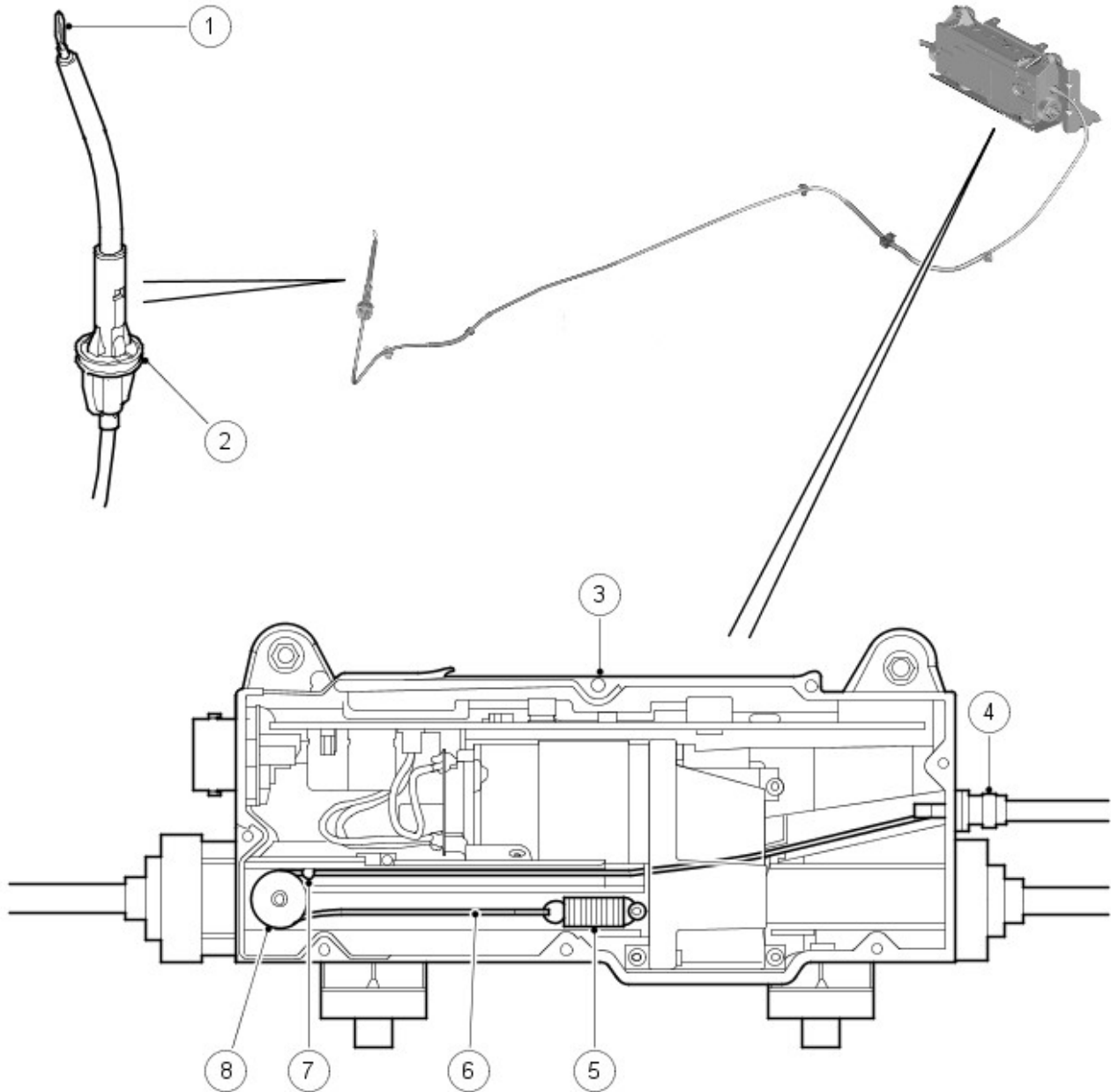
The inner cable of the **RH** brake cable is connected to a nipple on the force sensor by a 'shoe' on the end of the cable; a locking cover keeps the shoe engaged with the nipple.

The inner cable of the LH brake cable is connected to the spline shaft by a threaded connector (LH thread); a squared flange at the end of the threaded connector locates in the housing of the parking brake module, to prevent the threaded connector from turning with the spline shaft.

When the spline shaft turns, the threaded connector of the LH brake cable is screwed into or out of the spline shaft, which changes the effective length of the inner cables and operates the drum brakes. The ability of the spline shaft to move axially in the gearbox equalizes the load applied by the inner cables to the two drum brakes.

Prior to disconnecting a brake cable, power should be disconnected from the parking brake module. Operation of the parking brake switch while a brake cable is disconnected can cause the actuating mechanism in the parking brake module to seize. In addition, the parking brake may not switch off until 20 minutes after Power mode 0 selected. Automatic re-apply cannot be eliminated until this period has expired.

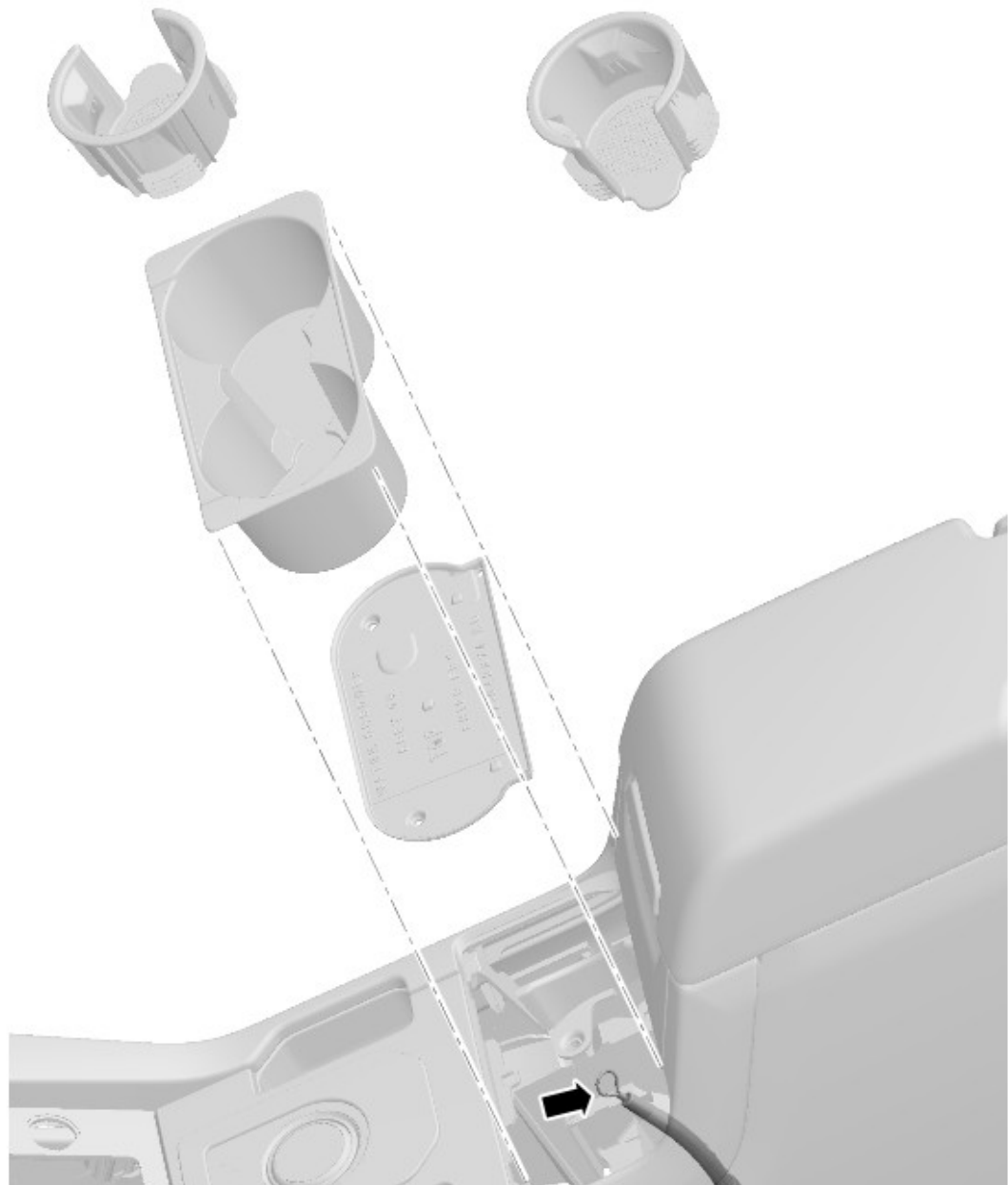
EMERGENCY RELEASE CABLE



E49846

Item	Part Number	Description
1	-	Pull ring
2	-	Quick release fitting
3	-	Parking brake module
4	-	Sealing collar
5	-	Spring
6	-	Inner cable
7	-	Nipple
8	-	Pulley wheel

Emergency Park Brake Release



E140242

The emergency release cable allows the parking brake to be mechanically released if:

- The parking brake cannot be electrically released because of a system fault.
- The battery is disconnected or battery voltage decreases below 7.5 volts while the parking brake is applied, so that the parking brake cannot be electrically released.

The parking brake is mechanically released by disconnecting the force sensor from the spline shaft in the parking brake module. During normal operation, the force sensor and the spline shaft are locked together by a lever operated pawl on the end of the spline shaft, which engages with a spigot on the force sensor.

The emergency release cable is a Bowden cable installed between the parking brake module and the center console. The emergency release cable is held in clips along the underside of the vehicle and enters the passenger compartment below the center console through an aperture in the transmission tunnel. A quick release fitting seals the emergency release cable in the aperture. At the parking brake module, a sealing collar on the outer cable is a push fit in the housing of the parking brake module.

In the center console, a pull ring is installed on the end of the inner cable. The pull ring is designed to fit the hook on the end of the jack handle which, in combination with a screwdriver shaft, can be used to pull on the cable.

The pull required to release the latch is approximately 200 N (45 lbf). When the pull ring of the emergency release cable is released, the spring in the parking brake module retracts the inner cable and the nipple moves away from the pawl operating lever.

After the emergency release cable has been used to release the parking brake, the next time an apply selection is made with the parking brake switch, the parking brake module automatically runs through a latching procedure to reconnect the spline shaft with the force sensor. The parking brake module turns the spline shaft so that it moves towards the force sensor. The pawl of the spline shaft then re-engages with the spigot of the force sensor. A second apply selection with the parking brake switch is required to apply the parking brake.

PARKING BRAKE INDICATORS



E140240

Item	Part Number	Description
1	-	Red or amber warning indicator (NAS only)
2	-	Red or amber warning indicator (all except NAS)

The parking brake has two warning indicators, one amber and one red, located in the speedometer of the instrument cluster (same symbol, illuminated in either red, or amber).

Amber Parking Brake Warning Indicator

The amber parking brake warning indicator is continuously illuminated if there is a parking brake system fault. Operation of the indicator is controlled by a high speed **CAN (controller area network)** bus signal from the parking brake module to the instrument cluster.

Red Parking Brake Warning Indicator

When the parking brake is applied, the red parking brake warning indicator is continuously illuminated while the ignition is on and for 3 minutes after the ignition is switched off. If the system is unable to comply with an apply or release request, due to a system fault, the indicator flashes.

When the ignition is on and the indicator is not flashing, operation is controlled by a high speed **CAN** bus signal. When the ignition is off or when the indicator is flashing, operation is controlled by a hardwired signal from the parking brake module to the instrument cluster.

Text Messages

On vehicles with the high line instrument cluster, when there is a fault condition, illumination of the warning indicators is accompanied by a text message displayed in the message center.

PARKING BRAKE MODULE

The parking brake module monitors external and internal inputs and adjusts the tension of the brake cables to operate the drum brakes and provide the required parking brake function.

The parking brake module is installed on a support bracket attached to the front of the spare wheel carrier. Two rubber mounts, installed on lugs on the underside of the parking brake module, locate in holes in the support bracket. The top corners of the parking brake module are secured to the support bracket with rubber mounts and flanged nuts.

The main components of the parking brake module are:

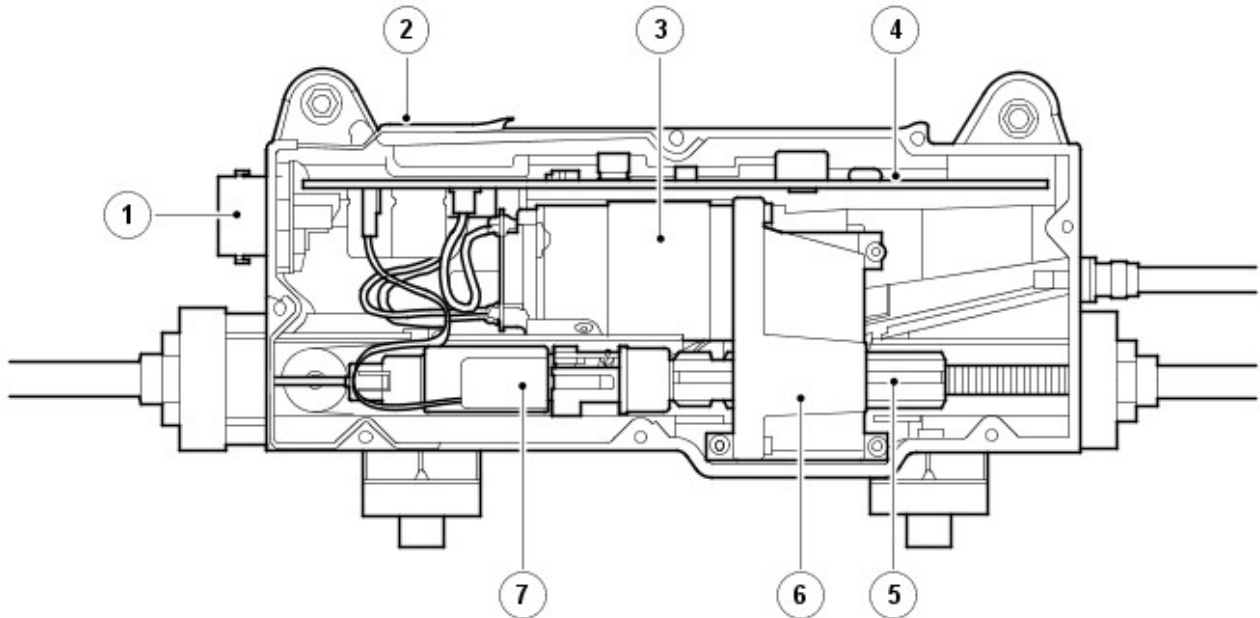
- A PCB (printed circuit board) incorporating the ASIC (application specific integrated circuit) for control of the parking brake.
- An electric motor.
- A gearbox.
- A spline shaft.
- A force sensor.

The spline shaft and the force sensor are connected together by a latch on the end of the spline shaft. The spline shaft rotates on the latch and moves axially in the gearbox. The latch and the force sensor slide in a channel in the

body of the parking brake module.

To apply or release the drum brakes, the parking brake module runs the electric motor, which drives the gearbox. The gearbox turns the spline shaft to increase or decrease the tension in the brake cables. The parking brake module monitors the load exerted by the brake cables using the input from the force sensor.

Interior of Parking Brake Module



E49850

Item	Part Number	Description
1	-	Electrical connector
2	-	Housing
3	-	Electric motor
4	-	PCB (Printed Circuit Board)
5	-	Spline shaft
6	-	Gearbox
7	-	Force sensor

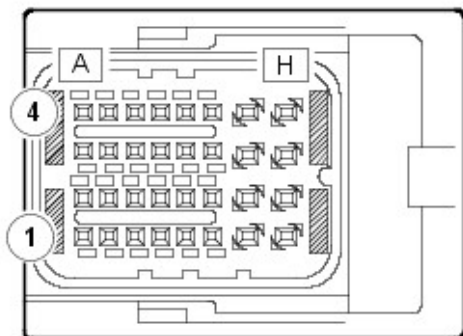
Inputs and Outputs

A 32 pin electrical connector on the **RH** side of the parking brake module provides the interface between the PCB and the vehicle wiring.

The parking brake module is powered by two permanent battery power feeds from the **EJB (engine junction box)**. Two connections with the **CJB (central junction box)** provide battery voltage signals in Power mode 0 and Power mode 6. Other hardwired inputs consist of those from the parking brake switch and, on manual transmission models, the clutch pedal position sensor.

In addition to the hardwired connections, the parking brake module is connected to the medium speed **CAN** bus to enable communication with other vehicle systems.

Parking Brake Module Harness Connector C2178



E49851

Parking Brake Module Harness Connector C2178 Pin Details

Pin No.	Description	Input/Output
A1	Not used	-
A2	Medium speed CAN bus low out	Input/Output
A3	Medium speed CAN bus high in	Input/Output
A4	Medium speed CAN bus low in	Input/Output
B1	Not used	-
B2	Medium speed CAN bus high out	Input/Output
B3	Parking brake switch SW1	Input
B4	Parking brake switch SW4	Input
C1 and C2	Not used	-
C3	Parking brake switch SW2	Input
C4	Parking brake switch SW5	Output
D1 to E1	Not used	-
E2	Clutch pedal position sensor ground	Input
E3	Clutch pedal position sensor signal	Input
E4	Clutch pedal position sensor power supply	Output
F1	Not used	-
F2	Not used	-
F3	Ignition power supply	Input
F4	Red parking brake indicator	Output
G1	Not used	-
G2	Ground	Output
G3	Not used	-
G4	Battery power supply	Input
H1	Not used	-
H2	Ground	Output
H3	Not used	-
H4	Battery power supply	Input

PARKING BRAKE OPERATION

The parking brake can be applied at any time provided sufficient battery power is available. For the parking brake to be released, various pre-conditions are required. The parking brake has manual and automatic operating modes, to cater for different operating circumstances, as detailed in the following table:

Operating Modes

Mode	Pre-Conditions	Driver Action
Static apply	Vehicle speed less than 2.5 km/h (1.6 mph).	Pull up parking brake switch.
Static release	1. Vehicle speed less than 2.5 km/h (1.6 mph). 2. Engine running. OR Ignition is ON and brake pedal or clutch pedal pressed (manual transmission). OR Ignition is ON and brake pedal or accelerator pedal pressed (automatic transmission).	Press down parking brake switch.
Ignition OFF apply	1. Vehicle speed less than 10 km/h (6.25 mph). 2. Ignition is OFF. 3. Selector lever is not in position 'P'. (automatic transmission).	Switch the ignition OFF.
Igniton OFF apply inhibit	1. Vehicle speed less than 2.5 km/h (1.6 mph). 2. Ignition is OFF. 3. Selector lever is not in position 'P'. (automatic transmission).	Switch the ignition OFF while pressing down parking brake switch.
Dynamic apply	Vehicle speed more than 2.5 km/h (1.6 mph).	Pull up parking brake switch as required.
Dynamic release	Vehicle speed more than 2.5 km/h (1.6 mph).	Release (to neutral position) or press down parking brake switch.
DAR (drive away release)	1. Ignition is ON.	None. Parking brake released

(automatic transmission only)	2. Transmission in gear 1, 2 or R (with high range selected) or 1, 2, 3 or R (with low range selected). 3. Accelerator pedal pressed more than 2%. 4. Seatbelt is fastened. 5. Drivers door is closed.	automatically on drive away.
-------------------------------	---	------------------------------

Operating Voltages

Actuation of the parking brake (apply or release) is only started if the power supply to the parking brake module is within 9 to 18 volts. At any voltage in this range, the parking brake module is able to tighten the brake cables to the maximum, to fully apply the parking brake, although at voltages between 9 and 10.5 volts the actuation time may exceed 1.0 second.

During a parking brake actuation:

- If the power supply to the parking brake module decreases to less than 8.3 volts, the parking brake module continues the actuation, but stores a related fault code. If the ignition is on, the parking brake module also signals the instrument cluster to illuminate the amber parking brake warning indicator and flash the red parking brake warning indicator. On vehicles with the high line instrument cluster, a message advising there is a parking brake fault is shown in the message center. The warning indications are discontinued if the power supply voltage increases to 8.3 volts or more.
- If the power supply voltage decreases to less than 7.5 volts, the parking brake module discontinues the actuation. Actuation is automatically resumed if the power supply voltage subsequently increases to 7.5 volts or more and the parking brake switch request is still valid.
- If the power supply voltage decreases below 6.5 volts, the parking brake function is disabled for the remainder of the ignition cycle.
- If the power supply voltage increases to more than 18.0 volts, the parking brake module immediately disables the parking brake function and stores a related fault code. If the ignition is on, the parking brake module also signals the instrument cluster to illuminate the amber parking brake warning indicator and flash the red parking brake warning indicator. On vehicles with the high line instrument cluster, a message advising that the parking brake has a fault and is not functioning is shown in the message center. The parking brake function remains disabled until the power supply voltage is within 9 to 18 volts again. When the power supply voltage is within 9 to 18 volts again, the warning indications are cancelled and actuation is automatically resumed if the parking brake module is in a dynamic mode of operation with a valid parking brake switch request.



NOTE: The instrument cluster shuts down below 8 volts, so warning indications and messages are not displayed below 8 volts. CAN transmission stops if battery voltage drops below 7.0 volts and re-starts when voltage goes above 7.5 volts.

Sleep Mode

To reduce quiescent drain on the vehicle battery, the parking brake module incorporates a sleep mode. The parking brake module enters the sleep mode, provided the ignition is off and there are no signals from the wheel speed sensors, when one of the following occurs:

- 20 minutes elapse after the last actuation of the parking brake.
- If no actuation occurred, 20 minutes elapse after the ignition is switched off.

The parking brake module wakes up from the sleep mode when one of the following occurs:

- An apply or release request is made with the parking brake switch.
- The ignition is switched on.
- A key out apply is activated.

The parking brake module wakes up within 500 ms. The high speed CAN bus is activated within 200 ms maximum.

When the parking brake module is woken with a release request from the parking brake switch, the parking brake module ignores the request but illuminates the red brake warning indicator. The parking brake module extinguishes the red brake warning indicator and goes back to sleep immediately the switch is released to the neutral position.

When the parking brake module is woken with an apply request from the parking brake switch, if the parking brake is already applied the parking brake module ignores the request but illuminates the red brake warning indicator. The parking brake module extinguishes the red brake warning indicator and goes back to sleep immediately the switch is released to the neutral position. If the parking brake is in the released condition when the apply request is made, the parking brake module illuminates the red brake warning indicator and applies the parking brake. The parking brake module extinguishes the red brake warning indicator and goes back to sleep 3 minutes after the apply activation, or immediately after the switch is released to the neutral position, whichever occurs last.

Dynamic Apply

In the dynamic apply mode, if the vehicle speed is more than 10 km/h (6.25 mph) when the parking brake switch is selected to apply, the parking brake module requests the **ABS (anti-lock brake system)** module to activate the disc brakes on all four wheels. When the vehicle comes to a standstill, the parking brake module statically applies the parking brake. Once the static load is achieved, the hydraulic pressure is removed. If the parking brake switch is released to the neutral position, or pressed down to the release position, during dynamic apply, braking is cancelled.

The **ABS** module monitors the deceleration rate using the wheel speed sensor signals, and adjusts the hydraulic pressure to the disc brakes as required to achieve the required rate. All of the anti-lock control - traction control system brake functions remain enabled in the dynamic apply mode.

The parking brake module incorporates two fallback functions for the dynamic apply mode.

- Fallback 1 is invoked if vehicle speed is between 2.5 km/h (1.25 mph) and V_{max} when the parking brake

switch is selected to apply and the **ABS** module is unable to fulfill a hydraulic request. When fallback 1 is invoked, the parking brake module decelerates the vehicle, using only the parking brake. The parking brake module monitors the deceleration rate using the wheel speed information from the **ABS** module, and adjusts the tension of the brake cables to achieve the required rate. During deceleration the parking brake module also uses the wheel speed inputs from the **ABS** module to operate an anti-lock function for the rear wheels. When vehicle speed decreases to 2.5 km/h (1.25 mph) the parking brake module switches to the static apply mode.

- Fallback 2 is invoked if there is a loss of communication between the parking brake module and the **ABS** module or the **CAN** bus has failed. When fallback 2 is invoked, the parking brake module decelerates the vehicle using only the parking brake. The parking brake module tightens the brake cables under the control of the driver, no anti-lock function is available.

While dynamic apply is active, including fallback 1 and fallback 2, the parking brake module also outputs high speed **CAN** bus signals to:

- The **ABS** module, to apply the stoplamps.
- The instrument cluster, to sound an intermittent warning buzzer, at 0.5 second on, 1.0 second off.
- The instrument cluster, to illuminate the red parking brake warning indicator. The indicator is permanently illuminated except in fallback 2, when it flashes.

DAR Pre-arming

The DAR pre-arming function operates when the transfer box is in high range to reduce the parking brake release time during DAR and to provide a smooth take-off. DAR pre-arming is invoked when:

- The ignition is ON.
- The transmission is in gear 1, 2 or R.
- The vehicle is stationary.
- No failsafe tighten actuation has occurred.

Automatic Load Adjustment

While the ignition is on, the parking brake module constantly monitors the input from the force sensor. If the tension of the brake cables goes outside the limits for a given operating mode, the parking brake module automatically restores the tension within limits.

Failsafe Tighten. If, during pre-arming, the vehicle moves, then the maximum cable force is reinstated for the remainder of that ignition cycle.

Automatic Apply. While the parking brake is applied, if the tension of the brake cables decreases by a prescribed amount from the initial setting, the parking brake module automatically restores the tension to the initial setting.

Automatic Release. While the parking brake is released, if the tension of the brake cables increase to a prescribed amount, the parking brake module automatically reduces the tension to zero.

Parking Brake Switch Monitoring

The parking brake module monitors for the following types of fault in the parking brake switch system. If a fault is detected, the parking brake module stores a related fault code:

- Short circuits between a pull-down transistor in the parking brake module and battery voltage.
- Broken wires and microswitches.
- Plausibility.

The parking brake switch has a degree of in-built redundancy. If a single microswitch fault is detected the parking brake module can still determine the operating state of the parking brake switch. Short circuits or multiple failures cause the parking brake module to disable the parking brake switch for the remainder of the ignition cycle. The parking brake module also disables the parking brake switch if a plausibility fault occurs. However, since plausibility faults are usually caused by incomplete operation of the parking brake switch, the parking brake switch is re-enabled if the parking brake module subsequently establishes a plausible operating state.

If a single microswitch fault is detected, the parking brake module signals the instrument cluster to illuminate the amber parking brake warning indicator. On vehicles with the high line instrument cluster, the parking brake module also signals the instrument cluster to display a message advising there is a parking brake fault. During an apply actuation, the parking brake module also signals the instrument cluster to flash the red parking brake warning indicator.

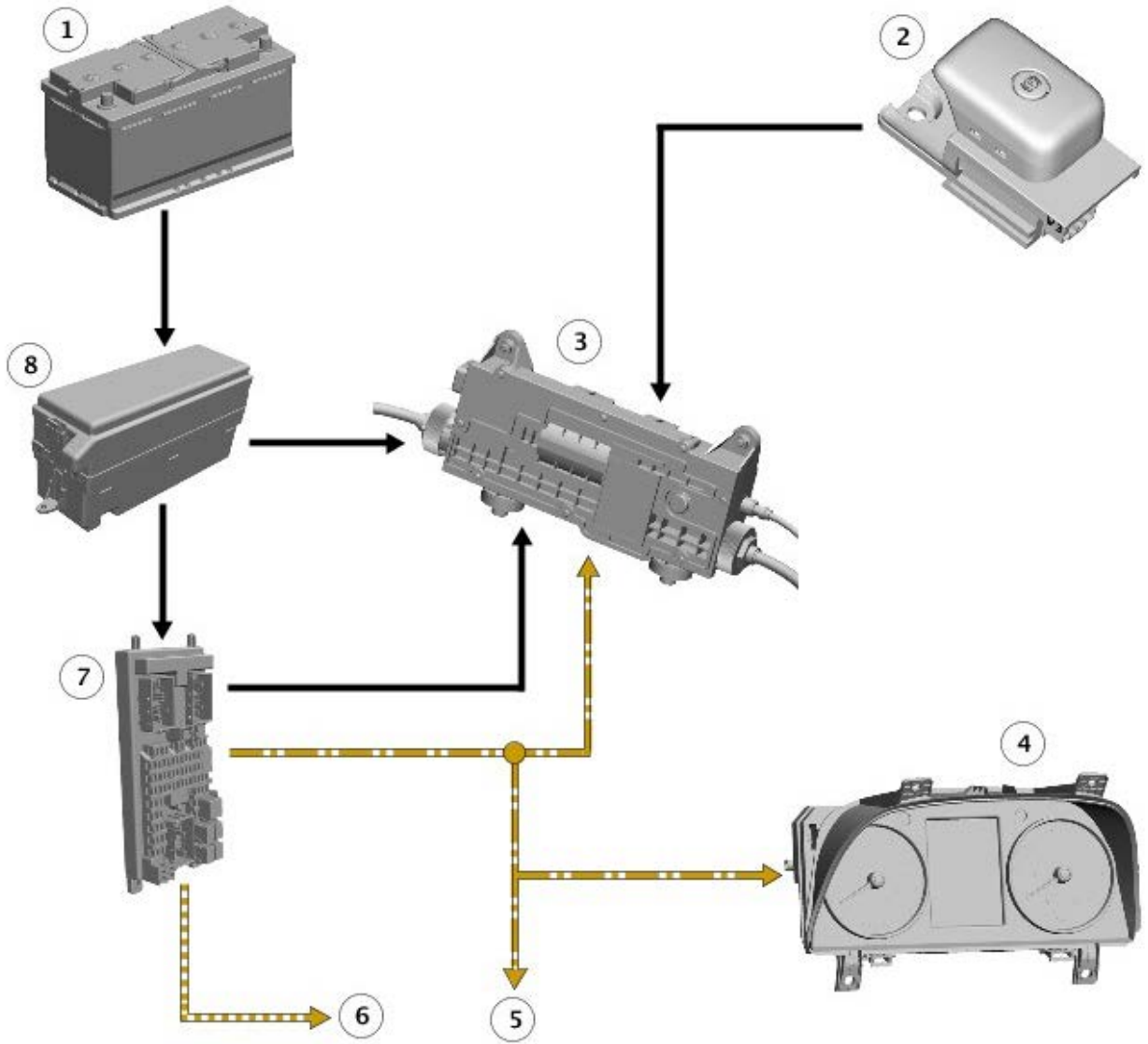
For all other fault types, the parking brake module signals the instrument cluster to illuminate the amber parking brake warning indicator, and, on vehicles with the high line instrument cluster, to display a message advising the parking brake has a fault and is not functioning. If it makes an apply actuation, the parking brake module signals the instrument cluster to flash the red parking brake warning indicator for the remainder of the ignition cycle.

On the next ignition cycle, the warning indicators and the messages are only activated if the fault is still present, although the fault code is retained by the parking brake module until cleared by T4.

CONTROL DIAGRAM



NOTE: **A** = Hardwired connection; **D** = High speed CAN bus; **N** = Medium speed CAN bus



E161668



Item	Part Number	Description
1	-	Battery
2	-	Parking brake switch
3	-	Parking brake module
4	-	Instrument cluster
5	-	Medium speed CAN bus connection to other systems
6	-	High speed CAN bus connection to other systems
7	-	Central Junction Box (CJB)
8	-	Engine Junction Box (EJB)

Parking Brake and Actuation - Parking Brake

Description and Operation

Overview

The armoured vehicle has an electrically operated parking brake.

The parking brake is operated by the parking brake module, which adjusts the tension of the brake cables to apply and release the drum brakes. Operation of the parking brake module is initiated by the parking brake switch.

The parking brake system fitted to armoured vehicles is the same as that fitted to the standard vehicle. For additional information, refer to: Parking Brake (206-05, Description and Operation).

Parking Brake and Actuation - Parking Brake

Diagnosis and Testing

Principles of Operation

For a detailed description of the Parking Brake System and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (206-05)

Parking Brake (Description and Operation),
Parking Brake (Description and Operation).

Inspection and Verification

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



Please note this is a sealed unit and no attempt must be made to open the actuator as it will invalidate any warranty claim.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Electric park brake cable(s) condition and installation • Electric park brake shoes condition and fitment • Electric park brake drums (integrated into rear brake discs) • Electric park brake actuator module condition and installation 	<ul style="list-style-type: none"> • Electric park brake warning indicators • Fuses • Wiring harness / electrical connectors <ul style="list-style-type: none"> - Check for bent/corroded pins • Controller Area Network (CAN) circuits • Electric park brake switch • Electric park brake actuator

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Electric park brake will not engage or release	<ul style="list-style-type: none"> • Electric park brake cables fouled, trapped or damaged • Electric park brake cables incorrectly routed or fixed • Electric park brake shoes, linings worn/contaminated • Electric park brake drums (integrated into rear brake discs) • Electric park brake shoes incorrectly adjusted following replacement • Electric park brake actuator malfunction 	<ul style="list-style-type: none"> • Check the electric park brake cables for fouling, trapping or damage • Check the electric park brake cables for correct routing • Check that the electric park brake cable end fitting connector(s) are correctly installed to the operating lever(s) • Inspect the electric park brake shoes and drums for condition/wear/contamination • Check the electric park brake shoes for correct adjustment • Check the operation of the electric park brake actuator, check for damage and/or excessive noise during operation • Check for electric park brake control module DTCs
Low electric park brake efficiency / electric park brake sticking/binding		

DTC Index

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Electric Park Brake Control Module (EPBCM) (100-00, Description and Operation).

Brake Bedding Mode

Bedding mode is a special mode available in the Electric Park Brake Control Module (EPBCM) that disables the stability assist system and allows the parking brake to provide the braking force rather than the conventional braking system whilst the vehicle is moving at a velocity of >3kph. This mode is entered via a series of brake pedal presses and switch applications, full details on this procedure is available in the relevant section of the workshop manual. If brake bedding mode is entered accidentally by the driver the RED warning lamp will flash in the instrument cluster, the electric park brake control module will return to normal operational mode when the ignition has been cycled. This DTC (C1104-68) is intended to highlight the fact that although the RED lamp was illuminated there was no fault present in the control module.

Drive Cycles

Drive Cycle 1 Description

- Ignition On
- Make sure that no electric park brake activation (diagnostic command or switch input) is attempted for a minimum of 3 seconds
- Retest for functionality

Drive Cycle 2 Description

- Ignition On
- Drive vehicle at a constant speed of 20kph (13mph) or slightly above in 2nd gear
- At a constant speed of 20kph (13mph) or slightly above, apply the electric park brake via the electric park brake switch
- Press the brake pedal

Drive Cycle 3 Description

- Ignition On
- Make sure that the vehicle is stationary and that the electric park brake is released
- Operate the electric park brake switch to the apply position and hold in this position until the electric park brake motor has stopped (this may take up to 5 seconds)
- Release the electric park brake switch to the idle position, leave in the idle position for 2 seconds
- Operate the electric park brake switch to the release position (while pressing the brake pedal) and hold in this position until the parking brake motor has stopped (this may take up to 5 seconds)
- Release the electric park brake switch to the idle position

Parking Brake and Actuation - Parking Brake Shoe and Lining Adjustment

General Procedures

Check



NOTE: This procedure must be carried out if the vehicle has been mud wading (not water) for more than 50 miles or if the park brake is adjusted as part of a vehicle service.

1. Check the park brake for correct operation.

2. **CAUTIONS:**



When the vehicle is in the mounting position a red flashing light may appear on the instrument cluster. This indicates that the park brake actuator is in the mounting position. It does not indicate a vehicle fault.



The warning lamp on the instrument cluster will flash whilst the park brake is being driven into the mounting position.

Using Land Rover approved diagnostic equipment, drive the park brake to the mounting position.

3. Place the vehicles transmission into NEUTRAL.



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

5. Remove the wheels and tires.

6. **NOTES:**



LH shown.



Align the access hole in the position shown.

Locate the park brake lever cable attachment point.

- Remove the access plug.
- Rotate the brake disc.



E161325

7. **NOTES:**



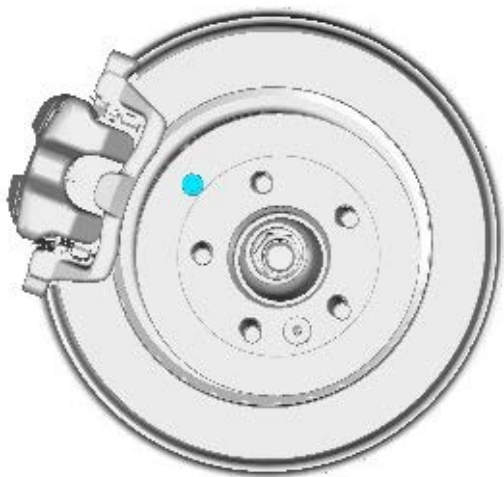
RH shown.



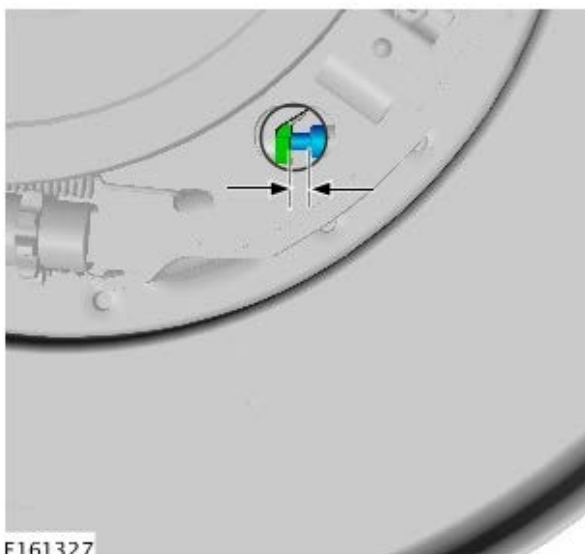
Align the access hole in the position shown.

Locate the park brake lever cable attachment point.

- Remove the access plug.
- Rotate the brake disc.




E161326



E161327

8. CAUTIONS:

 The park brake shoe lever should be visible as shown.

 There should be clearance between the park brake shoe lever and the park brake cable cap as shown.

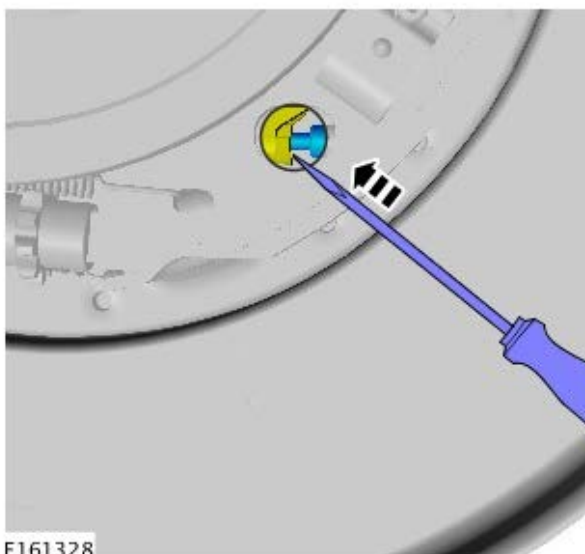
NOTES:

 LH shown.

 The step must be carried out on both sides.

Observe the position of the park brake shoe lever and the park brake cable cap.

- If the park brake shoe lever and park brake cable cap are not as shown, proceed to the next step.
- If the park brake shoe lever and park brake cable cap are as shown, proceed to step 11.



E161328

9. NOTES:

 LH shown.

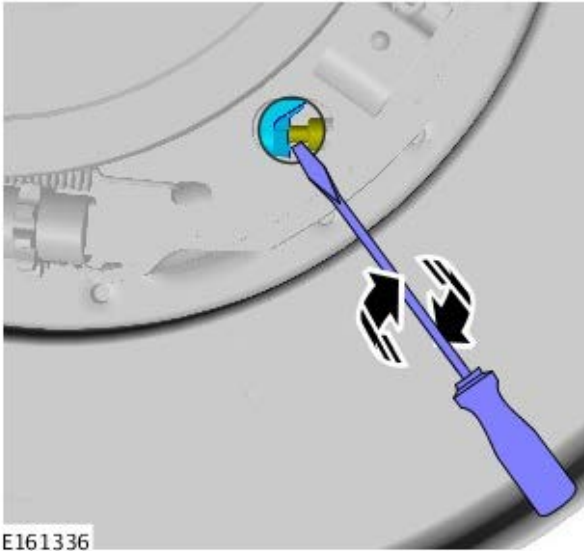
 The step must be carried out on both sides.

Using a suitable tool, check that the park brake shoe lever will move easily in the direction shown and returns to its original position.

- If the park brake shoe lever moves easily, proceed to the next step.
- If the park brake shoe lever does not move easily, rectify any concerns before proceeding.

10. NOTES:

 LH shown.




E161336

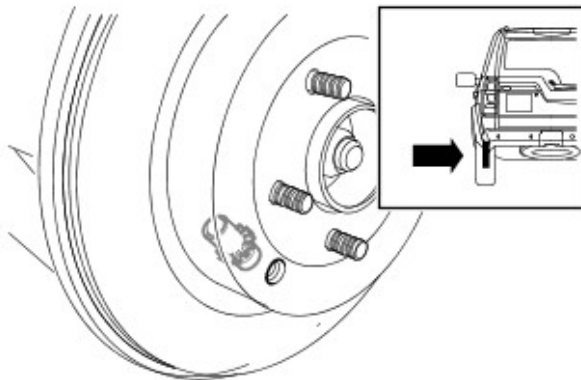
 The step must be carried out on both sides.


Using a suitable tool, check that the park brake cable moves easily as shown.

- If the park brake cable does not move easily, rectify any concerns before proceeding.

Adjust

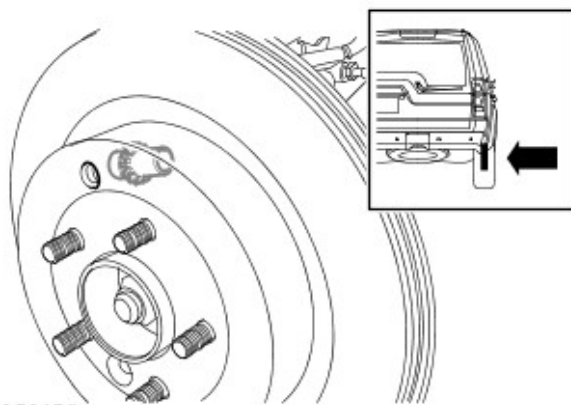
 NOTE: This procedure must be carried out if new park brake shoes are installed, new rear brake discs are installed, or if the vehicle has been mud wading (not water) for more than 50 miles or if the park brake is adjusted as part of a vehicle service.




1.  NOTE: Align the access hole with the indicators located on the back plate.

Locate the park brake shoe adjuster.


- Rotate the brake disc.



E161420

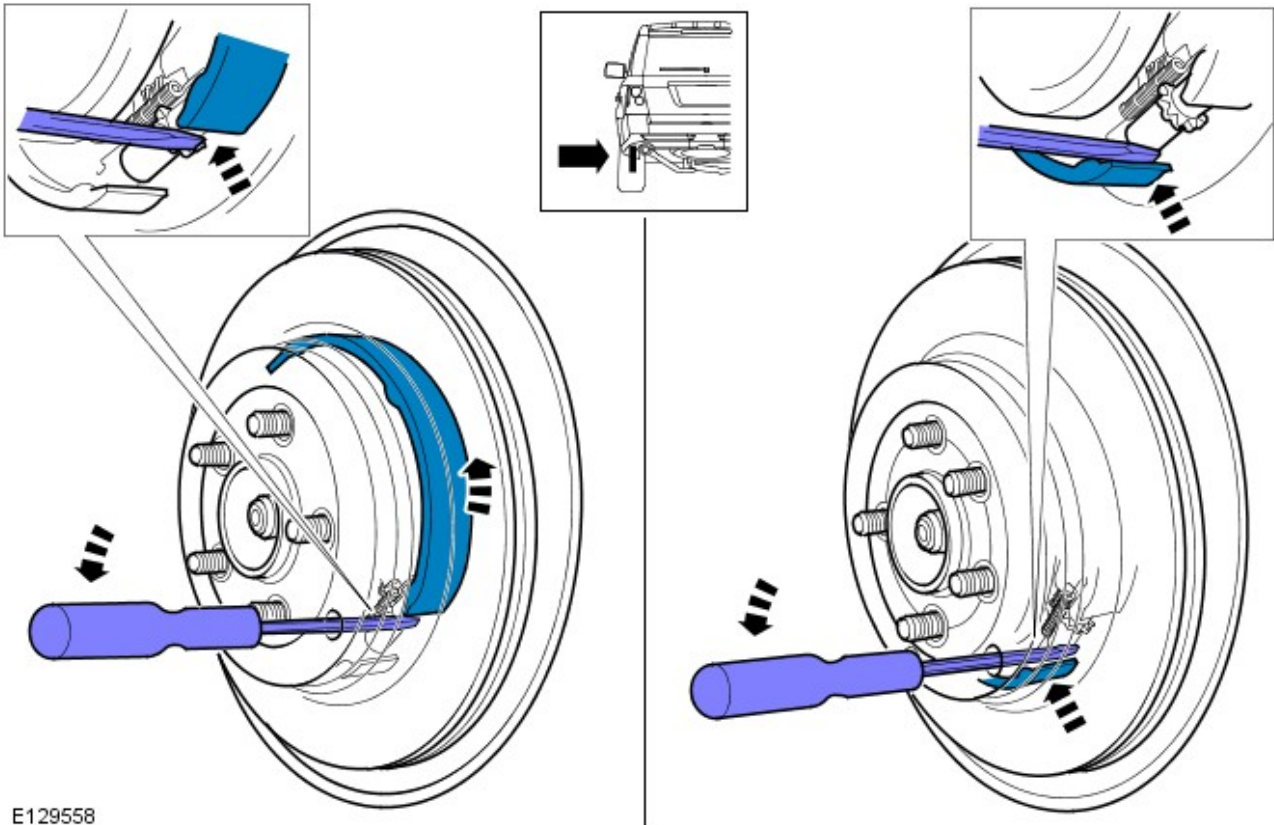
2.  CAUTION: Failure to follow this step may cause damage to the park brake system. Failure to displace the park brake shoes, as shown, will result in incorrect clearance when carrying out the adjustment step.

NOTES:


 The movement of the park brake shoe will be small and may not be felt when levering.

 LH shown.

Using a flat blade screwdriver, lever the brake shoes as indicated.



E129558

3.  **CAUTION:** Failure to follow this step may cause damage to the park brake system. Failure to displace the park brake shoes, as shown, will result in incorrect clearance when carrying out the adjustment step.

NOTES:

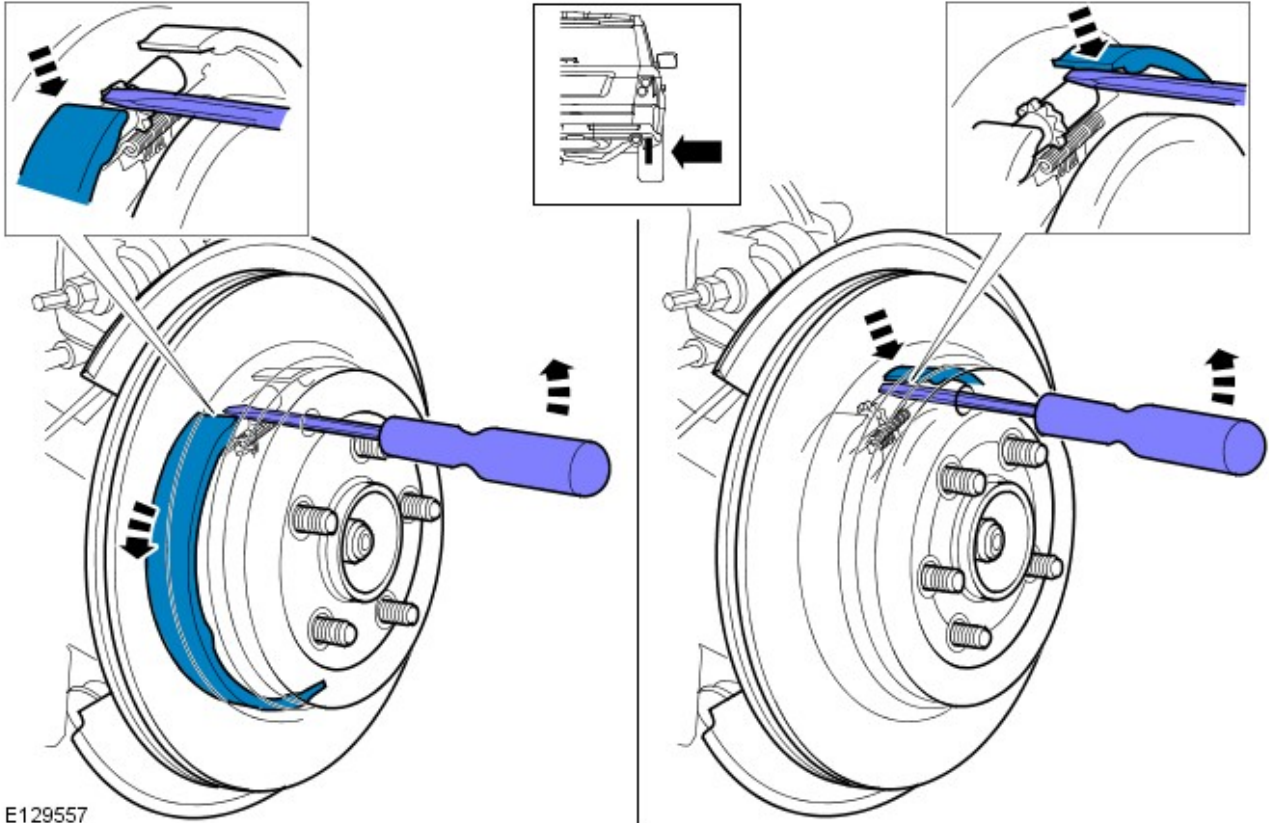


The movement of the park brake shoe will be small and may not be felt when levering.




RH Shown.

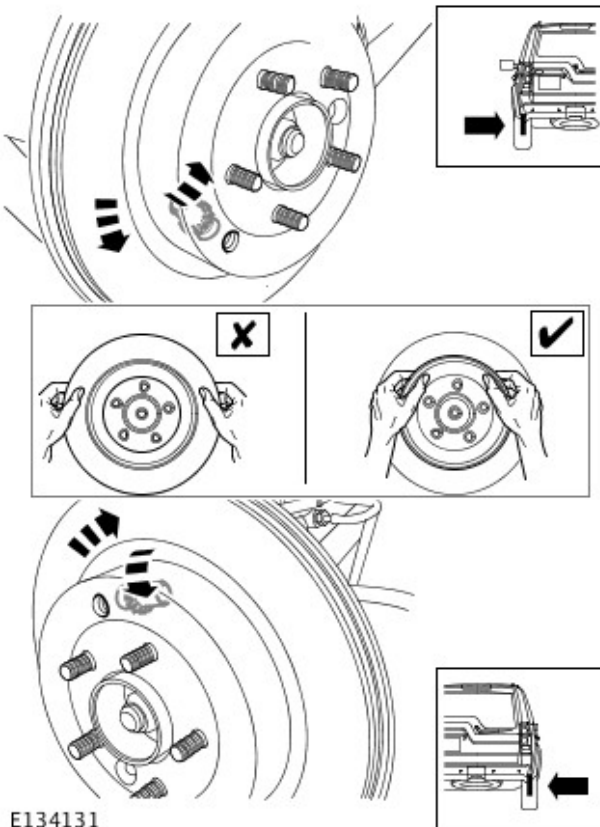
Using a flat blade screwdriver, lever the brake shoes as indicated.




E129557

4.  **CAUTION:** Do not apply excessive force on the park brake shoe adjuster. Failure to follow this instruction may result in damage to the park brake system.

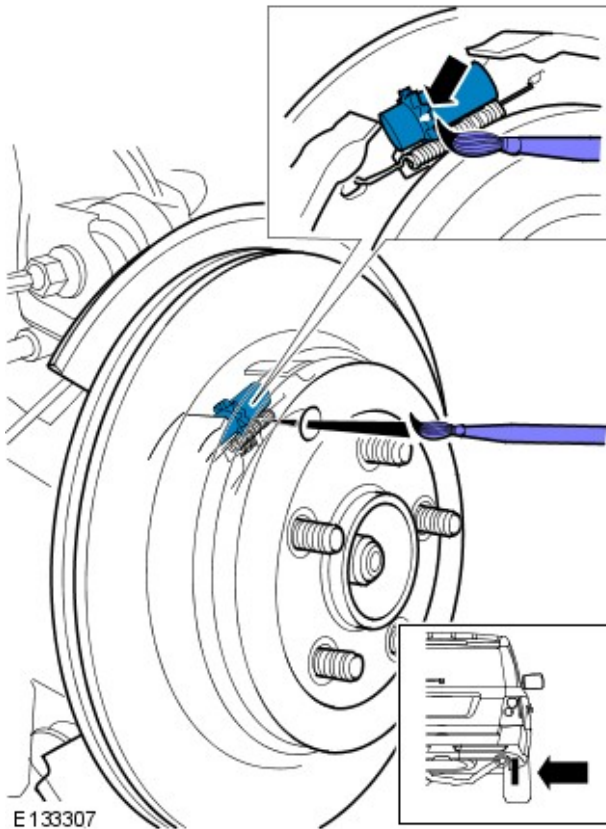
Using a flat bladed screwdriver rotate the brake shoe adjuster to extend it until the brake disc is locked hand tight.




E134131

5.  **CAUTION:** The following steps sets the running clearance for the park brake shoes, failure to adhere to the paint marking process may cause damage to the park brake system when the adjustment steps are carried out.

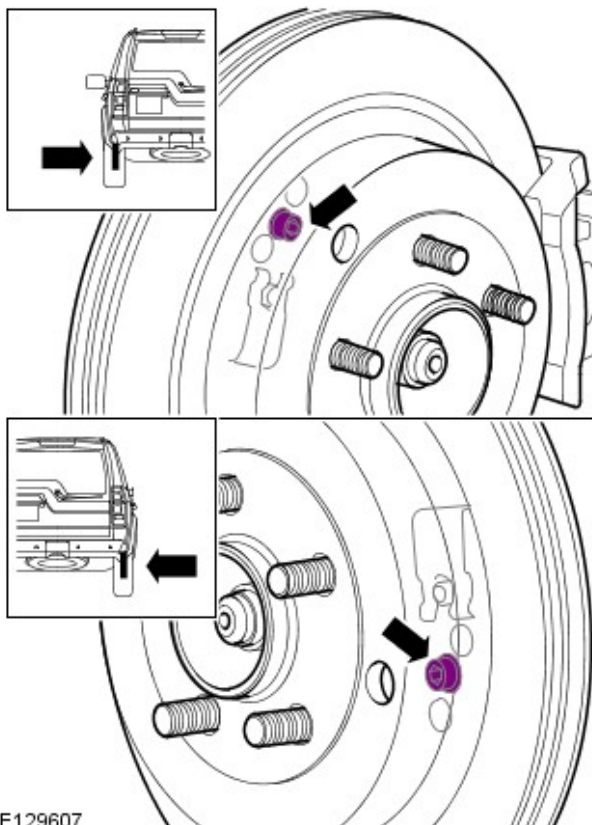
Using suitable marker, mark the position of the park brake shoe adjuster.




E133307

6.  **CAUTION:** The park brake adjuster must be rotated back **EXACTLY one full revolution (10 clicks)**. Failure to follow this instruction may result in damage to the park brake system.

Rotate the adjuster back **one revolution (10 clicks)** until paint mark is visible.



E129607

7.  **CAUTION:** The wedge adjuster must be correctly seated to make sure the park brake cable is correctly adjusted. Failure to follow this instruction may result in damage to the park brake system.

Loosen the wedge adjuster Allen screw half a turn.

- Tap the brake disc lightly with a soft faced mallet, around the park brake shoe location within the brake disc.
- Tighten the wedge adjuster Allen screw to 6 Nm (5 lb.ft).

8. Repeat the above procedure for the other side.

9. Take the vehicle out of the mounting position by operating the park brake twice.

10.  **CAUTION: The next step should only be carried out when new park brake shoes or brake disc have been installed.**

Carry out the park brake shoe bedding-in procedure.
For additional information, refer to: [Parking Brake Shoes Bedding-In](#) (206-05 Parking Brake and Actuation, General Procedures).

Parking Brake and Actuation - Parking Brake Shoes Bedding-In

General Procedures



NOTE: This procedure must be carried out if, new parking brake shoes are fitted, new rear brake discs are fitted or if the vehicle has been mud wading (not water) for more than 50 miles.

1. Carry out the parking brake shoe bedding-in procedure.



2. **NOTE:** The electronic parking brake 'Service Bedding-in Procedure mode' will be active for the remainder of the ignition cycle, or until the vehicle speed exceeds 31 mph (50 kph). If the procedure needs to be re-entered, the entry actions must be repeated.

To enter 'Service Bedding-in Procedure' mode.

- Start and run the engine.
- Apply the footbrake 3 times within 10 seconds and hold applied after the 3rd application.
- Apply the electronic parking brake switch 4 times, followed by 3 release applications within 10 seconds.

3. Once the Service Bedding-in procedure mode has been entered, the electronic parking brake linings can be bedded-in by conducting 10 repeated stops from 30 - 35 kph (19 - 22 mph), followed by a 500 metre (547 yard) interval between each stop to allow the brakes to cool, using the electronic parking brake control switch.
 - The electronic parking brake brake force will be increased up to the dynamic maximum so long as the switch is held in the applied position.
 - If the switch is released to either the NEUTRAL or OFF positions, the electronic parking brake will be released.
 - The electronic parking brake MUST be allowed to cool between applications, either by driving at 19 mph (30 kph) for 500 metres (547 yards) or remaining stationary for 1 minute between each application.

Parking Brake and Actuation - Parking Brake Cable LH

Removal and Installation

Removal



CAUTION: To avoid accidental operation of the parking brake, and possible damage to the parking brake actuator, remove Fusible link 8, located in the engine compartment fuse box before commencing work.



NOTE: If the parking brake system has completed less than 50,000 cycles it is permissible to replace the parking brake cables. If over 50,000 cycles have been completed, then the cables can only be replaced as part of the parking brake actuator and cable assembly. The parking brake cycle count can be checked using the Land Rover approved diagnostic system, (ON/OFF = 1 cycle). If a cable breaks or becomes detached whilst the vehicle is being driven, a 'parking brake actuator unjamming procedure' may be required using the Land Rover approved diagnostic system.

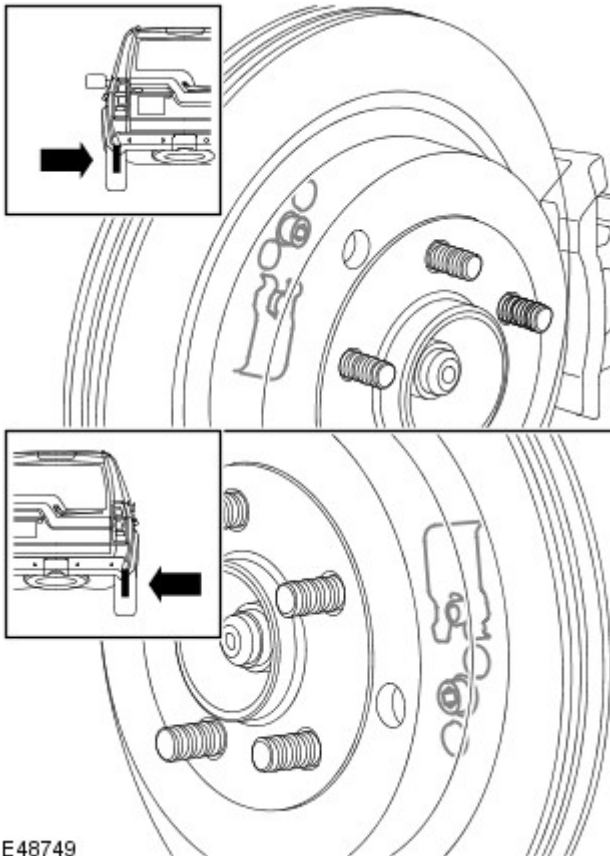
1. Using the Land Rover approved diagnostic system, drive the parking brake to the 'mounting position'.
2. Isolate the parking brake electrical circuit.
 - Remove fuse number 8 from the BJB.



3. **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

4. Remove both rear wheels and tires.
5. Release the parking brake shoe adjustment.
 - Loosen the screw.



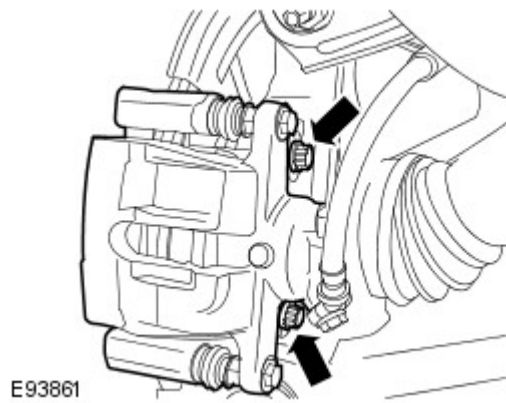
E48749



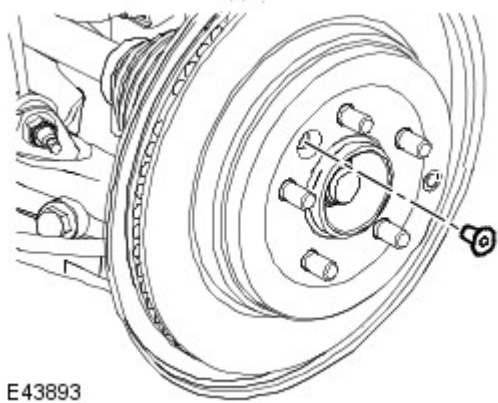
6. **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

Reposition the LH rear brake caliper.

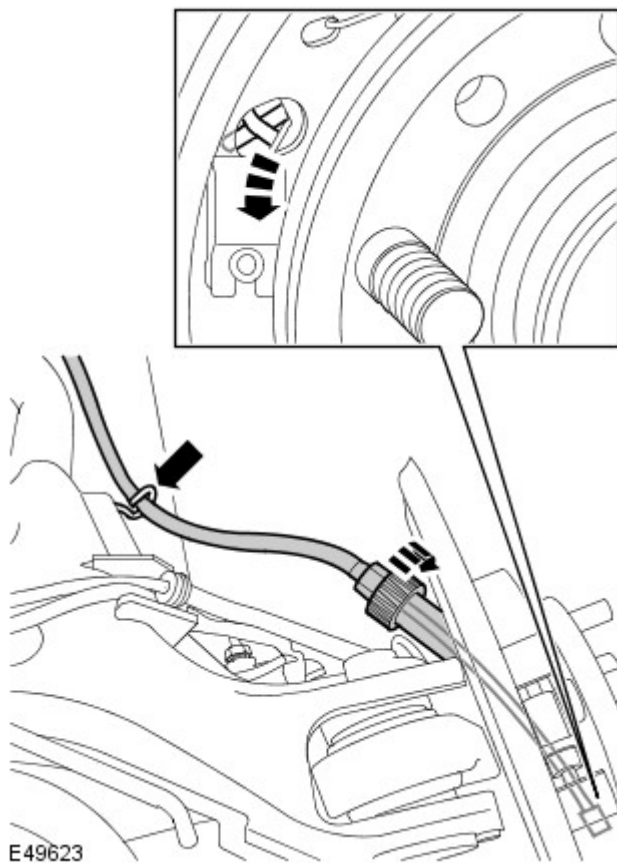
- Remove the 2 bolts.
- Using a suitable tie strap, support the brake caliper.



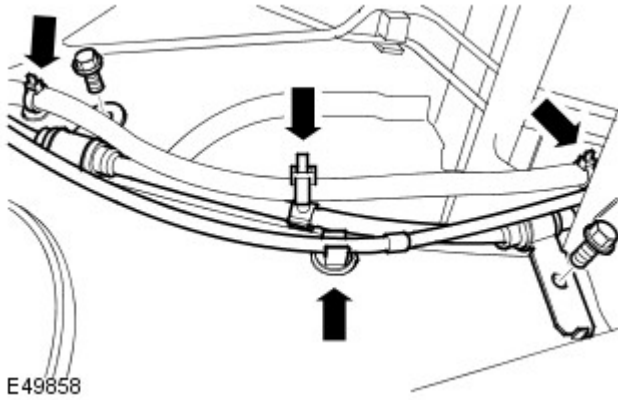
7. Remove the LH rear brake disc.
 - Remove the screw.



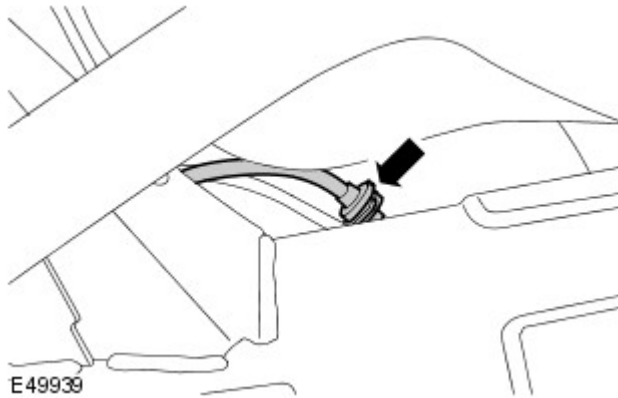
8. Disconnect parking brake cable from the wheel hub.
 - Fully loosen the nut.
 - Release the cable from the lower arm.
 - Disconnect the inner cable from the brake shoe.



9. Release the LH parking brake cable.
 - Remove the 2 bolts.
 - Release the 3 wiring harness clips.
 - Release the cable from the clip on the chassis.

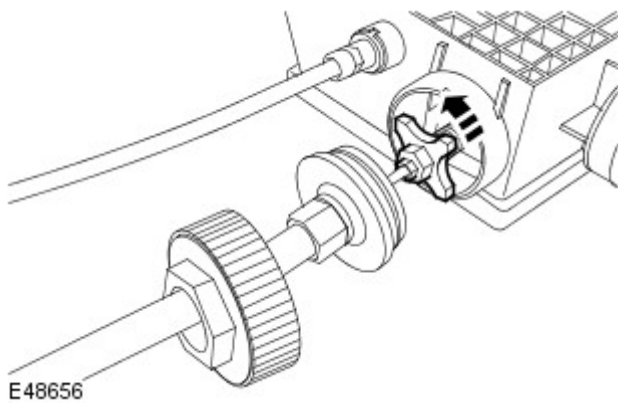


10. Release the LH parking brake cable.




11. Remove the LH parking brake cable.

- Release the retaining nut.
- Release and remove the cable.



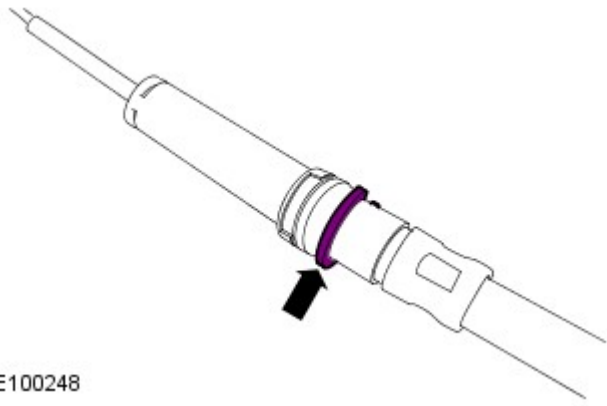
Installation

1. Install the LH parking brake cable.
 - LH cable: Screw the cable in 5 complete turns.
 - Tighten the retaining nut.
2. Locate and secure the LH parking brake cable.
 - Tighten the bolts to 22 Nm (16 lb.ft).
 - Secure the wiring harness.
 - Secure the cable grommet to the integrated body frame bracket.


3.  **NOTE:** Make sure that the brake cable circlip is positioned as shown.

Connect the parking brake cable to the wheel hub.

- Connect the cable to the brake shoe lever.
- Locate the cable to the backplate.
- Tighten the nut to 8 Nm (6 lb.ft).



E100248

4.  **CAUTION:** Make sure that the component is clean, free of foreign material and lubricant.

Install the LH rear brake disc.

- Tighten the Torx screw to 35 Nm (26 lb.ft).

5. Secure the LH rear brake caliper.
 - Remove and discard the tie strap.
 - Tighten the bolts to 115 Nm (85 lb.ft).

6.  **NOTE:** The adjustment procedure must be carried out in full.

Adjust the parking brake shoes.

For additional information, refer to: Parking Brake Shoe and Lining Adjustment (206-05, General Procedures).

7. Install the rear wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
8. Install fuse number 8 into the BJB.

Parking Brake and Actuation - Parking Brake Cable RH

Removal and Installation

Removal



CAUTION: To avoid accidental operation of the parking brake, and possible damage to the parking brake actuator, remove Fusible link 8, located in the engine compartment fuse box before commencing work.



NOTE: If the parking brake system has completed less than 50,000 cycles it is permissible to replace the parking brake cables. If over 50,000 cycles have been completed, then the cables can only be replaced as part of the parking brake actuator and cable assembly. The parking brake cycle count can be checked using the Land Rover approved diagnostic system, (ON/OFF = 1 cycle). If a cable breaks or becomes detached whilst the vehicle is being driven, a 'parking brake actuator unjamming procedure' may be required using the Land Rover approved diagnostic system.

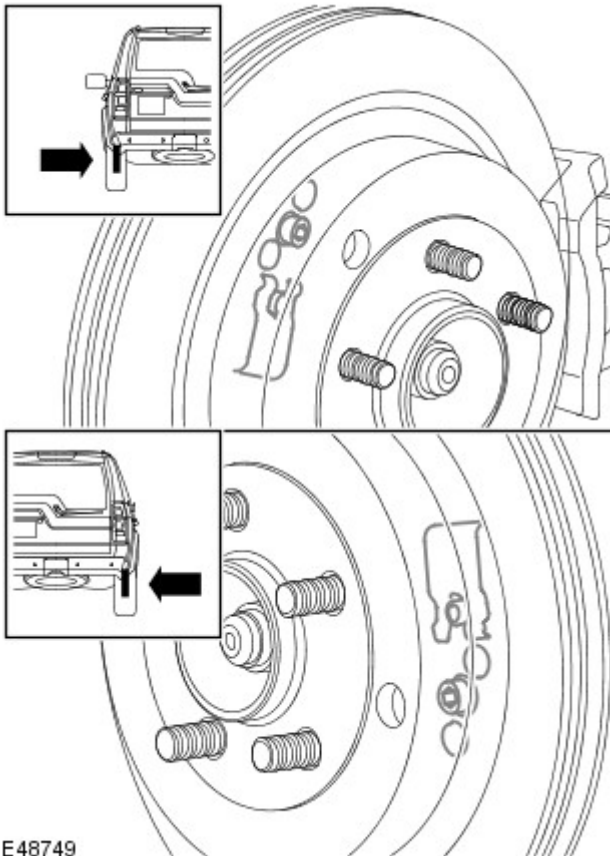
1. Using the Land Rover approved diagnostic system, drive the parking brake to the 'mounting position'.
2. Isolate the parking brake electrical circuit.
 - Remove fuse number 8 from the BJB.



3. **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

4. Remove the wheels and tires.
5. Release the parking brake shoe adjustment.
 - Loosen the screw.



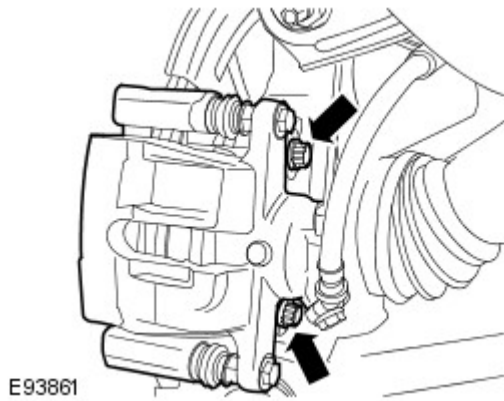
E48749



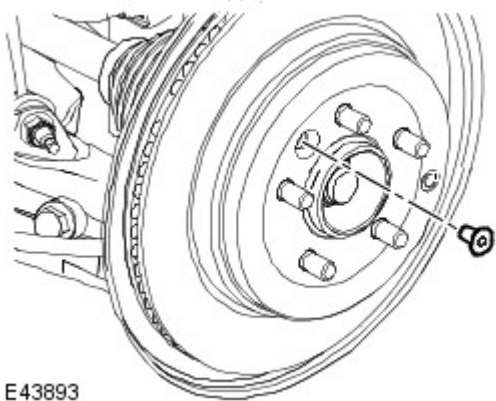
6. **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

Reposition the RH rear brake caliper.

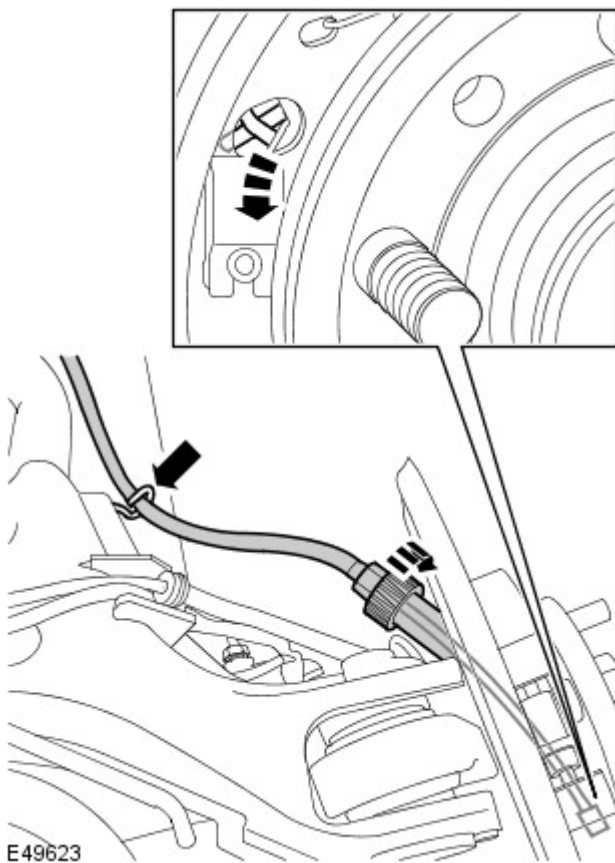
- Remove the 2 bolts.
- Using a suitable tie strap, support the brake caliper.




7. Remove the RH rear brake disc.
 - Remove the screw.

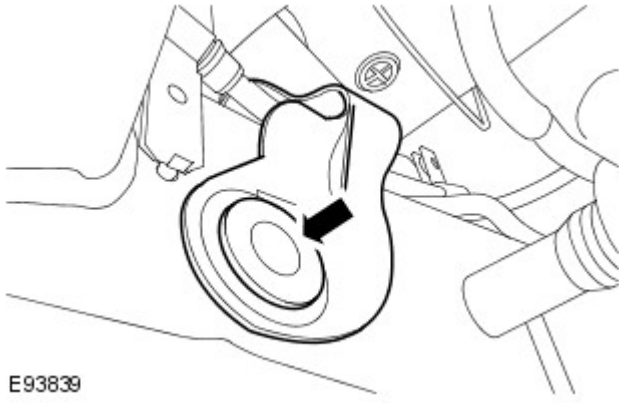


8. Disconnect parking brake cable from the wheel hub.
 - Fully loosen the nut.
 - Release the cable from the lower arm.
 - Disconnect the inner cable from the brake shoe.

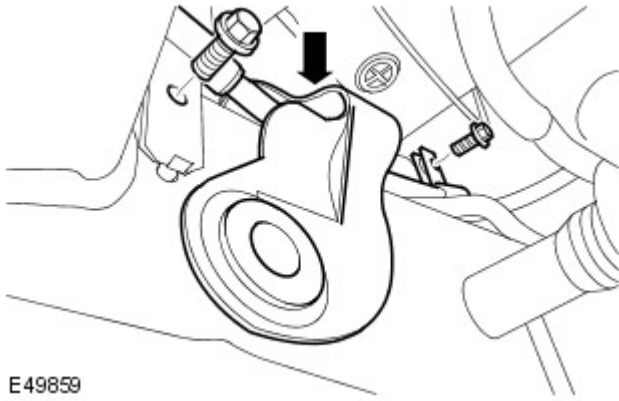


9.  **CAUTION:** The fuel tank breather line bracket can be easily damaged when releasing it from the chassis.

- Release the fuel tank breather line bracket.
- Remove the plastic insert.

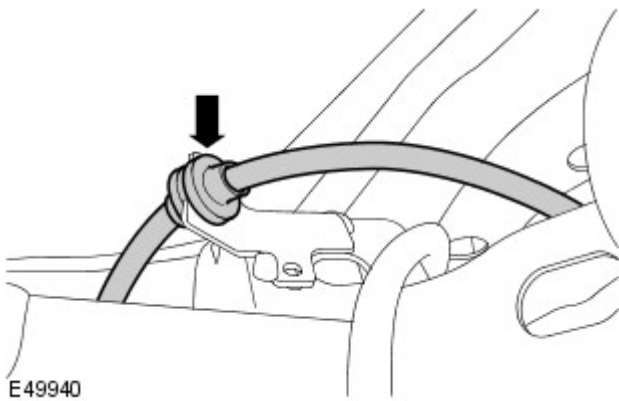


E93839



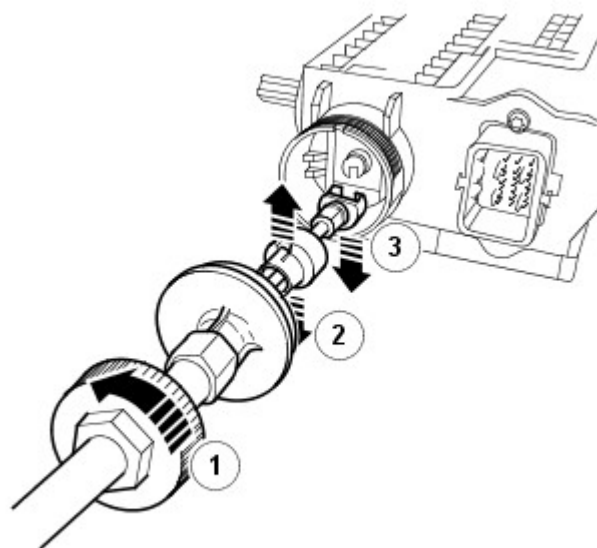
E49859

10. Release the RH parking brake cable.
 - Remove the 2 bolts.
 - Release the parking brake cable from the 2 pipe clips.
 - Release the cable from the clip on the chassis.




E49940

11. Release the RH parking brake cable.



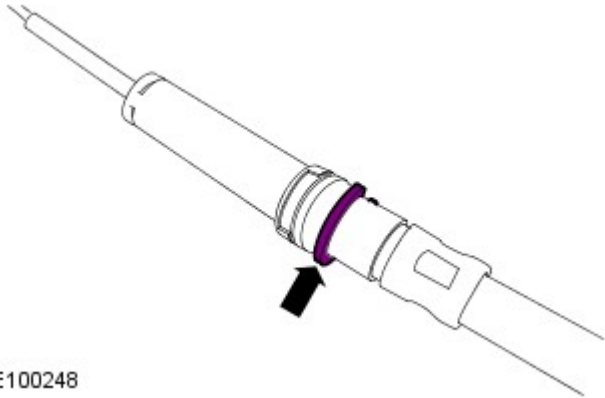
E61820

12.  **CAUTION:** Make sure that no dirt or moisture enters the actuator during cable replacement.


- Remove the RH parking brake cable.
- Release the retaining nut.
 - Release the cable retaining clip.
 - Release and remove the cable.

Installation

1. Install the RH parking brake cable.
 - Install the cable.
 - Install the cable retaining clip.
 - Tighten the retaining nut.
2. Secure the fuel tank breather line bracket.
 - Install the plastic insert.
3. Locate and secure the RH parking brake cable.
 - Tighten the bolts to 22 Nm (16 lb.ft).
 - Secure the parking brake cable to the 2 pipe clips.
 - Secure the cable grommet to the integrated body frame bracket.




E100248

4.  **NOTE:** Make sure that the brake cable circlip is positioned as shown.

Connect the parking brake cable to the wheel hub.

- Connect the cable to the brake shoe lever.
- Locate the cable to the backplate.
- Tighten the nut to 8 Nm (6 lb.ft).

5.  **CAUTION:** Make sure that the component is clean, free of foreign material and lubricant.

Install the RH rear brake disc.

- Tighten the Torx screw to 35 Nm (26 lb.ft).

6. Secure the RH rear brake caliper.
 - Remove and discard the tie strap.
 - Tighten the bolts to 115 Nm (85 lb.ft).

7.  **NOTE:** The adjustment procedure must be carried out in full.

Adjust the parking brake shoes.

For additional information, refer to: Parking Brake Shoe and Lining Adjustment (206-05, General Procedures).

8. Install the rear wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).

9. Install fuse number 8 into the BJB.

Parking Brake and Actuation - Parking Brake Switch

Removal and Installation

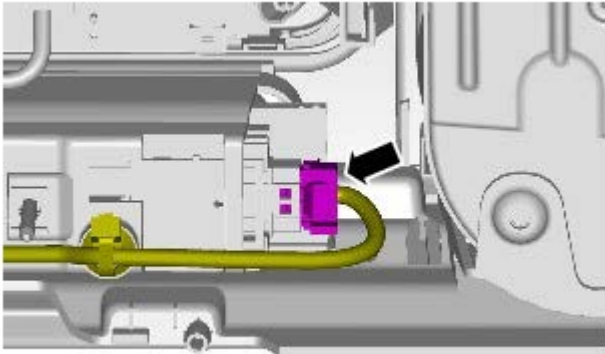
Removal



NOTE: Removal steps in this procedure may contain installation details.

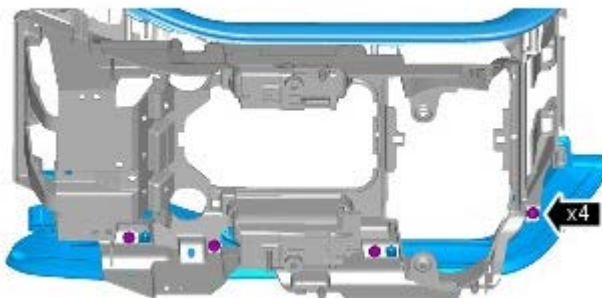
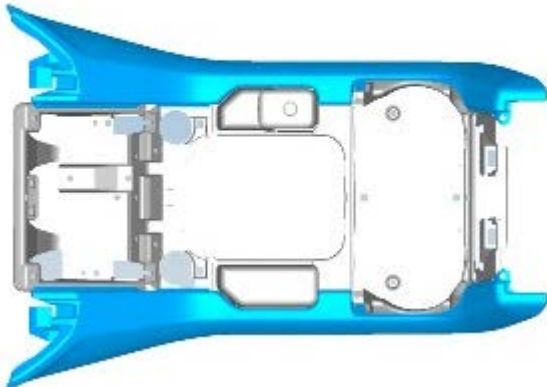
1. Refer to: Floor Console Upper Section (501-12, Removal and Installation).

2.



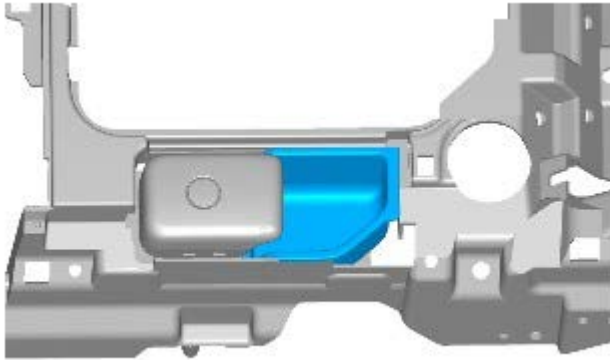
E 129852

3.



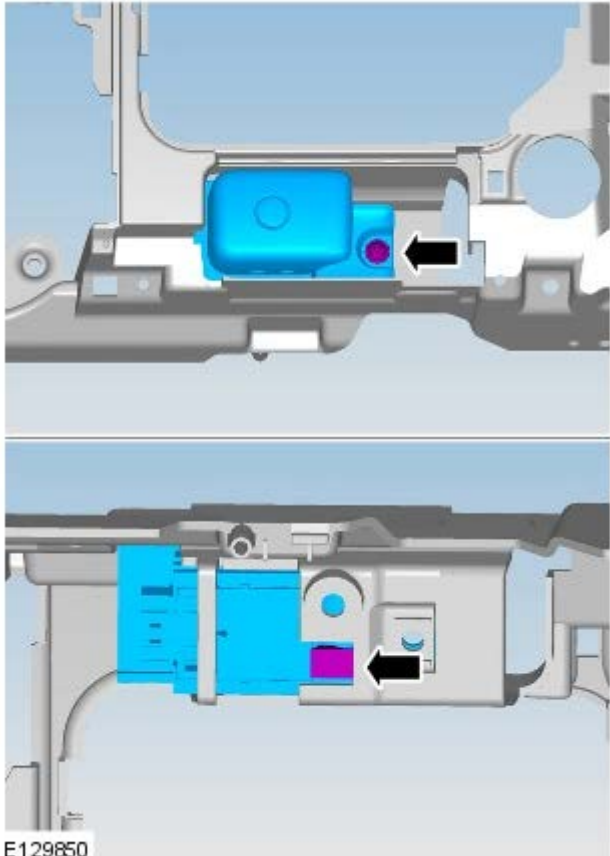
E129849

4.



E 129851

5.



E 129850

Installation


1. To install, reverse the removal procedure.

Parking Brake and Actuation - Parking Brake Actuator

Removal and Installation

Removal

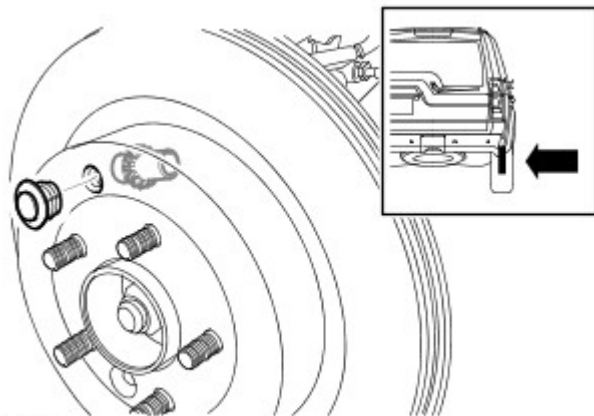
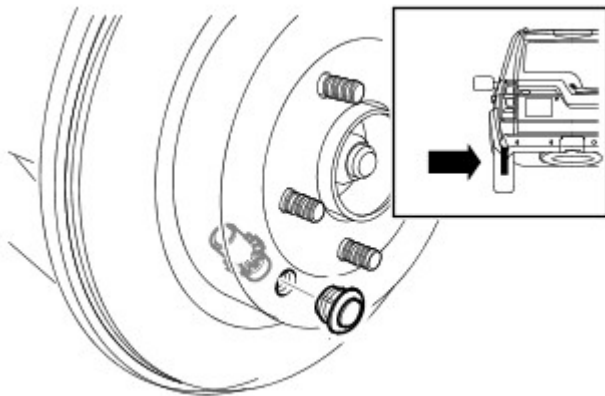
1. Using the Land Rover approved diagnostic system, drive the parking brake to the 'mounting position'.
2. Isolate the parking brake electrical circuit.
 - Remove fuse number 8 from the BJB.

3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

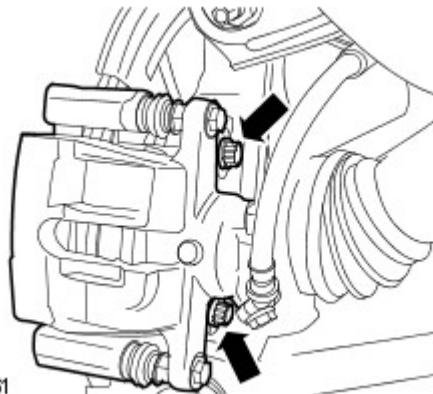
Raise and support the vehicle.

4. Remove the rear wheels and tires.


5. Release the parking brake shoe adjustment.
 - Remove the plug from the access hole in the brake disc.
 - Using a suitable tool, rotate the brake shoe adjuster to release the adjustment.



E48748



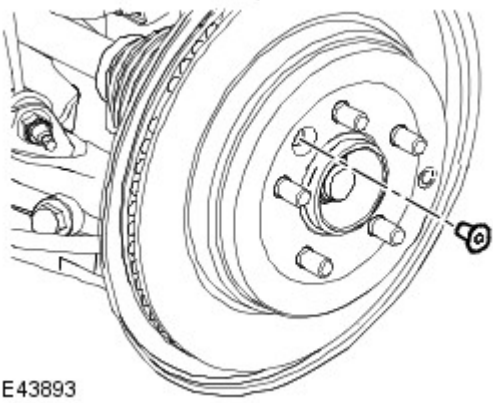
E93861


6.  **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

Reposition the RH rear brake caliper.

- Remove the 2 bolts.
- Using a suitable tie strap, support the brake caliper.

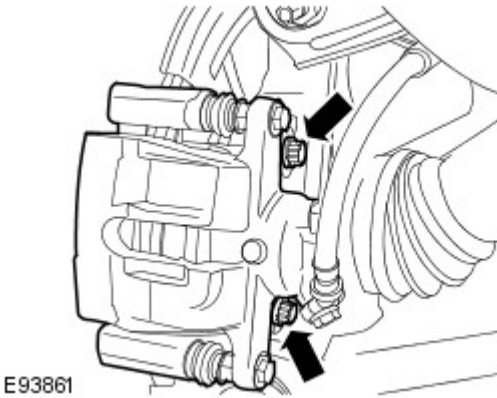
7. Remove the RH rear brake disc.
 - Remove the screw.



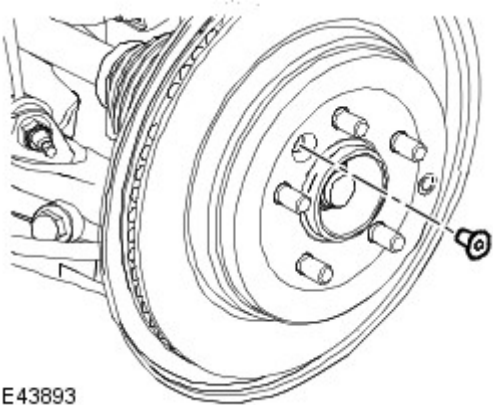
8.  **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

Reposition the LH rear brake caliper.

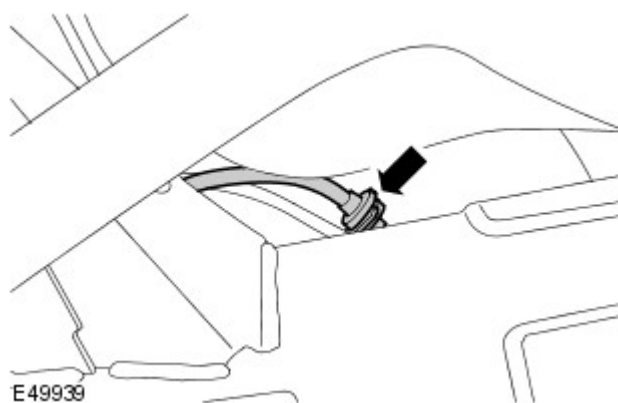
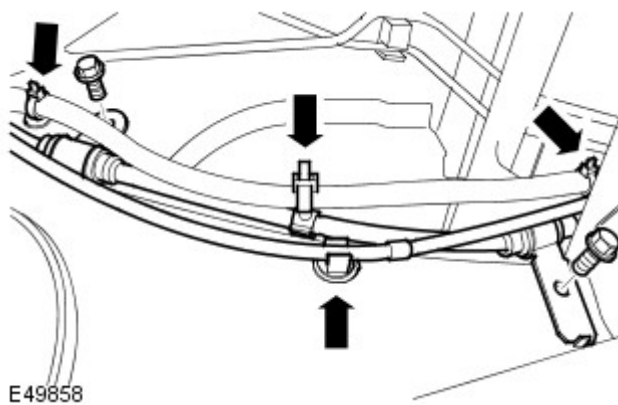
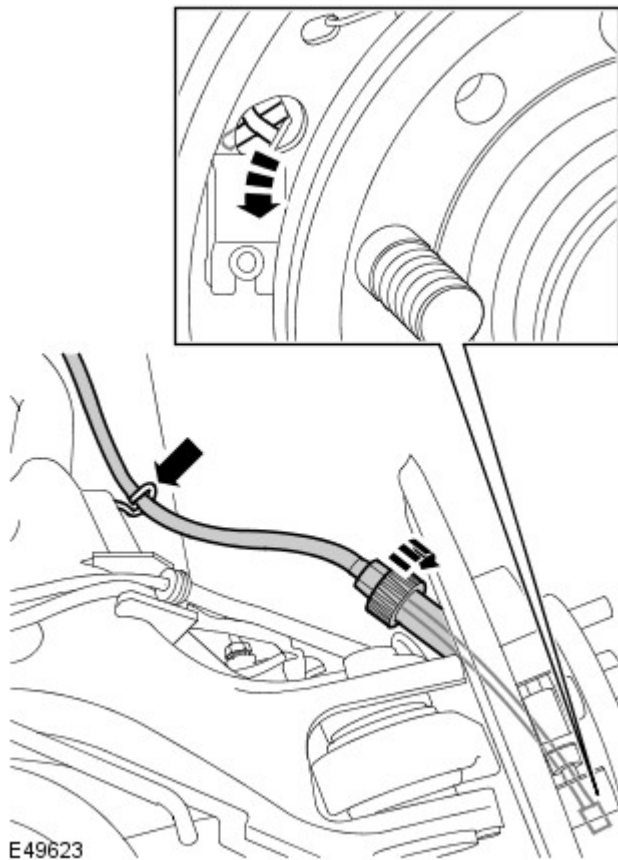
- Remove the 2 bolts.
- Using a suitable tie strap, support the brake caliper.



9. Remove the LH rear brake disc.
- Remove the screw.




10. Disconnect both parking brake cables from the wheel hubs.
- Fully loosen the nut.
 - Release the cable from the lower arm.
 - Disconnect the inner cable from the brake shoe.

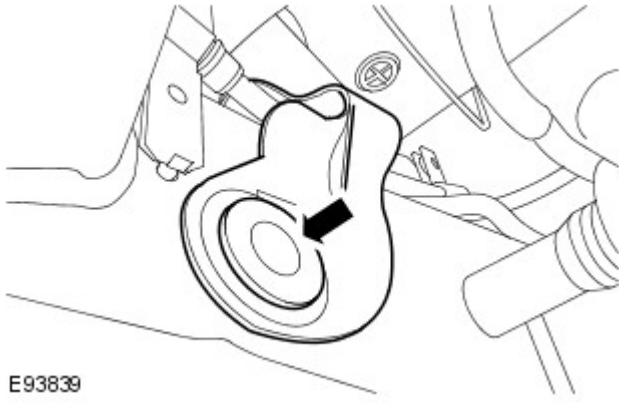


11. Release the LH parking brake cable.
 - Remove the 2 bolts.
 - Release the 3 wiring harness clips.
 - Release the cable from the clip on the chassis.

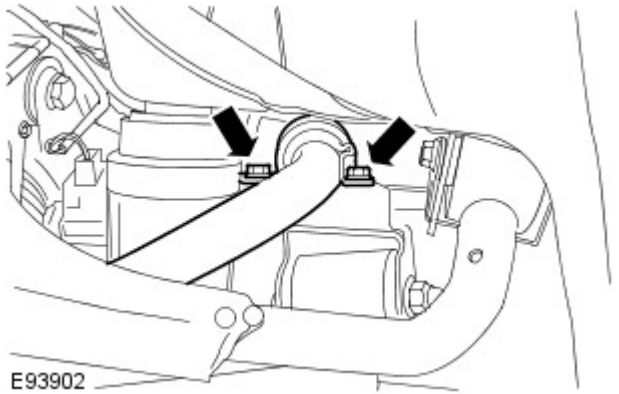
12. Release the LH parking brake cable.

13.  **CAUTION:** The fuel tank breather line bracket can be easily damaged when releasing it from the chassis.

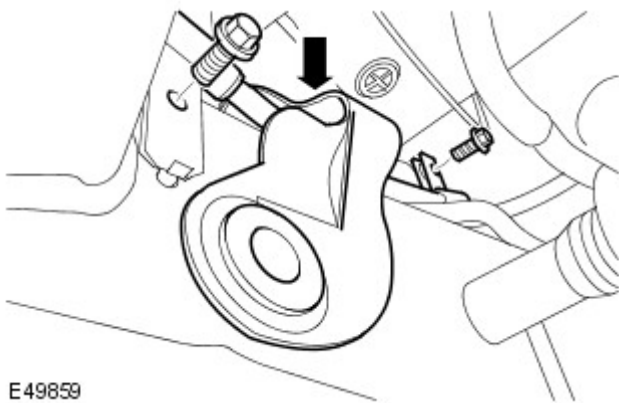
- Release the fuel tank breather line bracket.
- Remove the plastic insert.



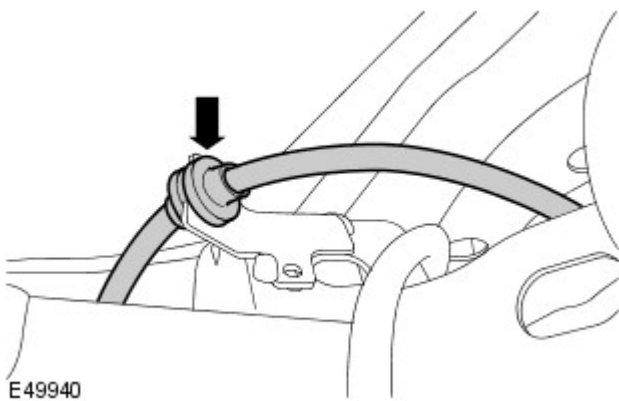
14. Raise the RH side of the rear stabilizer bar.
- Loosen the 2 bolts.



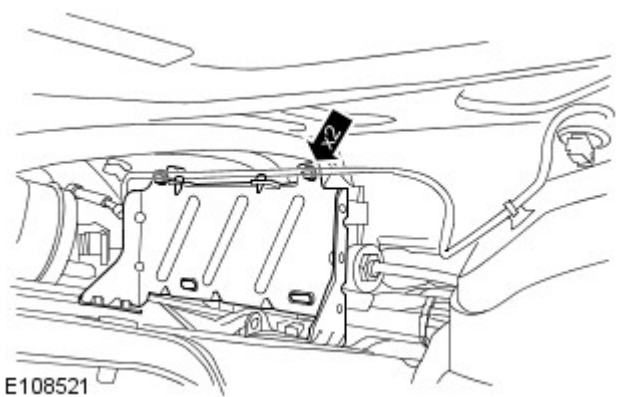
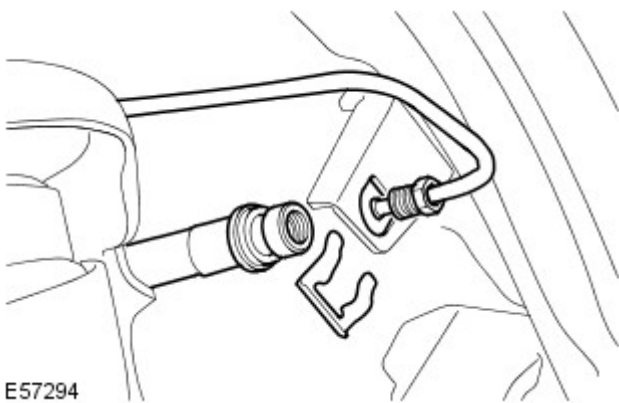
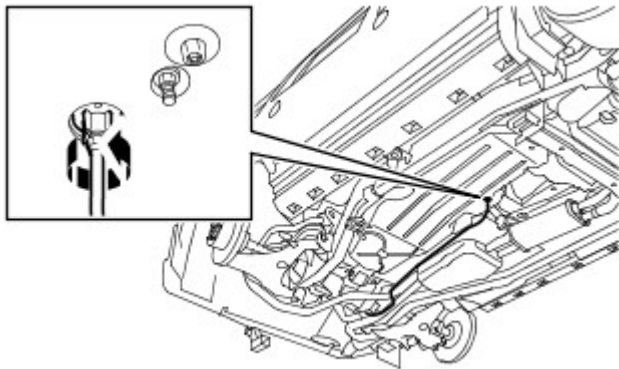
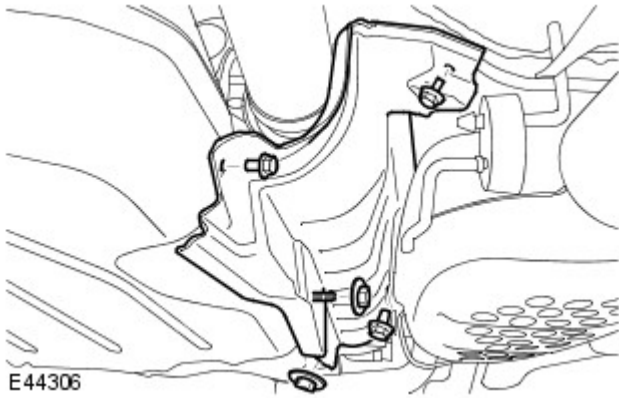
15. Release the RH parking brake cable.
- Remove the 2 bolts.
 - Release the parking brake cable from the 2 pipe clips.
 - Release the cable from the clip on the chassis.




16. Release the RH parking brake cable.




17. Remove the fuel tank heat shield.
- Remove the 3 bolts and 2 nuts.



18.  **CAUTION:** Inspect the parking brake emergency release cable to body seal and replace if damaged.

 **NOTE:** Note the fitted position of the parking brake emergency release cable to body seal.

Release the parking brake emergency release cable.

19.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

RH side rear: Disconnect the brake line.

- Position an absorbent cloth to collect fluid spillage.
- Disconnect the line union.
- Remove the clip.

20.  **NOTE:** Note the routing of the parking brake emergency release cable.

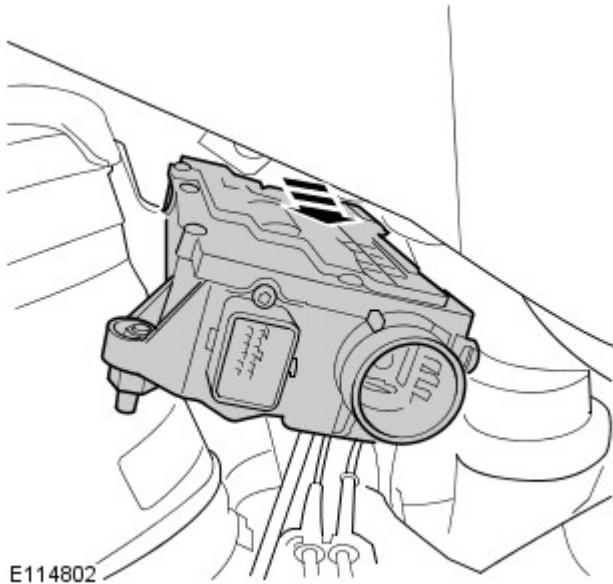
Displace the parking brake actuator and cable assembly.

- Disconnect the electrical connector.
- Remove the 2 nuts.

21.  **NOTE:** Brake cable shown removed for clarity.


Remove the parking brake actuator and cable assembly.

- Withdraw from the RH rear wheel arch aperture.




E114802


Installation

1.  **NOTE:** Note the routing of the parking brake emergency release cable.

Install the parking brake actuator and cable assembly.
 - Install the 2 nuts.
 - Connect the electrical connector.

2.  **NOTE:** Remove and discard the blanking caps.

RH side rear: Connect the brake line.
 - Clean the component mating faces.
 - Secure the clip.
 - Tighten the brake line union to 16 Nm (12 lb.ft).

3.  **CAUTION:** Make sure the parking brake emergency release cable to body seal is installed correctly.


Locate and secure the parking brake emergency release cable.

4. Install the fuel tank heat shield.
 - Tighten the bolts to 6 Nm (4 lb.ft).
 - Tighten the nuts to 3 Nm (2 lb.ft).

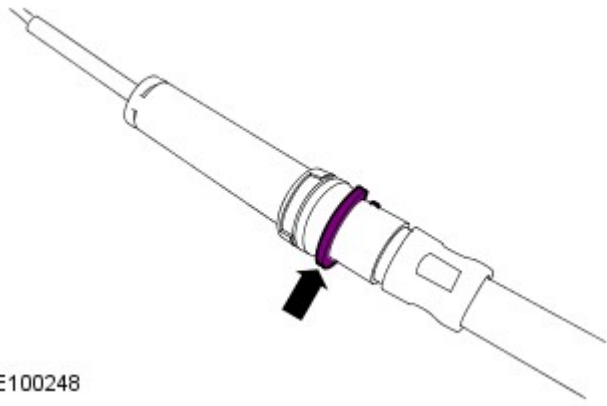
5. Secure the fuel tank breather line bracket.
 - Install the plastic insert.

6. Locate and secure the RH parking brake cable.
 - Tighten the bolts to 22 Nm (16 lb.ft).
 - Secure the parking brake cable to the 2 pipe clips.
 - Secure the cable grommet to the integrated body frame bracket.

7. Locate and secure the LH parking brake cable.
 - Tighten the bolts to 22 Nm (16 lb.ft).
 - Secure the wiring harness.
 - Secure the cable grommet to the integrated body frame bracket.


8.  **NOTE:** Make sure that the brake cable circlip is positioned as shown.

Connect the parking brake cables to the wheel hubs.
 - Connect the cable to the brake shoe lever.
 - Locate the cable to the backplate.



E100248


- Tighten the nut to 8 Nm (6 lb.ft).

9.  **CAUTION:** Make sure that the component is clean, free of foreign material and lubricant.

Install the LH rear brake disc.

- Tighten the Torx screw to 35 Nm (26 lb.ft).

10. Secure the LH rear brake caliper.
- Remove and discard the tie strap.
 - Tighten the bolts to 115 Nm (85 lb.ft).

11.  **CAUTION:** Make sure that the component is clean, free of foreign material and lubricant.

Install the RH rear brake disc.

- Tighten the Torx screw to 35 Nm (26 lb.ft).

12. Secure the RH rear brake caliper.
- Remove and discard the tie strap.
 - Tighten the bolts to 115 Nm (85 lb.ft).

13. Adjust the parking brake shoes.
For additional information, refer to: Parking Brake Shoe and Lining Adjustment (206-05, General Procedures).

14. Bleed the brake system.
For additional information, refer to: Component Bleeding (206-00, General Procedures).

15. Install the wheels and tires.
- Tighten the wheel nuts to 140 Nm (103 lb.ft).

16. Install fuse number 8 into the BJB.

17. Using the Land Rover approved diagnostic system, calibrate the parking brake actuator on an even surface.

18. Apply and release hand brake to confirm operation.

Parking Brake and Actuation - Parking Brake Shoes


Removal and Installation

Removal



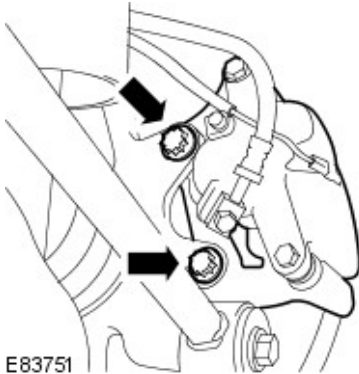
NOTE: If the parking brake shoes or the brake discs have been removed for access to other components then **DO NOT** carry out the bedding in procedure.

1. Using the Land Rover approved diagnostic system, drive the parking brake to the 'mounting position'.
2. Isolate the parking brake electrical circuit.
 - Remove fuse number 8 from the BJB.

3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

4. Remove the wheels and tires.
5. Release the brake caliper.
 - Remove the brake caliper anchor bolts.

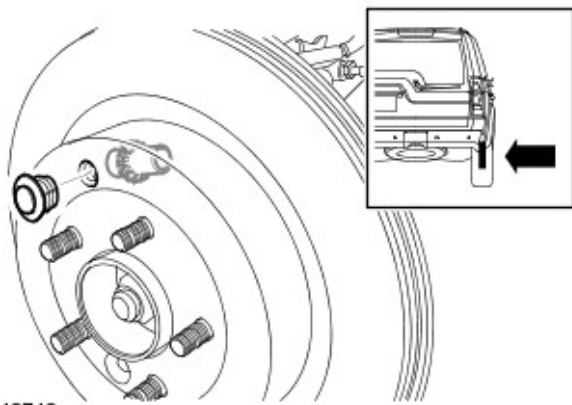
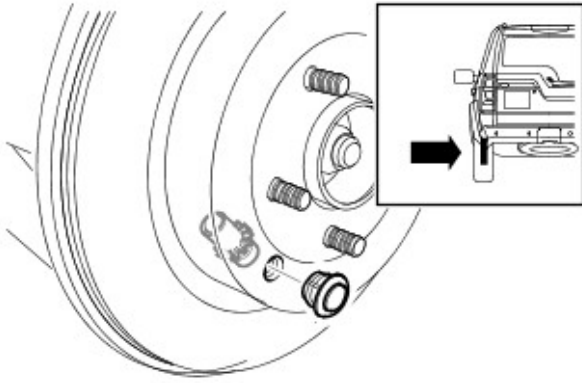


E83751

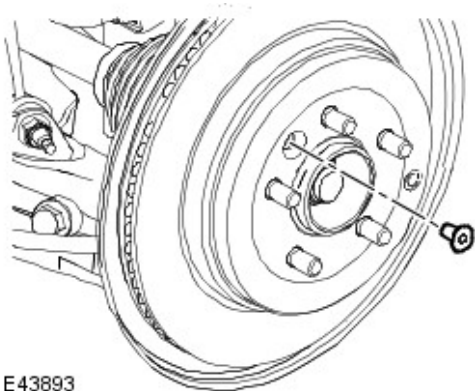
6.  **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

Tie the brake caliper aside.

7. Release the park brake shoe adjustment.
 - Remove the plug from the access hole in the brake disc.
 - Using a suitable tool, rotate the brake shoe adjuster to release the adjustment.



E48748



E43893

8. Remove the brake disc.
 - Remove the Torx screw.

9. CAUTIONS:



Make sure that the green bias spring is installed to the right hand parking brake shoes and the red bias spring is installed to the left hand parking brake shoes.

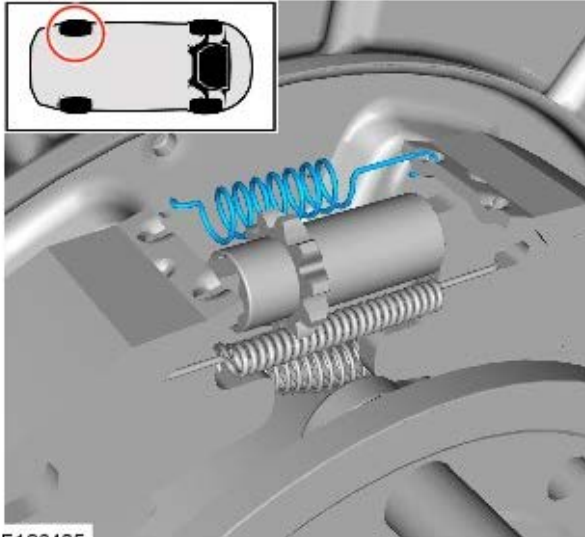


Make sure the brake shoe spring is not over stretched.

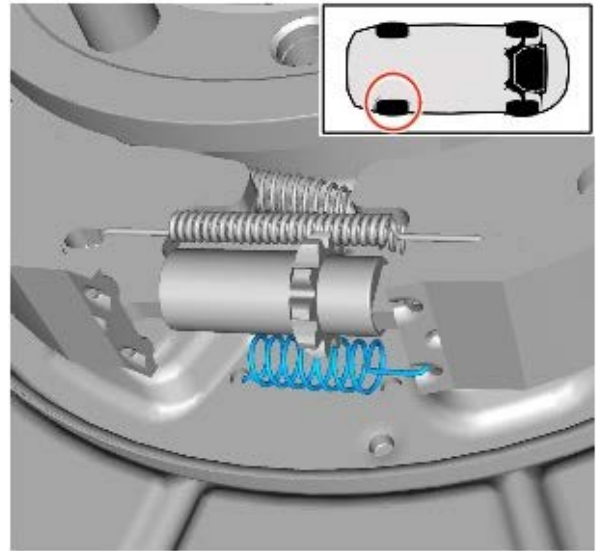


NOTE: If equipped.

Remove the bias spring(s).



E136405

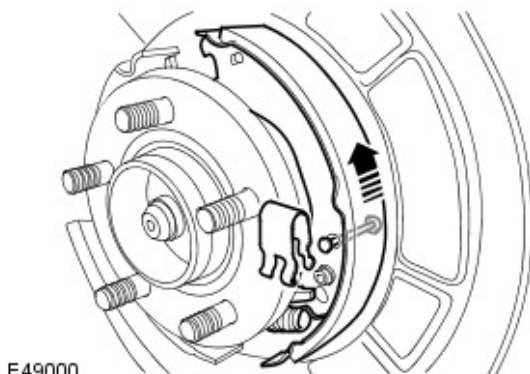


10. Remove the adjuster and return spring.
 - Release the parking brake shoe adjuster to the minimum adjustment.



E48999

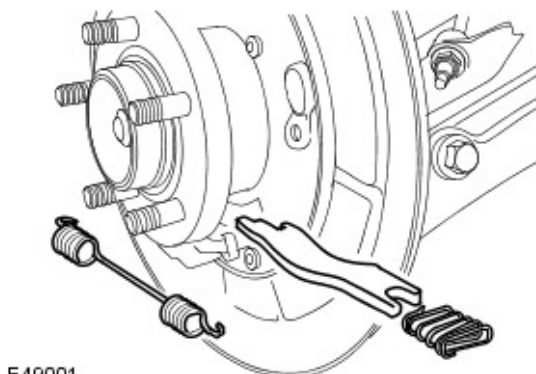
11. Remove the primary brake shoe.
 - Remove the hold-down spring and retaining pin.
 - Pivot the shoe to release it from the spreader plate and return spring.



E49000

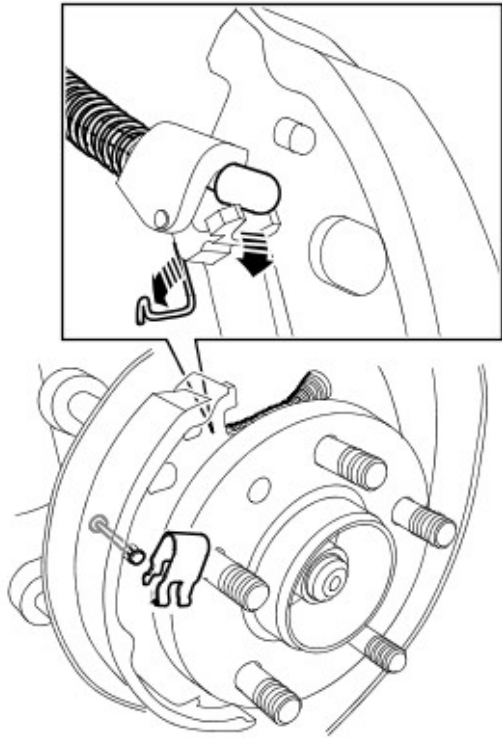
12. Remove the spreader plate and spring.

13. Remove the return spring.



E49001

14. Remove the secondary brake shoe.
 - Remove the hold-down spring and retaining pin.




- Disconnect the parking brake cable retaining spring from the brake shoe lever.
- Release the parking brake cable.

E49002

15. Repeat the above procedure for the other side.


Installation

1.  **WARNING:** Do not use compressed air to clean brake components. Dust from friction materials can be harmful if inhaled.

Clean the backing plate and apply grease to the brake shoe contacts.

2. Clean the adjuster and set it to its minimum extension.

3. **CAUTIONS:**

 Make sure the brake shoe spring is not over stretched.


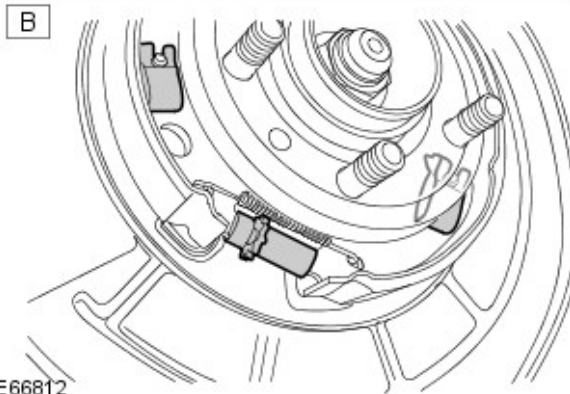
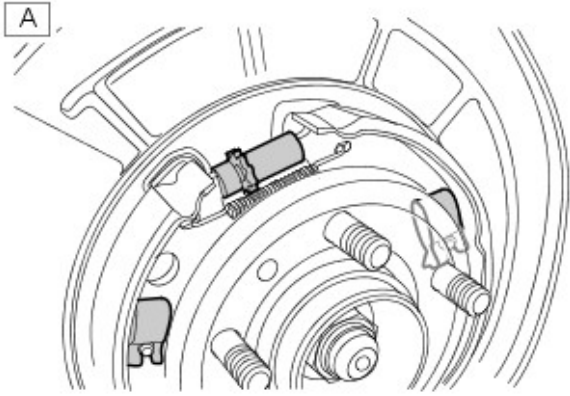
 Make sure the closed end of the retaining clip is installed facing the brake shoe adjuster. Failure to follow this instruction may result in damage to the vehicle.

 Illustration 'A' is the LH side and 'B' is the RH side.

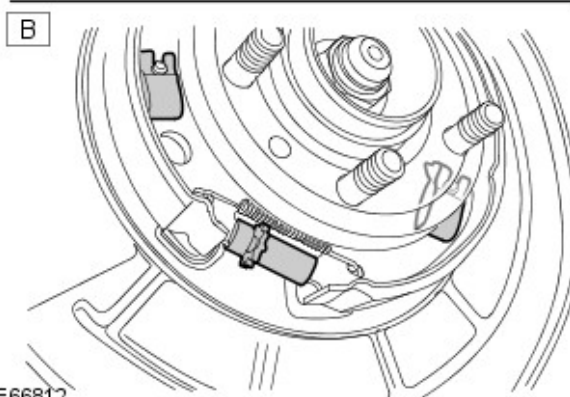
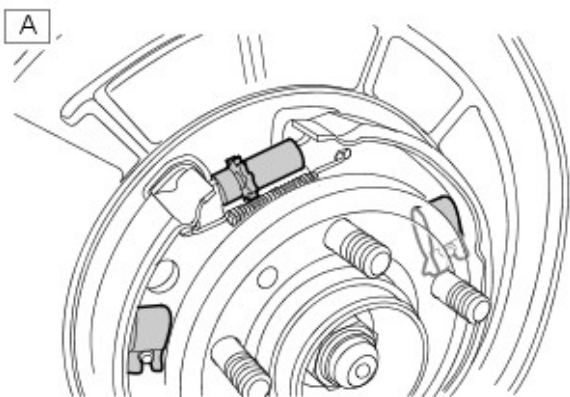
Install the secondary brake shoe.

- Connect the parking brake cable.
- Connect the parking brake cable retaining spring to the brake shoe lever, making sure the spring is not twisted.
- Install the hold-down spring and retaining pin.




E66812

4. Install the spreader plate and the spring.
 - Using a tie strap, tie back the spreader plate spring.



E66812

5.  **WARNING:** Make sure the return spring and the adjuster spring are correctly installed to the primary shoe.

CAUTIONS:

 Make sure the brake shoe spring is not over stretched.



 Make sure the closed end of the retaining clip is installed facing the brake shoe adjuster. Failure to follow this instruction may result in damage to the vehicle.

 Illustration 'A' is the LH side and 'B' is the RH side.

Install the primary brake shoe.


- Install the return spring.
- Connect the primary brake shoe to the return spring.
- Locate the primary brake shoe to the spreader plate.
- Install the hold-down spring and retaining pin.

6.  **CAUTION:** Make sure the brake shoe spring is not over stretched.

Install the brake shoe adjuster and the retaining spring.

7. Remove and discard the spreader plate spring tie strap.

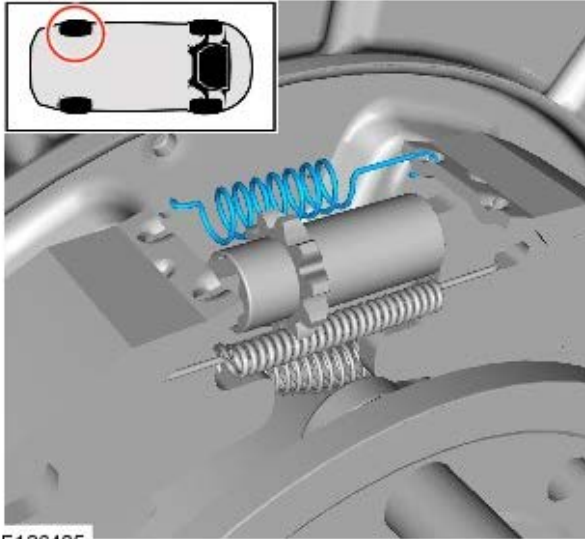
8. CAUTIONS:

 Make sure that the green bias spring is installed to the right hand parking brake shoes and the red bias spring is installed to the left hand parking brake shoes.

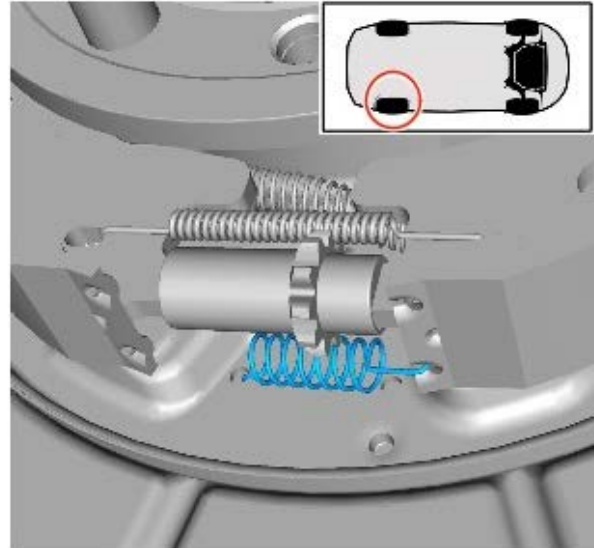
 Make sure the brake shoe spring is not over stretched.

 NOTE: **If equipped.**

Install the bias spring(s).



E136405



9. Make sure the brake disc and hub mating surfaces are clean.
10. Install the brake disc.
 - Tighten the Torx screw to 35 Nm (26 lb.ft).
11. Install the brake caliper.
 - Tighten the bolts to 115 Nm (85 lb.ft).
12. Repeat the above procedure for the other side.
13. Adjust the parking brake.
For additional information, refer to: Parking Brake Shoe and Lining Adjustment (206-05 Parking Brake and Actuation, General Procedures).
14. Install the wheels and tires.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
15. Install fuse number 8 into the BJB.

Hydraulic Brake Actuation -

General Specifications

Item	Specification
Master cylinder bore diameter:	
Primary	27 mm (1.1 in)
Secondary	20.6 mm (0.8 in)
Stroke	36 mm (1.4 in)

Torque Specifications

Description	Nm	lb-ft
Brake pedal nut and bolt - Automatic gearbox	45	33
Brake pedal bracket Torx bolts - Automatic gearbox	10	7
Brake booster to brake pedal bracket nuts - Automatic gearbox	25	18
Brake master cylinder nuts	26	19
Brake pipe unions	18	13

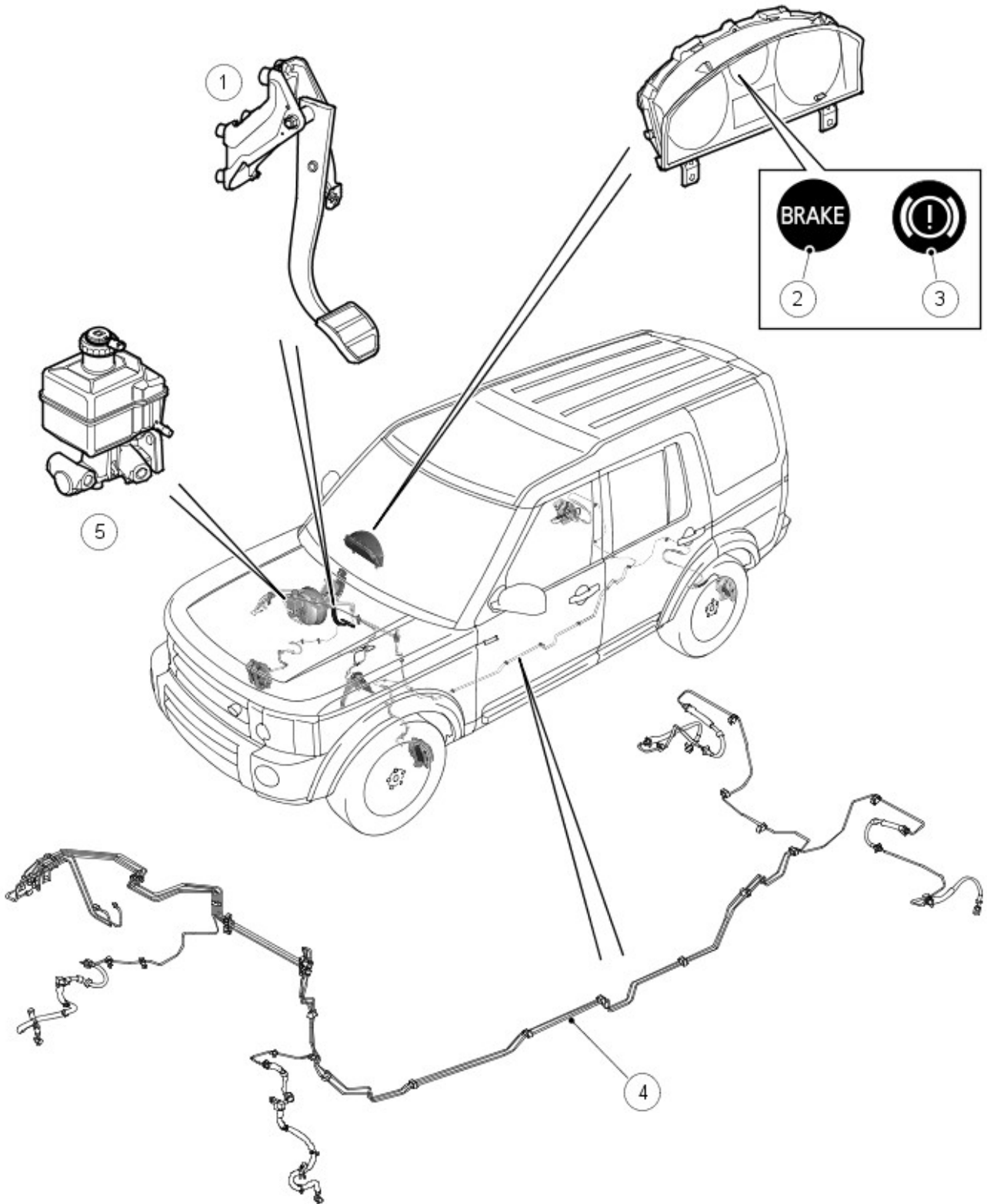
Hydraulic Brake Actuation - Hydraulic Brake Actuation

Description and Operation

COMPONENT LOCATIONS



NOTE: RHD shown, LHD similar



E48285

Item	Part Number	Description
1	-	Brake pedal (automatic shown)
2	-	Brake warning indicator (NAS)
3	-	Brake warning indicator (all except NAS)

- 4 - Brake pipes and hoses
- 5 - Brake master cylinder and reservoir

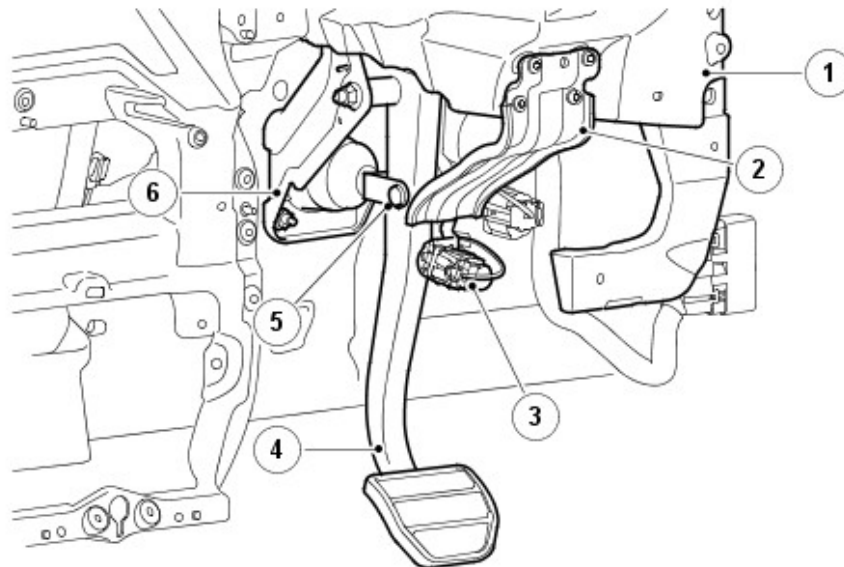
GENERAL

Hydraulic brake actuation consists of the brake pedal, the brake master cylinder and the hydraulic pipes and hoses.

BRAKE PEDAL



NOTE: Automatic gearbox model shown, manual gearbox model similar



E48286

Item	Part Number	Description
1	-	In-vehicle cross beam
2	-	Brake pedal buffer
3	-	Stoplamp switch
4	-	Brake pedal
5	-	Clevis pin and clip
6	-	Brake pedal bracket

The brake pedal is mounted in a bracket attached to the rear side of the engine bulkhead. On Left Hand Drive (LHD) manual gearbox models, the brake pedal shares a bracket and pivot bolt with the clutch pedal. On Right Hand Drive (RHD) manual gearbox models, the brake pedal has a separate bracket. A clevis pin and clip connect the brake pedal to the push rod of the brake booster. A brake pedal buffer is installed on the in-vehicle cross beam to restrain rearward movement of the brake pedal in an accident.

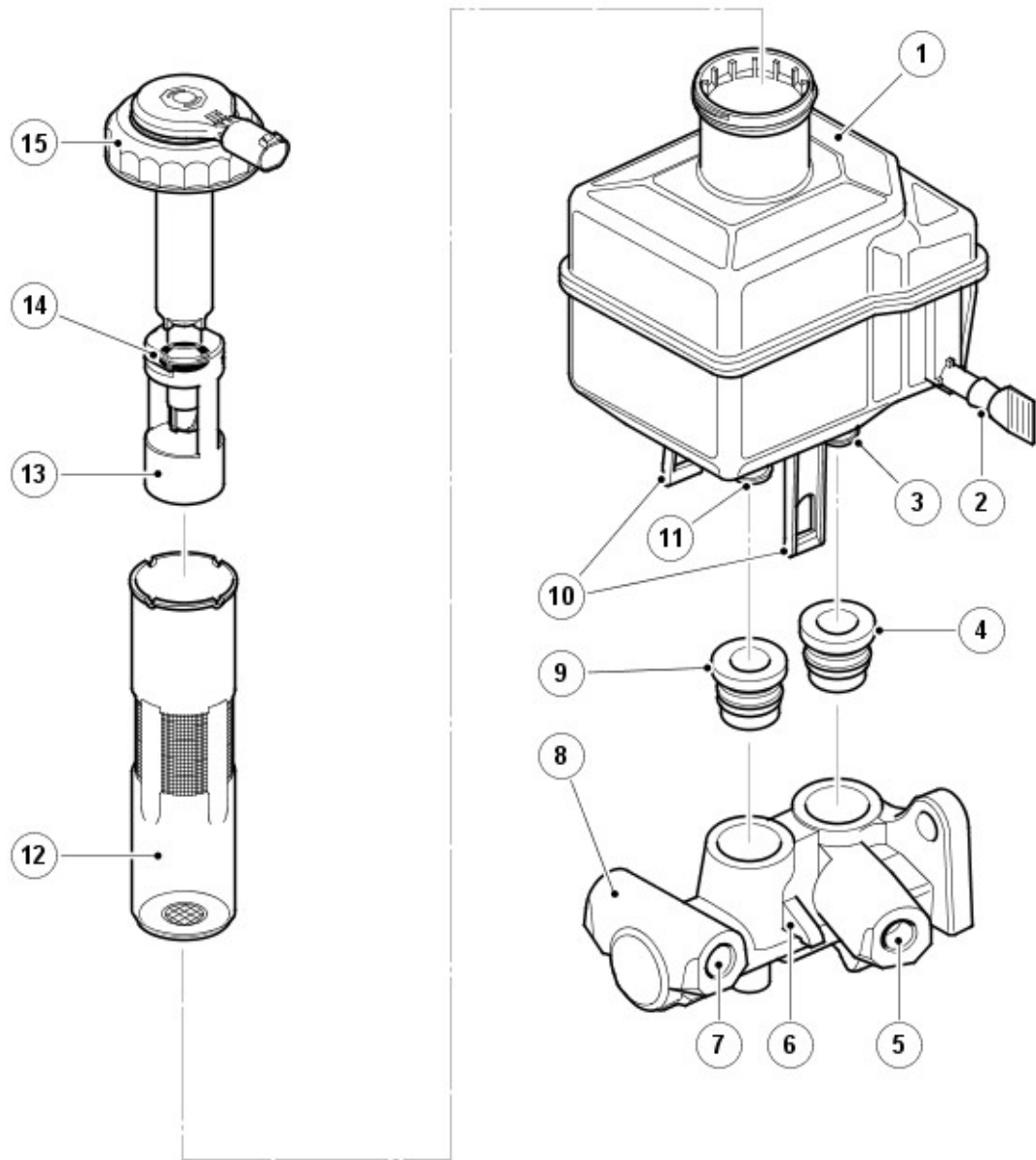
The stoplamp switch is mounted in the brake pedal bracket and operated by the brake pedal.

For additional information, refer to: Anti-Lock Control - Traction Control (206-09A Anti-Lock Control - Traction Control, Description and Operation).

BRAKE MASTER CYLINDER AND RESERVOIR



NOTE: RHD version shown, LHD version similar



E48287

Item	Part Number	Description
1	-	Reservoir
2	-	Clutch outlet spigot and sealing cap
3	-	Primary outlet spigot
4	-	Reservoir to master cylinder seal, primary inlet
5	-	Primary outlet port
6	-	Reservoir securing lug
7	-	Secondary outlet port
8	-	Cylinder housing
9	-	Reservoir to master cylinder seal, secondary inlet
10	-	Reservoir securing straps
11	-	Secondary outlet spigot
12	-	Filter
13	-	Float
14	-	Magnet
15	-	Reservoir cap and level switch

The brake master cylinder and reservoir is attached to the front of the brake booster, on the driver side of the engine compartment.

Master Cylinder

The brake master cylinder consists of a cylinder housing containing two pistons in tandem. The rear piston produces pressure for the primary circuit and the front piston produces pressure for the secondary circuit. The pistons incorporate center valves with a high flow rate to ensure there is always sufficient fluid available at the hydraulic control unit for stability control operations.

When the brake pedal is pressed, the front push rod in the brake booster pushes the primary piston along the bore of the cylinder housing. This produces pressure in the primary pressure chamber which, in conjunction with the primary spring, overcomes the secondary spring and simultaneously moves the secondary piston along the bore. The initial movement of the pistons, away from the piston stops, closes the primary and secondary center valves. Further movement of the pistons then pressurizes the fluid in the primary and secondary pressure chambers, and thus the brake circuits. The fluid in the chambers behind the pistons is unaffected by the movement of the pistons and can flow unrestricted through the feed holes between the chambers and the reservoir.

When the brake pedal is released, the primary and secondary springs push the pistons back down the bore of the cylinder housing. As the pistons contact the piston stops, the primary and secondary center valves open, which allows fluid to circulate unrestricted between the two hydraulic circuits and the reservoir, through the center valves, the chambers behind the pistons and the cylinder housing inlets.

Should a failure occur in one of the brake circuits, the remaining brake circuit will still operate effectively, although brake pedal travel and vehicle braking distances will increase.

Reservoir

The reservoir is installed on top of the master cylinder to provide a supply of brake fluid for the primary and secondary circuits of the brake system. On manual gearbox models, the reservoir also provides a supply of brake fluid for the clutch.

For additional information, refer to: Clutch Controls (308-02 Clutch Controls - 2.7L Diesel, Description and Operation).

Two straps, integrated onto the sides of the reservoir, engage with lugs on the master cylinder to secure the reservoir in position. Two outlet spigots on the underside of the reservoir locate in seals installed in the inlet ports of the master cylinder. An outlet spigot is installed on the left side of the reservoir for the clutch hydraulic circuit, if required. On automatic gearbox models, the clutch outlet spigot is sealed with a cap, formed during manufacture of the reservoir, which is only removed if the reservoir is installed on a manual gearbox model.

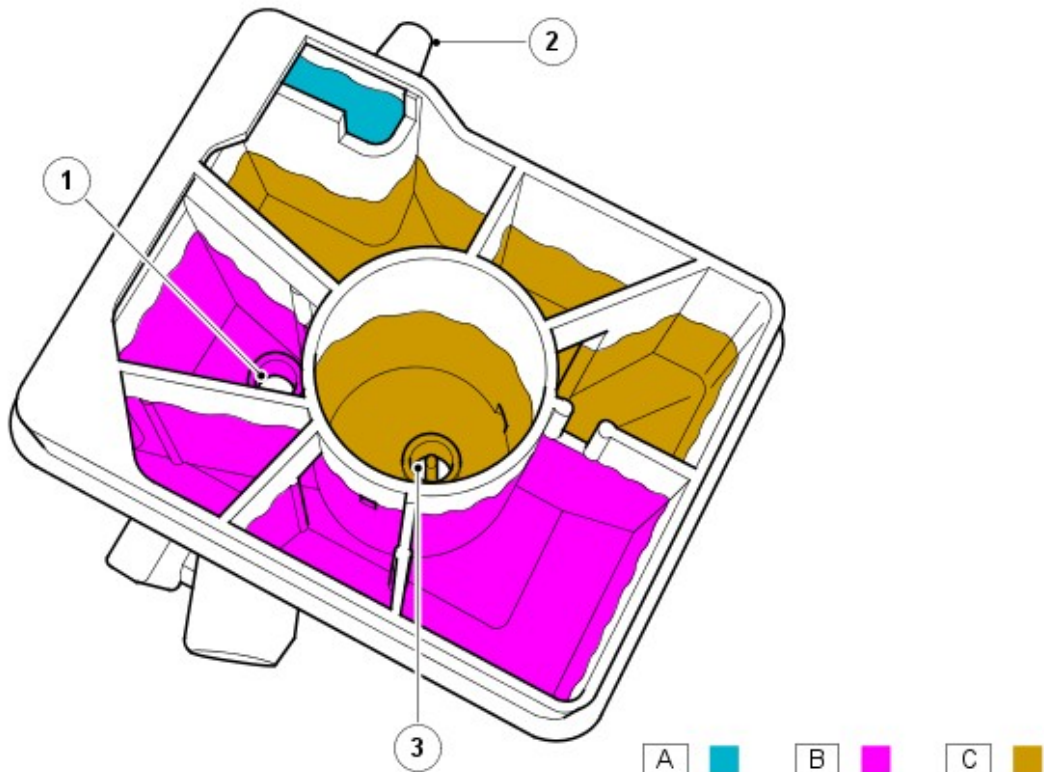
The reservoir is internally divided to isolate the circuits from each other at low fluid levels, and so prevent a leak in one circuit from disabling the other circuit(s). The dividing walls support a central well and divide the area around the well into a further eight separate compartments. The well forms an extension of the filler neck and contains the filter and the fluid level switch.

The well and the surrounding compartments are interconnected by slots in the dividing walls. The slots are positioned such that when the reservoir is full, fluid can move between the well and all of the surrounding compartments, but at low fluid levels the interior forms separate reservoirs for each circuit. The following figure shows the separate reservoirs for each circuit and the amount retained in each reservoir if there is a leak from one of the other circuits.

Reservoir Interior



NOTE: A = Clutch reservoir; B = Primary circuit reservoir; C = Secondary circuit reservoir



E48268

Item	Part Number	Description
1	-	Primary outlet

- 2 - Clutch outlet
- 3 - Secondary outlet

The filler neck of the reservoir is sealed with a cap incorporating the level switch. The level switch is operated by a magnet, which is installed in the float on the bottom of the switch. The switch reacts to the influence of the magnetic field surrounding the magnet.

When the reservoir is full, the float rests against the bottom of the switch and holds the level switch open. When the fluid level decreases, the float moves down and the switch closes to connect a ground to the instrument cluster. When the ground is made, the instrument cluster illuminates the red Light Emitting Diode (LED) in the brake warning indicator. Vehicles with the high line instrument cluster also display an appropriate warning in the message center. For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

At the beginning of each ignition cycle, the instrument cluster performs a bulb check on the brake warning indicator; the indicator is illuminated amber for 1.5 seconds, then red for 1.5 seconds.

The instrument cluster broadcasts the status of the brake fluid level, on the high speed Controller Area Network (CAN) bus, to the Anti-lock Brake System (ABS) module. For additional information, refer to: Anti-Lock Control - Traction Control (206-09A Anti-Lock Control - Traction Control, Description and Operation).

BRAKE PIPES AND HOSES

The brake pipes and hoses connect the master cylinder to the wheel brakes via the hydraulic control unit. The pipes are arranged to provide a front and rear split braking system. The brakes on the front axle are operated by the primary system; the brakes on the rear axle are operated by the secondary system.

Hydraulic Brake Actuation - Brake Fluid Reservoir


Removal and Installation

Removal



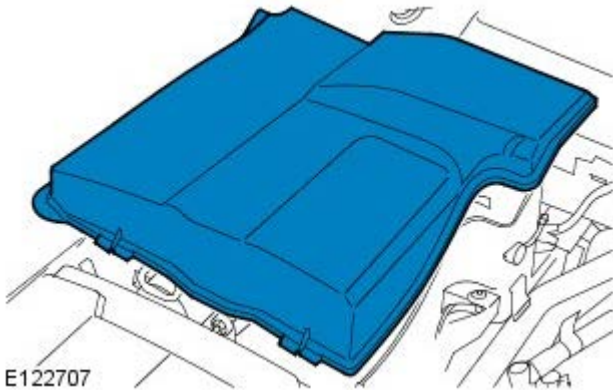
CAUTION: Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

All vehicles

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the cover.




3. Position an absorbent cloth to collect fluid spillage.
4. Disconnect the low brake fluid warning indicator switch electrical connector.

Vehicles with manual transmission

5.  **CAUTION:** Always plug any open connections to prevent contamination.

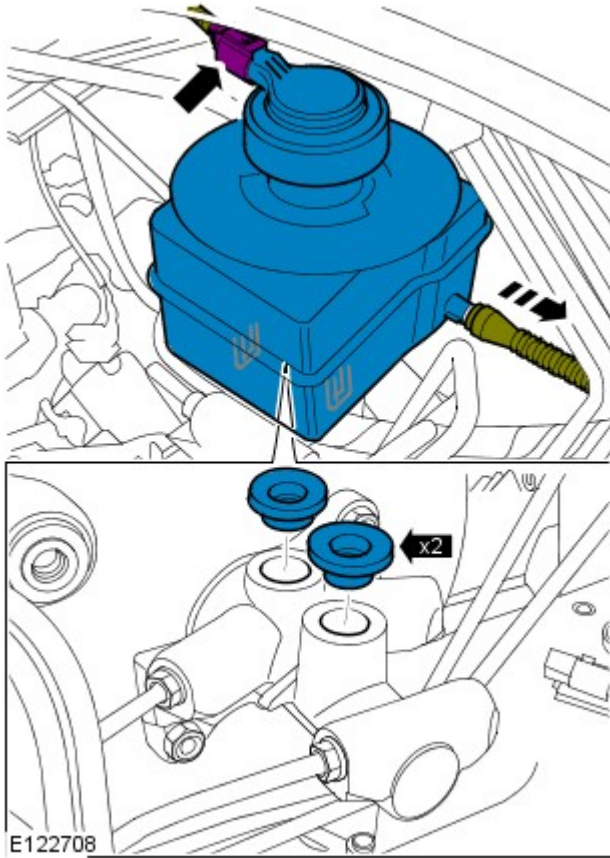
Disconnect the clutch master cylinder supply line.

All vehicles

6.  **CAUTION:** Always plug any open connections to prevent contamination.

Remove the brake fluid reservoir.

- Release the 2 clips.
- Remove and discard 2 brake fluid reservoir seals.



Installation

All vehicles

1. Clean the components.
2. Install the brake fluid reservoir.
 - Install new brake fluid reservoir seals.

Vehicles with manual transmission

3. Connect the clutch master cylinder supply line.

All vehicles

4. Connect the low brake fluid warning indicator switch electrical connector.
5. Bleed the brake system using T4.
For additional information, refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).

Vehicles with manual transmission

6. Bleed the clutch system.
For additional information, refer to: Clutch System Bleeding (308-00 Manual Transmission/Transaxle and Clutch - General Information, General Procedures).

Hydraulic Brake Actuation - Brake Master Cylinder


Removal and Installation

Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

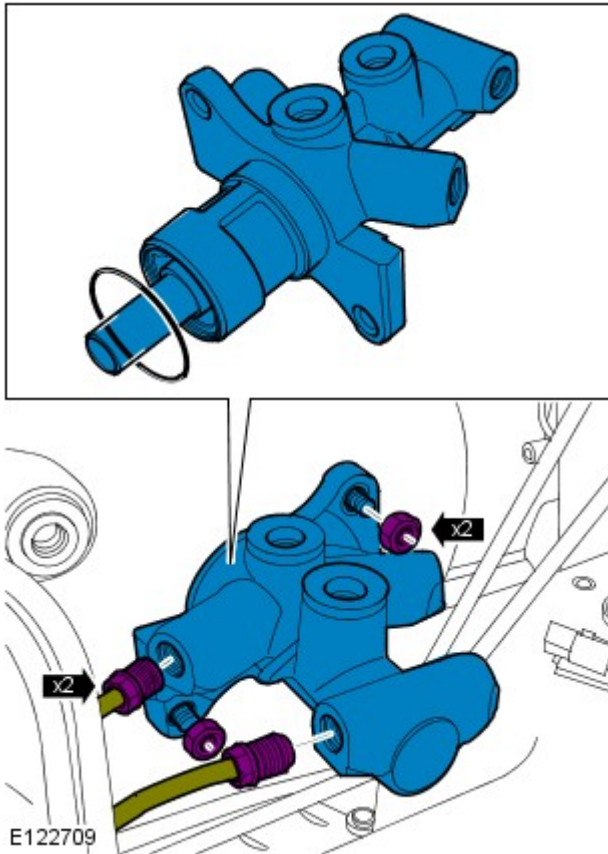
Raise and support the vehicle.

2. Remove the brake fluid reservoir.
For additional information, refer to: Brake Fluid Reservoir (206-06 Hydraulic Brake Actuation, Removal and Installation).

3.  **CAUTION:** Before the disconnection or removal of any components, make sure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

Disconnect the brake master cylinder brake tubes.

4. Remove the brake master cylinder.
 - Remove the 2 nuts.
 - Remove and discard the O-ring seal.



Installation

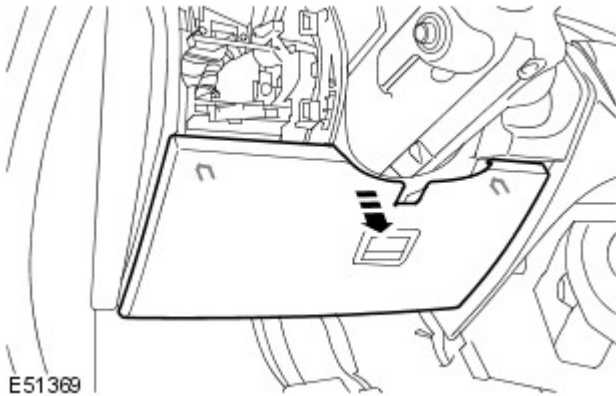
1. Install the brake master cylinder.
 - Install a new O-ring seal.
 - Tighten the nuts to 23 Nm (17 lb.ft).
2. Connect the brake tubes.
 - Tighten the brake tube unions to 18 Nm (13 lb.ft).
3. Install the brake fluid reservoir.
For additional information, refer to: Brake Fluid Reservoir (206-06 Hydraulic Brake Actuation, Removal and Installation).

Hydraulic Brake Actuation - Brake Pedal

Removal and Installation

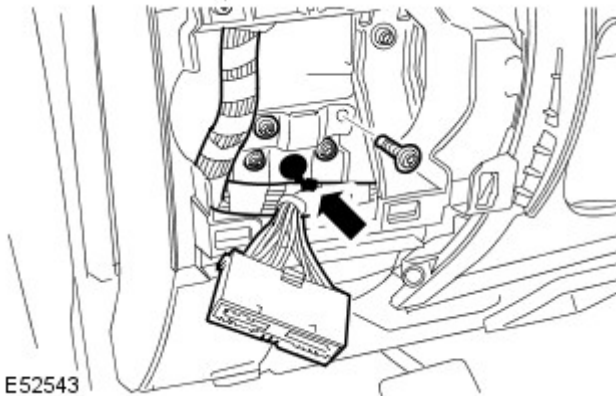
Removal

1. Remove the headlamp switch.
For additional information, refer to: Headlamp Switch (417-01, Removal and Installation).
2. Remove the stoplamp switch.
For additional information, refer to: Stoplamp Switch (417-01, Removal and Installation).
3. Remove the instrument panel access panel.
 - Release the 2 clips.



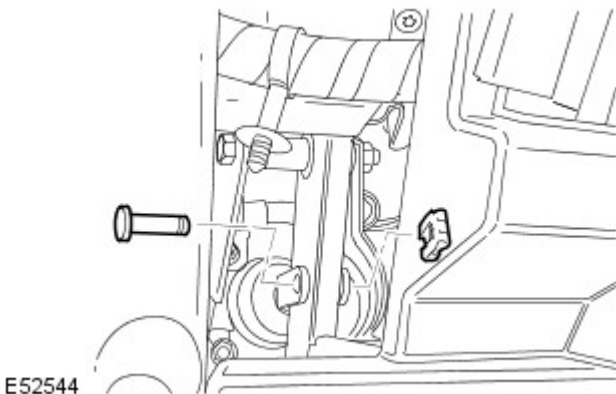
E51369

4. Remove the brake pedal bracket.
 - Release the wiring harness clip.
 - Remove the 4 Torx bolts.



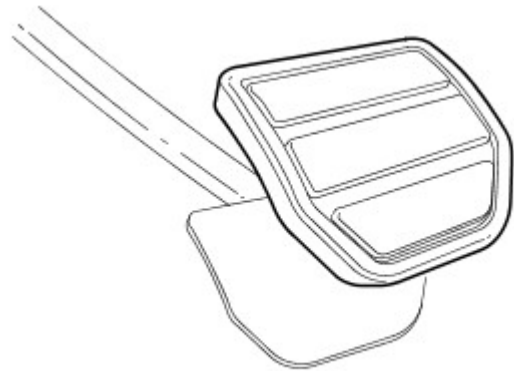
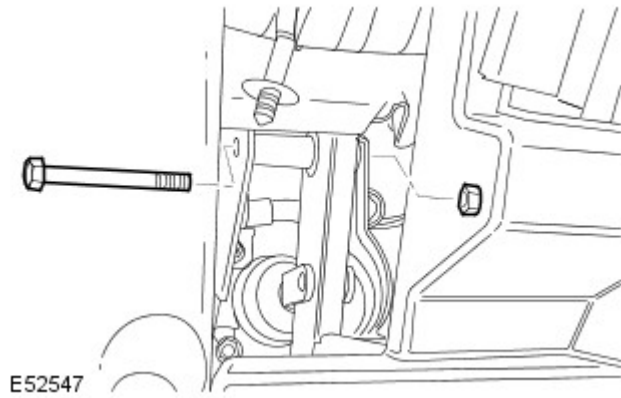
E52543


5. Remove the brake pedal clevis pin.
 - Remove the clip.



E52544

6. Remove the brake pedal.
 - Remove the nut and bolt.



7.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the brake pedal pad.

Installation

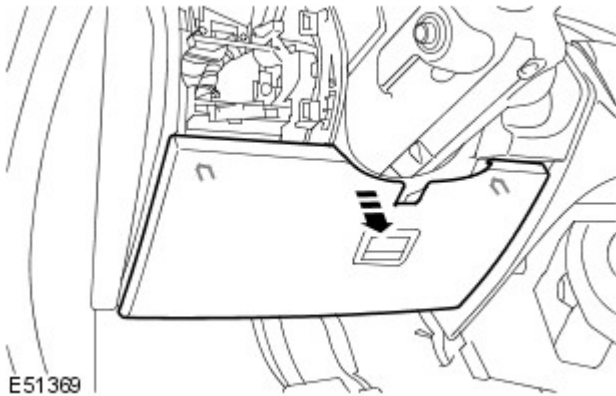
1. Install the brake pedal pad.
2. Install the brake pedal.
 - Clean the component mating faces.
 - Tighten the nut and bolt to 45 Nm (33 lb.ft).
3. Install the brake pedal clevis pin.
 - Install the clip.
4. Install the brake pedal bracket.
 - Tighten the Torx bolts to 10 Nm (7 lb.ft).
 - Secure the wiring harness.
5. Install the instrument panel access panel.
 - Secure with the clips.
6. Install the stoplamp switch.
For additional information, refer to: Stoplamp Switch (417-01, Removal and Installation).
7. Install the headlamp switch.
For additional information, refer to: Headlamp Switch (417-01, Removal and Installation).

Hydraulic Brake Actuation - Brake Pedal and Bracket

Removal and Installation

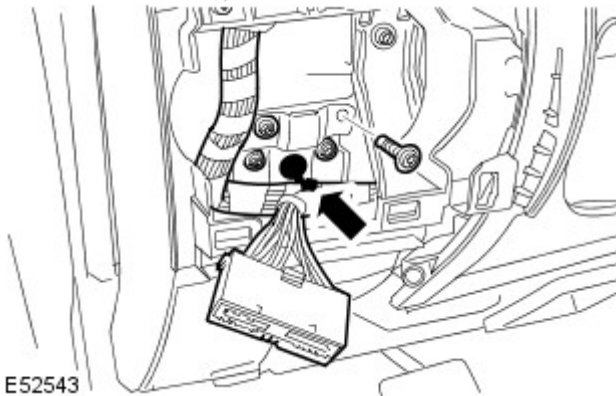
Removal

1. Remove the headlamp switch.
For additional information, refer to: Headlamp Switch (417-01, Removal and Installation).
2. Remove the stoplamp switch.
For additional information, refer to: Stoplamp Switch (417-01, Removal and Installation).
3. Remove the instrument panel access panel.
 - Release the 2 clips.



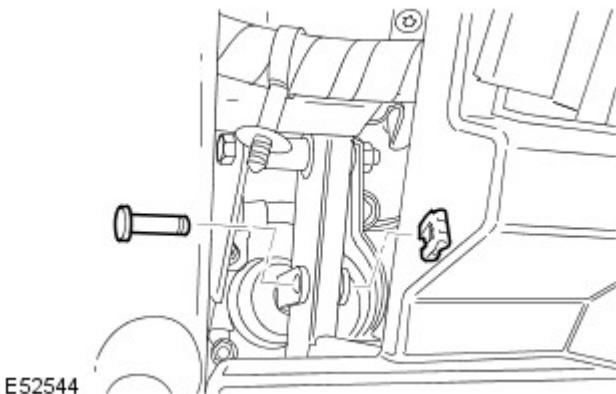
E51369

4. Remove the brake pedal bracket.
 - Release the wiring harness clip.
 - Remove the 4 Torx bolts.



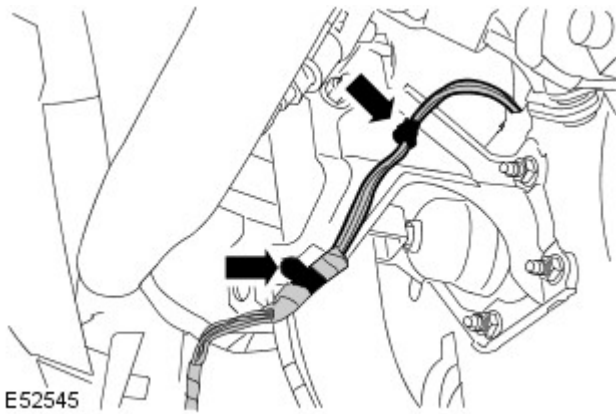
E52543

5. Remove the brake pedal clevis pin.
 - Remove the clip.

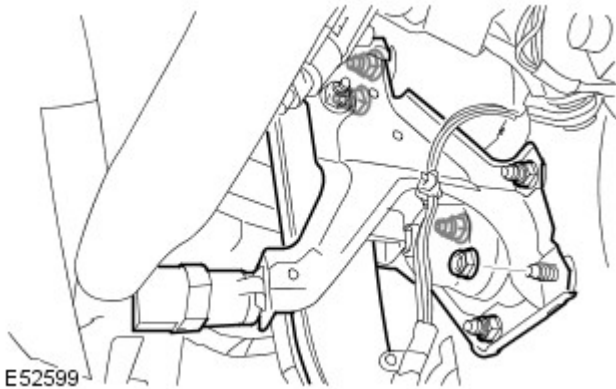


E52544

6. Release the stoplamp wiring harness.
 - Release the 2 clips.



7. Remove the brake pedal assembly.
 - Remove the 6 nuts.
 - Position the brake booster forward to aid the removal of the brake pedal assembly.



Installation

1. Install the brake pedal assembly.
 - Position the brake booster to the brake pedal bracket.
 - Tighten the nuts to 25 Nm (18 lb.ft).
2. Secure the wiring harness.
 - Secure the clips.
3. Install the brake pedal clevis pin.
 - Install the clip.
4. Install the brake pedal bracket.
 - Tighten the Torx bolt to 10 Nm (7 lb.ft).
 - Secure the wiring harness.
5. Install the instrument panel access panel.
 - Secure with the clips.
6. Install the stoplamp switch.
For additional information, refer to: Stoplamp Switch (417-01, Removal and Installation).
7. Install the headlamp switch.
For additional information, refer to: Headlamp Switch (417-01, Removal and Installation).

Power Brake Actuation -**Sealant**

Application	Land Rover Part No.
Brake vacuum pump - 2.7 Litre engine	8510302

General Specifications

Item	Specification
Brake booster type	Twin chamber 228 and 254 mm (9.0 and 10.0 in)
Boost ratio	7:1
Brake vacuum pump make and type:	
V6 - 2.7 litre diesel engine	Bosch 240cc SWP
V6 - 4.0 litre and V8 - 4.4 litre petrol engine	Hella UP28

Torque Specifications

Description	Nm	lb-ft
Brake booster nut	23	17
Brake master cylinder nuts	26	19
M12 brake pipe unions	16	12
M14 brake pipe unions	18	13
Brake pedal buffer bolts	10	7
Brake vacuum pump nuts - 4.0 and 4.4 litre engines	5	4
Brake vacuum pump bolts - 2.7 litre engine	23	17
Brake vacuum pump retaining stud - 2.7 litre engine	13	10
Brake vacuum pump retaining nut - 2.7 litre engine	13	10
High pressure fuel supply line retaining bolt - 2.7 litre engine	10	7
* Exhaust cross-over pipe nuts 2.7 litre engine	22	16
Exhaust cross-over pipe support bracket bolts - 2.7 litre	25	18
Exhaust manifold heatshield bolt - 2.7 litre	10	7

* **New nuts must be fitted**

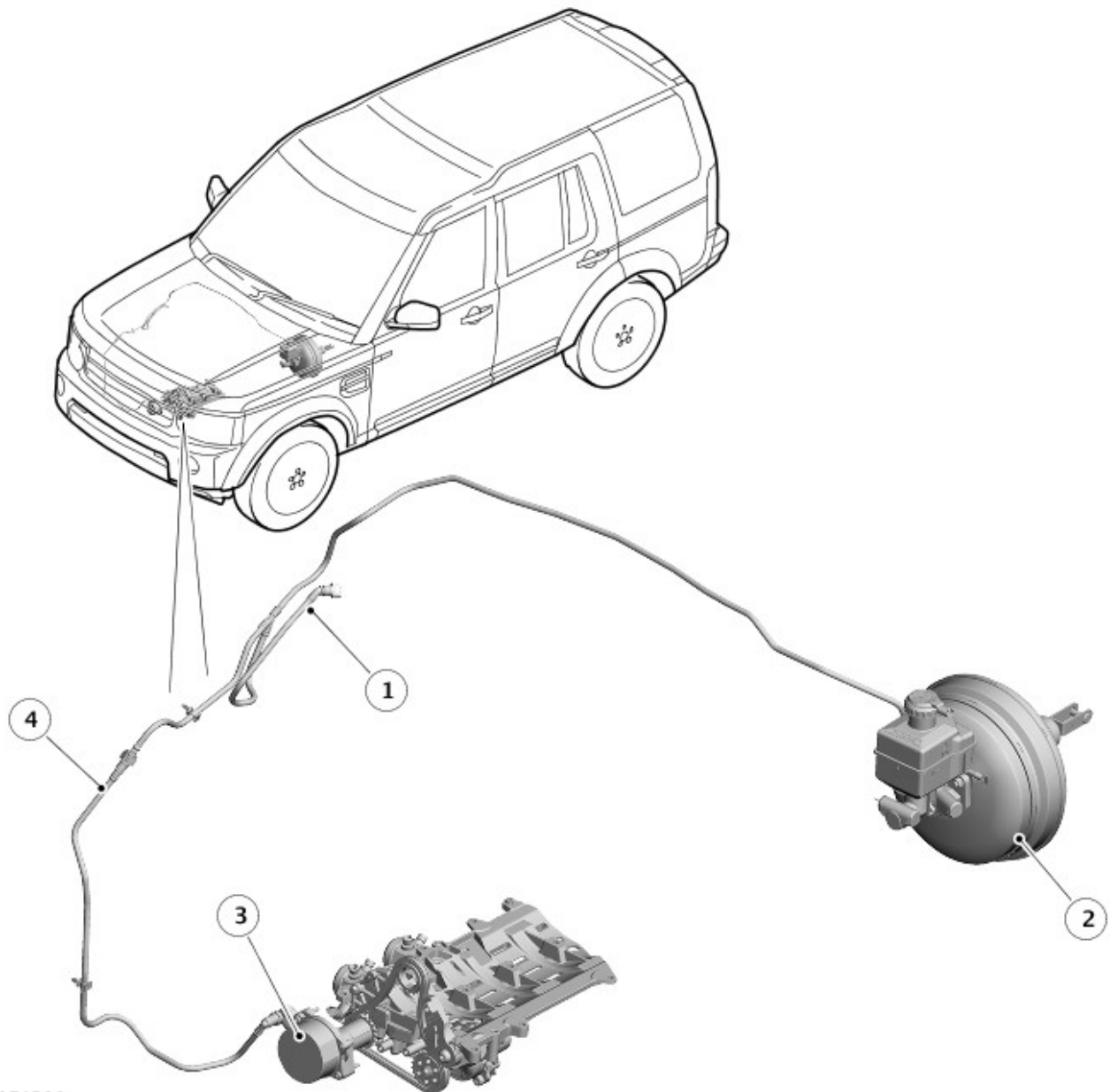
Power Brake Actuation - Brake Booster

Description and Operation

COMPONENT LOCATIONS - 5.0L NA



NOTE: LHD shown, RHD similar



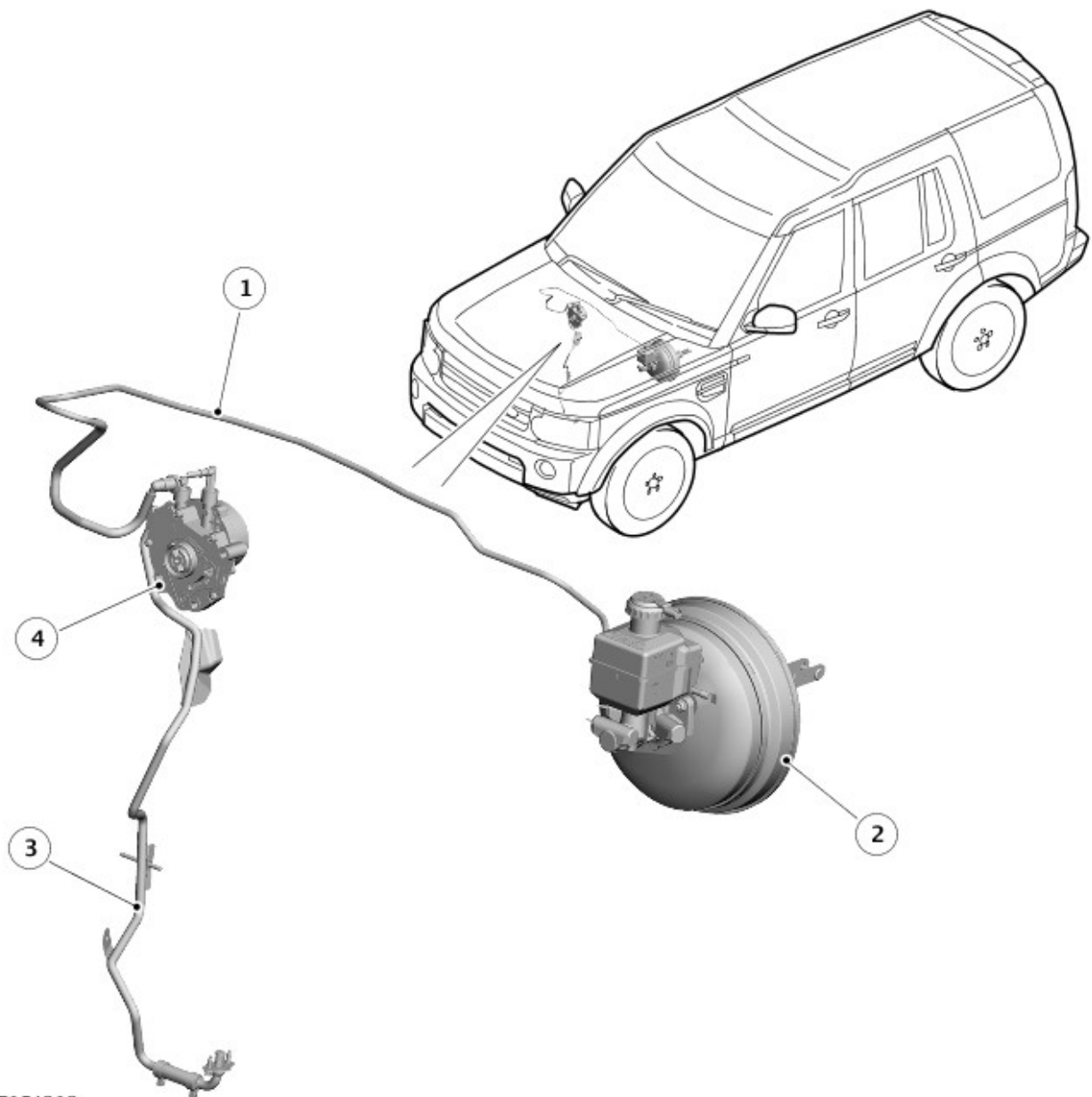
E154211

Item	Part Number	Description
1	-	Vacuum pipe connection to intake manifold
2	-	Brake Booster
3	-	Vacuum pump
4	-	Vacuum pipes

COMPONENT LOCATIONS - 3.0L DIESEL



NOTE: LHD shown, RHD similar



E154212

Item	Part Number	Description
1	-	Vacuum pipe connection to brake booster
2	-	Brake booster
3	-	Oil Scavenger pipe
4	-	Vacuum pump

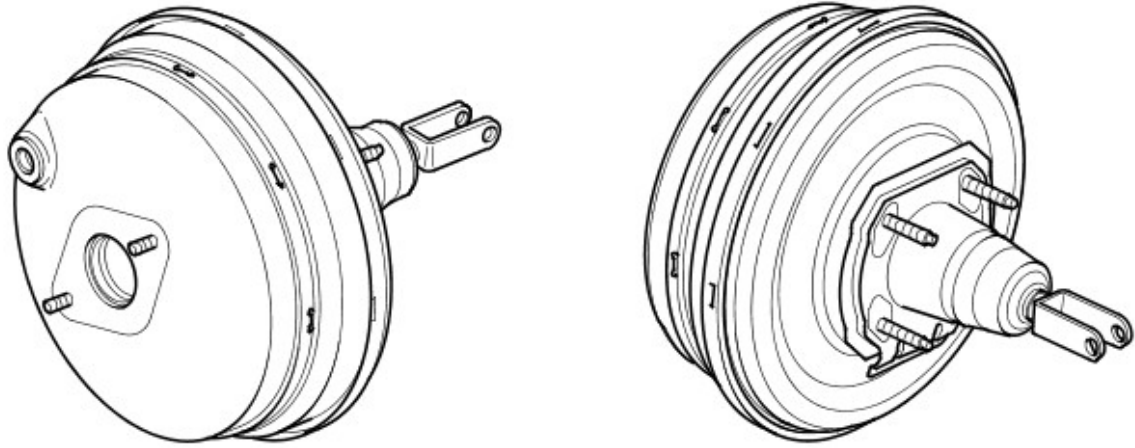
GENERAL

Power assistance for the brakes is provided by a vacuum operated brake booster. The vacuum is supplied by an engine mounted vacuum pump.

VACUUM PIPES

Plastic vacuum pipes connect the brake booster to the vacuum source. Check valves are incorporated into the vacuum pipes. On petrol models there are two in-line check valves, to maintain the vacuum in the brake booster when the throttle is open and the vacuum pump is not running, and prevent fuel vapor entering the brake booster. On diesel models there is a single check valve integrated into the vacuum pipe connection with the brake booster, to maintain the vacuum in the brake booster when the vacuum pump is operating at less than the optimum.

BRAKE BOOSTER

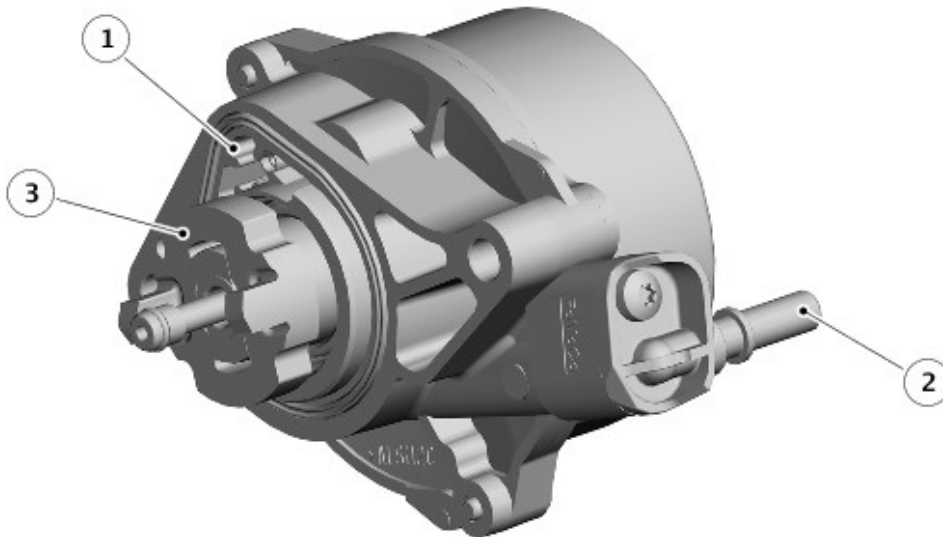


E49905

The brake booster is installed in the driver side of the engine compartment, on the engine bulkhead.

The brake booster is a dual diaphragm unit with a boost ratio of 8.0 : 1 and 28 bar loop-in in all engine variants. The input push rod is connected to the brake pedal. The output push rod locates in the primary piston of the brake master cylinder. A vacuum pipe, installed in a grommet in the front face of the housing, connects the brake booster to the intake manifold and electric vacuum pump (petrol models) or the engine driven vacuum pump (diesel models).

VACUUM PUMP (5.0L NA)



E154213

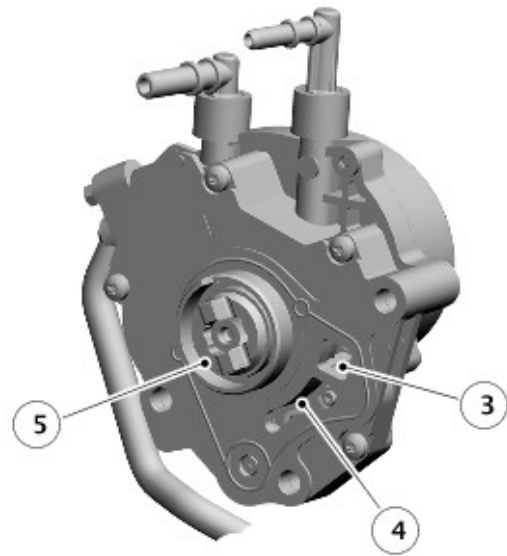
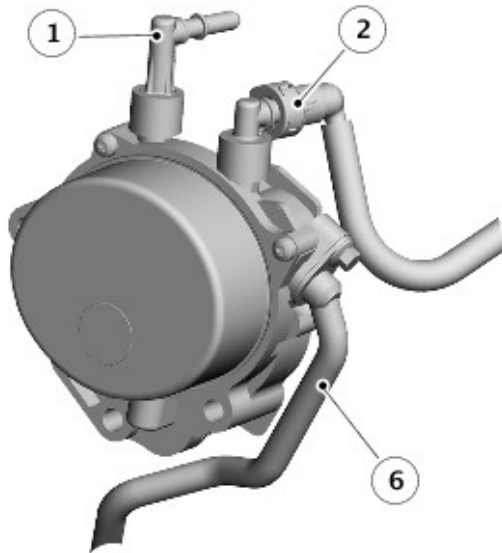
Item	Part Number	Description
1	-	Air vent
2	-	Vacuum pump inlet
3	-	Pump drive

On 5.0L (NA) petrol models the vacuum pump supplements the main vacuum supply from the engine manifold.

The vacuum pump is a radial vane pump which is attached to the end of the auxiliary drive camshaft and driven by crankshaft via the auxiliary drive chain. The vacuum pipe from the brake booster connects to an elbow on the rim of the vacuum pump.

The vacuum pump is lubricated and cooled by engine oil supplied from the gallery in the block, through the auxiliary shaft, to the oil pick up tube (see small hole in green shaft in picture above!). The oil return is through twin outlet ports in the front face of the pump into a drain cavity in the sump. Air extracted from the brake booster is vented into the drain cavity along with the returning engine oil.

VACUUM PUMP (3.0L DIESEL)



E154214

Item	Part Number	Description
1	-	Vacuum connection (turbo control)
2	-	Vacuum connection for brake booster
3	-	Oil inlet port
4	-	Air vent
5	-	Drive dog
6	-	Oil return/scavenge pipe

The vacuum pump is a combined vacuum and oil scavenge pump. The scavenge pump is g-rotor type pump that drains oil from the secondary turbocharger to accommodate vehicle tilt. The pump is located at the rear of the RH side cylinder head and is driven from the exhaust camshaft.

The vacuum pump is a radial vane pump. The vacuum pipe from the brake booster connects to an elbow on the rim of the vacuum pump.

The vacuum pump is lubricated and cooled by engine oil supplied to a port in the front face of the vacuum pump from a gallery in the cylinder head. The oil return is through a vent in the front face of the pump into a drain cavity in the cylinder head. Air extracted from the brake booster is vented into the drain cavity with the returning engine oil.

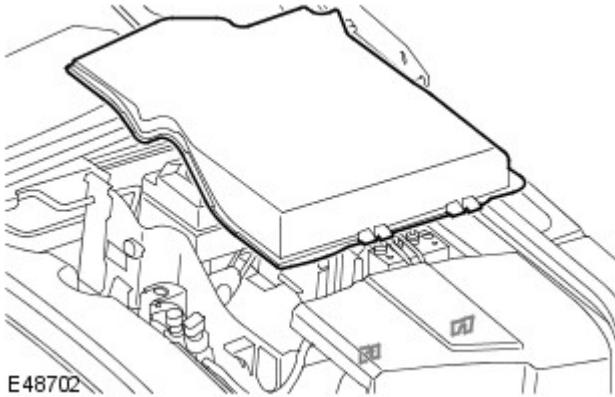
Power Brake Actuation - Brake Booster

Removal and Installation

Removal

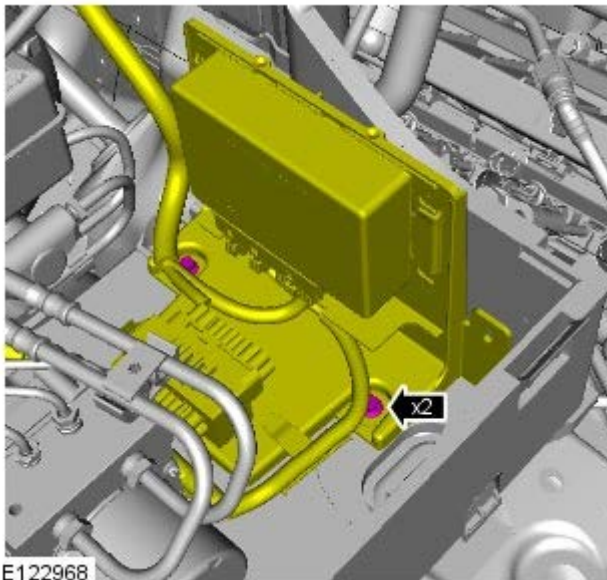
1. Pump the brake pedal until the brake vacuum assistance is exhausted.

2. Remove the auxiliary battery cover.
 - Release the 2 clips.

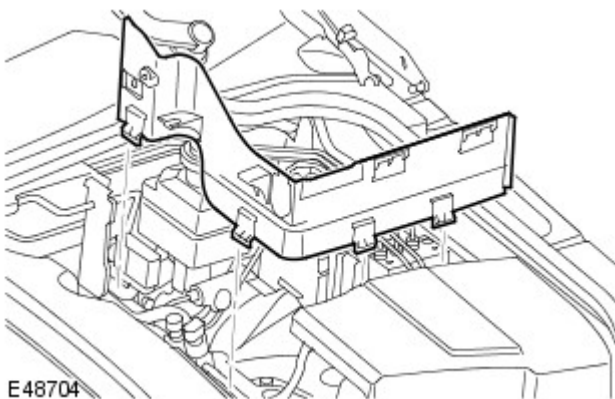


3. If installed, remove the auxiliary battery.

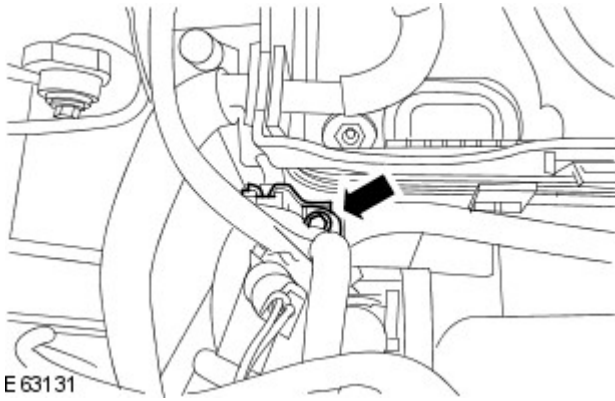
4. Detach the automatic transmission module bracket and position it to one side.
 - Remove the 2 bolts.



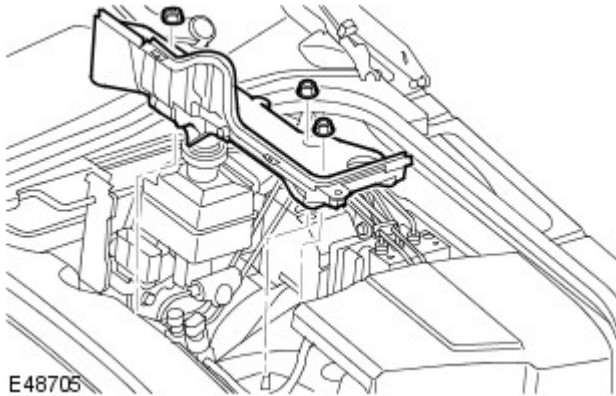
5. Remove the auxiliary battery compartment side wall.
 - Release the four clips.



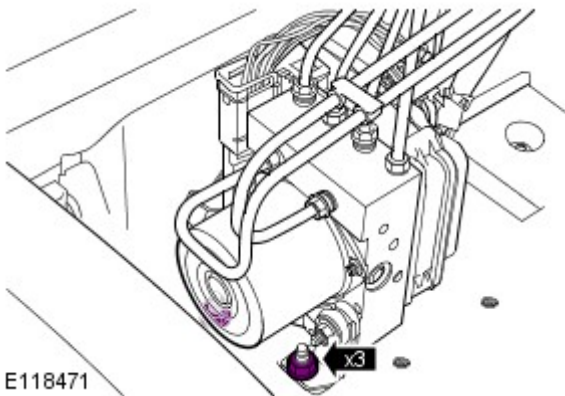
6. Release the Air Conditioning (A/C) pipes.
 - Remove the retaining screw.




7. Remove the auxiliary battery tray.
 - Remove the 3 bolts.



8. Release the Anti-lock Brake System (ABS) module.
 - Remove the 3 nuts.
 - Release the brake tubes from the clip.

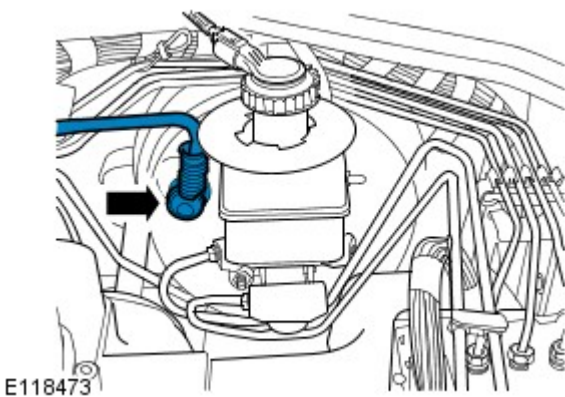


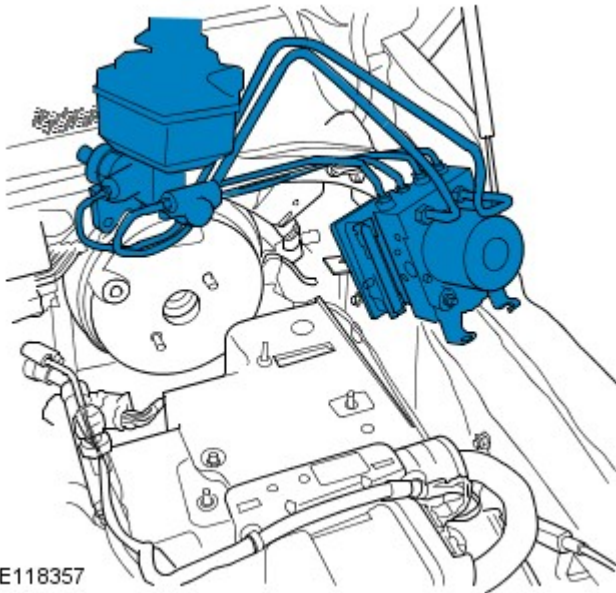
9. Disconnect the low brake fluid warning indicator switch electrical connector.

10.  **CAUTION:** Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

Position an absorbent cloth to collect fluid spillage.


11. Disconnect the brake booster vacuum hose from the brake booster.







E118357

12. CAUTIONS:

 Make sure that excessive force is not used. Failure to follow this instruction may result in damage to the vehicle.

 Make sure the wings and trim panels are covered and protected, failure to follow this instruction may result in damage to the vehicle.

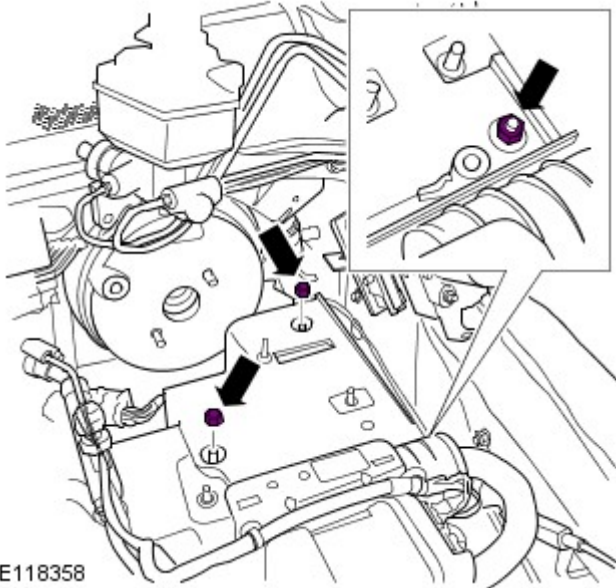
 Make sure the brake pipes are not damaged when displacing the brake master cylinder and ABS module. Failure to follow this instruction may result in damage to the vehicle.

Displace the brake master cylinder and ABS module as a complete assembly.

- Remove the 2 nuts.
- Discard the master cylinder seals.

13. Remove the outer plenum base.

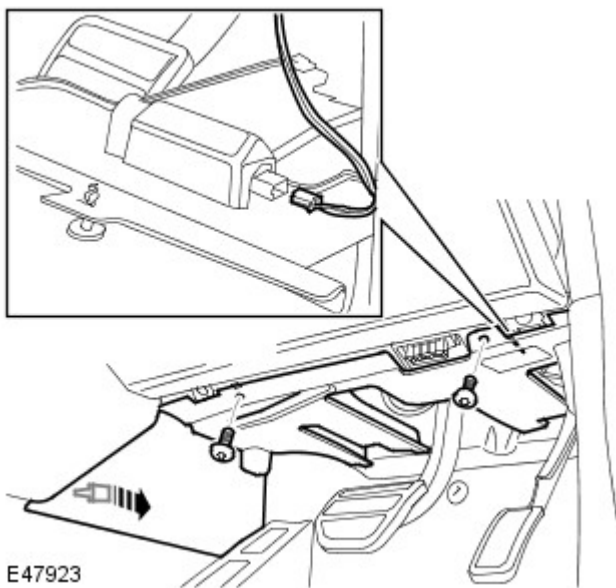
- Remove the 3 nuts.



E118358

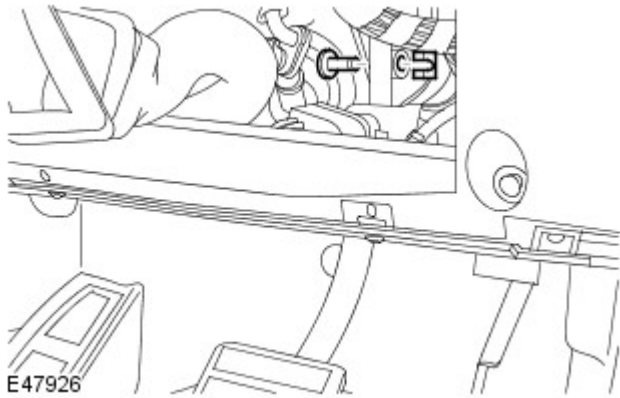
14. Remove the driver side closing trim panel.

- Release the clip.
- Remove the 2 screws.
- Disconnect the electrical connector.

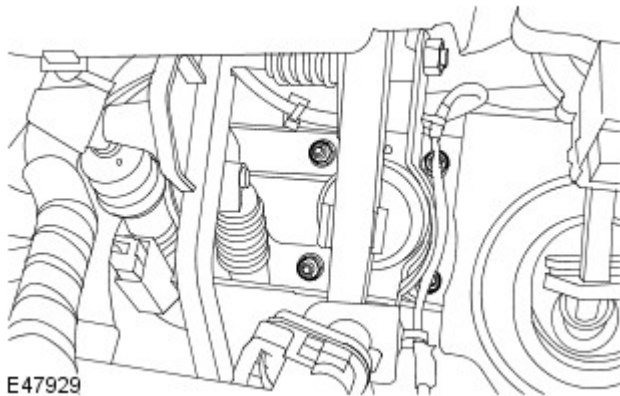


E47923

15.  NOTE: The cover is shown removed for clarity.




- Remove the brake booster push rod clevis pin.
- Remove the retaining clip.



16. Remove the brake booster.
- Remove the 4 nuts.

Installation

1. Install the brake booster.
 - Tighten the nuts to 23 Nm (17 lb.ft).
2. Install the brake booster push rod clevis pin.
 - Install the retaining clip.
3. Connect the brake booster vacuum hose.
4. Install the outer plenum base.
 - Carefully lift the anti-lock brake system modulator for access.
 - Install the 3 nuts.

5.  **CAUTION:** Make sure the master cylinder is correctly aligned.



NOTE: Install new seals and nuts.


Install the the brake master cylinder and ABS module.

- Tighten the nuts to 23 Nm (17 lb.ft).
6. Secure the anti-lock brake system modulator.
 - Install the 3 nuts.
 - Secure the brake tubes to the clip.
 7. Connect the low brake fluid warning indicator switch electrical connector.
 8. Install the auxiliary battery tray.
 - Install the 3 bolts.
 9. Install the auxiliary battery compartment side wall.
 - Secure with the four retaining clips.
 10. Secure the A/C pipes.
 - Install the retaining screw.

11. Secure the automatic transmission module bracket

- Install the 2 bolts.

12. If installed, install the auxiliary battery.

13.  NOTE: This step is to check the tightness of the retaining nuts after the initial tighten to make sure that torque has not relaxed.

Check the brake booster retaining nuts.

- Tighten the nuts to 23 Nm (17 lb.ft).

14. Install the closing trim panel.

- Connect the electrical connector.
- Secure the clip.
- Tighten the screws.

15. Start engine and check the brake booster operation.

Power Brake Actuation - Brake Vacuum Pump TDV6 3.0L Diesel

Removal and Installation

Removal

NOTES:



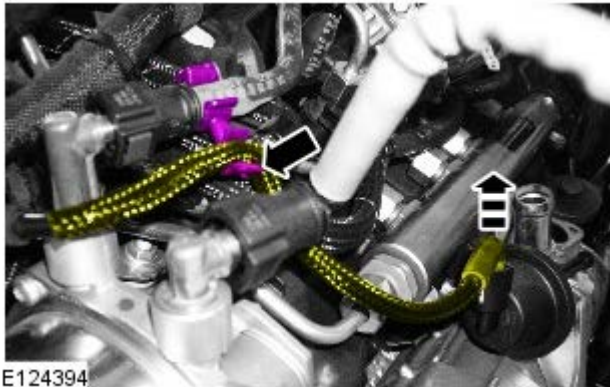
Removal steps in this procedure may contain installation details.



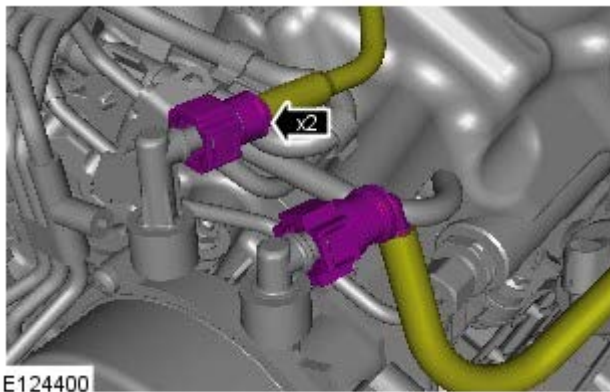
Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Body - Diesel (502-02, Removal and Installation).

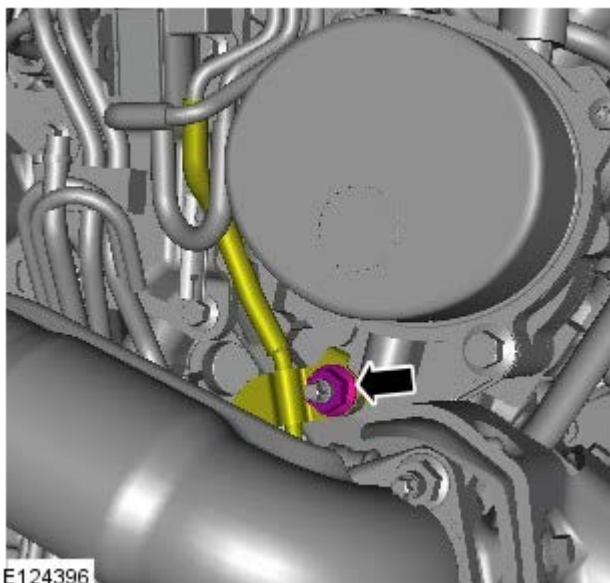
2.



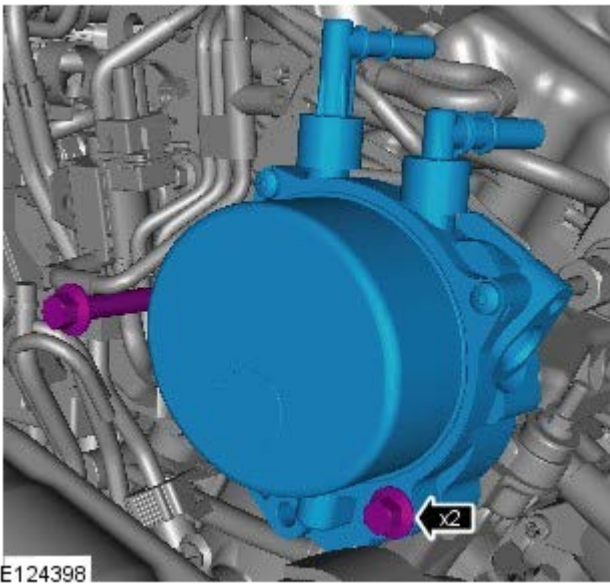
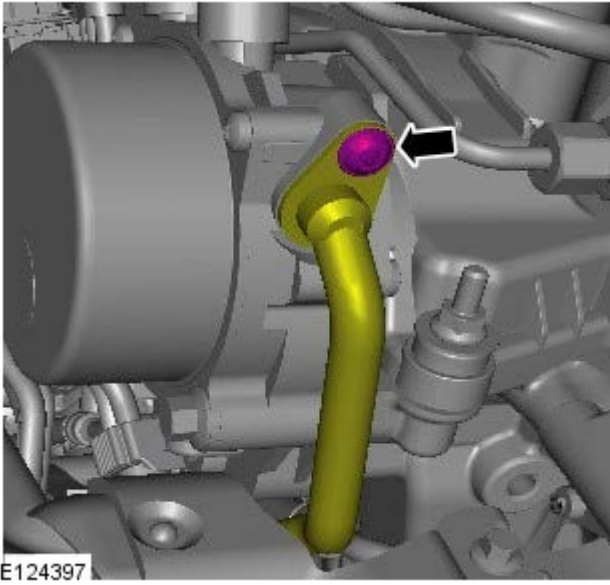
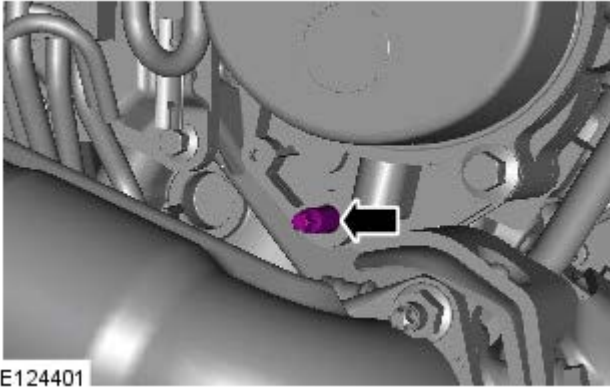
3.




4. Torque: 23 Nm



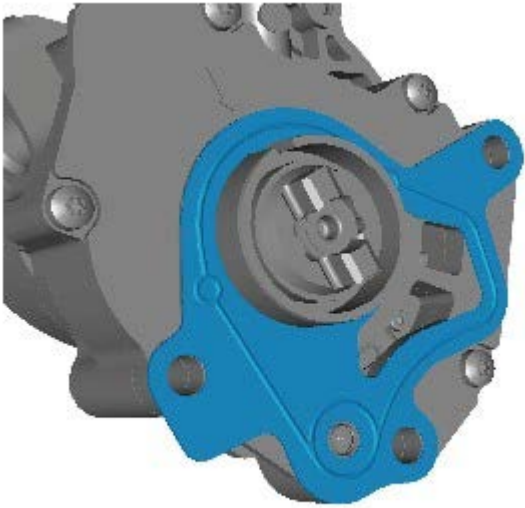
5. Torque: 13 Nm



6.  NOTE: Discard the O-ring seal.
Torque: 10 Nm

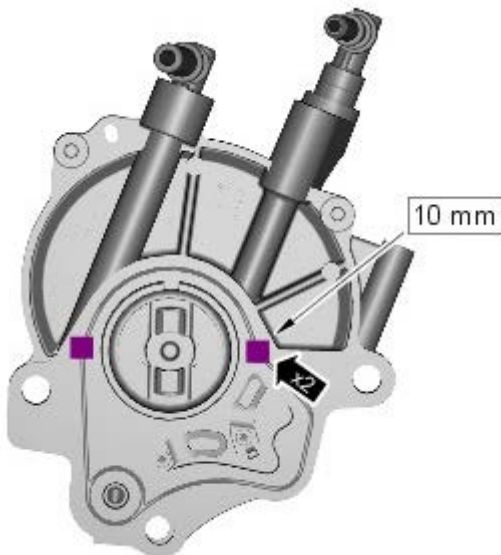
7. Torque: 23 Nm

- 8.









E124399

Installation



E116820

1. NOTES:

-  Install a new gasket.
-  Install a new O-ring seal.
-  Apply silicone gasket sealant or equivalent meeting Land Rover specification.
-  The application of sealant must be 10 mm square in two places. Install the brake vacuum pump immediately after applying the sealant.
-  The brake vacuum pump should be fitted directly to the engine without smearing the sealant.
-  Make sure that the drive coupling is aligned with camshaft coupling.

To install, reverse the removal procedure.

Power Brake Actuation - Brake Vacuum Pump V6 S/C 3.0L Petrol

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Refer to: Engine Undershield (501-02, Removal and Installation).

3. Refer to: Engine Oil Draining and Filling (303-01D, General Procedures).

4.



5. NOTES:

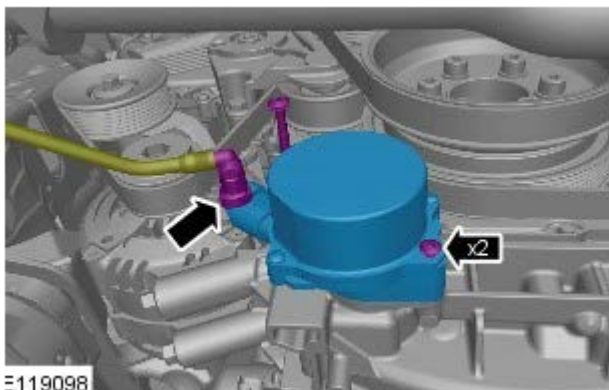


Discard the seal.



Some variation in the illustrations may occur, but the essential information is always correct.

Torque: 12 Nm



Installation

1.  NOTE: Install a new seal.

To install, reverse the removal procedure.

Anti-Lock Control - Traction Control -

General Specification

Item	Specification
System make/type	Bosch 8.0 Anti-lock braking system with Electronic Brake Distribution (EBD), Corner Brake Control (CBC), Electronic Traction Control (ETC), Hill Descent Control (HDC), Anti-roll Mitigation (ARM), Emergency Brake Assist (EBA), and Dynamic Stability Control (DSC)
Wheel speed sensors:	
Make/type	Bosch DF11i
Location	Front and rear knuckles with the active directional sensor acting on the driveshaft pole wheel
Yaw rate sensor make/type	Bosch DRS MM1.OR

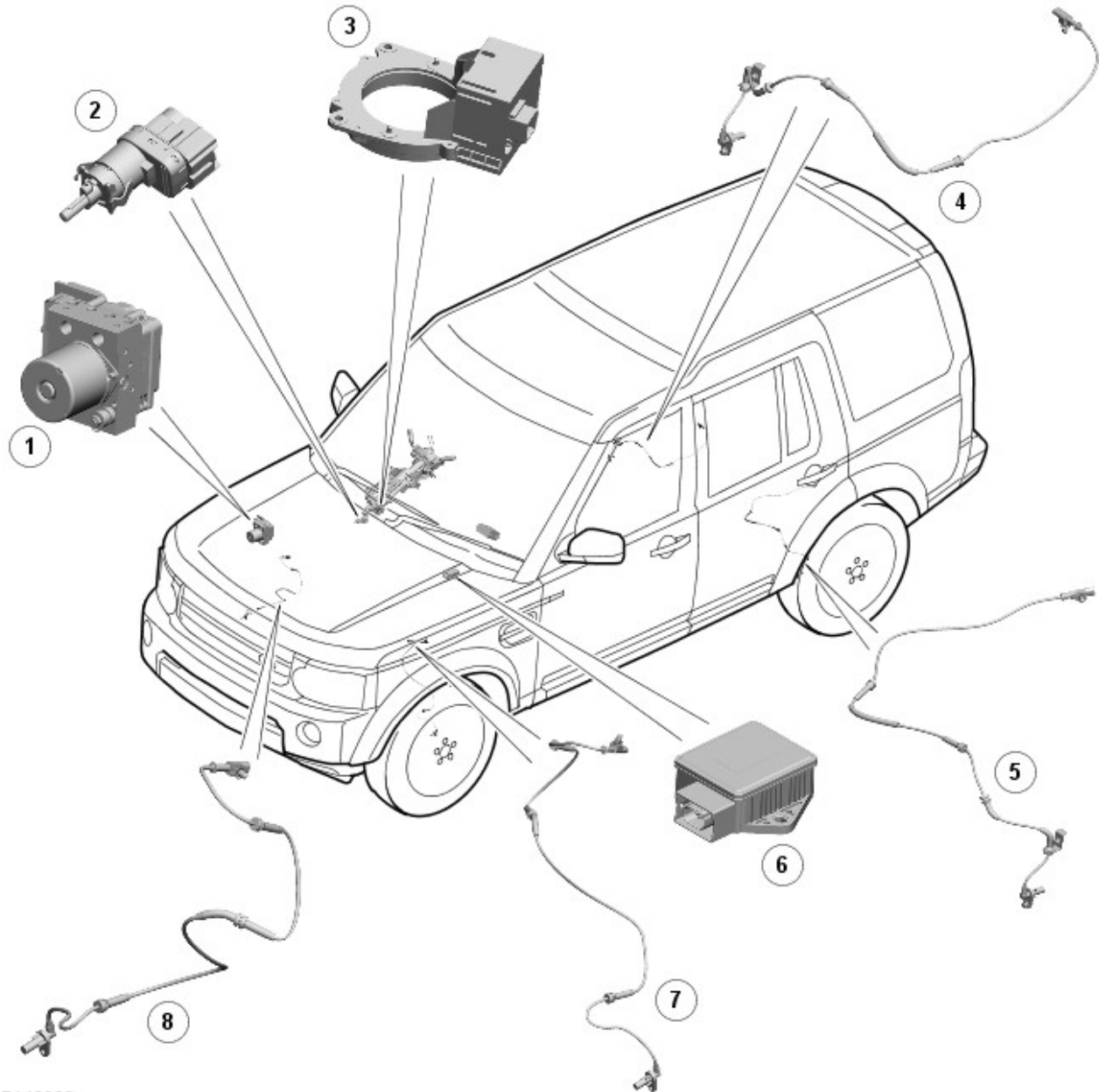
Torque Specifications

Description	Nm	lb-ft
Front road wheel speed sensor bolt	9	7
Front brake caliper anchor plate bolts	275	203
Front brake caliper housing bolts	32	24
Front brake hose retaining bracket to wheel knuckle bolt	25	18
Rear road wheel speed sensor to wheel knuckle bolt	9	7
ABS module mounting bracket nuts	8	6
ABS module to mounting bracket nuts	23	17
M10 Brake tube union nuts	15	11
M12 Brake tube union nuts	15	11
M14 Brake tube union nut	17	13
Yaw rate sensor bolts	7	5
Road wheel nuts	140	103

Anti-Lock Control - Traction Control - Anti-Lock Control - Traction Control

Description and Operation

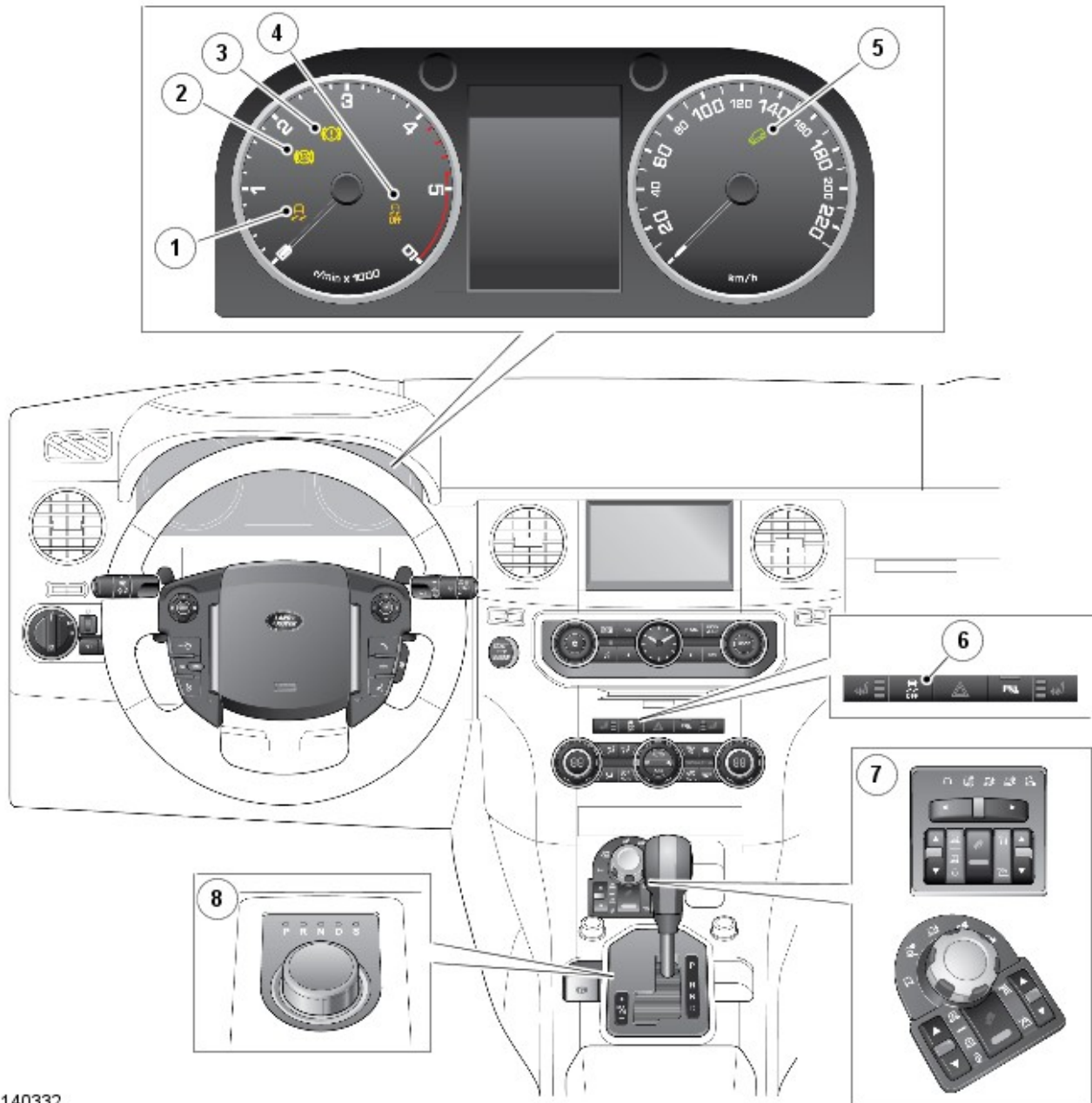
COMPONENT LOCATIONS - SHEET 1 OF 2



E140330

Item	Part Number	Description
1	-	Hydraulic control unit with attached anti-lock brake system (ABS) module
2	-	Stoplamp switch
3	-	Steering angle sensor
4	-	RH (right-hand) rear wheel speed sensor
5	-	LH (left-hand) rear wheel speed sensor
6	-	Yaw rate and lateral acceleration sensor
7	-	LH front wheel speed sensor
8	-	RH front wheel speed sensor

COMPONENT LOCATIONS - SHEET 2 OF 2



E140332

Item	Part Number	Description
1	-	DSC (dynamic stability control) system active warning lamp
2	-	ABS warning lamp
3	-	EBA (emergency brake assist) warning lamp
4	-	DSC (dynamic stability control) system off warning lamp
5	-	HDC (hill decent control) warning indicator
6	-	DSC (dynamic stability control) system on/off switch
7	-	HDC (hill decent control) system on/off switch
8	-	Transmission selector.

OVERVIEW

The anti-lock control - traction control system features a modulator, which is an integrated four-channel [HCU \(hydraulic control unit\)](#) and [ABS \(anti-lock brake system\)](#) module.

The [ABS](#) module is connected to the high speed [CAN \(controller area network\)](#) bus, and actively interacts with other vehicle system control modules and associated sensors to receive and transmit current vehicle operating information.

When required, the [ABS](#) module will actively intervene and operate the [HCU](#) during braking or vehicle maneuvers to correct the vehicle attitude, stability, traction or speed. During incidents of vehicle correction, the [ABS](#) module may also request the [ECM \(engine control module\)](#) to control engine power in order to further stabilize and correct the vehicle.

To provide full system functionality, the anti-lock control - traction control system comprises the following components:

- DSC switch.
- HDC switch.

- Four wheel speed sensors.
- Steering angle sensor.
- Yaw rate and lateral acceleration sensor.
- Stoplamp switch.
- Instrument cluster warning indicators.
- Integrated HCU and ABS module.

The anti-lock control - traction control system provides the following brake functions that are designed to assist the vehicle or aid the driver:

- ABS.
- ARM (active roll mitigation).
- CBC (corner brake control).
- DSC.
- EBD (electronic brake force distribution).
- Electronic brake prefill.
- ETC (electronic traction control).
- EBA.
- EDC (engine drag-torque control).
- EUC (enhanced understeer control).
- Gradient acceleration control.
- Gradient release control.
- HDC.
- Hill start assist.
- Trailer stability assist.

The HDC function is enabled either manually using the HDC switch, or automatically by the terrain response system, in the ignition on and engine running power modes. All of the other brake functions are automatically enabled in the ignition on and engine running power modes. The DSC function can be selected off using the DSC switch.

DYNAMIC STABILITY CONTROL SWITCH



E140471

The DSC switch allows the DSC function to be selected off. Although Land Rover recommend that DSC is selected on for all normal driving conditions, it may be beneficial to de-select DSC to maximize traction under the following conditions:

- If the vehicle needs to be rocked out of a hollow or a soft surface.
- Driving on loose surfaces or with snow chains.
- Driving in deep sand, snow or mud.
- On tracks with deep longitudinal ruts.

The DSC switch is a non-latching switch installed in the center console switch pack. Pressing the DSC switch connects an ignition power feed to the ABS module. With the first press of the DSC switch, the ABS module disables the DSC functions. When the DSC switch is pressed again, the ABS module re-enables the DSC functions. The DSC switch must be pressed for a minimum of 0.3 s for the ABS module to react. The DSC function is re-enabled at the beginning of each ignition cycle.

The status of the DSC switch selection is shown by the DSC OFF warning indicator. The DSC OFF warning indicator is extinguished while DSC is selected on, and continuously illuminated while DSC is selected off.

A DSC switch request to disable DSC is ignored by the ABS module if the air suspension system has failed, or is in off-road height at speeds above 60 km/h (37.5 mph).

To guard against incorrect operation or a broken switch, if the input from the DSC switch is held high for more than one minute, a DTC (diagnostic trouble code) is stored in the ABS module.

Even if DSC is deselected, driving maneuvers with extreme yaw or lateral acceleration may trigger DSC activity to assist vehicle stability.

HILL DESCENT CONTROL SWITCH



E140473

Item	Part Number	Description
------	-------------	-------------

1	-	HDC switch
---	---	------------

The HDC switch controls the selection of the HDC function.

The HDC switch is a non-latching switch installed on the floor console, forward of the gear selector. Pressing and releasing the HDC switch momentarily connects an ignition power feed to the **ABS** module. With the first press and release of the HDC switch, the **ABS** module enables operation of the HDC function. When the HDC switch is pressed and released again, the **ABS** module disables operation of the HDC function.

To guard against incorrect operation or a broken switch, if the switch is pressed for more than 10 seconds no change of state occurs. If the input from the HDC switch is held high for more than one minute, a **DTC** is stored in the **ABS** module.

HDC RELAY

The HDC relay is used to illuminate the stoplamps when the brakes are activated during HDC operation and during dynamic application of the parking brake.

The HDC relay is a non-serviceable, solid state relay on the circuit board of the central junction box (CJB). Operation of the HDC relay is controlled by the ABS module switching the coil to ground. The ABS module monitors brake system hydraulic pressure and energizes the HDC relay during active braking. A pressure threshold and time filter prevent the stoplamps from flickering when HDC is braking.

STOPLAMP SWITCH

The stoplamp switch is mounted in the brake pedal bracket and operated by the brake pedal. The stoplamp switch is a two pole switch: The Brake Switch (BS) pole supplies a brake pedal status signal to the ABS module; the Brake Lamp Switch (BLS) pole operates the stoplamps and also supplies a brake pedal status signal to the ABS module and to the engine control module (ECM).

While the brake pedal is released:

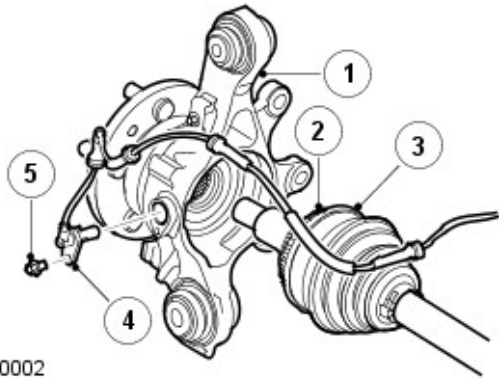
- The BS contacts are closed, and connect an ignition power feed from the CJB to the ABS module.
- The BLS contacts are open.

When the brake pedal is pressed:

- The BS contacts open.
- The BLS contacts close, and connect an ignition power feed from the CJB to the three stoplamps, the ABS module and the ECM.

The ABS module monitors the status inputs from the stoplamp switch and broadcasts the brake pedal status and an associated quality factor on the high speed controller area network (CAN) bus.

WHEEL SPEED SENSORS



E50002

Item	Part Number	Description
1	-	Cable clip
2	-	Hub assembly
3	-	Wheel speed sensor
4	-	Screw

An active wheel speed sensor is installed in each wheel hub to provide the **ABS** module with a rotational speed signal from each road wheel. The head of each wheel speed sensor is positioned close to a toothed sensor ring on the outer diameter of the constant velocity joint of the drive halfshaft. A flying lead connects each sensor to the vehicle wiring.

The wheel speed sensors each have a power supply connection and a signal connection with the **ABS** module. When the ignition switch is on, the **ABS** module supplies power to the wheel speed sensors and monitors the return signals. Any rotation of the drive halfshafts induces current fluctuations in the return signals which are converted into individual wheel speeds and the overall vehicle speed by the **ABS** module.

The **ABS** module outputs the individual wheel speeds and the vehicle speed on the high speed **CAN** bus for use by other systems. The quality of the vehicle speed signal is also broadcast on the high speed **CAN** bus. If all wheel speed signals are available to calculate vehicle speed from, the quality of the vehicle speed signal is set to 'data calculated within specified accuracy'. If one or more wheel speed sensors is faulty, the quality of the vehicle speed signal is set to 'accuracy outside specification'.

The **ABS** module monitors the wheel speed sensor circuits for faults. If a fault is detected the **ABS** module stores a **DTC** and illuminates the appropriate warning indicators, depending on the system functions affected (**DSC/ETC**, **ABS**, **EBA/EBD**, **HDC**). A warning chime sounds and a related message is shown in the message center. For additional information, refer to: Information and Message Center (413-08, Description and Operation).

Since the wheel speed sensors are active devices, a return signal is available when the road wheels are not turning, which enables the **ABS** module to check the sensors while the vehicle is stationary. In addition, the direction of travel of each wheel can be sensed. This information is broadcast on the high speed **CAN** bus for use by other systems.

STEERING ANGLE SENSOR



E140546

Item	Part Number	Description
1	-	Gear wheel
2	-	Electrical connector

The steering angle sensor measures the steering wheel angle, and the rate of steering wheel angle speed. The measurements are output on the high speed **CAN** bus together with a quality factor signal, and are used by the **ABS** module and the rear differential control module for **ARM**, **CBC** and **DSC** operation.

The steering angle sensor is fixed to the pivot bracket of the steering column by three screws. A gear wheel in the steering angle sensor engages with a plastic drive collar fixed onto the lower shaft of the column. Inside the steering angle sensor, the gear wheel meshes with a gear train containing magnets. A multipin electrical connector provides the interface between the vehicle wiring and integrated circuits in the steering angle sensor.

The steering angle sensor operates with the MR (magneto resistive) effect to evaluate the direction of magnetic fields, and measure the angular position of the lower shaft to provide the steering wheel angle. When the steering wheel turns, the steering column lower shaft rotates the gear wheel within the steering angle sensor. The gear wheel drives the gear train and rotates the magnets located on the gears. The direction of the magnetic field is constantly

monitored by the steering angle sensor and is converted into a steering wheel angle, and steering wheel angle speed.

The steering angle sensor performs a plausibility check of the steering wheel angle each time the following conditions co-exist:

- The vehicle is traveling in a straight line.
- The vehicle speed is between 20 and 25 km/h (12.5 and 15.6 mph).
- The transfer box is in high range.
- The brake pedal is not pressed.
- There is no [ABS](#), DSC or ETC activity.

The steering angle sensor uses inputs of wheel speed, yaw rate and lateral acceleration to determine when the vehicle is traveling in a straight line. When all of the conditions co-exist, the steering angle sensor checks the steering angle is between $0 \pm 15^\circ$. If the steering angle is outside the limits on two successive checks, the steering angle sensor changes the quality factor signal to 'outside specification' for the remainder of the ignition cycle and stores a [DTC](#). At the beginning of each ignition cycle the quality factor signal is reset to 'within specified accuracy'.

The status of the steering angle sensor is able to be determined using Land Rover approved diagnostic equipment.

If the steering angle sensor is renewed, the new sensor must be calibrated using Land Rover approved diagnostic equipment. The steering angle sensor must also be re-calibrated any time it is disturbed from the steering column, or if the upper and lower steering columns are separated.

YAW RATE AND LATERAL ACCELERATION SENSOR



E132328

The yaw rate and lateral acceleration sensor is located beneath the floor console and provides information of vehicle yaw rate and lateral acceleration to the [ABS](#) module. The sensor is internally damped to isolate it from body vibrations and is secured to the transmission tunnel with two bolts.

When the ignition is on, the yaw rate and lateral acceleration sensor receives a power feed from the [CJB](#) ([central junction box](#)). Yaw rate and lateral acceleration values are transmitted to the [ABS](#) module on a private high speed [CAN](#) bus. In addition to using the inputs for brake control functions, the [ABS](#) module also broadcasts the yaw rate and lateral acceleration values on the vehicle high speed [CAN](#) bus for use by other systems.

The [ABS](#) module monitors the yaw rate and lateral acceleration sensor for faults and can be interrogated using Land Rover approved diagnostic equipment. If a fault is detected, the [ABS](#) module stores a related [DTC](#) and transmits a high speed [CAN](#) bus signal to the instrument cluster to illuminate the DSC, HDC and brake warning indicators. The instrument cluster will also sound a warning chime and display a DSC fault message in the message center. For additional information, refer to: Information and Message Center (413-08, Description and Operation).

STOPLAMP SWITCH

The stoplamp switch is mounted in the brake pedal bracket and operated by the brake pedal. The stoplamp switch is a hall effect switch with dual status outputs. Both of the outputs are supplied to the [ECM](#). One of the outputs is also supplied to the [CJB](#), for operation of the stoplamps. The [ECM](#) broadcasts the status of the stoplamp switch on the high speed [CAN](#) for use by other systems.

Power for the stoplamp switch is provided by an ignition feed from the [CJB](#). The power circuit is completed by a ground connection from the stoplamp switch to a ground on the body.

WARNING INDICATORS



E140475

Item	Part Number	Description
A	-	ROW instrument cluster
B	-	NAS instrument Cluster
1	-	Brake system warning indicator (amber)
2	-	DSC OFF warning indicator (amber)
3	-	Brake system warning indicator (red)
4	-	DSC warning indicator (amber)
5	-	HDC warning indicator (green)
6	-	HDC warning indicator (green)

The instrument cluster contains two types of warning indicator to display the operating status of the selected anti-lock control/traction control functions. The warning indicators provide a visual notification of either a system warning or system information to the driver.

HYDRAULIC CONTROL UNIT (HCU)

The [HCU](#) is a four-channel unit that modulates the supply of hydraulic pressure to the brakes under control of the [ABS](#) module.

The [HCU](#) is installed in the engine compartment. Hydraulic pipes connect the [HCU](#) to the master cylinder and the brake calipers.

For additional information, refer to: Hydraulic Brake Actuation (206-06, Description and Operation).

The primary and secondary outlets of the master cylinder are connected to the primary and secondary circuits within the [HCU](#). The primary circuit in the [HCU](#) has separate outlet ports to the front brakes. The secondary circuit in the [HCU](#) has separate outlet ports to the rear brakes. Each of the circuits in the [HCU](#) contains the following components to control the supply of hydraulic pressure to the brakes:

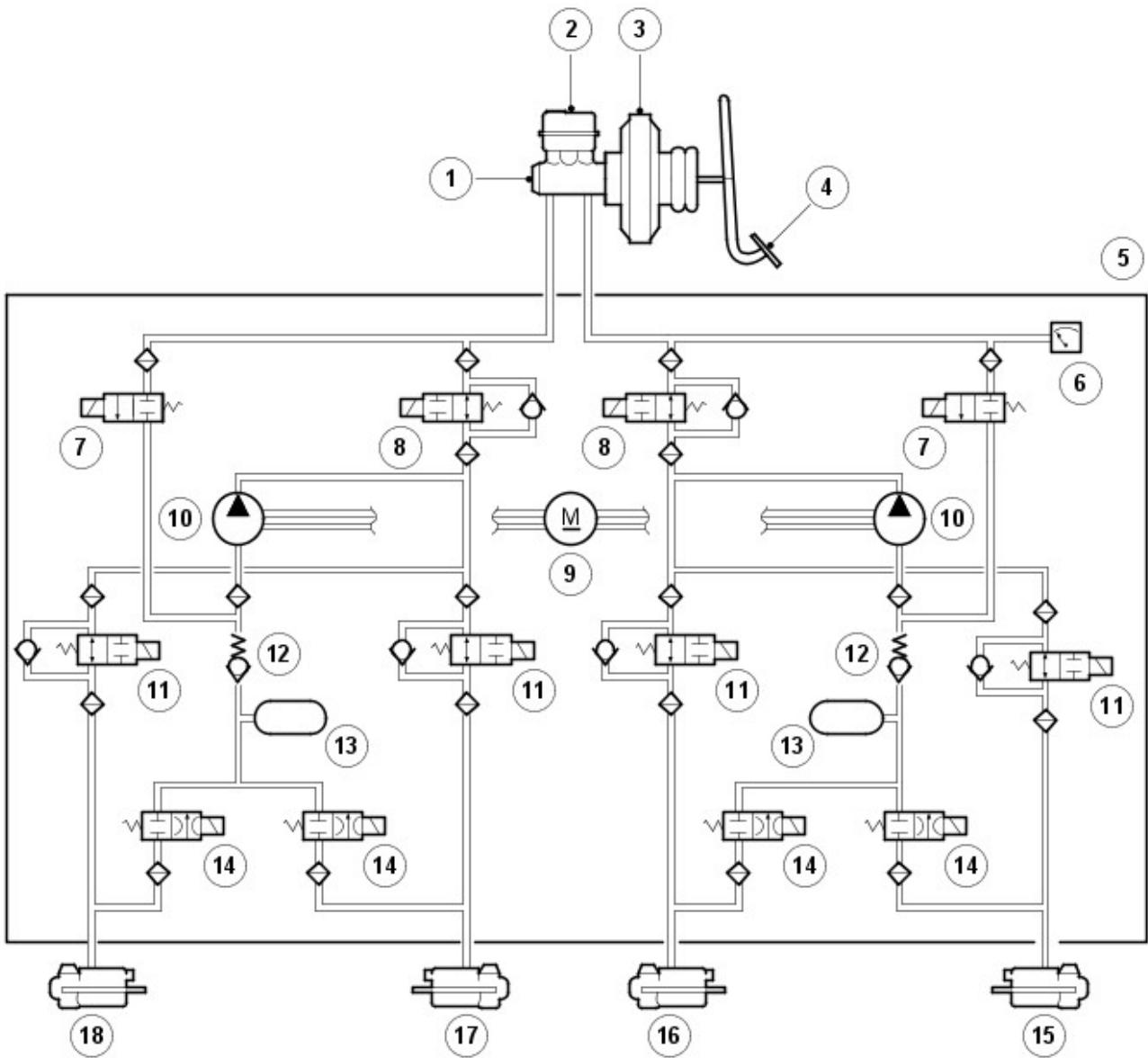
- A normally open, solenoid operated, pilot valve, to enable active braking.
- A normally closed, solenoid operated, priming valve, to connect the brake fluid reservoir to the return pump during active braking.
- A return pump to generate hydraulic pressure for active braking, and return brake fluid to the reservoir.
- Normally open, solenoid operated, inlet valves and normally closed, solenoid operated, outlet valves, to modulate the hydraulic pressure in the individual brakes.
- An accumulator and a relief valve to allow the fast release of pressure from the brakes.
- Filters to protect the components from contamination.

The primary circuit also incorporates a pressure sensor to provide the [ABS](#) module with a hydraulic pressure signal.

Contact pins on the [HCU](#) mate with contacts on the [ABS](#) module to provide the electrical connections from the [ABS](#) module to the return pump motor and the pressure sensor. The solenoids that operate the valves are installed in the [ABS](#) module.

A replacement [HCU](#) is supplied pre-filled. After installation on the vehicle, the Land Rover approved diagnostic system must be used to operate the solenoid valves and the return pump to ensure correct bleeding of the [HCU](#) and brake circuits.

Schematic of Hydraulic Control Unit



E50005

Item	Part Number	Description
1	-	Master cylinder
2	-	Reservoir
3	-	Brake booster
4	-	Brake pedal
5	-	HCU
6	-	Pressure sensor
7	-	Priming valve
8	-	Pilot valve
9	-	Return pump motor
10	-	Return pump
11	-	Inlet valve
12	-	Relief valve
13	-	Accumulator
14	-	Outlet valve
15	-	Left front brake
16	-	Right front brake
17	-	Right rear brake
18	-	Left rear brake

The HCU has three operating modes: Normal/EBD, ABS braking and active braking.

Normal Braking/Electronic Brake Force Distribution Mode

Initially, all of the solenoid operated valves are de-energized. Operating the brake pedal produces a corresponding increase or decrease of pressure in the brakes, through the open pilot valves and inlet valves. If the **ABS** module determines that **EBD** is necessary, it energizes the inlet valves for the brakes of the trailing axle, to isolate the brakes from any further increase in hydraulic pressure.

ABS Braking Mode

If the **ABS** module determines that **ABS** braking is necessary, it energizes the inlet and outlet valves of the related brake and starts the return pump. The inlet valve closes to isolate the brake from pressurized fluid; the outlet valve opens to release pressure from the brake into the accumulator and the return pump circuit. The reduced pressure allows the wheel to accelerate. The **ABS** module then operates the inlet and outlet valves to modulate the pressure in the brake to apply the maximum braking effort without locking the wheel. Control of the valves for each wheel takes place individually.

Active Braking Mode

The active braking mode is used to generate and control hydraulic pressure to the brakes for functions other than **ABS** braking, for example: **DSC**, **EBA**, **ETC**, **HDC** and dynamic application of the parking brake.

For active braking, the **ABS** module energizes the pilot valves and priming valves, starts the return pump and energizes all of the inlet valves. Brake fluid, drawn from the reservoir through the master cylinder and priming valve, is pressurized by the return pump and supplied to the inlet valves. The **ABS** module then operates the inlet valves and outlet valves, as required, to modulate the pressure in the individual brakes. Some noise may be generated during active braking.

ANTI -LOCK BRAKE SYSTEM MODULE

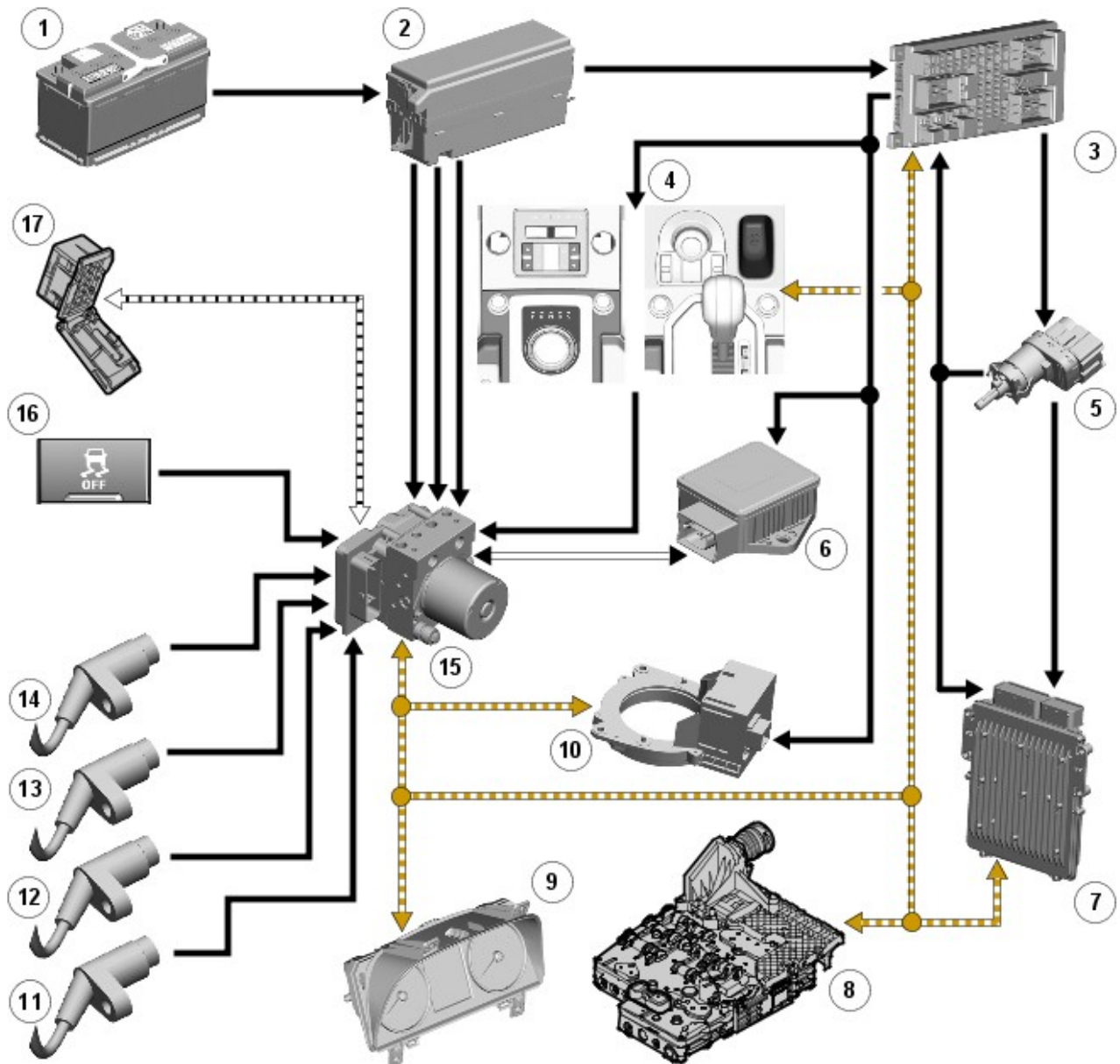
The **ABS** module controls the brake functions using the **HCU** to modulate hydraulic pressure to the individual wheel brakes.

The **ABS** module is attached to the **HCU**, on the driver side inner fender in the engine compartment. A multipin connector provides the electrical interface between the **ABS** module and the vehicle wiring.

CONTROL DIAGRAM



NOTE: A = Hardwired; D = High speed CAN bus; J = Diagnostic ISO 9141 K line; V = Private CAN bus.



E140334



Item	Part Number	Description
1	-	Battery
2	-	BJB (battery junction box)
3	-	CJB
4	-	Terrain response rotary control module
5	-	HDC switch
6	-	Stoplamp switch
7	-	Yaw-rate and lateral acceleration sensor
8	-	ECM
9	-	TCM (transmission control module)
10	-	Steering angle sensor
11	-	Instrument cluster
12	-	Wheel speed sensor
13	-	Wheel speed sensor
14	-	Wheel speed sensor
15	-	Wheel speed sensor
16	-	ABS module
17	-	DSC switch
18	-	EJB (engine junction box)
19	-	Diagnostic socket

OPERATION

Anti-lock Brake System

ABS controls the speed of all road wheels to ensure optimum wheel slip when braking at the adhesion limit. This prevents the wheels from locking in order to retain effective steering control of the vehicle.

On the front axle, the brake pressure is modulated separately for each wheel. On the rear axle, brake pressure is modulated by select low. Select low applies the same pressure to both rear brakes, with the pressure level being determined by the wheel on the lower friction surface. This maintains rear stability on split friction surfaces.

Active Roll Mitigation

The ARM function uses the brake system and engine torque control to attempt to restore vehicle stability if the vehicle is forced into such a harsh manoeuvre that it risks tipping over.

The **ABS** module monitors driver inputs and vehicle behavior using various powertrain signals and inputs from the wheel speed sensors, steering angle sensor and the yaw-rate and lateral acceleration sensor. These are compared with modeled behavior and, if vehicle behavior reaches a given risk level, the **ABS** module initiates a reduction in engine power, or brakes one or more wheels sufficiently to correct the vehicle stability and assist the driver remain in control.

While the ignition is on, ARM is permanently enabled, even when DSC is selected off.

Corner Brake Control

CBC influences the brake pressures, below the DSC and **ABS** thresholds, to counteract the yawing moment produced when braking in a corner. CBC produces a correction torque by limiting the brake pressure on one side of the vehicle.

Dynamic Stability Control

DSC uses the brakes and engine torque control to help maintain the lateral stability of the vehicle. While the ignition is on the DSC function is permanently enabled unless selected off by the DSC switch. Even if DSC is deselected, driving maneuvers with extreme yaw or lateral acceleration may trigger DSC activity to assist vehicle stability.

DSC enhances driving safety in abrupt maneuvers and in understeer or oversteer situations that may occur in a bend. The **ABS** module monitors the yaw-rate and lateral acceleration of the vehicle, and the steering input, then selectively applies individual brakes and signals for engine torque adjustments to reduce understeer or oversteer.

In general: in an understeering situation, the inner wheels are braked to counteract the yaw movement towards the outer edge of the bend. In an oversteering situation, the outer wheels are braked to prevent the rear end of the vehicle from pushing towards the outer edge of the bend.

The **ABS** module monitors the tracking stability of the vehicle using inputs from the wheel speed sensors, the steering angle sensor and the yaw-rate and lateral acceleration sensor. The tracking stability is compared with stored target data and, whenever the tracking stability deviates from the target data, the **ABS** module intervenes by applying the appropriate brakes. When the DSC function is active, the **ABS** module also signals the **TCM** to prevent gear shifts, and the instrument cluster to flash the DSC warning indicator.

If necessary, the **ABS** module also signals:

- The **ECM**, to reduce engine torque.
- The transfer box control module, to adjust the locking torque of the center differential.
- The active on-demand coupling module, to adjust the locking torque of the rear differential.

The DSC function overrides the differential locking torque requests from the terrain response system.

If DSC is selected off, a DSC system off message is displayed in the message center.

For additional information, refer to: Information and Message Center (413-08, Description and Operation).

Electronic Brake Force Distribution

EBD limits the brake pressure applied to the rear wheels. When the brakes are applied, the weight transfer of the vehicle reduces the adhesion of the rear wheels on the road surface. This may cause the rear wheels to slip and make the vehicle unstable.

EBD uses the **ABS** hardware to automatically optimize the pressure of the rear brakes, below the point where **ABS** intervention is normally invoked. Only the rear wheels are under **EBD** control.

Electronic Brake Prefill

Electronic brake prefill senses any rapid throttle lift off, activating a small brake hydraulic pressure build-up of approximately 3 to 5 bar (43.5 to 72.5 lbf/in²) in anticipation of the brakes being applied. This gives a quicker brake pedal response and consequently slightly shorter stopping distances.

When the **ABS** module detects rapid throttle lift off (from the signals received from the **ECM** over the high speed **CAN** bus), it controls the **HCU** to apply a low brake pressure to assist in a quicker brake application.

Electronic Traction Control

ETC attempts to optimize forward traction by reducing engine torque or braking a spinning wheel until traction is restored.

ETC is activated if an individual wheel speed is above that of the vehicle reference speed (positive slip) and the brake pedal is not pressed. The spinning wheel is braked, allowing the excess torque to be transmitted to the non spinning wheels through the drive line. If necessary, the **ABS** module also transmits a high speed **CAN** bus message to the **ECM** requesting a reduction in engine torque.

Torque reduction requests are for either a slow or fast response. A slow response requests a reduction of throttle angle; a fast response requests an ignition cut-off.

When the DSC function is selected off with the DSC switch, the engine torque reduction feature is disabled.

When the ETC function is active the [ABS](#) module also signals the [TCM](#) to prevent gear shifts.

Emergency Brake Assist

[EBA](#) assists the driver during emergency braking situations by automatically maximizing the braking effort. There are two situations when the [ABS](#) module will invoke [EBA](#):

- When the brake pedal is pressed very suddenly.
- When the brake pedal is pressed hard enough to bring the front brakes into [ABS](#) operation.

When the brake pedal is pressed very suddenly, the [ABS](#) module increases the hydraulic pressure to all of the brakes until the threshold for [ABS](#) operation is reached. This applies the maximum braking effort for the available traction. The [ABS](#) module monitors for the sudden application of the brakes using the stoplamp switch status broadcast on the high speed [CAN](#) by the [ECM](#), and from the pressure sensor within the [HCU](#). With the brake pedal pressed, if the rate of increase of hydraulic pressure exceeds the predetermined limit, the [ABS](#) module invokes emergency braking.

When the brake pedal is pressed hard enough to bring the front brakes into [ABS](#) operation, the [ABS](#) module increases the hydraulic pressure to the rear brakes up to the [ABS](#) threshold.

[EBA](#) operation continues until the driver releases the brake pedal enough for the hydraulic pressure in the [HCU](#) to fall below a pre-determined threshold value stored in the [ABS](#) module.

Engine Drag-torque Control

EDC prevents wheel slip caused by any of the following:

- A sudden decrease in engine torque when the accelerator is suddenly released.
- A downshift using the CommandShift™.

When the [ABS](#) module detects the onset of wheel slip without the brakes being applied, it transmits a message to the [ECM](#) via the high speed [CAN](#) bus to request a momentary increase in engine torque.

Enhanced Understeer Control

Understeer logic control monitors the vehicle for understeer by comparing signals from the yaw rate and lateral acceleration sensor with signals from the steering angle sensor and wheel speed sensors.

When the [ABS](#) module detects the onset of understeer, it signals the [ECM](#) via the high speed [CAN](#) bus to request a decrease in engine torque. If required the [ABS](#) module will control the [HCU](#) to apply brake pressure to the inside rear wheel to correct the understeer. If the vehicle continues to understeer, enhanced understeer control is activated and uses multiple brakes (maximum of three brakes) to rapidly reduce the vehicle speed.

Gradient Acceleration Control

Gradient acceleration control is an automatic feature and is always available when HDC is not selected.

When HDC is not selected, gradient acceleration control will intervene to limit downhill acceleration on a steep descent.

The feature uses generated brake pressure to control acceleration in situations where the driver could lose control of the vehicle on a steep incline.

Gradient acceleration control keeps the vehicle to a speed and throttle pedal dependant acceleration limit when the vehicle is moving in the intended direction of travel, for example:

- Descending an incline forwards, with D (drive) selected.
- Descending an incline backwards, with R (reverse) selected.

When the vehicle is moving against the intended direction of travel, for example: descending a slope, but facing uphill with D selected, gradient acceleration control will prevent the vehicle accelerating above 5 km/h (3 mph) for up to 20-30 seconds to aid the driver in re-establishing control of the vehicle.

Gradient Release Control

Gradient release control is an automatic feature which is always available when HDC is selected.

If the vehicle is brought to a standstill on a slope using the foot brake, gradient release control will become active (except in the terrain response, sand program). Subsequently, when the foot brake is released gradient release control will automatically delay and graduate the brake release. This allows time for the foot to be moved from the brake pedal to the accelerator pedal so that the vehicle can move smoothly away.

When descending a hill, a similar brake hold and gradual release is employed to provide a smooth transition into HDC. Gradient release control operates in forward and reverse gears and requires no driver intervention.

Hill Descent Control

HDC uses brake intervention to control vehicle speed and acceleration during low speed descents in off-road and low grip on-road conditions. Generally, equal pressure is applied to all four brakes, but pressure to individual brakes can be modified by the [ABS](#) and DSC functions to retain stability. Selection of the HDC function is controlled by the HDC switch and the terrain response rotary control located on the floor console. HDC operates in both high and low ranges, at vehicle speeds up to 50 km/h (31.3 mph).



WARNING: Incorrect use of the HDC function may compromise the stability of the vehicle, resulting in a dangerous and uncontrolled hill descent. Driving with the transmission in neutral while HDC is active will prevent engine braking from assisting the vehicle. The brakes will overheat and induce the HDC fade out strategy. In this condition there will be no control over the vehicle during a descent.



NOTE: With the HDC function selected, HDC is operative even when the transmission is in the neutral. It is not recommended to drive the vehicle further than is absolutely necessary with HDC selected and the transmission in neutral.

HDC may be used in D, R and CommandShift 1 in high range, and in D, R and all CommandShift gears in low range. When in D, the TCM will automatically select the most appropriate gear.

HDC can be selected at speeds up to 80 km/h (50 mph), but will only be enabled at speeds below 50 km/h (31.3 mph). When HDC is selected:

- At speeds up to 50 km/h (31.3 mph), the HDC information warning indicator is permanently illuminated if a valid gear is selected.
- At speeds from between 50 to 80 km/h (31 to 50 mph) the HDC information warning indicator flashes and a message advising that the speed is too high is displayed in the message center. If the HDC switch is pressed while vehicle speed is more than 80 km/h (50 mph), the HDC information warning indicator will not illuminate and HDC will not be selected.
- If the speed increases to 80 km/h (50 mph), the HDC function is switched off, the information warning indicator is extinguished, a warning chime sounds and a message advising that HDC has been switched off is displayed in the message center.

When HDC is enabled, the ABS module calculates a target deceleration value by comparing the set speed to the actual vehicle speed. The ABS module then operates the HCU in the active braking mode as required to achieve and maintain the target speed.

During active braking for HDC, the ABS module sends a high speed CAN message to the CJB to operate the stoplamps.

For additional information, refer to: Exterior Lighting (417-01, Description and Operation).

Applying the foot brake during active braking may result in a pulse through the brake pedal.

The target speed varies between minimum and maximum values for each gear and transmission range, depending on driver input with the accelerator pedal. If the accelerator pedal is not operated, the ABS module adopts a default target speed.

Low Range Target Speeds

Target Speed	Speed, km/h (mph)	
	Gears 1, R	Gears D, 2 to 6
Default	3.5 (2.19)	6 (3.75)
Minimum	3.5 (2.19)	3.5 (2.19)
Maximum	20 (12.5)	20 (12.5)

High Range Target Speeds

Target Speed	Speed, km/h (mph)	
	Gears 1, R	Gears D, 2 to 6
Default	6 (3.75)	10 (6.25)
Minimum	6 (3.75)	6 (3.75)
Maximum	20 (12.5)	20 (12.5)

As well as varying the target speed with the accelerator pedal, the target speed may also be varied by pressing the speed control '+' and '-' buttons (where fitted). For additional information, refer to:

- Speed Control (310-03A, Description and Operation),
- Speed Control (310-03B, Description and Operation).

During changes of target speed, the ABS module limits deceleration and acceleration to -0.5 m/s^2 (-1.65 ft/s^2) and $+0.5 \text{ m/s}^2$ ($+1.65 \text{ ft/s}^2$) respectively.

To provide a safe transition from active braking to brakes off, the ABS module invokes a fade out strategy that gradually releases the braking effort during active braking. The fade out strategy occurs if any of the following conditions are detected during active braking:

- HDC selected off with the HDC switch.
- Failure of a component used by HDC, but not critical to the fade out function.
- Accelerator pedal pressed when transmission is in neutral.
- Brake overheat.

If fade out is invoked because of deselection or component failure, the HDC function is cancelled by the ABS module. If fade out is invoked because the accelerator pedal is pressed with the transmission in neutral, or because of brake overheat, the HDC function remains in standby and resumes operation when the accelerator pedal is released or the brakes have cooled.

The fade out strategy increases the target speed, at a constant acceleration rate of 0.5 m/s^2 (1.65 ft/s^2), until the maximum target speed is reached or until no active braking is required for 0.5 s. If the accelerator pedal is positioned within the range that influences target speed, the acceleration rate is increased to 1.0 m/s^2 (3.3 ft/s^2).

When fade out is invoked because of component failure, a warning chime is sounded, the HDC information warning indicator is extinguished and a message advising there is a fault is displayed in the message center.

When fade out is invoked because of brake overheating, a message advising that HDC is temporarily unavailable is displayed. At the end of fade out, the HDC information warning indicator flashes. The message is displayed, while HDC remains selected, until the brakes have cooled.

To monitor for brake overheating, the [ABS](#) module monitors the amount of braking activity and, from this, estimates the temperature of each brake. If the estimated temperature of any brake exceeds a preset limit, the [ABS](#) module invokes the fade out strategy. After the fade out cycle, the HDC function is re-enabled when the [ABS](#) module estimates that all of the brake temperatures are at less than 64% of the temperature limit.

When HDC is selected off, the instrument cluster message center displays a system off message.

Hill Start Assist

Hill start assist is an automatic feature that operates in a similar manner to gradient release control, but does not require HDC to be active. The feature is not driver selectable and there is no indication to the driver when in operation.

On steep slopes, hill start assist will hold a portion of the driver generated brake pressure for a short time to allow the driver to move their foot from the brake pedal to the throttle pedal without the vehicle rolling back.

The system will release the brake pressure in a controlled manner, either after the timer has expired or if the driver has generated sufficient drive-torque to move the vehicle forward up the hill.

The timer function is controlled by the [ECM](#) and transmitted to the [ABS](#) module on the high speed [CAN](#) bus.

Trailer Stability Assist

When the trailer electrical socket is connected, trailer stability assist operates automatically to enhance the existing DSC and terrain response functions of the vehicle when towing. The system detects sway movements caused by trailer oscillations at speeds in excess of 60 km/h (37 mph) and acts to eliminate them. It does this through braking and engine management. Braking management counterbalances the sway movement through symmetric and asymmetric braking, thereby slowing the vehicle and eliminating the oscillations. Engine management adapts engine torque output to support the braking management in stabilizing the vehicle and trailer.

Typical conditions when sway can occur include:

- Changing highway lanes.
- Traversing a lengthy bend.
- Acceleration.
- Braking.

The capability of trailer stability assist to respond early to the beginning of trailer-sway makes the system almost unnoticeable under normal driving conditions and keeps the vehicle and trailer under safe control. Trailer stability assist requires no input from the driver and operates up to the maximum vehicle speed.

Trailer stability assist will not operate while DSC is switched off.

Anti-Lock Control - Traction Control - Anti-Lock Control - Traction Control

Diagnosis and Testing

Principles of Operation

For a detailed description of the Anti-Lock Control- Traction Control System and operation, refer to the relevant Description and Operation section of the workshop manual.

REFER to: Anti-Lock Control - Traction Control (206-09 Anti-Lock Control - Traction Control, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Tire size, condition and installation • Wheel speed sensor condition and installation • Steering Angle Sensor Module (SASM) condition and installation • Yaw rate sensor and accelerometer condition and installation • Hydraulic control unit (with attached anti-lock brake system control module) condition and installation 	<ul style="list-style-type: none"> • Fuses • Harnesses and connectors • Warning indicator operation • Wheel speed sensors • Central Junction Box (CJB) • Hill Descent Control (HDC) switch • Dynamic Stability Control (DSC) switch • Brake pedal switch • Yaw rate sensor and accelerometer • Steering Angle Sensor Module (SASM) • Anti-lock Brake System control module (ABS) • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Anti-Lock Brake System Control Module (ABS) (100-00 General Information, Description and Operation).

Anti-Lock Control - Traction Control - Anti-Lock Brake System (ABS) Module

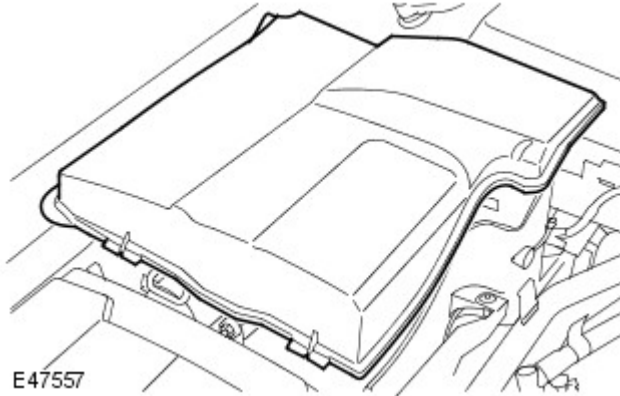
Removal and Installation

Removal



CAUTION: Make sure the ignition switch is in position 0.

1. Remove the cover.



2. Disconnect the electrical connector.

3. **CAUTIONS:**



Brake fluid will damage paint finished surfaces. If spilled, immediately remove the fluid and clean the area with water.

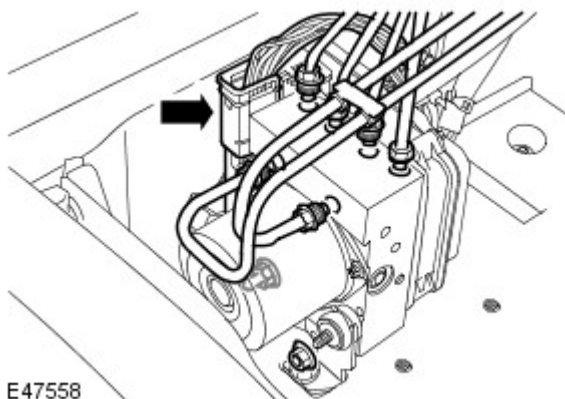


Before the disconnection or removal of any components, ensure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

Disconnect the 6 brake tubes.

- Position an absorbent cloth to collect fluid spillage.

4. Remove the ABS module from the mounting bracket.
 - Loosen, but do not remove, the 2 nuts securing the ABS module to the bracket.



Installation

1. **NOTES:**



Make sure the ABS module locating grommet is correctly seated in the bracket before installing the ABS module.



Make sure the ABS module locating pin is correctly located in the grommet, and the 2 front isolators are fully seated in the bracket slots.

Install the ABS module.

- Tighten the 2 ABS module retaining nuts to 8 Nm (6 lb.ft).
- Remove the blanking caps from the ports.
- Tighten the two M10 and three M12 brake tube unions to 15 Nm (11 lb.ft).
- Tighten the M14 brake tube union to 17 Nm (13 lb.ft).
- Connect the electrical connector.
- Remove the ABS module from the mounting bracket.

2. Using T4, bleed the braking system.

For additional information, refer to: Brake System Pressure Bleeding (206-00, General Procedures).


3. Install the cover.

4. If a new ABS module has been installed, interrogate the ABS system using T4.

Anti-Lock Control - Traction Control - Front Wheel Speed Sensor

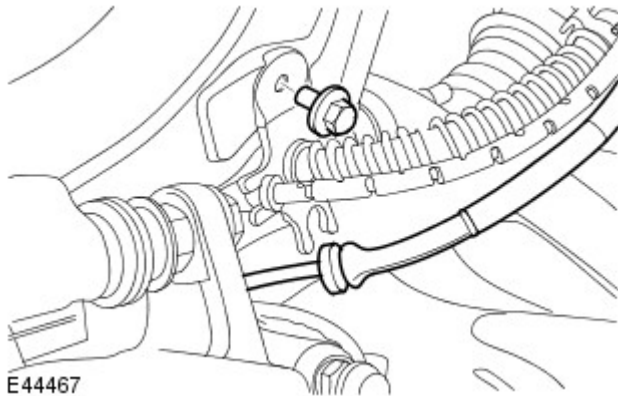
Removal and Installation

Removal

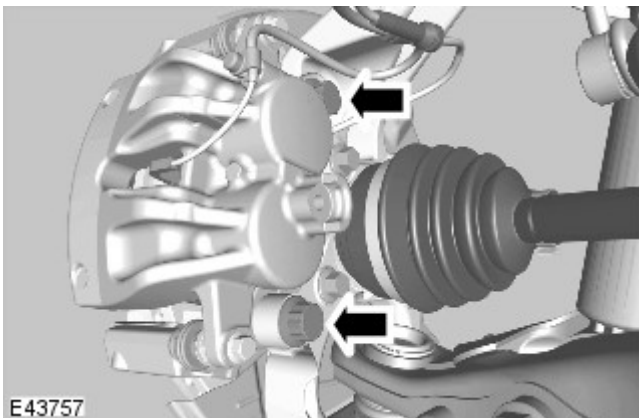
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the vehicle.

2. Remove the fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).



3. Release the brake hose bracket from the wheel knuckle.
 - Remove the retaining bolt.

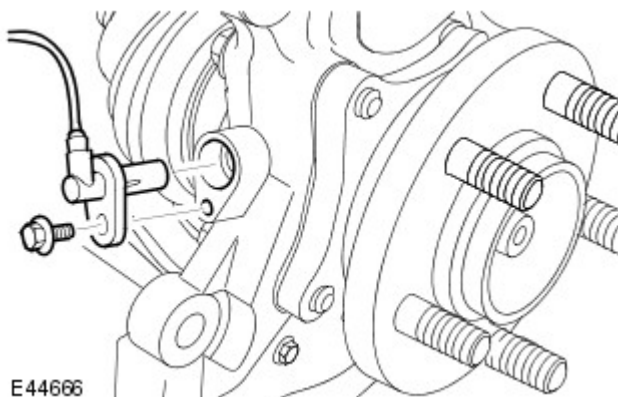


4.  **CAUTION:** Do not allow the brake caliper to hang on the brake hose.

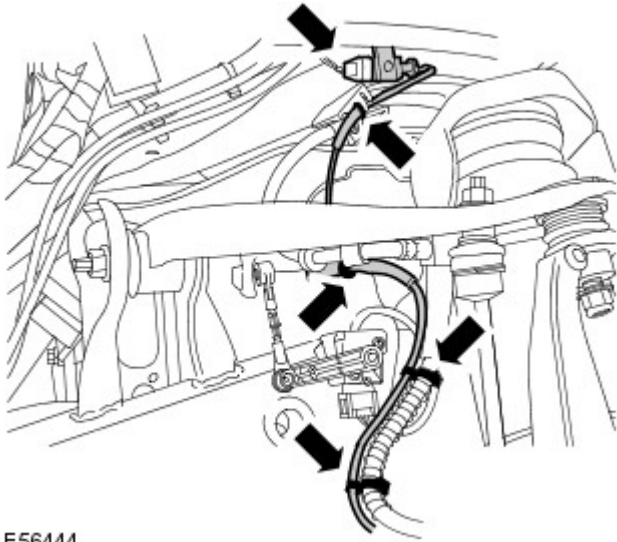
Release the brake caliper anchor plate from the wheel knuckle and tie the caliper aside.

- Remove the two retaining bolts.

5. Release the wheel speed sensor from the wheel knuckle.
 - Remove the bolt.




6. Remove the wheel speed sensor.
 - Disconnect the electrical connector.
 - Release the wiring harness from the 5 clips.



E56444

Installation

1. Make sure the wheel speed sensor location in the wheel knuckle is free of dirt.

2.  **NOTE:** Make sure the electrical connector retaining clip is attached to the body wiring harness.

Install the wheel speed sensor.


- Connect the electrical connector.
- Attach the wiring harness to the 5 clips.
- Tighten the bolt to 9 Nm (7 lb.ft).

3. Secure the brake caliper and anchor plate to the wheel knuckle.
 - Tighten the bolts to 275 Nm (203 lb.ft).
4. Secure the brake hose retaining bracket to the wheel knuckle.
 - Tighten the bolt to 25 Nm (18 lb.ft).
5. Install the fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).
6. Install the wheel and tire.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
7. Depress the brake pedal several times, check the fluid level in the brake fluid reservoir and top-up with brake fluid if necessary.
8. If a new wheel speed sensor has been installed, interrogate the ABS system using T4.

Anti-Lock Control - Traction Control - Rear Wheel Speed Sensor

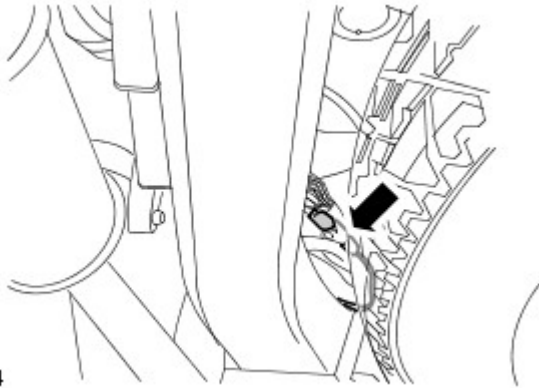
Removal and Installation

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

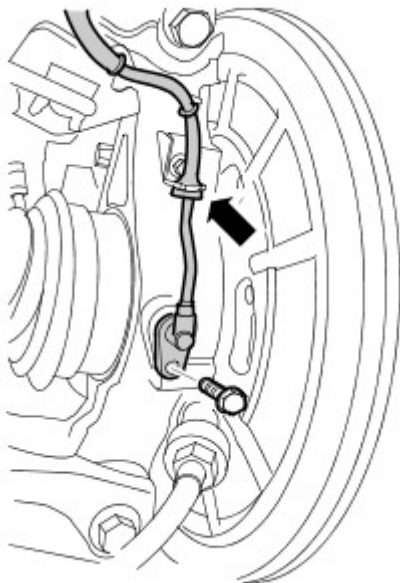
Raise and support the vehicle.

2. Remove the wheel and tire.
3. Disconnect the anti-lock brake system (ABS) sensor electrical connector.
 - Release the wiring harness retaining clip.



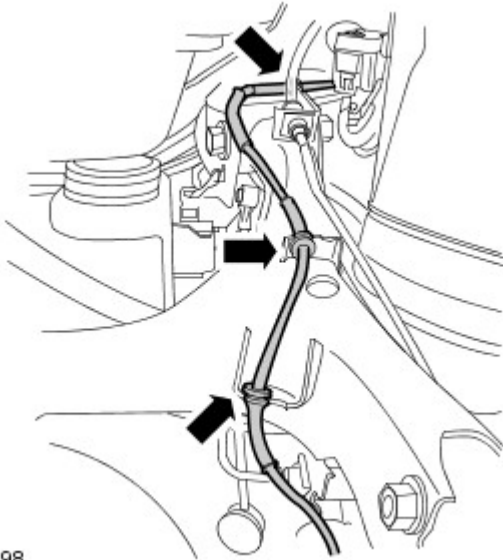
E52454

4. Release the wheel speed sensor from the wheel knuckle.
 - Release the wiring harness.
 - Remove the retaining bolt.



E56445


5. Remove the wheel speed sensor.
 - Release the wiring harness from the 4 clips.



E56698

Installation

1. Make sure the wheel speed sensor location in the wheel knuckle is free of dirt.
2. Install the wheel speed sensor.
 - Attach the wiring harness to the 4 clips.
3. Secure the wheel speed sensor to the wheel knuckle.
 - Tighten the bolt to 9 Nm (7 lb.ft).
 - Attach the wiring harness to the clip.

4.  **NOTE:** Make sure the electrical connector retaining clip is attached to the body wiring harness.

Connect the ABS sensor electrical connector.

- Attach the wiring harness.
5. If a new wheel speed sensor has been installed, interrogate the ABS system using T4.

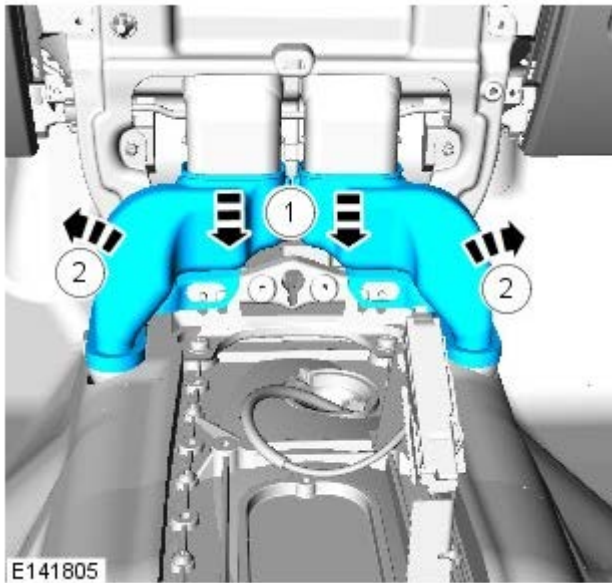
Anti-Lock Control - Stability Assist - Yaw Rate Sensor

Removal and Installation

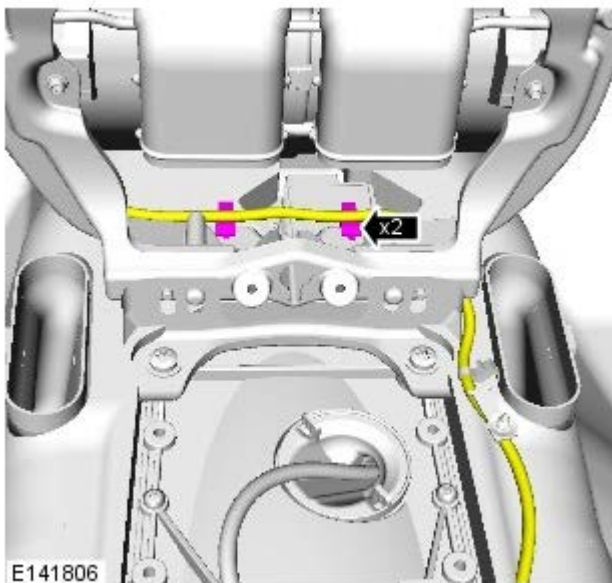
Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).
2. Remove the floor console.
For additional information, refer to: Floor Console (501-12, Removal and Installation).
3. Remove the instrument panel center reinforcement.
For additional information, refer to: Instrument Panel Center Reinforcement (501-12, Removal and Installation).

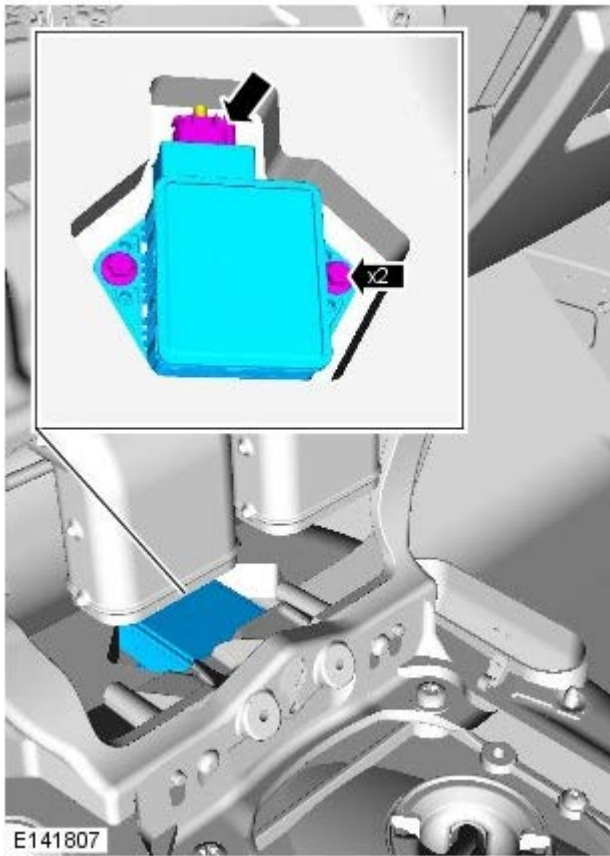
4.



5.

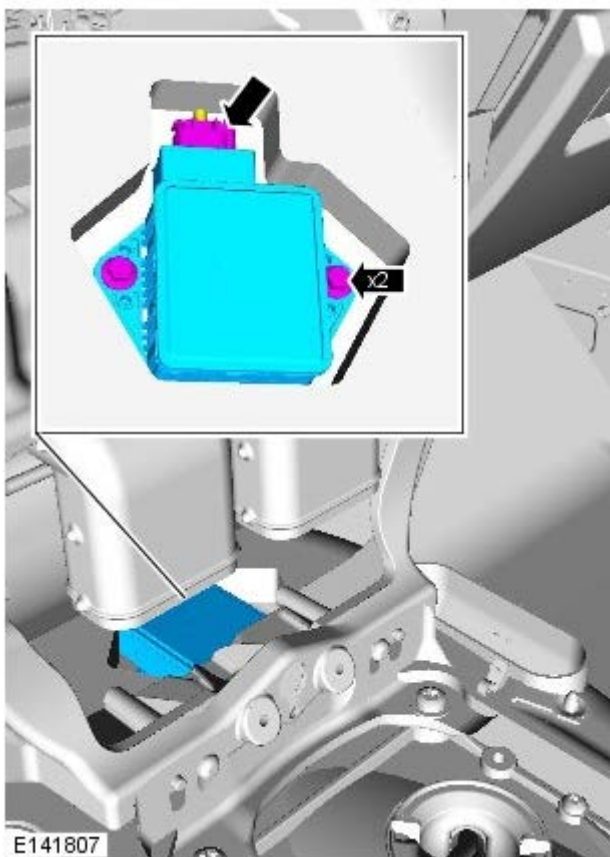


6. Remove the yaw rate sensor.

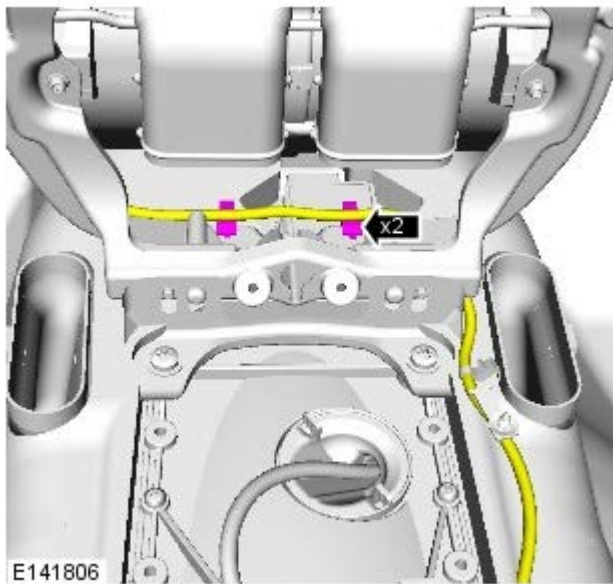


Installation

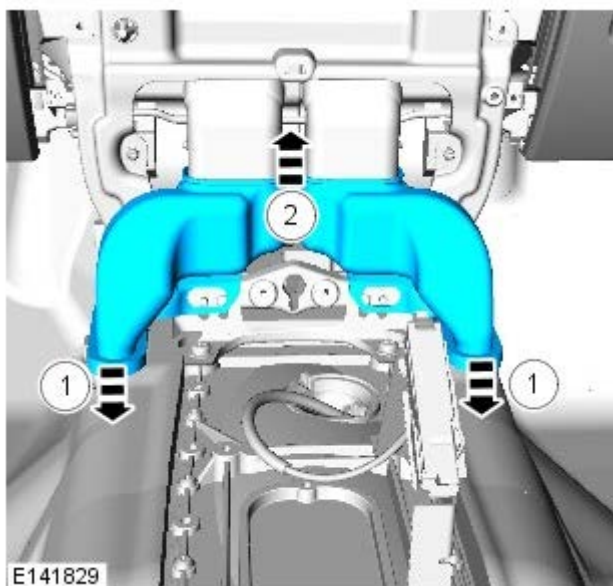
1. Install the yaw rate sensor.
 - Install the 2 bolts and tighten to 7 Nm (5 lb.ft).



2.



3.



4. Install the instrument panel center reinforcement.
For additional information, refer to: Instrument Panel Center Reinforcement (501-12, Removal and Installation).
5. Install the floor console.
For additional information, refer to: Floor Console (501-12, Removal and Installation).
6. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Steering System - General Information - Steering System

Diagnosis and Testing

Principles of Operation

For a detailed description of the Steering System and operation, refer to the relevant Description and Operation section of the workshop manual.

REFER to: Power Steering (211-02 Power Steering, Description and Operation) /
Steering Linkage (211-03 Steering Linkage, Description and Operation) /
Steering Column (211-04 Steering Column, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
 - If a road test is necessary make sure the vehicle is safe to do so.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Check the tires for correct pressure, size and tread pattern • Check for wheel rim and tire damage • Check road wheel security • Check the power steering fluid level and the hydraulic circuit for oil leaks • Check the power steering pump drive belt condition and tension • Check the power steering pump for security, wear, damage and excessive noise • Check the steering gear assembly for damage, wear and security • Check the hydraulic pipes and cooler lines for damage and correct routing • Check the steering joints for damage, excessive play, wear and security • Check the steering column and joints for damage, excessive play, wear and security 	<ul style="list-style-type: none"> • Steering Angle Sensor Module (SASM) and circuits • Controller Area Networks (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Steering wanders	<ul style="list-style-type: none"> • Excessive free play in the steering system • Steering geometry incorrectly aligned 	Check for excessive movement or play in the steering system with the engine running. Check for play at several different steering positions. Carry out steering geometry and alignment checks. Refer to the relevant section of the workshop manual
Steering pulls to the left or right	<ul style="list-style-type: none"> • Steering geometry incorrectly aligned 	Carry out steering geometry and alignment checks using a four wheel alignment system. REFER to: Four-Wheel Alignment (204-00 Suspension System - General Information, General Procedures). Ensure that the tire direction of rotation is correct for the position on the vehicle (where directional tires are installed)
Steering feels notchy when turning from lock to lock	<ul style="list-style-type: none"> • Steering or suspension swivel joints seized • Steering tie rod end 	Disconnect the steering gear from the suspension. Check for freedom of movement in the suspension. Disconnect the steering column from the steering gear. Check the steering column and universal joints for freedom of movement. Check the steering gear for freedom of movement. Rectify as necessary
Steering feels tight and does		

not self-center	<ul style="list-style-type: none"> joints or track rod inner joints seized Steering column or universal joints seized Steering gear internal components misaligned, worn or damaged 	
Power steering hydraulics noisy operation	<ul style="list-style-type: none"> Power steering fluid level low or contaminated Incorrect specification of power steering fluid Filter in the power steering reservoir blocked Power steering fluid aerated power steering hoses twisted or restricted 	<p>Check and top-up the power steering fluid level if required, using the correct specification of fluid. REFER to: Specifications (211-00 Steering System - General Information, Specifications).</p> <p>Check for contaminated fluid. Drain the fluid from the reservoir and visually inspect the filter for obstructions/blockage. Repair/renew as necessary. Check for air ingress into the system. Check the power steering hoses for twisting or restrictions. Rectify as necessary</p>
Power steering pump noisy	<ul style="list-style-type: none"> Power steering fluid level low or contaminated Filter in the power steering reservoir blocked Pump internal components worn or damaged 	<p>Check and top-up the power steering fluid level if required. REFER to: Power Steering System Filling and Bleeding (211-00 Steering System - General Information, General Procedures).</p> <p>Check for contaminated fluid. Drain the fluid from the reservoir and visually inspect the filter for obstructions/blockage. Repair/renew as necessary. Check for excessive pump noise. Rectify as necessary</p>
Power steering gear noisy	<ul style="list-style-type: none"> Power steering fluid level low or contaminated Steering gear internal components worn or damaged 	<p>Check and top-up the power steering fluid level if required. Refer to the relevant section of the workshop manual. Check for contaminated fluid. Check for excessive steering gear noise. Rectify as necessary</p>
Steering column noisy	<ul style="list-style-type: none"> Steering column fouling or universal joints dry 	<p>Check the steering column and universal joints. Rectify as necessary</p>
Power steering feels heavier than normal through its operating range	<ul style="list-style-type: none"> Lack of power assistance 	<p>Check the power steering pump pressure. Check the steering column has no damage and rotates freely</p>
Power steering feels too light at speed		
Power steering feels too heavy at standstill and low speed		

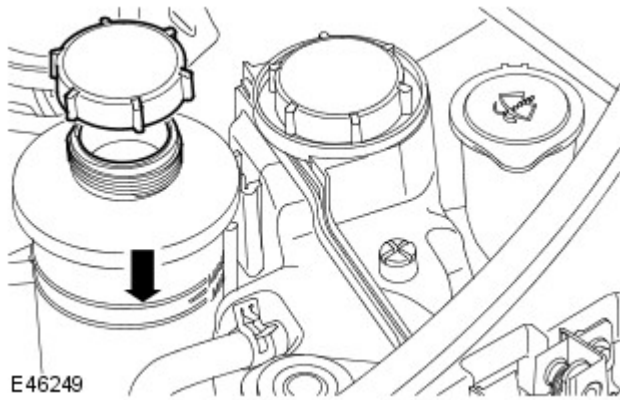
DTC Index


For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

Steering System - General Information - Power Steering System Filling and Bleeding

General Procedures

1. Check the power steering fluid level.



2.  **CAUTION:** Fluid must always be present in the reservoir during bleeding.

Remove the filler cap and fill to the MAX level mark.

- Install the reservoir filler cap.

3. Start the engine and allow to run for 10 seconds, stop the engine.
 - Check the power steering fluid, if aerated, wait until fluid is free from bubbles then top-up reservoir to UPPER level mark with recommended fluid.

4.  **CAUTION:** Do not hold steering on full lock for longer than 10 seconds.

Start the engine and turn steering fully lock to lock, stop the engine.

- Check and top-up power steering fluid level.

5. Start and run the engine for 2 minutes, turn the steering fully lock to lock.
 - Check and top-up power steering fluid level.

Steering System - General Information - Power Steering System Flushing

General Procedures

NOTES:

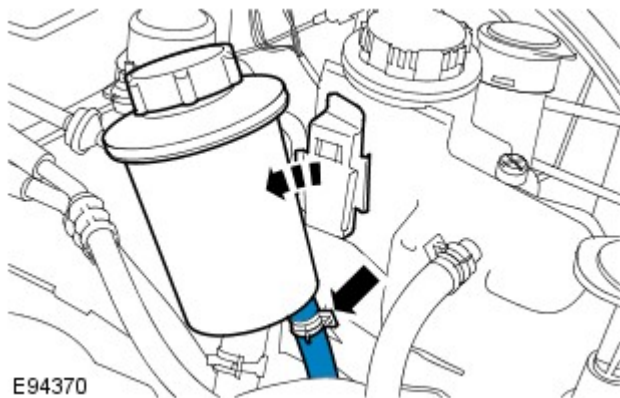


If heavy steering or contamination within the power steering system is found, it is necessary to carry out the system flush procedure as detailed below. If any components have been replaced in the power steering system the procedure below must be carried out in full.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Remove the power steering fluid reservoir cap.
2. Using a suitable syringe, remove the power steering fluid from the power steering fluid reservoir.



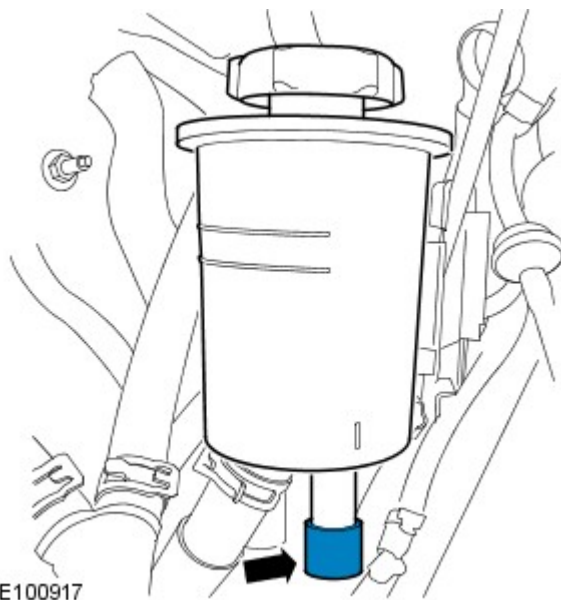
3. **CAUTION:** Be prepared to collect escaping fluids.



NOTE: Note the orientation of the clip.

Detach the power steering fluid reservoir.

- Detach but do not remove the power steering fluid reservoir.
- Release the power steering fluid return hose from the power steering fluid reservoir.
- If a quick release coupling is fitted to the power steering return hose, release the power steering fluid return hose from the coupling by removing the clip.



4. **CAUTION:** Be prepared to collect escaping fluids.



NOTE: Make sure that all openings are sealed. Use new blanking caps.

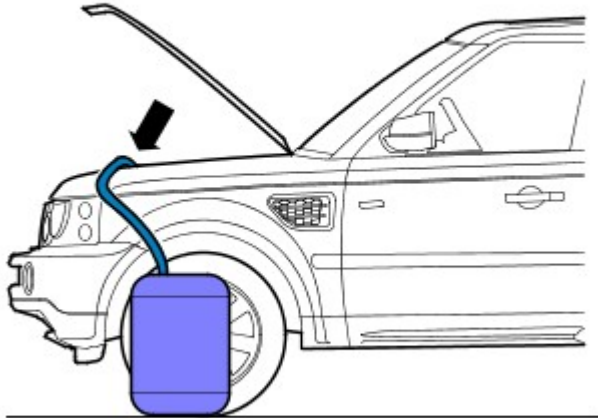
Using a suitable blanking cap, cap the power steering reservoir return pipe.

5. **CAUTION:** Be prepared to collect escaping fluids.

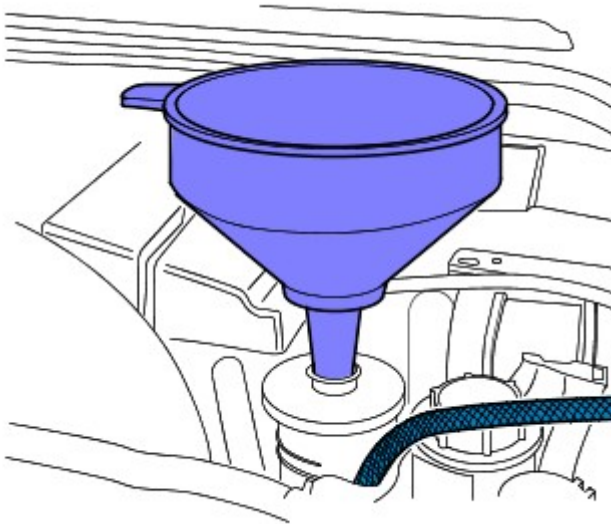


NOTE: Make sure the extended pipe is not kinked or twisted and is correctly secured with hose clips.

Attach a suitable pipe to the power steering return hose to allow the fluid to drain.




E 100918




E94372

6. NOTES:

 The suitable funnel should have the a capacity of 4 litres and O-ring seal


 The suitable funnel must be tightly sealed to the power steering fluid reservoir to avoid fluid leakage.

Install a suitable funnel onto the power steering fluid reservoir.

7.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle with the wheels just clear of the ground.

8. CAUTIONS:

 Steps 8 and 9 must be carried out within 2 - 3 seconds of each other. Failure to follow this instruction may result in damage to the power steering system.

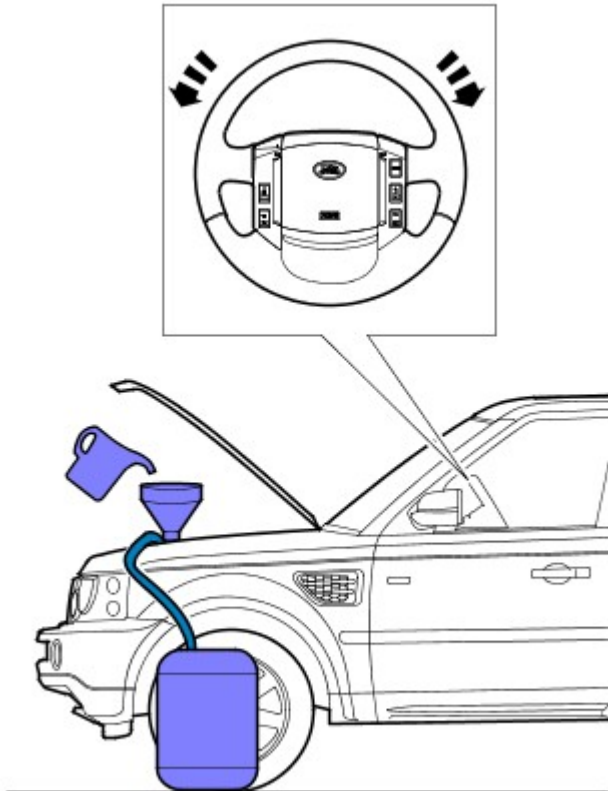
 Be prepared to collect escaping fluids.

Using the suitable funnel, top up the power steering system with the specified fluid. Make sure the fluid level is maintained at two thirds full in the funnel.

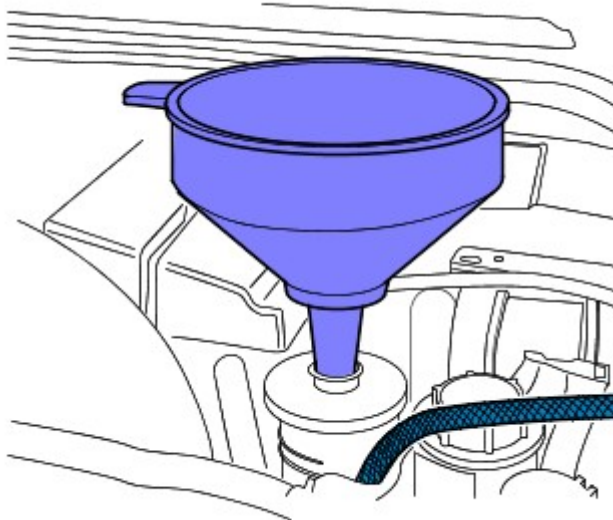
9. CAUTIONS:

 Be prepared to collect escaping fluids.





E94373



E94372


Do not allow the power steering fluid level in the power steering fluid reservoir to fall below the minimum power steering fluid level. Failure to follow this instruction may result in damage to the power steering system.



Make sure the engine is switched off as soon as the full 4 litres of power steering fluid has entered the power steering fluid reservoir.

Flush the power steering system.

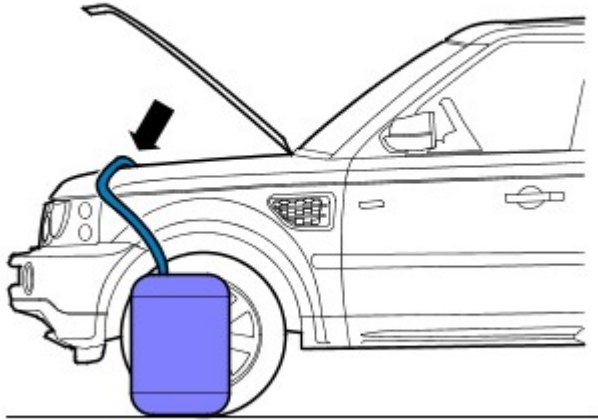
- Start the engine
- With assistance turn the steering slowly lock to lock 3 times at approximately 1 revolution every 5 seconds.
- Continue to flush the power steering system until 4 litres of power steering fluid has been added to the power steering reservoir. This should take approximately 30 seconds.

10.  CAUTION: Be prepared to collect escaping fluids.

Remove the suitable funnel.

11.  CAUTION: Be prepared to collect escaping fluids.

Remove the suitable pipe to the power steering return hose.



E 100918

12.  **CAUTION:** Be prepared to collect escaping fluids.



NOTE: Note the orientation of the clip.

If a quick release coupling is fitted to the power steering return hose, connect the power steering fluid return hose to the coupling by installing the clip.

13. Install a new power steering fluid reservoir.
For additional information, refer to: Power Steering Fluid Reservoir (211-02, Removal and Installation).

Power Steering -

Power Steering Fluid

Item	Specification
Recommended power steering fluid	Texaco Cold Climate Fluid 33270

Capacity

Item	Capacity
System capacity - Maximum - Fill to mark on reservoir	0.89 litre (1.5 pints) (0.9 US quarts)

General Specification

Item	Specification
Type	Power assisted rack and pinion, speed proportional with belt driven pump, remote hydraulic fluid reservoir and fluid cooler
Steering wheel diameter	395 mm (15.5 in)
Number of turns - lock to lock	3.32
Turning circle	11.45 m (37.5 ft)
System ratio	17.8:1
System operating pressure	110 bars (11000 kPa)(1595 lbf/in ²)
Pump relief valve operating pressure	114 ± 4 bar (11400 ± 400 kPa) (1653 ± 58 lbf/in ²)
Fluid flow rate - constant	8.8 ± 0.5 litre/min (15.4 ± 0.8 pints/min) (9.2 ± 0.5 US quarts/min)
Steering rack travel	166 mm (6.22 in)
Piston diameter	52 mm (1.9 in)
Rack bar diameter	30 mm (1.12 in)
Steering angle sensor make/part number	Panasonic ECS64SUKX

Torque Specifications

Description	Nm	lb-ft
Power steering pump bolts - All engines	25	18
High pressure line to power steering pump - All engines	25	18
Power steering pump bolts - All engines	25	18
High pressure line to power steering pump - All engines	25	18
Low pressure line to power steering pump - All engines	25	18
Steering angle sensor Torx screws	3	2
* Steering column intermediate shaft nut	22	16
++ Steering column intermediate shaft to the lower shaft bolt	25	18
Horn nut	10	7
Coolant expansion tank bolts	10	7
A/C condenser refrigerant line bolts	25	18
++ Power steering fluid lines bolt - 2.7 litre	25	18
+ Power steering gear to cross member bolts	175	129
High pressure line to steering gear bolt	25	18
Power steering line support bracket bolt	10	7
High pressure line union nut	30	22
* Tie rod end ball joint nuts	76	56
** Universal joint to steering gear bolt	25	18
Radiator access panel bolts	10	7
Oil filter	18	13

* New nut(s) must be fitted

+ New cage nuts must be fitted

** New 'Patchlok' bolt must be fitted

++ New bolt must be fitted

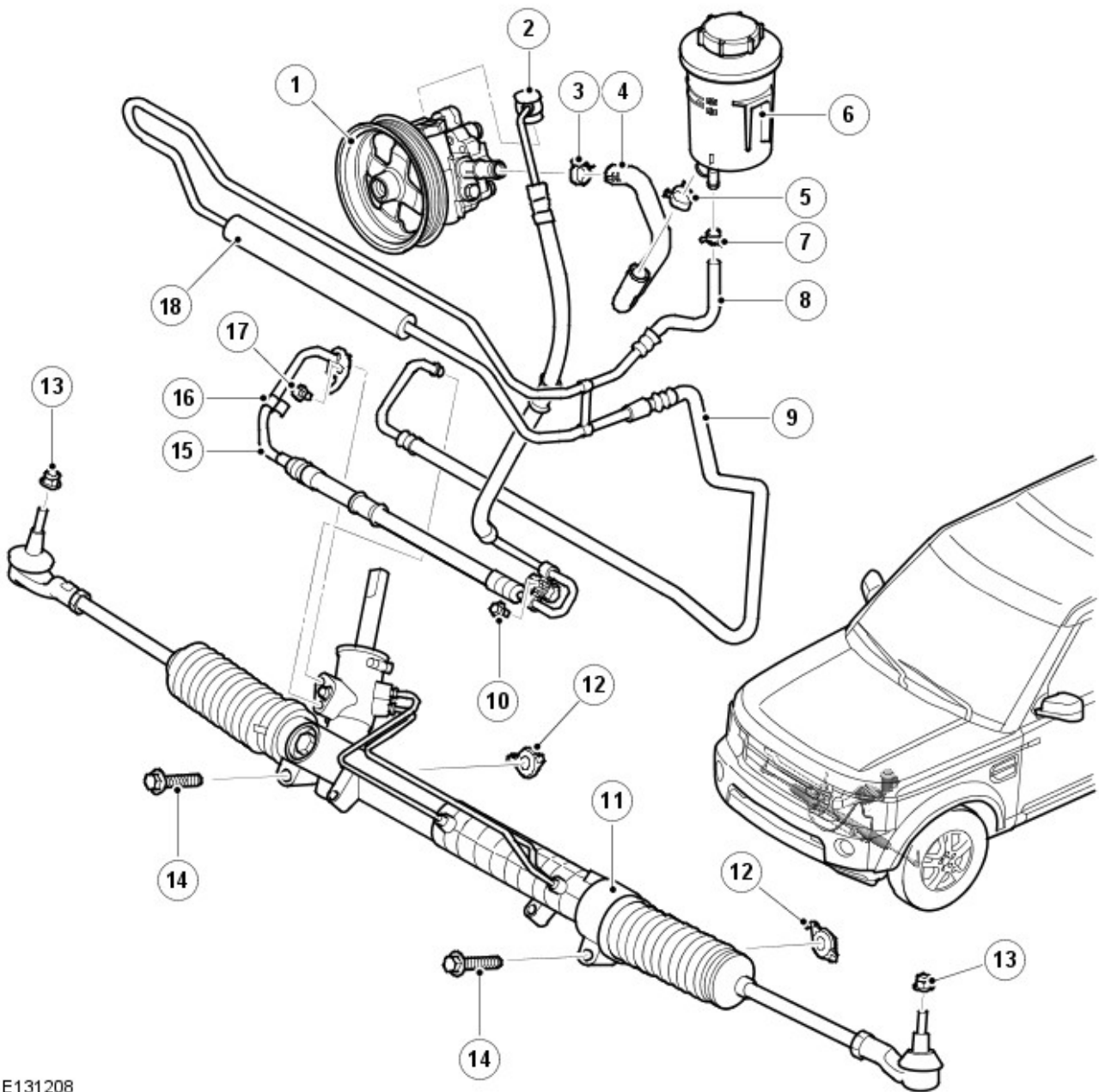
Power Steering - Power Steering

Description and Operation

COMPONENT LOCATION



NOTE: 5.0L RHD shown.



E131208

Item	Part Number	Description
1	-	Power steering pump
2	-	Banjo bolt
3	-	Spring clip
4	-	Suction hose - reservoir to pump
5	-	Spring clip
6	-	Reservoir
7	-	Spring clip
8	-	Fluid cooler and hose assembly - fluid return
9	-	Hose assembly - Steering gear to cooler - return
10	-	Screw
11	-	Steering gear
12	-	Caged nut (2 off)
13	-	Self-locking nut (2 off)
14	-	Bolt (2 off)

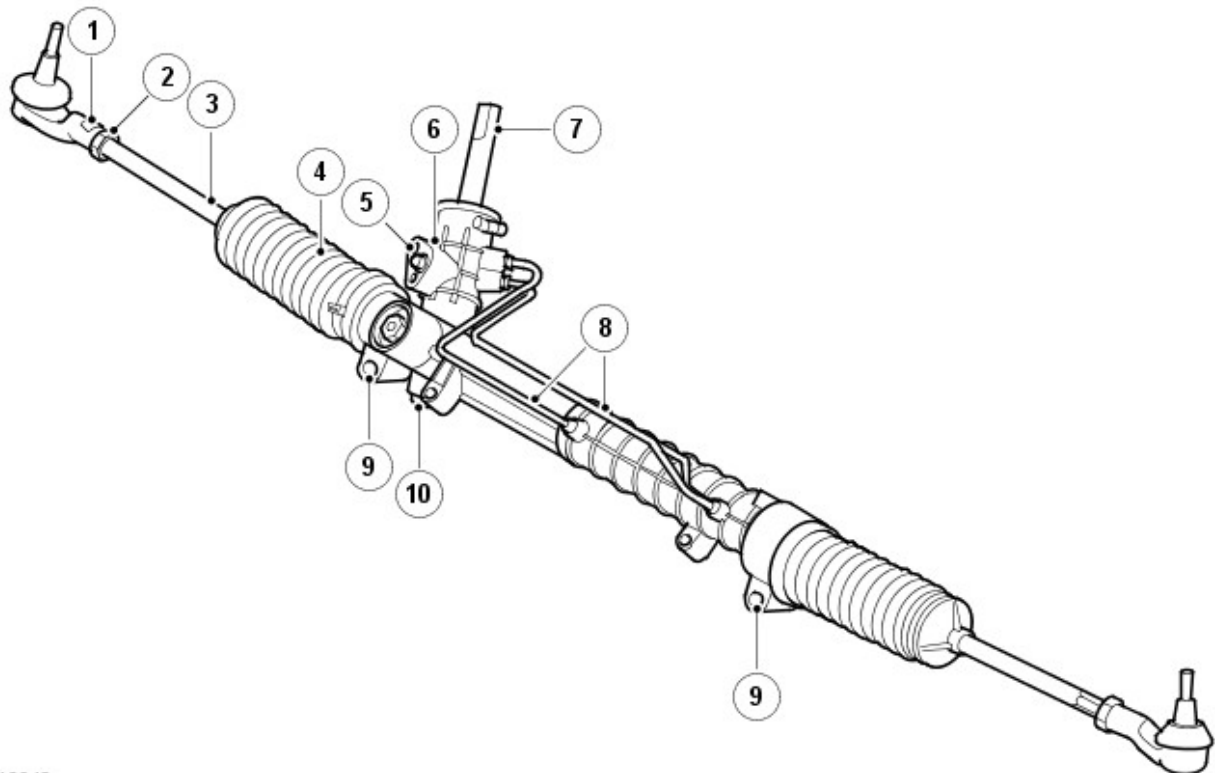
- 15 - Hose - pump to steering gear - pressure
- 16 - Pipe clip
- 17 - Screw
- 18 - Cooler

GENERAL

The steering system comprises a TRW manufactured rack and pinion steering gear, a power steering pump, a reservoir, a fluid cooler and fluid hoses. The steering gear is a conventional end take-off rack and pinion power assisted unit.

The steering gear rack has a travel of 166 mm (6.53 in). Lock to lock requires 3.33 revolutions of the steering wheel, which gives a ratio of 45 mm (1.77 in)/revolution at the center position and 52.6 mm (2.07 in)/revolution at end of lock.

STEERING GEAR



E46942

Item	Part Number	Description
1	-	Tie-rod end
2	-	Locknut
3	-	Tie-rod
4	-	Gaitor
5	-	Pressure/return connection from/to pump
6	-	Valve unit housing
7	-	Input shaft
8	-	Pressure/return pipes
9	-	Steering gear casing attachment lugs
10	-	Pinion housing

The steering gear is located at the front of the engine, below the accessory belt drive. The gear is attached to two brackets on the chassis and is secured to the brackets with flanged bolts and caged nuts. The cage prevents the nuts from turning when the bolts are loosened or tightened. The cage nuts can only be used once and must be replaced when the gear is removed. For service, M12 Nylock nuts are available as a replacement for the cage nut.

The steering gear comprises an aluminium, cast, one piece housing which contains a mechanical steering rack, a valve unit and an integrated hydraulic power unit.

The steering gear uses a rack with an integrated piston which is guided on plain bearings within the rack housing. The pinion, which is attached to the valve unit, runs in bearings and meshes with the rack teeth. The rack is pressed against the pinion by a spring loaded yoke which ensures that the teeth mesh with the minimum of play. The pinion is connected to the valve unit via a torsion bar. The rotary motion of the steering wheel is converted into linear movement of the rack by the pinion and is initiated by the valve unit. This movement is transferred into movement of the road wheels by adjustable tie-rods.

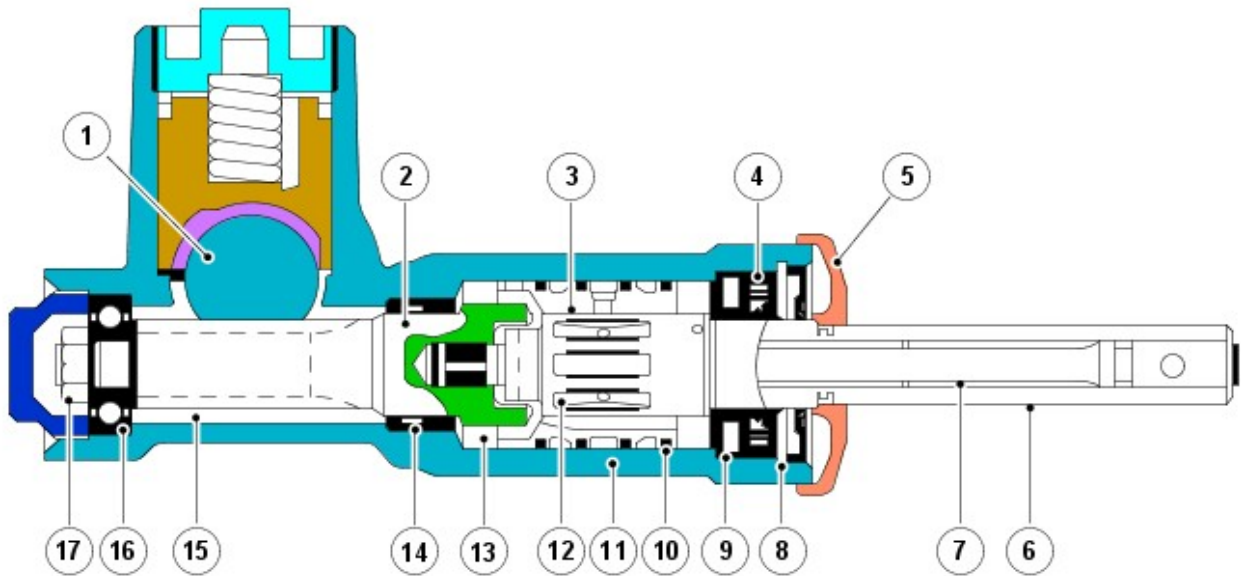
The 49 mm (1.92 in) diameter piston of the hydraulic power unit is located at one end of the gear housing. Each side

of the piston is connected to fluid pressure or fluid return via external metal pipes which are connected to the valve unit.

Each end of the gear has a threaded hole which provides for the fitment of the tie-rod. The external ends of the gear are sealed with gaitors which prevent the ingress of dirt and moisture. The tie-rod has a long threaded area which allows for the fitment of the tie-rod end. The thread allows for the adjustment of the steering toe. When the correct toe is achieved, a locknut is tightened against the tie-rod end preventing inadvertent movement.

The gear has a central hole machined along its length. The hole allows the air in the gaitors to be balanced when the steering is turned. The gaitors are serviceable items and are retained on the gear housing and the tie-rod with zip ties.

Valve Unit



E46943

Item	Part Number	Description
1	-	Rack
2	-	Pinion shaft
3	-	Outer sleeve
4	-	Oil sleeve
5	-	Dirt seal
6	-	Input shaft
7	-	Torsion bar
8	-	Circlip
9	-	Oil seal
10	-	PTFE ring
11	-	Steering gear casting
12	-	Slots
13	-	Pin - Pinion shaft to outer sleeve
14	-	Oil seal
15	-	Pinion shaft
16	-	Bearing
17	-	Pinion shaft nut

The valve unit is an integral part of the steering gear. The principle function of the valve unit is to provide maximum power assistance (i.e. when parking) with minimum effort required to turn the steering wheel.

The pinion housing of the valve is an integral part of the main steering gear casting. The pinion housing has four machined ports which provide connections for pressure feed from the power steering pump, return fluid to the reservoir and pressure feeds to each side of the cylinder piston.

The valve unit comprises an outer sleeve, an input shaft, a torsion bar and a pinion shaft. The valve unit is co-axial with the pinion shaft which is connected to the steering column via the input shaft. The valve unit components are located in the steering gear pinion housing which is sealed with a cap.

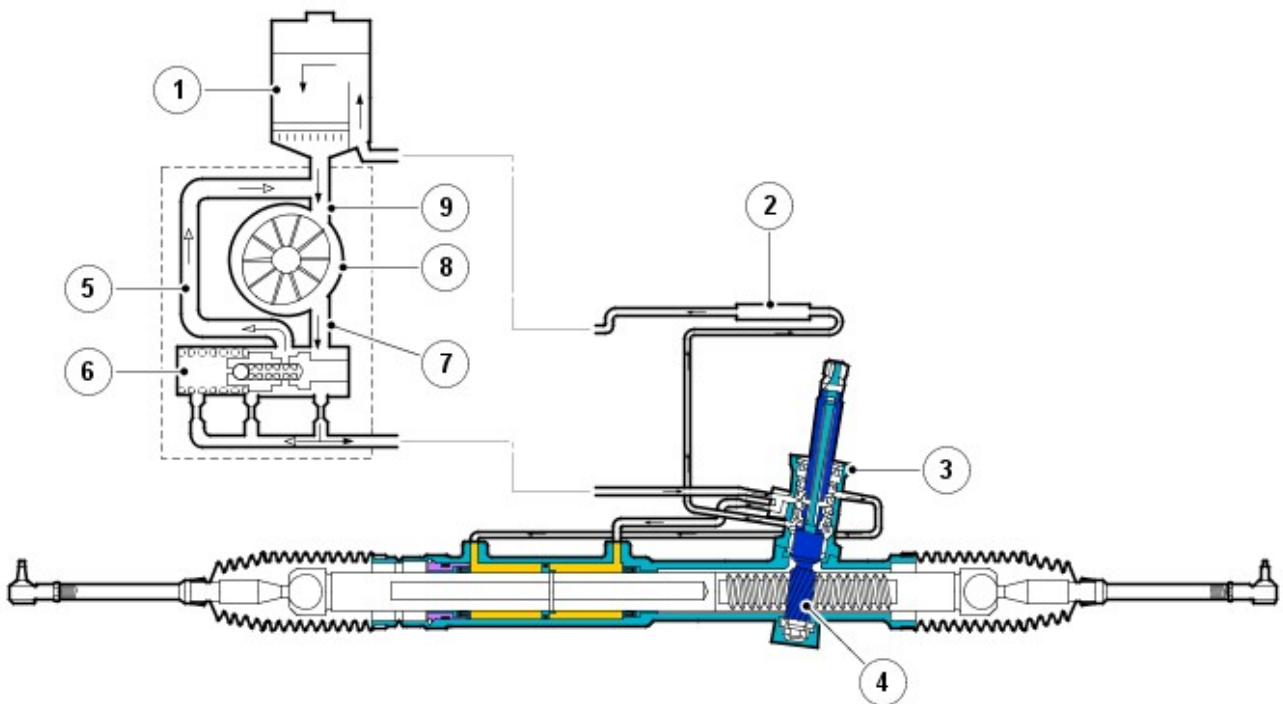
The outer sleeve is located in the main bore of the pinion housing. Three annular grooves are machined on its outer diameter. PTFE rings are located between the grooves and seal against the bore of the pinion housing. Holes are drilled radially in each annular groove through the wall of the sleeve. The bore of the outer sleeve is machined to accept the input shaft. Six equally spaced slots are machined in the bore of the sleeve. The ends of the slots are closed and do not continue to the end of the outer sleeve. The radial holes in the outer sleeve are drilled into each slot.

The input shaft has two machined flats at its outer end which allow for the attachment of the steering column intermediate shaft yoke. The flats ensure that the intermediate shaft is fitted in the correct position to maintain the optimum phase angle. The inner end of the input shaft forms a dog-tooth which mates with a slot in the pinion shaft. The fit of the dog-tooth in the slot allows a small amount of relative rotation between the input shaft and the pinion shaft before the dog-tooth contacts the wall of the slot. This ensures that, if the power assistance fails, the steering can be operated manually without over stressing the torsion bar. The central portion of the input shaft has equally spaced longitudinal slots machined in its circumference. The slots are arranged alternately around the input shaft.

The torsion bar is fitted inside the input shaft and is an interference fit in the pinion shaft. The torsion bar is connected to the input shaft by a drive pin. The central diameter of the torsion bar is machined to a smaller diameter in its central section. The smaller diameter allows the torsion bar to twist in response to torque applied from the steering wheel in relation to the grip of the tyres on the road surface.

The pinion shaft has machined upper teeth on its central diameter which mate with teeth on the steering gear rack. A slot, machined in the upper end of the pinion shaft mates with the dog-tooth on the input shaft. The pinion shaft locates in the pinion housing and rotates on ball and roller bearings.

Power Steering Hydraulic Operation



E46944

Item	Part Number	Description
1	-	Reservoir
2	-	Cooler
3	-	Valve unit
4	-	Steering rack and pinion
5	-	Flow control/pressure relief return
6	-	Flow control/Pressure relief valve
7	-	Output port
8	-	Power steering pump
9	-	Low pressure suction line

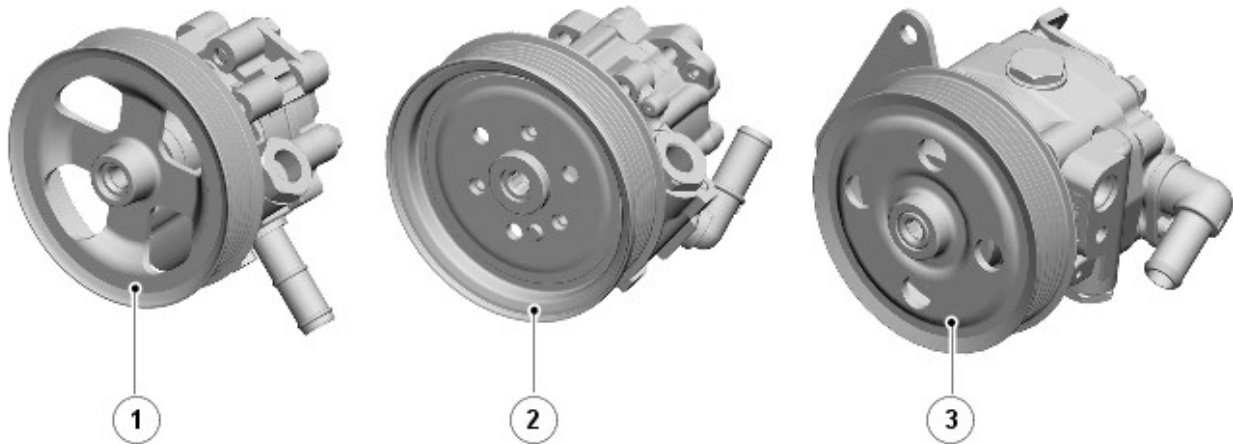
When the engine is started the power steering pump draws fluid from the reservoir into the low pressure suction line. The fluid passes through the pump and emerges as pressurised fluid at the outlet port. The attenuated high pressure hose passes the pressurised fluid to the steering gear valve unit.

If no steering effort is applied, there is minimal restriction within the system and the supply pressure from the pump is low. Minimal pressure is applied, via the valve unit, to each side of the piston in the hydraulic cylinder and the full flow from the power steering pump returns to the reservoir via the fluid cooler.

When steering effort is applied in either direction, the return flow of fluid to the reservoir is restricted, causing the

supply pressure from the pump to increase. The pressurised fluid is directed to the applicable side of the piston in the hydraulic cylinder, via the valve unit, providing the power assistance required to reduce the steering effort. Fluid displaced from the low pressure side of the cylinder is returned via the valve unit and fluid cooler to the reservoir. The fluid cooler reduces the fluid temperature which prolongs the life of hoses and seals in the system.

POWER STEERING PUMP



E131159

Item	Part Number	Description
1	-	4.0L V6
2	-	5.0L V8
3	-	2.7L, 3.0L TdV6

The power steering pumps used on the four engine variants are basically the same pump with different connection fittings. The pump is a positive displacement, vane type pump which supplies hydraulic pressure to the steering gear valve unit. The pump is driven by a Poly Vee belt from the crankshaft pulley and output from the pump increases proportionally with engine speed. A self-adjusting tensioner is fitted to maintain the correct tension on the belt.

The pump has an internal flow control valve which also incorporates a pressure relief valve. The pressure relief valve limits the maximum pressure supplied to the steering gear to 114 bar (1653 lbf in²) ± 4 bar (58 lbf in²) on V6 petrol engines, and 115 bar (1667 lbf in²) ± 4 bar (58 lbf in²) for V8 petrol, and V6 diesel models. The flow control valve regulates the flow to a constant value of 8.8 l/min (1.93 gal/min) ± 0.5 l/min (0.1 gal/min) regardless of engine speed. The pump has a displacement of 9.6 cc/rev (0.58 in³/rev) on V6 petrol, and V6 diesel, but 11 cc/rev (0.67 in³/rev) for V8 petrol.

A shaft runs longitudinally through the pump. One end of the shaft is fitted with a pressed-on drive pulley, the opposite end of the shaft is closed by a cover. The shaft runs in bearings located in the body and oil seals at each end of the shaft prevent leakage of hydraulic fluid.

The pump contains ten vanes on petrol models, and eleven vanes on diesel models which rotate within a cam ring and are driven by the shaft. As the vanes rotate, the cam ring causes the space between the vanes to increase. This causes a depression between the vanes and fluid is drawn from the reservoir via the suction hose into the space between the vanes.

As the shaft rotates, the inlet port is closed to the vanes which have drawn in fluid, trapping the fluid between the vanes. The cam ring causes the space between the vanes to reduce and consequentially compresses and pressurises the hydraulic fluid trapped between them.

Further rotation of the shaft moves the vanes to the outlet port. As the vanes pass the port plate the pressurised fluid passes from the pump outlet port into the pressure hose to the steering gear.

The pressurised fluid is subject to control by the flow control and pressure relief valve. The flow control valve maintains a constant flow of fluid supplied to the steering gear irrespective of engine speed variations. The pressure relief valve limits the pressure on the output side of the pump. A metering orifice is included in the discharge port of the pump. If the pressure in the orifice reaches a predetermined level, a spring loaded ball in the center of the flow control valve is lifted from its seat and allows pressurised fluid to recirculate within the pump.

The pressure relief valve will operate if the discharge from the pump is restricted, i.e.; steering held on full lock. If the output from the pump is blocked, all output is recirculated through the pump. In this condition, as no fresh fluid is drawn into the pump from the reservoir, the fluid temperature inside the pump will increase rapidly. Consequentially, periods of operation of the steering gear on full lock should be kept to a minimum to prevent overheating of the pump and the fluid within it.

RESERVOIR



E46941

The fluid reservoir is located on a bracket in the left hand side of the engine compartment, behind the radiator. The reservoir comprises a body, cap and filter. The purpose of the reservoir is to contain a surplus of the hydraulic fluid in the system to allow for expansion and contraction of the fluid due to temperature variations. The fluid level ensures that the supply connection on the bottom of the reservoir is covered with fluid at all operating vehicle attitudes. Any air which is present in the system is exhausted from the system in the reservoir.

The body is a plastic moulding with two ports at the bottom which provide for the connection of the suction supply and return hoses. Moulded markings on the side of the reservoir denote the upper and lower fluid levels. A non-serviceable, 100 micron nylon mesh filter is fitted in the body. The filter removes particulate matter from the fluid before it is drawn into the pump supply connection.

The cap is rotated counterclockwise for one quarter turn to release from the body. The cap is fitted with an O-ring to prevent fluid leakage. The cap incorporates a breather hole to allow for changes in fluid level during operation and prevent vacuum or pressurisation of the reservoir.

HIGH PRESSURE HOSE

The high pressure hose connecting the pump to the steering gear valve unit contains two attenuators. Each attenuator comprises a bullet shaped restrictor which is secured inside the hose. The restrictors damp pressure pulses from the pump, consequently reducing noise and strain on downstream components. The attenuators are an integral part of the hose and cannot be serviced separately.

FLUID COOLER



NOTE: Diesel engine vehicles are not fitted with a fluid cooler.



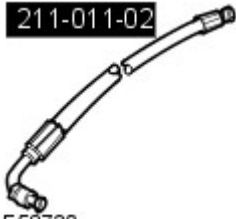
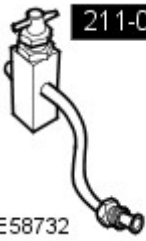

The fluid cooler is located in the return line from the steering gear to the reservoir. The cooler comprises a flexible hose and a solid pipe which connect between the reservoir and the return pipe from the steering gear. The cooler is an integral part of the pipe and cannot be replaced as a separate component.

The cooler is a fabricated aluminium tube, through which the power steering fluid passes. The outer diameter of the cooler tube has aluminium loops attached to it which dissipate heat. Cool air entering the front of the vehicle passes over the cooler and flows through the loops. The loops act as heat exchangers, conducting heat from the fluid as it passes through the tube.

Power Steering - Power Steering Pressure Test TDV6 3.0L Diesel

General Procedures

Special Tool(s)

 <p>E161208</p>	Adaptor, power steering pressure test 211-011-14
 <p>211-011-02 E58730</p>	Hose - power steering pressure test 211-011-02(LRT-57-002)
 <p>211-011-02 E58730</p>	Hose - power steering pressure test 211-011-02(LRT-57-002)
 <p>211-011-01 E58732</p>	Valve block power steering test 211-011-01(LRT-57-001)
 <p>211-287 E58733</p>	Hose and gauge - power steering pressure test 211-287(LRT-57-005)



CAUTION: If power steering fluid comes into contact with the paintwork, the affected area must be immediately washed down with cold water.

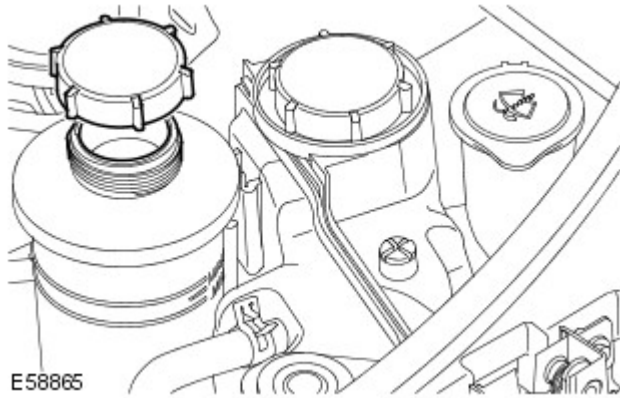


1. **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

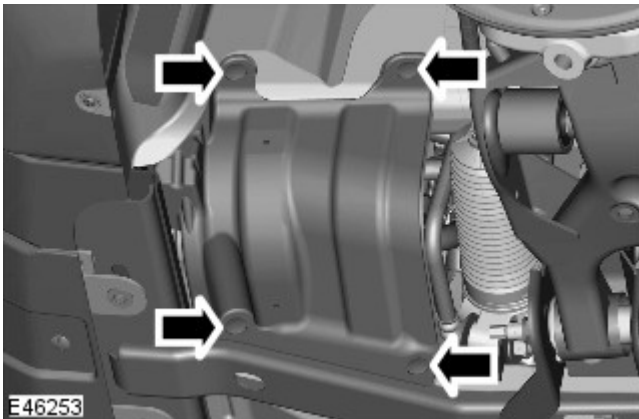
Raise and support the vehicle.

2. Disconnect the battery ground cable.
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

3. Siphon the fluid from the power steering reservoir.
 - Remove the filler cap.

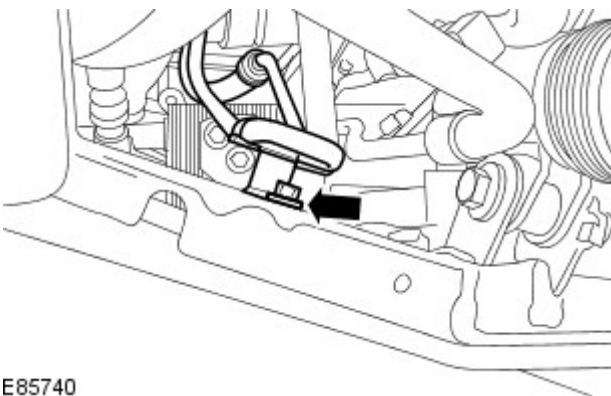


E58865



E46253

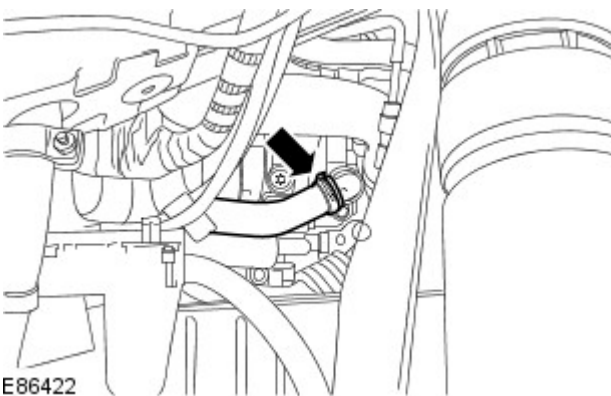
4. Remove the front LH splash shield.
 - Remove the 4 clips.



E85740

5. Release the steering gear high-pressure line.
 - Remove the bolt.


6. Remove the front LH fender splash shield.
 For additional information, refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).



E86422


7. **CAUTIONS:**

 Make sure that all openings are sealed. Use new blanking caps.

 Make sure that the area around the component is clean and free of foreign material.

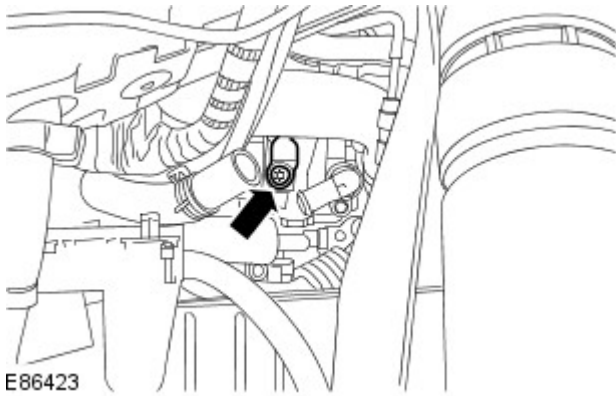
Disconnect the power steering pump supply hose.

- Release the clip.
- Position a container to collect the fluid.

8.  **CAUTION:** Make sure that the area around the component is clean and free of foreign material.

Disconnect the power steering pump high-pressure line.

- Remove the bolt.



9. Install the special tools.
 - Tie the pressure gauge aside.


10.  **NOTE:** Remove and discard the blanking caps.

Connect the power steering pump supply hose.

- Secure with the clip.

11. Fill the power steering reservoir.
12. Connect the battery ground cable.
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

13. **NOTES:**

 Make sure the steering components and test equipment are free from leaks.

 Maintain the maximum fluid level during the test.

 Make sure the steering is in the straight ahead position.

 Under no circumstances must the low pressure spigot be removed from the steering pump.


With the test valve open start the engine.

- Start the engine and turn steering fully lock to lock, stop the engine.
 - Top-up the power steering fluid reservoir.
 - Install the reservoir filler cap.
14. For correct power steering pressures, refer to the steering specification section.
For additional information, refer to: [Specifications](#) (211-02 Power Steering, Specifications).

15.  **CAUTION:** Do not hold steering at full lock for longer than 10 seconds.

With the engine at idle, slowly turn the steering wheel and hold on full lock.

- Record the pressure reading.
16. Repeat the above procedure for the other side.
 - Record the pressure reading.
 17. With the engine at idle, release the steering wheel. The pressure should be, at or below, the pressure specified.
 18. Pressure outside this tolerance, indicates a fault.

19.  CAUTION: Pump damage will occur if test valve is closed for longer periods.

To determine if the fault is in the steering pump or the steering rack, close the test valve for a maximum of 5 seconds.

20. If the pressures recorded fall outside the given values, replace the power steering pump.
21. If the maximum pump pressure is correct, check the hoses for correct routing and condition, if correct suspect the steering gear.
22. On completion of the test stop the engine, disconnect the battery ground cable and siphon the steering fluid from the reservoir.

23. CAUTIONS:



Make sure that all openings are sealed. Use new blanking caps.



Make sure that the area around the component is clean and free of foreign material.

Disconnect the power steering pump supply hose.

- Release the clip.

24. Disassemble the test equipment.
25. Connect the power steering pump high-pressure line.
- Tighten the bolt to 25 Nm (18 lb.ft).



26. NOTE: Remove and discard the blanking caps.

Connect the power steering pump supply hose.

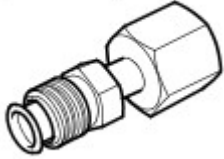





- Secure with the clip.
- Remove the container.


27. Secure the steering gear high-pressure line.
- Tighten the bolt to 10 Nm (7 lb.ft).
28. Install the front LH splash shield.
- Install the clips.
29. Install the front LH fender splash shield.
For additional information, refer to: [Fender Splash Shield](#) (501-02 Front End Body Panels, Removal and Installation).
30. Connect the battery ground cable.
31. Fill and bleed the power steering system.
For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

Power Steering - Power Steering Pressure Test V6 S/C 3.0L Petrol

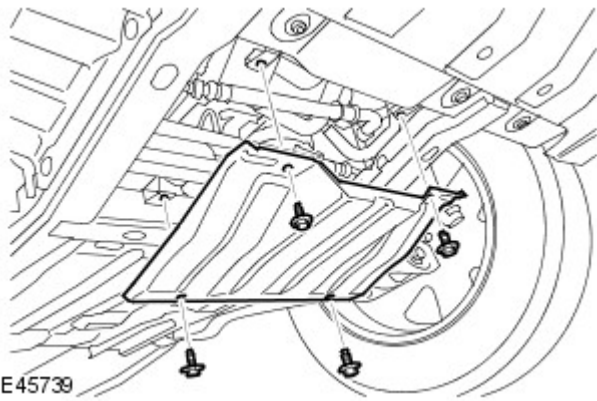
General Procedures

Special Tool(s)

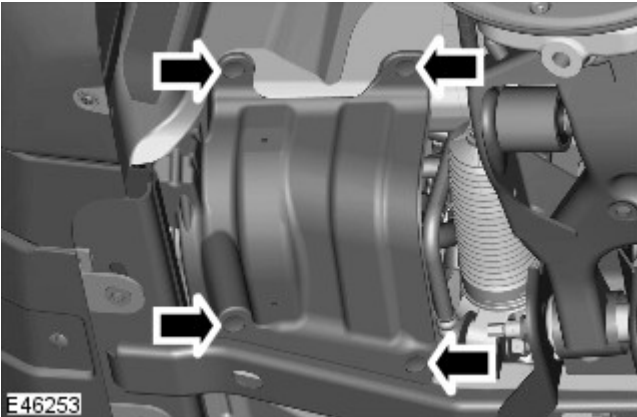
 <p>211-313 E58729</p>	<p>Adapter, power steering test 211-313 (LRT-57-035A)</p>
 <p>211-011-02 E58730</p>	<p>Hose, power steering test 211-011-02 (LRT-57-002)</p>
 <p>211-011-11 E58731</p>	<p>Hose, power steering test 211-011-11</p>
 <p>211-011-01 E58732</p>	<p>Valve block, power steering test 211-011-01 (LRT-57-001)</p>
 <p>211-287 E58733</p>	<p>Hose and gauge, power steering test 211-287 (LRT-57-005)</p>
 <p>211-325 E58734</p>	<p>Adapter, power steering test 211-325 (LRT-57-042)</p>

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.
- Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

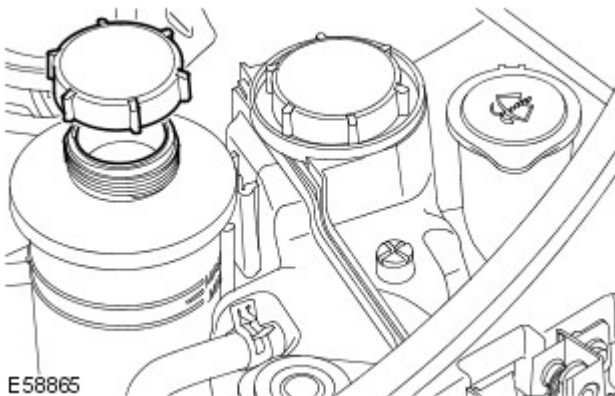


3. Remove the radiator access panel.
 - Remove the 4 bolts.




4. Remove the front LH splash shield.
 - Remove the 4 clips.

5. Remove the front LH fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).



6. Siphon the fluid from the power steering reservoir.
 - Remove the filler cap.
 - Install the filler cap.

7. Position an absorbent cloth to collect fluid spillage.

8.  **CAUTION:** Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

NOTES:



Some fluid spillage is inevitable during this operation.

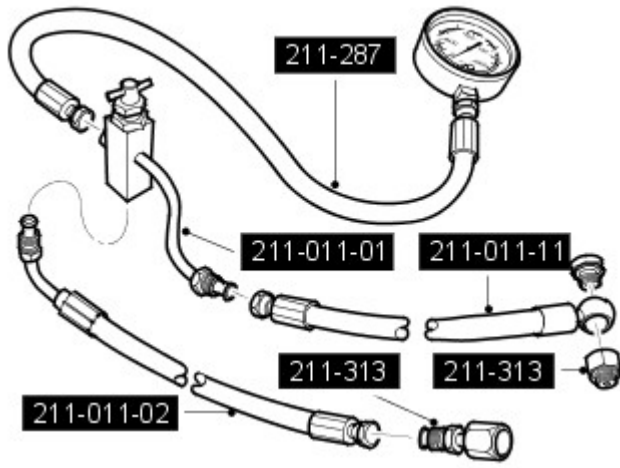


Care must be taken to avoid contamination of the drive belt.

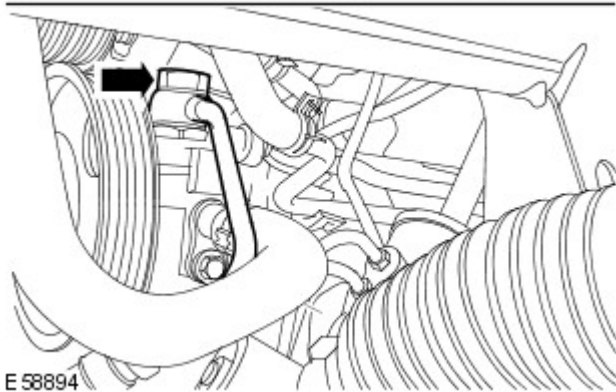
Disconnect the power steering high-pressure pipe union.

- Remove the bolt.
- Remove and discard the 2 sealing washers.
- Position a container to collect the fluid.

9. Install the special tools to the power steering high-pressure port.
 - Install the O-ring seal.
 - Tie the pressure gauge aside under the hood.



10. Install the special tool to the high-pressure union.
 - Install the O-ring seals.
 - Connect the special tool line, to the special tool valve block assembly.



11. Refill the power steering reservoir.
 - Remove the filler cap.
12. Connect the battery ground cable. For additional information, refer to: Specifications (414-00, Specifications).

13. **NOTES:**

 Ensure the steering components and test equipment are free from leaks.

 Maintain the maximum fluid level during the test.

 Make sure the steering is in the straight ahead position.

 Under no circumstances must the low pressure spigot be removed from the steering pump.

With the test valve open start the engine.

- Start the engine and turn steering fully lock to lock, stop the engine.
 - Top-up the power steering fluid reservoir.
 - Install the reservoir filler cap.
14. For correct power steering pressures, refer to the steering specification section. For additional information, refer to: Specifications (211-02, Specifications).
 15. With the engine at idle, slowly turn the steering wheel and hold on full lock.

- Record the pressure reading.
16. Repeat the above procedure for the other side.
 - Record the pressure reading.
 17. With the engine at idle, release the steering wheel. The pressure should be, at or below, the pressure specified.
 18. Pressure outside this tolerance, indicates a fault.
 19. To determine if the fault is in the steering pump or the steering rack, close the test valve for a maximum of 5 seconds.
 20. If the pressures recorded fall outside the given values, replace the power steering pump.
 21. If the maximum pump pressure is correct, then suspect the power steering rack.
 22. On completion of the test stop the engine, disconnect the battery ground cable and siphon the steering fluid from the reservoir.
 - Remove the filler cap.
 - Install the filler cap.
 23. Disassemble the test equipment.
 24. Connect the high-pressure line to the power steering pump.
 - Clean the component mating faces.
 - Install the new O-ring seals.
 - Tighten the bolt to 25 Nm (18 lb.ft).
 25. Install the front LH fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).
 26. Install the front LH splash shield.
 - Secure with the clips.
 27. Install the radiator access panel.
 - Tighten the M6 bolts to 10 Nm (7 lb.ft).
 - Tighten the M10 bolts to 45 Nm (33 lb.ft).
 28. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
 29. Refill and bleed the power steering.
For additional information, refer to: Power Steering System Filling and Bleeding (211-00, General Procedures).

Power Steering - Steering Gear TDV6 3.0L Diesel

Removal and Installation

Removal


NOTES:




LHD illustration shown, RHD is similar.



Some variation in the illustrations may occur, but the essential information is always correct.

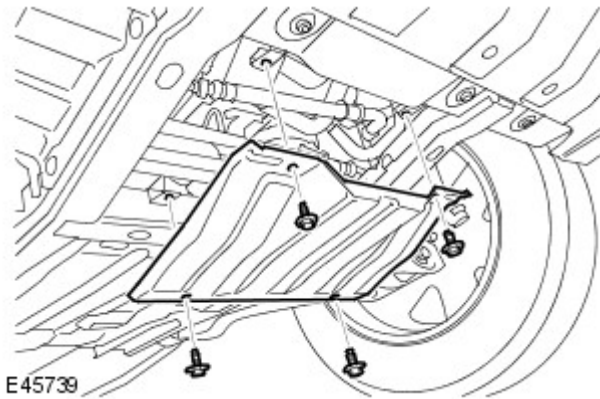
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2.  **CAUTION:** Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

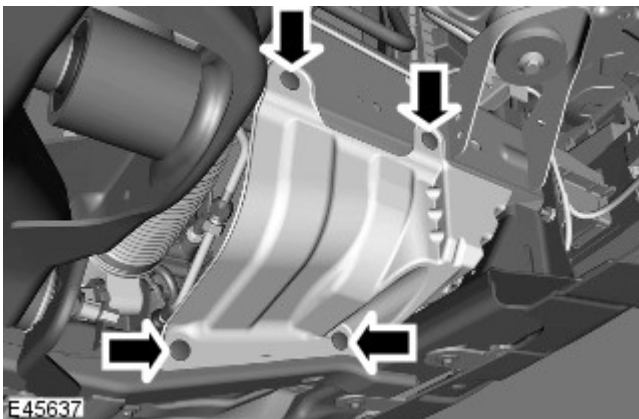
Center the steering wheel.

3. Remove the radiator splash shield.
 - Remove the 4 bolts.

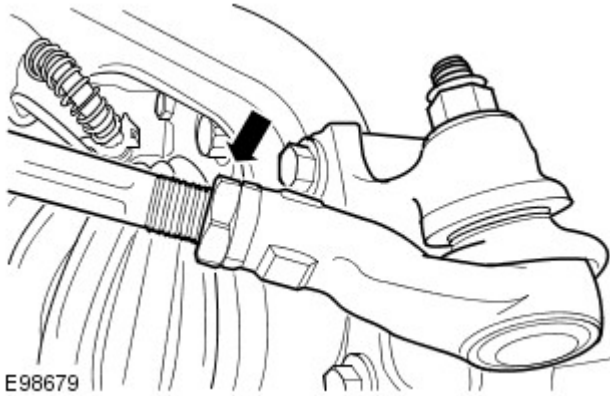
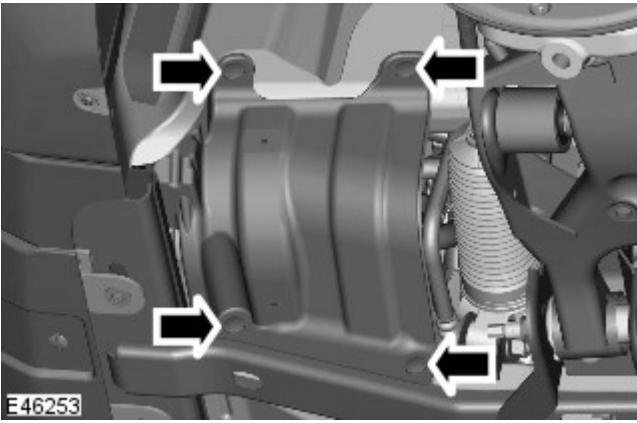


4. Remove the engine undershield.
For additional information, refer to: Engine Undershield (501-02, Removal and Installation).

5. Remove the front RH splash shield.
 - Remove the 4 clips.



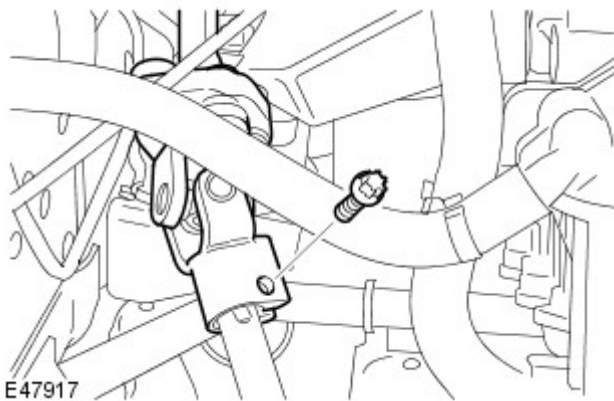
6. Remove the front LH splash shield.
 - Remove the 4 clips.




7.  **NOTE:** LH illustration shown, RH is similar.

Release both tie-rod end ball joints.

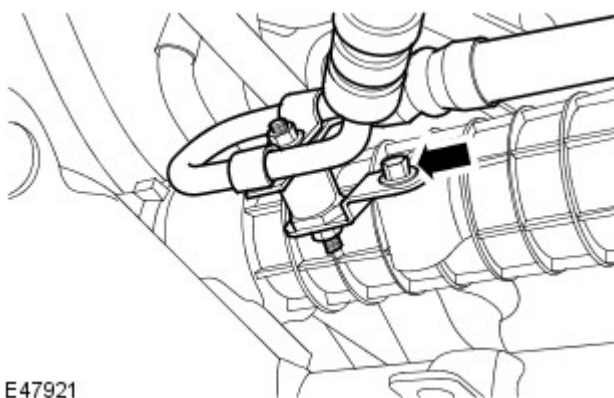
- Loosen the locknut.
- Release both track rods from tie rod ends, note the number of turns for installation.



8.  **NOTE:** Note the fitted position.

Disconnect the lower steering column from the steering gear.

- Remove and discard the bolt.

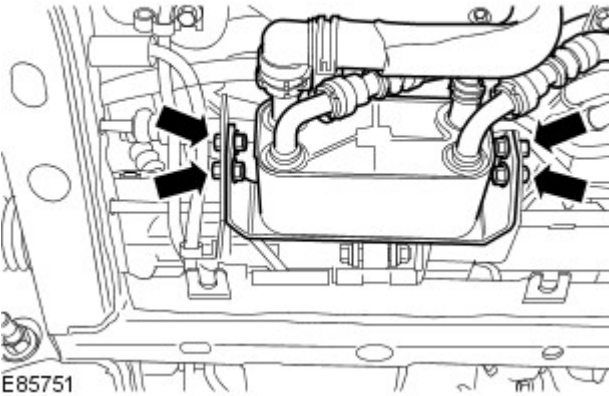


9. Remove the steering gear high-pressure line.
- Remove the bolts.

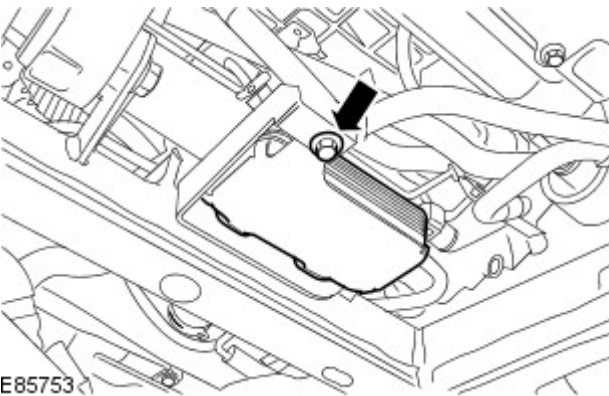
10. Disconnect the steering gear control valve actuator electrical connector.




11. Release the transmission fluid cooler.
 - Remove the 4 bolts.



12. Release the fuel cooler.
 - Remove the bolt.



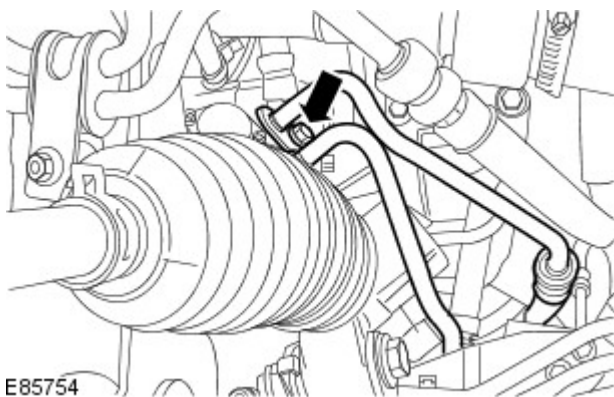
13. CAUTIONS:

 Make sure that the area around the component is clean and free of foreign material.

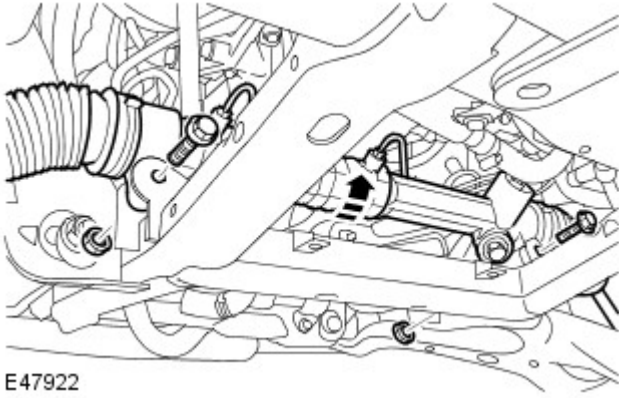
 Make sure that all openings are sealed. Use new blanking caps.

Disconnect the power steering high pressure line and return line from the steering gear.

- Remove and discard the bolt.
- Remove and discard the 2 O-ring seals.

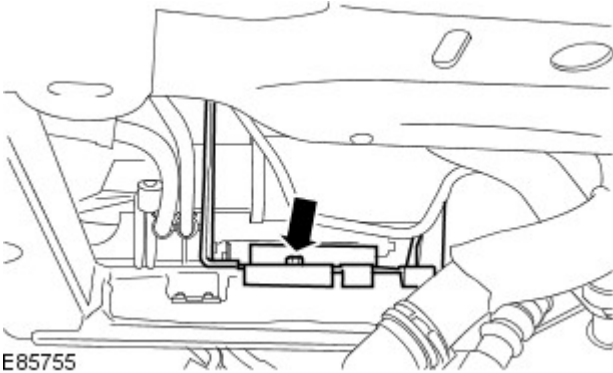


14. Release the steering gear.
 - Remove the 2 bolts.



E47922

15. Remove the transmission fluid cooler and fuel cooler support bracket.
 - Remove the bolt.
 - Release the coolant line.



E85755

16. Remove the steering gear.

Installation

1. Install the steering gear.
2. Install the transmission fluid cooler and fuel cooler support bracket.
 - Secure the coolant line.
 - Tighten the bolt to 23 Nm (17 lb.ft).
3. Secure the steering gear.
 - Tighten the bolts to 175 Nm (129 lb.ft).

4. NOTES:



Remove and discard the blanking caps.



Lubricate the seals with clean power steering fluid.

Connect the power steering high pressure line and return line to the steering gear.

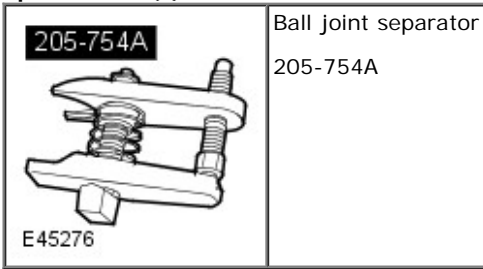
- Install new O-ring seals.
 - Tighten the new bolt to 22 Nm (16 lb.ft).
5. Secure the fuel cooler.
 - Tighten the bolt to 23 Nm (17 lb.ft).
 6. Secure the transmission fluid cooler.
 - Tighten the nuts and bolts to 25 Nm (18 lb.ft).
 7. Connect the steering gear control valve actuator electrical connector.
 8. Install the power steering line support bracket.
 - Tighten the bolt to 10 Nm (7 lb.ft).
 9. Connect the lower steering column shaft to the steering gear.
 - Tighten the new bolt to 24 Nm (18 lb.ft).

10. Connect the tie-rod end ball joints.
 - Attach both tie rods to previously noted positions.
 - Tighten the tie-rod locking nut.
11. Install the front LH splash shield.
 - Install the clips.
12. Install the front RH splash shield.
 - Install the clips.
13. Install the engine undershield.
For additional information, refer to: Engine Undershield (501-02, Removal and Installation).
14. Install the radiator splash shield.
 - Tighten the bolts to 10 Nm (7 lb.ft).
15. Fill and bleed the power steering system.
For additional information, refer to: Power Steering System Filling and Bleeding (211-00, General Procedures).
16. Adjust the front wheel alignment.

Power Steering - Steering Gear V6 S/C 3.0L Petrol

Removal and Installation

Special Tool(s)



Removal

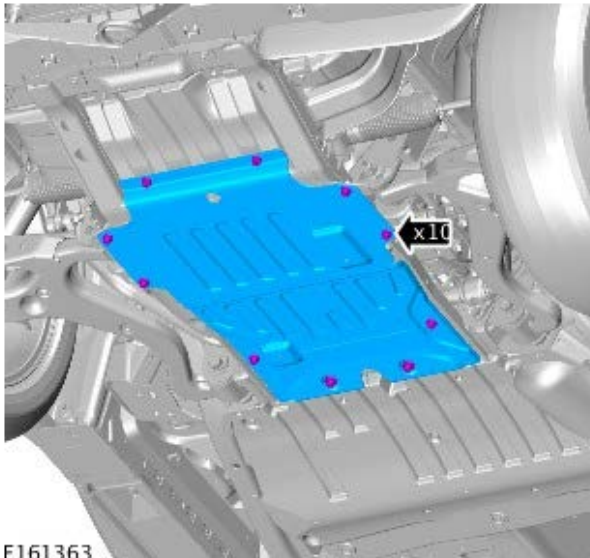


NOTE: Removal steps in this procedure may contain installation details.

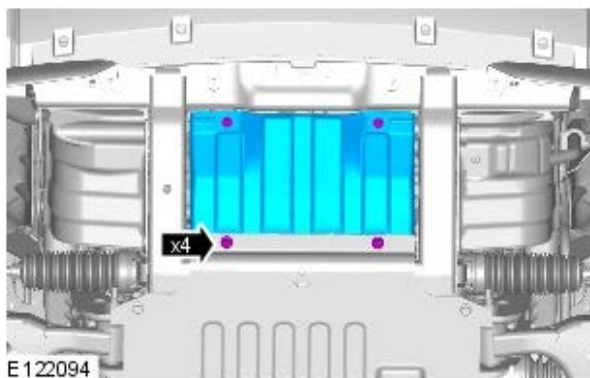
1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

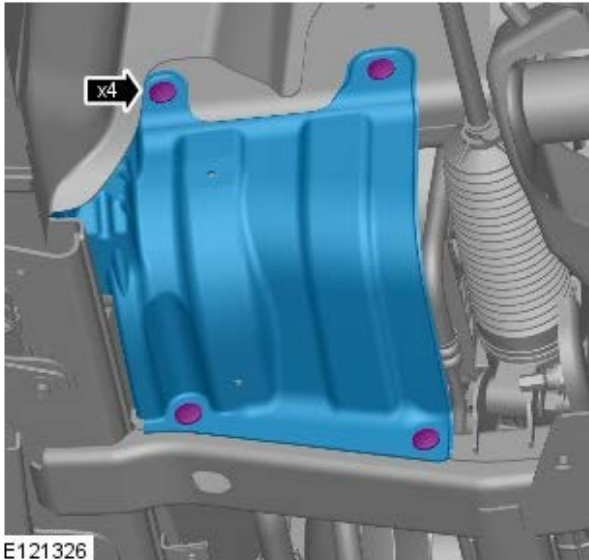
2.



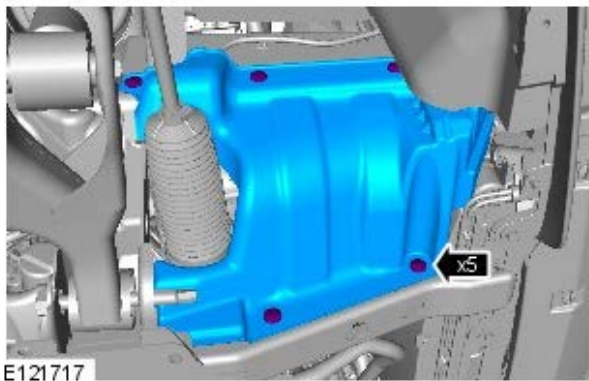
3.



4.



5.



6. CAUTIONS:



Make sure the steering is in the straight ahead position.

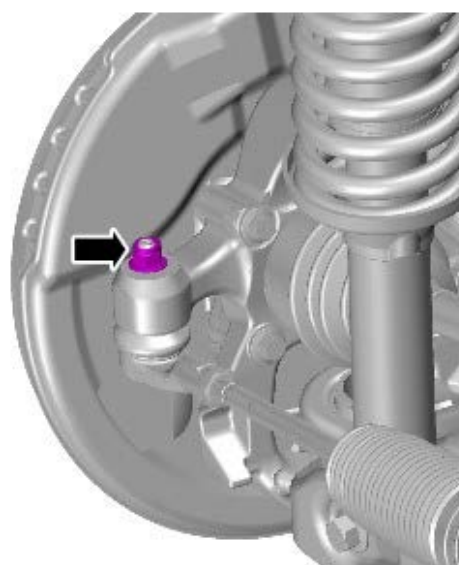
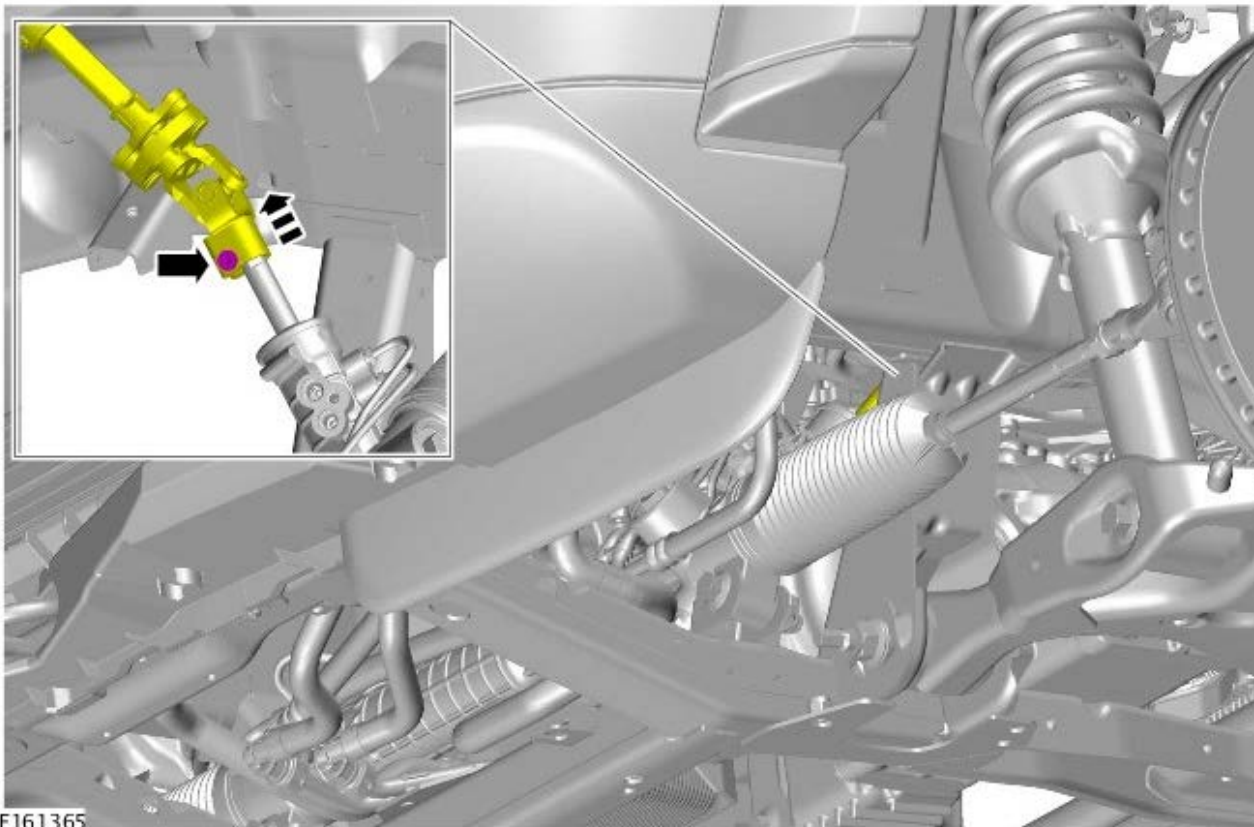


Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.





Discard the bolt.

Torque: 25 Nm




7. NOTES:

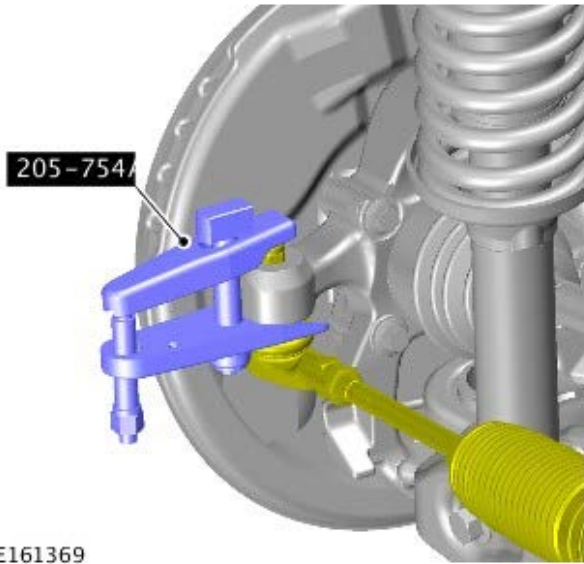
 Loosen but do not fully remove .

 The step must be carried out on both sides.

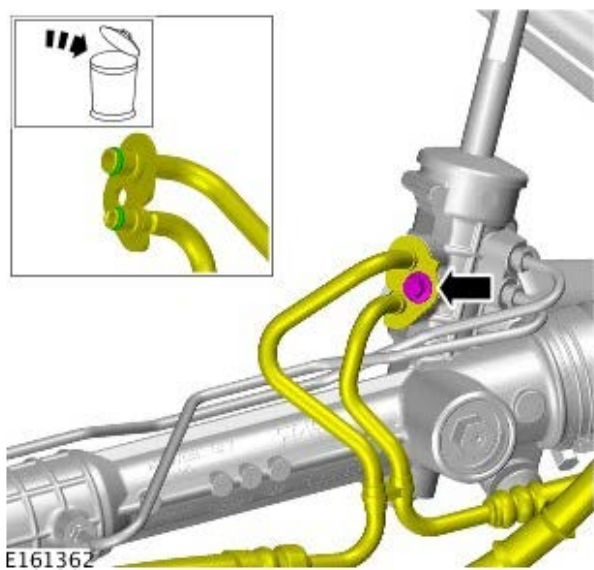
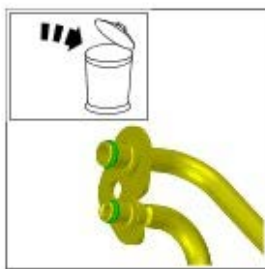
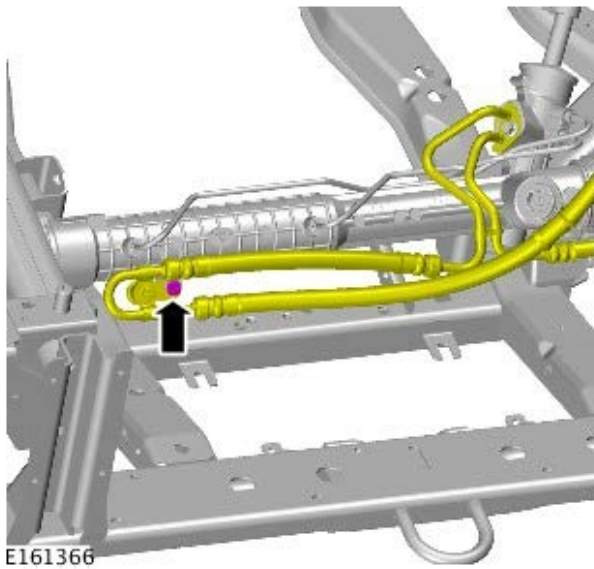
- Torque: M14, 150 Nm
- Torque: M12, 76 Nm

8.  CAUTION: Discard the nuts.

 NOTE: The step must be carried out on both sides.



9. Torque: 10 Nm



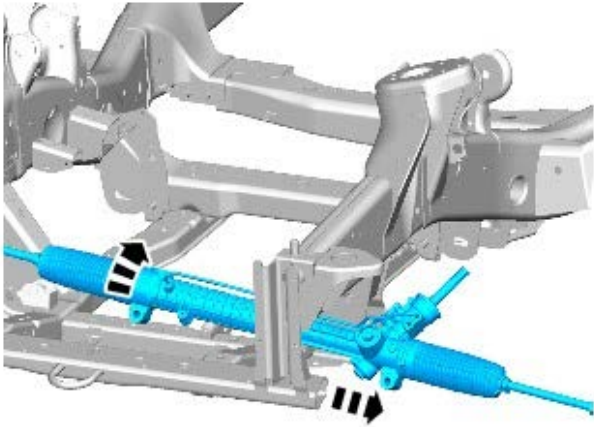
10. CAUTIONS:

 Be prepared to collect escaping fluids.

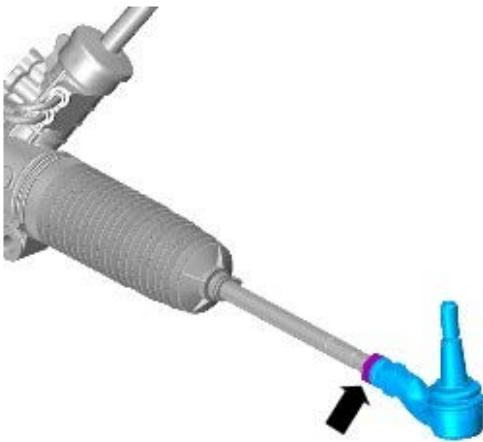
 Make sure that all openings are sealed. Use new blanking caps.

Torque: 22 Nm


11.



E161367



12. NOTES:

 Do not disassemble further if the component is removed for access only.


 The step must be carried out on both sides.

 Note the number of turns when removing the tie rod end to aid installation.

Torque: 55 Nm

E161417

Installation

-  NOTE: Remove and discard all blanking caps.
To install, reverse the removal procedure.
- For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

Power Steering - Power Steering Fluid Reservoir TDV6 3.0L Diesel /V6 S/C 3.0L Petrol

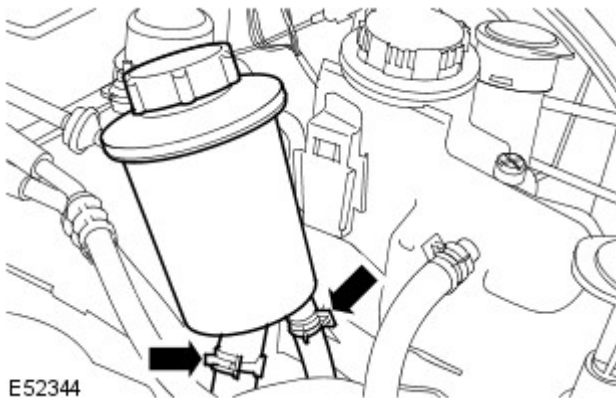
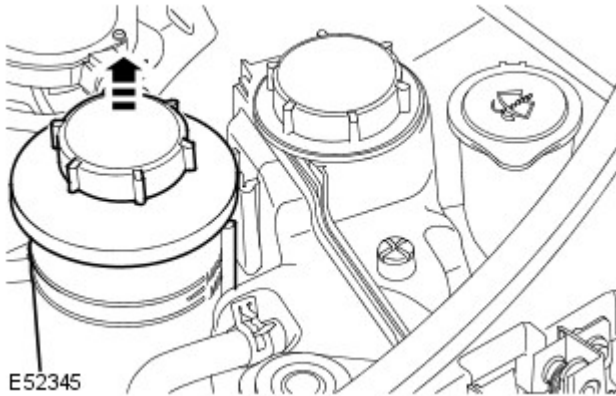
Removal and Installation


Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Siphon the fluid from the power steering reservoir.
3. Release the power steering fluid reservoir from the bracket.



4.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.



NOTE: Some fluid spillage is inevitable during this operation.

Remove the power steering fluid reservoir.

- Position an absorbent cloth to collect fluid spillage.
- Release the hose clips and disconnect the hoses.

Installation

1. To install, reverse the removal procedure.
2. Fill and bleed the power steering system.
For additional information, refer to: Power Steering System Filling and Bleeding (211-00, General Procedures).

Power Steering - Power Steering Fluid Cooler V6 S/C 3.0L Petrol

Removal and Installation

Special Tool(s)

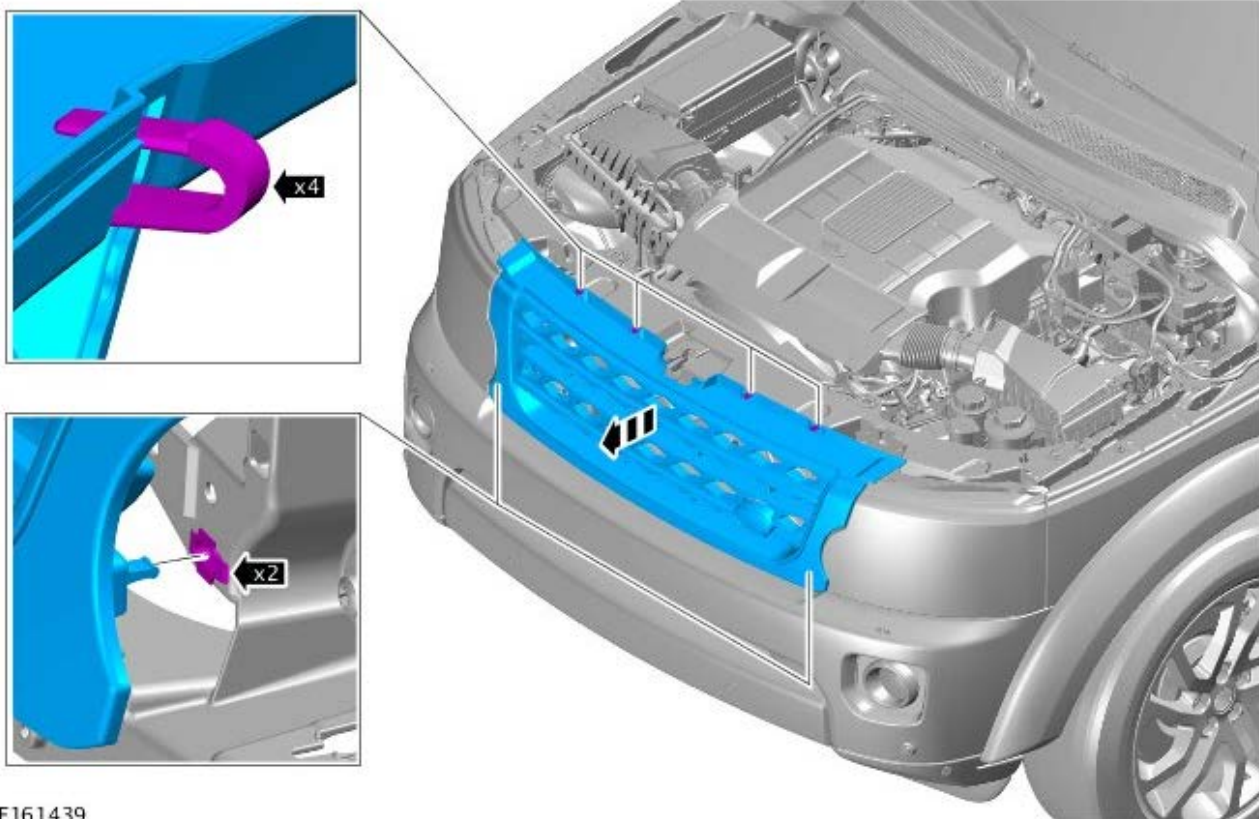
	Disconnect Tool, Fuel Line (5/16") 310-040
2304:	

Removal



NOTE: Removal steps in this procedure may contain installation details.

1.



E161439

2. For additional information, refer to: [Coolant Expansion Tank](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).

3. Siphon the fluid from the power steering reservoir.

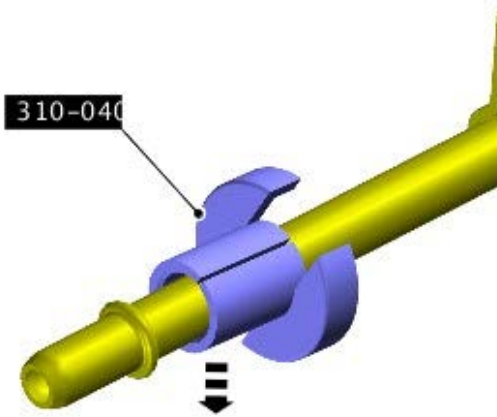
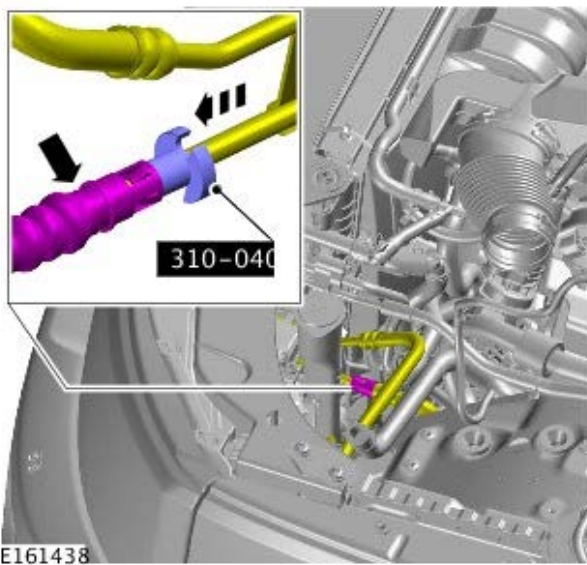
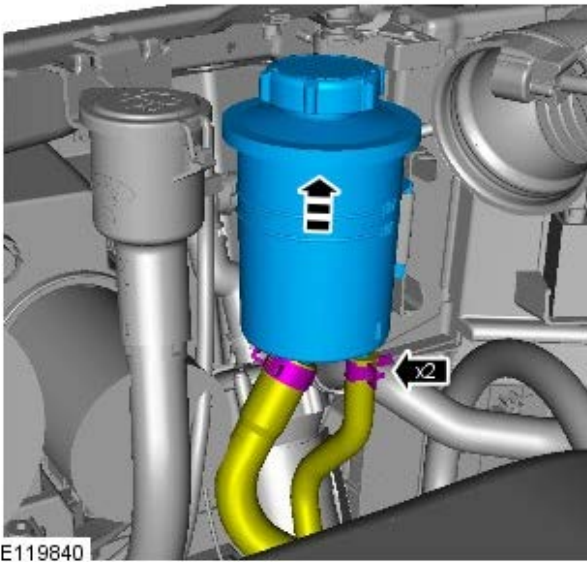
4. CAUTIONS:




Be prepared to collect escaping fluids.



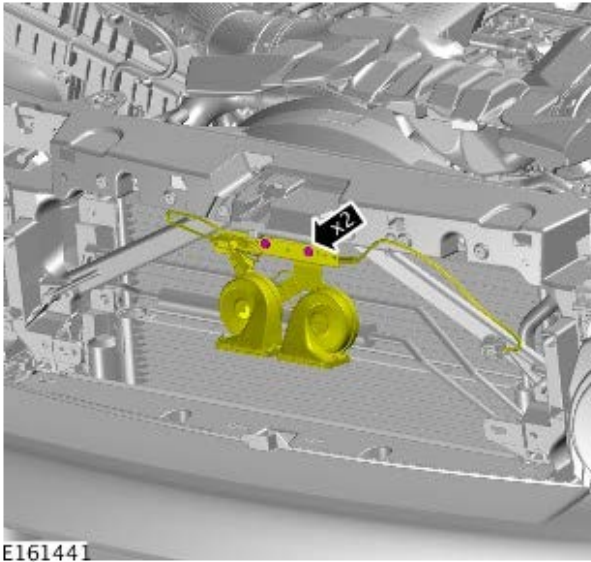
Make sure that all openings are sealed. Use new blanking caps.



5.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

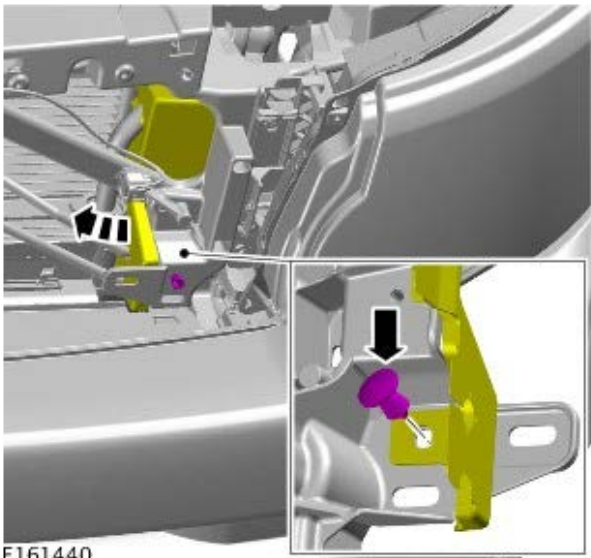
6. Remove the special tool.

7. Torque: 10 Nm



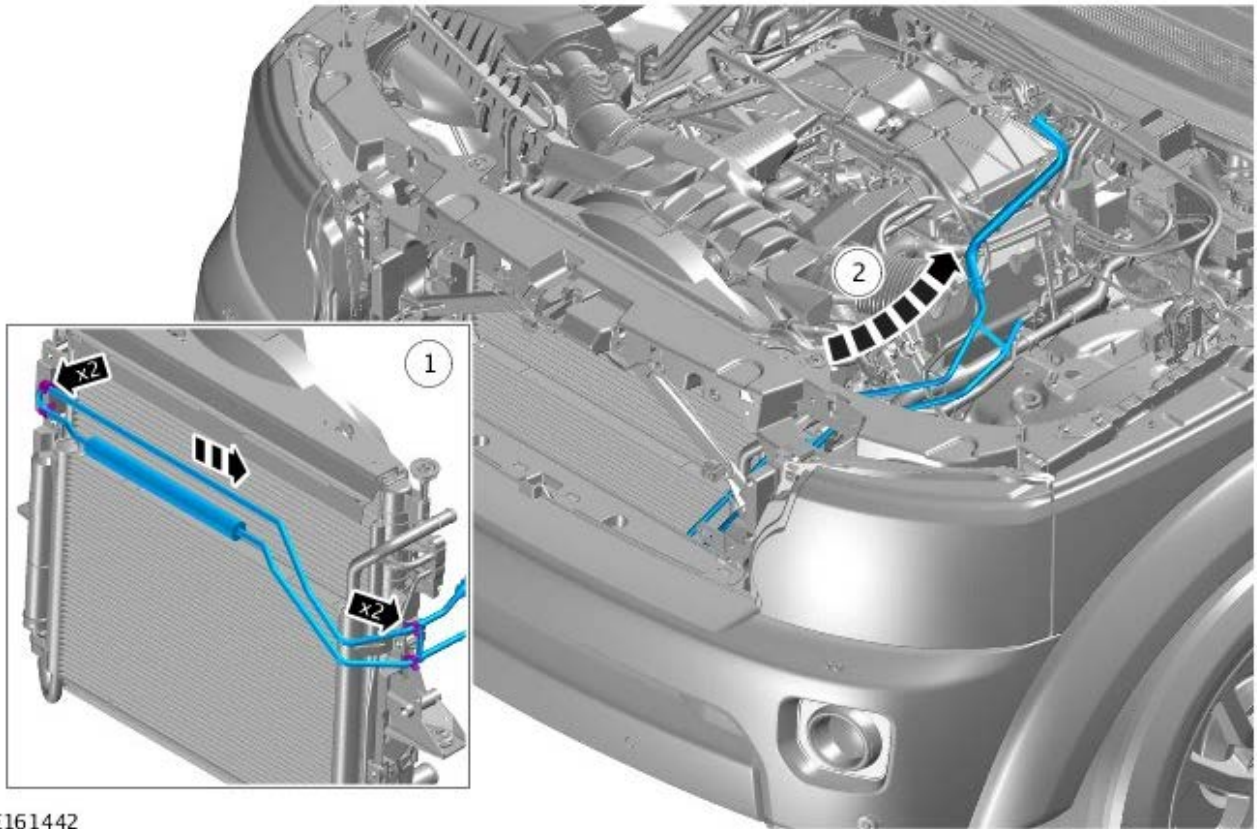
E161441

8.




E161440

9.



E161442

Installation

1.  **NOTE:** Remove and discard all blanking caps.
To install, reverse the removal procedure.
2. For additional information, refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

Power Steering - Power Steering Pump TDV6 3.0L Diesel

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

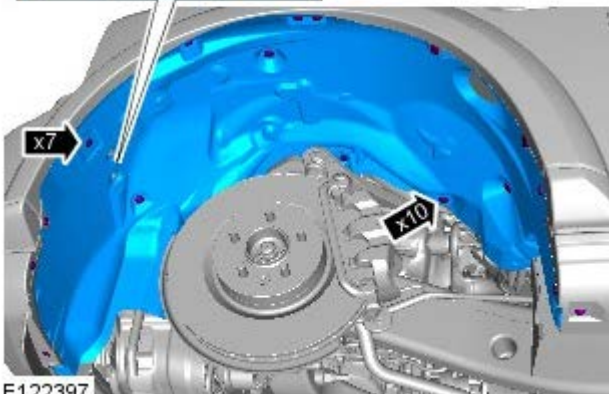
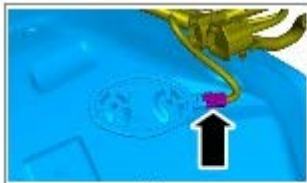
3. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00, General Procedures).

4. Refer to: Accessory Drive Belt (303-05, Removal and Installation).

5. Remove the LH front wheel and tire.

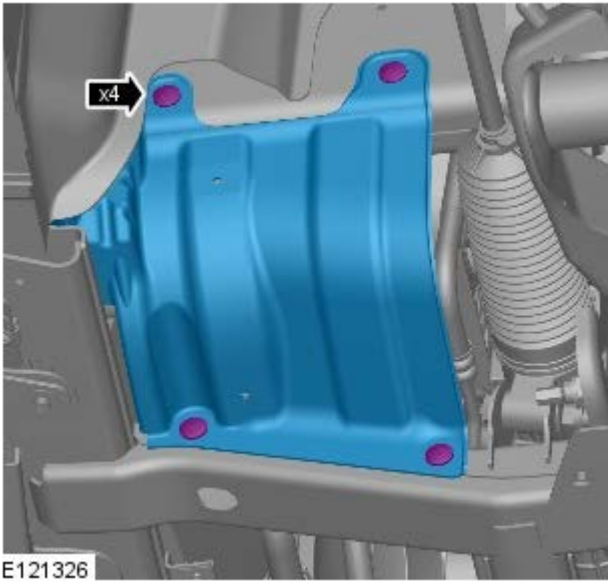
Torque: 140 Nm

- 6.

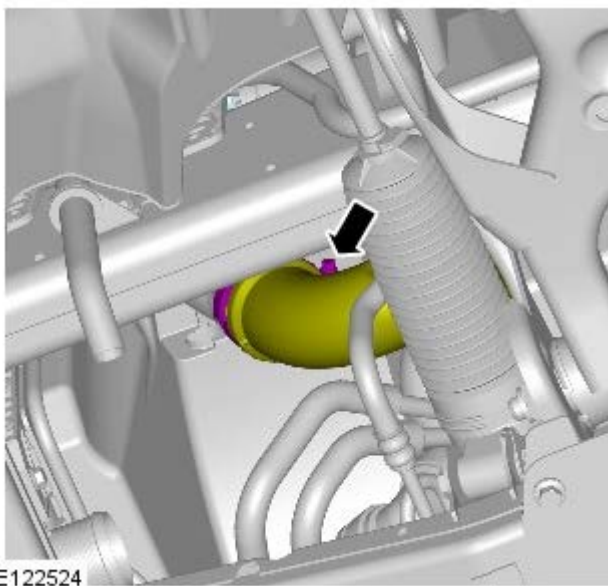


E122397

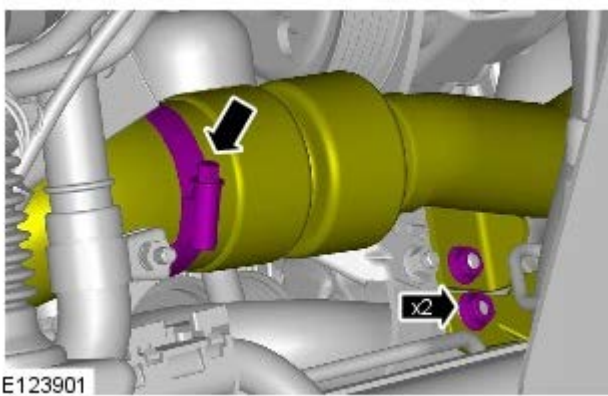
- 7.



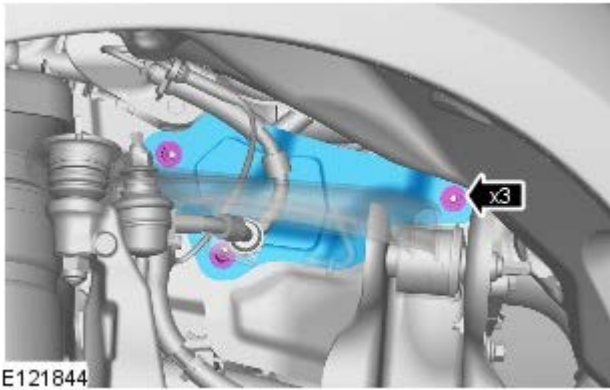
8.



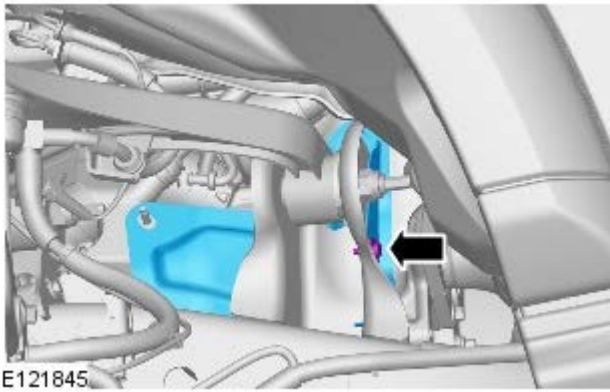
9. Torque:
Nuts 6 Nm



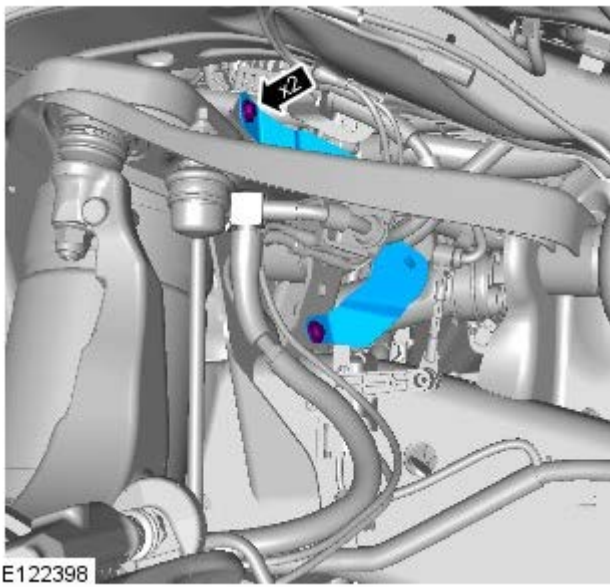
10. Torque: 9 Nm



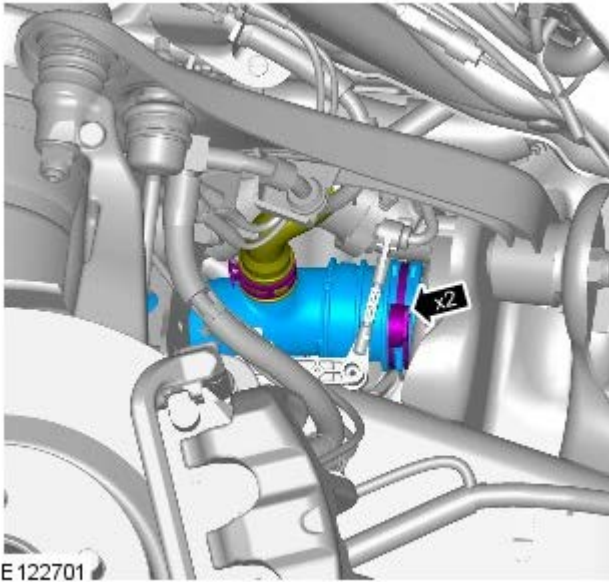
11. Torque: 9 Nm



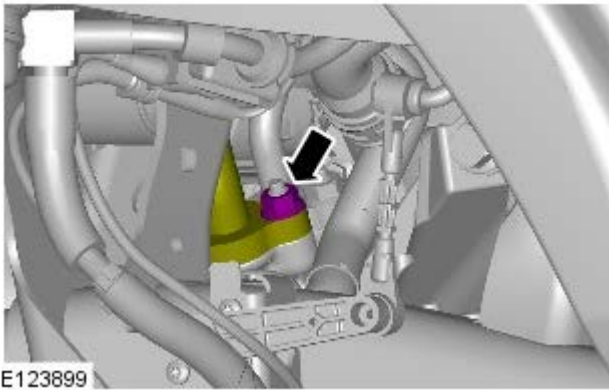
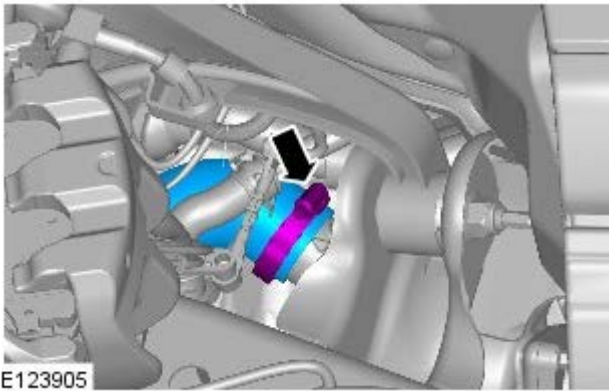
12. Torque: 9 Nm




13.

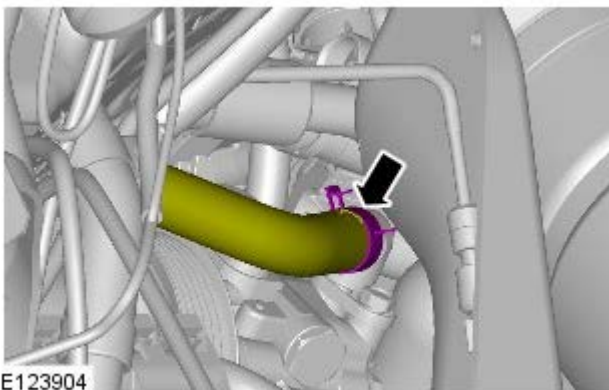



14.





15.  NOTE: Make sure that all openings are sealed. Use new blanking caps.


Torque: 18 Nm

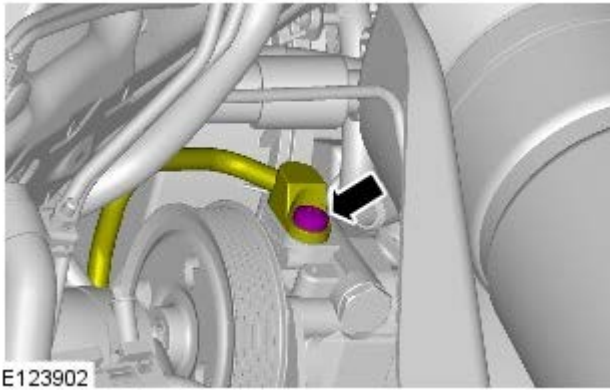


16.  WARNING: Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.


 CAUTION: Make sure that the mating faces are clean and free of foreign material.


 NOTE: Make sure that all openings are sealed. Use new blanking caps.

17.  WARNING: Fluid loss is unavoidable, use absorbent cloth or a container to collect the



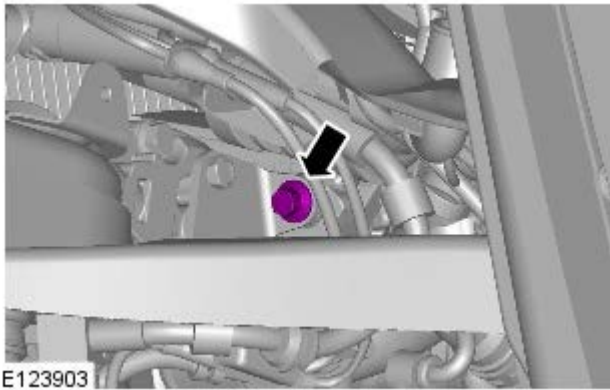
fluid.

 **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

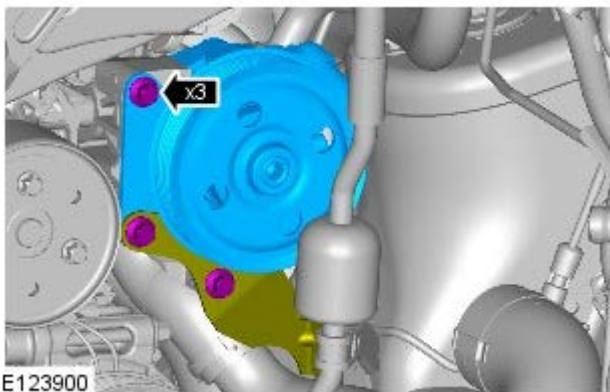
 **NOTE:** Make sure that all openings are sealed. Use new blanking caps.

Torque: 24 Nm

18. *Torque:* 25 Nm



19. *Torque:* 25 Nm



Installation

1. To install, reverse the removal procedure.
2. Refer to: Power Steering System Filling and Bleeding (211-00, General Procedures).

Power Steering - Power Steering Pump V6 S/C 3.0L Petrol

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

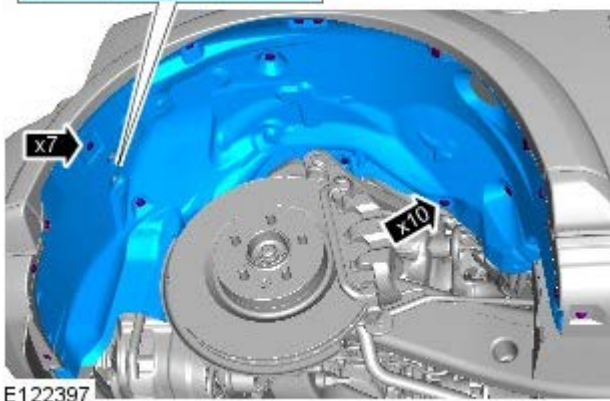
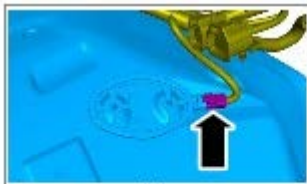
3. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

4. Refer to: [Accessory Drive Belt](#) (303-05B Accessory Drive - V6 S/C 3.0L Petrol, Removal and Installation).

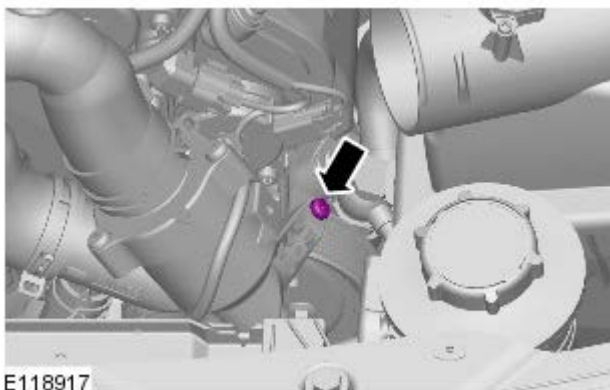
5. Remove the LH front road wheel.

Torque: 140 Nm

- 6.



7. Torque: 10 Nm



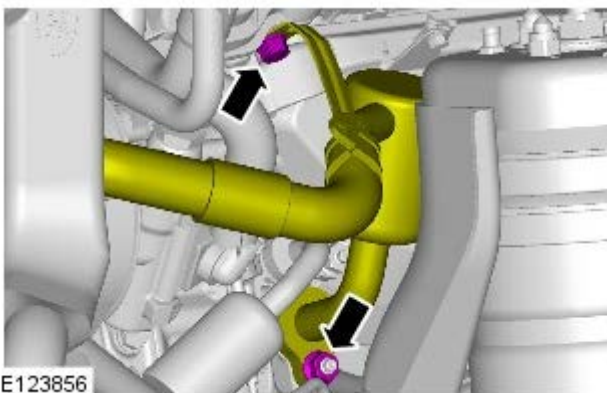
8.  **CAUTION:** Note the fitted position of the



E116364


component prior to removal.

Torque: 25 Nm



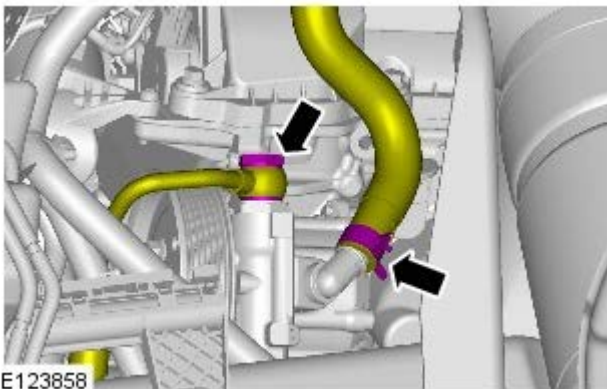
E123856

9. CAUTIONS:

 Make sure that all openings are sealed. Use new blanking caps.


 A new O-ring seal is to be installed.


Torque: 18 Nm



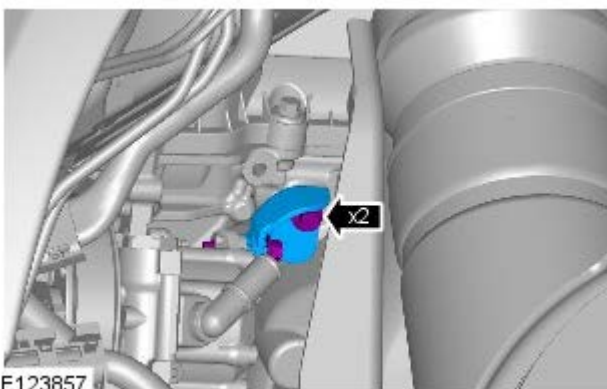
E123858

10. CAUTIONS:

 Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.


 Make sure that all openings are sealed. Use new blanking caps.

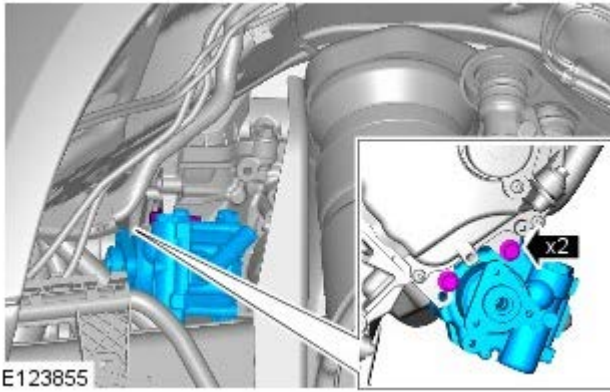
Torque: 25 Nm



E123857

11. Torque: 25 Nm

12.  CAUTION: Note the fitted position of the component prior to removal.



Torque: 25 Nm

Installation

1. To install, reverse the removal procedure.
2. Refer to: [Power Steering System Filling and Bleeding](#) (211-00 Steering System - General Information, General Procedures).

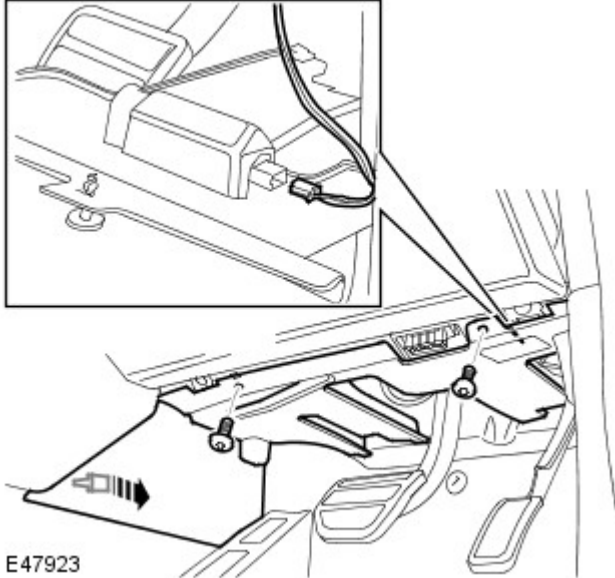
Power Steering - Steering Angle Sensor

Removal and Installation

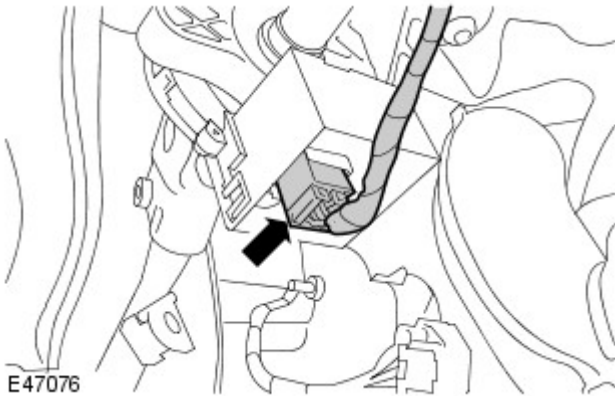
Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

2. Remove the driver side closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.



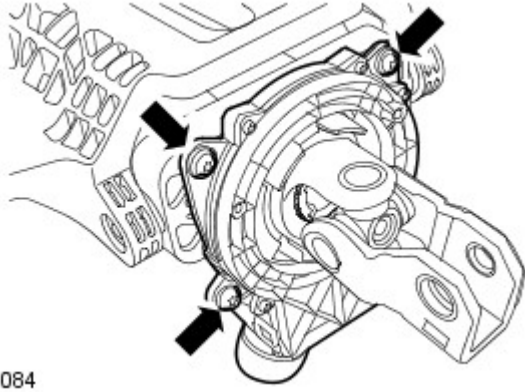
3. Disconnect the steering angle sensor electrical connector.



4. Disconnect the steering column intermediate shaft from the steering column.
 - Note the fitted position.
 - Remove the special bolt and discard the nut.



5. Remove the steering angle sensor.
 - Remove the 3 Torx screws.



E47084

Installation

1. Install the steering angle sensor.
 - Tighten the Torx screws to 3 Nm (2 lb.ft).
2. Connect the steering column intermediate shaft.
 - Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).
3. Connect the steering angle sensor electrical connector.
4. Install the closing trim panel.
 - Connect the electrical connector.
 - Secure the clip.
 - Tighten the screws.
5. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
6. Initiate a new steering angle sensor using T4.

Power Steering - Power Steering Pump to Steering Gear Pressure Line

Removal and Installation

Removal

NOTES:



RHD shown, LHD is similar.

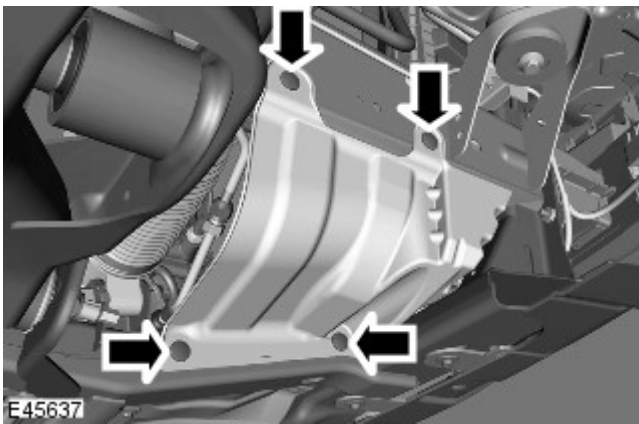


Some variation in the illustrations may occur, but the essential information is always correct.

All vehicles

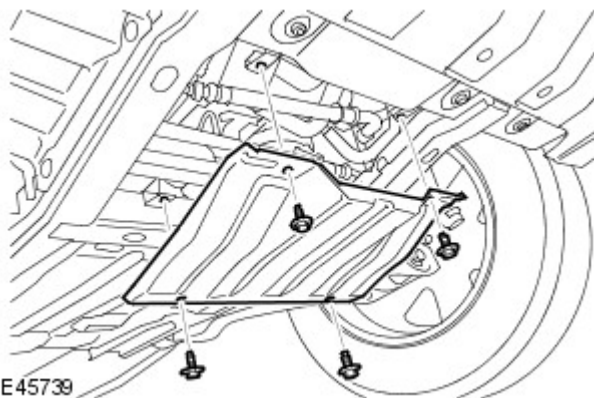
1. **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.



2. Remove the front RH splash shield.
 - Remove the 4 clips.

3. Remove the front LH fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).

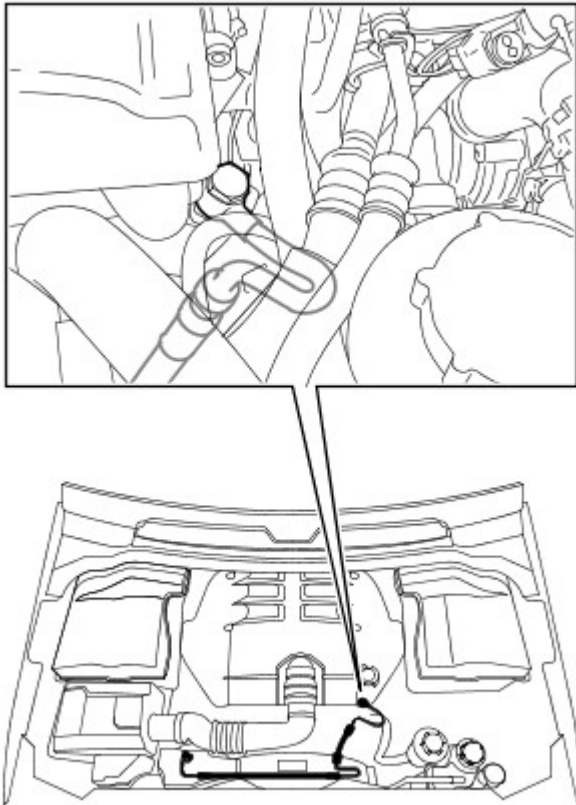


4. Remove the radiator access panel.
 - Remove the 4 bolts.

5. **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

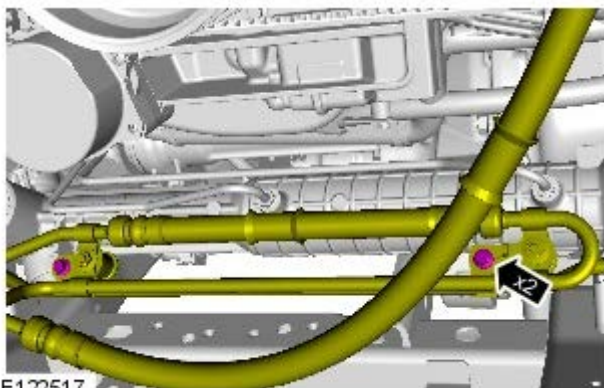
Disconnect the high pressure line from the power steering pump.

- Loosen and release the power steering pump line.
- Allow the fluid to drain into a container.
- Remove and discard the 2 sealing washers.



E72350

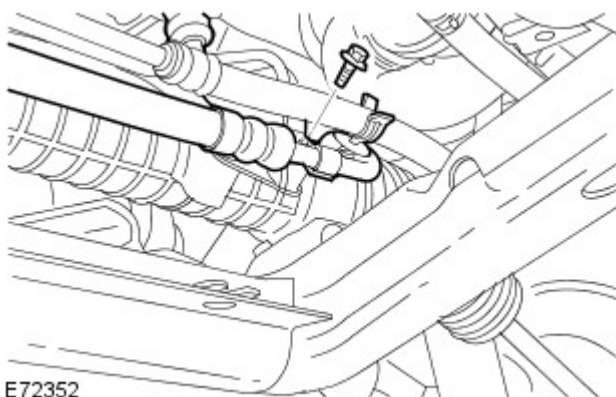
Vehicles with 5.0L engine



E122517

6. Release the power steering line support brackets.
 - Remove the 2 nuts.
 - Release the hose.

All other engine types

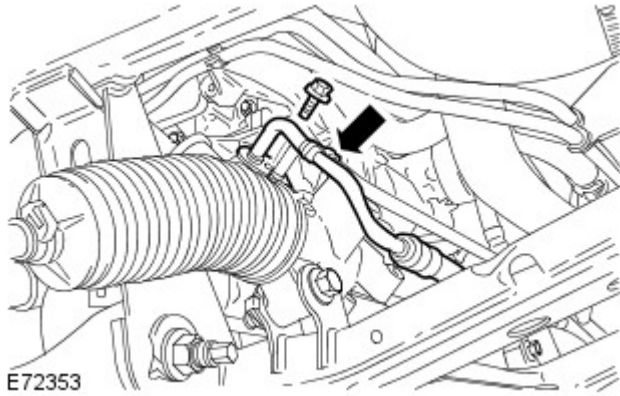


E72352

7. Release the power steering line support bracket.
 - Remove the nut.
 - Release the hose.

All vehicles

8.  **CAUTION:** Before disconnecting or removing the components, make sure the area



around the joint faces and connections are clean. Plug open connections to prevent contamination.

Disconnect the high pressure line from the power steering gear.

- Remove the bolt.
- Release the power steering gear line.
- Remove and discard the O-ring seal.

9. Remove the steering gear high-pressure line.

Installation

All vehicles

1. Install the steering gear high-pressure line.
2. Connect the high-pressure line to the power steering gear.
 - Install the O-ring seal.
 - Attach the power steering gear high-pressure line.
 - Tighten the bolt to 25 Nm (18 lb.ft).

Vehicles with 5.0L engine

3. Install the power steering line support brackets.
 - Tighten the nuts to 10 Nm (7 lb.ft).
 - Secure the hose with the clip.

All other engine types

4. Install the power steering line support bracket.
 - Tighten the nut to 10 Nm (7 lb.ft).
 - Secure the hose with the clip.

All vehicles

5. Connect the high-pressure line to the power steering pump.
 - Install new sealing washers.
 - Connect the power steering pump high-pressure line.
6. Install the radiator access panel.
 - Tighten the bolts to 10 Nm (7 lb.ft).
7. Install the front LH fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).
8. Install the front RH splash shield.
 - Secure with the clips.
9. Fill and bleed the power steering system.
For additional information, refer to: Power Steering System Filling and Bleeding (211-00 Steering System - General Information, General Procedures).

Steering Linkage -

Torque Specifications

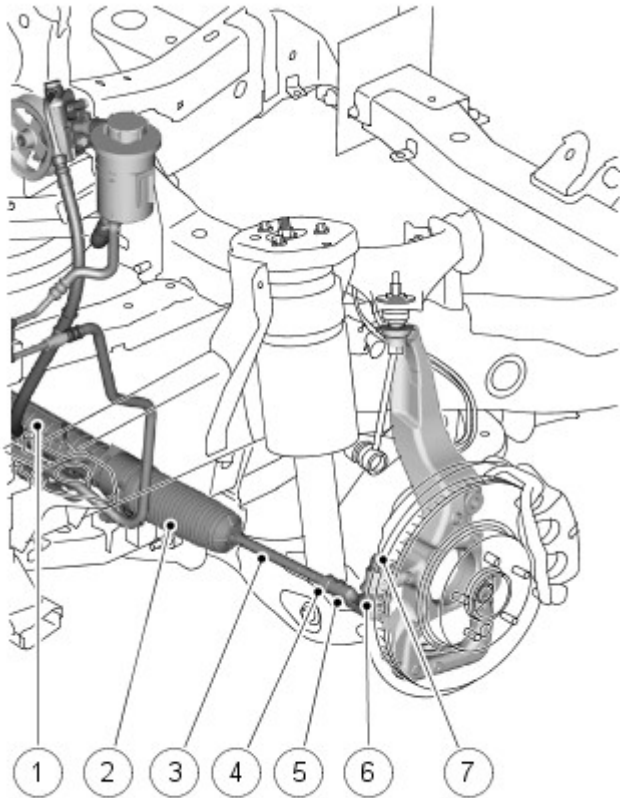
Description	Nm	lb-ft
* Tie-rod end nut - Vehicles fitted with an M12 nut	76	56
* Tie-rod end nut - Vehicles fitted with an M14 nut	150	111
Tie-rod locking nut	55	40
Road wheel nuts	140	103

* **New nut must be installed**

Steering Linkage - Steering Linkage

Description and Operation

Steering Linkage Component Location



E46659

Item	Part Number	Description
1	-	Steering gear
2	-	Steering gear boot
3	-	Tie rod
4	-	Locknut
5	-	Tie rod end
6	-	Ball joint
7	-	Self-locking nut

GENERAL

The steering linkage comprises the tie rod which provides the connection between the steering gear and the front wheel knuckle.

Each end of the steering gear has a threaded hole which provides for the fitment of the tie rods. The external ends of the tie rods are sealed with steering gear boots to prevent the ingress of dirt and moisture into the steering gear.

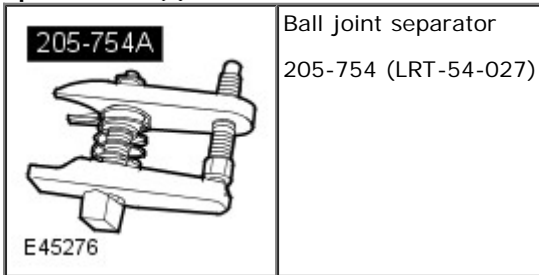
The outer ends of the tie rods are threaded to allow the fitment of the tie rod ends. The tie rod ends are screwed onto the tie rods and locked with locknuts to prevent inadvertent movement. The thread on the tie rod allows the position of the tie rod end to be adjusted in order to set the correct toe angle for each front wheel.

The tie rod end comprises a forged housing with a threaded bore for attachment to the tie rod. The tie rod end incorporates a non-serviceable tapered ball joint which locates in a tapered hole in the front wheel knuckle and is secured with a self-locking nut. The ball joint has an internal hexagonal drive which enables the joint to be held stationary when the self-locking nut is tightened.


Steering Linkage - Tie Rod End

Removal and Installation

Special Tool(s)

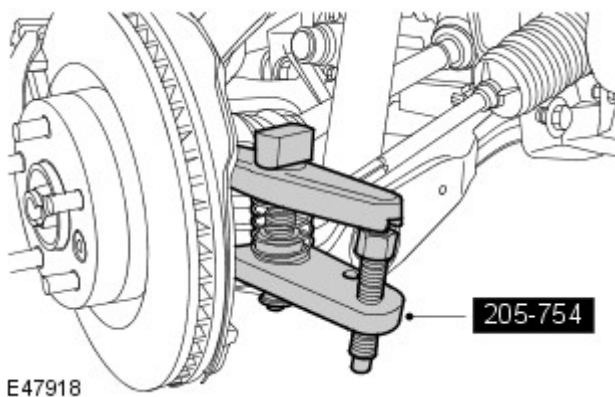


Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

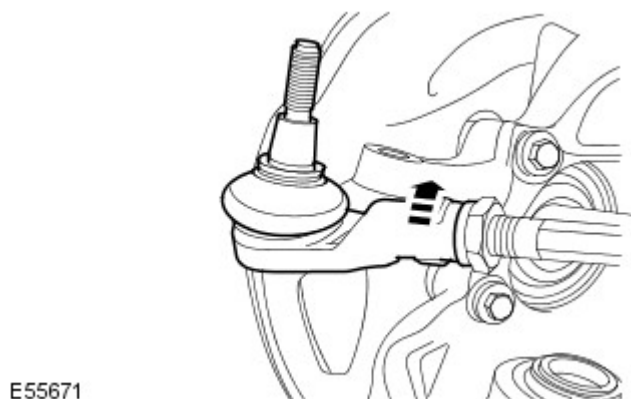
Raise and support the vehicle.

2. Remove the front wheel.
3. Loosen the tie rod end ball joint retaining nut.
4. Loosen the tie rod end lock nut.



5. Using the special tool, release the tie-rod end ball joint from the wheel knuckle.
 - Remove and discard the tie rod end retaining nut.

6. Remove the tie-rod end, note the number of turns for installation.



Installation

1. Install the tie rod end, note the number of turns until adjacent to the locknut.

2.  **CAUTION:** To prevent damage to the tie rods, use an additional wrench when loosening or tightening the components.

Connect the tie rod end ball joint.


- Clean the component mating faces.
 - For vehicles fitted with an M12 nut, install a new nut and tighten to 76 Nm (56 lb.ft).
 - For vehicles fitted with an M14 nut, install a new nut and tighten to 150 Nm (111 lb.ft).
3. Tighten the tie rod locking nut.
 - Clean the component mating faces.
 - Tighten the nut to 55 Nm (40 lb.ft).
 4. Install the front wheel.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
 5. Lower the vehicle.
 6. Using only four wheel alignment equipment approved by Land Rover, check and adjust the wheel alignment.

Steering Linkage - Steering Gear Boot

Removal and Installation

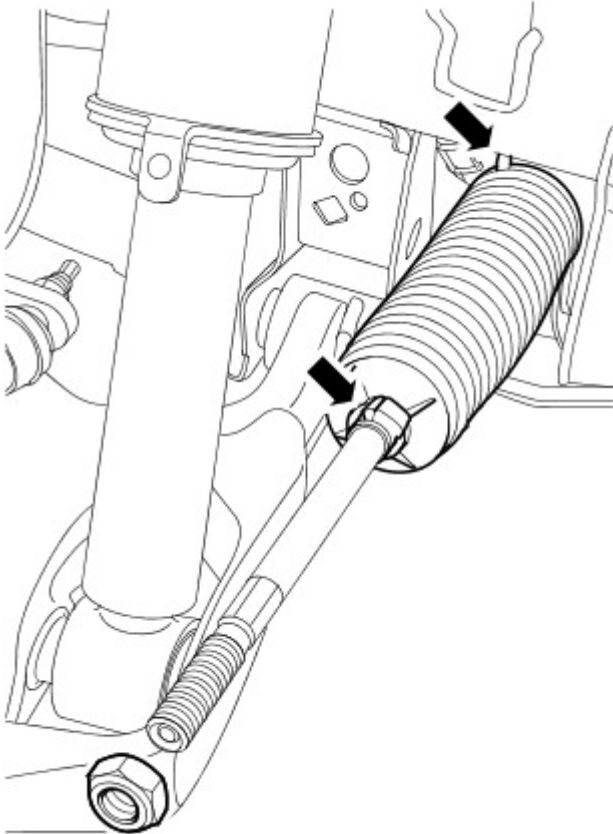
Removal

1. Remove the tie-rod end.
For additional information, refer to: Tie-Rod End (211-03, Removal and Installation).

2.  **NOTE:** Note the fitted position.

Remove the locknut.

3. Remove the steering gear boot.
 - Release the 2 clips.



E55694

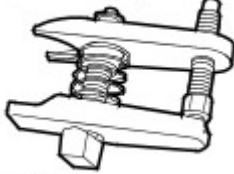
Installation

1. Install the steering gear boot.
 - Clean the component mating faces.
 - Secure with the clips.
2. Install the locknut.
3. Install the tie-rod end.
For additional information, refer to: Tie-Rod End (211-03, Removal and Installation).


Steering Linkage - Tie Rod

Removal and Installation

Special Tool(s)

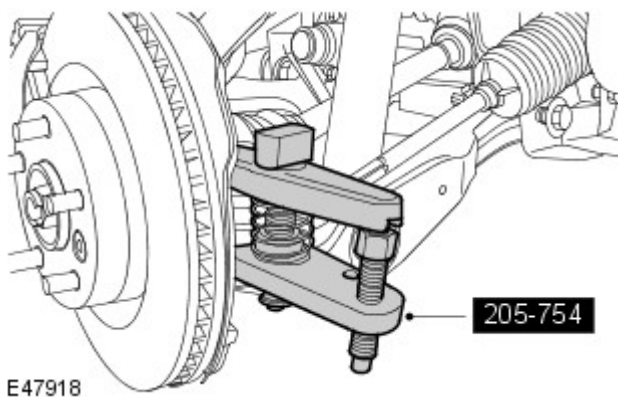
 <p>205-754A E45276</p>	<p>Ball joint separator 205-754(LRT-54-027)</p>
--	---

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

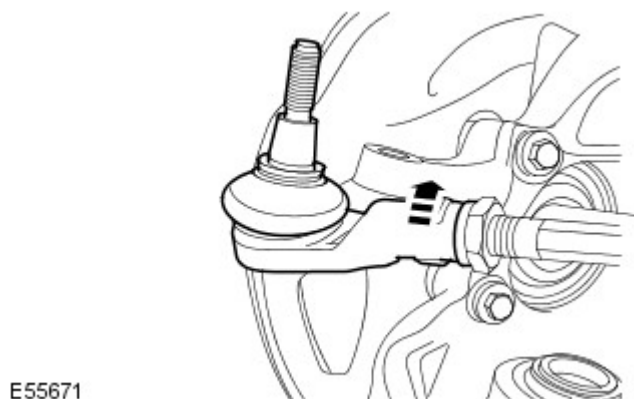
Raise and support the vehicle.

2. Remove the front wheel.
3. Loosen the outer tie-rod end ball joint retaining nut.
4. Loosen the outer tie-rod end lock nut.



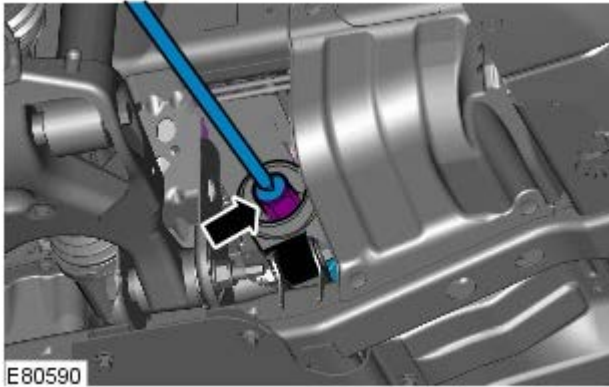
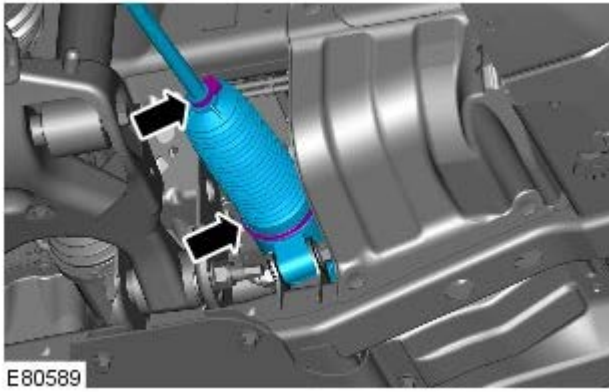
5. Using the special tool, release the tie-rod end ball joint from the wheel knuckle.
 - Remove and discard the tie rod end retaining nut.

6. Remove the outer tie-rod end, note the number of turns for installation.




7. Remove the outer tie-rod end lock nut.

8. Remove the steering gear boot.
 - Release the 2 clips.



9. Remove the inner tie-rod end.
 - Loosen the nut.

Installation

1. Install the inner tie-rod end.
 - Tighten the nut to 100 Nm (74 lb.ft).
2. Install the steering gear boot.
 - Secure with the clips.
3. Install the outer tie-rod end lock nut.
4. Install the tie rod end, note the number of turns until adjacent to the locknut.
5.  **CAUTION:** To prevent damage to the tie rods, use an additional wrench when loosening or tightening the components.
 - Connect the tie-rod end ball joint.
 - Clean the component mating faces.
 - For vehicles fitted with an M12 nut, install a new nut and tighten to 76 Nm (56 lb.ft).
 - For vehicles fitted with an M14 nut, install a new nut and tighten to 150 Nm (111 lb.ft).
6. Tighten the tie-rod locking nut.
 - Clean the component mating faces.
 - Tighten the nut to 55 Nm (40 lb.ft).
7. Install the front wheel.
 - Tighten the wheel nuts to 140 Nm (103 lb.ft).
8. Lower the vehicle.
9. Using only four wheel alignment equipment approved by Land Rover, check and adjust the wheel alignment.

Steering Column -

General Specification

Item	Specification
Type	Two piece, articulated with flexible coupling to steering rack; fitted with energy absorption system and having a 120 mm (4.7 in) ride down capability with a 4.5 kN (0.45 ton force) maximum decoupling load on the intermediate shaft and a 77 mm (3.0 in) collapse stroke on the lower shaft.
Upper column adjustment:	
Reach	40 mm (1.57 in)
Rake	6°

Torque Specifications

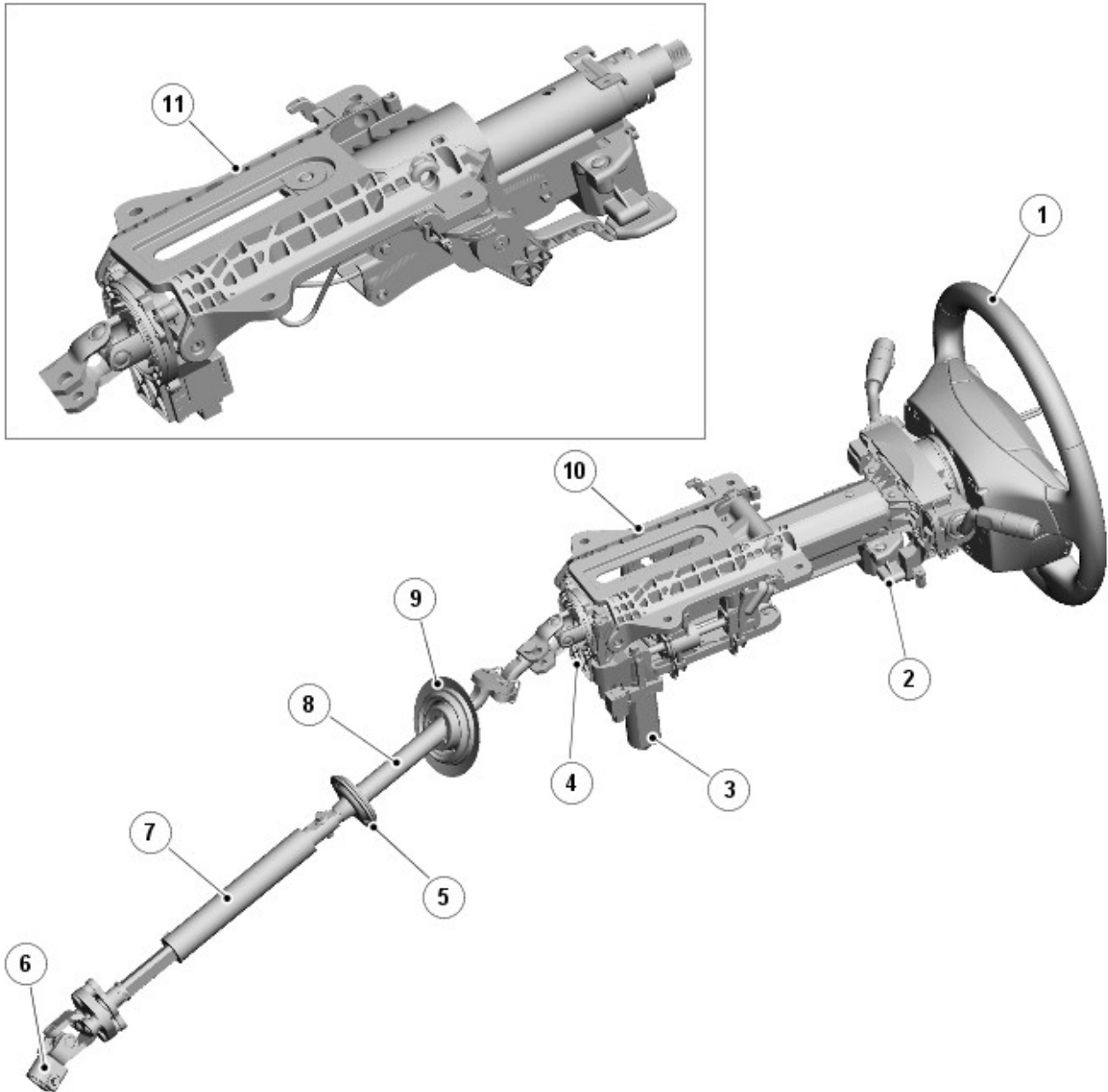
Description	Nm	lb-ft
Steering angle sensor Torx screws	3	2
* Steering column intermediate shaft to lower shaft bolts	30	22
* Steering column intermediate shaft to steering column nut	22	16
Steering column switch assembly Torx bolts	3	2
Steering wheel bolt	63	46

* **New bolts/nut must be installed**

Steering Column - Steering Column

Description and Operation

Component Location



E124335

Item	Part Number	Description
1	-	Steering wheel
2	-	Electronic steering lock
3	-	Electric motor
4	-	Steering angle sensor
5	-	Bulkhead mounting
6	-	Lower collapsible shaft yoke
7	-	Lower collapsible shaft
8	-	Intermediate shaft
9	-	Gaitor
10	-	Upper steering column assembly - Electric
11	-	Upper steering column assembly - Manual

Overview

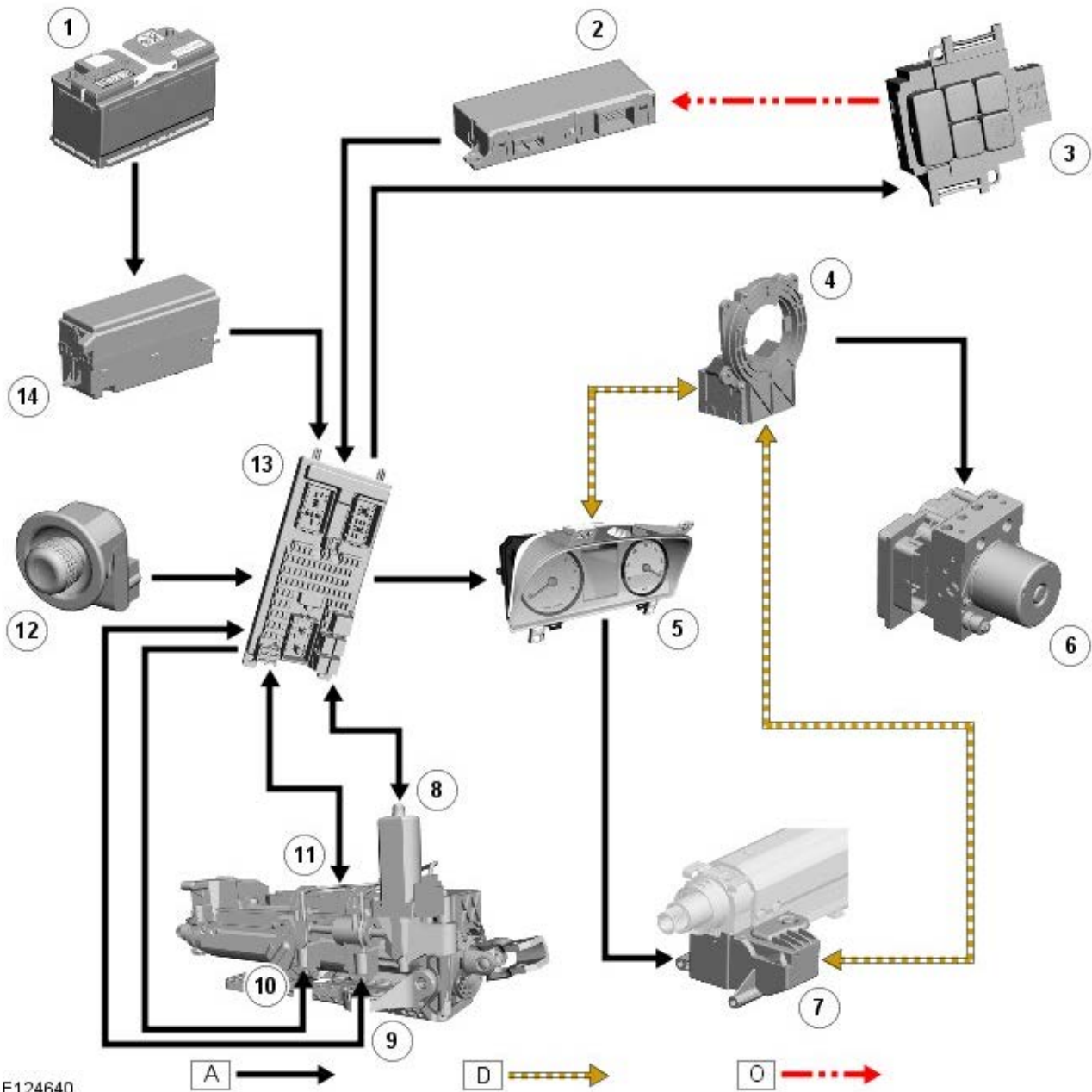
The steering column comprises the upper column assembly, the intermediate shaft and the lower collapsible shaft. The three components are positively connected together to pass driver rotary input from the steering wheel to a linear output of the steering rack.

The upper steering column assembly is electronically adjustable for steering wheel reach and rake and is controlled by the **CJB (central junction box)**. The upper steering column assembly also provides the location for the electronic steering lock mechanism and the steering angle sensor.

Control Diagram



NOTE: A = Hardwired; D = High-speed CAN (controller area network) bus; O = LIN (local interconnect network) bus

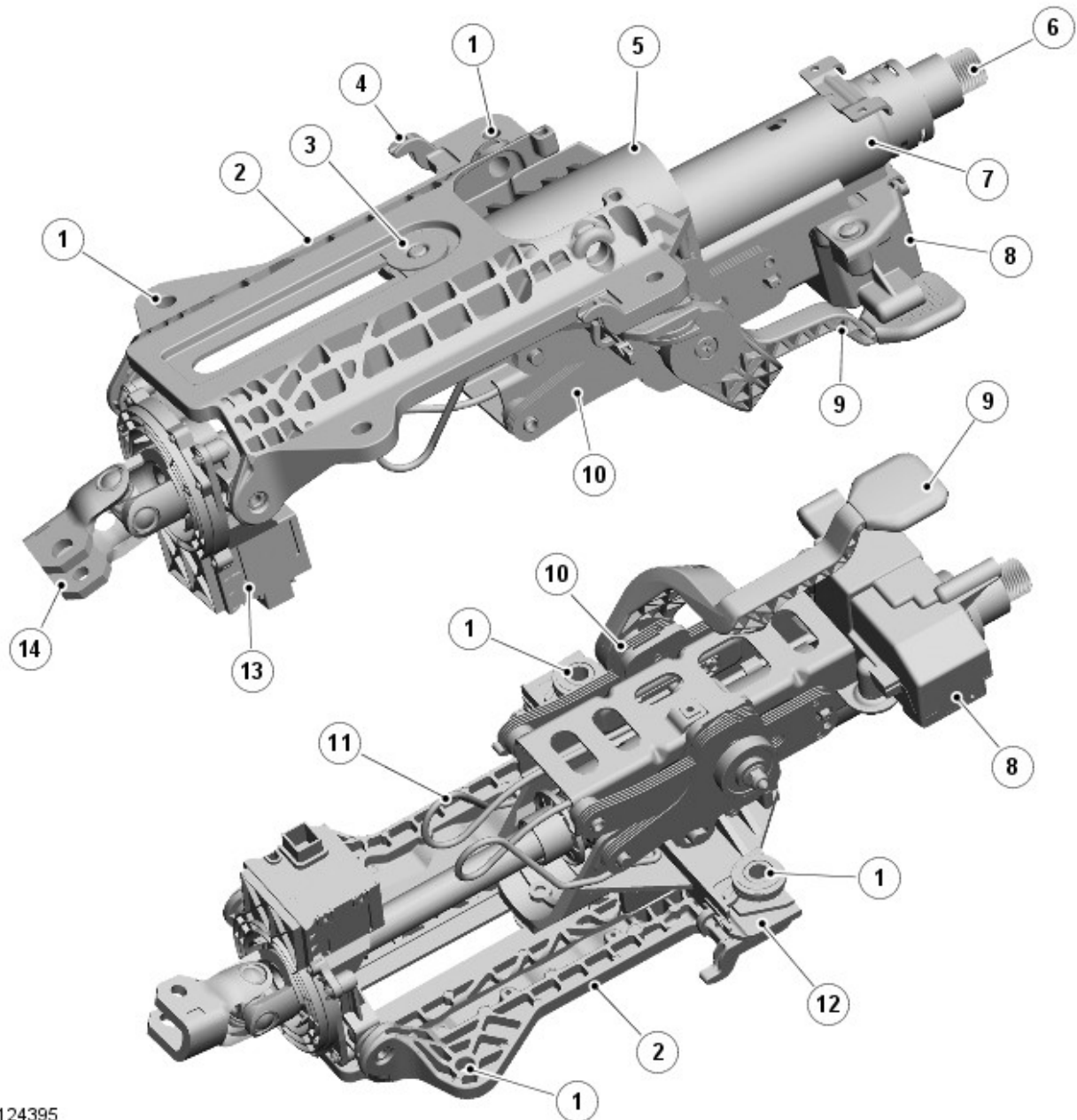


E124640

Item	Part Number	Description
1	-	Battery
2	-	Driver seat module
3	-	Driver memory switch pack
4	-	Steering angle sensor
5	-	Instrument cluster
6	-	ABS module
7	-	Electronic steering lock
8	-	Reach/rake motor
9	-	Reach solenoid and clutch
10	-	Rake solenoid and clutch
11	-	Potentiometer
12	-	Steering column switch
13	-	CJB
14	-	EJB

Component Description

Upper Column Assembly - Manual



E124395

Item	Part Number	Description
1	-	Attachment holes
2	-	Roof bracket
3	-	Screw
4	-	Locating hook
5	-	'U' bracket
6	-	Steering wheel splines
7	-	Main body
8	-	Electronic steering lock
9	-	Adjustment lever
10	-	Clamp plate assembly
11	-	Adjustment balance spring (2 off)
12	-	Shearing capsule (2 off)
13	-	Steering angle sensor
14	-	Swing yoke

The steering column is attached to the in-vehicle crossbeam and secured with four, 8 mm thread forming, pan head Torx drive screws. The two forward attachment screws are fixed through the column mounting bracket, the two rearward mounting screws also pass through the shearing capsules. In the event of a high energy frontal impact, the shearing capsules remain fixed to the crossbeam, but the 'U' bracket (with the main body) disengages from the capsules, allowing the column to shorten axially (collapse), with the coiled straps absorbing energy to reduce

occupant loading.



WARNING: Take care when handling the column not to trap fingers if releasing the adjustment lever at any point during the removal procedure when the column is not in the vehicle. The balance springs will cause the column to rapidly move to its upper-most position.

The column comprises a cast magnesium roof bracket which is attached to the in-vehicle crossbeam. Attached to the roof bracket is a pivot housing, a 'U' bracket, upper and lower shafts and a main body. The roof bracket has two hooks which locate in slots in the in-vehicle crossbeam. The hooks assist in supporting the weight of the column during removal or installation.

The pivot housing is attached to the forward end of the roof bracket with two pivot pins. The pivot housing allows for adjustment of the column rake and contains a bearing which supports the column lower shaft.

The 'U' bracket is attached to the roof bracket by a screw, bush and plastic washer assembly (third fixing) located in a slot in the top of the roof bracket. When the column is assembled into the vehicle, the shearing capsules, which are attached to the 'U' bracket, are clamped up against the roof bracket by the fixing screws, preventing movement of the 'U' bracket. The bolts also pass through rectangular section steel straps, which at one end, have coils that locate around a plastic bush (positioned on the shearing capsule). The straps are used to control the rate of column collapse, in the event of a high energy frontal impact.

The main body is positioned in the 'U' bracket via the lever bolt. The bolt is captive within the vertical slots in the 'U' bracket and the horizontal slots in the main body. The bolt also passes through the clamp plate assemblies (one on either side of the 'U' bracket). The body houses the middle and upper bearings through which the upper shaft is located. Two offset holes in the main body provide for the attachment of the electronic steering lock assembly.

The upper and lower shafts are located through the length of the column assembly. The upper shaft is supported in two bearings in the main body and the lower shaft is located in the upper shaft and supported in a bearing in the pivot housing. The lower shaft has a tubular section with external splines. These mate with the internal splines in the upper shaft. The purpose of the splines is to transmit rotational movement of the upper shaft to the lower shaft, but allowing the two components to telescope into each other in the event of a collision. The length of the splined sections allow for 120 mm (4.72 in) of linear movement. The lower shaft is fitted with a universal joint spider to which a swivel yoke is attached. The swivel yoke attaches to the intermediate shaft of the steering column on the interior side of the bulkhead using a special cam bolt and self-locking nut.

A steering angle sensor is attached to the pivot housing of the column and its centre gear is rotated by a drive collar which is attached to the lower shaft and rotates with movement of the steering wheel. The sensor transmits steering angle data on the high speed CAN bus which is used by various systems on the vehicle. The steering angle sensor is designed to become detached from the column in the event of a frontal impact. Care must be taken when handling the column assembly to prevent accidental damage to the sensor.

The upper steering column assembly houses the electronic column lock mechanism and control module.

The steering column is adjustable for reach and rake. The column can be adjusted for 40 mm (1.57 in) of reach adjustment and 6° of rake adjustment. The adjustment mechanism comprises an adjustment lever, a cam plate, a lever bolt and nut, two brake pads and two clamp plate assemblies.

A plastic adjustment lever is located on the underside of the column assembly and is attached to a cam plate. When the lever is pulled downwards, the cam plate rotates and releases tension in the lever bolt. The lever bolt also passes through two sets of clamp plate assemblies. When the lever is moved upwards, the cam plate rotates applying tension to the lever bolt, which applies pressure to the brake pads which in turn apply pressure to the clamp plate assemblies (which lock the column in the desired position). The lever bolt is retained by a self-locking lever nut, which abuts a thrust bearing.



WARNING: Under no circumstances should the lever nut torque be reduced, as this will reduce the clamping efficiency of the adjustment mechanism possibly affecting the stability of the column during a frontal impact.

The pivot housing is attached to the roof bracket with two pivot pins. When the rake adjustment is operated, the pivot housing rotates around the pivot pins to allow for the up and down adjustment, but maintains a positive location to the roof bracket. An adjustment spring is fitted between the 'U' bracket and the main body, to counteract the weight of the main body, upper shaft, steering wheel and airbag, preventing the steering wheel from dropping rapidly when the adjustment lever is released.

In the event of a high energy frontal impact, the upper column assembly is designed to axially collapse reducing impact injury to the driver. A number of components interact together to ensure that the collapse of the column is in a controlled manner. The following components control the column collapse:

- Pressure washer and bush (third fixing)
- Shearing capsules
- Straps
- Upper and lower shaft (splined) connection

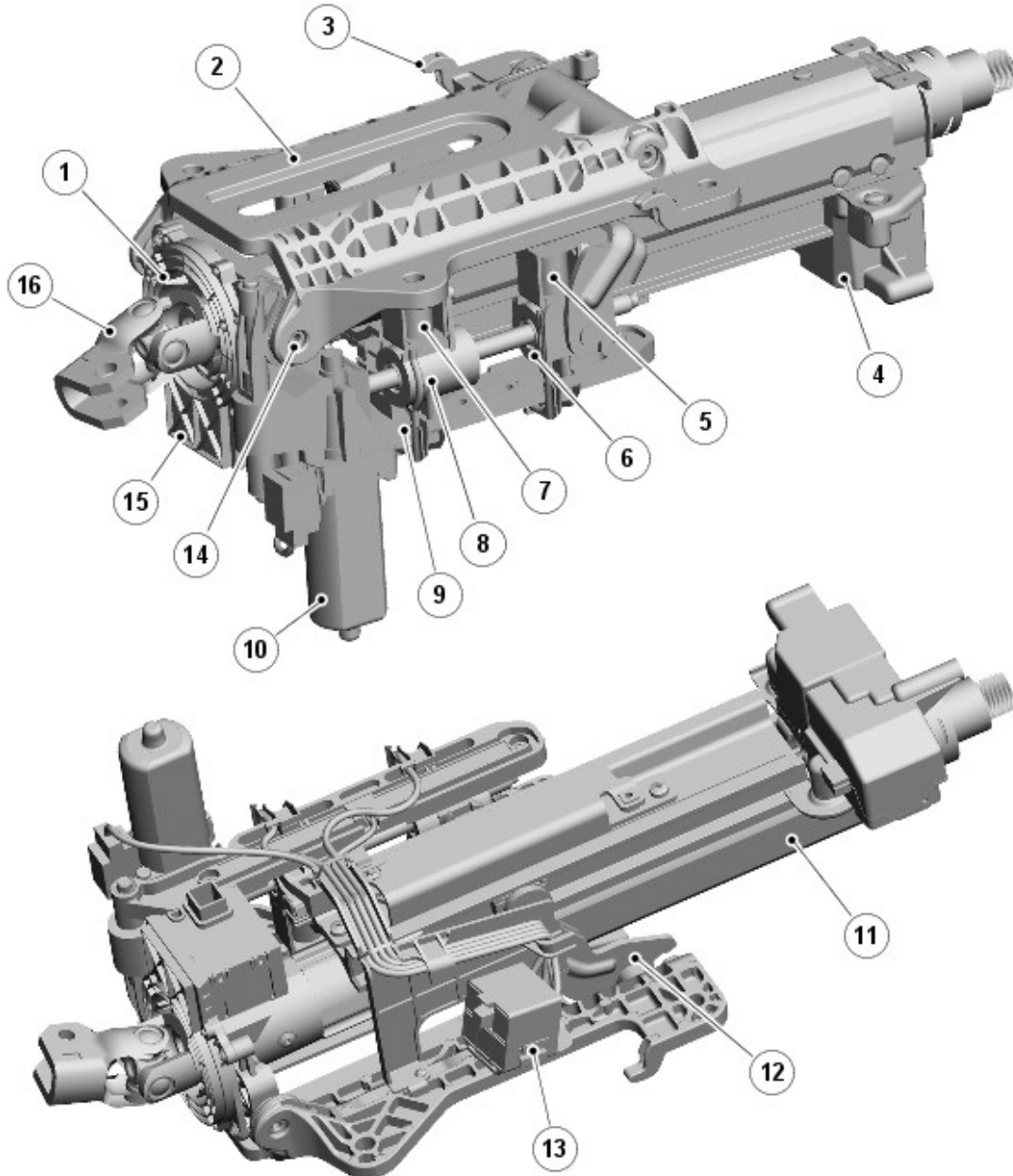
The shearing capsules have a central hole through which the rearward attachment bolts pass through into the roof bracket. The capsules are located in the 'U' bracket by tapered slots, which have small cut-outs in the inside faces. The shearing capsules have a number of small holes which align with the cut-outs in the 'U' bracket. When the capsules are installed, plastic is injected into the holes and cut-outs. This plastic retention of the capsules provides the initial controlled break-out force for the column in the event of a collision. After 10 mm of displacement, the 'U' bracket is no longer located by the shearing capsules. When handling the column, care should be taken that the shearing capsules are not impacted or dislodged.

The tension in the 'Third Fixing' screw, applies a clamp load to the roof bracket (via the bush and compression washers). In the event of a collision, this clamp load (supplementary to the shearing capsules) must be overcome before the column can collapse. When this load has been exceeded (and the fixing has been displaced 20 mm (0.79

in)) it slides easily within the roof bracket slot, providing directional control to the column, as it collapses. Under no circumstances should the screw torque be adjusted.

The straps are rectangular section steel, which at one end, have coils that locate around a plastic bush (positioned on the shearing capsule). The other end is formed into a hook which locates within a slot in the 'U' bracket. When a collision has occurred, and the 'U' bracket has been displaced from the shearing capsules by 8 mm (0.3 in), the straps begin to un-roll due to the displacement of the 'U' bracket. The straps provide the main element for energy absorption as the column collapses. The cross section of the straps change after approximately 40 mm (1.6 in) of extension, changing the amount of energy that they absorb.

Upper Column Assembly - Electric



E124336

Item	Part Number	Description
1	-	Pivot housing
2	-	Roof bracket
3	-	Locating hook
4	-	Electronic steering lock
5	-	Rake solenoid
6	-	Rake clutch
7	-	Reach solenoid
8	-	Reach clutch
9	-	Potentiometer
10	-	Electric motor
11	-	Outer profile
12	-	Rake lever
13	-	Electrical connector

14	-	Pivot pin
15	-	Steering angle sensor
16	-	Swing yoke

The steering column is attached to the in-vehicle crossbeam and secured with four, 8mm, thread forming, pan head Torx drive screws. In the event of a high energy frontal impact, a strap and shear pin on the underside of the column provides a controlled collapse of the outer housing on the inner housing, allowing the column to shorten axially (collapse), absorbing energy to reduce occupant loading.

The column comprises a cast magnesium roof bracket which is attached to the in-vehicle crossbeam. Attached to the roof bracket is a pivot housing, a outer housing and upper and lower shafts. The roof bracket has two hooks which locate in slots in the in-vehicle crossbeam. The hooks assist in supporting the weight of the column during removal or installation.

The rake lever locates the aluminum outer profile, into which is fixed the electronic steering lock adaptor. The inner profile is located within the outer profile, by 2 linear bearing assemblies, which allow a telescopic action for the reach adjustment.

The assembly of the upper and lower shafts is located within the column by the bearings in the electronic steering lock adaptor and the pivot housing. Both shafts are tubular. The lower shaft has external splines (which are over molded with nylon), and these mate with the internal splines in the upper shaft. The purpose of the splines is to transmit rotational movement of the upper shaft to the lower shaft, yet allow telescopic movement during column axial collapse. The lower shaft is fitted with a universal joint spider to which a swivel yoke is attached. The swivel yoke attaches to the intermediate shaft of the steering column on the interior side of the bulkhead using a special cam bolt and self-locking nut.

A steering angle sensor is attached to the pivot housing of the column and its centre gear is rotated by a drive collar which is attached to the lower shaft and rotates with movement of the steering wheel. The sensor transmits steering angle data on the high speed CAN bus which is used by various systems on the vehicle. The steering angle sensor is designed to become detached from the column in the event of a frontal impact. Care must be taken when handling the column assembly to prevent accidental damage to the sensor.

The upper steering column assembly houses the electronic column lock mechanism and control module.

The steering column is adjustable electrically for reach and rake. The adjustment mechanism comprises an electric adjustment motor, a lead screw, a rake solenoid, a reach solenoid, a rake clutch and a reach clutch.

The column adjustment is controlled by the driver using a joystick switch located on the left hand side of the column cowl. The joystick can be moved forward and backward to adjust the column reach in and out and moved up and down to adjust the rake. The single electric motor is used for both adjustment ranges. The switch selection uses the applicable solenoid, engaging the applicable clutch on the lead screw.

When the auto function is activated, the steering column will adjust to the uppermost tilt position with ignition off, and re-adjust to the previous set position, with ignition on.

For the reach adjustment, the lead screw drives the outer housing in or out as required. For the rake adjustment, the lead screw drives a rake lever which moves the column up or down as applicable.

The pivot housing is attached to the roof bracket with two pivot pins. When the rake adjustment is operated, the pivot housing rotates around the pivot pins to allow for the up and down adjustment, but maintains a positive location to the roof bracket.

The electric steering column is linked to and controlled by the memory control module. The memory control module provides storage of three separate memory positions which are stored against three individual vehicle keys. For additional information, refer to: Seats (501-10, Description and Operation).

. The electric column also has an easy egress feature which lifts the column to its maximum rake to allow easier access to the vehicle.

In the event of a high energy frontal impact, the upper column assembly is designed to collapse reducing impact injury to the driver. A number of components interact together to ensure that the collapse of the column is in a controlled manner. The following components control the column collapse:

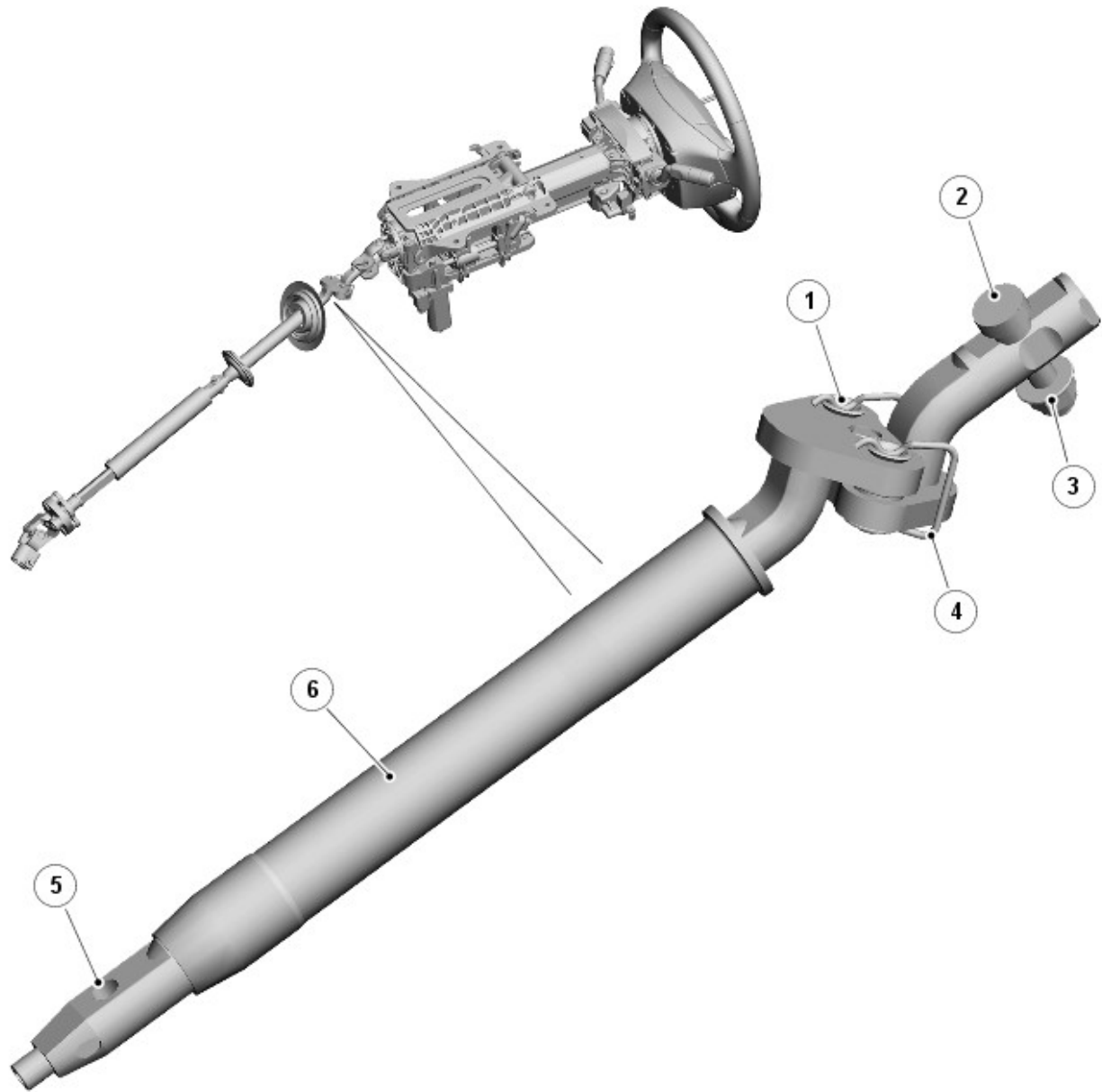
- Shear pin
- Strap
- Upper and lower shaft (splined) connection

The strap is rectangular section steel, which is secured by two Allen screws to the outer housing and by a shear pin to the strap guide. The strap provides the main element for energy absorption as the column collapses. To initiate axial movement of the column, the shear pin has to be severed, friction between several column interfaces has to be overcome, and an axial load applied sufficient to initiate strap guide deformation. Once the column is telescoping, deformation of the strap guide, and sliding friction between column interfaces, absorbs the energy of the occupant in a controlled manner, as the column collapses.



WARNING: Do not attempt to dismantle the steering column. The crash safety of the unit will be compromised.

Intermediate Shaft



E124337

Item	Part Number	Description
1	-	Load limiter pins
2	-	Cam bolt
3	-	Self-locking nut
4	-	Retention spring
5	-	Attachment hole
6	-	Seal sleeve



CAUTION: Care should be taken when handling the intermediate shaft, to ensure that it is not subject to impacts or that the retention spring is not displaced.

The non-handed, intermediate shaft is attached at its upper end to the swivel yoke on the lower shaft of the steering column assembly. The intermediate shaft comprises two main parts; the upper and lower axis which are joined together with a shear joint.

The upper axis has a cut-out in the shaft which allows for the fitment of the cam bolt. Only when the shaft is located correctly in the swivel yoke, can the cam bolt be inserted. A self-locking nut is fitted to the cam bolt. The torque applied as the nut is tightened, rotates the bolt, forcing the cam against the shaft, positioning it correctly in the swivel yoke prior to the joint being clamped.



NOTE: If the self-locking nut is removed for any reason, it is recommended that a new, correct nut is fitted to maintain the optimum torque on the cam bolt.

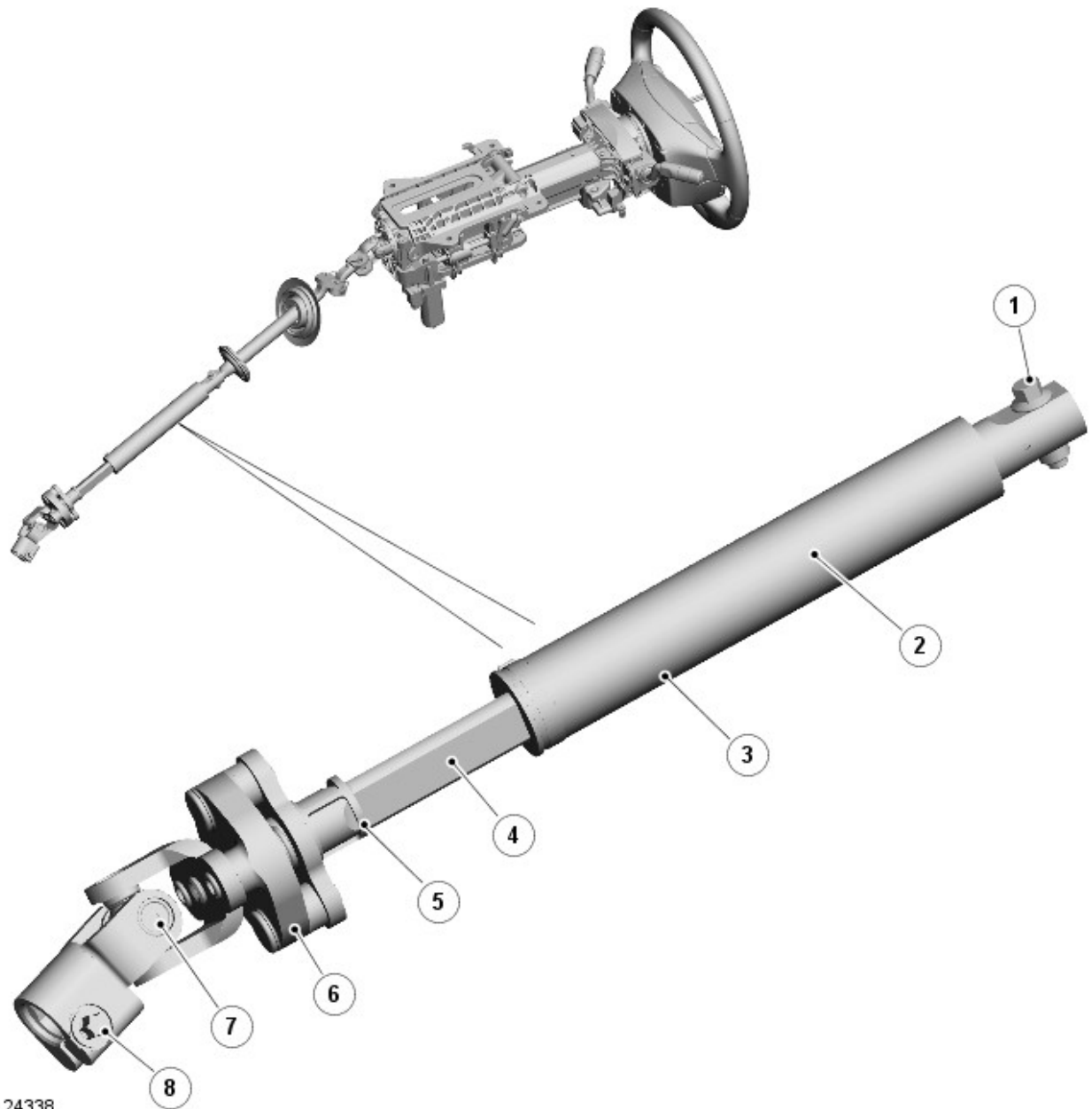
The lower axis is fitted with a plastic molded seal sleeve which provides a suitable surface for the location of the plastic bearings within the two bulkhead seals. The bottom of the lower axis is machined to a double 'D' shape which tapers at the end. One side of the taper has a slot which is used to align the intermediate shaft and the lower

collapsible shaft to ensure that the correct orientation of the steering wheel to steering gear is maintained. A hole is drilled through the double 'D' shape and provides for attachment of the intermediate shaft to the lower collapsible shaft.

The upper and lower axis, are joined together via a load limiter. The load limiter is designed to disconnect the upper and lower axis in the event of a high energy frontal impact preventing an excessive load being applied to the steering column (causing intrusion into the passenger compartment or an unstable airbag deployment).

The load limiter comprises two plates which are part of the upper and lower axis. The plates have a central 'guide' pin, and two retention pins, which pass through bushes in the plates, onto which a rubber and steel washer are staked in position. The size of the staking controls the load at which the lower axis separates from the upper axis. A wire 'retention' spring is also fitted to the load limiter.

Lower Collapsible Shaft



E124338

Item	Part Number	Description
1	-	Bolt
2	-	Heat shield
3	-	Female shaft
4	-	Male shaft
5	-	Plastic spacer
6	-	Flexible coupling
7	-	Universal joint
8	-	Torx bolt

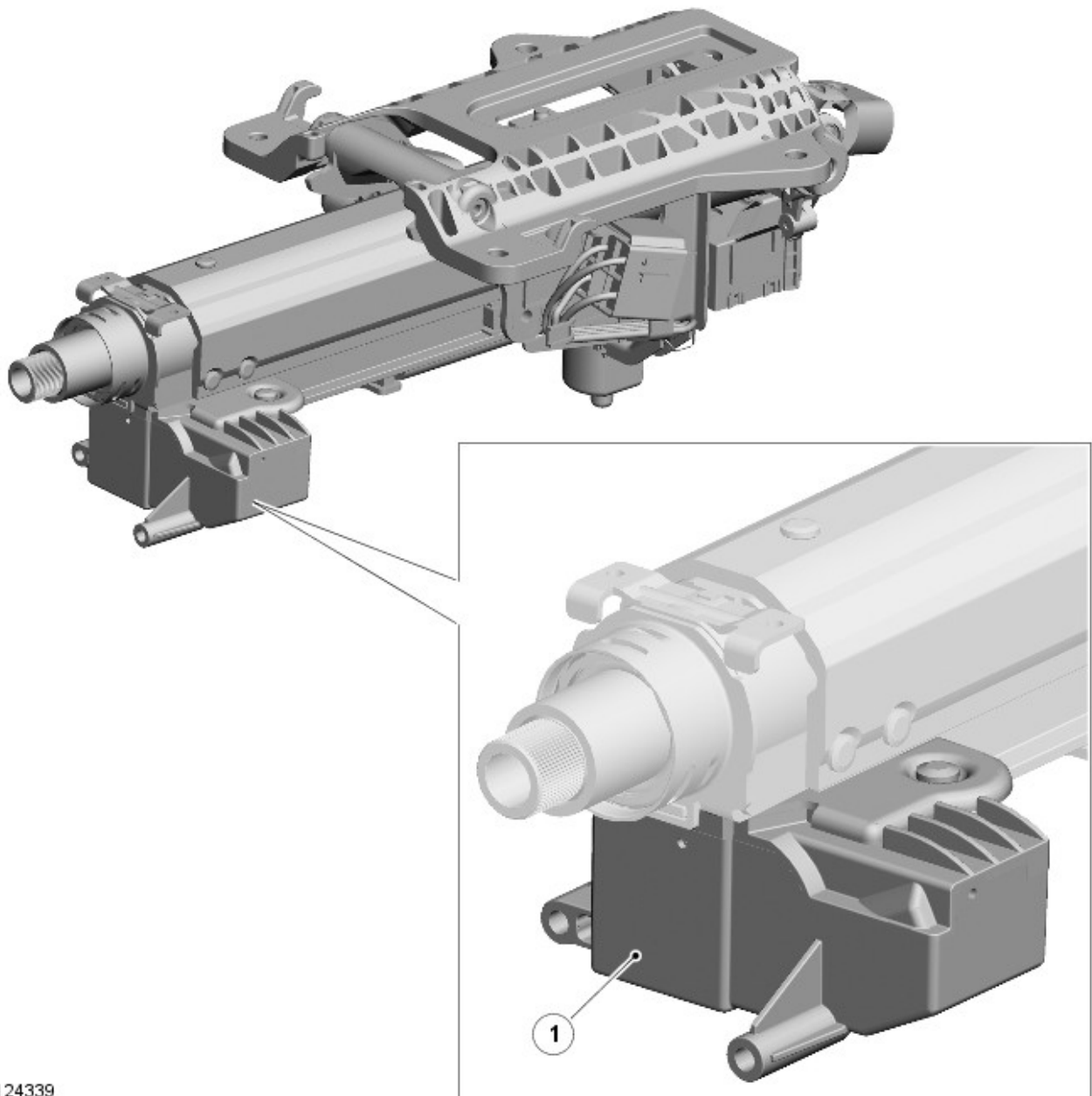
The lower collapsible shaft is a handed component and the correct component must be fitted to ensure that the steering phase angle is maintained. The shaft is attached at its upper end to the intermediate shaft and at its lower end to the valve unit pinion on the steering gear. These attachment joints can only be fitted in one orientation to

ensure the correct alignment of the steering wheel to the steering gear. The shaft comprises two female and male shafts which are a telescopic fit on each other. The male shaft can slide up to 77 mm (3.03 in) within the female shaft in the event of a frontal impact, to minimize the effect of frontal intrusion. The sliding fit also allows for dynamic displacement between the chassis and the body during severe off-road driving. A plastic spacer is fitted to the male shaft which is only used as an assembly aid during vehicle production and serves no function once the shaft is assembled to the vehicle.

The female shaft is a triangular section tube which is formed to a double 'D' hole at its upper end which mates with the intermediate shaft. An indentation pressed in the wall of the tube ensures the correct alignment between the intermediate shaft and the lower collapsible shaft. A captive nut, clinched to one side of a hole in the double 'D' section, allows for the fitment of a patchlock bolt to secure the intermediate shaft. Clamped around the end of the female shaft is a dust seal which prevents the ingress of dirt and moisture into the sliding joint, and a heat sleeve is also fitted to reflect radiant heat from the exhaust.

The male shaft is a triangular section tube which is staked at its lower end into a flange. A cage and curved 'spring plates' are fitted to its upper end, which slide in the female shaft. A pin is fitted into the side of the female tube, to secure the male tube in the bore. The lower end of the male shaft is fitted with a flexible coupling to absorb vibration and steering 'kick back', transmitted from the steering gear. A 'stabilizing pin' is fitted through the coupling to prevent coupling articulation (acting as a universal joint), while still allowing rotational flexing and plunge movement. The coupling is a rubber molding within which are nylon fibres wound around the attachment holes to transmit torque applied to the steering. The coupling is attached to a drive flange (which is part of the male shaft), and to the 'U' yoke which in turn is connected to the pinion yoke, by the universal joint assembly.

Electronic Steering Column Lock



E124339

Item	Part Number	Description
1	-	Electronic steering column lock

With the passive start system, a conventional steering lock mechanism cannot be used. An electronic system was developed which comprises a steering column assembly locking unit with an integrated control module. The steering

lock is operated with the door locks when the vehicle is locked or unlocked. A control module, located inside the steering column, controls a motor, releasing the steering lock when appropriate.

The upper steering column assembly houses the column lock mechanism and control module. The components are assembled with non-removable pins for security reasons and are therefore non-serviceable. Failure of any steering lock components will require replacement of the upper steering column assembly.

The steering column lock comprises a locking motor and locking bolt. The locking motor drives a cam, which moves the locking bolt into and out of engagement with the locking sleeve on the steering column. The locking motor is fitted with a Hall effect sensor, which informs the control module of the position (locked/unlocked) of the steering lock mechanism.

Steering Column - Steering Column

Removal and Installation

Removal



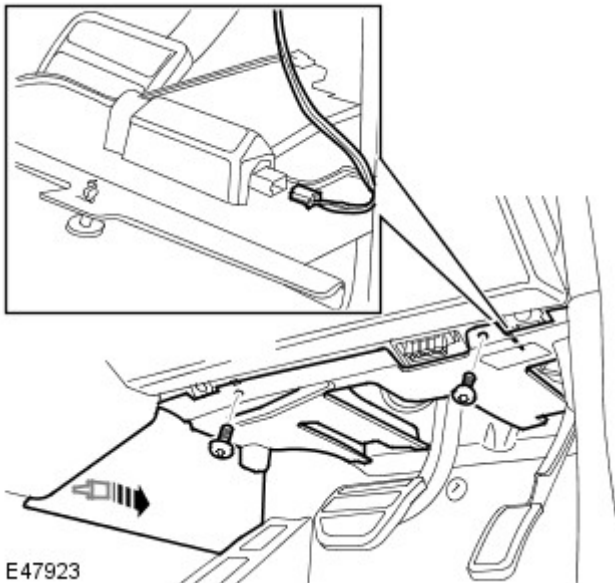
WARNING: Take care if releasing the adjustment lever when the column has been removed from the vehicle. The spring is under a high tension, and if released, could cause personal injury. Make sure fingers are clear from any areas, likely to be trapped.



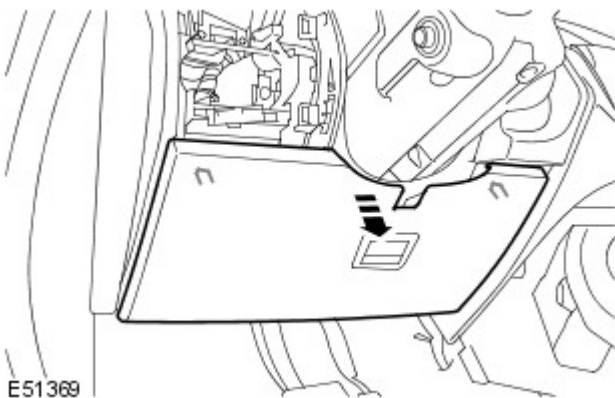
CAUTION: Air tools **MUST NOT** be used on steering column bolts.

All vehicles

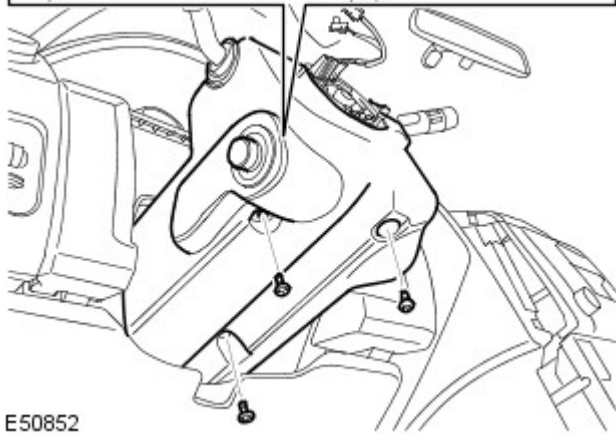
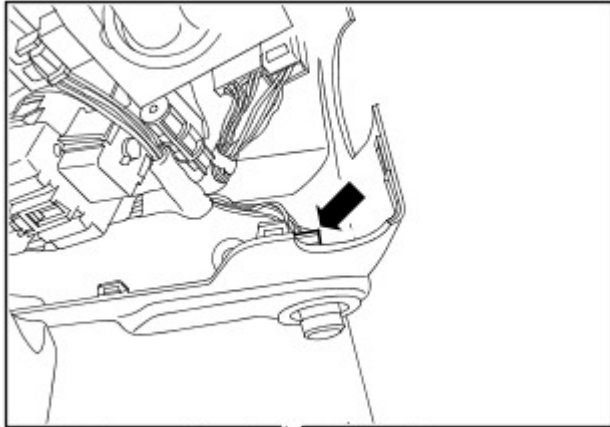
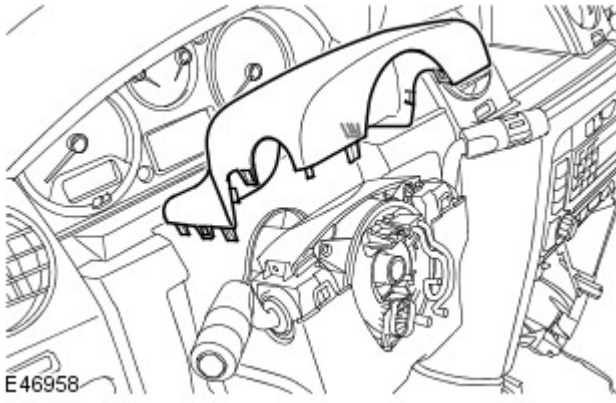
1. Fully extend the steering column for access.
2. Remove the steering wheel.
For additional information, refer to: Steering Wheel (211-04, Removal and Installation).
3. Remove the drivers side register trim panel.
For additional information, refer to: Driver Side Register Trim Panel (412-01, Removal and Installation).
4. Remove the driver side closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.



5. Remove the instrument panel access panel.
 - Release the 2 clips.

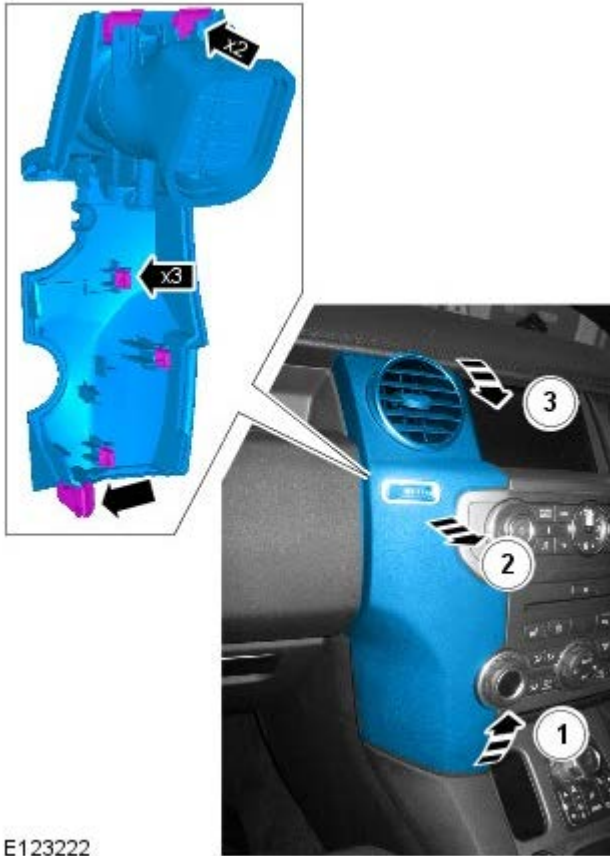


6. Remove the steering column upper shroud.
 - Release the 6 clips.



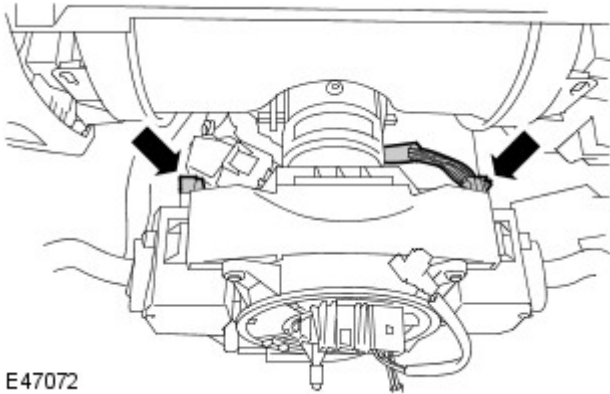
7. Remove the steering column lower shroud.
 - Remove the 3 Torx screws.
 - Disconnect the electrical connector.

8. Remove the steering column side trim panel.
 - Release the 4 clips.
 - Disconnect 2 tabs.



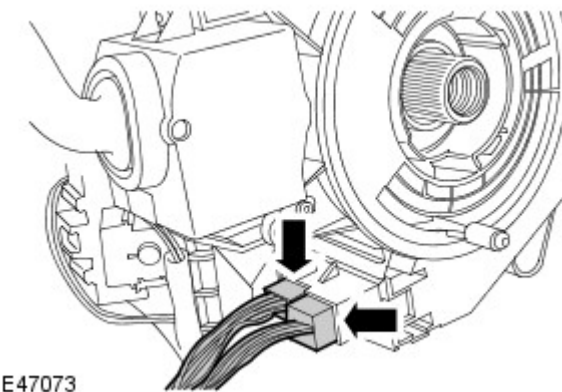
E123222

9. Disconnect the 2 electrical connectors from the steering column multifunction switches.



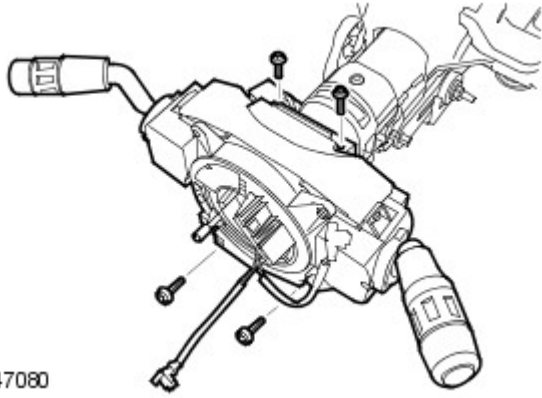
E47072

10. Disconnect the 2 electrical connectors from the clockspring.



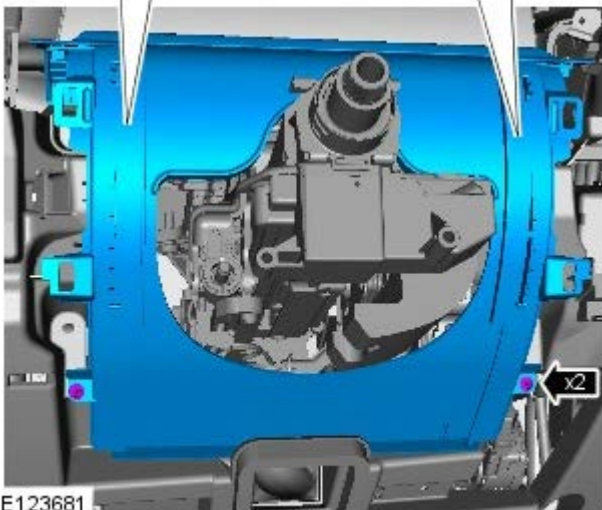
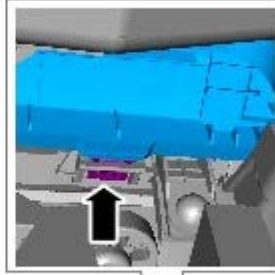
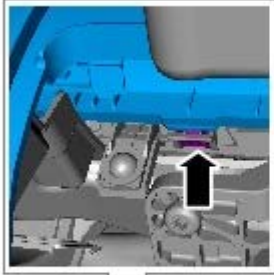
E47073

11. Remove the steering column switch assembly.
 - Remove the 4 Torx bolts.



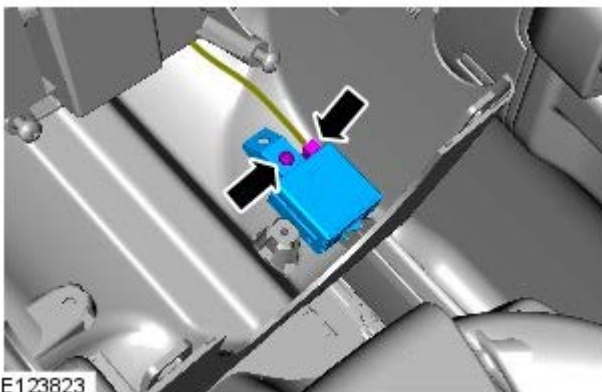
E47080

12. Remove the steering column gaiter panel.
 - Remove the 2 Torx screws.
 - Release the 2 clips.



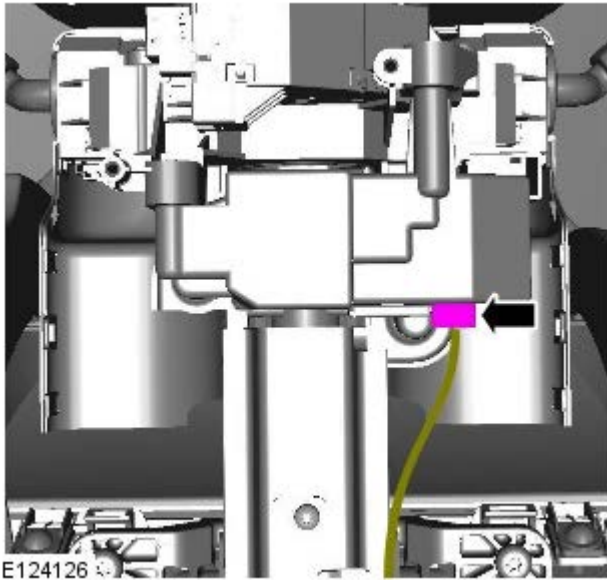
E123681

13. Disconnect the smart key antenna.



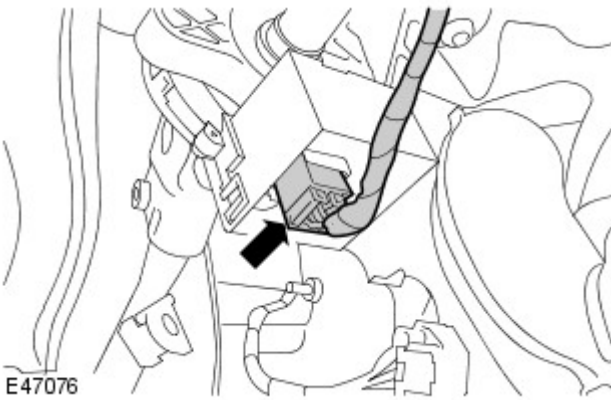
E123823

14. Disconnect the steering column lock electrical connector.



E124126

15. Disconnect the steering angle sensor electrical connector.



E47076

Vehicles with electric steering column

16. Disconnect the steering column adjustment motor electrical connector.

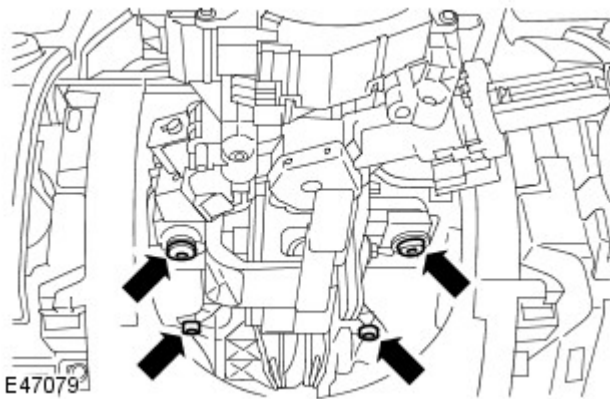


E51371

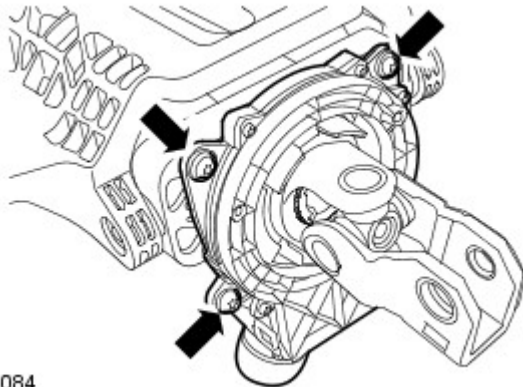
17. Disconnect the steering column intermediate shaft from the steering column.
 - Note the fitted position.
 - Remove the special bolt and discard the nut.




E49465




E47079



E47084

18.  **WARNING:** Take care if releasing the adjustment lever when the column has been removed from the vehicle. The spring is under a high tension, and if released, could cause personal injury. Make sure fingers are clear from any areas, likely to be trapped.

 **CAUTION:** If the steering angle sensor is damaged upon removal of the steering column, the sensor **MUST** be replaced.


With assistance, remove the steering column.

- Remove the 4 Torx bolts.

19. Remove the steering angle sensor.
- Remove the 3 Torx screws.

Installation

Vehicles with electric steering column

1.  **CAUTION:** The potentiometer adjustment values are unique for each steering column. Failure to enter the correct code during calibration may result in damage to the vehicle.

Note the potentiometer hexadecimal code on the new steering column label for future reference.



E102064

All vehicles

2. Install the steering angle sensor.
- Tighten the Torx screws to 3 Nm (2.2 lb.ft).

3. **CAUTIONS:**

 Make sure the bolt holes are clean and free of swarf.

 The steering column bolts must be tightened by hand a minimum of 3 revolutions.

 Air tools **MUST NOT** be used on steering column bolts.

With assistance, install the steering column.

- Tighten the bolts in sequence to 25 Nm (18 lb.ft).

4. Connect the steering column intermediate shaft.

Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).

5. Secure the wiring harness to the steering column.

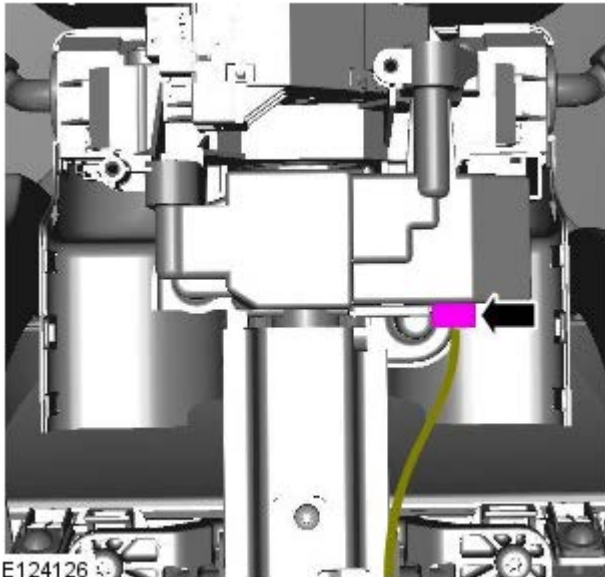
Vehicles with electric steering column

6. Connect the steering column adjustment motor electrical connector.

All vehicles

7. Connect the steering angle sensor electrical connector.

8. Connect the steering column lock electrical connector.



9. Connect the smart key antenna.
10. Install the steering column gaiter panel.
 - Secure with the clips.
 - Tighten the Torx screws.
11. Install the steering column switch assembly.
 - Tighten the Torx bolts to 3 Nm (2 lb.ft).
12. Connect the clockspring and multifunction switch electrical connectors.
13. Install the steering column side trim panel.
 - Secure with the clips.
14. Install the steering column shrouds.
15. Install the instrument panel access panel.
 - Secure with the clips.
16. Install the closing trim panel.
 - Connect the electrical connector.
 - Secure the clip.
 - Tighten the screws.
17. Install the steering wheel.

For additional information, refer to: Steering Wheel (211-04, Removal and Installation).
18. Install the drivers side register trim panel.

For additional information, refer to: Driver Side Register Trim Panel (412-01, Removal and Installation).
19. Calibrate the steering angle sensor using the Land Rover approved diagnostic tool.

Vehicles with electric steering column

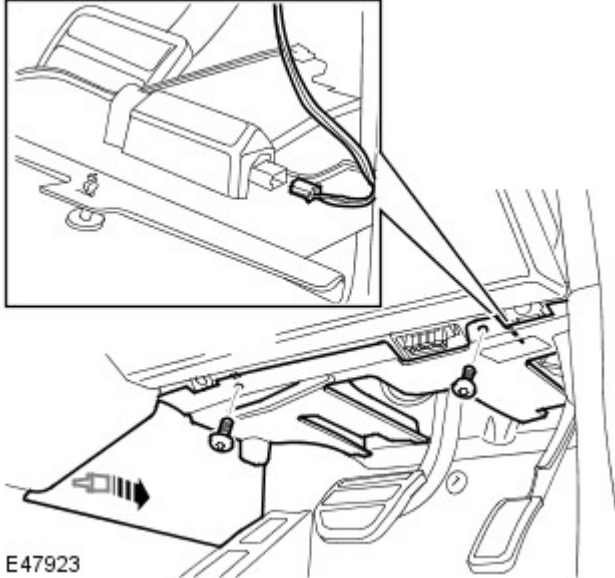
20. If a new electric steering column is fitted re-calibrate the steering column potentiometer using the Land Rover approved diagnostic system.

Steering Column - Steering Column Shaft

Removal and Installation

Removal

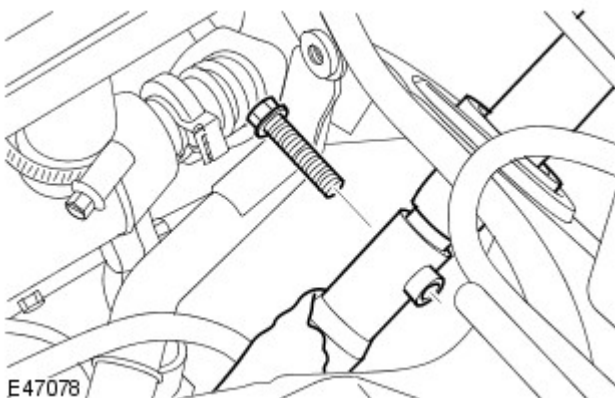
1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).



2. Remove the driver side closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.



3. Disconnect the steering column intermediate shaft from the steering column.
 - Note the fitted position.
 - Remove the special bolt and discard the nut.



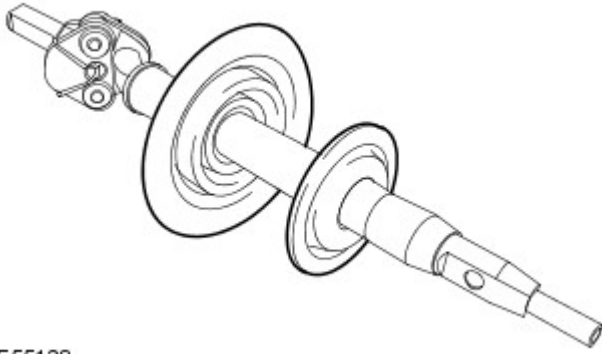
4. Disconnect the steering column intermediate shaft from the lower shaft.
 - Note the fitted position.
 - Remove and discard the bolt.

5. Remove the steering column intermediate shaft.
 - Release the 2 grommets.

6. NOTES:



Do not disassemble further if the



E55128

component is removed for access only.



Note the fitted position.

Remove the 2 intermediate shaft grommets.

Installation

1. Install the steering column intermediate shaft.
 - Install the grommets.
2. Connect the steering column intermediate shaft to the lower shaft.
 - Tighten the new bolt to 25 Nm (18 lb.ft).
3. Connect the steering column intermediate shaft to the steering column.
 - Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).
4. Install the driver side closing trim panel.
 - Connect the electrical connector.
 - Secure the clip.
 - Tighten the screws.
5. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

Steering Column - Steering Column Lower Shaft

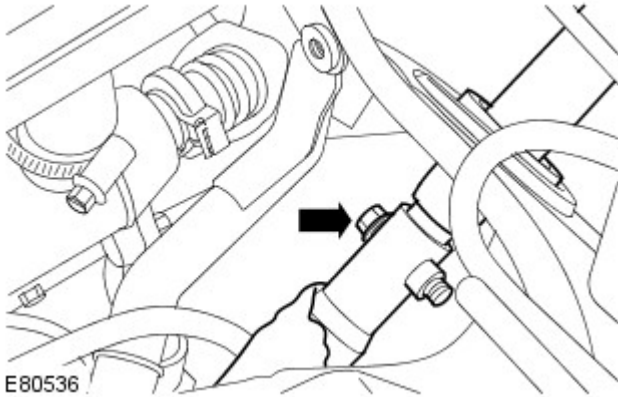
Removal and Installation

Removal



CAUTION: Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Turn the steering wheel to the straight ahead position.



E80536

3. CAUTIONS:



Make sure the steering wheel is in the straight ahead position.




Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

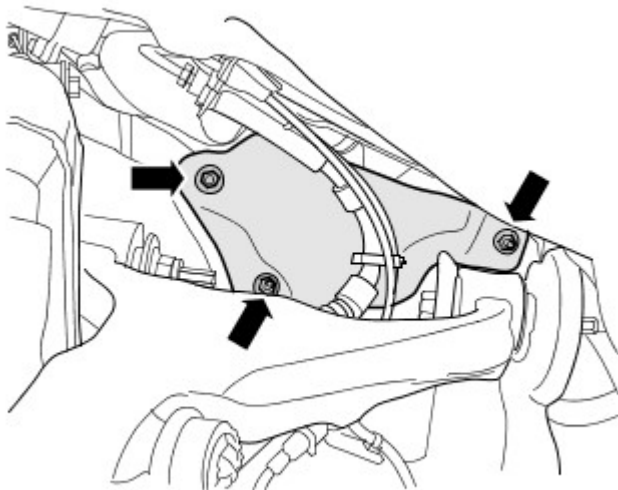


NOTE: Note the fitted position.


Remove and discard the steering column lower shaft upper bolt.

4.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.




E102486

5.  **CAUTION:** Make sure that the brake hose and the wiring harnesses are not damaged during the removal and installation of the heat shields.

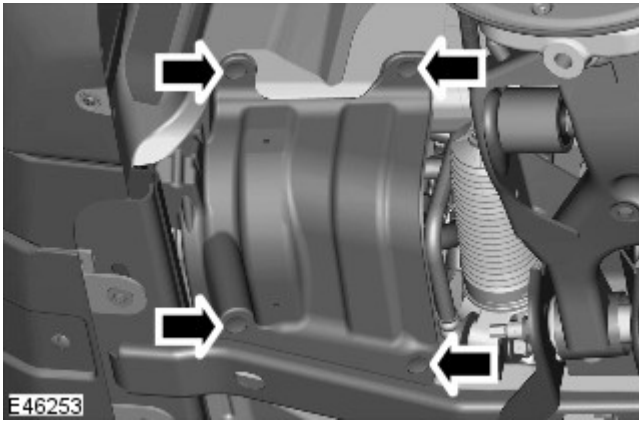
Remove the upper suspension arm heat shield for access.


- Remove the 3 nuts.

6.  **CAUTION:** Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

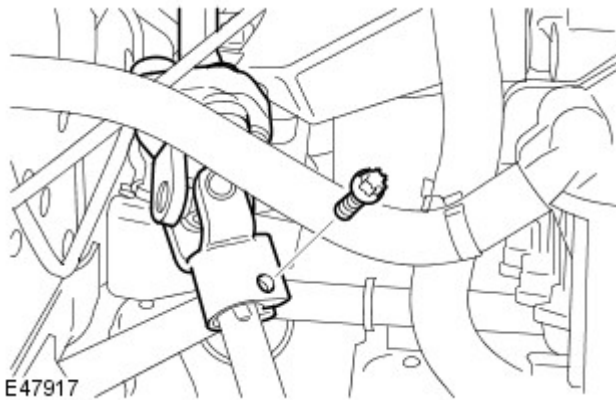
Disconnect the steering column lower shaft from the intermediate shaft.


7. Remove the fender splash shield lower trim.
 - Remove the 4 clips.



8.  **CAUTION:** Make sure that the steering is correctly positioned using the road wheels. Do not turn the steering wheel. Failure to follow this instruction may result in damage to the vehicle.

Turn the steering until access can be gained to the steering column lower shaft bolt.




9.  **CAUTION:** Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the clockspring and steering wheel switches may occur.

Remove and discard the steering column lower shaft bolt.

10. Remove the steering column lower shaft.
- Disconnect the steering column lower shaft from the steering gear.

Installation

1. Clean the component mating faces.

2.  **CAUTION:** Make sure that the road wheels are in the straight ahead position.

Install the steering column lower shaft.

- Connect the steering column lower shaft to the steering gear.
- Connect the steering column intermediate shaft to the lower shaft.

3. Lower the vehicle on the lift.

4.  **CAUTION:** Make sure that a new bolt is installed.

Install the steering column lower shaft upper bolt.

- Install a new bolt and tighten to 30 Nm (22 lb.ft).

5. Raise the vehicle on the lift.

6. **CAUTIONS:**

 Do not turn the steering wheel with the steering column lower shaft disconnected as damage to the

clockspring and steering wheel switches may occur.



Make sure that the steering is correctly positioned using the road wheels. Do not turn the steering wheel. Failure to follow this instruction may result in damage to the vehicle.

Turn the steering until access can be gained to the steering column lower shaft bolt.

7. Install the steering column lower shaft to steering gear bolt.
 - Install a new bolt and tighten to 30 Nm (22 lb.ft).
8. Install the fender splash shield lower trim.
 - Install the 4 clips.
9. Install the upper suspension arm heat shield.
 - Install the 3 nuts.
10. Lower the vehicle on the lift.

Steering Column - Steering Wheel


Removal and Installation

Removal

1. Refer to: Important Safety Instructions (100-00, Description and Operation).

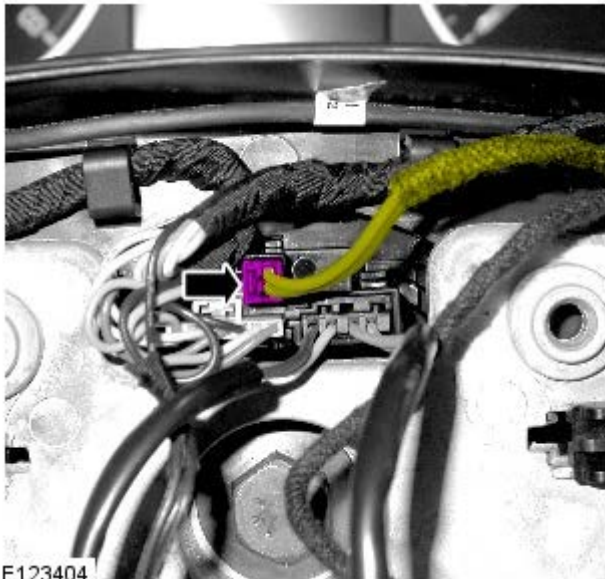
2. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

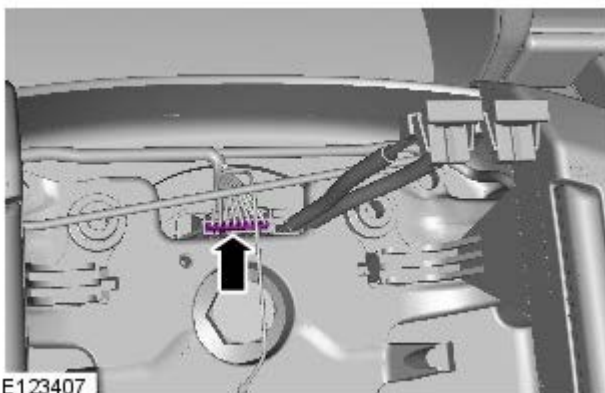
3.  **WARNING:** To avoid accidental deployment and possible personal injury, the backup power supply must be depleted before repairing or replacing any air bag supplementary restraints system (SRS) components. To deplete the backup power supply energy, disconnect the battery ground cable and wait for one minute. Failure to follow this instruction may result in personal injury.


Refer to: Driver Air Bag Module (501-20, Removal and Installation).

- 4.



- 5.

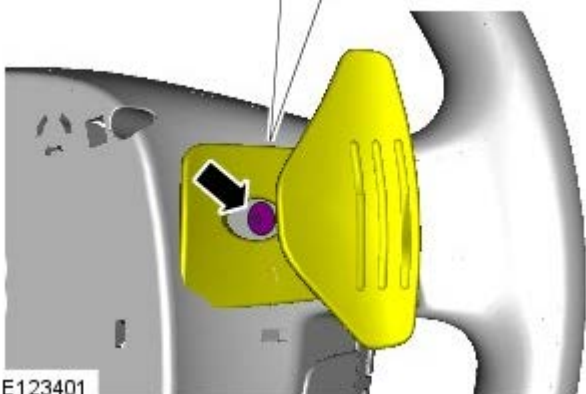
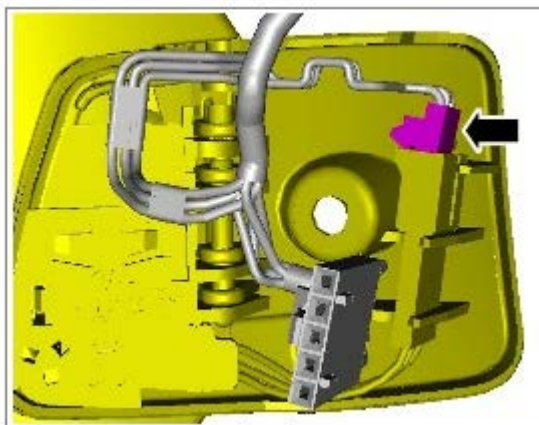


6.  **NOTE:** Note the steering wheel to column alignment marks.



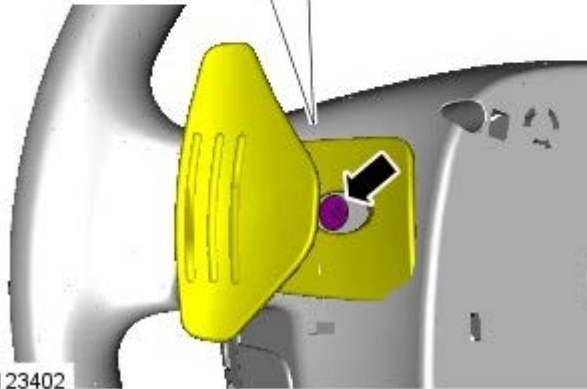
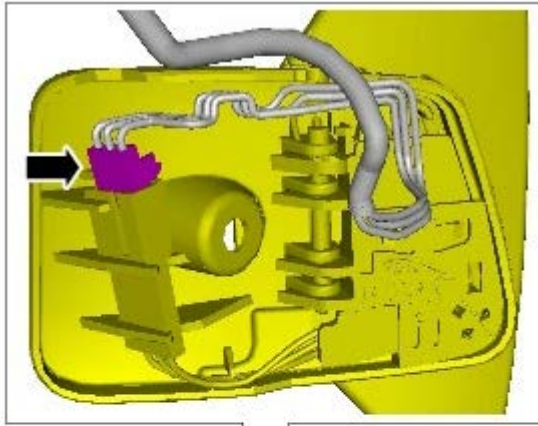
E123409

7.



E123401

8.



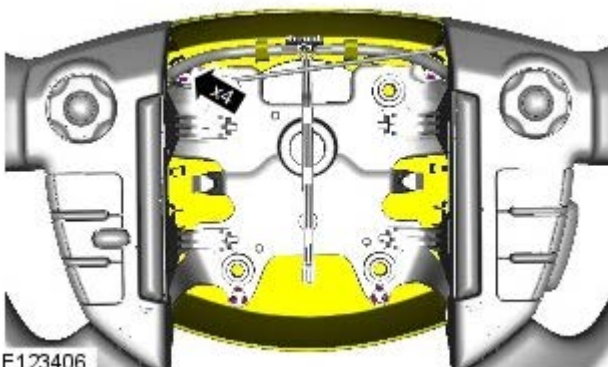
E123402

9.



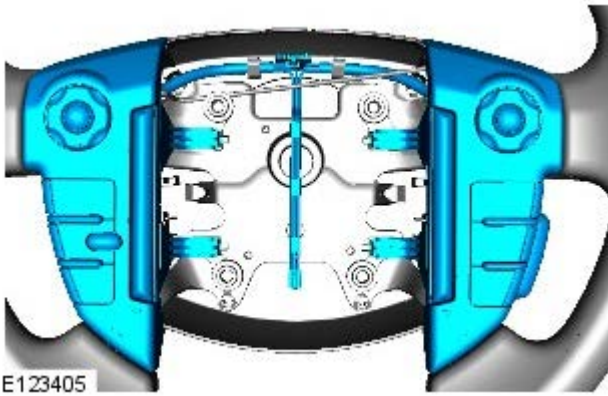
E123408

10.

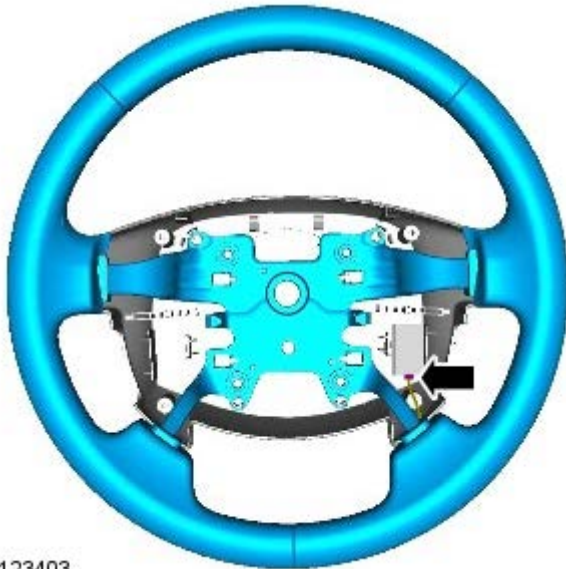


E123406

11.



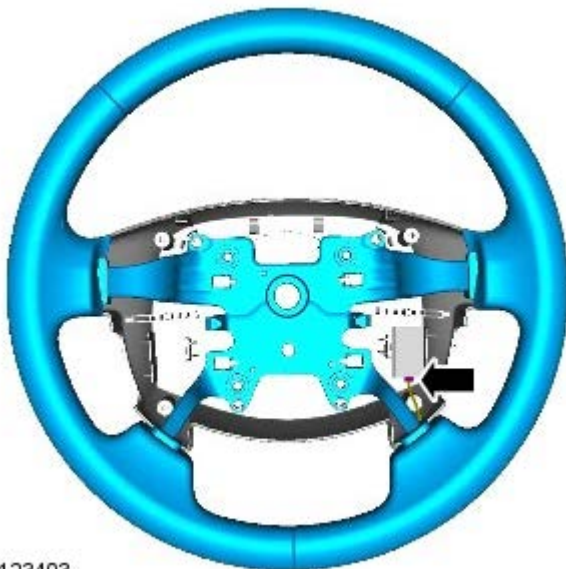
12.



E123403

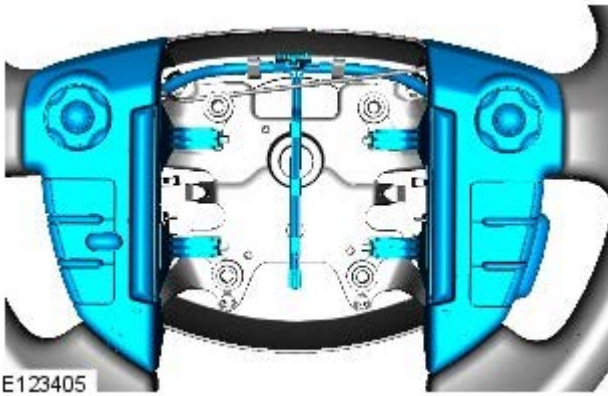
Installation

1.



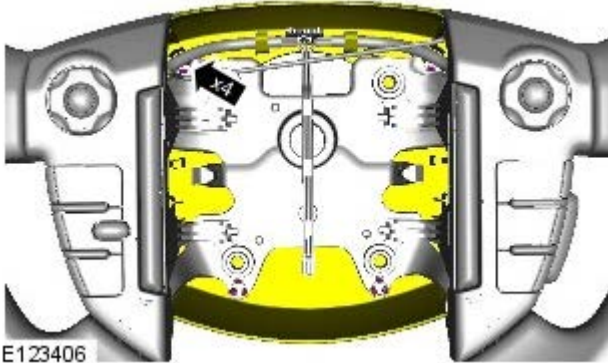
E123403

2.



E123405

3.



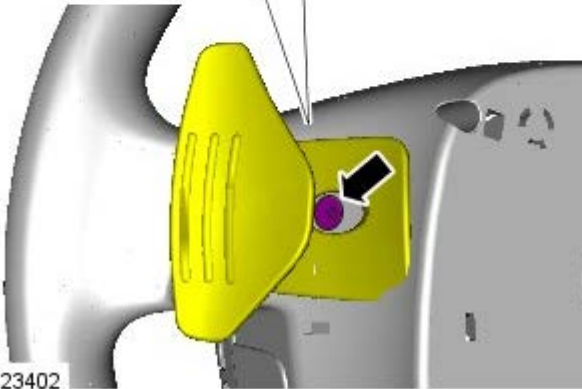
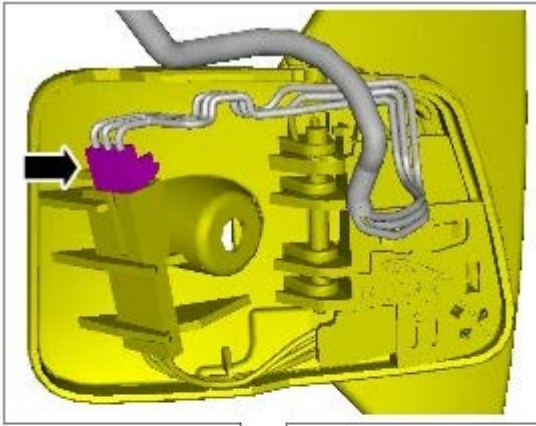
E123406

4. Torque: 6 Nm



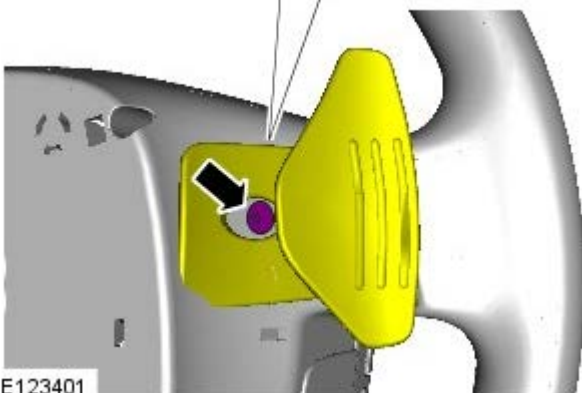
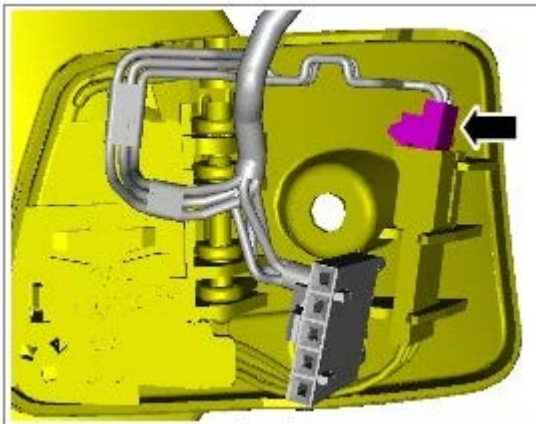
E123408

5. Torque: 3 Nm




E123402

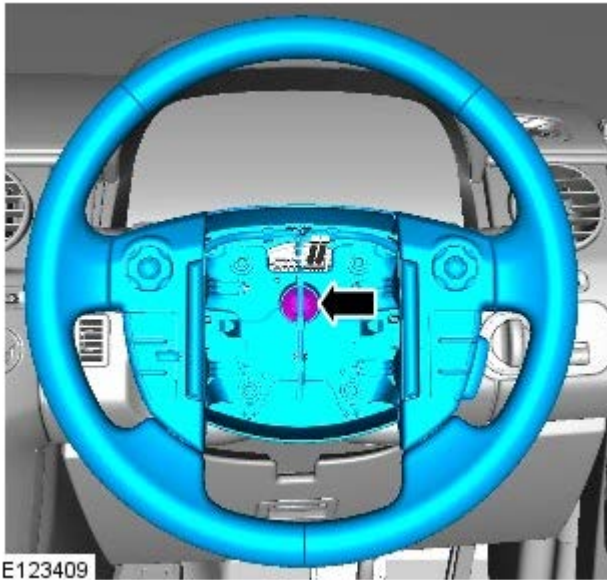
6. Torque: 3 Nm



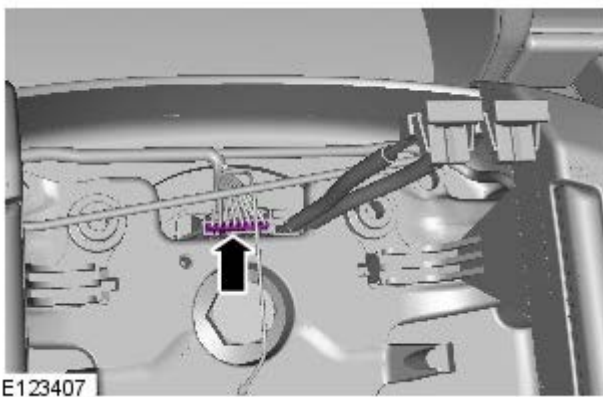
E123401

7.  NOTE: Note the steering wheel to column alignment marks.

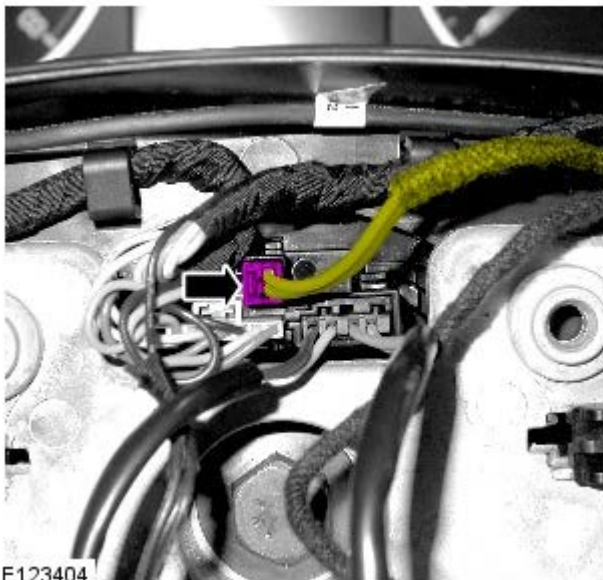
Torque: 63 Nm



8.



9.



10. Refer to: Driver Air Bag Module (501-20, Removal and Installation).

11. Connect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

Steering Column Switches -

Torque Specifications

Description	Nm	lb-ft
Steering column switch Torx screws	3	2

Steering Column Switches - Steering Column Switches

Diagnosis and Testing

Principles of Operation

For a detailed description of the steering column switches, refer to the relevant Description and Operation section of the workshop manual. REFER to:

Exterior Lighting (417-01, Description and Operation),
 Exterior Lighting (417-01, Description and Operation),
 Wipers and Washers (501-16, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Switches 	<ul style="list-style-type: none"> • Fuse(s) • Electrical connector(s) • Wiring harness

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, check for DTCs and refer to the DTC Index

DTC Index

For a list of diagnostic trouble codes that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00, Description and Operation).

Steering Column Switches - Steering Column Lock and Ignition Switch Housing

Removal and Installation

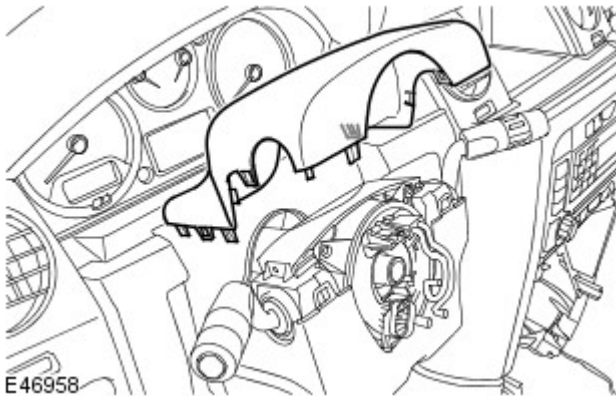
Removal



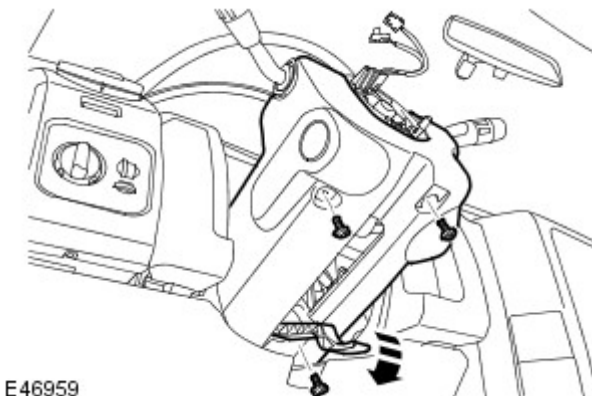
CAUTION: If the ignition lock cylinder and switch are both removed from the ignition switch assembly, the assembly shaft **MUST NOT** be rotated. Failure to comply will cause the incorrect operation of the lock, and the assembly must be replaced.

1. Fully extend the steering column for access.
2. Remove the steering wheel.
For additional information, refer to: Steering Wheel (211-04, Removal and Installation).

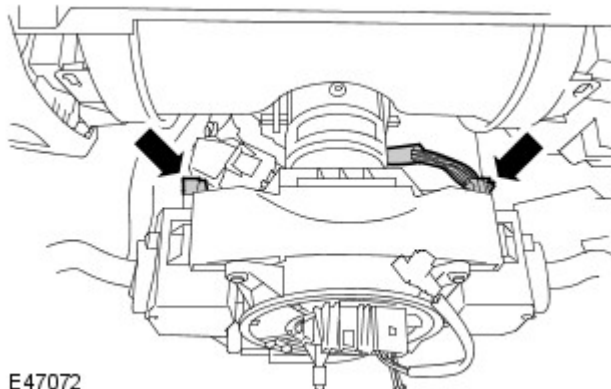
3. Remove the steering column upper shroud.
 - Release the 6 clips.



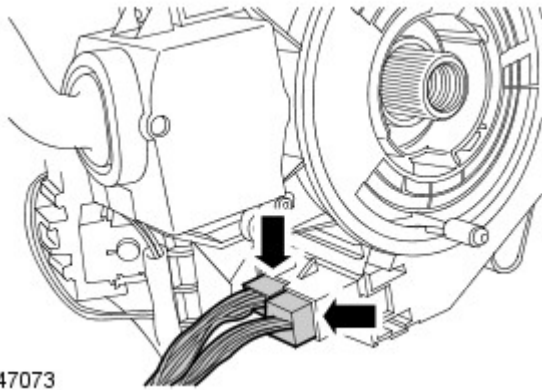
4. Remove the steering column lower shroud.
 - Remove the 3 Torx screws.
 - Release the steering column adjustment lever.



5. Disconnect the 2 electrical connectors from the steering column multifunction switches.

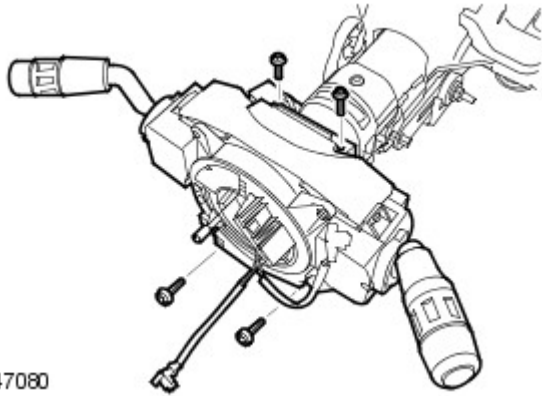


6. Disconnect the 2 electrical connectors from the clockspring.



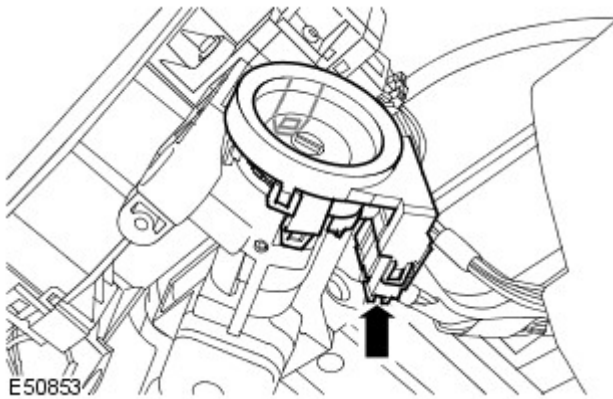
E47073

7. Remove the steering column switch assembly.
 - Remove the 4 Torx bolts.



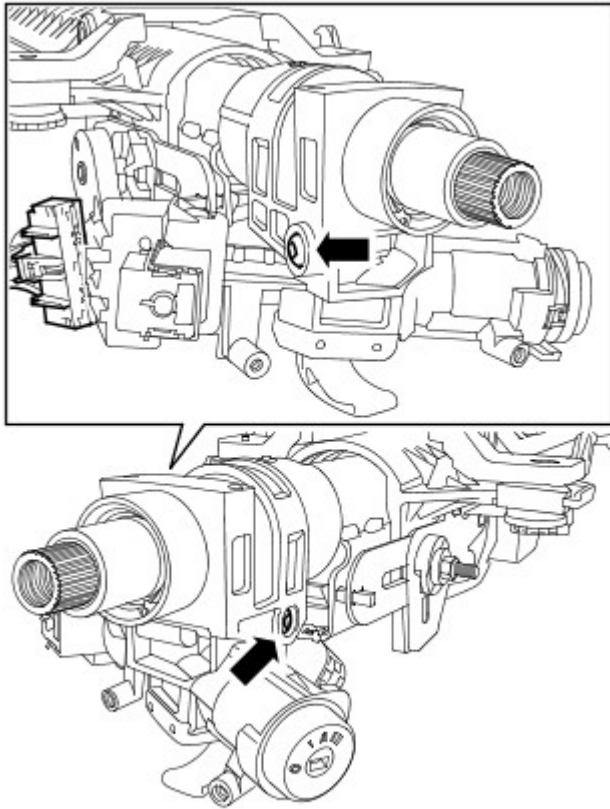
E47080

8. Remove the passive coil.
 - Disconnect the electrical connector.
 - Release the 2 clips.

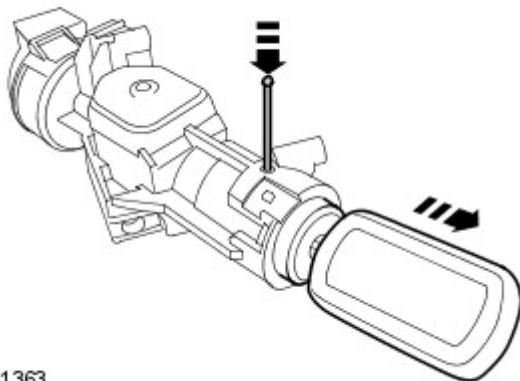


E50853

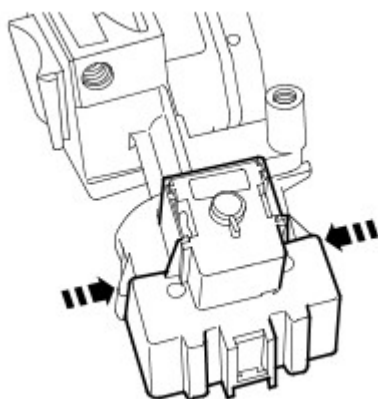
9. Remove the ignition switch assembly.
 - Remove and discard the 2 shear bolts.
 - Disconnect the electrical connector.




E50482



E51363



E51364

10.  **NOTE:** Do not disassemble further if the component is removed for access only.

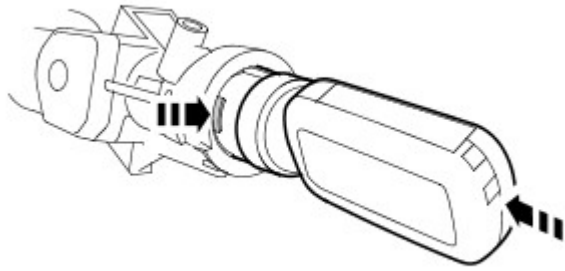
Remove the ignition lock cylinder.

- Turn the ignition key to position 1.
- Insert a pin, not exceeding 2 mm diameter, through the access hole in the ignition lock cylinder housing to depress the plunger, and release the ignition lock cylinder.

11. Remove the ignition switch.
- Depress the 2 clips.

Installation

1. Install the ignition switch.
 - Secure with the clips.
2. Install the ignition lock cylinder.
 - Turn the ignition key to position 1.
 - Locate into guides and depress the plunger.



E51372

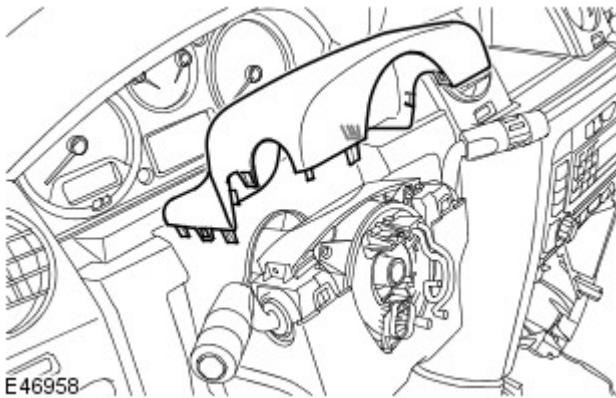
3. Install the passive coil.
 - Secure the clips.
 - Connect the electrical connector.
4. Install the ignition switch assembly.
 - Tighten the shear bolts until the heads shear off.
 - Connect the electrical connector.
5. Install the steering column switch assembly.
 - Tighten the Torx bolts to 3 Nm (2 lb.ft).
6. Connect the clockspring and multifunction switch electrical connectors.
7. Install the steering column shrouds.
8. Install the steering wheel.
For additional information, refer to: Steering Wheel (211-04, Removal and Installation).

Steering Column Switches - Ignition Switch

Removal and Installation

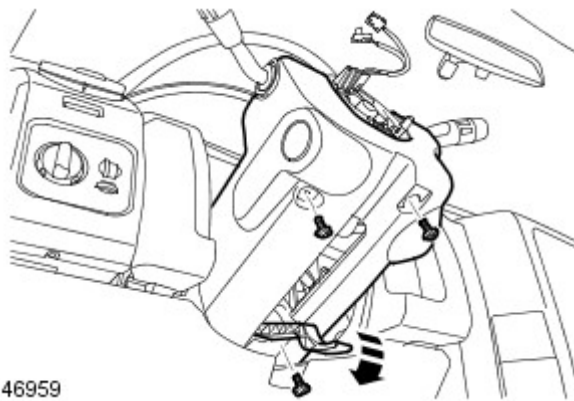
Removal

1. Fully extend the steering column for access.
2. Remove the steering column upper shroud.
 - Release the 4 clips.




E46958

3. Remove the steering column lower shroud.
 - Remove the 3 Torx screws.
 - Release the steering column adjustment lever.

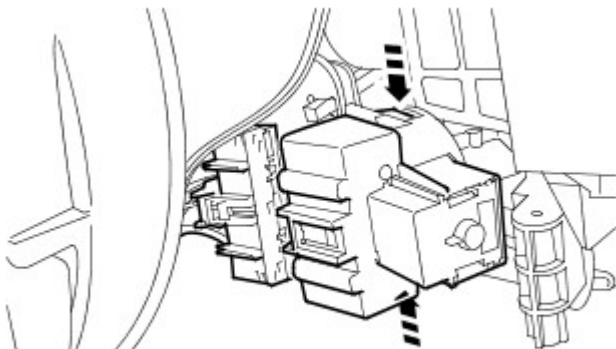


E46959

4.  **CAUTION:** The ignition key must be removed prior to the removal of the ignition switch.

Remove the ignition switch.

- Disconnect the electrical connector.
- Depress the 2 clips.



E47074

Installation

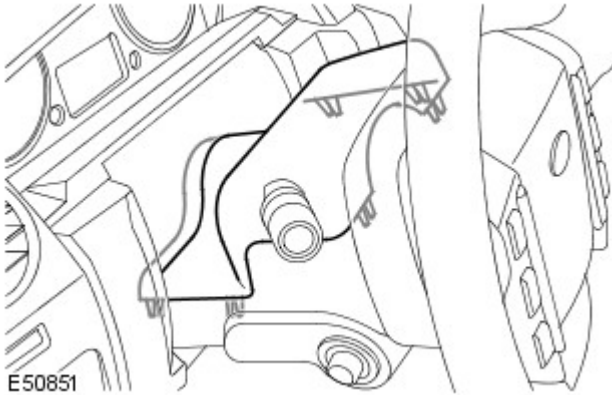
1. Install the ignition switch.
 - Secure with the clips.
 - Connect the electrical connector.
2. Install the steering column shrouds.
 - Tighten the Torx screws.
 - Secure the clips.
 - Secure the adjustment lever.

Steering Column Switches - Steering Column Multifunction Switch RH

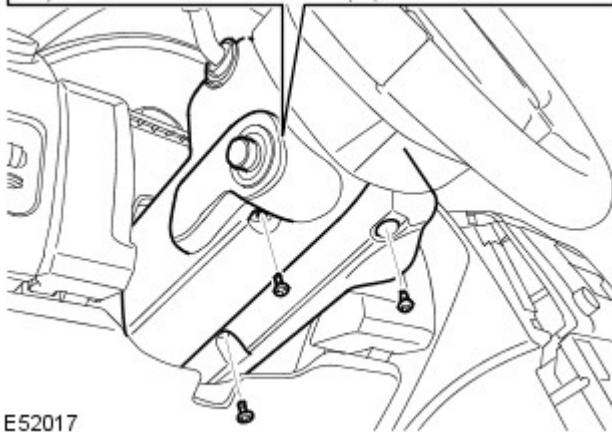
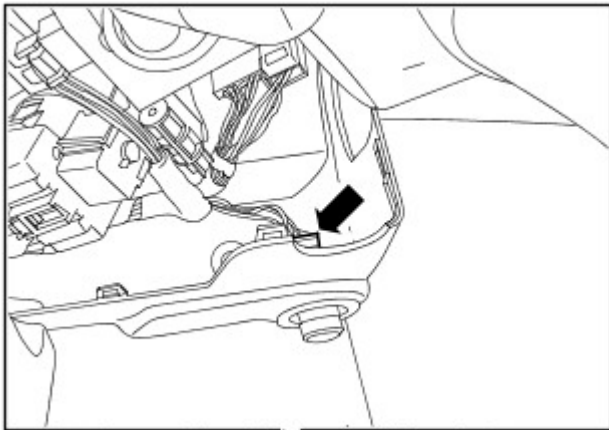
Removal and Installation

Removal

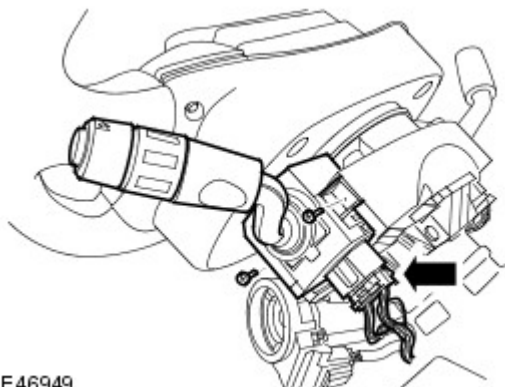
1. Fully extend the steering column for access.
2. Remove the steering column upper shroud.
 - Release the 6 clips.



3. Remove the steering column lower shroud.
 - Remove the 3 Torx screws.
 - Disconnect the electrical connector.



4. Remove the steering column multifunction switch.
 - Disconnect the electrical connector.
 - Remove the 2 screws.



E46949

Installation

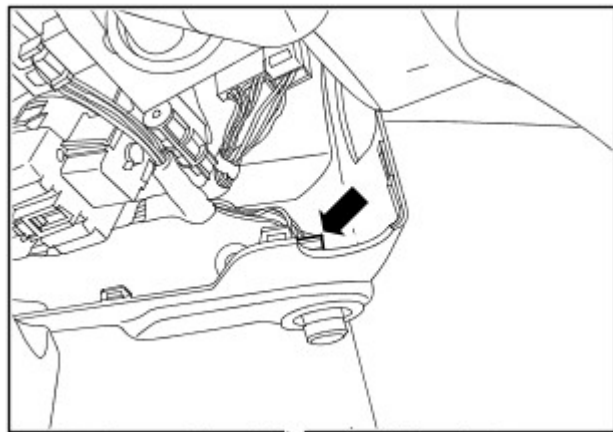
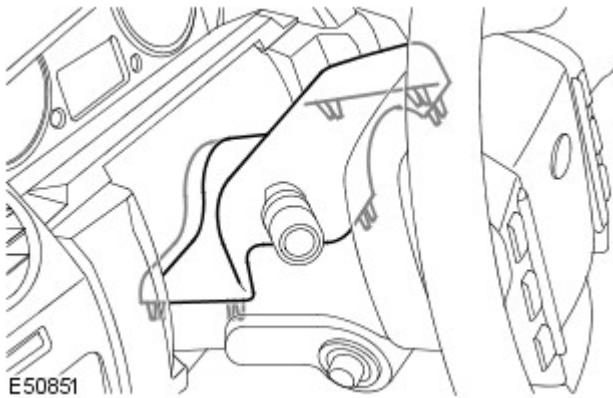
1. To install, reverse the removal procedure.

Steering Column Switches - Steering Column Multifunction Switch LH

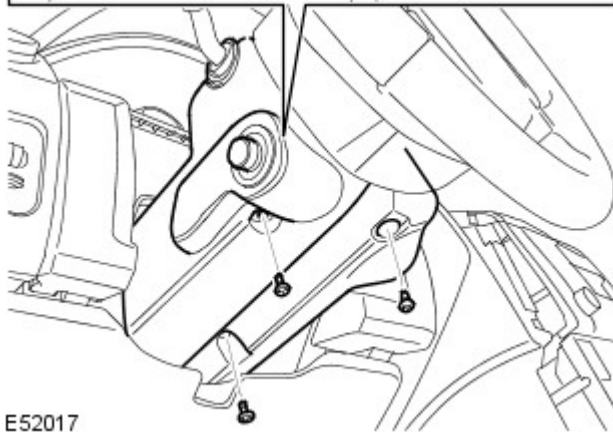
Removal and Installation

Removal

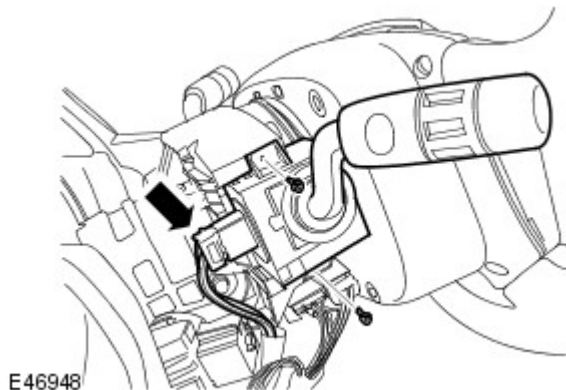
1. Fully extend the steering column for access.
2. Remove the steering column upper shroud.
 - Release the 6 clips.



3. Remove the steering column lower shroud.
 - Remove the 3 Torx screws.
 - Disconnect the electrical connector.



4. Remove the steering column multifunction switch.
 - Disconnect the electrical connector.
 - Remove the 2 screws.



Installation

1. To install, reverse the removal procedure.

Engine System - General Information - Engine TDV6 3.0L Diesel

Diagnosis and Testing

Principle of Operation

For a detailed description of the 3.0L Diesel engine, refer to the relevant Description and Operation section in the workshop manual. REFER to: (303-01 Engine - TDV6 3.0L Diesel)

- Engine (Description and Operation),
- Engine (Description and Operation),
- Engine (Description and Operation).

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Coolant level • Coolant leaks • Oil level • Oil leaks • Visibly damaged or worn parts • Loose or missing nuts or bolts 	<ul style="list-style-type: none"> • Wiring harness • Electrical connector(s) • Injectors • Glow plugs • 5V sensor supply • Sensor(s) • Cooling fan control module and motor • Engine Control Module (ECM)

If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

3. If the concern is not visually evident, verify the symptom and refer to the relevant Symptom Chart. Symptom Charts have been separated into **Leaks** and **Noise Vibration and Harshness (NVH)** for ease of use. Alternatively, check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Charts

Symptom Chart, Leaks

Symptom	Possible Cause	Action
External coolant leaks	<ul style="list-style-type: none"> • Damaged hose(s) • Damaged expansion tank • Damaged radiator • Leaking seals/gaskets • Cracked/damaged casings 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual and test the cooling system for leaks
Internal coolant leaks Note: This may be indicated by the production of white smoke from the exhaust	<ul style="list-style-type: none"> • Leaking seals/gaskets • Cracked/damaged casings 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual and test the cooling system for leaks
Engine overheats	<ul style="list-style-type: none"> • Insufficient coolant • Insufficient oil • Pressure cap fault • Thermostat not opening • Coolant pump failure • Cooling fan failure 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual and test the cooling system for leaks • Check the engine oil • Test the operation of the thermostat • Test the operation of the coolant pump • Test the operation of the cooling fan
Engine takes too long to reach operating temperature	<ul style="list-style-type: none"> • Thermostat stuck open 	<ul style="list-style-type: none"> • Test the operation of the thermostat
External oil leaks	<ul style="list-style-type: none"> • Gaskets • Seals • Oil pipes • Oil filter • Oil cooler • Damaged/cracked casings • Crankcase ventilation system • Piston ring blow- 	<ul style="list-style-type: none"> • Clean and confirm the area of the leak. Check the visual condition of oil carrying components • Check the crankcase ventilation system • Carry out a compression test, GO to Pinpoint Test A.

	by	
Internal oil leaks (leaks into coolant or combustion chamber) Note: This may be indicated by the production of blue smoke from the exhaust	<ul style="list-style-type: none"> • Gaskets • Seals • Damaged/cracked casings • Worn valve guides • Worn cylinder bores/pistons • Broken piston rings 	<ul style="list-style-type: none"> • Check for traces of oil in the coolant. Check for evidence of oil in the combustion chambers (deposits on the glow plugs, etc). Confirm oil consumption and vehicle usage with the owner/driver. Carry out an oil consumption test, GO to Pinpoint Test B.

Symptom Chart, NVH



NOTE: As the checks suggested here are open to interpretation, they should be used as a guide only. Descriptions of noises, etc, are in general terms, so depend on a degree of experience on the part of the technician.

Symptom	Possible Cause	Action
Rattle/ticking from top of engine	<ul style="list-style-type: none"> • Valve gear noise • Camshaft bearing noise • Timing belt noise • Tensioner noise • Vacuum pump noise • High pressure fuel pump noise 	<ul style="list-style-type: none"> • Check the engine oil pressure, GO to Pinpoint Test C. • Check the function of the hydraulic tappets and the camshaft condition. Check the camshaft bearings • Check the timing belt and tensioner • Check the vacuum pump • Check the high pressure fuel pump
Growl from top of engine	<ul style="list-style-type: none"> • High pressure fuel pump belt noise • High pressure fuel pump belt tensioner noise 	<ul style="list-style-type: none"> • Check the high pressure fuel pump belt • Check the high pressure fuel pump belt tensioner
Squeaking/creaking/squeal from front of engine	<ul style="list-style-type: none"> • Auxiliary drive belt • Auxiliary drive belt tensioner • Driven components on auxiliary drive belt 	<ul style="list-style-type: none"> • Check the auxiliary drive belt • Check the auxiliary drive belt tensioner • Check the driven components
Whine/slap/growl from front of engine	<ul style="list-style-type: none"> • Auxiliary drive belt • Auxiliary drive belt tensioner • Driven components on auxiliary drive belt • Timing belt noise • Timing belt tensioner noise 	<ul style="list-style-type: none"> • Check the auxiliary drive belt • Check the auxiliary drive belt tensioner • Check the driven components • Check the timing belt • Check the timing belt tensioner
Knock from lower half of engine (often worse with a cold engine)	<ul style="list-style-type: none"> • Piston slap • Piston pin noise • Connecting rod bearing noise 	<ul style="list-style-type: none"> • Check the engine oil pressure, GO to Pinpoint Test C. Check piston, cylinder bore, piston pin and connecting rod bearing for excess wear
Knock/rumble from lower half of engine (often worse on overrun)	<ul style="list-style-type: none"> • Main bearing noise 	<ul style="list-style-type: none"> • Check the engine oil pressure, GO to Pinpoint Test C. Check connecting rod bearing for excess wear
Misfire/rough running	<ul style="list-style-type: none"> • Engine management system • Fuel charging and controls • Exhaust Gas Recirculation (EGR) system • Burnt/sticking valves • Worn valve guides • Worn cylinder 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Carry out a compression test, GO to Pinpoint Test A. Check for excess wear in engine components

- bores/pistons
- Broken piston rings
- Damaged/cracked casings

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (PCM) (100-00, Description and Operation).

Pinpoint Tests



NOTE: Where reference is made to 'suitable equipment', this refers to standard workshop equipment. Refer to the operating instructions for your own equipment when performing any tests.

PINPOINT TEST A : CHECK THE CYLINDER COMPRESSIONS



WARNING: Only compression testers able to read the higher compression pressures found in diesel engines should be used. Failure to follow this instruction may result in personal injury.



NOTE: Where possible, compression testing should be carried out on an engine at operating temperature.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CARRY OUT A DRY CYLINDER COMPRESSION TEST	
	1 Make sure the parking brake is applied and that the selector lever is in park.
	2 Set the ignition status to OFF .
	3 Remove the starter relay.
	4 Disconnect the starter motor solenoid connector.
	5 Connect a suitable remote starter device to the starter motor solenoid.
	6 Remove the glow plugs.
	7 Install adaptor 303-1131 in place of the glow plug in the first cylinder to be tested.
	8 Connect a suitable compression tester to the adaptor. See warning above.
	9 Using the remote starter device, crank the engine a minimum of five revolutions.
	10 Record the compression figure and the number of revolutions taken to reach it.
	11 Repeat steps 7 - 10 above for the remaining cylinders, cranking the engine for a similar number of revolutions each time.
	12 Compare the compression figures across all the cylinders.
	Are the compression figures within 10% of each other? Yes Unless the compression figures are universally very low (experience will indicate this), check for other causes for the customer complaint. No GO to A2.

A2: CARRY OUT A WET CYLINDER COMPRESSION TEST



CAUTION: If engine oil is introduced into the cylinders, run the engine at 2,000 rpm for a minimum of ten minutes after completing testing to prevent damage to the catalytic converters. Failure to follow this instruction may result in damage to the vehicle.



NOTE: There is a combustion chamber in the top of each piston. Make sure that the oil is not allowed to run into this chamber.

	1 Using a suitable oil can with a flexible spout, introduce a small amount of clean engine oil into the cylinder just before testing, such that the oil is able to run between the piston and the cylinder bore.
	2 Repeat steps 7 - 10 from the test above, introducing oil into each cylinder just before testing.
	3 Compare the compression figures across all the cylinders.
	Is the compression figure higher than the dry test? Yes A higher figure following the introduction of oil may indicate a worn or damaged cylinder bore, piston and/or piston rings. Disassembly would be required to confirm this. No If the compression figure is unaffected by the introduction of oil, but the figure is still less than 90% of the other cylinders, this may indicate a burnt and/or sticking valve, leaking head gasket, etc. Disassembly would be required to confirm this. Clear any DTCs which may have been induced by the test.

PINPOINT TEST B : OIL CONSUMPTION TEST



NOTE: Oil consumption will vary, depending on a number of factors. New engines will normally use more

oil than 'run-in' engines, although a guideline would be to expect 16,000 Km (10,000 miles) per liter.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHECK FOR EXCESSIVE OIL CONSUMPTION	
	1 Start the engine and allow it to run until it reaches normal operating temperature.
	2 Make sure the vehicle is parked on a level surface and set ignition status to OFF .
	3 Allow to settle for at least five minutes.
	4 Check the oil level.
	5 Correct the level, if necessary, and record the reading and mileage in the vehicle history.
	6 Make sure that the owner/driver is aware that a test is being carried out, and that they should not top-up their oil level for the duration of the test, but should check the level every 160-240 Km (100-150 miles).
	7 When the oil level reaches the ADD mark, the customer should bring the vehicle in to be checked.
	8 Top-up the oil to the level at the beginning of the test and record the amount of oil needed to do so, and the mileage covered in the course of the test.
	9 From this, the consumption can be calculated, and a decision made as to whether or not the consumption is considered excessive.
	Is the consumption excessive for the mileage and/or use? Yes Disassembly will be required to check the components indicated in the symptom chart. No No further action is required.

PINPOINT TEST C : CHECK THE ENGINE OIL PRESSURE

NOTES:



Check and, if necessary, top-up the engine oil level before beginning this test.





Where reference is made to 'suitable equipment', this refers to standard workshop equipment. Refer to the operating instructions for your own equipment when performing any tests.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: CHECK FOR LOW ENGINE OIL PRESSURE	
	1 Remove the oil pressure sensor.
	2 Connect a suitable oil pressure gauge in place of the oil pressure sensor.
	3 Start the engine and check for leaks at the gauge connection.
	4 Allow the engine to idle and monitor the oil pressure.
	5 Raise the engine speed to 2,500 rpm and monitor the oil pressure.
	Is the oil pressure less than 0.50 bar (7.25 psi) between idle and 2,500 rpm? Yes GO to C2. No GO to C3.
C2: CHECK FOR LOW ENGINE OIL PRESSURE AT ENGINE SPEEDS GREATER THAN 2,500 RPM	
	1 Raise the engine speed to above 2,500 rpm and monitor the oil pressure.
	Is the oil pressure less than 1.0 bar (14.5 psi) at engine speeds greater than 2,500 rpm? Yes Pressure this low may indicate a problem with: oil pump, filtering, clearances within the engine. Check if there are any other indications of engine faults (noise, etc), refer to the symptom chart above. No GO to C3.
C3: CHECK FOR HIGH ENGINE OIL PRESSURE	
	1 Monitor the engine oil pressure at varying engine speeds.
	Does the oil pressure reach 4.0 bar (58 psi)? Yes Pressure this high may indicate a blockage in the lubrication system. If this is not resolved, high oil pressure will lead to engine oil leaks and other failures. No If the oil pressure stays in the band between 0.50 bar (7.25 psi) and 1.0 bar (14.5 psi) this would be considered normal.

Engine System - General Information - Engine V6 S/C 3.0L Petrol

Diagnosis and Testing

Special Tool(s)

 <p>303-1451</p> <p>E136285</p>	Oil pressure testing adaptor, 303-1451
 <p>303-871</p> <p>E57919</p>	Oil pressure testing gauge, 303-871

Principle of Operation

For a detailed description of the 3.0L engine, refer to the relevant Description and Operation sections in the workshop manual. REFER to:

[Engine](#) (303-01B Engine - V6 S/C 3.0L Petrol, Description and Operation),
[Engine](#) (303-01D, Description and Operation),
[Engine](#) (303-01D, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection

Mechanical
<ul style="list-style-type: none"> • Engine oil level • Coolant level • Transmission fluid level • Fuel level • Coolant leaks • Oil leaks • Fuel leaks • Visibly damaged or worn parts • Loose or missing nuts or bolts • Fuel contamination/grade/quality • Sensor installation/condition • Viscous fan and solenoid

3. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the symptom chart.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

NOTES:



If an engine is suspect, and the vehicle remains under the Manufacturers warranty refer to the Warranty Policy and Procedure manual (section B1.2), or determine if any prior approval programme is in operation, prior

to the installation of a new engine.



Due to the possibility of loose carbon, that has become trapped between the valve face and seat, effecting the pressure readings, when carrying out a compression test and some cylinders are found to have low pressures, install the spark plugs, road test the vehicle and re-test the suspect cylinders. If the correct pressures are restored, no further action is required.

Symptom	Action
All engine related issues	<ul style="list-style-type: none"> • Check ECM for Diagnostic Trouble Codes (DTCs) and refer to DTC Index.
Difficult to start hot and cold	<ul style="list-style-type: none"> • Carry out general engine checks: <ul style="list-style-type: none"> - Compression test. Refer to component tests in this section. - Valve clearances - Spark plug condition and color
Poor idle	<ul style="list-style-type: none"> • Ensure the air intake system is free from leaks • Carry out general engine checks: <ul style="list-style-type: none"> - Compression test. Refer to component tests in this section. - Valve clearances - Spark plug condition and color • Check for collapsed catalytic converter/blocked exhaust system • Check long and short term fuel trim datalogger signals <ul style="list-style-type: none"> - Readings up to 10%: may be considered as acceptable if the readings are equal bank to bank - Positive readings of between 10-20%: check for air leaks in air intake system - Negative readings of between 10-20%: check for over fuelling e.g. leaking injectors, high fuel pressure - Readings above 20%: check for DTCs and refer to DTC Index. • Carry out a vacuum gauge check. Refer to component tests in this section
Insufficient power/Insufficient compression	<ul style="list-style-type: none"> • Ensure the air intake system is free from leaks • Carry out general engine checks: <ul style="list-style-type: none"> - Compression test. Refer to component tests in this section. - Valve clearances - Spark plug condition and color • Check for collapsed catalytic converter/blocked exhaust system • Check long and short term fuel trim datalogger signals <ul style="list-style-type: none"> - Readings up to 10%: may be considered as acceptable if the readings are equal bank to bank - Positive readings of between 10-20%: check for air leaks in air intake system - Negative readings of between 10-20%: check for over fuelling e.g. leaking injectors, high fuel pressure - Readings above 20%: check for DTCs and refer to DTC Index. • Carry out a vacuum gauge check. Refer to component tests in this section
Oil consumption	<ul style="list-style-type: none"> • Carry out oil leak check followed by an oil consumption test. Refer to the component tests in this section • If oil consumption is excessive: • Check the integrity of the engine breather system • Carry out general engine checks: <ul style="list-style-type: none"> - Compression test. Refer to component tests in this section. - Valve clearances - Spark plug condition and color
Noise	<ul style="list-style-type: none"> • Refer to the Special Service Messages on the Electronic Product Quality Report (EPQR) system for sound files. If the symptom does NOT compare to any of the sound files, contact Dealer Technical Support (DTS)

DTC Index

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: V6 3.0L S/C Petrol, DTC: Engine Control Module \(ECM\)](#) (100-00 General Information, Description and Operation).

Component Tests

Engine Oil Leaks



NOTE: Before installing new gaskets or oil seals, make sure that the fault is clearly established.

If the oil leak cannot be identified clearly by a visual inspection, carry out an Ultraviolet test:

Fluorescent Oil Additive Method

1. Clean the engine with a suitable cleaning fluid (brake cleaner).

2. Drain the engine oil and refill with recommended oil, premixed with Diesel Engine Oil Dye or equivalent. Use a minimum 14.8 ml (0.5 ounce) to a maximum 29.6 ml (1 ounce) of fluorescent additive to all engines. If oil is not premixed, fluorescent additive must first be added to the crankcase.
3. Run engine for 15 minutes. Stop the engine and inspect all seal and gasket areas for leaks using a 12 Volt Master UV Diagnostic Inspection Kit or equivalent. A clear bright yellow or orange area will identify leak. For extremely small leaks, several hours may be required for the leak to appear.
4. As necessary, pressurize the main oil gallery system to locate leaks due to incorrectly sealed, loose or cocked plugs. If the flywheel bolts leak oil, look for sealer on the threads.
5. Repair all leaks as necessary.

Compression Test

General Remarks

NOTES:



Removing fuses and disconnecting electrical components may cause the Engine Control Module (ECM) to log Diagnostic Trouble Codes (DTCs). After the measurements have been carried out, DTCs should be cleared from memory by connecting to the Manufacturer Approved Diagnostic System.



Only check the compression pressure with the valves set to the prescribed clearance (if this can be adjusted).

The compression pressure should be checked with the engine at normal operating temperature.

Check the Compression Pressure



WARNING: Move gear selector lever to 'P' position. Failure to follow this instruction may result in personal injury.

1. Remove the fuel pump relay.
2. Start the engine - the engine will start, run for a few seconds then stall.
3. Remove the spark plugs.
4. Install the compression tester.
5. Install an auxiliary starter switch in the starting circuit. With the ignition switch OFF, using the auxiliary starter switch, crank the engine a minimum of five compression strokes and record the highest reading. Note the approximate number of compression strokes required to obtain the highest reading.
6. Repeat the test on each cylinder, cranking the engine approximately the same number of compression strokes.
7. Install the removed components in reverse order, observing the specified tightening torques.
8. Clear all DTCs from the ECM.

Interpretation of the Results



NOTE: Due to the possibility of loose carbon that has become trapped between the valve face and seat effecting the pressure readings, when carrying out a compression test and cylinders are found to have low pressures, install the spark plugs, road test the vehicle and re-test the suspect cylinders. If the correct pressures are restored, no further action is required.

The indicated compression pressures are considered within specification if the lowest reading cylinder is within 75% of the highest reading.

If the cylinder pressures are found to be low, carry out a leakdown test to determine the location of the fault (if any leakback can be heard through the engine breather system suspect the piston rings, if any leakback can be heard through the inlet system suspect the inlet valve or seat, if any leakback can be heard through the exhaust manifold suspect the exhaust valve or seat. If the measurements for two cylinders next to each other are both too low then it is very likely that the cylinder head gasket between them is burnt through. This can also be recognized by traces of engine oil in the coolant and/or coolant in the engine oil).

Oil Consumption Test

The amount of oil an engine uses will vary with the way the vehicle is driven in addition to normal engine-to-engine variation. This is especially true during the first 16,100 km (10,000 miles) when a new engine is being broken in or until certain internal components become conditioned. Vehicles used in heavy-duty operation may use more oil. The following are examples of heavy-duty operation:

- Trailer towing applications
- Severe loading applications

- Sustained high speed operation

Engines need oil to lubricate the following internal components:

- Cylinder block cylinder walls
- Pistons and piston rings
- Intake and exhaust valve stems
- Intake and exhaust valve guides
- All internal engine components

When the pistons move downward, a thin film of oil is left on the cylinder walls. As the vehicle is operated, some oil is also drawn into the combustion chambers past the intake and exhaust valve stem seals and burned.

The following are examples of conditions that can affect oil consumption rates:

- Engine size
- Operator driving habits
- Ambient temperatures
- Quality and viscosity of oil
- Engine is being run in an overfilled condition (check the oil level at least five minutes after a hot shutdown with the vehicle parked on a level surface. The oil level should not be above the top of the cross-hatched area and the letter "F" in FULL).

Operation under varying conditions can frequently be misleading. A vehicle that has been run for several thousand miles on short trips or in below-freezing ambient temperatures may have consumed a "normal" amount of oil. However, when checking the engine oil level, it may measure up to the full mark on the oil level indicator due to dilution (condensation and fuel) in the engine crankcase. The vehicle then might be driven at high speeds on the highway where the condensation and fuel boil off. The next time the engine oil is checked it may appear that a liter of oil was used in about 160 km (100 miles). Oil consumption rate is about one liter per 2,400 km (1,500 miles).

Make sure the selected engine oil meets Jaguar specification and the recommended API Performance category "SG" and SAE viscosity grade as shown in the vehicle Owner's Guide. It is also important that the engine oil is changed at the intervals specified for the typical operating conditions.

The following diagnostic procedure is used to determine the source of excessive oil consumption.



NOTE: Oil use is normally greater during the first 16,100 km (10,000 miles) of service. As mileage increases, oil use decreases. High speed driving, towing, high ambient temperature and other factors may result in greater oil use.

1. Define excessive consumption, such as the number of miles driven per liter of oil used. Also determine customer's driving habits, such as sustained high speed operation, towing, extended idle and other considerations.
2. Verify that the engine has no external oil leaks as described under Engine Oil Leaks in this section.
3. Carry out an oil consumption test:
 - Run the engine to normal operating temperature. Switch engine OFF and allow oil to drain back for at least five minutes .
 - With vehicle parked on level surface, check the engine oil level.
 - If required, add engine oil to set level exactly to the FULL mark.
 - Record the vehicle mileage.
 - Instruct the customer to return for a level check after driving the vehicle as usual for 1,610 km (1000 miles).
 - Check the oil level under the same conditions and at the same location as the initial check.



NOTE: If the oil consumption rate is unacceptable go to Step 4.

4. Check the Positive Crankcase Ventilation (PCV) system. Make sure the system is not plugged.
5. Check for plugged oil drain-back holes in the cylinder head and cylinder block.
6. If the condition still exists after carrying out the above tests go to step 9.
7. Carry out a cylinder compression test. Refer to the Compression Test procedure in this section. This can help determine the source of oil consumption such as valves, piston rings or other areas.
8. Check valve guides for excessive guide clearance. Install new valve stem seals after verifying valve guide clearance.
9. Worn or damaged internal engine components can cause excessive oil consumption. Small deposits of oil on the tips of the spark plugs can be a clue to internal oil consumption.

Intake Manifold Vacuum Test

Bring the engine to normal operating temperature. Connect a vacuum gauge or equivalent to the intake manifold. Run the engine at the specified idle speed.

The vacuum gauge should read between 51-74 kPa (15-22 in-Hg) depending upon the engine condition and the altitude at which the test is performed. Subtract 4.0193 kPa (1 in-Hg) from the specified reading for every 304.8

m (1,000 feet) of elevation above sea level.

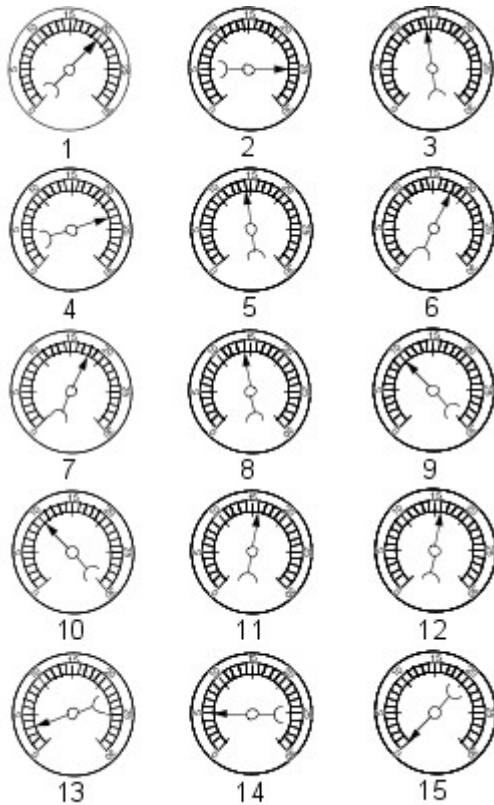
The reading should be steady. As necessary, adjust the gauge damper control (where used) if the needle is fluttering rapidly. Adjust damper until needle moves easily without excessive flutter.

Interpreting Vacuum Gauge Readings

A careful study of the vacuum gauge reading while the engine is idling will help pinpoint trouble areas. Always conduct other appropriate tests before arriving at a final diagnostic decision. Vacuum gauge readings, although helpful, must be interpreted carefully.

Most vacuum gauges have a normal band indicated on the gauge face.

The following are potential gauge readings. Some are normal; others should be investigated further.



VUJ0001694

1. **NORMAL READING:** Needle between 51-74 kPa (15-22 in-Hg) and holding steady.
2. **NORMAL READING DURING RAPID ACCELERATION:** When the engine is rapidly accelerated, the needle will drop to a low (not to zero) reading. When the throttle is suddenly released, the needle will snap back up to a higher than normal figure.
3. **NORMAL FOR HIGH-LIFT CAMSHAFT WITH LARGE OVERLAP:** The needle will register as low as 51 kPa (15 in-Hg) but will be relatively steady. Some oscillation is normal.
4. **WORN RINGS OR DILUTED OIL:** When the engine is accelerated, the needle drops to 0 kPa (0 in-Hg). Upon deceleration, the needle runs slightly above 74 kPa (22 in-Hg).
5. **STICKING VALVES:** When the needle remains steady at a normal vacuum but occasionally flicks (sharp, fast movement) down and back about 13 kPa (4 in-Hg), one or more valves may be sticking.
6. **BURNED OR BENT VALVES:** A regular, evenly-spaced, downscale flicking of the needle indicates one or more burned or damaged valves. Insufficient hydraulic valve tappet or hydraulic lash adjuster clearance will also cause this reaction.
7. **POOR VALVE SEATING:** A small but regular downscale flicking can mean one or more valves are not seating correctly.
8. **WORN VALVE GUIDES:** When the needle oscillates over about a 13 kPa (4 in-Hg) range at idle speed, the valve guides could be worn. As engine speed increases, the needle will become steady if guides are responsible.
9. **WEAK VALVE SPRINGS:** When the needle oscillation becomes more violent as engine RPM is increased, weak valve springs are indicated. The reading at idle could be relatively steady.
10. **LATE VALVE TIMING:** A steady but low reading could be caused by late valve timing.
11. **IGNITION TIMING RETARDED:** Retarded ignition timing will produce a steady but somewhat low reading.
12. **INSUFFICIENT SPARK PLUG GAP:** When spark plugs are gapped too close, a regular, small pulsation of

the needle can occur.

13. INTAKE LEAK: A low, steady reading can be caused by an intake manifold or throttle body gasket leak.
14. BLOWN HEAD GASKET: A regular drop of fair magnitude can be caused by a blown head gasket or warped cylinder head to cylinder block surface.
15. RESTRICTED EXHAUST SYSTEM: When the engine is first started and is idled, the reading may be normal, but as the engine RPM is increased, the back pressure caused by a clogged muffler, kinked tail pipe or other concerns will cause the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust clogging will cause the needle to drop to a low point even if the engine is only idling.

When vacuum leaks are indicated, search out and correct the cause. Excess air leaking into the system will upset the fuel mixture and cause concerns such as rough idle, missing on acceleration or burned valves. If the leak exists in an accessory such as the power brake booster, the unit will not function correctly. Always repair vacuum leaks.

Engine Oil Pressure Check



NOTE: Prior to checking the engine oil pressure, a road test of 6 miles (10 kilometres), must be carried out. Do not attempt to attain engine normal operating temperature by allowing the engine to idle.

1. Disconnect the battery ground cable. Refer to section 414-01 - Battery and Charging System. REFER to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
2. **WARNINGS:**



The spilling of hot engine oil is unavoidable during this procedure, care must be taken to prevent scalding.



Wear protective gloves.

Remove the engine oil filter element.



NOTE: Ensure the oil filter element is not contaminated during this procedure

3. Install the oil filter element into special tool (Oil filter adapter number 303-1451)
4. Install the special tool (Oil filter adapter number 303-1451) to the engine. Torque: 25 Nm
5. Install the special tool (Oil pressure testing gauge, 303-871) and tighten the union
6. Connect the battery ground cable
7. Refer to owner hand book, check and top-up the engine oil if required
8. Start and run the engine
9. Note the oil pressure readings with the engine running at idle and 3500 RPM
10. Turn off the engine
11. Disconnect the battery ground cable
12. Remove the special tools
 1. Clean the components
13. Install the engine oil filter element



NOTE: Ensure the oil filter element is not contaminated during this procedure

14. Connect the battery ground cable
15. Refer to owner hand book, check and top-up the engine oil if required

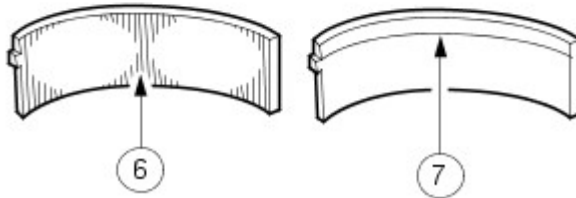
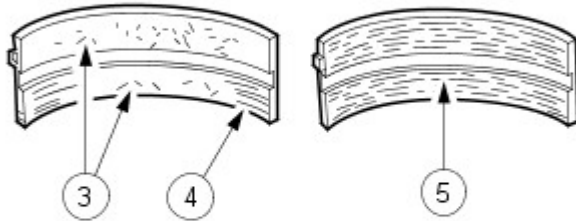
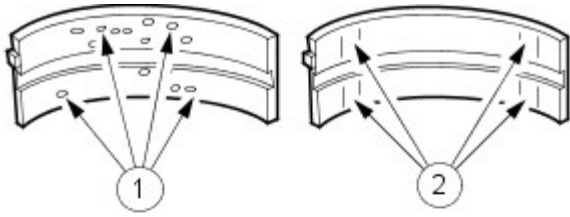
DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: V6 3.0L S/C Petrol, DTC: Engine Control Module \(ECM\)](#) (100-00 General Information, Description and Operation).

Engine System - General Information - Bearing Inspection

General Procedures

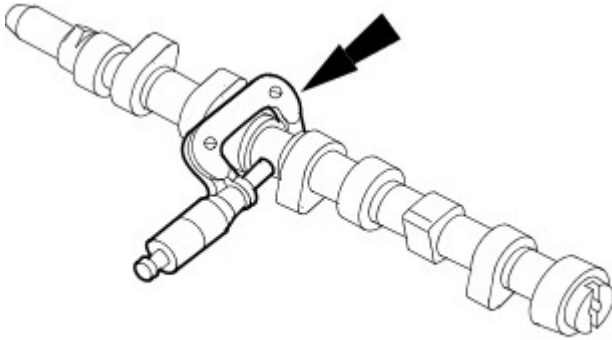


1. Inspect bearings for the following defects.
 1. Cratering - fatigue failure
 2. Spot polishing - incorrect seating.
 3. Imbedded dirt engine oil.
 4. Scratching - dirty engine oil.
 5. Base exposed - poor lubrication.
 6. Both edges worn - journal damaged.
 7. One edge worn - journal tapered or bearing not seated.

Engine System - General Information - Camshaft Bearing Journal

Diameter

General Procedures

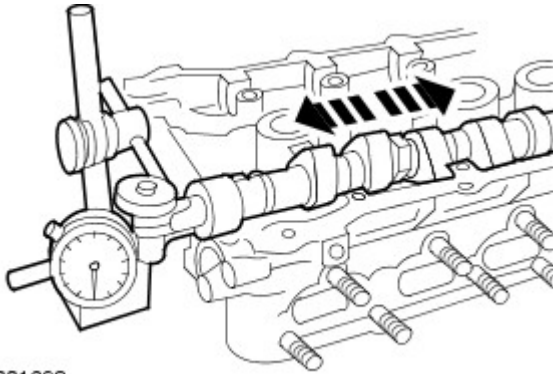


VUJ0001695


1. Determine the diameter of the camshaft journals.
 - Using a micrometer measure the diameter at 90 degree intervals to determine if the journals are out-of-round.
 - Measure at two different points on the journal to determine if there is any tapering.
 - If the measurements are out of the specified range, install a new camshaft.

Engine System - General Information - Camshaft End Play

General Procedures



VUJ0001698

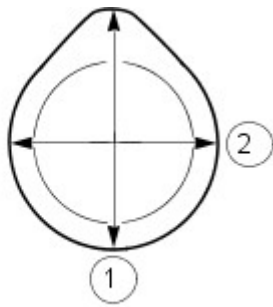
1.  **NOTE:** Make sure that the camshaft is to specification.

Using the special tool, measure the end play.

- Slide the camshaft in both directions. Read and note the maximum and minimum values on the dial indicator gauge.
 1. End play = maximum value minus minimum value.
- If the measurement is out of specification, install new components.

Engine System - General Information - Camshaft Lobe Lift

General Procedures

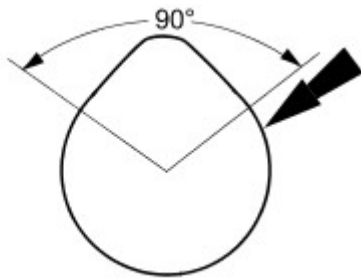


1. Measure the diameter (1) and diameter (2) with a vernier caliper. The difference in measurements is the lobe lift.

VJJ0001699

Engine System - General Information - Camshaft Surface Inspection

General Procedures

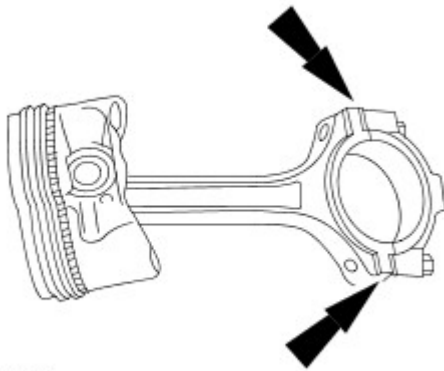


1. Inspect camshaft lobes for pitting or damage in the active area. Minor pitting is acceptable outside the active area.


VJJ0001700

Engine System - General Information - Connecting Rod Cleaning

General Procedures



VUJ0002224

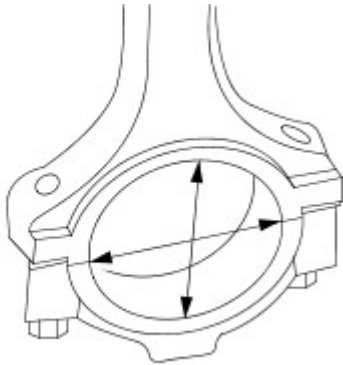
1.  **CAUTION:** Do not use a caustic cleaning solution or damage to connecting rods may occur.

Mark and separate the parts and clean with solvent. Clean the oil passages.

Engine System - General Information - Connecting Rod Large End Bore

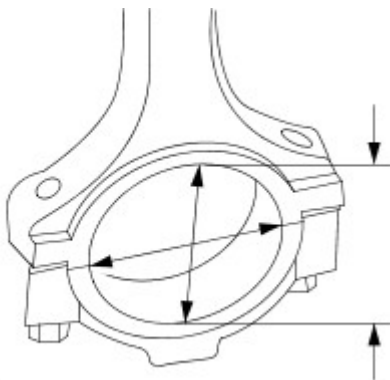
General Procedures

1. Measure the bearing bore in two directions. The difference is the connecting rod bore out-of-round. Verify the out-of-round is within specification.



VUJ0002223

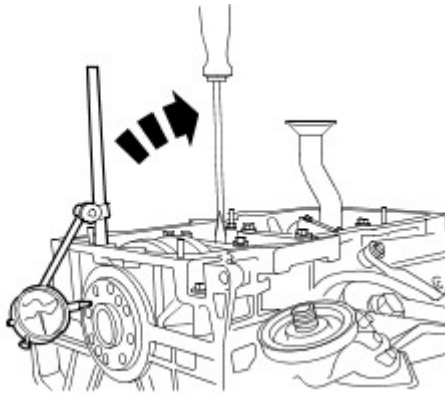
2. Measure the bearing bore diameter in two directions. Verify the bearing bore is within specification.



VUJ0002222

Engine System - General Information - Crankshaft End Play

General Procedures

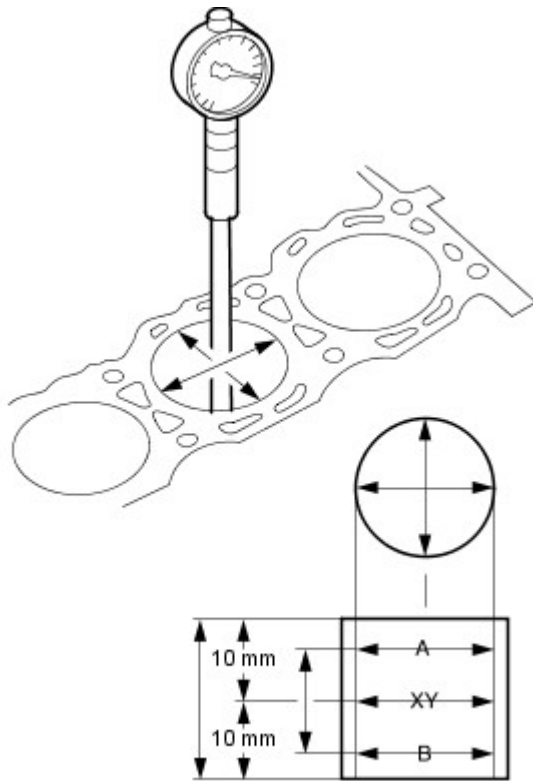



VUJ0002235

1. Using the Dial Indicator Gauge with Brackets, measure the end play.
 - Measure the end play by lifting the crankshaft using a lever.
 - If the value is out of the specification, install new thrust half rings to take up the end float and repeat the measurement.

Engine System - General Information - Cylinder Bore Out-of-Round

General Procedures



1.  **NOTE:** The main bearing caps or lower crankcase must be in place and tightened to the specified torque; however, the bearing shells should not be installed.

Measure the cylinder bore with an internal micrometer.

- Carry out the measurements in different directions and at different heights to determine if there is any out-of-roundness or tapering.
- If the measurement is out of the specified range, hone out the cylinder block or install a new block.

VUJ0002234

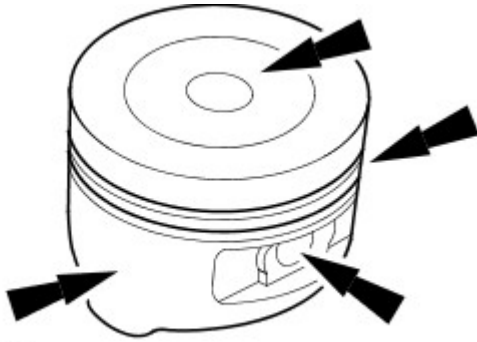
Engine System - General Information - Exhaust Manifold Cleaning and Inspection

General Procedures


1. Inspect the cylinder head joining flanges of the exhaust manifold for evidence of exhaust gas leaks.
2. Inspect the exhaust manifold for cracks, damaged gasket surfaces, or other damage that would make it unfit for further use.

Engine System - General Information - Piston Inspection

General Procedures



VUJ0002233

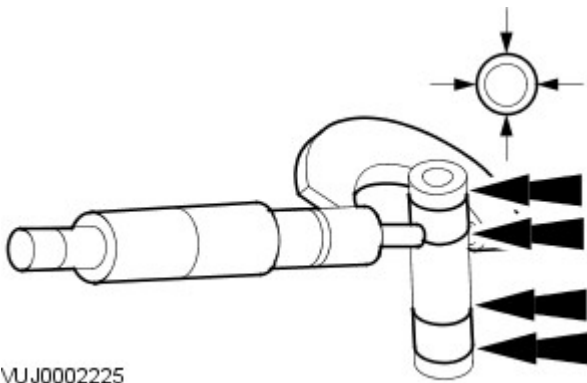
1.  **CAUTION:** Do not use any aggressive cleaning fluid or a wire brush to clean the piston.

Carry out a visual inspection.


- Clean the piston skirt, pin bush, ring grooves and crown and check for wear or cracks.
- If there are signs of wear on the piston skirt, check whether the connecting rod is twisted or bent.

Engine System - General Information - Piston Pin Diameter

General Procedures



VUJ0002225

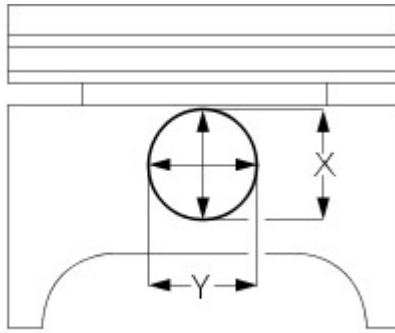
1.  **NOTE:** The piston and piston pin are a matched pair. Do not mix up the components.

Measure the piston pin diameter.


- Measure the diameter in two directions.
- If the values are not to specification, install a new piston and a new piston pin.

Engine System - General Information - Piston Pin to Bore Diameter

General Procedures



VUJ0002232

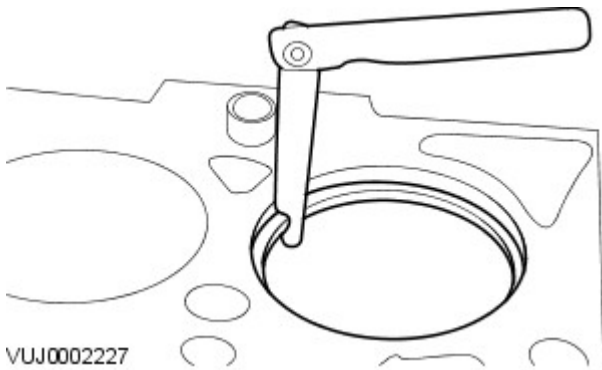
1.  **NOTE:** The piston and piston pin form a matched pair. Do not mix up the components.


Measure the diameter of the piston pin bore.

- Measure the diameter in two directions.
- If the values are not to specification, install both a new piston and a new piston pin.

Engine System - General Information - Piston Ring End Gap

General Procedures



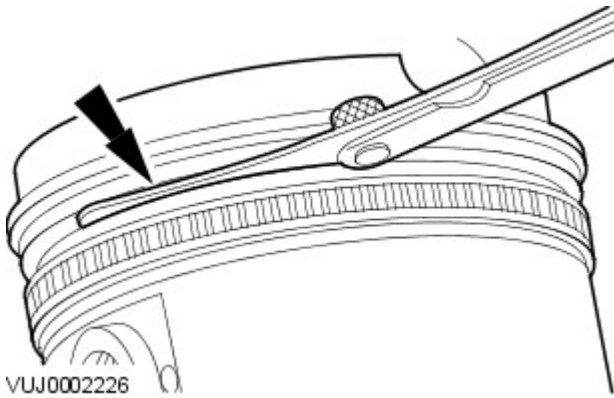
1.  **CAUTION:** Do not mix up the piston rings. Install the piston rings in the same position and location.


Using the Feeler Gauge, measure the piston ring gap.

- The values given in the specification refer to a gauge ring used during production.

Engine System - General Information - Piston Ring-to-Groove Clearance

General Procedures

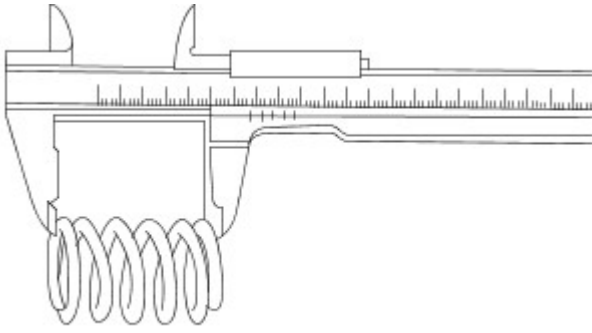


1.  NOTE: The piston ring must protrude from the piston groove. To determine the piston ring clearance, insert the Feeler Gauge right to the back of the groove, behind the wear ridge.

Using the Feeler Gauge, measure the piston ring clearance.

Engine System - General Information - Valve Spring Free Length

General Procedures

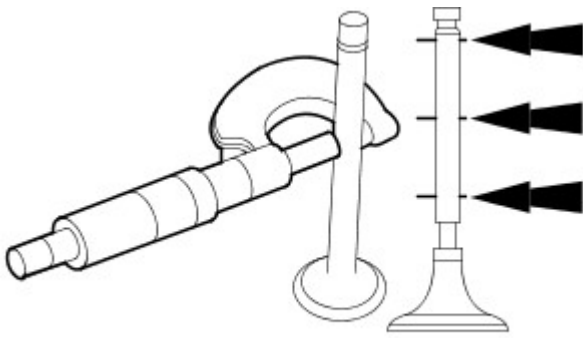


VJJ0002221

1. Using a vernier gauge, measure the free length of each valve spring. Verify the length is within specification.

Engine System - General Information - Valve Stem Diameter

General Procedures



1. Using a micrometer measure the diameter of the valve stems.
 - If the measurements are not to specification, install a new valve.

VUJ0002220

Engine System - General Information - Leakage Test Using Smoke Test Equipment

General Procedures



CAUTION: The compressed air line supply pressure must be between 3.5 and 12 bar (50 and 175 psi) for the smoke test equipment to function correctly. Do not exceed this pressure. Failure to follow this instruction may result in damage to the smoke test equipment.

NOTES:



The vehicle battery must be in good condition and fully charged before carrying out this procedure.



On vehicles with 3.0L TDV6, it will be necessary to insert smoke at both air cleaner outlet pipes independently if the right hand turbocharger and associated hoses are to be tested.



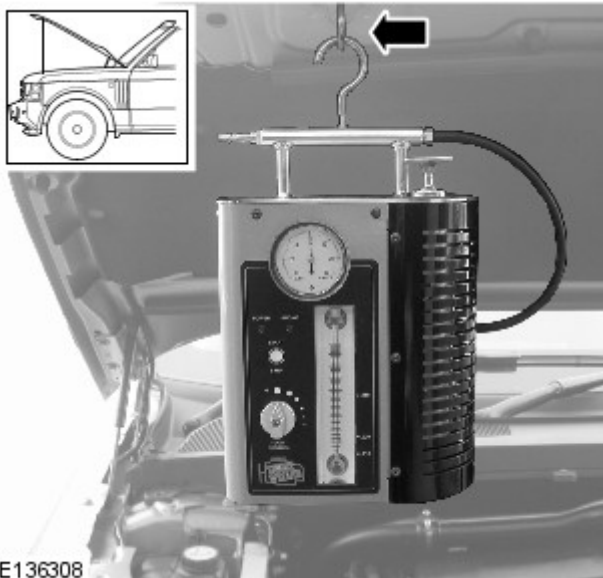
In some cases it may be necessary to remove undertrays, trim or engine covers to obtain access to all potential leak locations.



Some variation in the illustrations may occur, but the essential information is always correct.



For further information regarding operation of the test equipment refer to the manufacturers operators manual supplied with the kit.



- WARNING:** Use an additional support to prevent the hood from falling if the smoke test equipment is secured to the hood. Failure to follow this instruction may result in personal injury.

Install the smoke test equipment to a suitable location under the hood.

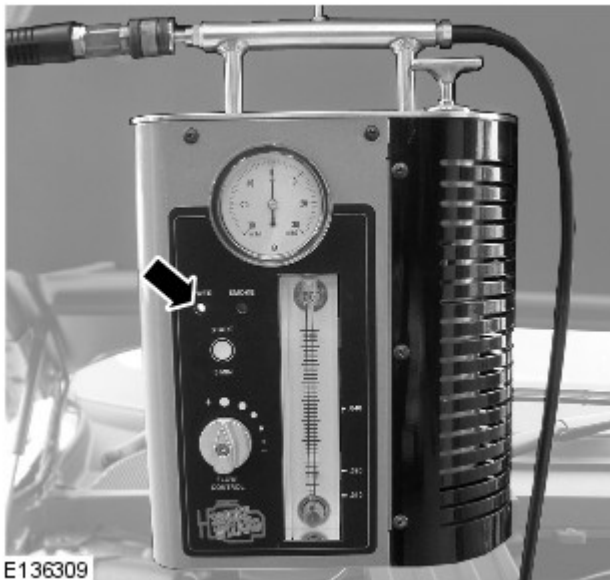
- Connect a suitable compressed air line to the smoke test equipment.
- Connect the smoke test equipment positive power cable to the battery positive terminal.

- WARNING:** Do not connect the smoke test equipment negative cable to the battery negative terminal.

Connect the smoke test equipment negative cable to a suitable body ground point.

- NOTE:** A flashing green light indicates low battery voltage. In this case, place the battery on charge and make sure that the battery is fully charged before using the smoke test equipment.


Observe the power indicator lamp on the smoke test equipment. Make sure that a




continuous green light is displayed.




6. NOTES:

 In some cases it may be necessary to remove the air cleaner(s) to allow access to the air cleaner outlet pipes.

 In some cases it will be necessary to cap one of the air cleaner outlet pipes. Use the blanking caps supplied in the kit to cap the open orifice.

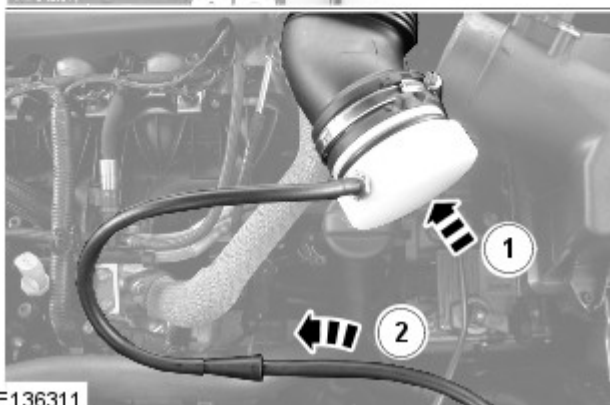
Disconnect the air cleaner outlet pipe(s).



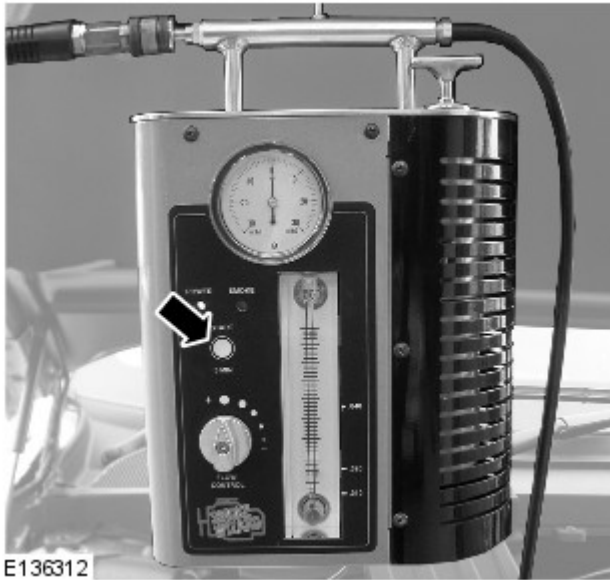
7.  NOTE: Make sure the smoke test equipment adapter is a good fit to the air cleaner outlet pipe. This must be an air tight seal.

Connect the smoke test equipment supply hose to the air cleaner outlet pipe.


1. Install the appropriate adapter to the air cleaner outlet pipe.
2. Connect the smoke test equipment supply hose to the adapter link hose.



8. NOTES:




 The flow control valve must be in the fully open position.

 Smoke is produced for 5 minutes. The smoke test equipment will automatically switch off after this period of time.

Switch the smoke test equipment on.

9. Remove the oil filler cap, and observe until a constant flow of smoke is visible leaving the oil filler orifice. Install the oil filler cap.

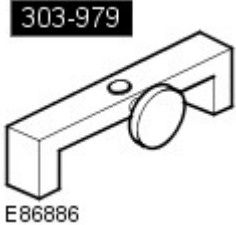
10.  **NOTE:** The longer smoke is allowed to exit from a leak, the more fluorescent dye will be deposited at a leak location.

Using the torch supplied in the kit set to white light, look for escaping smoke. Alternatively, use the ultraviolet light to look for fluorescent dye deposits at the source of a leak.

Engine System - General Information - Cylinder Head Gasket Selection TDV6 3.0L Diesel

General Procedures

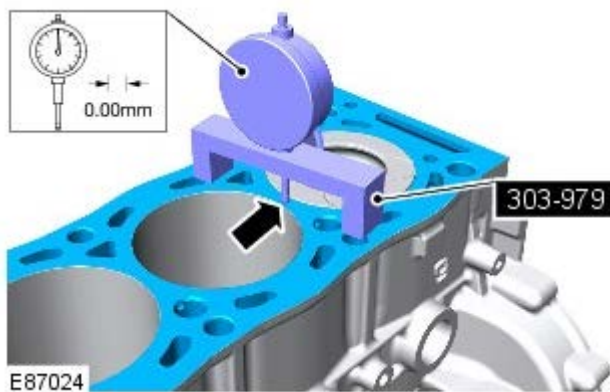
Special Tool(s)

 <p>303-979 E86886</p>	<p>303-979 Measuring Bridge, Piston Protusion</p>
---	---

Check



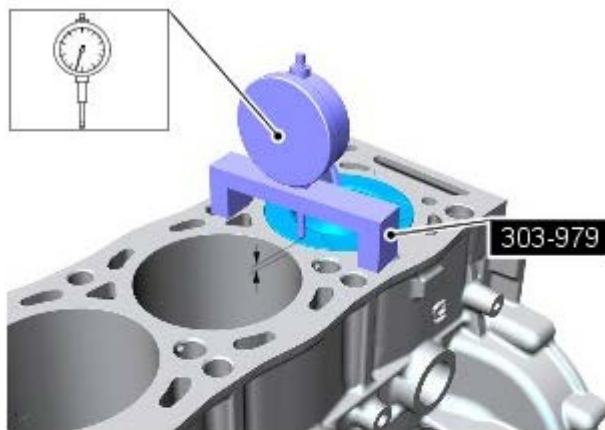
NOTE: Some variation in the illustrations may occur, but the essential information is always correct.




1.  CAUTION: Make sure that the surface is clean and free of foreign material.

Zero the gauge on the cylinder block machined face.

Special Tool(s): [303-979](#)



2.  CAUTION: Make sure that the surface is clean and free of foreign material.

 NOTE: Note the dial gauge readings.

Take 2 measurements on each piston crown.



E87025

3. Use the average piston protrusion measurement (taken from all piston measurements), to select the correct thickness cylinder head gasket.

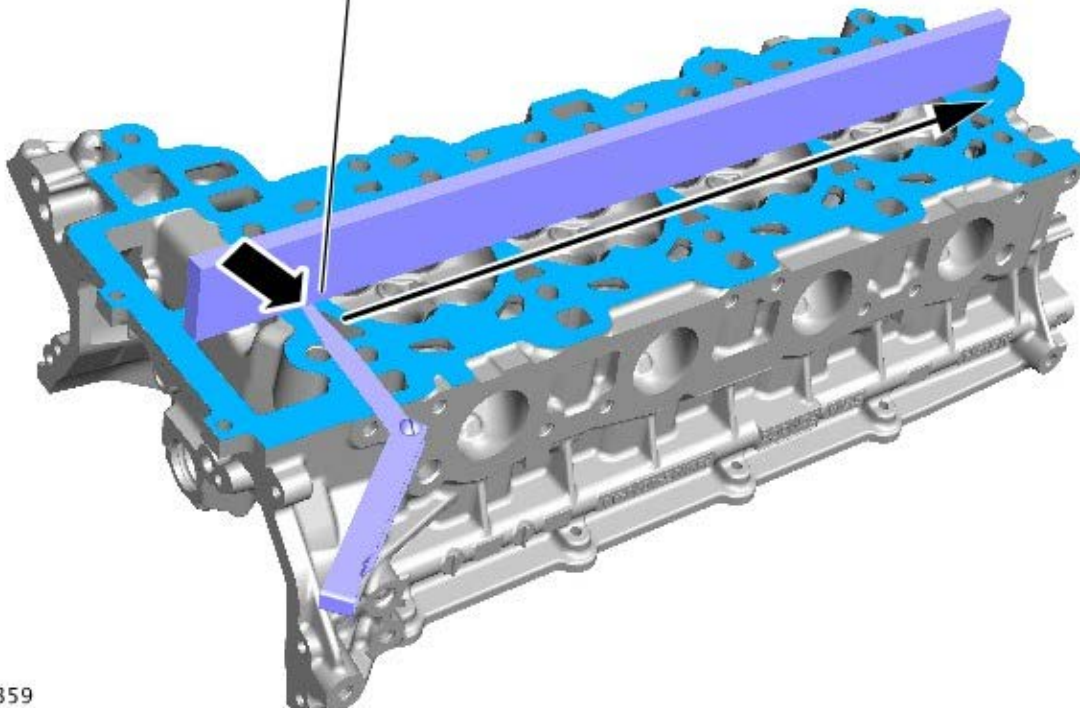
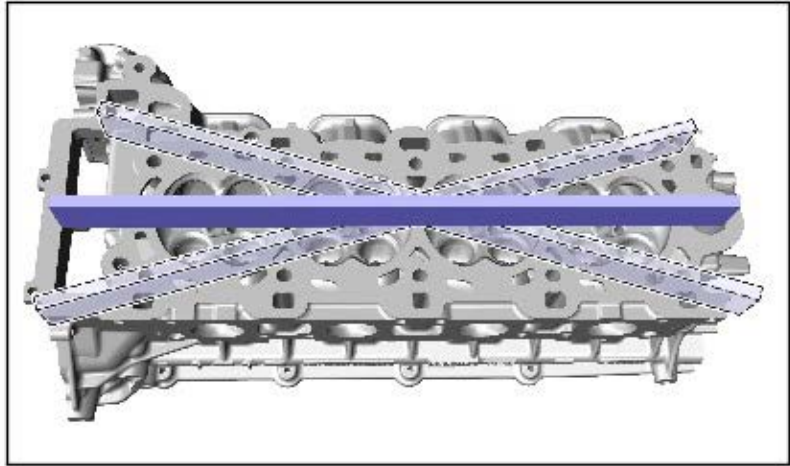
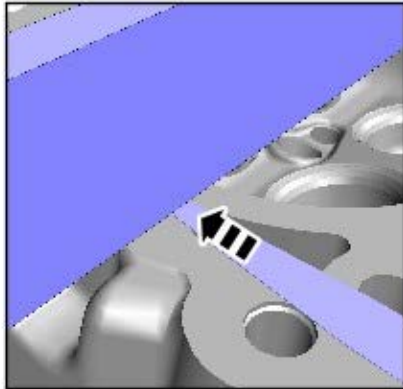
Refer to: Specifications (303-01B, Specifications).

Engine System - General Information - Cylinder Head Distortion


General Procedures

Activation

1. Using a suitable metallic straight edge and feeler gauge, measure the cylinder head face in the areas illustrated. **Note the maximum value.**



E160359

2.  **CAUTION:** Machine the **minimum** thickness of material from the cylinder head to meet specification, then increase the thickness of the cylinder head gasket by one size.

NOTES:



Prior to having the cylinder head being machined, prior approval is required by Jaguar or Land Rover engineering.



If the cylinder head requires machining, this must be carried out by a local engineering company.

If the cylinder head exceeds the maximum value (0.2mm), the cylinder head must be machined.

This section contains no data

Engine - TDV6 3.0L Diesel -

Engine Data

Engine Description	Engine Capacity	Maximum Engine Torque (EEC) (SAE)	Maximum Engine Power (EEC) (SAE)	Compression Ratio	Bore	Stroke
60° "Vee" • 6 Cylinder • 24 Valves	2993 ccm	600 Nm at 2000 RPM	180 kW at 4000 RPM	16.1:1 ± 0.5	84	90

Engine Firing Order

Firing Order
1:4:2:5:3:6

Glow Plug

Specification
9X2Q-6M090-AC

Lubricants, Fluids, Sealers and Adhesives

Description	Specification
Engine oil (EUR)	5W/30 – WSS–M2C934–B
Engine oil (ROW)	5W/30 – WSS–M2C913–B or C
Sealant	WSE–M4G323–A5
Core plug and stub pipe retainer	WSK–M2G349–A7
Jaguar premium cooling system fluid	WSS–M97B44–D

Capacities

Description	Liters
Engine oil initial fill	6.75
Engine oil service fill with oil filter change	5.9

Cylinder Head and Valve Train

Item	Specification
Valve guide inner diameter (mm)	5.980 ± 0.010
Intake valve effective length (mm) (tip to gauge line)	94.99mm +/- 0.15
Exhaust valve effective length (mm) (tip to gauge line)	94.45mm +/-0.15
Valve stem to guide clearance intake diametrical (mm)	0.027 - 0.063
Valve stem to guide clearance exhaust diametrical (mm)	0.037 - 0.073
Valve head diameter intake (mm)	27.8mm +/-0.1
Valve head diameter exhaust (mm)	25.2mm +/-0.1
Intake valve face angle (degrees)	44 deg 52 min +/-7min30sec
Exhaust valve face angle (degrees)	44 deg 52 min +/-7min30sec
Valve stem diameter intake (mm)	5.935±0.008
Valve stem diameter exhaust (mm)	5.925±0.008
Valve spring free length (mm) - inlet	38.9mm
Valve spring free length (mm) - exhaust	38.9mm
Valve spring installed height (mm) - inlet	31.22mm
Valve spring installed height (mm) - exhaust	31.22mm
Camshaft lobe max lift intake (mm)	3.75187mm
Camshaft lobe max lift exhaust (mm)	3.80999mm
Camshaft journal to cylinder head bearing surface clearance diametrical (mm)	0.040-0.090
Camshaft journal diameter - all positions	26.015±0.015
Bearing diameter - all positions	25.950±0.010
Camshaft journal maximum run out limit (mm)	0.030mm
Camshaft journal maximum out of round (mm) - all journals	0.010mm
Crankshaft end play	0.21 - 0.43 mm

Cylinder Head Gasket

Identification	Gasket Thickness (mm)	Piston Protrusion (mm)
2	1.17	0.552 - 0.603
3	1.22	0.604 - 0.655
4	1.27	0.656 - 0.707
5	1.32	0.708 - 0.760

Torque Specification



NOTE: A = refer to procedure for correct torque sequence

Description	Nm	lb-ft	lb-in
Piston cooling nozzle	10	7	-
Engine coolant drain plug	18	13	-
Cylinder head retaining bolts	A	-	-
Oil filter housing retaining bolts	10	7	-
Fuel injection pump cradle retaining bolts	23	17	-

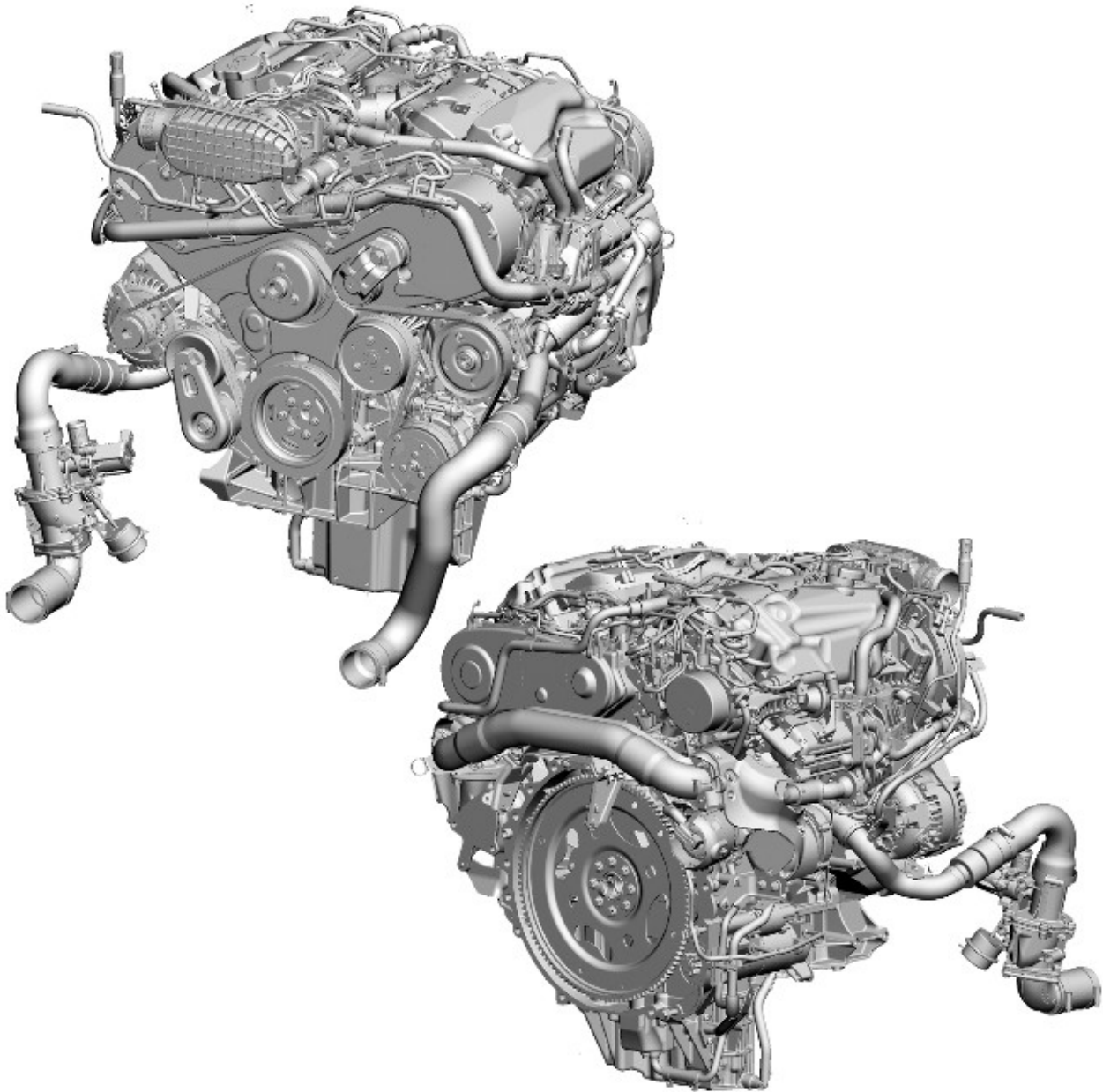
Fuel injection pump to cradle retaining bolts	23	17	-
Fuel injection pump bracket to cradle retaining bolts	10	7	-
Fuel injection pump to bracket retaining bolts	10	7	-
Oil pump retaining bolts	10	7	-
Crankshaft rear oil seal housing retaining bolts	10	7	-
Oil pan retaining bolts M6	10	7	-
Oil pan retaining bolts M8	23	17	-
Oil pump pick up pipe retaining bolts	10	7	-
Engine oil level sensor retaining nuts	10	7	-
Crankshaft timing belt pulley retaining bolt	Stage 1 - 150 Stage 2 - 300 Stage 3 - 90 degrees	-Stage 1 - 111 Stage 2 - 221 Stage 3 - 90 degrees	-
Crankshaft position sensor (CKP) retaining bolt	5	-	44
Timing chain tensioner retaining bolts	10	7	-
Camshaft bearing cap retaining bolts	A	-	-
Timing belt idler pulley retaining bolt	45	33	-
Fuel injection pump belt rear cover retaining bolts	10	7	-
Fuel injection pump sprocket retaining nut	50	37	-
Coolant outlet pipe retaining bolts	10	7	-
Coolant pump retaining bolts	10	7	-
Timing belt tensioner retaining bolt	26	19	-
Engine lifting eye bolts	23	17	-
Camshaft rear end accessory drive (READ) pulley hub retaining bolt	Stage 1 - 80 Stage 2 - 80 degrees	Stage 1 - 59 Stage 2 - 80 degrees	-
Camshaft front timing pulley hub retaining bolt	80 + 80°	59 + 80 °	-
Camshaft READ pulley retaining bolt	23	17	-
Camshaft front timing pulley retaining bolt	23	17	-
Fuel injection pump timing belt tensioner bolt	23	17	-
Camshaft position sensor (CMP) retaining bolt	10	7	-
Intake manifold / camshaft cover retaining bolts	10	7	-
Brake vacuum pump retaining bolts	23	17	-
Engine oil pressure (EOP) switch	14	10	-
Glow plug	11	8	-
Fuel rail retaining bolts	23	17	-
Fuel rail bracket retaining bolts	23	17	-
Fuel injector retaining bolts	A	-	-
High pressure fuel line union nuts	A	-	-
High pressure fuel line bracket retaining bolts	9	-	80
Turbocharger assembly to exhaust manifold retaining nuts	24	18	-
Exhaust manifold to cylinder head retaining nuts	A	-	-
Exhaust manifold heatshield retaining bolts	11	8	-
Turbocharger heatshield retaining bolts	11	8	-
Exhaust gas recirculation (EGR) valve retaining bolts M6	10	7	-
Accessory drive belt idler pulley bracket retaining bolts	83	61	-
Timing belt covers retaining bolts	10	7	-
Engine mount bracket to engine retaining bolts	115	85	-
Exhaust cross over pipe retaining nuts	24	18	-
Engine coolant inlet pipe retaining bolts	10	7	-
Coolant pump pulley retaining bolts	25	18	-
Crankshaft pulley/vibration damper retaining bolts	25	18	-
Throttle body retaining threaded stud	10	7	-
Wiring harness retaining nuts	10	7	-
Vacuum hose assembly retaining bolts	10	7	-
Flexplate retaining bolts	A	-	-
Accessory drive component bracket	23	17	-

retaining bolts			
Power steering pump retaining bolts	23	17	-
Generator retaining bolts	47	35	-
Accessory drive belt tensioner retaining bolt	47	35	-
Accessory drive belt idler pulley retaining bolt	47	35	-
Air conditioning compressor bracket retaining bolts	23	17	-
Air conditioning compressor retaining bolts	23	17	-

Engine - TDV6 3.0L Diesel - Engine - Component Location

Description and Operation

External Views



E120969

Engine - TDV6 3.0L Diesel - Engine - Overview

Description and Operation

OVERVIEW

The 3.0 liter diesel engine is a V6 configuration unit with 2 banks of 3 cylinders arranged at 60 degrees to each other. There are 4 valves per cylinder, which are operated by 2 overhead camshafts per cylinder bank.

The cylinder block is cast in compacted graphite iron, which uses less material to produce compared to a conventional cast iron block. This provides reduced weight and length with superior structural capabilities.

The cylinder heads are cast aluminum with a moulded plastic camshaft cover with an integral air intake. The single-piece structural oil pan is high pressure die cast from aluminum. The exhaust manifolds are cast from an iron alloy. A moulded plastic acoustic cover is fitted over the upper engine to absorb engine-generated noise.

A low compression ratio of 16:1 contributes to improved emissions quality, quieter combustion and compatibility with the engine's unique forced induction system. For additional information refer to Intake Air distribution and Filtering.

The low compression ratio also means less heat build-up in the piston bowl and more efficient fuel burn, resulting in the production of lower levels of pollutants. It also assists with cold starting allowing a faster cranking speed.

The engine is available in two power output forms. The power difference is achieved by changes to the engine calibration within the [ECM \(engine control module\)](#) and other vehicle control modules.



NOTE: It is not possible to re-configure a lower power output engine to the higher output specification.

Engine - TDV6 3.0L Diesel - Engine - System Operation and Component Description

Description and Operation

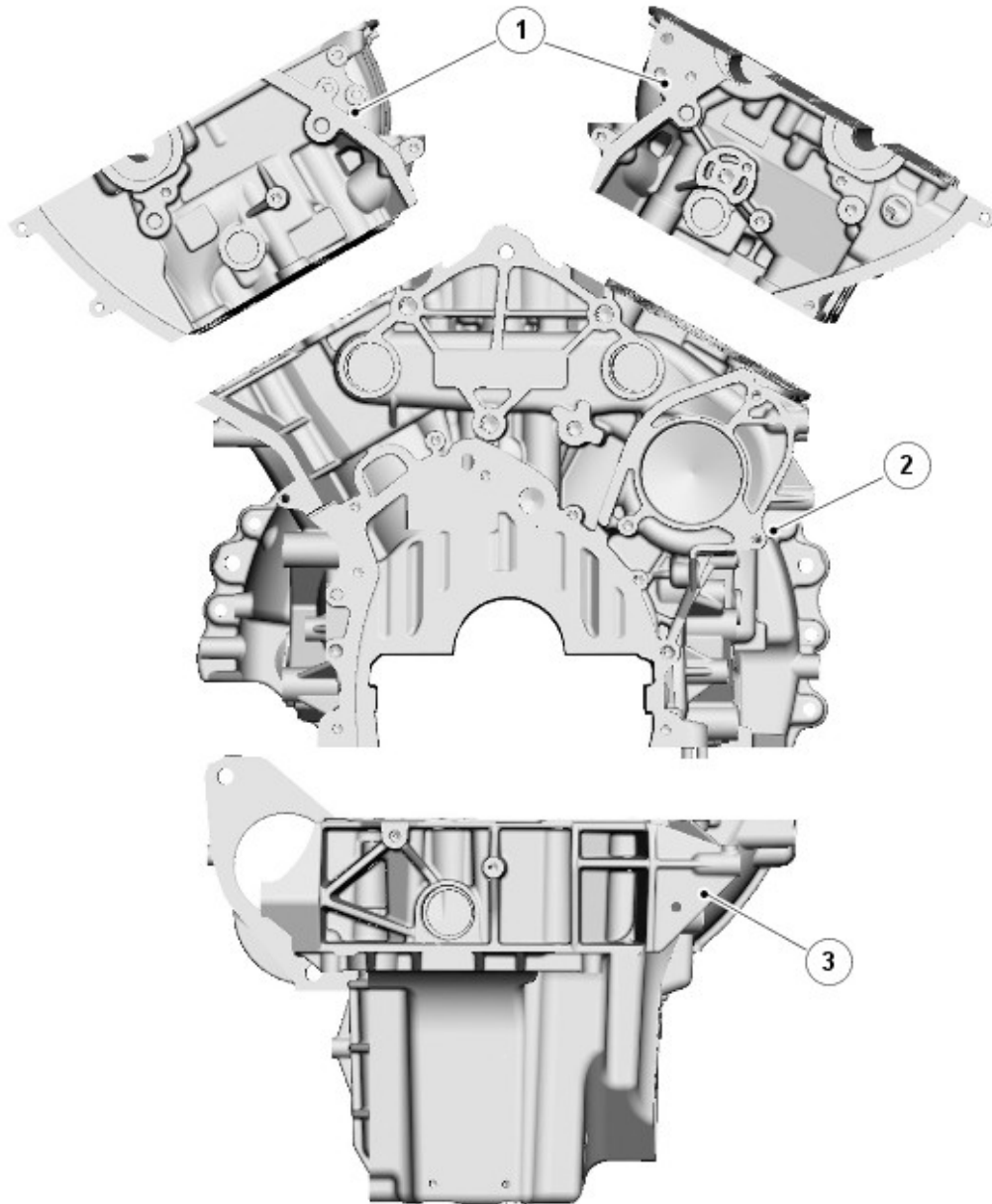
System Operation

OPERATION

Operation of the engine is controlled by the [ECM \(engine control module\)](#). For additional information refer to 303-14A Electronic Engine Controls.

Component Description

ENGINE STRUCTURE



E120983

Item Description

- 1 Cylinder heads
- 2 Cylinder block
- 3 Oil pan

CYLINDER BLOCK COMPONENTS

The cylinder block is a single cast construction with a hollow beam structure, cast from compact graphite iron. This type of construction provides outstanding strength and durability and uses less material than a conventional cast iron block, therefore reducing engine weight and length.

The use of compact graphite iron allows the cross sectional areas of the casting to be reduced, compared with a conventional gray cast iron block. This ensures reduced engine weight and length, with higher structural capabilities.

To maintain the stiffness of the bottom end of the cylinder block and crankshaft system, the cylinder block has a deep skirt and bearing cap design. Each of the main bearing caps is double bolted at each side of the crankshaft bearing and cross bolted back to the cylinder block.

Lubrication oil is distributed through the cylinder block, via a main oil gallery and channels bored in the block, to all critical moving parts. These channels divert oil to the main and connecting rod bearings via holes machined into the crankshaft.

A tapping at the rear of the cylinder block connects a pipe to the turbochargers by means of banjo connections. Oil is supplied, under pressure via this tapping, from the oil pump to provide lubrication for the bearings of the turbochargers.

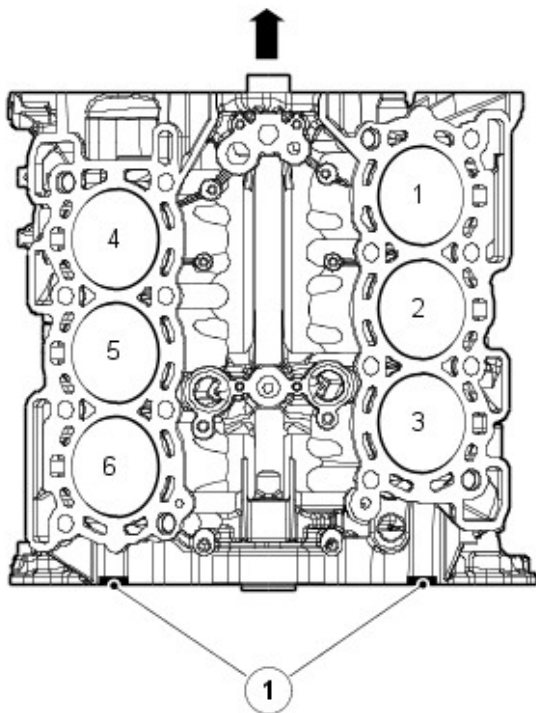
Cylinder cooling is achieved by coolant circulating through chambers in the cylinder block casting.

Two hollow metal dowels are used to locate the cylinder heads to the cylinder block, 1 on each side at the rear of the unit.

A port is included at the RH (right-hand) and LH (left-hand) side of the cylinder block, below each of the turbochargers, to connect the turbochargers oil return pipe to the oil pan.

Two coolant drain plugs are installed in the cylinder block; one is fitted in the rear RH side, and the other is fitted in the middle of the cylinder block on the LH side.

Engine Data



E44217

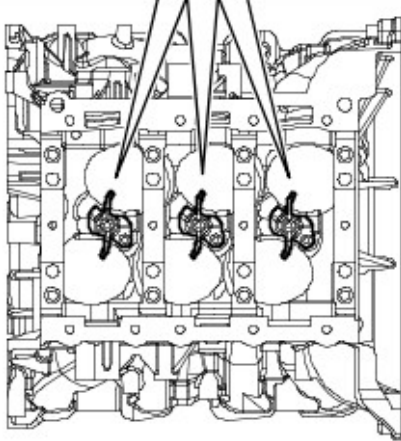
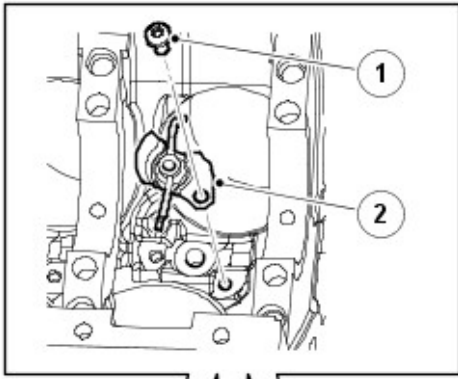
NOTE: Arrow indicates front of engine

Item Description

1 Engine data locations

Engine data is marked at 2 locations at the back of the cylinder block. Component diameters are represented by alphabetical and numerical codes; keys to the codes are in the removal and installation section of this manual.

Piston Cooling Jets



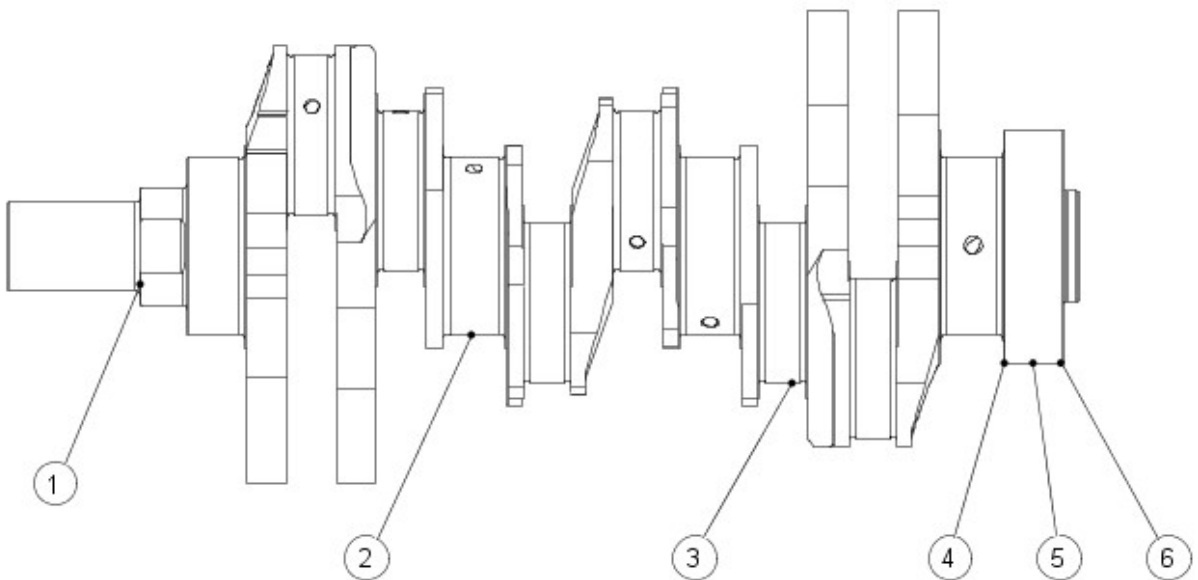
E44219

Item Description

- 1 Bolt
- 2 Cooling jet

Jets located in the cylinder block provide piston and piston pin lubrication and cooling. These jets spray oil on to the inside of the piston, the oil then flows through 2 internal wave shaped channels to help cool each piston crown.

CRANKSHAFT



E52135

Item Description

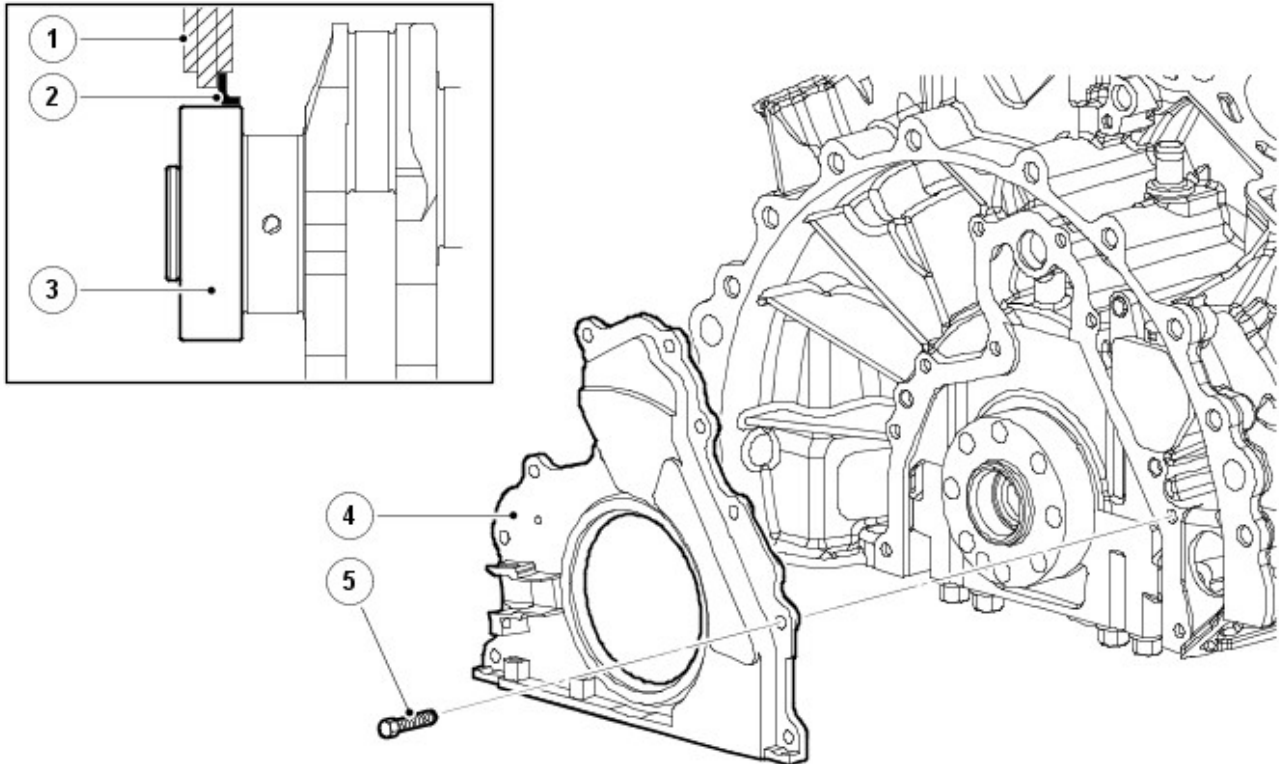
- 1 Oil pump drive
- 2 Main bearing Journal

- 3 Connecting rod bearing journal
- 4 Rear drive flange
- 5 Rear oil seal location
- 6 Trigger wheel location

The crankshaft is forged steel and fillet rolled with induction hardened journals, which run in 4 bearings with clamped 2 layer bearing shells. The upper and lower shells of bearing number 4 are flanged, which limits the end float of the crankshaft. The main bearing caps are double bolted and cross bolted to increase the strength and rigidity of the engine block.

The main bearings are aluminum/tin split plain selective bearings. An oil groove in the top half of each bearing transfers oil into the crankshaft for lubrication of the connecting rod bearings. The upper and lower shells of bearing number 4 contain integral thrust washers, which limits the end float of the crankshaft.

Rear Crankshaft Oil Seal



E44227

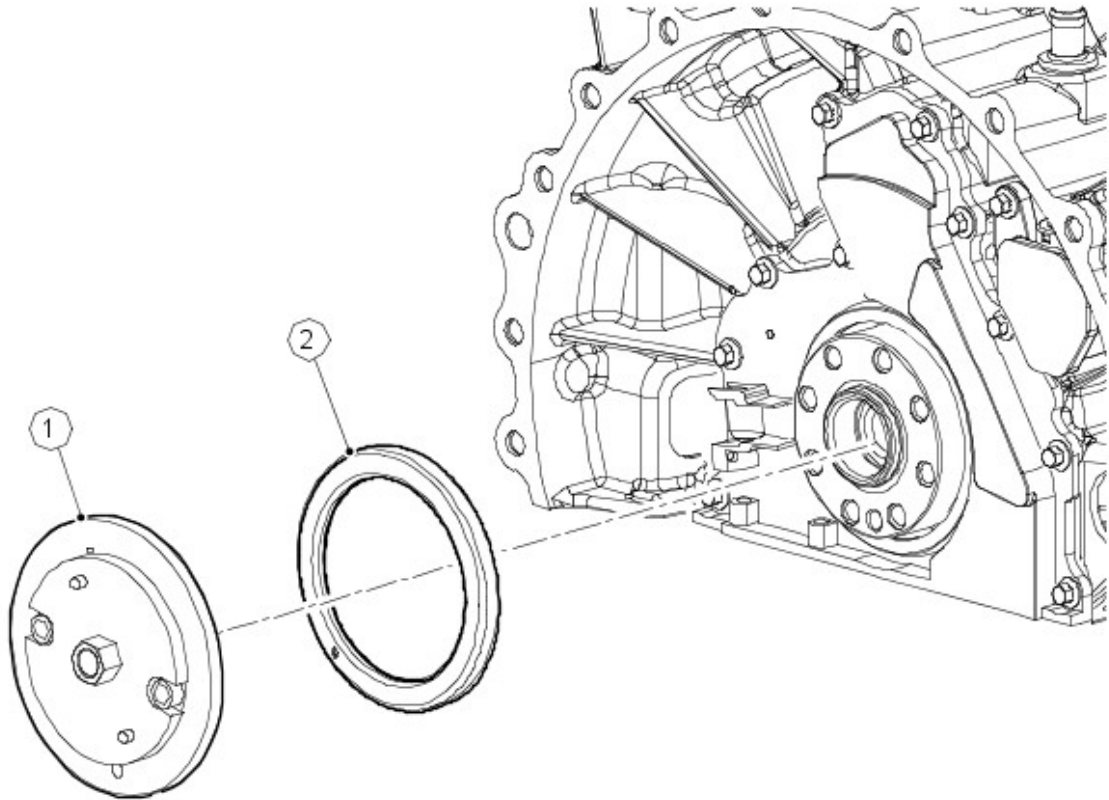
Item Description

- 1 Housing
- 2 Seal
- 3 Crankshaft
- 4 Rear oil seal retainer
- 5 Bolt (10 off)

The rear main oil seal and retainer assembly is a one-piece unit and is supplied with its own plastic fitting sleeve. The seal and retainer have 2 locating dowels, 10 fixing bolts and a rubber seal. In addition, the retainer has a location for the crankshaft position sensor. For additional information refer to 303-14A Electronic Engine Controls.

A torsional vibration crankshaft damper pulley is bolted to the front of the crankshaft.

Crankshaft Trigger Wheel



E52137

Item Description

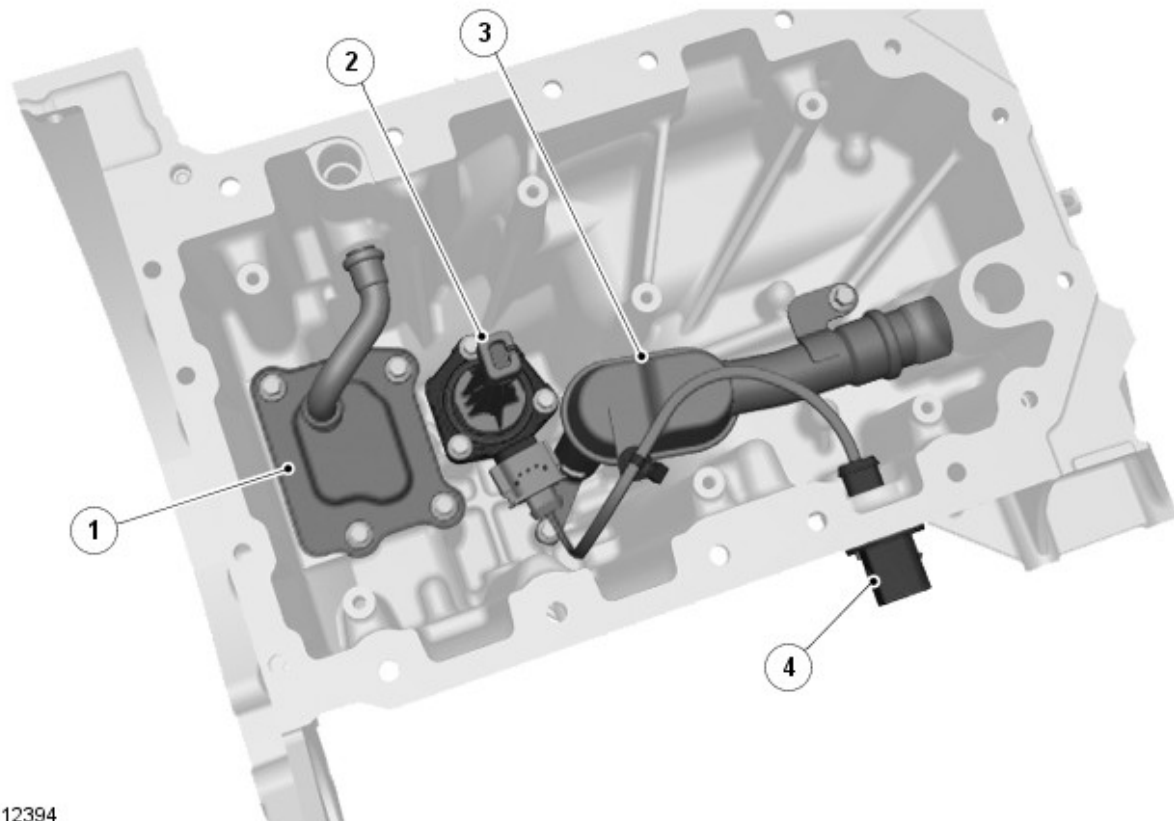
- 1 Special Tool
- 2 Trigger wheel

The crankshaft trigger wheel is located on the rear of the crankshaft. It is pressed onto the crank using a special tool, which also precisely aligns the trigger wheel for crankshaft position and timing.

The trigger wheel consists of 60 magnets minus 2 for [ECM](#) crankshaft position reference and synchronization. The magnets cannot be seen on the trigger wheel, which therefore can only be positioned using a special tool. For additional information refer to 303-14A Electronic Engine Controls.

If the trigger is removed for any reason, then a new trigger wheel must be fitted.

OIL PAN COMPONENTS



E112394

Item Description

- 1 Oil scavenge reservoir
- 2 Oil level and temperature sensor
- 3 Oil pick-up pipe
- 4 Oil level and temperature sensor connector

The structural oil pan is of a single piece die cast aluminum construction and is fitted to the lower cylinder block to stiffen the base structure of the engine, helping to reduce noise, vibration and harshness. The oil pan also incorporates an oil baffle plate to reduce oil foaming and splash.

The oil pan is secured to the cylinder block with 2 dowels, 2 locator pins for the gasket and 18 retaining bolts; 3 different lengths of bolts are used:

- M6 x 20 (6 off)
- M8 x 75 (4 off)
- M6 x 105 (8 off).

Iron inserts, cast into the main bearing supports of the stiffening frame, minimize main bearing clearance changes due to heat expansion.

A gasket seals the joint between the oil pan and the cylinder block.

An oil pick-up pipe with integral strainer locates in the oil pan to provide oil to the crankshaft driven oil pump.

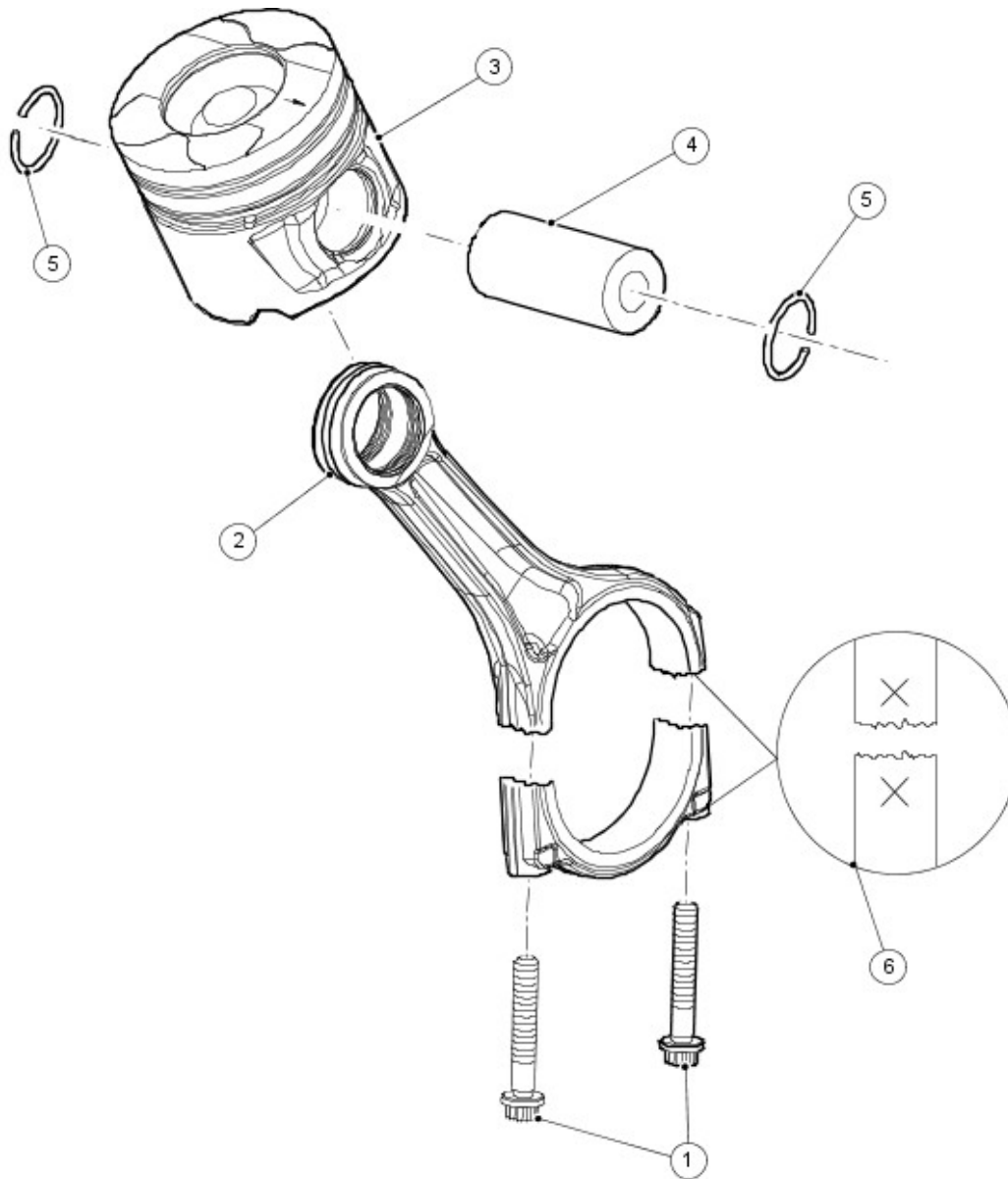
An ultrasonic sensor provides an electronic indication when the oil in the oil pan is low or high. This removes the requirement for the mechanical dipstick. An advantage in comparison with the static 'dipstick' method is that all marginal influences, for example vehicle being on a slope, lateral and longitudinal acceleration, are compensated for by averaging.

The values determined can be used to signal that the minimum oil level has been reached or to display the current oil level if required.

The sensor is mounted inside the oil pan where it sends an ultrasonic pulse vertically upward, it then measures the time for the pulse to be reflected back from the top surface of the oil.

Warnings will be displayed in the message center if the oil level is not maintained within the safe operating levels (minimum and maximum). A warning will also be displayed if there is a fault with the oil level monitoring system.

PISTON AND CONNECTING ROD ASSEMBLY



E52134

Item Description

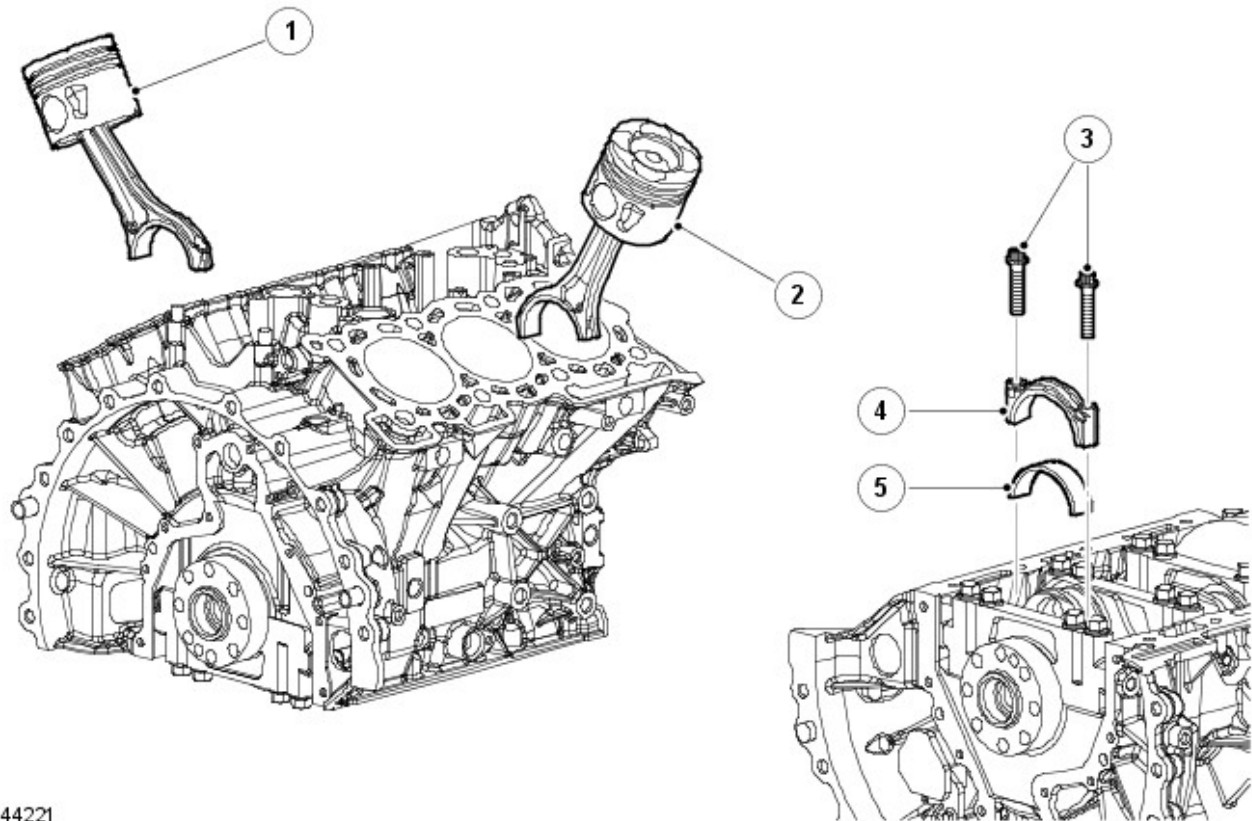
- 1 Connecting rod bolts (2 off)
- 2 Connecting rod
- 3 Piston
- 4 Piston pin
- 5 Circlips
- 6 Connecting rod identification

The connecting rods are manufactured from sinter-forged steel and have fracture-split bearing caps. The bearing caps are produced by fracturing the opposing sides of the connecting rod at the bearing horizontal centre-line. As well as being easier to manufacture, when reassembled the fractured surfaces interlock to form a strong seamless joint. The cylinder position is etched on adjoining sides of the joint to identify matching connecting rods and bearing caps. The selective connecting rod bearings are aluminum/tin split plain bearings. The connecting rod bearing is 'sputter coated', which is a manufacturing process that layers the bearing material to produce a higher load capacity for improved durability.



NOTE: The connecting rods are not selective.

Piston and Connecting Rod Orientation



E44221

Item Description

- 1 Piston and connecting rod assembly, cylinders 4-6
- 2 Piston and connecting rod assembly, cylinders 1-3
- 3 Bolts (12 off)
- 4 Connecting rod bearing cap (6 off)
- 5 Connecting rod lower bearing (6 off)

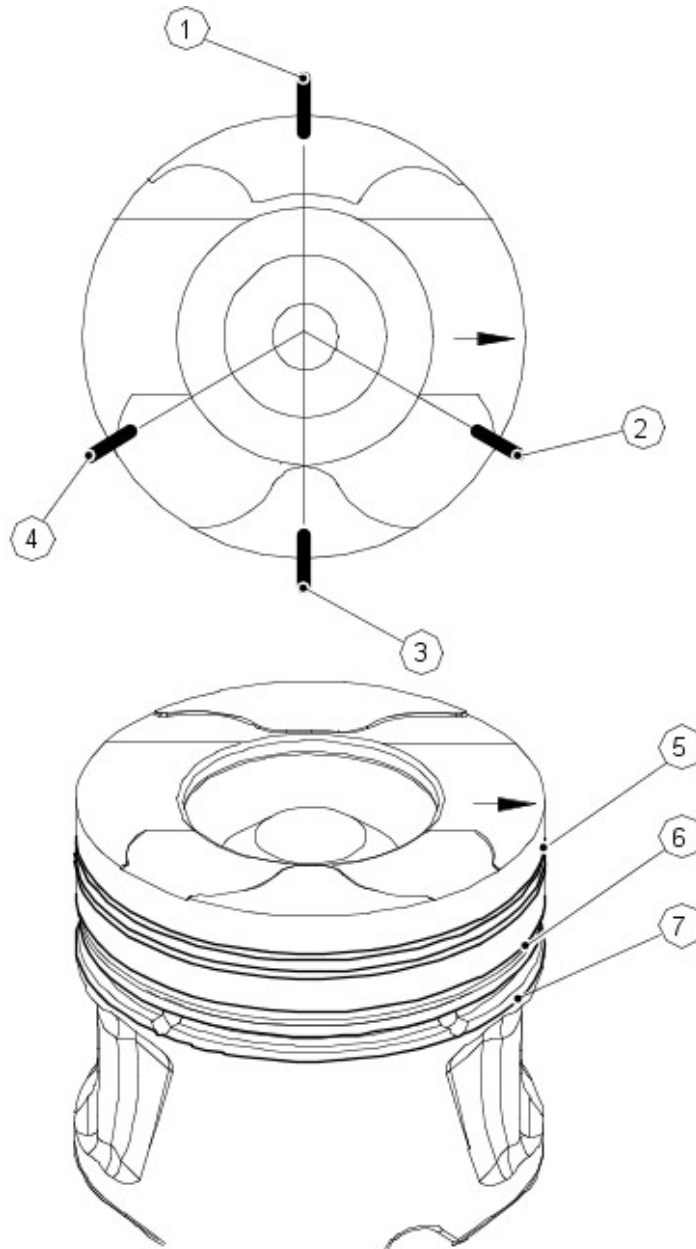
When installing a connecting rod, ensure the back of the connecting rod faces the center of the 'vee'.

The pistons are made from aluminum alloy and are fitted with 3 rings. The piston crown incorporates a pronounced bowl; this forms the combustion chamber, which promotes swirl and turbulence necessary for good combustion and improved emissions. In addition, the piston skirt has a molybdenum-coated surface, which counteracts scoring of the cylinder bore and piston.

The piston also incorporates a double wave gallery within the piston crown to enhance piston cooling. The pistons are supplied oil by means of spray jets located in the cylinder block oil gallery. These jets ensure optimum piston cooling to counteract the high temperatures generated by the combustion process.

Each piston is installed on a piston pin located in a aluminum/tin bushing in the connecting rod.

Piston Ring Orientation



E52133

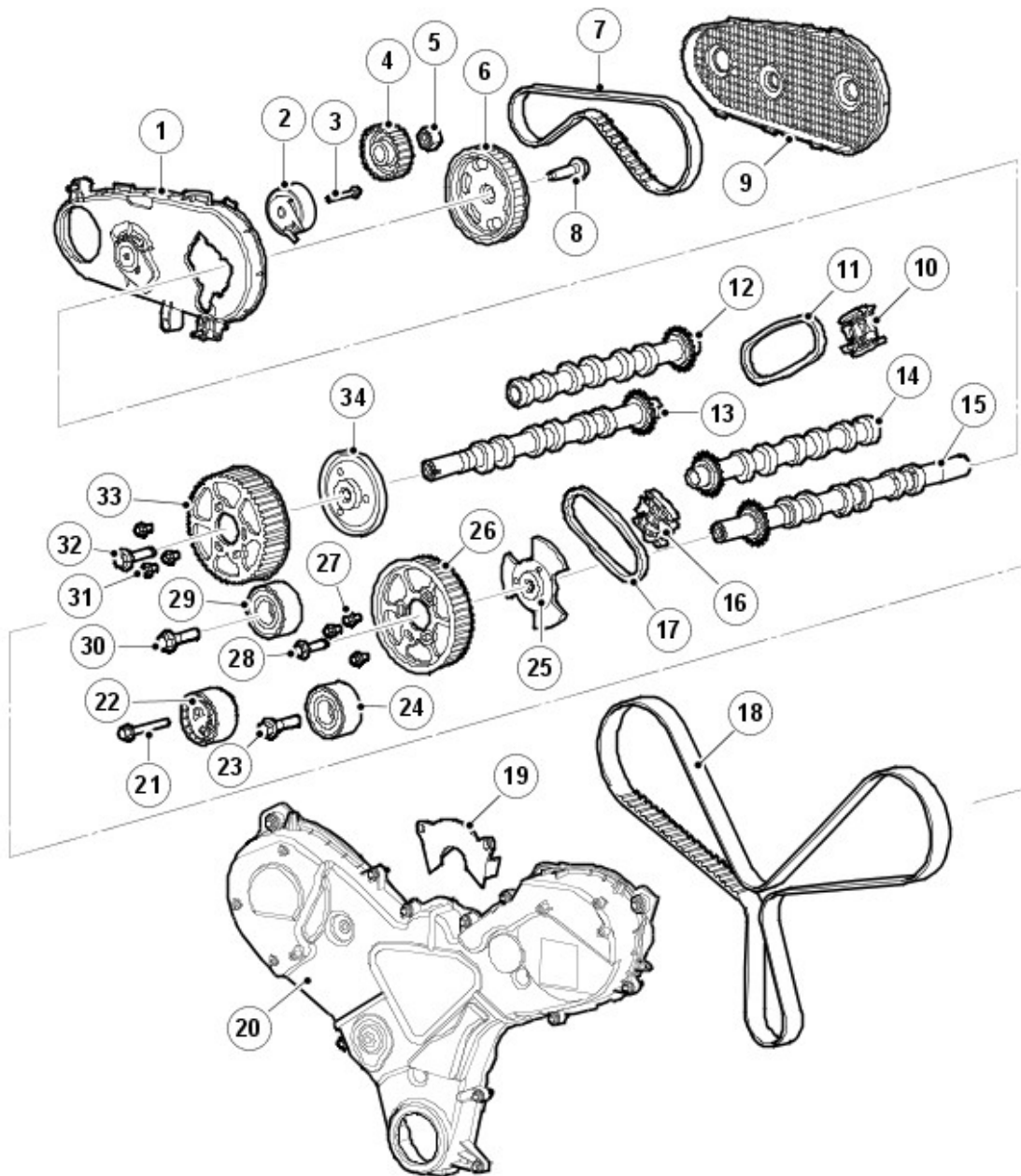
Item Description

- 1 Ring gap oil control
- 2 Ring gap upper compression
- 3 Spiral joint oil control
- 4 Ring gap lower compression
- 5 Upper compression ring
- 6 Lower compression ring
- 7 Oil control ring

When installing pistons ensure the arrows on the piston crowns all point to the front of the engine. All pistons are common single grade/single part number for all engines.

The piston top ring is a taper type and is fitted with the taper to the top of the piston. All rings marked 'top' are assembled with 'top' uppermost. All rings must be spaced evenly around the piston before installing. The circumference gap of the double bevelled oil control ring must be opposite the spiral control joint.

CAMSHAFT TIMING COMPONENTS



E94884

Item Description

- 1 Rear engine accessory drive rear cover
- 2 Rear engine accessory drive tensioner
- 3 Bolt
- 4 Fuel pump pulley
- 5 Nut
- 6 Rear engine accessory drive camshaft pulley
- 7 Rear engine accessory drive belt
- 8 Bolt
- 9 Rear engine accessory drive front cover
- 10 RH chain tensioner
- 11 RH timing chain
- 12 RH intake camshaft
- 13 RH exhaust camshaft
- 14 LH intake camshaft
- 15 LH exhaust camshaft
- 16 LH chain tensioner
- 17 LH timing chain
- 18 Timing belt
- 19 Front cover bridge
- 20 Primary drive cover
- 21 Bolt

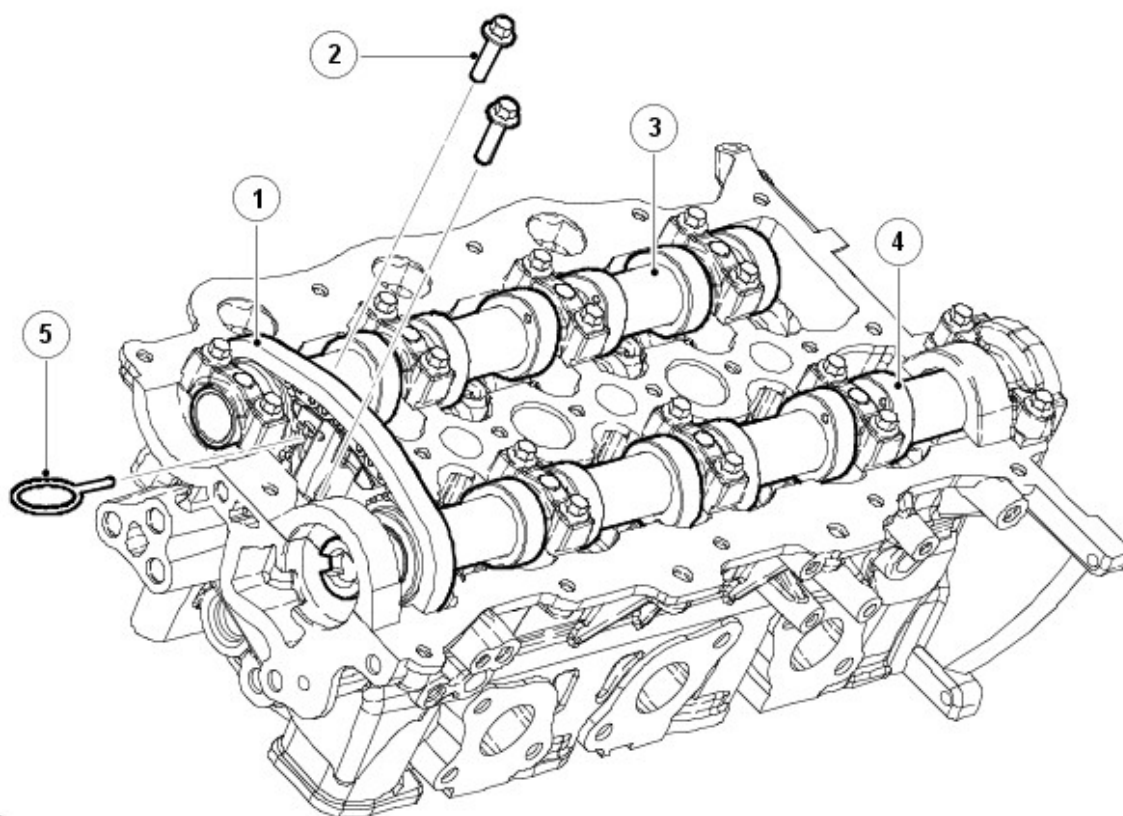
- 22 Tensioner
- 23 Bolt
- 24 Idler
- 25 Camshaft hub
- 26 LH camshaft timing pulley
- 27 Bolt (3 off)
- 28 Bolt
- 29 Idler
- 30 Bolt
- 31 Bolt (3 off)
- 32 Bolt
- 33 RH camshaft timing pulley
- 34 Camshaft hub

Primary drive is provided by a single toothed belt from the crankshaft to the exhaust camshaft gears of each cylinder bank via 2 idler pulleys and a tensioner.

Timing belt adjustment is carried out by an eccentric type tensioner mounted on the RH front face of the cylinder block.

A primary drive cover is made up from 3 separate plastic mouldings. The covers are secured to the front of the cylinder block and cylinder heads with 15 bolts and 1 stud and nut. The 2 upper covers are partially sealed with a rubber seal.

Secondary Drive



E44233

Item Description

- 1 Timing chain
- 2 Bolts
- 3 Intake camshaft
- 4 Exhaust camshaft
- 5 Tensioner firing pin

Secondary drive is provided by 2 short crossover chains, which transfer drive from the exhaust camshaft gears to the intake camshaft gears. The crossover drives are located at the rear of the RH cylinder bank and the front of the LH cylinder bank. This allows for a much shorter and simpler run for the main camshaft drive belt at the front of the engine.

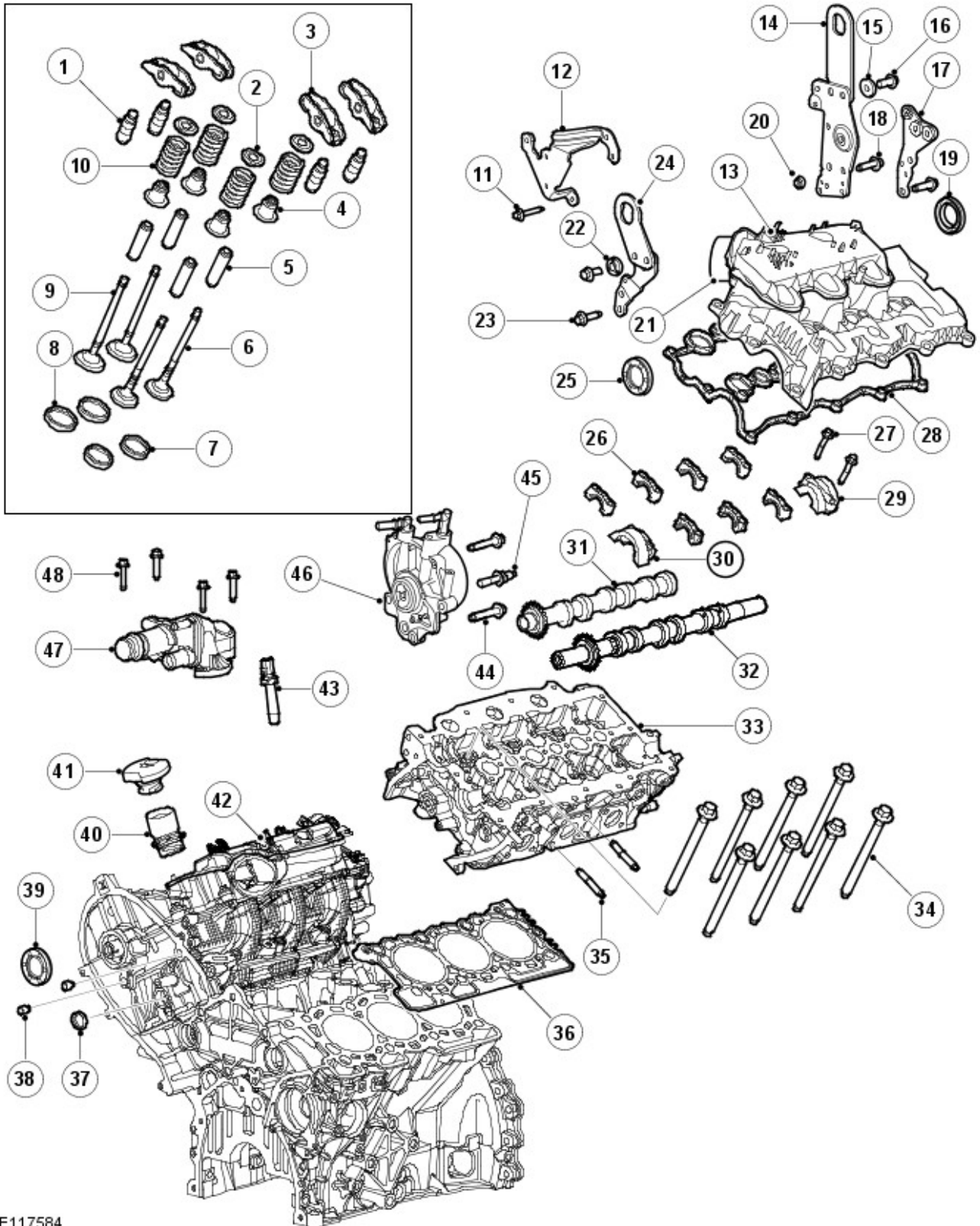
Each crossover chain is tensioned via an automatic chain tensioner, which acts directly on the chains via a guide rail. The tensioners are located between the exhaust and intake camshafts at the front or rear of the cylinder head, depending on the cylinder bank.

The tensioner firing pin holds the automatic chain tensioner in a compressed state to aid installation.

CYLINDER HEAD COMPONENTS



NOTE: LH cylinder head shown; RH cylinder head similar.



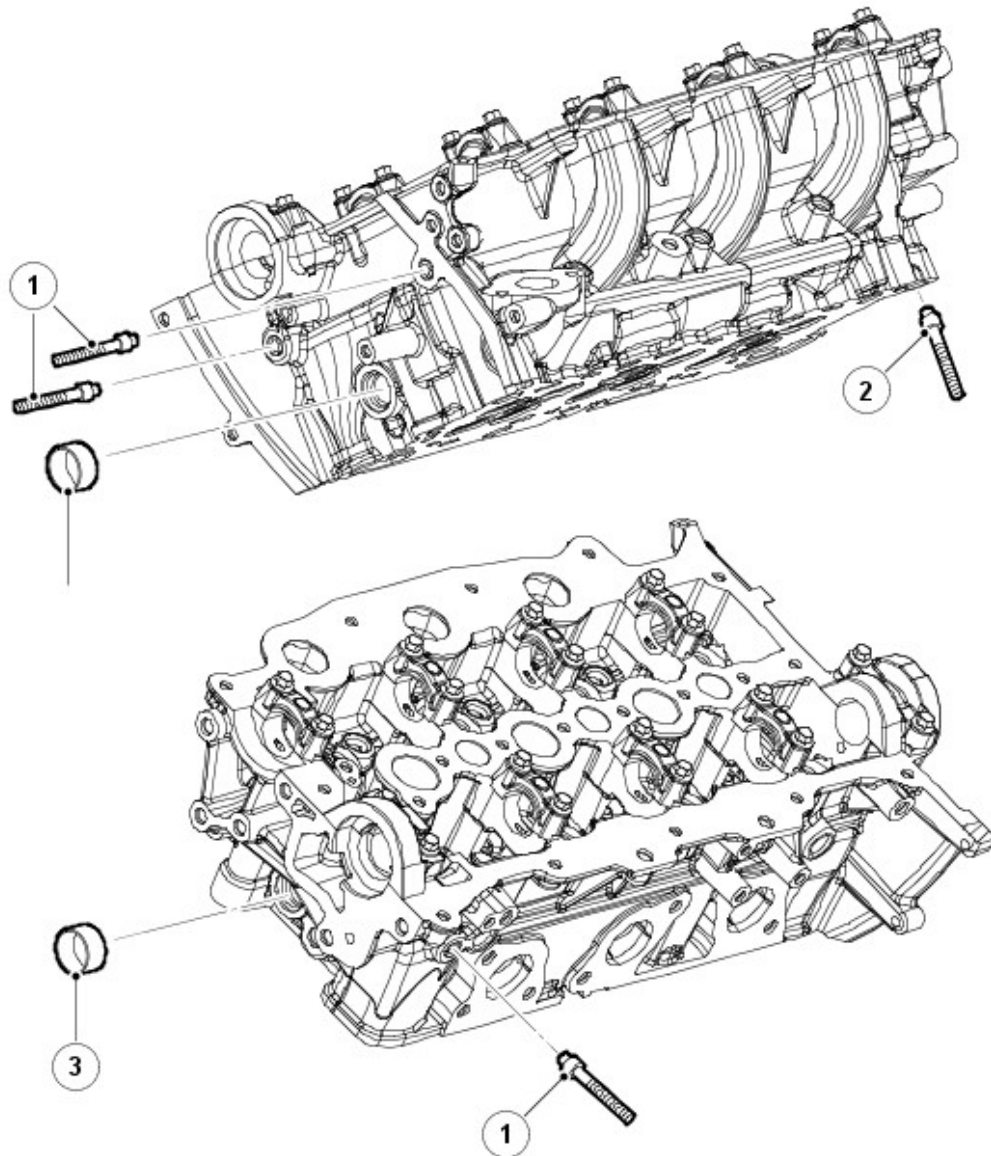
E117584

Item Description

- 1 Hydraulic lash adjusters (12 off)
- 2 Valve spring retainers (12 off)
- 3 Roller rockers (12 off)
- 4 Valve stem seals (12 off)
- 5 Valve guides (12 off)

- 6 Exhaust valves (6 off)
- 7 Intake valve seats (6 off)
- 8 Exhaust valve seats (6 off)
- 9 Intake valves (6 off)
- 10 Valve springs (12 off)
- 11 Bolt
- 12 Bracket
- 13 Intake manifold
- 14 Lifting eye
- 15 Washer
- 16 Bolt
- 17 Bolt
- 18 Bolt
- 19 Seal
- 20 Cap
- 21 Intake manifold cover assembly
- 22 Washer
- 23 Bolt
- 24 Lifting eye
- 25 Seal
- 26 Camshaft bearing caps (7 off)
- 27 Bolts (18 off)
- 28 Gasket
- 29 Camshaft bearing cap and seal housing
- 30 Camshaft bearing cap and seal housing
- 31 Intake camshaft
- 32 Exhaust camshaft
- 33 Cylinder head
- 34 Cylinder head bolts (8 off)
- 35 Exhaust manifold studs (6 off)
- 36 Cylinder head gasket
- 37 Core plug
- 38 Plug
- 39 Seal
- 40 Oil filler tube
- 41 Oil filler cap
- 42 Intake manifold
- 43 Injectors (3 off)
- 44 Bolt (2 off)
- 45 Bolt
- 46 Tandem pump
- 47 Water outlet assembly
- 48 Bolt (4 off)

Cylinder Heads



E44236

Item Description

- 1 Studs
- 2 Bolts
- 3 Blanking plug

The aluminum gravity die cast cylinder heads are unique to each cylinder bank. Eight deep-seated bolts help reduce distortion and secure each cylinder head to the cylinder block. The cylinder head bolts are located beneath the camshafts, 4 under the intake camshaft and 4 under the exhaust camshaft. Two hollow dowels align each cylinder head with the cylinder block.



NOTE: The cylinder heads cannot be reworked.

The cylinder head gasket is a 3-layer, laminated steel type and is available in 5 different thicknesses. The choice of gasket thickness is dependent on the maximum piston protrusion. Gasket thickness is identified by serrations cut into the front end of the gasket.

The cylinder head has 4 ports machined at each cylinder location, 2 exhaust ports and 2 intake ports. One of the intake ports is helical and functions as a swirl port, the other is arranged laterally as a tangential port and functions as a charge port.

The camshafts are of a hollow steel tube construction, with pressed on sintered lobes. Each camshaft is retained by aluminum alloy caps, 5 for the exhaust camshafts and 4 for the intake camshafts. Location letters, A to I for the intake camshaft and R to Z for the exhaust camshaft, are marked on the outer faces of the caps for each cylinder head.

The LH cylinder bank exhaust camshaft is machined to accept a rear camshaft gear. The rear camshaft gear provides drive for the high-pressure fuel pump. For additional information refer to 303-04A Fuel Charging and Controls.

The exhaust camshaft gear of the **LH** cylinder head also incorporates a trigger wheel, which is used in conjunction with the camshaft sensor to measure engine position. For additional information refer to 303-14A Electronic Engine Controls.

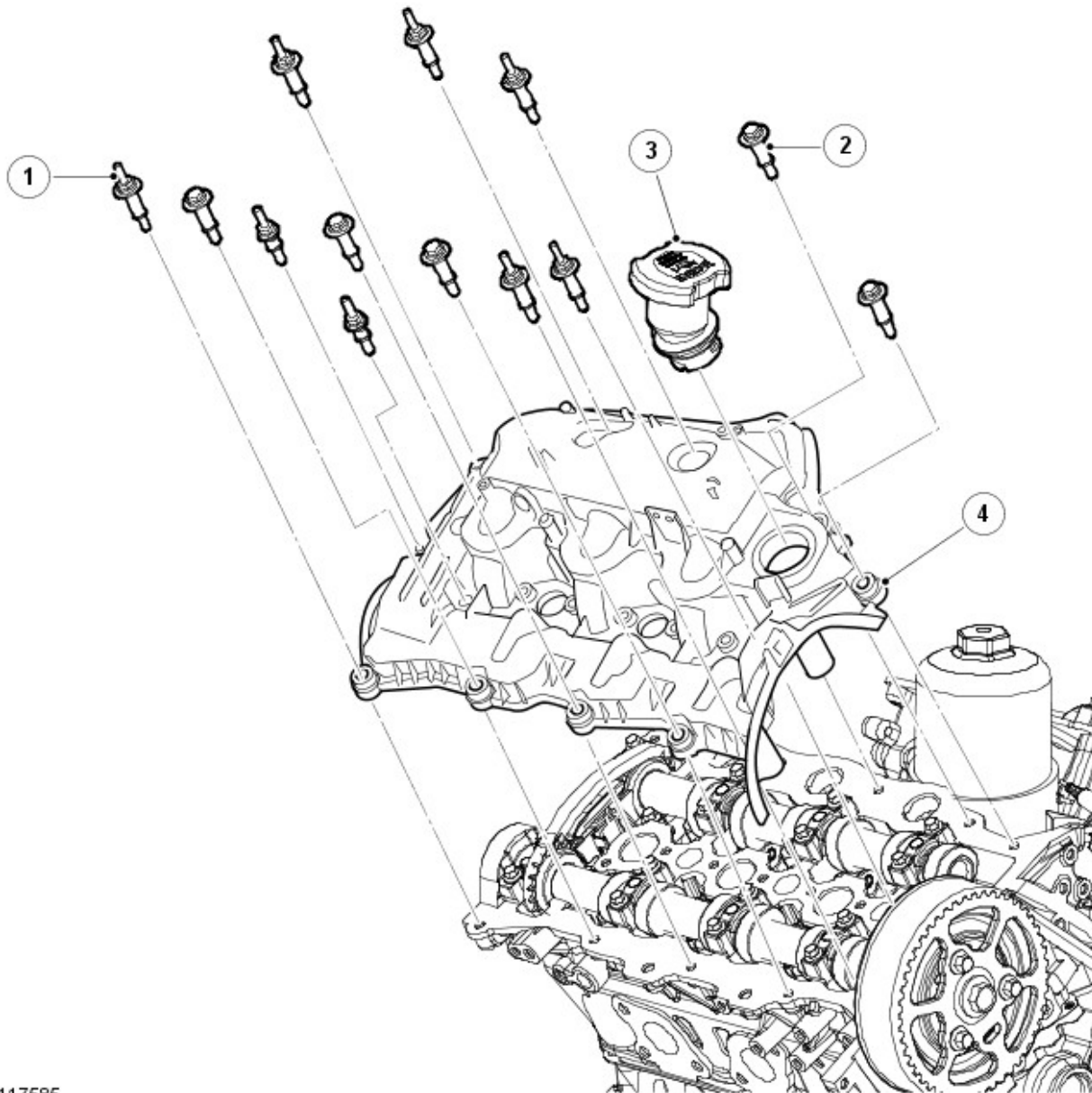
The **RH** cylinder head exhaust camshaft is machined at the rear end to provide a drive connection for the tandem pump.

The fuel injection nozzles are centrally mounted above each cylinder. For additional information refer to 303-04A Fuel Charging and Controls.

The glow plugs are arranged centrally on the intake side of the cylinder heads, between the 2 intake ports of each cylinder. For additional information refer to 303-07D Glow Plug System.

The engine lifting eyes are bolted to the cylinder head, 1 at the front and 2 at the rear, 1 per cylinder head.

Camshaft Covers



E117585

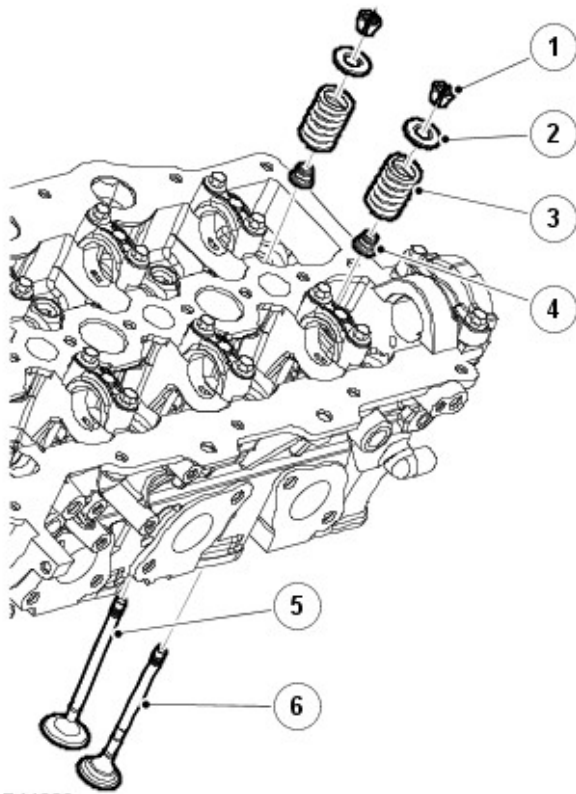
Item Description

- 1 Stud bolt M6 x 40 (6 off)
- 2 Bolt M6 x 40 (7 off)
- 3 Oil filler cap
- 4 **RH** camshaft cover assembly

The camshaft covers are manufactured from vinyl ester composite. The **RH** bank camshaft cover incorporates an outlet for the full load engine breather and the engine oil filler cap. The **LH** bank camshaft cover incorporates an outlet for the part load engine breather. For additional information refer to 303-08A engine Emission Control.

Silicon rubber in-groove gaskets seal the joints between the camshaft covers and the cylinder heads. Together with spacers and seals on the camshaft cover fasteners, they also isolate the covers from direct contact with the cylinder heads, to reduce noise.

Intake and Exhaust Valves



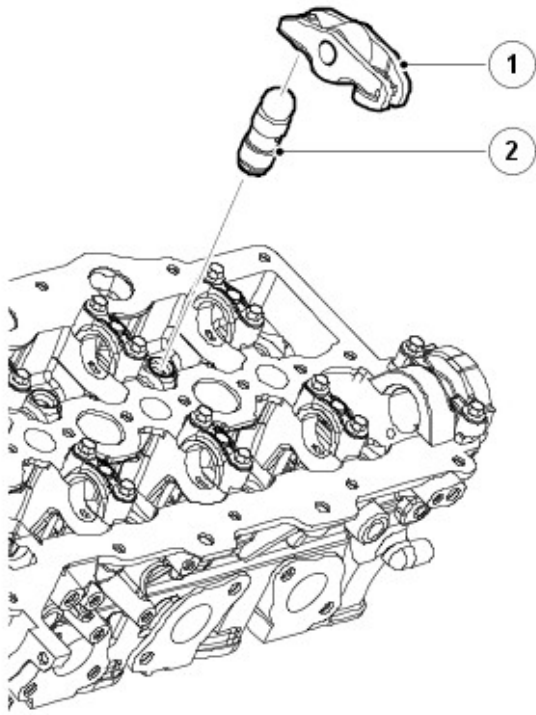
E44239

Item Description

- 1 Valve spring collet (24 off, 12 per cylinder head)
- 2 Valve spring retainer (24 off, 12 per cylinder head)
- 3 Valve spring (24 off, 12 per cylinder head)
- 4 Valve stem seal (24 off, 12 per cylinder head)
- 5 Intake valve (12 off, 6 per cylinder head)
- 6 Exhaust valve (12 off, 6 per cylinder head)

Each cylinder head incorporates 2 overhead camshafts operating 4 valves per cylinder via steel roller rockers with hydraulic lash adjusters.

Roller Rockers with Hydraulic Lash Adjusters



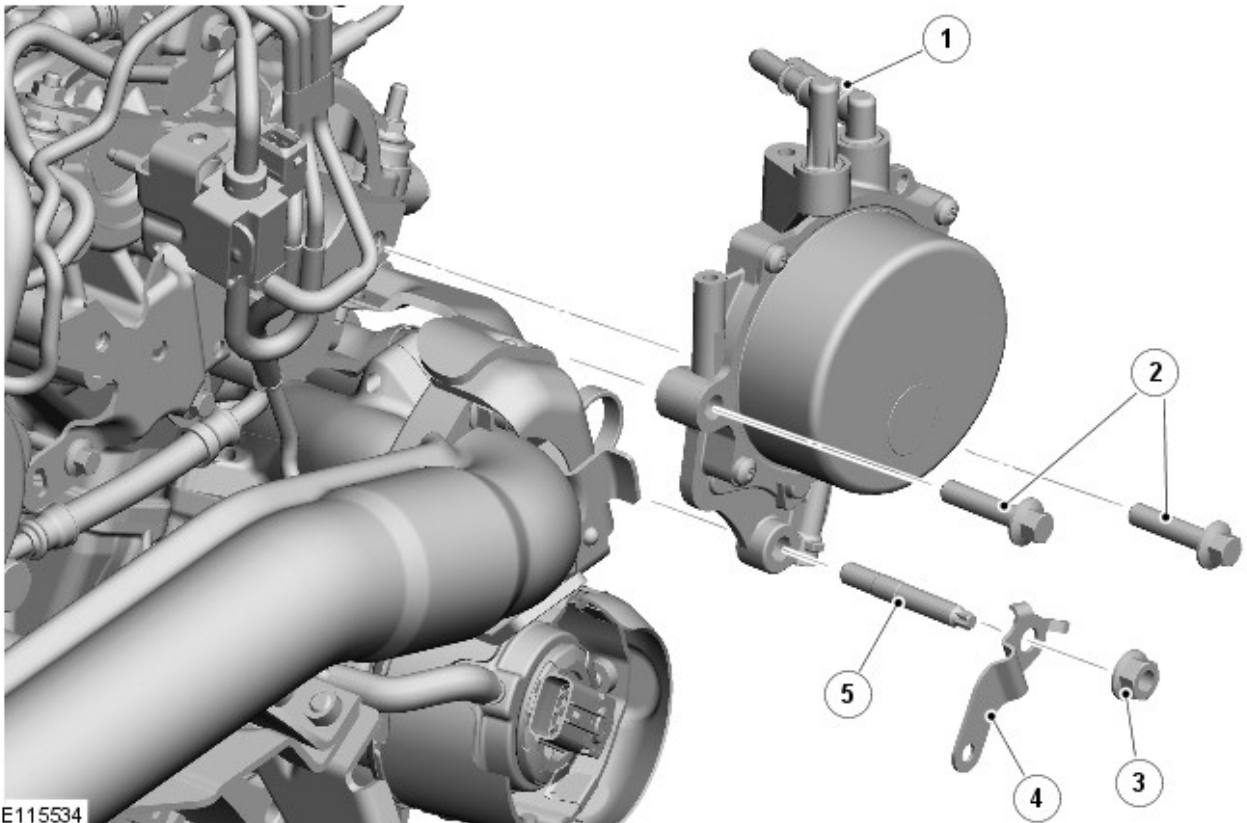
E44238

Item Description

- 1 Roller rocker (24 off, 12 per cylinder head)
- 2 Hydraulic lash adjuster (24 off, 12 per cylinder head)

The lightweight valve gear provides good economy and noise levels. Valve head diameters are 31 mm (1.220 in) for the exhaust and 35 mm (1.378 in) for the intake. All valves have 5 mm (0.197 in) diameter stems supported in sintered metal seats and guide inserts. Collets, valve collars and spring seats locate single valve springs on both intake and exhaust valves. Valve stem seals are integrated into the spring seats.

Tandem Pump



E115534

Item Description

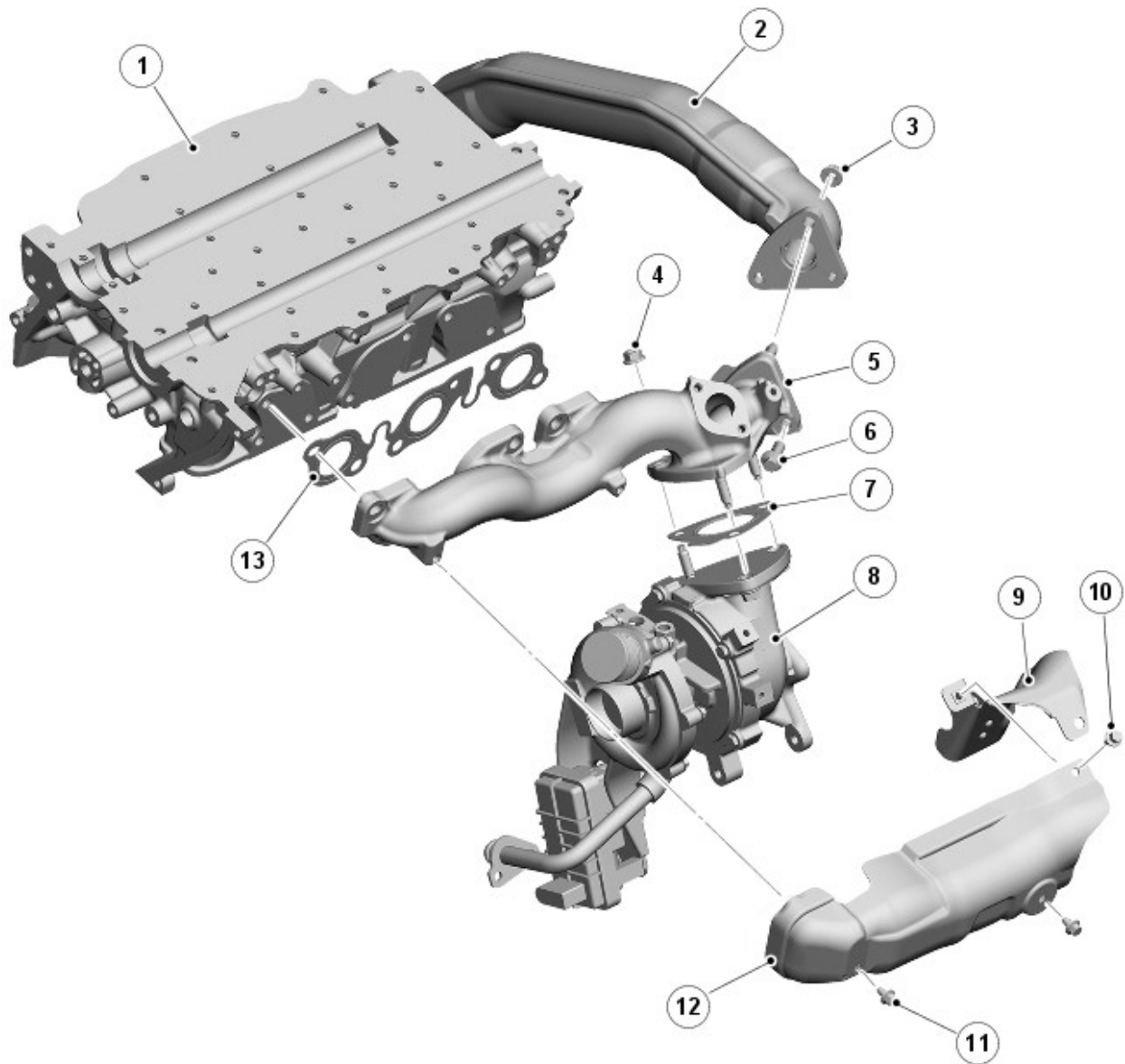
- 1 Tandem pump connections
- 2 Bolt (2 off)
- 3 Nut
- 4 Bracket (emission hose)
- 5 Stud

The tandem pump is a combined vacuum and oil scavenge pump. The scavenge pump is g-rotor type pump that drains oil from the secondary turbocharger to accommodate vehicle tilt. The pump is located at the rear of the RH side cylinder head and is driven from the exhaust camshaft.

Exhaust Manifolds



NOTE: LH exhaust manifold shown; RH exhaust manifold similar.



E115531

Item Description

- 1 Cylinder head
- 2 Connecting pipe
- 3 Nut (2 off)
- 4 Nut (3 off)
- 5 Exhaust manifold
- 6 Bolt
- 7 Gasket
- 8 Turbocharger (primary turbocharger shown)
- 9 Manifold rear heat shield
- 10 Bolt
- 11 Bolt
- 12 Bolt
- 13 Tandem pump

11 Bolt (2 off)

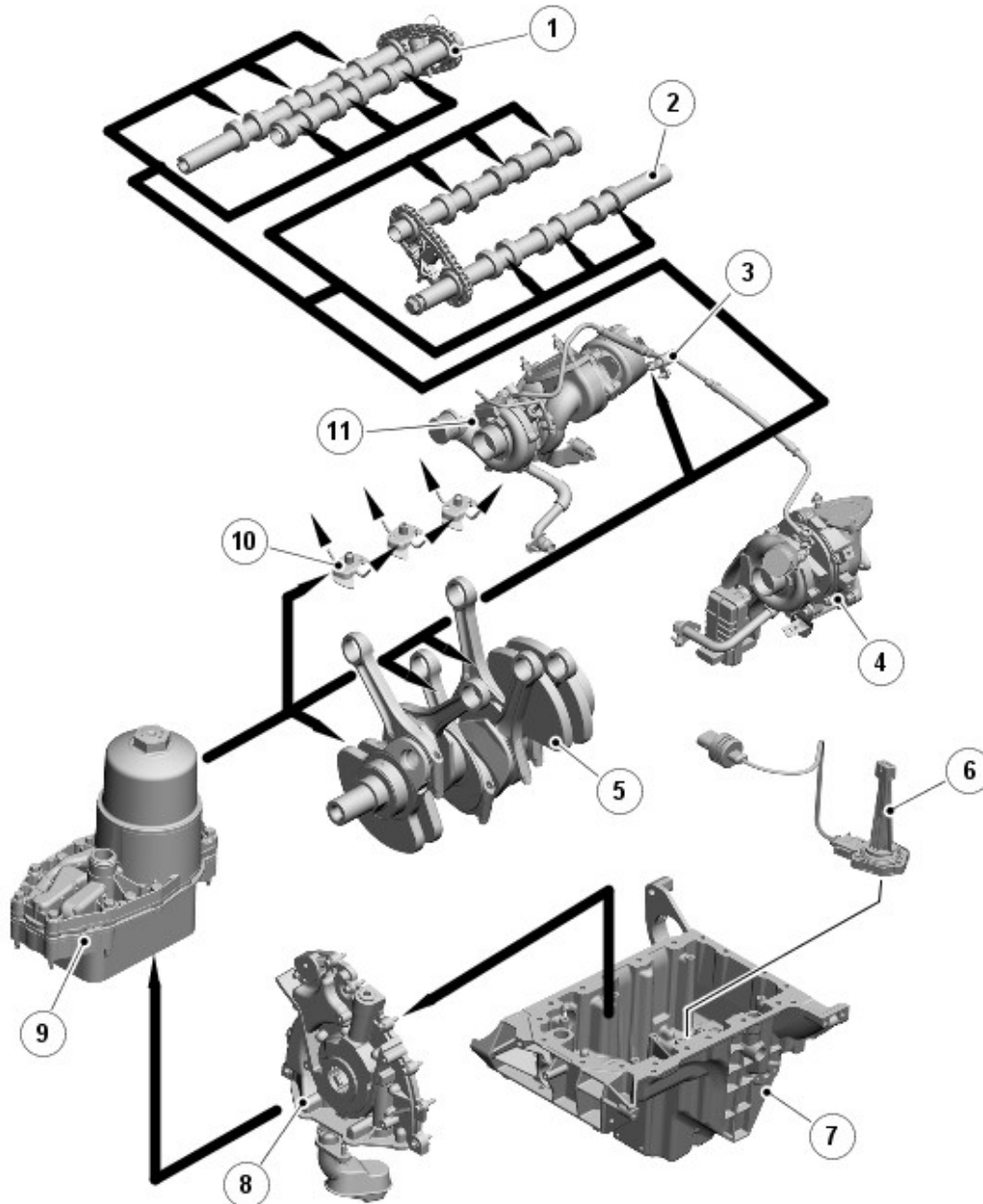
12 Manifold heat shield

The exhaust manifolds are cast from an iron alloy with a high nickel content giving excellent heat and corrosion resistance properties. They are sealed to the cylinder head by means of a steel gasket. Sacrificial plastic sleeves are used to align the manifolds. These sleeves must be changed when refitting the manifolds. Spacers on the securing bolts allow the manifolds to expand and retract with changes of temperature while maintaining the clamping loads.

Each manifold has a connection for the [EGR \(exhaust gas recirculation\)](#) transfer pipe.

The engine is fitted with twin variable geometry turbochargers, which fix to the exhaust manifolds by a 3-hole flange with a steel gasket.

LUBRICATION SYSTEM



E117573

Item Description

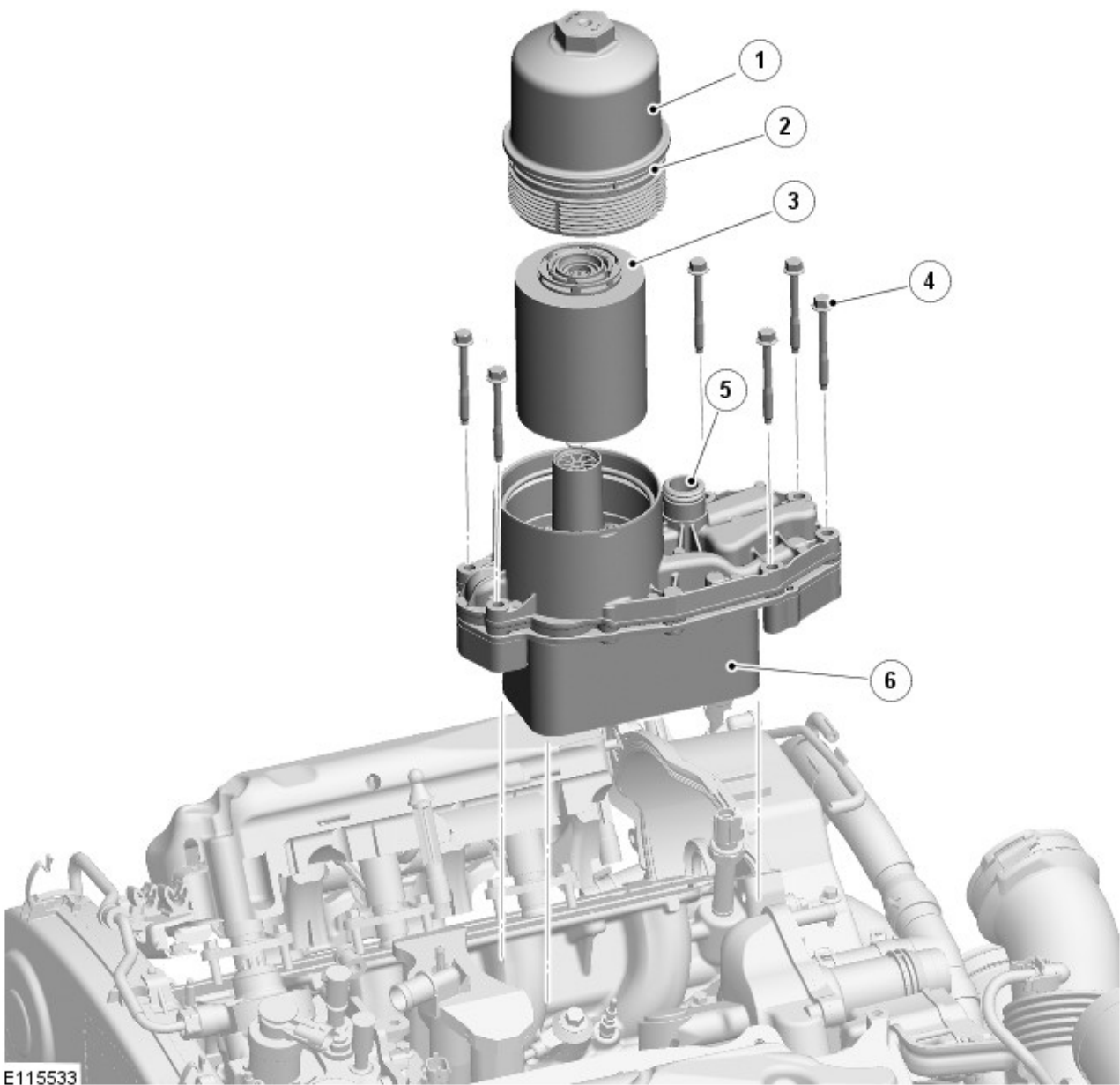
- 1 Inlet camshaft
- 2 Exhaust camshaft
- 3 Turbocharger oil supply
- 4 Primary turbocharger
- 5 Crankshaft and connecting rods
- 6 Oil level and temperature sensor
- 7 Oil pan
- 8 Oil pump
- 9 Oil cooler and filter assembly
- 10 Piston cooling jets

11 Secondary turbocharger

Oil is drawn from the oil pan and pressurized by the oil pump. The output from the oil pump is then filtered and distributed through internal oil passageways.

All moving parts are lubricated by pressure or splash oil. Pressurized oil is also provided for operation of the hydraulic adjusters and the timing gear chain tensioners.

Oil Cooler and Filter Assembly



E115533

Item Description

- 1 Filter housing
- 2 'O' ring seal
- 3 Paper element
- 4 Retaining bolt (6 off)
- 5 Coolant outlet connection
- 6 Cooler assembly

The engine is lubricated by a force-feed oil circulation system with a full flow oil filter. The oil cooler forms a unit with the oil filter, which is mounted centrally in the middle of the cylinder block between the 2 banks of cylinders. The engine oil is cooled using the engine cooling system. This eliminates the need for an additional engine oil cooler remotely mounted.

Oil returns to the oil pan under gravity. Large drain holes through the cylinder heads and cylinder block ensure the quick return of the oil, reducing the volume of oil required and enabling an accurate check of the contents soon after the engine stops.

System replenishment is through the oil filler cap on the [RH](#) camshaft cover.

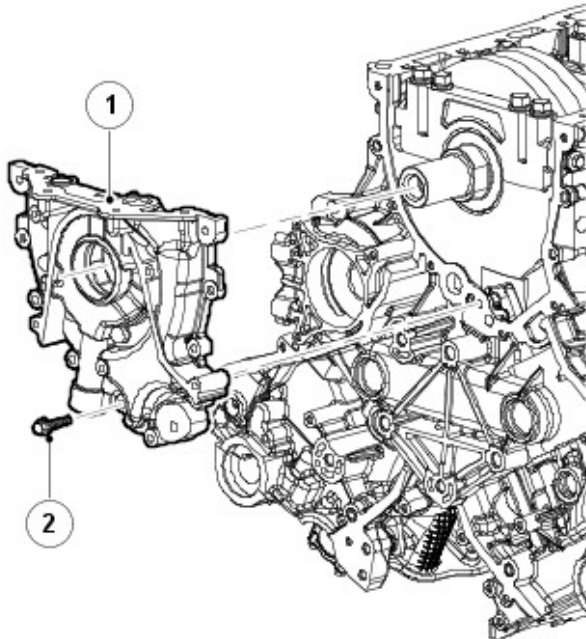
The moulded composite oil pick-up is immersed in the oil reservoir to provide a supply to the oil pump during all

normal vehicle attitudes. A mesh screen in the inlet prevents debris from entering the oil system.



NOTE: Fuel cooling is facilitated by a blast air fuel cooler in the return line to the fuel tank.

Oil Pump



E44230

Item Description

- 1 Oil pump
- 2 Bolt (10 off)

The oil pump is a gear type pump and is bolted and dowelled to the front of the cylinder block. It is sealed by means of a rubber gasket, which is recessed into the oil pump housing. The pump inlet and outlet ports align with oil passages in the stiffening frame.

The pumping element is an eccentric rotor, which is directly driven by flats on the crankshaft. An integral pressure relief valve regulates pump outlet pressure at 4.5 bar (65.25 lb/in²).

The front crankshaft oil seal is housed in the oil pump casing and is fitted such that its front face is 1 mm (0.04 in) under flush with the machined front face of the oil pump.

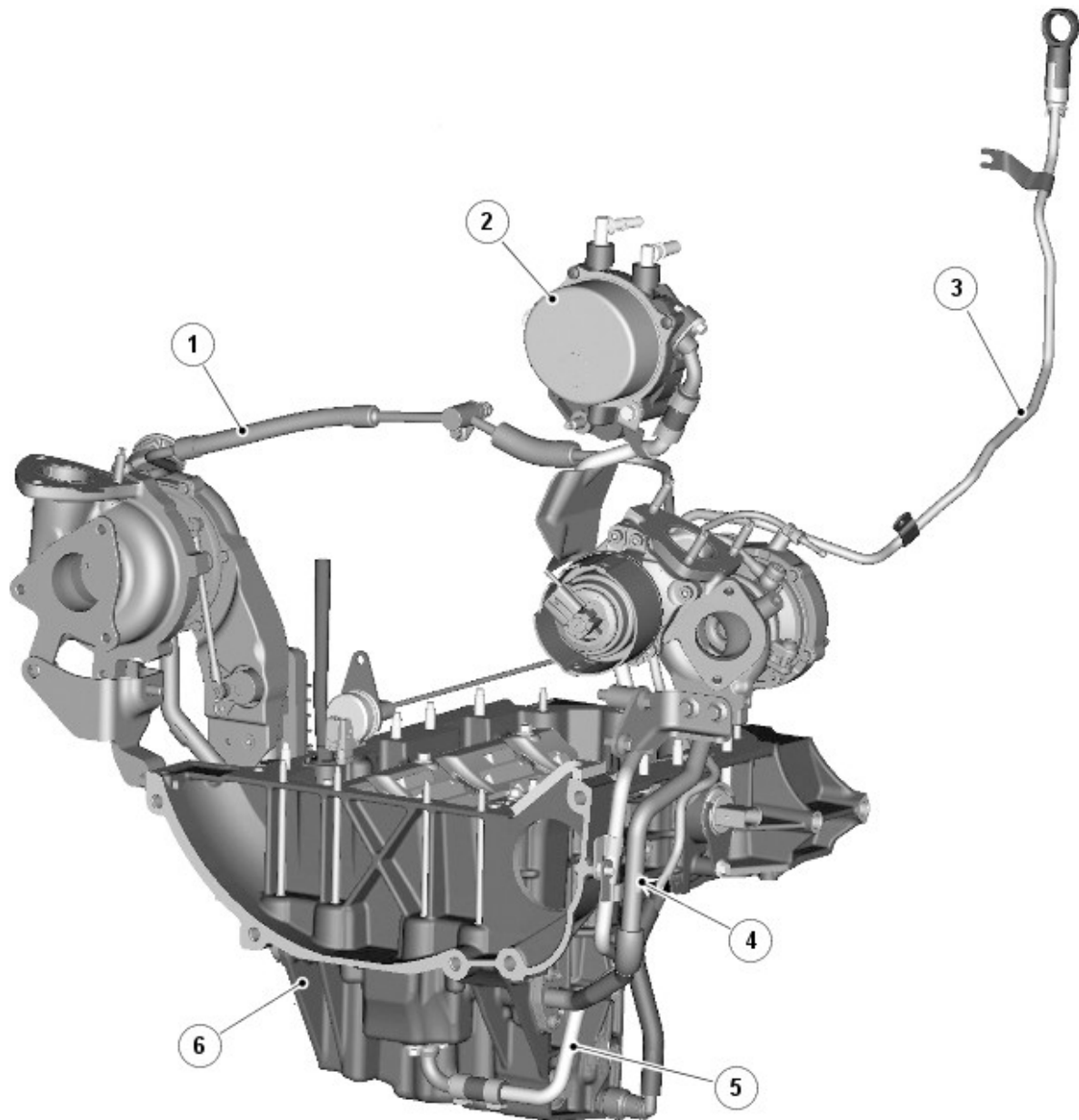


NOTE: The seal is not to be pushed all the way into the bore as this will block the seal drains.

Due to the wide range of inclines Land Rover vehicles operate across, the geometry of the oil pan has been configured to guarantee oil pick-up across all operating angles. An oil-scavenge system has been developed to guarantee excellent oil flow through the turbochargers on severe side-slopes. Whilst the 60-degree cylinder bank angle of a V6 engine allows the turbochargers to be packaged relatively higher in the vehicle, to obtain the best configuration for the V6 engine, the turbochargers must be sited much lower. At extreme angles, there is a risk they may be below the oil level on the oil pan, restricting oil return flow.

To overcome this, the engine uses:

- the oil pump to supply oil to the turbocharger bearings from the main oil reservoir (oil pan)
- a secondary reservoir to receive oil from the turbocharger bearings
- a tandem pump to urge oil to flow from the turbocharger bearings into the secondary reservoir and to pump the oil back from the secondary reservoir to the primary reservoir (oil pan)



E107569

Item Description

- 1 Turbocharger oil feed pipe
- 2 Tandem pump
- 3 Oil evacuation tube
- 4 Turbocharger oil return pipe
- 5 Oil scavenge pipe
- 6 Oil pan

An additional feature of this system is that the tandem pump used to pump oil back from the secondary reservoir can also be used as a source of vacuum for a vacuum operated system.

A semi-synthetic, low SAPS (sulphated ash, phosphorus and sulphur) oil is specified, which reduces the ash loading in the [DPF \(diesel particulate filter\)](#). Ash cannot be burnt off like soot so it remains in the [DPF](#) for life. Without the use of low SAPS oil, the [DPF](#) will not be a 'fit for life' component.

This low SAPS oil is also more resistant to temperature-related degradation than conventional mineral oil. It has lower viscosity at low temperatures and improved lubrication performance at higher temperatures.

Engine - TDV6 3.0L Diesel - Engine

Diagnosis and Testing

Overview

For specific areas of the engine, refer to the general procedures in this section and the relevant section of the manual.

For testing of excessive smoke from exhaust, please refer to the **Pinpoint Tests** list below and complete the **Test Results** section as required.

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is NOT acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Engine oil level • Coolant level • Transmission fluid level • Fuel level • Coolant leaks • Oil leaks • Fuel leaks • Intake air system • Hose connections • Visibly damaged or worn parts • Loose or missing nuts or bolts • Fuel contamination/grade/quality • Sensor installation/condition • Viscous fan and solenoid • Active engine mounts, correct installation/damage • Charge air coolers • Turbochargers • General engine condition 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Electrical connector(s) • Injectors • Glow plugs • Active engine mounts • 5 volt sensor supply • Sensor(s) • Turbocharger actuators • Viscous fan solenoid • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Excessive smoke from exhaust	<ul style="list-style-type: none"> • Oil passing through the turbocharger 	<ul style="list-style-type: none"> • Carry out pinpoint tests GO to Pinpoint Test A.
Poor performance (off-boost)	<ul style="list-style-type: none"> • Low/contaminated fuel • Restricted intake air system • General engine condition • Engine Control Module (ECM) internal failure 	<ul style="list-style-type: none"> • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Check the intake air system for restriction • Check the engine condition, compressions, etc if there are indications of a mechanical fault • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index
No boost	<ul style="list-style-type: none"> • Electrical connections and harnesses • Restricted intake air system • Charge air cooler restricted/leaking • Turbocharger actuator failure(s) 	<ul style="list-style-type: none"> • Check the electrical connections and harnesses • Check the intake air system for restriction/leakage • Check the charge air cooler for restriction/leakage • Check the turbocharger actuators and circuits • Check the turbochargers for wear. Disconnect the turbocharger intake and outlet pipework and turn the turbochargers by hand. Any roughness indicates a fault. Check any up and down movement in the turbocharger shafts. Excessive movement indicates a fault. If in doubt, compare the suspect unit with a

	<ul style="list-style-type: none"> • Turbocharger failure(s) • Engine Control Module (ECM) internal failure 	<ul style="list-style-type: none"> • new turbocharger • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index
No boost/excessive noise	<ul style="list-style-type: none"> • Turbocharger failure(s) 	<ul style="list-style-type: none"> • Disconnect the turbocharger intake and outlet pipework and turn the turbochargers by hand. Any roughness indicates a fault. Check any up and down movement in the turbocharger shafts. Excessive movement indicates a fault. If in doubt, compare the suspect unit with a new turbocharger

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (PCM) (100-00 General Information, Description and Operation).

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer approved diagnostic system)



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals


Test Results

During the following pinpoint routine you will be asked to record certain information. The following table identifies the type of recorded information which will be required by dealer technical support for further advice if required. Please locally construct a template to record the information as shown in the table below

TDV6 3.0L DIESEL	Results
<ul style="list-style-type: none"> • A. Customer complaint • B. Description of the drive cycle • C. Description of weather conditions when symptoms observed 	<ul style="list-style-type: none"> • A. • B. • C.
<ul style="list-style-type: none"> • Were the symptoms reproduced? 	<ul style="list-style-type: none"> • YES • NO
<ul style="list-style-type: none"> • Was the check engine lamp illuminated? 	<ul style="list-style-type: none"> • YES • NO
<ul style="list-style-type: none"> • Were there engine related warning messages displayed? 	<ul style="list-style-type: none"> • YES • NO
<ul style="list-style-type: none"> • What were the engine related warning messages displayed? 	<ul style="list-style-type: none"> • A. • B. • C.
<ul style="list-style-type: none"> • List all stored DTCs 	<ul style="list-style-type: none"> • A. • B. • C.
<ul style="list-style-type: none"> • Did oil level need topping up, or was there too much oil in engine? 	<ul style="list-style-type: none"> • Needed topping up • Too much oil in engine
<ul style="list-style-type: none"> • Had LTBO0358 already been carried out previously? 	<ul style="list-style-type: none"> • YES • NO
<ul style="list-style-type: none"> • Was the one-way valve (LR028945) already installed? 	<ul style="list-style-type: none"> • YES • NO
<ul style="list-style-type: none"> • Was the secondary turbocharger part number LR035869 	<ul style="list-style-type: none"> • YES

previously installed to the vehicle?	<ul style="list-style-type: none"> • NO
<ul style="list-style-type: none"> • Did the smoke test find a leakage? 	<ul style="list-style-type: none"> • No leakage found • In air induction system • In exhaust system
<ul style="list-style-type: none"> • What was the pressure at the oil filler cap? 	<ul style="list-style-type: none"> • A. At idle engine cold <ul style="list-style-type: none"> - Pressure = • B. At idle engine warm <ul style="list-style-type: none"> - Pressure = • C. At idle engine warm, secondary turbocharger operating <ul style="list-style-type: none"> - Pressure = • D. At 3000rpm <ul style="list-style-type: none"> - Pressure =
<ul style="list-style-type: none"> • Was there excessive blow-by? • What was the cause of the excessive blow-by? 	<ul style="list-style-type: none"> • YES • NO • Cause of excessive blow-by was
<ul style="list-style-type: none"> • How many milliliters of oil were drained from the oil scavenge tank? 	<ul style="list-style-type: none"> • Oil drained from the oil scavenge tank was .....ml

PINPOINT TEST A : TDV6 3.0L DIESEL EXCESSIVE SMOKE FROM EXHAUST	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: FOLLOW CUSTOMER INFORMATION TO REPRODUCE THE SYMPTOMS	
	1 Follow customer information. Carry out road test to reproduce the symptoms
	Can customer symptoms be reproduced? Yes If smoke is seen determine whether smoke is white, blue or blackProceed to next step No Proceed to next step
A2: ENGINE RELATED MESSAGES OR WARNING LAMPS	
	1 Check for engine related messages and warning lamps
	Are there engine related messages and warning lamps displayed? Yes Using the manufacturer approved diagnostic system check engine control module for additional DTCs and refer to relevant DTC index. Rectify these firstProceed to next step No Proceed to next step
A3: OIL VOLUME	
	1 Drain the engine oil into a measured container
	Record the total oil volume drainedRemove the oil filterCheck the oil filter element for damageRemove the oil filler capCheck the oil filler cap for damage. Replace if requiredCheck that the oil drain back valve is installed correctly and closes correctly. The oil drain back valve is situated in the bottom of the oil filter housingInstall new oil filter elementInstall new oil filter housing sealRefill engine oil with clean oil to the correct oil level. DO NOT OVERFILL Install oil filler capWere there any defects with the filter cap, filter element or oil drain back valve? Yes Rectify defects, then proceed to next step No Proceed to next step
A4: VACUUM CHECK	
	1 Vacuum check on the compressor shut off valve <ul style="list-style-type: none"> • Use a Mityvac device to apply a vacuum of at least 750 mmHg (1000 mbar or 15 psi) to the compressor shut off valve hose line • Observe the compressor shut-off valve arm for movement. It should move more than 10 mm. If compressor shut-off valve does not open install a new compressor shut-off valve • If vacuum decays over 10 seconds (or cannot generate a vacuum) use a smoke tester to find leak and repair • Remove Mityvac and return vacuum line to

	<p>standard</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signal compressor shut off valve Start the engine, allow to idle Allow engine to idle for a further 4 minutes, the during this time the datalogger signal compressor shut off valve value should change, indicating the secondary turbocharger is operating
	<p>Did the compressor shut-off valve operate during the above tests?</p> <p>Yes Proceed to next step</p> <p>No If it was not possible to create the required vacuum use a smoke tester to find leak and repairIf the compressor shut-off valve did not operate during the 4 minute idle test use the manufacturer approved diagnostic system check and install latest relevant level of software to the engine control moduleProceed to next step</p>
<p>A5: SMOKE TEST AIR INDUCTION SYSTEM</p>	
 <p>E148051</p>	<p>1 Using the manufacturer approved smoke leak detector, carry out a leak check of the air intake system</p>
	<p>Were air intake system leaks detected?</p> <p>Yes Refer to the workshop manual and rectify any leaks detected in the air intake systemThoroughly clean air induction system, remove intercooler, compressor shut off valve and clean & remove all oil from exhaust. Refer to TSB LTB00358. When the engine is restarted and run you must be satisfied that any smoke observed is not due to residual oil left in the system, (see below)Carry out a 30 minute road drive. Keep engine rpm below 1200 rpm and avoid hard acceleration. After 30 minutes stop the vehicle, switch off the engine and wait 15 minutes. Restart the engine drive away and, when safe to do so, accelerate uphill. During this acceleration it is important that the secondary turbo is activated. If a co-driver is available SDD may be used to monitor turbo shut off valve commanded position to ensure the valve opens. Otherwise engine speed will need to exceed 2800 rpm. Using manual gear selection may help to achieve higher engine speed without excessive road speed. Be aware of the rear view using mirrors. Look for excessive smoke from the exhaust. Return to the workshop and with the vehicle in Park raise the engine rpm to above 3200 rpm and hold it for 2 minutes. Observe whether or not there is smoke from the exhaust tail pipesContact dealer technical support for further advice if smoke still coming from the exhaust tail pipes</p> <p>No Proceed to next step</p>
<p>A6: INTAKE MANIFOLD BLOW-BY</p>	
	<p>1 Modify a spare oil filler cap by drilling a 6mm hole in the center and connecting a Mityvac tool or pressure gauge</p>



E148055

- This test needs to be carried out on the vehicle while the engine is still cold. The vehicle in PARK with the handbrake applied
- Connect the modified oil filler cap to the vehicle
- Using the manufacturer approved diagnostic system check datalogger signal compressor shut off valve
- Start the engine, allow to idle
- Record the pressure value from the pressure gauge
 - Value should be approx atmospheric pressure
- Allow engine to idle for a further 3 minutes, the during this time the datalogger signal compressor shut off valve value should change, indicating the secondary turbocharger is operating
- Record the pressure value from the pressure gauge
 - Value should be approx atmospheric pressure
- Raise the engine speed to 3000rpm
- Record the pressure value from the pressure gauge with engine speed at 3000rpm
 - Value should now show a slight vacuum
- Switch off the engine

Was there a positive pressure value from the pressure gauge with engine speed at 3000rpm

Yes

Install the correct oil filler cap. Check the engine for high manifold blow-by, check for low cylinder compression and restrictions in the breather system. Thoroughly clean air induction system, remove intercooler, compressor shut off valve and clean & remove all oil from exhaust. Refer to TSB LT B00358. When the engine is restarted and run you must be satisfied that any smoke observed is not due to residual oil left in the system, (see below). Carry out a 30 minute road drive. Keep engine rpm below 1200 rpm and avoid hard acceleration. After 30 minutes stop the vehicle, switch off the engine and wait 15 minutes. Restart the engine drive away and, when safe to do so, accelerate uphill. During this acceleration it is important that the secondary turbo is activated. If a co-driver is available SDD may be used to monitor turbo shut off valve commanded position to ensure the valve opens. Otherwise engine speed will need to exceed 2800 rpm. Using manual gear selection may help to achieve higher engine speed without excessive road speed. Be aware of the rear view using mirrors. Look for excessive smoke from the exhaust. Return to the workshop and with the vehicle in Park raise the engine rpm to above 3200 rpm and hold it for 2 minutes. Observe whether or not there is smoke from the exhaust tail pipes. Contact dealer technical support for further advice if smoke still coming from the exhaust tail pipes

No

Proceed to next step

A7: OIL SCAVENGE TANK

- 1 Check the oil scavenge pipe connector is correctly installed to the oil scavenge pump. Refer to picture, which shows the scavenge pipe fully disconnected



E148053

Was more than 500ml of oil collected from the oil scavenge tank?

Yes

If the oil scavenge pump **has** previously been replaced on this vehicle, check the scavenge pipes are not blocked or restricted. If the oil scavenge pump **has not** previously been replaced on this vehicle, replace the oil scavenge pump and check the scavenge pipes are not blocked or restricted. Thoroughly clean air induction system, remove intercooler, compressor shut off valve and clean & remove all oil from exhaust. Refer to TSB LTBO0358. When the engine is restarted and run you must be satisfied that any smoke observed is not due to residual oil left in the system, (see below). Carry out a 30 minute road drive. Keep engine rpm below 1200 rpm and avoid hard acceleration. After 30 minutes stop the vehicle, switch off the engine and wait 15 minutes. Restart the engine drive away and, when safe to do so, accelerate uphill. During this acceleration it is important that the secondary turbo is activated. If a co-driver is available SDD may be used to monitor turbo shut off valve commanded position to ensure the valve opens. Otherwise engine speed will need to exceed 2800 rpm. Using manual gear selection may help to achieve higher engine speed without excessive road speed. Be aware of the rear view using mirrors. Look for excessive smoke from the exhaust. Return to the workshop and with the vehicle in Park raise the engine rpm to above 3200 rpm and hold it for 2 minutes. Observe whether or not there is smoke from the exhaust tail pipes

No

Proceed to next step

A8: CHECK THE LATEST LEVEL CALIBRATION FILE IS LOADED TO THE ENGINE CONTROL MODULE.

1 Calibration Part Numbers **10MY**: AH22-12K532-PTK - High Power DPF, AH22-12K532-PSH - Low Power DPF, AH22-12K532-PCJ - High Power no DPF, **12MY**: CH22-12K532-PTD - Hi Flow DPF, CH22-12K532-PSD - Lo Flow DPF,

Is the latest level calibration file is loaded to the engine control module?

Yes

Proceed to next step

No

Using the manufacturer approved diagnostic system, update the engine control module calibration file to the latest level. Proceed to next step

A9: OIL IN EXHAUST OR CHARGED AIR SYSTEM

1 Check for oil contamination in the exhaust system and charged air system downstream of the primary turbocharger

- Confirm if a primary turbocharger has recently be installed

Is there oil contamination in the exhaust system and charged air system downstream of the primary turbocharger?

Yes

If a primary turbocharger **has** previously been replaced on this vehicle, contact dealer technical support for further advice. If a primary turbocharger **has not** previously been replaced on this vehicle, replace the primary turbocharger. Thoroughly clean air induction system, remove intercooler, compressor shut off valve and clean & remove all oil from exhaust. Refer to TSB LTB00358. When the engine is restarted and run you must be satisfied that any smoke observed is not due to residual oil left in the system, (see below). Carry out a 30 minute road drive. Keep engine rpm below 1200 rpm and avoid hard acceleration. After 30 minutes stop the vehicle, switch off the engine and wait 15 minutes. Restart the engine drive away and, when safe to do so, accelerate uphill. During this acceleration it is important that the secondary turbo is activated. If a co-driver is available SDD may be used to monitor turbo shut off valve commanded position to ensure the valve opens. Otherwise engine speed will need to exceed 2800 rpm. Using manual gear selection may help to achieve higher engine speed without excessive road speed. Be aware of the rear view using mirrors. Look for excessive smoke from the exhaust. Return to the workshop and with the vehicle in Park raise the engine rpm to above 3200 rpm and hold it for 2 minutes. Observe whether or not there is smoke from the exhaust tail pipes.

No

Allow an overnight drain of the oil from the oil scavenge tank. Carry out a 30 minute road drive. Keep engine rpm below 1200 rpm and avoid hard acceleration. After 30 minutes stop the vehicle, switch off the engine and wait 15 minutes. Restart the engine drive away and, when safe to do so, accelerate uphill. During this acceleration it is important that the secondary turbo is activated. If a co-driver is available SDD may be used to monitor turbo shut off valve commanded position to ensure the valve opens. Otherwise engine speed will need to exceed 2800 rpm. Using manual gear selection may help to achieve higher engine speed without excessive road speed. Be aware of the rear view using mirrors. Look for excessive smoke from the exhaust. Return to the workshop and with the vehicle in Park raise the engine rpm to above 3200 rpm and hold it for 2 minutes. Observe whether or not there is smoke from the exhaust tail pipes. Contact dealer technical support for further advice if smoke still coming from the exhaust tail pipes.

Engine - TDV6 3.0L Diesel - Engine Oil Draining and Filling

General Procedures

Draining



WARNING: The spilling of hot engine oil is unavoidable during this procedure, care must be taken to prevent scalding.



CAUTION: Make sure the engine is warm.

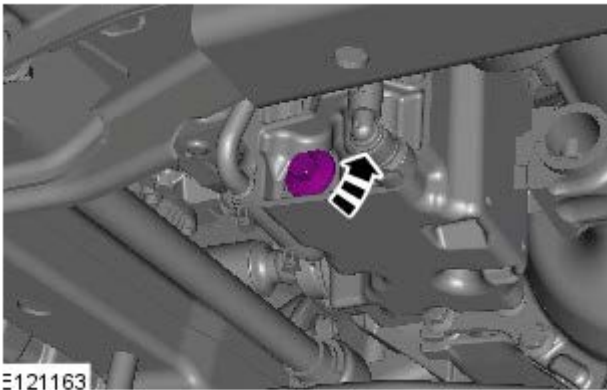
1. Refer to: Oil Filter Element (303-01 Engine - 3.0L Diesel, Removal and Installation).



2. **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Refer to: Engine Undershield (501-02, Removal and Installation).



4. **WARNING:** Observe due care when draining engine oil as the oil can be very hot.

CAUTIONS:



Be prepared to collect escaping oil.



Discard the bolt.



Allow at least 10 minutes for the engine oil to drain.

Drain the engine oil.

Filling

1. **CAUTIONS:**

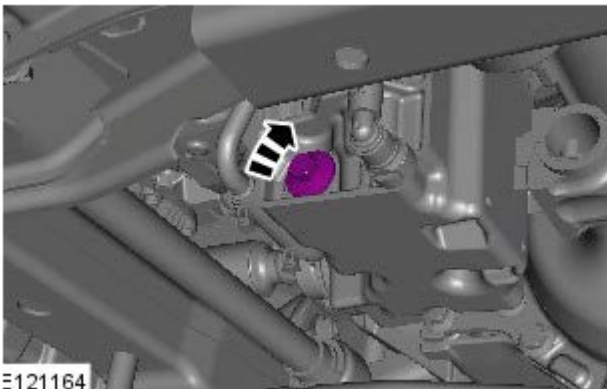


Make sure that the component is clean, free of foreign material and lubricant.



Make sure that a new bolt is installed.

Torque: 23 Nm

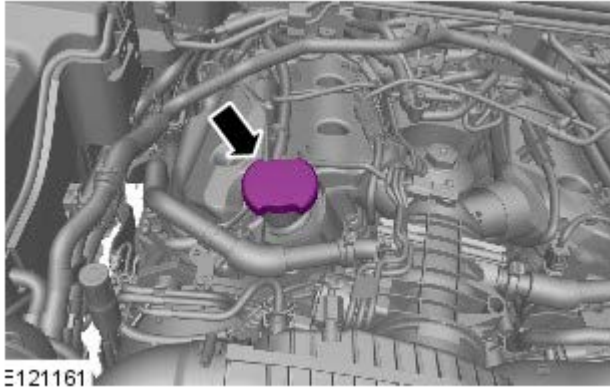



2. Refer to: Engine Undershield (501-02, Removal and Installation).

3. Lower the vehicle.

4. Refer to: Oil Filter Element (303-01 Engine - 3.0L Diesel, Removal and Installation).

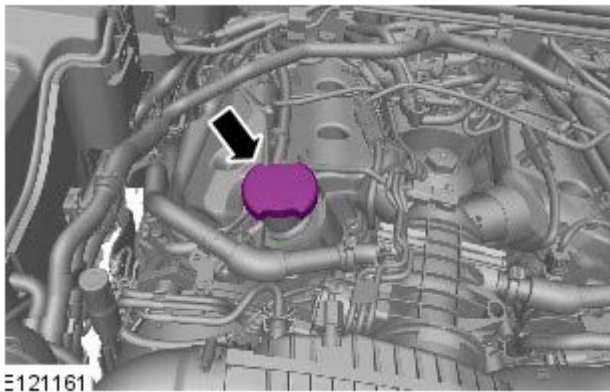
5. Fill the engine with oil.



6.  CAUTION: Make sure that the vehicle is left for 5 minutes from filling with oil and that the engine oil level is reading at least minimum, before starting the engine. To check engine oil level follow steps 9-12.

Clean any residual engine oil from the oil filler cap area.


7.




- 8.
- Start the engine and allow to run for 10 minutes, stop the engine.
 - Check for leaks.

9. CAUTIONS:

 Make sure that the vehicle is parked on level ground.

 Make sure that the selector lever and the gearshift mechanism are in the park (P) position.

 Make sure that the hood is open.

 NOTE: Allow 10 minutes from the engine switch off for the engine oil level to stabilize.

- Turn the ignition on.

10.

- Press the right-hand directional button to access the instrument cluster menu.



E123926

11.

- Press the right-hand OK button.



E123925

12.

- Press the right-hand directional button to access the Oil Level Display.



E123927

13.

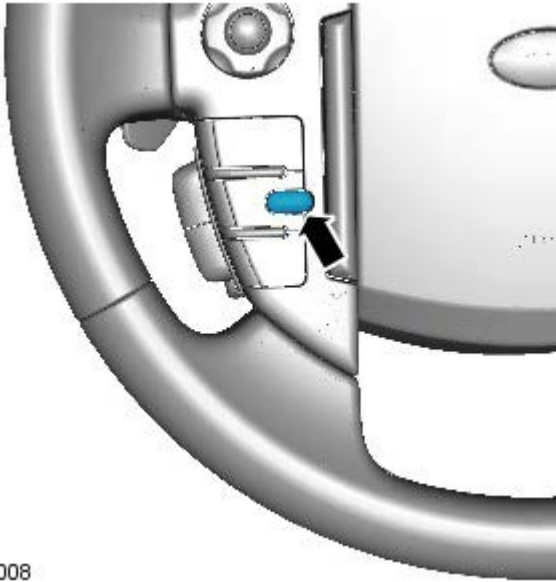
- Press the right-hand OK button and follow the instructions.



E123928

14.

- Press the cruise control cancel button twice within 2 seconds.



E121008



E123929

15.

- The message center display will revert to the normal display in the trip computer.
- Press the right-hand OK button and follow the instructions.
- Check that the oil level display shows an oil level reading.
- Take a reading from the level display and, if necessary, top up with oil as instructed.

16. Turn the ignition off.

17.  **NOTE:** Allow 10 minutes for the engine oil level to stabilize if there has been additional oil top up.

- Turn the ignition on.

18.

- Press the right-hand directional button to access the instrument cluster menu.



E123926

19.

- Press the right-hand OK button.



E123925

20.

- Press the right-hand directional button to access the Oil Level Display.



E123927

21.

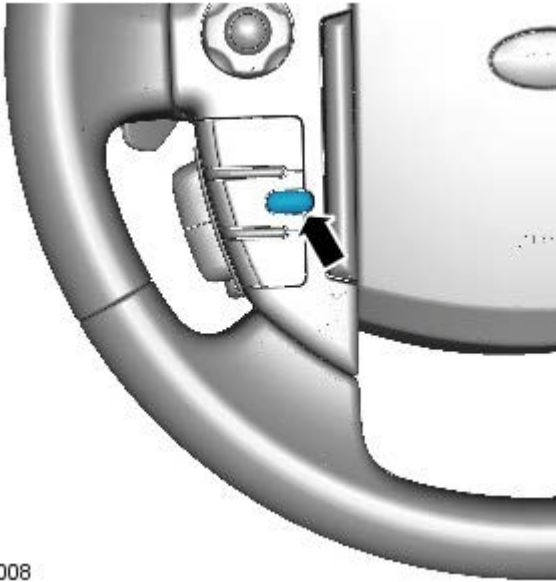
- Scroll through the trip menu to access the engine oil level display.



E123929

22.


- Press the cruise control cancel button twice within 2 seconds.



E121008



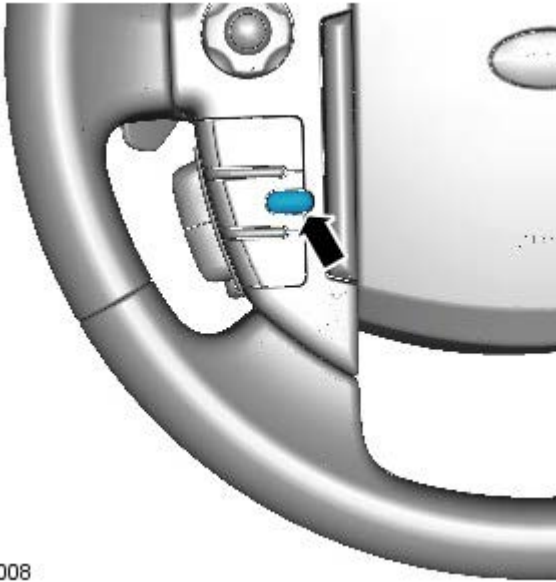
E123929

23.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

- The message center display will revert to the normal display in the trip computer.
- Scroll through the trip menu to access the engine oil level display.
- This display is now the live reading of the engine oil level.
- Take a reading from the level display and, if necessary, top up with oil as instructed.

24.


- Press and hold the cruise control cancel button for more than 2 seconds.



E121008

25.
 - The message center display will revert to the normal display in the trip computer.
26. Turn the ignition off.
27. Turn the ignition on.



28.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.
 - Scroll through the trip menu to access the engine oil level display.
 - Make sure that the average oil level value has now been updated.





E123929

29. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).

Engine - TDV6 3.0L Diesel - Engine Oil Vacuum Draining and Filling

General Procedures

Special Tool(s)

 <p>E129630</p>	<p>303-1484 Vacuum Pump, Oil Drain</p>
 <p>E129631</p>	<p>303-1484-01 Adapter for 303-1484</p>

Draining



WARNING: The spilling of hot engine oil is unavoidable during this procedure, care must be taken to prevent scalding.

NOTES:



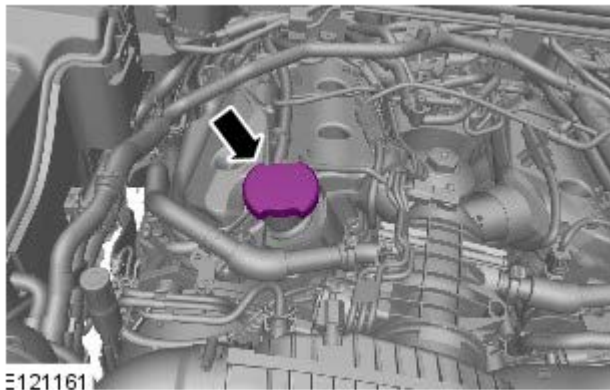
Make sure that the vehicle is parked on level ground.



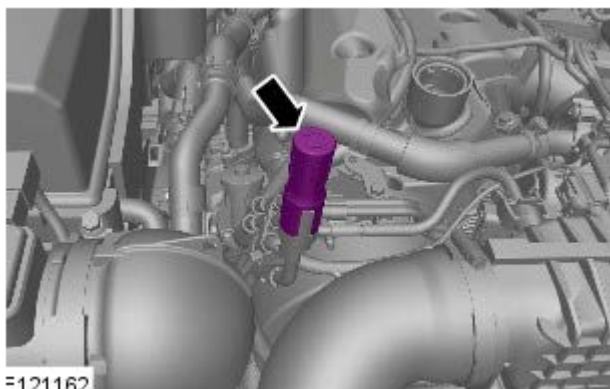
Clean the components general area prior to dismantling.

1. Refer to: Oil Filter Element (303-01 Engine - 3.0L V6 - TdV6, Removal and Installation).

2.

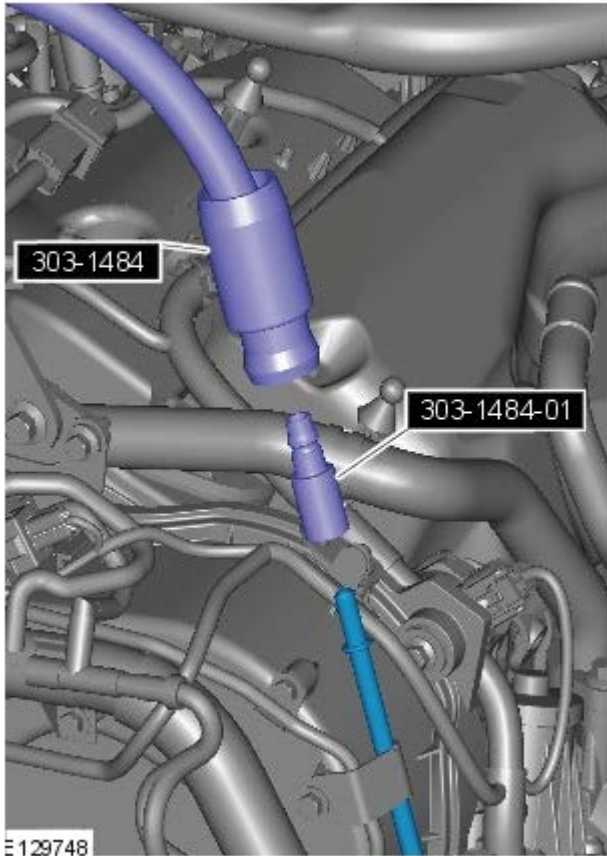


3.  **CAUTION:** Allow 10 minutes from turning the engine off before starting oil extraction.



4.

- Using the oil vacuum pump drain the oil



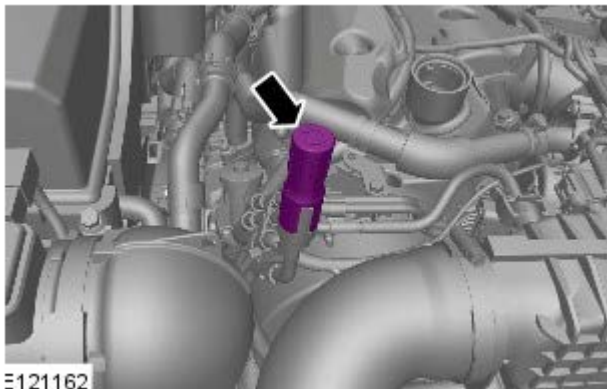
out through the oil extraction tube.

Special Tool(s): [303-1484](#), [303-1484-01](#)


5.
 - Remove the oil vacuum pump.

Filling


1. Refer to: Oil Filter Element (303-01 Engine - 3.0L V6 - TdV6, Removal and Installation).
- 2.

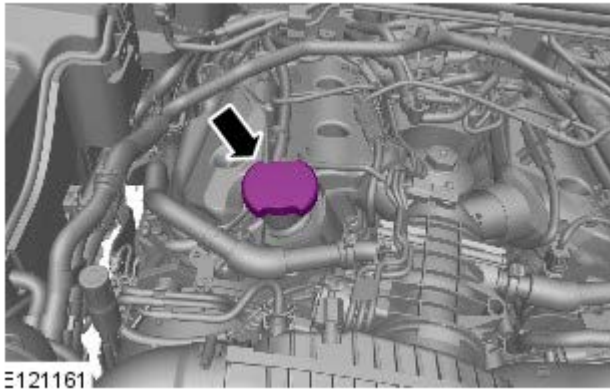


3. Fill the engine with oil.

4.  **CAUTION:** Make sure that the vehicle is left for 5 minutes from filling with oil and that the engine oil level is reading at least minimum, before starting the engine. To check engine oil level follow steps 8-10.

Clean any residual engine oil from the oil filler cap area.

5.  **CAUTION:** Correct installation of the oil filler cap can be obtained by tightening the cap until an audible click is heard.





E121161

6.
 - Start the engine and allow to run for 10 minutes, stop the engine.
 - Check for leaks.

7. CAUTIONS:

 Make sure that the vehicle is parked on level ground.

 Make sure that the selector lever and the gearshift mechanism are in the park (P) position.

 Make sure that the hood is open.

 NOTE: Allow 10 minutes from the engine switch off for the engine oil level to stabilize.

- Turn the ignition on.

8.

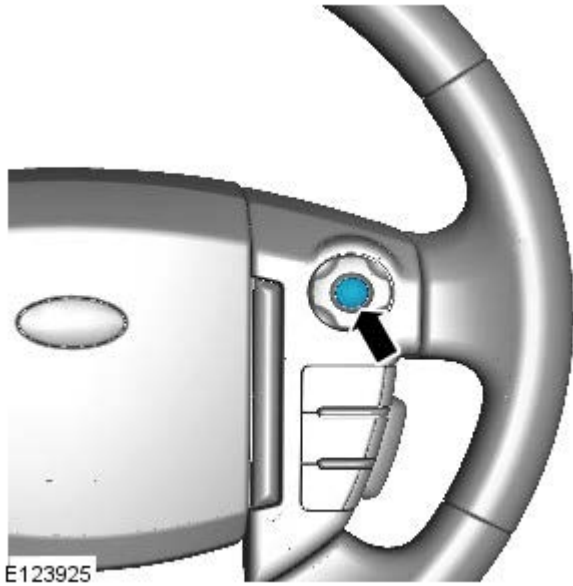
- Press the right-hand directional button to access the instrument cluster menu.



E123926

9.

- Press the right-hand OK button.



E123925

10.

- Press the right-hand directional button to access the Oil Level Display.



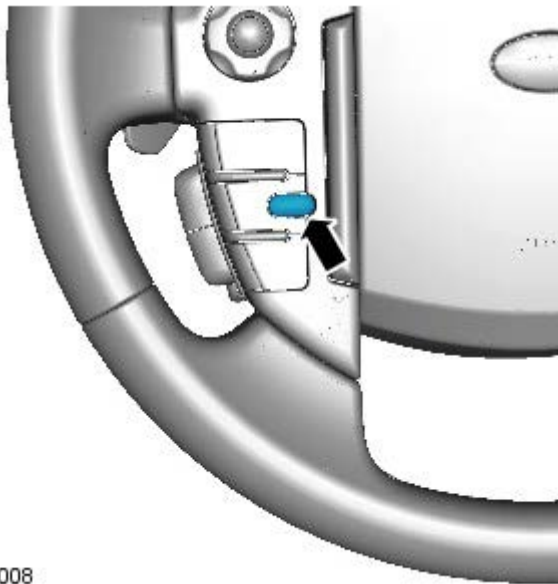
E123927

11.

- Press the right-hand OK button and follow the instructions.



E123928



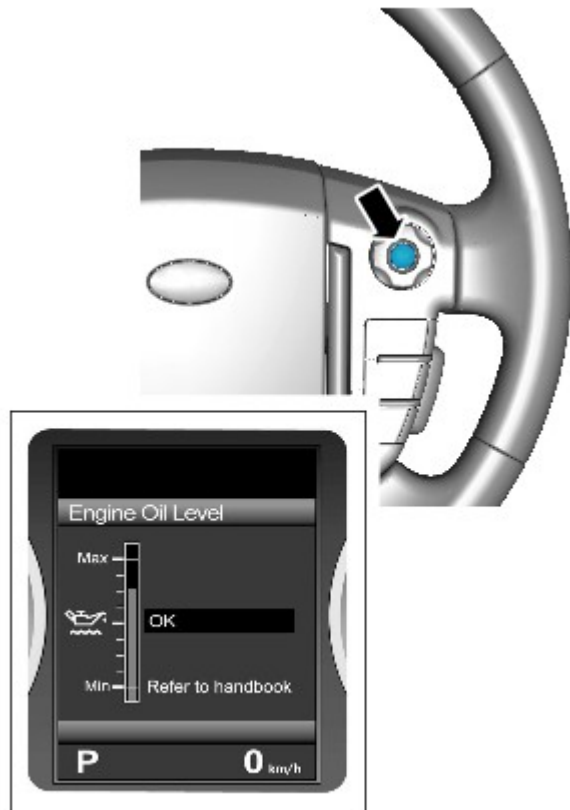
E121008

12.

- Press the cruise control cancel button twice within 2 seconds.

13.

- The message center display will revert to the normal display in the trip computer.
- Press the right-hand OK button and follow the instructions.
- Check that the oil level display shows an oil level reading.
- Only after having started and run the engine for 10 minutes, switch off the engine, then stabilizing for 10 minutes, take a reading from the oil level display and, if necessary top up with engine oil.



E123929

14. Turn the ignition off.

15.  **NOTE:** Allow 10 minutes for the engine oil level to stabilize if there has been additional oil top up.

Turn the ignition on.

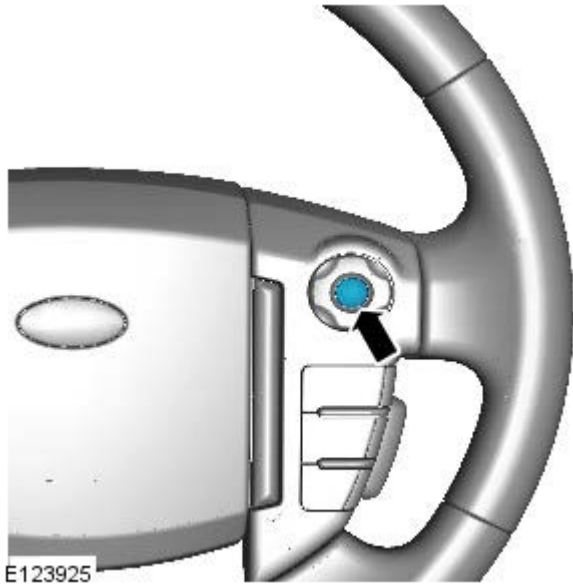
16.

- Press the right-hand directional button to access the instrument cluster menu.



E123926

17.



E123925

- Press the right-hand OK button.



18.

- Press the right-hand directional button to access the Oil Level Display.



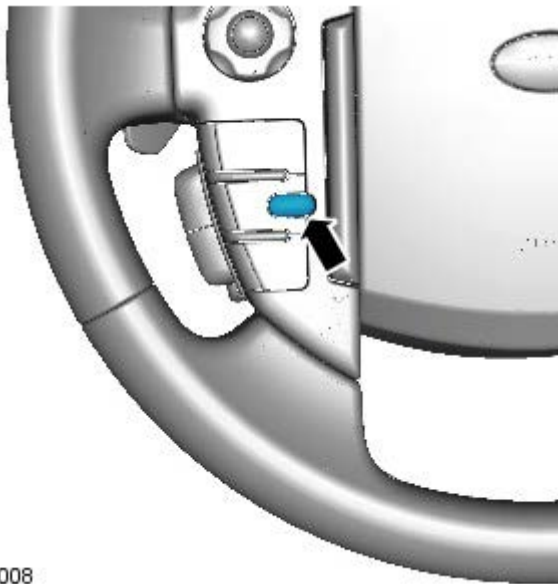
E123927

19.

- Press the right-hand OK button and follow the instructions.




E123928



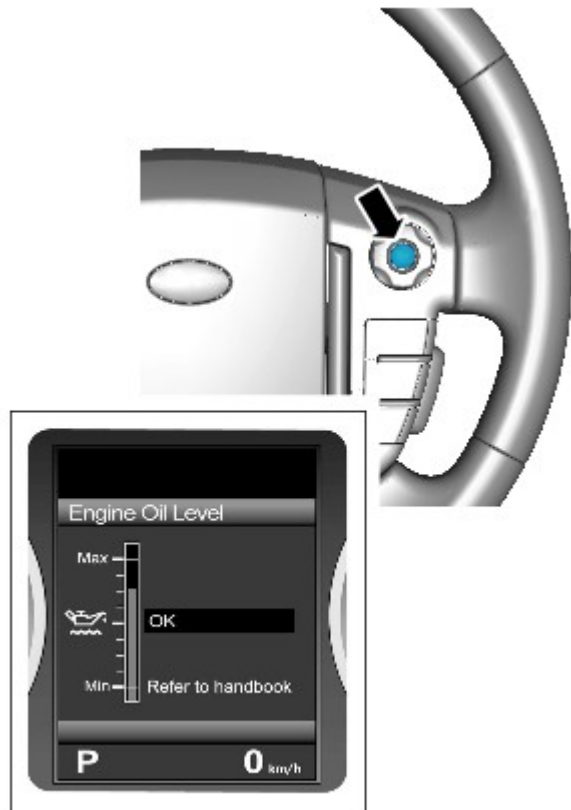
E121008

20.

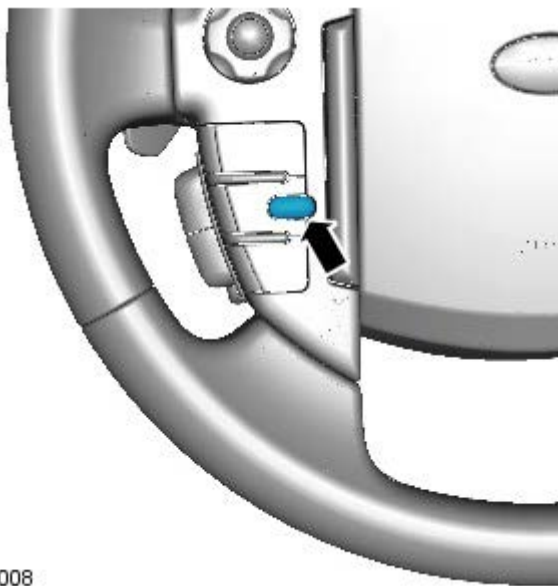
- Press and hold the cruise control cancel button for more than 2 seconds.

21.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

- The message center display will revert to the normal display in the trip computer.
- Press the right-hand OK button and follow the instructions.
- This display is now the live reading of the engine oil level.
- Take a reading from the level display and, if necessary, top up with oil as instructed.



E123929



E121008

22.

- Press and hold the cruise control cancel button for more than 2 seconds.

23. The message center display will revert to the normal display in the trip computer.

24. Turn the ignition off.

25. Turn the ignition on.

26.

- Press the right-hand directional button to access the instrument cluster menu.



E123926

27.

- Press the right-hand OK button.




E123925

28.

- Press the right-hand directional button to access the Oil Level Display.



E123927

29.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

- Press the right-hand OK button and follow the instructions.
- Make sure that the average oil level value has now been updated.




E123929

30. Refer to: Engine Cover - 3.0L V6 - TdV6 (501-05 Interior Trim and Ornamentation, Removal and Installation).

Engine - TDV6 3.0L Diesel - Camshaft LH

Removal and Installation

Special Tool(s)

 <p>303-1145/2 E60429</p>	<p>303-1145/2 Remover, Camshaft Rear Pulley Bolt</p>
--	--

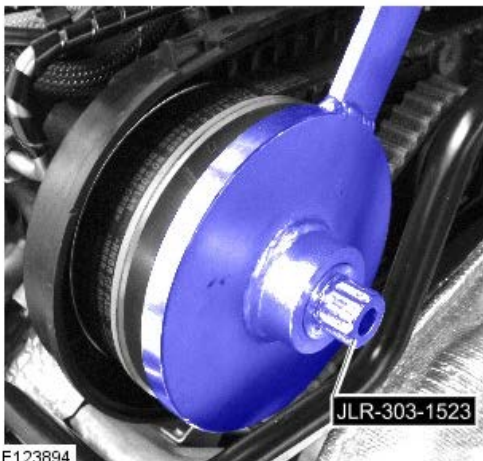
Removal

1. Refer to: Specifications (414-00, Specifications).
2. Refer to: Rear End Accessory Drive (READ) (303-05, Removal and Installation).
3. Refer to: Timing Belt (303-01, Removal and Installation).
4. Install the special tool.



E123893

5. Install the special tool.



E123894

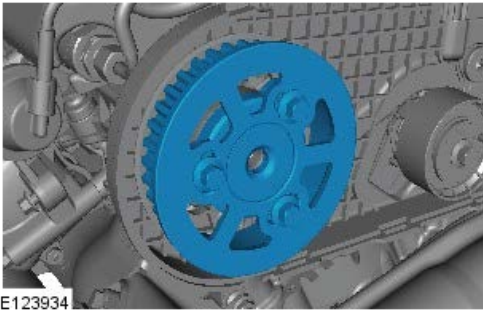
6. Using the special tool, remove the rear camshaft pulley retaining bolt.



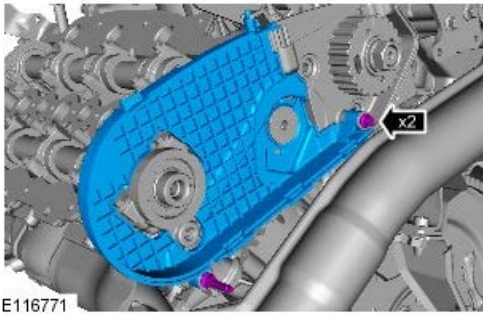
E123895

7. Remove the special tools.

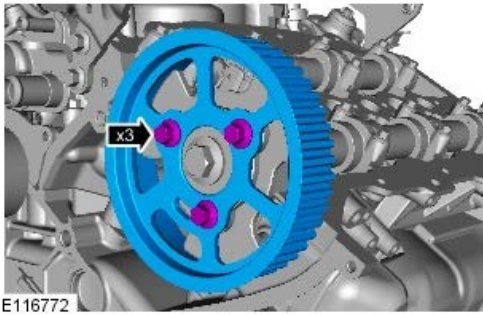
8.



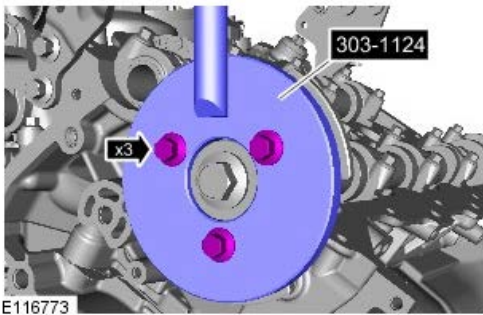
9.



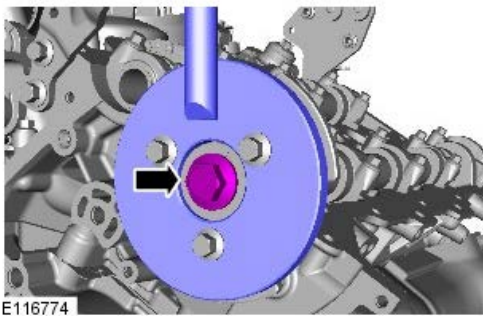
10.



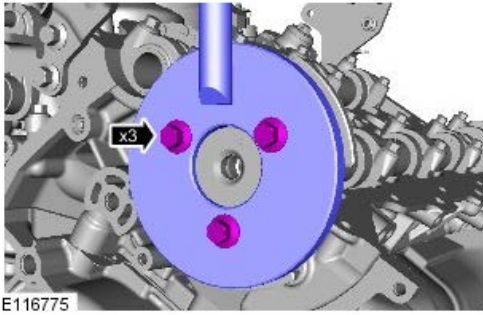
11. Install the special tool.



12.

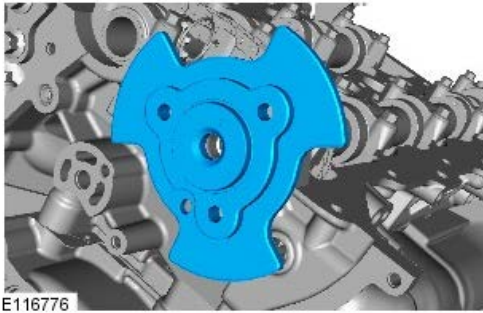


13. Remove the special tool.



E116775

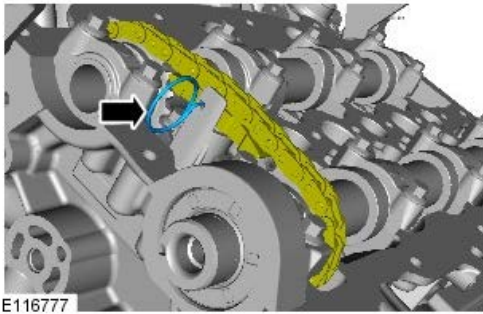
14.



E116776

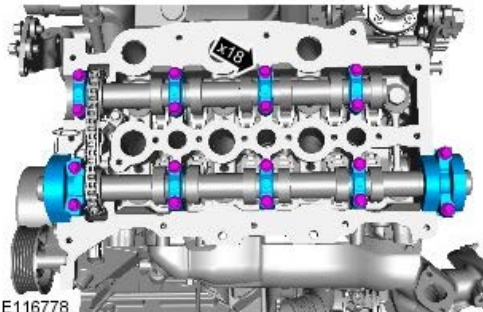
15.

- Reposition the secondary timing chain tensioner.
- Retain the secondary timing chain tensioner plunger.



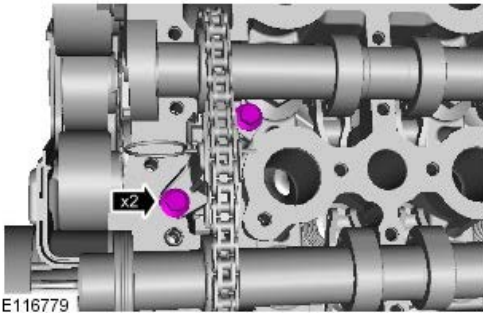
E116777

16. Remove the camshaft bearing caps evenly.



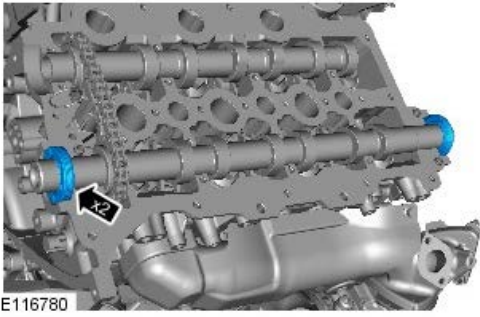
E116778

17.



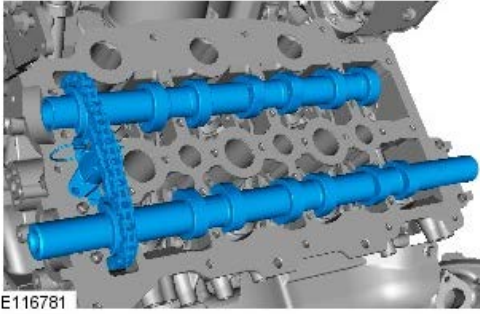
E116779

18.  CAUTION: Discard the seals.



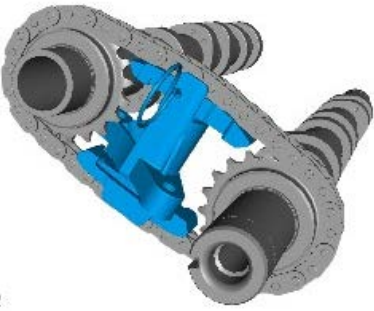
E116780

19.



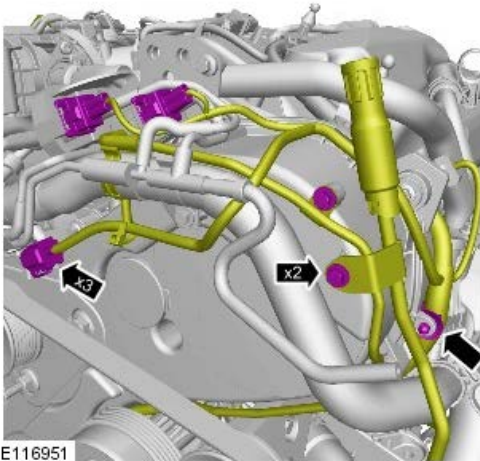
E116781

20.



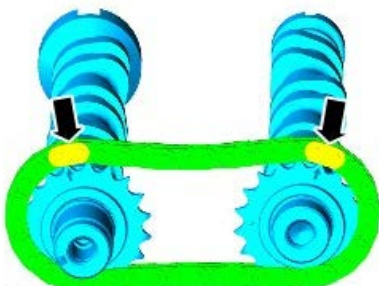
E116782

21.



E116951

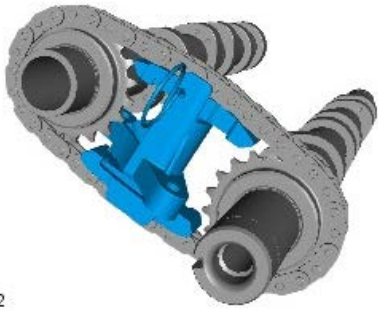
Installation



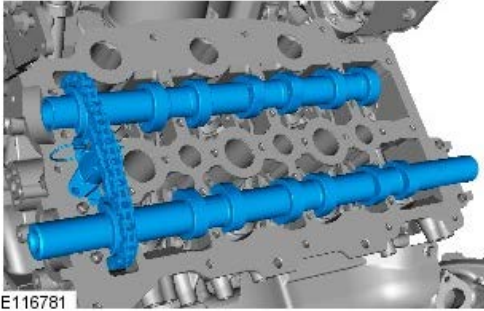
E86461

1. Install the secondary timing chain onto the camshafts.

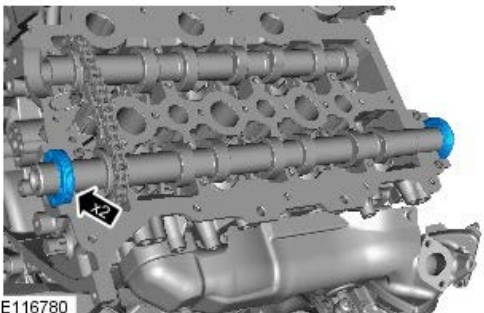
2. Install the secondary timing chain tensioner assembly.



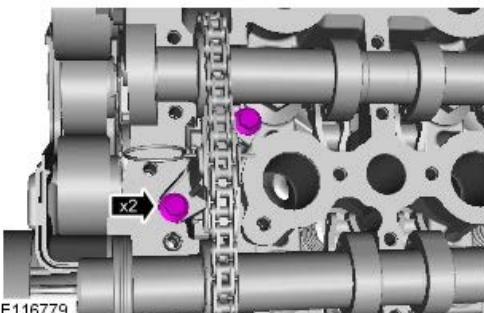
E116782



E116781



E116780



E116779

3.  CAUTION: Make sure that the dots on the camshafts are aligned at the 12 o'clock position. Failure to follow this instruction may result in damage to the engine.

NOTES:



Lubricate the camshafts and the camshaft bearing caps with oil meeting Jaguar specification prior to installation.



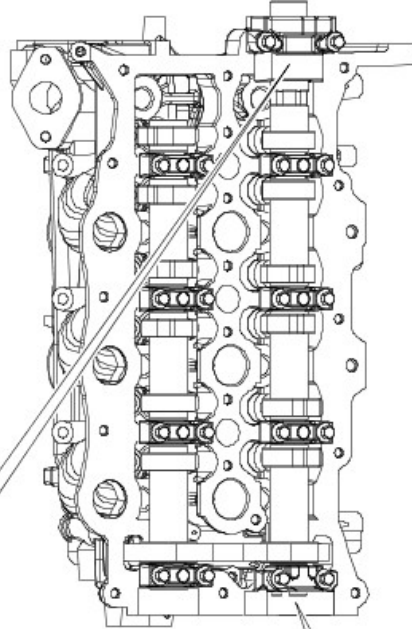
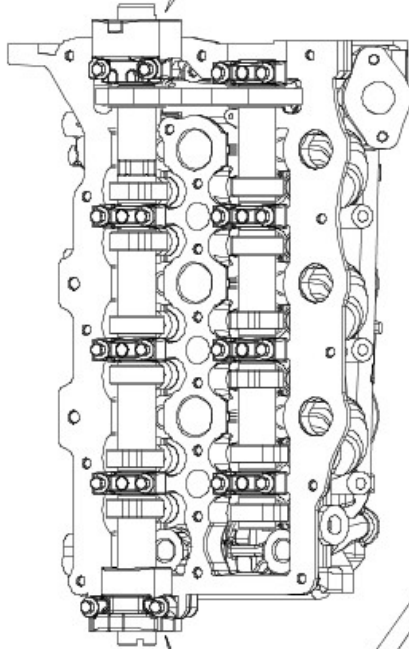
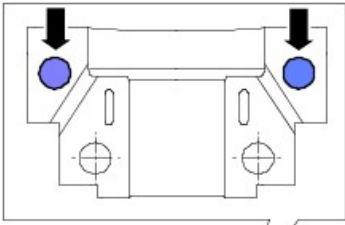
Use hypoid oil to lubricate the camshafts.

Install the camshafts.

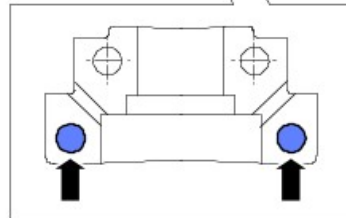
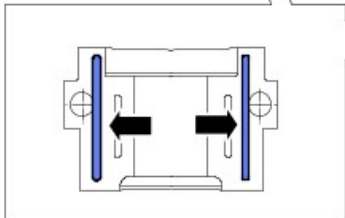
4.  NOTE: Install new seals.

5. Torque: 10 Nm

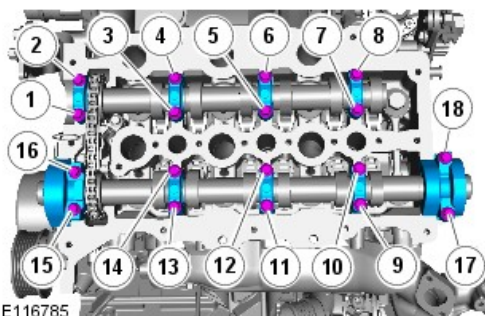
6.
 - Apply Loctite 518 sealant to the exhaust camshaft seal bearing caps.
 - Apply Loctite 518 sealant, 2 mm wide, to the LH rear and RH front camshaft bearing caps.
 - Apply Loctite 518 sealant, 7 mm diameter, to the LH front and



RH rear
camshaft
bearing
caps.



E116784

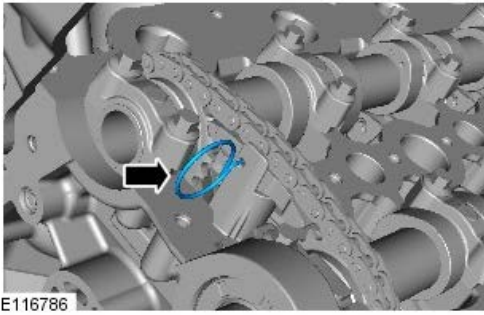


E116785

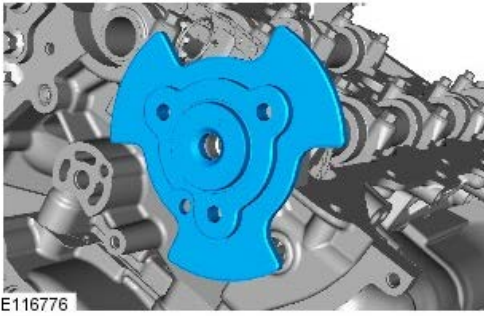
7.  NOTE: Tighten the bolts in the indicated sequence.

- Install the camshaft bearing caps in their original positions.
- Stage 1: Bolts 1 to 14, 1 Nm.
- Stage 2: Bolts 1 to 14, 5 Nm.
- Stage 3: Bolts 1 to 14, 10 Nm.
- Stage 4: Bolts 15 to 18, 1 Nm.
- Stage 5: Bolts 15 to 18, 5 Nm.
- Stage 6: Bolts 15 to 18, 10 Nm.

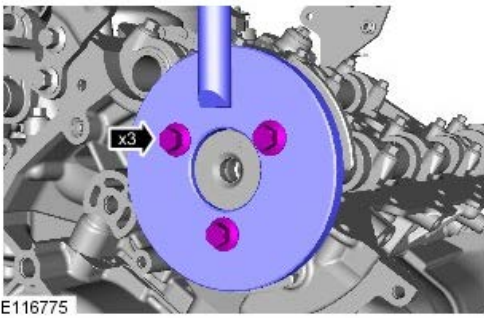
8. Remove the secondary timing chain tensioner retaining pin.



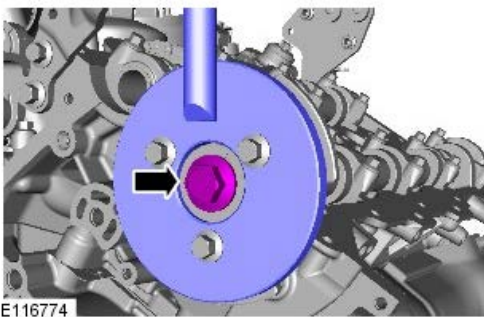
9.



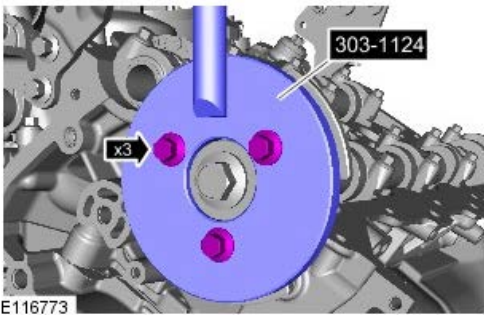
10. Install the special tool.



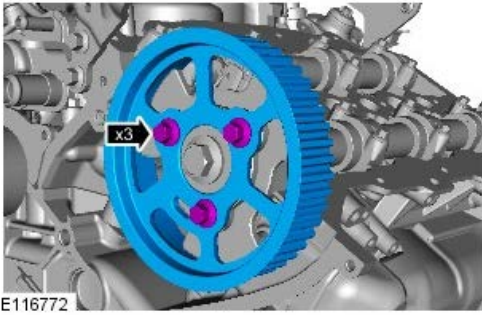
11. *Torque:*
Stage 1: 80 Nm
Stage 2: 80°



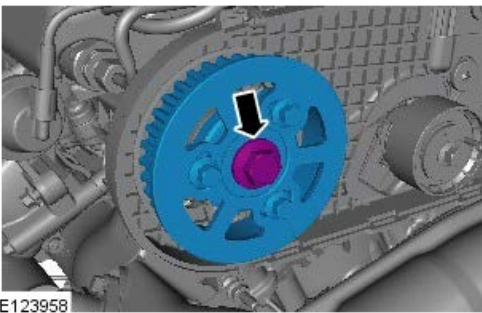
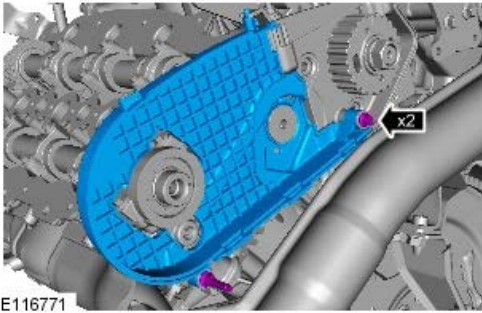
12. Remove the special tool.



13.  CAUTION: Only tighten the bolt finger-tight at this stage.



14. Torque: 10 Nm



15.  CAUTION: Only tighten the bolt finger-tight at this stage.

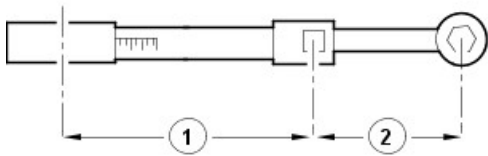



16. Install the special tool.

17. Install the special tool.



E123894




18.  **CAUTION:** Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.
- Calculate the setting for the torque wrench.

E37107



E123895

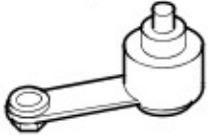
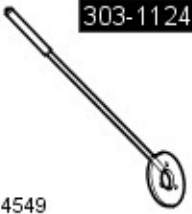

19.  **CAUTION:** Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.
- Using the special tool, install the camshaft rear pulley retaining bolt.
 - *Special Tool(s):* [303-1145/2](#)
 - *Torque:*
 - Stage 1: 80 Nm
 - Stage 2: 80°

20. Remove the special tools.
21. Refer to: Timing Belt (303-01, Removal and Installation).
22. Refer to: Rear End Accessory Drive (READ) (303-05, Removal and Installation).
23. Refer to: Specifications (414-00, Specifications).

Engine - TDV6 3.0L Diesel - Camshaft RH

Removal and Installation

Special Tool(s)

 <p>303-1117</p> <p>E54540</p>	<p>303-1117 Timing Peg, Automatic Transmission</p>
 <p>303-1124</p> <p>E54549</p>	<p>303-1124 Holding Tool, Camshaft Front Pulley</p>
 <p>303-1126</p> <p>E54551</p>	<p>303-1126 Timing Peg, Camshaft Pulley</p>

Removal

1. Disconnect the battery ground cable.

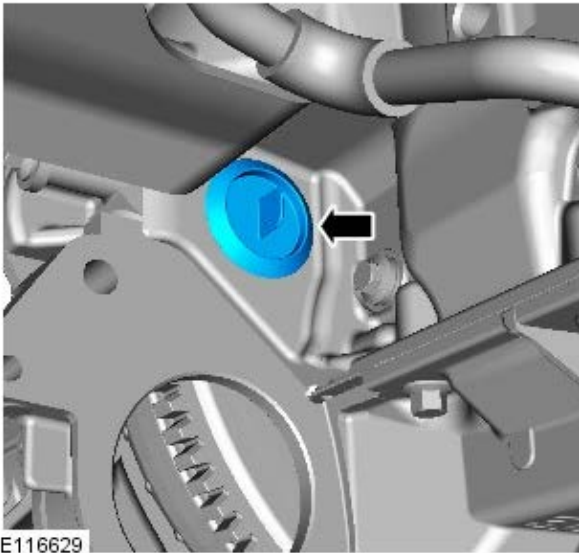
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Refer to: [Starter Motor](#) (303-06A Starting System - TDV6 3.0L Diesel, Removal and Installation).
4. Refer to: [Brake Vacuum Pump - TDV6 3.0L Diesel](#) (206-07 Power Brake Actuation, Removal and Installation).
5. Refer to: [Valve Cover RH](#) (303-01A Engine - TDV6 3.0L Diesel, Removal and Installation).

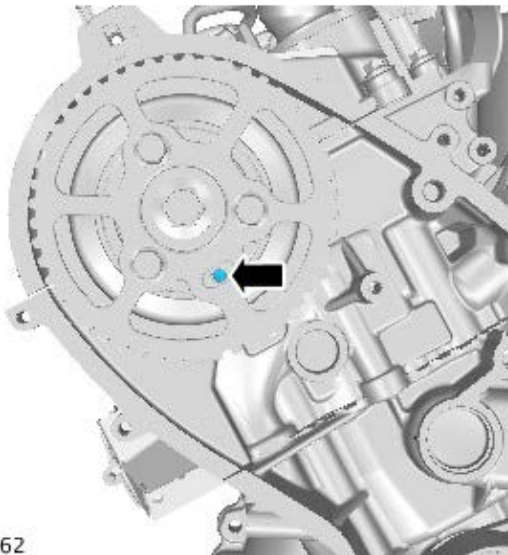
6.



E116629

7. Rotate the crankshaft clockwise to align the crankshaft alignment hole in the flywheel or flexplate with the block aperture.

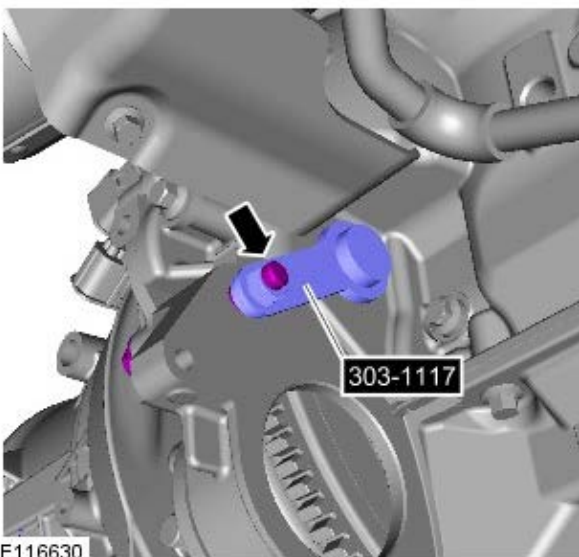
8. Check the camshaft pulley alignment holes are correctly aligned. If the alignment holes are not aligned, rotate the crankshaft one full turn clockwise.



E160262

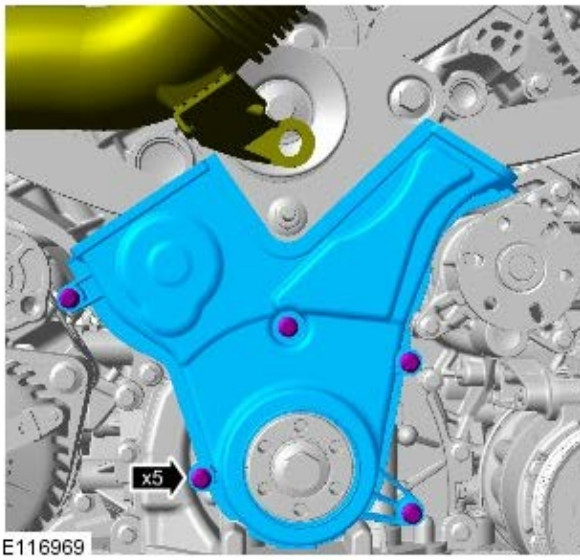
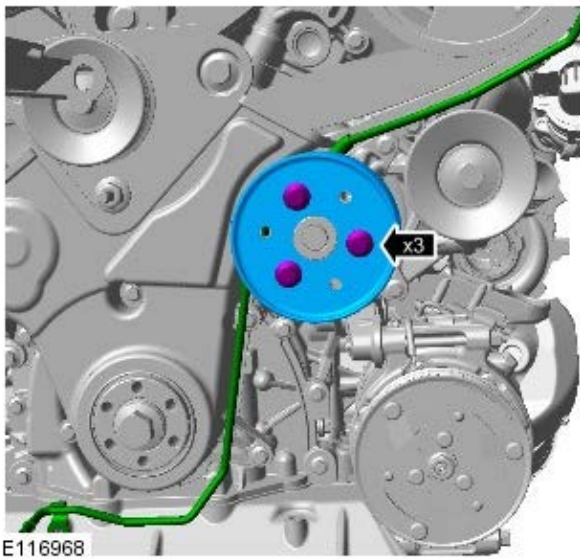
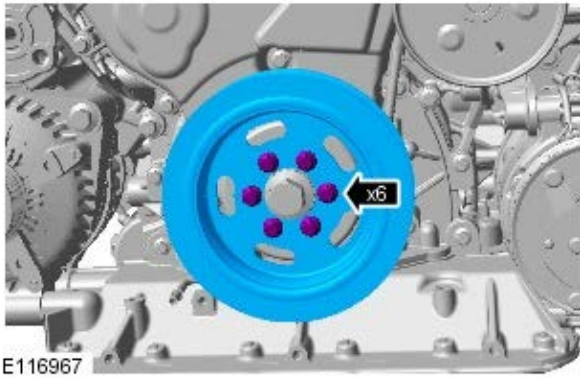
9. Install the special tool.

Special Tool(s): [303-1117](#)



E116630

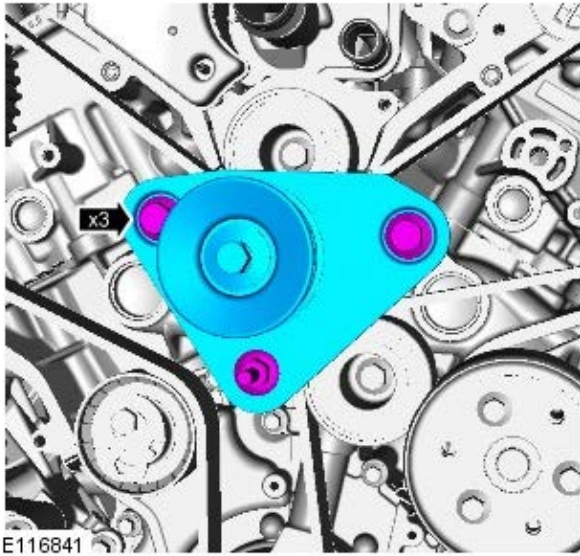
10.



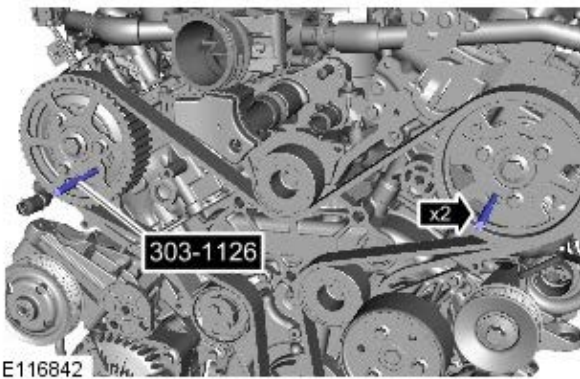
11.  CAUTION: Discard the bolts.


12.  NOTE: Discard the gasket.

13.



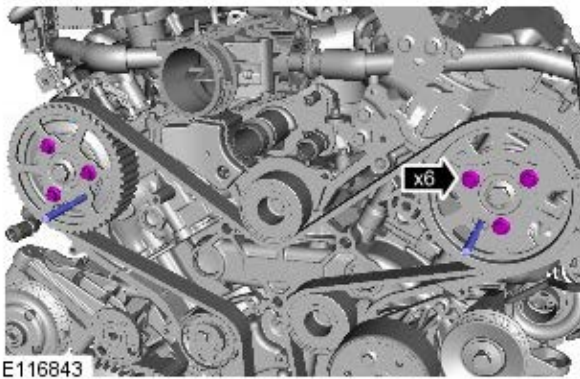
14. *Special Tool(s):* [303-1126](#)



15.  **CAUTION:** Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.



NOTE: Do not loosen the bolts more than 2 turns.



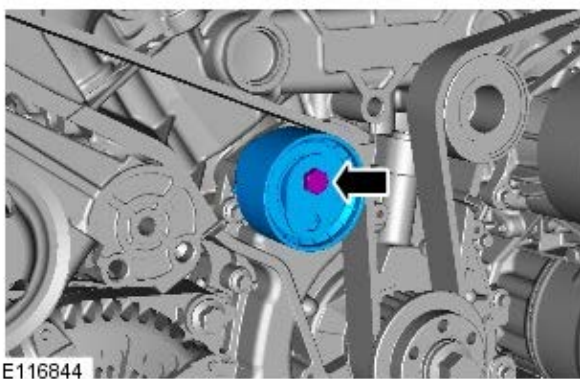
16. **CAUTIONS:**



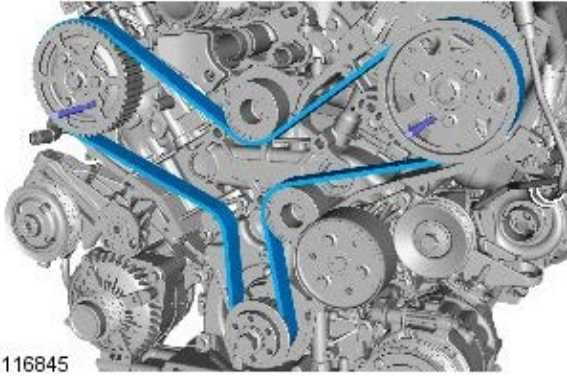
Discard the component.



Discard the bolt.

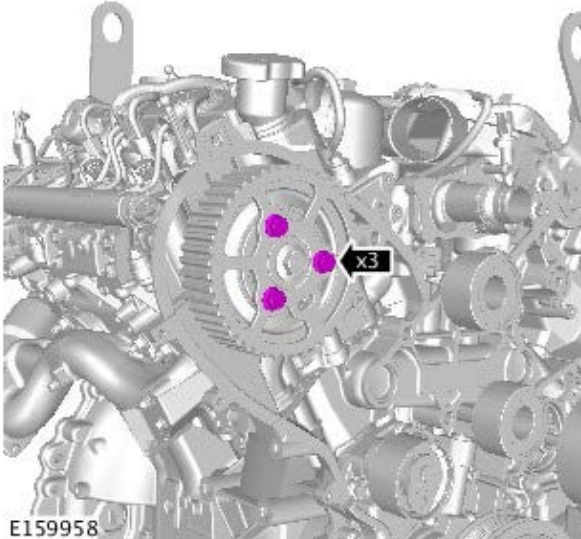


17.  **CAUTION:** Discard the component.



E116845

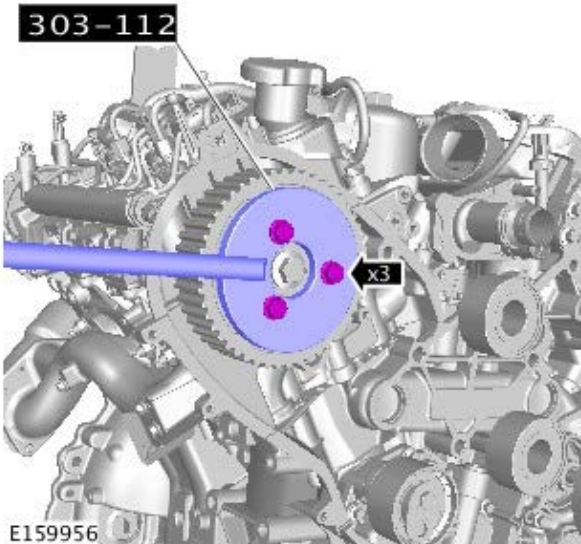
18.



E159958

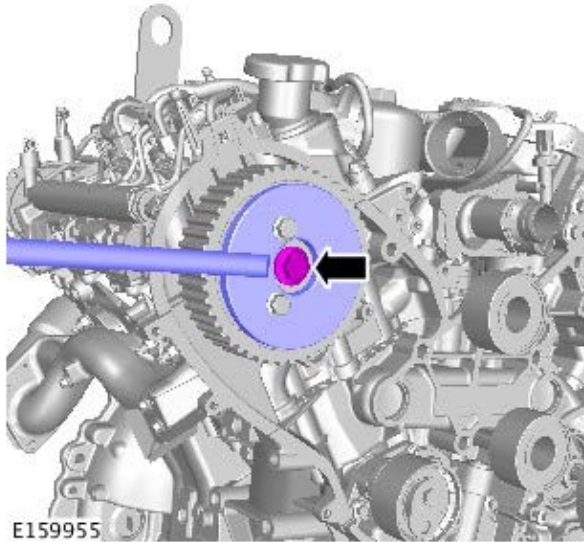
19. Install the special tool.

Special Tool(s): [303-1124](#)



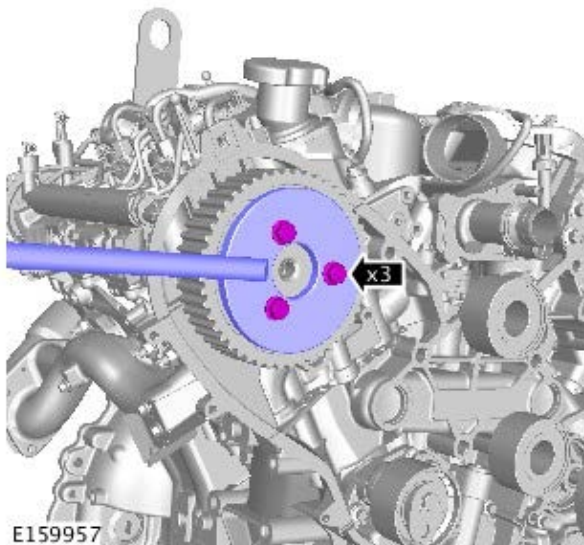
E159956

20.

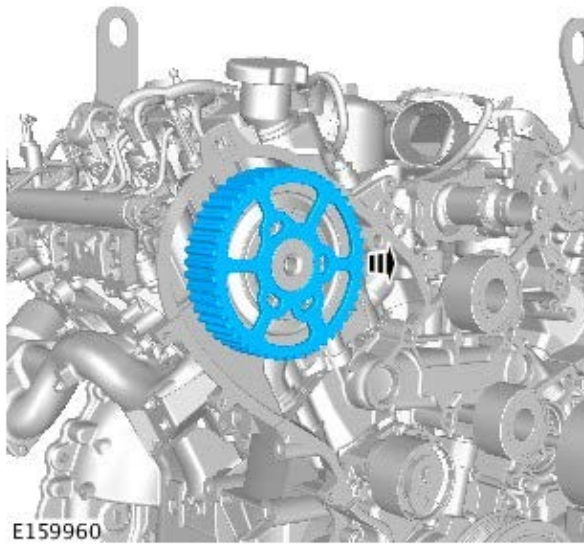


21. Remove the special tool.

Special Tool(s): [303-1124](#)

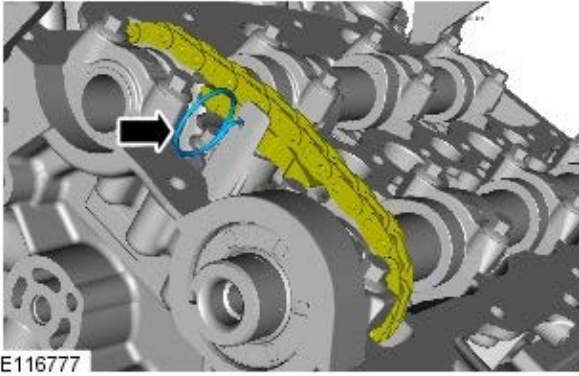


22.

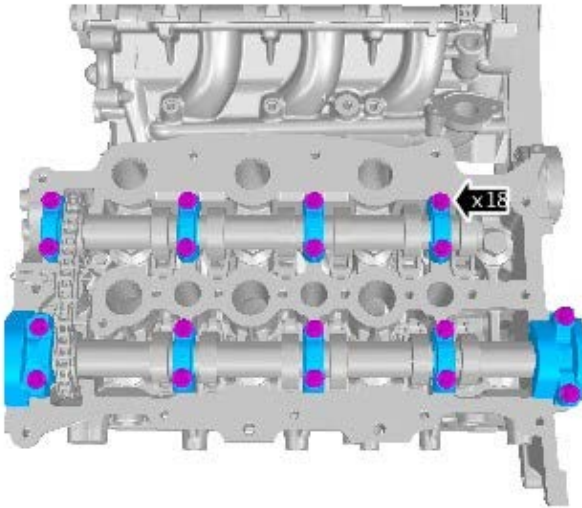


23.

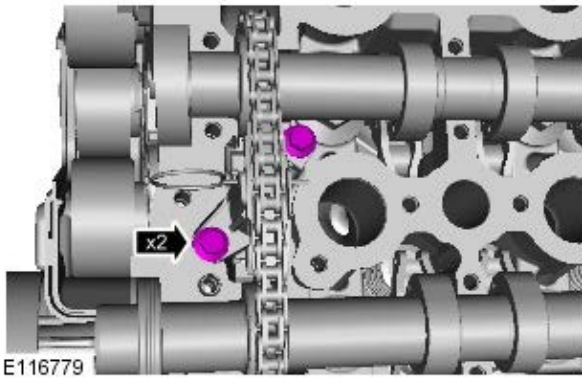
- Reposition the secondary timing chain tensioner.
- Retain the secondary timing chain tensioner plunger.



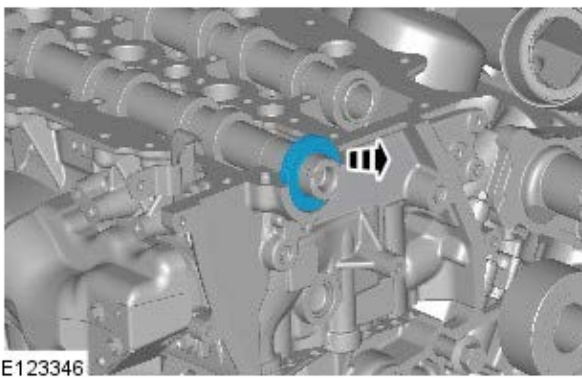
24. Remove the camshaft bearing caps evenly.



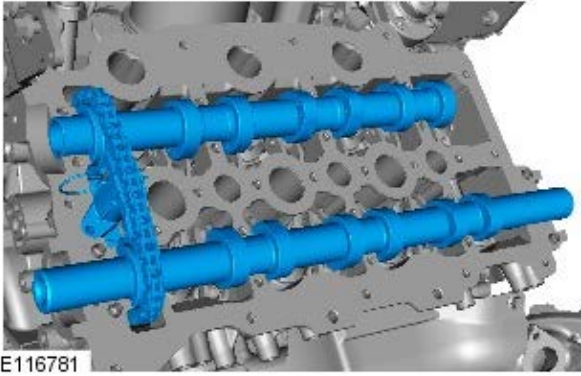
25.



26.  CAUTION: Discard the seal.

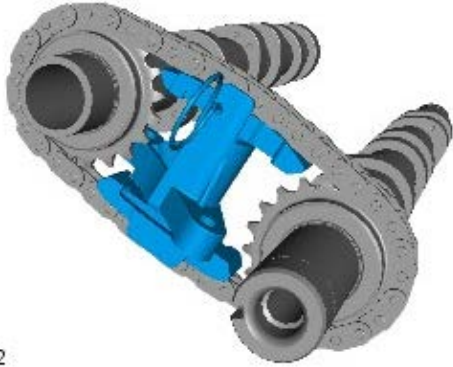


27. Remove the RH bank camshafts and secondary timing chain tensioner assembly.



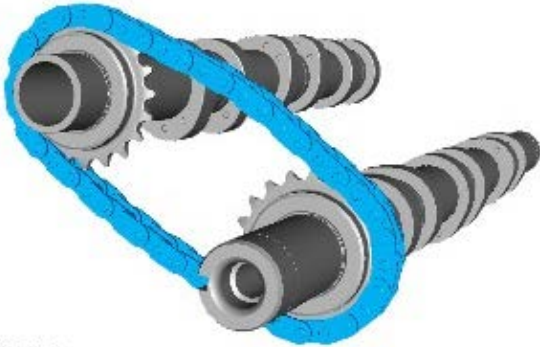
E116781

28. Remove the secondary timing chain tensioner assembly.



E116782

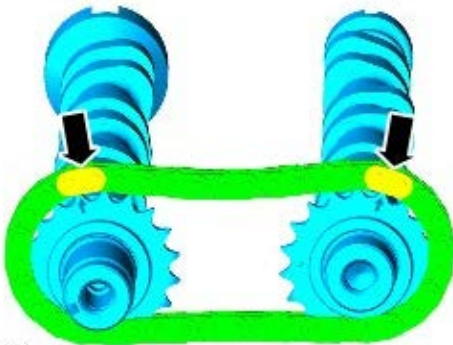
29. Remove the secondary timing chain from the camshafts.



E116783

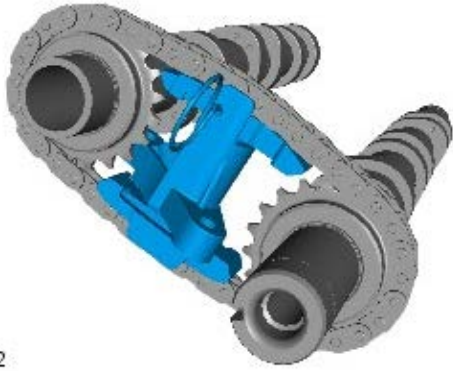
Installation

1. Install the secondary timing chain onto the camshafts.

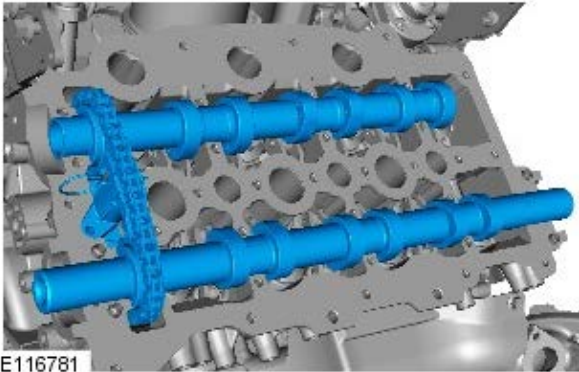


E86461

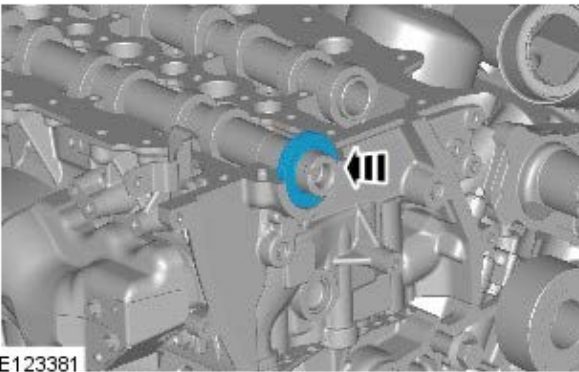
2. Install the secondary timing chain tensioner assembly.



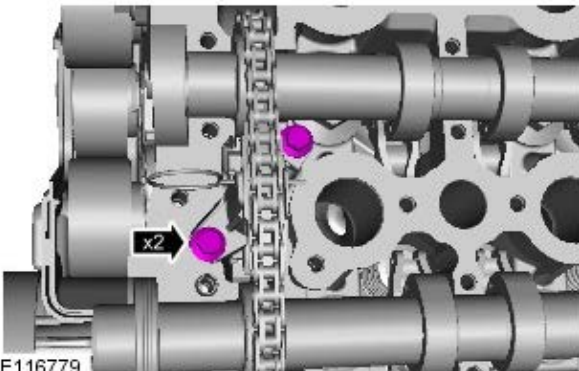
E116782




E116781



E123381



E116779

- 
CAUTION: Make sure that the dots on the camshafts are aligned at the 12 o'clock position. Failure to follow this instruction may result in damage to the engine.

NOTES:

 Lubricate the camshafts and the camshaft bearing caps with oil meeting Jaguar specification prior to installation.

 Use hypoid oil to lubricate the camshafts.

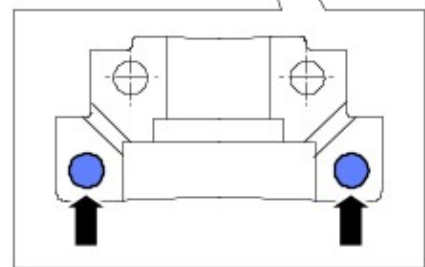
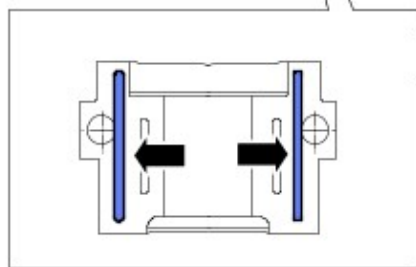
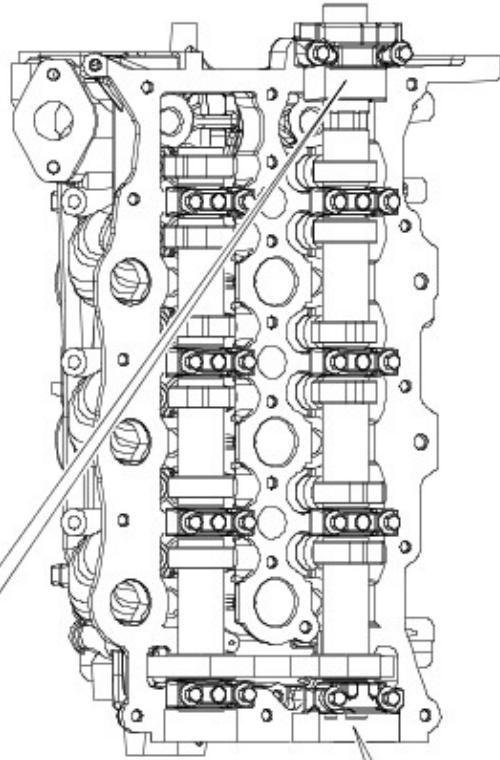
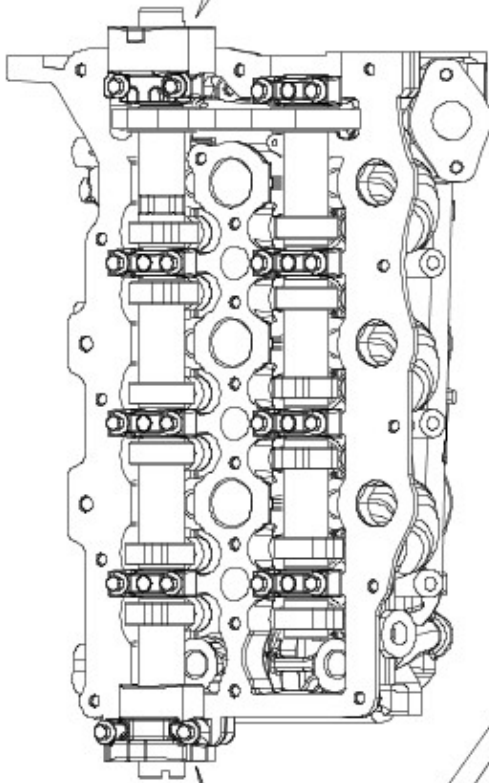
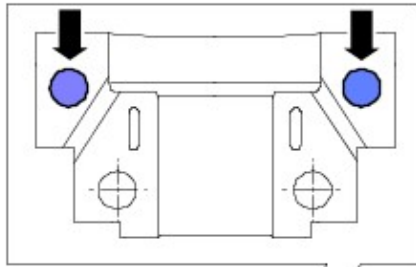
Install the camshafts.

- 
NOTE: Install a new seal.

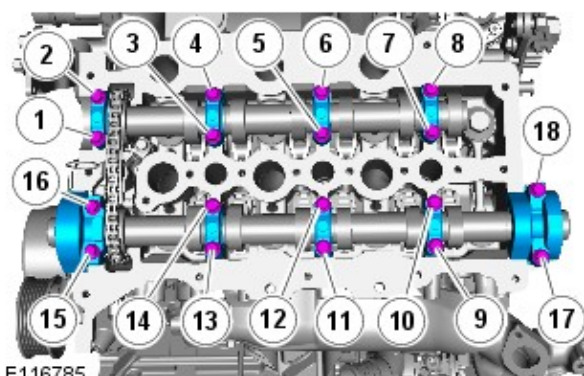
- Torque:** 10 Nm

6.

- Apply Loctite 518 sealant to the exhaust camshaft seal bearing caps.
- Apply Loctite 518 sealant, 2 mm wide, to the LH rear and RH front camshaft bearing caps.
- Apply Loctite 518 sealant, 7 mm diameter, to the LH front and RH rear camshaft bearing caps.



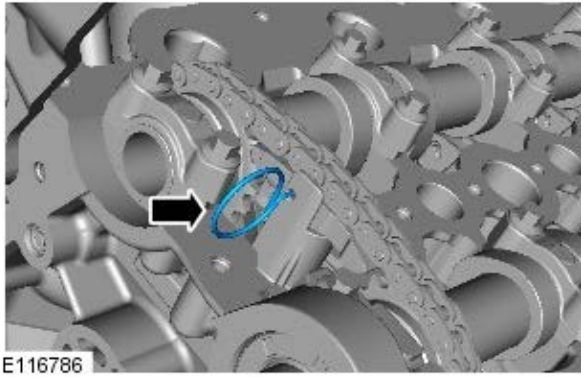
E116784



E116785

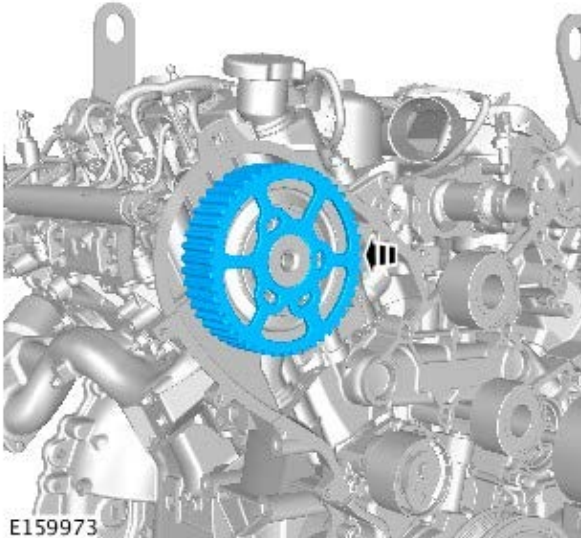
7.  NOTE: Tighten the bolts in the indicated sequence.

- Install the camshaft bearing caps in their original positions.
- Stage 1: Bolts 1 to 14, 1 Nm.
- Stage 2: Bolts 1 to 14, 5 Nm.
- Stage 3: Bolts 1 to 14, 10 Nm.
- Stage 4: Bolts 15 to 18, 1 Nm.
- Stage 5: Bolts 15 to 18, 5 Nm.
- Stage 6: Bolts 15 to 18, 10 Nm.



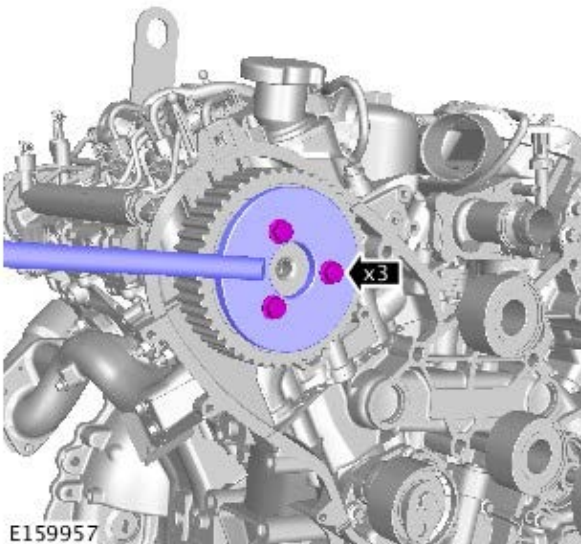
8. Remove the secondary timing chain tensioner retaining pin.

9.

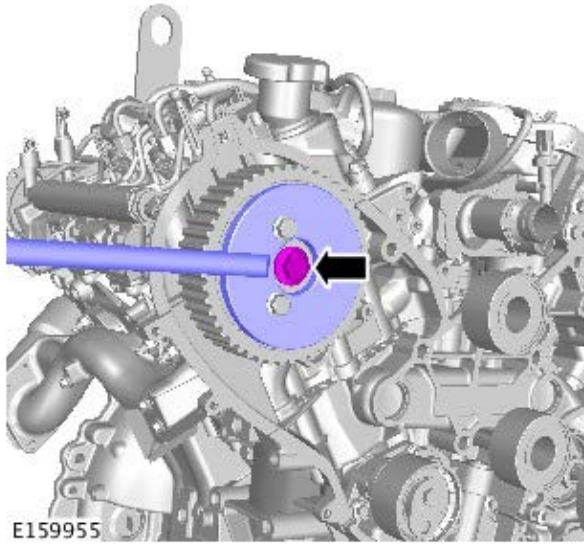


10. Install the special tool.

Special Tool(s): [303-1124](#)

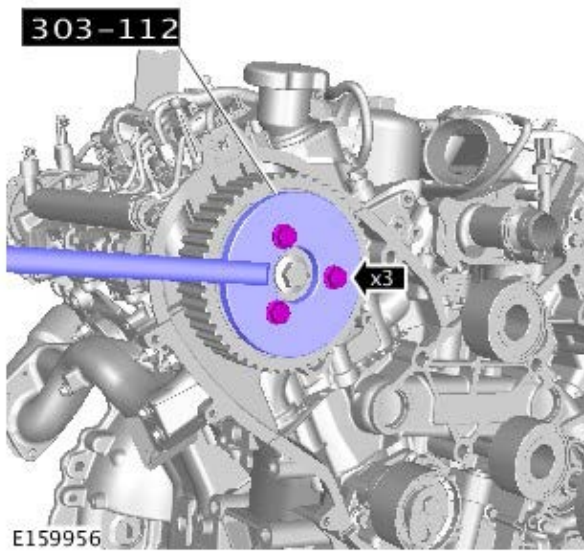


11. *Torque:*
Stage 1: 80 Nm
Stage 2: 80°

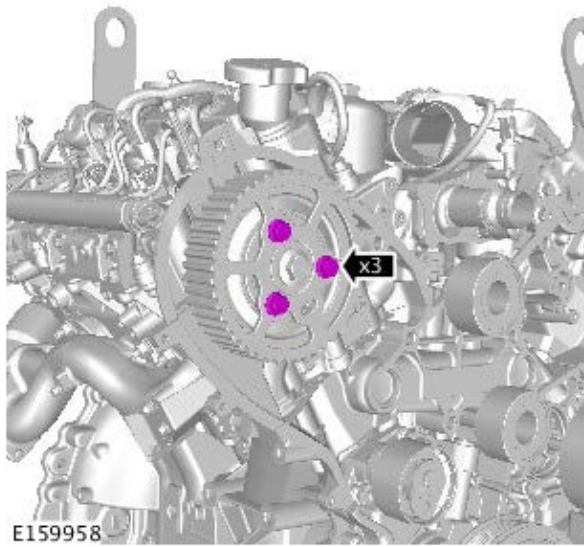


12. Remove the special tool.

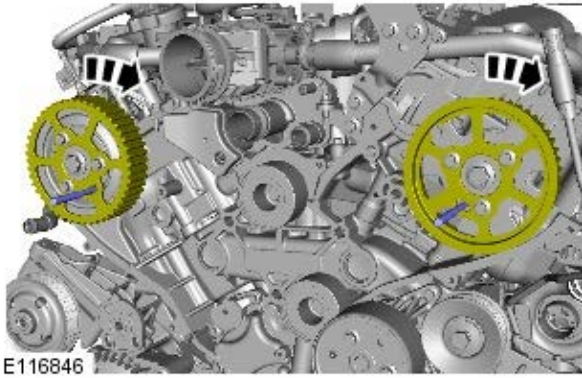
Special Tool(s): [303-1124](#)



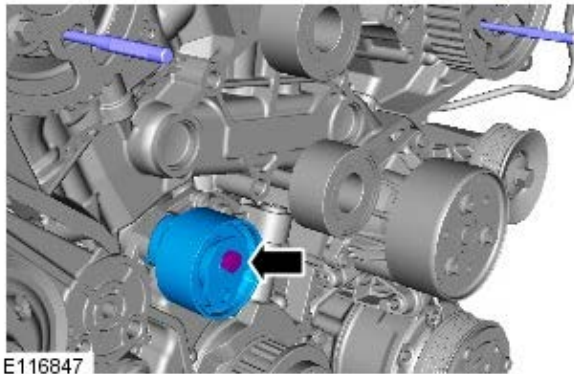
13.  CAUTION: Only tighten the bolt finger-tight at this stage.



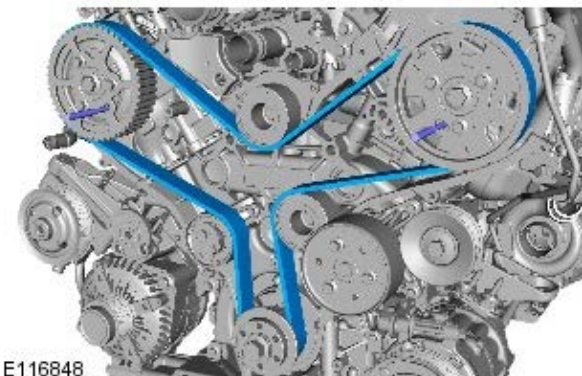
14.



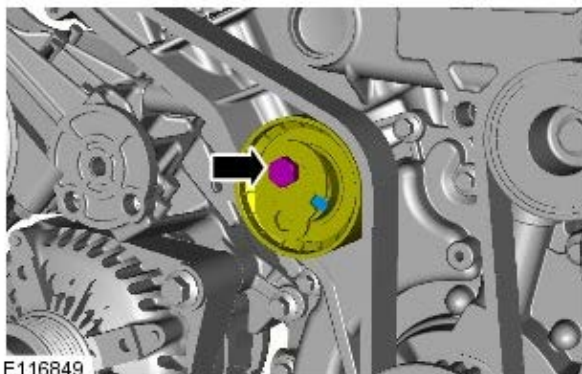
E116846



E116847



E116848



E116849


15. CAUTIONS:




Make sure that a new bolt is installed.




Only tighten the bolts finger-tight at this stage.

16.  CAUTION: Make sure the camshaft pulleys remain in the clockwise position.

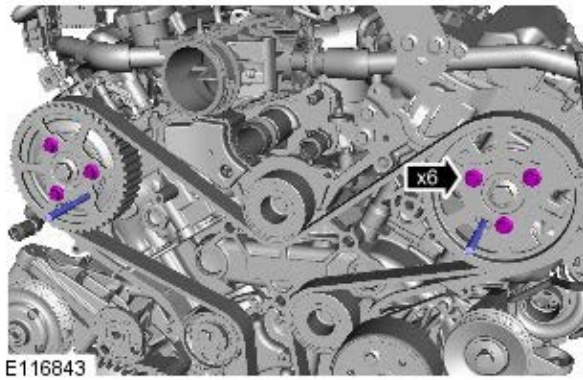
- Install the new timing belt.
- Starting at the crankshaft pulley, install the timing belt in a counter-clockwise direction, in the sequence shown.
- Stage one: Attach the timing belt to the crankshaft pulley.
- Stage two: Attach the timing belt to the idler pulley.
- Stage three: Attach the timing belt to the left-hand camshaft pulley.
- Stage four: Attach the timing belt to the idler pulley.
- Stage five: Attach the timing belt to the RH camshaft pulley.
- Stage six: Attach the timing belt to the timing belt tensioner.

17.  CAUTION: Make sure the timing belt tensioner window is aligned with the groove as illustrated.

- Tension the timing belt.
- Rotate the tensioner assembly counter-clockwise.
- *Torque: 26 Nm*

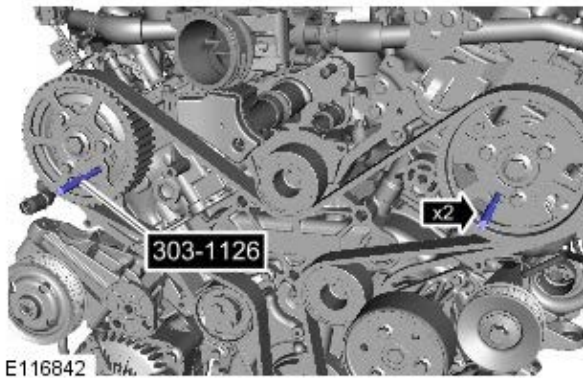
18.  CAUTION: Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.

- Using a suitable tool, counterhold the camshaft pulley center retaining bolts.
- *Torque: 23 Nm*



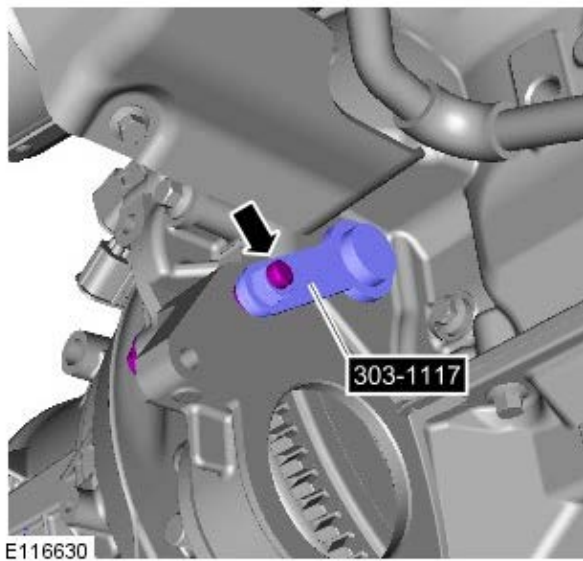
19. Remove the special tool.


Special Tool(s): [303-1126](#)



20. Remove the special tool.

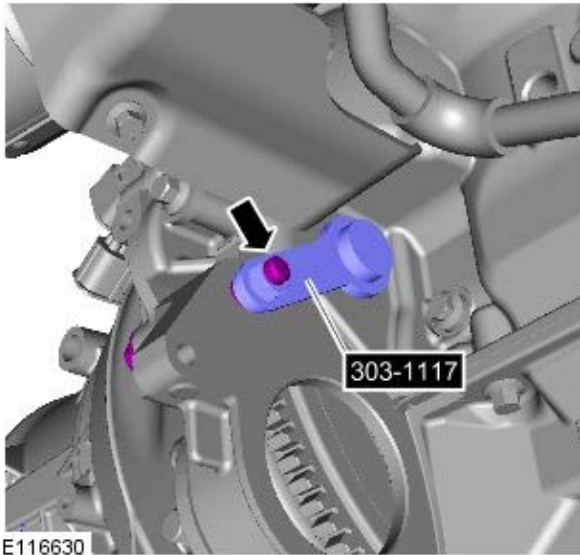
Special Tool(s): [303-1117](#)



21.  **CAUTION:** Only rotate the crankshaft clockwise.
Rotate the engine two complete turns clockwise.

22. Install with the special tool.

Special Tool(s): [303-1117](#)

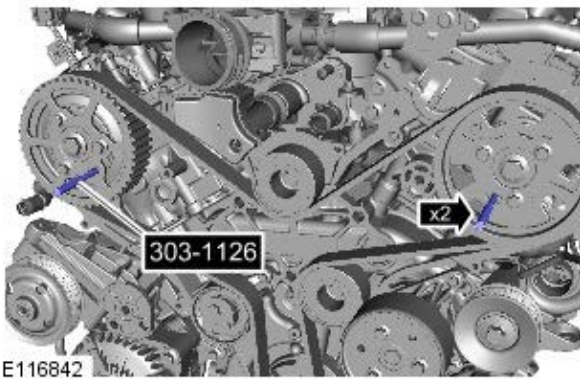


23.

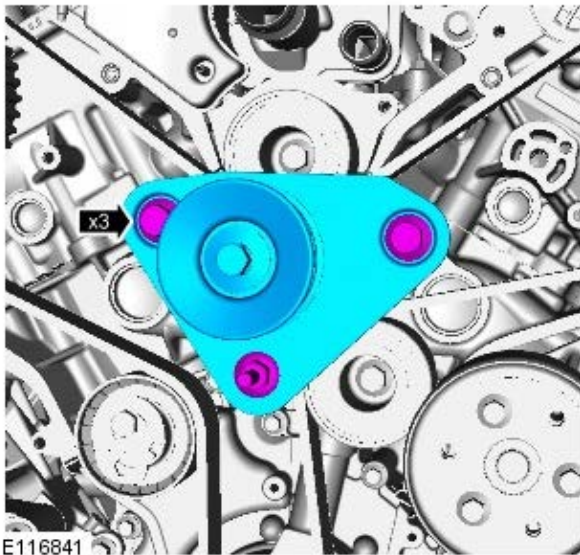
- Install the special tools to the exhaust camshaft pulleys.

Special Tool(s): [303-1126](#)

- If the special tool does not fit correctly, repeat the timing belt installation procedure.
- Remove the special tools from the camshaft pulleys.

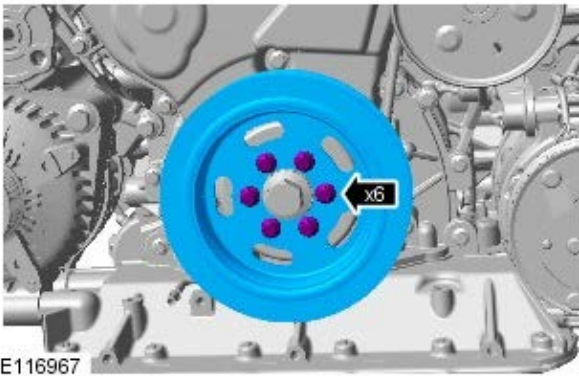
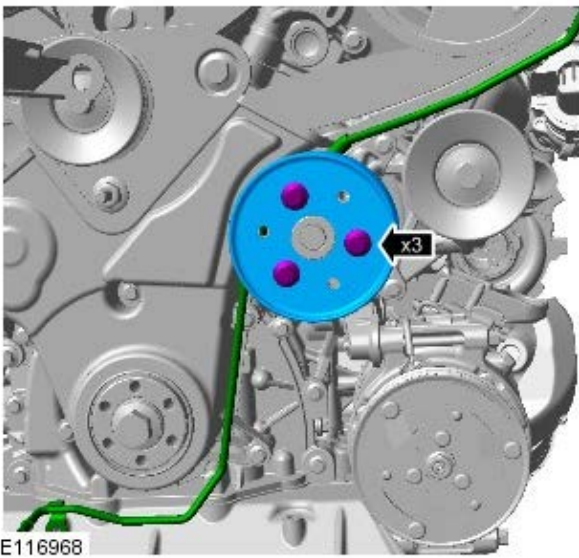


24. Torque: 80 Nm



25.  NOTE: Install a new gasket.

Torque: 10 Nm



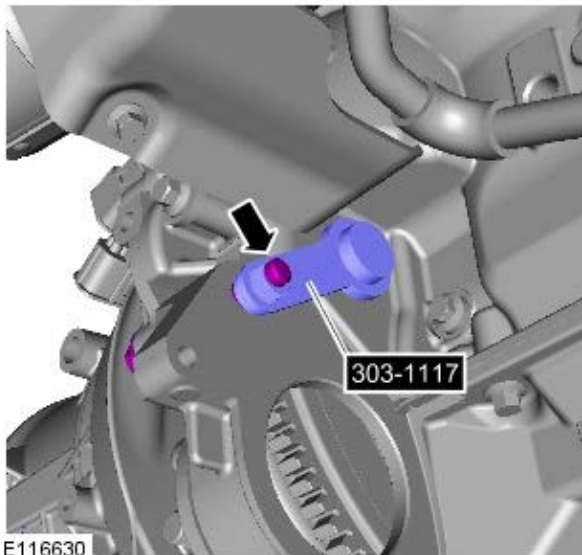
26.  CAUTION: Make sure that new bolts are installed.

Torque: 24 Nm

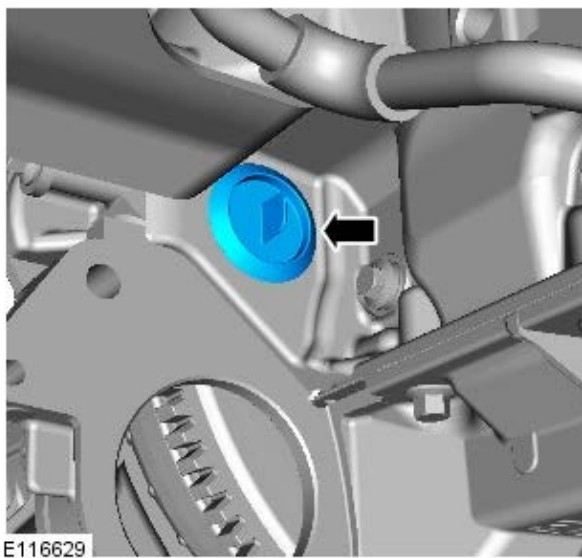
27. Torque: 25 Nm

28. Remove the special tool.

Special Tool(s): [303-1117](#)



29.







30. Refer to: [Valve Cover RH](#) (303-01A Engine - TDV6 3.0L Diesel, Removal and Installation).
31. Refer to: [Brake Vacuum Pump - TDV6 3.0L Diesel](#) (206-07 Power Brake Actuation, Removal and Installation).
32. Refer to: [Starter Motor](#) (303-06A Starting System - TDV6 3.0L Diesel, Removal and Installation).
33. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - TDV6 3.0L Diesel - Camshaft Front Seal

Removal and Installation

Special Tool(s)

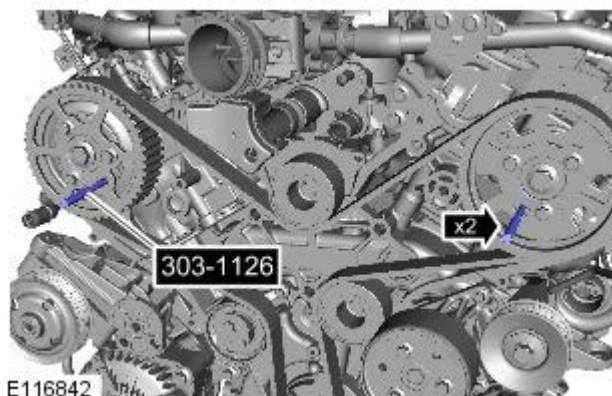
 <p>303-1118</p> <p>E54541</p>	<p>303-1118 Remover, Camshaft Seal</p>
 <p>303-1119</p> <p>E54542</p>	<p>303-1119 Installer, Camshaft Seal</p>
 <p>303-1124</p> <p>E54549</p>	<p>303-1124 Holding Tool, Camshaft Front Pulley</p>
 <p>303-1126</p> <p>E54551</p>	<p>303-1126 Timing Peg, Camshaft Pulley</p>


Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

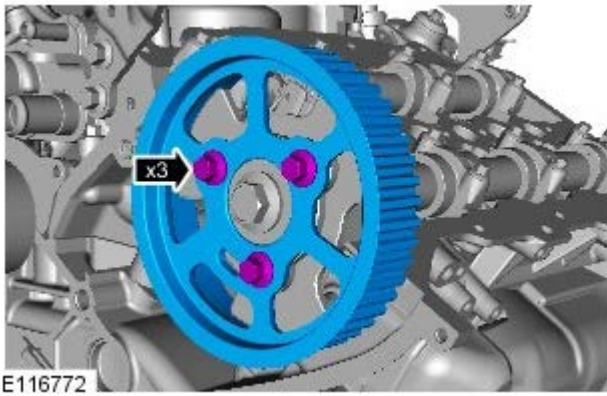
1. Refer to: Specifications (414-00, Specifications).
2. Refer to: Timing Belt (303-01, Removal and Installation).



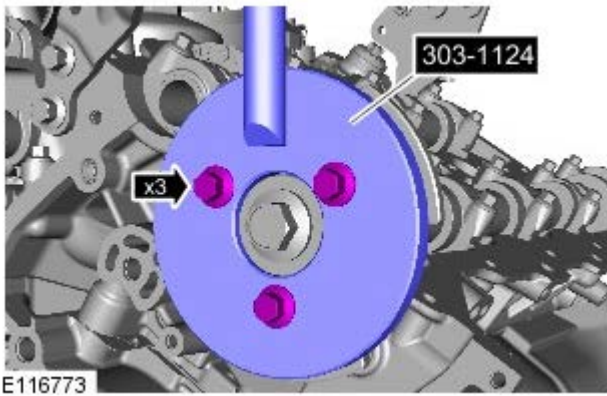
3.  **CAUTION:** Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.

Special Tool(s): [303-1126](#)

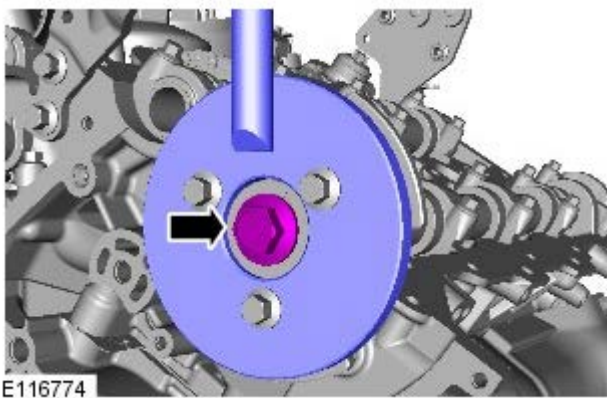
- 4.



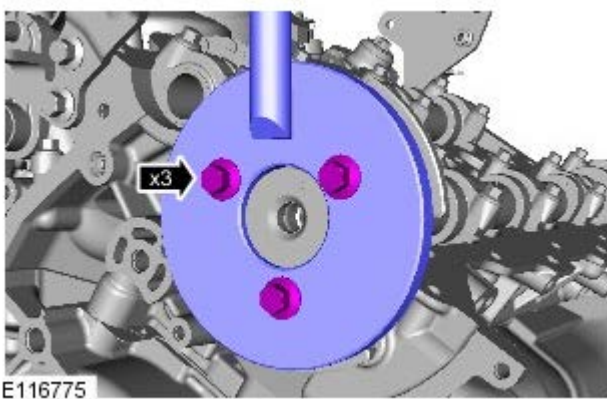
5. *Special Tool(s):* [303-1124](#)



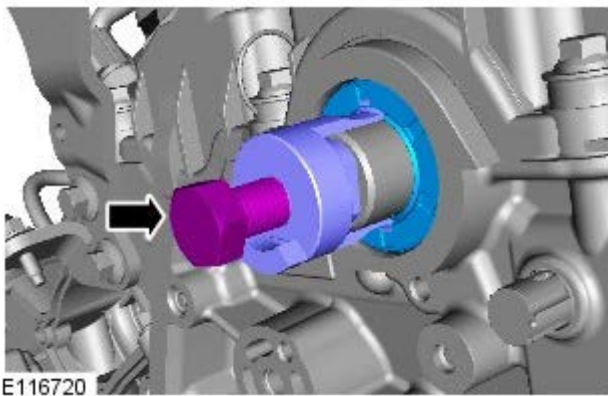
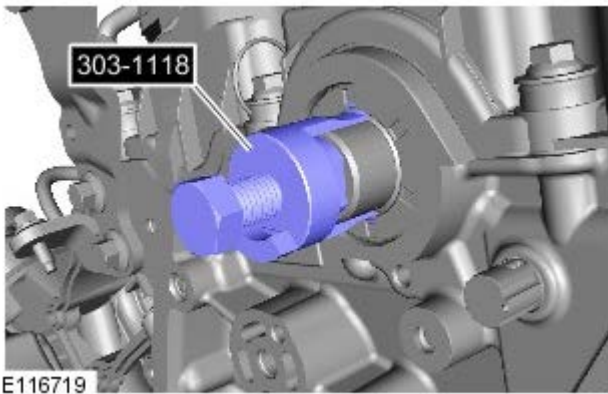
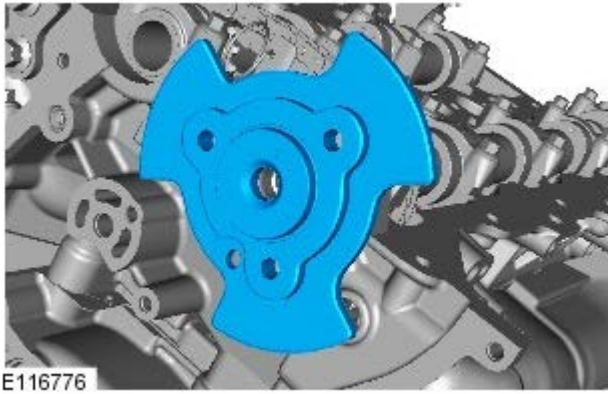
6.




7. *Special Tool(s):* [303-1124](#)



8.

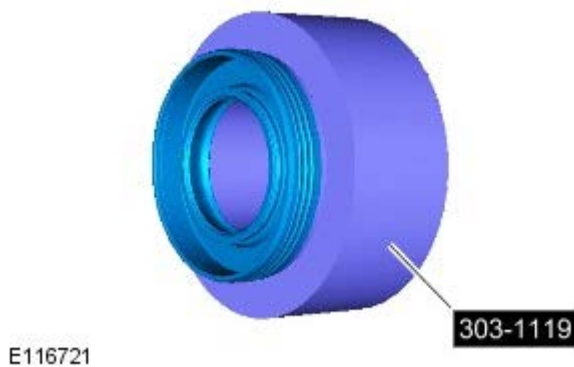


9.  CAUTION: Make sure the special tool is correctly seated behind the camshaft seal. Failure to follow this instruction may result in damage to the special tool.

Special Tool(s): [303-1118](#)


10.

Installation

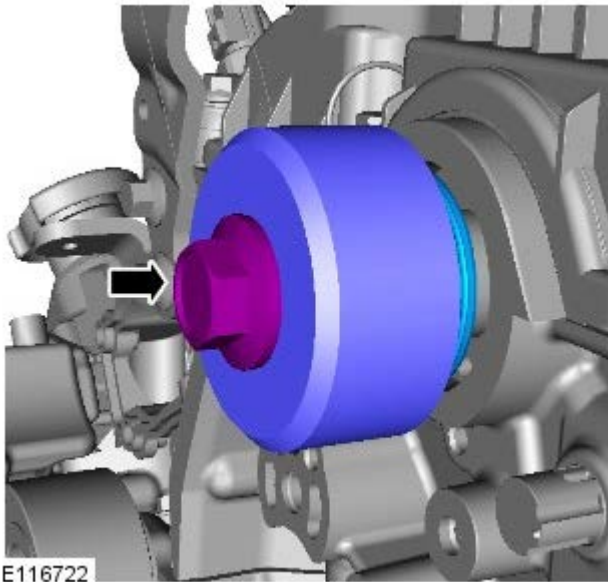


1. Special Tool(s): [303-1119](#)


2. CAUTIONS:


 Make sure the seal is installed correctly.

 Make sure that the mating faces are clean

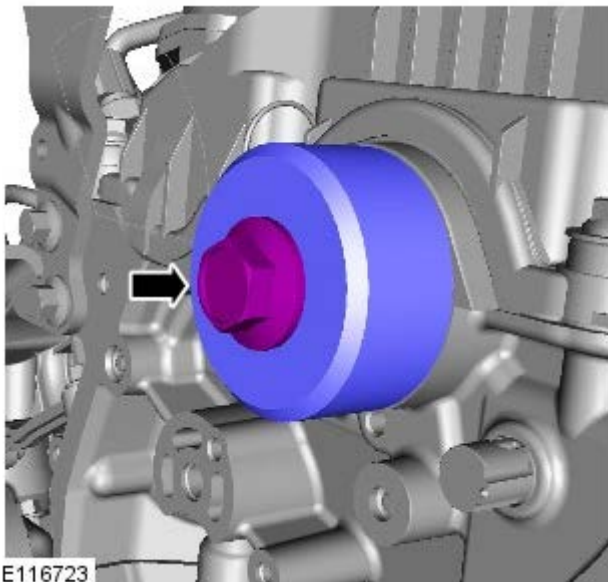


and free of corrosion and foreign material.

 Do not use any lubricant on the camshaft front seal or the camshaft. Failure to follow this instruction may result in damage to the vehicle.

 NOTE: Make sure that the seal is 1mm below the face of the cylinder head.

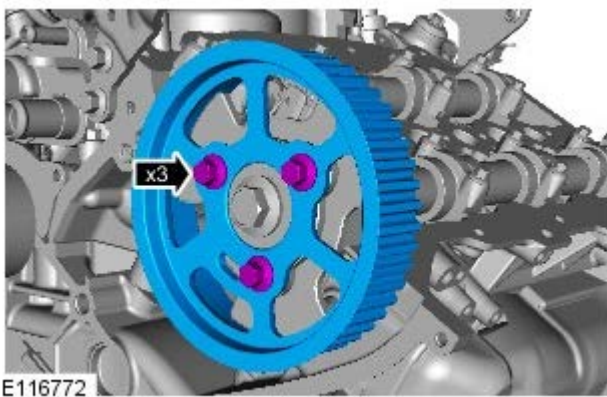
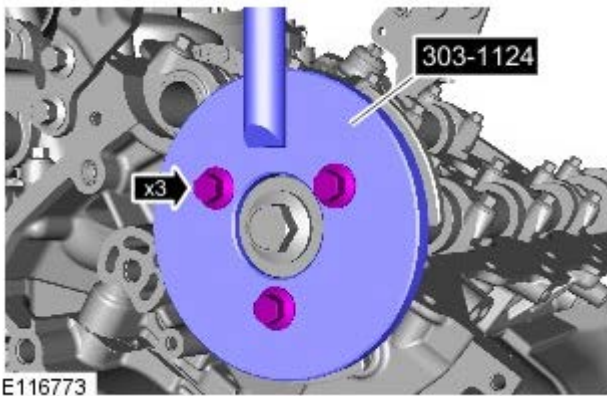
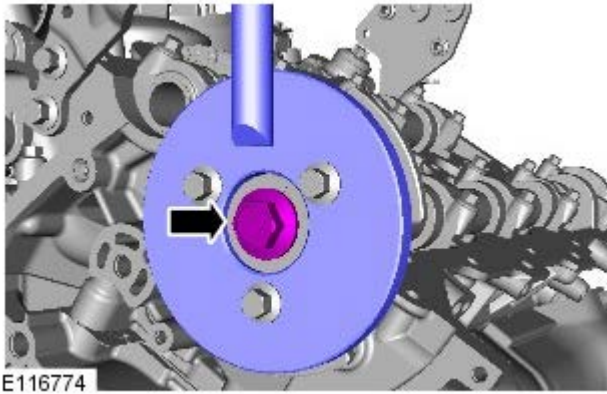
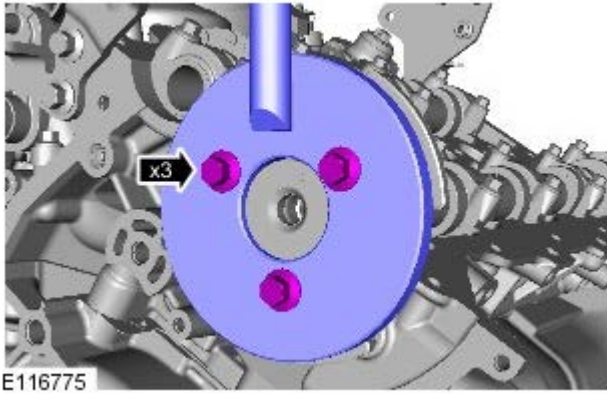
3. *Special Tool(s)*: [303-1119](#)



4.





5. *Special Tool(s)*: [303-1124](#)



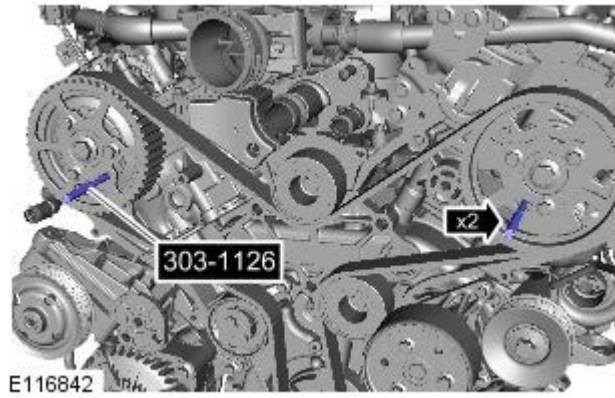
6. *Torque:*
Stage 1: 80 Nm
Stage 2: 80°

7. *Special Tool(s):* [303-1124](#)

8.  CAUTION: Only tighten the bolt finger-tight at this stage.

9.  CAUTION: Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.

Special Tool(s): [303-1126](#)



E116842

10. Refer to: Timing Belt (303-01, Removal and Installation).
11. Refer to: Specifications (414-00, Specifications).

Engine - TDV6 3.0L Diesel - Camshaft Rear Seal

Removal and Installation

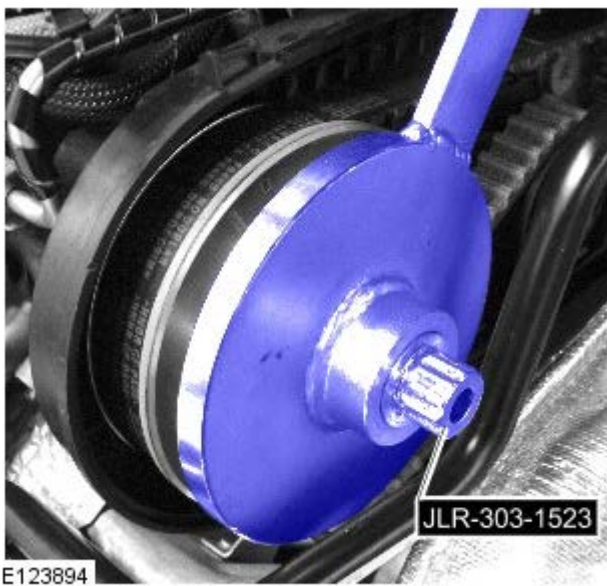
Removal

1. Refer to: [Rear End Accessory Drive \(READ\)](#) (303-05A Accessory Drive - TDV6 3.0L Diesel, Removal and Installation).

2. Install the special tool.



3. Install the special tool.



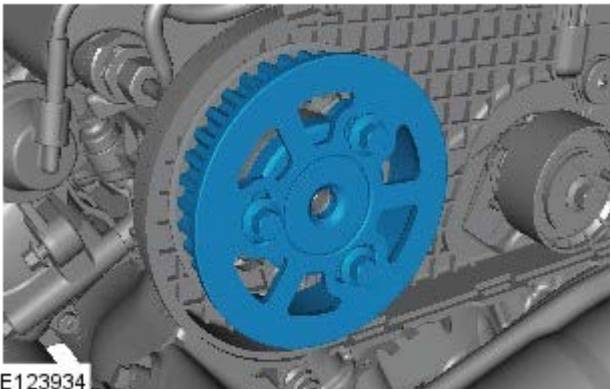
4. Using the special tool, remove the rear camshaft pulley retaining bolt.




E123895

5. Remove the special tools.

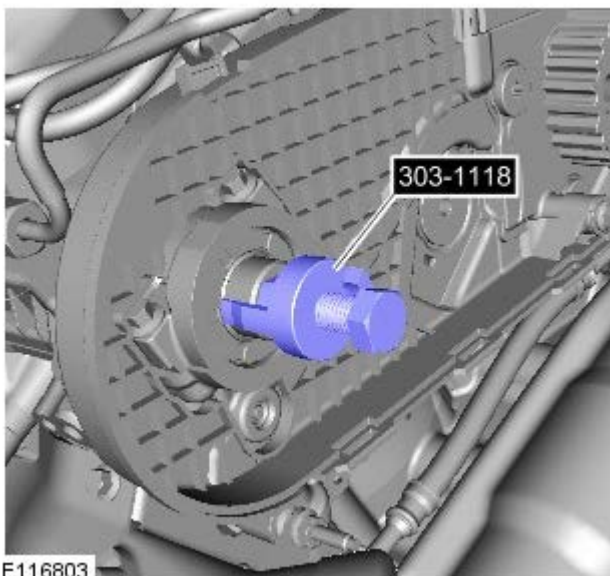
6.



E123934

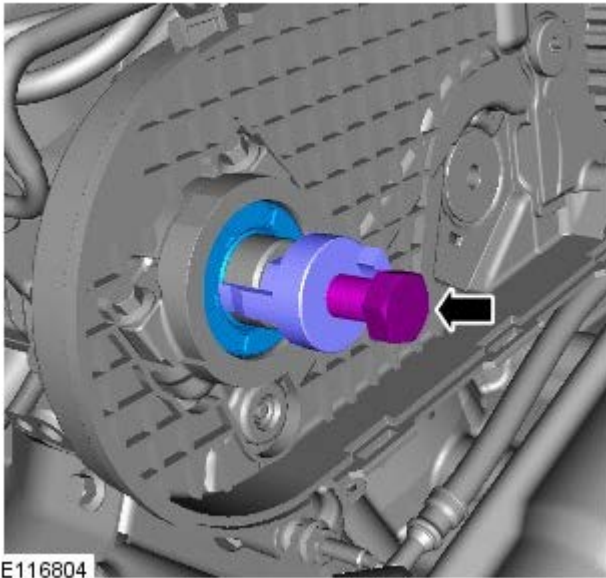
7.  CAUTION: Make sure the special tool is correctly seated behind the camshaft seal. Failure to follow this instruction may result in damage to the special tool.

Install the special tool.

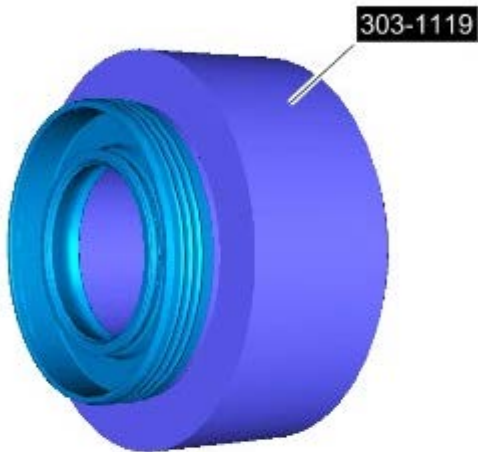


E116803

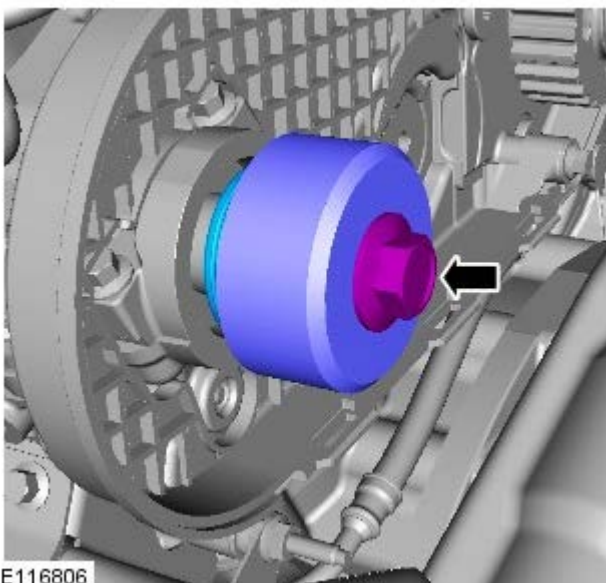
8.



Installation







E116805



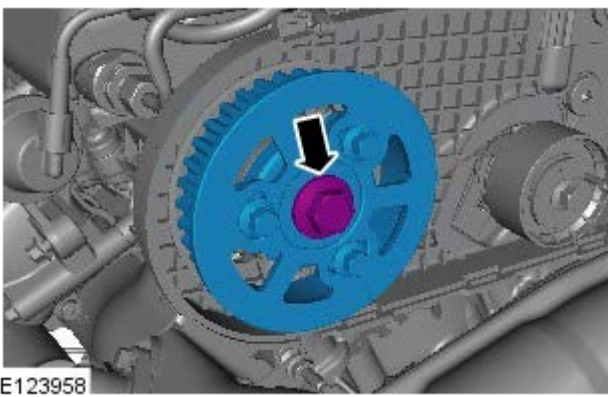
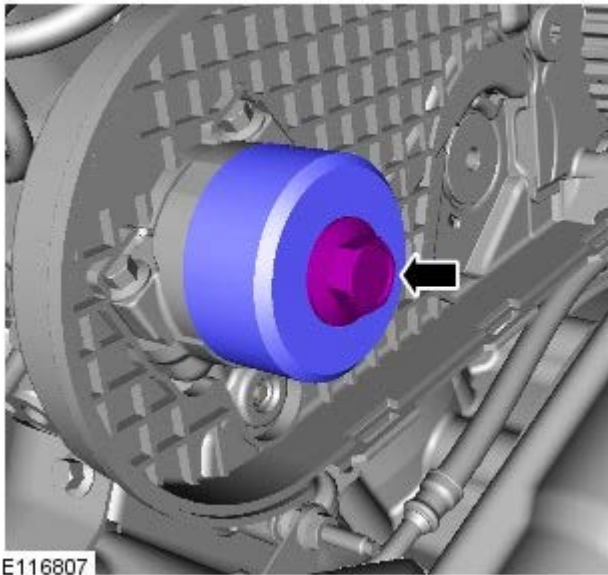
1. Install with the special tool.


2. CAUTIONS:

-  Make sure the seal is installed correctly.
-  Make sure that the mating faces are clean and free of corrosion and foreign material.
-  Do not use any lubricant on the camshaft rear seal or the camshaft. Failure to follow this instruction may result in damage to the vehicle.

 **NOTE:** Make sure that the seal is 1mm below the face of the cylinder head.

3. Remove the special tool.



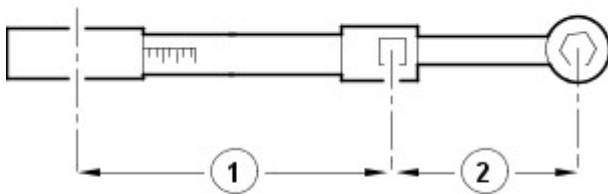
4.  CAUTION: Only tighten the bolt finger-tight at this stage.

5. Install the special tool.


6. Install the special tool.




E123894



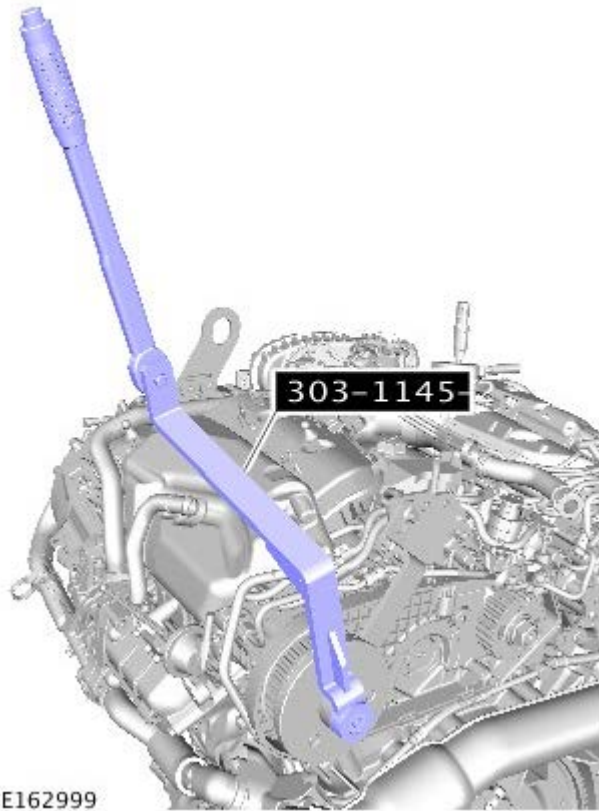
E37107

7.  CAUTION: Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.

- Calculate the setting for the torque wrench using the following method:
- Stage 1: Multiply the required torque by the effective length of the torque wrench (1).
- Stage 2: Add the effective length of the special tool (2) to the effective length of the torque wrench.
- Stage 3: Divide the total of stage 1 by the total of stage 2.
- Stage 4: Set the torque wrench to the figure arrived at in stage 3.

8.  CAUTION: Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.

- Using the special tool, install the camshaft rear pulley retaining bolt.
- Stage one: Tighten to 80 Nm (59 lb/ft).
- Stage two: Tighten a further 80 degrees.






E162999

9. Refer to: [Rear End Accessory Drive \(READ\)](#) (303-05A Accessory Drive - TDV6 3.0L Diesel, Removal and Installation).
10. Remove the special tools.

Engine - TDV6 3.0L Diesel - Crankshaft Front Seal

Removal and Installation

Special Tool(s)

 <p>E54543</p>	<p>303-1120 Remover, Crankshaft Front Seal</p>
 <p>E52717</p>	<p>303-1121 Installer, Crankshaft Seal</p>
 <p>E54545</p>	<p>303-1122 Installer, Crankshaft Front Seal</p>

Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

Refer to: Specifications (414-01, Specifications).

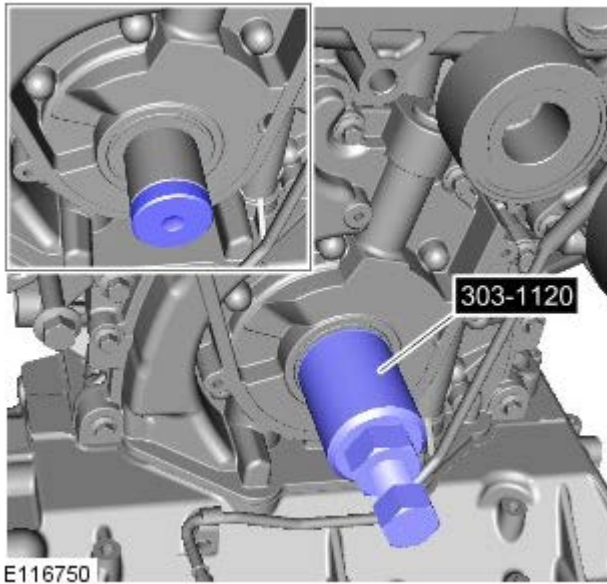
2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

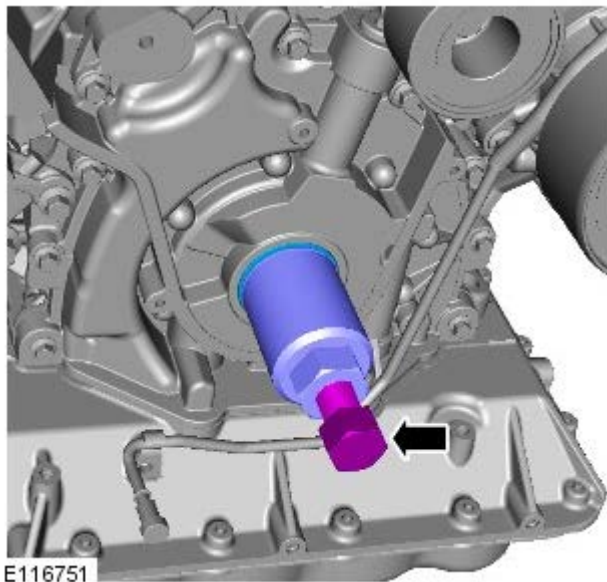
3. Refer to: Crankshaft Pulley (303-01B, Removal and Installation).

4. Install the special tool.

Special Tool(s): [303-1120](#)

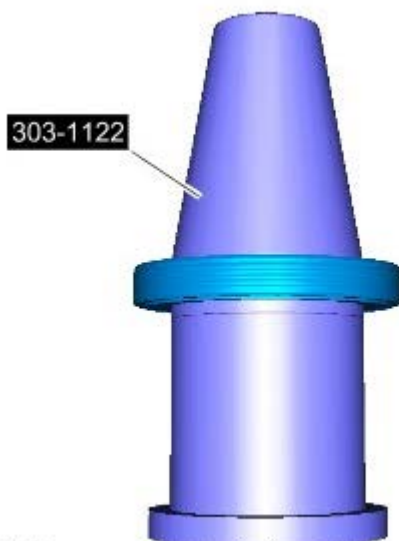


E116750



E116751


Installation




E116752

5.  **CAUTION:** Discard the seal.

Using the special tool, remove the crankshaft front seal.

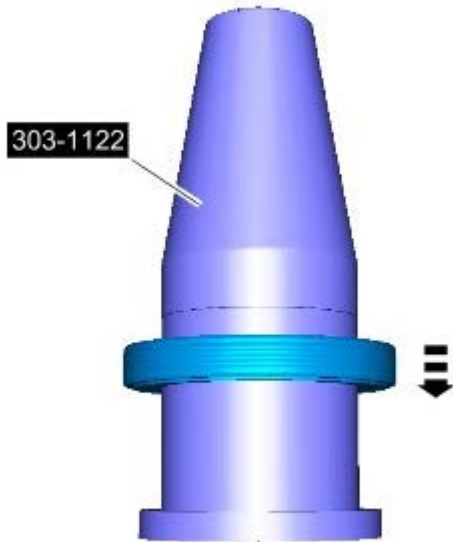
1.  **CAUTION:** Do not use any lubricant on the crankshaft front seal, special tools or the crankshaft. Failure to follow this instruction may result in damage to the vehicle.

 **NOTE:** Make sure that all the component mating faces are clean.

Install a new crankshaft front seal to the special tool.

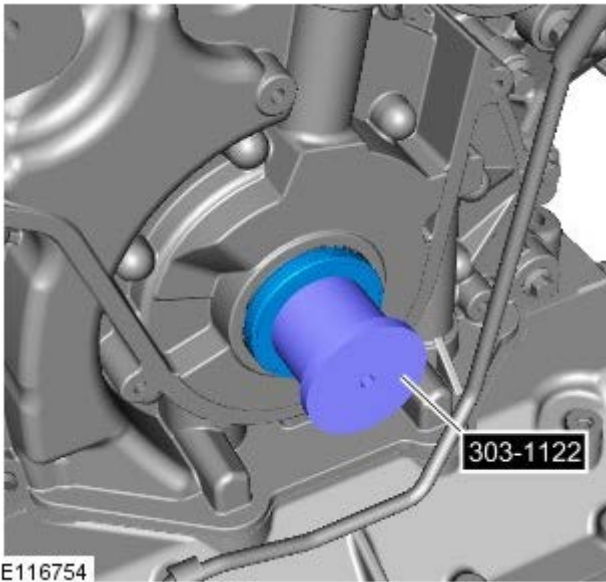
Special Tool(s): [303-1122](#)

2. Reposition the crankshaft front seal along the special tool.



E116753

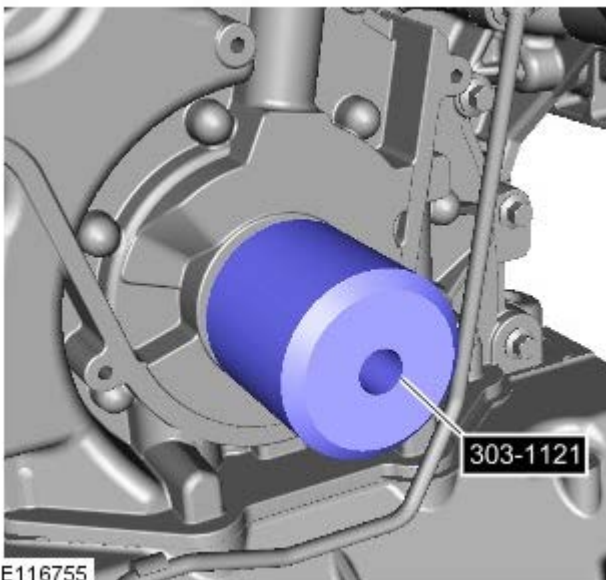
3. Install the special tool to the crankshaft.



E116754


4. Install the special tool to the crankshaft.

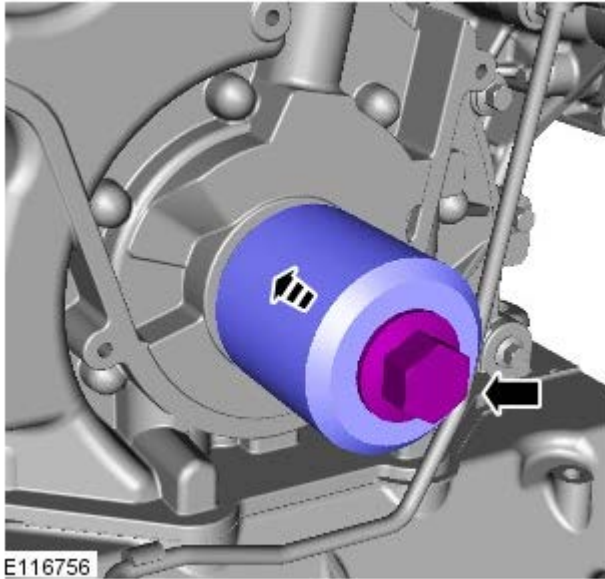
Special Tool(s): [303-1121](#)




E116755

5. CAUTIONS:

 Make sure the seal is installed correctly.



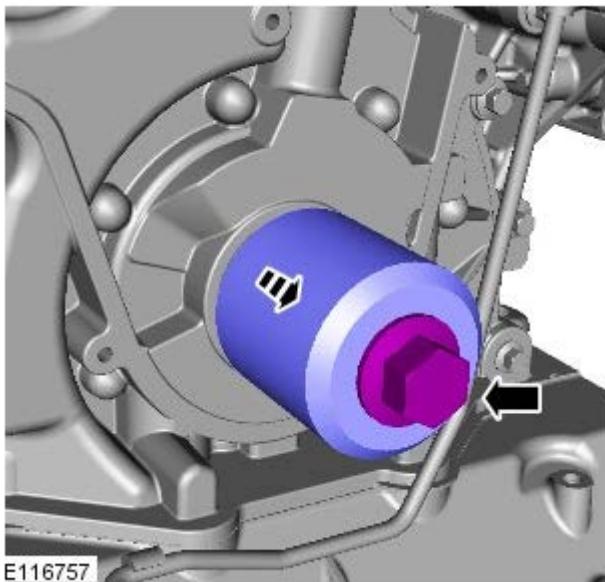
 Make sure that the seal is seated 1mm under flush.

 Discard the bolt.

Using the special tool, install the crankshaft front seal.

6. Remove the special tool.

Special Tool(s): [303-1121](#)



7. Refer to: Crankshaft Pulley (303-01B, Removal and Installation).

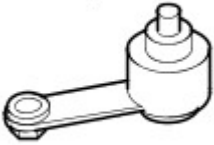
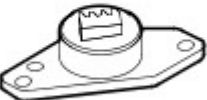

8. Connect the battery ground cable.

Refer to: Specifications (414-01, Specifications).


Engine - TDV6 3.0L Diesel - Crankshaft Pulley

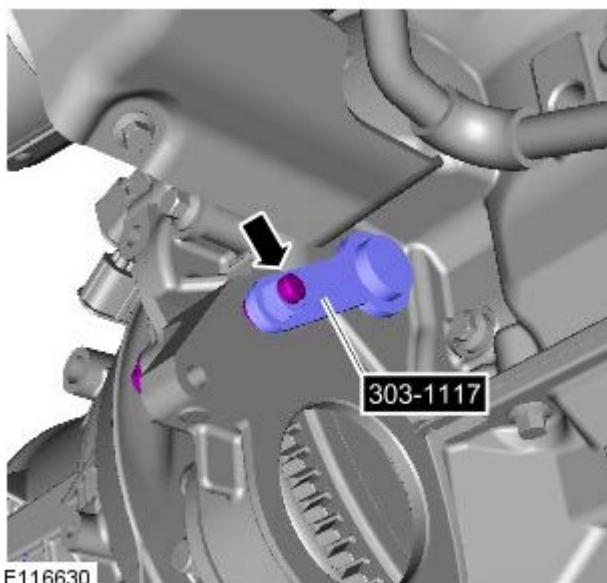
Removal and Installation

Special Tool(s)

 <p>303-1117</p> <p>E54540</p>	<p>303-1117 Timing Peg, Automatic Transmission</p>
 <p>303-1123</p> <p>E 54546</p>	<p>303-1123 Locking Tool, Flywheel</p>
 <p>303-D121</p> <p>E64849</p>	<p>303-D121 Puller, General Purpose</p>

Removal

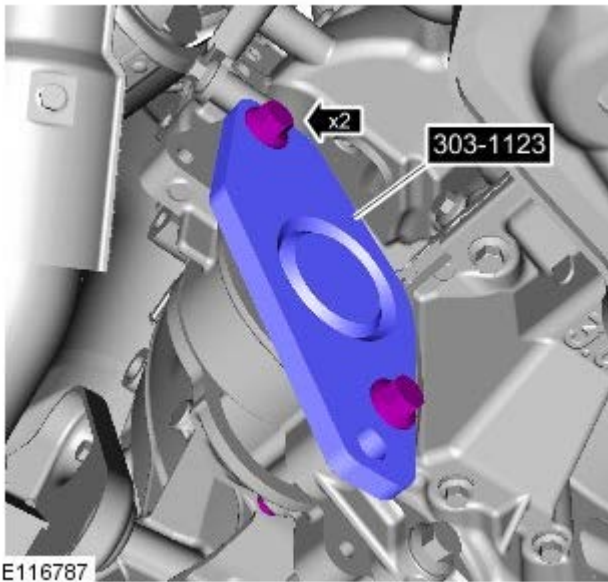
1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: Timing Belt (303-01, Removal and Installation).
3. Refer to: Cooling Fan (303-03, Removal and Installation).



E116630

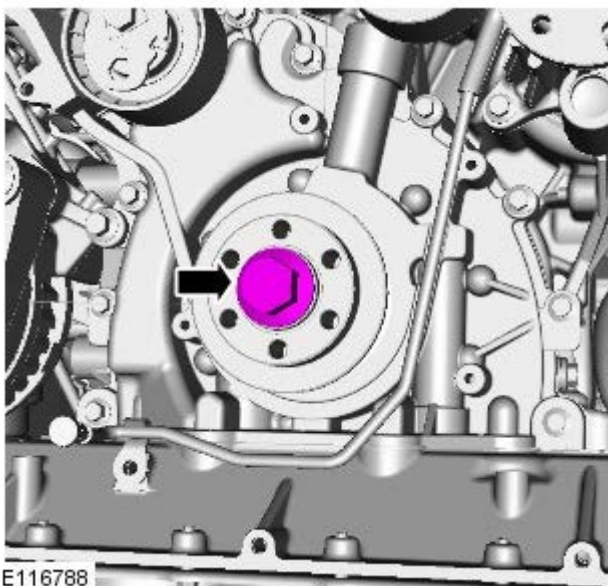
4.
 - Remove the special tool.
 - *Special Tool(s):* [303-1117](#)

5.
 - Install the special tool.
 - *Special Tool(s):* [303-1123](#)



E116787

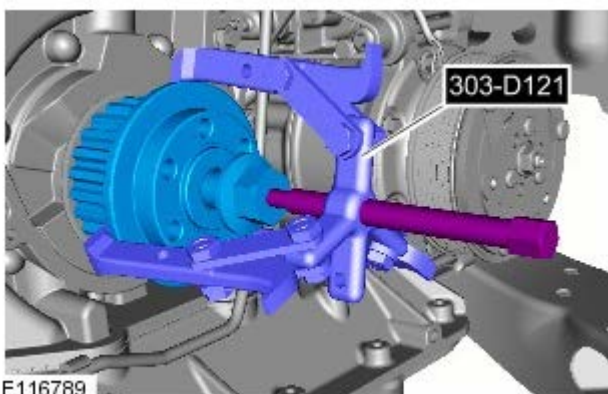
6.



E116788

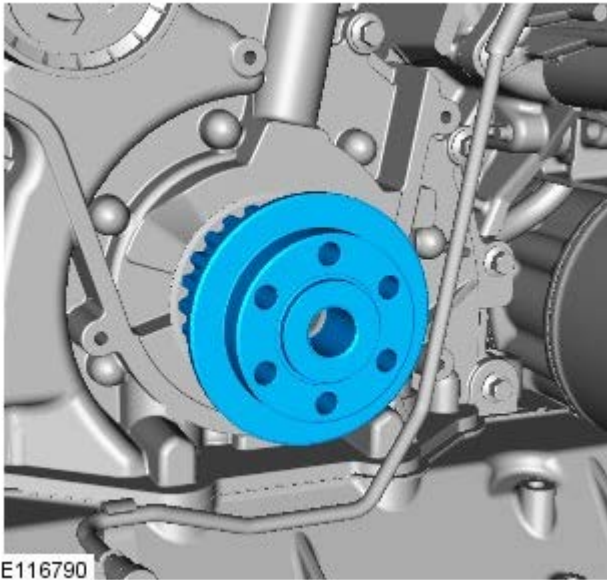
7.

- Install the special tool.
- *Special Tool(s):* [303-D121](#)

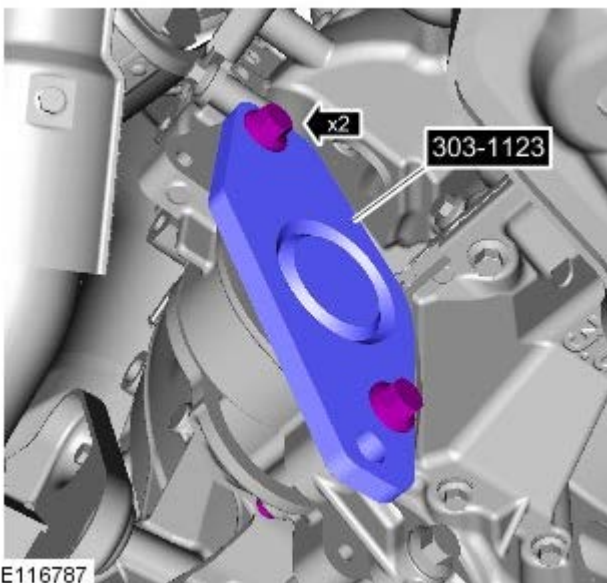
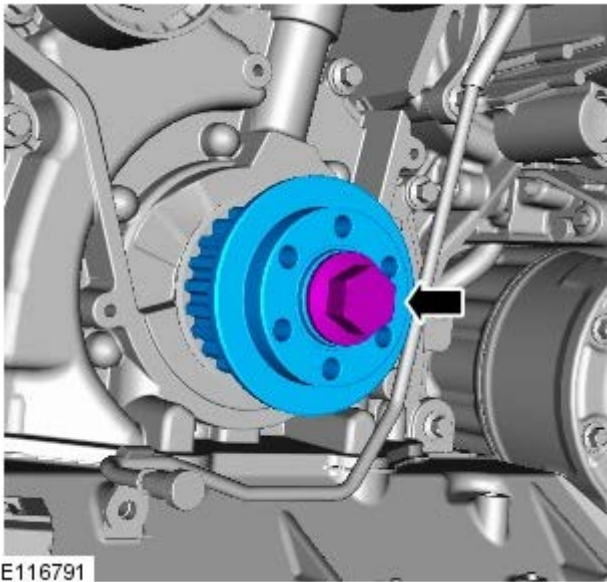


E116789




8.  CAUTION: Discard the bolt.



Installation



1. CAUTIONS:

-  Make sure that the pulley washer is correctly seated before installing the pulley.
-  Do not lubricate the components.
-  Make sure that a new bolt is installed.

Torque:

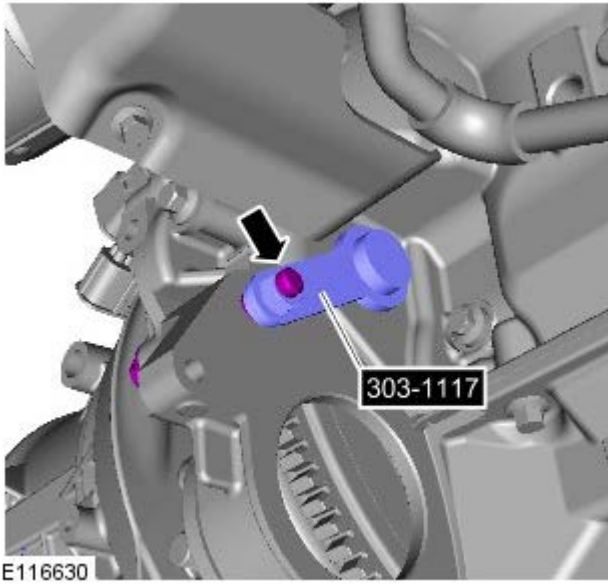
- Stage 1: 150 Nm
- Stage 2: 300 Nm
- Stage 3: 90°

2.

- Remove the special tool.
- *Special Tool(s)*: [303-1123](#)

3.

- Install the special tool.
- *Special Tool(s)*: [303-1117](#)



4. Refer to: Cooling Fan (303-03, Removal and Installation).

5. Refer to: Timing Belt (303-01, Removal and Installation).

Engine - TDV6 3.0L Diesel - Crankshaft Rear Seal

Removal and Installation

Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

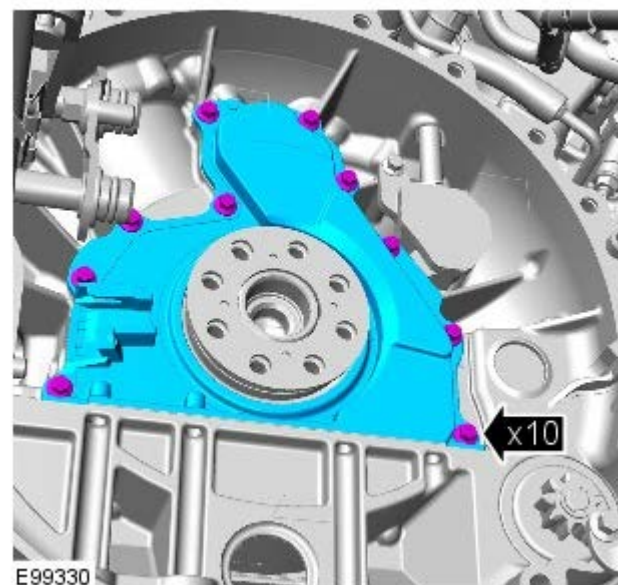
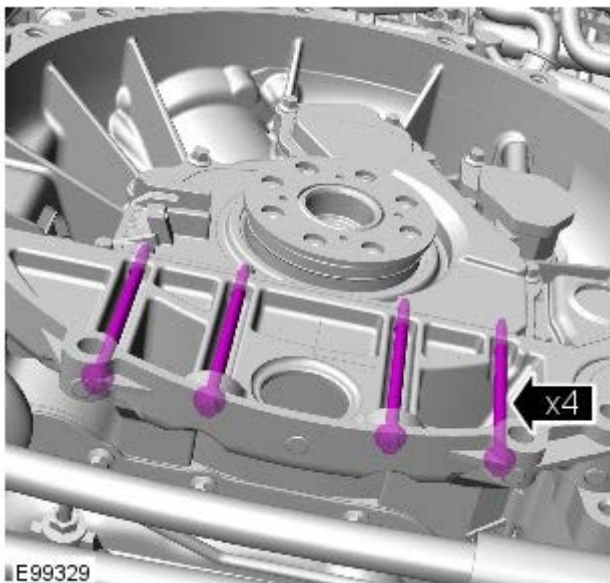
Refer to: Specifications (414-01, Specifications).

2.  WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Refer to: Crankshaft Position (CKP) Sensor Ring (303-14B, Removal and Installation).

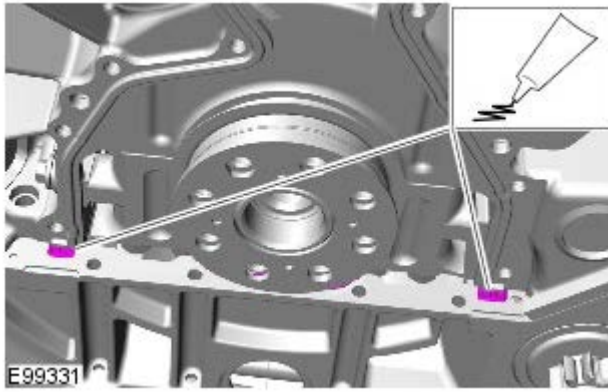
4.




5.  CAUTION: Discard the seal.

Installation

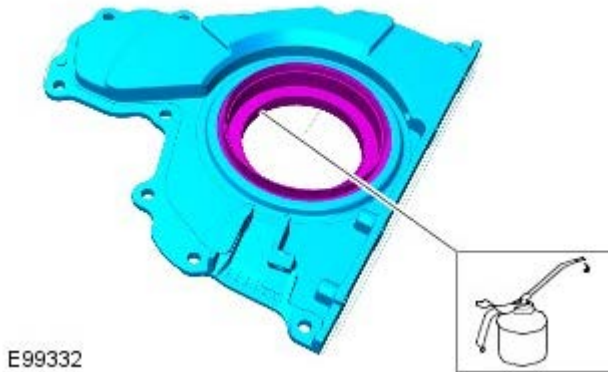
1. CAUTIONS:



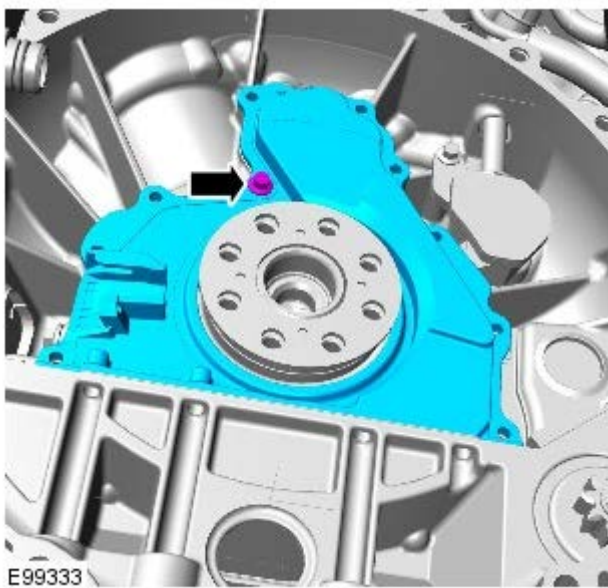
 Make sure that the crankshaft rear oil seal is correctly located.

 Make sure the crankshaft seal mating faces are clean and dry.

Apply an 8 mm bead of sealant to the cylinder block in the areas shown.

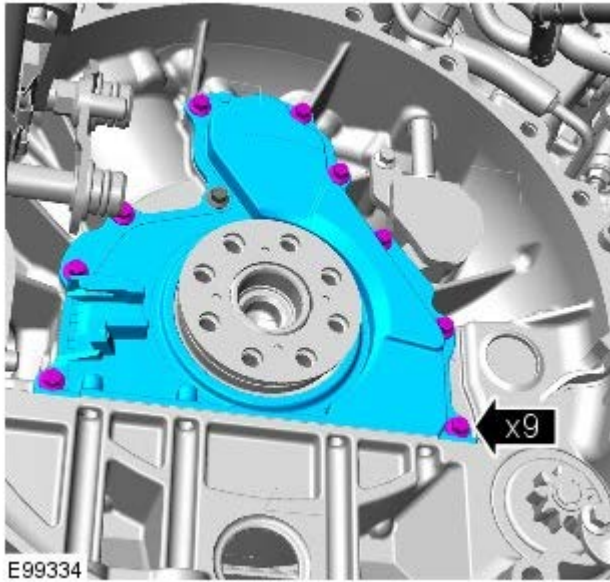


2.
 - Lubricate the oil seal.

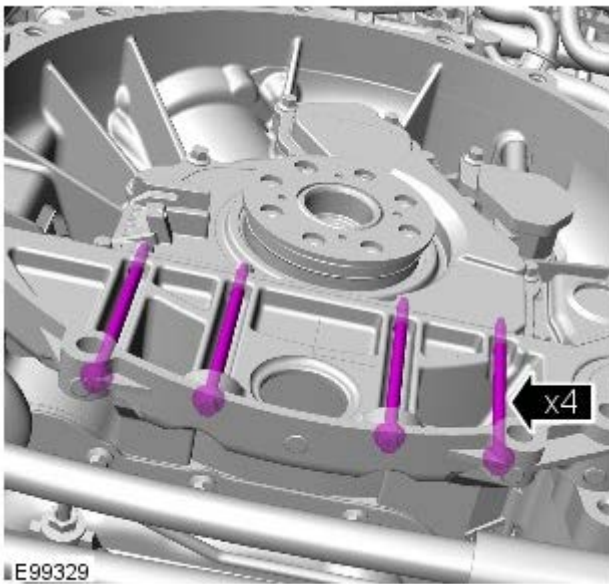


3. Torque: 10 Nm

4. Torque: 10 Nm



5. Torque: 10 Nm



6. Refer to: Crankshaft Position (CKP) Sensor Ring (303-14B, Removal and Installation).

7. Connect the battery ground cable.

Refer to: Specifications (414-01, Specifications).

Engine - TDV6 3.0L Diesel - Cylinder Head LH

Removal and Installation

Removal

1. Disconnect the battery ground cable.

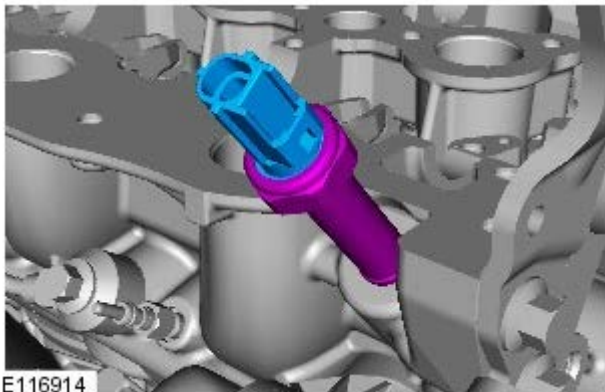
Refer to: Specifications (414-00 Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

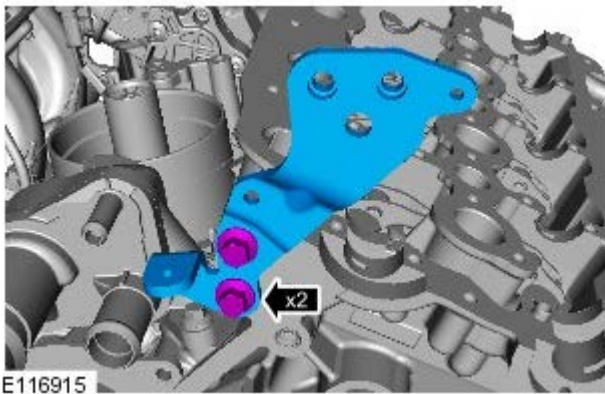
Raise and support the vehicle.

3. Refer to: Camshaft LH (303-01 Engine - 3.0L V6 - TdV6, Removal and Installation).
4. Refer to: Glow Plugs (303-07 Glow Plug System - 3.0L V6 - TdV6, Removal and Installation).
5. Refer to: Exhaust Manifold (303-01 Engine - 3.0L V6 - TdV6, Removal and Installation).

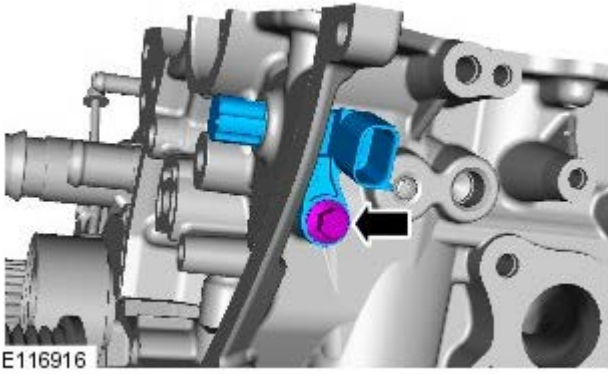
6.



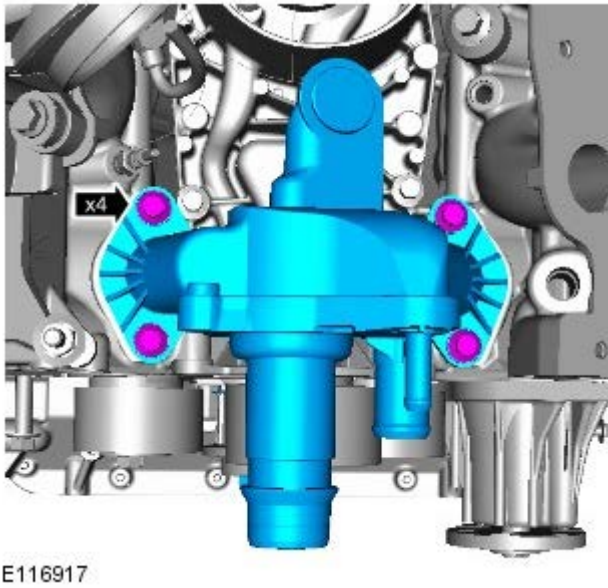
7.



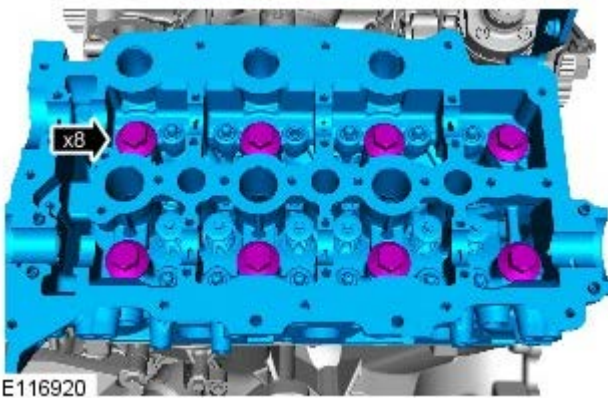
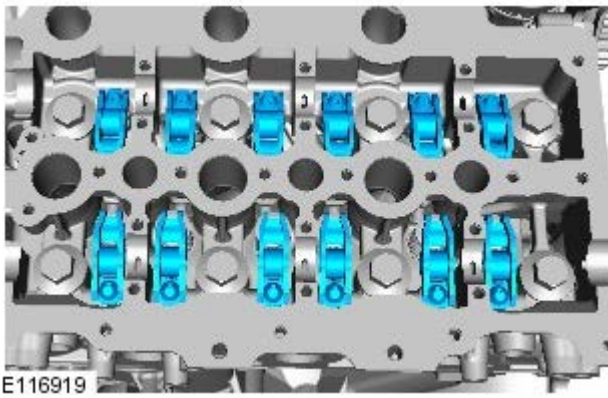
8.



9.




10.



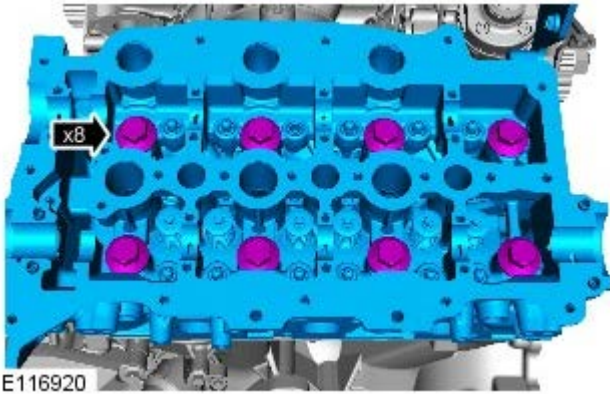
11.  CAUTION: Discard the bolts.

 NOTE: Discard the gasket.

Installation

1.  CAUTION: Make sure that the mating faces are clean and free of foreign material.

Clean and inspect the cylinder head and cylinder block.





E116920

2. CAUTIONS:


 Only tighten the bolts finger-tight at this stage.


 Make sure that new bolts are installed.

 Use care when installing the cylinder head. Damage to the cylinder block, cylinder head or cylinder head gasket may result.

 The head gasket must be installed over the cylinder block dowels.

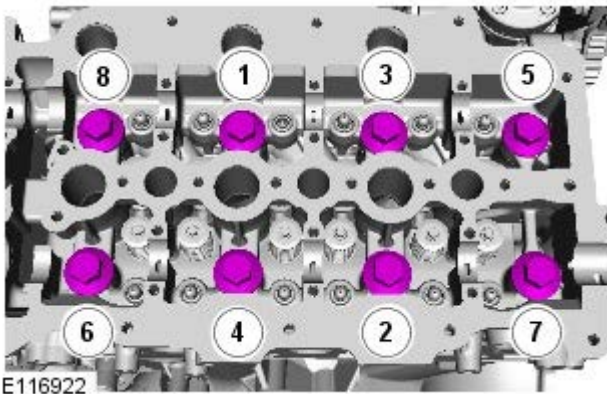
NOTES:

 Install a new gasket.

 No additional lubrication to the cylinder head bolts is required.

3.  NOTE: Tighten the bolts in the indicated sequence.

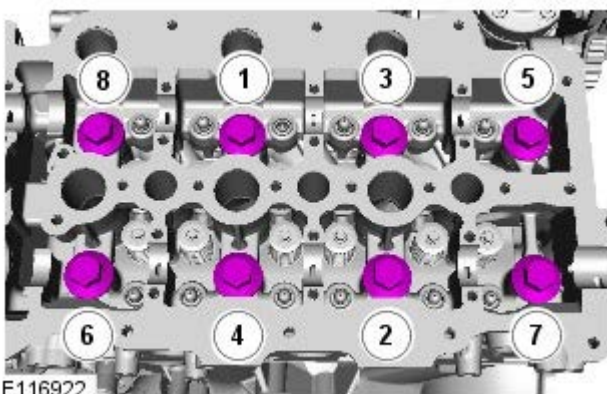
- Torque: 80 Nm



E116922

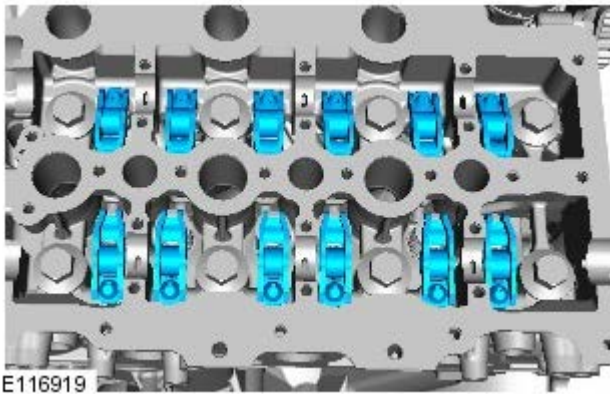
4.  NOTE: Tighten the bolts in the indicated sequence.

- Torque: 180°

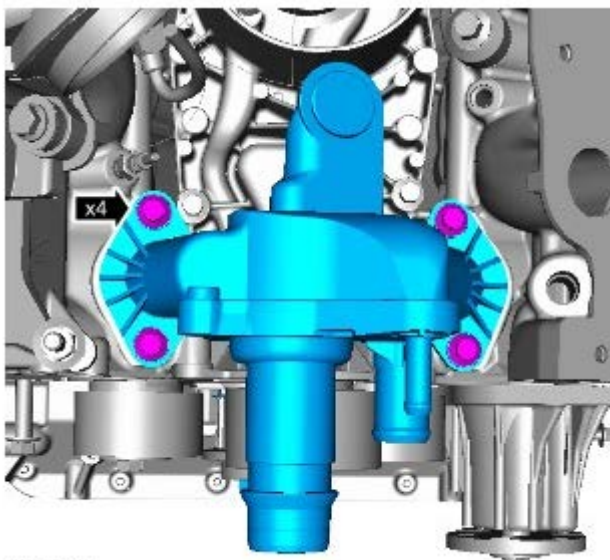


E116922

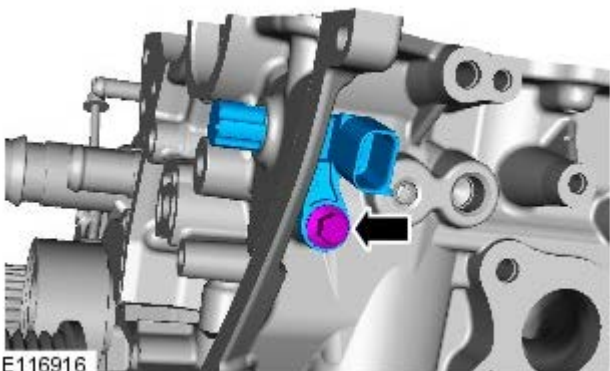
5. .



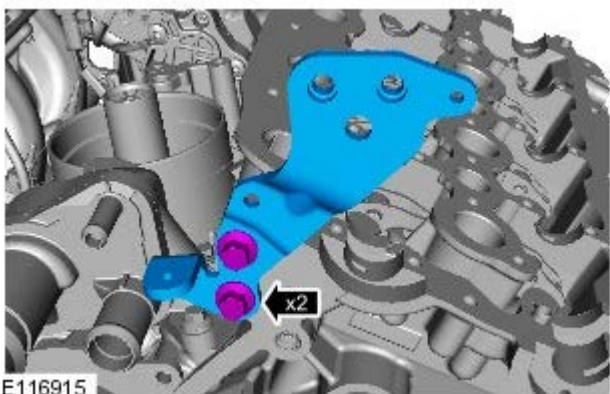
E116919



E116917



E116916



E116915

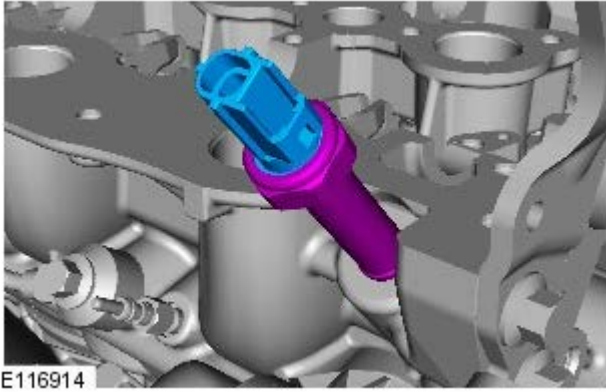
6.  CAUTION: Install the new seals.

Torque: 10 Nm

7. Torque: 10 Nm

8. Torque: 24 Nm

9. Torque: 14 Nm



10. Refer to: Exhaust Manifold (303-01 Engine - 3.0L V6 - TdV6, Removal and Installation).
11. Refer to: Glow Plugs (303-07 Glow Plug System - 3.0L V6 - TdV6, Removal and Installation).
12. Refer to: Camshaft LH (303-01 Engine - 3.0L V6 - TdV6, Removal and Installation).
13. Connect the battery ground cable.

Refer to: Specifications (414-00 Charging System - General Information, Specifications).

Engine - TDV6 3.0L Diesel - Cylinder Head RH

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

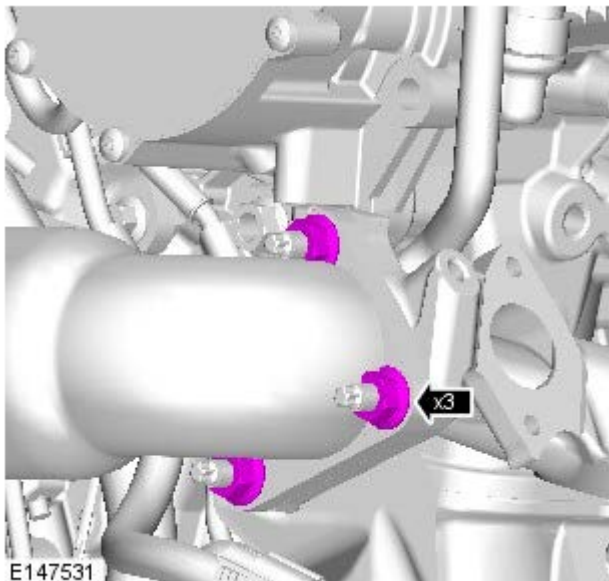
1. Disconnect the battery ground cable

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

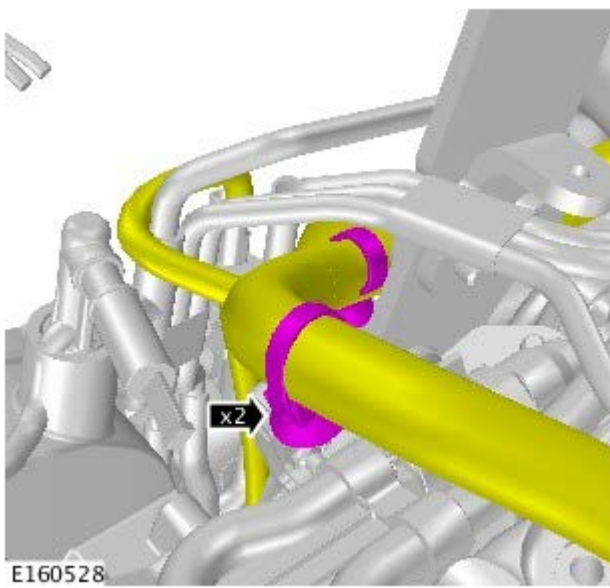
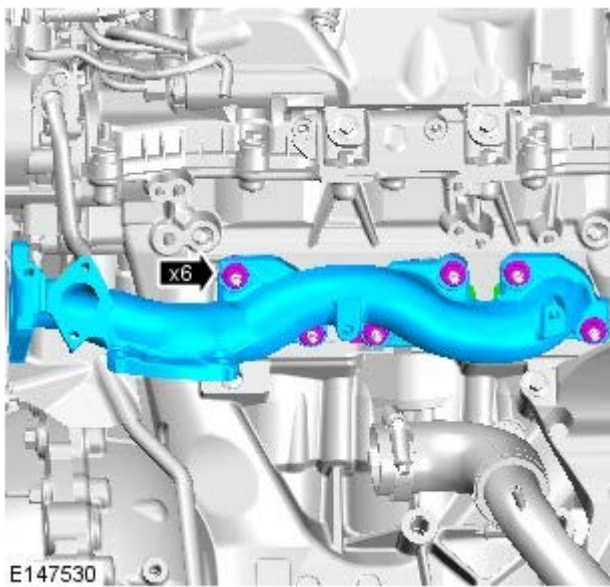
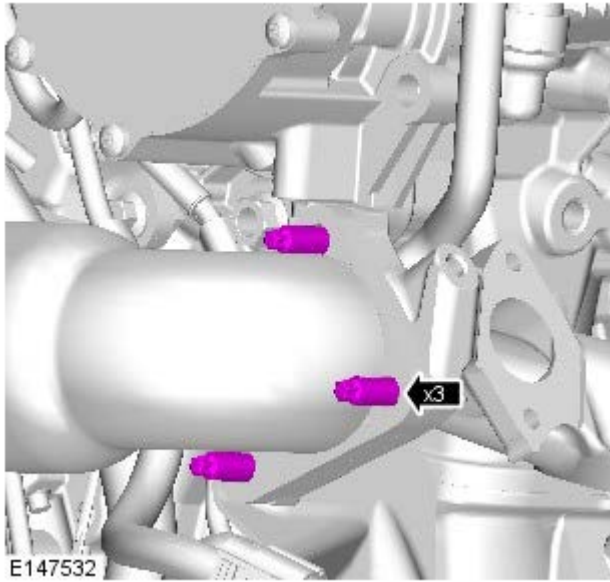
Raise and support the vehicle.

3. Refer to: [Turbocharger RH](#) (303-04B Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel, Removal and Installation).



4.  **CAUTION:** Discard the nuts.

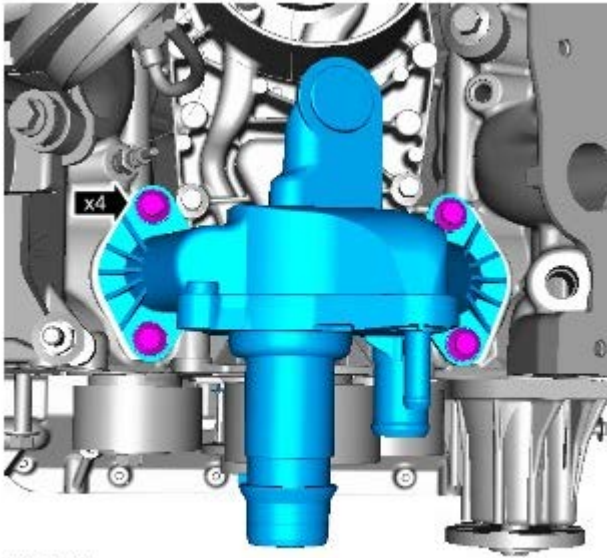
5.  **CAUTION:** Discard the studs.



6.  NOTE: Discard the gasket.

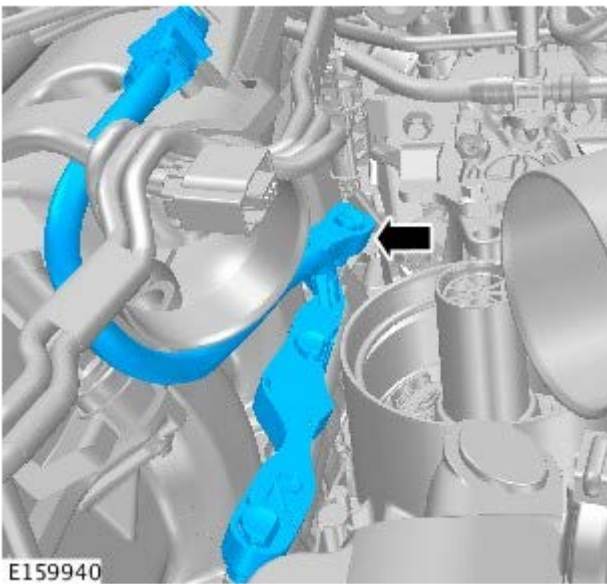
7.

8.



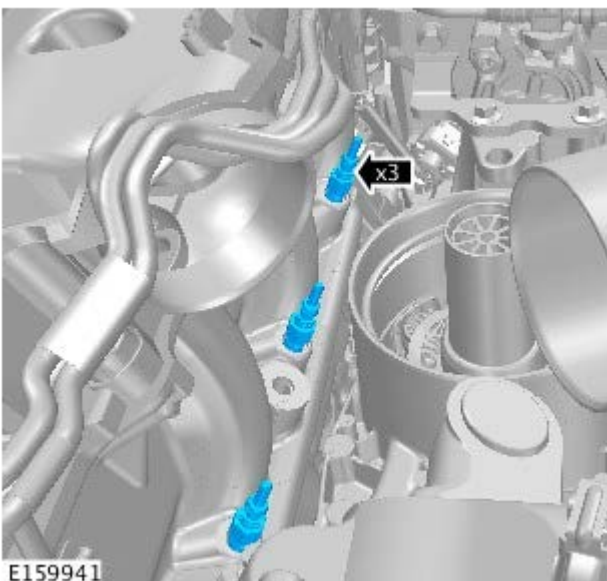
E116917

9.



E159940

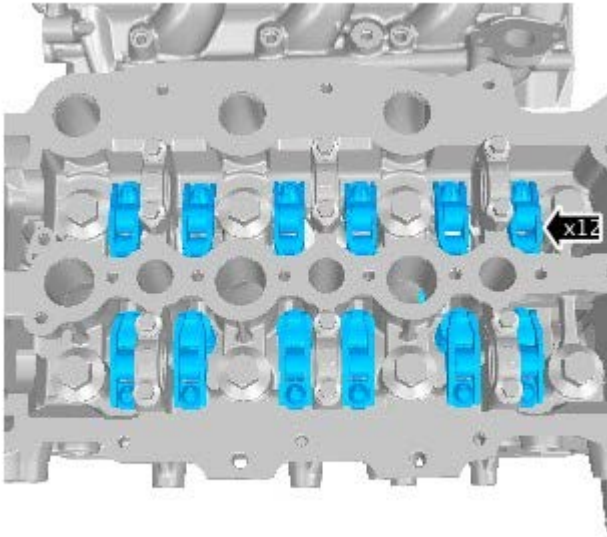
10.



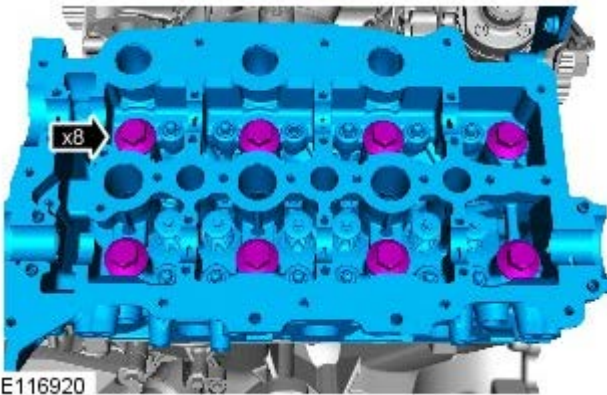
E159941

11. Refer to: [Camshaft RH](#) (303-01A Engine - TDV6 3.0L Diesel, Removal and Installation).

12.



E159939




E116920

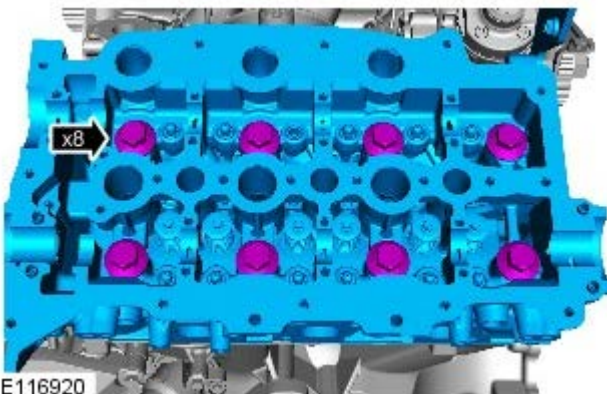
13.  CAUTION: Discard the bolts.

 NOTE: Discard the gasket.

Installation

1.  CAUTION: Make sure that the mating faces are clean and free of foreign material.

Clean and inspect the cylinder head and cylinder block.




E116920

2. CAUTIONS:

 Only tighten the bolts finger-tight at this stage.


 Make sure that new bolts are installed.

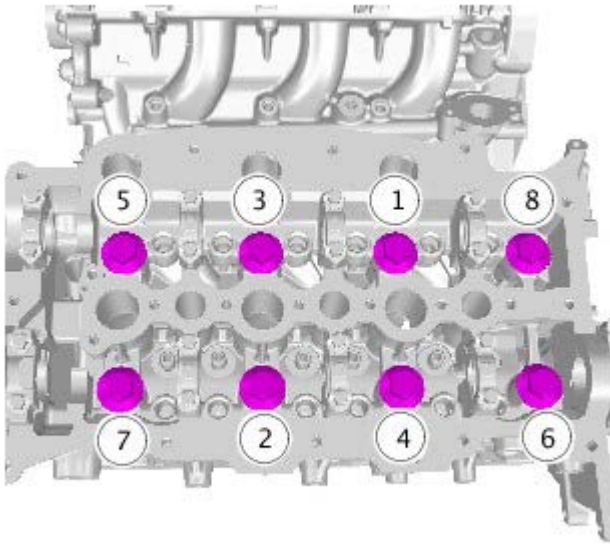
 Use care when installing the cylinder head. Damage to the cylinder block, cylinder head or cylinder head gasket may result.

 The head gasket must be installed over the cylinder block dowels.


NOTES:

 Install a new gasket.

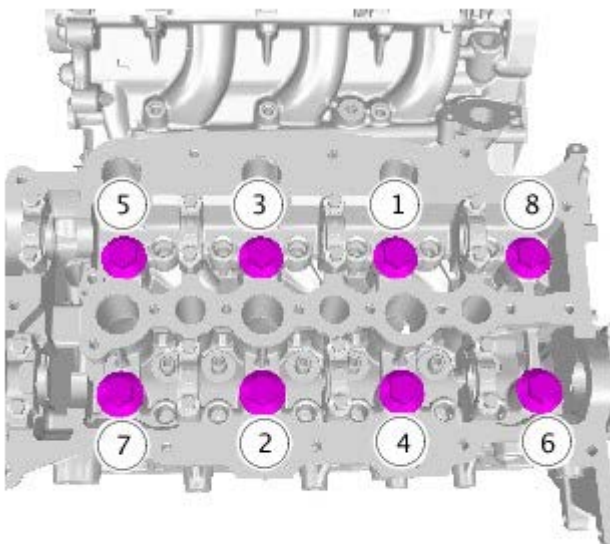
 No additional lubrication to the cylinder head bolts is required.



E159942

3.  NOTE: Tighten the bolts in the indicated sequence.

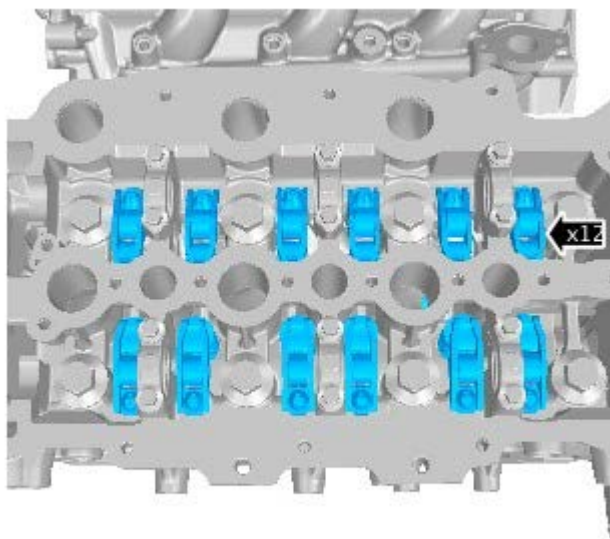
- Torque: 80 Nm



E159942

4.  NOTE: Tighten the bolts in the indicated sequence.

- Torque: 180°

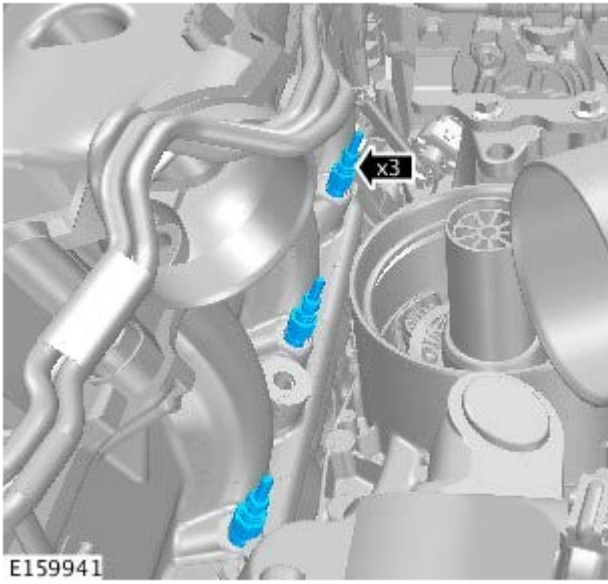


E159939

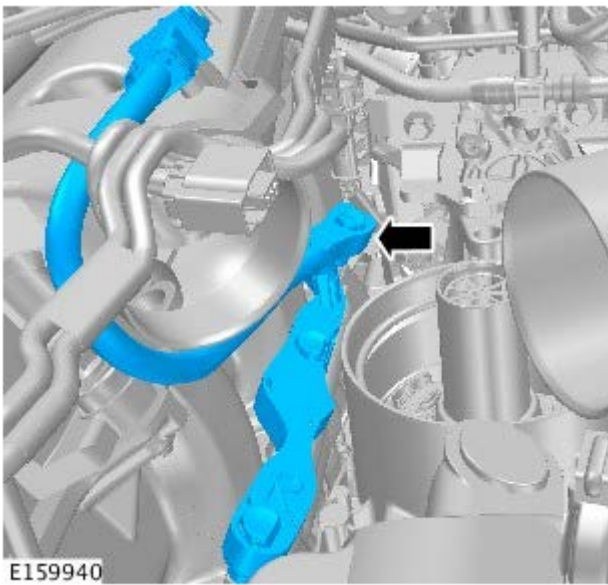
- 5.

6. Refer to: [Camshaft RH](#) (303-01A Engine - TDV6 3.0L Diesel, Removal and Installation).

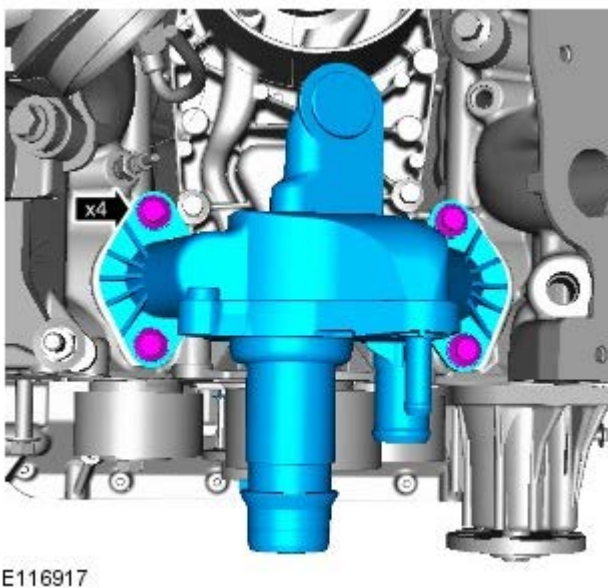
7. Torque: 10 Nm



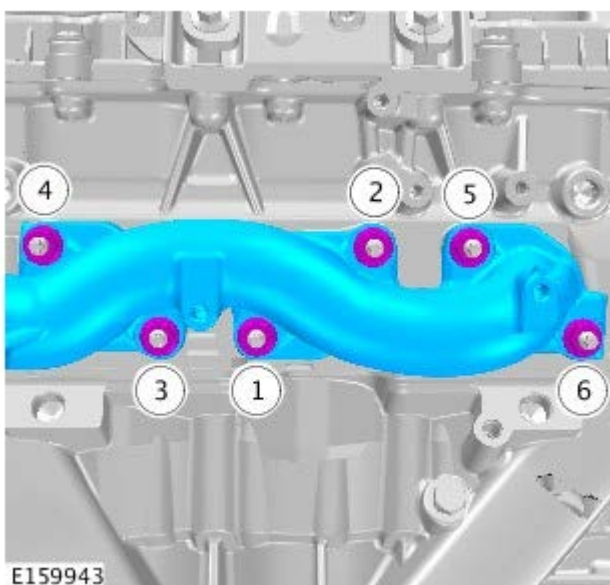
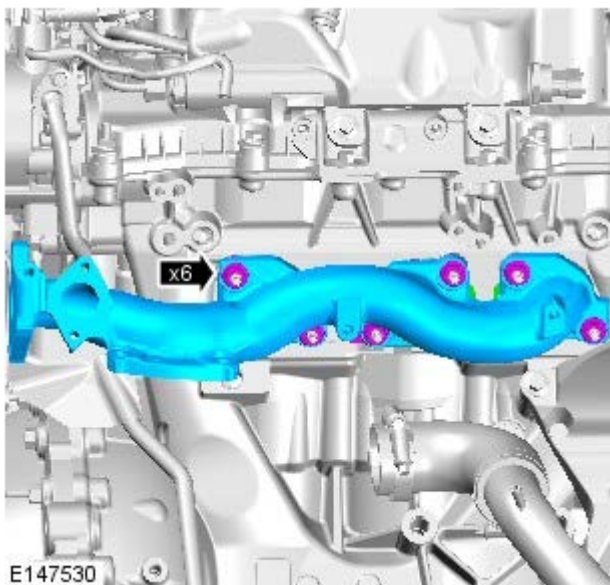
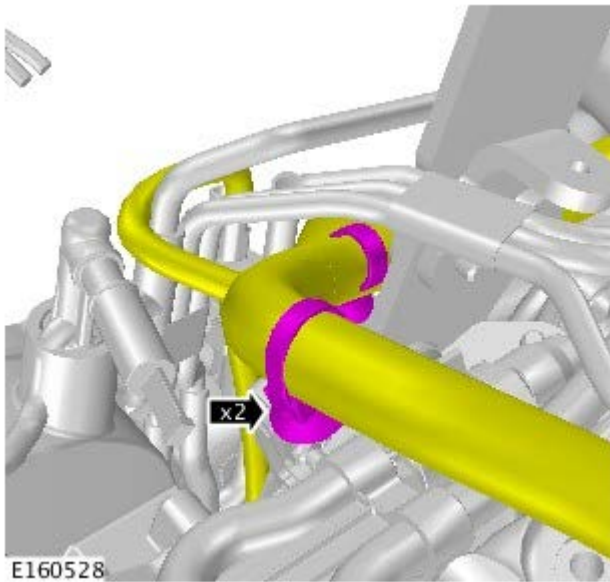
8.




9. Torque: 10 Nm




10.



11.  **WARNING:** Make sure that new nuts are installed.

 **CAUTION:** Install the nuts finger tight before final tightening.

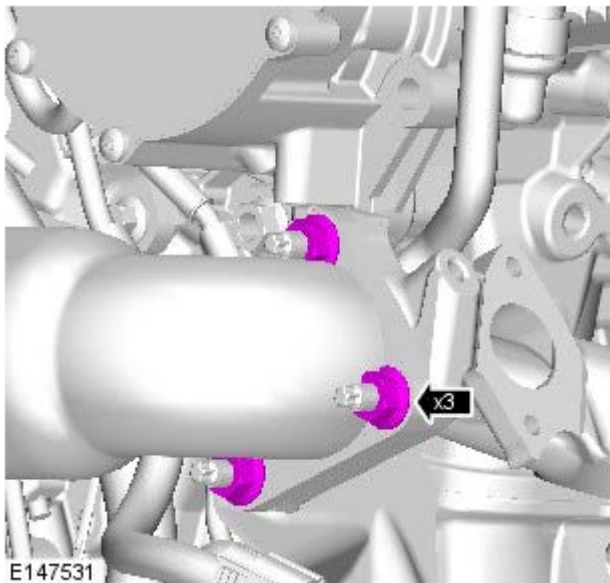
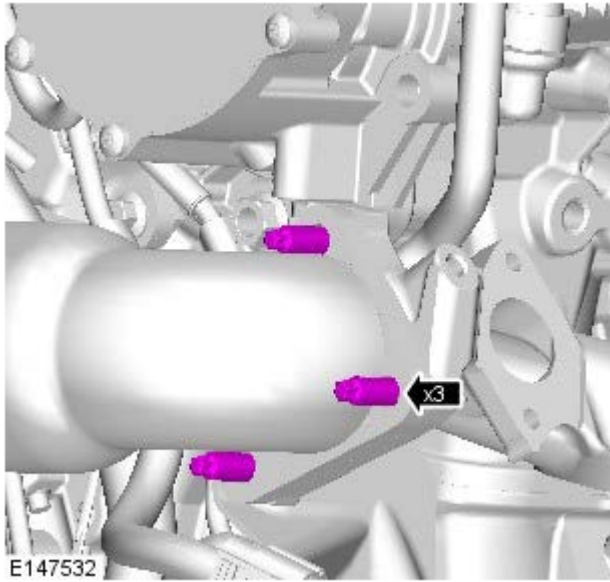
 **NOTE:** Install a new gasket.


12.  **NOTE:** Tighten the bolts in the indicated sequence.

Torque: 28 Nm

13.  **CAUTION:** Install new studs.

Torque: 13 Nm



14.  **WARNING:** Make sure that new nuts are installed.

Torque: 24 Nm

15. Refer to: [Turbocharger RH](#) (303-04B Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel, Removal and Installation).

16. Reconnect the battery ground cable

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - TDV6 3.0L Diesel - Engine Mount LH

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Cooling Fan Shroud (303-03, Removal and Installation).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

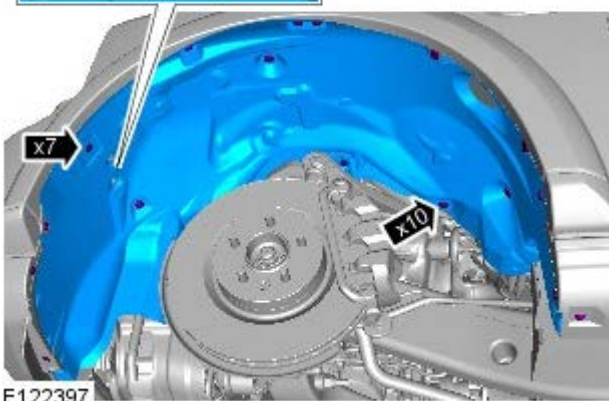
Raise and support the vehicle.

3. Refer to: Catalytic Converter (309-00, Removal and Installation).

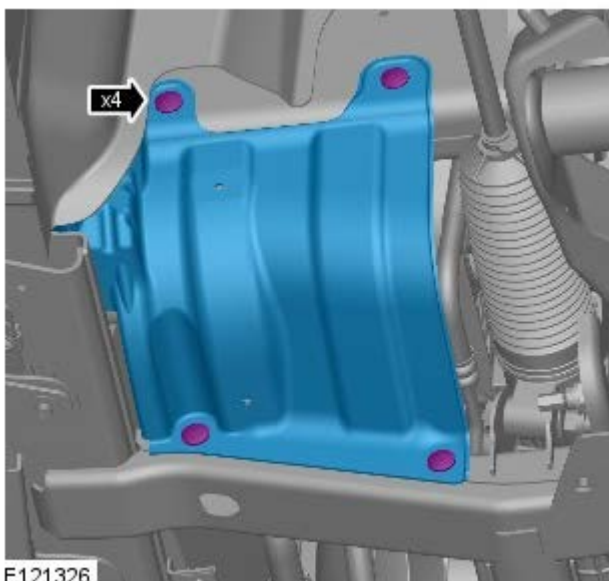
4. Remove the LH front wheel and tire.

Torque: 140 Nm

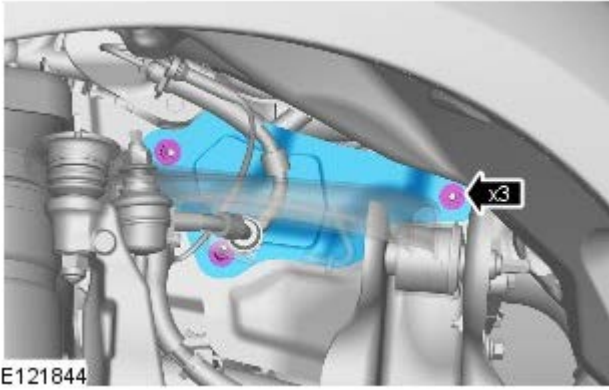
- 5.



- 6.

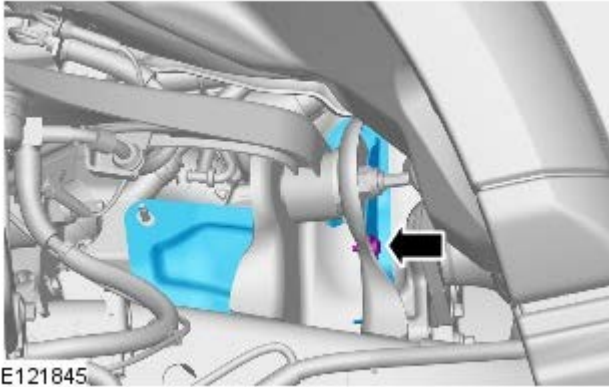


7. Torque: 9 Nm



E121844

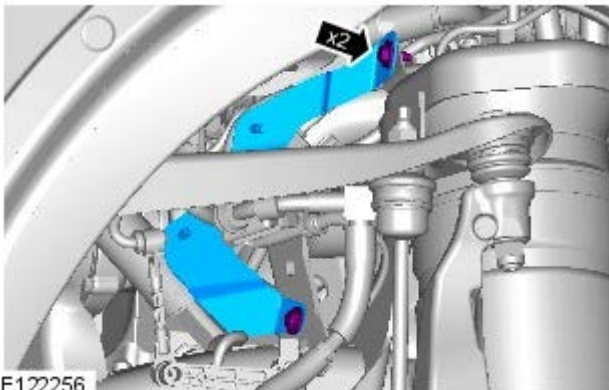
8. Torque: 9 Nm



E121845

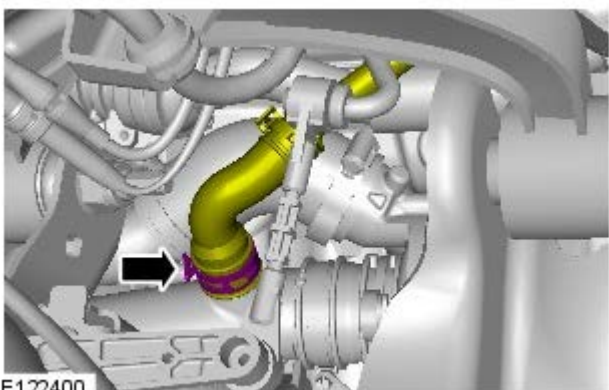
9.  NOTE: RH illustration shown, LH is similar.

Torque: 9 Nm




E122256

10.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

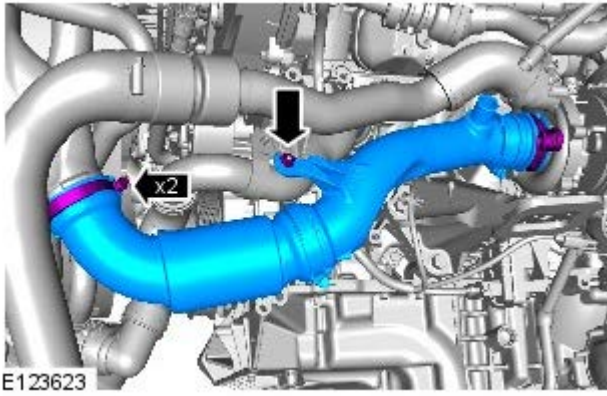


E122400

11.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

 NOTE: Engine shown removed for clarity.

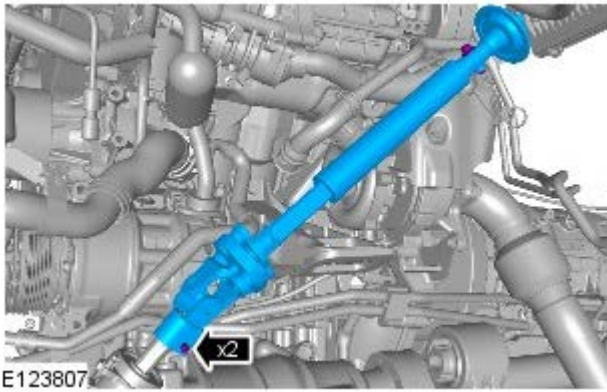
Torque: 10 Nm




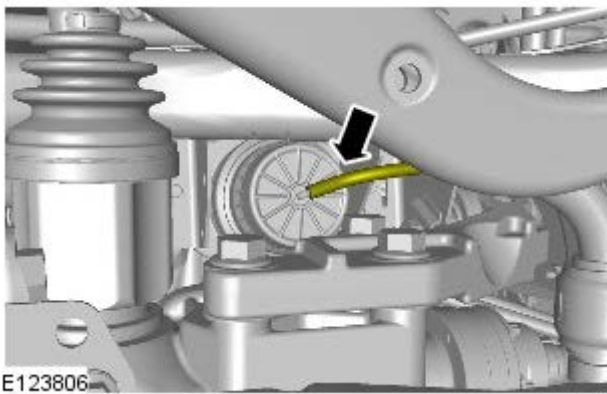
12.  CAUTION: Make sure that new bolts are installed.

 NOTE: Engine shown removed for clarity.

Torque: 30 Nm



13.  CAUTION: Make sure that all openings are sealed.



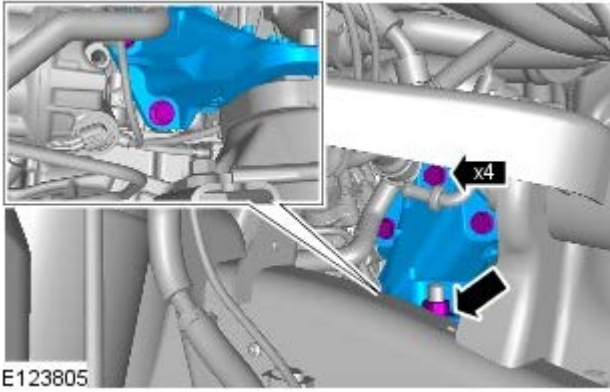
14. CAUTIONS:

 Use a wooden block to protect the oil pan when supporting the engine.

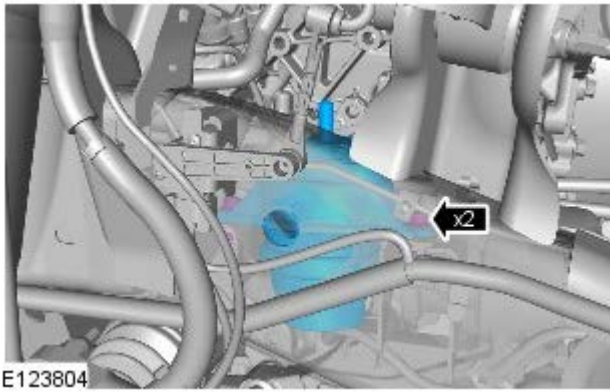
 Protect the radiator during this operation.

Using a suitable hydraulic jack, raise and support the engine.

15. Torque:
Bolts 115 Nm
nut 90 Nm



16. *Torque:*
Stage 1: 45 Nm
Stage 2: 60°



Installation

1. To install, reverse the removal procedure.

Engine - TDV6 3.0L Diesel - Engine Mount RH

Removal and Installation

Removal

NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.



Removal steps in this procedure may contain installation details.

1. Disconnect both battery cables.

Refer to: Specifications (414-00, Specifications).
2. Refer to: Exhaust System (309-00, Removal and Installation).
3. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
4. Refer to: Generator (414-02, Removal and Installation).

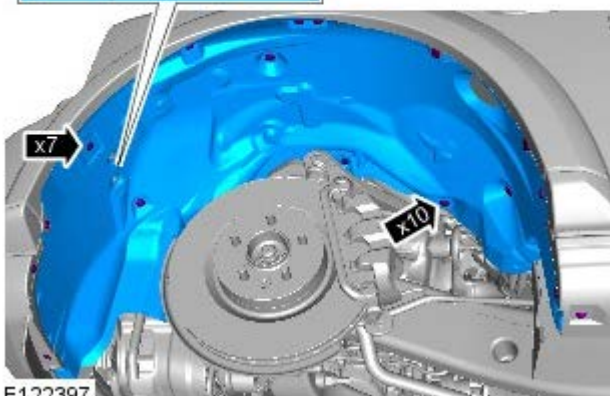
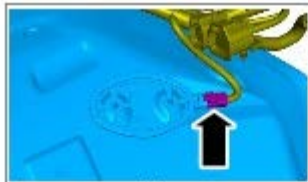
5.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

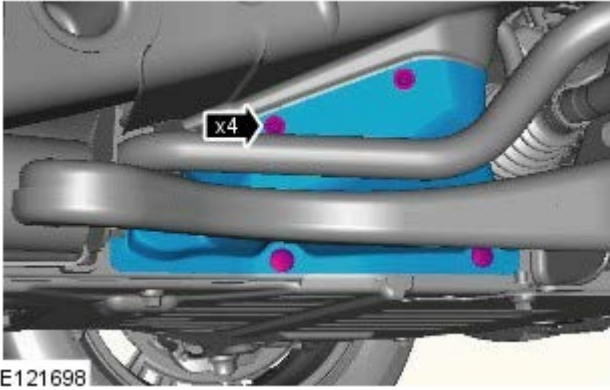
6. Remove the RH front wheel and tire.

Torque: 140 Nm

7.

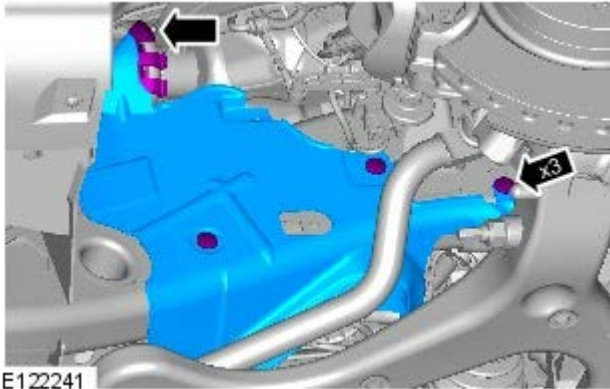


8.



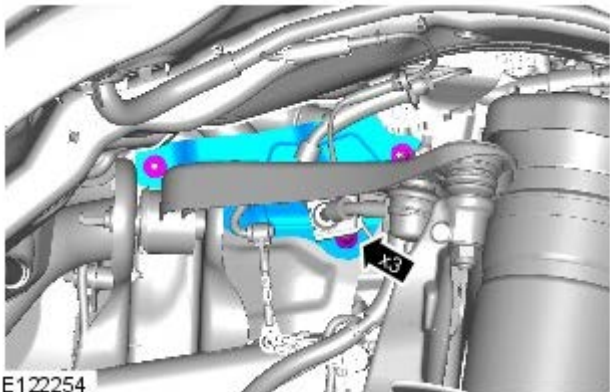
E121698

9.



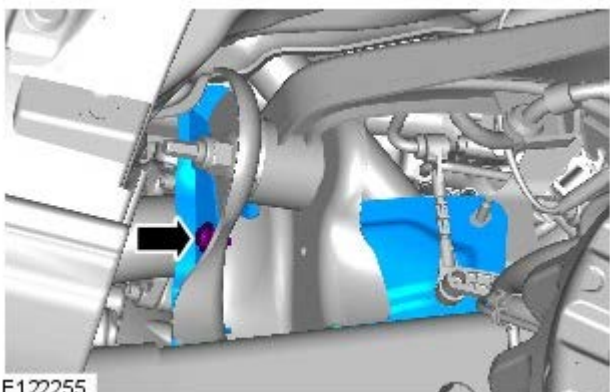
E122241

10. Torque: 9 Nm



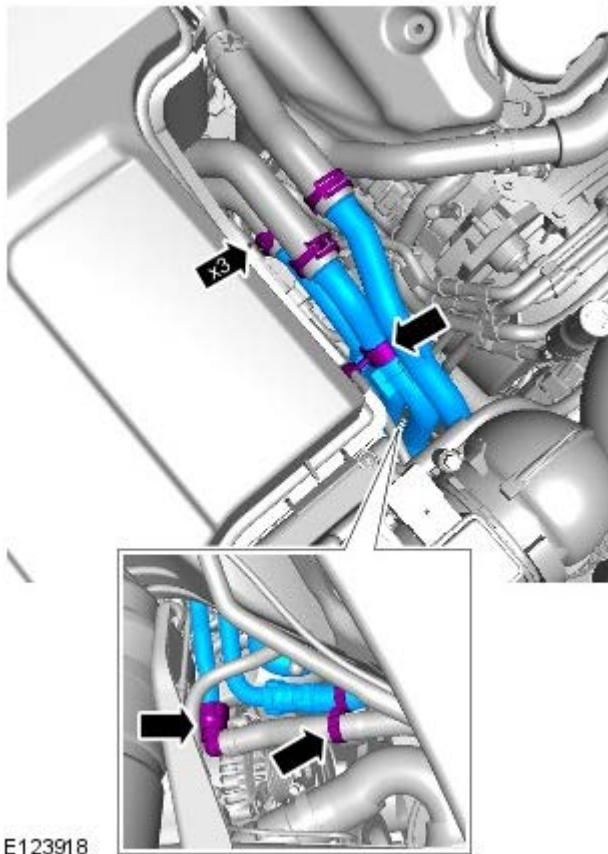
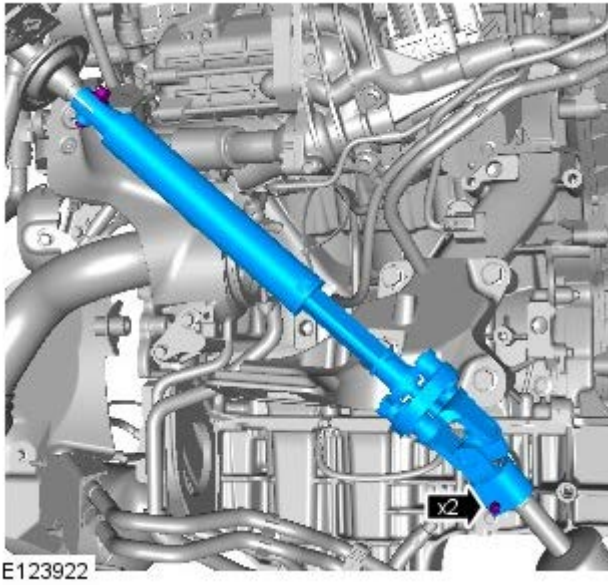
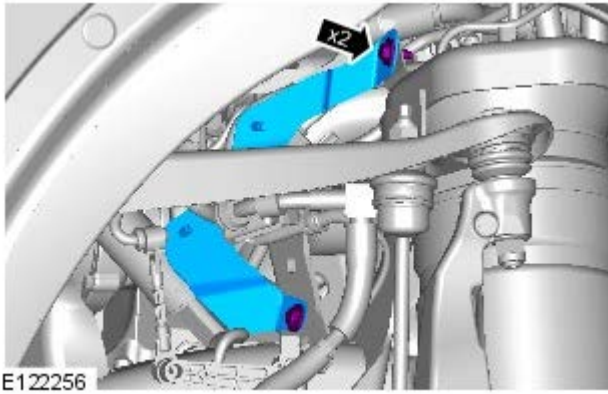
E122254

11. Torque: 9 Nm



E122255

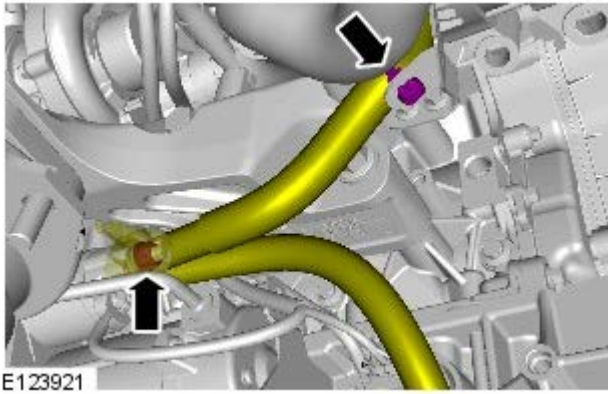
12. Torque: 9 Nm



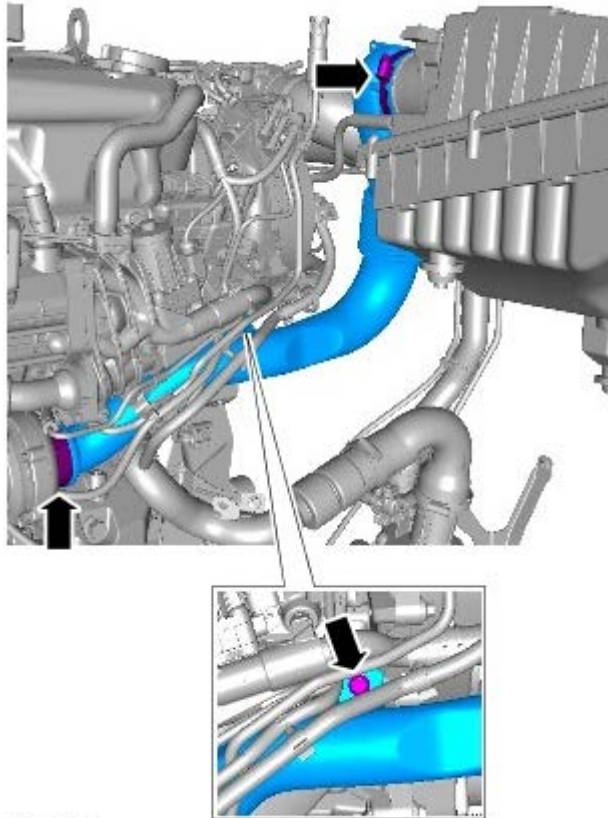
13.  NOTE: Engine shown removed for clarity.
Torque: 30 Nm

14.

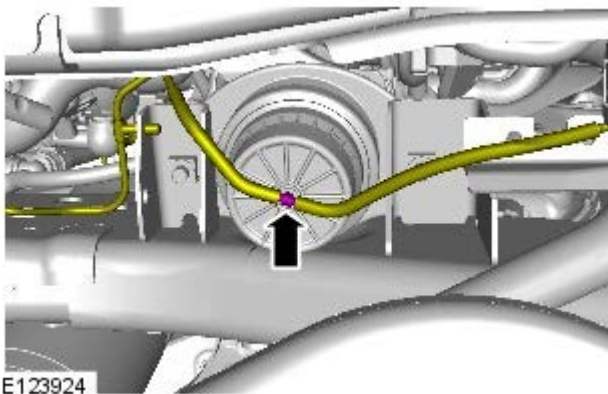
15. Torque: 10 Nm



E123921



E123923



E123924

16.  NOTE: Engine shown removed for clarity.
Torque: 10 Nm

17.

18. CAUTIONS:

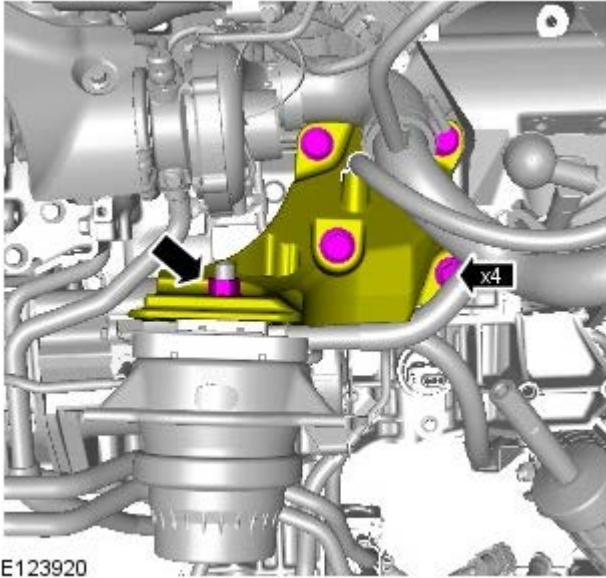
 Use a wooden block to protect the oil pan when supporting the engine.

 Protect the radiator during this operation.

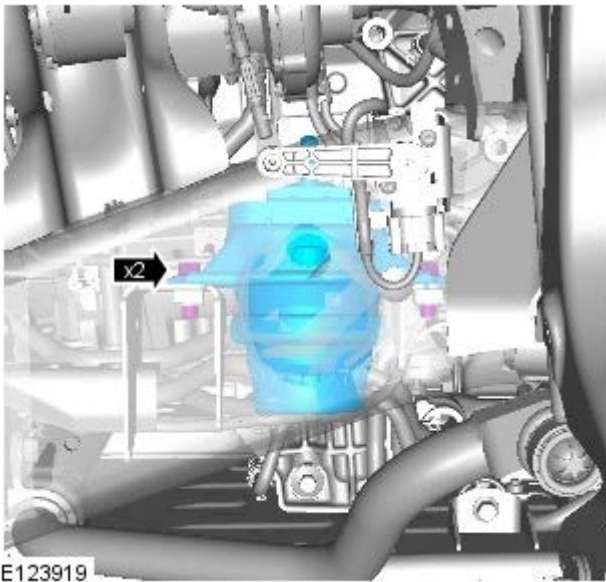
Using a suitable hydraulic jack, raise and support the engine.

19.  NOTE: Engine shown removed for clarity.

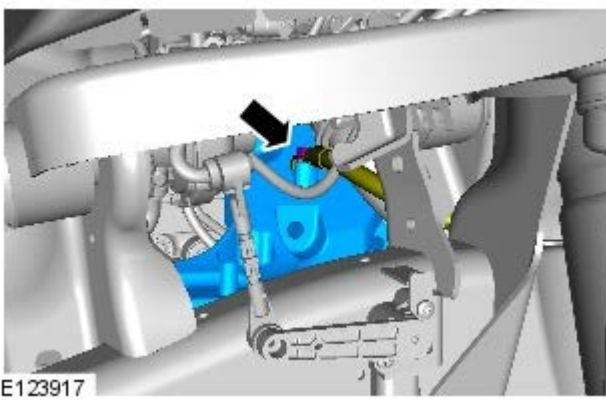
Torque:
Bolts 115 Nm
nut 90 Nm



20. Torque: 45 Nm



21. Torque: 10 Nm



Installation

1. To install, reverse the removal procedure.

Engine - TDV6 3.0L Diesel - Exhaust Manifold LH

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

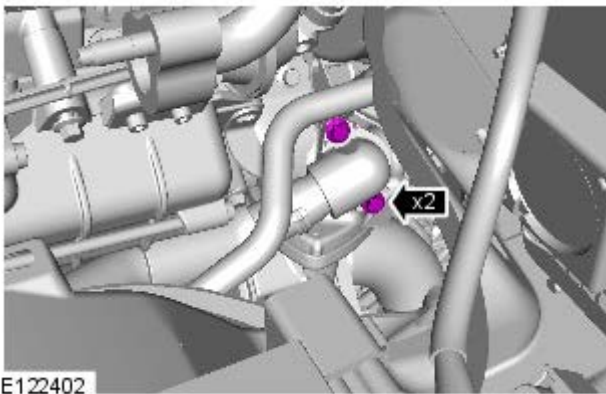
1. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

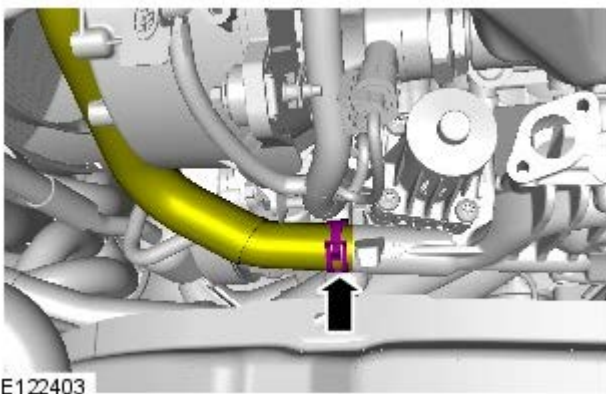
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).

3. Refer to: Turbocharger LH (303-04, Removal and Installation).

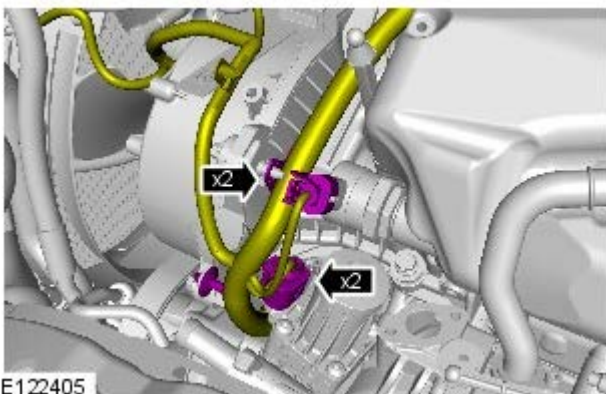
4.

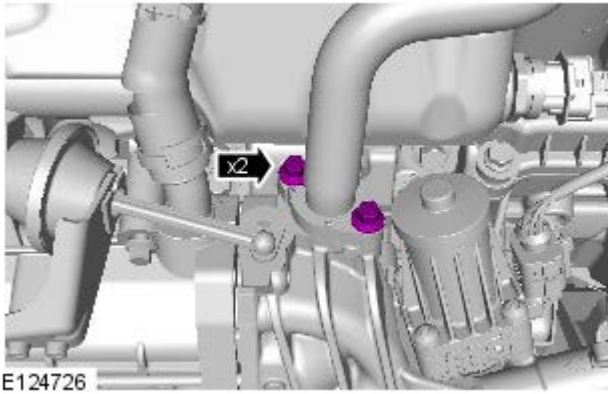


5.

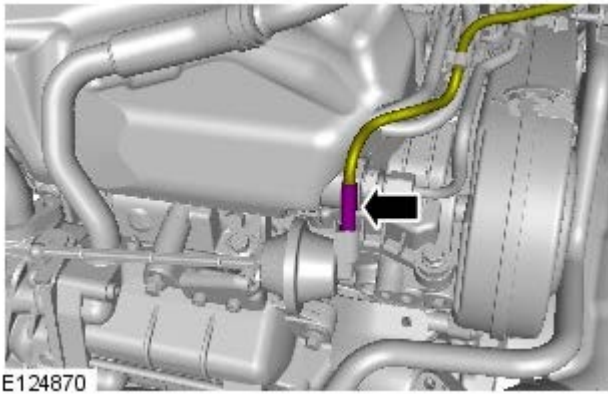


6.

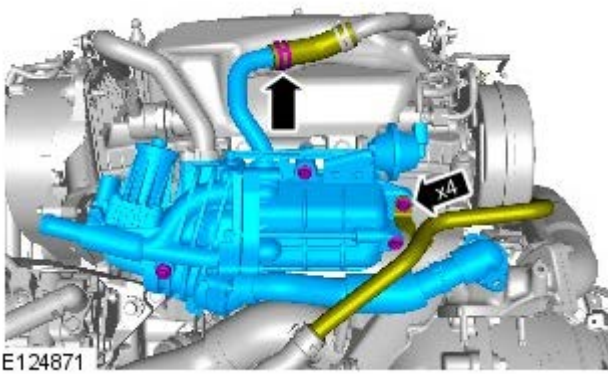





7.  NOTE: RH illustration shown, LH is similar.



- 8.

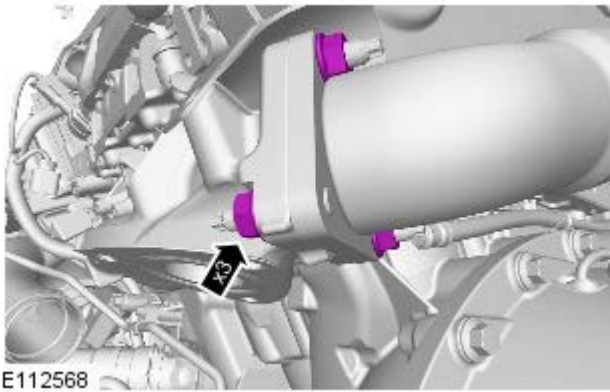


9.  NOTE: Remove and discard the gasket.

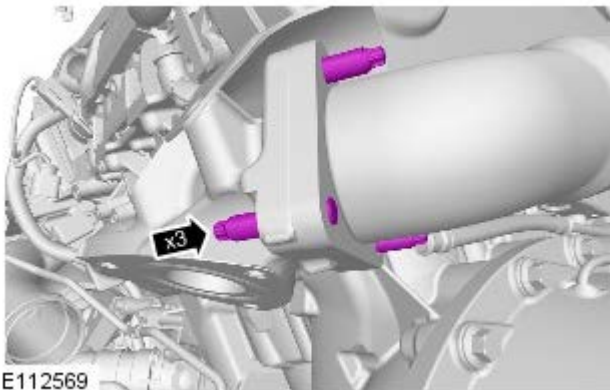


- 10.

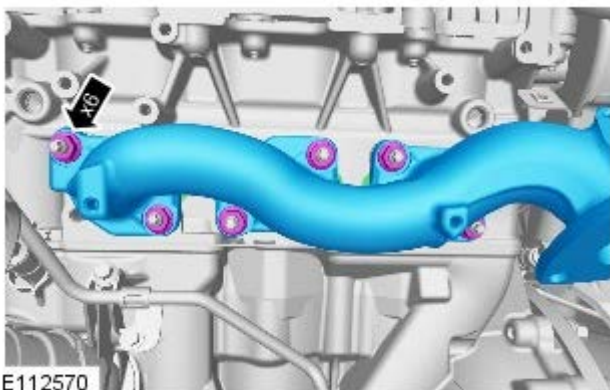
11.  CAUTION: Discard the nuts.



E112568

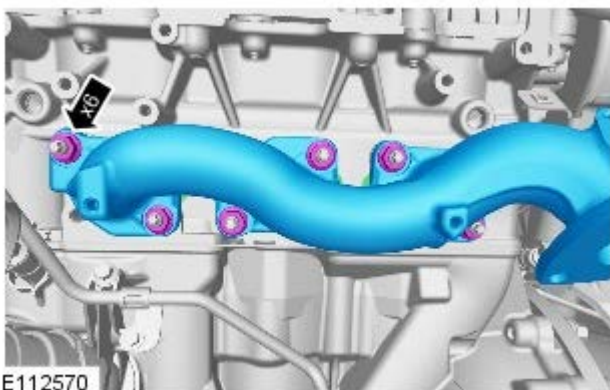


E112569



E112570

Installation




E112570

12.  CAUTION: Discard the studs.

13.  CAUTION: Discard the nuts.

 NOTE: Discard the gasket.

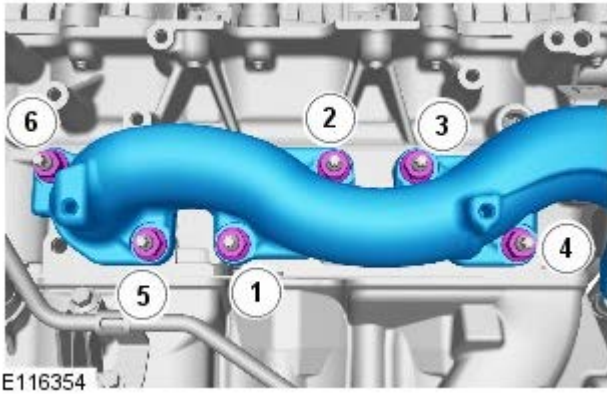
1.  WARNING: Make sure that new nuts are installed.

 CAUTION: Install the nuts finger tight before final tightening.

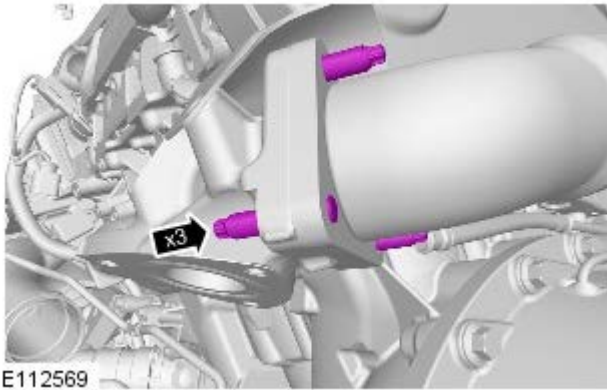
 NOTE: Install a new gasket.

2.  NOTE: Tighten the bolts in the indicated sequence.


Torque: 28 Nm

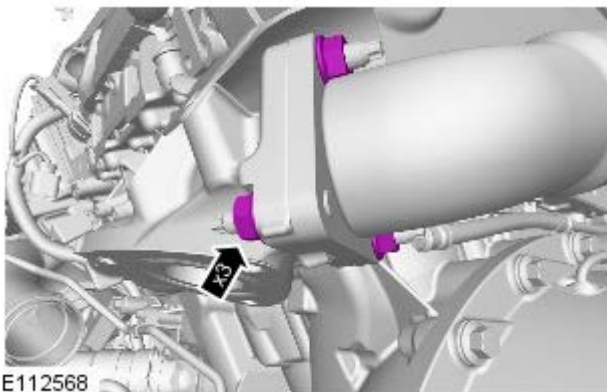


E116354




E112569

3.  CAUTION: Install new studs.
Torque: 24 Nm




E112568

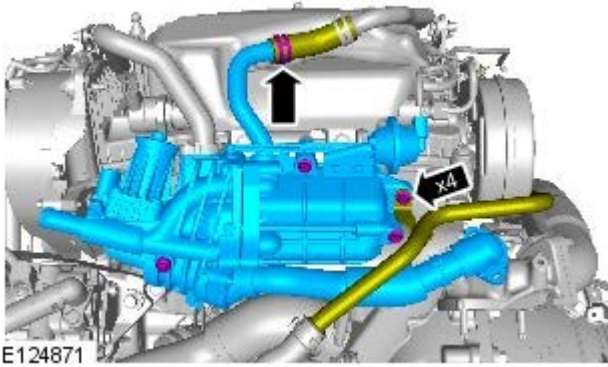
4.  WARNING: Make sure that new nuts are installed.
Torque: 24 Nm



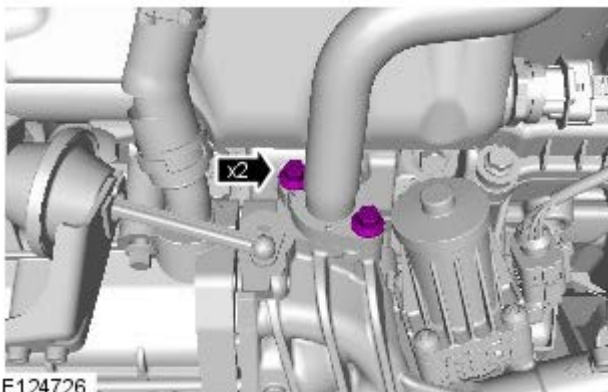
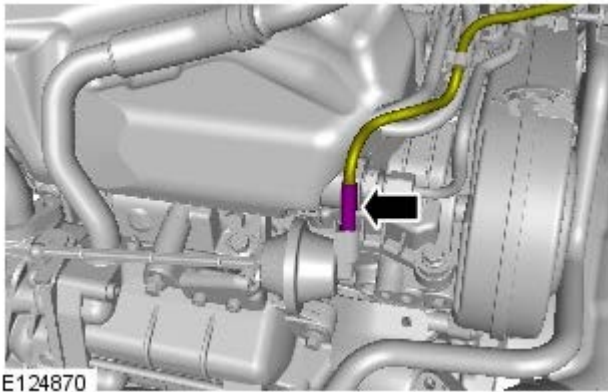
E112567

5. Torque: 10 Nm

6.  NOTE: Install new gaskets.
Torque: 10 Nm

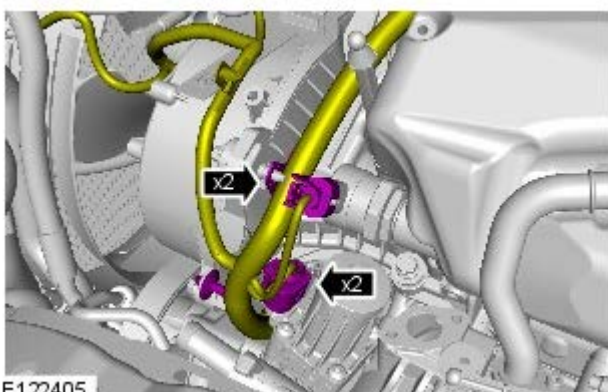


7.



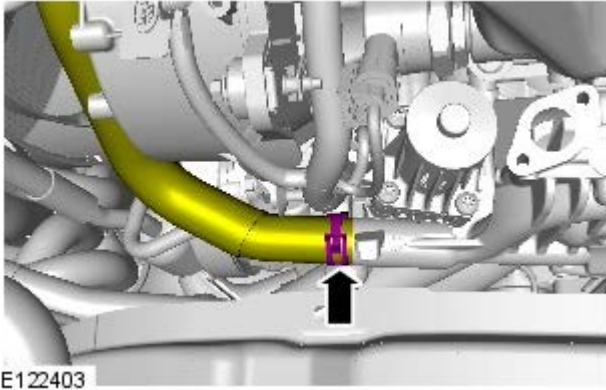
8.  NOTE: RH illustration shown, LH is similar.

Torque: 10 Nm

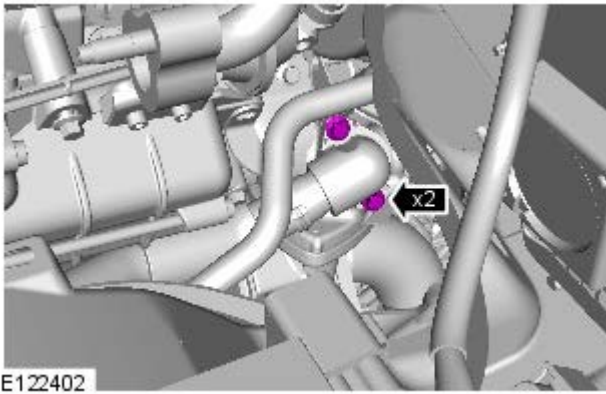


9.

10.



11. Torque: 10 Nm



12. Refer to: Turbocharger LH (303-04, Removal and Installation).

13. Connect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

14. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).

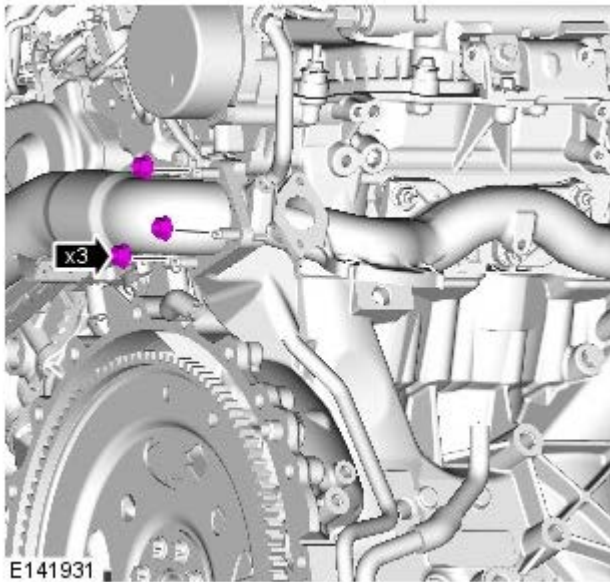
Engine - TDV6 3.0L Diesel - Exhaust Manifold RH

Removal and Installation

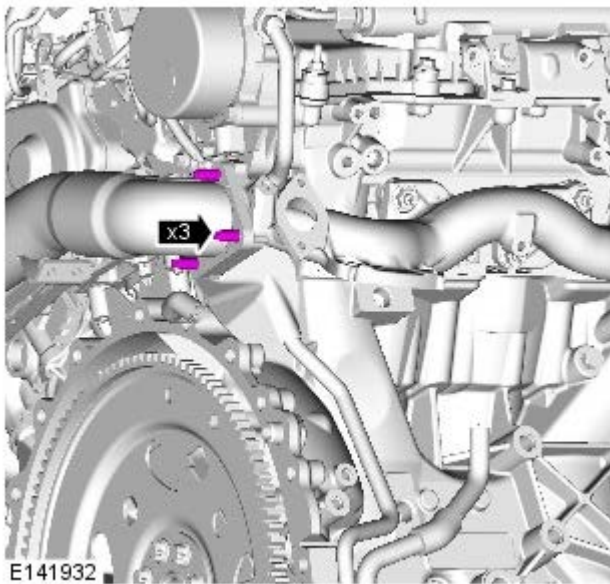
Removal

1. Remove the RH turbocharger.


Refer to: Turbocharger RH (303-04 Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel, Removal and Installation).

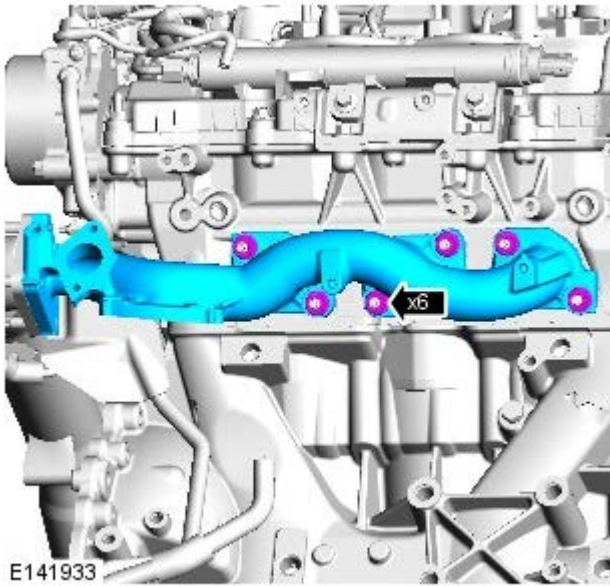


2.  CAUTION: Discard the nuts.

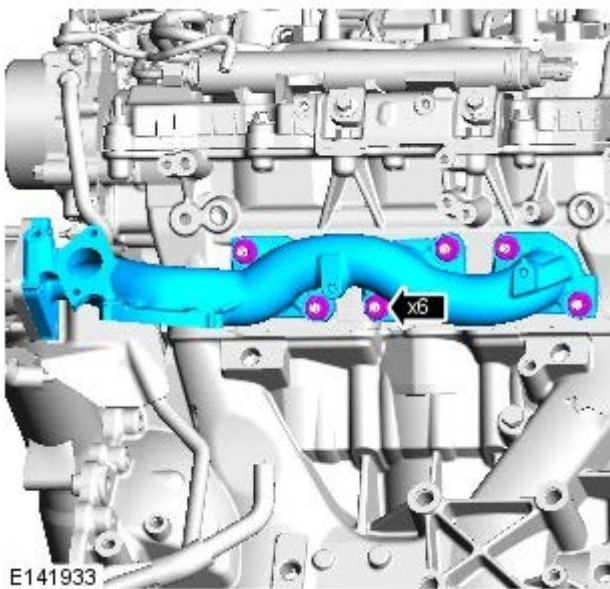


3.  CAUTION: Discard the studs.

4.  CAUTION: Discard the nuts.
 - Discard the gaskets.




Installation

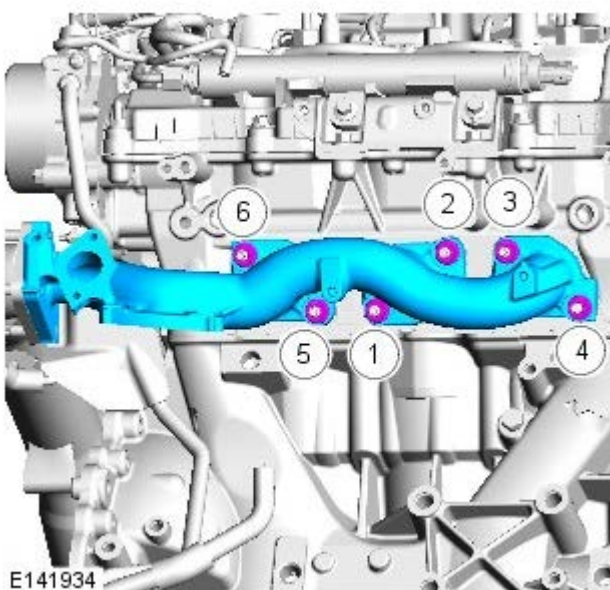


1. CAUTIONS:

 Make sure that new nuts are installed.

 Install the nuts finger tight before final tightening.

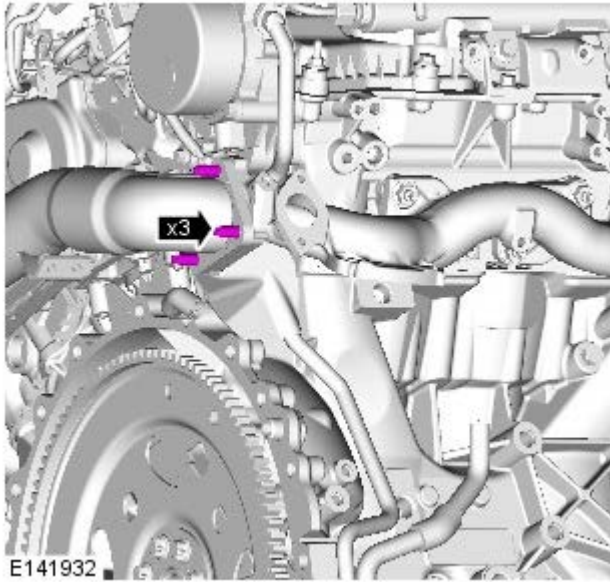
- Install new gaskets.



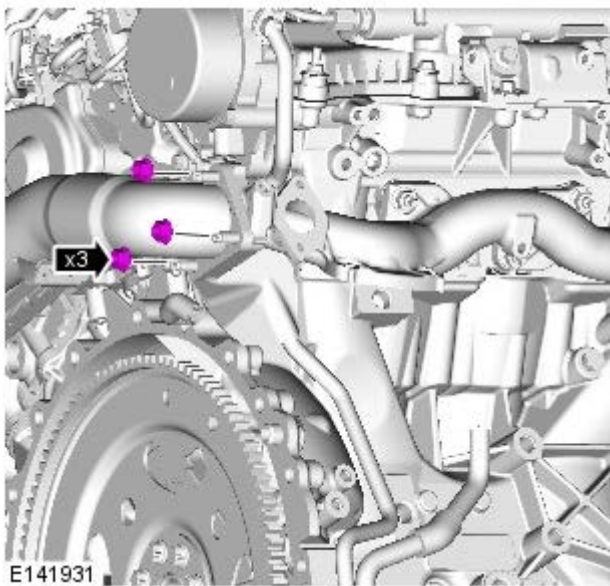
2.  NOTE: Tighten the bolts in the indicated sequence.

Torque: 28 Nm

3.  CAUTION: Install new studs.



Torque: 13 Nm



4.  **WARNING:** Make sure that new nuts are installed.

Torque: 24 Nm

5. Install the RH turbocharger.

Refer to: Turbocharger RH (303-04 Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel, Removal and Installation).

Engine - TDV6 3.0L Diesel - Exhaust Manifold Crossover Pipe

Removal and Installation

Removal



CAUTION: Take care when handling the cross-over pipe as damage to the insulating material may occur.

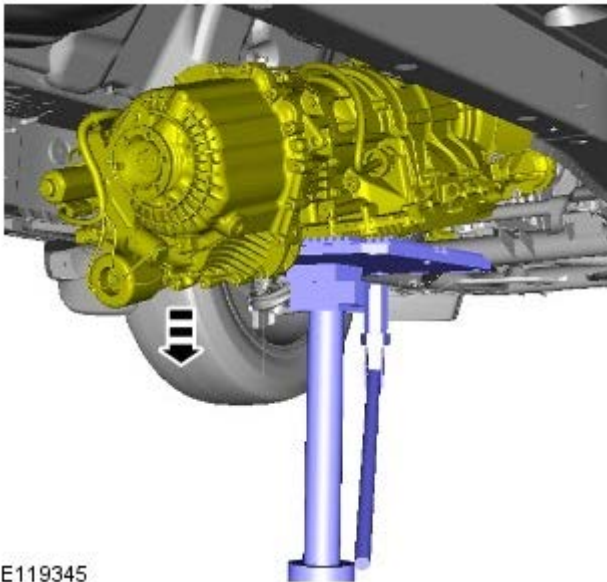
1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Refer to: Transmission Support Crossmember - TDV6 3.0L Diesel (502-02 Full Frame and Body Mounting, Removal and Installation).

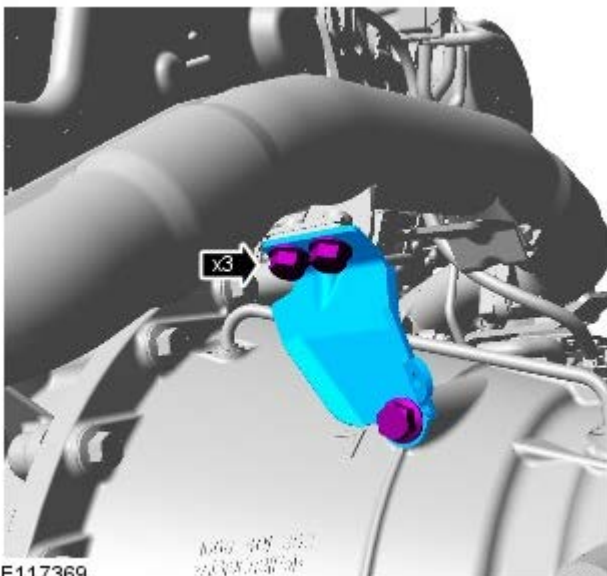
3. Refer to: Exhaust System (309-00 Exhaust System - TDV6 3.0L Diesel, Removal and Installation).

4.  **NOTE:** The transmission is lowered for access.



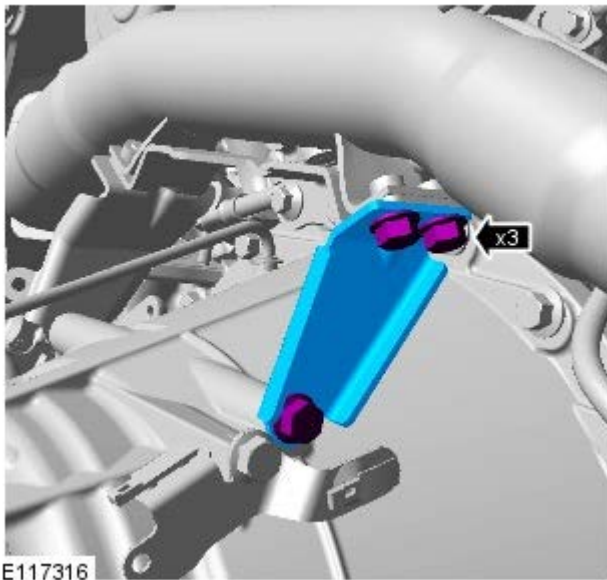
E119345

- 5.

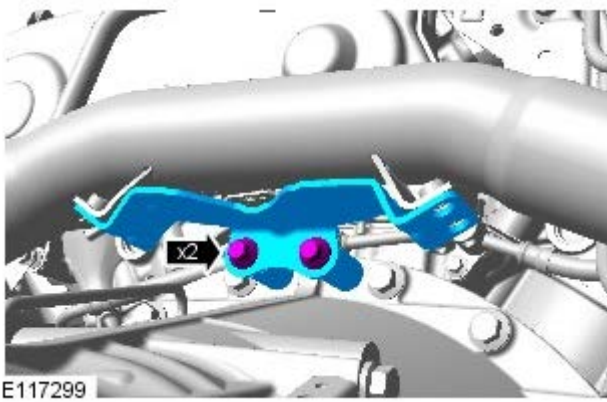


E117369

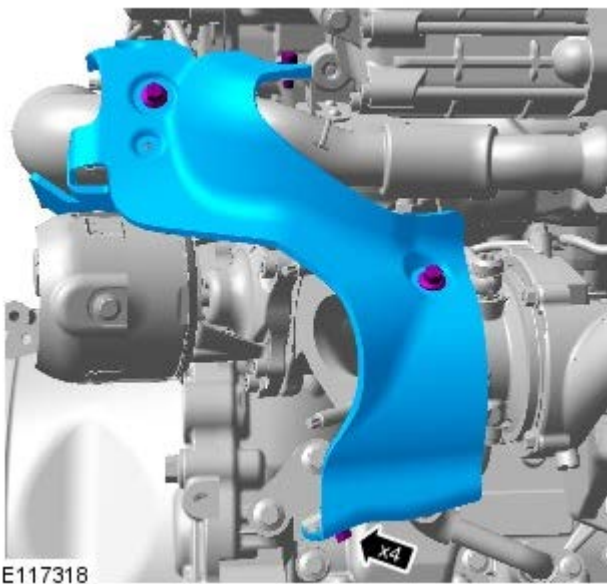
- 6.



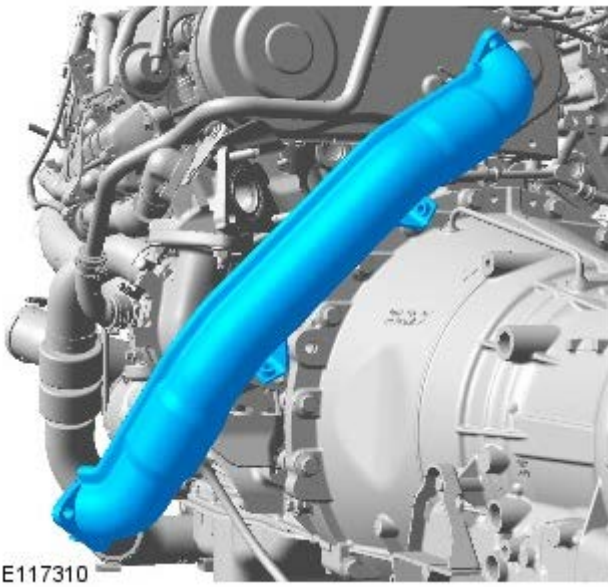
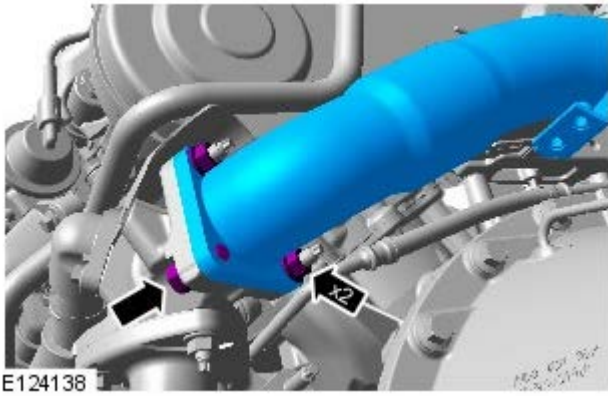
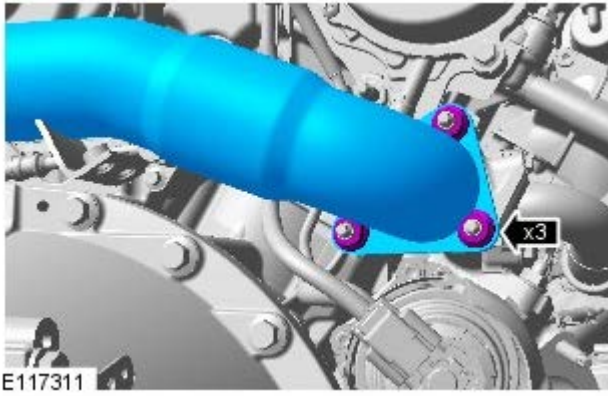
7.



8.



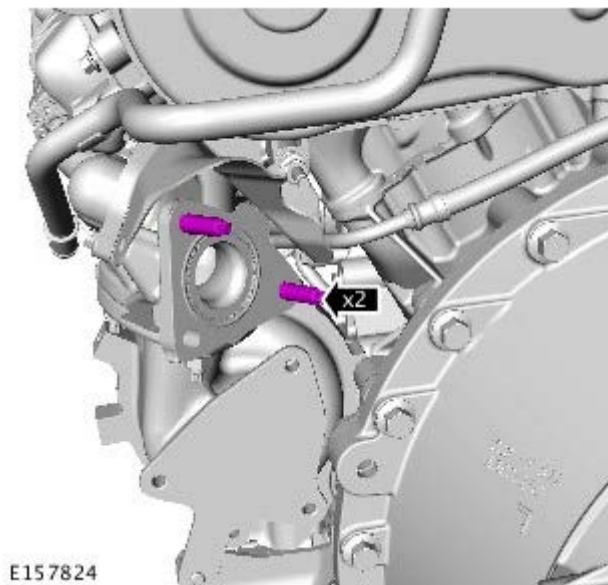
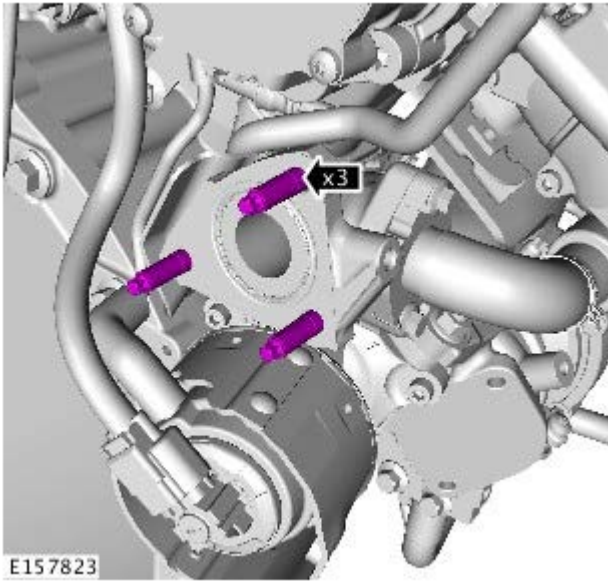
9.  CAUTION: Discard the nuts.



10.  CAUTION: Discard the nuts and bolt.

11.

12.  CAUTION: Discard the studs.



Installation

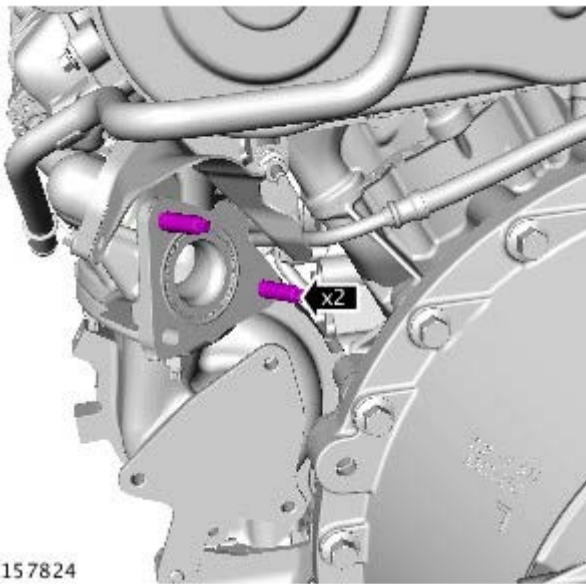
13.  CAUTION: Discard the studs.

14.  NOTE: Discard the gasket.


1.  NOTE: Install new gaskets.



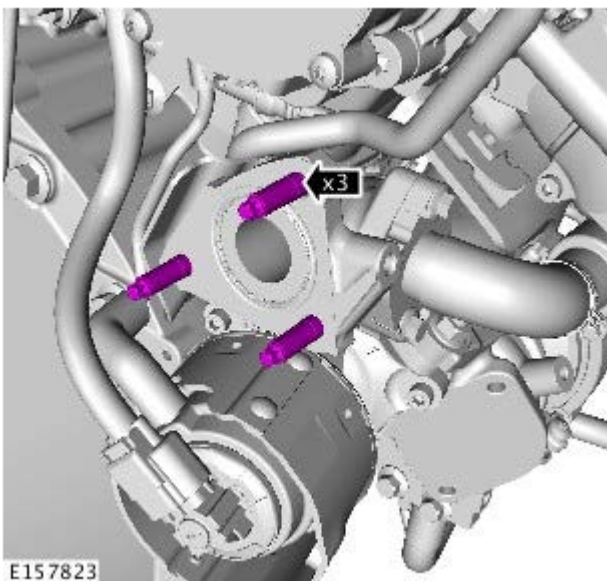
E124137




E157824

2.  NOTE: New exhaust manifold retaining studs must be fitted if the old studs are removed.

Torque: 13 Nm

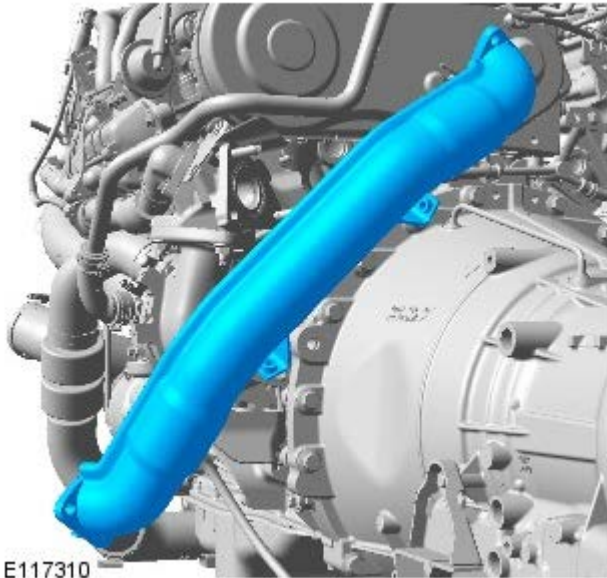


E157823

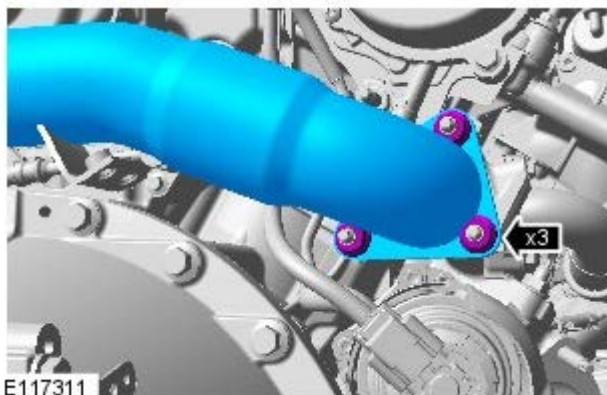
3.  NOTE: New exhaust manifold retaining studs must be fitted if the old studs are removed.

Torque: 13 Nm

4.



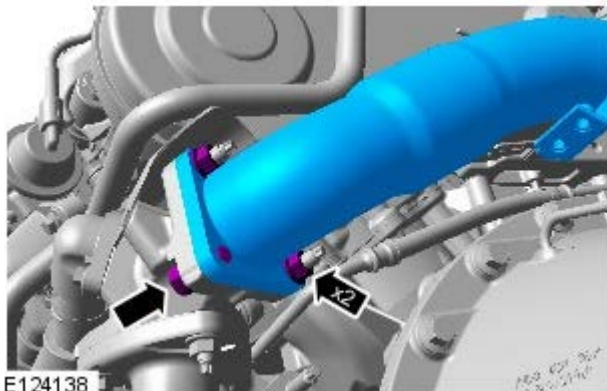
E117310



E117311

5.  **WARNING:** Make sure that new nuts are installed.

 **CAUTION:** Only tighten the nuts finger-tight at this stage.

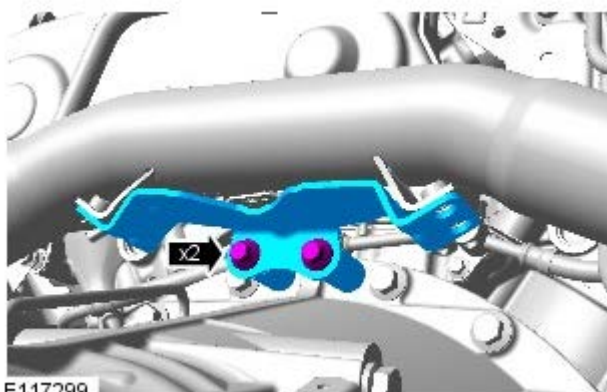


E124138


6. **CAUTIONS:**


 Only tighten the nuts and bolt finger-tight at this stage.

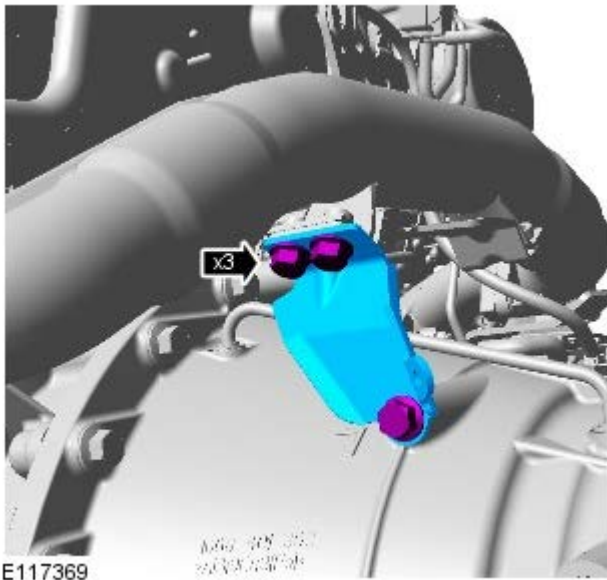
 Make sure that new nuts and bolt are installed.



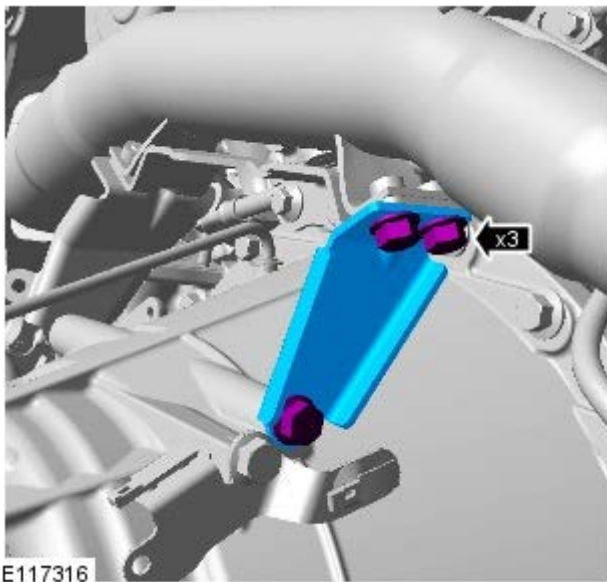
E117299


7.  **CAUTION:** Only tighten the bolts finger-tight at this stage.

8.  **CAUTION:** Only tighten the bolts finger-tight at this stage.

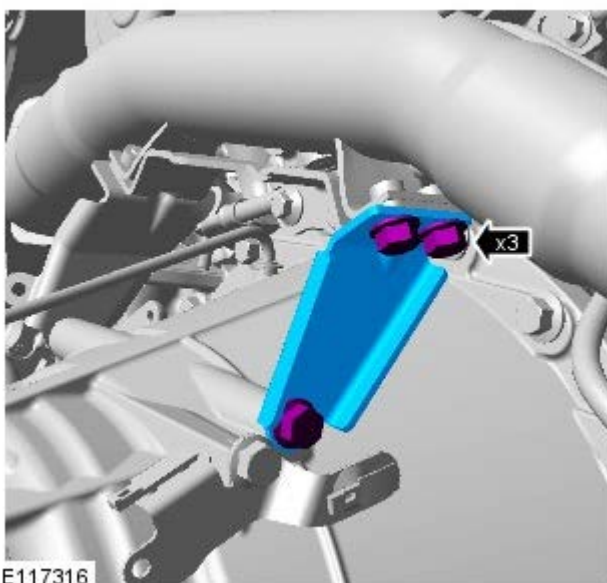


Check for correct alignment.



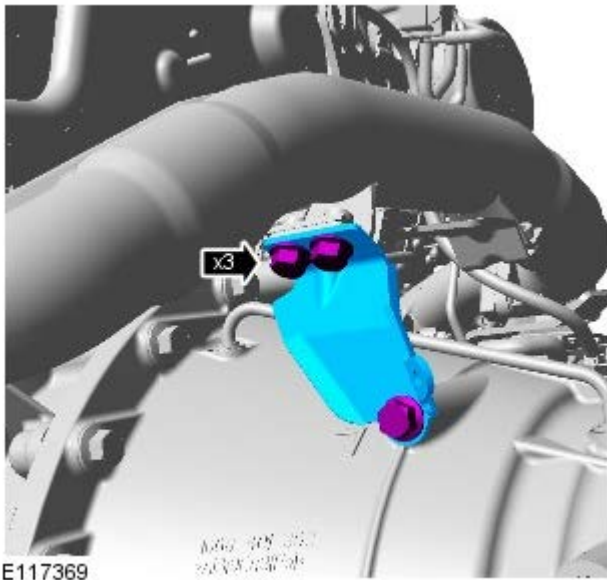
9.  CAUTION: Only tighten the bolts finger-tight at this stage.

Check for correct alignment.

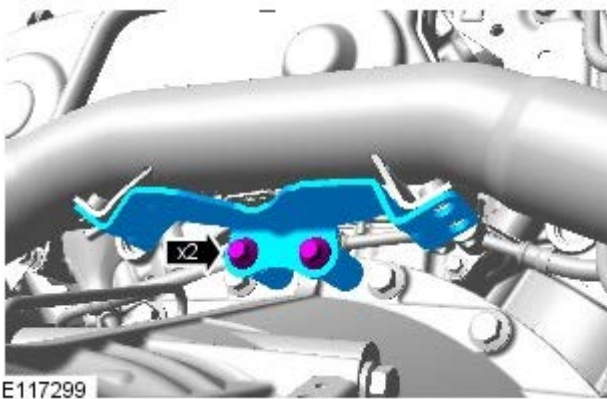



10. Remove the exhaust cross-over pipe RH support bracket.

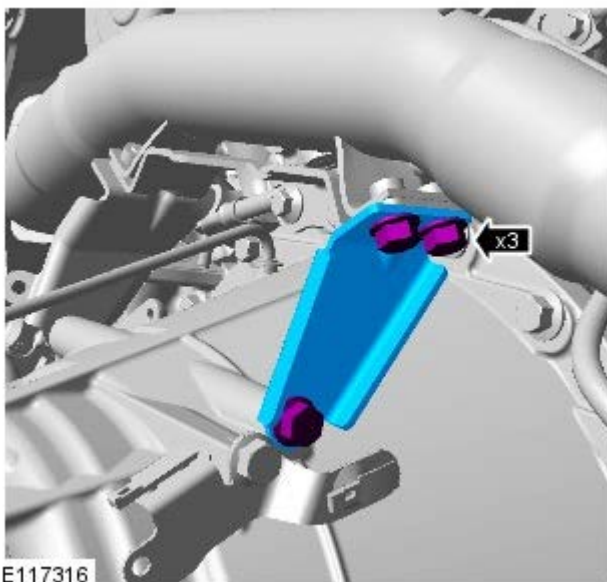
11. Remove the exhaust cross-over pipe LH support bracket.




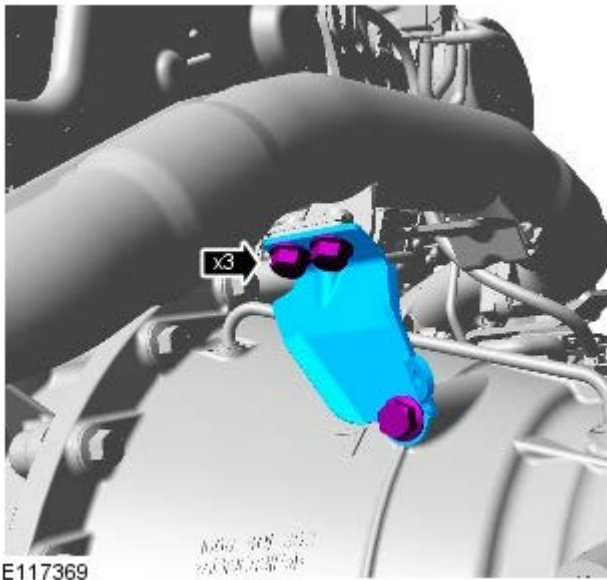
12. Torque: 23 Nm



13.  CAUTION: Only tighten the bolts finger-tight at this stage.

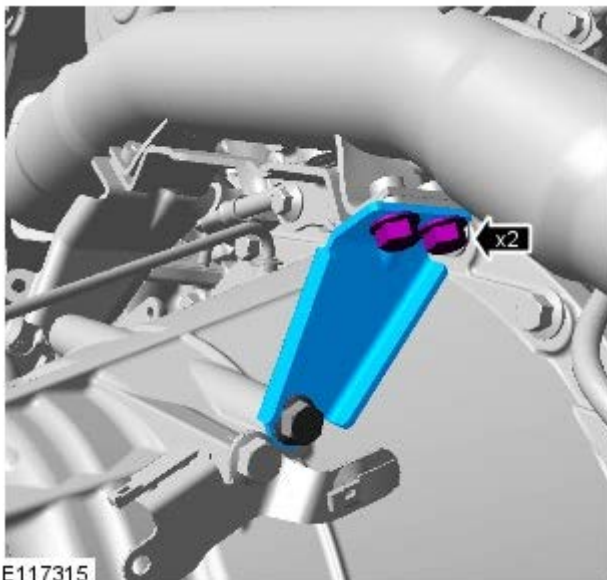


14.  CAUTION: Only tighten the bolts finger-tight at this stage.



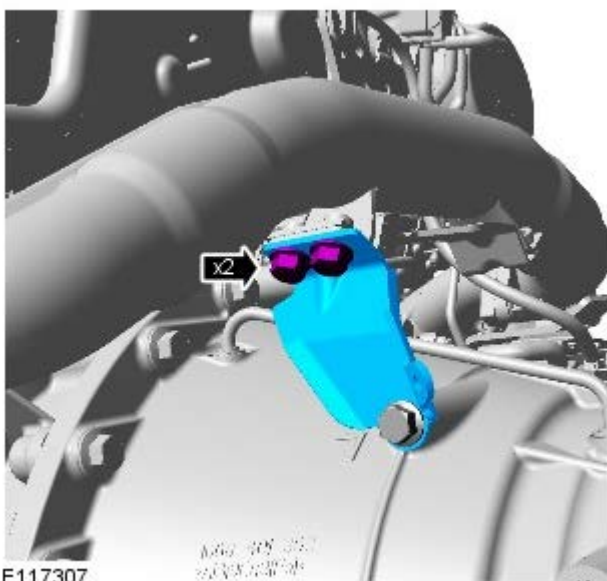
E117369

15. Torque: 23 Nm



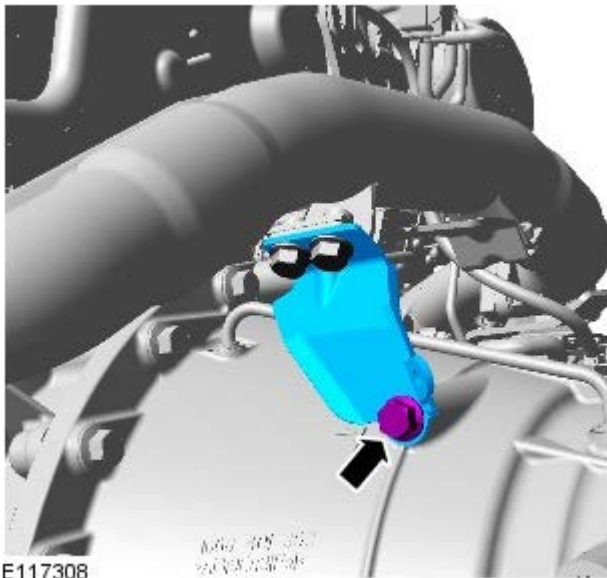
E117315

16. Torque: 23 Nm

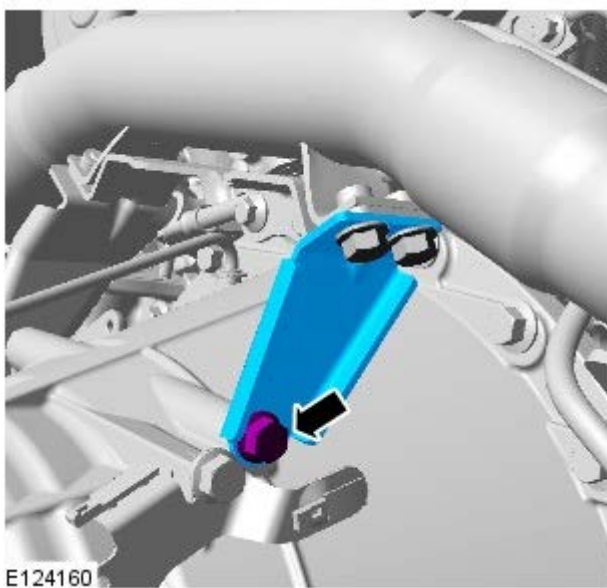


E117307

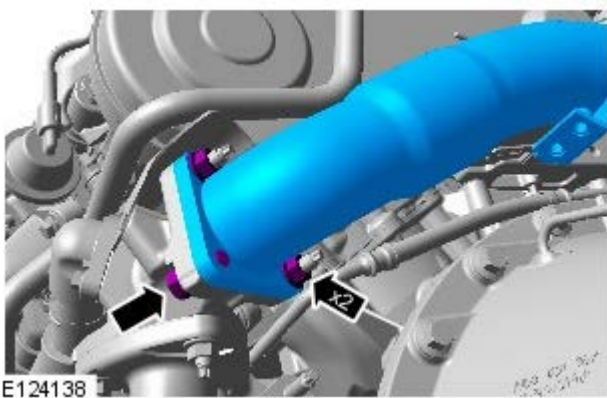
17. Torque: 23 Nm



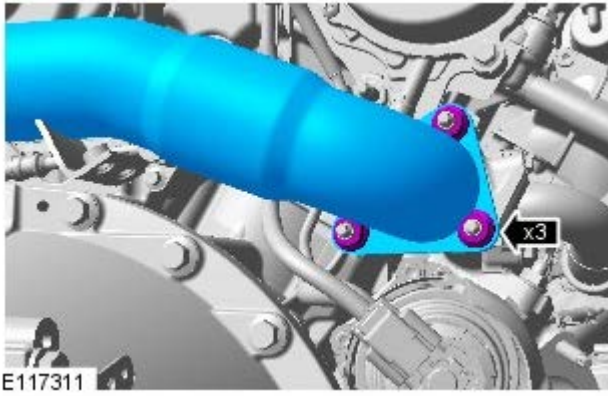
18. Torque: 23 Nm



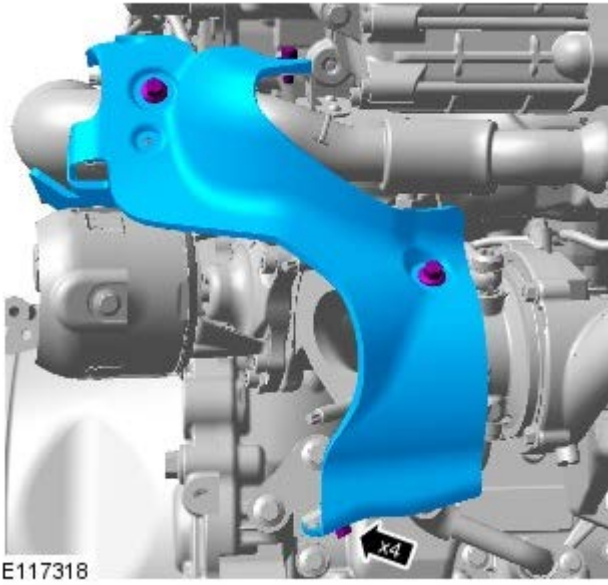
19. Torque: 23 Nm



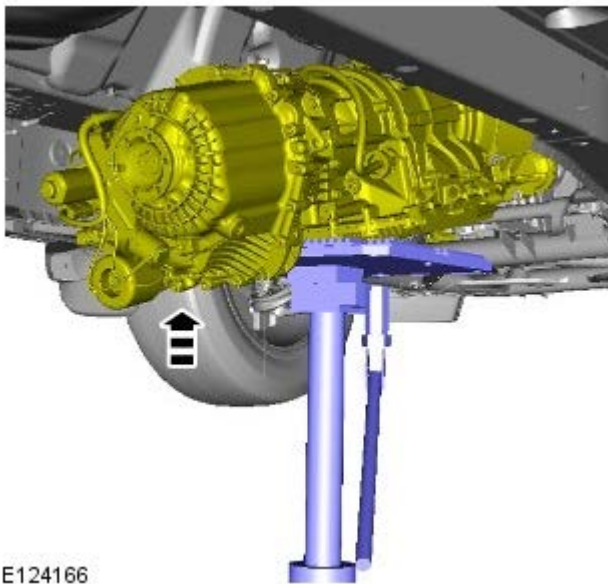
20. Torque: 23 Nm



21. Torque: 11 Nm



22.

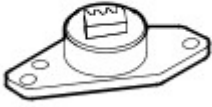


- 23. Refer to: Exhaust System (309-00 Exhaust System - TDV6 3.0L Diesel, Removal and Installation).
- 24. Refer to: Transmission Support Crossmember - TDV6 3.0L Diesel (502-02 Full Frame and Body Mounting, Removal and Installation).

Engine - TDV6 3.0L Diesel - Flexplate

Removal and Installation

Special Tool(s)

 <p>303-1123 Locking Tool, Flywheel</p> <p>E 54546</p>	<p>303-1123 Locking Tool, Flywheel</p>
---	--


Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

Refer to: Specifications (414-01, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

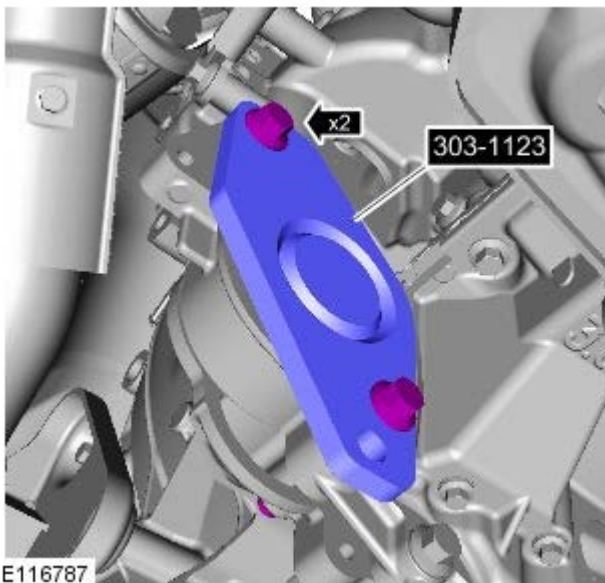
Raise and support the vehicle.

3. Refer to: Starter Motor (303-06B, Removal and Installation).

4. Refer to: Transmission - 3.0L Diesel (307-01D, Removal).

5.

- Install the special tool.
- *Special Tool(s):* [303-1123](#)




6.  **CAUTION:** Discard the bolts.



NOTE: Prevent the flexplate from rotating.



Installation

1.  CAUTION: Make sure that new bolts are installed.

NOTES:

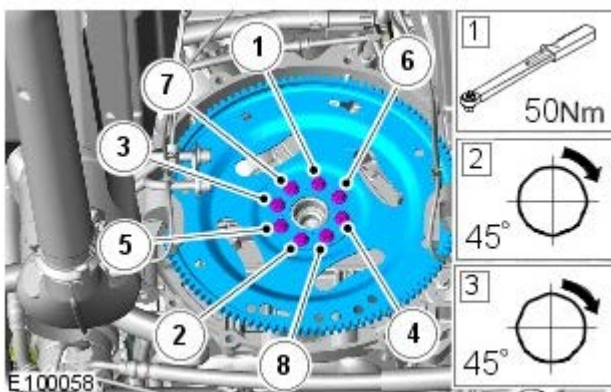


Make sure that all the component mating faces are clean.



Loosely install all retaining bolts.

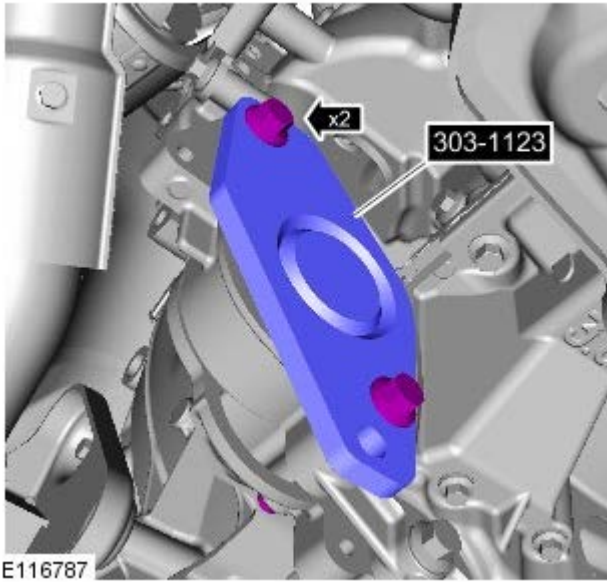
- Prevent the flexplate from rotating.



2.  CAUTION: Tighten the bolts evenly in the stages shown.

- Stage 1: Tighten to 50 Nm.
- Stage 2: Tighten to 45 degrees.
- Stage 3: Tighten to 45 degrees.

3.
 - Remove the special tool.
 - *Special Tool(s)*: [303-1123](#)



4. Refer to: Transmission - 3.0L Diesel (307-01D, Installation).
5. Refer to: Starter Motor (303-06B, Removal and Installation).
6. Connect the battery ground cable.

Refer to: Specifications (414-01, Specifications).

Engine - TDV6 3.0L Diesel - Oil Cooler

Removal and Installation

Removal

NOTES:

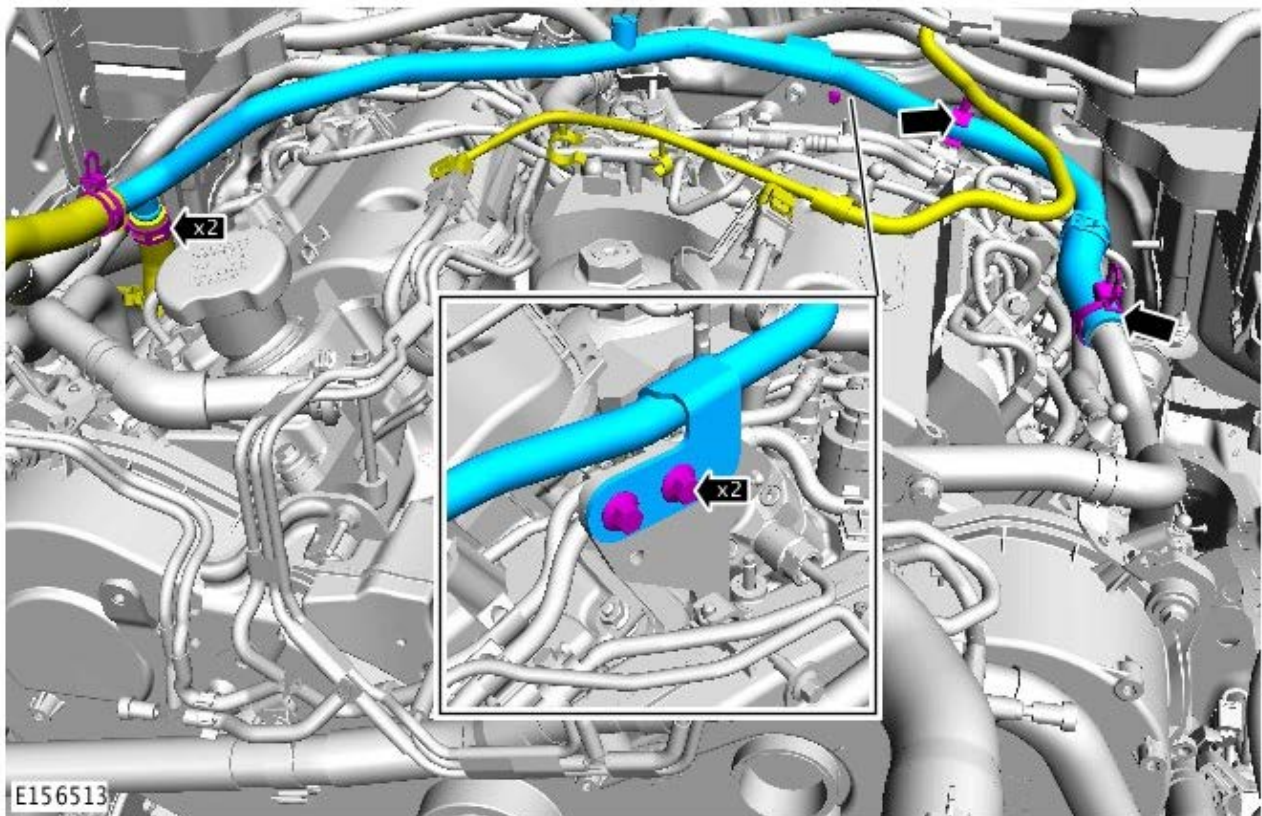


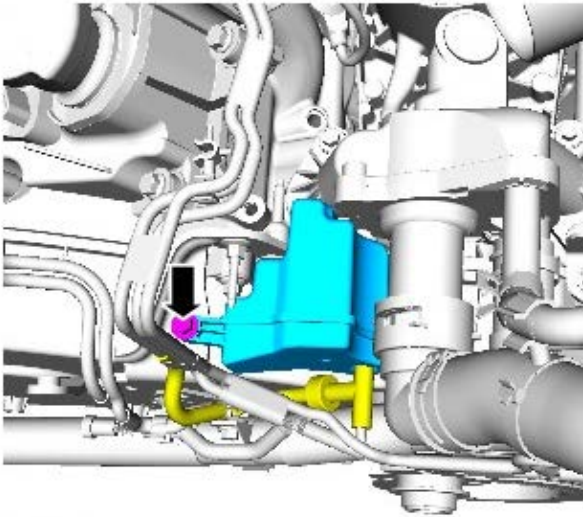
Some variation in the illustrations may occur, but the essential information is always correct.



Some illustrations may show the engine removed for clarity.

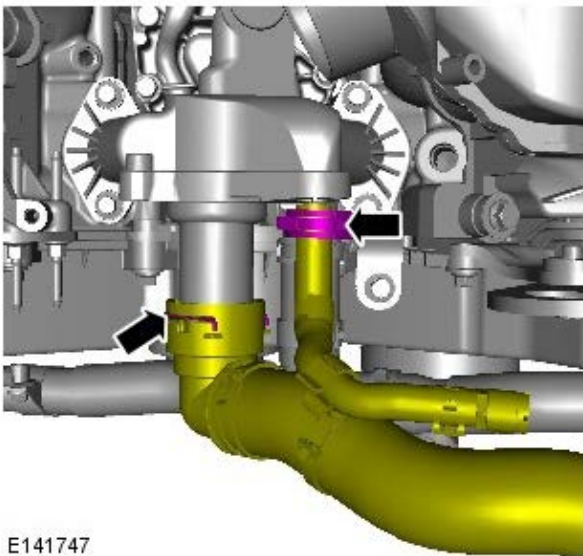
1. Refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - TDV6 3.0L Diesel, General Procedures).
3. Refer to: Glow Plugs (303-07 Glow Plug System - TDV6 3.0L Diesel, Removal and Installation).
4. *Torque:* 25 Nm





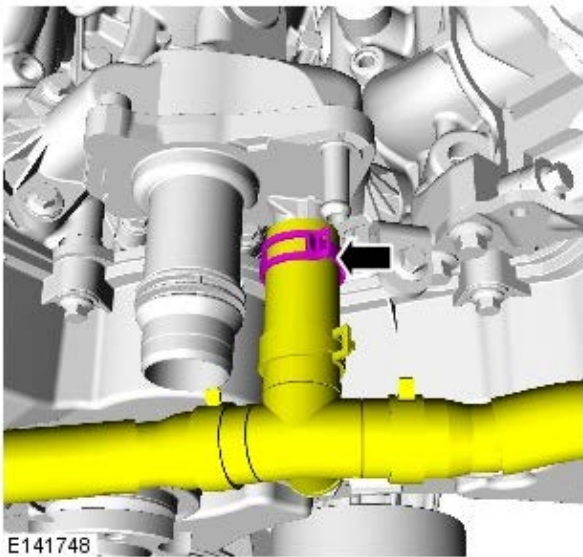
E141746

6.



E141747

7.



E141748

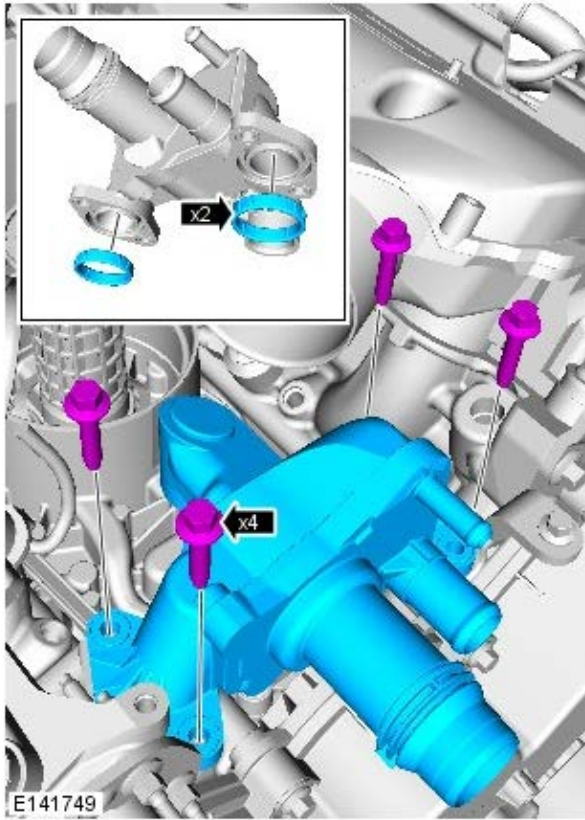
8. CAUTIONS:



Install new o-ring seals

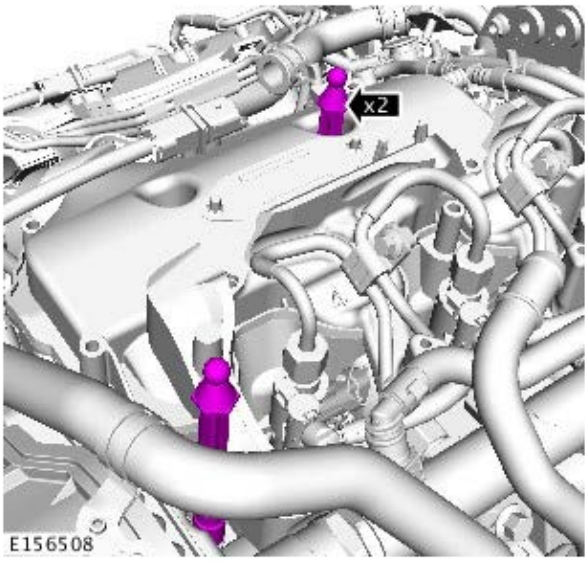


Make sure that the mating faces are clean and free of foreign material.

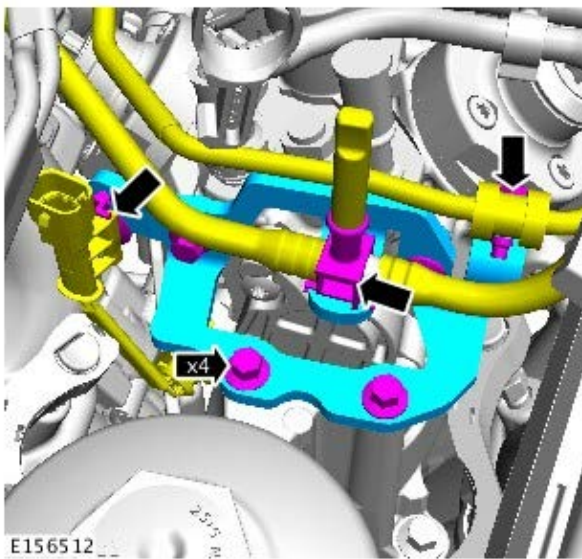
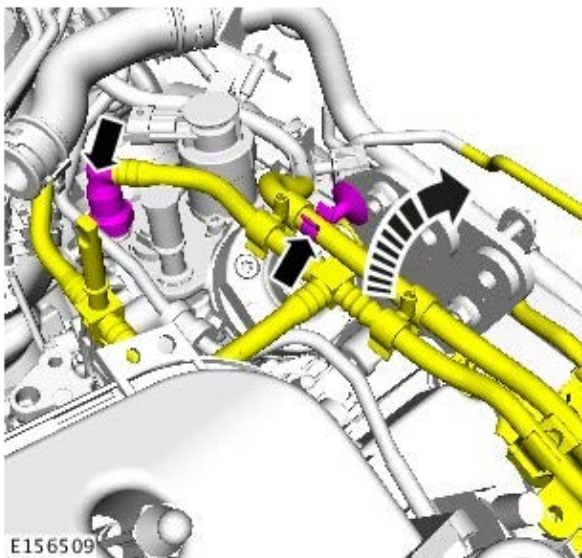
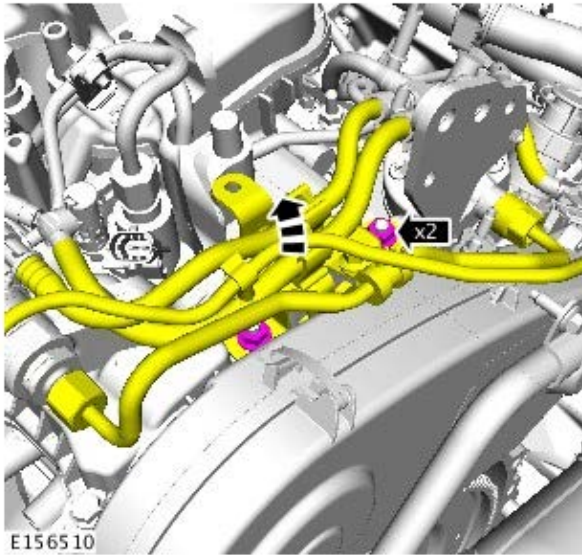


Torque: 10 Nm

9.



10.

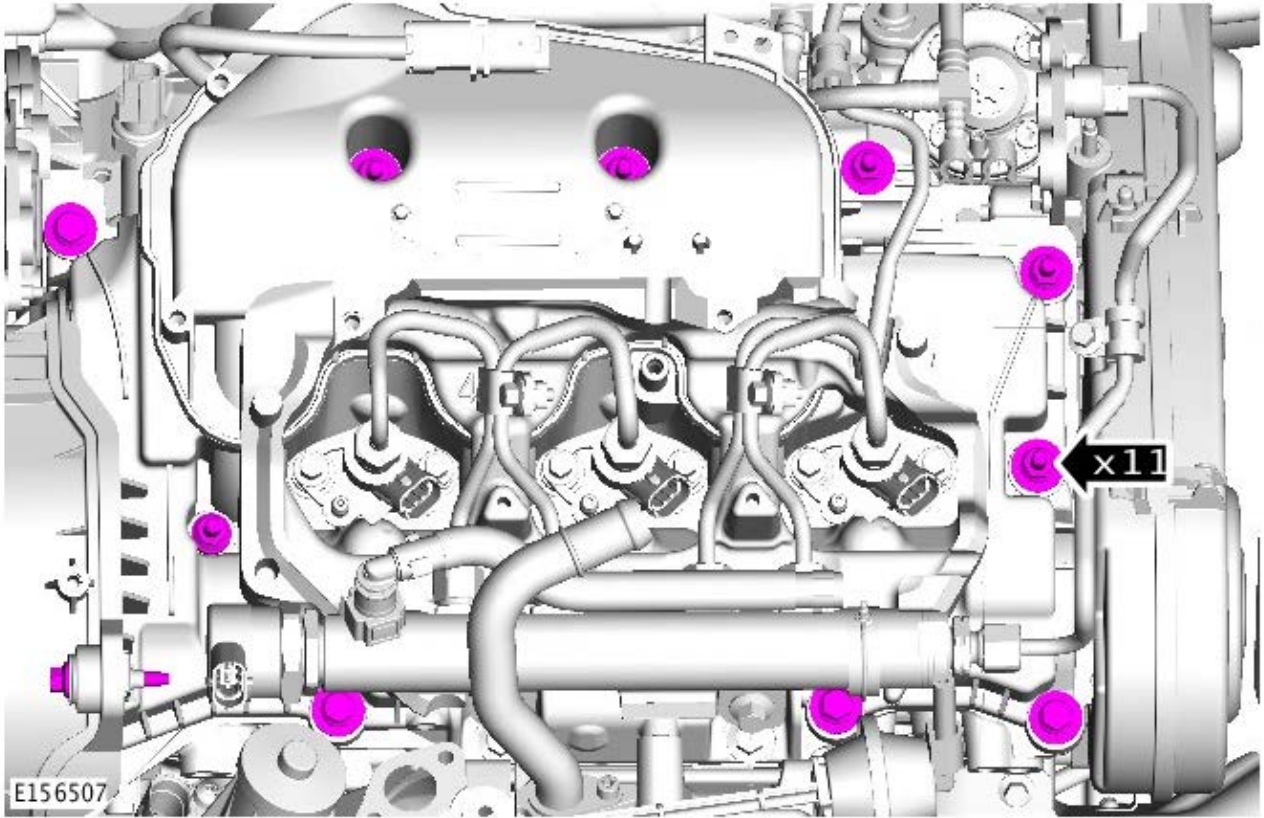


11. CAUTIONS:

- ⚠ Be prepared to collect escaping fuel.
- ⚠ Make sure that all openings are sealed. Use new blanking caps.

12. Torque: 25 Nm

13. Torque: 10 Nm

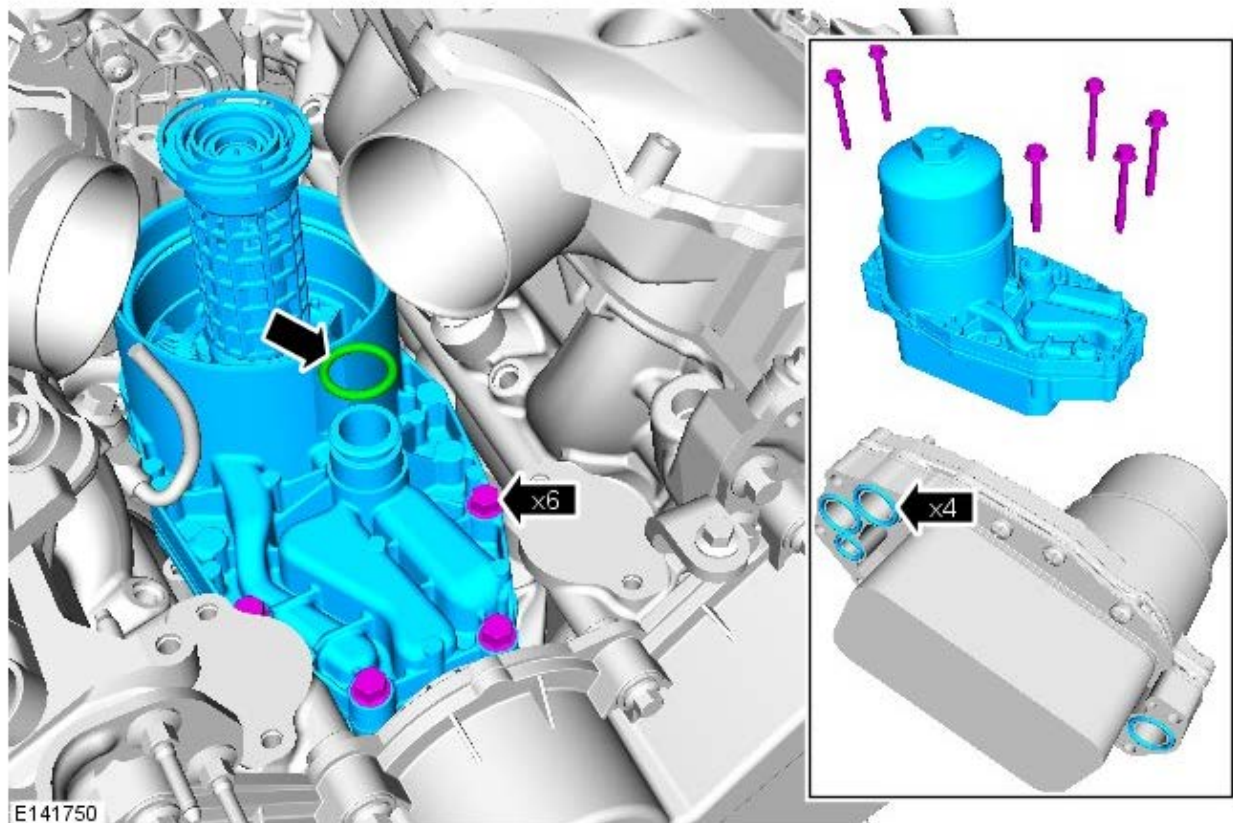


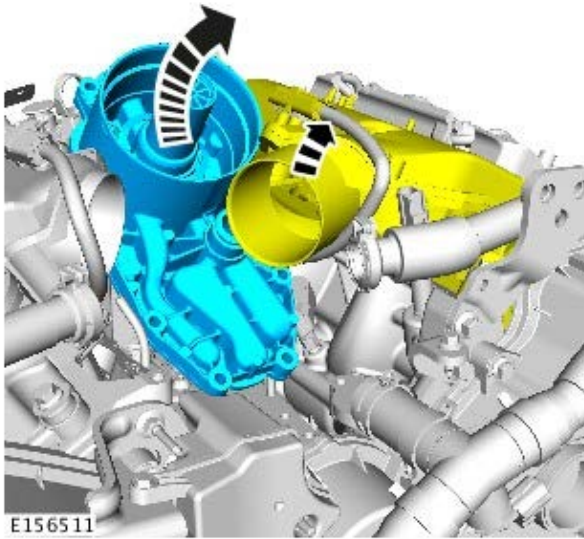
14. CAUTIONS:


 Install new o-ring seals

 Make sure that the mating faces are clean and free of foreign material.

Torque: 10 Nm





15.  CAUTION: Carefully lift the LH side intake manifold to remove the oil cooler.

Installation

1. To install, reverse the removal procedure.

Engine - TDV6 3.0L Diesel - Oil Filter Element

Removal and Installation

Removal

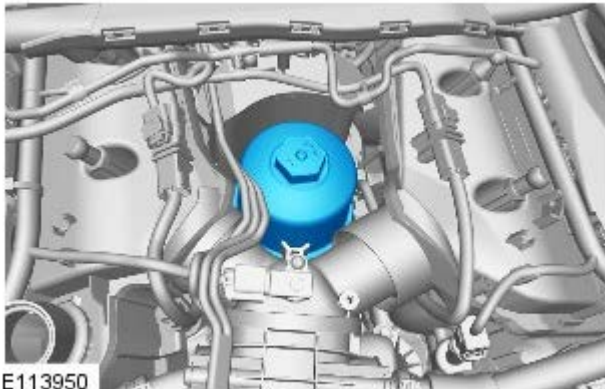


CAUTION: Make sure that the correct tools are used to remove and install the oil filter element cap.



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.


1. Refer to: Engine Cover - 3.0L V6 - TdV6 (501-05, Removal and Installation).



E113950

2.

- Rotate the oil filter element housing six complete turns counter-clockwise.
- Allow the engine oil to drain from the oil filter element housing for two minutes.
- Remove the oil filter element housing.

3.  **NOTE:** Remove and discard the O-ring seal.



E113951

Installation

1.  **CAUTION:** A new O-ring seal is to be installed.

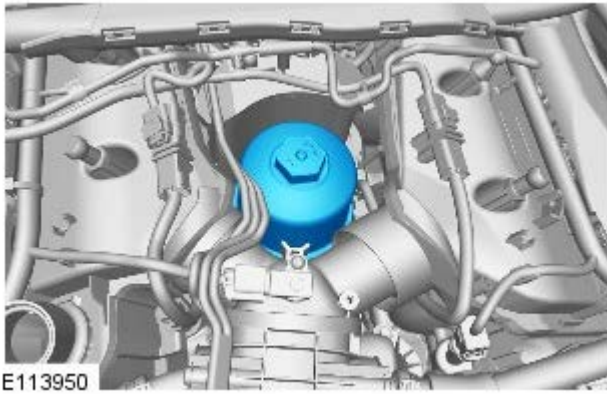


NOTE: Lubricate the O-ring seal with clean engine oil.



E113952

2. Torque: 28 Nm



3. Refer to: Engine Cover - 3.0L V6 - TdV6 (501-05, Removal and Installation).
4. Start and run the engine.
5. Check and top-up the engine oil.

Engine - TDV6 3.0L Diesel - Oil Pan

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

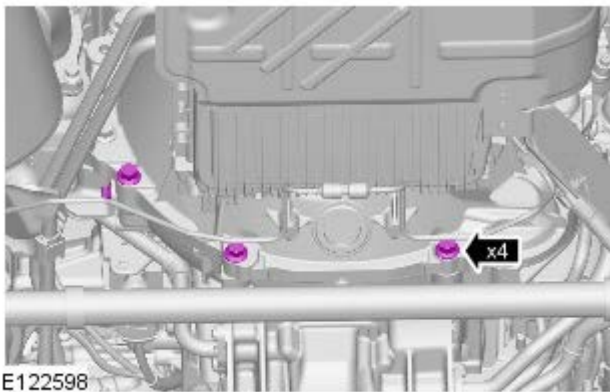
Raise and support the vehicle.

3. Refer to: [Engine Oil Draining and Filling](#) (303-01A Engine - TDV6 3.0L Diesel, General Procedures).


4. Refer to: [Axle Assembly](#) (205-03 Front Drive Axle/Differential, Removal and Installation).

5. Refer to: [Starter Motor](#) (303-06A Starting System - TDV6 3.0L Diesel, Removal and Installation).

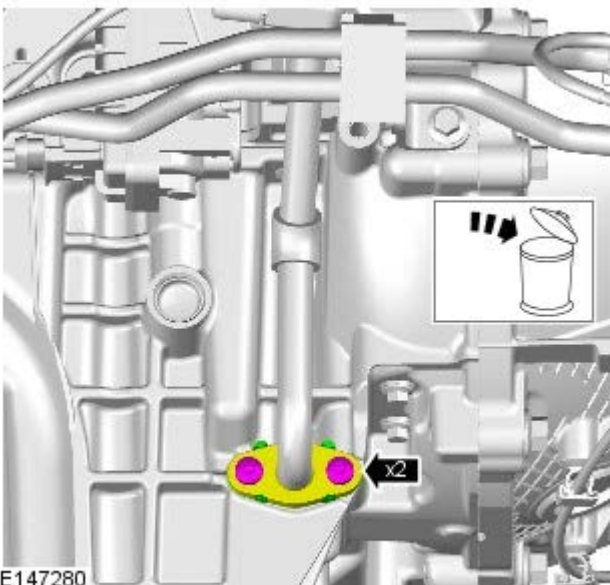
6. *Torque:*
M10 40 Nm
M8 24 Nm




E122598

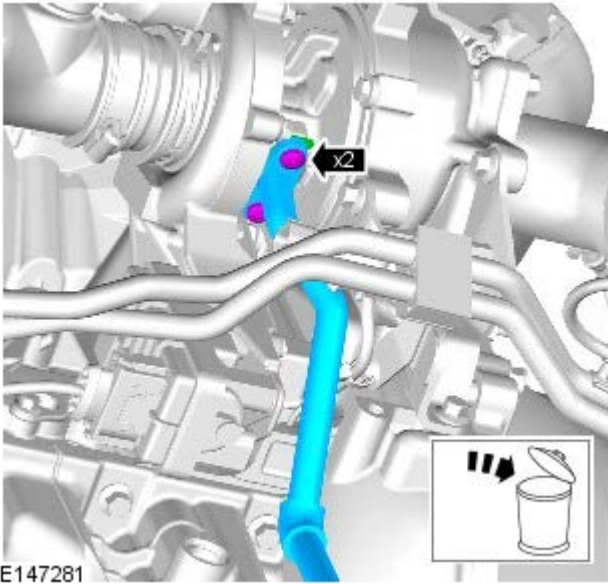
7.  NOTE: Remove and discard the gasket.

Torque: 10 Nm



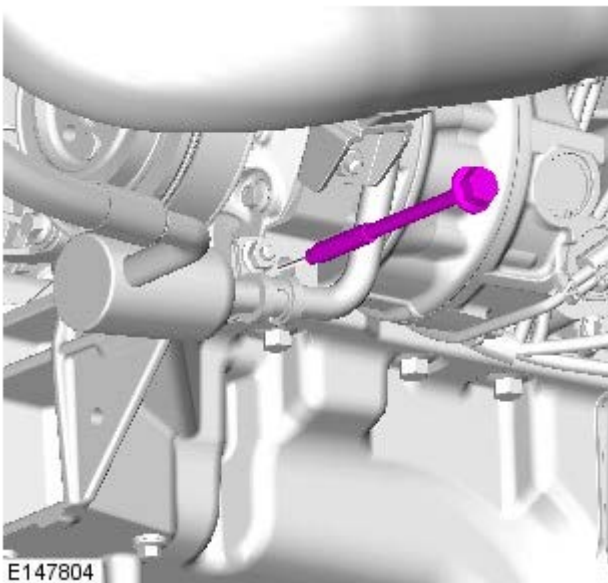
E147280

8.  NOTE: Remove and discard the gasket.



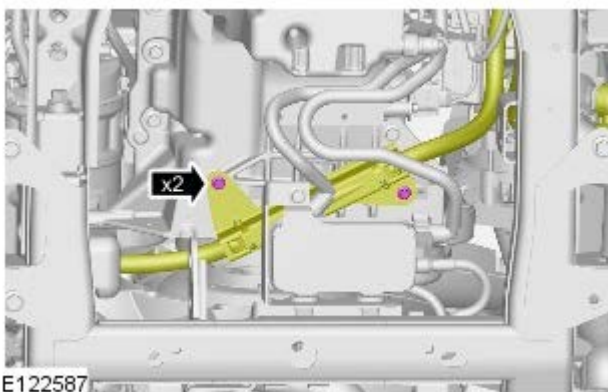
E147281

9. Torque: 25 Nm



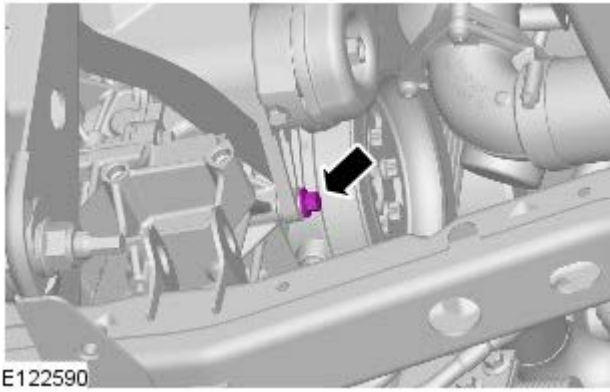
E147804

10. Torque: 10 Nm

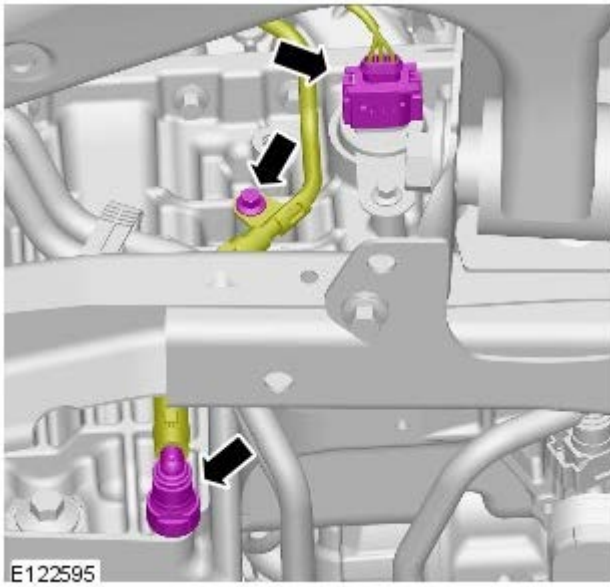


E122587

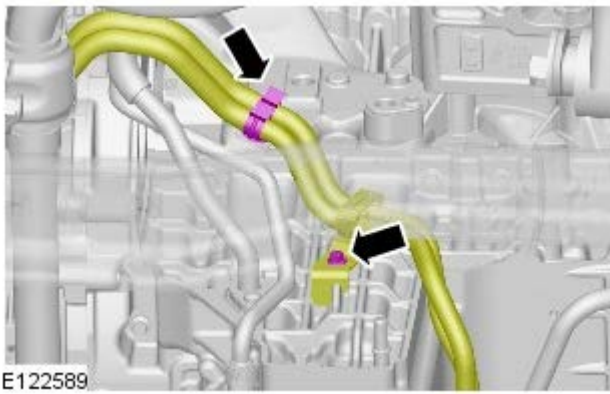
11. Torque: 24 Nm




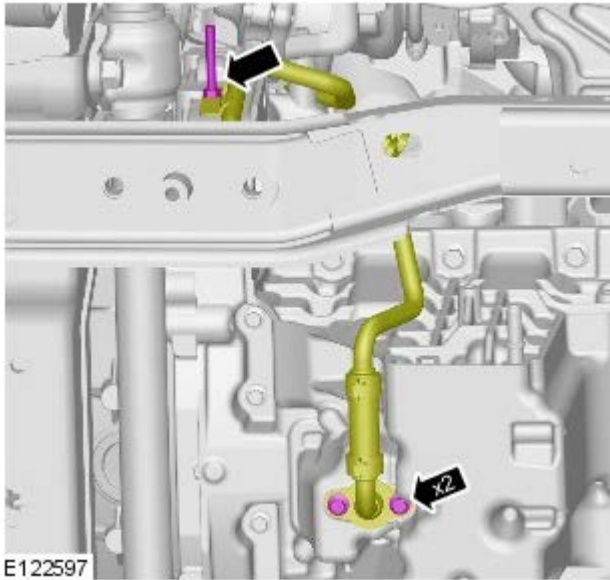
12. Torque: 10 Nm



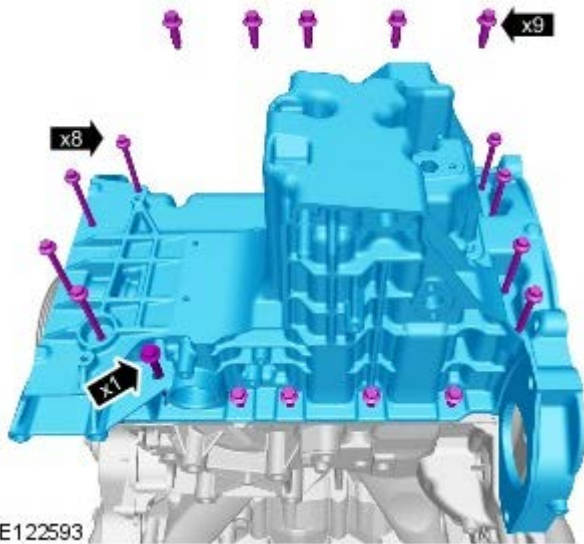
13. Torque: 10 Nm



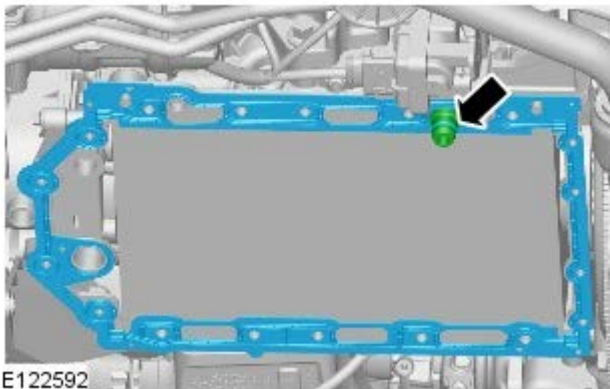
14.  NOTE: Remove and discard the gasket.
Torque: 10 Nm




E122597



E122593




E122592


15.  CAUTION: Note the position of the bolts, prior to removal.

Torque:

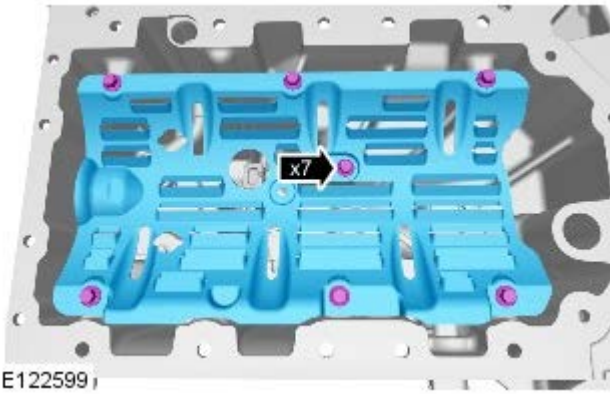
M8 23 Nm

M6 10 Nm

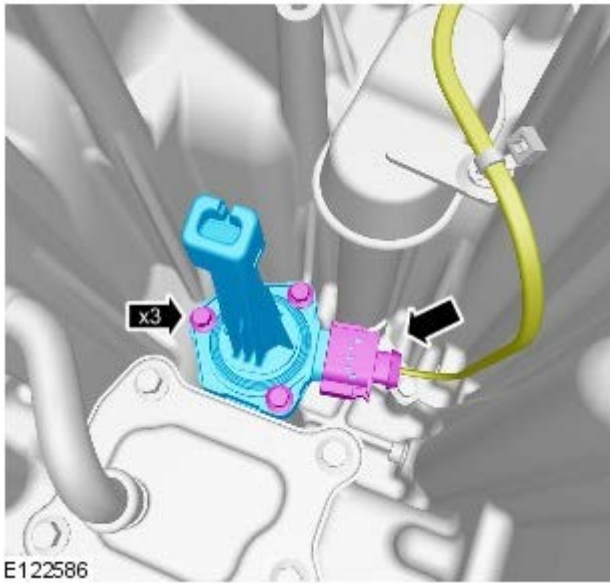
16.  NOTE: Remove and discard the O-ring seal.


17.  NOTE: Do not disassemble further if the component is removed for access only.

Torque: 10 Nm

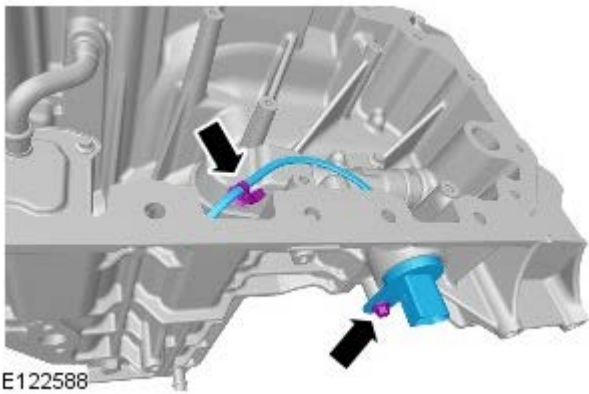


18. Torque: 10 Nm



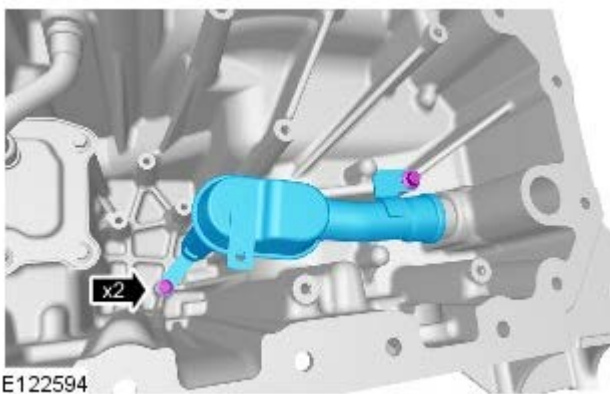
19.  NOTE: Remove and discard the O-ring seal.

Torque: 10 Nm

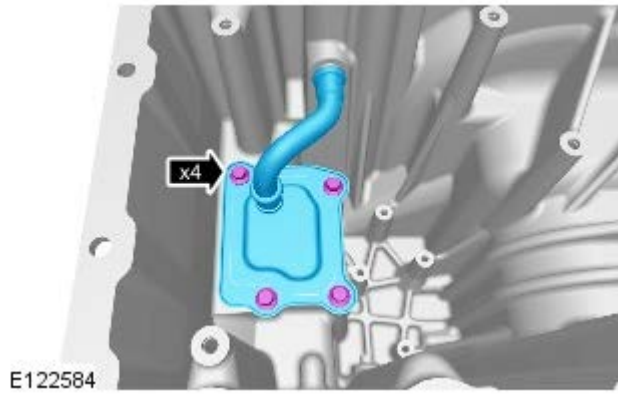


20.  NOTE: Remove and discard the O-ring seal.


Torque: 10 Nm



21. NOTES:

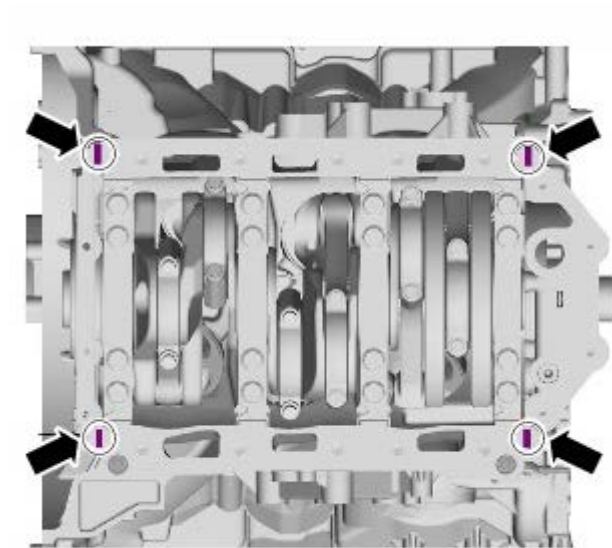


 Remove and discard the O-ring seals.


 Discard the gasket.


Torque: 10 Nm

Installation



1. CAUTIONS:

 Make sure that the mating faces are clean and free of corrosion and foreign material.

 Installation of the oil pan and tightening must be carried out within 7 minutes of applying the sealant.

Apply an 8 mm bead of sealant to the cylinder block in the areas shown.

2. To install, reverse the removal procedure.

Engine - TDV6 3.0L Diesel - Oil Pan Extension

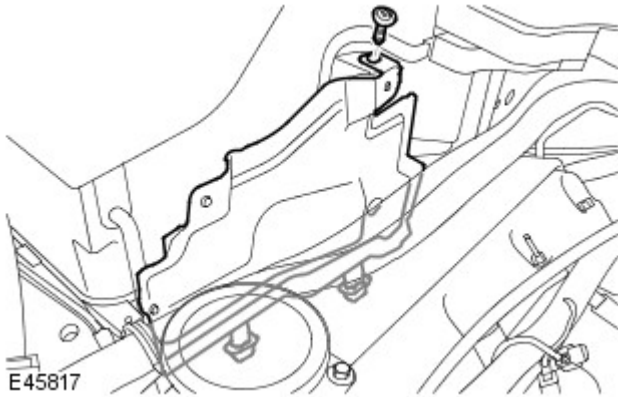
Removal and Installation

Removal

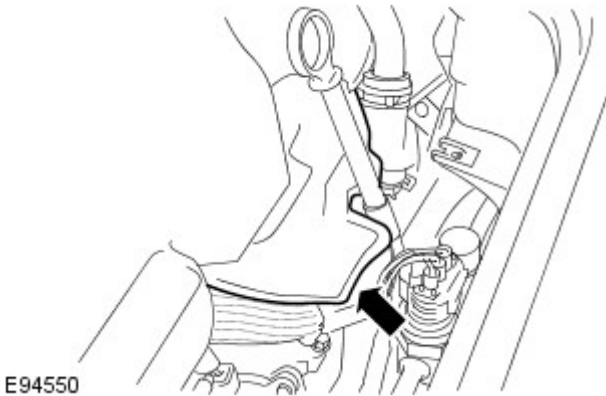
1. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

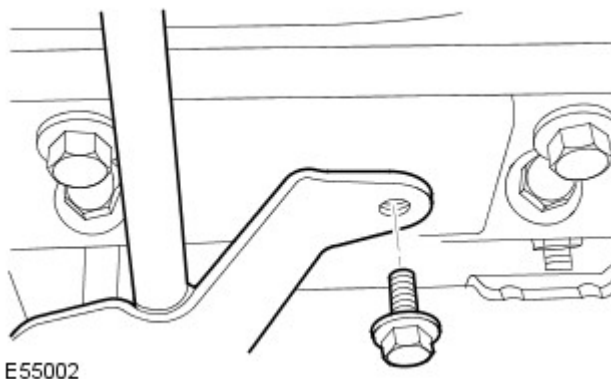
2. Remove the engine compartment upper heat shield.




3. Reposition the injector sound proofing.



4. Release the oil level indicator and tube from the oil pan extension.



5.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

6. Remove the front wheels and tires.
7. Remove the front axle tube.

Refer to: Axle Tube (205-03, In-vehicle Repair).

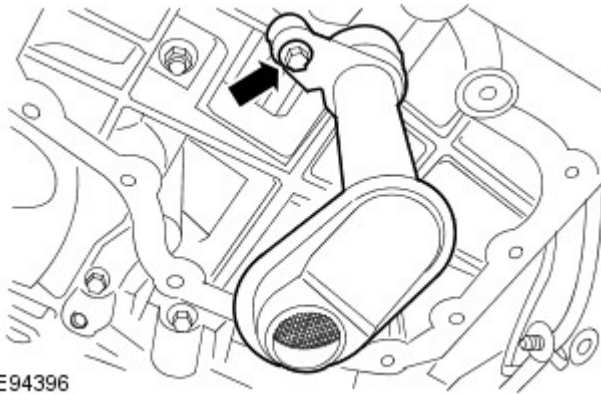
8. Remove the oil pan.

Refer to: Oil Pan (303-01, Removal and Installation).

9. Remove the starter motor.

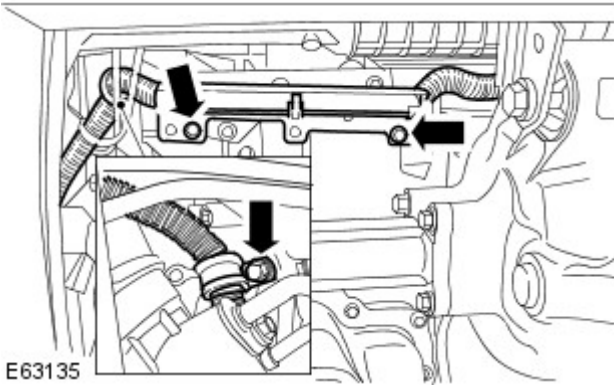
Refer to: Starter Motor (303-06, Removal and Installation).

10. Remove the oil strainer pick-up assembly.



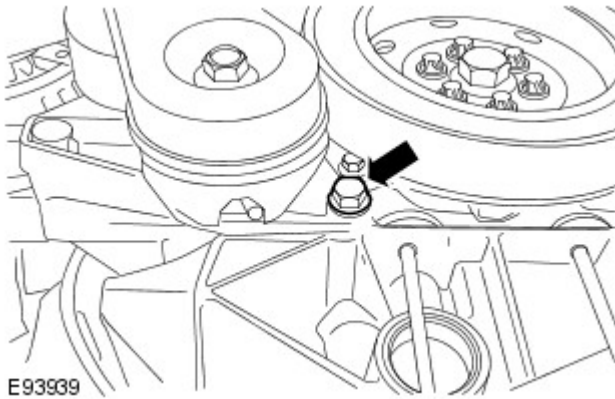
E94396

11. Remove the 3 bolts from the battery to starter motor solenoid cable.



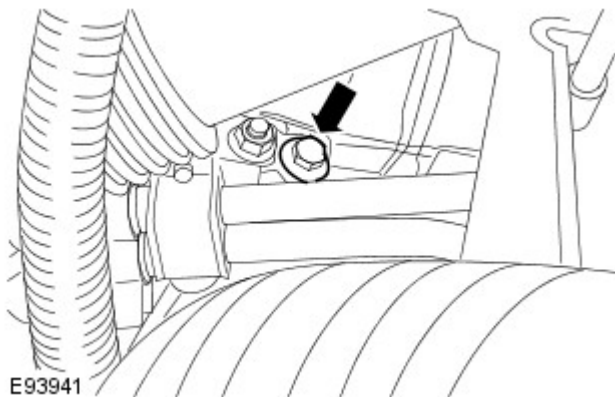
E63135

12. Remove the bolt from the accessory drive belt tensioner bracket.



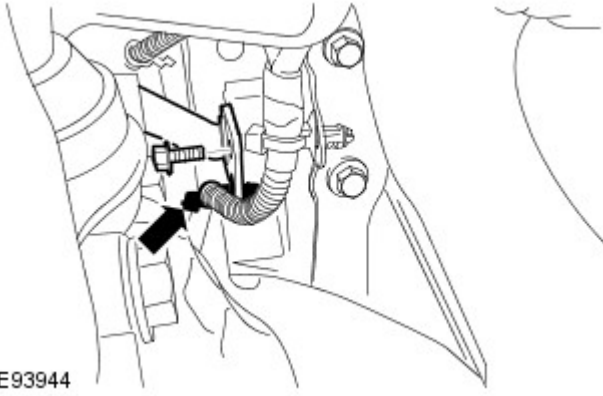
E93939

13. Remove the lower bolt from the air conditioning (A/C) compressor.



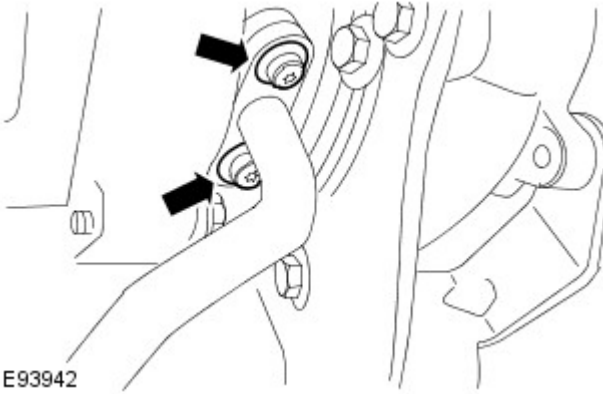
E93941

14. Release the turbocharger oil return tube.



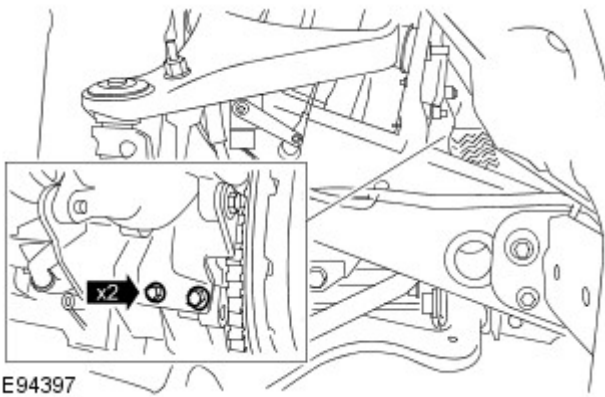
E93944

15. Remove the turbocharger oil return tube.



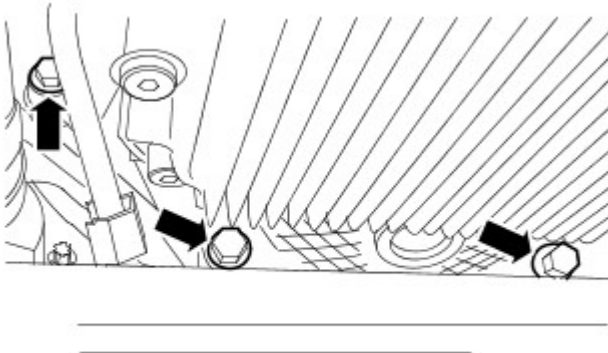
E93942

16. Remove the 2 bolts from the turbocharger support bracket.



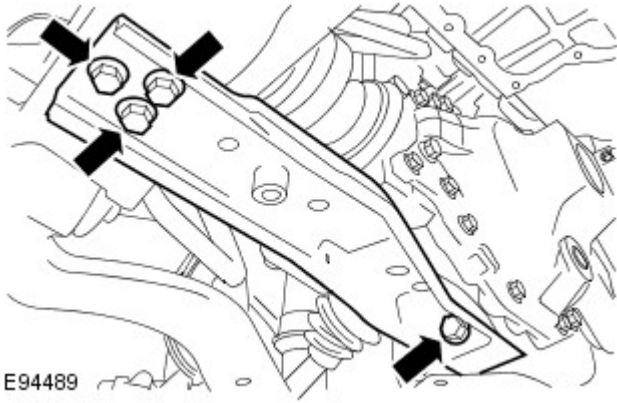
E94397

17. Remove the 3 lower bolts from the transmission to the engine.



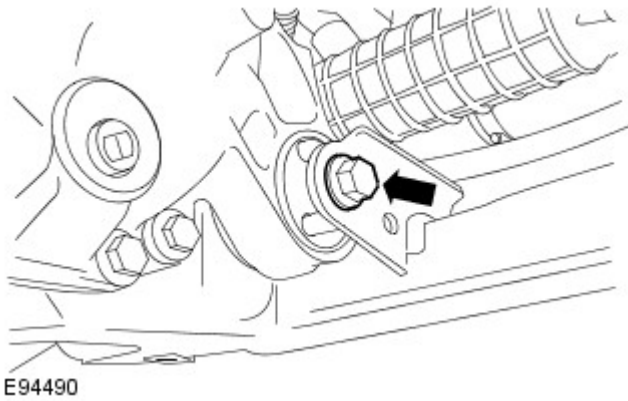
E94398


18. Remove the front axle crossmember.



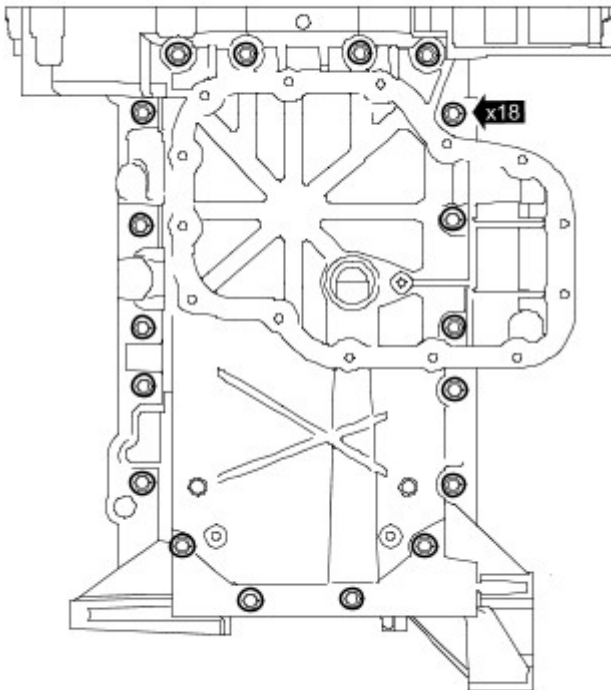
19. Using a transmission jack, support the front axle assembly.

20. Remove the front axle assembly front mounting bolt.



21.  **NOTE:** Note the fitted position of the retaining bolts prior to removal.


Remove the oil pan extension.

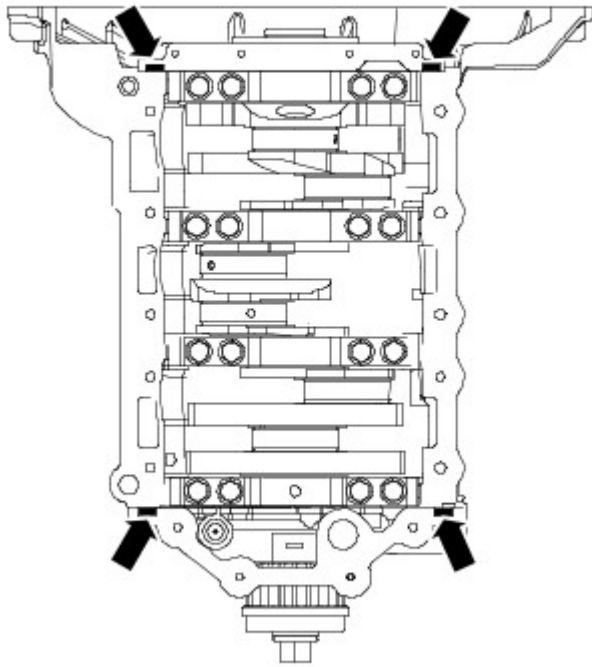



E93945

Installation

1. **NOTES:**

 Make sure that all the component mating faces are clean.



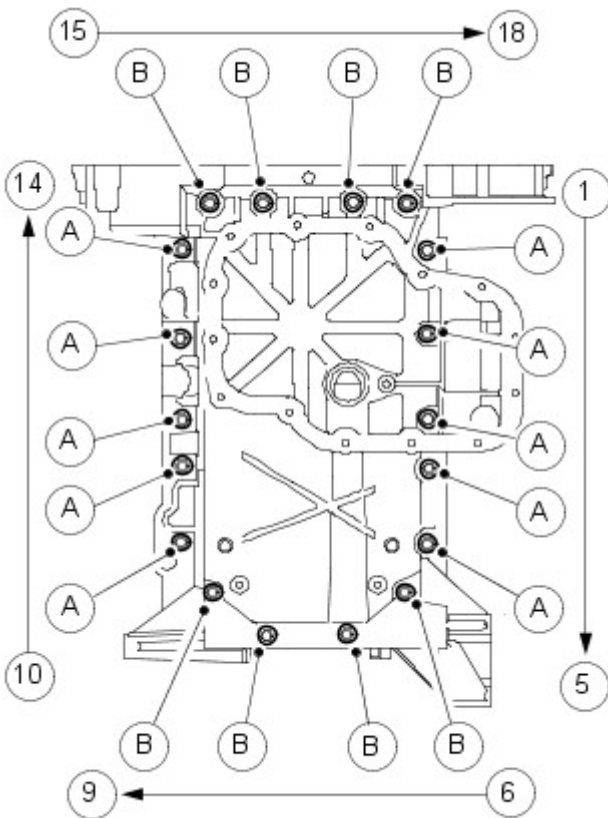
 It is important that the oil pan extension is bolted to the crankshaft main bearing carrier within twenty minutes of applying the sealant.

Apply an 8 mm bead of sealant to the cylinder block in the areas shown.

E93678

2. Install the oil pan extension.

3. Tighten the retaining bolts in the sequence shown.



E93962

4. Align and secure the front axle assembly.

5. Install the front axle crossmember.

6. Install the 3 lower bolts from the transmission to the engine.

7. Install the 2 bolts to the turbocharger support bracket.

8. NOTES:



Make sure that all the component mating faces are clean.



Remove and discard the blanking caps.

Install the turbocharger oil return tube.

9. Install the bolt to the turbocharger oil return tube.

10. Install the lower bolt to the A/C compressor.

11. Install the bolt to the accessory drive belt tensioner bracket.

12. Secure the battery to starter motor solenoid cable.



13. NOTE: Make sure that all the component mating faces are clean.

Install the oil strainer pick-up assembly.

14. Install the starter motor.

Refer to: Starter Motor (303-06, Removal and Installation).

15. Install the oil pan.

Refer to: Oil Pan (303-01, Removal and Installation).

16. Install the front axle tube.

Refer to: Axle Tube (205-03, In-vehicle Repair).

17. Install the front wheels and tires.



18. NOTE: Make sure that all the component mating faces are clean.

Secure the oil level indicator and tube into the oil pan extension.

19. Reposition the injector sound proofing.

20. Install the engine compartment upper heat shield.

21. Connect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

Engine - TDV6 3.0L Diesel - Oil Pump

Removal and Installation

Removal

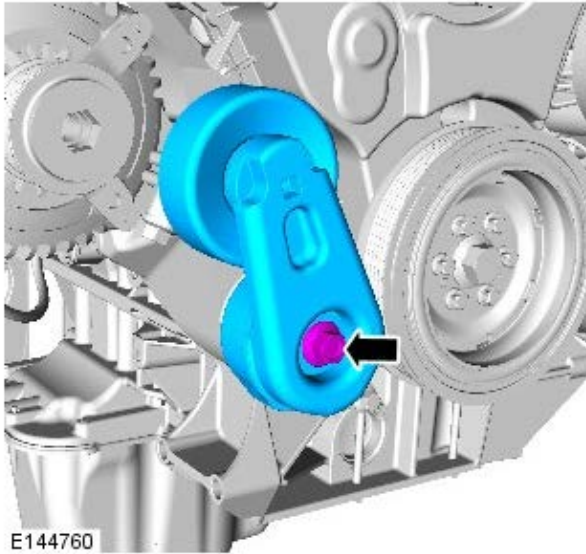
1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

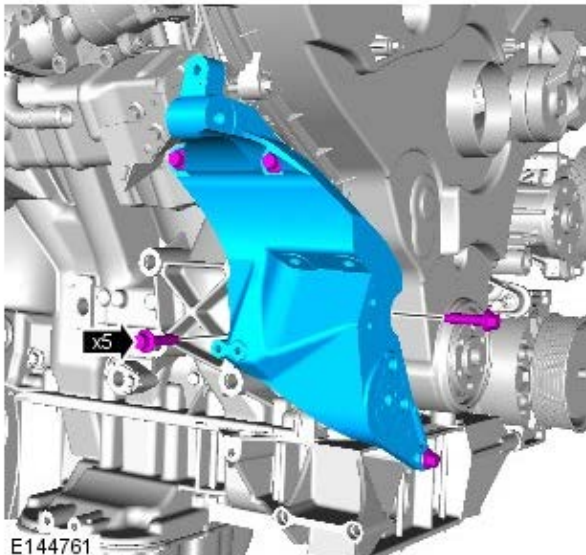
2. Remove the generator.

Refer to: [Generator](#) (414-02B Generator and Regulator - TDV6 3.0L Diesel, Removal and Installation).

3. Remove the accessory drive belt tensioner.

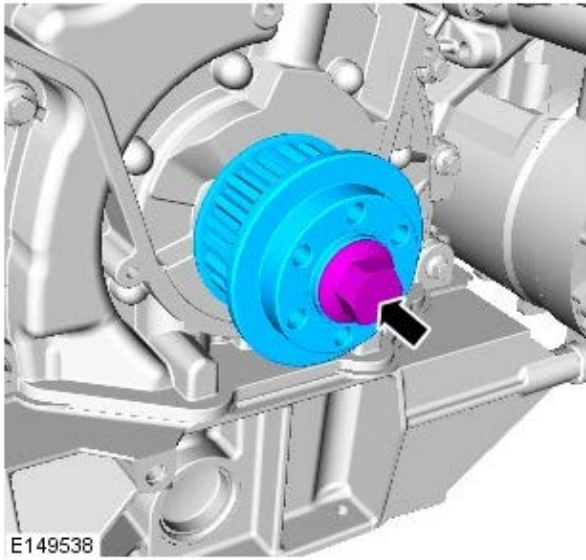


4. Remove the generator mounting bracket.




5. Refer to: [Timing Belt](#) (303-01A Engine - TDV6 3.0L Diesel, Removal and Installation).

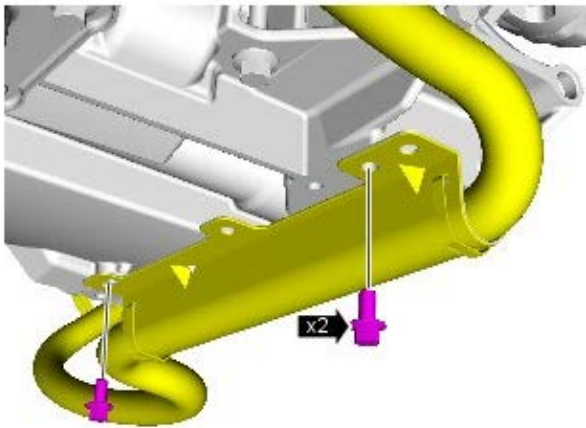
6. Remove the crankshaft pulley.



E149538

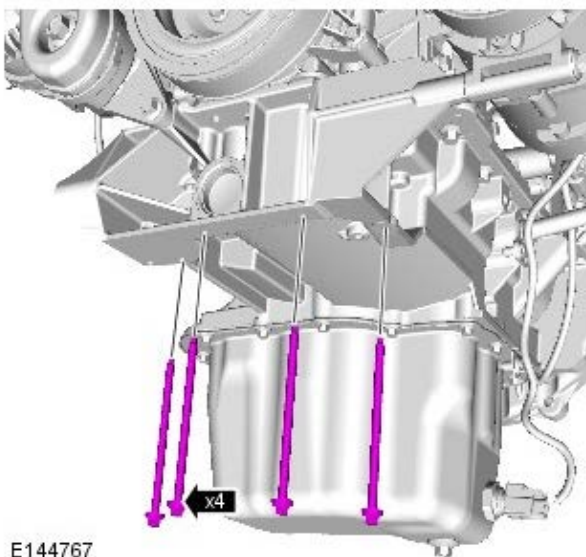
7.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.

8. Release the battery positive cable.



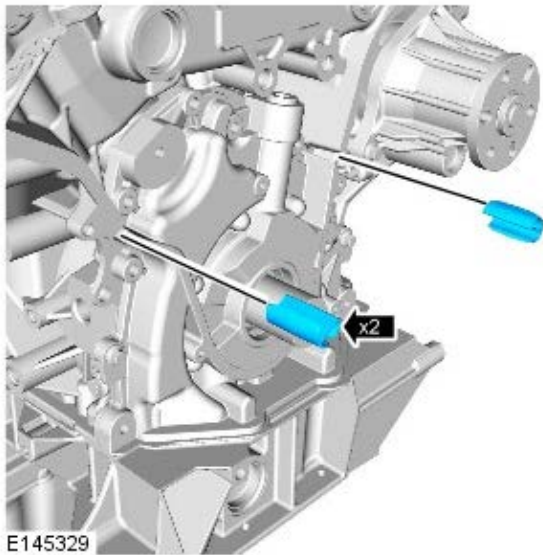
E144765

9. Remove the oil pump lower retaining bolts.

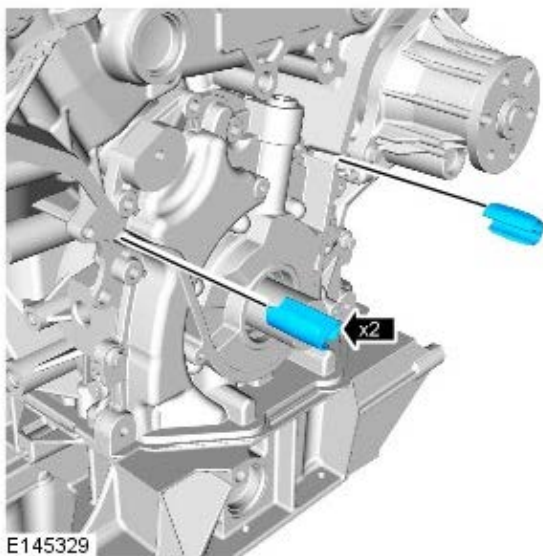


E144767

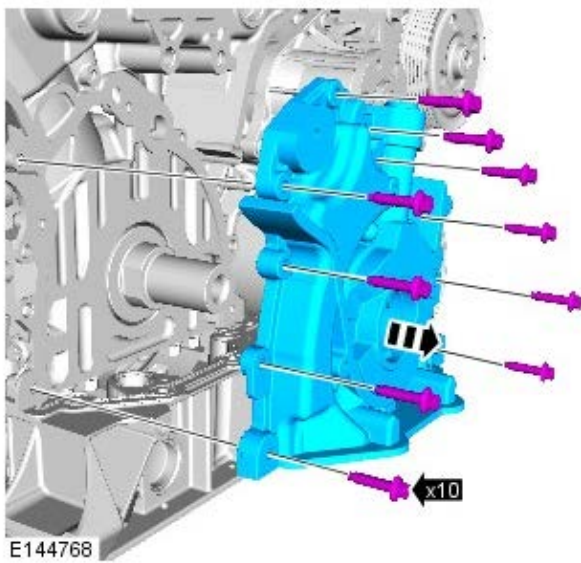
10. Remove the timing belt cover sealing strips.



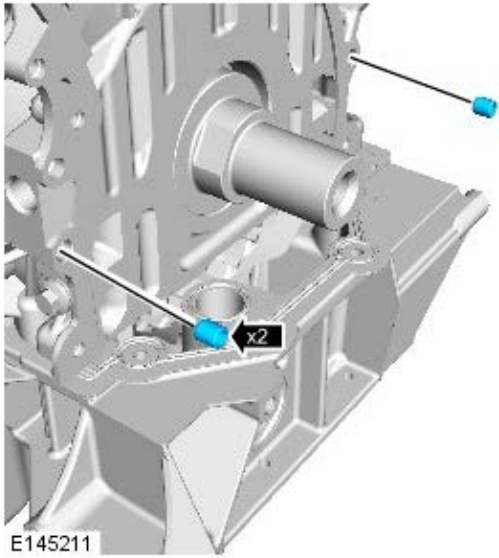
11. Remove the timing belt cover sealing strips.



12. Remove the oil pump.

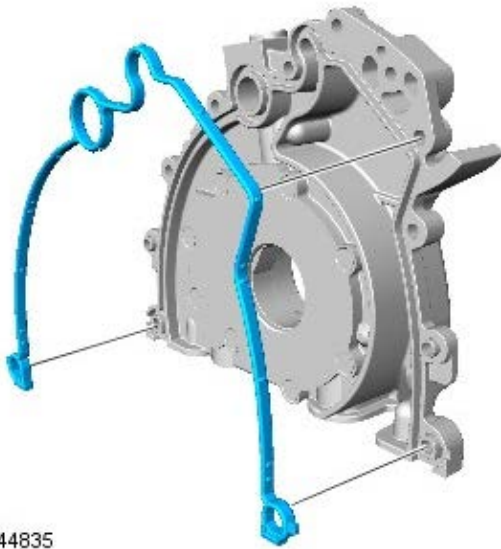



13. Remove the alignment dowels (if equipped).

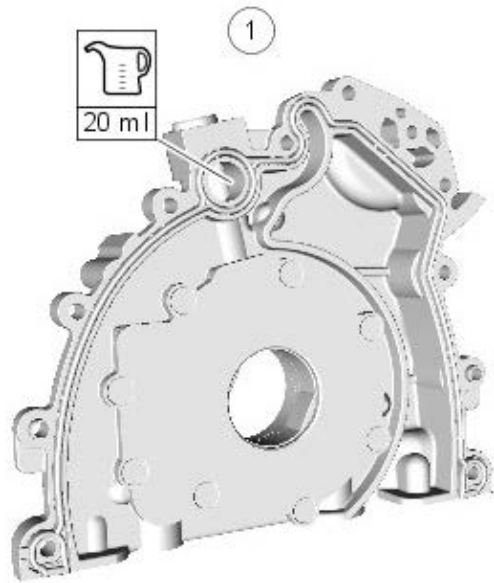


Installation

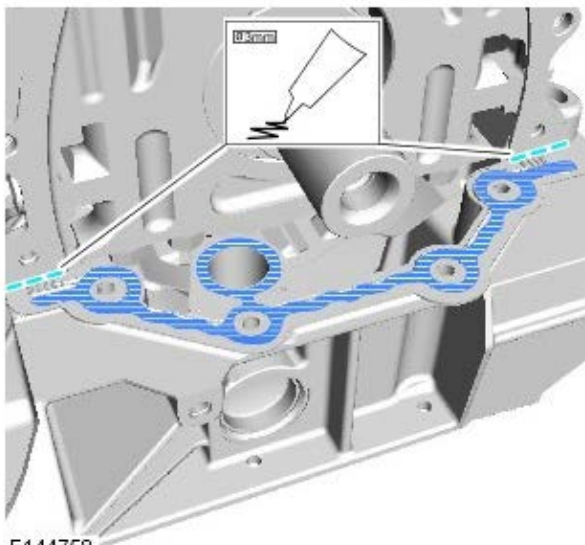
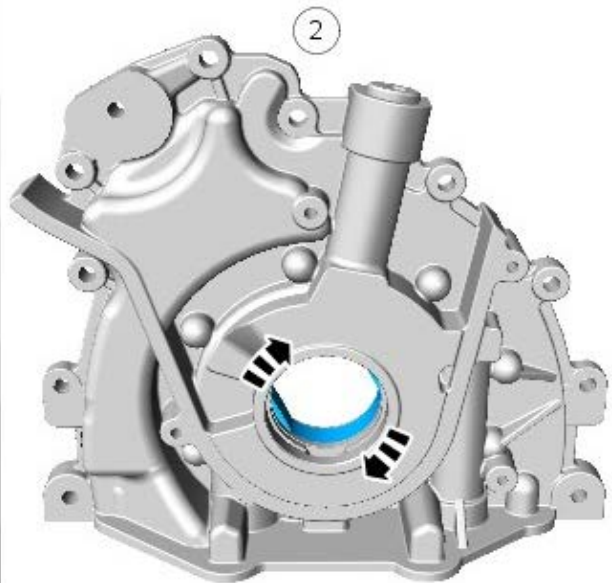
1. Install a new oil pump gasket.




2.  **NOTE: Prime the oil pump.**
 - Fill the orifice shown with 20 ml of engine oil.
 - Rotate the oil pump drive 2 complete turns.




E144763



E144758

3.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

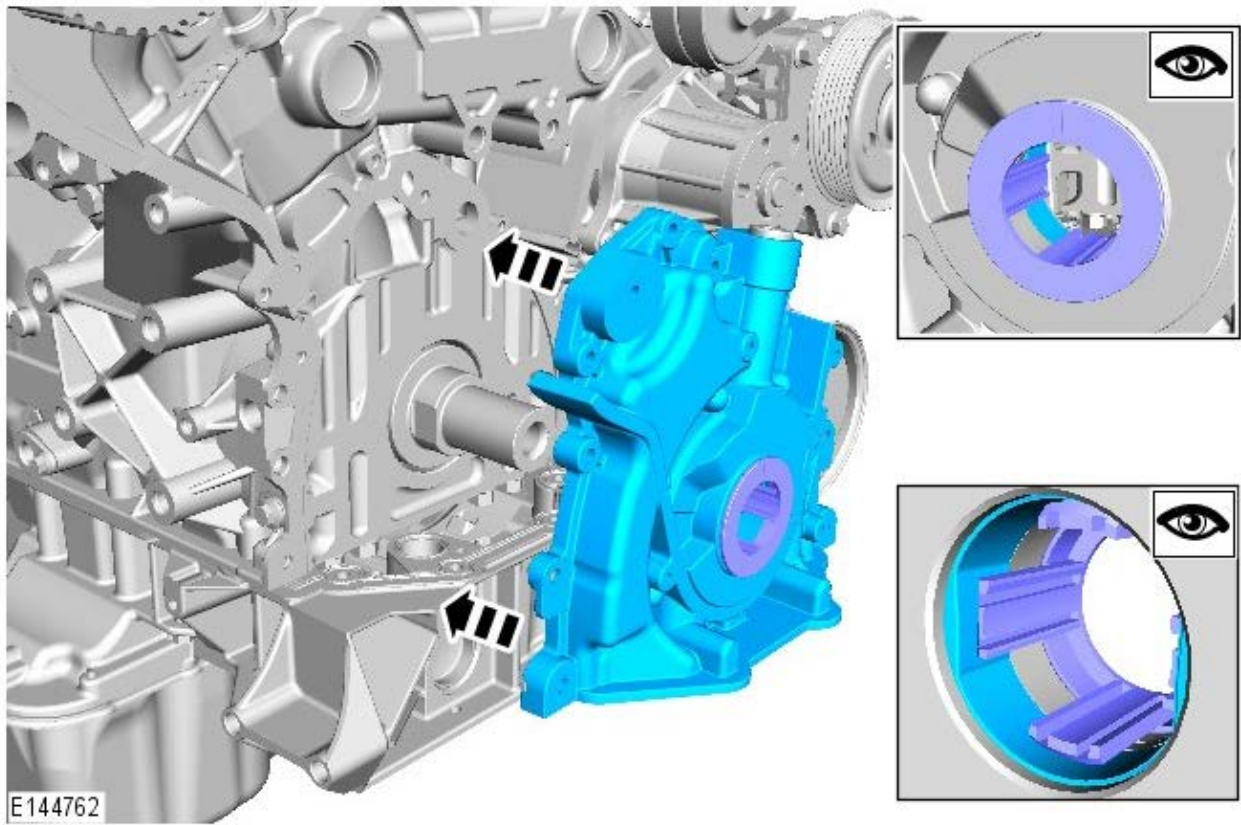
Apply sealant WSE-M4G323-A5 in an 3mm bead to the two areas shown, also apply a smear of sealant to the gasket face as illustrated.

4.  **CAUTION:** Make sure the base of the oil pump is aligned within 0.2 mm of the base of the engine block. Failure to follow this instruction may result in damage to the vehicle.

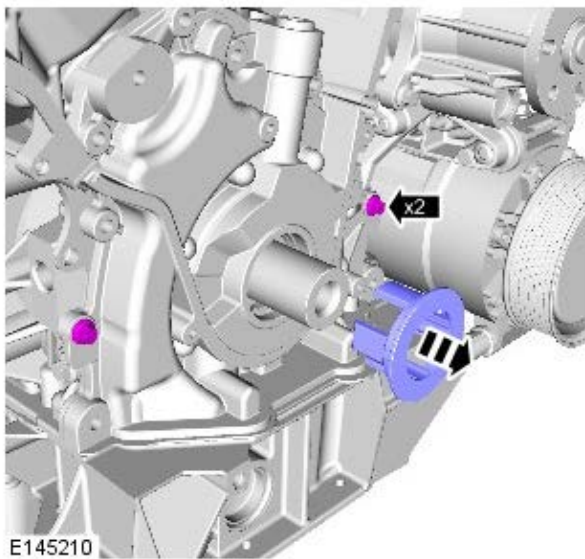


NOTE: Vehicles fitted with oil pumps without dowels.

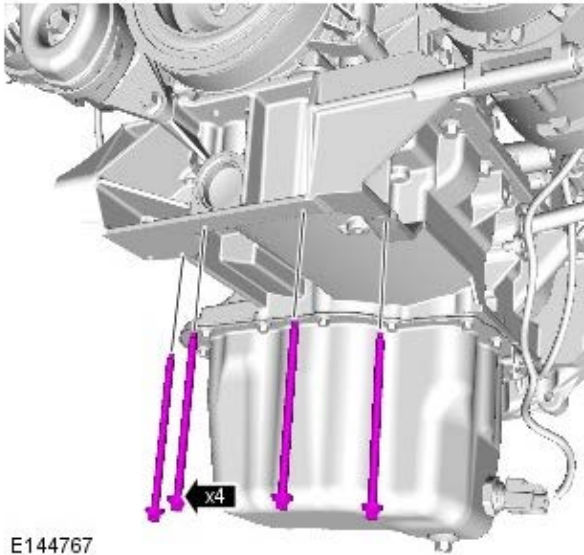
Check the oil pump to engine block alignment.



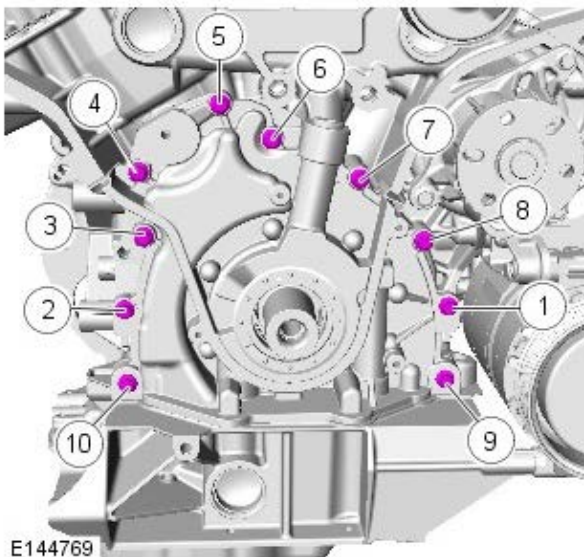
5. Install two bolts to the oil pump, only finger tighten at this stage.



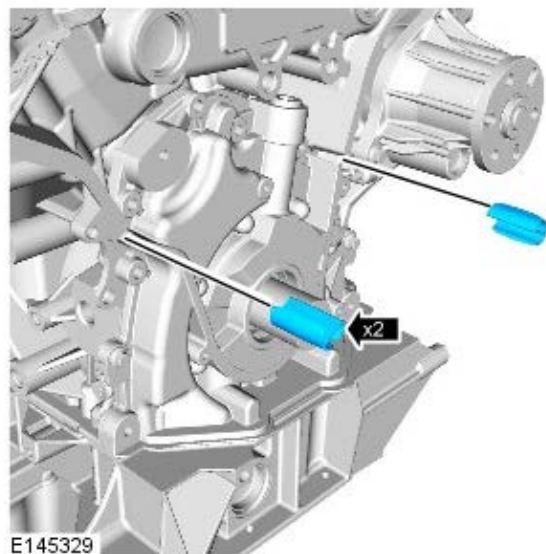
6. Install the oil pump lower retaining bolts.



E144767



E144769




E145329

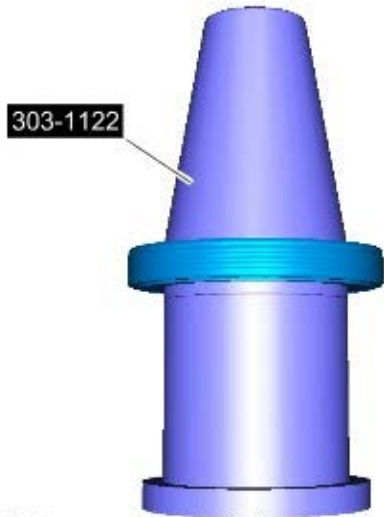
7.  NOTE: Tighten the bolts in the sequence shown to 10 Nm .

Secure the oil pump.

8. Install the timing belt cover sealing strips.

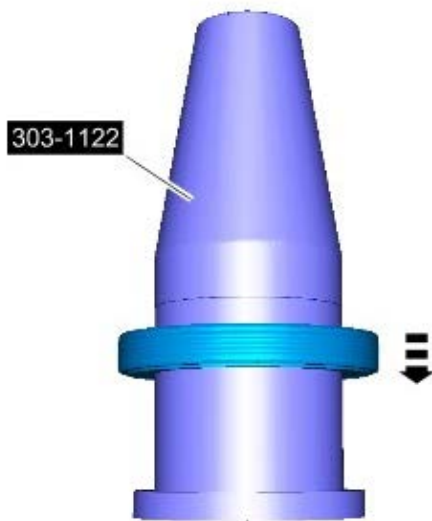
9.  CAUTION: Do not use any lubricant on the crankshaft front seal, special tools or the crankshaft. Failure to follow this instruction may result in damage to the vehicle.

 NOTE: Make sure all component mating faces are clean.




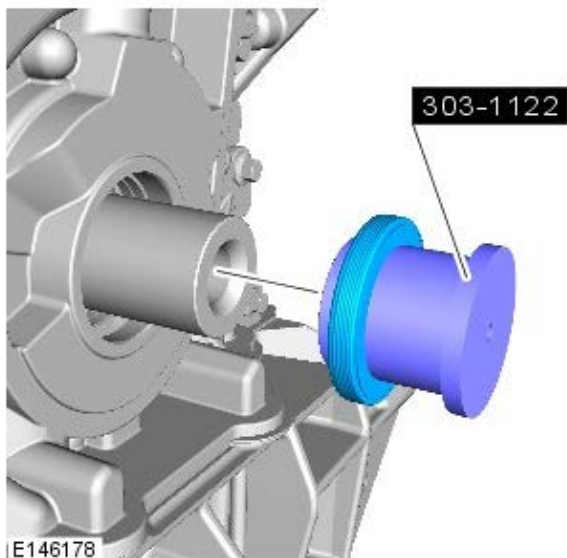
E116752

Install a new crankshaft front seal to the special tool.



E116753

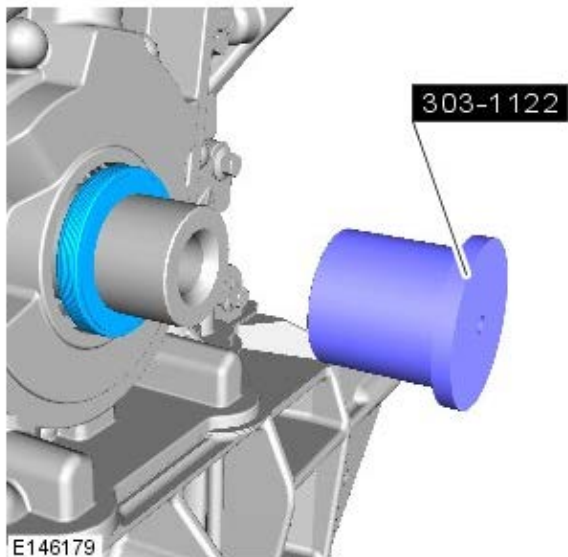
10.  **NOTE:** Remove the sleeve from the special tool.
Reposition the crankshaft front seal along the special tool.



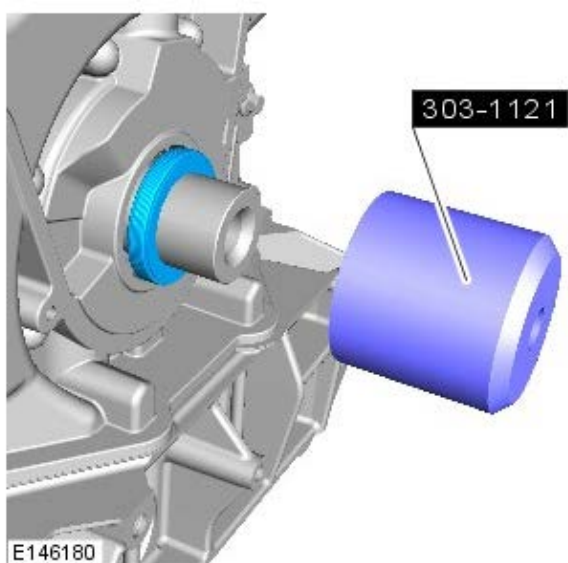
E146178

11. Install the special tool to the crankshaft.

12. Remove the special tool from the crankshaft.



13. Install the special tool to the crankshaft.

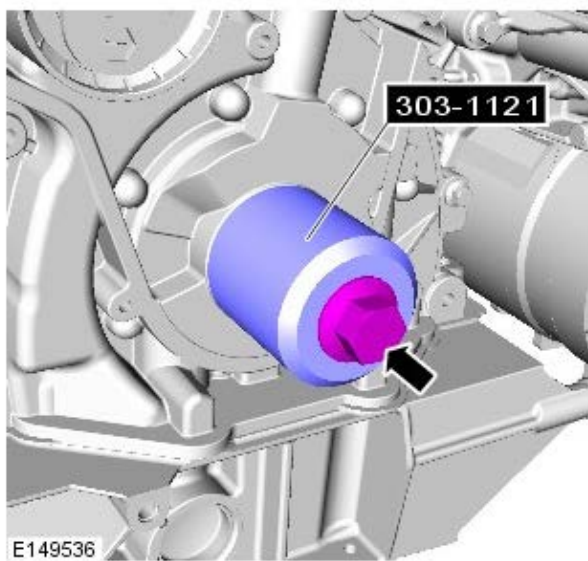


14. NOTES:


 Make sure the seal is installed correctly.


 Use the crankshaft bolt with the service tool.

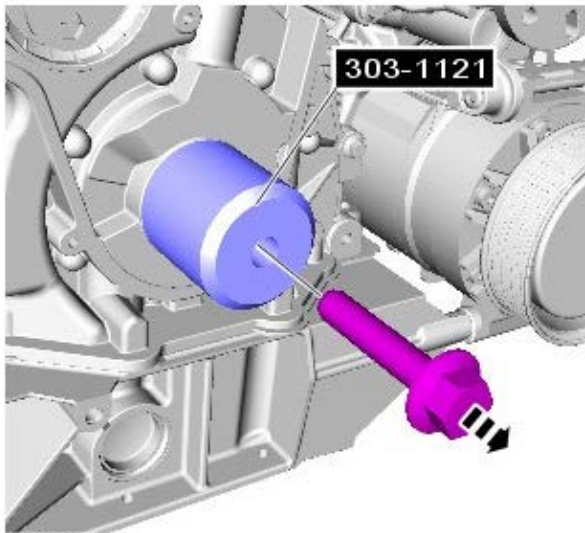
Install the special tool to the crankshaft.



15. NOTES:

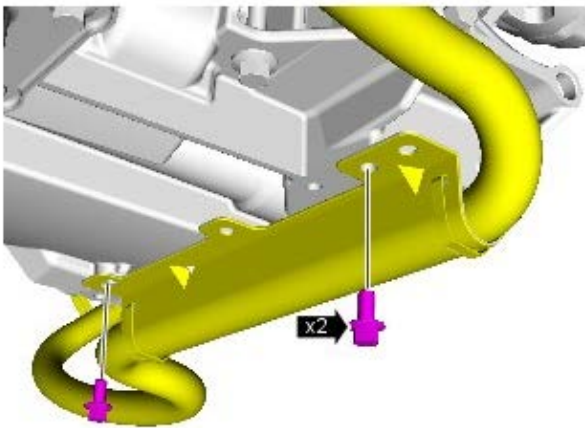
 Make sure the seal is installed correctly.

 Wait 10 seconds before removing the crankshaft seal installation tool.



E149537

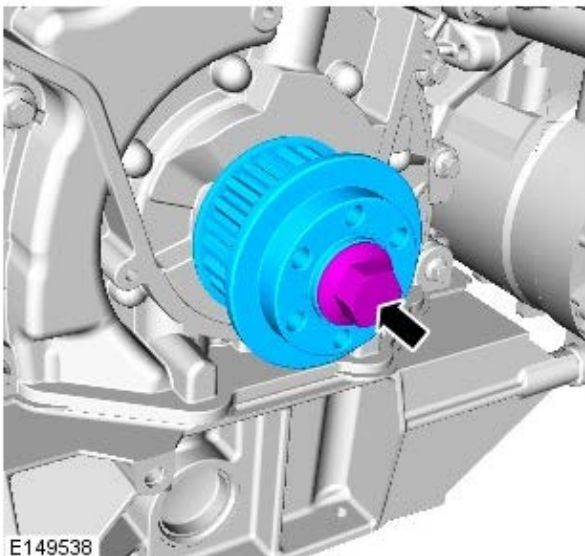
Remove and discard the crankshaft pulley retaining bolt.



E144765


16. Install the battery positive cable.

Torque: 10 Nm




E149538

17. CAUTIONS:

 Make sure that the pulley washer is correctly seated before installing the pulley.

 Do not lubricate the components.

 Make sure that a new bolt is installed.

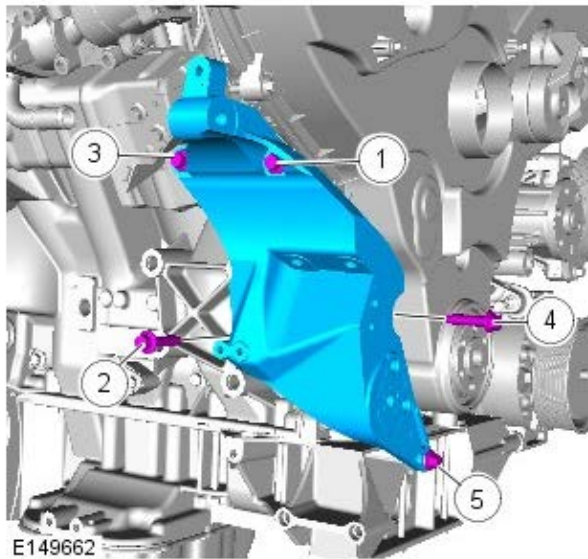
Install the crankshaft pulley.

Torque:
 Stage 1: 150 Nm
 Stage 2: 300 Nm
 Stage 3: 90°

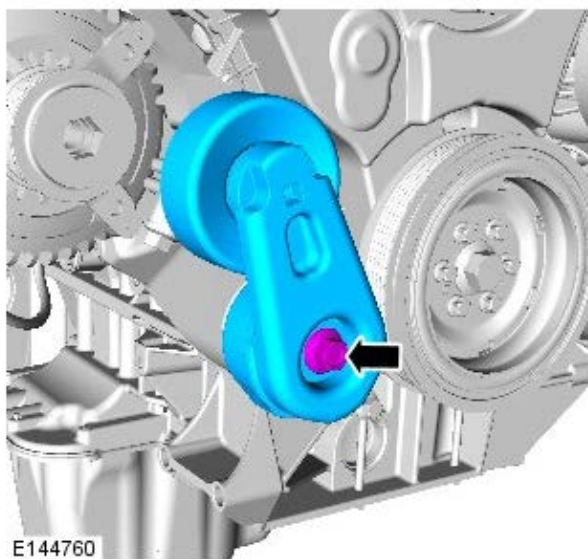
18. Refer to: [Timing Belt](#) (303-01A Engine - TDV6 3.0L Diesel, Removal and Installation).

19. Tighten the bolts in the sequence shown.

Torque: 22 Nm



20. Torque: 45 Nm



21. Remove the generator.

Refer to: [Generator](#) (414-02B Generator and Regulator - TDV6 3.0L Diesel, Removal and Installation).

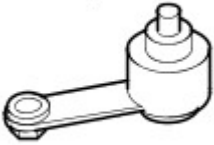

22. Connect the battery ground cable.

Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).


Engine - TDV6 3.0L Diesel - Timing Belt

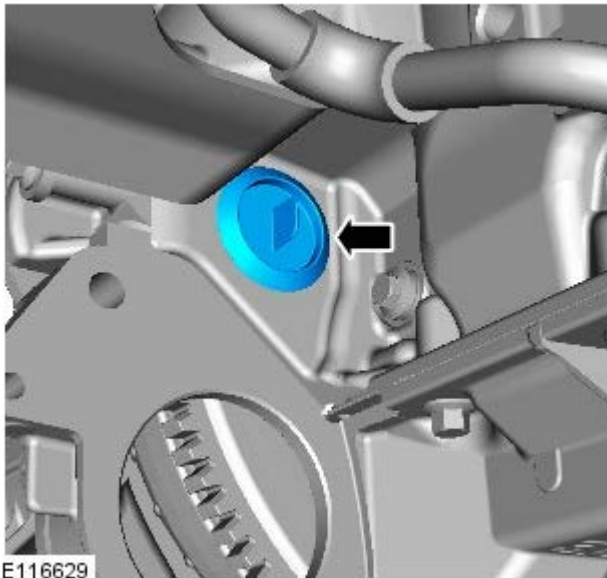
Removal and Installation

Special Tool(s)

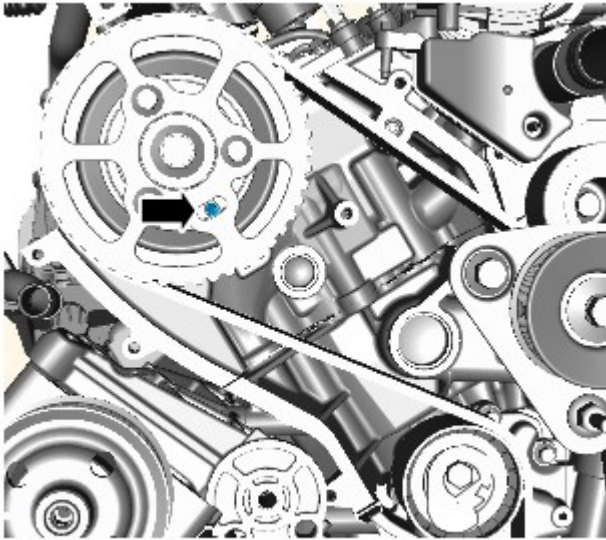
 <p>303-1117</p> <p>E54540</p>	<p>303-1117 Timing Peg, Automatic Transmission</p>
 <p>303-1126</p> <p>E54551</p>	<p>303-1126 Timing Peg, Camshaft Pulley</p>

Removal

-  **WARNING:** Make sure to support the vehicle with axle stands.
 Raise and support the vehicle.
- Refer to: Timing Cover (303-01 Engine - 3.0L V6 - TdV6, Removal and Installation).
- Refer to: Starter Motor (303-06 Starting System - 3.0L V6 - TdV6, Removal and Installation).
-

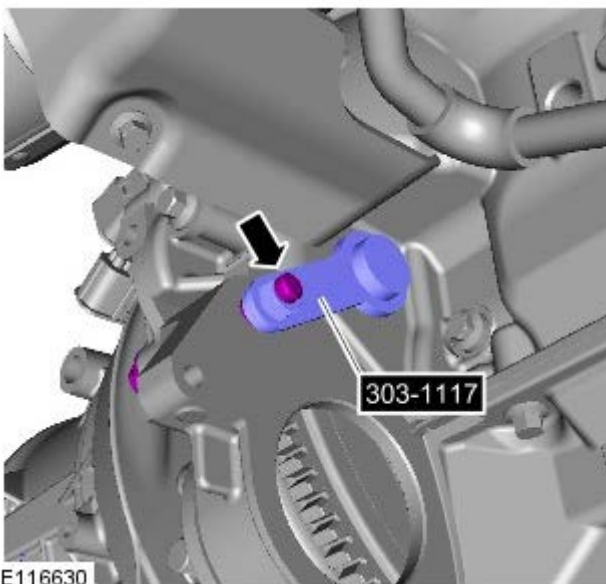


- Rotate the crankshaft clockwise to align the crankshaft alignment hole in the flywheel or flexplate with the block aperture.
- Check the camshaft pulley alignment holes are correctly aligned. If the alignment holes are not aligned, rotate the crankshaft one full turn clockwise.



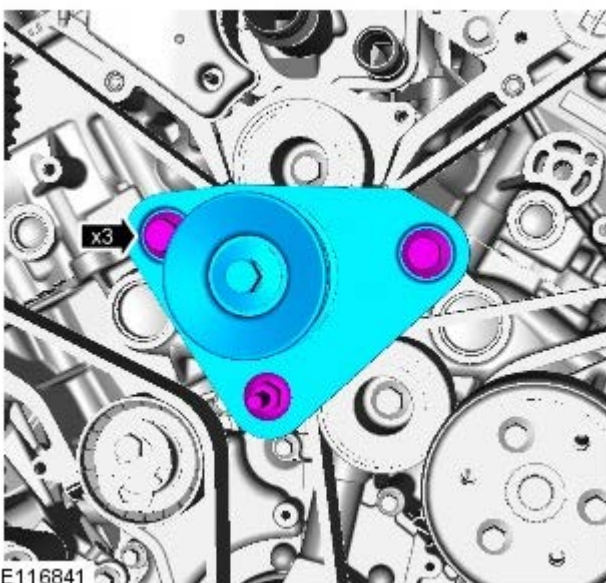
E116840

7. *Special Tool(s):* [303-1117](#)



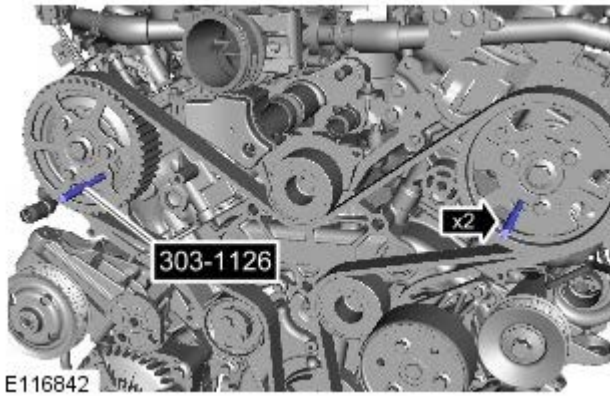
E116630


8.

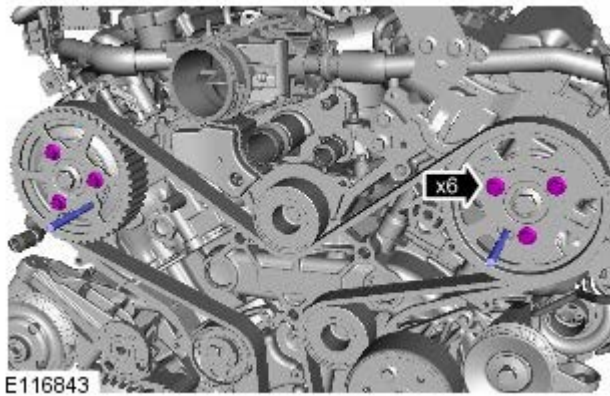


E116841

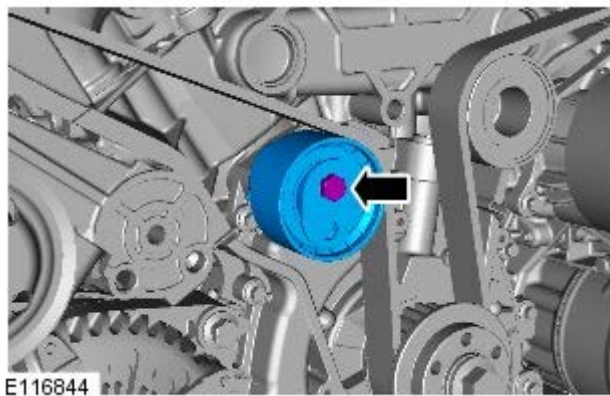
9. *Special Tool(s):* [303-1126](#)



10.  CAUTION: Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.



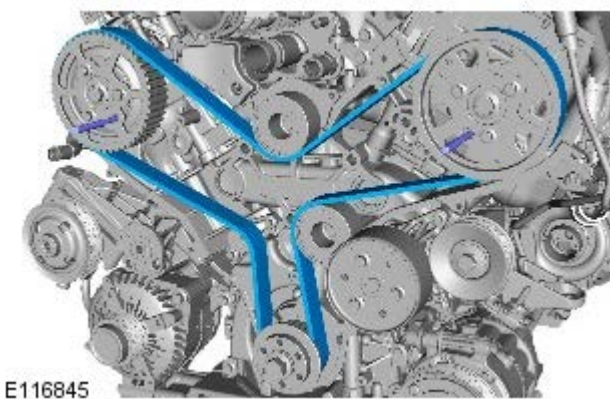
 NOTE: Do not loosen the bolts more than 2 turns.



11. CAUTIONS:

 Discard the component.

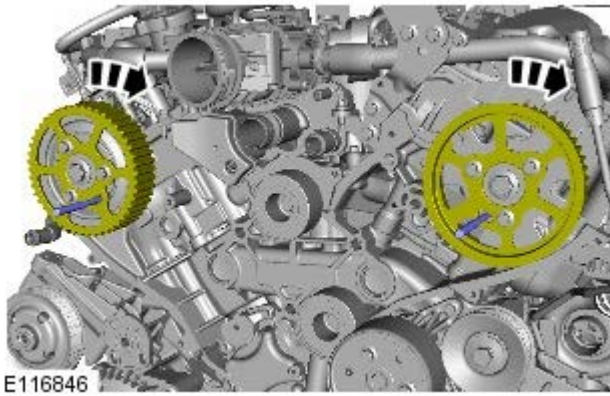
 Discard the bolt.



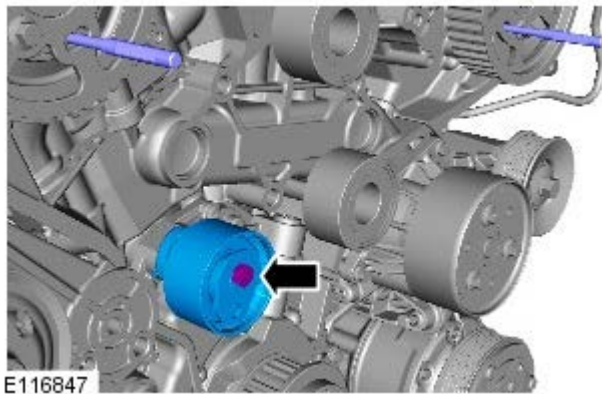
12.  CAUTION: Discard the component.

Installation

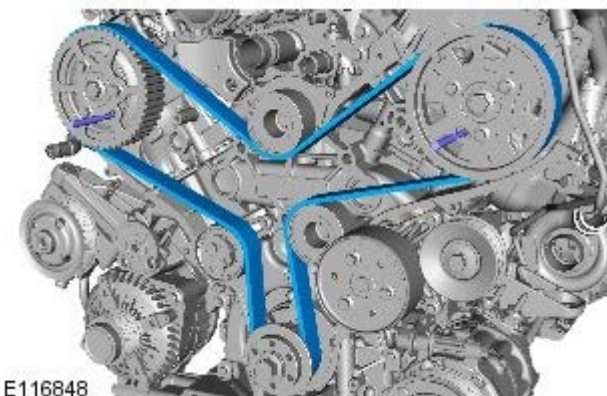
- 1.



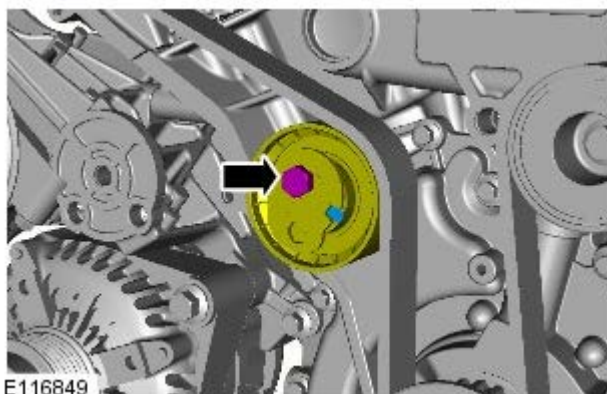
E116846



E116847



E116848




E116849


2. CAUTIONS:

 Make sure that a new bolt is installed.


 Only tighten the bolts finger-tight at this stage.

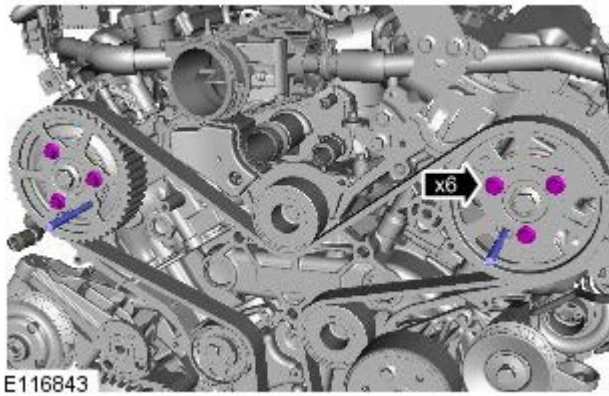
3.  CAUTION: Make sure the camshaft pulleys remain in the clockwise position.

- Install the new timing belt.
- Starting at the crankshaft pulley, install the timing belt in a counter-clockwise direction, in the sequence shown.
- Stage one: Attach the timing belt to the crankshaft pulley.
- Stage two: Attach the timing belt to the idler pulley.
- Stage three: Attach the timing belt to the left-hand camshaft pulley.
- Stage four: Attach the timing belt to the idler pulley.
- Stage five: Attach the timing belt to the RH camshaft pulley.
- Stage six: Attach the timing belt to the timing belt tensioner.

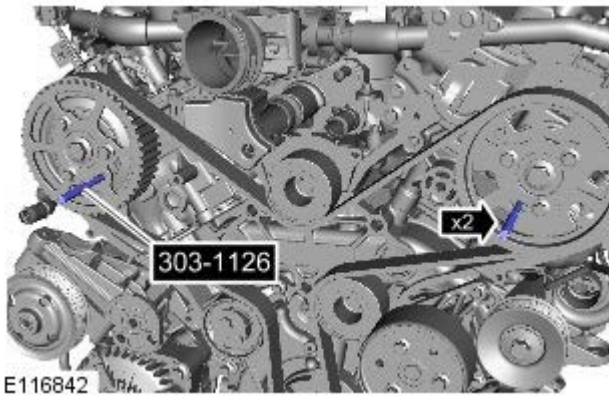
4.  CAUTION: Make sure the timing belt tensioner window is aligned with the groove as illustrated.

- Tension the timing belt.
- Rotate the tensioner assembly counter-clockwise.
- *Torque: 26 Nm*

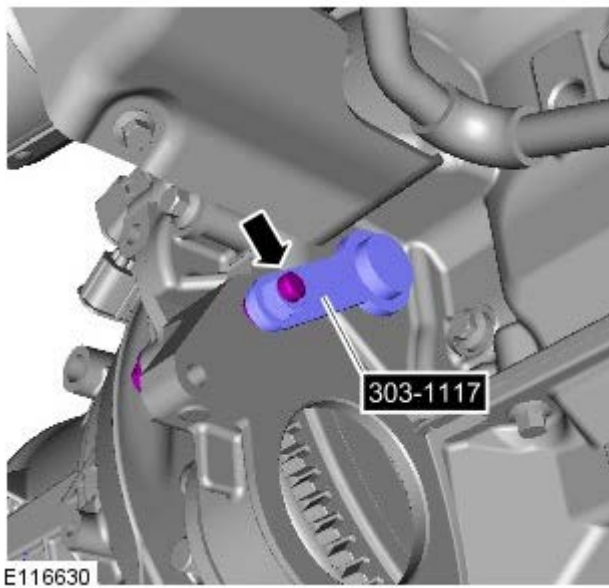
5.  CAUTION: Do not use the special tools to lock the camshafts. Failure to follow this instruction may result in damage to the engine or the special tools.




- Using a suitable tool, counterhold the camshaft pulley center retaining bolts.
- *Torque:* 23 Nm



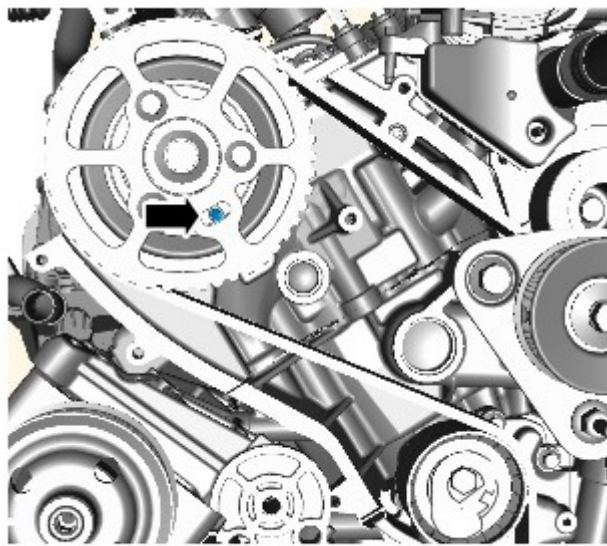
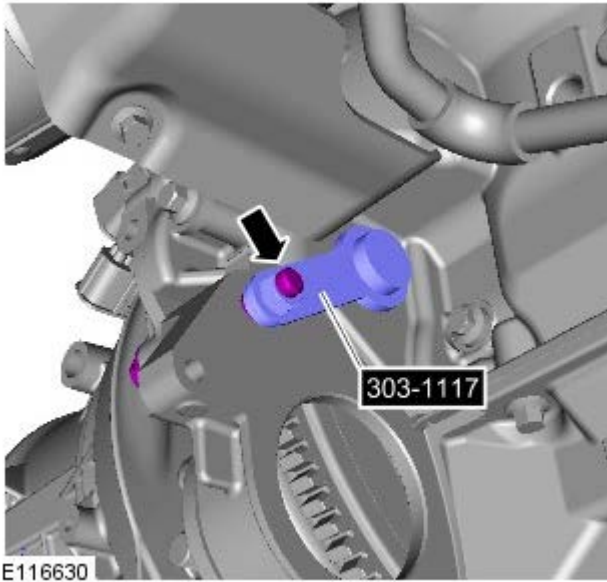
6. *Special Tool(s):* [303-1126](#)



7. *Special Tool(s):* [303-1117](#)

8.  **CAUTION:** Only rotate the crankshaft clockwise.
Rotate the engine two complete turns clockwise.

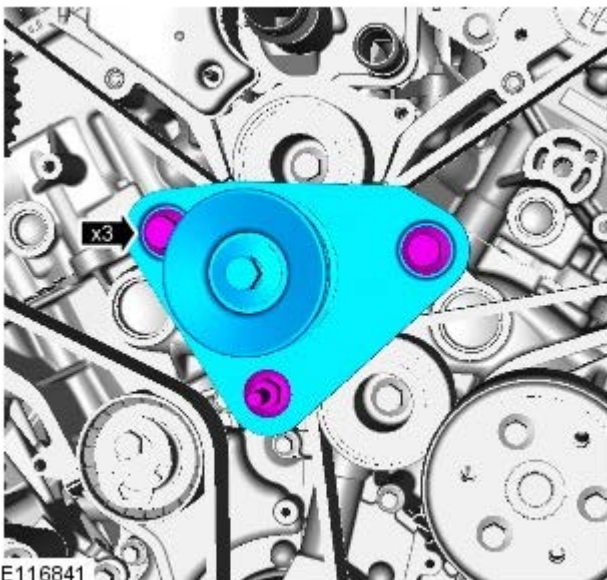
9. *Special Tool(s):* [303-1117](#)



E116840

10.

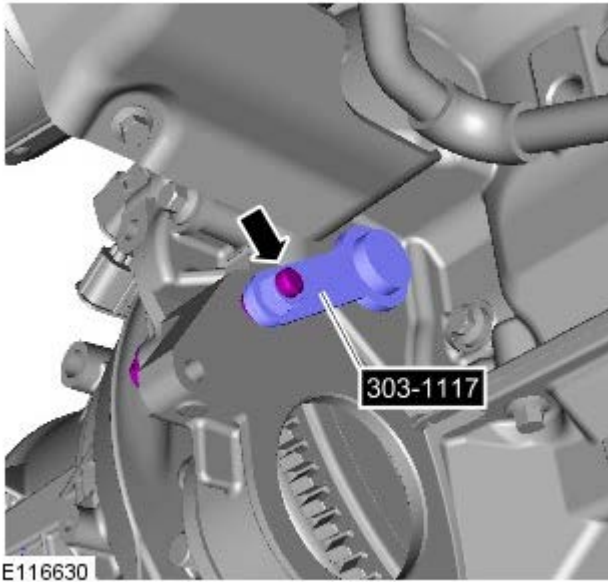
- Install the special tools to the exhaust camshaft pulleys.
- If the special tool does not fit correctly, repeat the timing belt installation procedure.
- Remove the special tools from the camshaft pulleys.



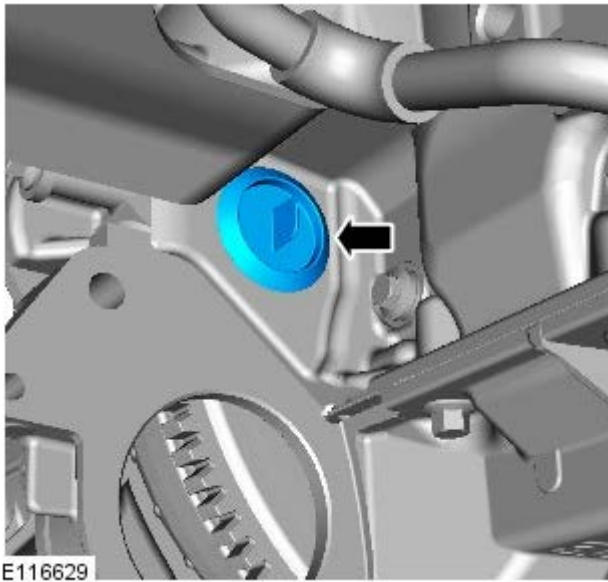
E116841

11. Torque: 80 Nm

12. Special Tool(s): [303-1117](#)



13.



14. Refer to: Starter Motor (303-06 Starting System - 3.0L V6 - TdV6, Removal and Installation).
15. Refer to: Timing Cover (303-01 Engine - 3.0L V6 - TdV6, Removal and Installation).

Engine - TDV6 3.0L Diesel - Timing Cover

Removal and Installation

Removal

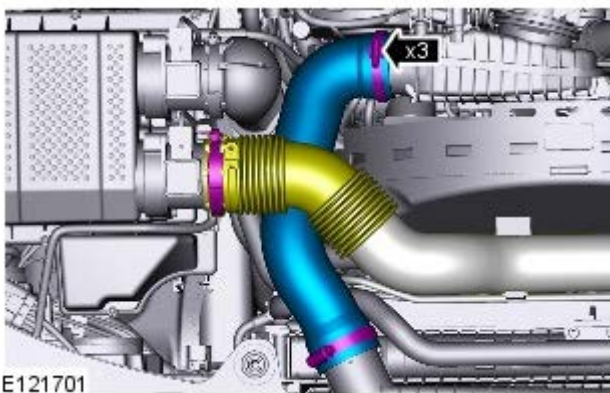


NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

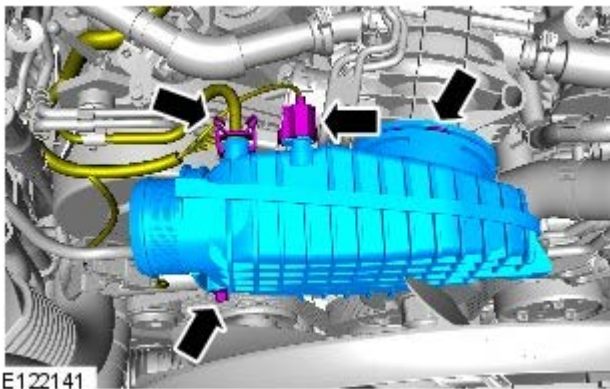
Refer to: Specifications (414-00, Specifications).
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
3. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).
4. Refer to: Cooling Fan (303-03, Removal and Installation).

5.



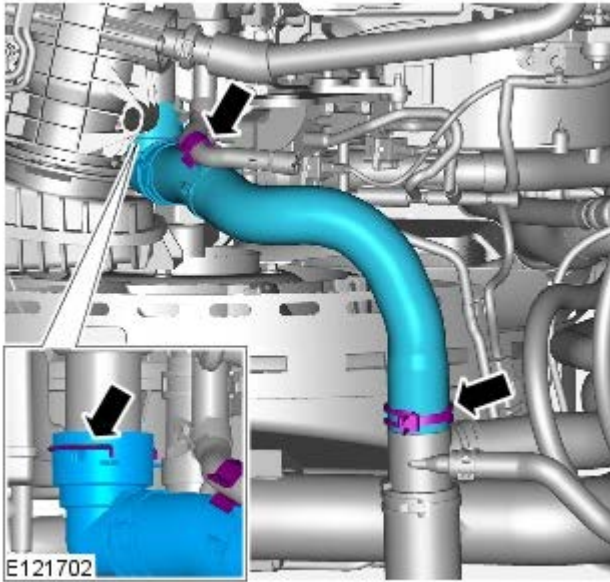
E121701

6. *Torque:* 10 Nm

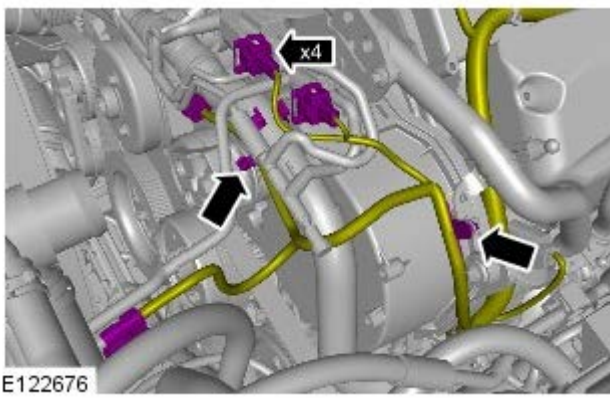


E122141

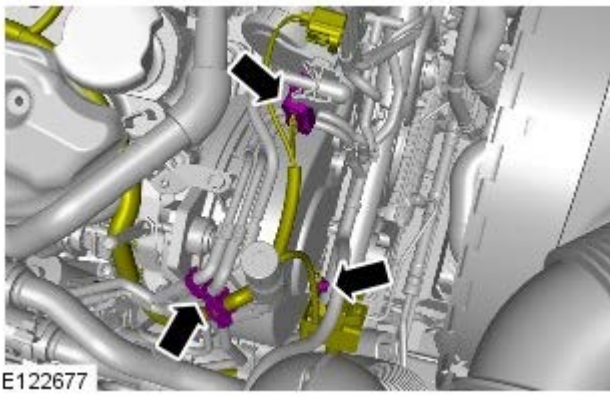
7.



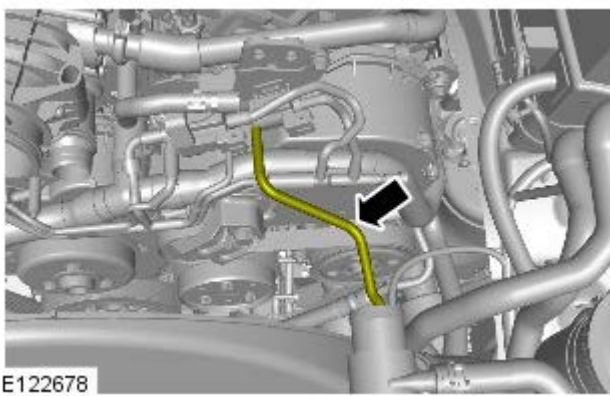
8.



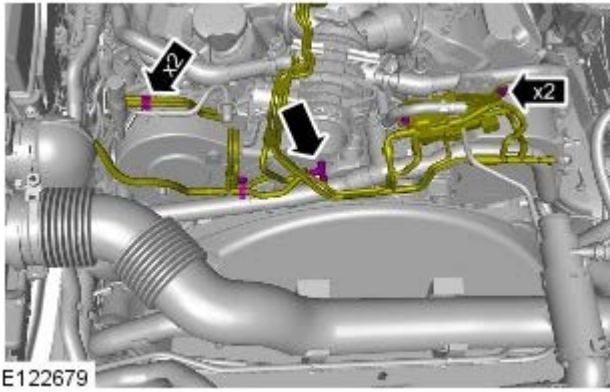
9. Torque: 3 Nm



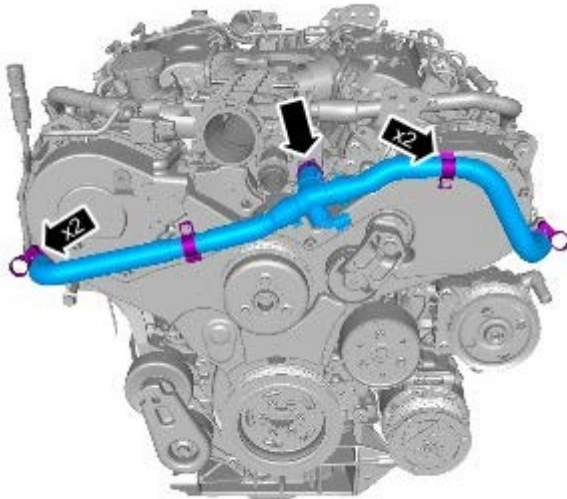
10.



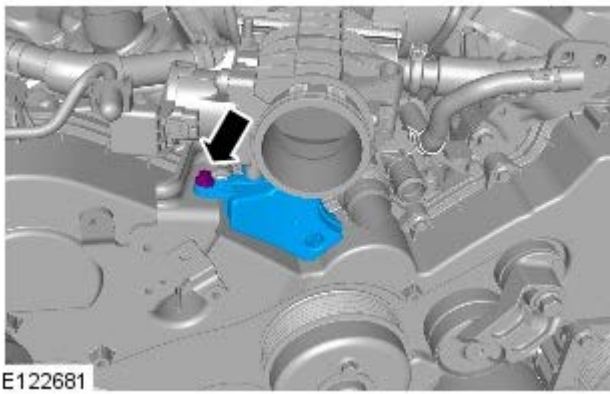
11. Torque: 8 Nm



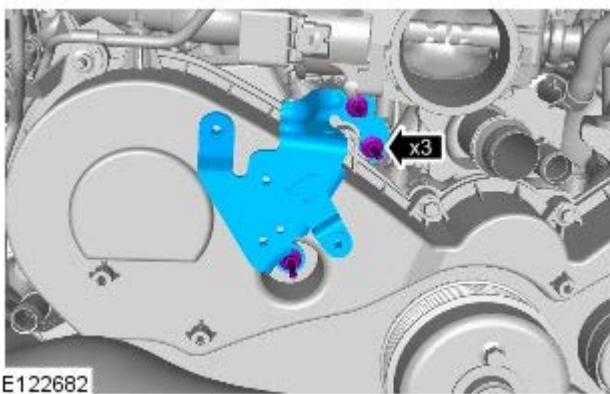
12.  NOTE: Engine shown removed for clarity.



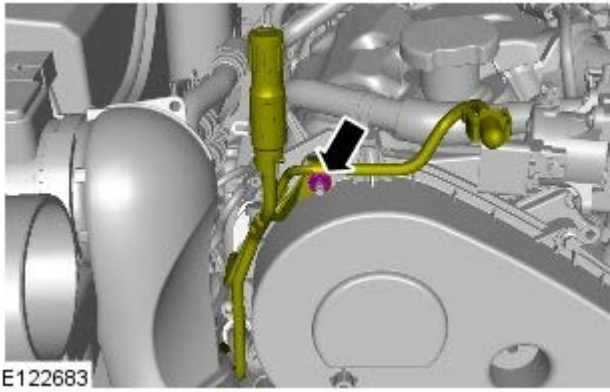
13. Torque: 8 Nm



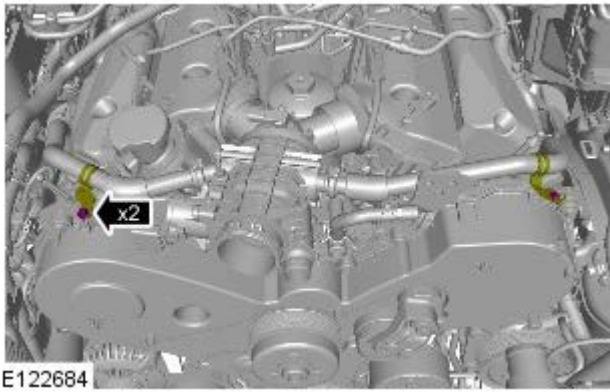
14. Torque: 8 Nm



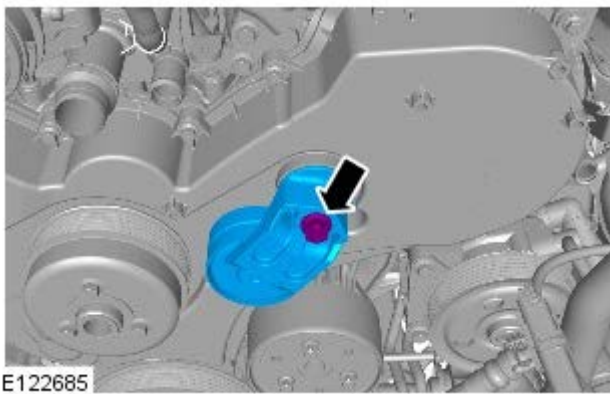
15. Torque: 8 Nm



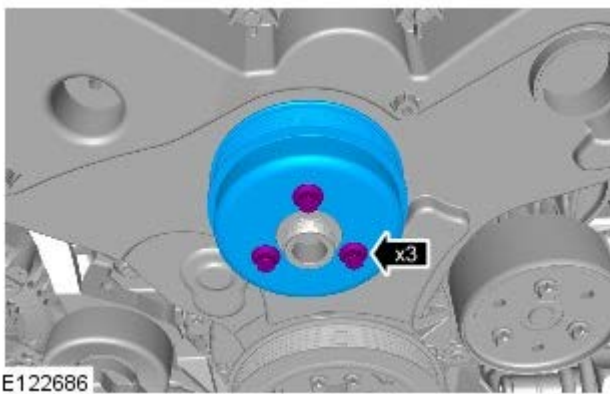
16. Torque: 5 Nm



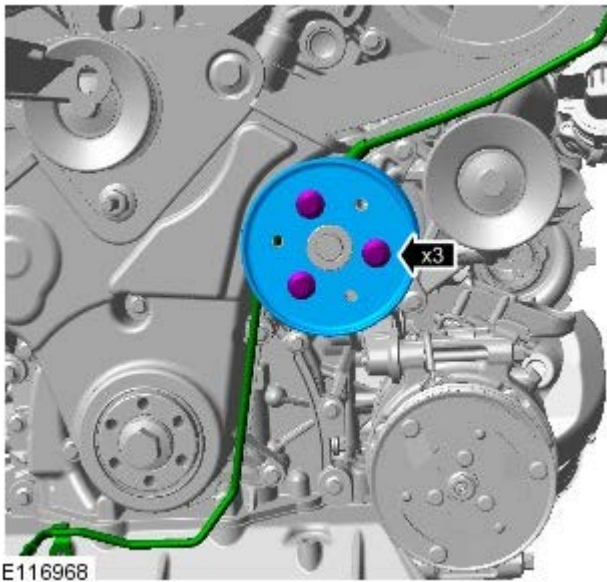
17. Torque: 47 Nm



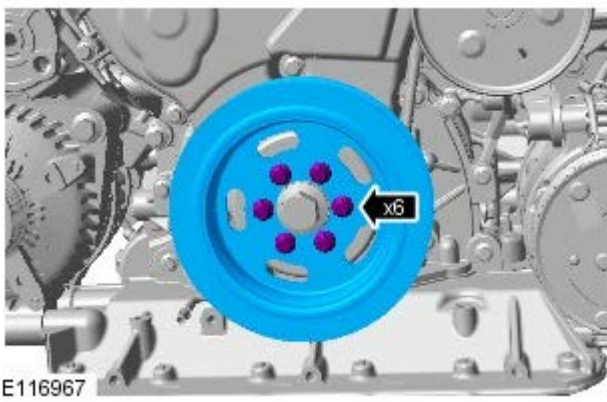
18. Torque: 24 Nm




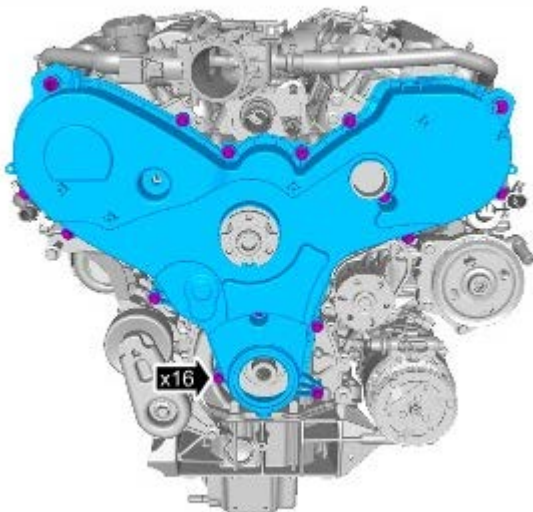
19. Torque: 24 Nm



20. Torque: 25 Nm



21.  NOTE: Engine shown removed for clarity.
Torque: 10 Nm



Installation

1. To install, reverse the removal procedure.

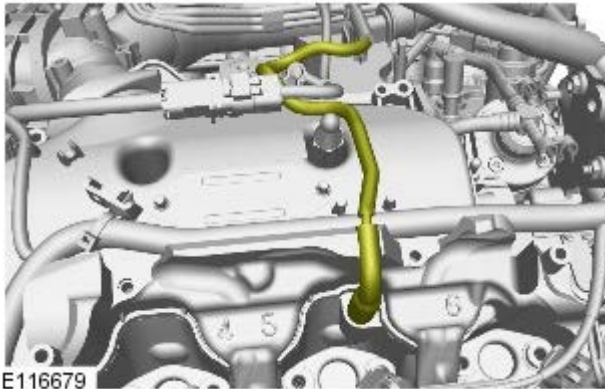
Engine - TDV6 3.0L Diesel - Valve Cover LH

Removal and Installation

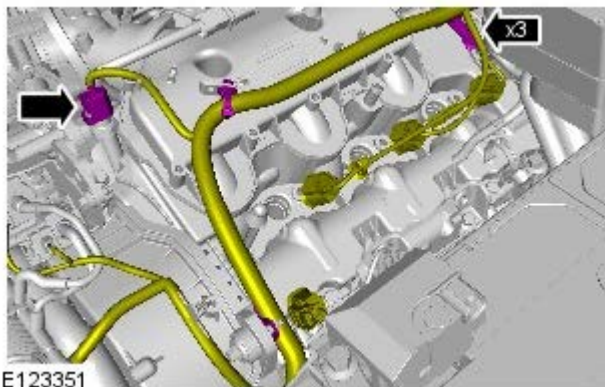
Removal

1. Refer to: Specifications (414-00, Specifications).
2. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).
3. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
4. Refer to: Accessory Drive Belt (303-05, Removal and Installation).
5. Refer to: Fuel Rail LH (303-04, Removal and Installation).
6. Refer to: Intake Air Shutoff Throttle (303-04, Removal and Installation).
7. Refer to: Timing Cover (303-01, Removal and Installation).
8. Refer to: Fuel Injector (303-04, Removal and Installation).

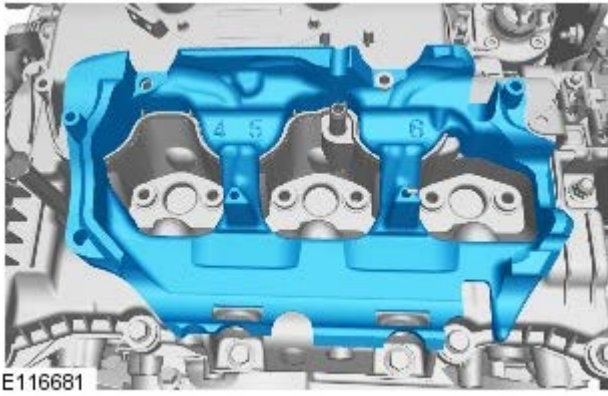
9.



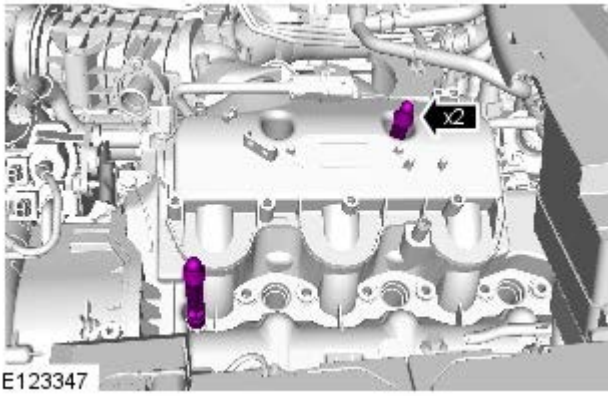
10.



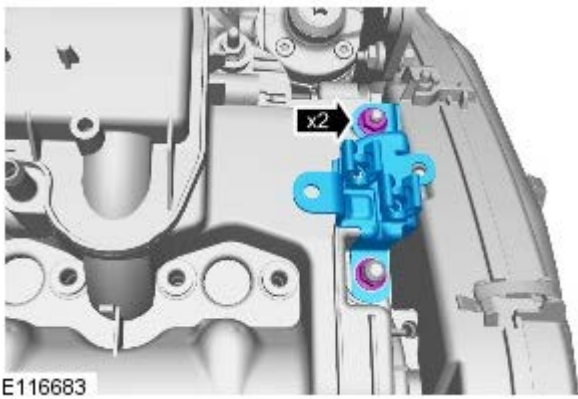
11.



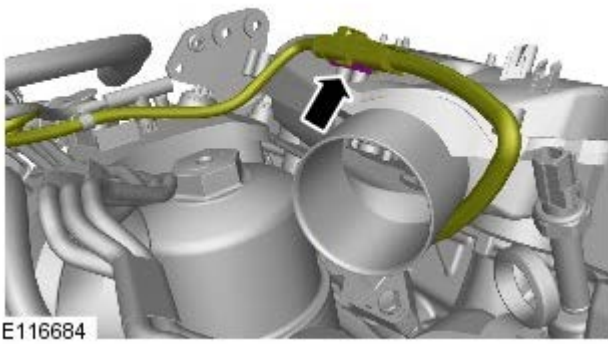
12.



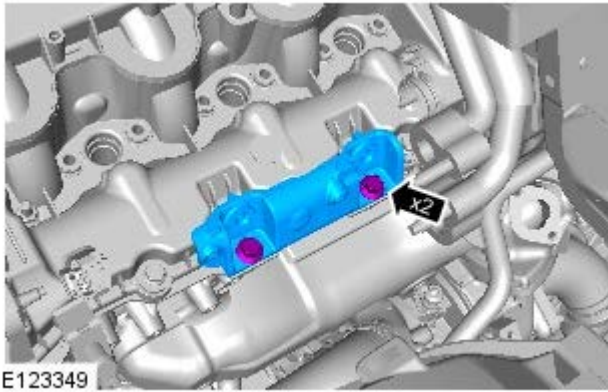
13.



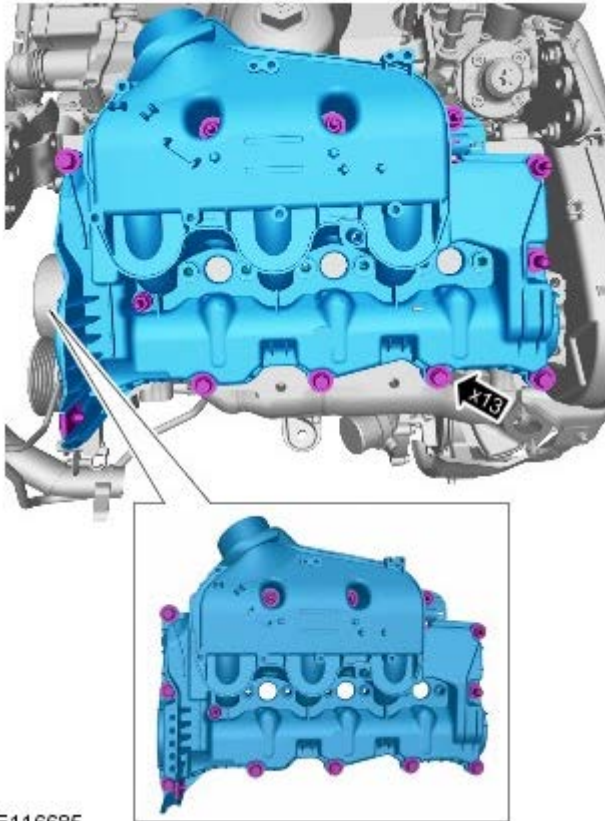
14.



15.




E123349





E116685

Installation


16.  CAUTION: Make sure that the mating faces are clean and free of corrosion and foreign material.

NOTES:

 Discard the gasket.

 Some variation in the illustrations may occur, but the essential information is always correct.

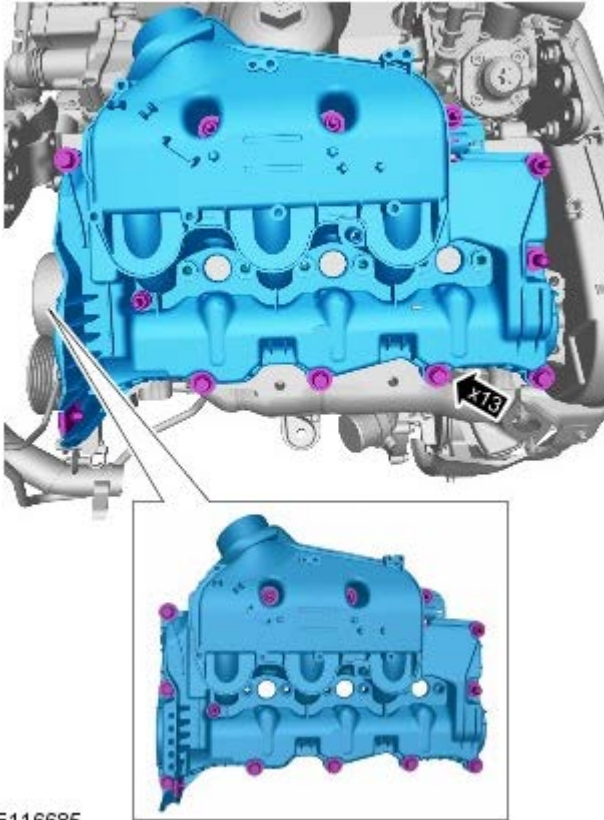
1. CAUTIONS:

 Make sure that the mating faces are clean and free of corrosion and foreign material.

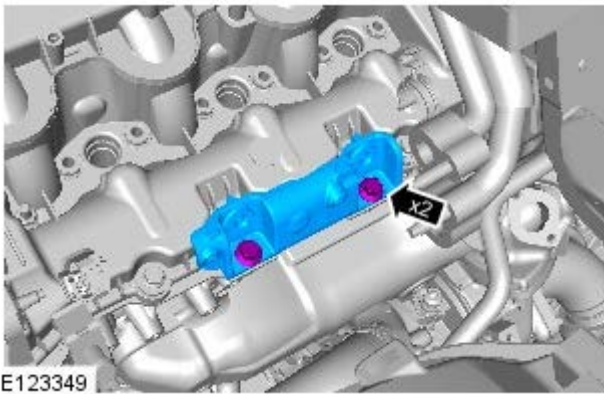
 Install all the bolts finger tight before final tightening.

 NOTE: Install a new gasket.

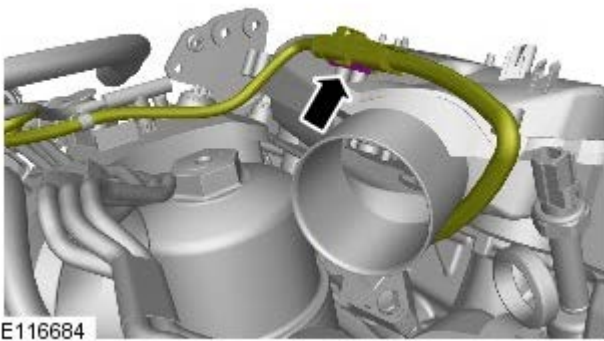
Torque: 10 Nm



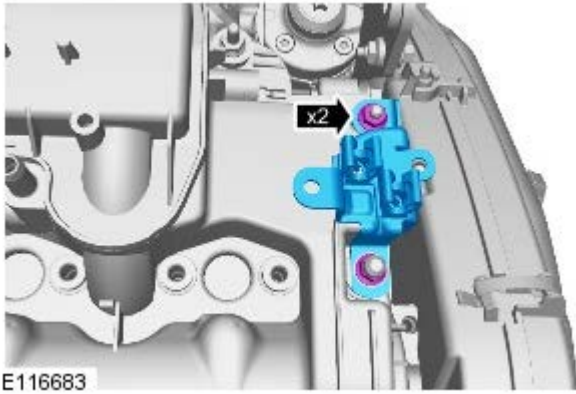
2. Torque: 23 Nm



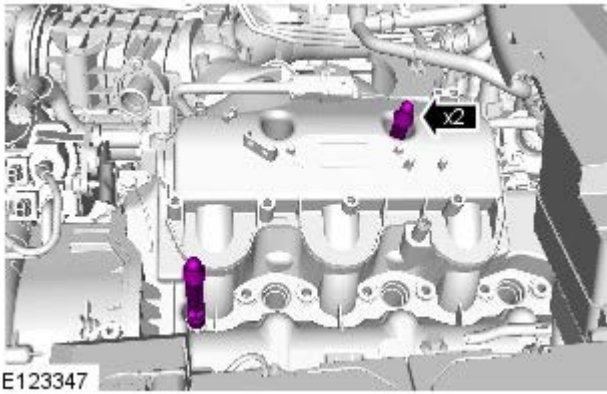
3.



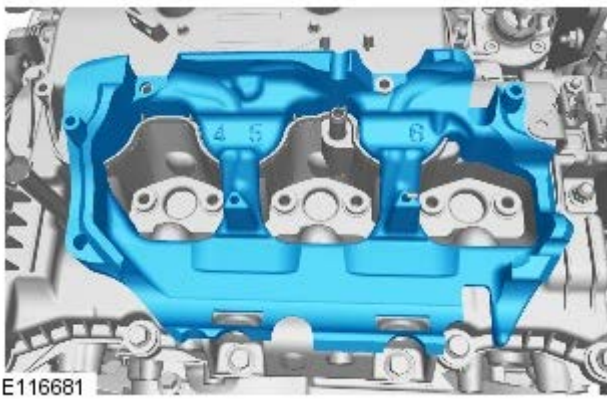
4. Torque: 10 Nm



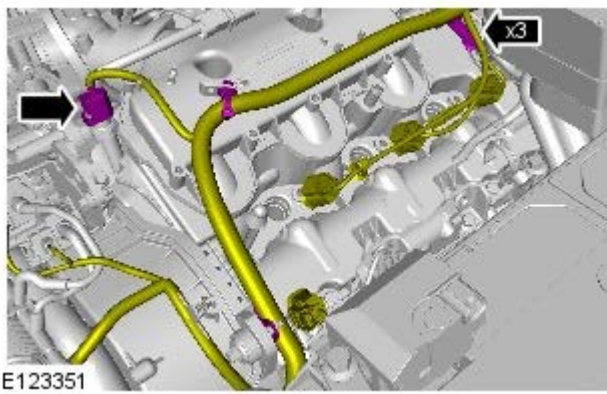
5. Torque: 5 Nm



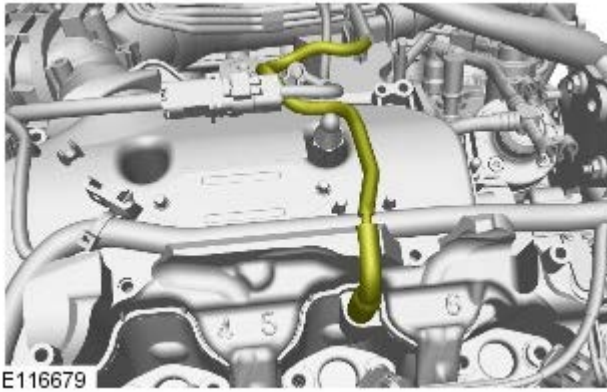
6.



7.



8.



9. Refer to: Fuel Injector (303-04, Removal and Installation).
10. Refer to: Timing Cover (303-01, Removal and Installation).
11. Refer to: Intake Air Shutoff Throttle (303-04, Removal and Installation).
12. Refer to: Fuel Rail LH (303-04, Removal and Installation).
13. Refer to: Accessory Drive Belt (303-05, Removal and Installation).
14. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
15. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).
16. Refer to: Specifications (414-00, Specifications).

Engine - TDV6 3.0L Diesel - Valve Cover RH

Removal and Installation

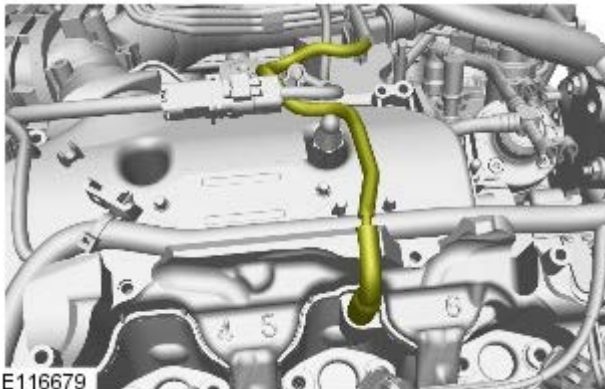
Removal



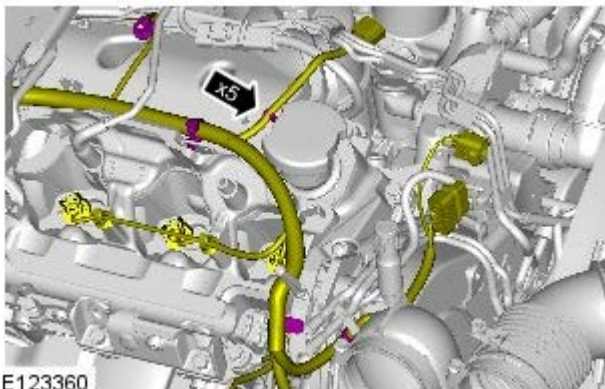
NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Specifications (414-00, Specifications).
2. Refer to: Accessory Drive Belt (303-05, Removal and Installation).
3. Refer to: Fuel Rail RH (303-04, Removal and Installation).
4. Refer to: Intake Air Shutoff Throttle (303-04, Removal and Installation).
5. Refer to: Timing Cover (303-01, Removal and Installation).
6. Refer to: Fuel Injectors RH (303-04, Removal and Installation).

7.



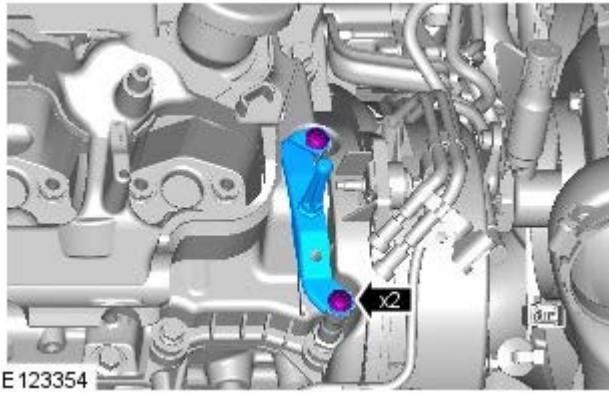
8.



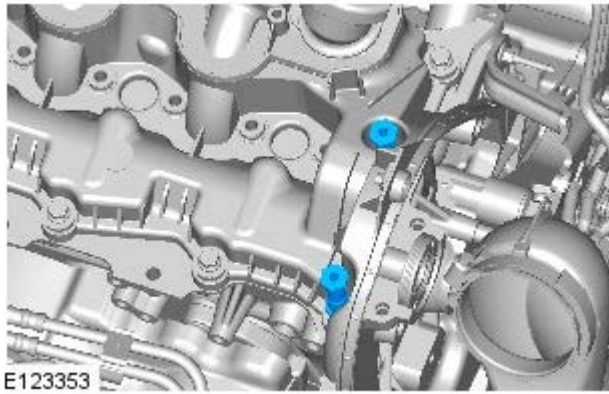
9.



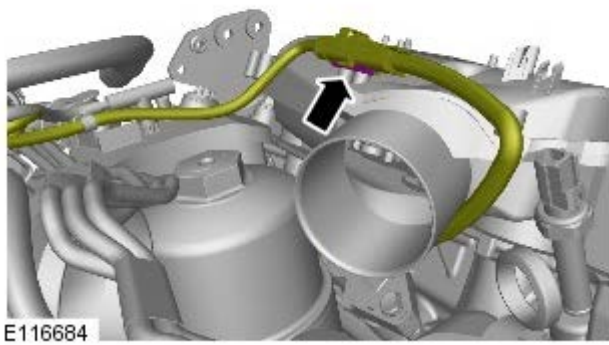
10.



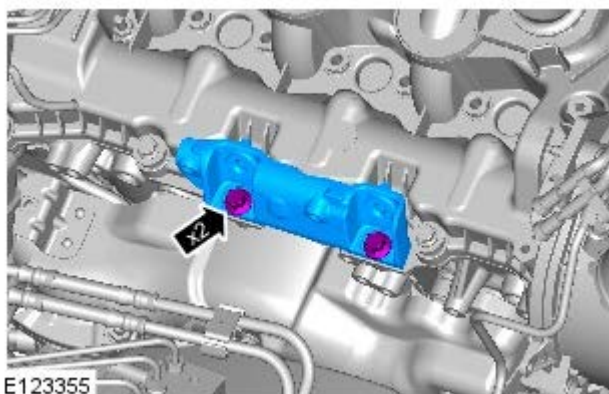
11.




12.

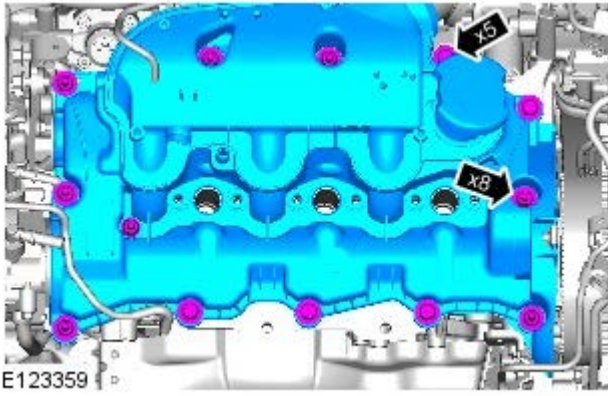


13.



14.  CAUTION: Make sure that the mating faces are clean and free of corrosion and foreign material.


 NOTE: Discard the gasket.



Installation



1. CAUTIONS:

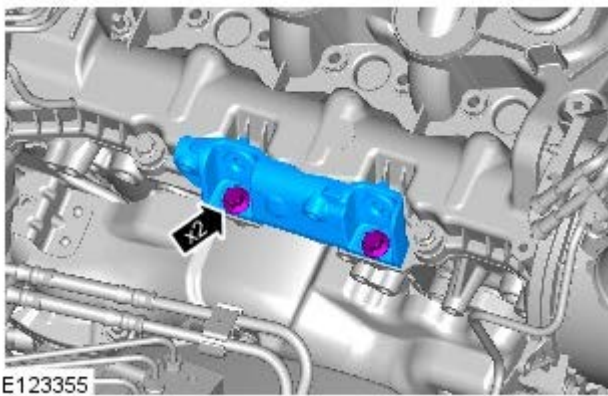
 Make sure that the mating faces are clean and free of corrosion and foreign material.

 Install all the bolts finger tight before final tightening.

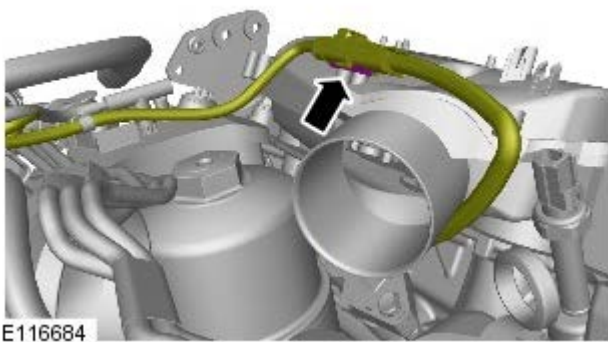
 NOTE: Install a new gasket.

Torque: 10 Nm

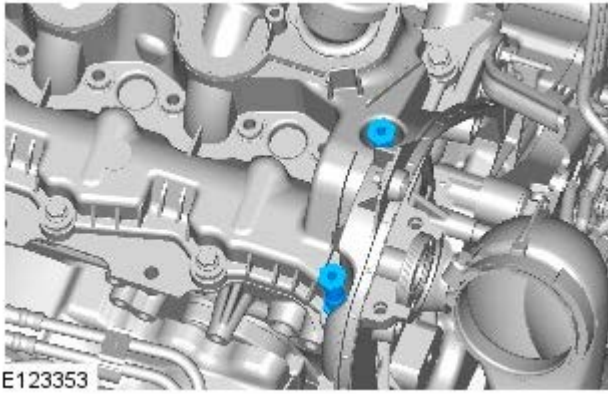
2. Torque: 23 Nm



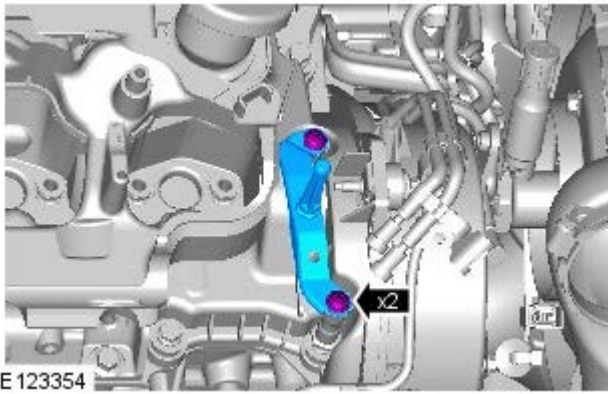
3.



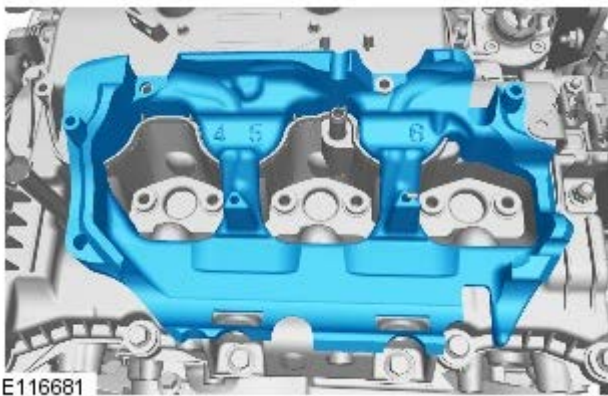
4. Torque: 7 Nm



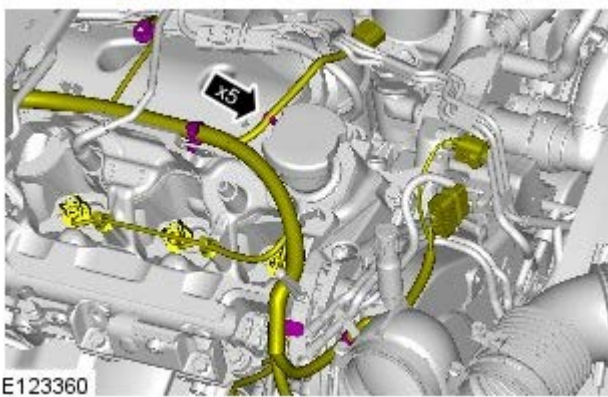
5. Torque: 7 Nm



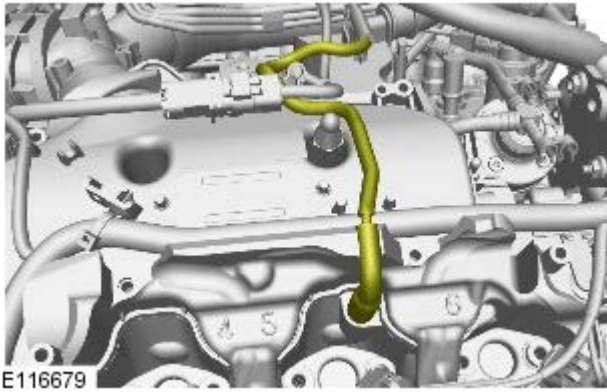
6.



7.



8.

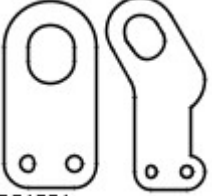



9. Refer to: Fuel Injectors RH (303-04, Removal and Installation).
10. Refer to: Timing Cover (303-01, Removal and Installation).
11. Refer to: Intake Air Shutoff Throttle (303-04, Removal and Installation).
12. Refer to: Fuel Rail RH (303-04, Removal and Installation).
13. Refer to: Accessory Drive Belt (303-05, Removal and Installation).
14. Refer to: Specifications (414-00, Specifications).

Engine - TDV6 3.0L Diesel - Engine

Removal

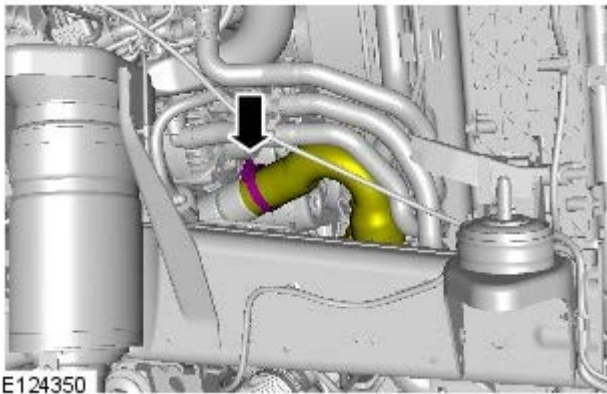
Special Tool(s)


 <p>E54554</p>	<p>303-1129 Engine Lifting Brackets</p>
 <p>E116925</p>	<p>303-1497 Left-Hand Rear Engine Lifting Bracket</p>




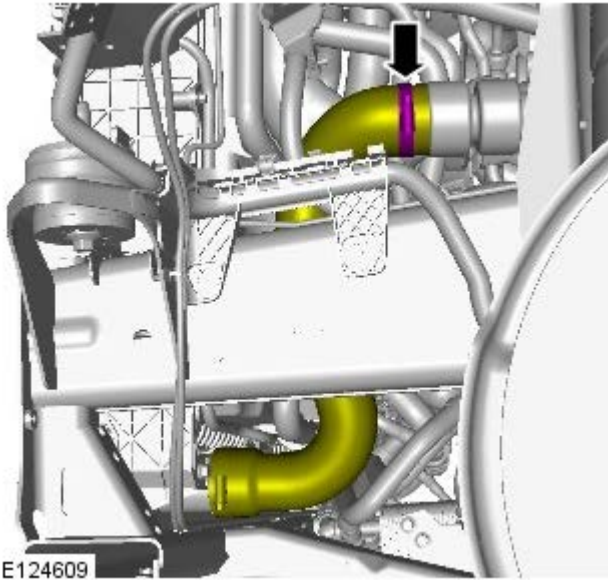
NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Body - TDV6 2.7L Diesel/TDV6 3.0L Diesel (502-02 Full Frame and Body Mounting, Removal and Installation).
2. Refer to: Cooling Fan (303-03 Engine Cooling - TDV6 3.0L Diesel, Removal and Installation).

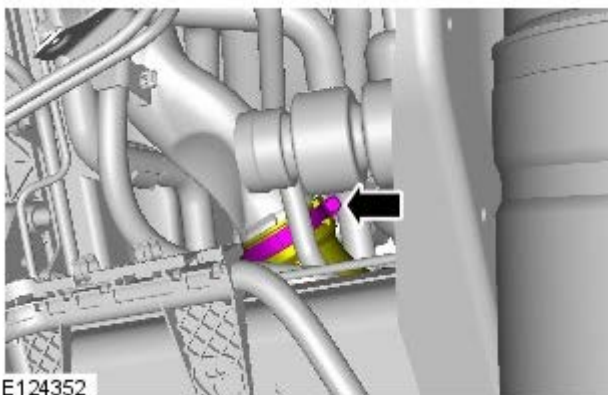


3.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

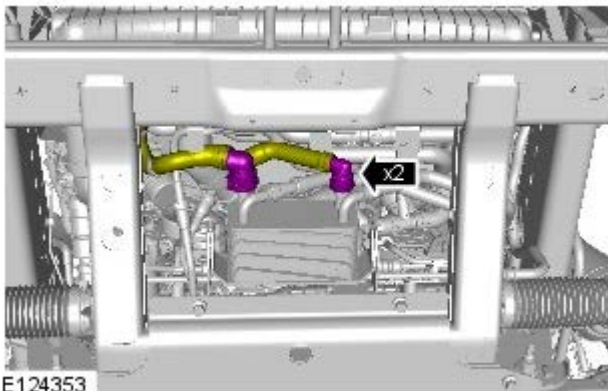
4.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.



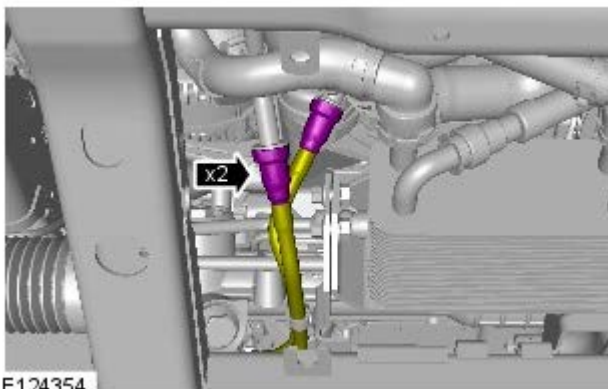
E124609




E124352





E124353




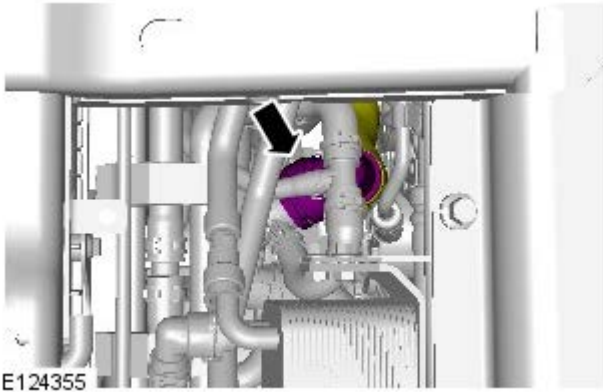
E124354

5.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

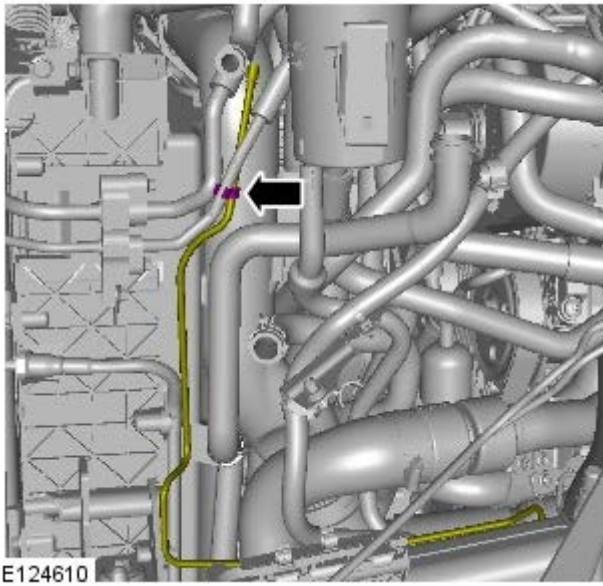
6.  CAUTION: Be prepared to collect escaping coolant.

7.  CAUTION: Be prepared to collect escaping coolant.

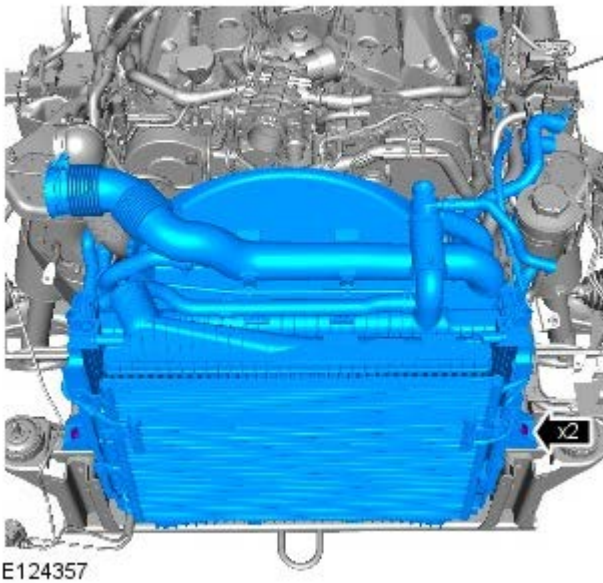
8.  CAUTION: Be prepared to collect escaping coolant.



9.




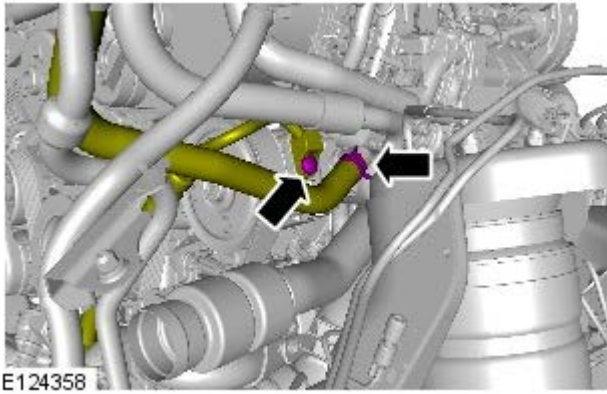
10.



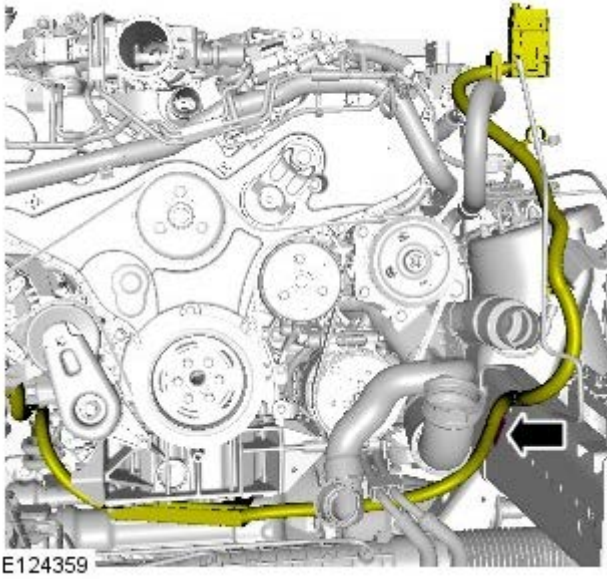
11. CAUTIONS:

 Be prepared to collect escaping fluids.

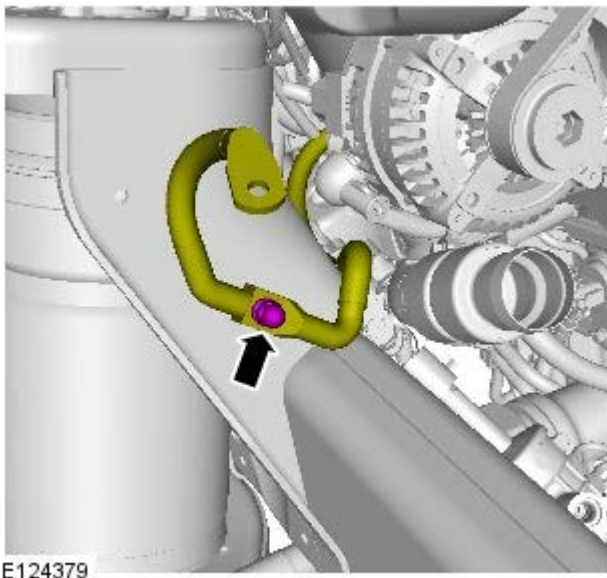
 Make sure that all openings are sealed. Use new blanking caps.



12.

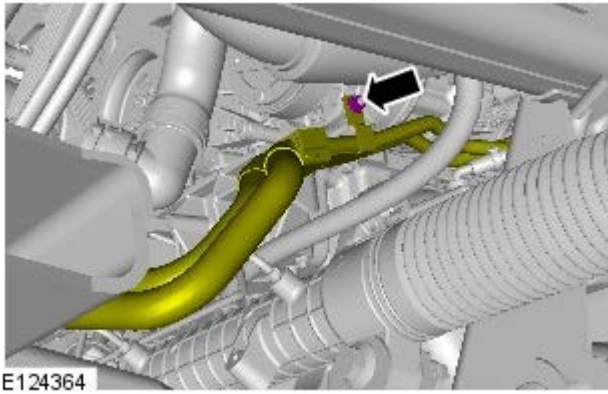


13.

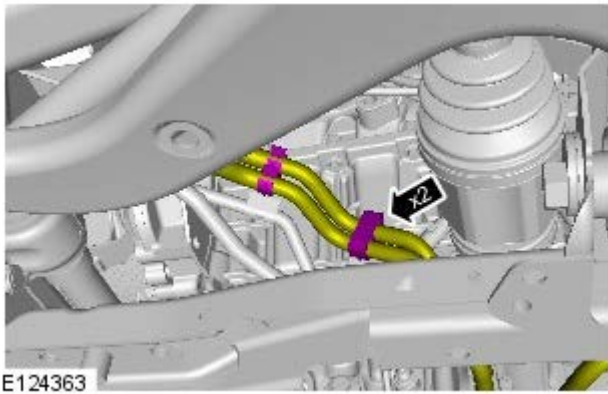


14. Refer to: Starter Motor (303-06 Starting System - TDV6 3.0L Diesel, Removal and Installation).

15.

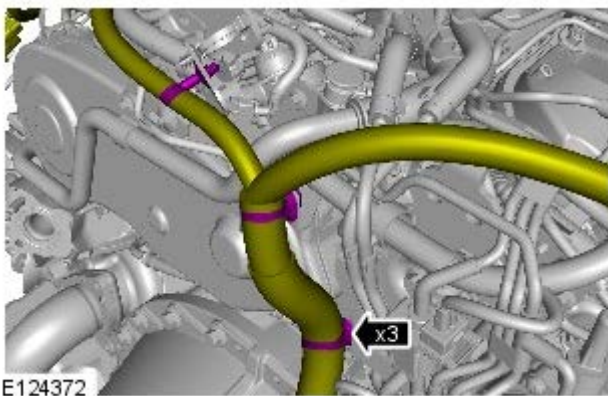


16.

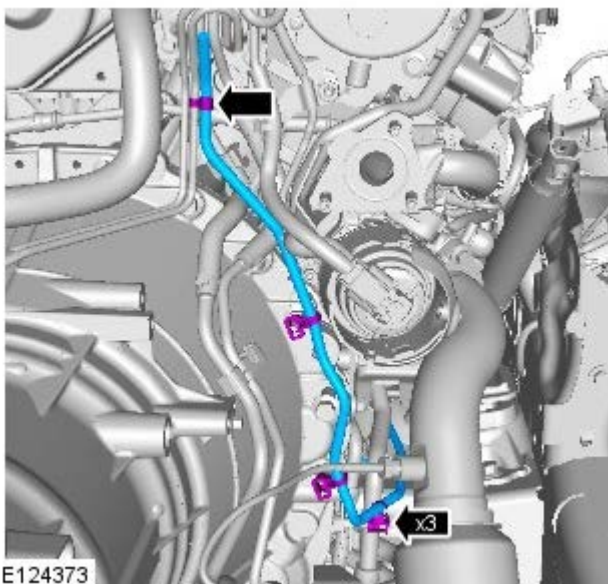


17. Refer to: Exhaust Manifold Crossover Pipe (303-01 Engine - TDV6 3.0L Diesel, Removal and Installation).

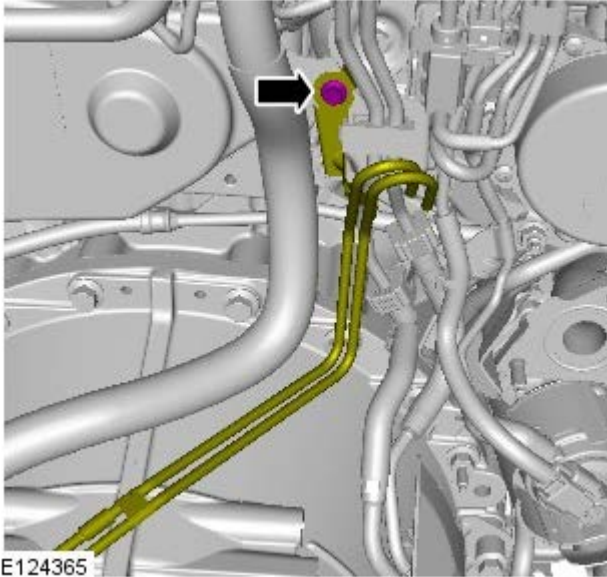
18.



19.




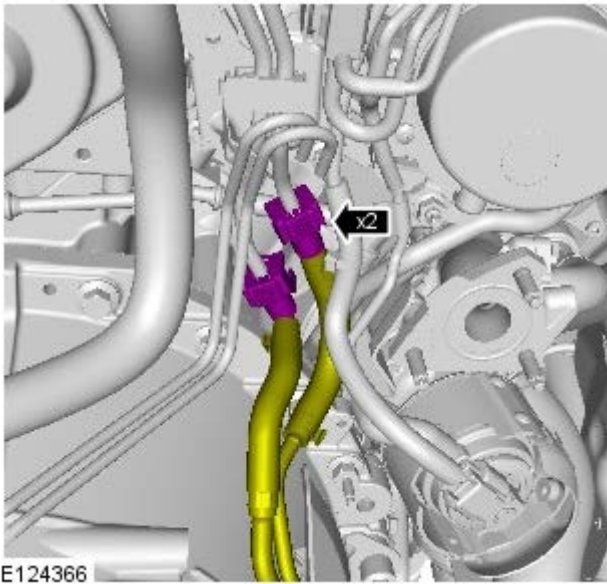
20.



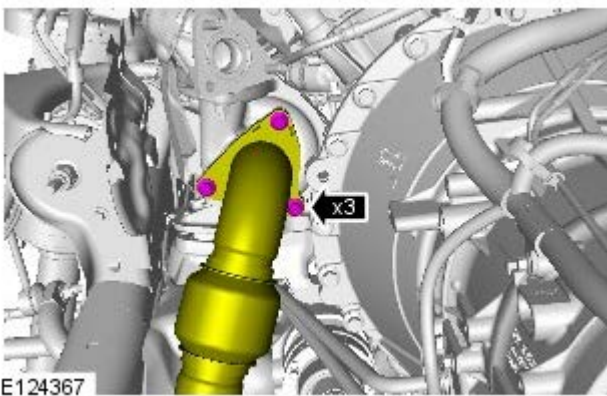
21. CAUTIONS:

 Be prepared to collect escaping fuel.

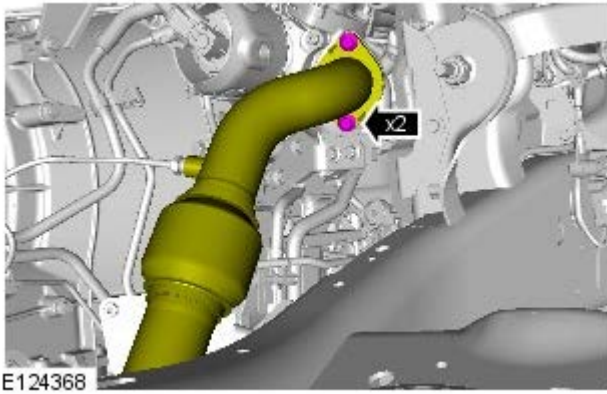
 Make sure that all openings are sealed. Use new blanking caps.



22.  NOTE: Remove and discard the gasket.

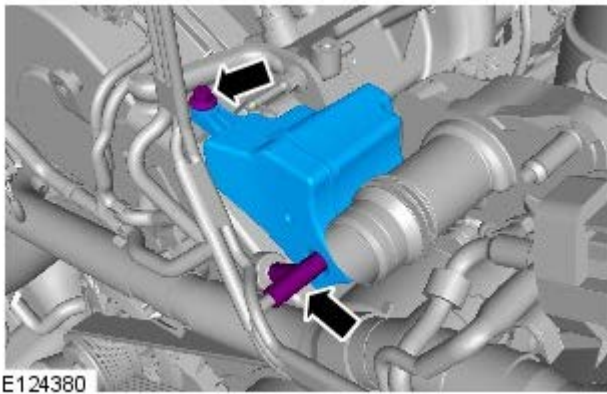


23.  NOTE: Remove and discard the gasket.

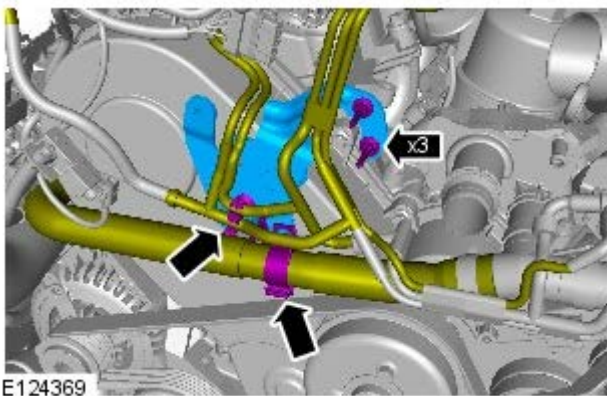


24. Refer to: Intake Air Shutoff Throttle (303-04 Fuel Charging and Controls - TDV6 3.0L Diesel, Removal and Installation).

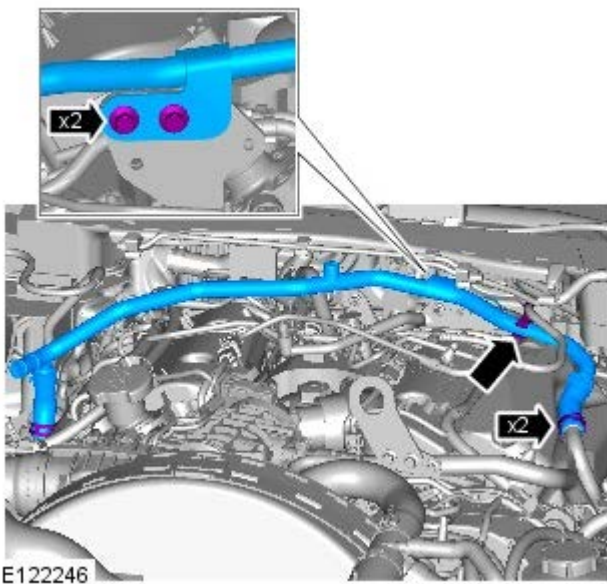
25.



26.



27.  CAUTION: Make sure that all openings are sealed.

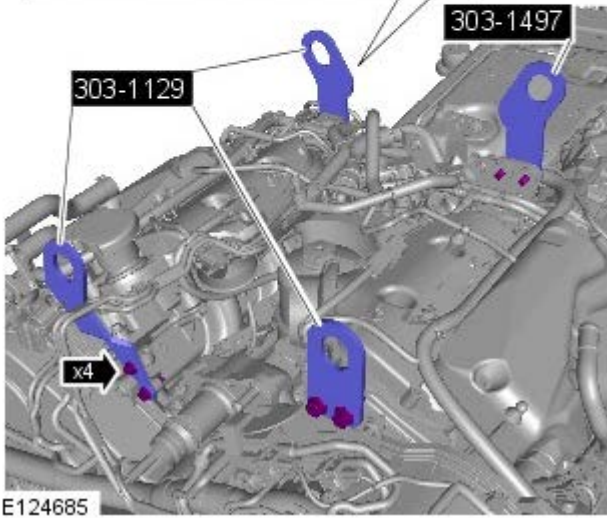
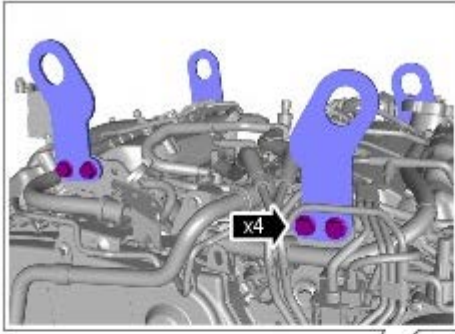


28. *Special Tool(s)*: [303-1129](#), [303-1497](#)

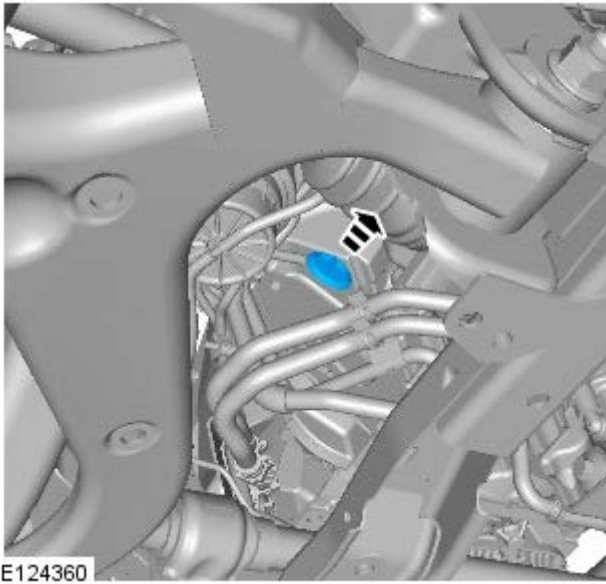
Torque:

M6 bolts 8 Nm

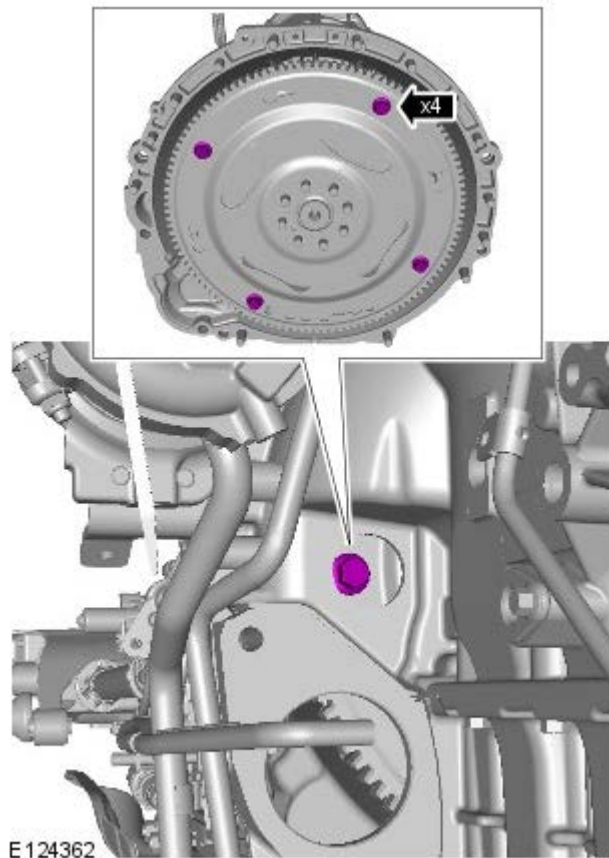
M8 bolts 22 Nm



29.

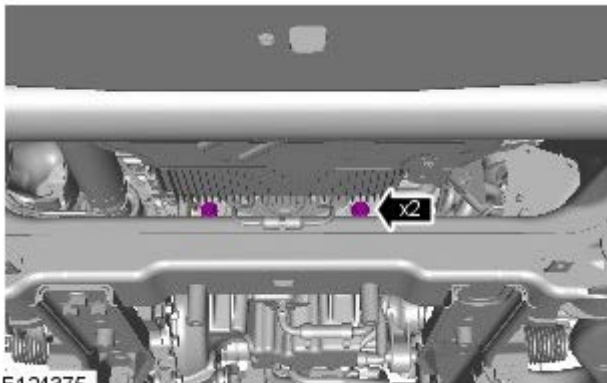


30.  CAUTION: Discard the bolts.



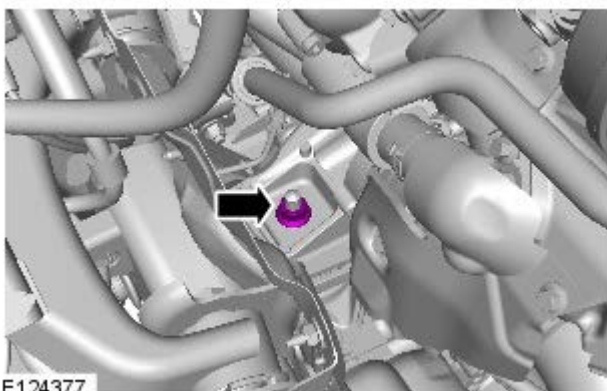
E124362

31.



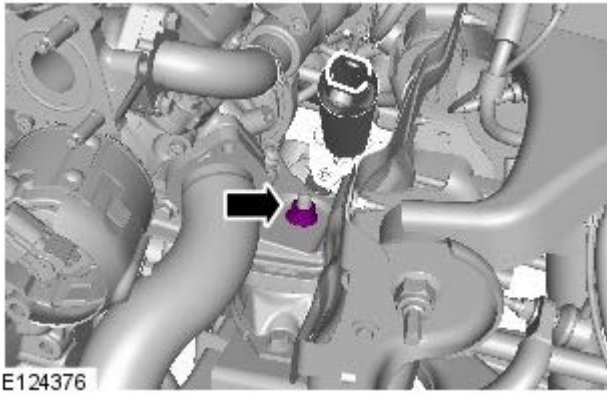
E124375

32.

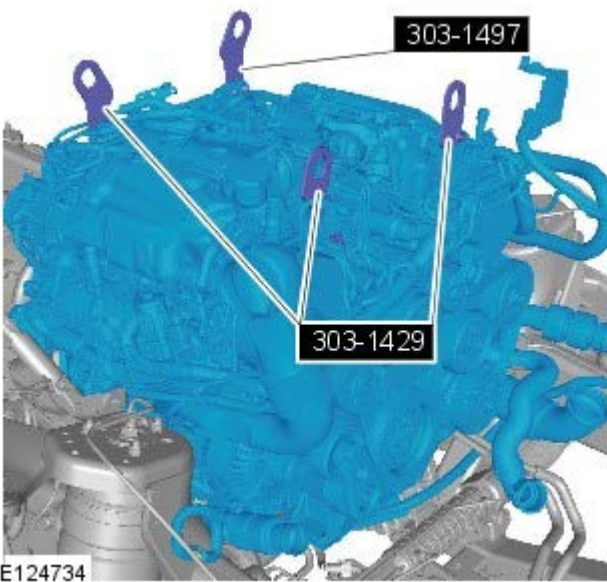
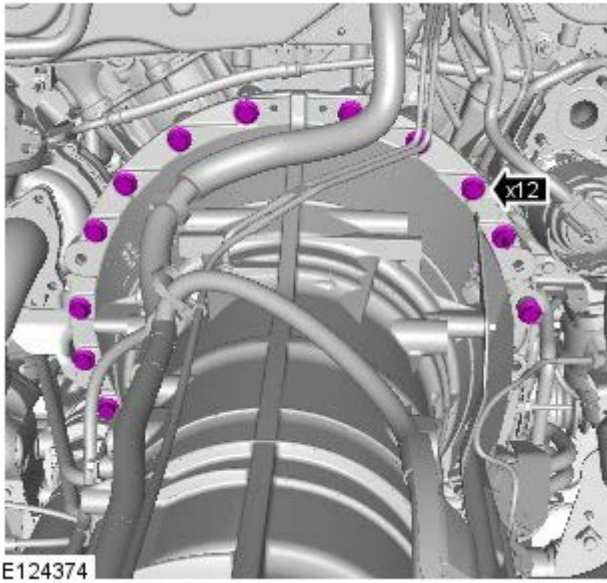


E124377

33.




34. Using a suitable tool, support the transmission.



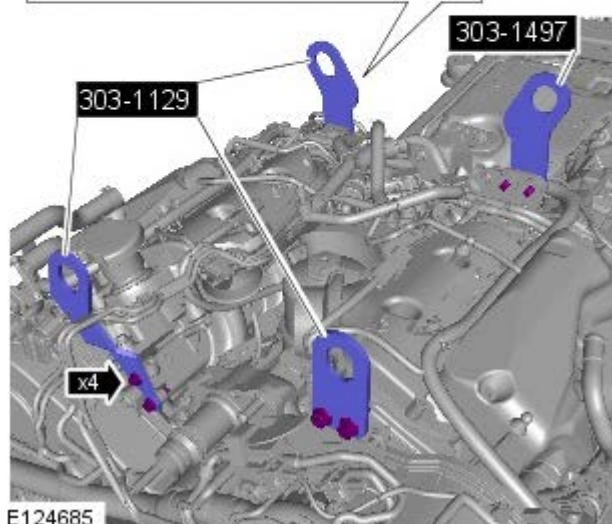
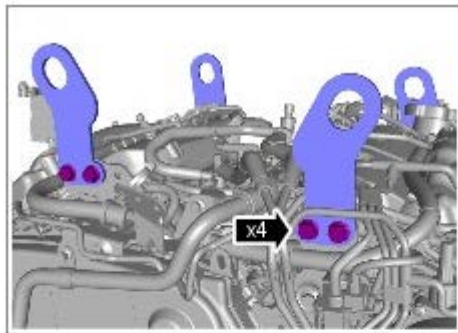
35. NOTES:

 Note the routing of the battery positive cable.

 Note the routing of the transmission wiring harness.

 This step requires the aid of another technician.

36. *Special Tool(s):* [303-1129](#), [303-1497](#)

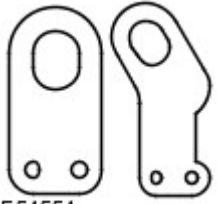



E124685

Engine - TDV6 3.0L Diesel - Engine

Installation

Special Tool(s)

 <p>E54554</p>	<p>303-1129 Engine Lifting Brackets</p>
 <p>E116925</p>	<p>303-1497 Left-Hand Rear Engine Lifting Bracket</p>

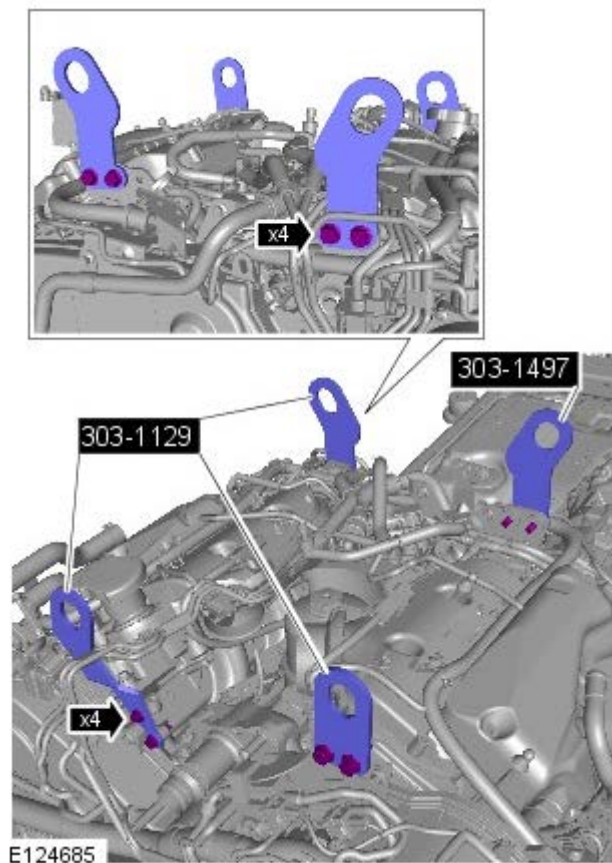


NOTE: Some variation in the illustrations may occur, but the essential information is always correct.


1. *Special Tool(s):* [303-1129](#), [303-1497](#)


Torque:

M6 bolts 8 Nm
M8 bolts 22 Nm

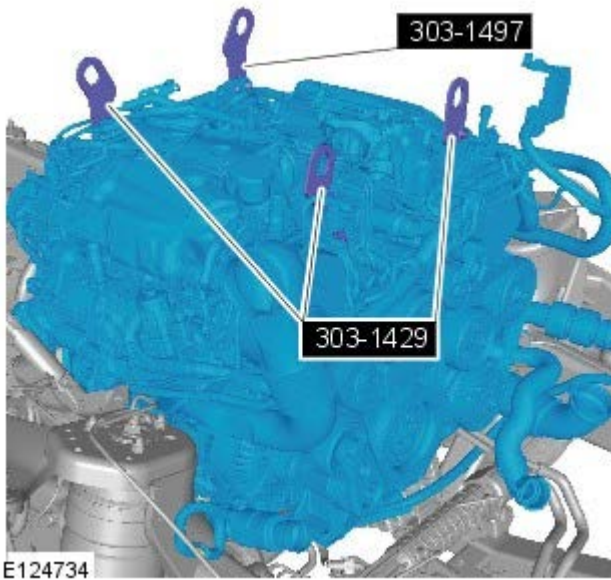


2. CAUTIONS:

 Apply grease of the correct specification to the torque converter spigot.

 Make sure the torque converter is fully located into the oil pump drive.

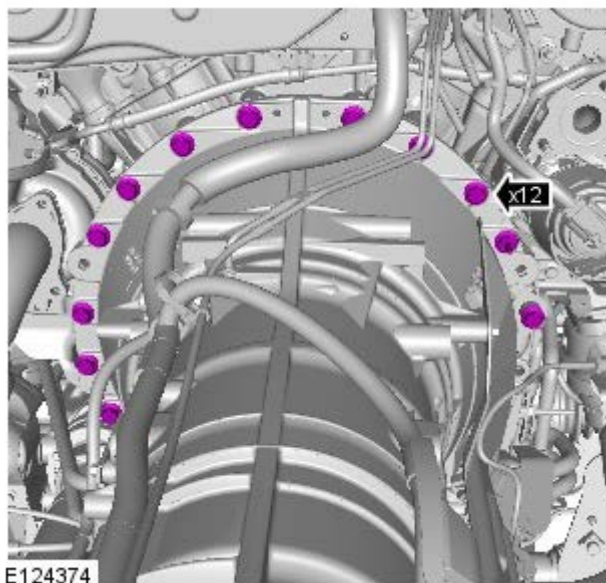
 Make sure that the mating faces are clean




and free of foreign material.

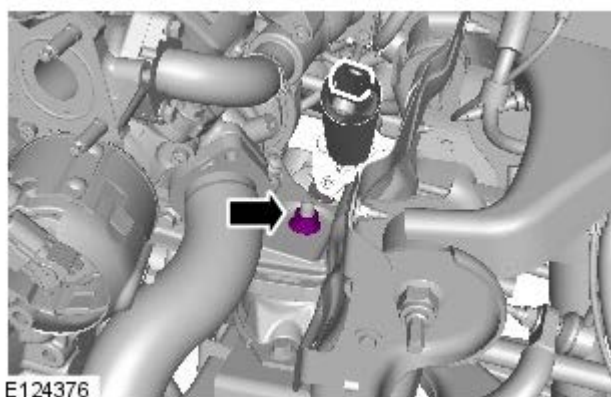


NOTE: This step requires the aid of another technician.



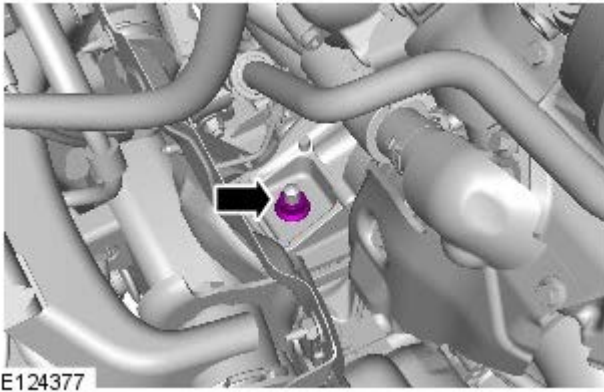
3.  CAUTION: Make sure the torque converter remains connected to the transmission.

Torque: 40 Nm

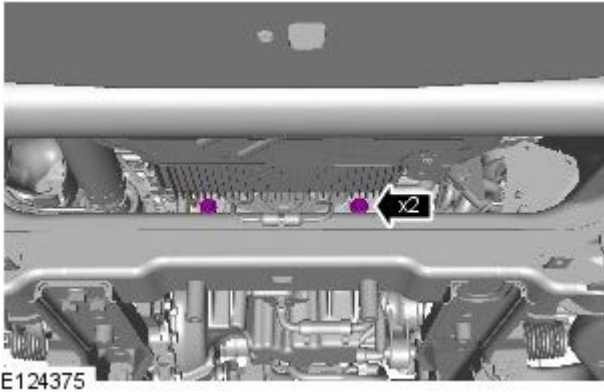


4. Torque: 90 Nm



5. Torque: 90 Nm



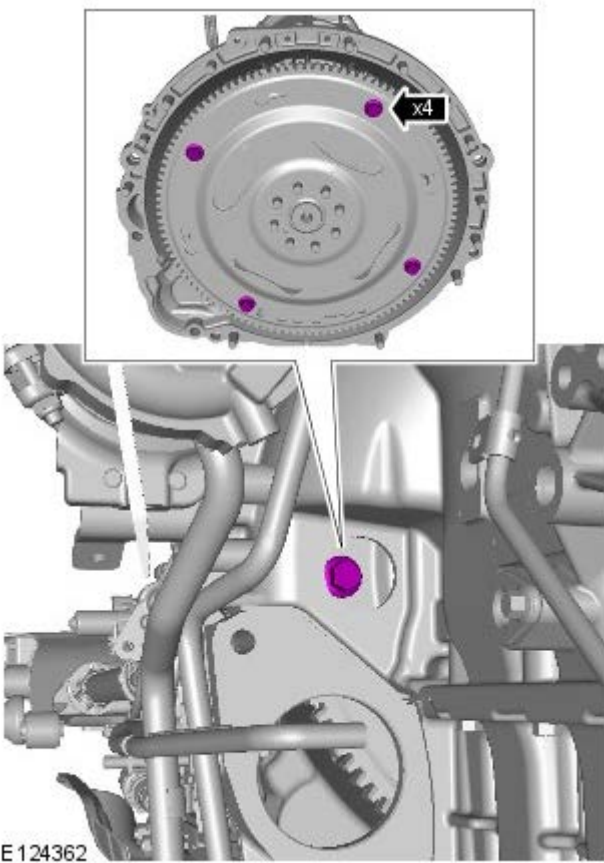
6. Torque: 40 Nm



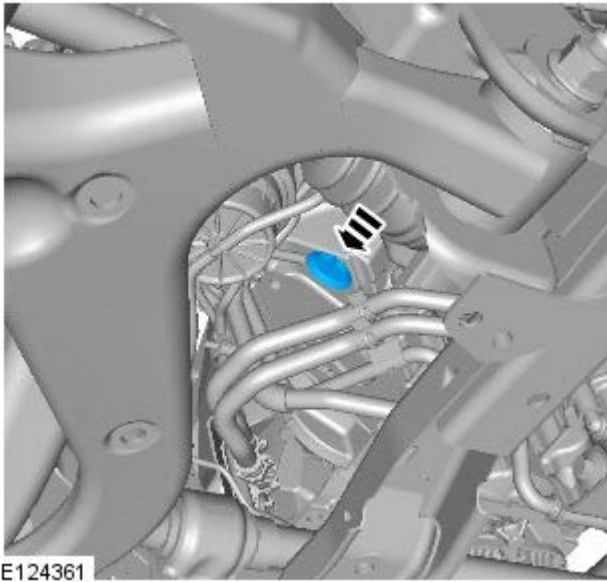
7. CAUTIONS:

-  Only rotate the crankshaft clockwise.
-  Make sure that new bolts are installed.

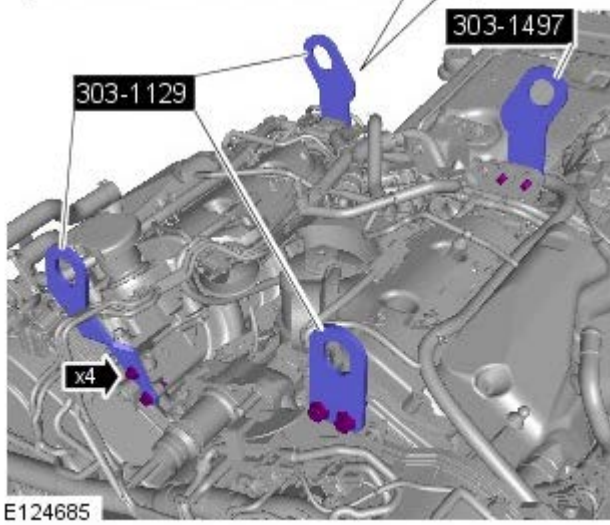
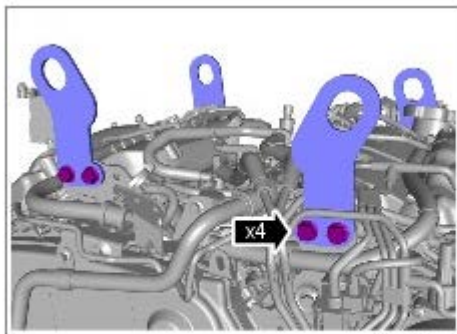
Torque: 63 Nm




8.

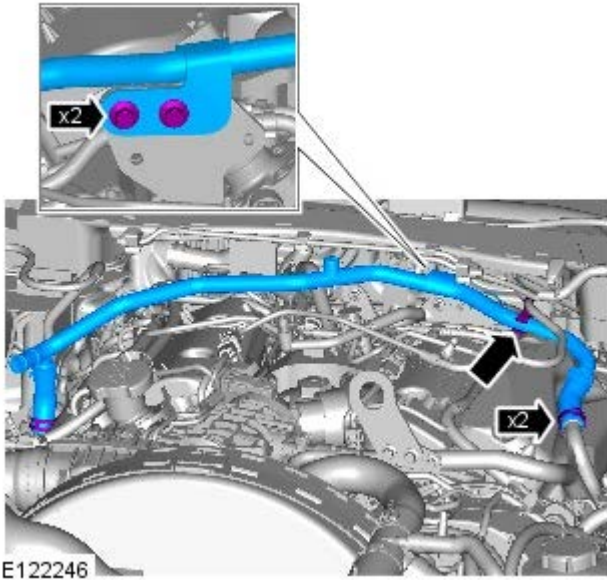


9. *Special Tool(s):* [303-1129](#), [303-1497](#)

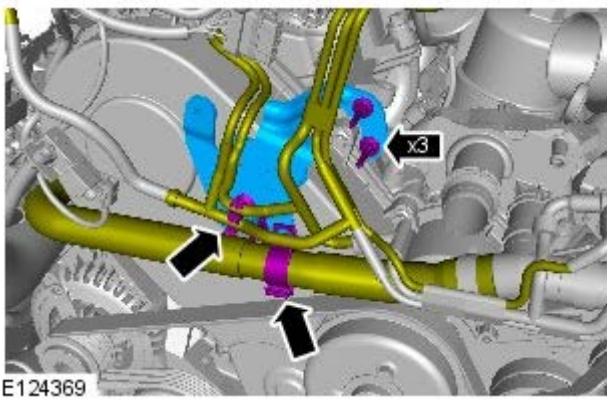


10.  **NOTE:** Remove and discard the blanking caps.

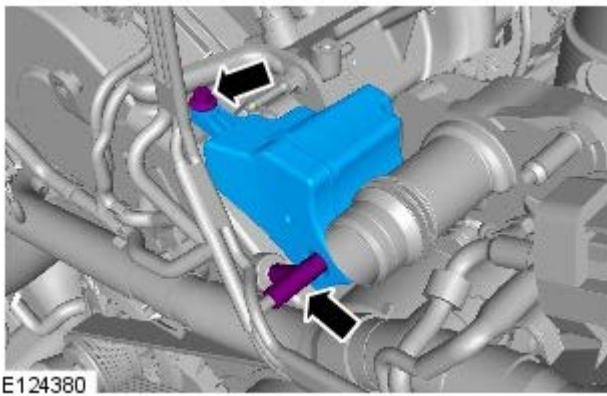
Torque: 10 Nm



11. Torque: 8 Nm




12. Torque: 8 Nm




13. Refer to: Intake Air Shutoff Throttle (303-04 Fuel Charging and Controls - TDV6 3.0L Diesel, Removal and Installation).

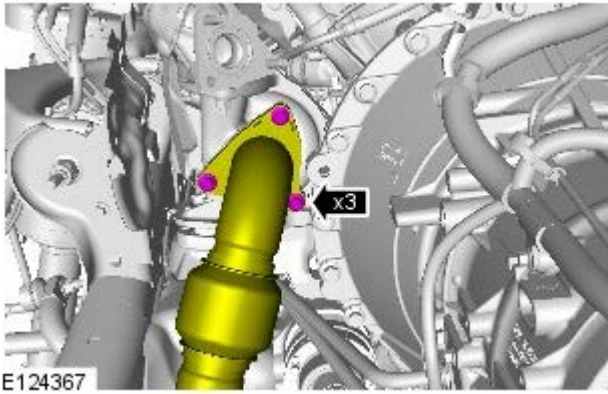


14. NOTES:


 Make sure that all the component mating faces are clean.


 Install a new gasket.

Torque: 28 Nm

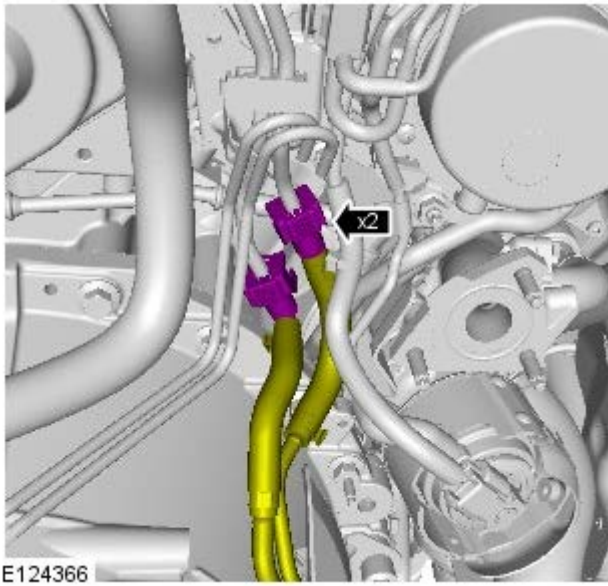



15. NOTES:

 Make sure that all the component mating faces are clean.

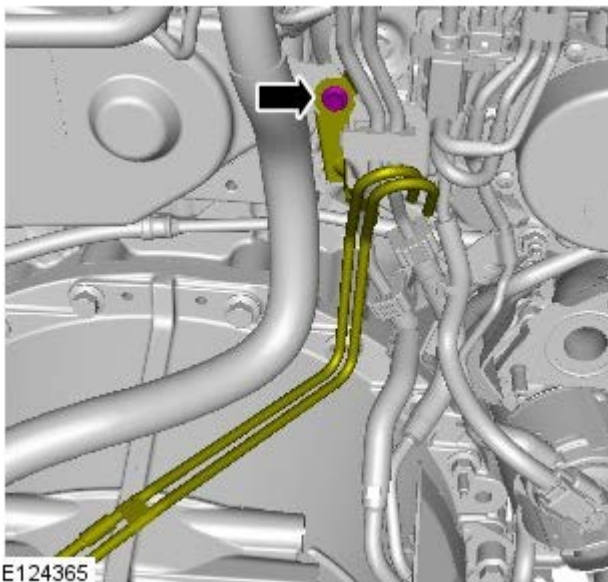
 Install a new gasket.

Torque: 28 Nm

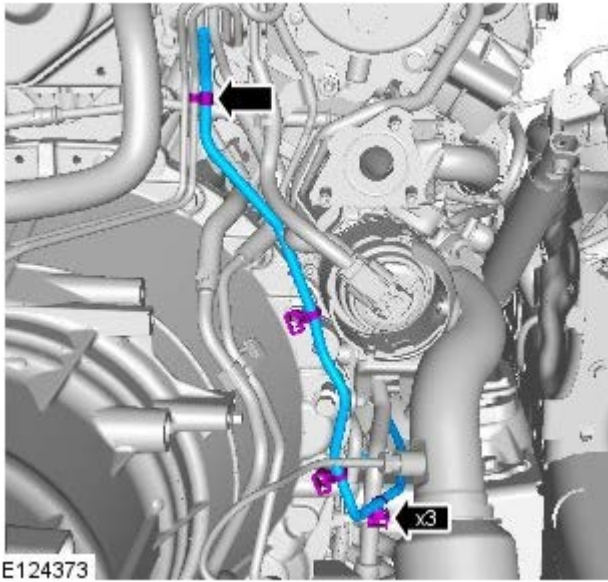


16.  NOTE: Remove and discard the blanking caps.

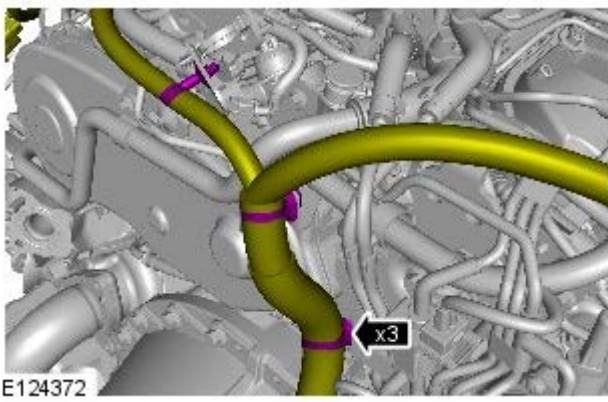
17. Torque: 7 Nm



18.

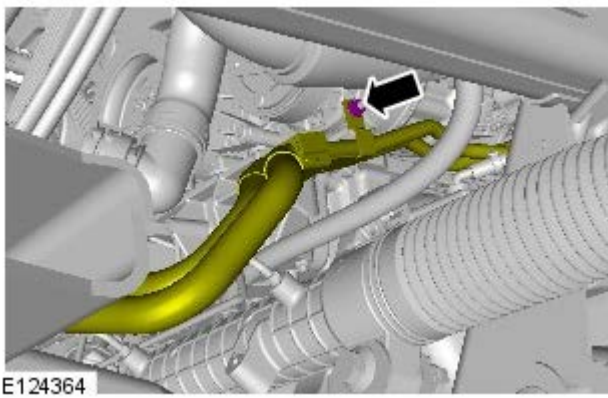


19.

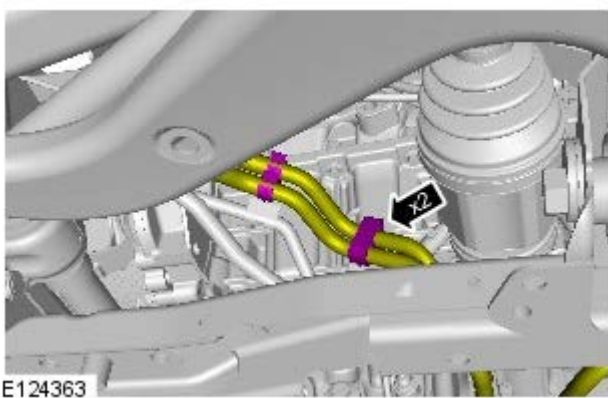


20. Refer to: Exhaust Manifold Crossover Pipe (303-01 Engine - TDV6 3.0L Diesel, Removal and Installation).

21. Torque: 10 Nm

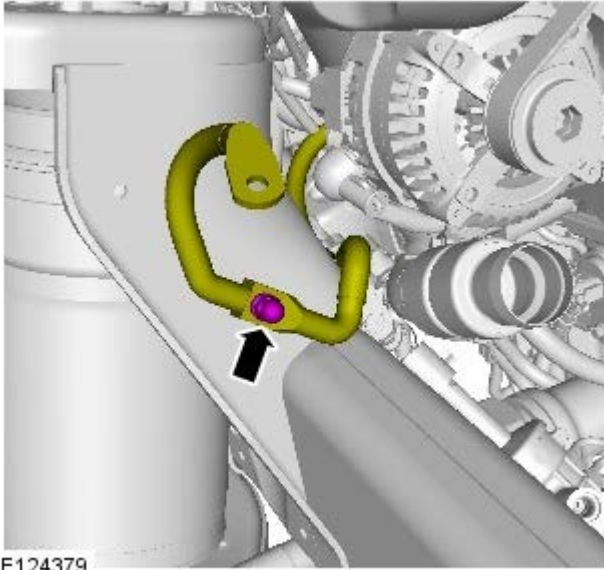


22.



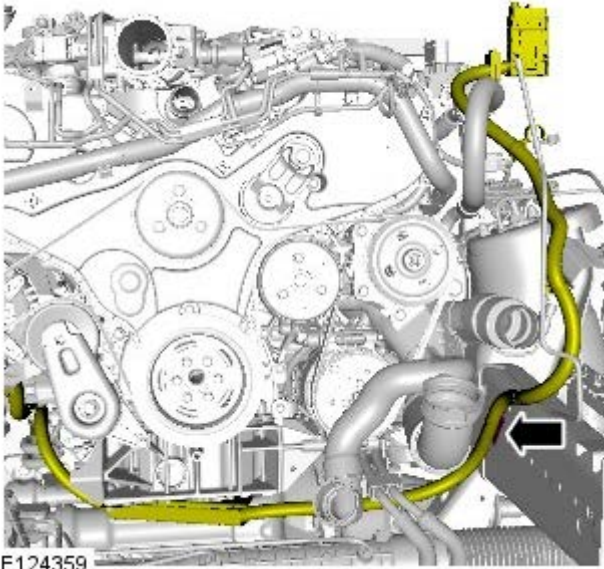
23. Refer to: Starter Motor (303-06 Starting System - TDV6 3.0L Diesel, Removal and Installation).

24. Torque: 22 Nm




E124379

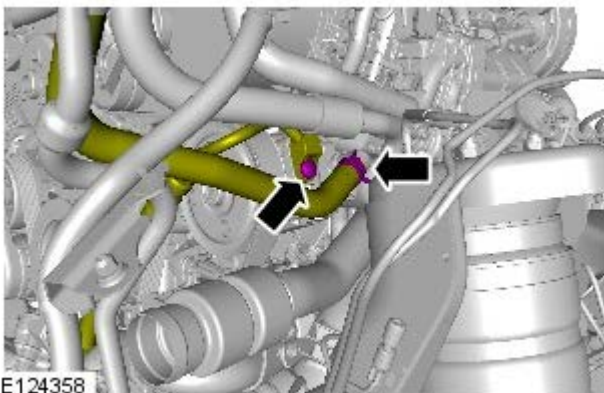
25.



E124359

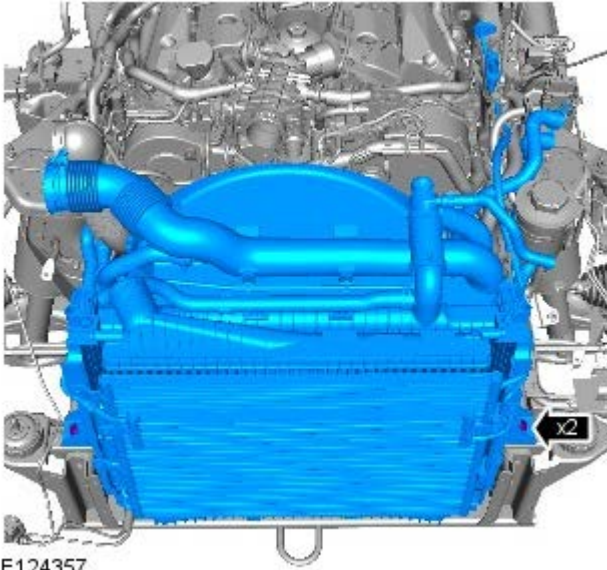
26.  NOTE: Remove and discard the blanking caps.

Torque: 25 Nm



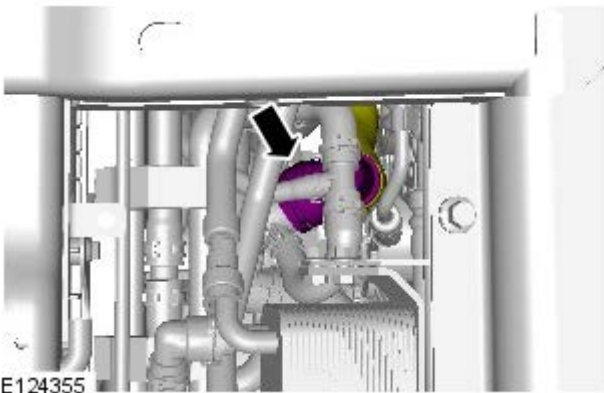
E124358

27. Torque: 15 Nm



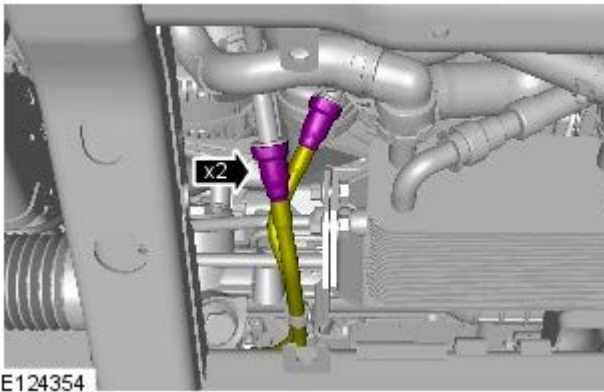
E124357

28.



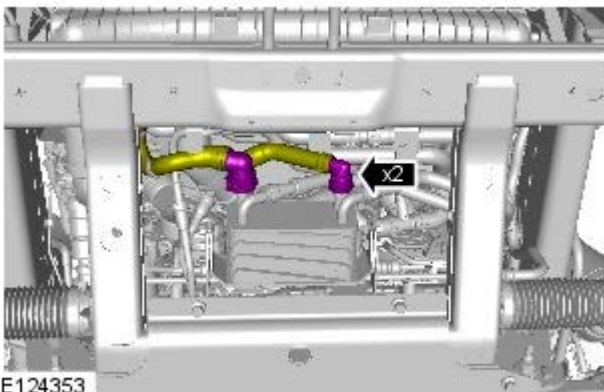
E124355

29.




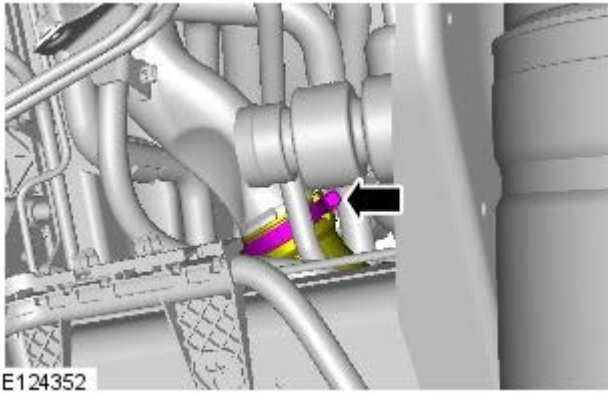
E124354

30.

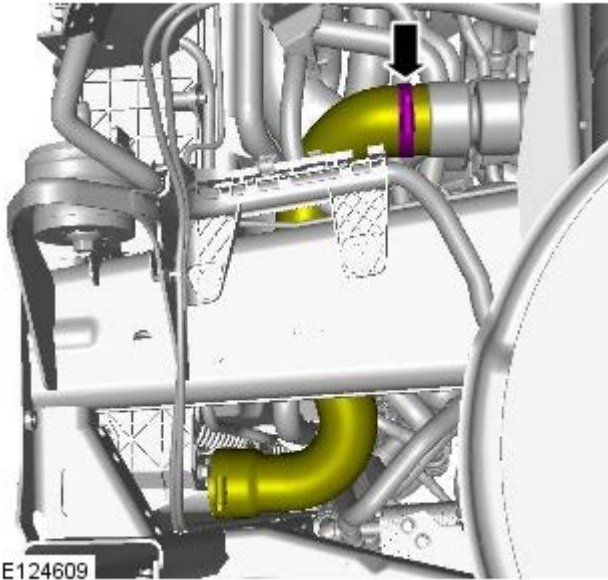



E124353

31.  NOTE: Remove and discard the blanking

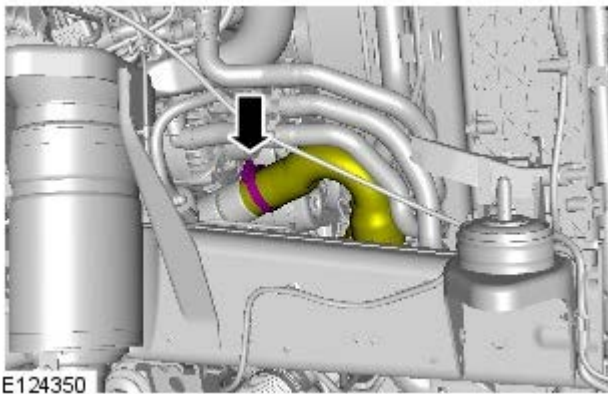



caps.



32.  NOTE: Remove and discard the blanking caps.

Torque: 5 Nm



33.  NOTE: Remove and discard the blanking caps.

Torque: 5 Nm

34. Refer to: Cooling Fan (303-03 Engine Cooling - TDV6 3.0L Diesel, Removal and Installation).
35. Refer to: Body - TDV6 2.7L Diesel/TDV6 3.0L Diesel (502-02 Full Frame and Body Mounting, Removal and Installation).
36. Refer to: Power Steering System Filling and Bleeding (211-00 Steering System - General Information, General Procedures).

Engine - V6 S/C 3.0L Petrol -**Engine Data**

Engine Description	Engine Capacity	Maximum Engine Torque (EEC) (SAE)	Maximum Engine Power (EEC) (SAE)	Compression Ratio	Bore	Stroke
• 90° "Vee" • 6 Cylinder • 24 Valves	2.995 ccm	450 Nm at 3.500 - 5.000 RPM	250 kW at 6.500 RPM	10.5 ± 0.50	84.5 ± 0.000 mm	89 ± 0.0 mm

Engine Firing Order

Firing Order
1:4:2:5:3:6

Engine Valve Clearance (cold)

Intake Valve (mm)	Exhaust Valve (mm)
0.18 - 0.22	0.23 - 0.27

Spark Plugs

Specification	Spark Plug Gap
SILZKAR7C-10S	0.9 - 1.0 mm

Lubricants, Fluids, Sealers and Adhesives

Description	Specification
Engine Oil	SAE 5W20 WSS-M2C925-A
Sealant	WSE-M4G323-A6
Core plug and stub pipe retainer	WSK-M2G349-A7
Jaguar Premium Cooling System Fluid	WSS-M97B44-D

Capacities

Description	Litres
Engine oil, initial fill	9.5
Engine oil, service fill with oil filter change	8.0
Engine oil, service fill without oil filter change	7.5

Cylinder Head and Valve Train

Item	Specification
Cylinder head maximum permitted warp (mm) (flatness specification)	
overall	0.08
over 150x150 mm area	0.05
over 25x25 mm area	0.02
Valve guide inner diameter (mm)	5.51 ± 0.01
Intake valve effective length (mm) (tip to gauge line)	117.21 ± 0.1
Exhaust valve effective length (mm) (tip to gauge line)	94.39 ± 0.1
Valve stem to guide clearance intake diametrical (mm)	0.022 - 0.057
Valve stem to guide clearance exhaust diametrical (mm)	0.03 - 0.065
Valve head diameter intake (mm)	36 ± 0.1
Valve head diameter exhaust (mm)	30 ± 0.1
Intake valve face angle (degrees)	44.875 ± 0.125
Exhaust valve face angle (degrees)	44.875 ± 0.125
Valve stem diameter intake (mm)	5.4705 ± 0.0075
Valve stem diameter exhaust (mm)	5.4625 ± 0.0075
Valve spring free length (mm) - inlet	46.1
Valve spring free length (mm) - exhaust	46.1
Valve spring installed height (mm) - inlet	35.74
Valve spring installed height (mm) - exhaust	35.1
Camshaft lobe lift intake (mm)	10
Camshaft lobe lift exhaust (mm)	9.36
Camshaft journal to cylinder head bearing surface clearance diametrical (mm)	0.025 - 0.065
Camshaft journal diameter - all positions	26.965 ± 0.01
Bearing diameter - all positions	27.01 ± 0.01
Camshaft journal maximum run out limit (mm)	
Camshaft journals to end journals	0.03
Camshaft journals to adjacent journals	0.015
Camshaft journal maximum out of round (mm) - all journals	0.005

Crankshaft Pin and Bearing

NOTE: Make sure that the crankshaft pin journal classification number is noted correctly, so that the correct bearing is installed.

Crankshaft Pin Diameter Bearing Size (mm)	Crankshaft Pin Letter
55.982 - 55.988	A - G
55.989 - 55.994	H - N

55.995 - 56.000	P - W
Crankshaft Pin Letter	Color
A - G	Brown/Yellow (Part Number - DX23-6211-BFA)
H - N	Brown/Red (Part Number - DX23-6211-BEA)
P - W	Brown/Blue (Part Number - DX23-6211-BDA)

Torque Specification



NOTE: A = Refer to procedure for correct torque sequence.

Description	Nm	lb-ft	lb-in
Engine cover mounting bolts	10	7	-
Accessory drive belt tensioner retaining bolt	40	30	-
Supercharger belt idler/tensioner bracket retaining bolts	25	18	-
Secondary drive belt idler retaining bolts	40	30	-
Power steering pump pulley retaining bolts	25	18	-
Power steering pump retaining bolts	25	18	-
Power steering pump bracket to engine retaining bolts	25	18	-
Generator retaining bolts	48	35	-
Starter motor retaining bolts	48	35	-
Air conditioning compressor retaining bolts	25	18	-
Engine mounting to engine mounting bracket retaining nuts	48	35	-
Engine mounting to subframe retaining nuts	63	46	-
Engine mounting bracket to engine retaining bolts	48	35	-
Crankshaft damper pulley retaining LH threaded bolt	200 + 270°	148 + 180°	-
Flexplate retaining bolts	45 + 90°	33 + 90°	-
Exhaust manifold heat shield retaining bolts	A	-	-
Exhaust manifold retaining bolts	A	-	-
Engine wiring harness bracket retaining bolts	10	7	-
Coolant outlet pipe	10	7	-
Intercooler retaining bolts	25	18	-
Intake manifold retaining bolts	25	18	-
Oil Cooler retaining bolts	13	10	-
Knock sensor (KS) retaining bolt	20	14	-
Ignition coil retaining bolts	8	-	71
Spark plugs	20	15	-
Fuel rail retaining bolts	A	-	-
High pressure fuel pipe retaining bolts	A	-	-
High pressure fuel pump retaining bolts	12	9	-
Oil filter housing assembly retaining bolts	12	9	-
Oil filter cap	28	21	-
Lifting eye bolts	25 + 90°	18 + 90°	-
Manifold absolute pressure and temperature (MAPT) sensor sensor retaining bolts	5	-	44
Coolant pump retaining bolts	12	9	-
Variable valve timing (VVT) oil control solenoid retaining bolts	10	7	-
Camshaft position (CMP) sensor retaining bolts	10	7	-
Camshaft cover retaining bolts	13	10	-
Front upper timing cover retaining bolts	12	9	-
Front lower timing cover retaining bolts	A	-	-
Engine rear cover retaining bolts	A	-	-
VVT to camshaft retaining bolts	32	24	-
Camshaft bearing caps retaining bolts	11	8	-
Primary timing chain fixed guide retaining bolts	12	9	-
Primary timing chain tensioner retaining bolts	12	9	-
Primary timing chain tensioner guide blade retaining bolts	25	18	-
Auxiliary chain tensioner guide retaining bolts	21	15	-
Auxiliary chain fixed guide retaining bolt	12	9	-
Oil pump sprocket retaining bolt	25	18	-
Cylinder head retaining bolts	A	-	-
Engine oil level (EOL) sensor retaining bolt	12	9	-
Oil pan to oil sump body retaining bolts	12	9	-
Oil sump body to engine retaining bolts	25	18	-
Oil pan drain plug	24	17	-
Oil transfer tube to Oil pan body retaining bolts	11	8	-
Oil pump to engine block retaining bolts	25	18	-
Pick-up pipe to oil pump retaining bolts	12	9	-
Windage tray retaining bolts	25	18	-
Piston cooling jet retaining bolts	12	9	-

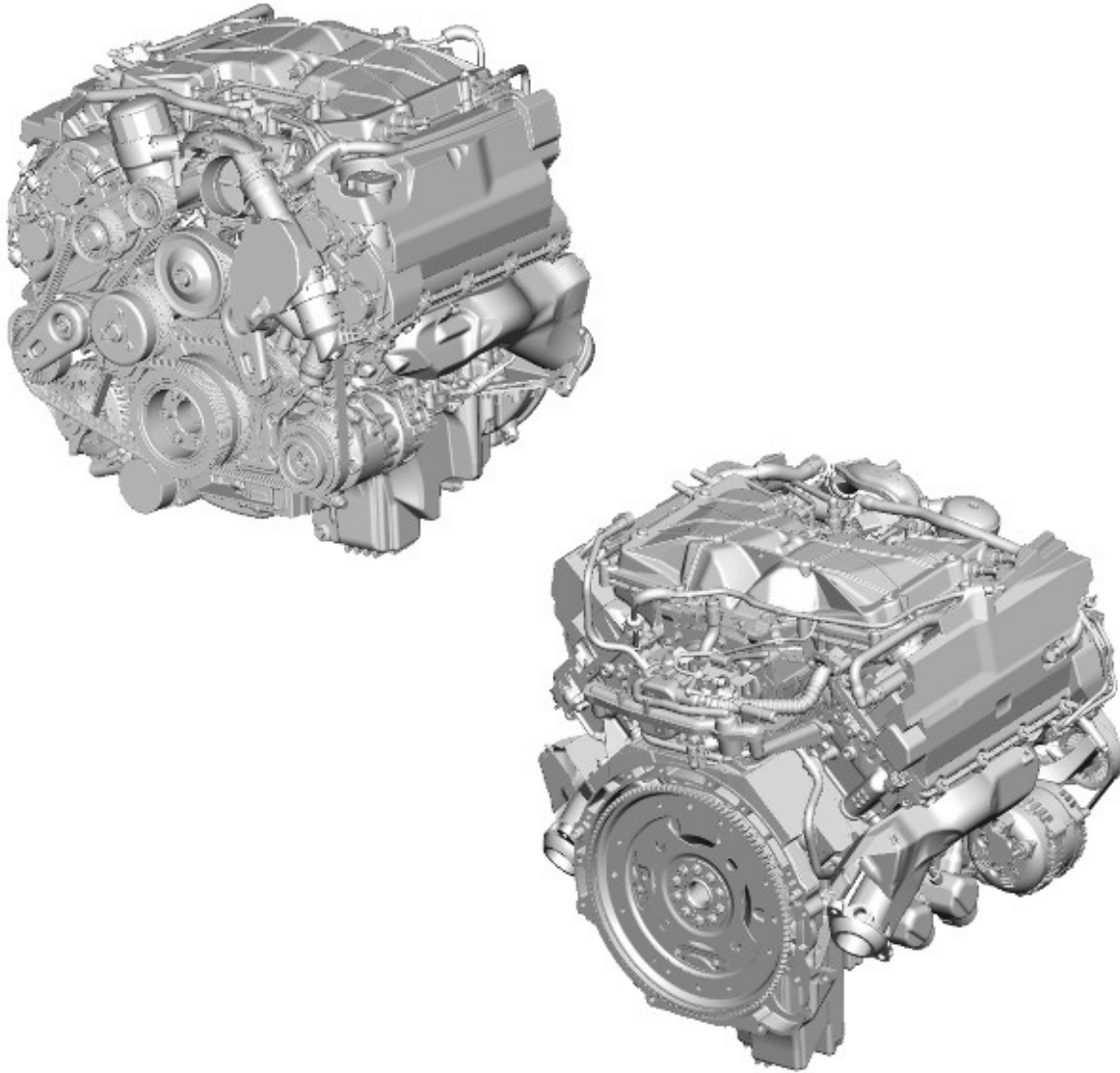
Engine block coolant draining plug	50	37	-
Balance shaft assembly retaining bolts	25 + 90°	18 + 90°	-
Rear balance weight assembly retaining nuts	25 + 38°	18 + 38°	-
Rear balance weight assembly chain bracket retaining bolt	25	18	-
Connecting rod bolts	20 + 125°	14 + 125°	-

Engine - V6 S/C 3.0L Petrol - Engine

Description and Operation

COMPONENT LOCATION

V6 3.0L SC Petrol Engine



E152254

OVERVIEW

The V6 3.0L SC petrol engine is a liquid cooled V6 unit featuring direct fuel injection, four overhead camshafts and four valves per cylinder.

The main structural components of the engine are all manufactured from aluminum alloy. The engine is built around a very stiff, lightweight, enclosed V, deep skirt cylinder block. A structural windage tray is bolted to the bottom of the cylinder block to further improve the block stiffness, minimize **NVH (noise, vibration and harshness)** and help reduce oil foaming. To further enhance the stiffness of the lower engine structure, a heavily ribbed sump body is installed. The sump body also helps to reduce engine noise.

The engine uses a Bosch HP (high pressure) direct injection fuel system with fuel pressure provided by two, cam driven high pressure fuel pumps which are driven by a dedicated camshaft. The HP fuel pumps supply the fuel rails which in turn supply the three injectors for that bank with fuel at a controlled pressure.

The four camshafts incorporate **VCT (variable camshaft timing)**. The **VCT** allows the timing of the intake and exhaust valves to be adjusted independently of each other. The **VCT** system is controlled by the Bosch **ECM (engine control module)** using information from **CMP (camshaft position)** sensors.

The supercharger is located in the 'vee' of the engine and is driven from the crankshaft by a dedicated secondary auxiliary drive belt.

The engine meets EU5 emission regulations in Europe and Rest of World (ROW) and ULEV 70 emission regulations in North American Specification (NAS) markets.

The direct fuel injection system, advanced piston and combustion chamber design and the supercharger provide improved fuel consumption and emissions.

Various engine systems are located on the engine assembly and driven directly and indirectly by the engine operation. Refer to relevant section for the further information:

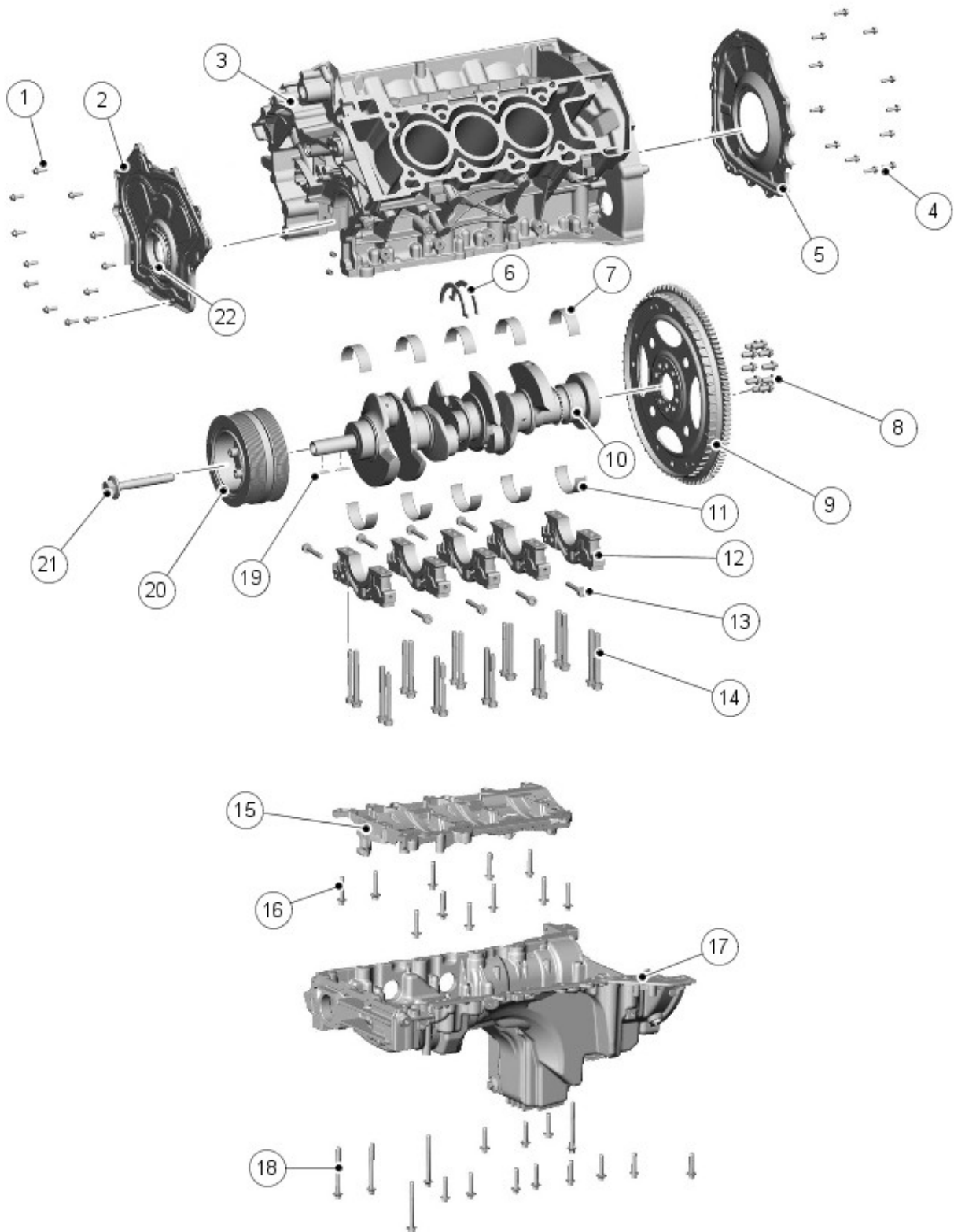
- **Engine cooling** -
For additional information, refer to: [Engine Cooling](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Description and Operation).
- **Supercharger cooling** -
For additional information, refer to: [Supercharger Cooling](#) (303-03C Supercharger Cooling - V6 S/C 3.0L Petrol, Description and Operation).
- **Fuel system** -
For additional information, refer to: [Fuel Tank and Lines](#) (310-01B Fuel Tank and Lines - V6 S/C 3.0L Petrol, Description and Operation).
- **Accessory drive** -
For additional information, refer to: [Accessory Drive](#) (303-05B Accessory Drive - V6 S/C 3.0L Petrol, Description and Operation).
- **Starting system** -
For additional information, refer to: [Starting System](#) (303-06B Starting System - V6 S/C 3.0L Petrol, Description and Operation).
- **Electronic engine controls** -
For additional information, refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 S/C 3.0L Petrol, Description and Operation).

Technical Specifications

Description	Specification
Configuration	90° 'V' configuration 6 cylinder
Displacement	2995 cc
Bore and Stroke	84.5 X 89 mm
Maximum Power	340 PS @ 6500 RPM
Maximum Torque	450 Nm @ 3500 - 5000 RPM
Compression Ratio	10.5:1

CYLINDER BLOCK - DESCRIPTION

Cylinder Block Components

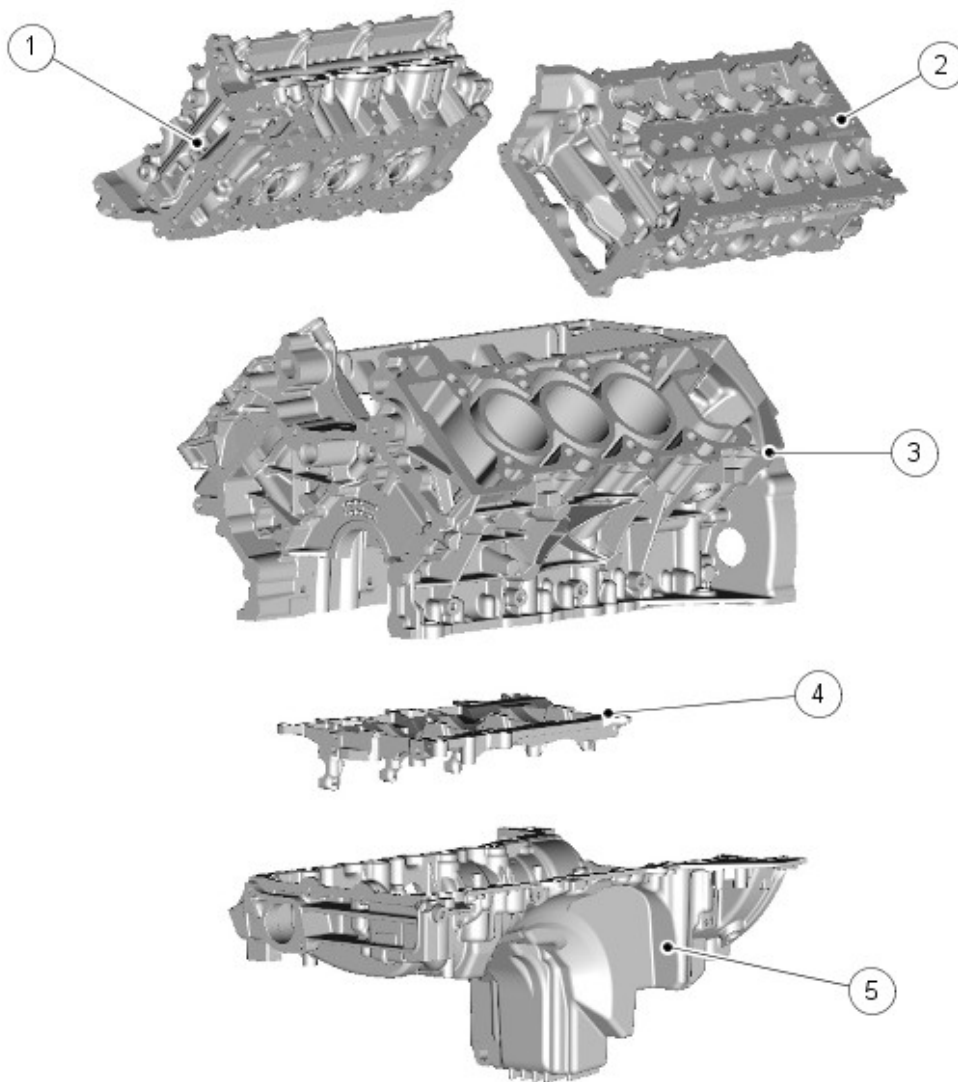


E152255

Item	Part Number	Description
1	-	M6 Bolt (12 off) M8 (1 off)
2	-	Cylinder Block Front Cover
3	-	Cylinder Block
4	-	M6 Bolt (12 off)
5	-	Cylinder Block Rear Cover and Oil Seal
6	-	Thrust Washer (2 off)
7	-	Upper Main Bearing (5 off)
8	-	M10 Bolt (10 off)
9	-	Drive Plate

- 10 - Crankshaft
- 11 - Lower Main Bearing (5 off)
- 12 - Crankshaft Main Bearing Cap (5 off)
- 13 - Cross Bolt - Crankshaft Main Bearing Cap (M8 8 off)
- 14 - Inner and Outer Bolts - Crankshaft Main Bearing Cap (M8 10 off and M10 10 off)
- 15 - Windage Tray
- 16 - M8 Bolt (11 off)
- 17 - Oil Pan
- 18 - M8 Bolt (16 off)
- 19 - Woodruff Key (2 off)
- 20 - Crankshaft Pulley/Vibration Damper Assembly
- 21 - Crankshaft Damper Bolt
- 22 - Crankshaft Front Oil Seal

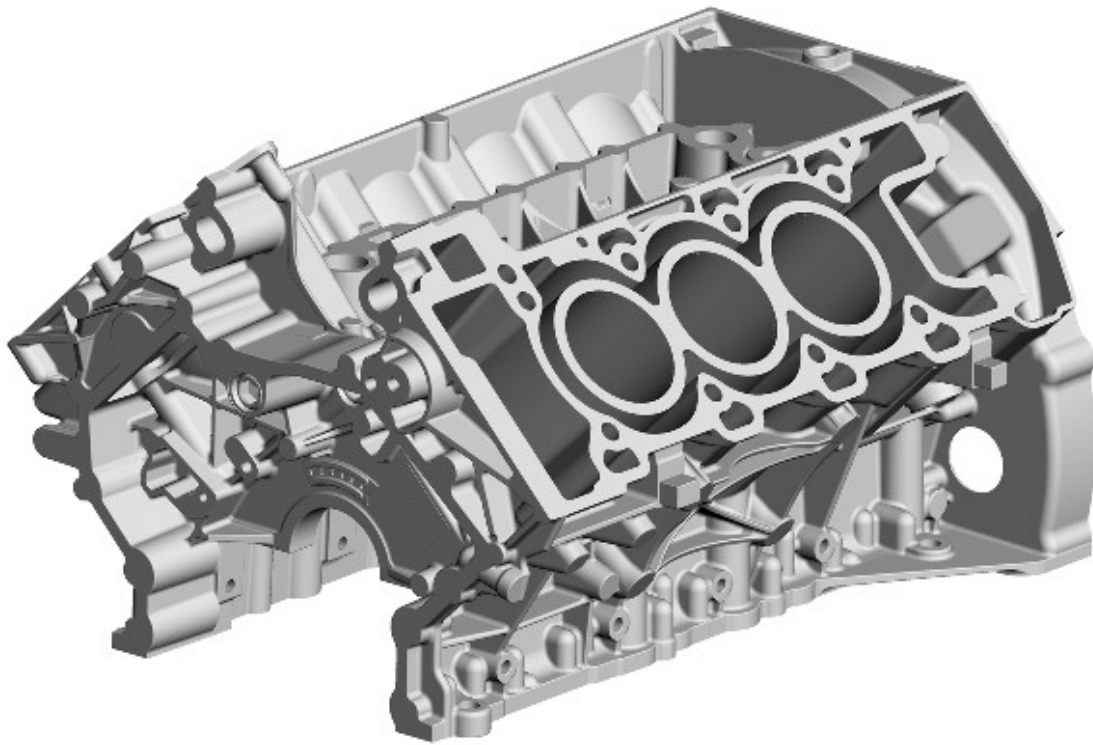
Major Structural Components



E152256

Item	Part Number	Description
1	-	Right Cylinder Head (bank 1)
2	-	Left Cylinder Head (bank 2)
3	-	Cylinder Block
4	-	Windage Tray
5	-	Oil Pan

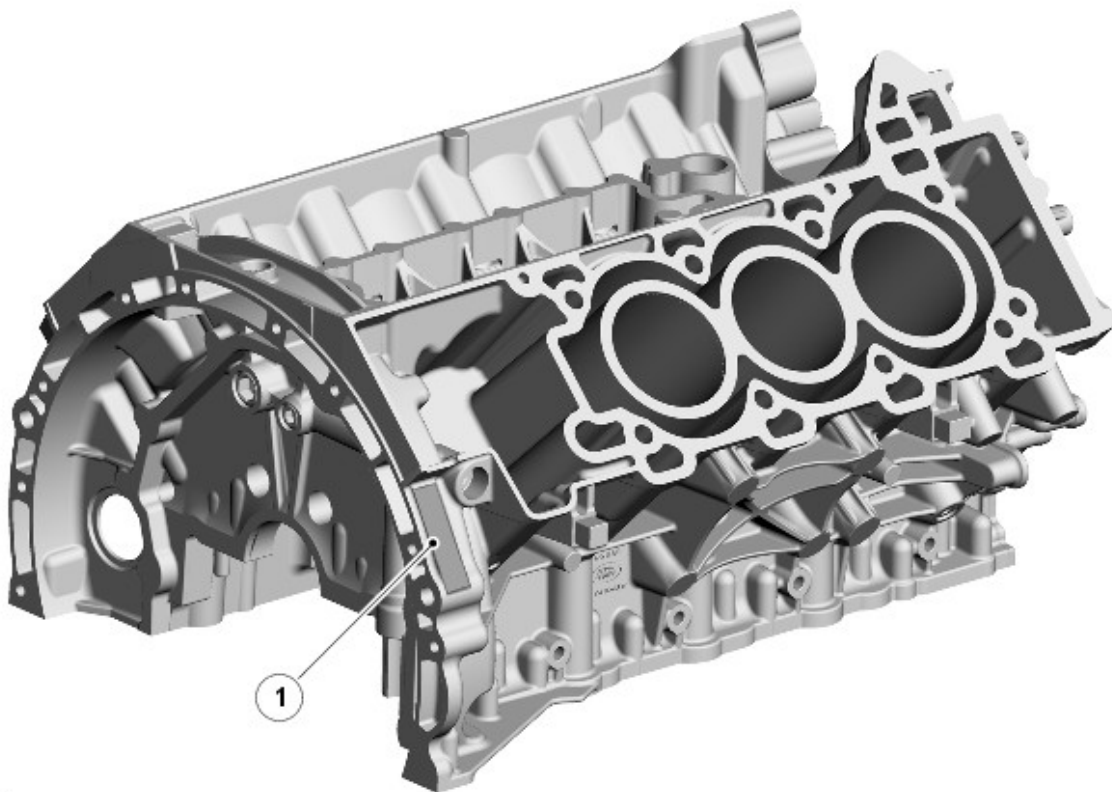
Cylinder Block



E142779

The high pressure die-cast aluminum cylinder block is a 90 degree configuration with cast-in iron cylinder liners and an open deck die-cast coolant jacket. The low volume coolant jacket gives good warm-up times and low piston noise levels. The longitudinal flow design of the coolant jacket, with a single cylinder head coolant transfer port in each bank, provides good rigidity and head gasket sealing.

Engine Data Location

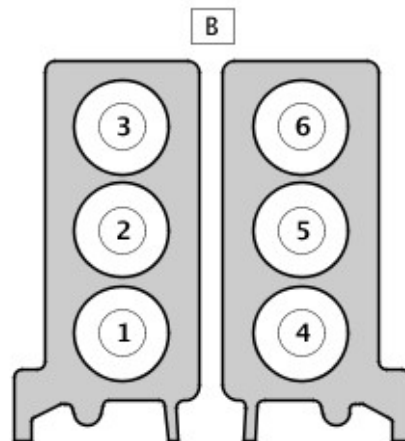


E142780

Item	Part Number	Description
1	-	Engine Data Location

Engine data is marked on the cylinder block at the rear of the right cylinder bank '1'.

Cylinder Numbering

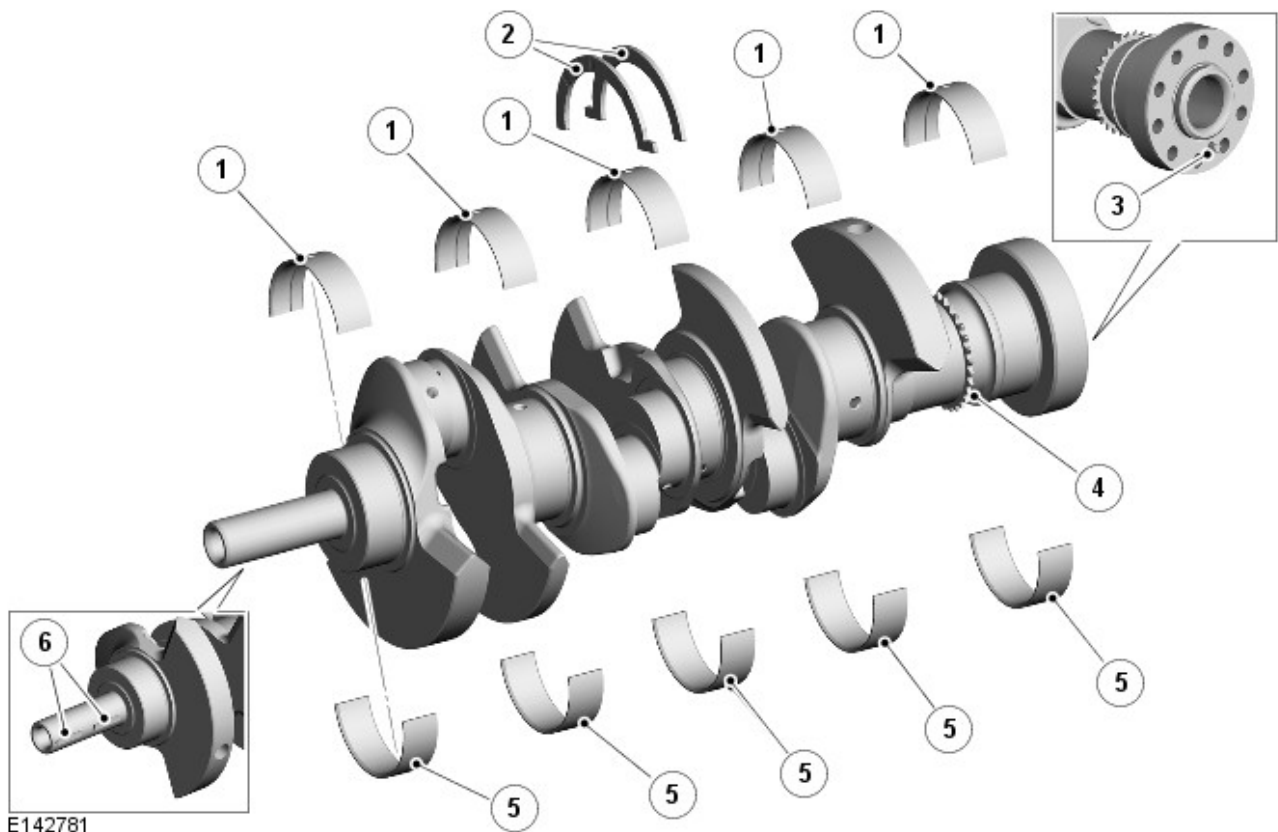


E163885

Item	Part Number	Description
A	-	DIN standard cylinder numbering

DIN cylinder firing order 1.4.2.5.3.6

Crankshaft



E142781

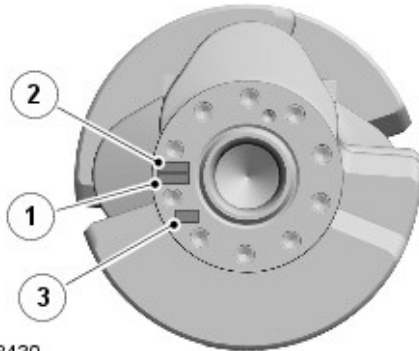
Item	Part Number	Description
1	-	Upper main bearing (5 off)
2	-	Thrust Washer (2 off)
3	-	Drive Plate Location Dowel
4	-	Rear Dynamic Balancer Drive Sprocket
5	-	Lower Main Bearing (5 off)
6	-	Woodruff Key Locations

The crankshaft is manufactured from forged carbon steel C38 with induction hardened main and pin bearing journals. The fillets of the main journals are fillet rolled to improve strength. The fillets of the pins are induction hardened due to the split pin design, improving the strength of the crankshaft.

A six counterweight design has been used to balance the V6 split pin design ensuring less vibration.

An oil groove in the upper half of each main bearing transfers the oil into the crankshaft for lubrication of the connecting rod bearings.

Crankshaft Data Location

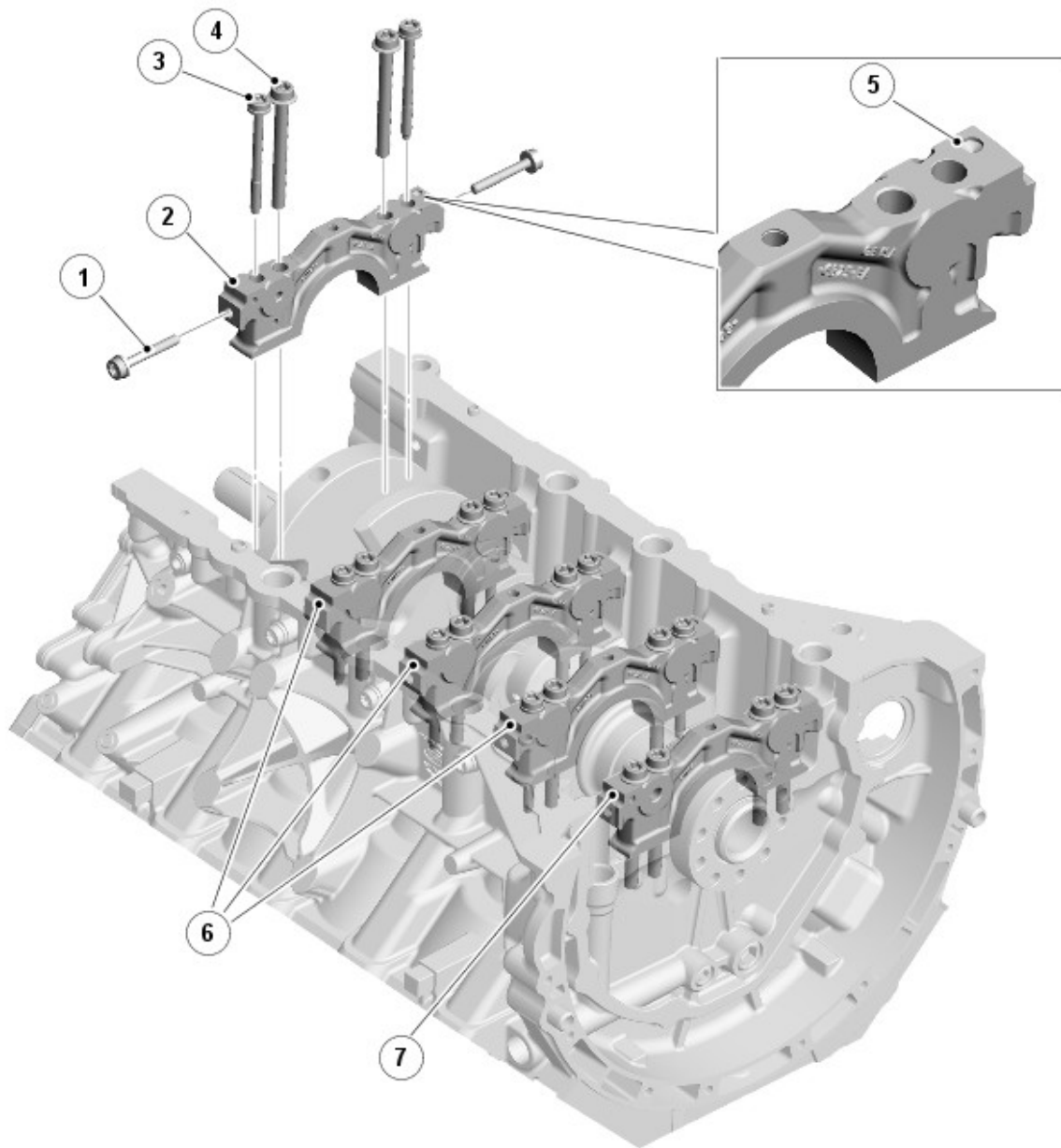


E108430

Item	Part Number	Description
1	-	Pin Journal Classification and Plant Identification
2	-	Main Journal Classification
3	-	Date and Time Codes

The main bearings are numbered 1 to 5 starting from the front of the engine. There are six grades of main bearing available, each being color coded. Journal sizes are marked on the rear of the crankshaft.

Crankshaft Installation



E142783

Item	Part Number	Description
1	-	Cross Cap M8 bolt (8 off - not fitted to rear main bearing cap)
2	-	Front Main Bearing Cap
3	-	Outer Main Bearing Cap M8 bolt (10 off)
4	-	Inner Main Bearing Cap M10 bolt (10 off)
5	-	Identification Mark (must face front of engine)
6	-	Main Bearing Caps (3 off)
7	-	Rear Main Bearing Cap

The main bearing caps are made from cast iron and are cross bolted to increase rigidity. An identification mark on each bearing cap must face the front of the engine.

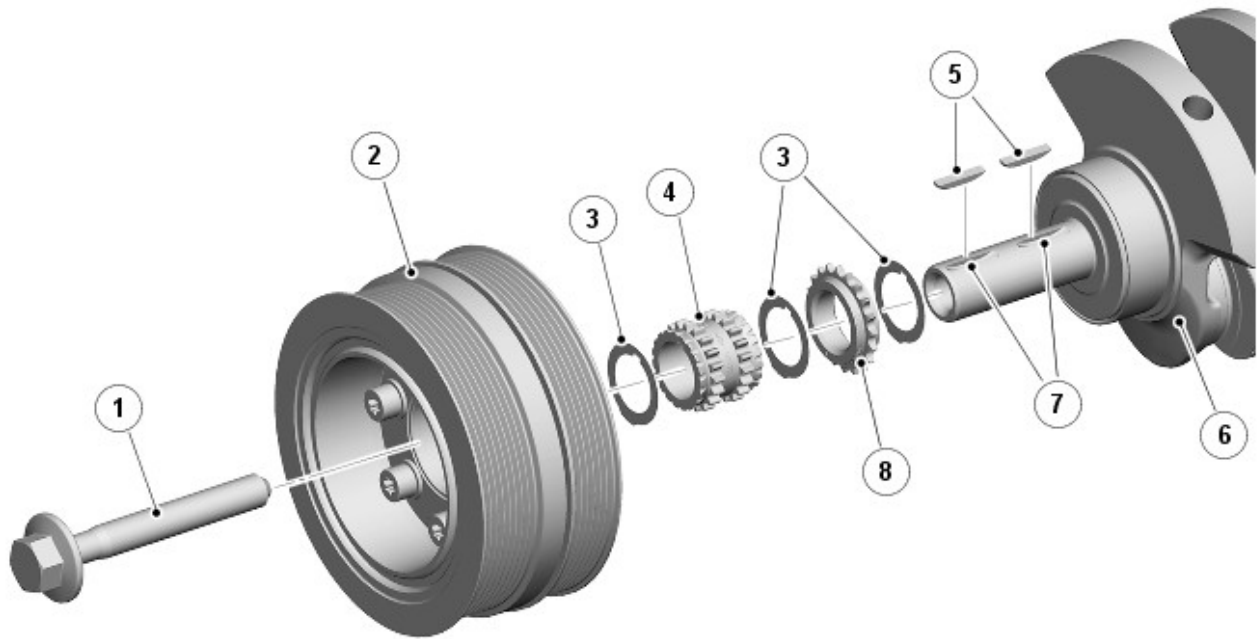
There are five grades of main bearing available, each being color coded. Journal sizes are marked on the rear of the crankshaft.

The thickness grade of all main bearing shells are to be selected to give a total running clearance of not less than 0.029mm or not greater than 0.051mm.

The main bearing shells in the cylinder block have a central hole and an internal groove to allow for main journal lubrication. The bearing shells in the main bearing caps are plain with no grooves.

Special tools are required to ensure the correct alignment of the upper and lower main bearing shells.

Crankshaft Pulley / Vibration Damper



E142784

Item	Part Number	Description
1	-	Pulley Bolt
2	-	Crankshaft Pulley/Vibration Damper
3	-	Friction Washer
4	-	Timing Chain Drive Sprocket
5	-	Woodruff Keys
6	-	Crankshaft
7	-	Woodruff Key Slots
8	-	Oil Pump Drive Sprocket

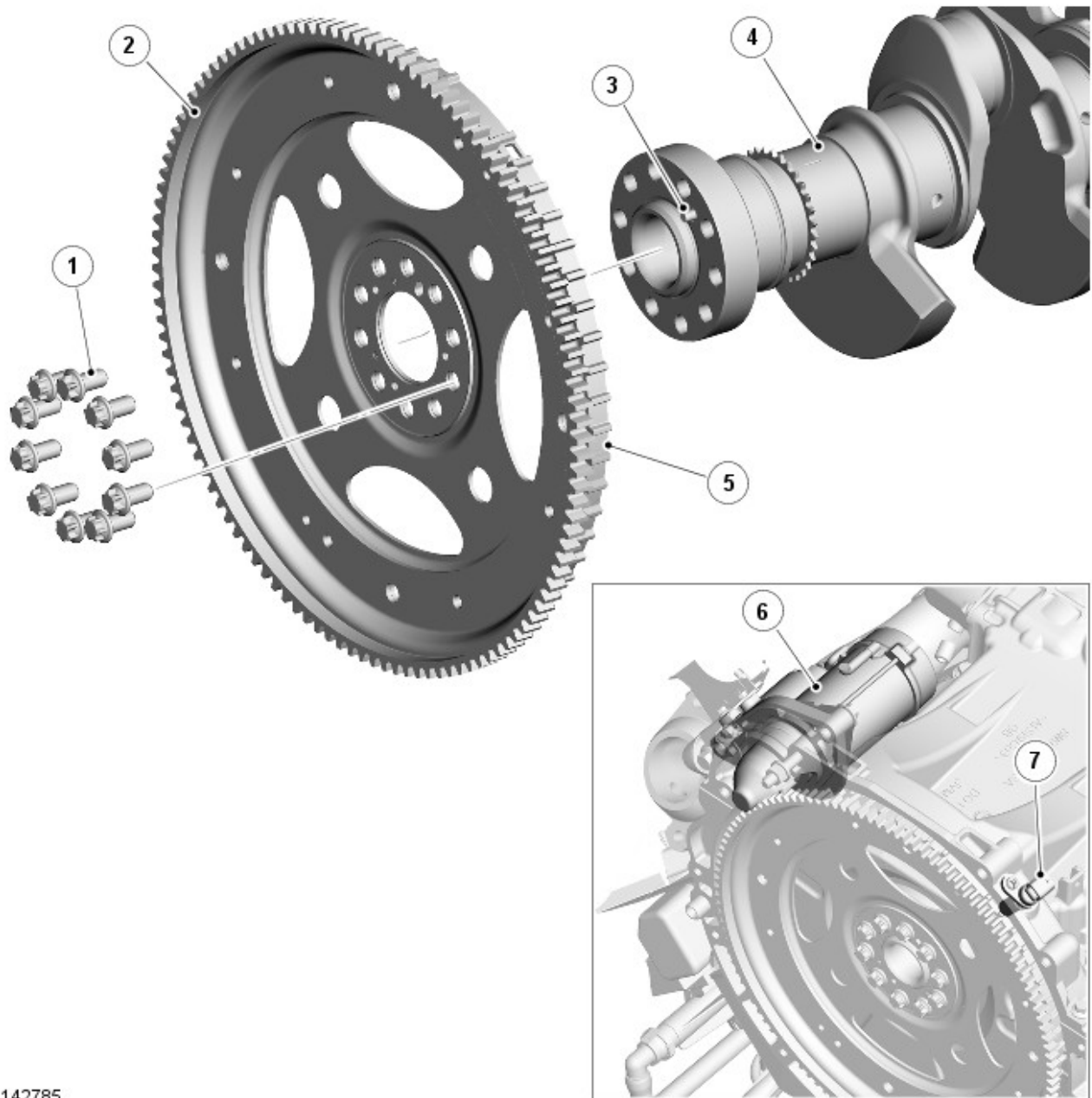
At the front of the crankshaft, a tuned torsional vibration damper is incorporated into the crankshaft pulley.

The pulley is located on two woodruff keys which are located in slots in the crankshaft. The woodruff keys are a press fit in the slots and must be correctly aligned.

If the pulley is removed, a new friction washer must be located between the timing chain drive sprocket and the crankshaft pulley and a new pulley bolt must also be used.

The crankshaft pulley/vibration damper is not a serviceable component and must not be disassembled.

Drive Plate



E142785

Item	Part Number	Description
1	-	M10 Bolt (10 off)
2	-	Drive Plate
3	-	Dowel
4	-	Crankshaft
5	-	Reluctor Ring
6	-	Starter Motor
7	-	CKP (crankshaft position) Sensor

The drive plate is located at the rear of the crankshaft. The drive plate has three functions; to transfer drive from the crankshaft to the transmission, to transfer drive from the starter motor to the crankshaft and to provide the engine management system with crankshaft speed and position via a reluctor ring and a sensor.

The drive plate is secured to the crankshaft flange with 10 bolts and is located with a dowel to ensure the correct timing of the reluctor ring to the crankshaft orientation.

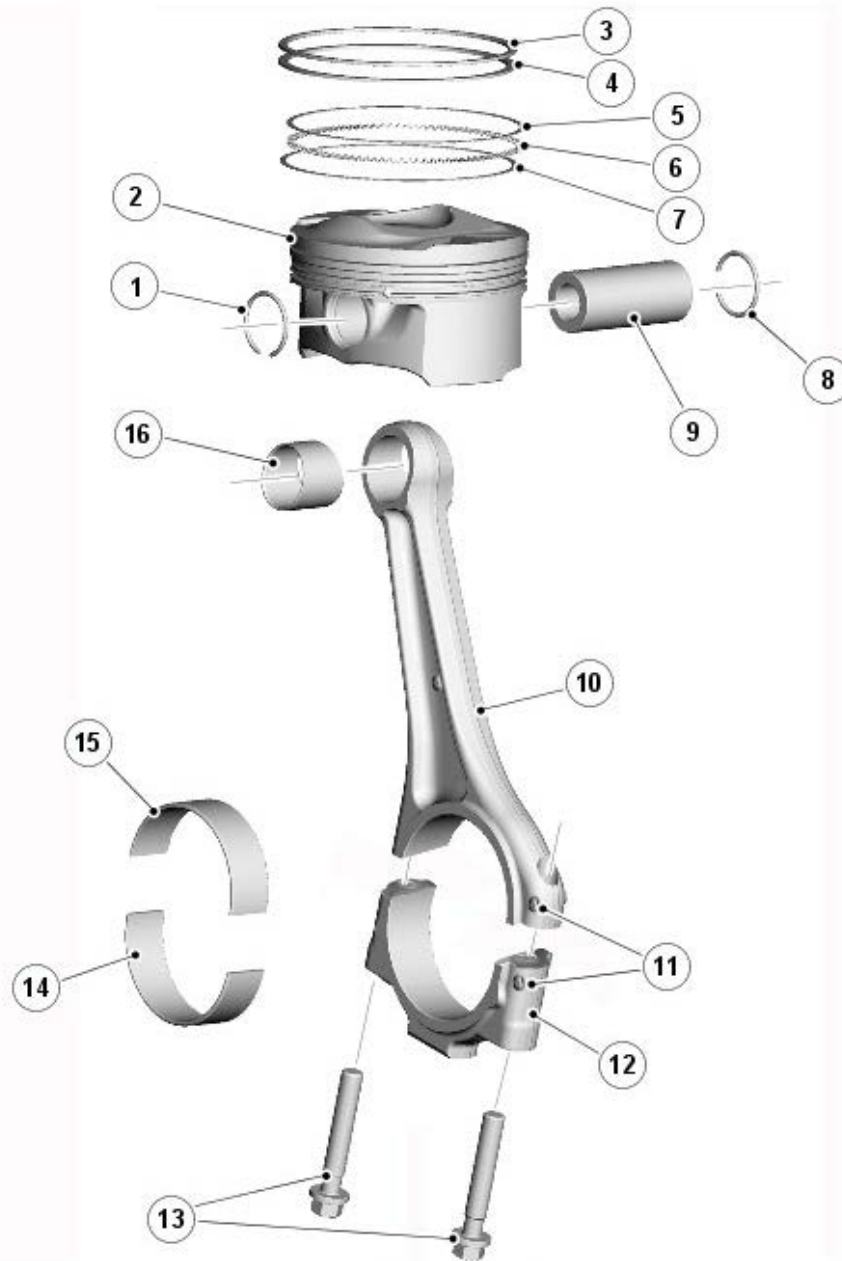
The drive plate is a pressed and cast steel fabrication, which comprises a cast steel starter ring gear and a pressed steel drive plate and reluctor ring. The two components are riveted together as one assembly.

Four holes in the drive plate provide for the attachment of the transmission torque converter to transfer drive from the crankshaft to the transmission.

The reluctor ring has 60 teeth with 2 teeth missing to provide a gap. A **CKP (crankshaft position)** sensor is located in the oil pan casting and measures speed and position as the reluctor ring rotates.

For additional information, refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 S/C 3.0L Petrol, Description and Operation).

Pistons and Connecting Rods



E142786

Item	Part Number	Description
1	-	Circlip
2	-	Piston
3	-	Upper Compression Ring
4	-	Lower Compression Ring
5	-	Oil Control Ring
6	-	Separator
7	-	Oil Control Ring
8	-	Circlip
9	-	Gudgeon Pin
10	-	Connecting Rod
11	-	Alignment Marks
12	-	Connecting Rod Cap
13	-	Bolts
14	-	Lower Big End Shell Bearing
15	-	Upper Big End Shell Bearing
16	-	Little End Bearing

In the vertical plane, the pistons have a slight barrel form, which helps to ensure a reliable oil film is maintained between the piston and the cylinder bore. A solid film lubricant coating is applied to both reaction faces of the piston to reduce wear and improve fuel economy.

A three-ring piston-sealing system is used. The steel top ring is treated with a PVD (physical vapor deposition) peripheral coating. PVD is a coating technique where material can be deposited with improved properties to ensure

good cylinder bore compatibility and wear resistance. A Napier center ring helps cylinder pressure and oil management, while the three-piece oil control lower ring is produced from nitrided steel. The two upper rings are marked with an 'R' which must face upwards, towards the top of the piston.

The pistons are cooled with engine oil from three piston cooling jets installed under the valley of the cylinder block.

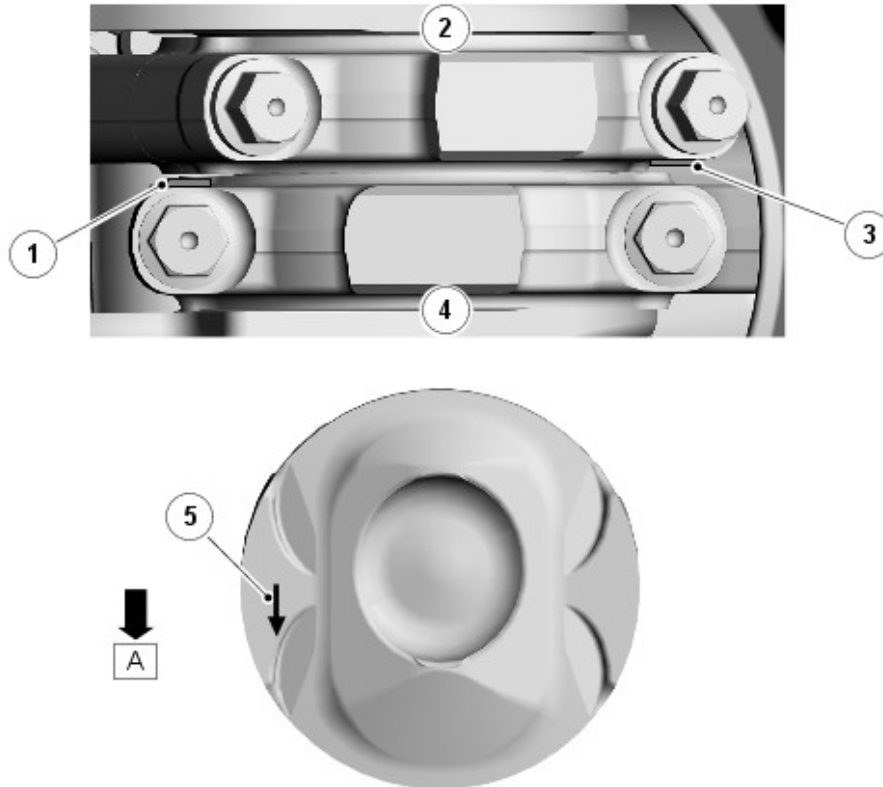
The connecting rods are forged from high strength steel. The connecting rod cap is fracture-split from the rod to ensure precision re-assembly for shell bearing alignment. There are three grades of big end bearing available, each being color coded.

For additional information, refer to: [Connecting Rod Cleaning](#) (303-00 Engine System - General Information, General Procedures).

The correct alignment of the cap with the connecting rod is indicated by marks on adjacent faces of the two components.

The pistons are attached to the connecting rods with a gudgeon pin, which is secured with 2 circlips. The gudgeon pin is located through the small end bearing in the connecting rod which allows the piston to articulate with the linear movement of the connecting rod. The circlips locate in grooves in the piston.

Connecting Rod and Piston Orientation



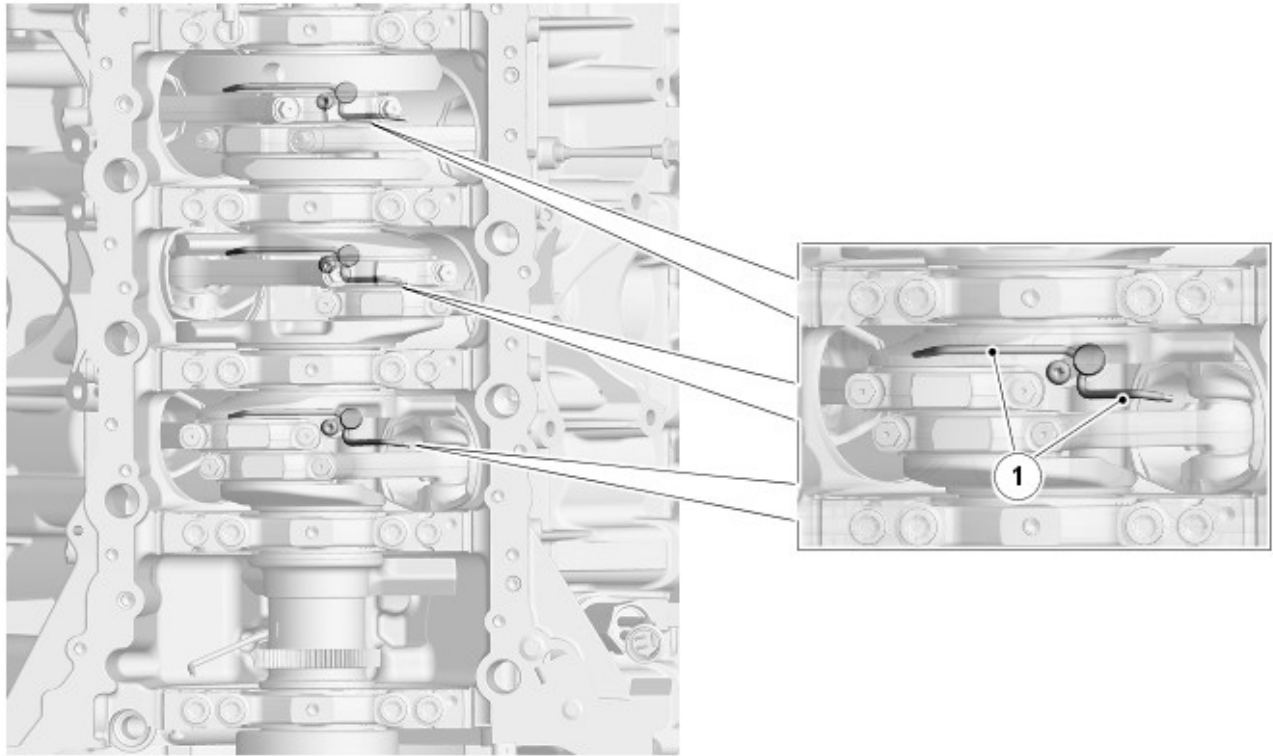
E142787

Item	Part Number	Description
A	-	Front of Engine
1	-	Alignment Mark
2	-	Left Side (bank 2)
3	-	Alignment Mark
4	-	Right Side (bank 1)
5	-	Piston Orientation Arrow

The orientation of the connecting rods and pistons on the crankshaft are given below:

- Bank 1 - The arrow on the piston crown must face the front of the engine and the cap and connecting rod alignment marks must face the rear of the engine.
- Bank 2 - The arrow on the piston crown must face the front of the engine and the cap and connecting rod alignment marks must face the front of the engine.

Piston Cooling Jets



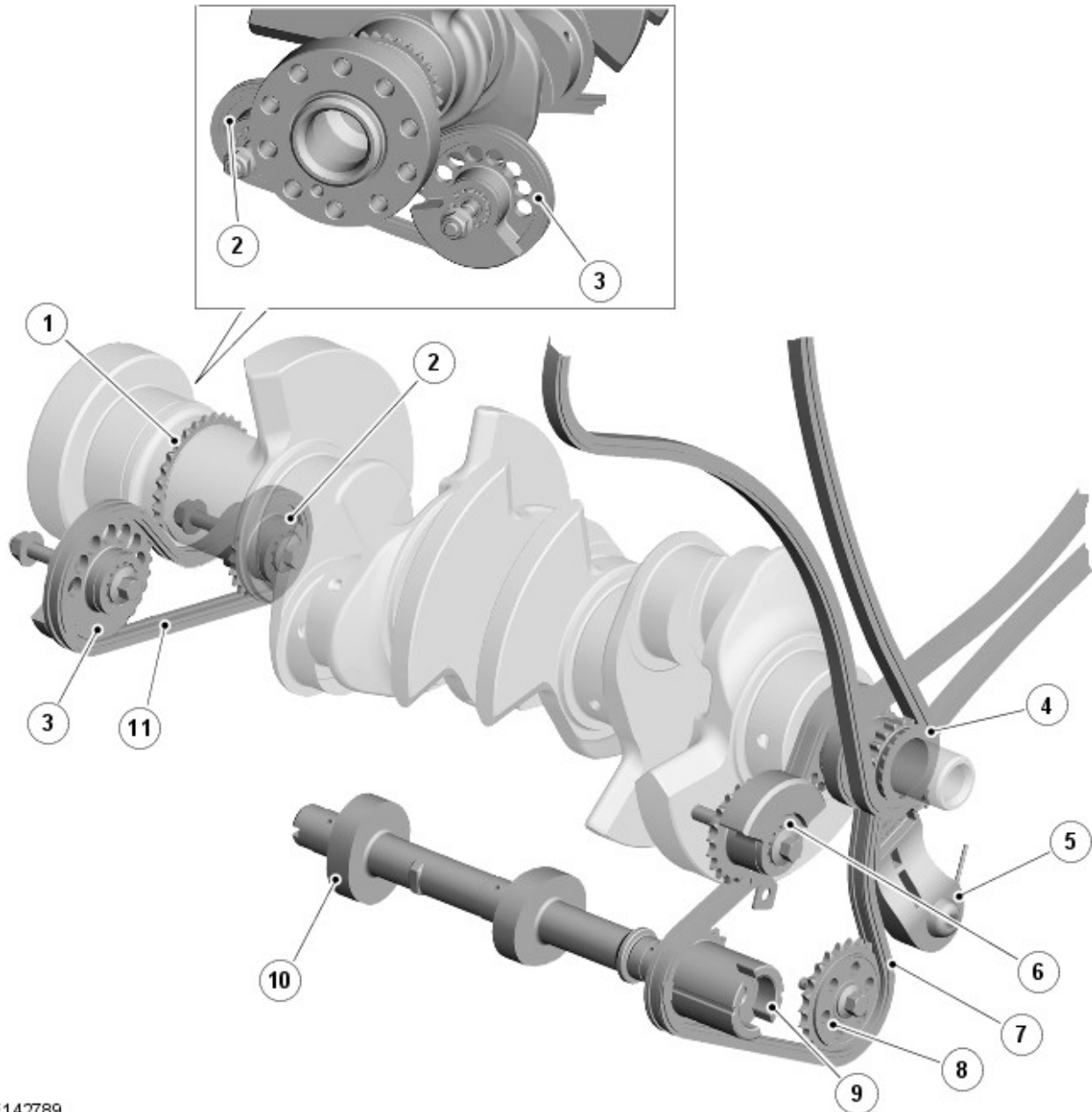
E142788

Item	Part Number	Description
1	-	Piston Cooling Jets

Piston cooling jets, located in the cylinder block, provide piston and piston pin cooling and lubrication. Each piston cooling jet has two outlet nozzles which spray oil onto the underside of the two adjacent pistons, one from each cylinder bank. Each jet is located between the pair of cylinders and is secured with a bolt. The jets are supplied pressurized engine oil from the oil pump via a drilling in the cylinder block.

Each jet sprays oil onto the underside of the piston to help cool each piston crown. Additionally, oil lubricates the small end bearing and gudgeon pin.

Dynamic Balancers and Auxiliary Camshaft



E142789

Item	Part Number	Description
1	-	Crankshaft Rear Dynamic Balancer Drive Sprocket
2	-	Idler Sprocket
3	-	Rear Dynamic Balancer
4	-	Crankshaft Timing Chain Sprocket
5	-	Auxiliary Drive Tensioner
6	-	Front Dynamic Balancer
7	-	Auxiliary Drive Chain
8	-	Oil Pump Sprocket
9	-	Auxiliary Shaft Sprocket
10	-	Auxiliary Shaft
11	-	Drive Chain

Dynamic engine balancing is performed by two weighted dynamic balancers, located at the front and rear of the cylinder block. The dynamic balancers oppose and cancel out vibrations created by the engine's rotating components.

The front and rear dynamic balancers comprise a sprocket with an offset weight.

Both dynamic balancers are fitted with two needle roller bearings bolted to the rear main bearing cap for the rear dynamic balancer and the front main bearing cap for the front dynamic balancer by use of a threaded shaft. A shoulder on the shaft maintains the correct lateral position of the dynamic balance. Thrust bearings on either side of the dynamic balancer control lateral movement.

The rear dynamic balancer is driven by a dedicated drive chain which is driven by a sprocket which is integral with the crankshaft. An non-weighted idler sprocket, supported on needle roller bearings, is fitted in the same way on the opposite side of the crankshaft main bearing cap. The drive chain connects the two sprockets and the drive gear on

the crankshaft.

The front dynamic balancer is driven by the auxiliary drive chain which is driven off the crankshaft sprocket, which in turn drives the auxiliary camshaft used to operate the two high pressure fuel pumps.

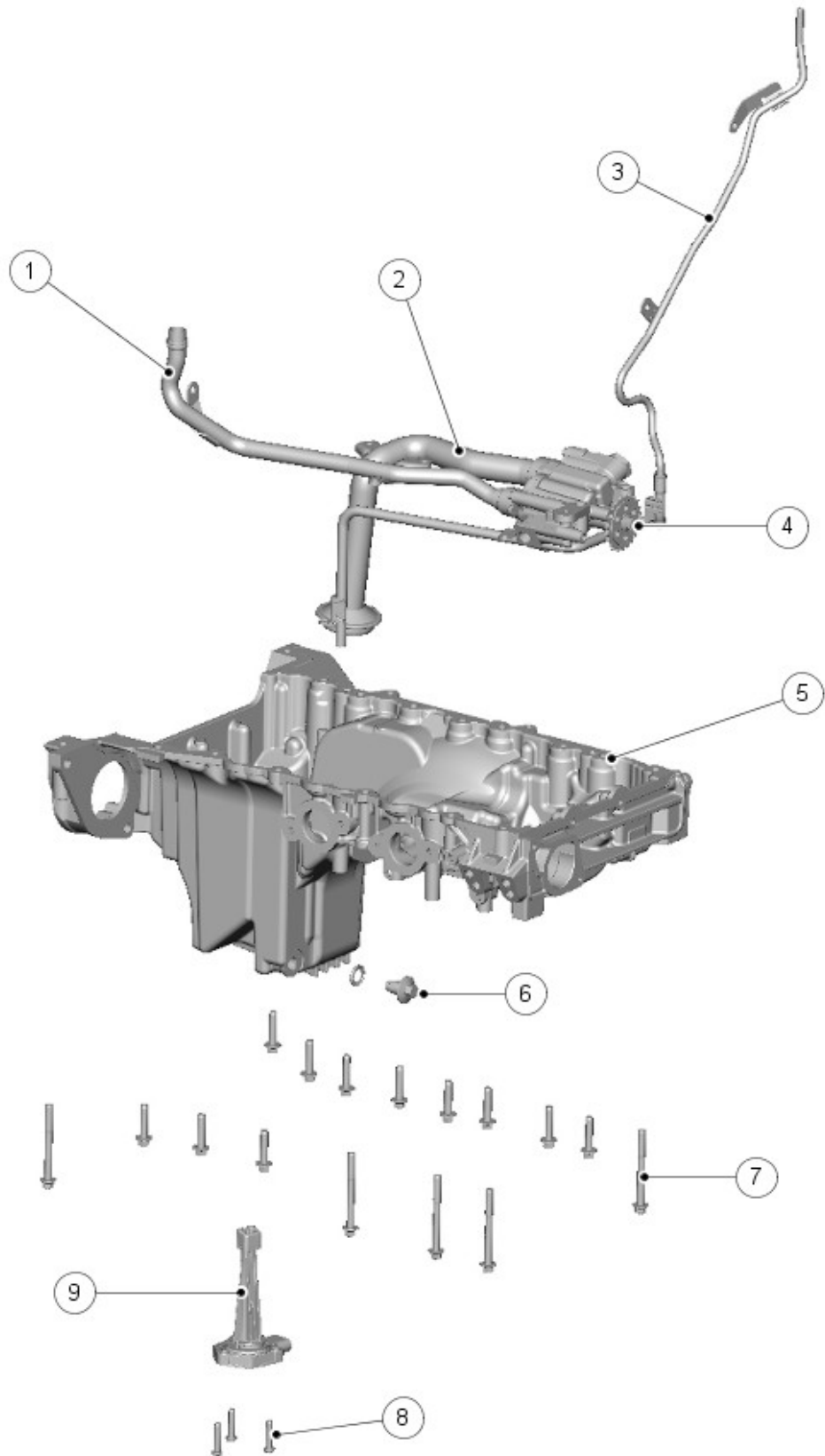
The dynamic balancers rotate at crankshaft speed in the opposite directions to the crankshaft. The balancer weights are phased so that the inertia reaction to their counter-rotation cancels out vibration caused by the engine in both horizontal and vertical planes.

Both dynamic balancers must be timed to the crankshaft position by their position on the drive chain. Refer Engine - V6 3.0L SC Petrol - Removal and Installation for procedure.

The auxiliary camshaft is located on two machined bosses on the windage tray and secured with a camshaft carrier which is secured to windage tray with eight bolts. The auxiliary camshaft has two cam lobes, with each lobe operating a high pressure fuel pump, via a tappet. The camshaft is fitted with a drive sprocket which is a press fit on the camshaft. The sprocket is timed to the cam lobes to match the pump delivery strokes with crankshaft position and therefore must not be removed.

For additional information, refer to: [Fuel Charging and Controls](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Description and Operation).

Oil Pan



E152258

Item	Part Number	Description
1	-	Oil Pump Outlet Pipe to Cylinder Block
2	-	Oil Pump Pick-Up Pipe
3	-	Oil Evacuation Tube
4	-	Oil Pump
5	-	Oil Pan
6	-	Drain Plug with Washer
7	-	Oil Pan Retaining Bolts (16 off)
8	-	Bolts (3 off)
9	-	Oil Level and Temperature Sensor

The oil pan body is located on the underside of the cylinder block. It is sealed to the cylinder block with a 3 mm bead of RTV sealant and is secured with 16 bolts.

The oil pan covers the windage tray and the oil pump and also collects engine oil returning from the cylinder heads and crankshaft lubrication.

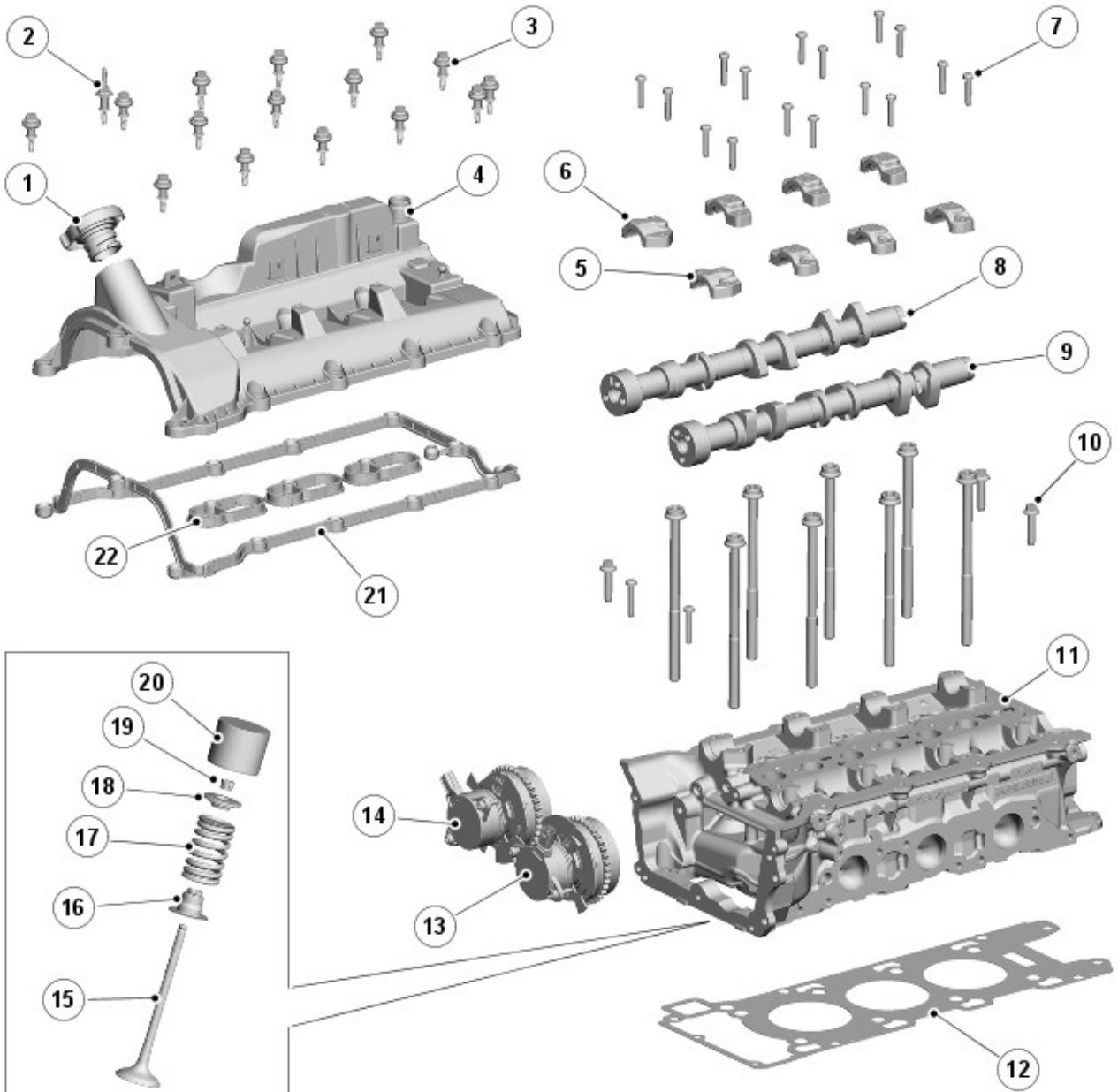
A drain plug and seal are located on the right side of the oil pan. The oil level and temperature sensor is located in the bottom of the oil pan and is sealed with a rubber gasket and secured with 3 screws.

The lower section of the oil pan remains full of engine oil and provides the location for the oil pump pick-up pipe and filter. The shape of the oil pan ensures that engine oil is always available at the oil pump pick-up and prevents oil starvation due to vehicle inclination and oil surge due to cornering, braking and acceleration.

An oil evacuation tube is installed to allow oil to be drawn from the sump pan. The upper end of the oil evacuation tube is located under the oil filler cap in the camshaft cover.

CYLINDER HEADS - DESCRIPTION

Cylinder Head Components



E142791

Item	Part Number	Description
1	-	Oil Filler Cap Assembly
2	-	Stud, Nut, Grommet and Sleeve
3	-	Bolt, Grommet and Sleeve (15 off)
4	-	Camshaft Cover
5	-	Exhaust Camshaft Caps (4 off)
6	-	Inlet Camshaft Caps (4 off)

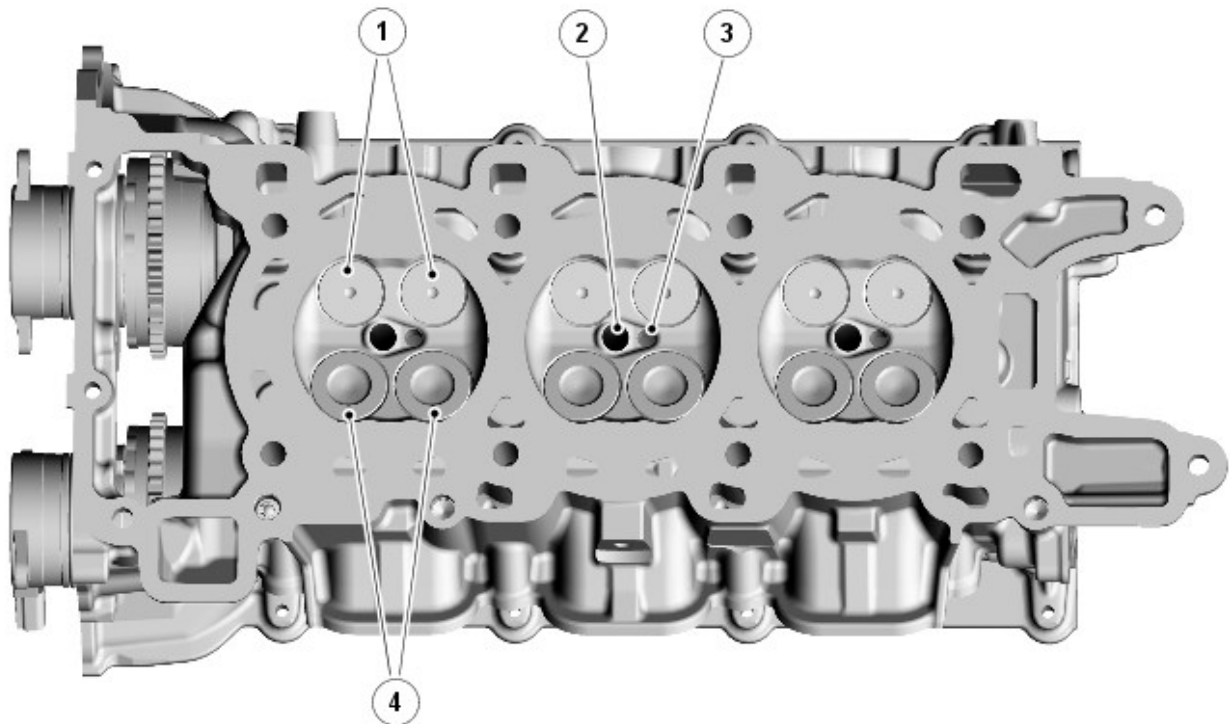
7	-	Camshaft Cap Bolts (16 off)
8	-	Inlet Camshaft
9	-	Exhaust Camshaft
10	-	Cylinder Head Bolts (13 off)
11	-	Cylinder Head
12	-	Cylinder Head Gasket
13	-	VCT (variable camshaft timing) Actuator (exhaust)
14	-	VCT Actuator Assembly (inlet)
15	-	Valve (12 off (6 inlet, 6 outlet))
16	-	Valve Spring Seat and Stem Seal (12 off)
17	-	Valve Spring (12 off)
18	-	Valve Spring Retainer (12 off)
19	-	Valve Spring Collet (24 off)
20	-	Valve Tappet (12 off)
21	-	Camshaft Cover Gasket
22	-	Camshaft Cover Spark Plug/Injector Gasket (3 off)

Cylinder Heads

The cylinder heads are manufactured in gravity die cast aluminum alloy and are unique for each cylinder bank. Deep-seated head bolts reduce head lift and bore distortion and secure the cylinder heads to the cylinder block.

Each cylinder is served by four valves. To help achieve the required gas-flow characteristics, these are arranged asymmetrically around the cylinder bore. Each cylinder has a centrally mounted fuel injector and spark plug.

The valves are a conventional direct acting tappet arrangement, with a valve and spring assembly retained by two valve collets. The valve tappets are graded and selected on assembly to obtain the correct camshaft to tappet clearance dimensions.



E142792

Item	Part Number	Description
1	-	Exhaust Valves
2	-	Fuel Injector Location
3	-	Spark Plug Location
4	-	Inlet Valves

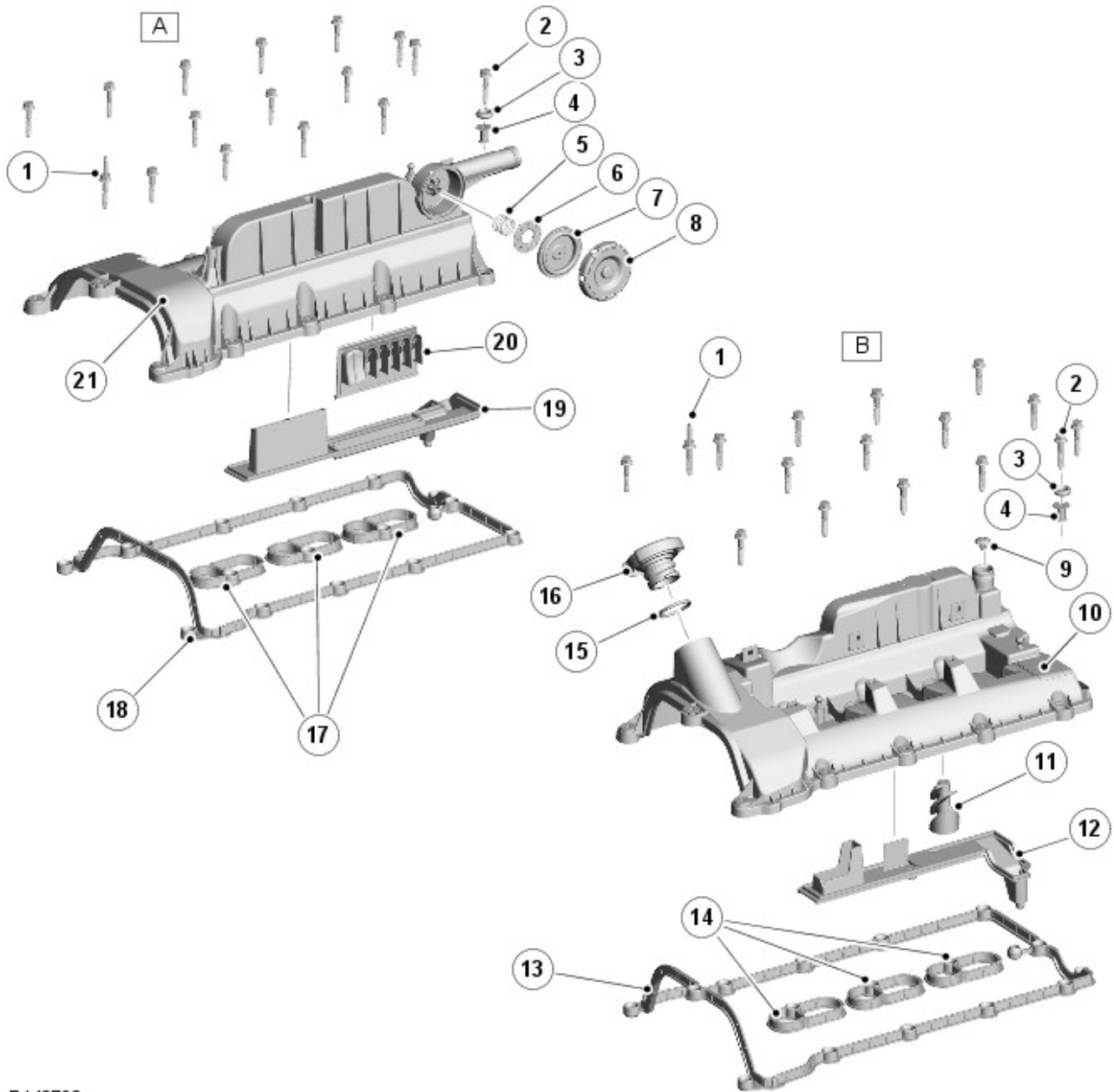
The cylinder head gasket is of a multi-layer steel construction.

The threads for the spark plugs are machined at a precise start point to ensure that each spark plug is orientated in the cylinder correctly. The benefits of this are optimum spark plug intrusion into the combustion chamber to improve combustion, idle stability, dilution tolerance and spark plug durability. The spark plug must be tightened to the specified torque to ensure the correct orientation.

The camshafts run on line bored journals in the cylinder head and camshaft caps. Therefore it is very important that the camshaft caps are maintained with their respective journal and the orientation is as marked on the cap.

A camshaft cover is fitted and sealed with a rubber seal and 3 smaller rubber seals. The cover is retained in position with 15 bolts which are located through a sleeve and a grommet for sealing and a single stud and nut.

Camshaft Covers



E142793

Item	Part Number	Description
A	-	Right Side Bank 1
B	-	Left Side Bank 2
1	-	Stud and Nut (2 off)
2	-	Bolt (15 off Bank 2, 14 off Bank 1)
3	-	Grommet (15 off per cover)
4	-	Spacer (15 off per cover)
5	-	Pressure Control Valve Spring
6	-	Pressure Control Valve Inlet
7	-	Twin Pressure Control Valve
8	-	Pressure Control Valve Cover
9	-	Two-Way Valve
10	-	Camshaft Cover - Left
11	-	Spiral Oil Separator
12	-	Baffle Plate
13	-	Camshaft Cover Gasket
14	-	Camshaft Cover Spark Plug/Injector Gasket (3 off)

15	-	O-Ring Seal
16	-	Oil Filler Cap Assembly
17	-	Camshaft Cover Spark Plug/Injector Gasket (3 off)
18	-	Camshaft Cover Gasket
19	-	Baffle Plate
20	-	Omega Flap Plate
21	-	Camshaft Cover - Right

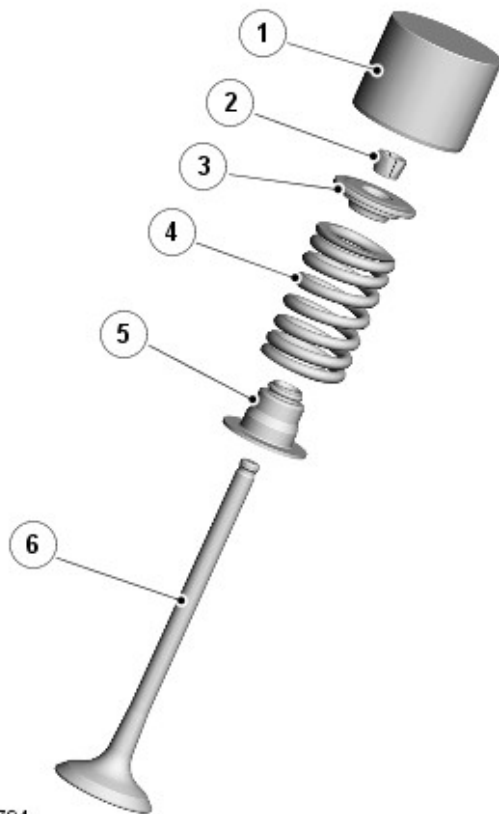
Each camshaft cover is secured to the cylinder head with 15 bolts and 1 stud and nut. A grommet seals the holes in the cover and a sleeve controls the compression of the grommet.

Threaded inserts are fitted to each cover to allow for the attachment of the ignition coils. A rubber moulded NVH cover is fitted over the ignition coils and is secured with snaplock studs.

Each camshaft cover is fitted with a breather. The left side cover has a baffle plate which collects oil vapor and allows it drain back into the oil pan via the cylinder block. The left side breather provides for engine full load operation and vents cylinder block emissions into the left side air filter outlet. The right side cover is fitted with an omega plate and a pressure control valve. The right side breather provides for engine part load operation and vents cylinder block emissions into the throttle which is integral with the supercharger.

A groove in the outer edge of each cover provides the location for the re-useable camshaft cover gasket. Three separate gaskets, located in the center of the camshaft cover, prevent oil leaking into the area around the fuel injectors, spark plugs and coils.

Valves and Tappets



E142794

Item	Part Number	Description
1	-	Valve Tappet
2	-	Valve Collet
3	-	Valve Retainer
4	-	Valve Spring
5	-	Valve Stem Seal
6	-	Valve

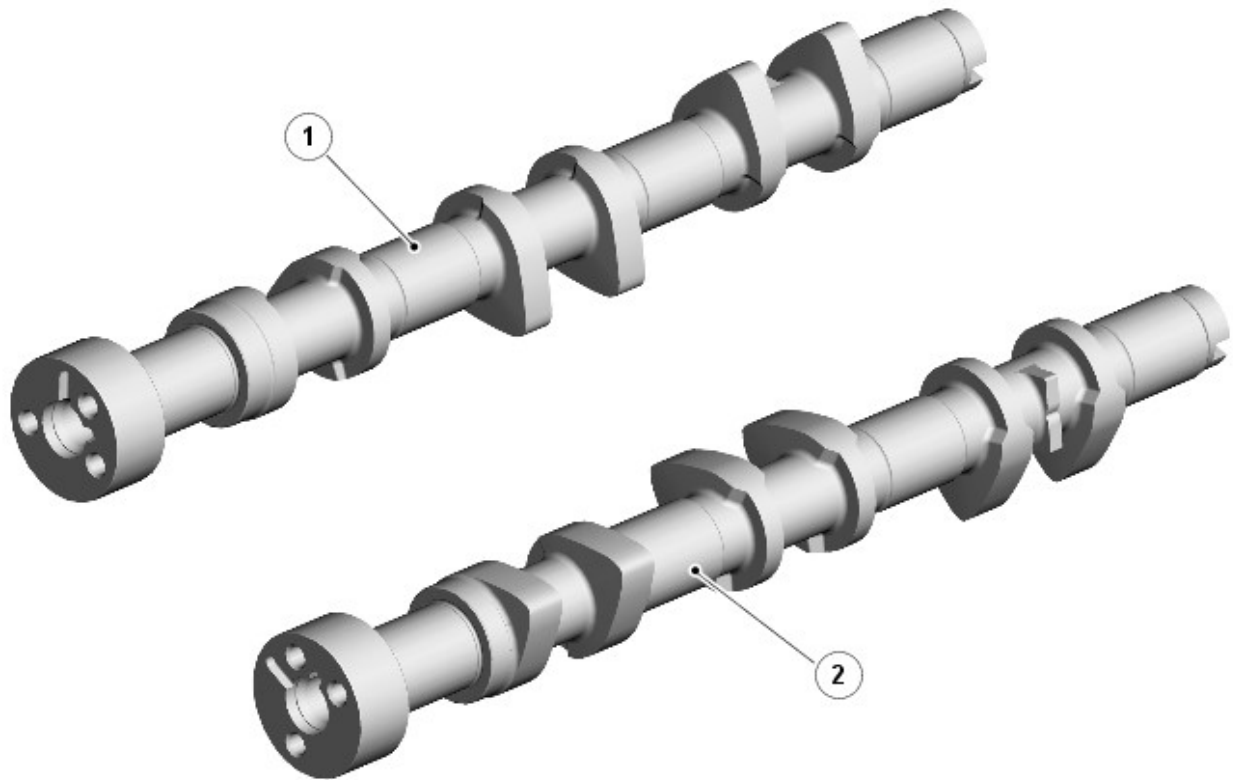
The engine uses 24 mono metallic valves; 12 inlet and 12 exhaust. The inlet valve heads are 33.0 mm diameter and the exhaust valve heads are 28.0 mm diameter. The large valve size allows for large cylinder head port sizes which assist with engine performance and improved emissions. The valve stems are 5.4 mm diameter which allows for reduced flow interruption through the inlet and exhaust ports assisting with performance and improved emissions.

The valves are located in conventional, non-serviceable valve guides in the cylinder head. A valve guide and valve seat is located in the cylinder head. The valve spring is retained in a compressed states on the valve stem by a valve retainer and a pair of valve spring collects.

The valves are opened mechanically by a bucket design valve tappet which is operated directly by the associated

camshaft lobe. The valve clearance is set by selection of the appropriate valve tappet to achieve the required valve clearance.

Camshafts



E142795

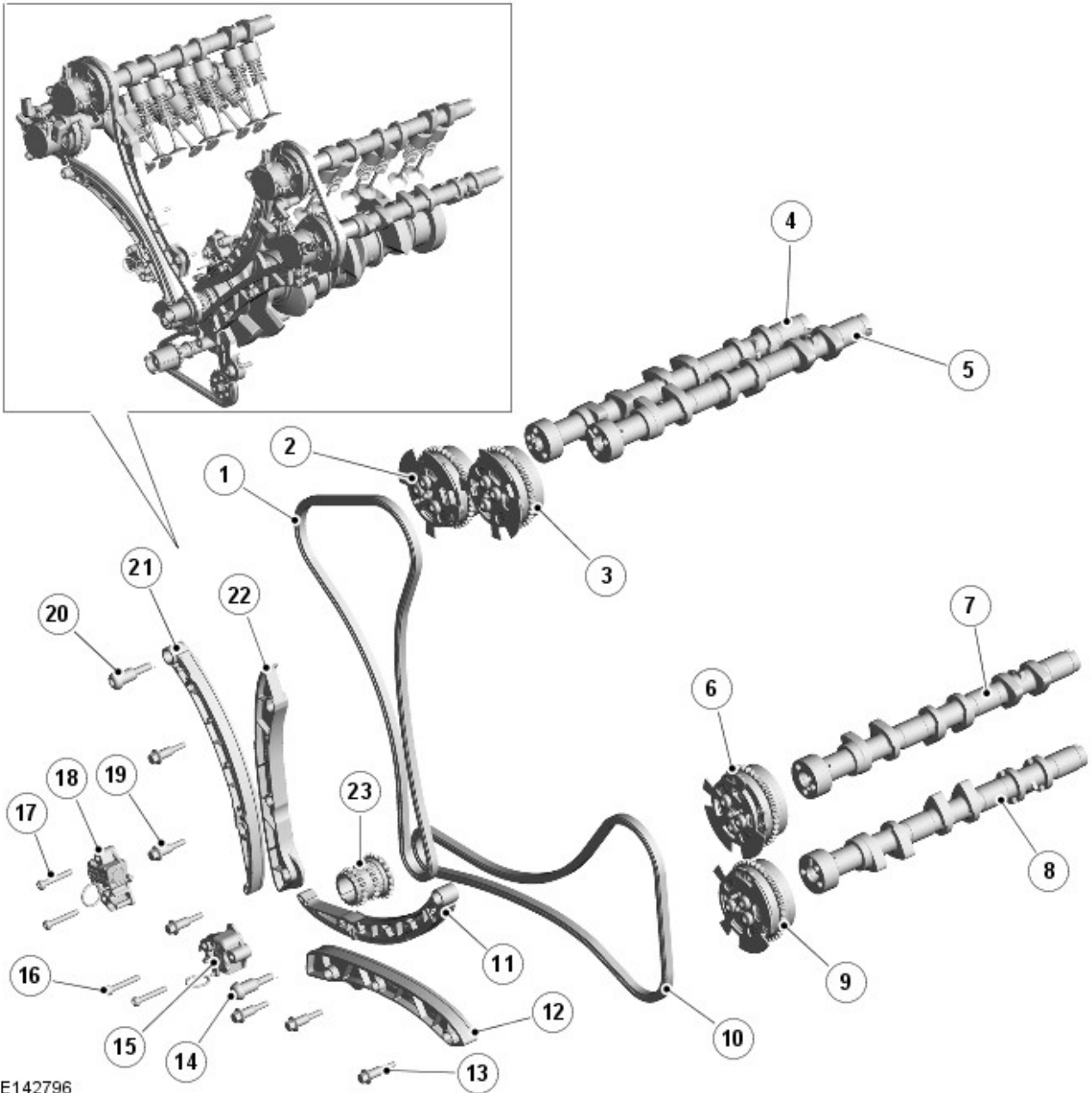
Item	Part Number	Description
1	-	Inlet Camshaft
2	-	Exhaust Camshaft

Each cylinder head is fitted with 2 camshafts; inlet and exhaust. The lobes on the camshafts act on the valve tappets to open and close the valves.

The camshafts run on machined bearing journals in the cylinder heads and camshaft caps. The camshaft caps are marked with 'IN' and 'EX' to denote inlet and exhaust. The caps at the front of the engine are marked 'AB'. Before removal, each camshaft cap must be marked with its position to ensure correct re-assembly. Each camshaft cap is secured with 2 M6 screws.

Each camshaft is fitted with a **VCT** actuator. Each actuator contains a sprocket which drives the camshaft via a timing chain driven from the crankshaft. The **VCT** actuator can change the timing of the camshaft, increasing engine efficiency and performance.

Camshaft Timing Chain



E142796

Item	Part Number	Description
1	-	Timing Chain - Right Bank 1
2	-	Exhaust VCT (variable camshaft timing) Actuator
3	-	Inlet VCT Actuator
4	-	Exhaust Camshaft
5	-	Inlet Camshaft
6	-	Inlet VCT Actuator
7	-	Inlet Camshaft
8	-	Exhaust Camshaft
9	-	Exhaust VCT Actuator
10	-	Timing Chain - Left Bank 2
11	-	Tensioner Arm - Left
12	-	Timing Chain Guide - Left
13	-	Shoulder Bolt (3 off)
14	-	Shoulder Pivot Bolt
15	-	Timing Chain Tensioner Assembly - Left
16	-	Screw (2 off)
17	-	Screw (2 off)
18	-	Timing Chain Tensioner Assembly - Right
19	-	Shoulder Bolt (3 off)
20	-	Shoulder Pivot Bolt
21	-	Tensioner Arm - right

22	-	Timing Chain Guide - right
23	-	Crankshaft Sprocket

Two, endless, simplex roller timing chains are used to drive the camshafts; one chain for each cylinder bank. The timing chains are driven from a crankshaft sprocket and are passed over two sprockets which are integral with the [VCT](#) actuators.

A procedure is required to ensure that the correct crankshaft to camshaft timing is achieved. Refer Engine - V6 3.0L SC Petrol - Removal and Installation for procedure.

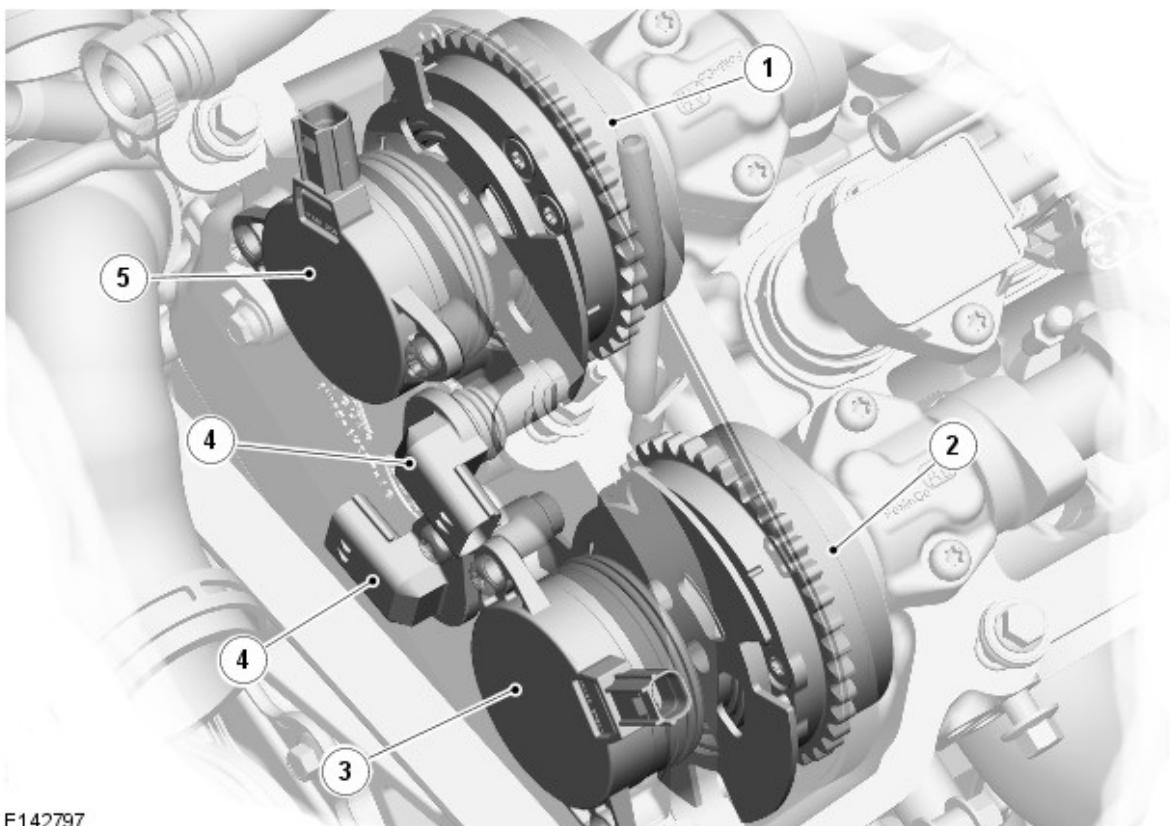
Each timing chain has a fixed timing chain guide which is secured to the cylinder block with three shoulder bolts. A tensioner arm is fitted to each timing chain which can rotate around a shoulder pivot bolt. Each timing chain has a mechanical tensioner operated by spring tension to apply a controlled tension to the timing chain. This maintains the timing chain at the correct tension and allows for and dampens backlash in the chain tension due to engine deceleration. The timing chains and tensioners are maintenance free components.

Each timing chain tensioner has a hole which allow for the locking of the tensioner to facilitate removal of the tensioner arm, guide or camshaft timing chain. The tensioner plunger can be pushed back into the housing and a pin inserted to lock the tensioner in the retracted position.

The timing chains are lubricated with engine oil from jets located at the front of the engine block.

VARIABLE CAMSHAFT TIMING (VCT)

Variable Camshaft Timing



E142797

Item	Part Number	Description
1	-	Inlet Camshaft VCT Actuator
2	-	Exhaust Camshaft VCT Actuator
3	-	Exhaust VCT Solenoid
4	-	CMP (camshaft position) Sensors
5	-	Inlet VCT Solenoid

The timing of the inlet and exhaust camshafts can be adjusted independently by an electro-hydraulic controlled [VCT](#) system. The [ECM](#) controls the system using information from the [CMP](#) sensors and the [CKP](#) sensor.

The [VCT](#) system varies the timing of the intake and exhaust camshafts to deliver optimum engine power, efficiency and emissions. The timing of the intake camshafts has a range of 62 degrees of crankshaft angle. The timing of the exhaust camshafts has a range of 50 degrees of crankshaft angle.

In the base timing position:

- The intake camshafts are fully retarded.
- The exhaust camshafts are fully advanced.

Camshaft	Valve Opens	Valve Closes
----------	-------------	--------------

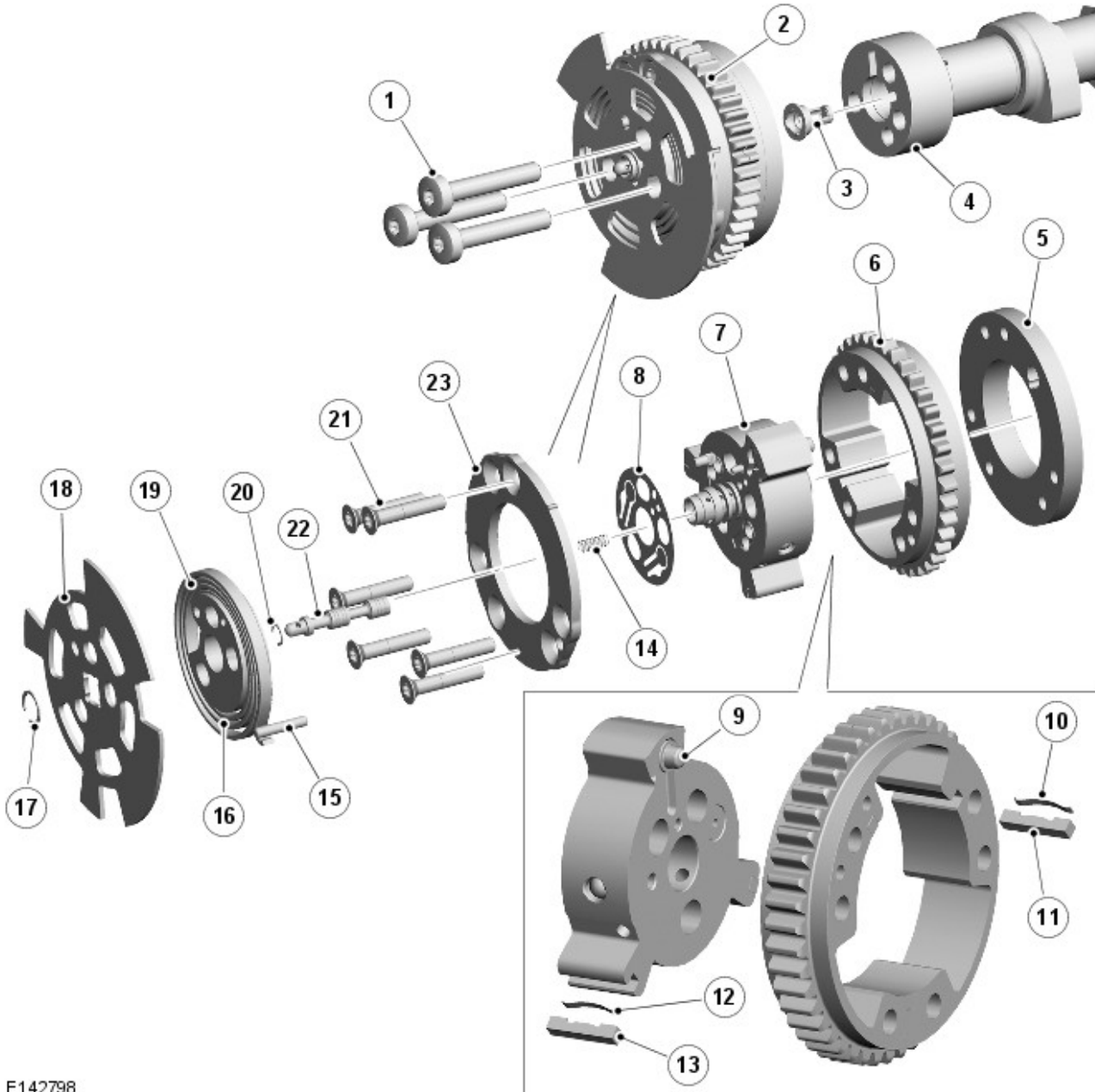
Intake	33 degrees BTDC (before top dead center) to 29 degrees ATDC (after top dead center)	197 to 259 degrees ATDC
Exhaust	236 to 186 degrees BTDC	6 to 56 degrees ATDC

The system consists of a **VCT** unit and a **VCT** solenoid for each camshaft. The **ECM** controls the system using **PWM** (pulse width modulation) signals to the **VCT** solenoids.

The torsional energy generated by the valve springs and the inertia of the valve train components are used to operate the system.

Variable Camshaft Timing Units

The **VCT** units change the position of the camshafts in relation to the timing chains.



E142798

Item	Part Number	Description
1	-	Bolt (3 off)
2	-	VCT Unit
3	-	Filter
4	-	Camshaft
5	-	Inner Plate
6	-	Housing and Sprocket
7	-	Rotor Assembly
8	-	Reed Plate
9	-	Spring and Lock Pin
10	-	Spring (3 off)
11	-	Tip Seal (3 off)

12	-	Spring (2 off)
13	-	Tip Seal (2 off)
14	-	Spring
15	-	Dowel Pin
16	-	Bias Spring
17	-	Snap Ring
18	-	Sensor Wheel
19	-	Center Plate
20	-	Snap Ring
21	-	Screw (6 off)
22	-	Spool Valve
23	-	Outer Plate

Each **VCT** unit is attached to the camshaft by three bolts. A rotor assembly and a reed plate are installed inside a sprocket housing, which consists of a sprocket, an outer plate and an inner plate held together by six screws.

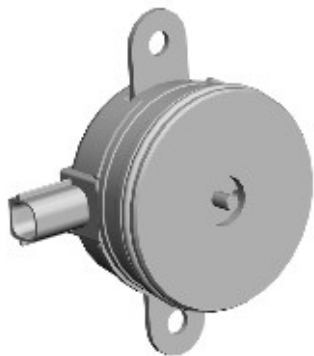
A sensor wheel, for the **CMP** sensor, a center plate and a bias spring are installed at the front of the **VCT** unit. The ends of the bias spring locate on the center plate assembly and the sprocket housing, to give a turning moment to the camshaft in the advance direction. A snap ring locates the sensor wheel on to a sleeve installed in the center of the rotor assembly. The opposite end of the sleeve locates in a bore in the front face of the camshaft, which contains a filter.

A spring and spool valve are installed in the rotor assembly sleeve and retained by a snap ring. The spring keeps the spool valve in contact with the armature of the related **VCT** solenoid.

Each **VCT** unit is supplied with engine oil from an oil gallery in the cylinder head, through the camshaft front bearing cap and a bore in the center of the camshaft.

Variable Camshaft Timing Solenoids

The **VCT** solenoids control the position of the spool valves in the **VCT** units.



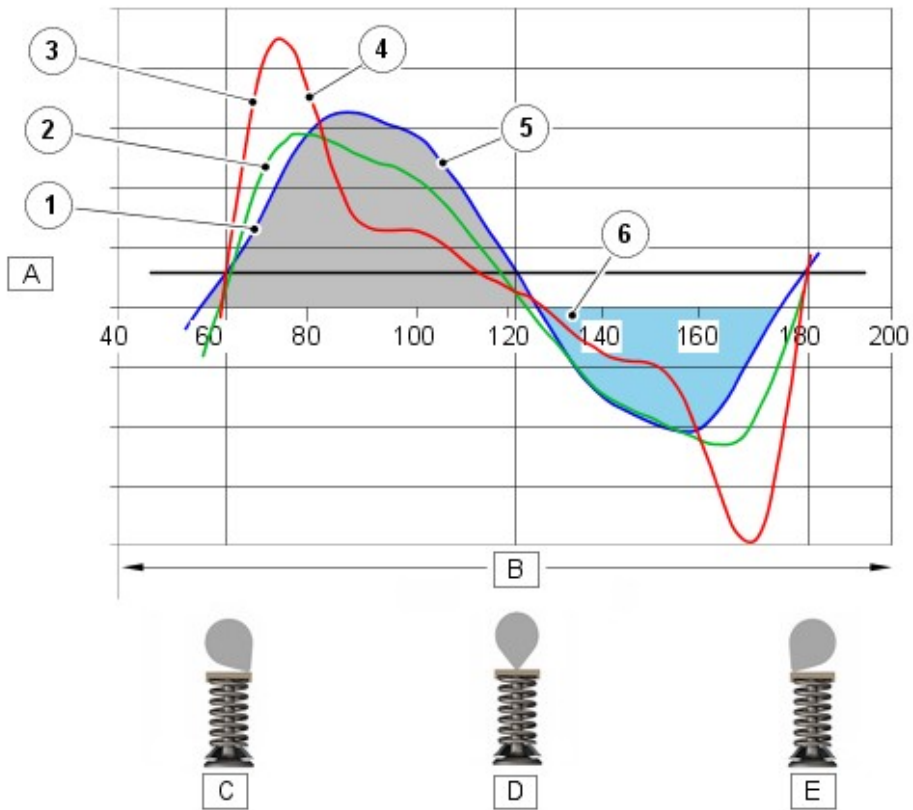
E 115929

The **VCT** solenoids are installed in the front upper timing covers, immediately in front of their related **VCT** units. Each **VCT** solenoid is secured with two screws and sealed with an O-ring. A two pin electrical connector provides the interface with the engine harness.

Each **VCT** solenoid incorporates a spindle that acts on the spool valve in the related **VCT** unit to advance and retard the camshaft timing. The **VCT** solenoids operate independently and are controlled by a **PWM** signal from the **ECM**.

Variable Camshaft Timing Operation

When the engine is running, the compression and expansion of the valve springs causes momentary increases and decreases in the torque acting on the camshafts. These momentary changes of torque are sensed in the **VCT** units and used to change the camshaft timing.



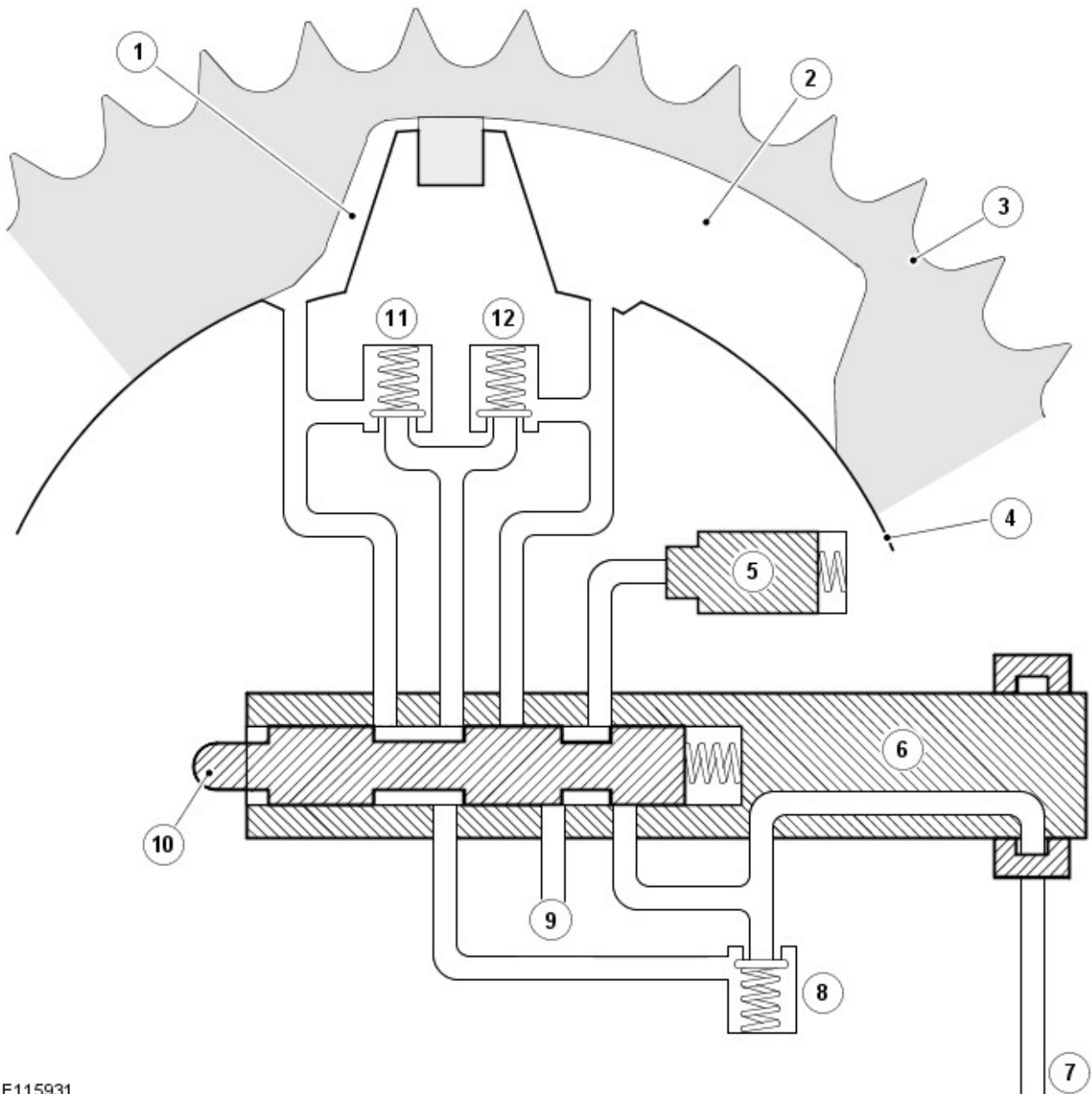
E112406

Item	Part Number	Description
A	-	Camshaft Torque
B	-	Camshaft Rotation (degrees)
C	-	Valve Opening
D	-	Peak Lift
E	-	Valve Closing
1	-	1000 rev/min
2	-	4000 rev/min
3	-	7000 rev/min
4	-	Inertia Effects from Valve Train Rotating Components
5	-	Force Caused by Valve Spring
6	-	Bias Torque from Friction

Variable Camshaft Timing Unit Schematic - Base Timing



NOTE: Intake camshaft VCT unit shown. For exhaust camshaft VCT unit, read advance for retard and retard for advance.



E115931

Item	Part Number	Description
1	-	Advance Chamber
2	-	Retard Chamber
3	-	Sprocket Housing
4	-	Rotor Assembly
5	-	Lock Pin
6	-	Sleeve
7	-	Engine Oil Supply from Camshaft
8	-	Inlet Check Valve
9	-	Lock Pin Drain
10	-	Spool Valve
11	-	Advance Check Valve
12	-	Retard Check Valve

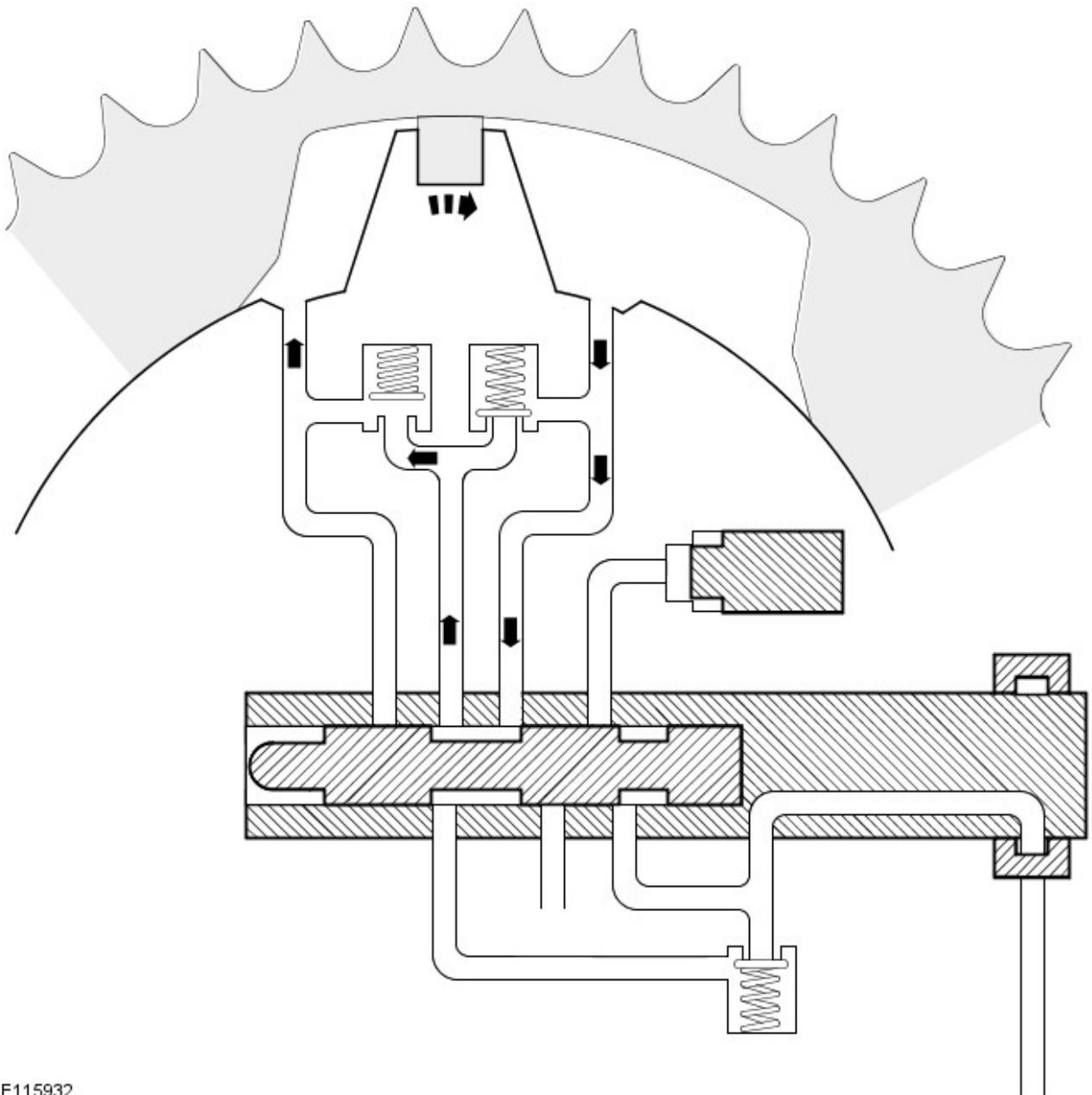


NOTE: The following description is for intake camshaft VCT units. For exhaust camshaft VCT units, read advance for retard, and retard for advance.

At engine start-up, once the engine oil pressure in the camshaft is sufficient to open the inlet check valve, engine oil flows across the spool valve, through the advance and retard check valves and into the advance and retard chambers. During the start cycle, the ECM signals the VCT solenoid to move the spool valve into the sleeve and connect the lock pin to inlet oil pressure. The inlet oil pressure causes the lock pin to retract from the inner plate and unlock the rotor assembly and camshaft from the sprocket housing.

There is a constant supply of oil to the VCT to ensure the unit remains filled during operation.

Variable Camshaft Timing Unit Schematic - Advance

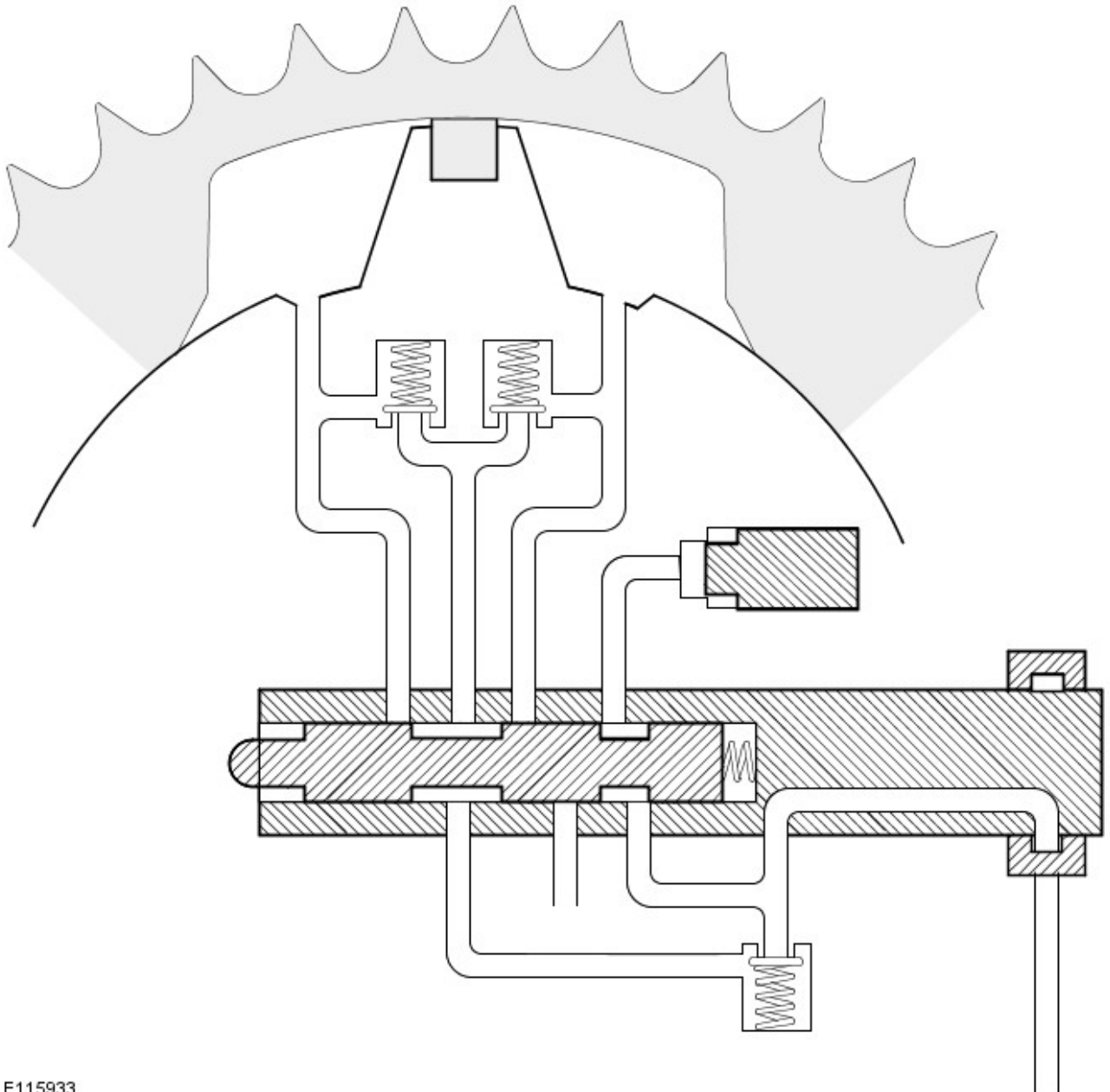


E115932

To advance the camshaft timing, the **ECM** adjusts the signal to the **VCT** solenoid to move the spool valve so that the advance chamber oil passage is closed and the retard chamber oil passage is connected to inlet oil.

Each momentary increase of the torque acting on the camshaft generates a pressure pulse in the retard chamber. Oil moves from the retard chamber, through the spool valve and the advance check valve to the advance chamber, to equalize the pressures in the two chambers. The displacement of oil from the retard chamber causes the rotor assembly to advance in relation to the sprocket housing. Each momentary decrease of torque acting on the camshaft also generates a pressure pulse in the advance chamber, but, with the advance chamber oil passage closed, no movement of oil between the advance and retard chambers occurs and the rotor assembly cannot move in the retard direction.

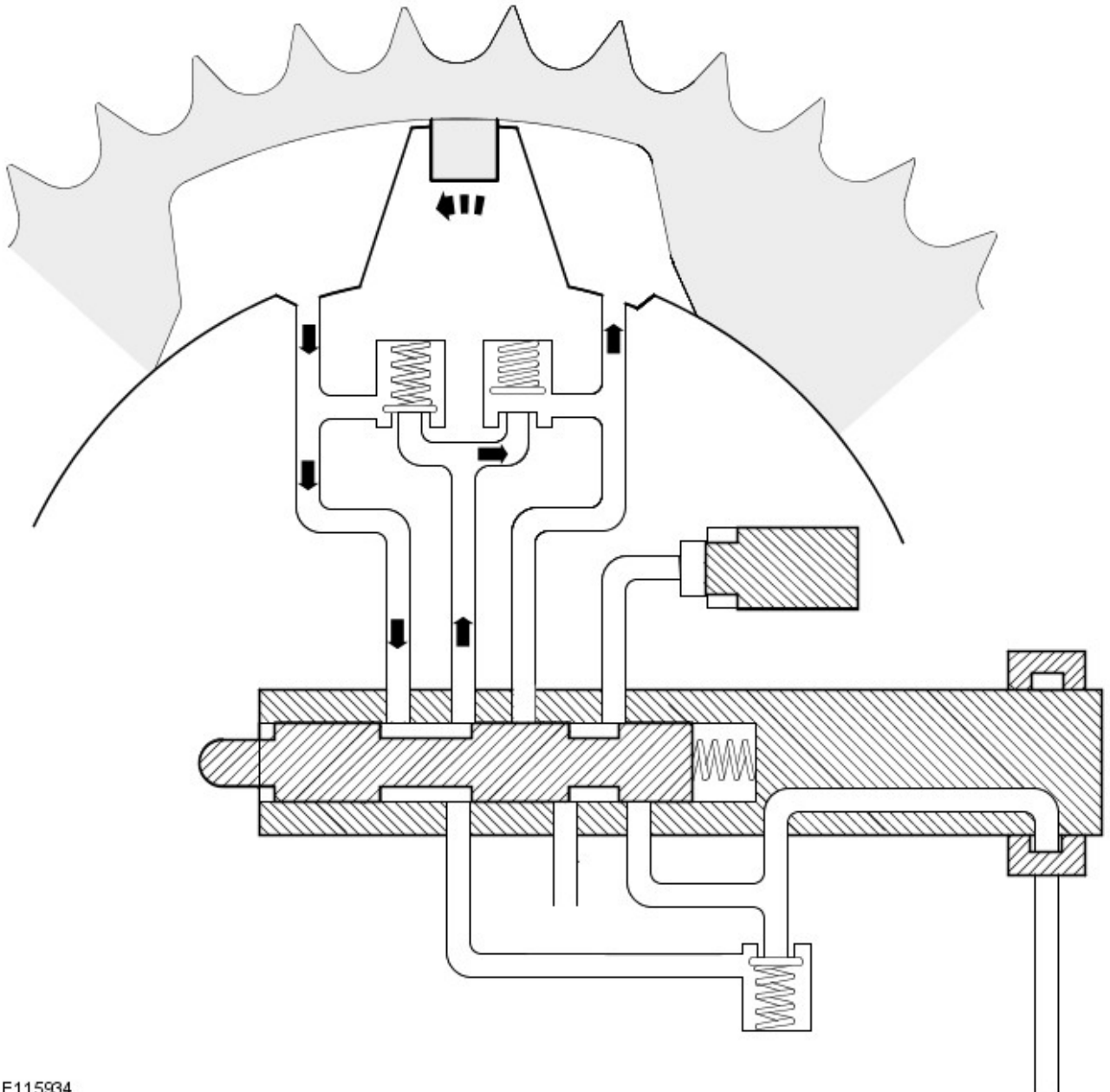
Variable Camshaft Timing Unit Schematic - Null



E115933

Once the camshaft has reached the required timing position the [ECM](#) adjusts the signal to the [VCT](#) solenoid to set the spool valve in the null position. In the null position, the advance and retard chamber oil passages are both closed by the spool valve and the rotor assembly is hydraulically locked to the sprocket housing.

Variable Camshaft Timing Unit Schematic - Retard

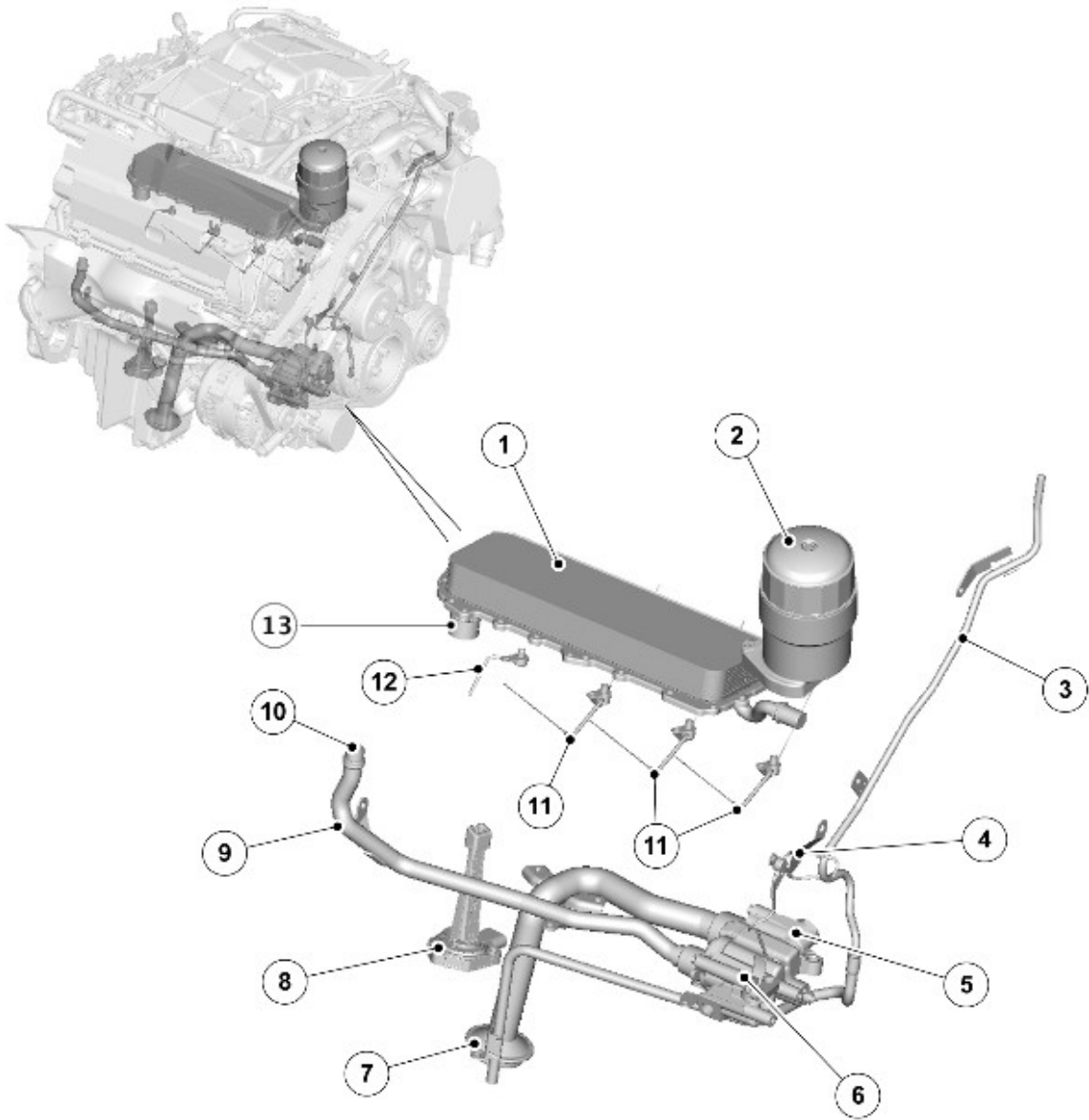


E115934

To retard the camshaft timing, the **ECM** adjusts the signal to the **VCT** solenoid to move the spool valve to close the retard chamber oil passage and connect the advance chamber oil passage to the inlet oil.

Each momentary decrease of the torque acting on the camshaft causes oil to transfer from the advance chamber, through the spool valve and the retard check valve to the retard chamber, and so retard the camshaft timing.

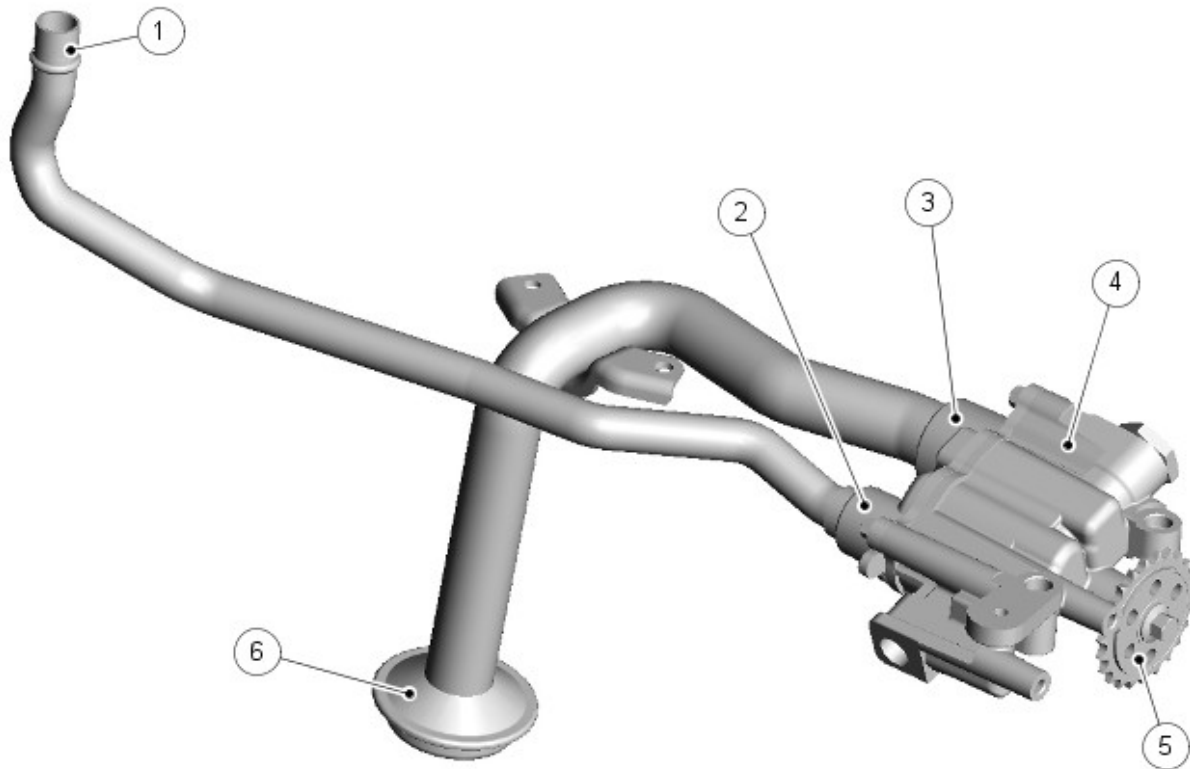
LUBRICATION SYSTEM



E152257

Item	Part Number	Description
1	-	Oil Cooler
2	-	Oil Filter
3	-	Oil Evacuation Tube
4	-	Upper Timing Chain Lubrication Jet
5	-	Oil Pump
6	-	Lower Timing Chain Lubrication Jet
7	-	Oil Pick-Up
8	-	Oil Level and Temperature Sensor
9	-	Oil Pump Outlet Tube
10	-	Outlet Tube Connection to Right Cylinder Block
11	-	Piston Cooling Jets
12	-	Rear Dynamic Balancer Drive Chain Lubrication Jet
13	-	Anti Drain Valve

Oil Pump



E152259

Item	Part Number	Description
1	-	Pressurized Oil Outlet to Cylinder Block
2	-	Pump Pressure Outlet
3	-	Pump Inlet
4	-	Oil Pump
5	-	Oil Pump Drive Sprocket
6	-	Oil Pick-Up Pipe

The oil pump is attached to the underside of the windage tray with 3 bolts. The input shaft of the oil pump is driven from the front of the crankshaft, by the auxiliary chain, at 0.87 engine speed.

The oil pump draws oil from the oil pan through a centrally mounted pick-up pipe. The oil is pressurized and pumped through an output tube to the cylinder block. After passing through an anti-drain valve and a plate type oil cooler, the oil is filtered by a replaceable cartridge installed on the front of the right (bank 1) cylinder head.

The output from the oil filter is distributed through oil galleries in the cylinder heads and the cylinder block. All moving parts are lubricated by pressure or splash oil. Pressurized oil is also provided for the VCT system, the piston cooling jets and the timing chain lubrication jets.

The oil returns to the oil pan under gravity. Large drain holes through the cylinder heads and cylinder block ensure the rapid return of the oil to the oil pan. System replenishment is through the oil filler cap on the left cylinder head cover.

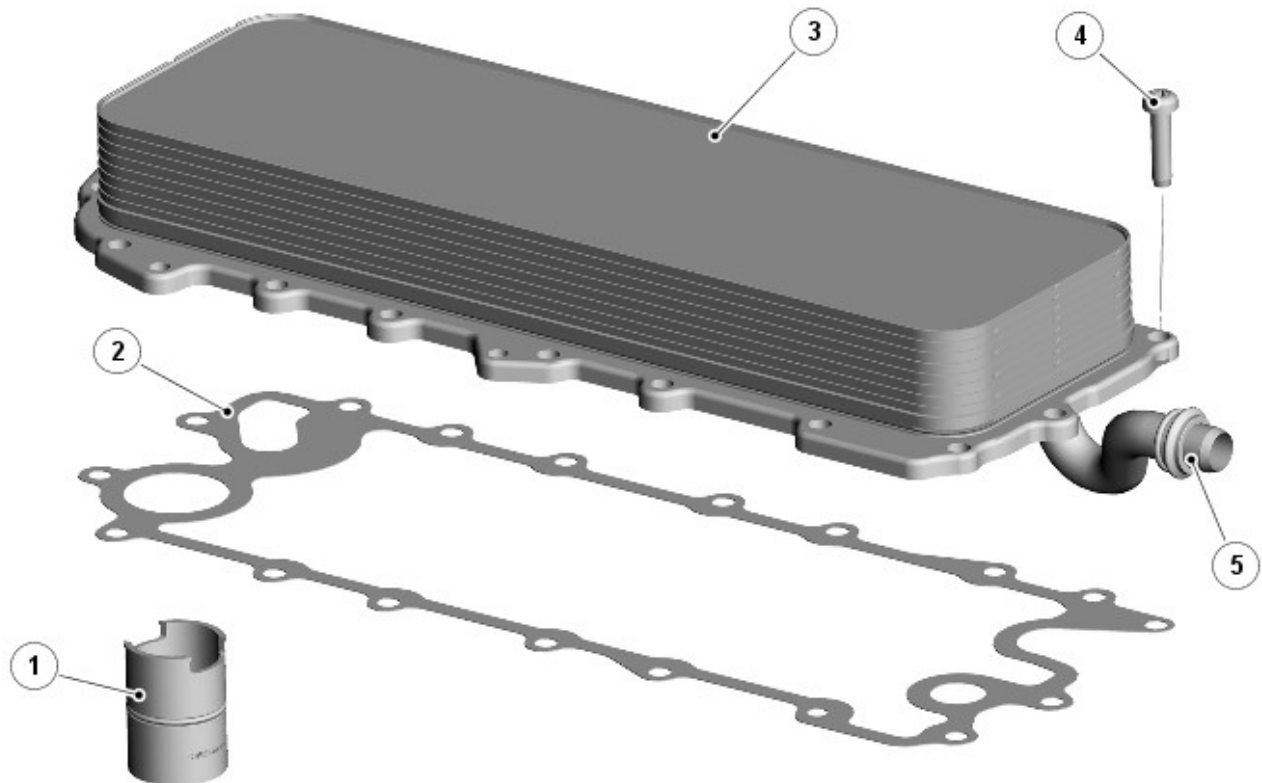
An oil evacuation tube is installed to allow oil to be drawn from the oil pan. The upper end of the oil evacuation tube is located under the oil filler cap.

An oil drain plug is installed in the right side of the oil pan.

Oil Pump Nominal Operating Pressures

Engine Speed, rev/min	Temperature, °C (°F)	Pressure, bar (lbf/in ²)
Idle	20 (68)	2.0 (29.0)
1500	20 (68)	6.0 (87.0)
3000	40 (104)	6.2 (90.0)
3000	110 (230)	5.0 (72.5)
3000	130 (266)	4.0 (58.0)

Engine Oil Cooler



E142801

Item	Part Number	Description
1	-	Anti-Drain Valve Assembly
2	-	Gasket
3	-	Engine Oil Cooler
4	-	Screw (18 off)
5	-	Engine Coolant Inlet from Water Pump

The engine oil cooler is located on the top of the cylinder block, in the 'V' between the cylinder heads. The cooler is sealed to the cylinder block with a gasket and secured with 18 screws.

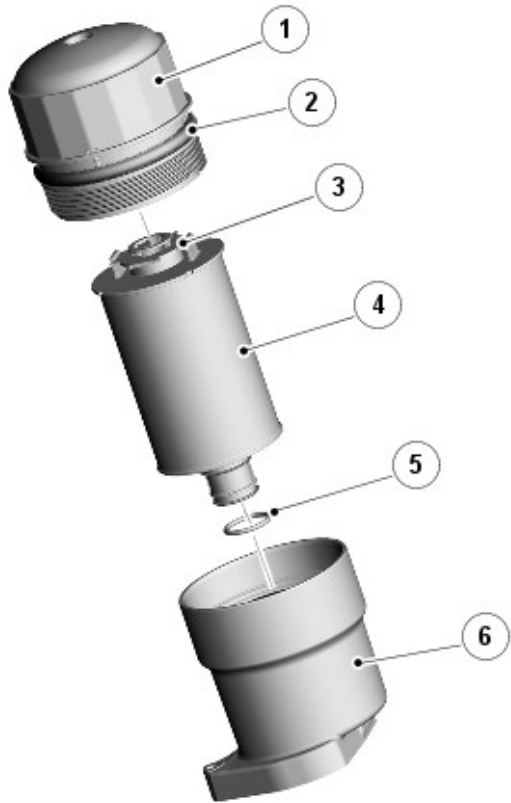
There are three ports on the underside of the cooler; an engine oil inlet and outlet and an engine coolant outlet. The engine coolant inlet is positioned on the side of the cooler. The engine oil cooler is an aluminum housing comprising louvered fins and plates. The plates allow a cross-flow of engine oil and engine coolant through the cooler but keeping the two fluids separate.

The engine coolant is directed from the engine coolant pump into the cooler via a plastic tube.

The plates are immersed in engine coolant from the engine coolant pump which provides cooling of the engine oil by the temperature differential between the engine oil and the engine coolant.

An anti-drain valve is located in the cylinder block and prevents the engine oil cooler draining of oil when the engine is not running.

Engine Oil Filter



E142804

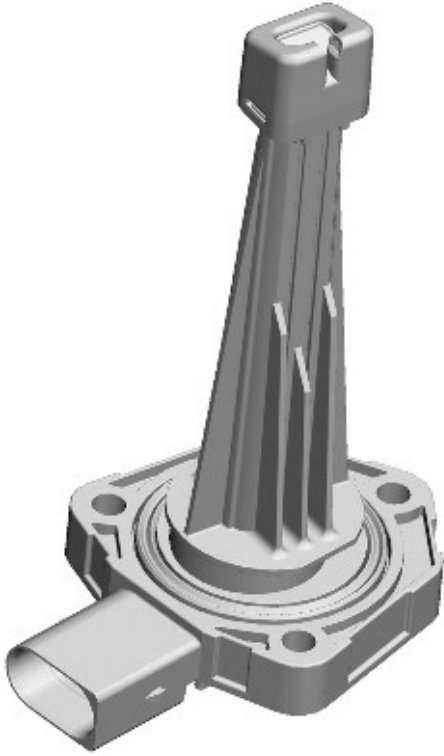
Item	Part Number	Description
1	-	Cap
2	-	O-Ring Seal
3	-	By-Pass Valve
4	-	Filter Element
5	-	O-Ring Seal
6	-	Oil Filter Body

The oil filter assembly is located on a casting which is integral with the right cylinder head. The oil filter body is sealed with a gasket and secured to the cylinder head with 4 screws, 3 internal and 1 external.

A replaceable cartridge filter element is located in the oil filter body. An O-ring seal seals the filter element to the filter body.

The filter element is fitted with an integral by-pass valve. If the filter becomes contaminated, to the point that oil flow is restricted, the by-pass valve opens to allow oil to flow through the oil filter body to avoid starving the engine of engine oil.

Oil Level Monitoring



E115936

The oil level and temperature sensor supplies the [ECM](#) with a signal containing the level of the oil in the oil pan. The oil level and temperature sensor is secured to the bottom of the oil pan with three screws and sealed with a gasket.



NOTE: The temperature function of the oil level and temperature sensor is not operational on the [V6 3.0L SC engine](#).

The oil level and temperature sensor sends an ultrasonic pulse vertically upward and measures the time taken for the pulse to be reflected back from the top surface of the oil. This time is compared with the time taken for an ultrasonic pulse to travel a reference distance within the oil level and temperature sensor to determine the oil level. The oil level reading is transmitted in a [PWM](#) signal to the [ECM](#).

Oil Level and Temperature Sensor Specifications

Feature	Details
Power Source	Battery Voltage
Temperature Accuracy	± 2 °C (± 3.6 °F)
Operating Level Range	18 to 147 mm (0.71 to 5.79 in.)
Operating Temperature Range	-40 to 160 °C (-40 to 320 °F)

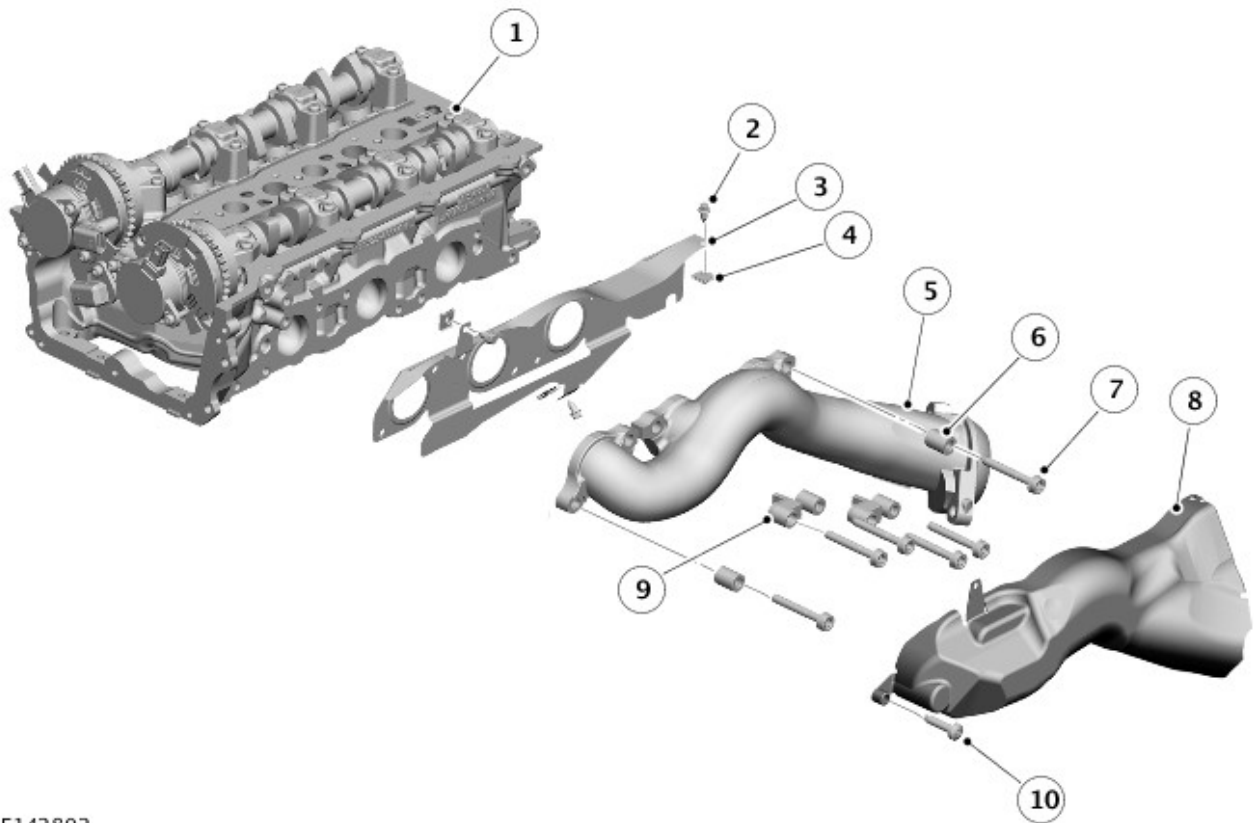
Oil Level Check

For accuracy, oil level checks should be performed with the vehicle on level ground when the oil is hot. The vehicle needs to stand for approximately 10 minutes, after the engine is switched off, to allow the oil to drain back into the oil pan and the oil level to stabilize. The oil level system will not give a reading until the oil level has stabilized.

For additional information, refer to: [Engine Oil Draining and Filling](#) (303-01A Engine - TDV6 3.0L Diesel, General Procedures).

For additional information, refer to: [Engine Oil Vacuum Draining and Filling](#) (303-01A Engine - TDV6 3.0L Diesel, General Procedures).

Exhaust Manifolds



E142802

Item	Part Number	Description
1	-	Cylinder Head
2	-	Bolt (3 off)
3	-	Layered Gasket
4	-	Threaded Insert (3 off)
5	-	Exhaust Manifold
6	-	Parallel Spacer (24 off)
7	-	Bolt (6 off)
8	-	Heat Shield
9	-	Forged Spacer (2 off)
10	-	Bolt (1 off)

The cast iron exhaust manifolds are unique for each cylinder bank. Each exhaust manifold installation includes a layered metal gasket and heat shields. The spacers limit the contraction of the individual ports over time.

OPERATION

Operation of the engine is controlled by the [ECM](#).

For additional information, refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 S/C 3.0L Petrol, Description and Operation).

Engine - V6 S/C 3.0L Petrol - Engine

Diagnosis and Testing

For additional information, refer to Diagnosis and Testing, Engine - V6 3.0 Petrol.

REFER to: [Engine - V6 S/C 3.0L Petrol](#) (303-00 Engine System - General Information, Diagnosis and Testing).

Engine - V6 S/C 3.0L Petrol - Engine Oil Draining and Filling

General Procedures

Draining



WARNING: The spilling of hot engine oil is unavoidable during this procedure, care must be taken to prevent scalding.

CAUTIONS:



Correct installation of the oil filler cap can be obtained by tightening the cap until hard stop.



Make sure the engine is warm.



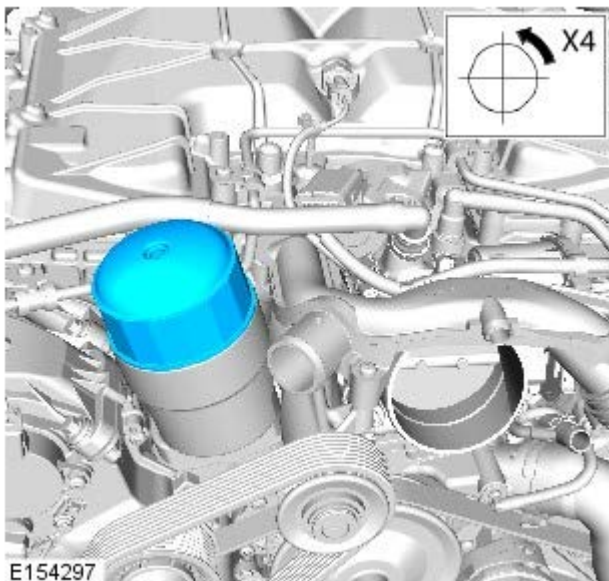
NOTE: Clean the components general area prior to dismantling.

1.
 - Start the engine and allow to run for 10 minutes, stop the engine.
2. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

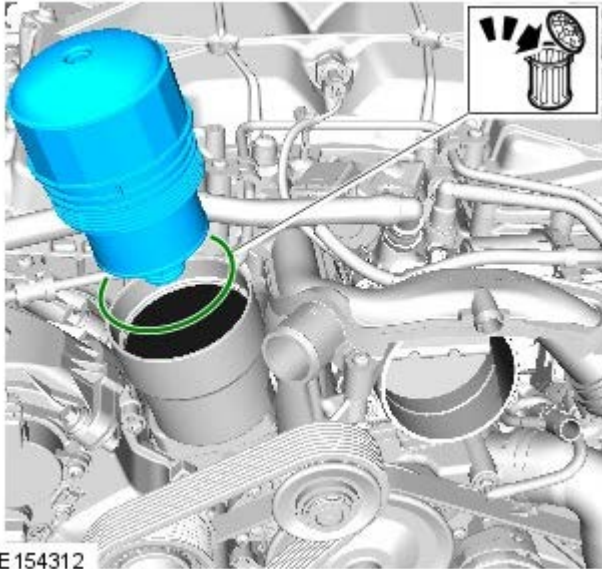
3.



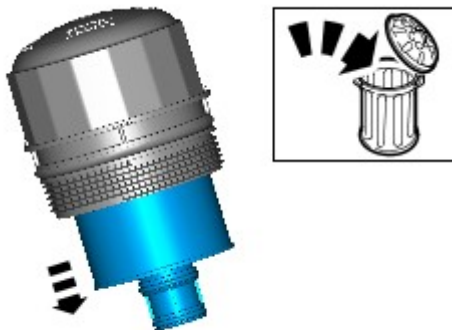
4.  **NOTE:** Allow 10 minutes for the engine oil to drain from the oil filter housing.




5.  **CAUTION:** Remove and discard the O-ring seal.



E154312



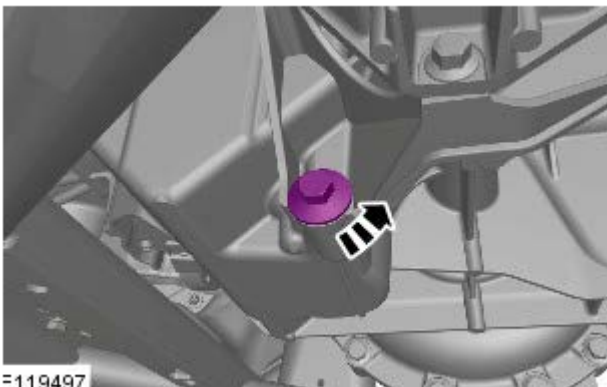
E107394

6.  CAUTION: Remove and discard the element.


7.  WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

8. Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).



E119497

9.  WARNING: Observe due care when draining engine oil as the oil can be very hot.


CAUTIONS:

 Be prepared to collect escaping oil.

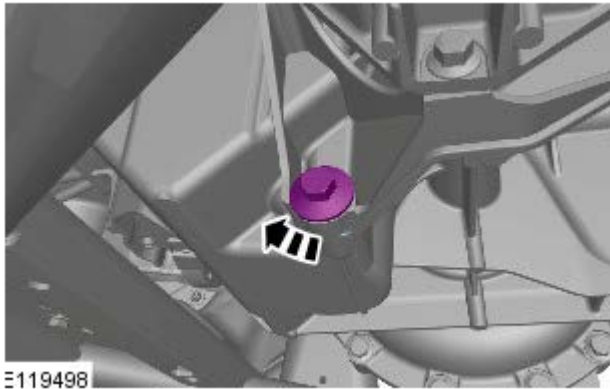
 Allow at least 10 minutes for the engine oil to drain.

 NOTE: Discard the sealing washer.

Filling

1.  CAUTION: Make sure that the area around the component is clean and free of foreign material.

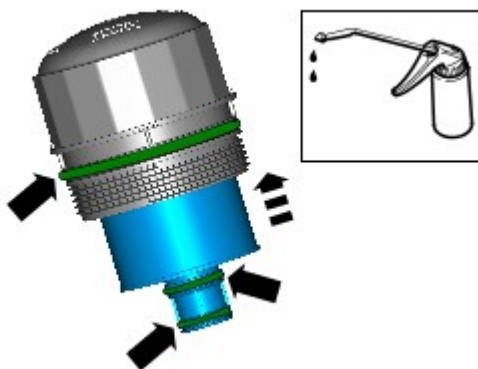
 NOTE: Install a new sealing washer.



Torque: 24 Nm

2. Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

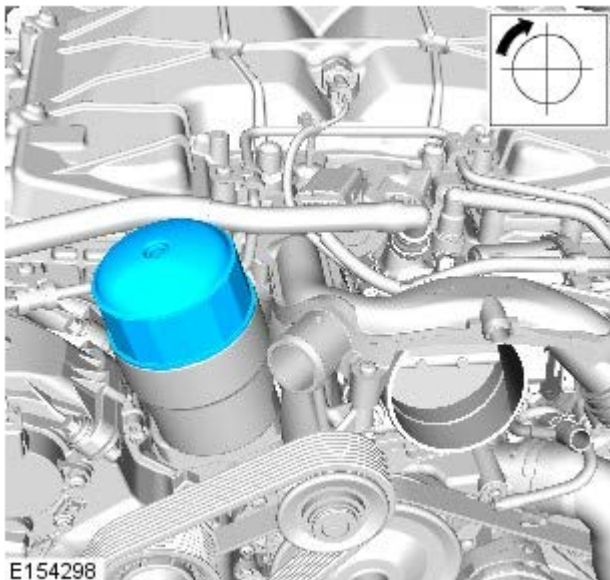
3. Lower the vehicle.



4.  **NOTE:** Install new O-ring seals.


Lubricate the oil filter element O-ring seal with clean engine oil.

E107727



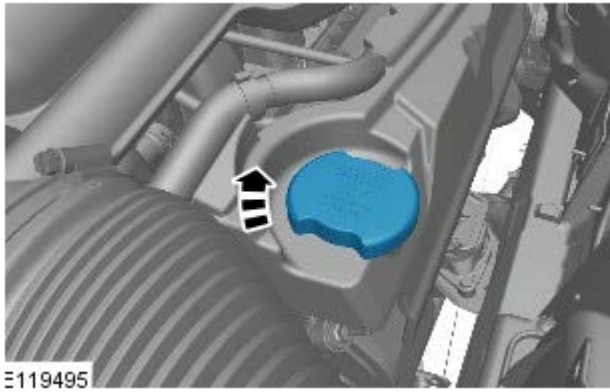
5.  **CAUTION:** Tighten the component finger tight first.

Torque: 25 Nm

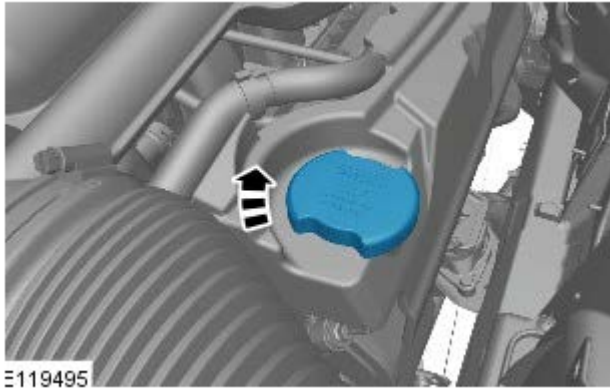
6.  **CAUTION:** Make sure that the vehicle is left for 5 minutes from filling with oil and that the engine oil level is reading at least minimum (by following Steps 10-16), before starting the engine


Fill the engine with oil.

Refer to: [Specifications](#) (303-01B Engine - V6 S/C 3.0L Petrol, Specifications).



7. Clean any residual engine oil from the oil filler cap area.



8.  **CAUTION:** Make sure that the vehicle has been left for 5 minutes from filling with oil.
 - Start the engine and allow to run for 10 minutes, stop the engine.
 - Check for leaks.

9. **CAUTIONS:**

 Make sure that the selector lever is in the park (P) position.

 Make sure that the hood is open.

 **NOTE:** Allow 10 minutes from the engine switch off for the engine oil level to stabilize.

- Set the ignition to the ON position.

- 10.

- Press the right-hand directional button to access the instrument cluster menu.



E123926

11.

- Press the right-hand OK button.



E123925

12.

- Press the right-hand directional button to access the Oil Level Display.



E123927

13.

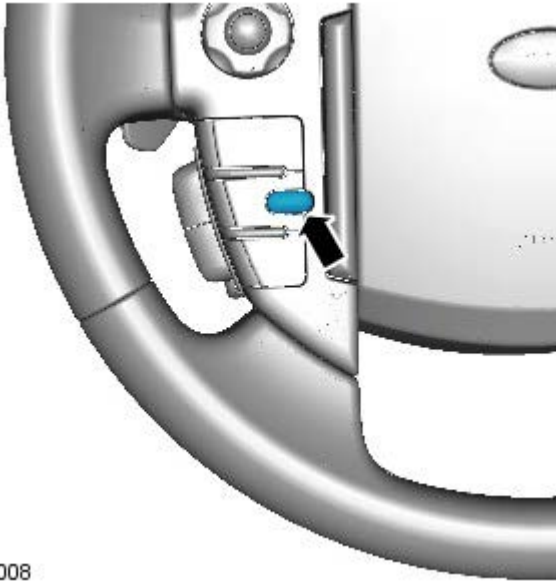
- Press the right-hand OK button and follow the instructions.



E123928

14.

- Press the cruise control cancel button twice within 2 seconds.



E121008



E123929

15.

- The message center display will revert to the normal display in the trip computer.
- Press the right-hand OK button and follow the instructions.
- Check that the oil level display shows an oil level reading.
- Take a reading from the level display and, if necessary, top up with oil as instructed.

16. Turn the ignition off.

17.  **NOTE:** Allow 10 minutes for the engine oil level to stabilize if there has been additional oil top up.

- Turn the ignition on.

18.

- Press the right-hand directional button to access the instrument cluster menu.



E123926

19.

- Press the right-hand OK button.



E123925

20.

- Press the right-hand directional button to access the Oil Level Display.



E123927

21.

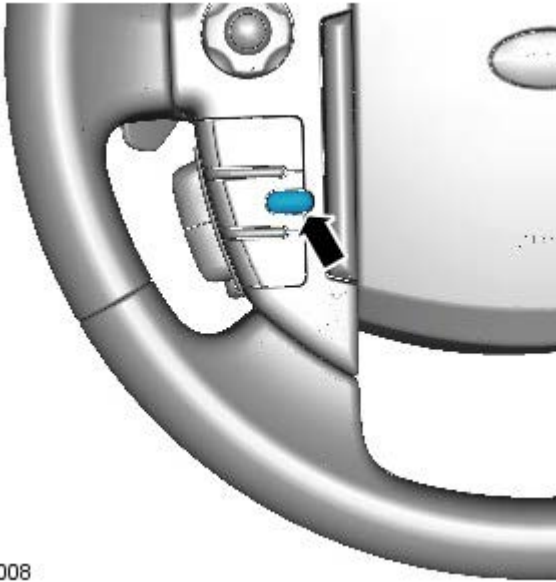
- Scroll through the trip menu to access the engine oil level display.



E123929

22.


- Press the cruise control cancel button twice within 2 seconds.



E121008



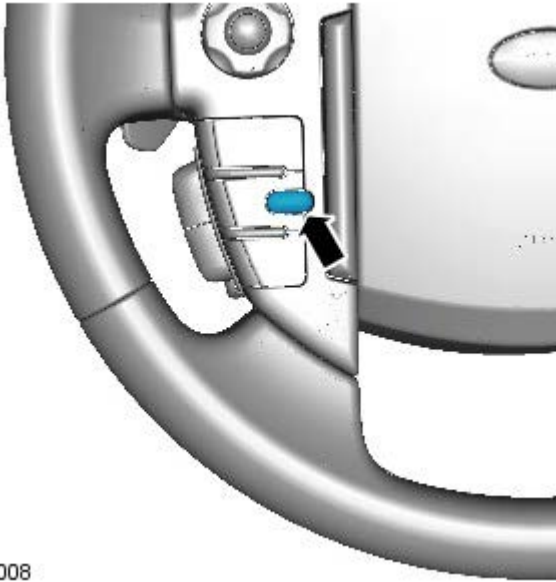
E123929

23.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

- The message center display will revert to the normal display in the trip computer.
- Scroll through the trip menu to access the engine oil level display.
- This display is now the live reading of the engine oil level.
- Take a reading from the level display and, if necessary, top up with oil as instructed.

24.


- Press and hold the cruise control cancel button for more than 2 seconds.



E121008

25.
 - The message center display will revert to the normal display in the trip computer.
26. Turn the ignition off.
27. Turn the ignition on.



28.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.
 - Scroll through the trip menu to access the engine oil level display.
 - Make sure that the average oil level value has now been updated.





E123929

29. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

Engine - V6 S/C 3.0L Petrol - Engine Oil Vacuum Draining and Filling

General Procedures

Special Tool(s)

 <p>E129630</p>	<p>303-1484 Vacuum Pump, Oil Drain</p>
 <p>E129631</p>	<p>303-1484-01 Adapter for 303-1484</p>

Draining



WARNING: The spilling of hot engine oil is unavoidable during this procedure, care must be taken to prevent scalding.

CAUTIONS:

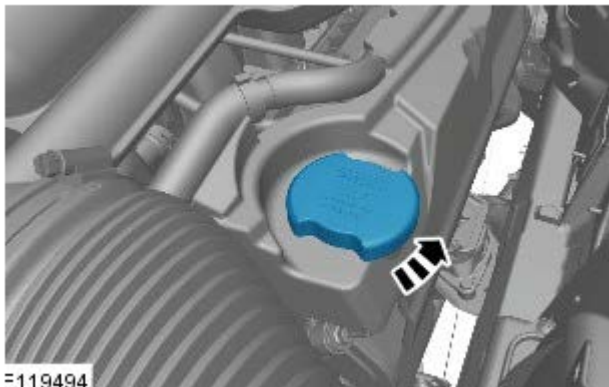


Make sure the engine is warm.



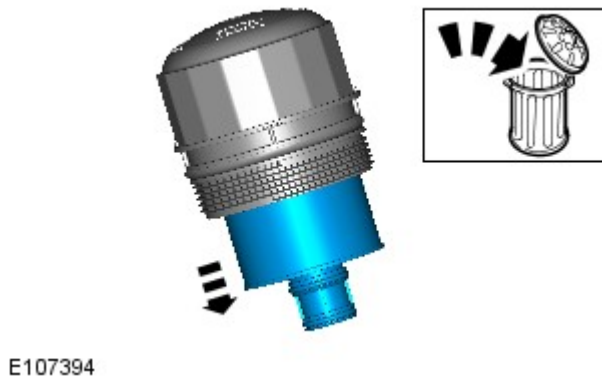
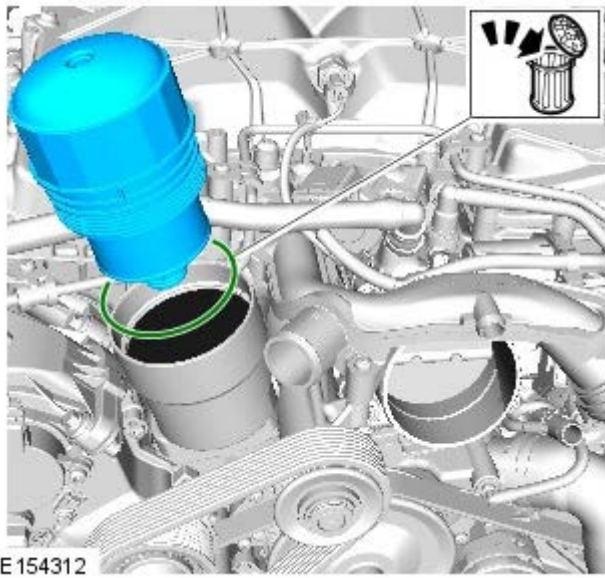
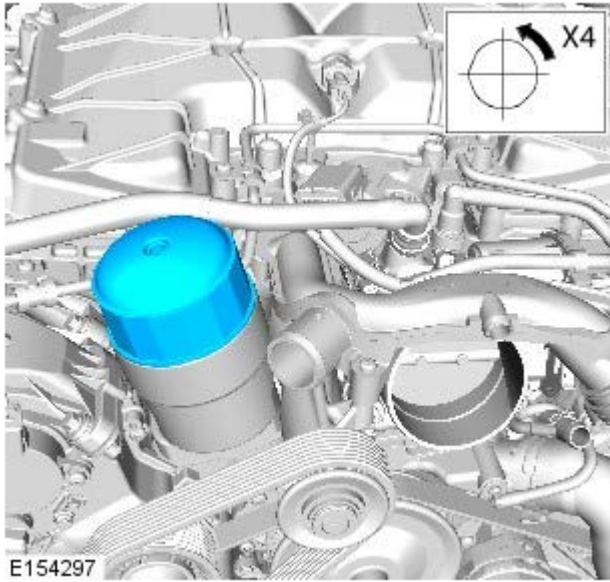
Make sure that the vehicle is parked on level ground.

1.
 - Start the engine and allow to run for 10 minutes, stop the engine.
2. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).



3.  **CAUTION:** Allow 10 minutes from turning the engine off before starting oil extraction.

4.  **NOTE:** Allow 10 minutes for the engine oil to drain from the oil filter housing.

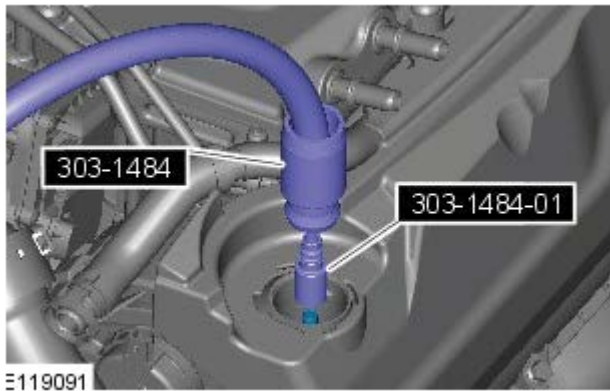


5.  CAUTION: Remove and discard the O-ring seal.

6.  CAUTION: Remove and discard the element.

7.
 - Using the oil vacuum pump drain the oil out through the oil extraction tube.

Special Tool(s): [303-1484](#), [303-1484-01](#)



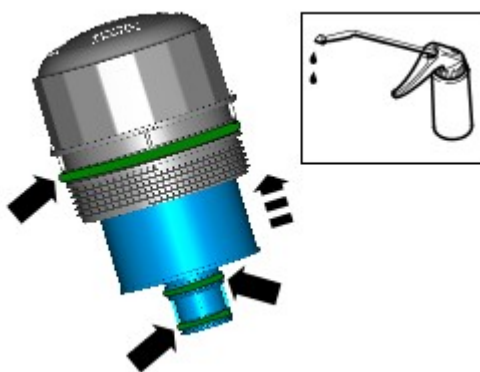
8.

- Remove the oil vacuum pump.

Filling

- 
NOTE: Install new O-ring seals.

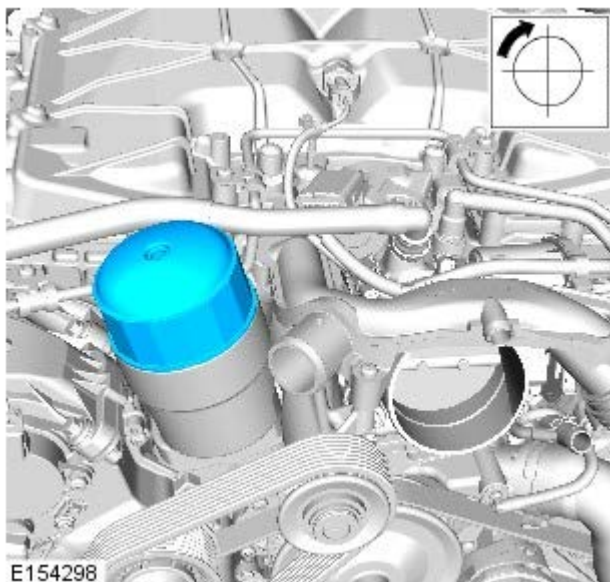
Lubricate the oil filter element O-ring seal with clean engine oil.



E107727

- 
CAUTION: Tighten the component finger tight first.

Torque: 25 Nm



E154298

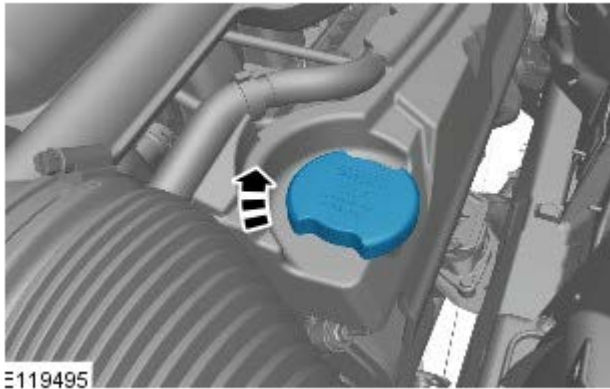
3.

- Fill the engine with the recommended oil to the correct level.


Refer to: [Specifications](#) (303-01B Engine - V6 S/C 3.0L Petrol, Specifications).

- Clean any residual engine oil from the oil filler cap area.

4.




E119495

5.  **CAUTION:** Make sure that the vehicle has been left for 5 minutes from filling with oil.

- Start the engine and allow to run for 10 minutes, stop the engine.
- Check for leaks.

6. **CAUTIONS:**

 Make sure that the selector lever is in the park (P) position.

 Make sure that the hood is open.

- Set the ignition to the ON position.

7.

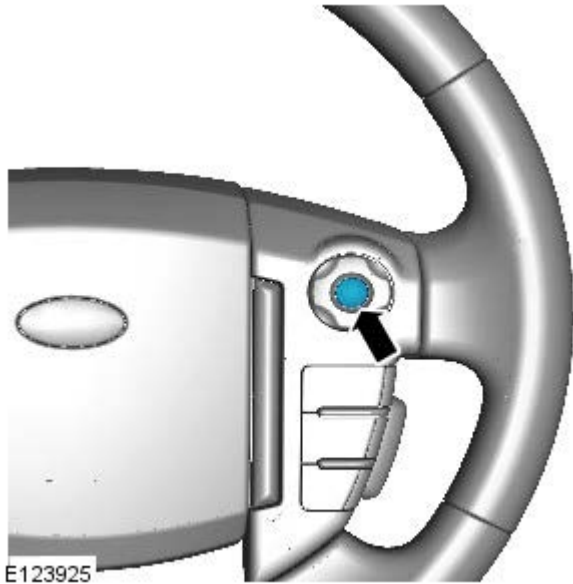
- Press the right-hand directional button to access the instrument cluster menu.



E123926

8.

- Press the right-hand OK button.



9.

- Press the right-hand directional button to access the Oil Level Display.



10.

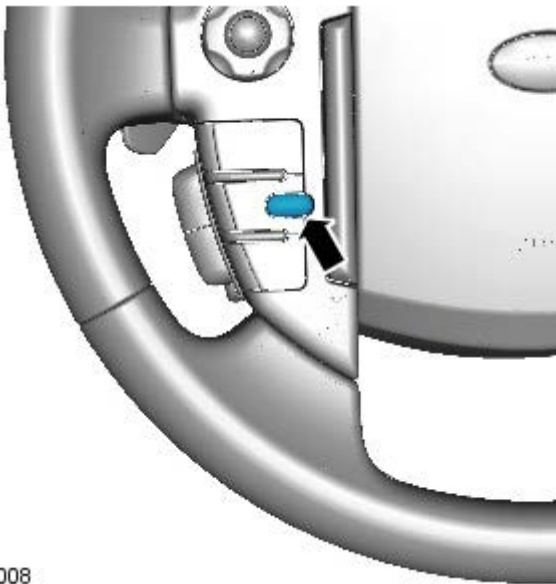
- Press the right-hand OK button and follow the instructions.



E123928

11.

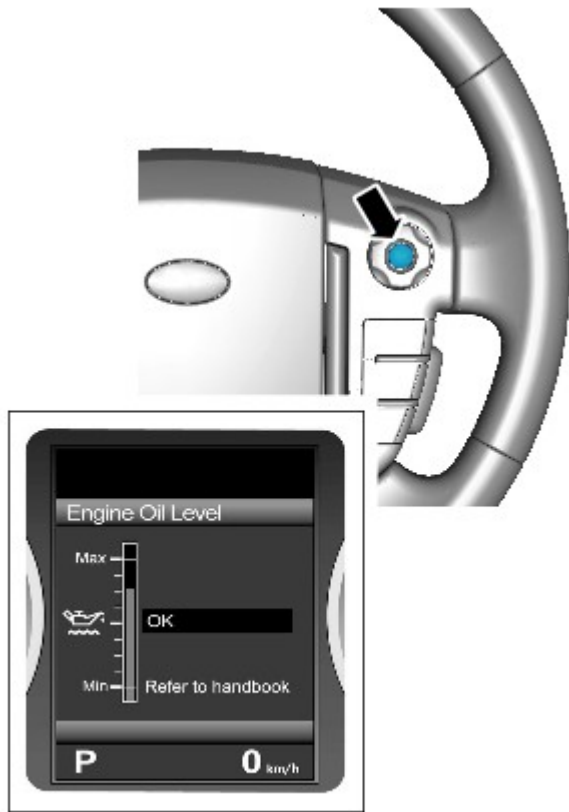
- Press the cruise control cancel button twice within 2 seconds.



E121008


12.

- The message center display will revert to the normal display in the trip computer.
- Press the right-hand OK button and follow the instructions.
- Check that the oil level display shows an oil level reading.
- Take a reading from the level display and, if necessary, top up with oil as instructed.



E123929

13. Turn the ignition off.

14.  **NOTE:** Allow 10 minutes for the engine oil level to stabilize if there has been additional oil top up.

- Turn the ignition on.

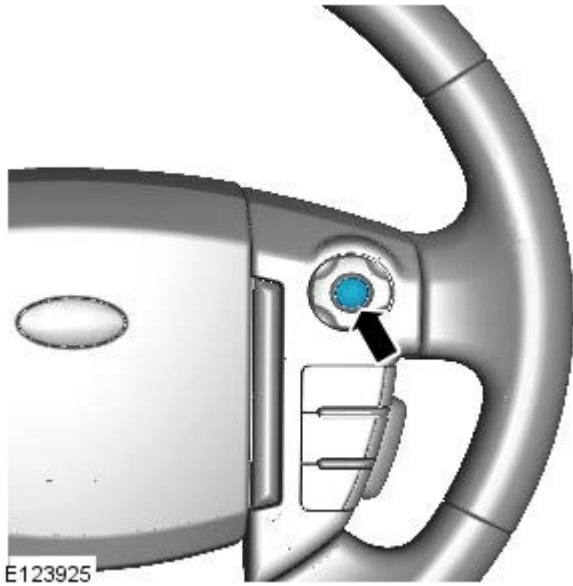
15.

- Press the right-hand directional button to access the instrument cluster menu.



E123926

16.



- Press the right-hand OK button.



17.

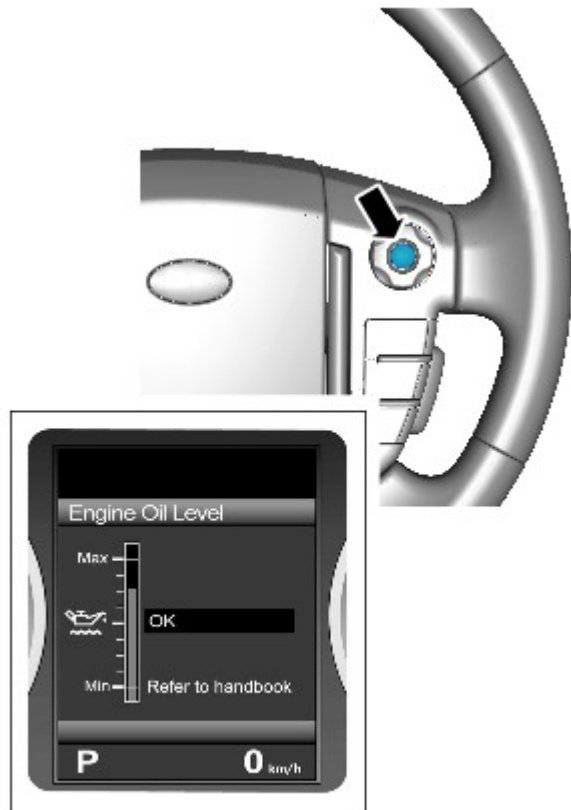
- Press the right-hand directional button to access the Oil Level Display.



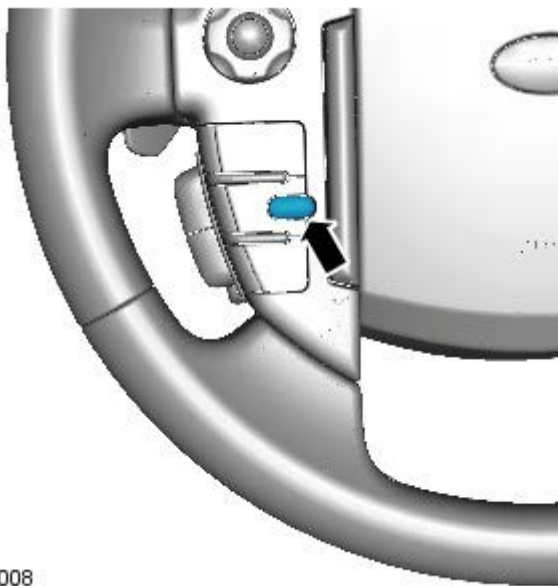
E123927

18.

- Scroll through the trip menu to access the engine oil level display.



E123929



E121008

19.

- Press the cruise control cancel button twice within 2 seconds.

20.

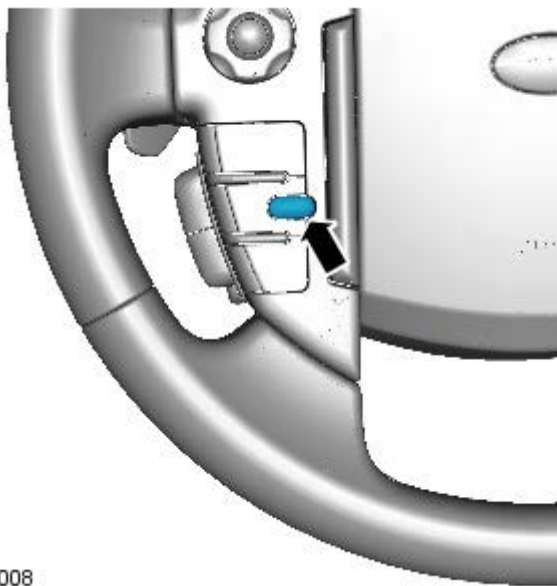


NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

- The message center display will revert to the normal display in the trip computer.
- Scroll through the trip menu to access the engine oil level display.
- This display is now the live reading of the engine oil level.
- Take a reading from the level display and, if necessary, top up with oil as instructed.



E123929



E121008

21.


- Press and hold the cruise control cancel button for more than 2 seconds.

22.

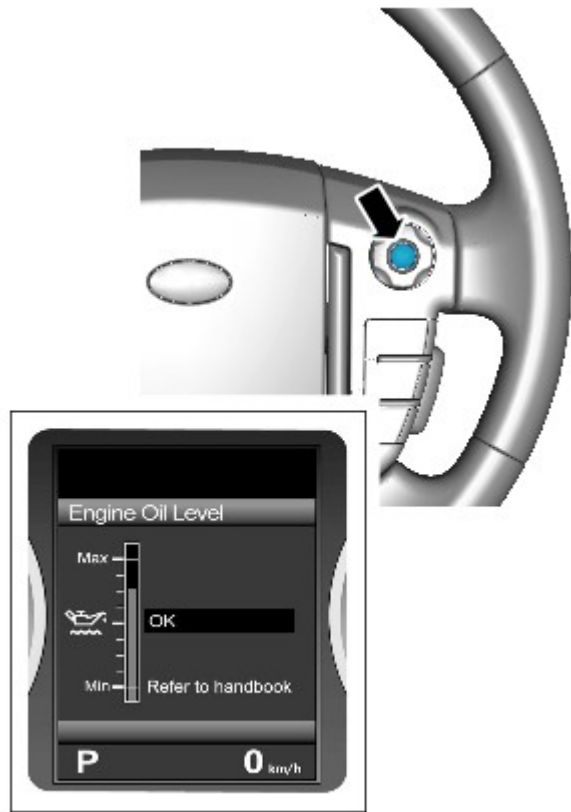
- The message center display will revert to the normal display in the trip computer.

23. Turn the ignition off.

24. Turn the ignition on.

25.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

- Scroll through the trip menu to access the engine oil level display.
- Make sure that the average oil level value has now been updated.





E123929

26. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

Engine - V6 S/C 3.0L Petrol - Fuel Pump Camshaft Timing Check

General Procedures

Special Tool(s)


 <p>E152575</p>	<p>JLR-303-1303 Timing Tool</p>
 <p>E140377</p>	<p>JLR-303-1621 Alignment Tool, Fuel Pump Camshaft Timing</p>

Check

1. Disconnect the battery ground cable.

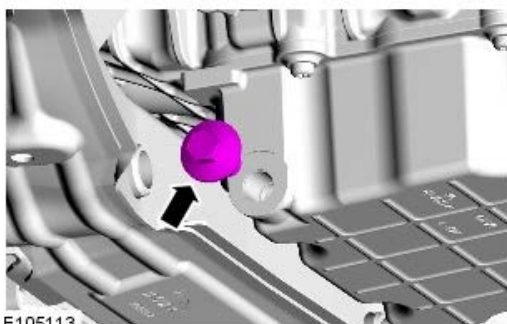
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

4. Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).



E105113

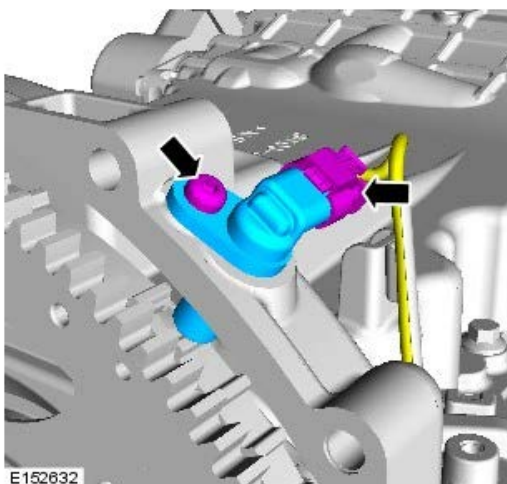
5.  **CAUTION:** Be prepared to collect escaping oil.

NOTES:

 Discard the sealing washer.

 Collect the engine oil in a clean container.

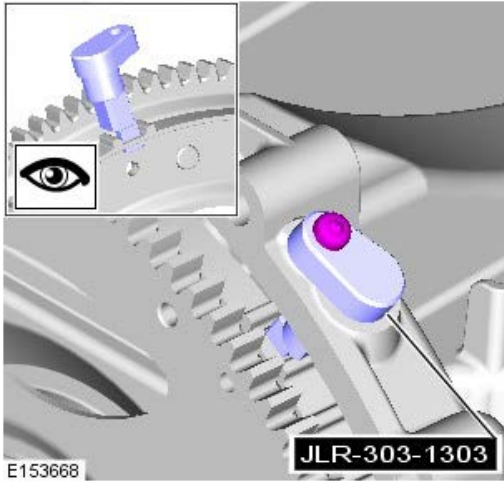
- 6.




E152632

7. **CAUTIONS:**

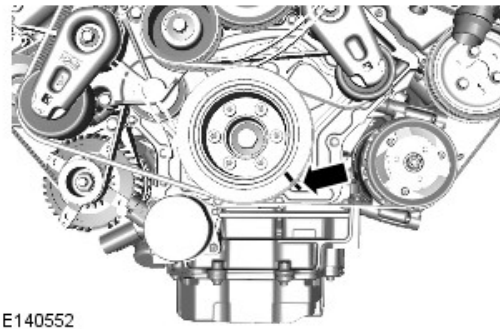
 Only rotate the crankshaft clockwise.



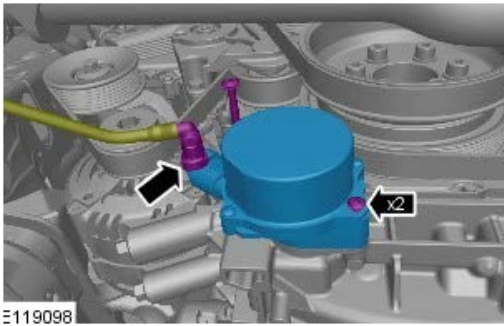
 Make sure that the crankshaft is fully locked.

Special Tool(s): [JLR-303-1303](#)

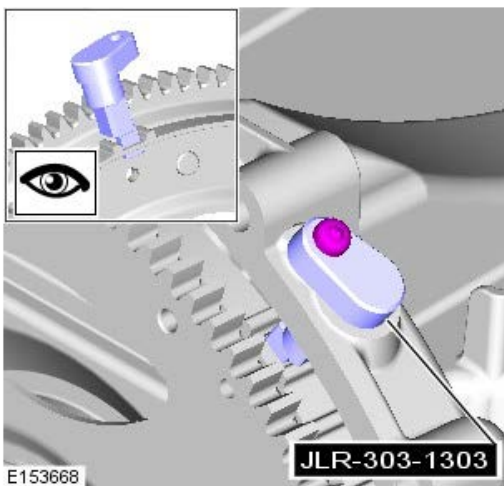
8. Using a suitable marker, mark the position of the crankshaft pulley as illustrated.



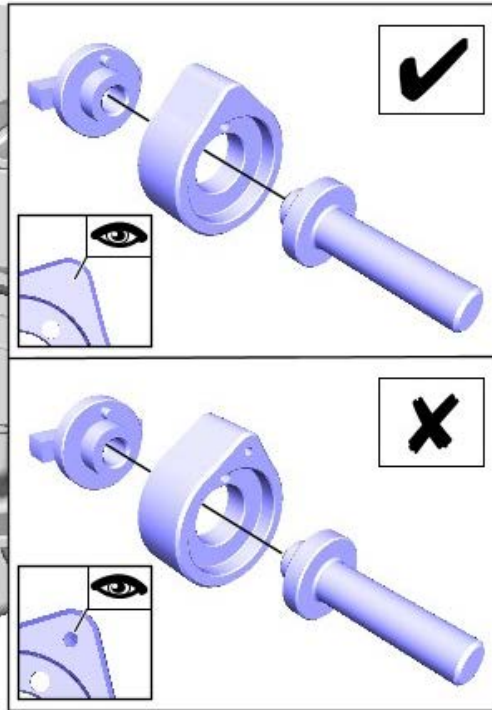
9.  CAUTION: Discard the seal.



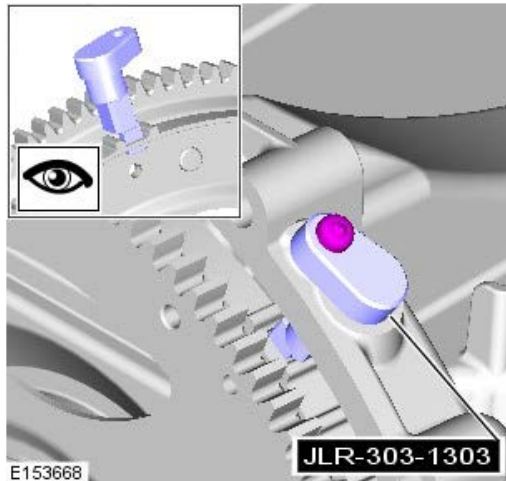
10. Special Tool(s): [JLR-303-1303](#)



11. If required, carefully adjust the crankshaft position to allow correct installation of the special tool.

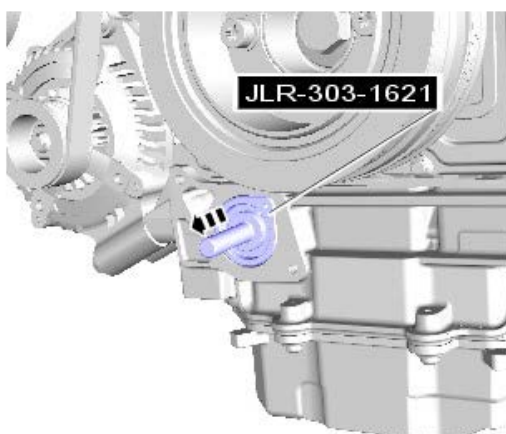


Special Tool(s): [JLR-303-1621](#)



12. CAUTION: Do not use excessive force when adjusting the crankshaft position.

- If required, carefully adjust the crankshaft position to allow correct installation of the special tool.
- Special Tool(s): [JLR-303-1303](#)



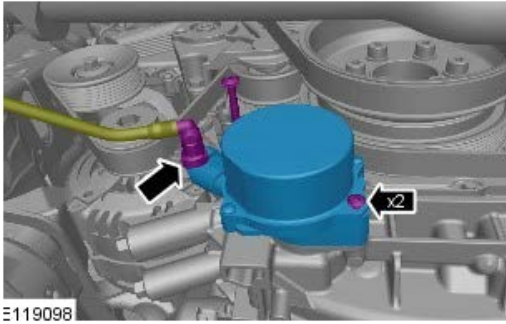
E154428

13.

- Special Tool(s): [JLR-303-1621](#)

14. CAUTION: Install a new seal.

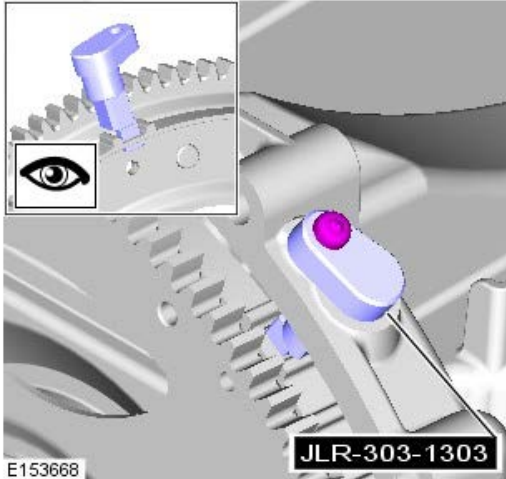
- Torque: 12 Nm



E119098

15.

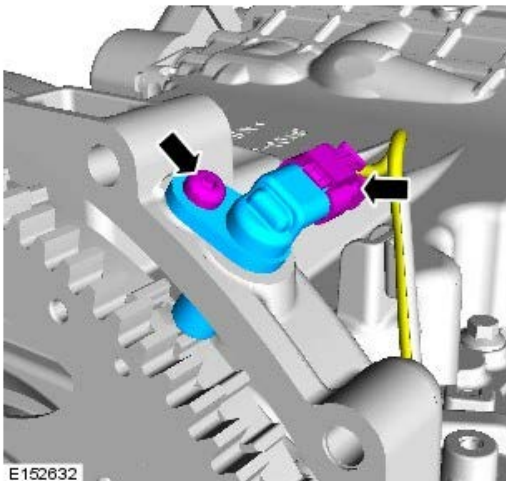
- *Special Tool(s):* [JLR-303-1303](#)



E153668

16.

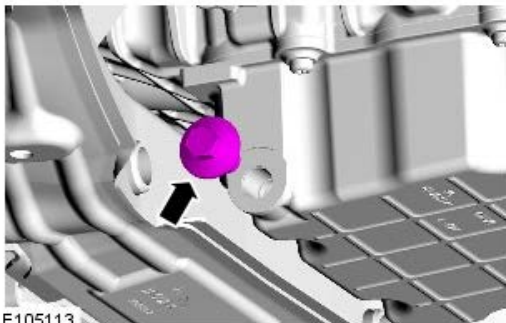
- *Torque:* 10 Nm



E152632

17.  **NOTE:** Install a new sealing washer.

Torque: 24 Nm



E105113

18.

19. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

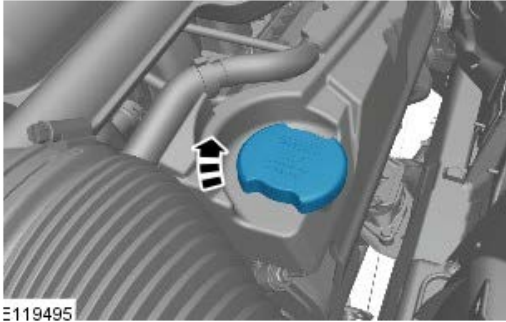
20.

- Fill the engine with oil - for filling values:

Refer to: [Specifications](#) (303-01B Engine - V6 S/C 3.0L Petrol,

- Specifications).
- Clean any residual engine oil from the oil filler cap area.

21.



E119495

22. CAUTIONS:



Follow the steps 25-31 before starting the engine.



Make sure that the vehicle has been left for 5 minutes from filling with oil.

- Start the engine and allow to run for 10 minutes, stop the engine.
- Check for leaks.

23. CAUTIONS:



Make sure that the selector lever is in the park (P) position.



Make sure that the hood is open.

- Set the ignition to the ON position.

24.

- Press the right-hand directional button to access the instrument cluster menu.



E123926

25.

- Press the right-hand OK button.



E123925

26.

- Press the right-hand directional button to access the Oil Level Display.



E123927

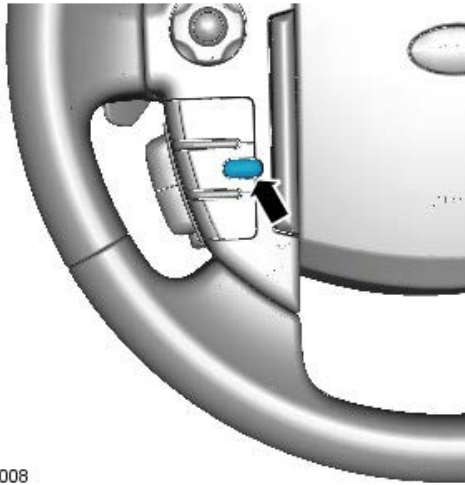
27.

- Press the right-hand OK button and follow the instructions.



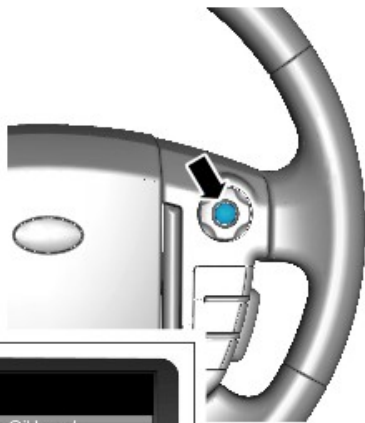
E123928

28.



E121008

- Press the cruise control cancel button twice within 2 seconds.




E123929

29.

- The message center display will revert to the normal display in the trip computer.
- Press the right-hand OK button and follow the instructions.
- Check that the oil level display shows an oil level reading.
- Take a reading from the level display and, if necessary, top up with oil as instructed.

30. Turn the ignition off.

31.  **NOTE:** Allow 10 minutes for the engine oil level to stabilize if there has been additional oil top up.

- Turn the ignition on.

32.

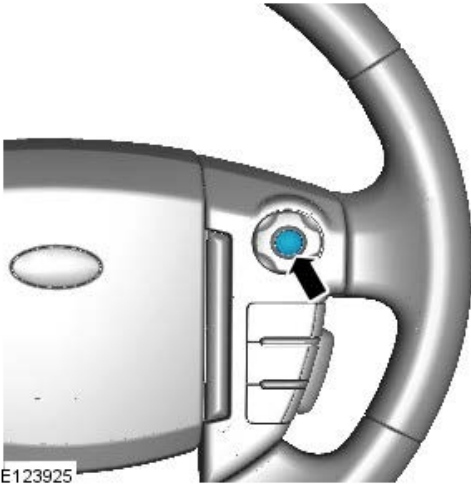
- Press the right-hand directional button to access the instrument cluster menu.



E123926

33.

- Press the right-hand OK button.



E123925

34.

- Press the right-hand directional button to access the Oil Level Display.



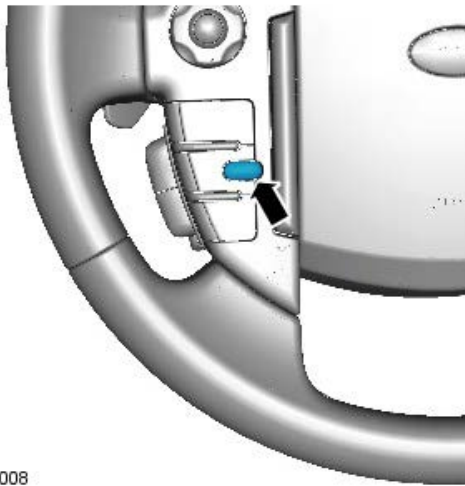
E123927

35.



E123929

- Scroll through the trip menu to access the engine oil level display.




E121008

36.

- Press the cruise control cancel button twice within 2 seconds.

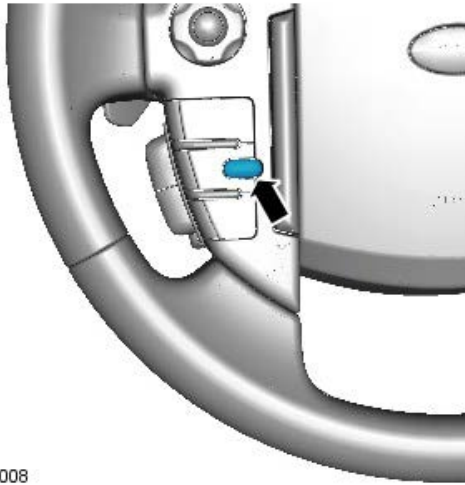


E123929

37.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

- The message center display will revert to the normal display in the trip computer.
- Scroll through the trip menu to access the engine oil level display.
- This display is now the live reading of the engine oil level.
- Take a reading from the level display and, if necessary, top up with oil as instructed.

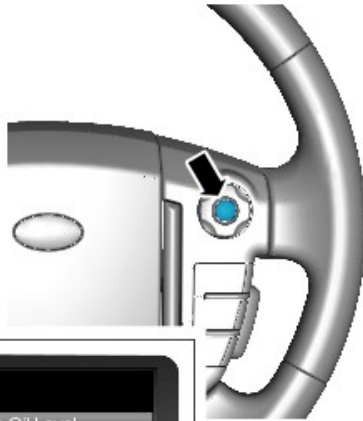
38.




- Press and hold the cruise control cancel button for more than 2 seconds.

E121008

39.
 - The message center display will revert to the normal display in the trip computer.
40. Turn the ignition off.
41. Turn the ignition on.



42.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

- Scroll through the trip menu to access the engine oil level display.
- Make sure that the average oil level value has now been updated.





E123929

43. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
44. Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

Engine - V6 S/C 3.0L Petrol - Fuel Pump Camshaft Timing Adjustment

General Procedures

Special Tool(s)

 <p>E152575</p>	<p>JLR-303-1303 Timing Tool</p>
 <p>E140377</p>	<p>JLR-303-1621 Alignment Tool, Fuel Pump Camshaft Timing</p>


Check



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.


Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

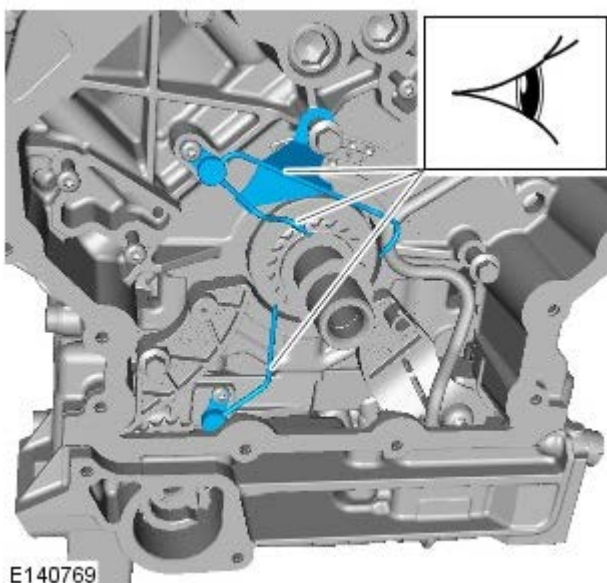
Raise and support the vehicle.

3. Refer to: [Fuel Pump Camshaft Timing Check](#) (303-01B Engine - V6 S/C 3.0L Petrol, General Procedures).
4. Refer to: [Lower Timing Cover](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

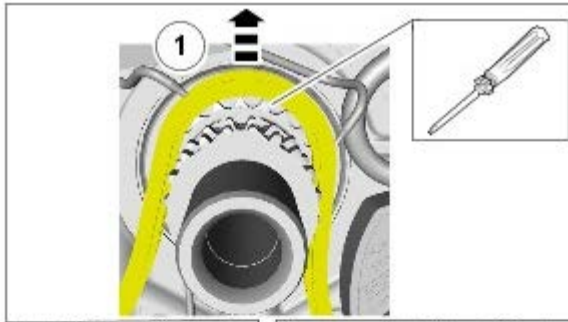
5. CAUTIONS:


 Make sure that the area around the component is clean and free of foreign material.


 Inspect the 3 timing chain oil nozzles for signs of damage, install as necessary.



6. CAUTIONS:



 Using a suitable tie strap, position the tensioner to one side.

 Take extra care when removing the component. Make sure the washers fitted both sides of the balance weight do not fall into the engine oil pan.

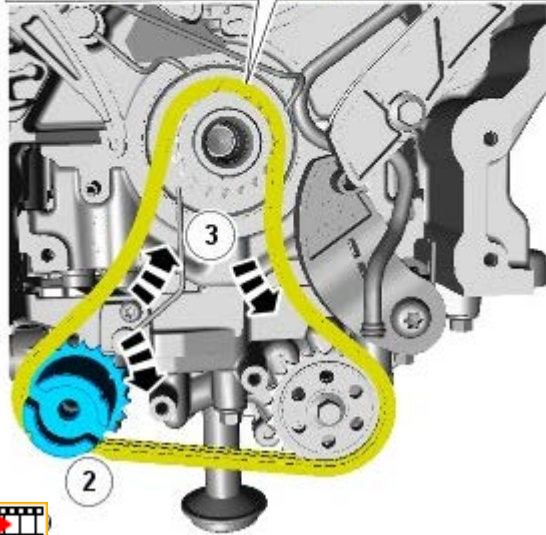
- Make sure the coloured chain links align correctly with the fuel rail high-pressure fuel pumps camshaft, balance shaft and crankshaft sprocket markings.

Special Tool(s): [JLR-303-1621](#)

Torque:

Stage 1: 25 Nm

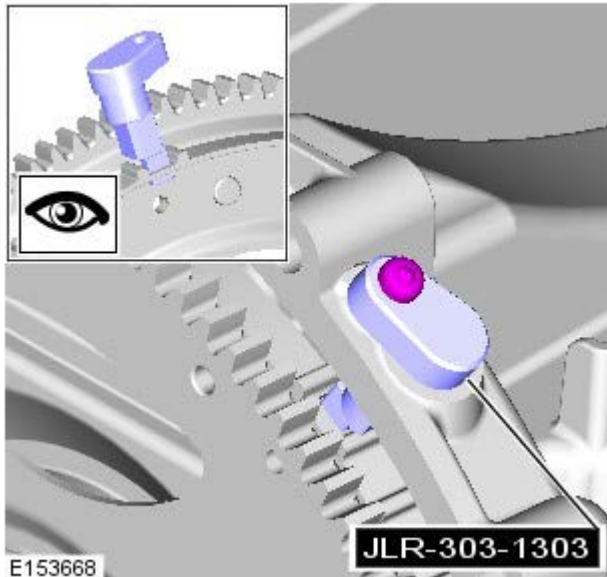
Stage 2: 90°



7. Refer to: [Lower Timing Cover](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

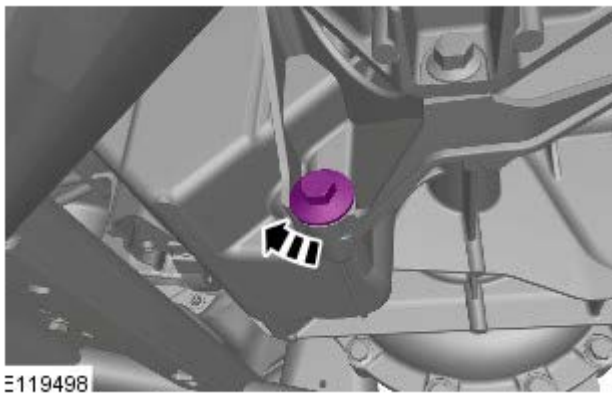
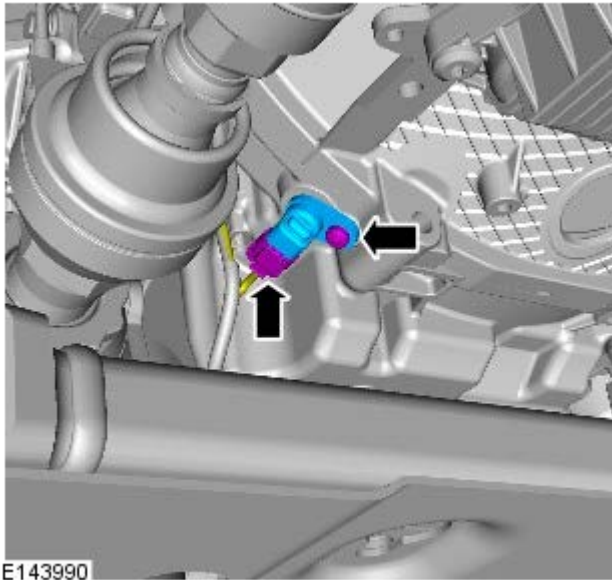
8. Remove the special tool.


Special Tool(s): [JLR-303-1303](#)



- 9.

- *Torque:* 10 Nm




10.  **NOTE:** Install a new sealing washer.
Torque: 24 Nm

11. Connect the battery ground cable.


Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

- 12.
- Fill the engine with oil - for filling values on vehicles with supercharger:
- Refer to: [Specifications](#) (303-01B Engine - V6 S/C 3.0L Petrol, Specifications).
- Clean any residual engine oil from the oil filler cap area.

13.  **CAUTION:** Make sure that the vehicle has been left for 5 minutes from filling with oil.
- Start the engine and allow to run for 10 minutes, stop the engine.
 - Check for leaks.

14. **CAUTIONS:**

 Make sure that the selector lever is in the park (P) position.

 Make sure that the hood is open.

- Set the ignition to the ON position.

- 15.
- Press the left-hand OK button to access the Instrument Cluster (IC) Main Menu.



16.

- Press the left-hand directional button and select Service Menu.

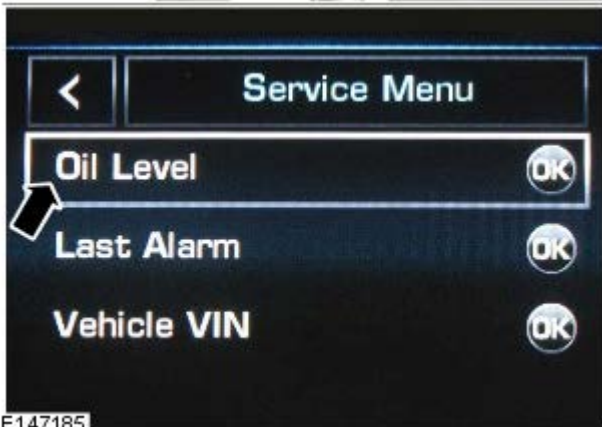
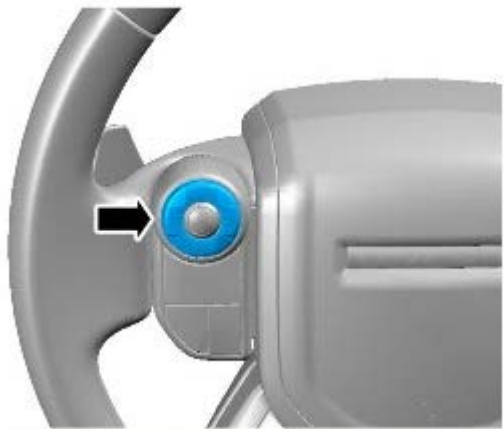


17.

- Press the left-hand OK button.



E147184



E147185


18.

- Press the left-hand directional button and select the Oil Level display.

19.

- Press the left-hand OK button to access the Oil Level display.



20.  **CAUTION:** Make sure that the hood is open.
- Press the speed control cancel button twice within 2 seconds while being on the oil level display.

- 21.
- The message center displays the actual oil level in service mode.
 - Only after having started and run the engine for 15 minutes (as indicated in Step 13), switch off the engine, then stabilizing for 10 minutes, take a reading from the oil level display and, if necessary top up with engine oil.



E147272


22. Set the ignition to the OFF position.
23. Allow 10 minutes for the engine oil level to stabilize if there has been additional oil top up.



NOTE: The following steps are to update the average oil level value.

24. Repeat step 14 to 20 to access the oil level display in service mode.



25.  NOTE: The actual volume displayed on the bar graph will be written into the electronic control unit as a new value.

- Press and hold the speed control cancel button for more than 5 seconds.
- The message center display the current oil level.



E147187

26. Set the ignition to the OFF position.
27. Set the ignition to the ON position.
28.
 - Press the left-hand OK button to access the Instrument Cluster (IC) Main Menu.



E147435

29.

- Press the left-hand directional button and select Service Menu.



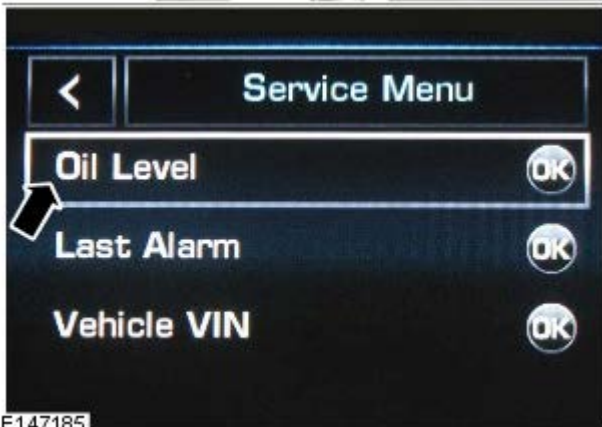
E147186

30.

- Press the left-hand OK button.



E147184




E147185

31.

- Press the left-hand directional button and select the Oil Level display.

32.

- Press the left-hand OK button and follow the instructions.

-  **NOTE:** If the message shows "Not available" wait for further 10 mins to allow the oil level to stabilize.

Make sure that the average oil level value has now been updated.




E147182

Engine - V6 S/C 3.0L Petrol - Valve Clearance Check

General Procedures

Check

1. Refer to: Specifications (414-00, Specifications).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
3. Refer to: [Valve Cover LH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
4. Refer to: [Valve Cover RH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

5. CAUTIONS:



Rotate the engine clockwise until the camshafts are positioned as shown.



Do not rotate the crankshaft counterclockwise. The timing chains may bind causing engine damage.

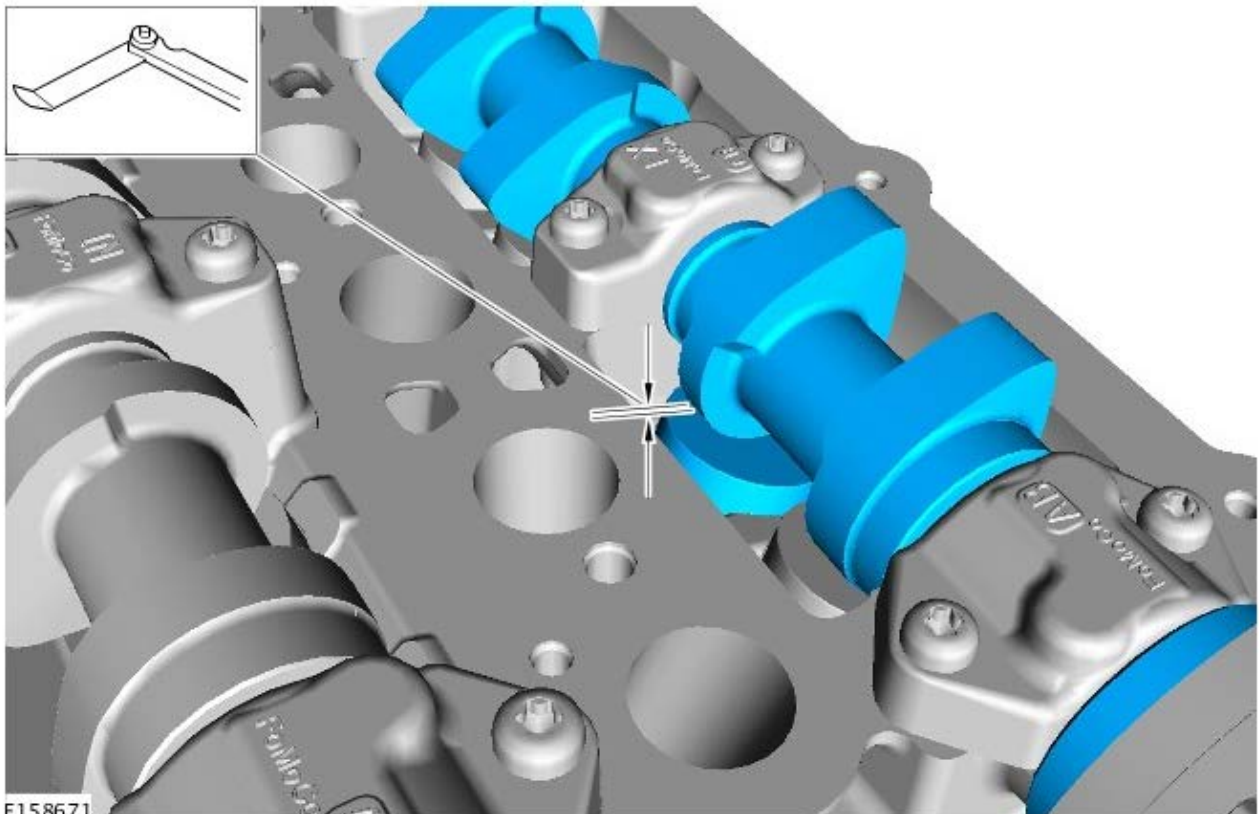


Camshaft lobes must be 180 degrees away from each valve tappet or valve clearance will be incorrect.



NOTE: Using feeler gauge check the gap between the tappet and the camshaft lobe and check against specifications table.

- Using feeler gauge check the gap between the tappet and the camshaft lobe and check against specifications table.
- Repeat this step for the remaining valve tappets.




E158671

Engine - V6 S/C 3.0L Petrol - Valve Clearance Adjustment

General Procedures

Check

1. Refer to: Specifications (414-00, Specifications).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

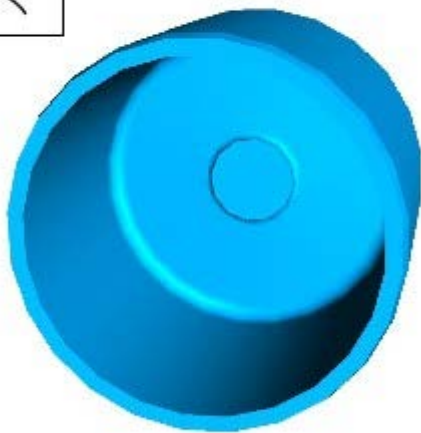
Raise and support the vehicle.

3. Refer to: Valve Clearance Check (303-01, General Procedures).

Adjustment

1. Refer to: Camshaft RH (303-01, Removal and Installation).
2. Refer to: Camshaft LH (303-01, Removal and Installation).

3.



E158863

Engine - V6 S/C 3.0L Petrol - Camshaft LH

Removal and Installation

Removal



CAUTION: Make sure that the orientation and code on the top of the camshaft bearing caps is noted (along with the bank - A or B), so that on installation the components are installed to their original position. Failure to follow this instruction may cause damage to the vehicle.



NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Refer to: [Timing Drive Components](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

4. **CAUTIONS:**



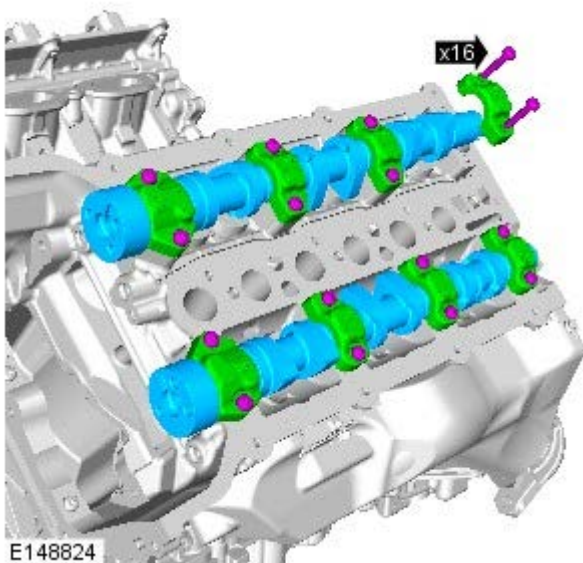
Rotate the camshafts until all the valves are at their minimum open point.



Evenly and progressively, release the camshaft bearing caps.



NOTE: Remove the camshaft bearing caps. Note: their position, orientation and markings. Each is marked with its position (number) and an orientation (arrow).



Installation

1. **CAUTIONS:**



Prior to installing the camshafts, position the crankshaft 45 degrees ATDC cylinder 1A to prevent valve/piston collision.



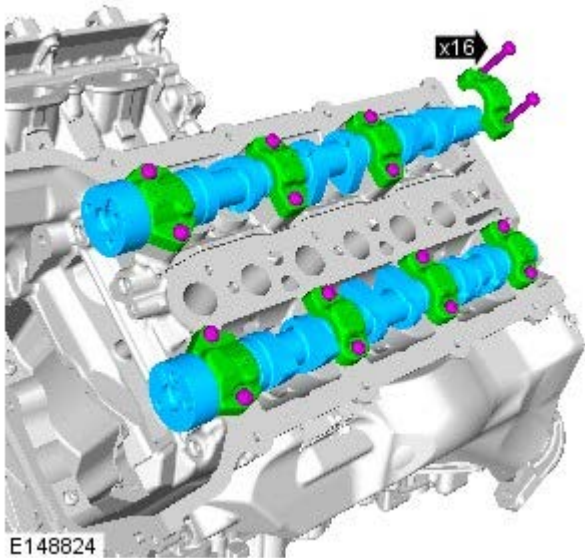
Make sure that the camshafts and camshaft bearing caps are installed in their original locations.



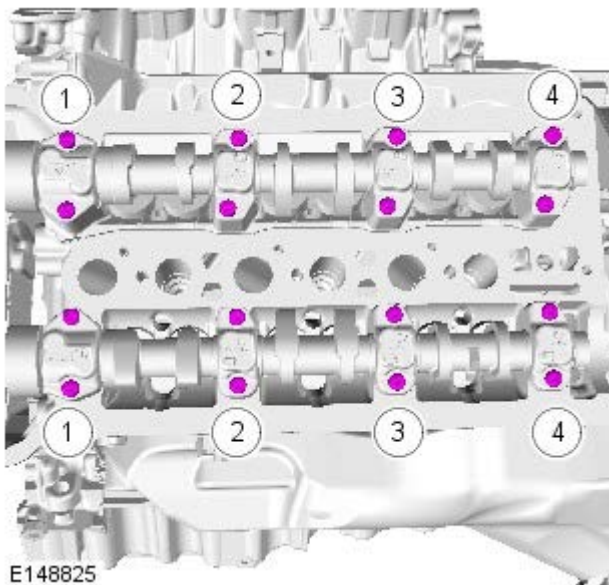
Evenly and progressively install and tighten the camshaft bearing caps.



NOTE: Lubricate the camshafts and the camshaft bearing caps with EP90 oil (or 75/90 viscosity oil will suffice) prior to installation.



Torque: 3 Nm




2.  NOTE: Tighten the bolts in the indicated sequence.

Torque: 12 Nm

3.  CAUTION: Only rotate the crankshaft clockwise.


Rotate the crankshaft until the camshaft lobe on the valve being checked is 180 degrees from the maximum opening position.

4.  NOTE: If the valve clearance is incorrect, continue to the next step. If the valve clearance is correct, continue to step 8.

Using feeler gauge check the gap between the tappet and the camshaft lobe and check against specifications table.

5. CAUTIONS:

 Do not use a magnet to remove the tappet.

 Use the following formula to calculate the required bucket thickness. Original thickness + measured clearance - desired clearance = required bucket thickness.

Remove the tappet and measure the thickness.

6.  NOTE: If a new tappet is installed then go back to

[step 1 of the install procedure.](#)

Install a new tappet if required.

7. Using feeler gauge check the gap between the tappet and the camshaft lobe and check against specifications table.
8. Refer to: [Timing Drive Components](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
9. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - V6 S/C 3.0L Petrol - Camshaft RH

Removal and Installation

Removal



CAUTION: Make sure that the orientation and code on the top of the camshaft bearing caps is noted (along with the bank - A or B), so that on installation the components are installed to their original position. Failure to follow this instruction may cause damage to the vehicle.

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

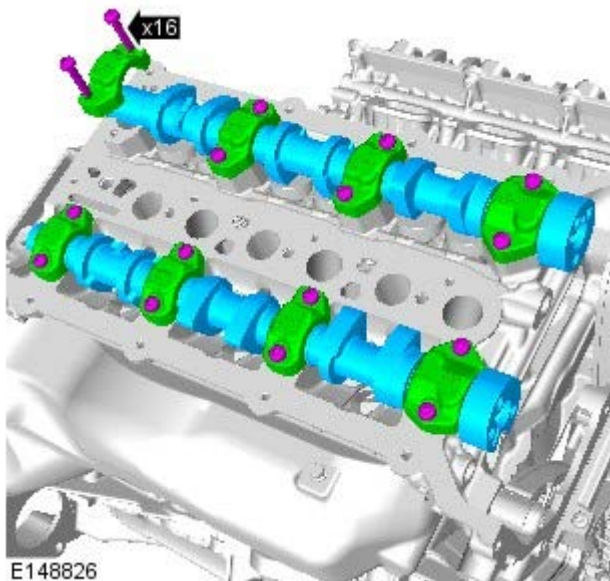
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).



2. **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Refer to: [Timing Drive Components](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).



4. **CAUTIONS:**



Rotate the camshafts until all the valves are at their minimum open point.



Evenly and progressively, release the camshaft bearing caps.



NOTE: Remove the camshaft bearing caps. Note: their position, orientation and markings. Each is marked with its position (number) and an orientation (arrow).

Installation

1. **CAUTIONS:**



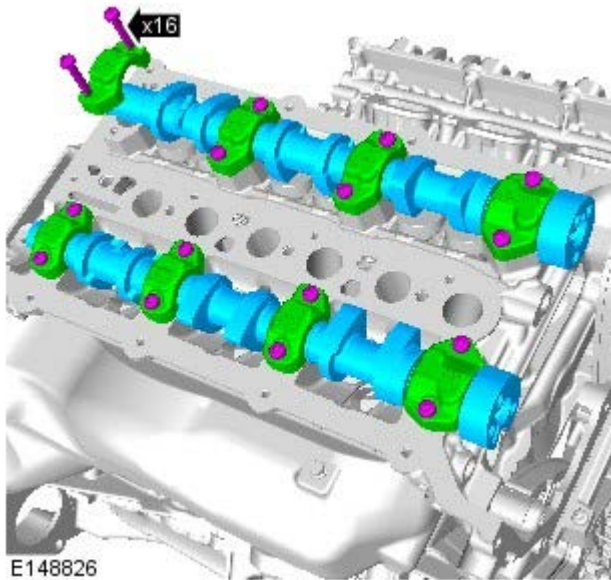
Prior to installing the camshafts, position the crankshaft 45 degrees ATDC cylinder 1A to prevent valve/piston collision.




Evenly and progressively install and tighten the camshaft bearing caps.

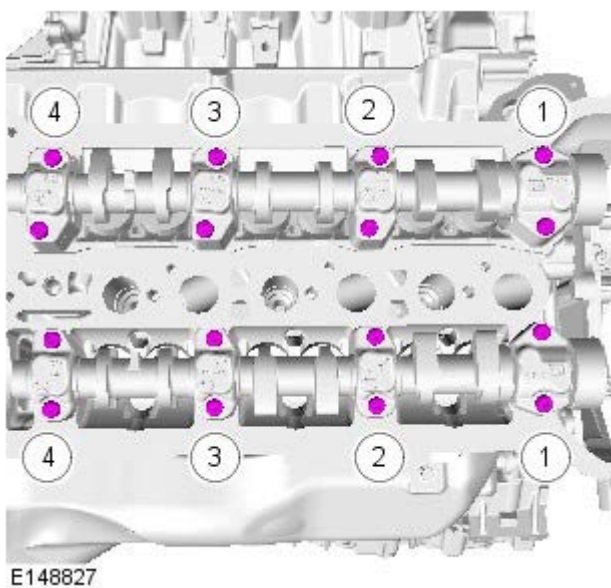


Make sure that the camshafts and camshaft bearing caps are installed in their original locations.



 NOTE: Lubricate the camshafts and the camshaft bearing caps with EP90 oil (or 75/90 viscosity oil will suffice) prior to installation.

Torque: 3 Nm




2.  NOTE: Tighten the bolts in the indicated sequence.

Torque: 12 Nm


3.  CAUTION: Only rotate the crankshaft clockwise.

Rotate the crankshaft until the camshaft lobe on the valve being checked is 180 degrees from the maximum opening position.

4.  NOTE: If the valve clearance is incorrect, continue to the next step. If the valve clearance is correct, continue to step 8.

Using feeler gauge check the gap between the tappet and the camshaft lobe and check against specifications table.

5. CAUTIONS:

 Use the following formula to calculate the required bucket thickness. Original thickness + measured clearance - desired clearance = required bucket thickness.

 Do not use a magnet to remove the tappet.

Remove the tappet and measure the thickness.

6.  NOTE: If a new tappet is installed then go back to

[step 1 of the install procedure.](#)

Install a new tappet if required.

7. Using feeler gauge check the gap between the tappet and the camshaft lobe and check against specifications table.
8. Refer to: [Timing Drive Components](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
9. Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - V6 S/C 3.0L Petrol - Crankshaft Front Seal

Removal and Installation

Special Tool(s)

 <p>E107677</p>	<p>303-1434 Remover/Installer, Front Crankshaft Seal</p>
--	--

Removal



NOTE: Removal steps in this procedure may contain installation details.

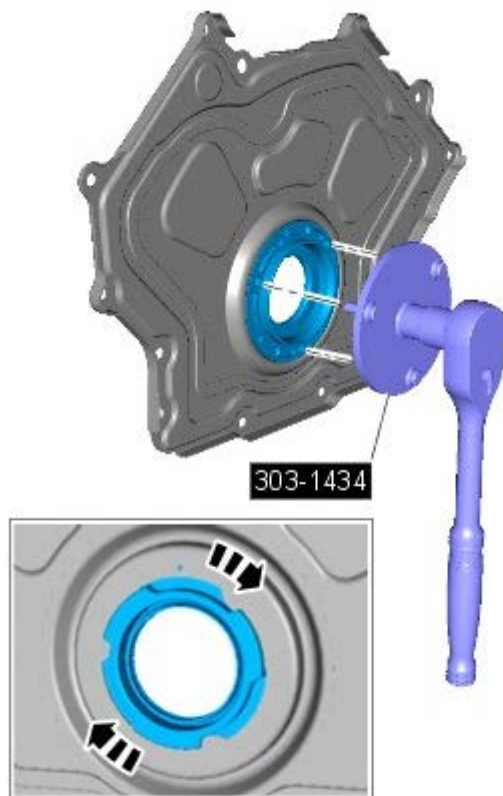
Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: [Crankshaft Pulley](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

3. *Special Tool(s):* [303-1434](#)



E112056

Installation

1. CAUTIONS:



Do not over tighten the crankshaft front seal. Failure to follow this instruction may result in damage to the vehicle.



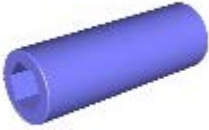




Take extra care not to damage the seal.

To install, reverse the removal procedure.

Engine - V6 S/C 3.0L Petrol - Crankshaft Pulley

Removal and Installation

Special Tool(s)

 <p>E115256</p>	<p>303-1437 Crankshaft Damper Remover/Installer</p>
 <p>E115257</p>	<p>303-1438 Crankshaft Damper Bolt Remover/Installer</p>
 <p>E115258</p>	<p>303-1439 Crankshaft Damper Removal Plate</p>
 <p>E115259</p>	<p>303-1440 Crankshaft Damper Removal/Installation Stud</p>
 <p>E115260</p>	<p>303-1441 Crankshaft Damper Remover/Installer Body</p>
 <p>E152576</p>	<p>JLR-303-1304 Locking Tool</p>

Removal

NOTES:



Some illustrations may show the engine removed for clarity.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

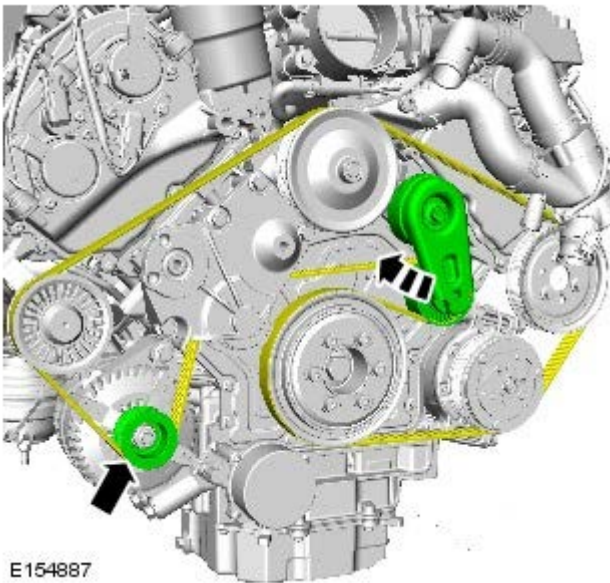
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

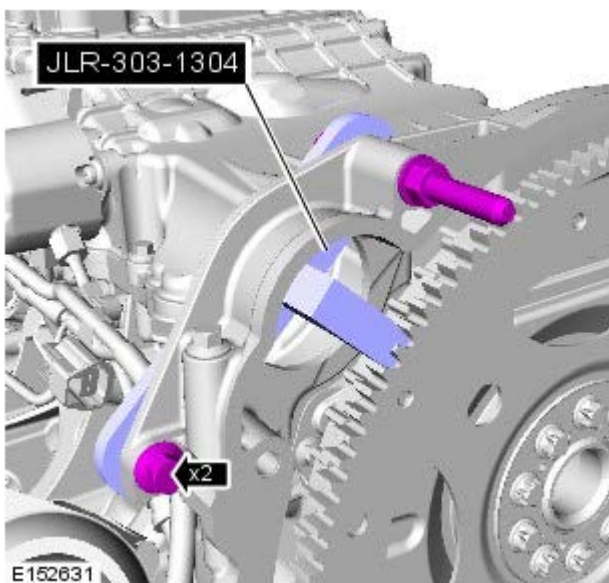
3. Refer to: [Supercharger Belt](#) (303-05B Accessory Drive - V6 S/C 3.0L Petrol, Removal and Installation).
4. Refer to: [Radiator](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).
5. Refer to: [Starter Motor](#) (303-06B Starting System - V6 S/C 3.0L Petrol, Removal and Installation).


6.



7. Install the special tool.

Special Tool(s): [JLR-303-1304](#)



8.  **CAUTION:** Before removing the crankshaft pulley bolt, note the numbers on the bolt head. If the bolt head shows 10.9, the bolt must be removed counter clockwise. If the bolt head shows 12.9, the bolt must be removed clockwise. Failure to follow this instruction may



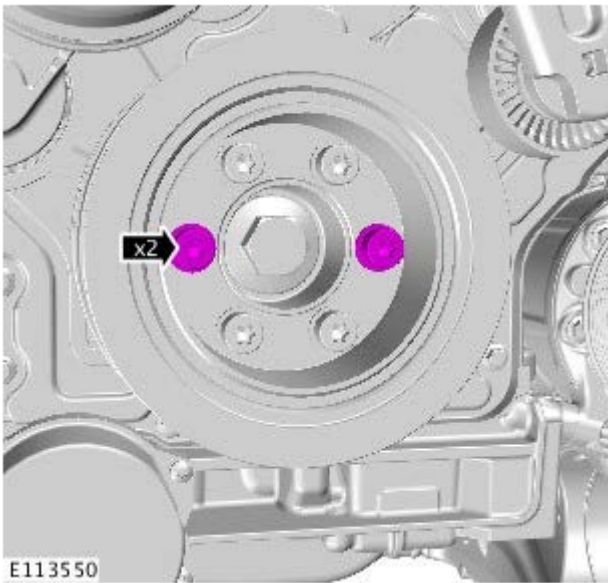
result in damage to the crankshaft.

Note the markings on the crankshaft pulley bolt.



E120873

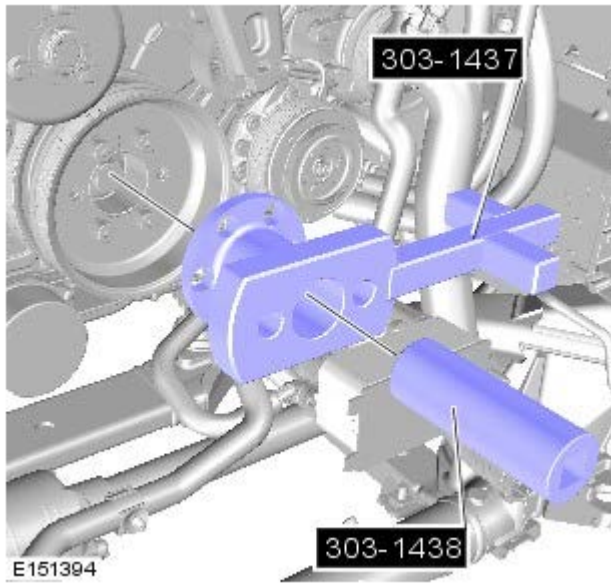
9.



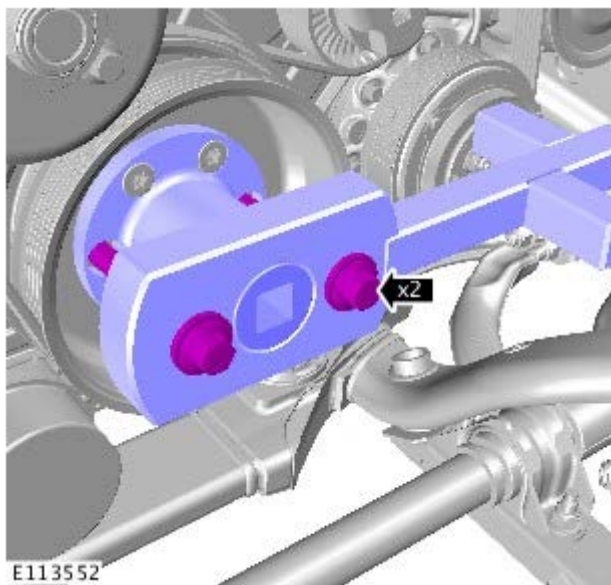
E113550

10. Install the special tool.

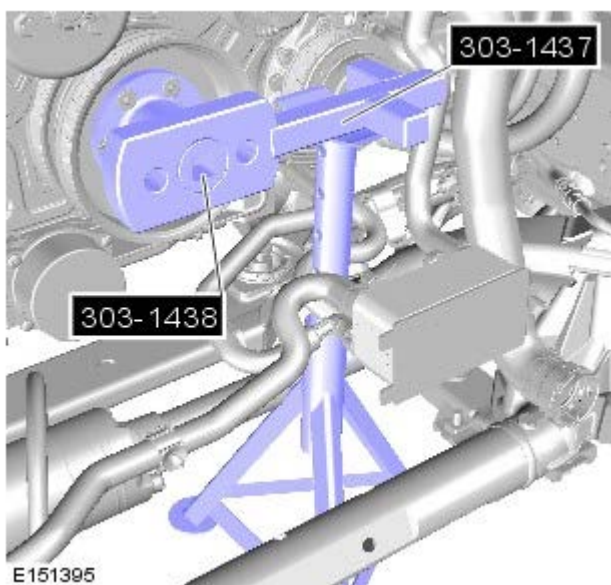
Special Tool(s): [303-1438](#), [303-1437](#)



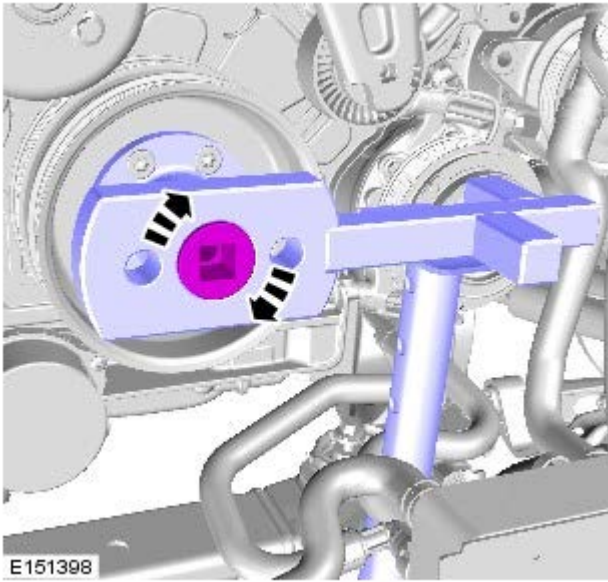
11. Torque: 25 Nm



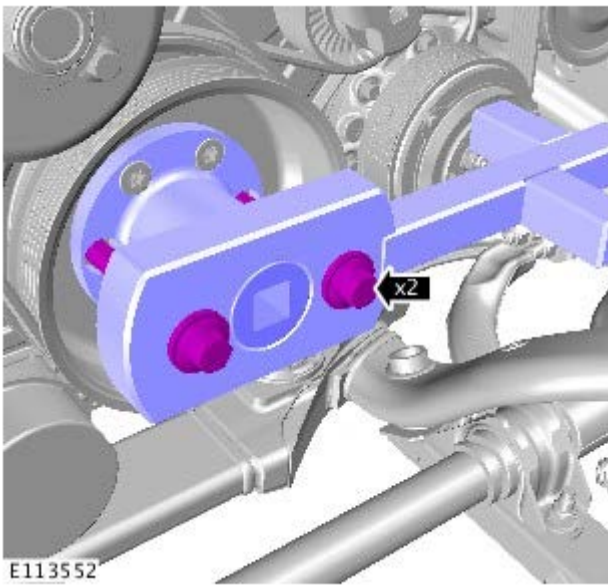
12. Support the special tool using a suitable vehicle stand.



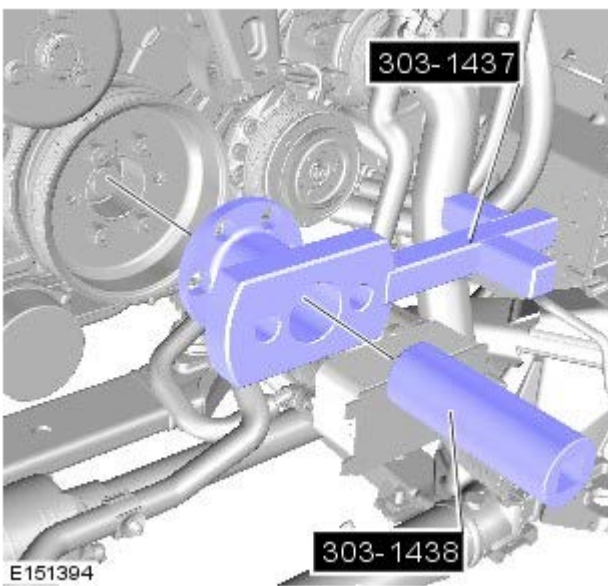
13.  NOTE: The crankshaft pulley bolt will be very tight.




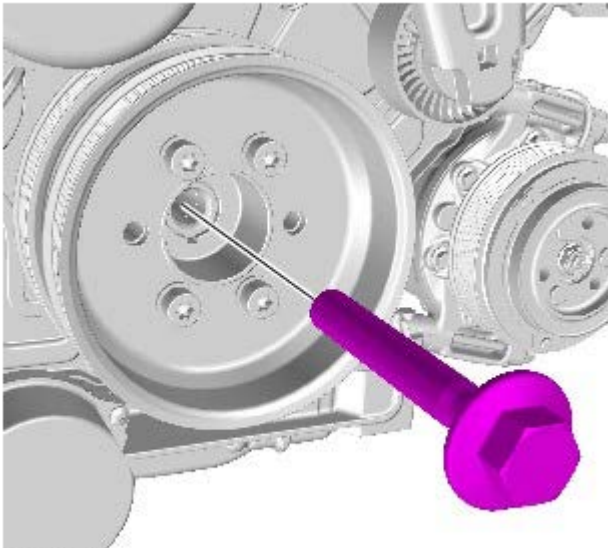
14.



15. Remove the special tools.

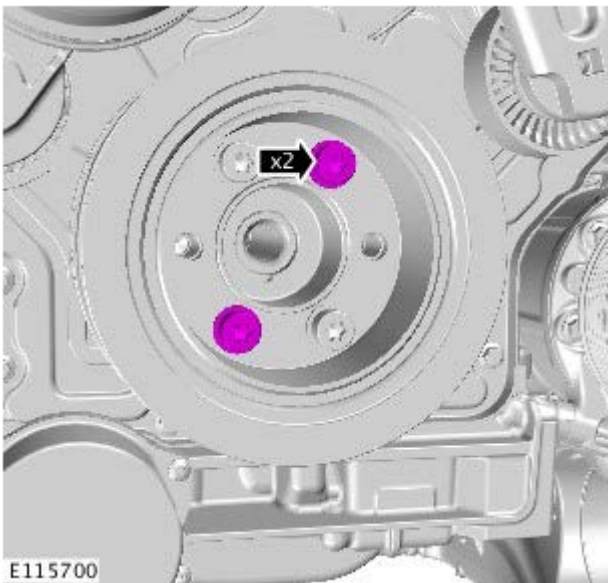


16.  NOTE: Discard the bolt after removal.

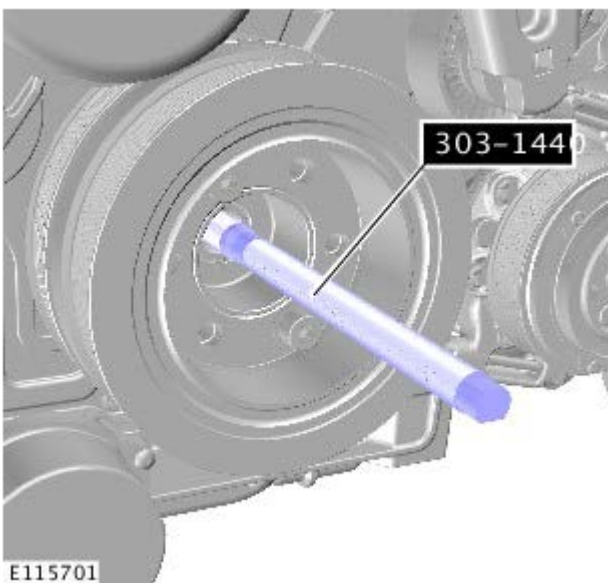


E112268


17.



E115700



E115701

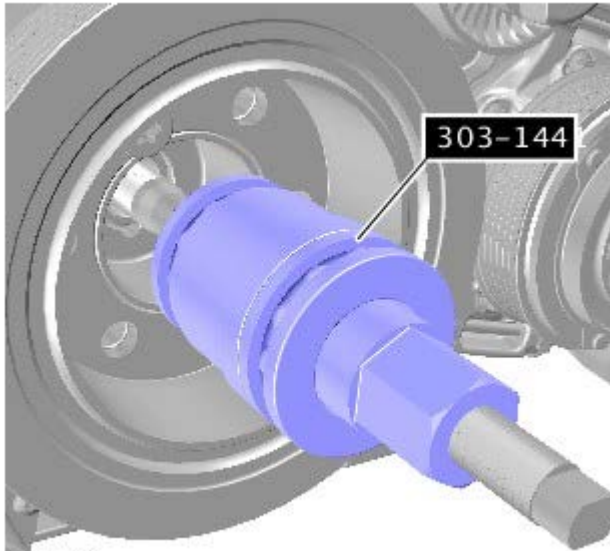
18.  NOTE: If the crankshaft damper is fitted with an early RH thread crankshaft bolt then the pulley can be removed with a standard puller.

Install the special tool.

Special Tool(s): [303-1440](#)

19. Install the special tool.

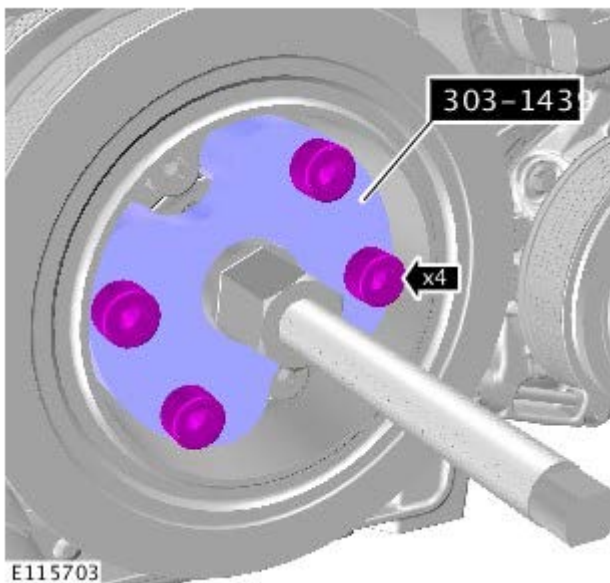
Special Tool(s): [303-1441](#)



E115702

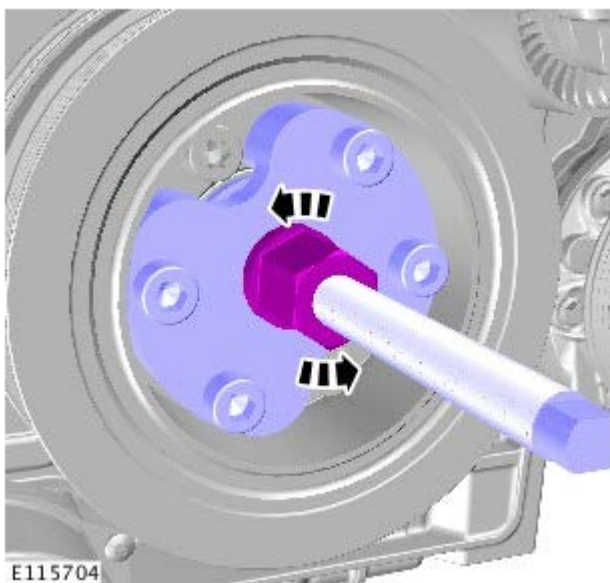
20. Install the special tool.

Special Tool(s): [303-1439](#)
Torque: 25 Nm




E115703

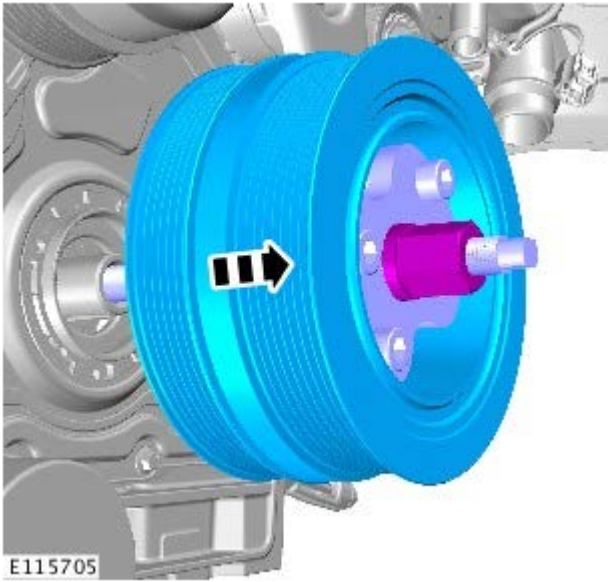
21.



E115704

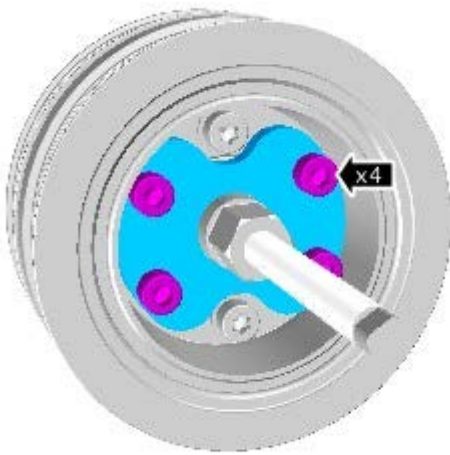
22.  CAUTION: Discard the friction washer after removing the crankshaft pulley.

 NOTE: Make sure to clean the threads in



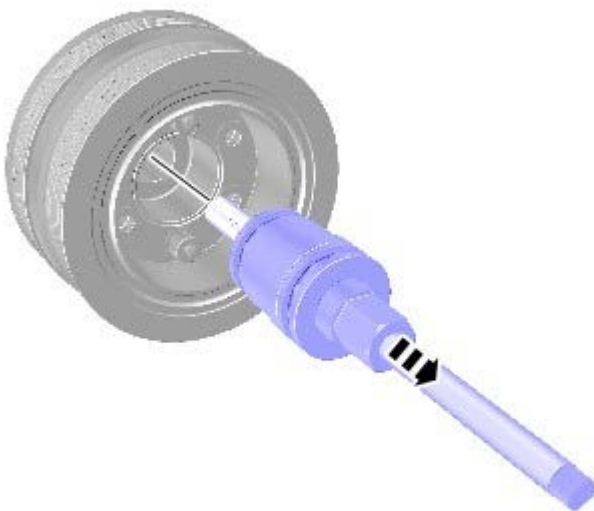
the end of the crankshaft and that the crank nose is free of any foreign materials.

23.



E115706

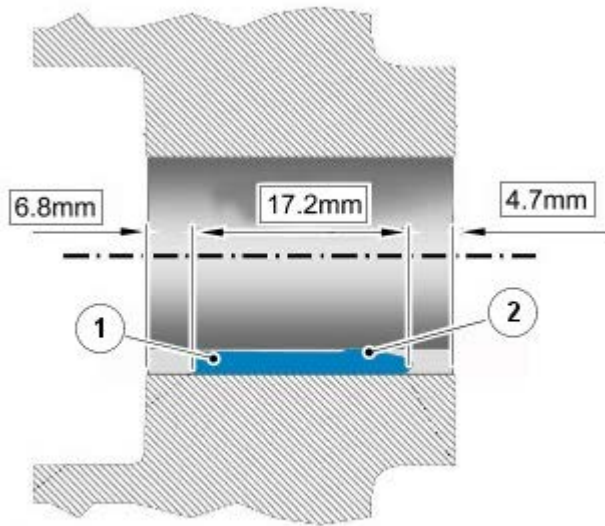
24.



E115707

Installation

1.
 - Apply RTV sealant to the crankshaft pulley keyway.





E115889

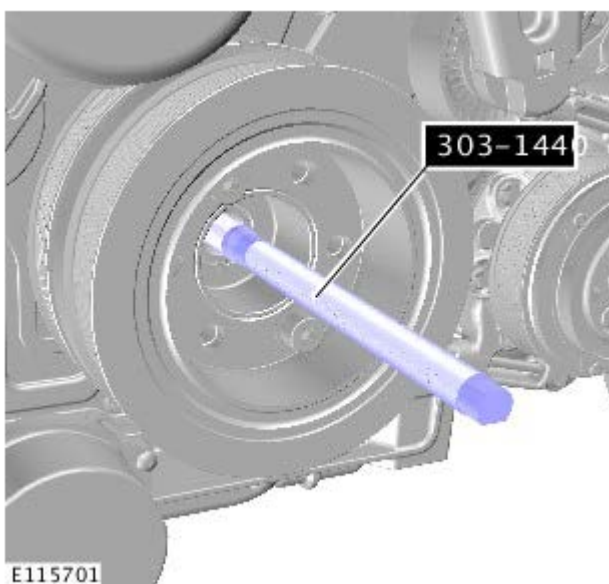
- Make sure that the RTV sealant is applied in a 2mm diameter bead.
- Make sure that when the RTV sealant is applied that the RTV sealant is level with the top of the keyway.



E112288

2.  CAUTION: Install a new friction washer before installing the crankshaft pulley.

 NOTE: Make sure to clean the threads in the end of the crankshaft and that the crank nose is free of any foreign materials.

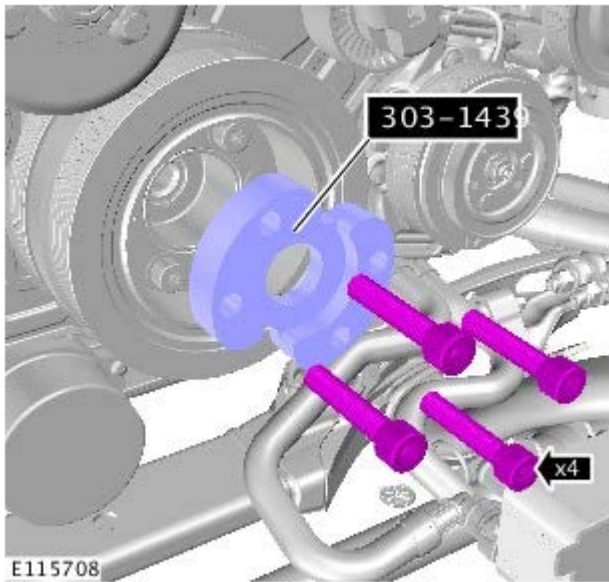


E115701

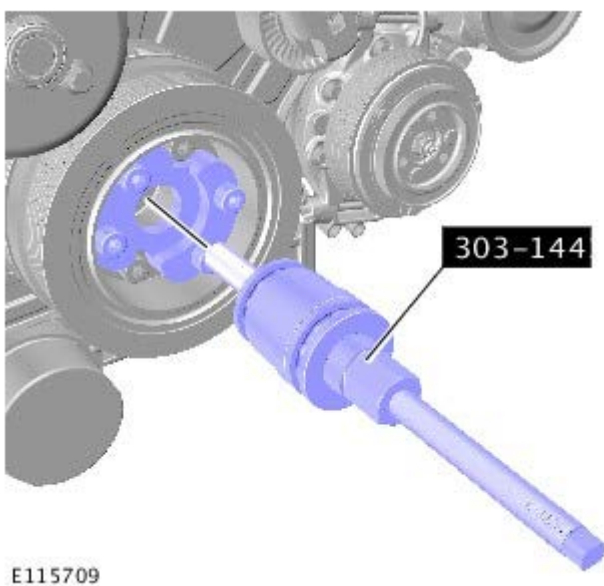
3. Install the special tool.


4. Install the special tool.

Torque: 25 Nm



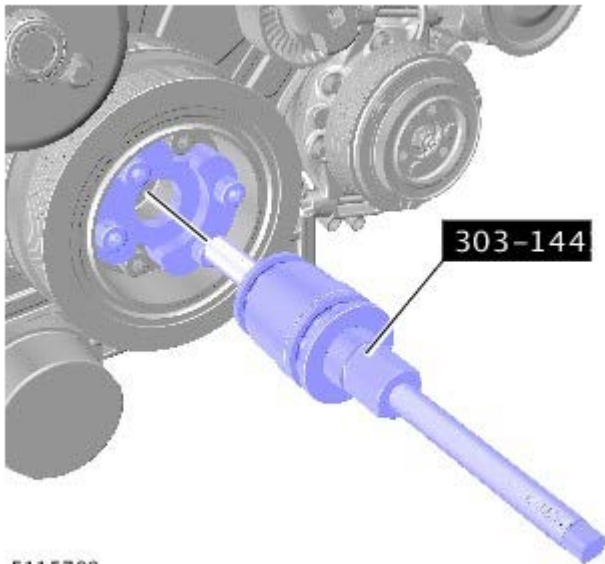
5. Install the special tool.



6.  CAUTION: Rotate the crankshaft pulley installation tool until the pulley is fully located, do not over tighten. Failure to do this may result in damage to the components.

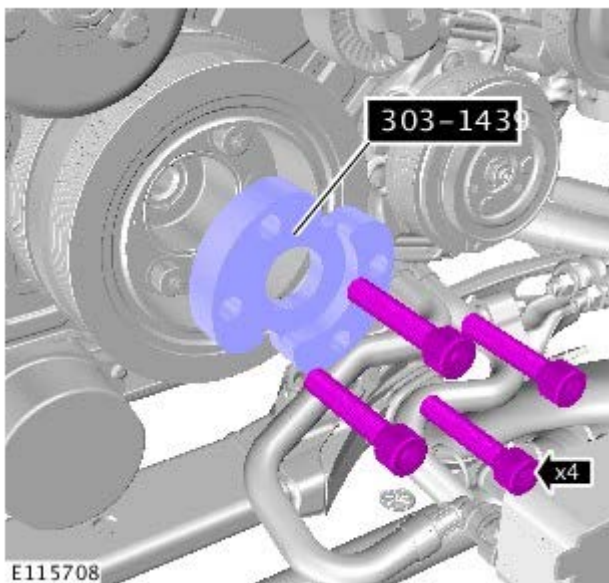


7. Remove the special tool.



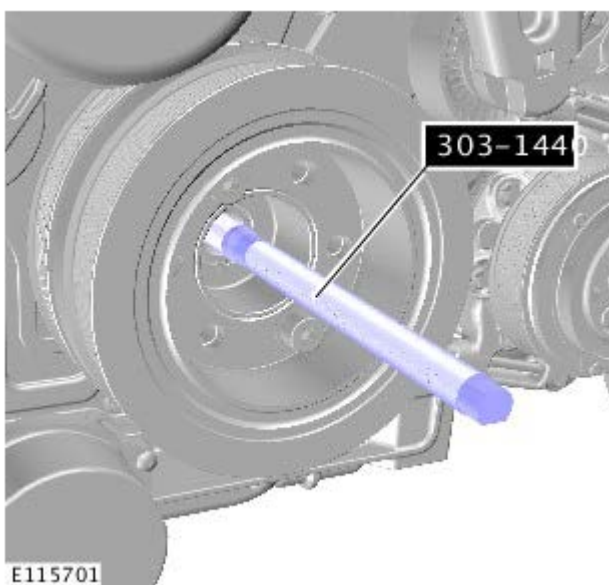
E115709

- 8.
- Remove the special tool.



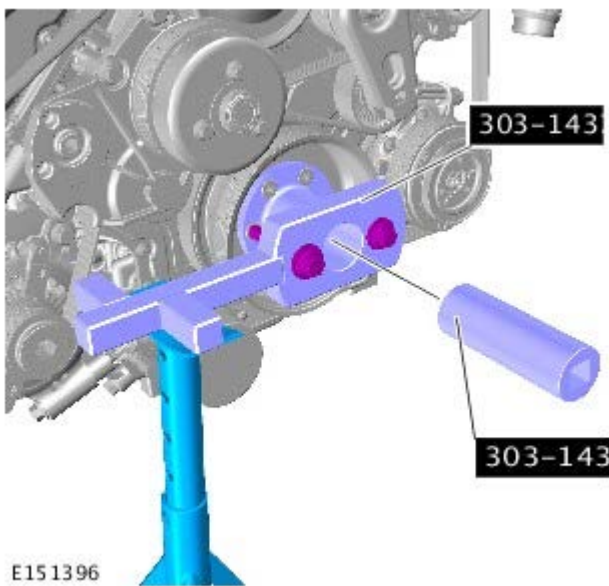
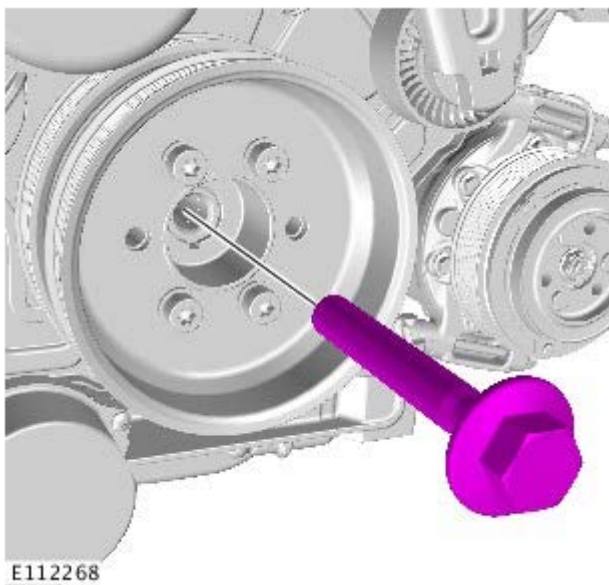
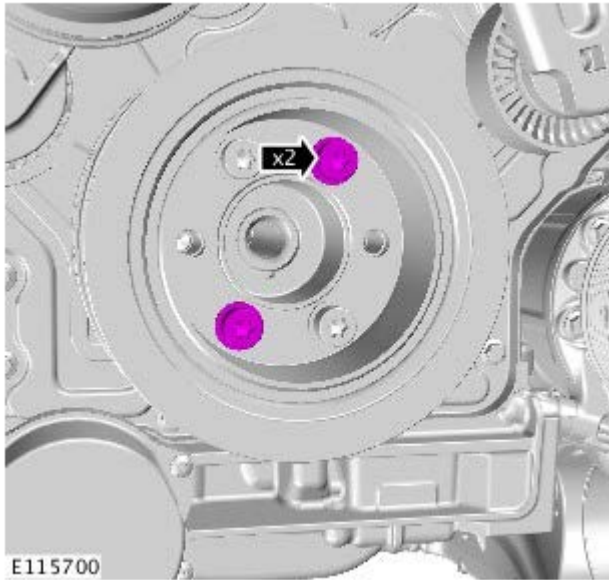
E115708

9. Remove the special tool.




E115701

- 10.
- Apply loctite 270 to the thread of the bolts.
 - *Torque: 65 Nm*



11.  **WARNING:** Make sure that a new bolt is installed.

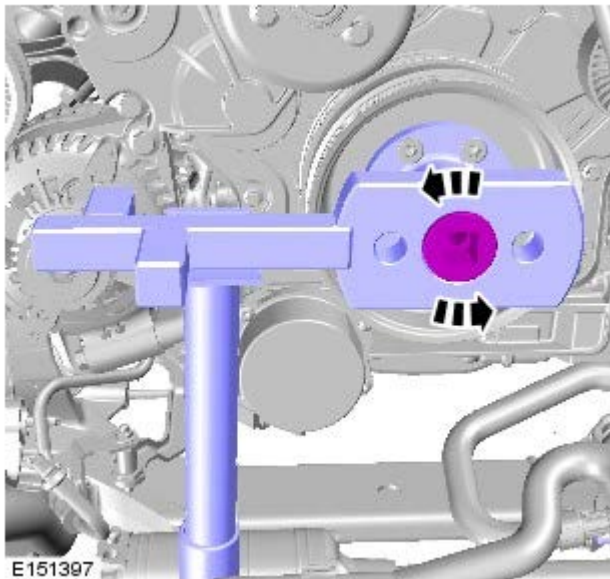
 **CAUTION:** Tighten the component finger tight first.


Install the crankshaft pulley bolt.


12.  **NOTE:** The graphic shows the step for LH thread only, RH thread will be the opposite.

Torque: 25 Nm

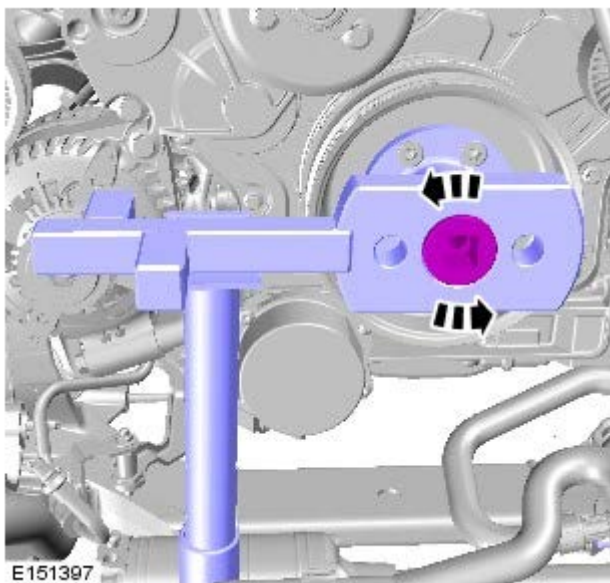
13. *Torque: 200 Nm*



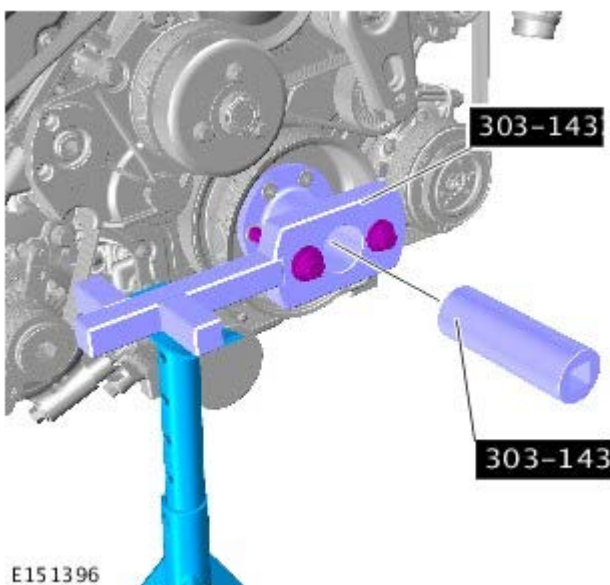
14.  CAUTION: Make sure that the socket is turned through 270 degrees not the torque wrench.

 NOTE: The use of a torque multiplier capable of 600Nm will be required.

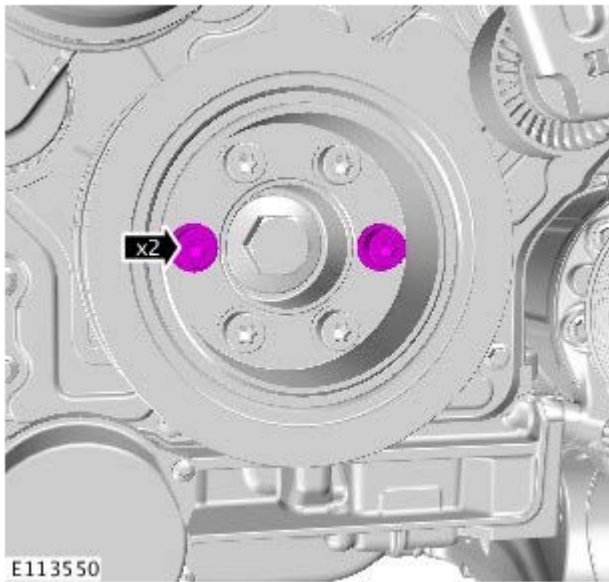
Torque: 270°



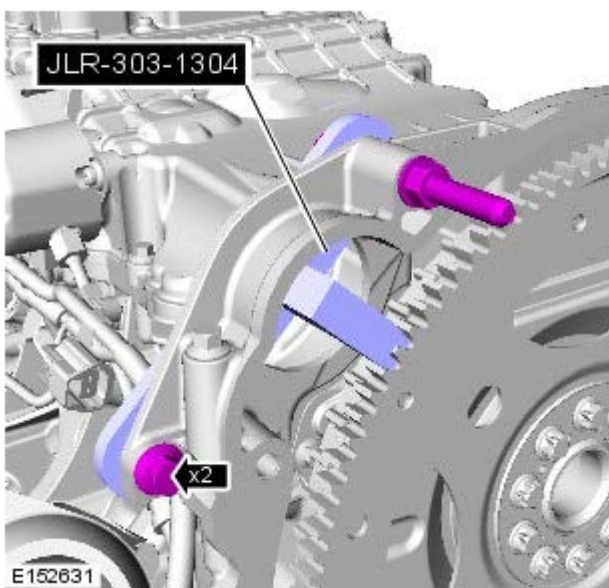
15. Remove the special tools.



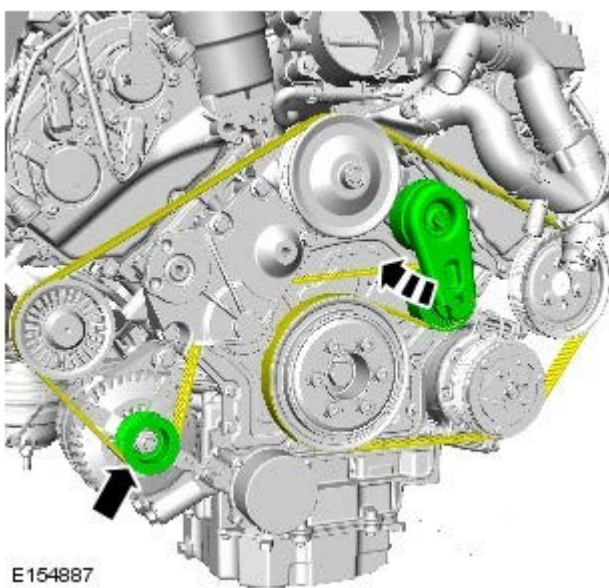
- 16.
- Apply loctite 270 to the thread of the bolts.
 - *Torque: 65 Nm*



17. Remove the special tool.



18.



19. Refer to: [Starter Motor](#) (303-06B Starting System - V6 S/C 3.0L Petrol, Removal and Installation).
20. Refer to: [Radiator](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).

21. Refer to: [Supercharger Belt](#) (303-05B Accessory Drive - V6 S/C 3.0L Petrol, Removal and Installation).


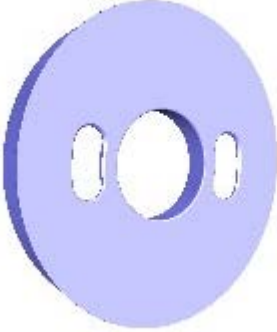
22. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - V6 S/C 3.0L Petrol - Crankshaft Rear Seal

Removal and Installation

Special Tool(s)

 <p>E107678</p>	<p>303-1442 Rear Crankshaft Seal Installer</p>
 <p>E154431</p>	<p>JLR-303-1622 Alignment Tool, Engine Rear Oil Seal</p>

Removal

NOTES:



Removal steps in this procedure may contain installation details.



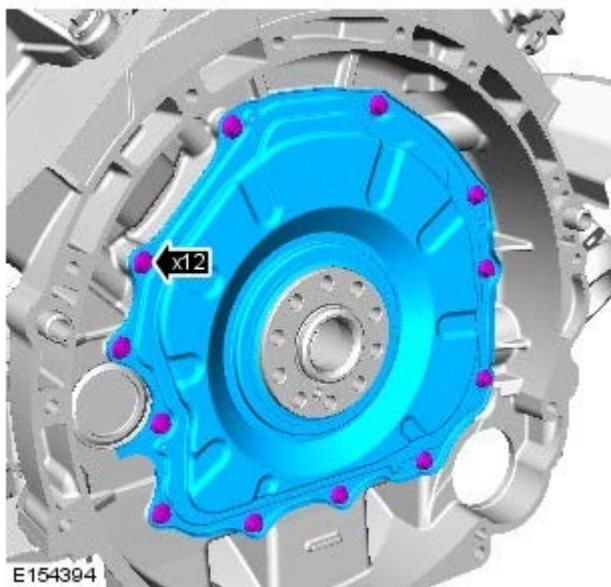
Some illustrations may show the engine removed for clarity.



Some variation in the illustrations may occur, but the essential information is always correct.

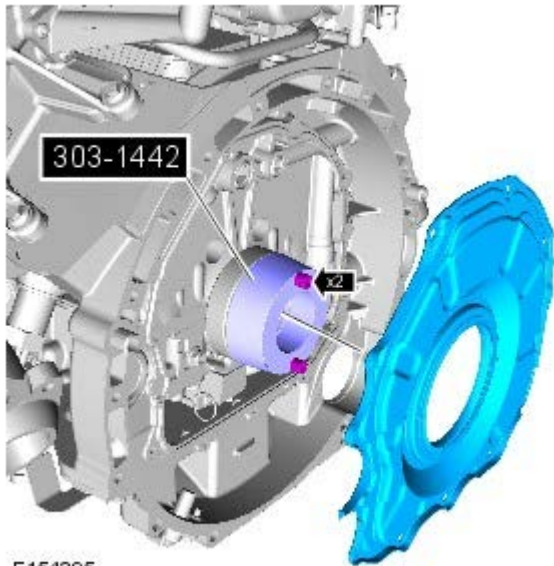
1. Refer to: [Flexplate](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

2.



Installation

1. Install the special tool.

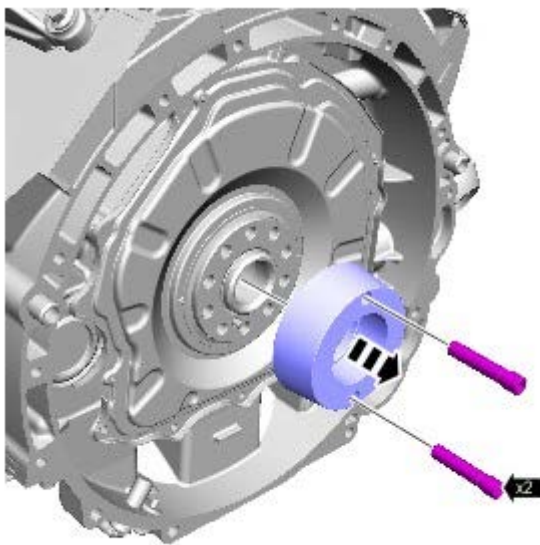


E154395

Special Tool(s): [303-1442](#)

2. Remove the special tool.

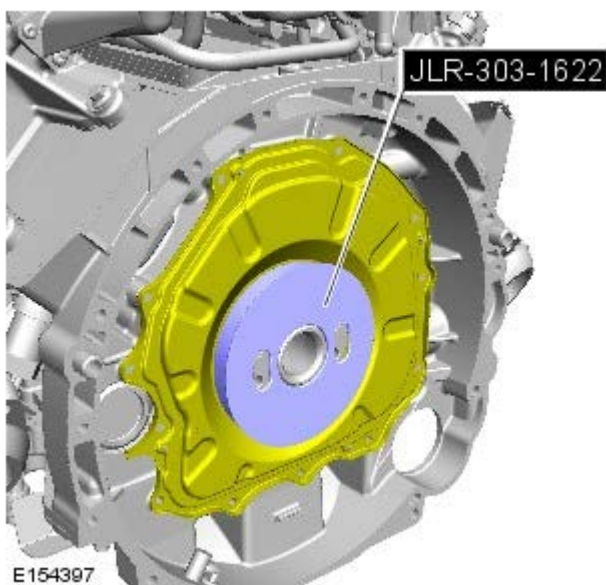
Special Tool(s): [303-1442](#)



E154396

3. Align the engine rear oil seal plate using the special tool.

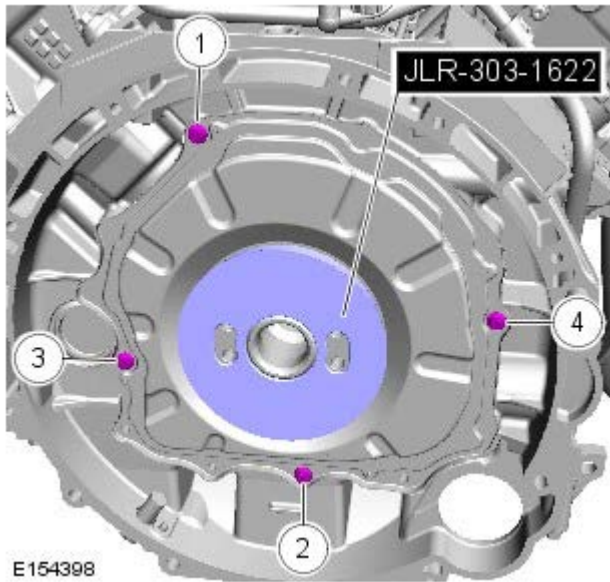
Special Tool(s): [JLR-303-1622](#)



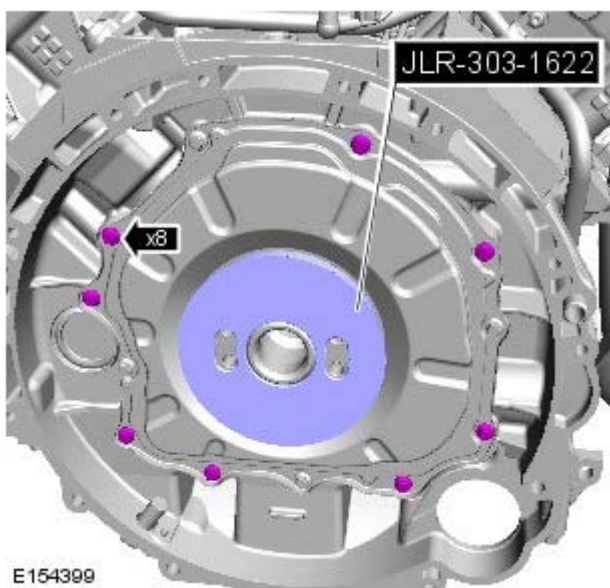
E154397

4.  NOTE: Tighten the bolts in the indicated sequence.

Special Tool(s): [JLR-303-1622](#)
Torque: 11 Nm



5. *Special Tool(s):* [JLR-303-1622](#)
Torque: 11 Nm




6. Refer to: [Flexplate](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

Engine - V6 S/C 3.0L Petrol - Cylinder Head LH

Removal and Installation

Special Tool(s)

 <p>E129632</p>	<p>303-1492 Guide Sleeve, Cylinder Head Bolt</p>
--	--

Removal

NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.



Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

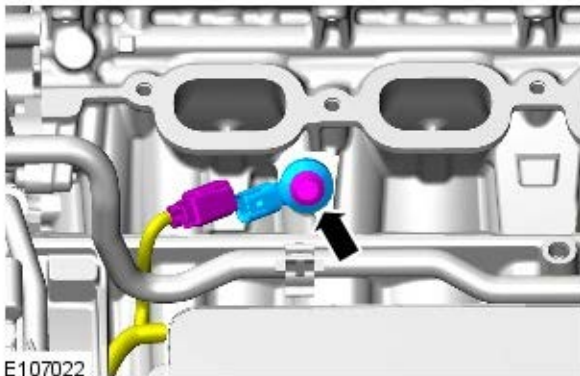
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

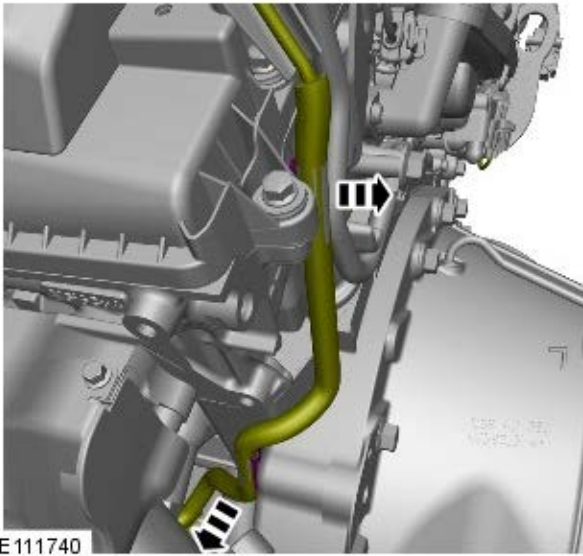
Raise and support the vehicle.

3. Refer to: [Exhaust Manifold LH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
4. Refer to: [Camshaft LH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

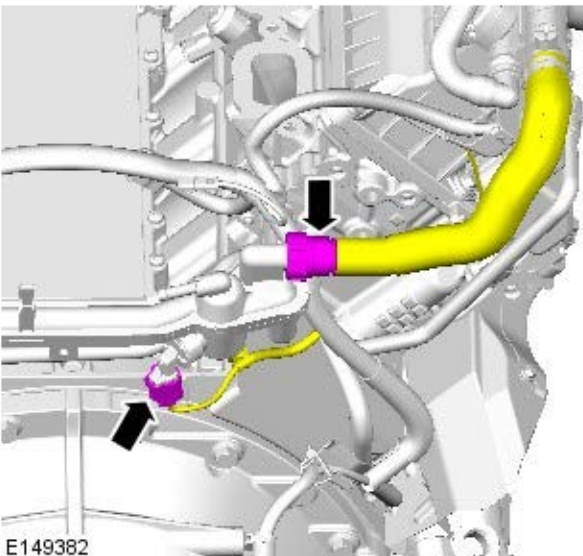
5.




6.

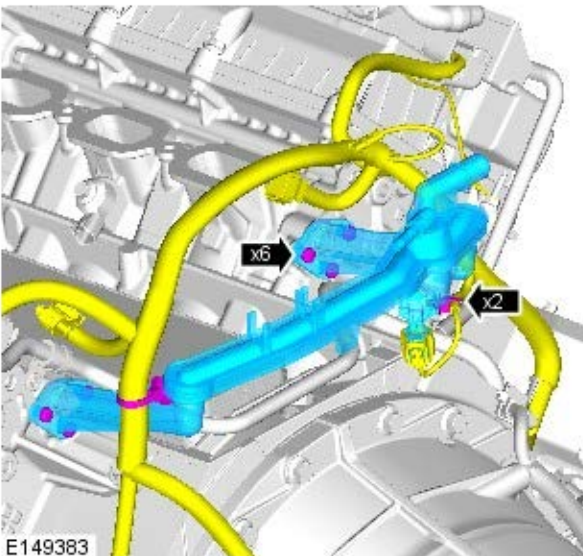


E111740





E149382

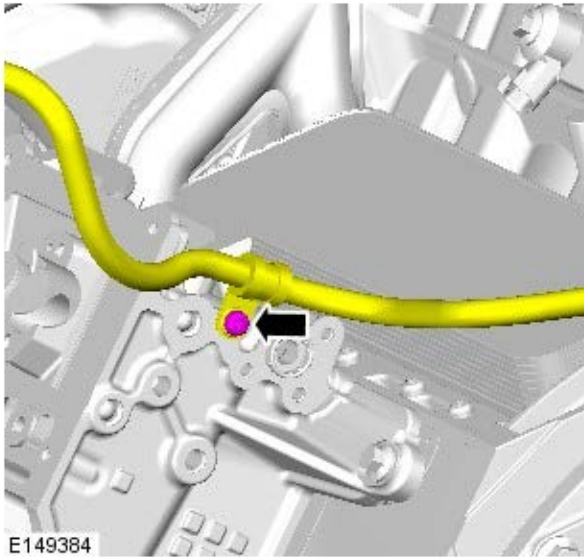
7.  NOTE: Clamp the hose to minimize coolant loss.



E149383

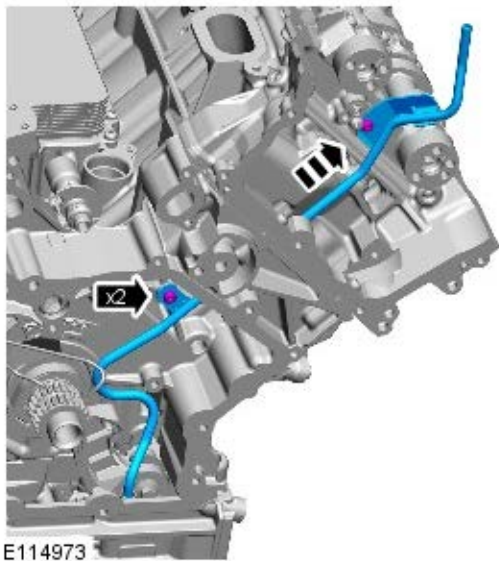
8. CAUTIONS:
-  Be prepared to collect escaping coolant.
 -  Discard the seals.

9.



E149384

10.



E114973

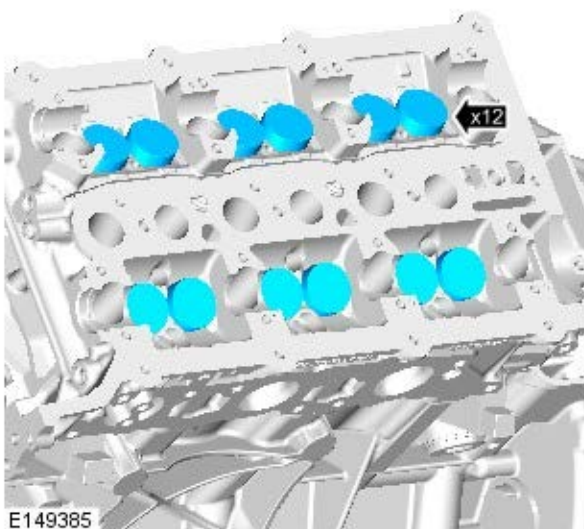
11. CAUTIONS:



If a new cylinder head has been installed then new tappets must be installed.

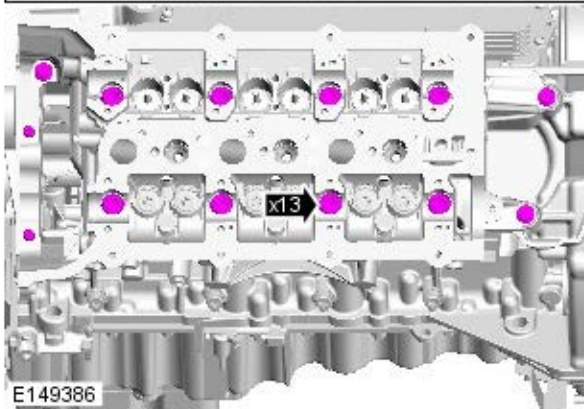
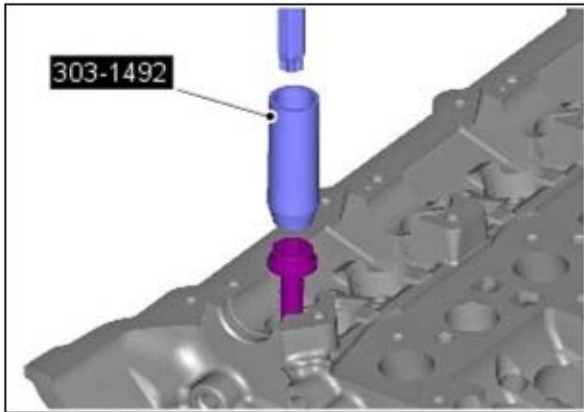


If the cylinder head is being removed without a new component being installed, the tappets must be installed in their original positions.

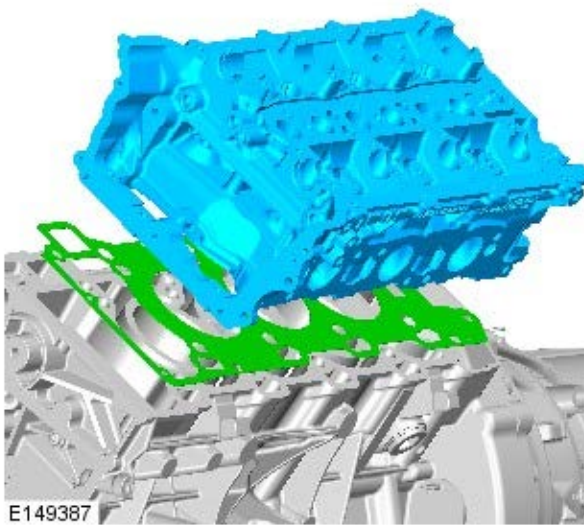


E149385


12. *Special Tool(s):* [303-1492](#)

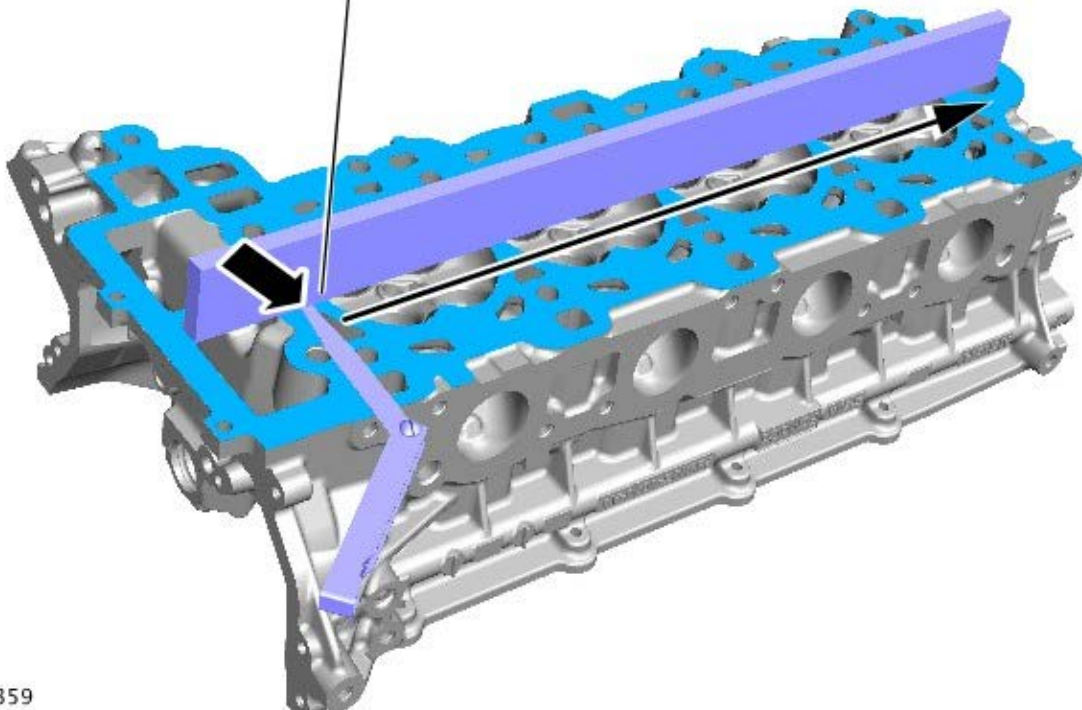
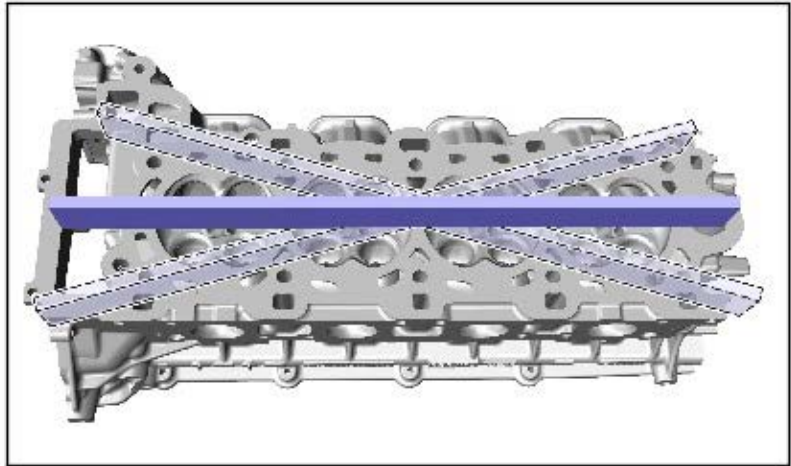
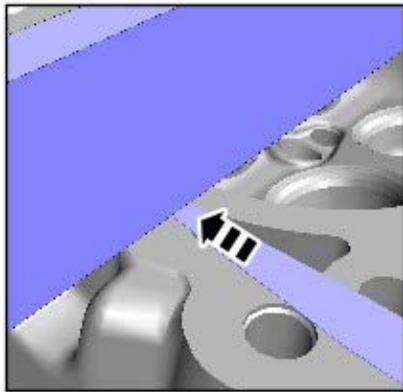


13.

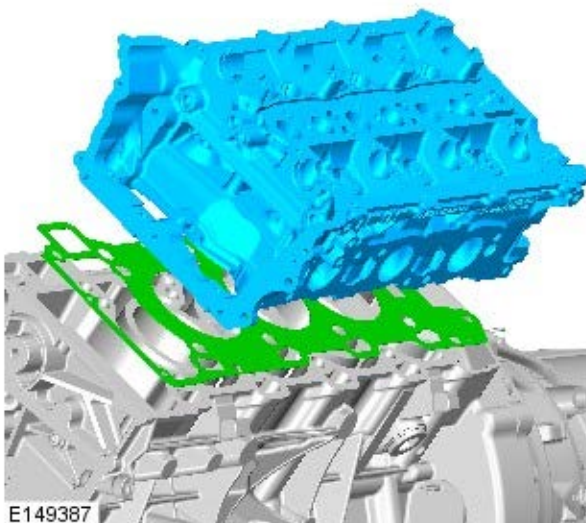


Installation

1.  **CAUTION:** An acceptable flatness of the cylinder head is 0.1mm.
Check cylinder head face for distortion, across the center and from corner to corner.




E160359




E149387


2.  **WARNING:** Make sure care is taken when handling the cylinder head gasket.

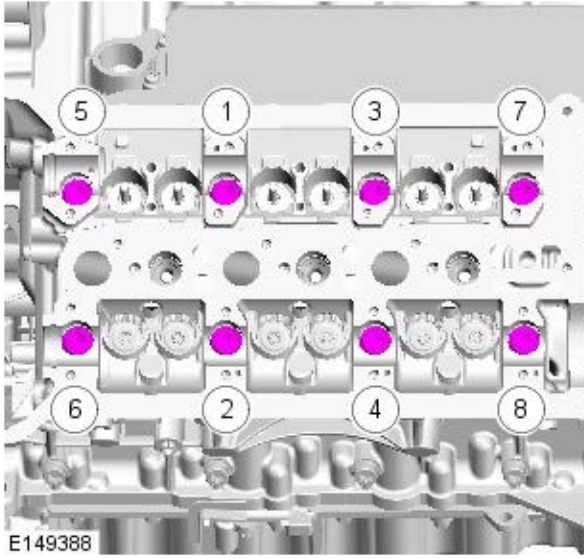
CAUTIONS:


 The head gasket must be installed over the cylinder block dowels.

 Make sure that the mating faces are clean and free of foreign material.

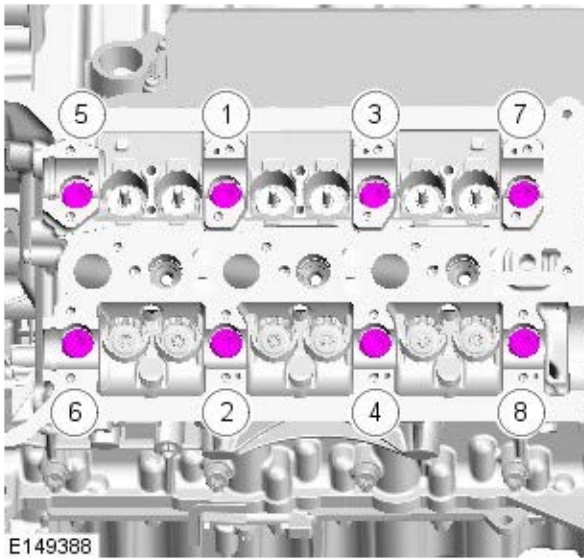
 **NOTE:** Install a new cylinder head gasket.

3.  **CAUTION:** Make sure that new cylinder head bolts are installed.



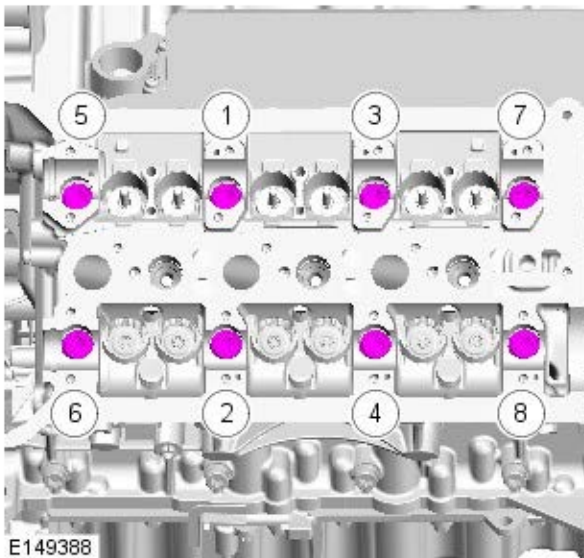
 NOTE: Tighten the bolts in the indicated sequence.

Torque: 20 Nm



4.  NOTE: Tighten the bolts in the indicated sequence.

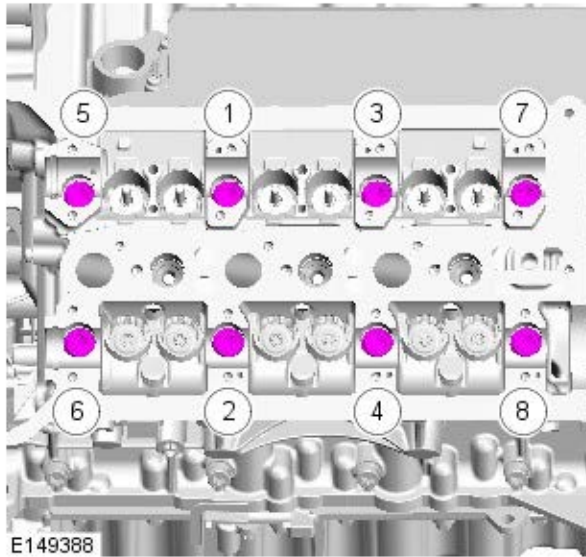
Torque: 35 Nm



5.  NOTE: Slacken the bolts in the sequence shown.

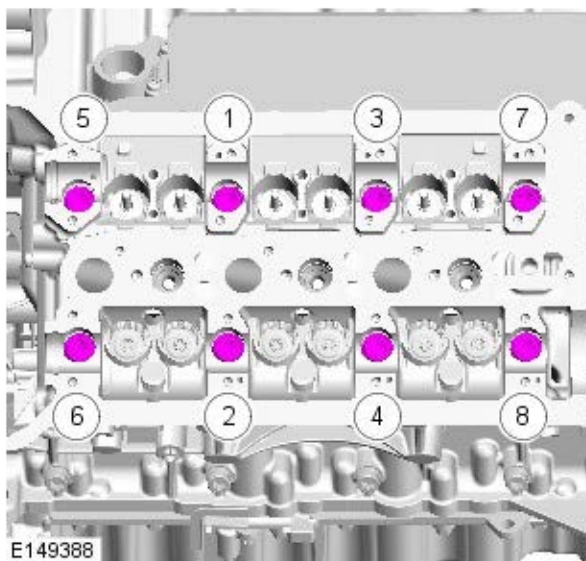
6.  NOTE: Tighten the bolts in the indicated sequence.

Torque: 35 Nm



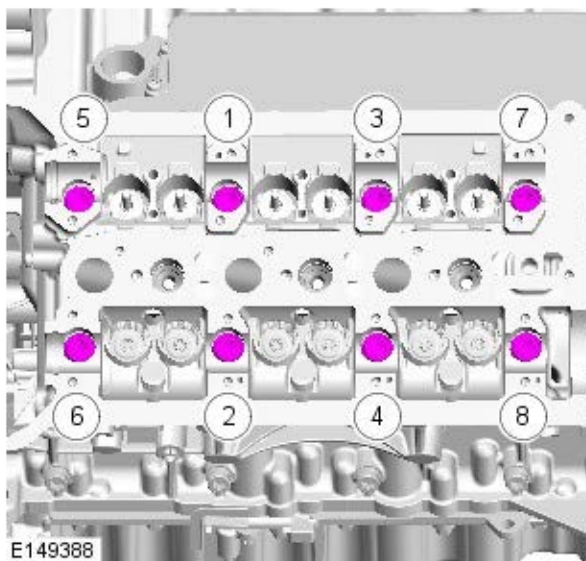
7.  NOTE: Tighten the bolts in the indicated sequence.

Tighten the bolts 1 to 8, a further 90 degrees.



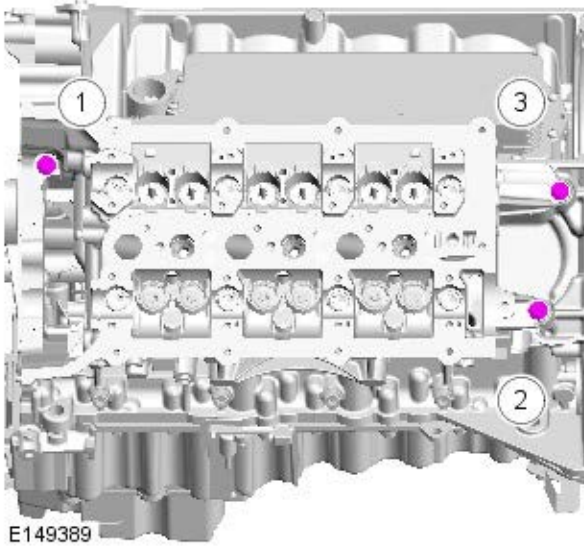
8.  NOTE: Tighten the bolts in the indicated sequence.

Tighten the bolts 1 to 8, a further 120 degrees.

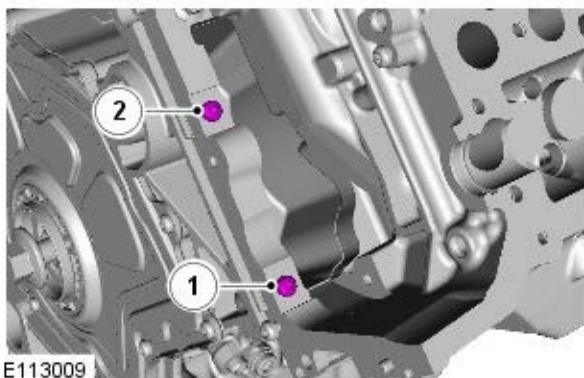


9.  NOTE: Tighten the bolts in the indicated sequence.


Torque: 25 Nm



E149389



E113009

10.  NOTE: Tighten the bolts in the indicated sequence.

Torque: 12 Nm

11. CAUTIONS:

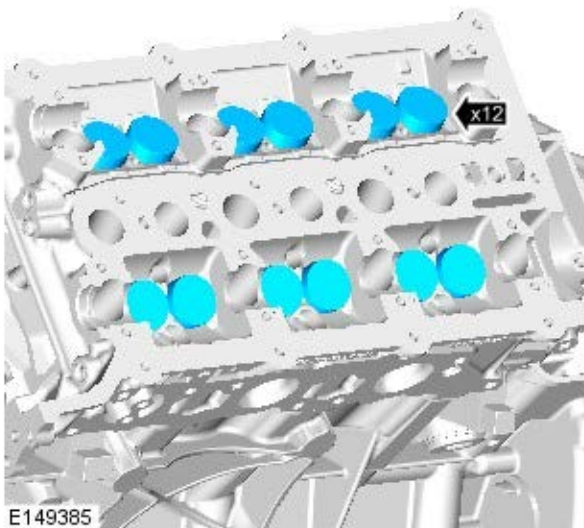


If a new cylinder head has been installed then new tappets must be installed.



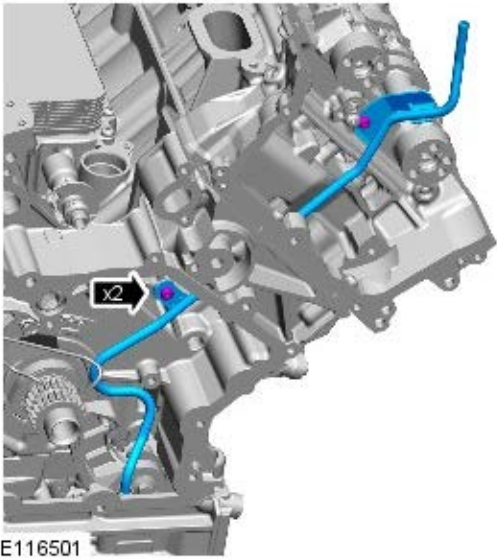
If the cylinder head is being removed without a new component being installed, the tappets must be installed in their original positions.

Lubricate the valve tappets with clean engine oil.

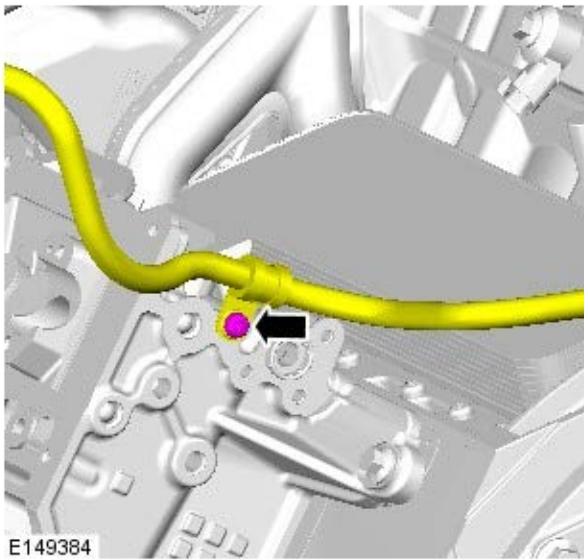



E149385

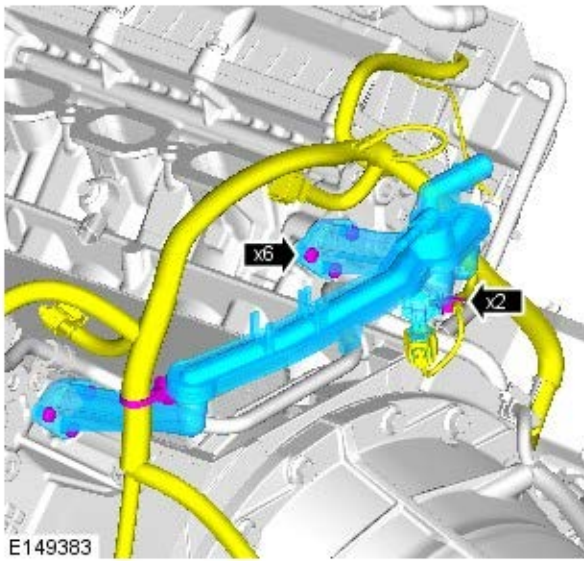
12. Torque: 12 Nm



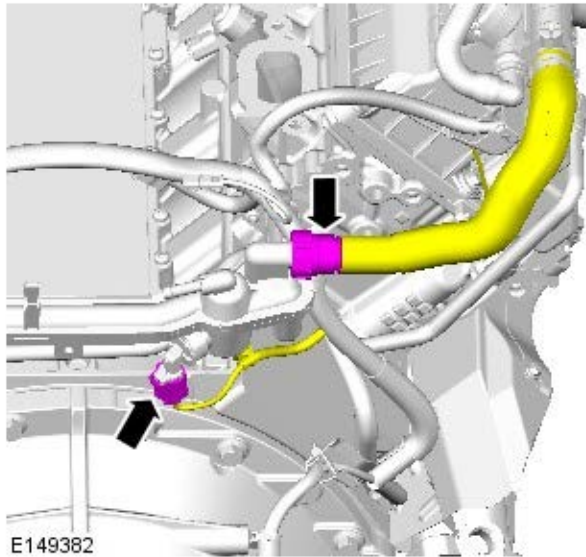
13. Torque: 10 Nm



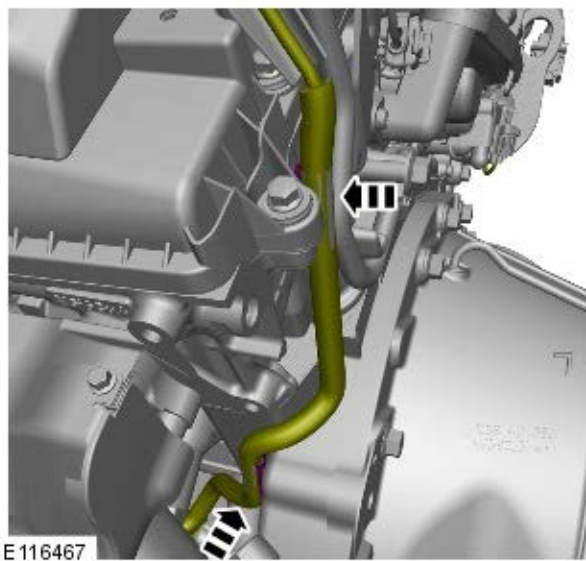
14.  CAUTION: Install the new seals.
Torque: 10 Nm



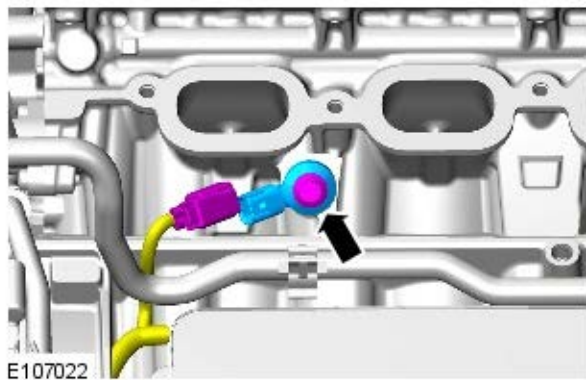
15.



16.



17. Torque: 20 Nm



18. Refer to: [Camshaft LH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
19. Refer to: [Exhaust Manifold LH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
20. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - V6 S/C 3.0L Petrol - Cylinder Head RH

Removal and Installation

Removal

NOTES:



Some illustrations may show the engine removed for clarity.



Some variation in the illustrations may occur, but the essential information is always correct.



Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

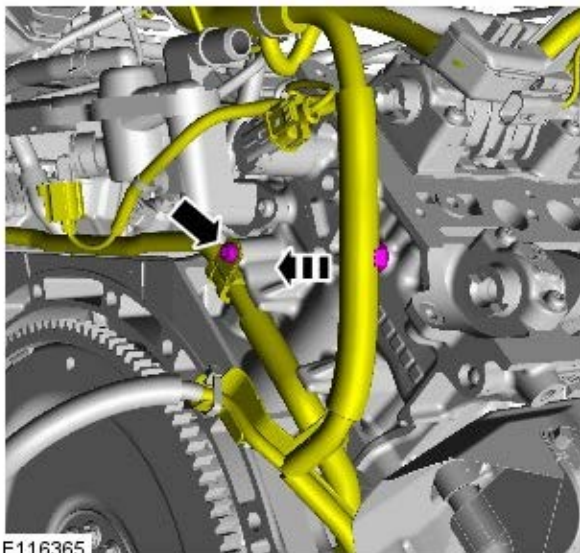
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2. Raise and support the vehicle.

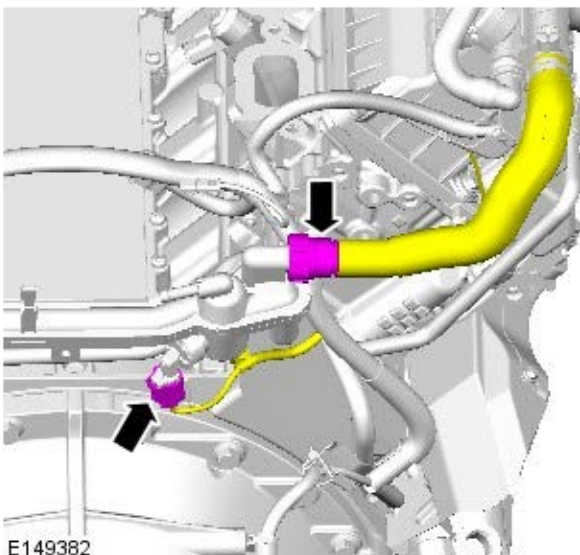
3. Refer to: [Exhaust Manifold RH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

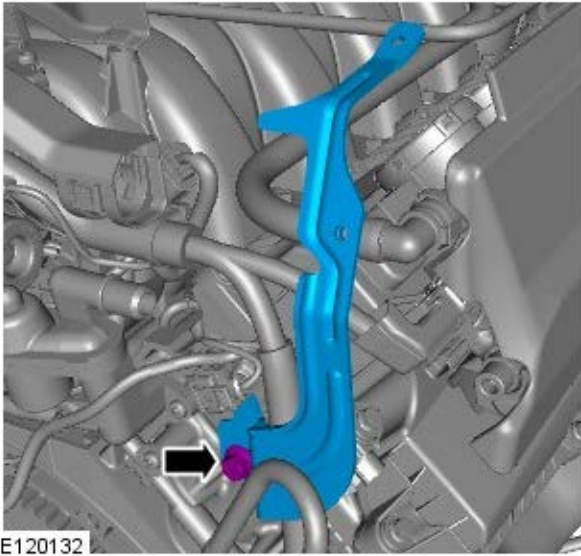
4. Refer to: [Camshaft RH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

5.

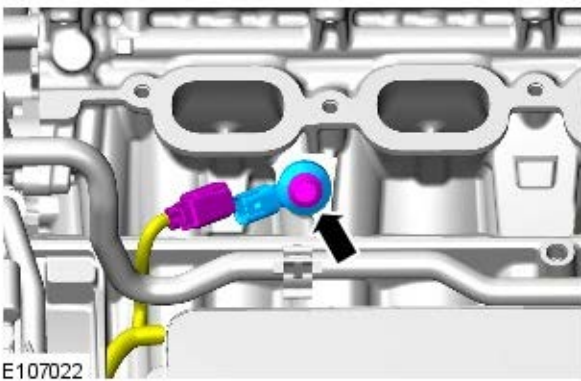


6. NOTE: Clamp the hose to minimize coolant loss.

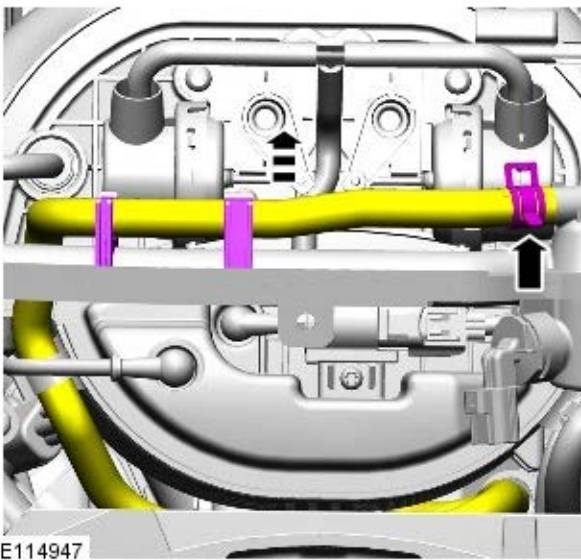




7.



8.

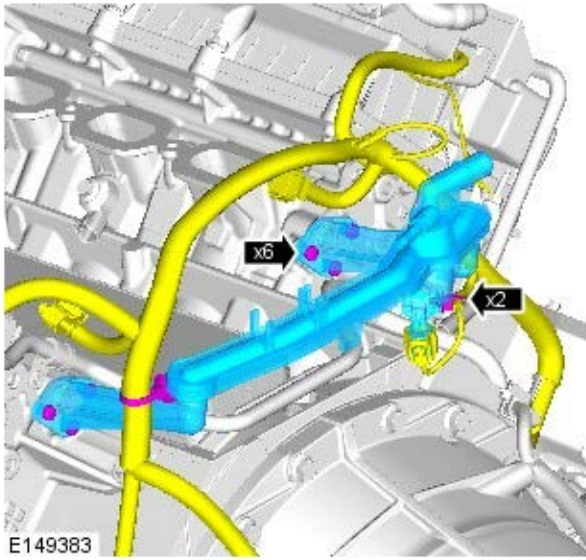


9.  CAUTION: Clamp the hoses to minimize coolant loss.

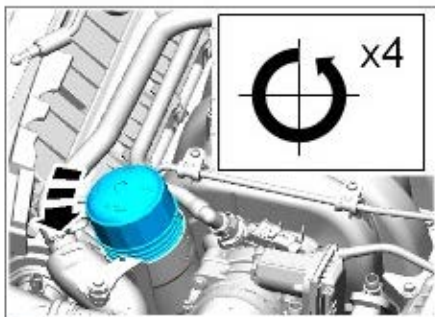
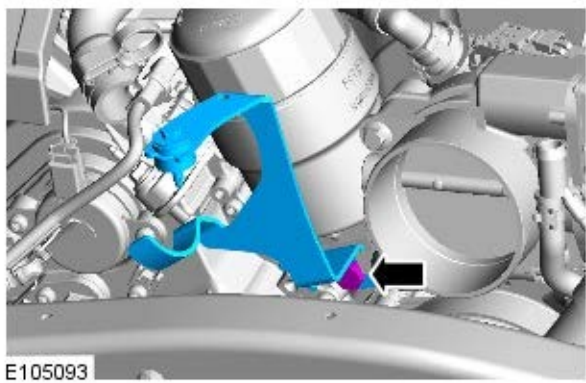
10. CAUTIONS:

 Discard the seals.

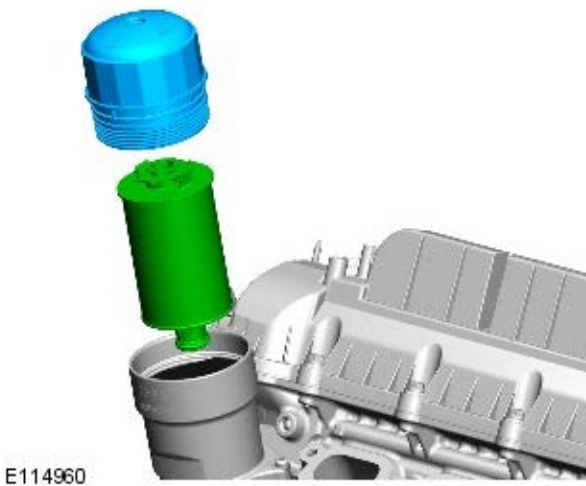
 Be prepared to collect escaping coolant.



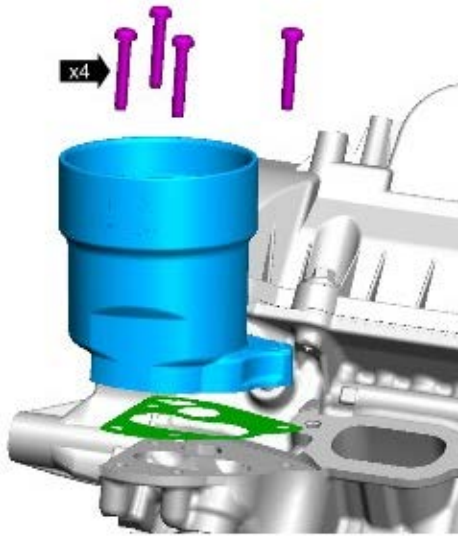
11.



12.  NOTE: Remove and discard the O-ring seal.

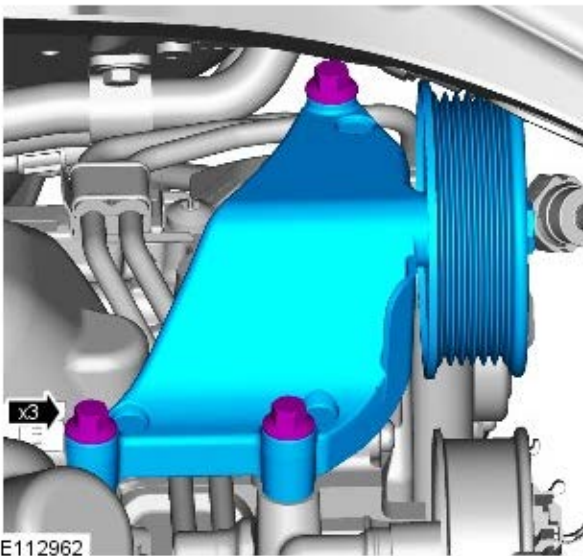


13.  NOTE: Discard the gasket.



E114959

14.



E112962

15. CAUTIONS:



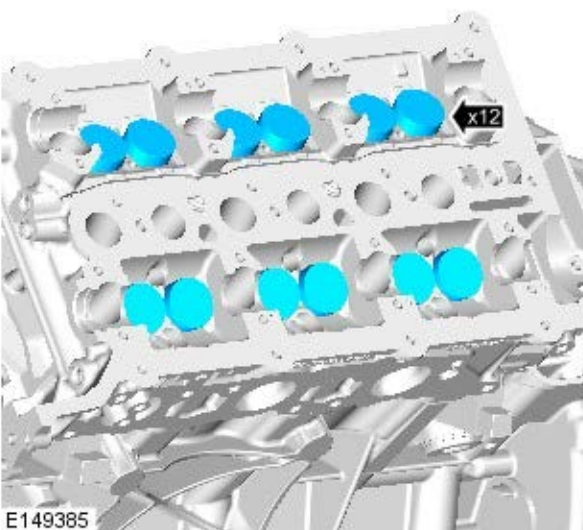
If a new cylinder head has been installed then new tappets must be installed.



If the cylinder head is being removed without a new component being installed, the tappets must be installed in their original positions.

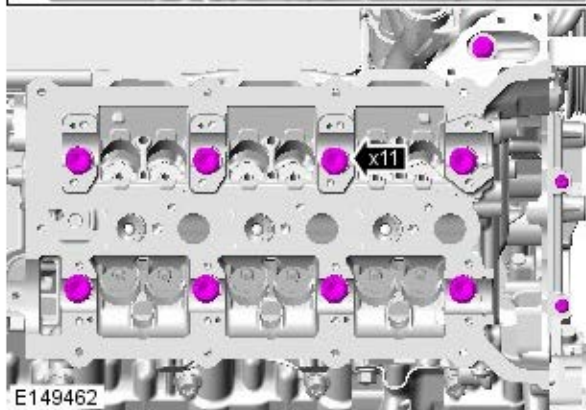
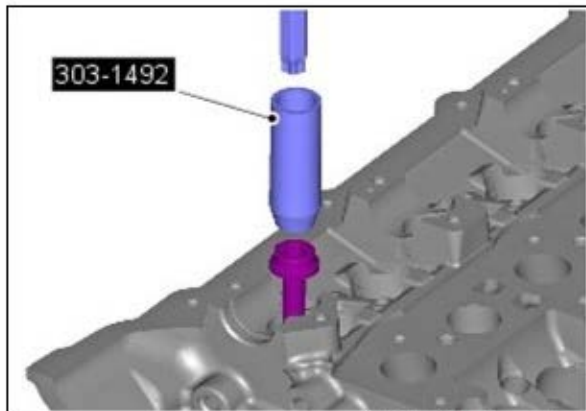


NOTE: Left-hand shown, right-hand similar.

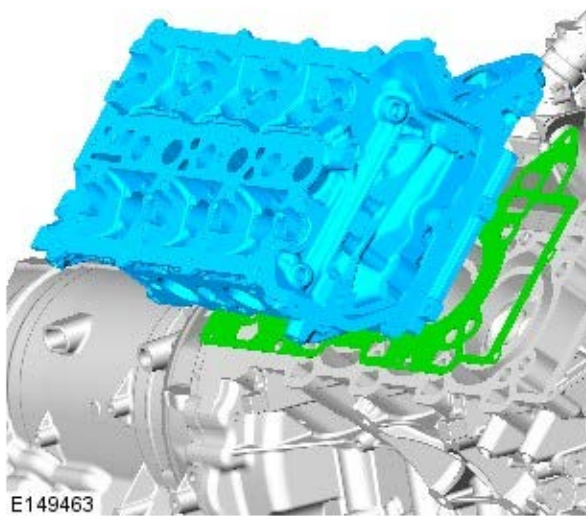


E149385


16.  CAUTION: Discard the bolts.

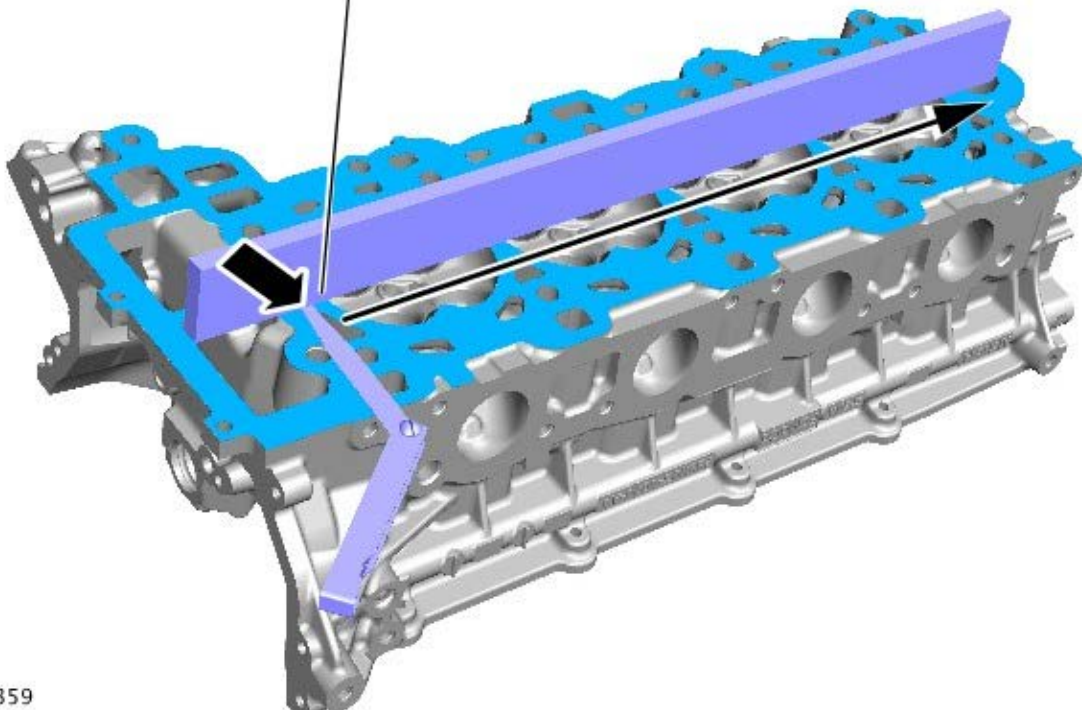
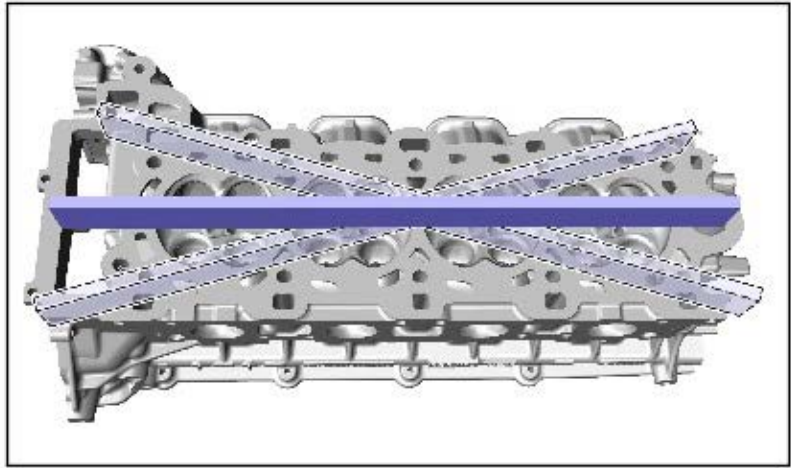
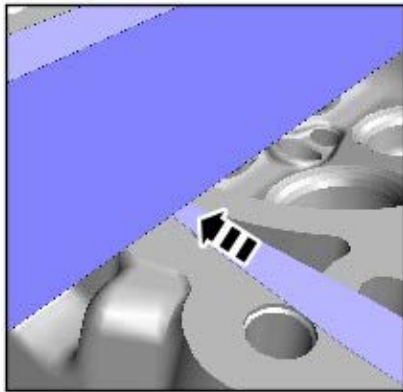


17.

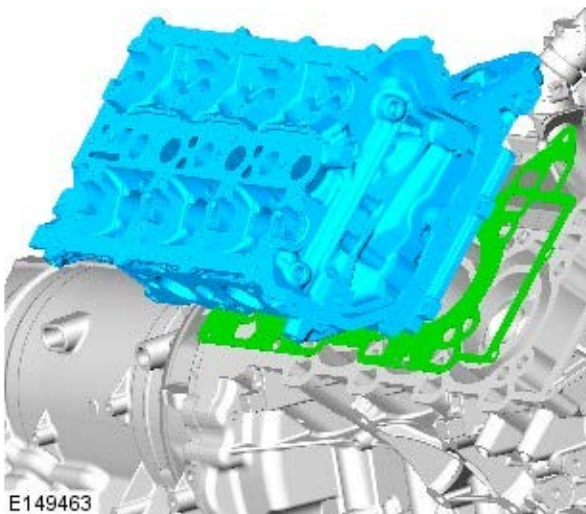


Installation


1.  **CAUTION:** An acceptable flatness of the cylinder head is 0.1mm.
Check cylinder head face for distortion, across the center and from corner to corner.




E160359




E149463

2.  **WARNING:** Make sure care is taken when handling the cylinder head gasket.

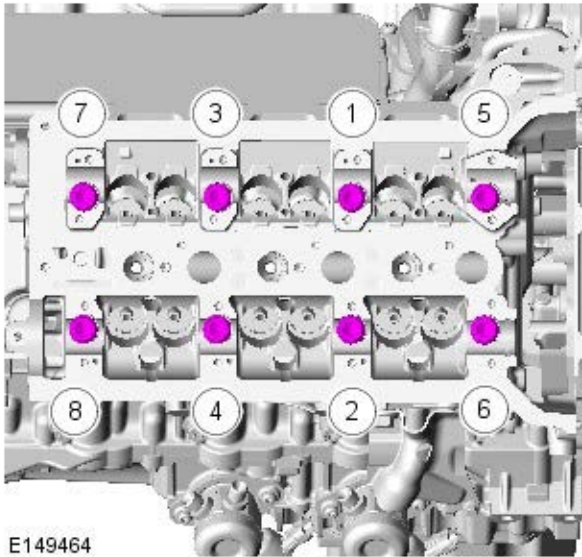
CAUTIONS:

 The head gasket must be installed over the cylinder block dowels.

 Make sure that the mating faces are clean and free of foreign material.

 **NOTE:** Install a new cylinder head gasket.

3.  **CAUTION:** Make sure that new cylinder head bolts are installed.

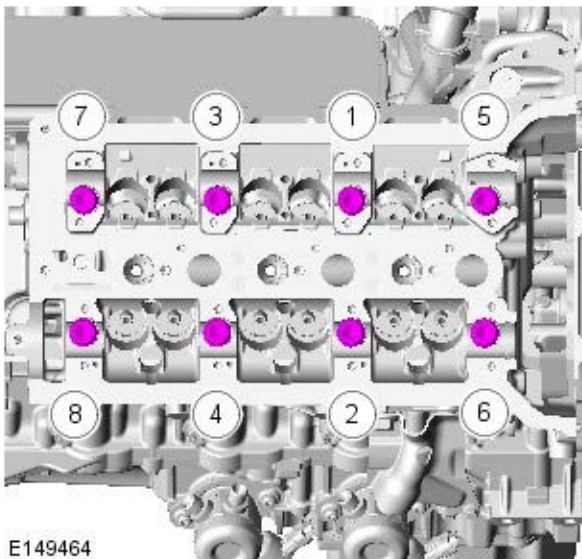


E149464



NOTE: Tighten the bolts in the indicated sequence.

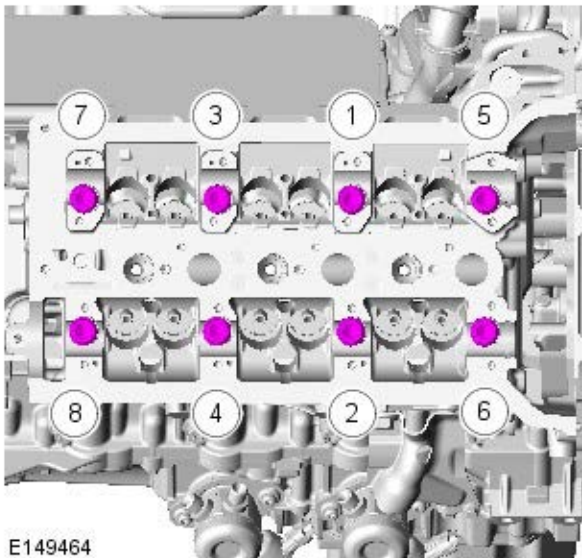
Torque: 20 Nm




E149464

4.  NOTE: Tighten the bolts in the indicated sequence.

Torque: 35 Nm

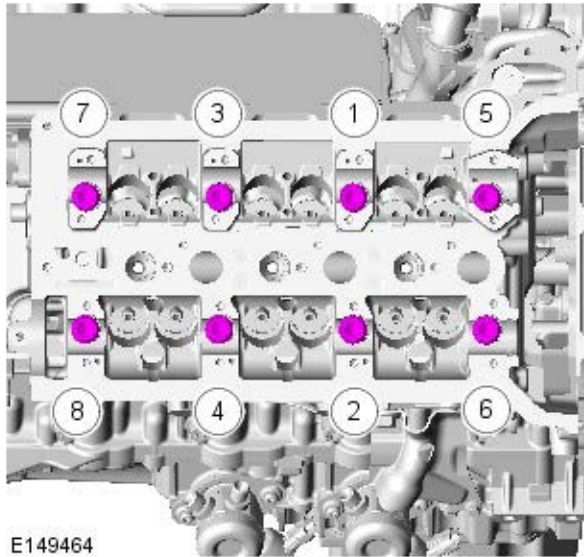


E149464

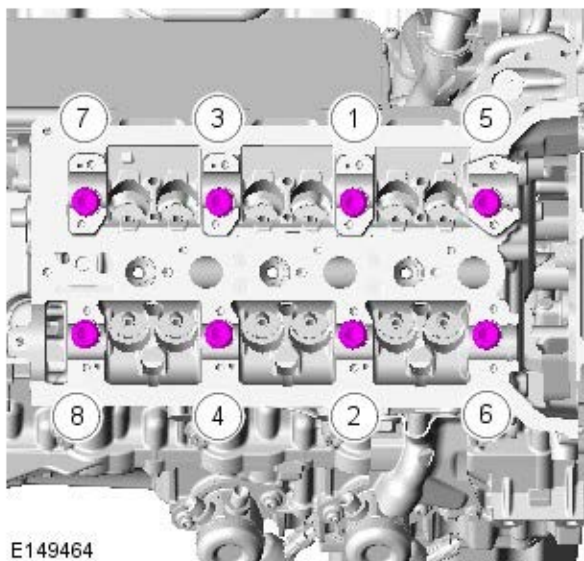
5.  NOTE: Slacken the bolts in the sequence shown.

6.  NOTE: Tighten the bolts in the indicated sequence.

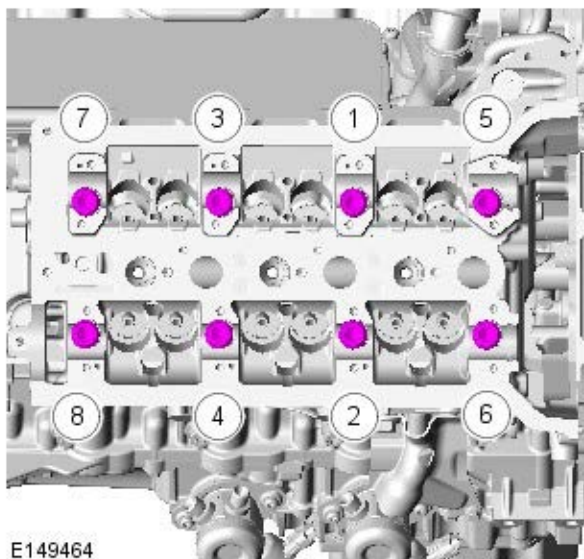
Torque: 35 Nm




E149464



E149464



E149464

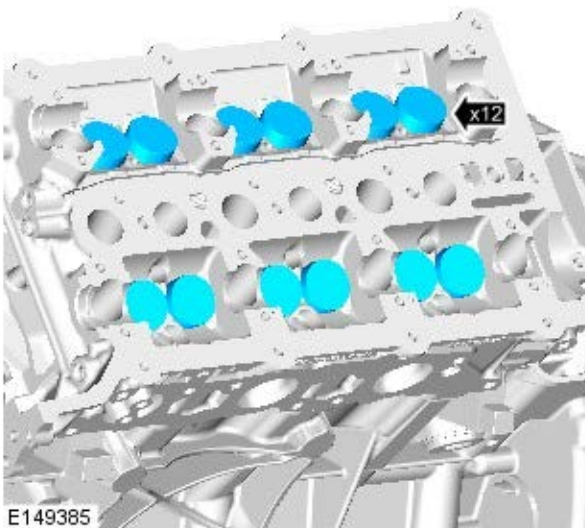
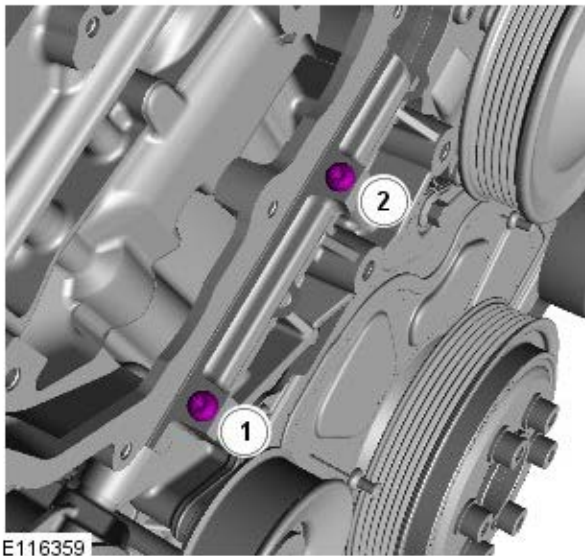
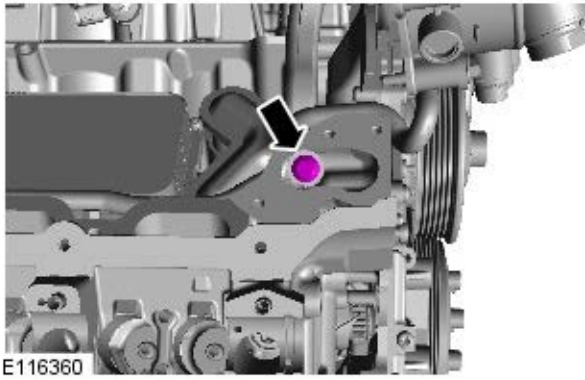
7.  NOTE: Tighten the bolts in the indicated sequence.

Tighten the bolts 1 to 8, a further 90 degrees.

8.  NOTE: Tighten the bolts in the indicated sequence.

Tighten the bolts 1 to 8, a further 120 degrees.

9. Torque: 25 Nm




10.  NOTE: Tighten the bolts in the indicated sequence.


Torque: 12 Nm


11. CAUTIONS:

 If a new cylinder head has been installed then new tappets must be installed.

 If the cylinder head is being removed without a new component being installed, the tappets must be installed in their original positions.

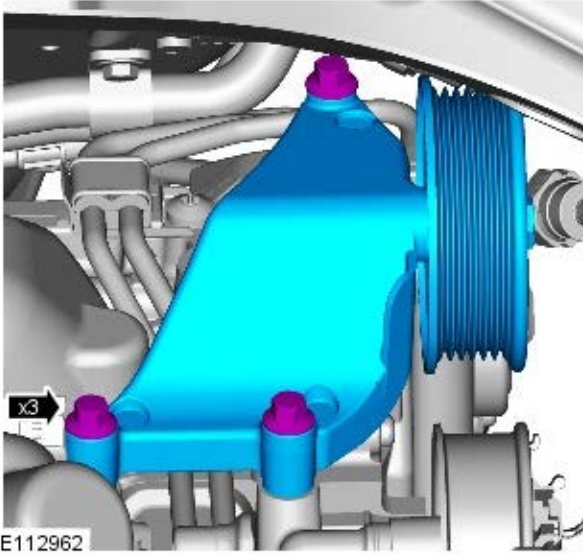
NOTES:

 Some variation in the illustrations may occur, but the essential information is always correct.

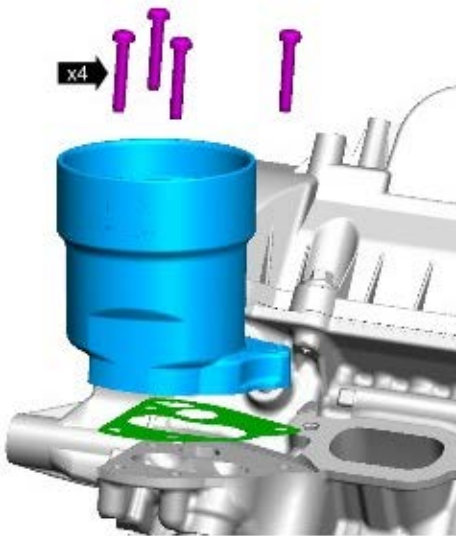
 Left-hand shown, right-hand similar.

Lubricate the valve tappets with clean engine oil.


12. Torque: 25 Nm





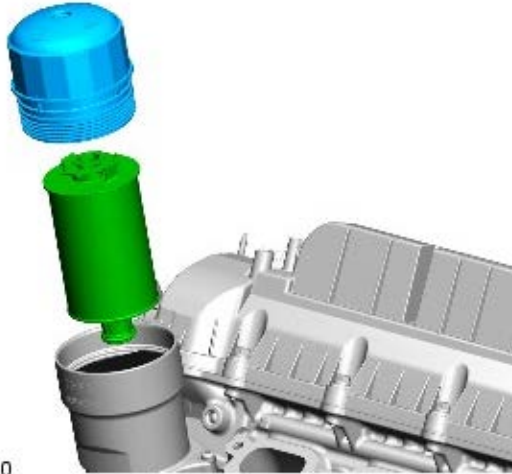
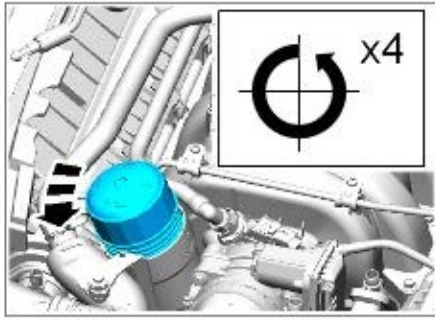
E112962



E114959

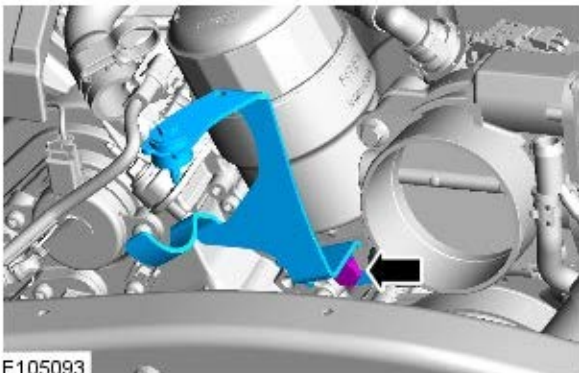
13.  NOTE: Install a new gasket.
Torque: 12 Nm

14.  CAUTION: A new O-ring seal is to be installed.
 NOTE: Install a new engine oil filter.



E114960

15. *Torque: 10 Nm*



E105093

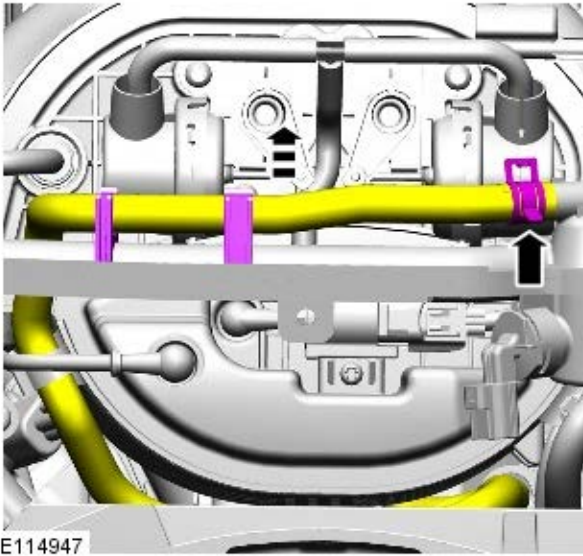
16.  **CAUTION:** Install the new seals.

Torque: 10 Nm



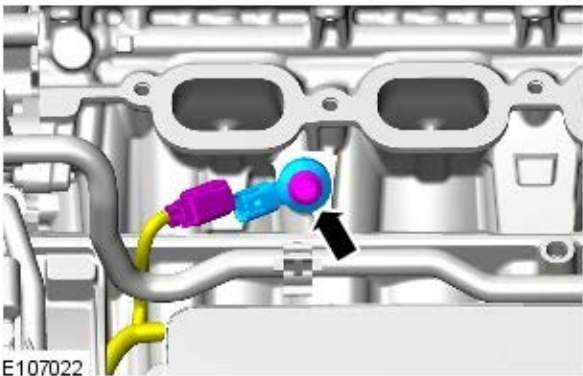
E149383

17.



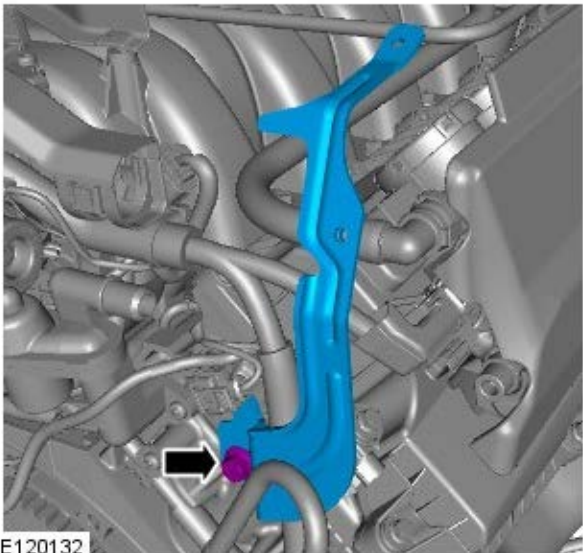
E114947

18. Torque: 20 Nm



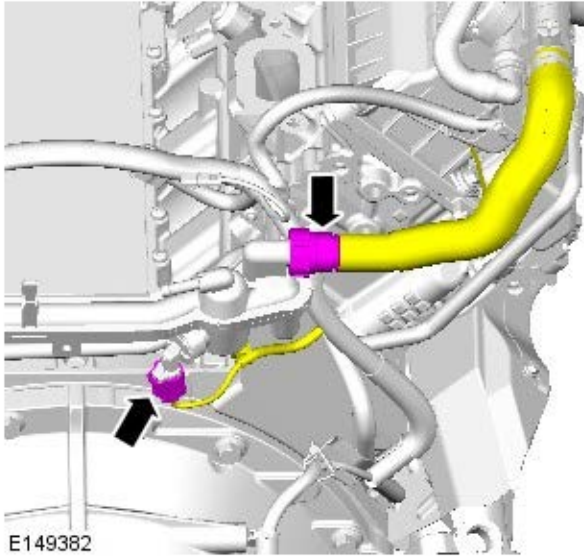
E107022

19. Torque: 10 Nm

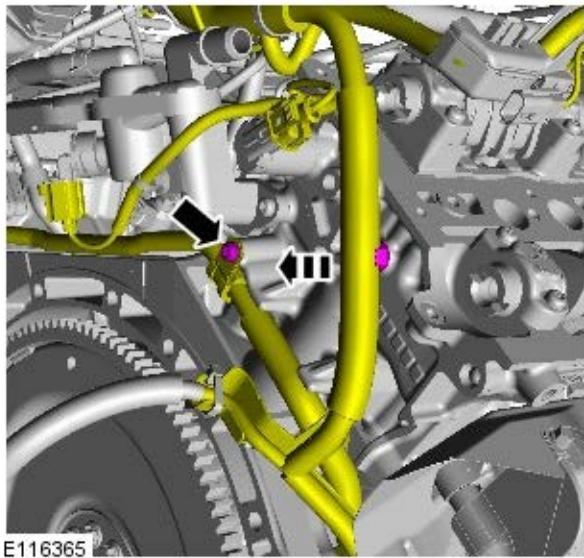


E120132

20.



21. Torque: 10 Nm



22. Refer to: [Camshaft RH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
23. Refer to: [Exhaust Manifold RH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
24. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - V6 S/C 3.0L Petrol - Engine Mount LH

Removal and Installation

Removal

NOTES:



Some components shown removed for clarity.



Some variation in the illustrations may occur, but the essential information is always correct.

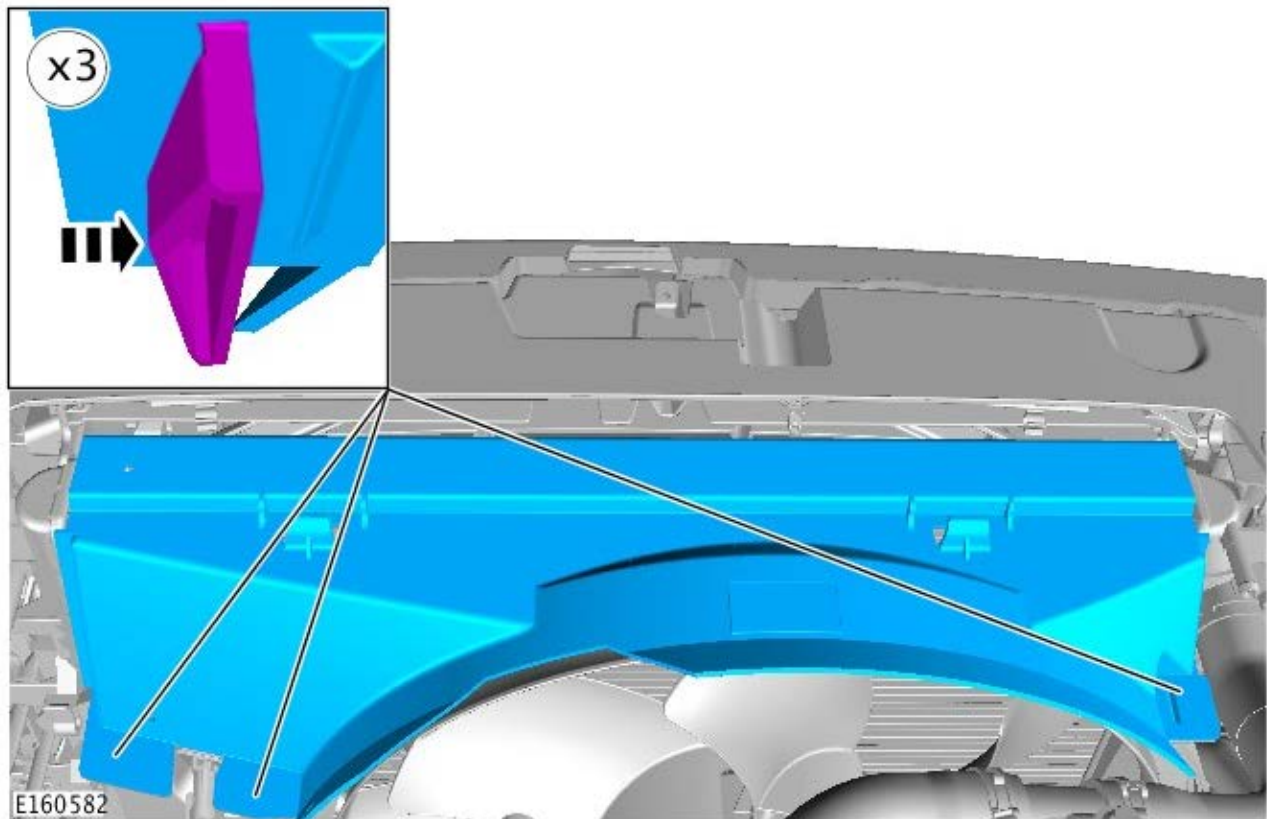
All vehicles

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

- 3.



4.  **WARNING:** Make sure to support the vehicle with axle stands.

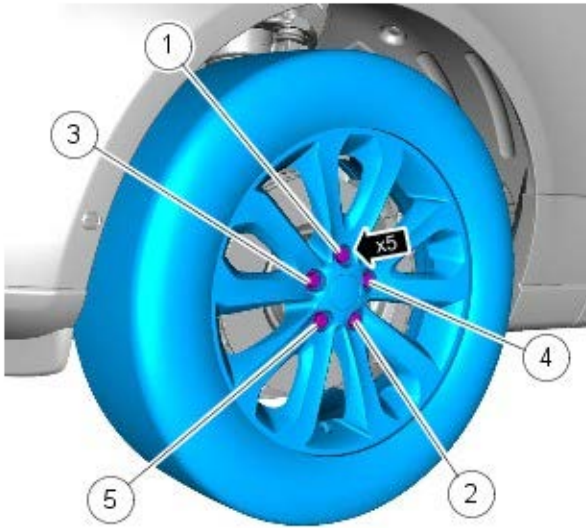
Raise and support the vehicle.

5.  **WARNING:** The wheel and tire assembly will be heavy.



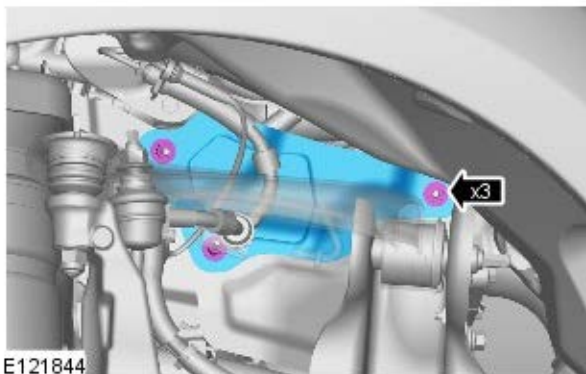
NOTE: Note the position of the component before removal.

Remove the wheel and tire.



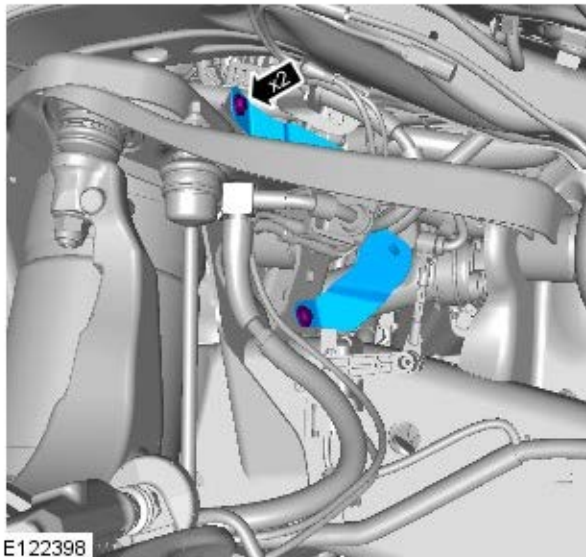
E142105

6.



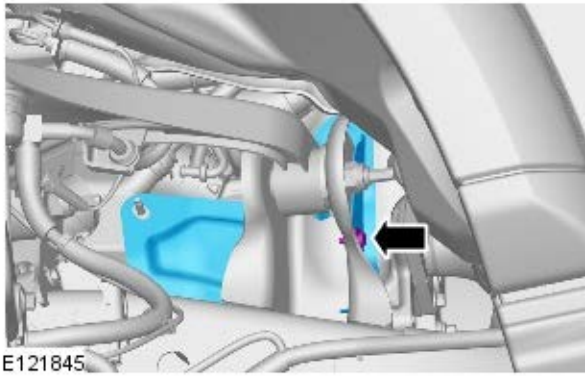
E121844

7.



E122398

8.



E121845

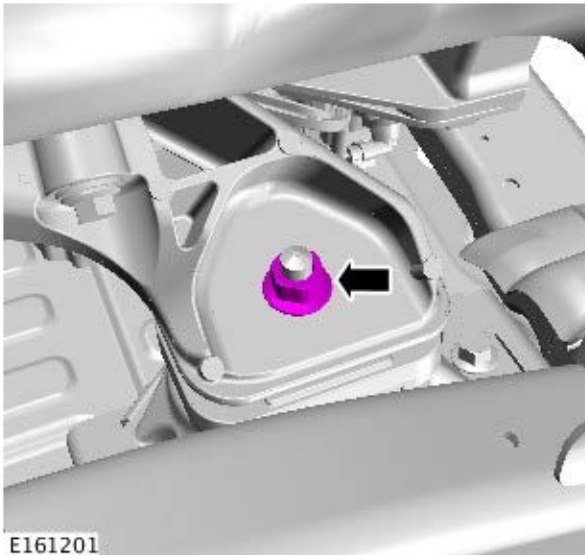
9. Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).

Left-hand drive vehicles

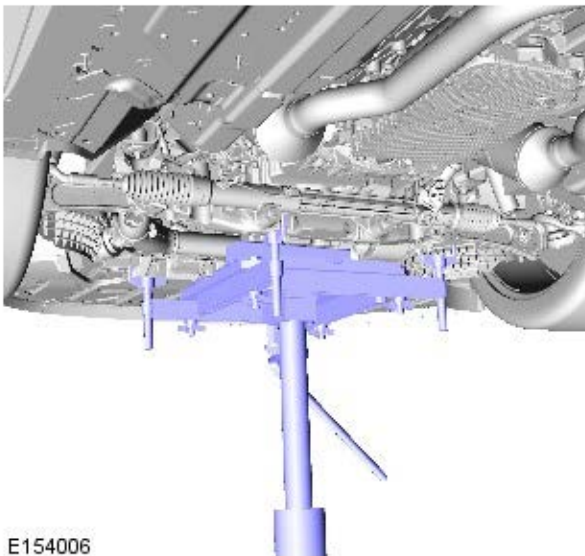
10. Refer to: [Steering Column Lower Shaft](#) (211-04 Steering Column, Removal and Installation).

All vehicles

11.




E161201



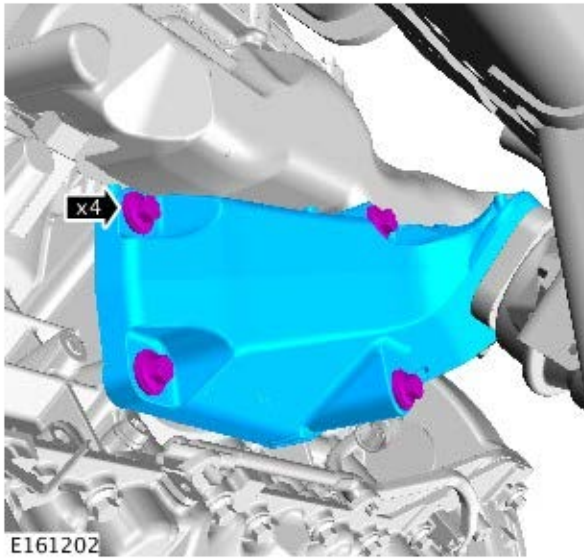
E154006

12. CAUTIONS:

 Support the engine on a jack. The angle may need to be adjusted during this procedure.

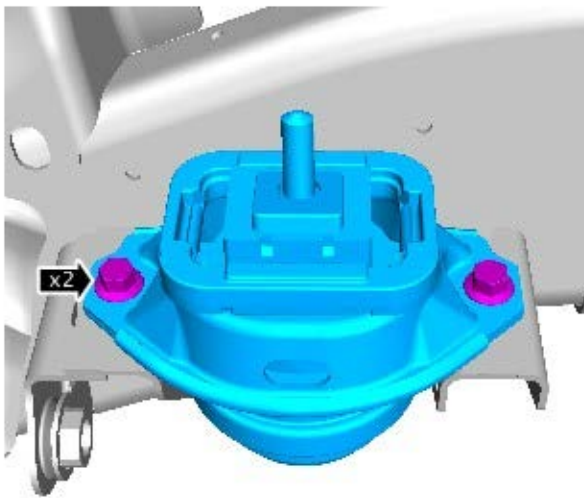
 Use a wooden block to protect the oil pan when supporting the engine.

13.



E161202

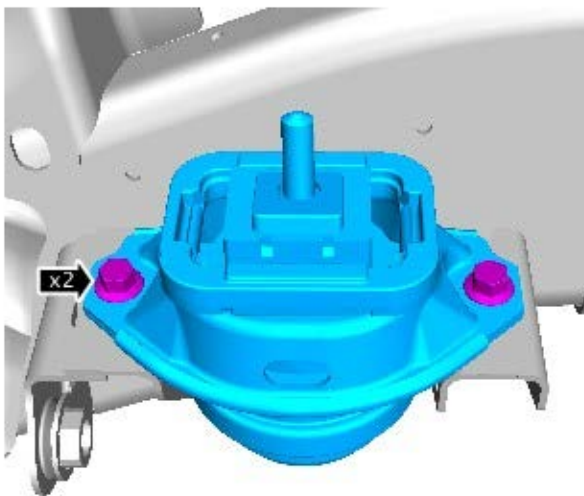
14.



E161203

Installation

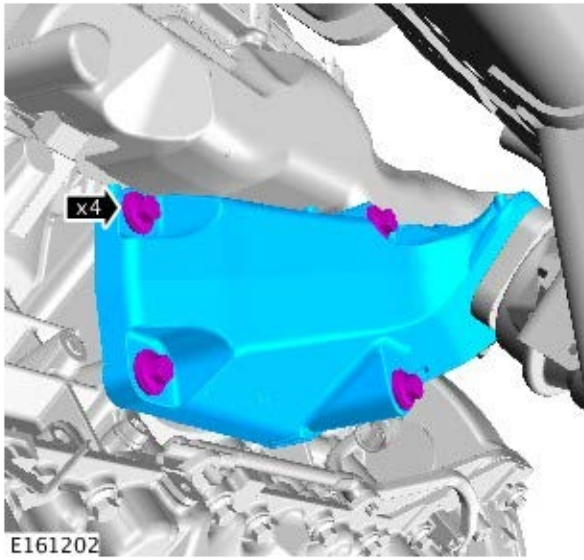
All vehicles



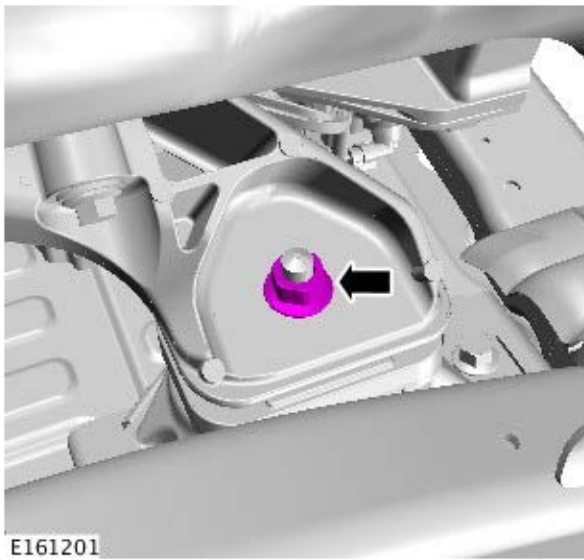
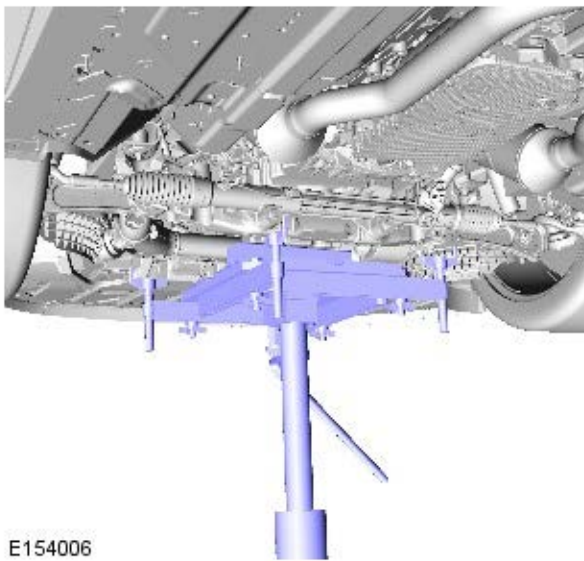
E161203

1.  CAUTION: Only tighten the bolts finger-tight at this stage.

2. Torque:
 Stage 1: 45 Nm
 Stage 2: 60°

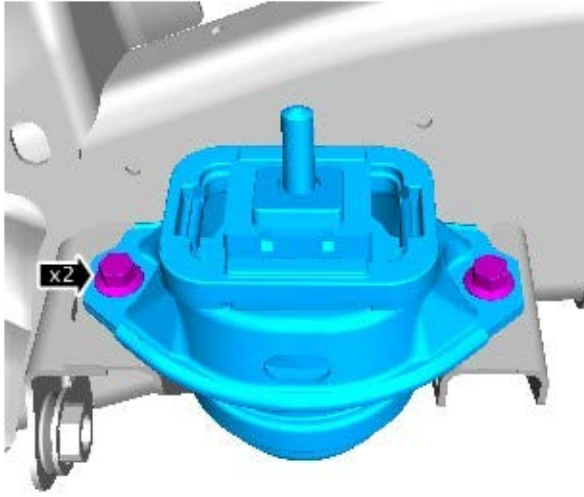


3. Lower the engine onto the mount.



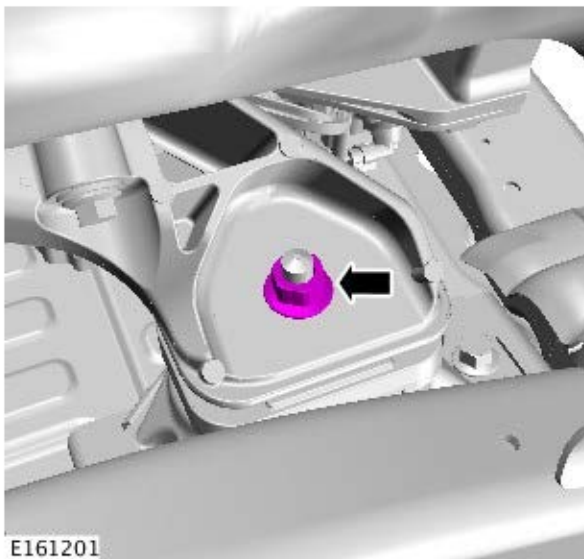
4.  CAUTION: Only tighten the nut finger tight at this stage.

5. Torque: 56 Nm



E161203

6. Torque: 100 Nm



E161201

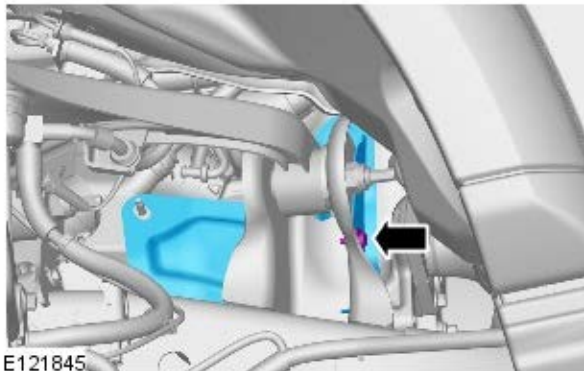
Left-hand drive vehicles

7. Refer to: [Steering Column Lower Shaft](#) (211-04 Steering Column, Removal and Installation).

All vehicles

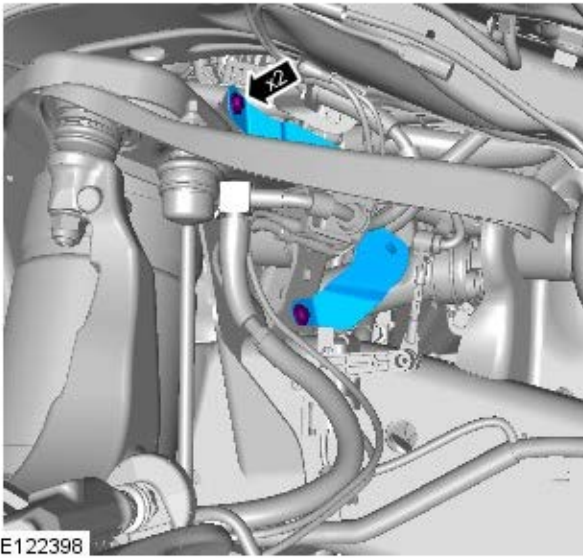
8. Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).

9. Torque: 10 Nm



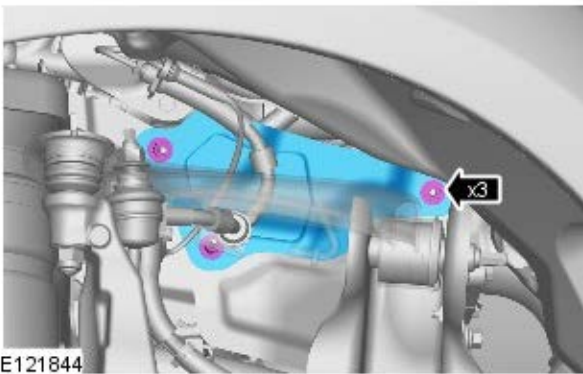
E121845

10. Torque: 10 Nm




E122398


11. Torque: 10 Nm



E121844

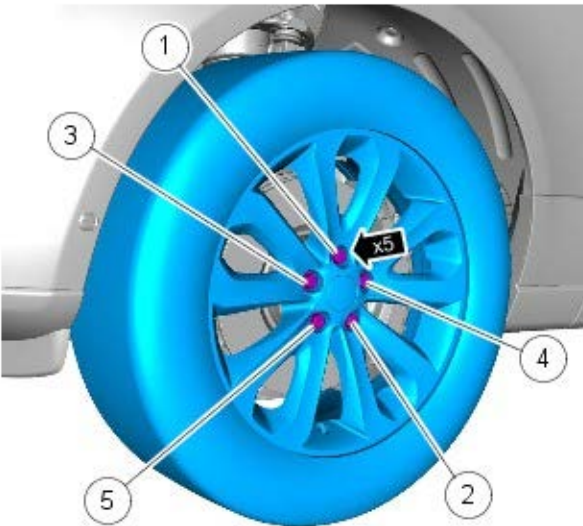
12.  **WARNING:** The wheel and tire assembly will be heavy.

 **CAUTION:** Apply a small amount of grease to the hub and wheel mating surfaces before installation. Make sure the grease does not come into contact with the vehicles braking components and the wheel stud threads. Failure to follow these instructions may result in personal injury.

 **NOTE:** Make sure that the component is installed to the noted removal position.

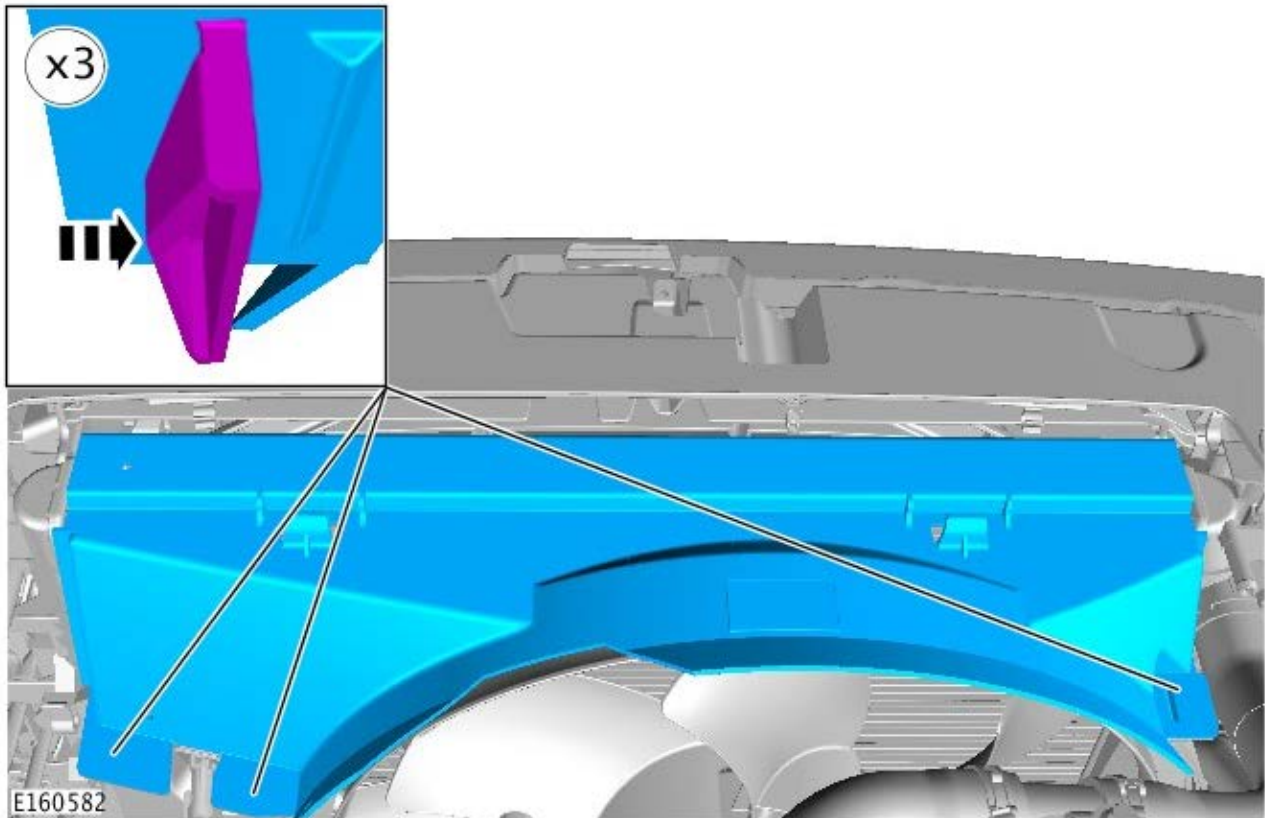
Install the wheel and tire.

Torque:
 Stage 1: 4 Nm
 Stage 2: 70 Nm
 Stage 3: 140 Nm



E142105

13.



14. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

15. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - V6 S/C 3.0L Petrol - Engine Mount RH

Removal and Installation

Removal

NOTES:



Some components shown removed for clarity.



Some variation in the illustrations may occur, but the essential information is always correct.

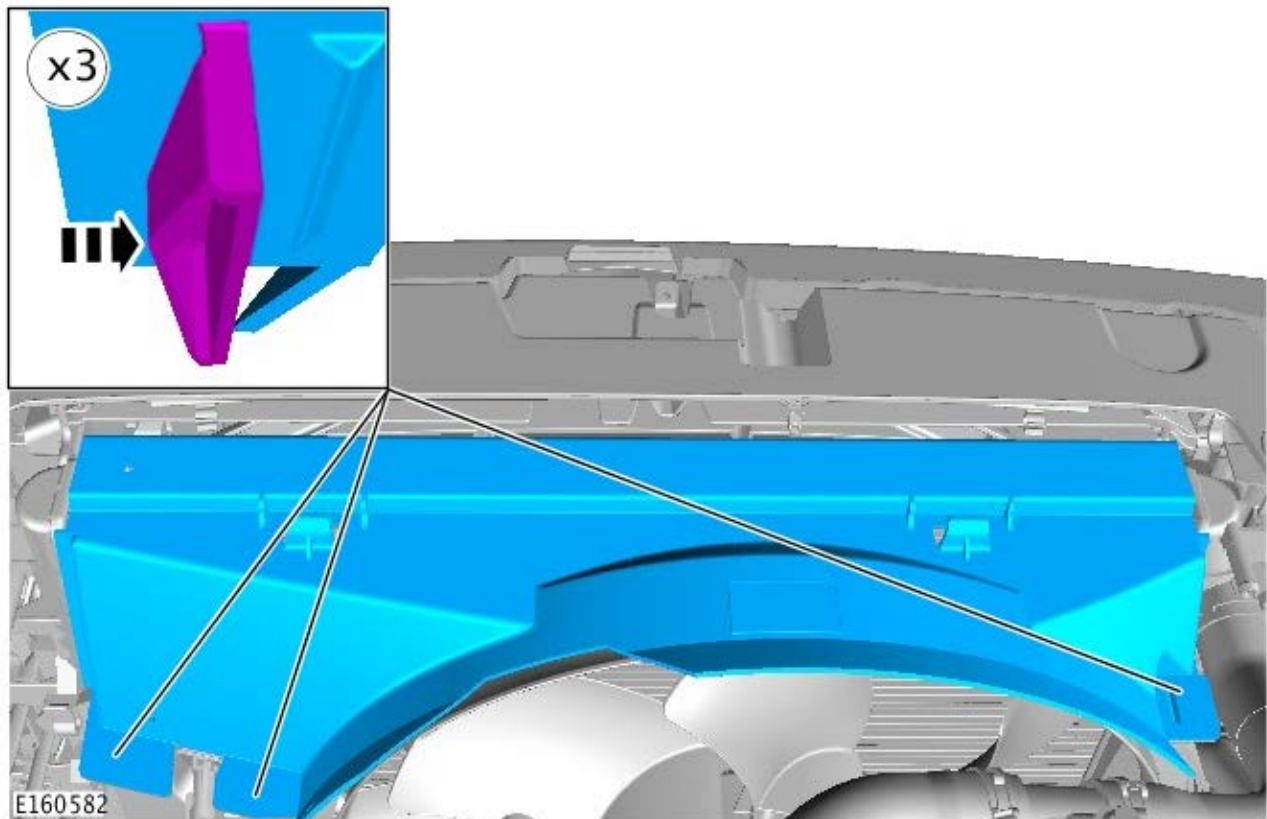
All vehicles

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).


2. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

- 3.



4.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

5.  **WARNING:** The wheel and tire assembly will be heavy.

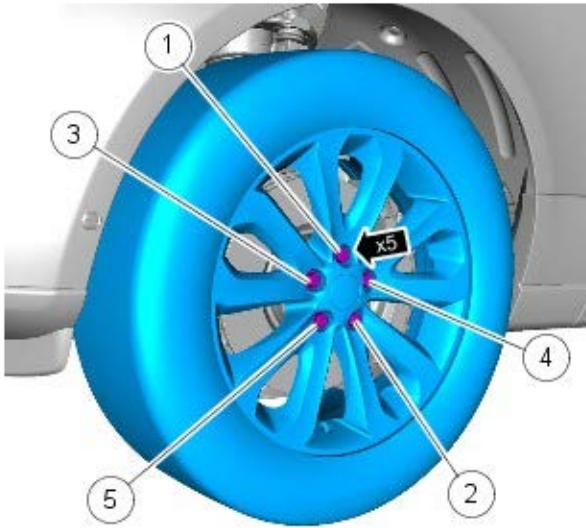
NOTES:



Note the position of the component before removal.



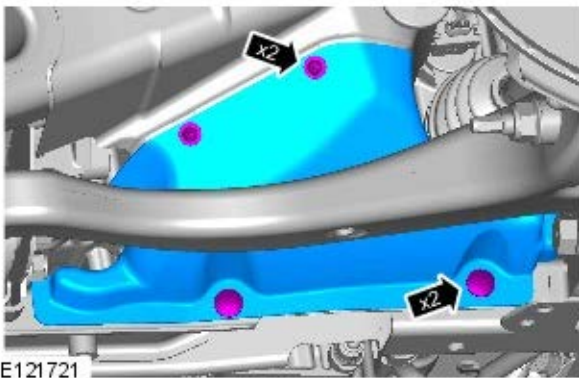
Left hand illustration shown, right hand similar.



E142105

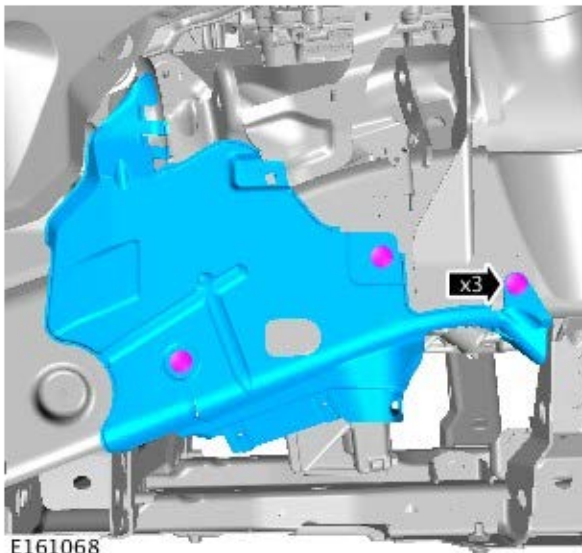
Remove the right hand front wheel and tire.

6.



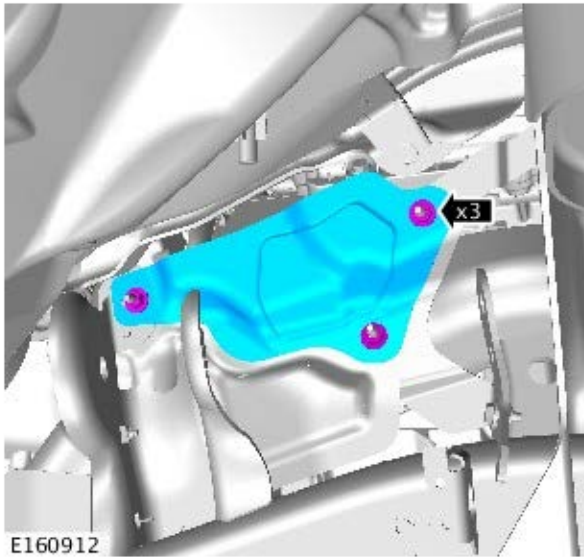
E121721

7.

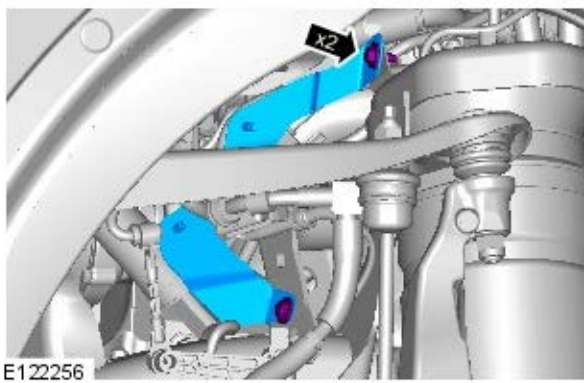


E161068

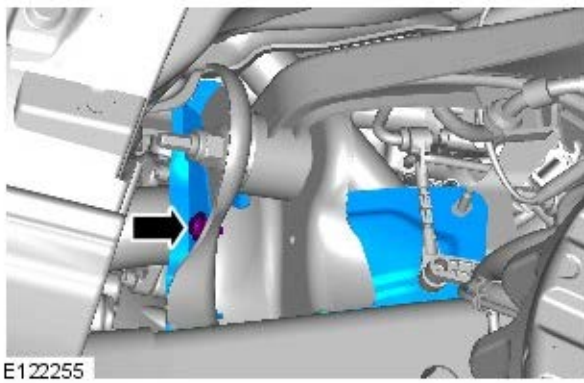
8.



9.



10.



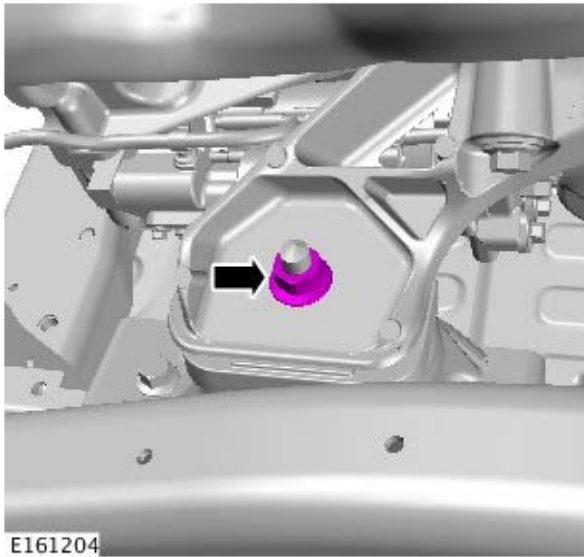
11. Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).

Right-hand drive vehicles

12. Refer to: [Steering Column Lower Shaft](#) (211-04 Steering Column, Removal and Installation).


All vehicles

13.

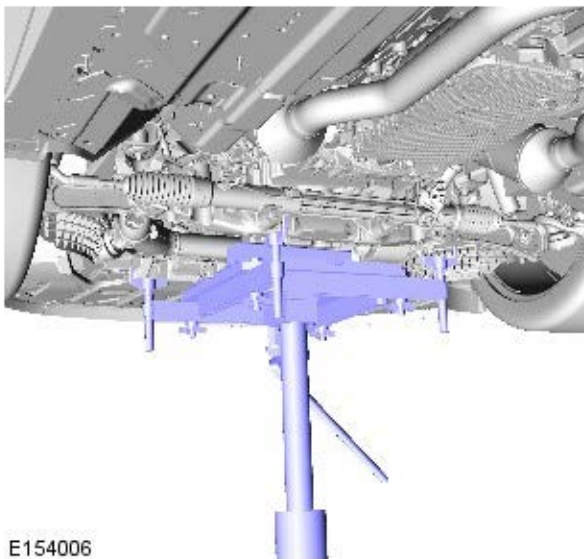


E161204

14. CAUTIONS:

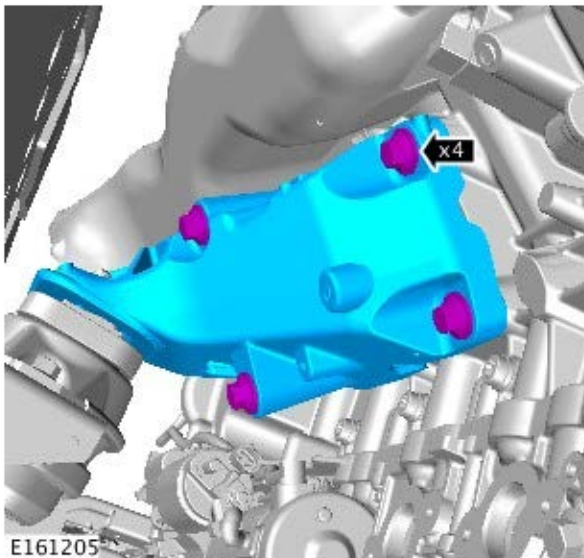
 Support the engine on a jack. The angle may need to be adjusted during this procedure.

 Use a wooden block to protect the oil pan when supporting the engine.



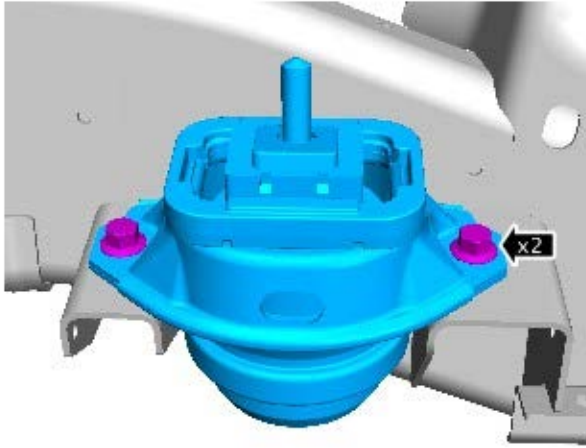
E154006

15.



E161205

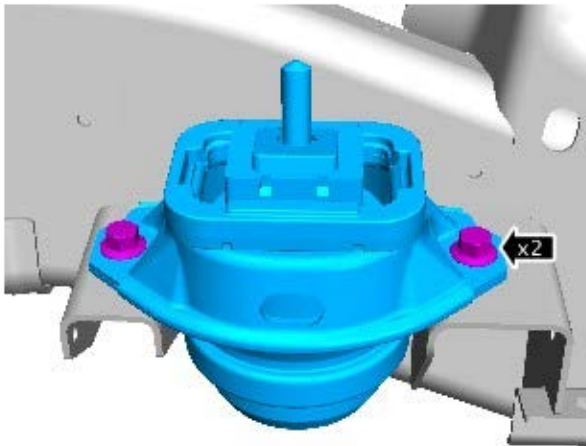
16.



E161206

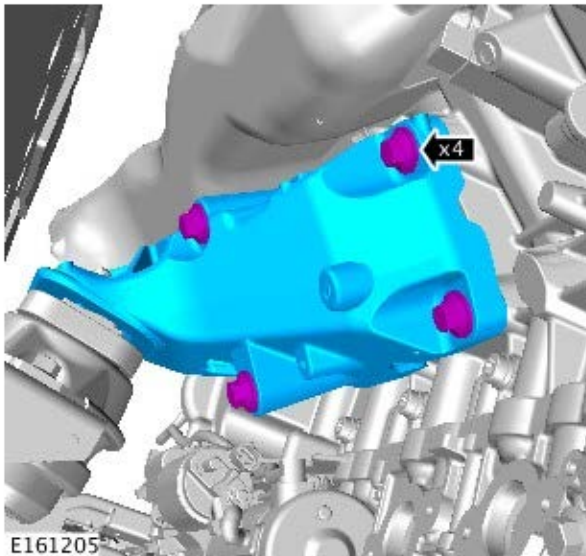
Installation

All vehicles



E161206

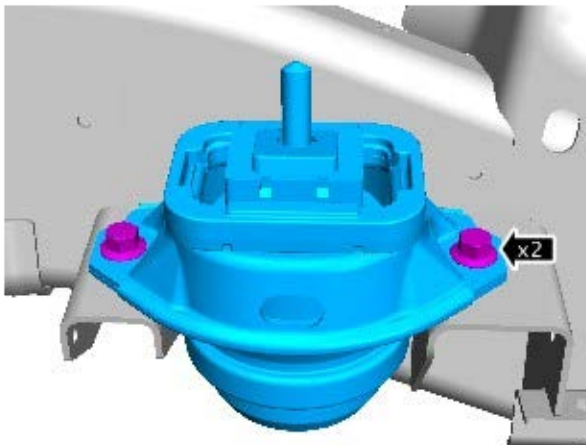
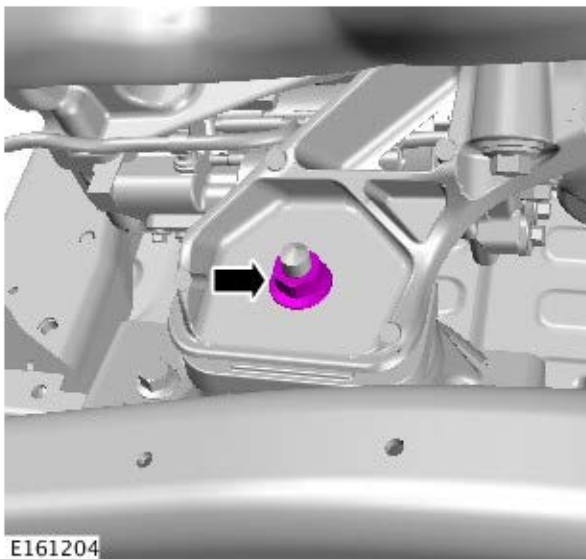
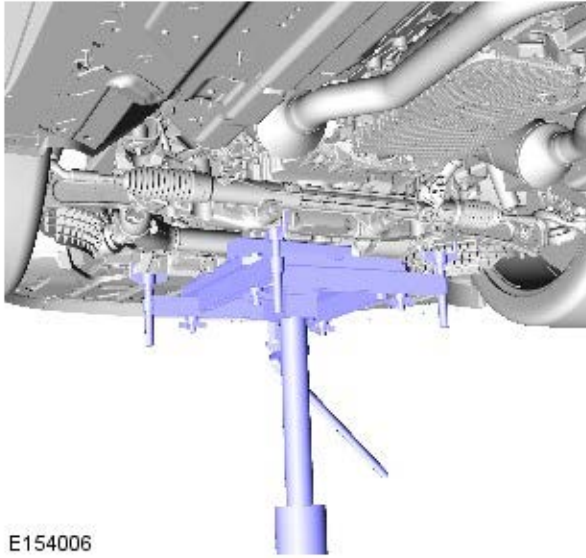
1.  CAUTION: Only tighten the bolts finger-tight at this stage.



E161205

2. *Torque:*
Stage 1: 45 Nm
Stage 2: 60°

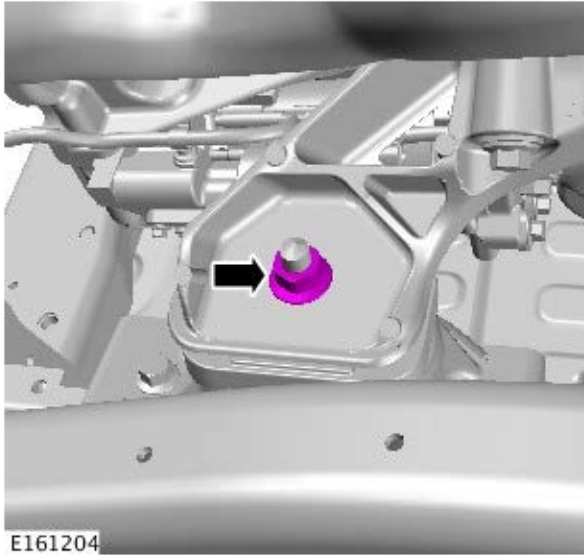
3. Lower the engine onto the mount.



4.  CAUTION: Only tighten the nut finger tight at this stage.

5. Torque: 56 Nm

6. Torque: 100 Nm



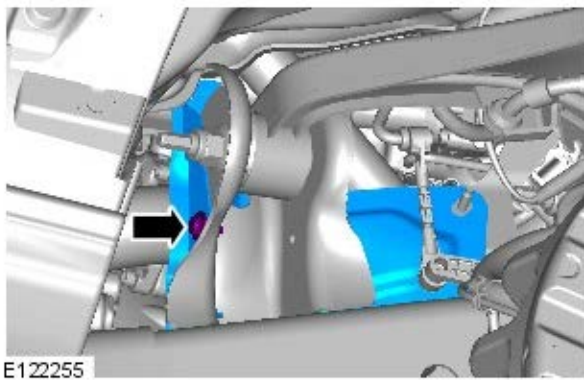
Right-hand drive vehicles

7. Refer to: [Steering Column Lower Shaft](#) (211-04 Steering Column, Removal and Installation).

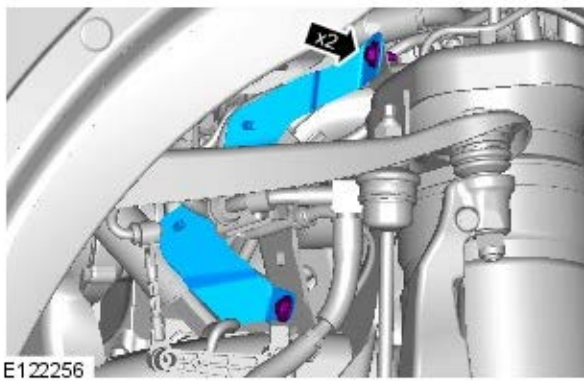
All vehicles

8. Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).

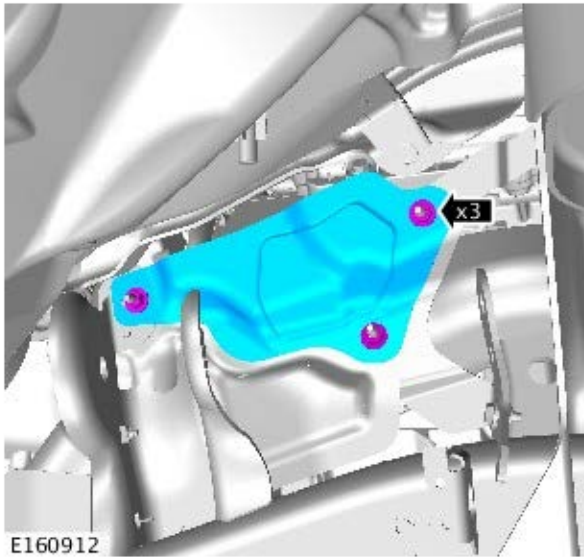
9. Torque: 10 Nm



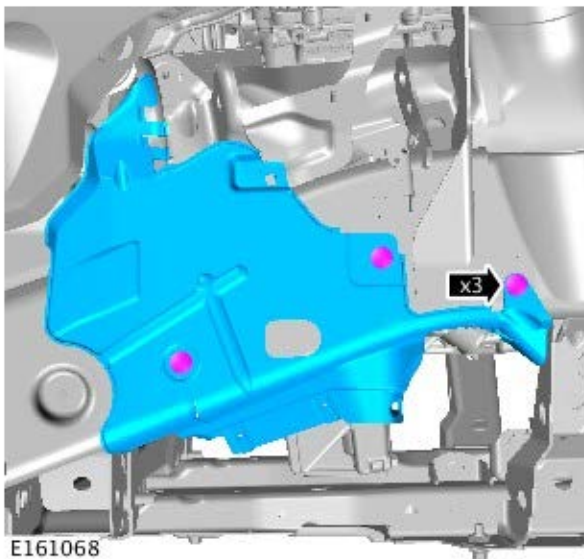
10. Torque: 10 Nm



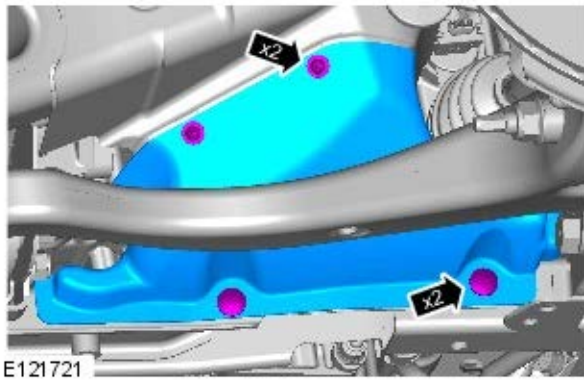
11. Torque: 10 Nm





12.



13.

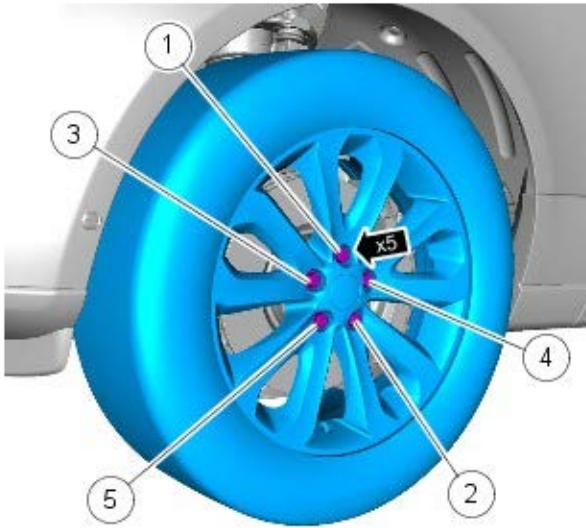


14.  **WARNING:** The wheel and tire assembly will be heavy.

 **CAUTION:** Apply a small amount of grease to the hub and wheel mating surfaces before installation. Make sure the grease does not come into contact with the vehicles braking components and the wheel stud threads. Failure to follow these instructions may result in personal injury.

NOTES:

 Make sure that the component is installed to



E142105

the noted removal position.



Left hand illustration shown, right hand similar.

Install the wheel and tire.

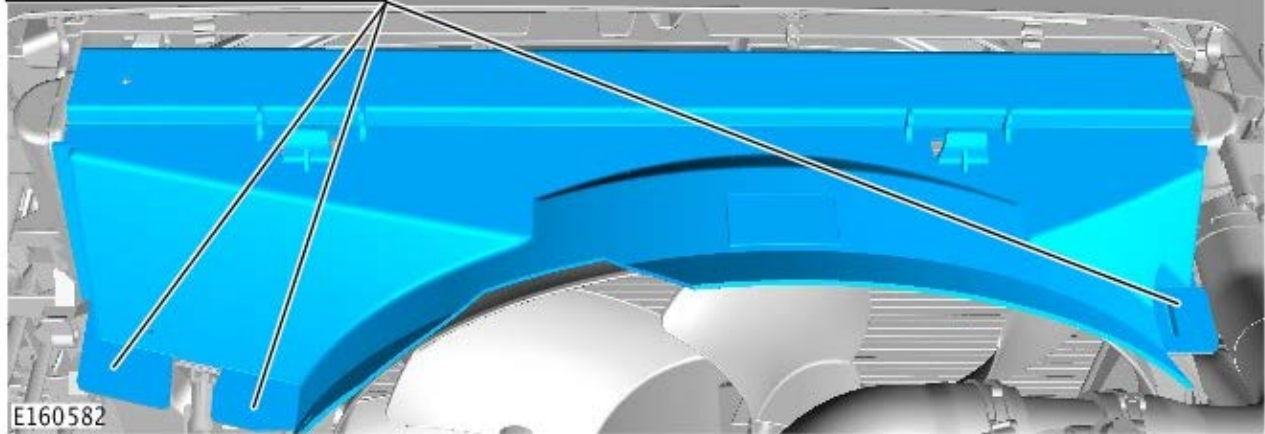
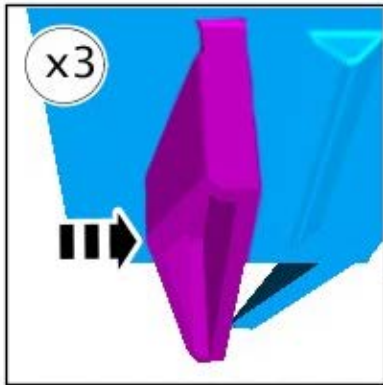
Torque:

Stage 1: 4 Nm

Stage 2: 70 Nm

Stage 3: 140 Nm

15.



E160582

16. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).


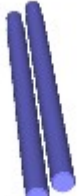
17. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - V6 S/C 3.0L Petrol - Exhaust Manifold LH

Removal and Installation

Special Tool(s)

 <p>E115261</p>	<p>303-1444-01 Exhaust Manifold Installation Guide Pins - Threaded</p>
 <p>E115262</p>	<p>303-1444-02 Exhaust Manifold Installation Guide Pins - Unthreaded</p>

Removal

NOTES:




Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

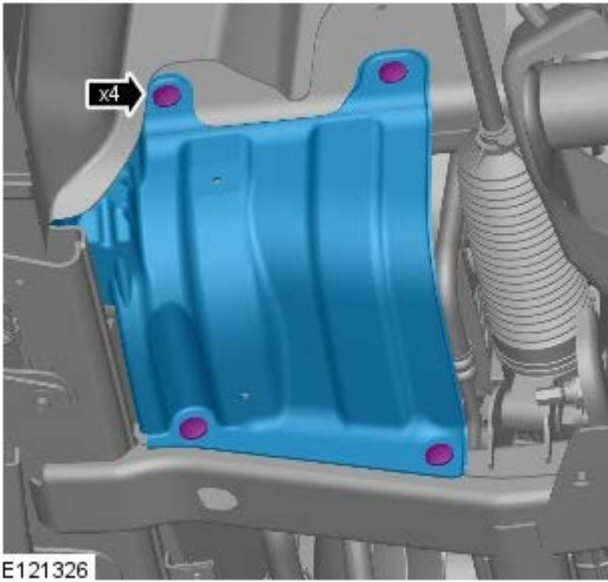
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

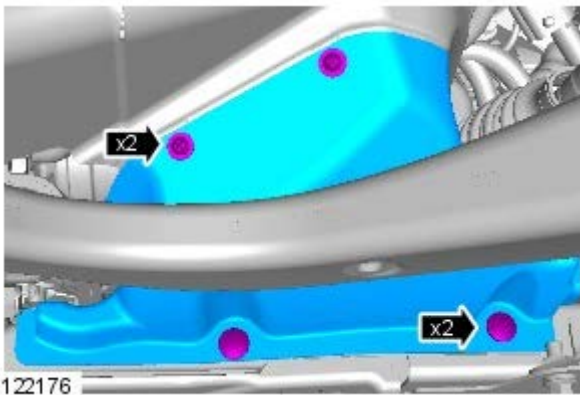
3. Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).
4. Refer to: [Accessory Drive Belt](#) (303-05B Accessory Drive - V6 S/C 3.0L Petrol, Removal and Installation).
5. Refer to: [Engine Mount LH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

6.



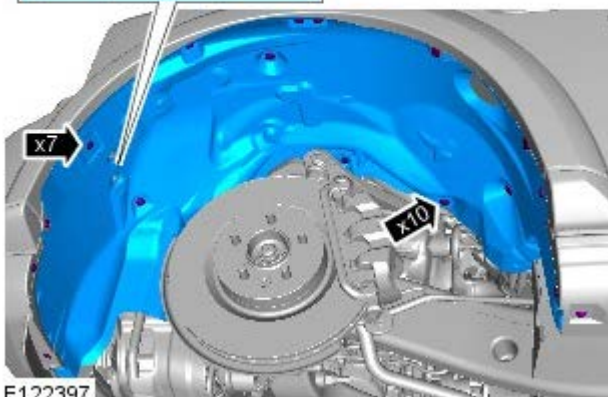
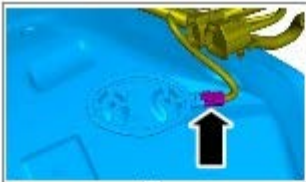
E121326

7.



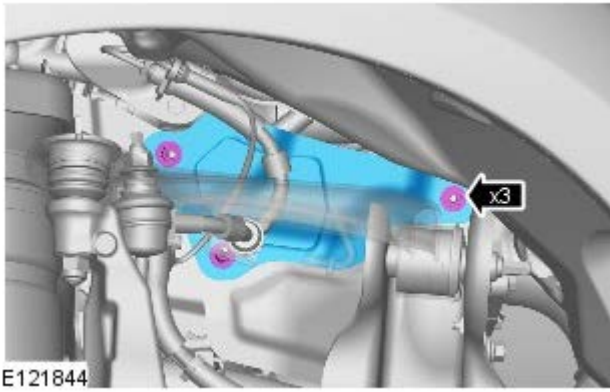
E122176

8.

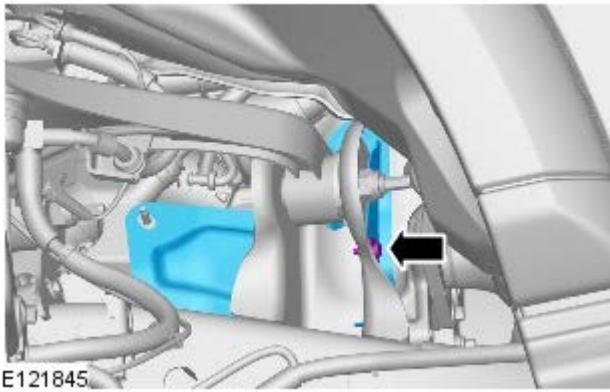


E122397

9.



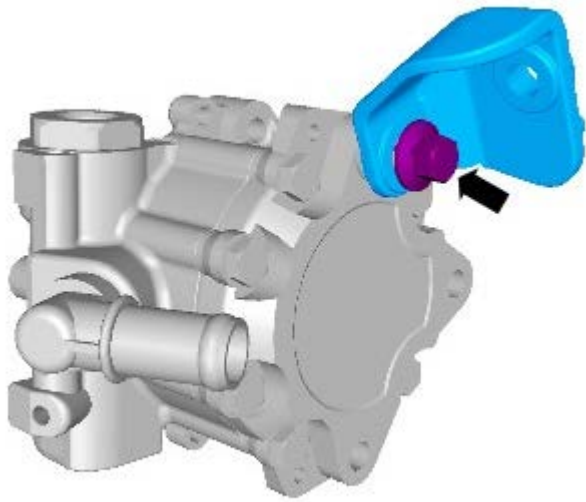
10.



11.

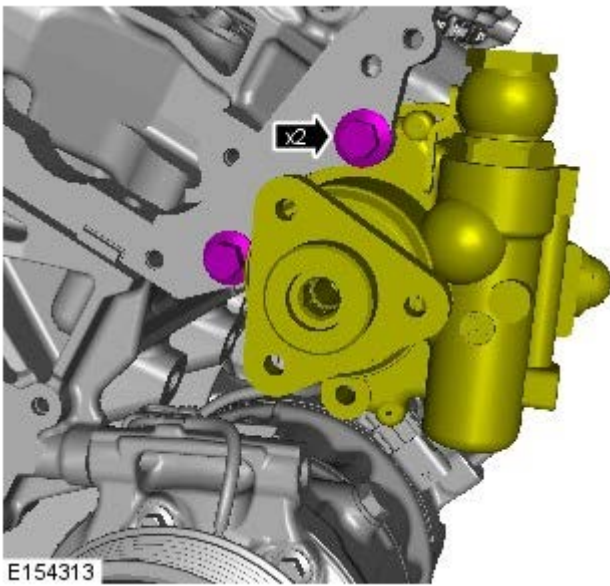


12.




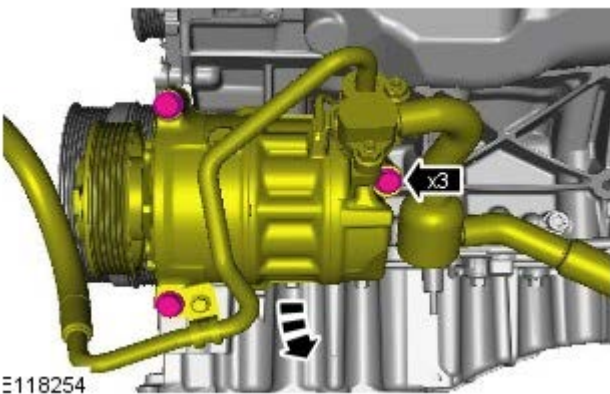
E120280

13.



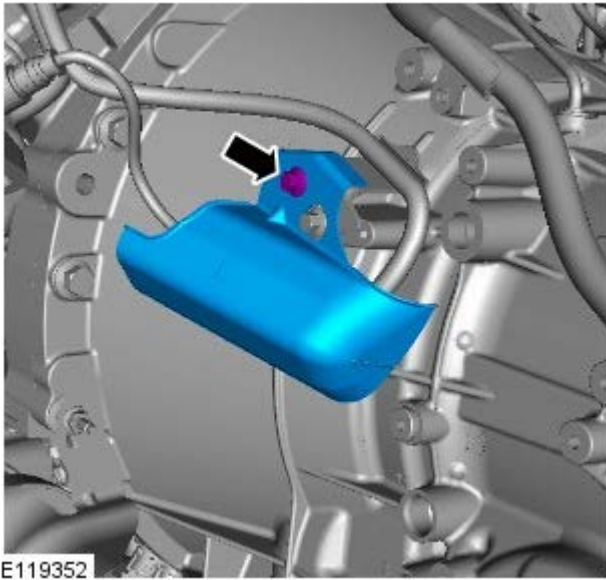
E154313

14.  NOTE: Loosen the bolts, but do not fully remove.

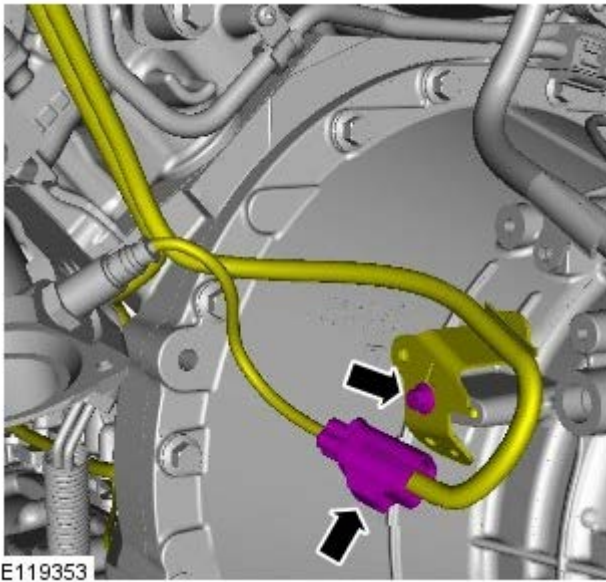


E118254

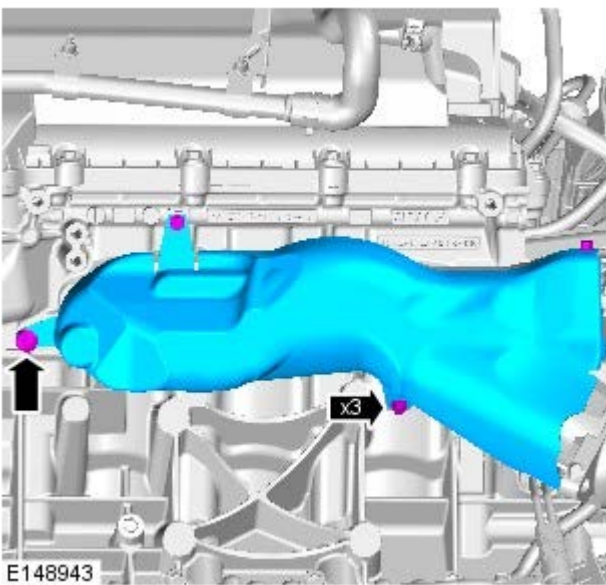
15.



16.

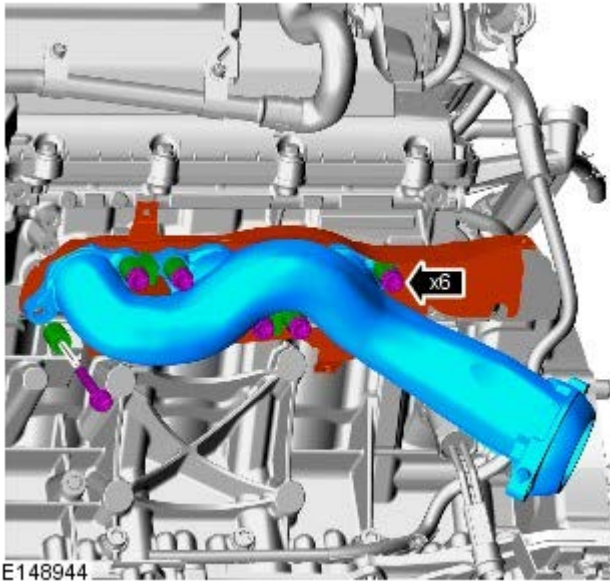


17.



18.  CAUTION: Discard the bolts.

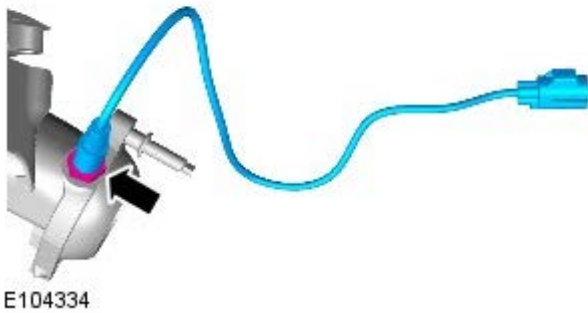
NOTES:



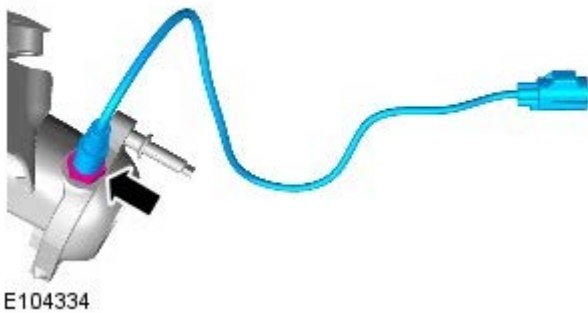
Discard the gasket.

Make sure that the position of the spacers is noted before removal of the manifold.

19. NOTE: Do not disassemble further if the component is removed for access only.



Installation



1. CAUTIONS:

If accidentally dropped or knocked install a new sensor.

Make sure that the mating faces are clean and free of foreign material.

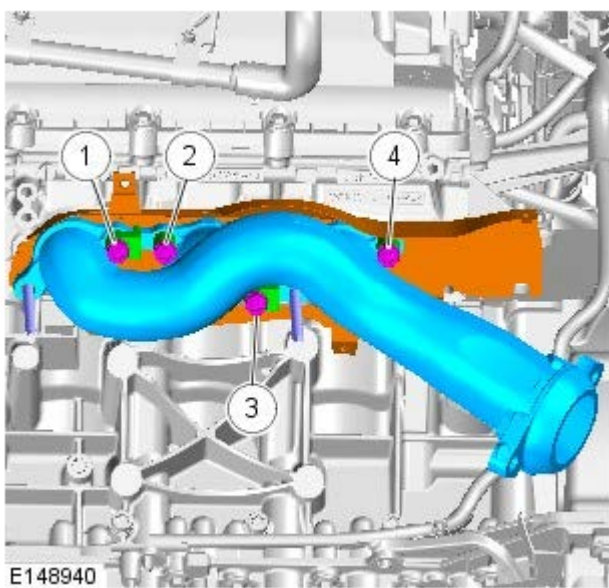
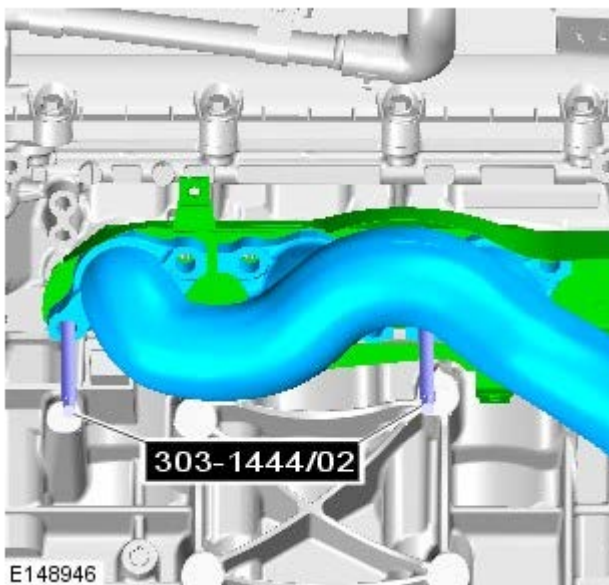
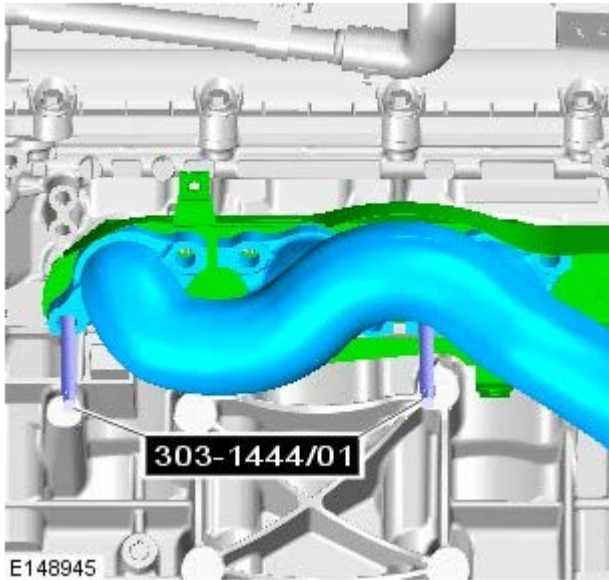
Make sure the anti-seize compound does not contact the HO2S tip.

NOTE: If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

Torque: 45 Nm

2. NOTE: Install a new gasket.

Special Tool(s): [303-1444-01](#)



3.  NOTE: If a new cylinder head is installed use the special tools in the illustration.

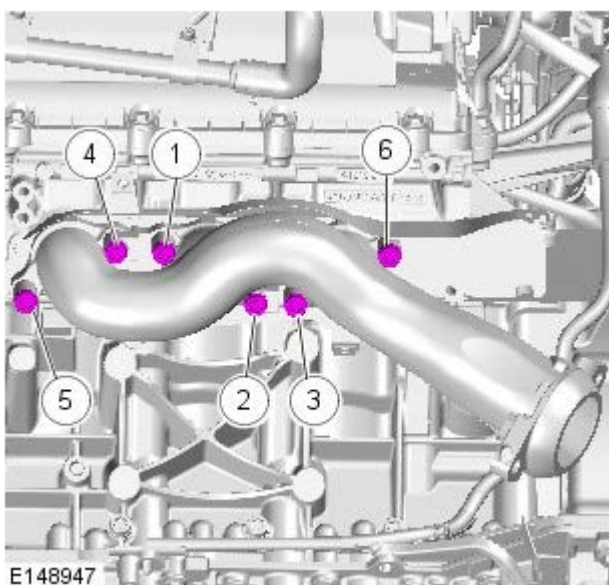
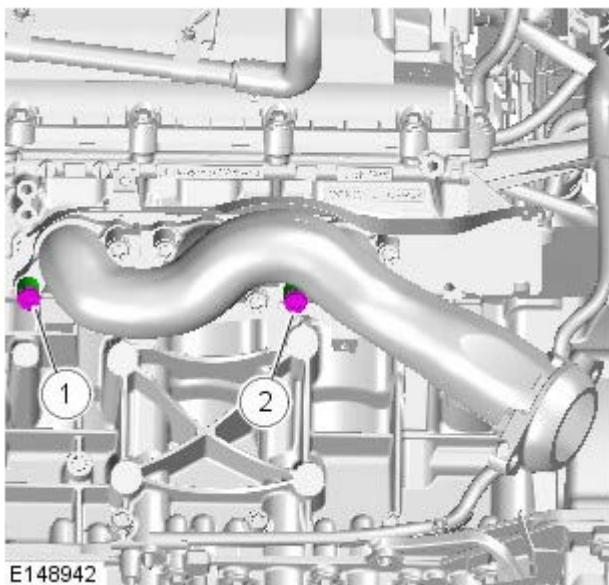
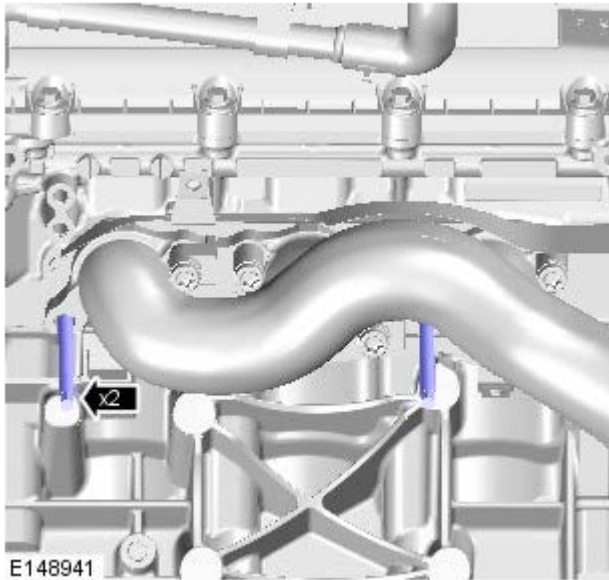
Special Tool(s): [303-1444-02](#)

4.  CAUTION: Make sure that new bolts are installed.

 NOTE: Install the spacers in the noted position.

Torque: 10 Nm

5. Remove the special tool.



6. NOTES:

 Make sure that new bolts are installed.

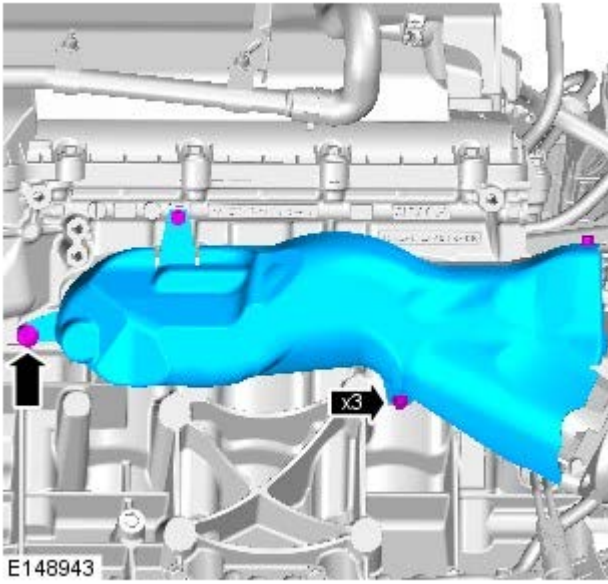
 Install the spacers in the noted position.

Torque: 10 Nm

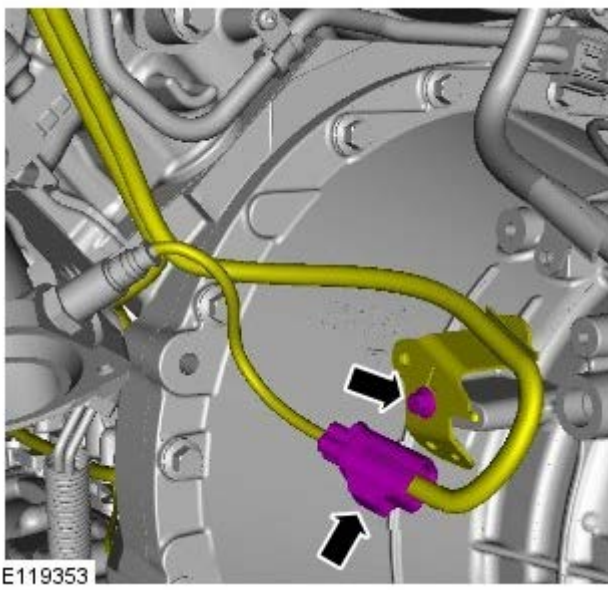
7.  CAUTION: Tighten the bolts in the sequence shown.

Torque: 18 Nm

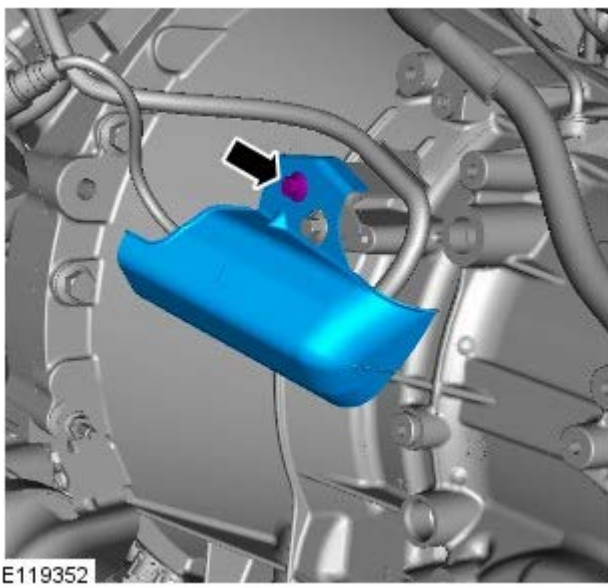
8. Torque:
 Bolt 6.3 x 13 3 Nm
 M8 25 Nm



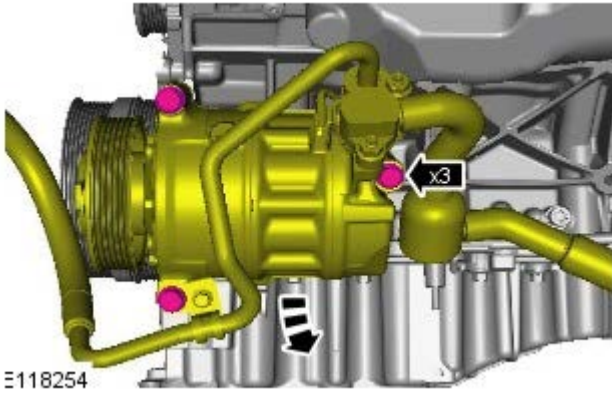
9.



10.

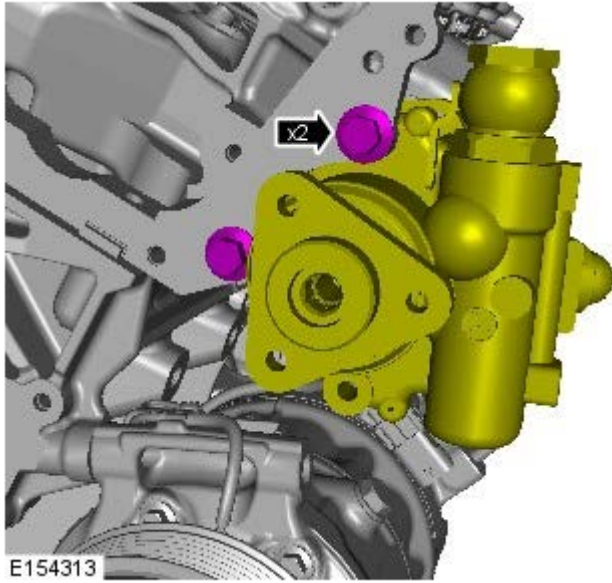


11. Torque: 25 Nm



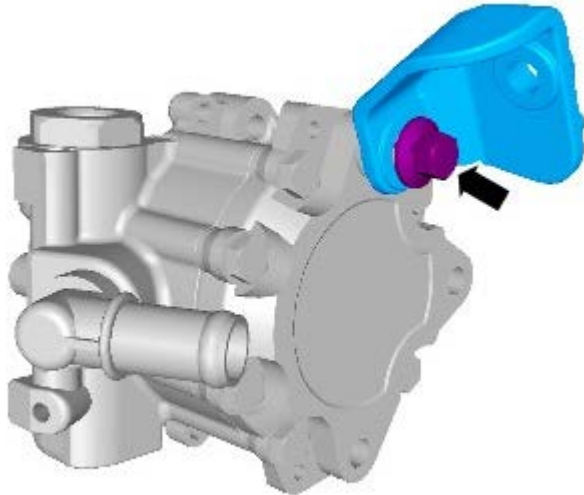
E118254

12.



E154313

13.



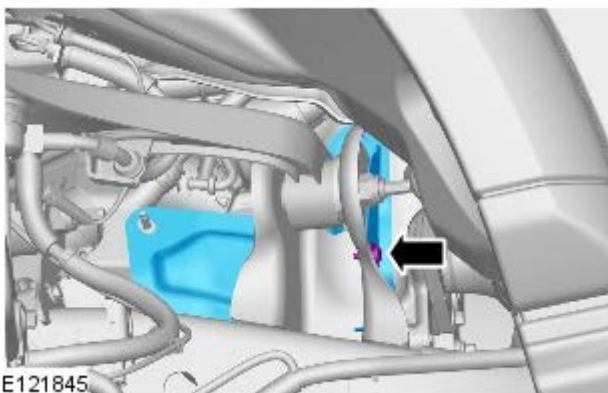
E120280

14.



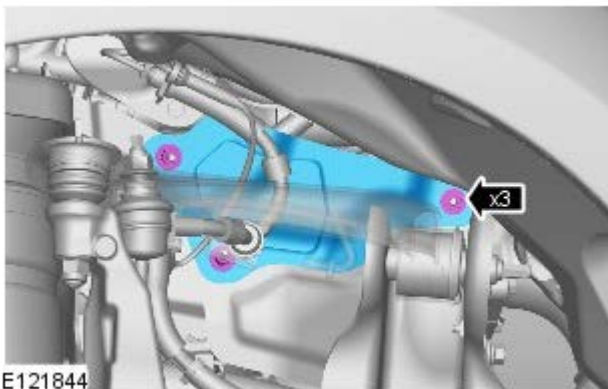
E116364

15.



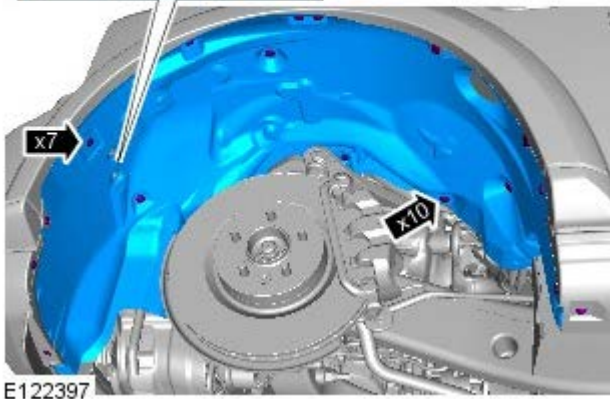
E121845

16.



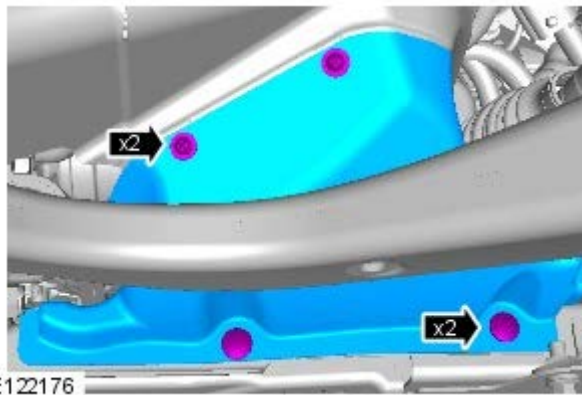
E121844

17.



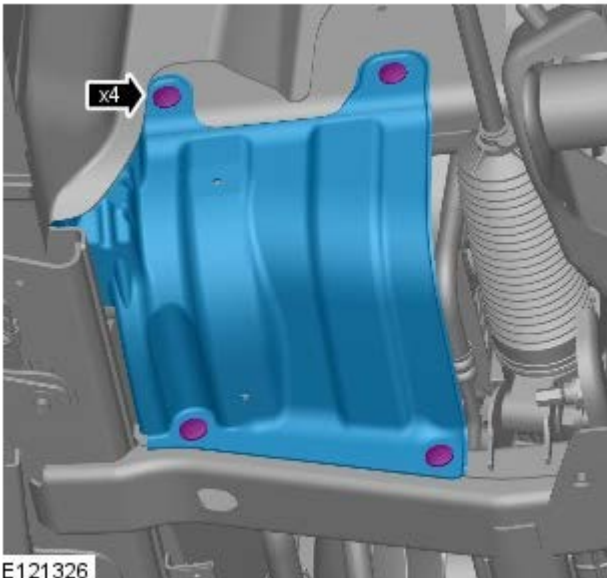
E122397

18.



E122176

19.



E121326

20. Refer to: [Engine Mount LH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
21. Refer to: [Accessory Drive Belt](#) (303-05B Accessory Drive - V6 S/C 3.0L Petrol, Removal and Installation).
22. Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).
23. Connect the battery ground cable.



Refer to: [Specifications](#) (414-00 Battery and Charging)

System - General Information, Specifications).

Engine - V6 S/C 3.0L Petrol - Exhaust Manifold RH

Removal and Installation

Special Tool(s)

 <p>E115261</p>	<p>303-1444-01 Exhaust Manifold Installation Guide Pins - Threaded</p>
 <p>E115262</p>	<p>303-1444-02 Exhaust Manifold Installation Guide Pins - Unthreaded</p>

Removal



WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

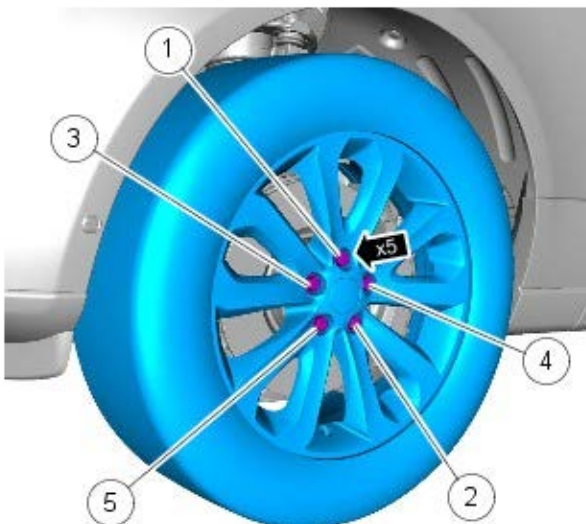
1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).


2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).



E142105

4.  **WARNING:** The wheel and tire assembly will be heavy.

NOTES:

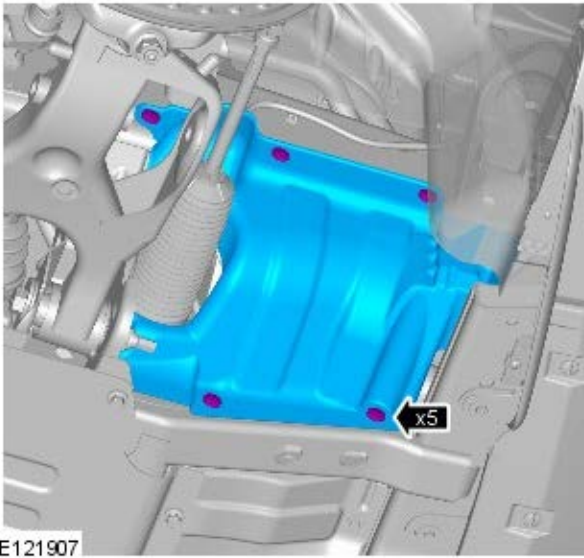


Left hand shown, right hand similar.

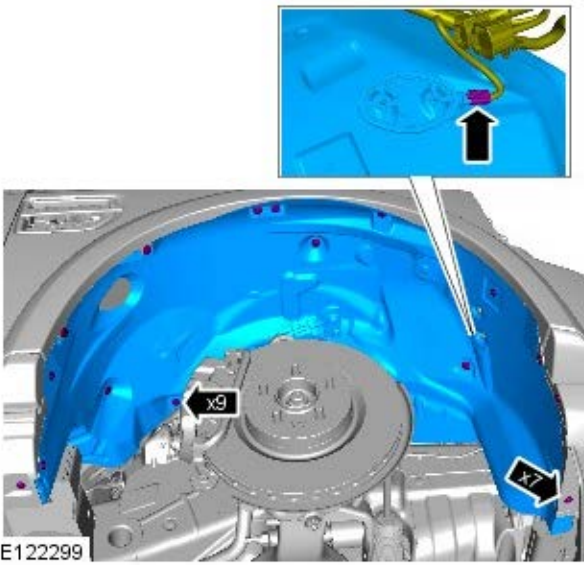


Note the position of the component before removal.

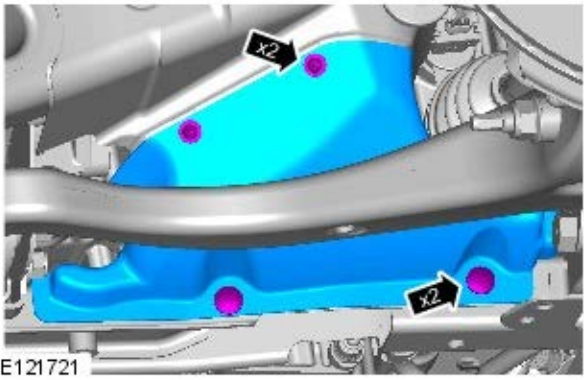
Remove the right hand front wheel and tire.



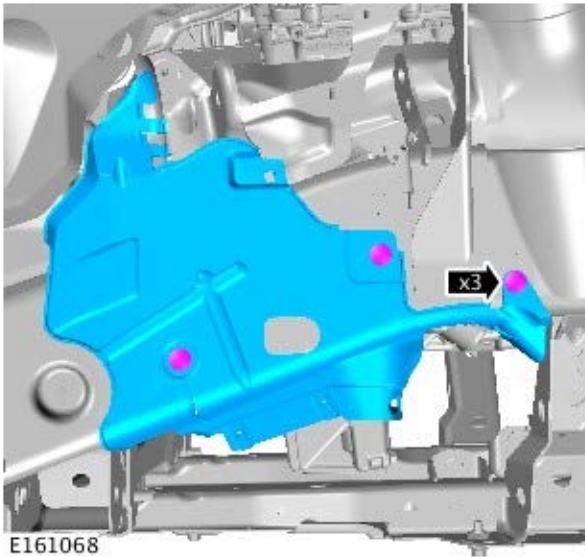
6.



7.



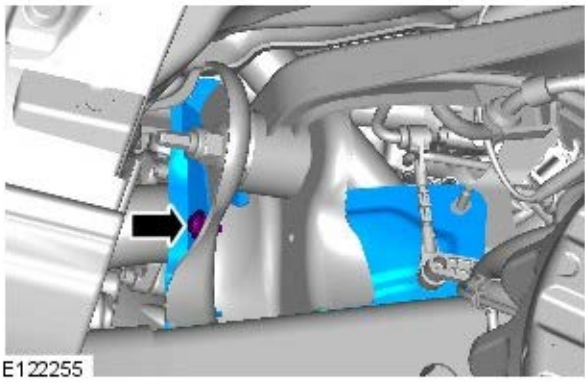
8.



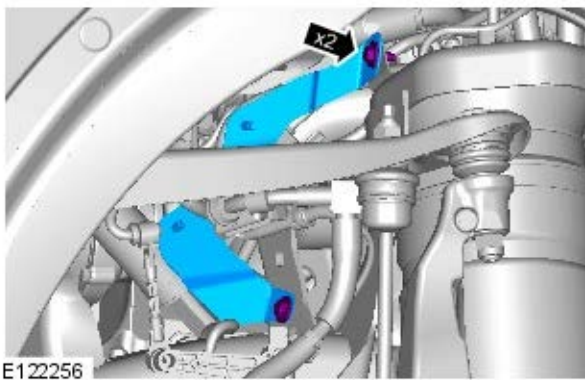
9.



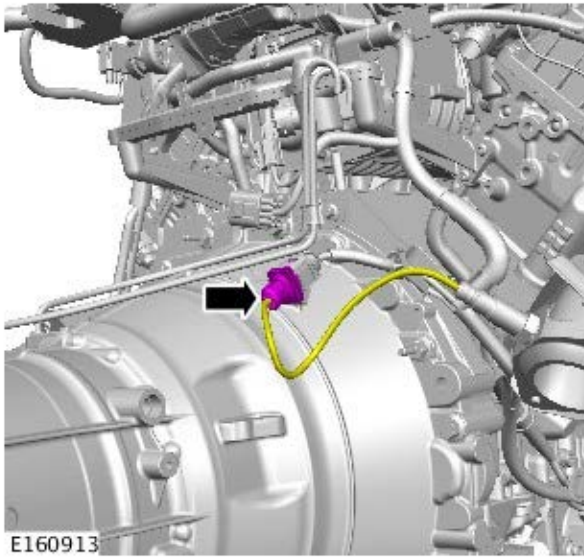
10.



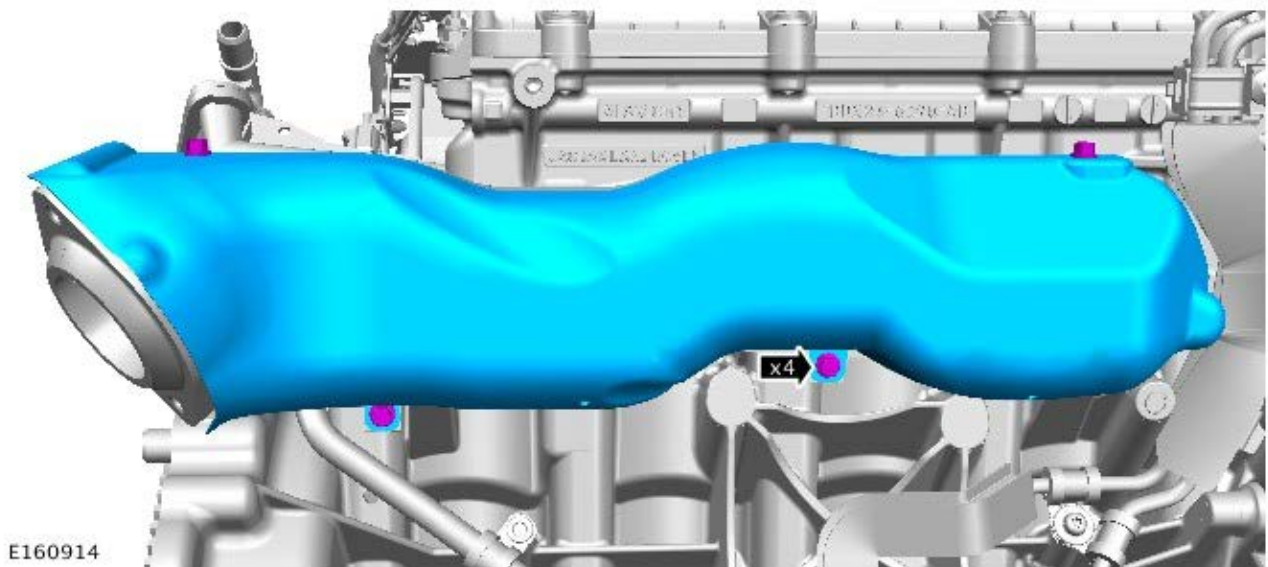
11.



12.




13.

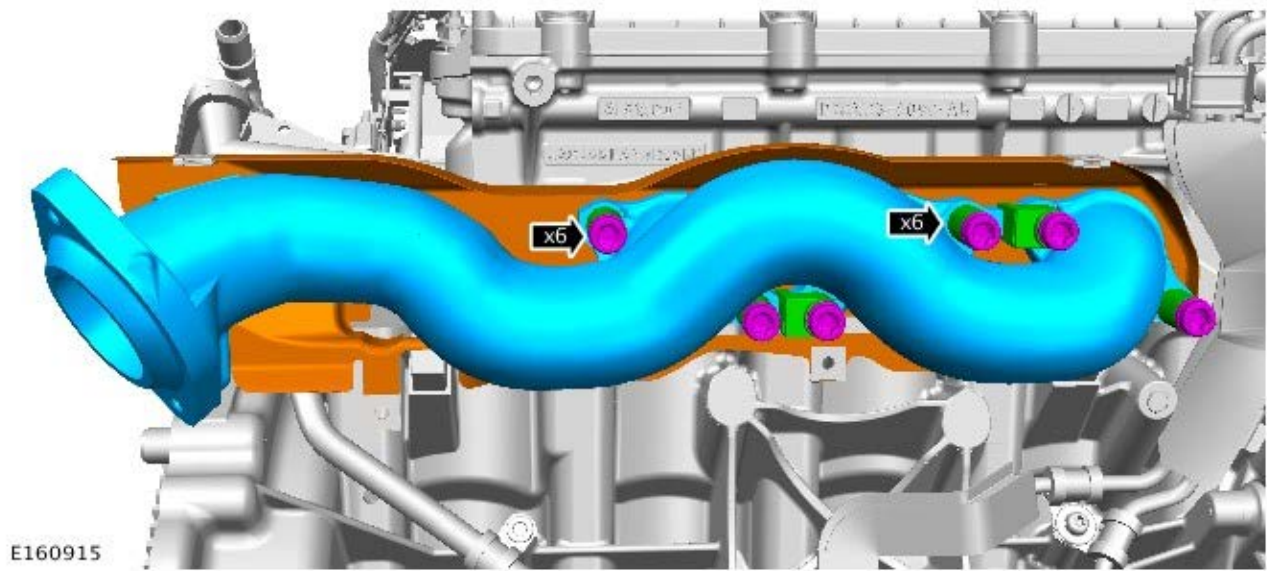


14.  CAUTION: Discard the bolts.


NOTES:

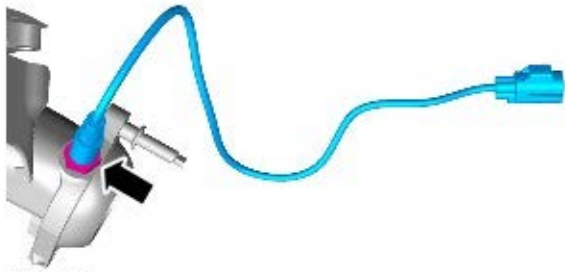
 Discard the gasket.

 Make sure that the position of the spacers is noted before removal of the manifold.



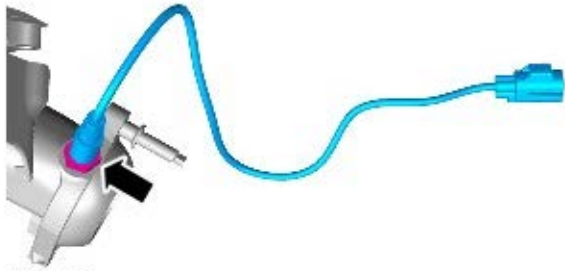
E160915

15.  NOTE: Do not disassemble further if the component is removed for access only.




E104334


Installation




E104334

1. CAUTIONS:

 Make sure that the mating faces are clean and free of foreign material.

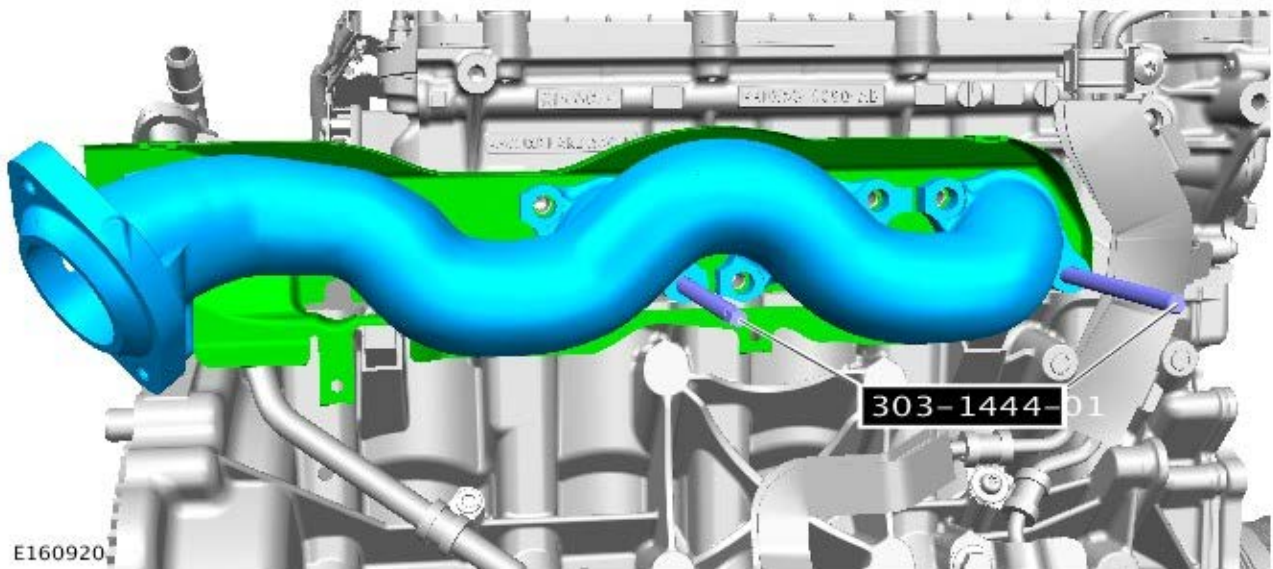
 Make sure the anti-seize compound does not contact the HO2S tip.

 NOTE: If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

Torque: 45 Nm

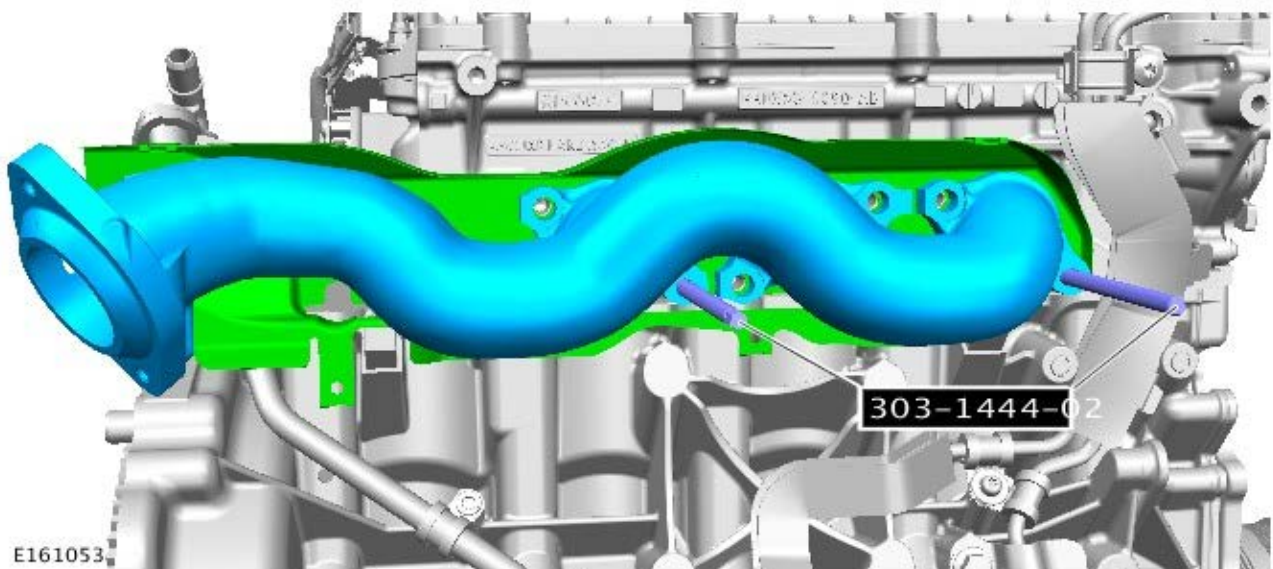
2.  NOTE: Install a new gasket.


Special Tool(s): [303-1444-01](#)



3.  NOTE: If a new cylinder head is installed use the special tools in the illustration.

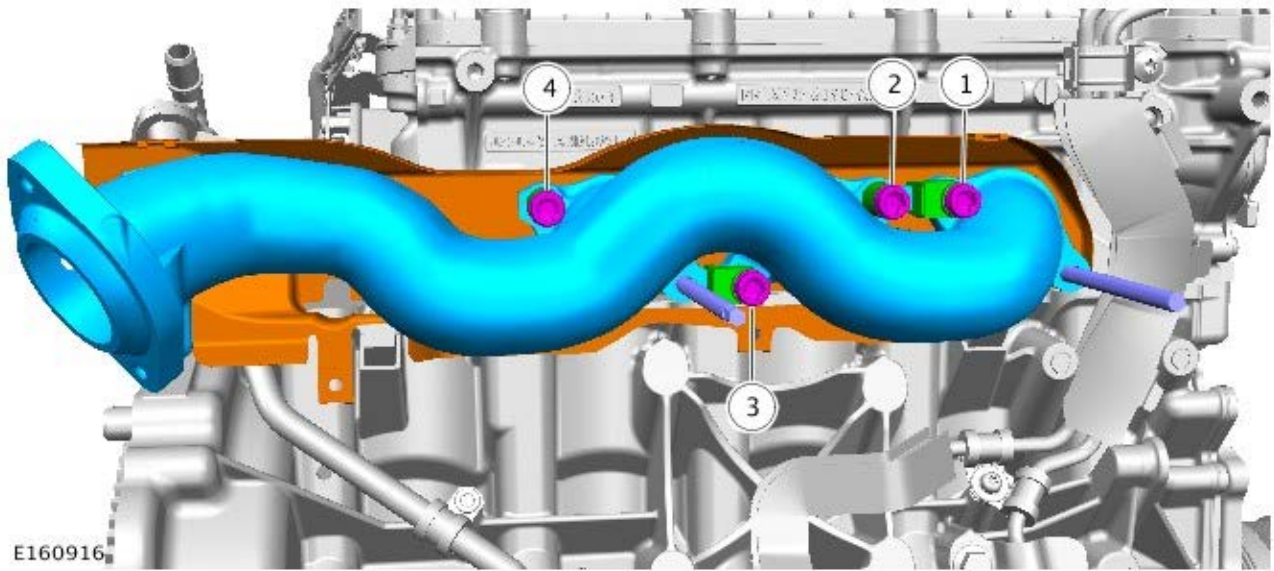
Special Tool(s): [303-1444-02](#)



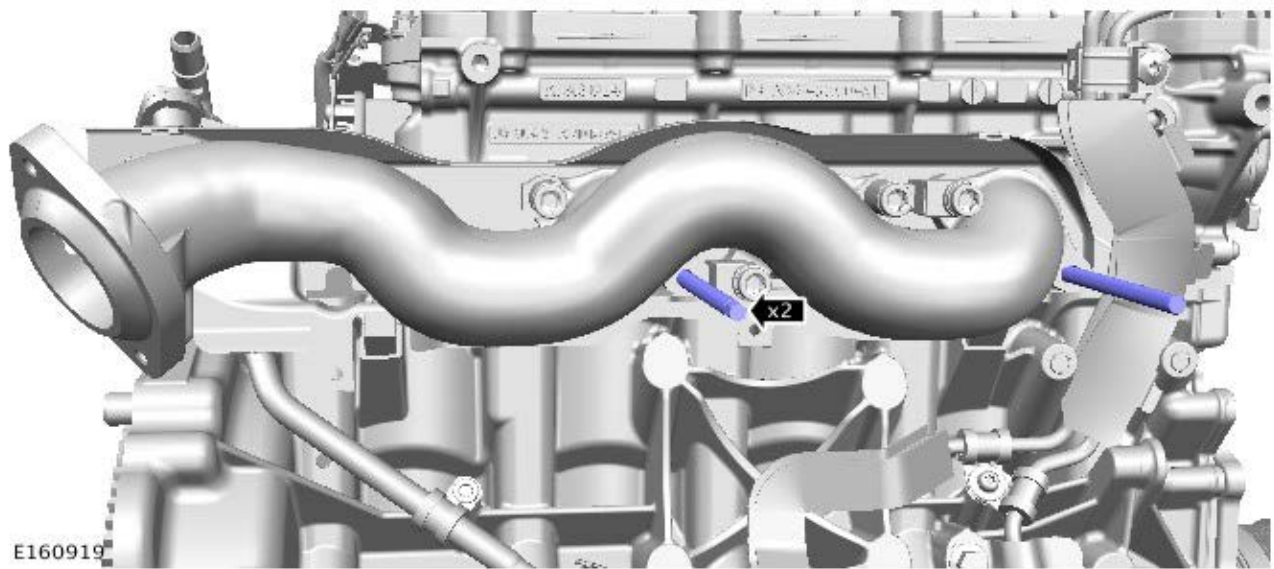
4.  CAUTION: Make sure that new bolts are installed.

 NOTE: Install the spacers in the noted position.

Torque: 10 Nm



5. Remove the special tool.

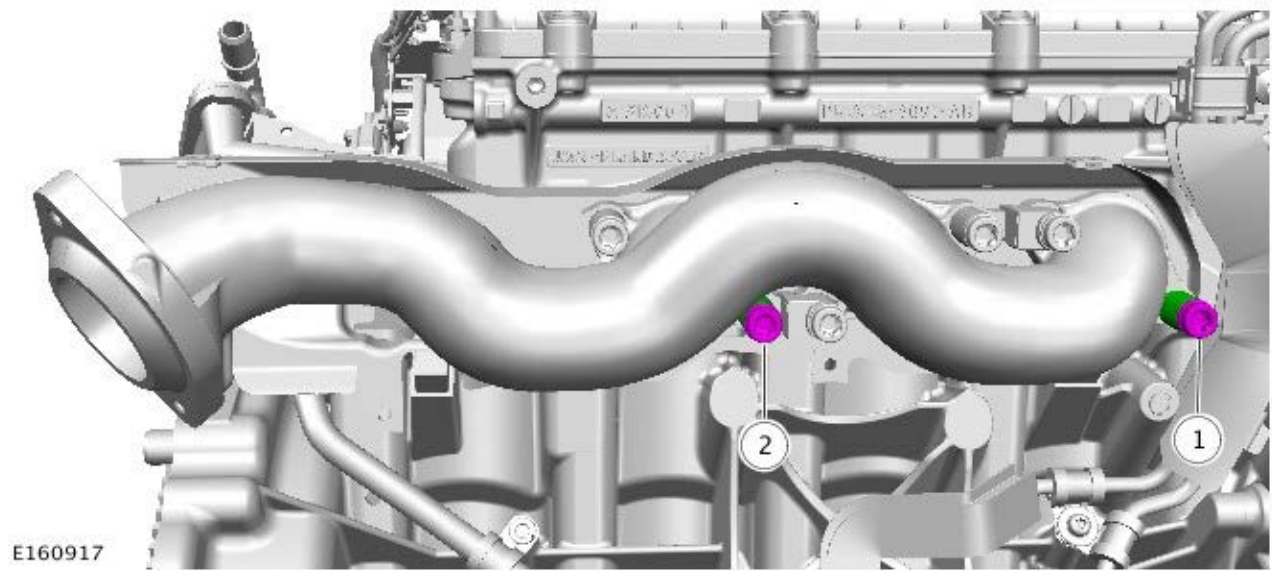


6. NOTES:

 Make sure that new bolts are installed.

 Install the spacers in the noted position.

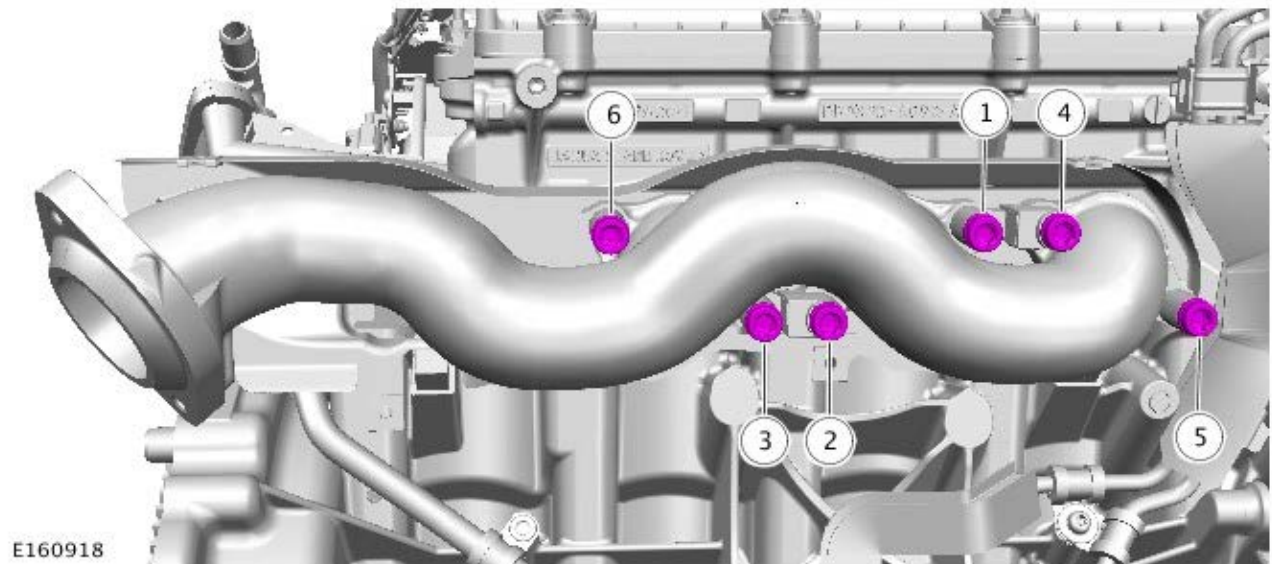
Torque: 10 Nm



E160917

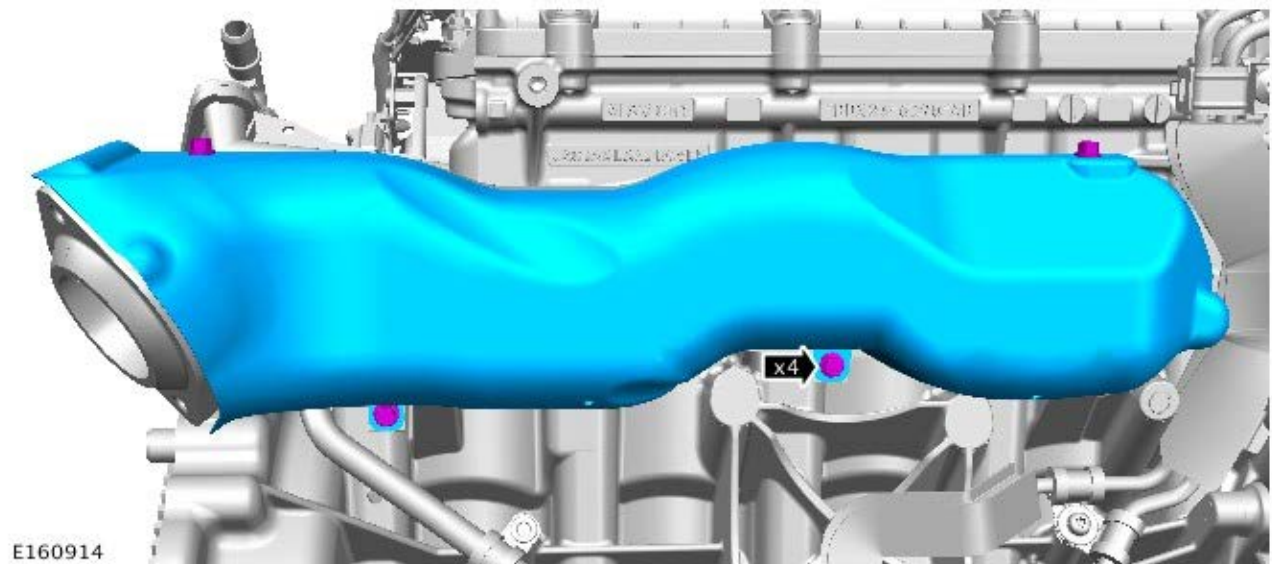
7.  CAUTION: Tighten the bolts in the sequence shown.

Torque: 18 Nm



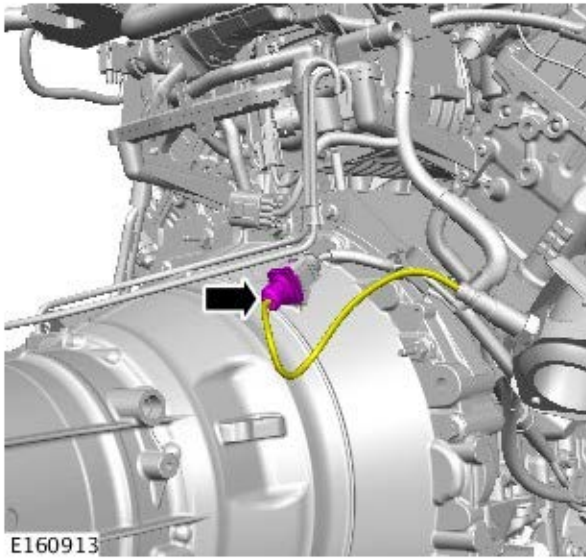
E160918

8. Torque: 3 Nm

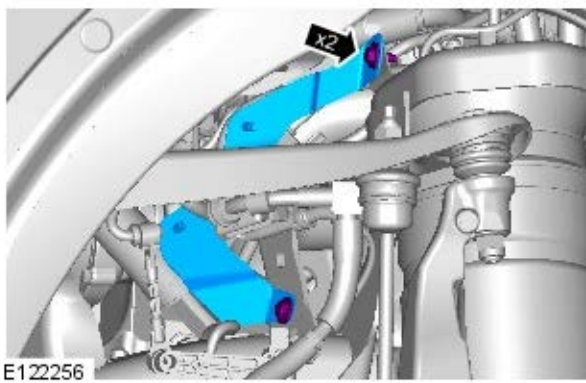


E160914

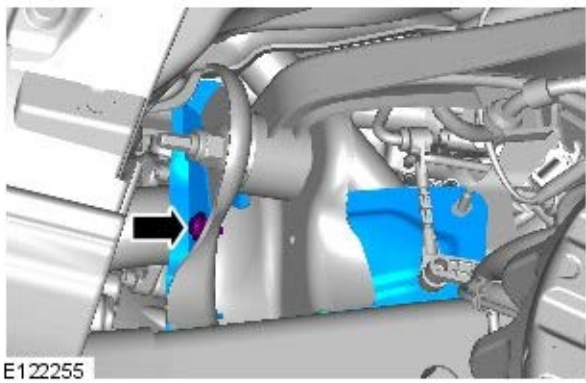
9.



10. Torque: 10 Nm



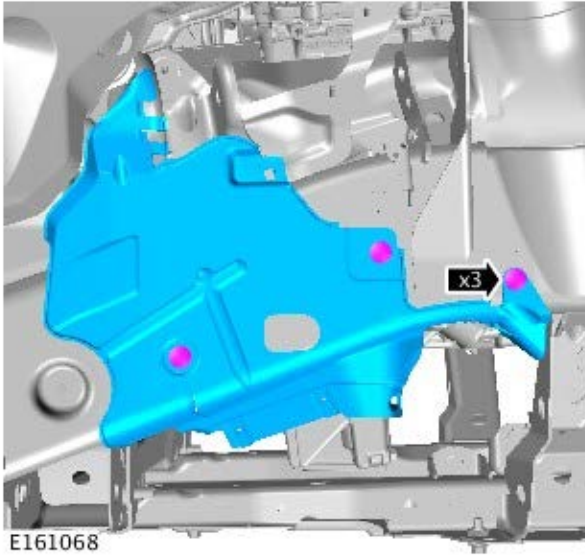
11. Torque: 10 Nm



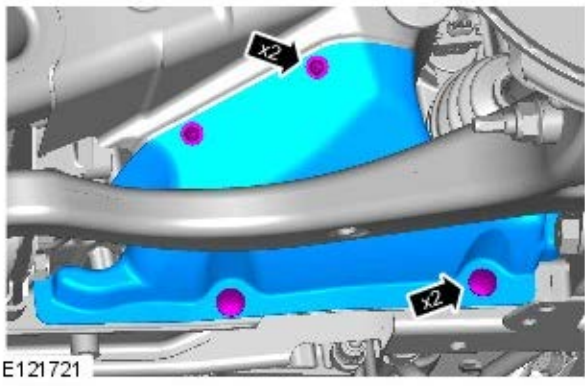
12. Torque: 10 Nm



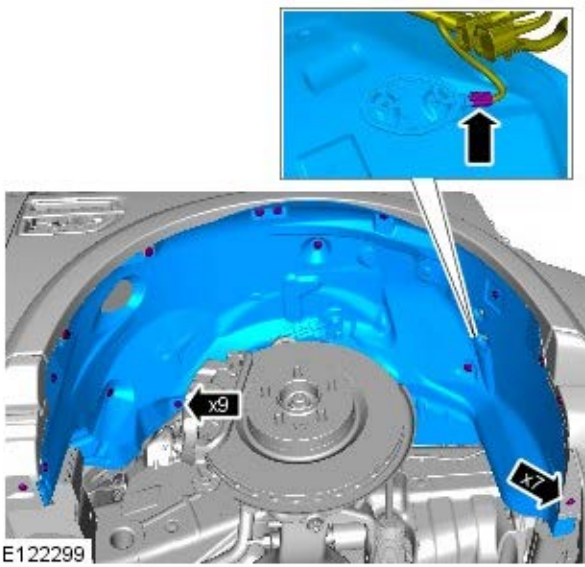
13.



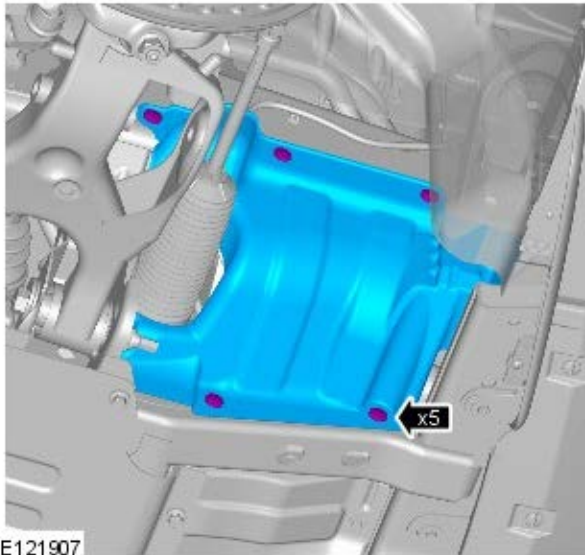
14.



15.



16.





E121907

17. Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).



E142105

18.  **WARNING:** The wheel and tire assembly will be heavy.

 **CAUTION:** Apply a small amount of grease to the hub and wheel mating surfaces before installation. Make sure the grease does not come into contact with the vehicles braking components and the wheel stud threads. Failure to follow these instructions may result in personal injury.

NOTES:



Left-hand shown, right hand similar.



Make sure that the component is installed to the noted removal position.

Install the wheel and tire.

Torque:

Stage 1: 4 Nm

Stage 2: 70 Nm

Stage 3: 140 Nm

19. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - V6 S/C 3.0L Petrol - Flexplate

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.


Raise and support the vehicle.


3. Refer to: [Transmission - V6 S/C 3.0L Petrol](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, Removal).



4. **CAUTIONS:**


 Install all the bolts finger tight before final tightening.


 The bolts can only be used 3 times, mark the bolts with a center punch. If 2 punch marks are visible, discard the bolts.


 Make sure that no components fall off during removal.

 Install the bolts in the noted position.

NOTES:

 Make sure the crankshaft and flexplate mating faces are clean before installation.

 Make sure that the crankshaft is not rotated.

 Tighten the retaining bolts working diagonally.

Torque:

Stage 1: 45 Nm

Stage 2: 90°

Installation

1. To install, reverse the removal procedure.

Engine - V6 S/C 3.0L Petrol - Oil Cooler

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

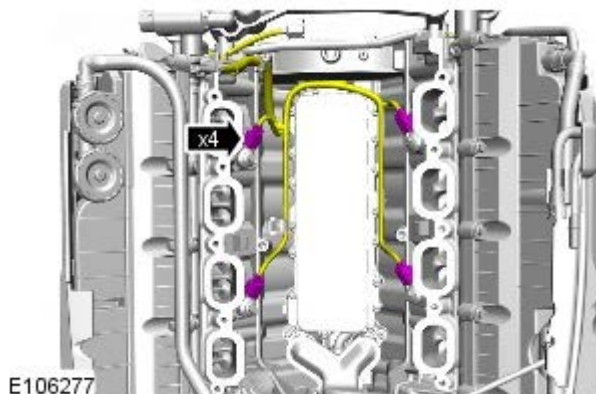
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

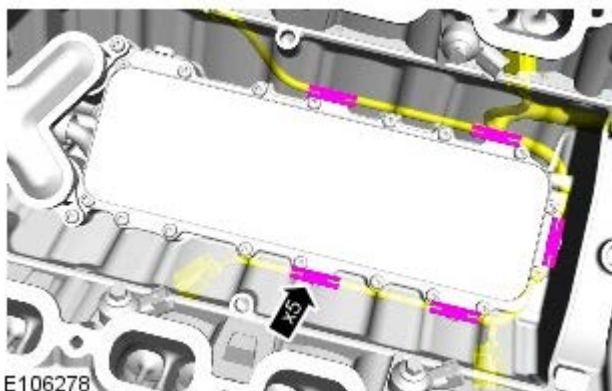
Raise and support the vehicle.

3. Refer to: [Engine Oil Draining and Filling](#) (303-01B Engine - V6 S/C 3.0L Petrol, General Procedures).
4. Refer to: [Supercharger](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

5.



6.



7. **CAUTIONS:**

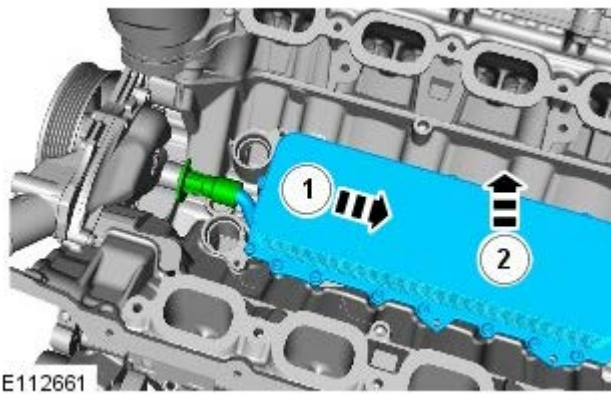
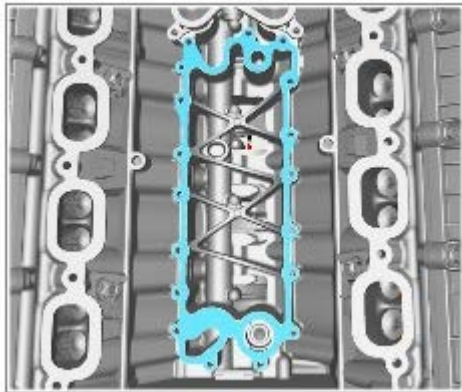
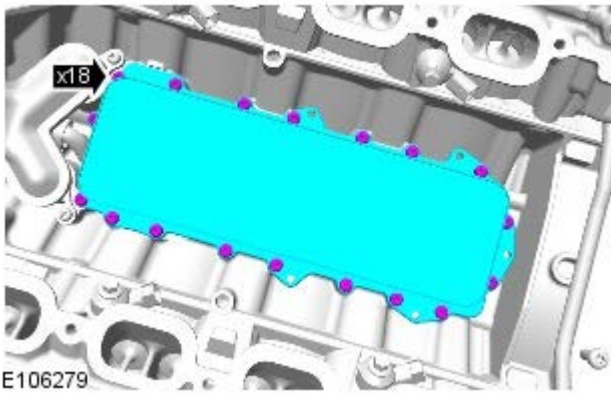



Be prepared to collect escaping oil.



Be prepared to collect escaping coolant.


Torque: 13 Nm



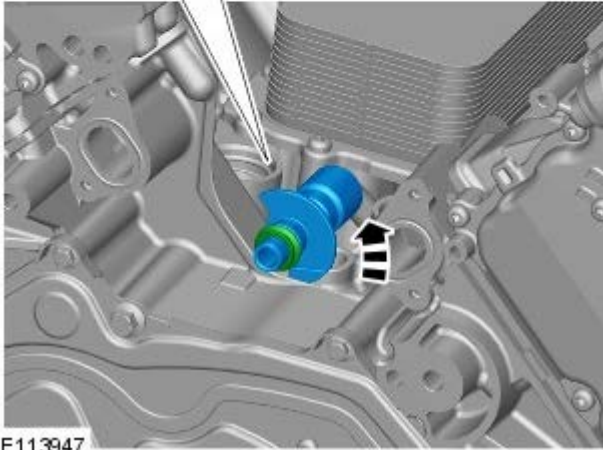
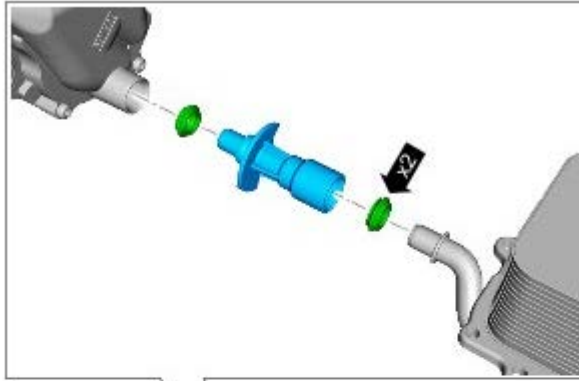
8.  CAUTION: Make sure that these components are installed to the noted removal position.

 NOTE: Install a new gasket.

9. CAUTIONS:

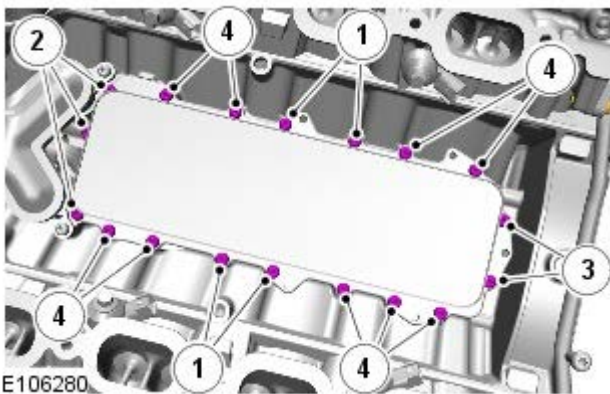
 Make sure that these components are installed to the noted removal position.

 Install new o-ring seals



E113947


Installation





E106280

1. CAUTIONS:

 Install all the bolts finger tight before final tightening.

 Make sure that the area around the component is clean and free of foreign material.

 Install the new seals.

 NOTE: Tighten the bolts in the indicated sequence.

To install, reverse the removal procedure.

Engine - V6 S/C 3.0L Petrol - Oil Filter Element

Removal and Installation

Removal

NOTES:

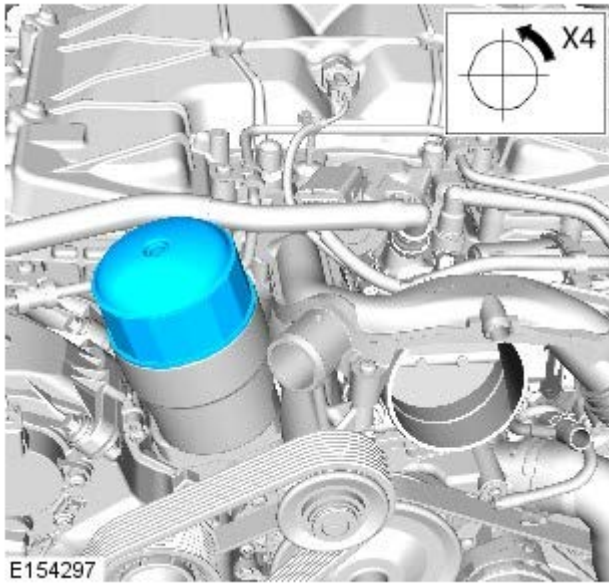


Some variation in the illustrations may occur, but the essential information is always correct.

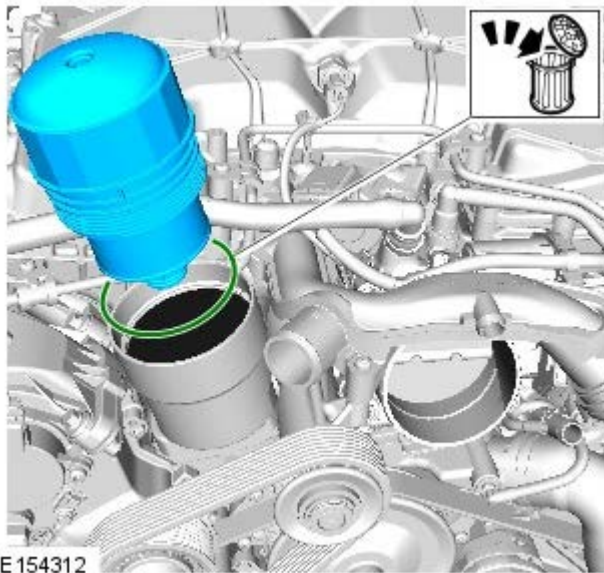


Removal steps in this procedure may contain installation details.

1. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

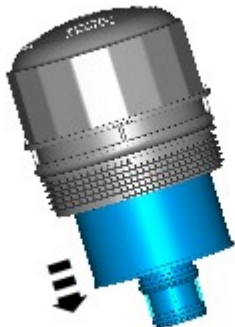


2.  NOTE: Allow 10 minutes for the engine oil to drain from the oil filter housing.



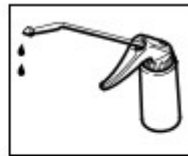
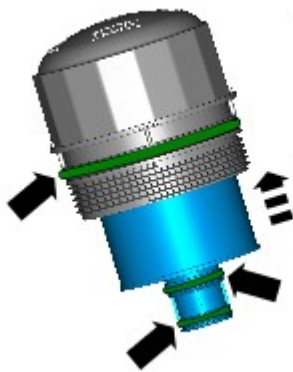
3.  CAUTION: Remove and discard the O-ring seal.

4.  CAUTION: Remove and discard the element.



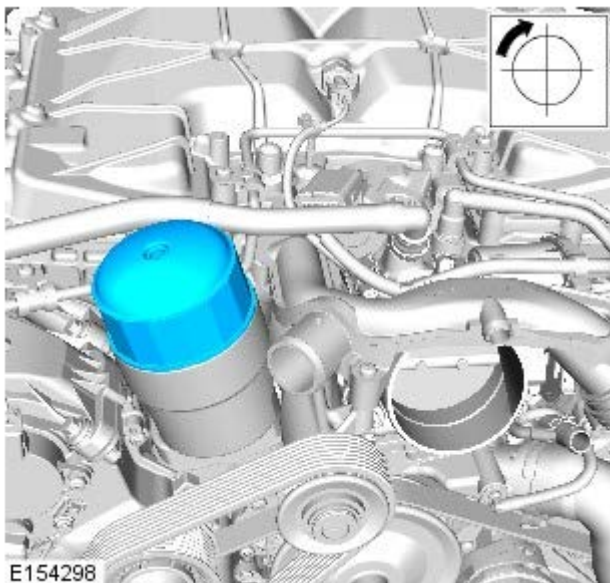
E107394

Installation



E107727

1.  CAUTION: Install new O-ring seals.




E154298

2.  CAUTION: Tighten the component finger tight first.

Torque: 25 Nm

3. Start and run the engine.

4.  NOTE: Allow 10 minutes from the engine switch off for the engine oil level to stabilize.



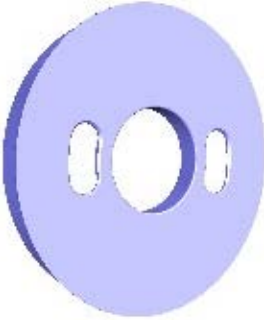
5. Check and top-up the engine oil.

6. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

Engine - V6 S/C 3.0L Petrol - Oil Pan Extension

Removal and Installation

Special Tool(s)

 <p>E107678</p>	<p>303-1442 Rear Crankshaft Seal Installer</p>
 <p>E152576</p>	<p>JLR-303-1304 Locking Tool</p>
 <p>E154431</p>	<p>JLR-303-1622 Alignment Tool, Engine Rear Oil Seal</p>

Removal

NOTES:




Some components shown removed for clarity.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Fuel System Pressure Release - V6 S/C 3.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).
3. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).



4.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

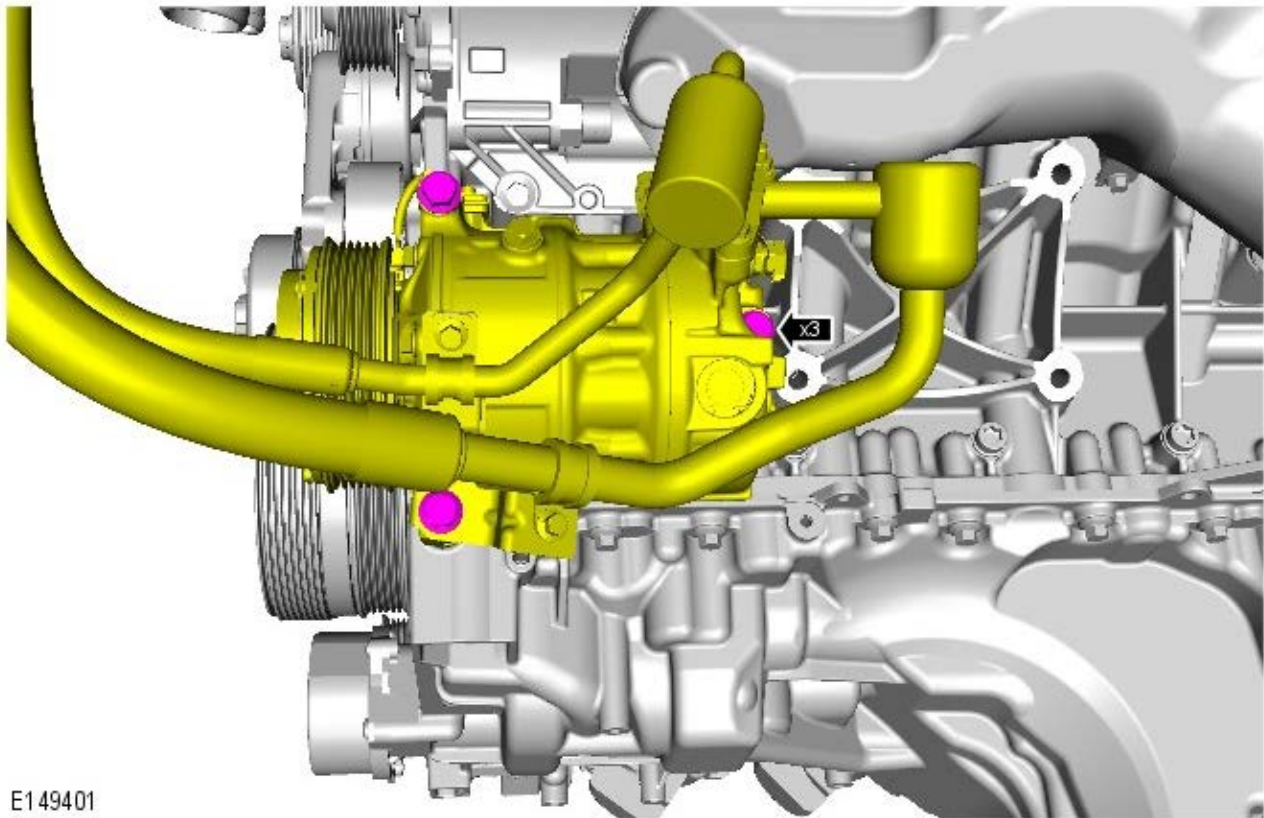
Raise and support the vehicle.

5. Refer to: [Engine Oil Draining and Filling](#) (303-01B Engine - V6 S/C 3.0L Petrol, General Procedures).
6. Refer to: [Fuel Injection Component Cleaning](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, General Procedures).
7. Refer to: [Starter Motor](#) (303-06B Starting System - V6 S/C 3.0L Petrol, Removal and Installation).

8. Refer to: [High Pressure Fuel Pump_1](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Removal and Installation).
9. Refer to: [Axle Assembly](#) (205-03 Front Drive Axle/Differential, Removal and Installation).
10. Refer to: [Transmission - V6 S/C 3.0L Petrol](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, Removal).

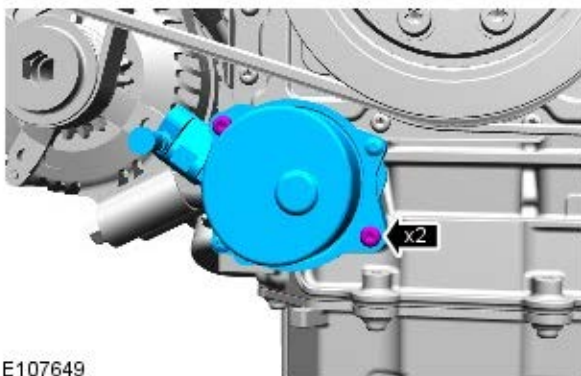
11. NOTES:

-  Using suitable cable tie secure the A/C compressor.
-  Engine shown removed for clarity.




E149401

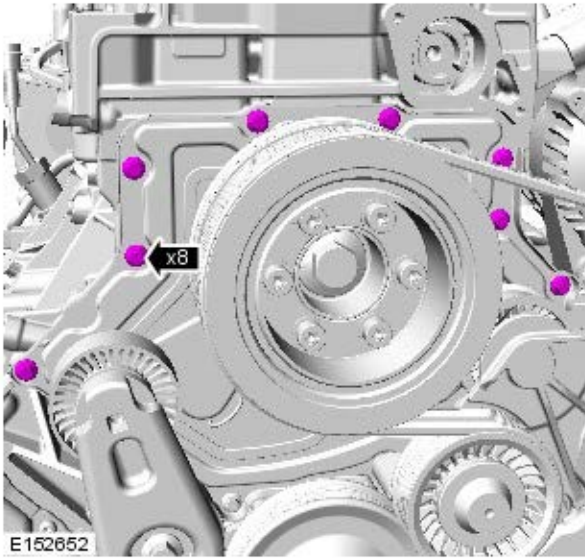
12.



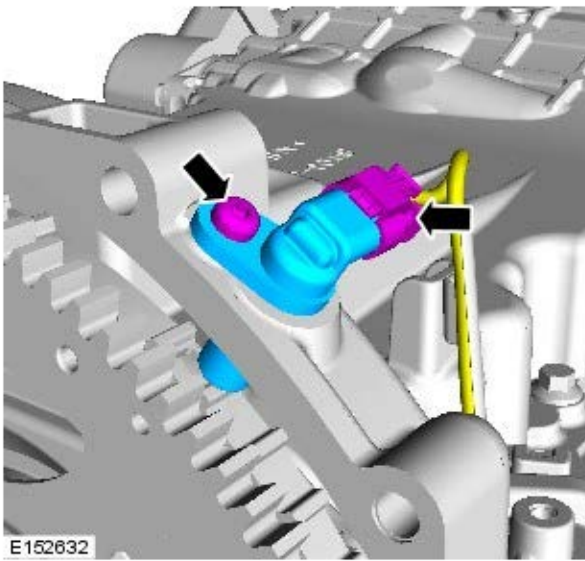
E107649

13.  CAUTION: Only remove the bolts shown in the illustration, do not remove the crankshaft damper.

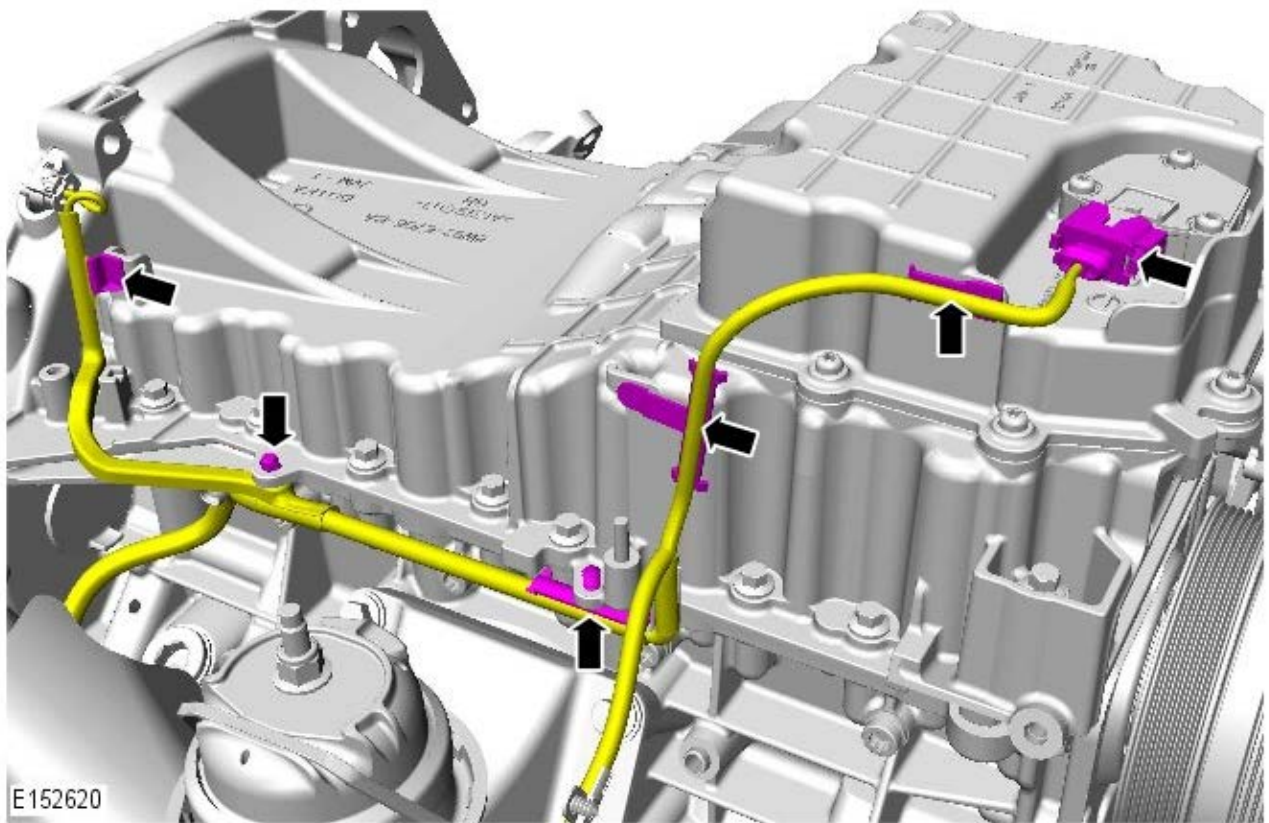
-  NOTE: Engine shown removed for clarity.



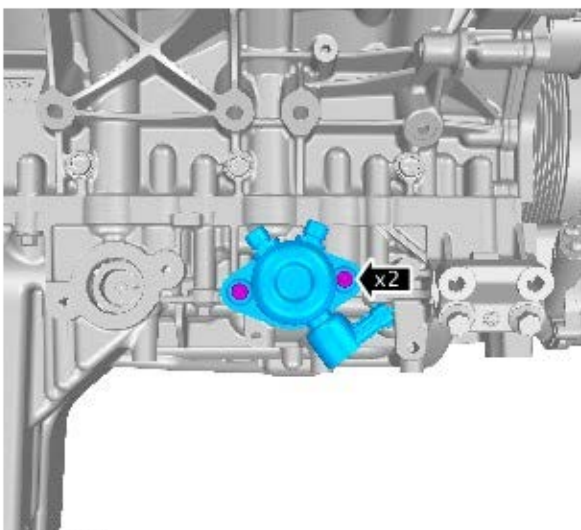
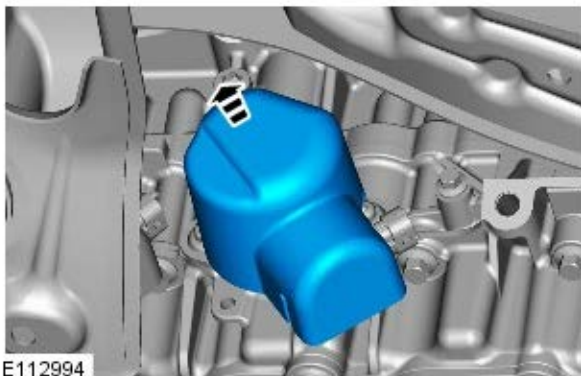
14.





15.  NOTE: Engine shown removed for clarity.



16.



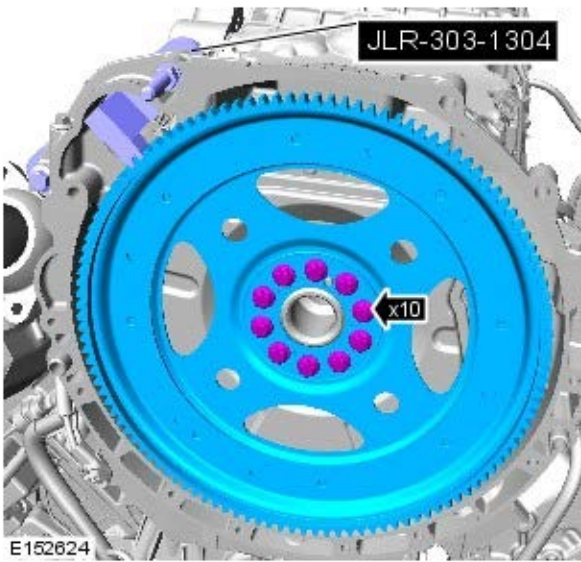
17.  CAUTION: Be prepared to collect escaping fluids.


18.  CAUTION: Be prepared to collect escaping fluids.

 NOTE: Note the orientation of the component



prior to removal.




19.  CAUTION: The bolts can only be used 3 times, mark the bolts with a center punch. If 2 punch marks are visible, discard the bolts.

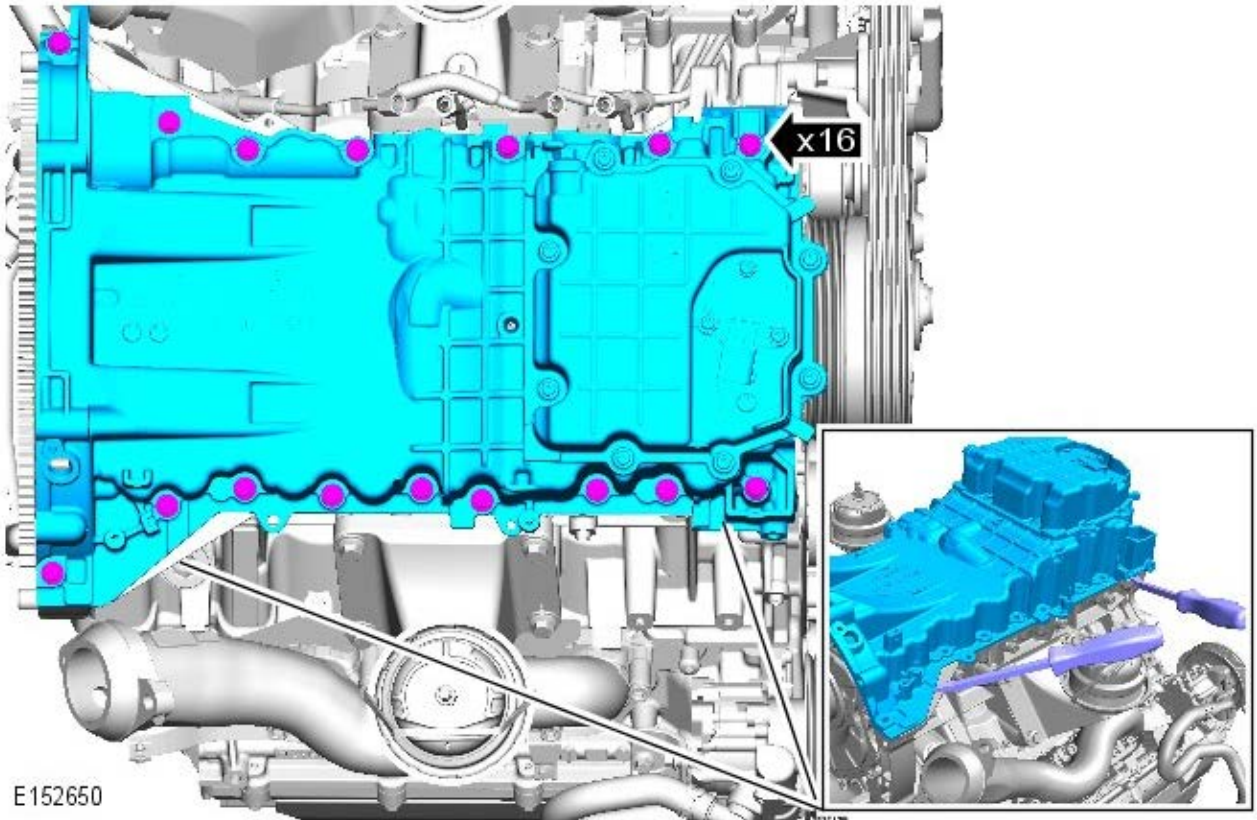
Install the special tool as shown.

Special Tool(s): [JLR-303-1304](#)

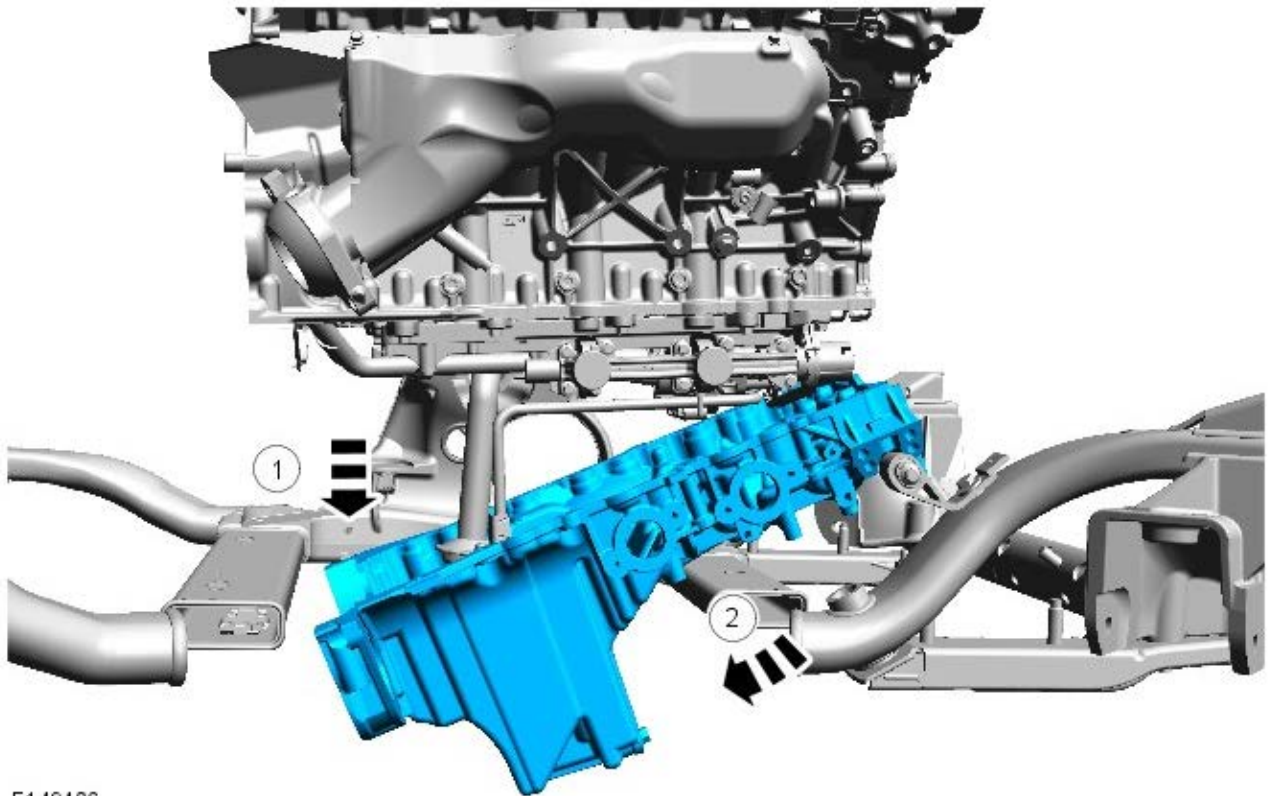
20.




21.  NOTE: Make sure to use the aluminium lug provided on the oil pan extension to lever against.



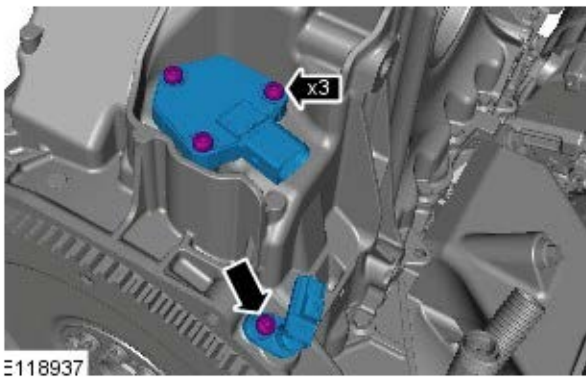
22.



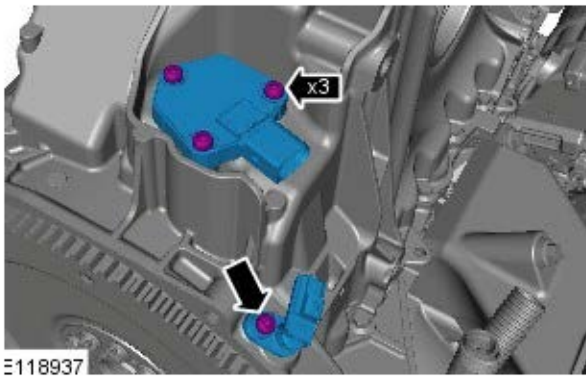
23.  NOTE: Do not disassemble further if the component is removed for access only.



24.



Installation



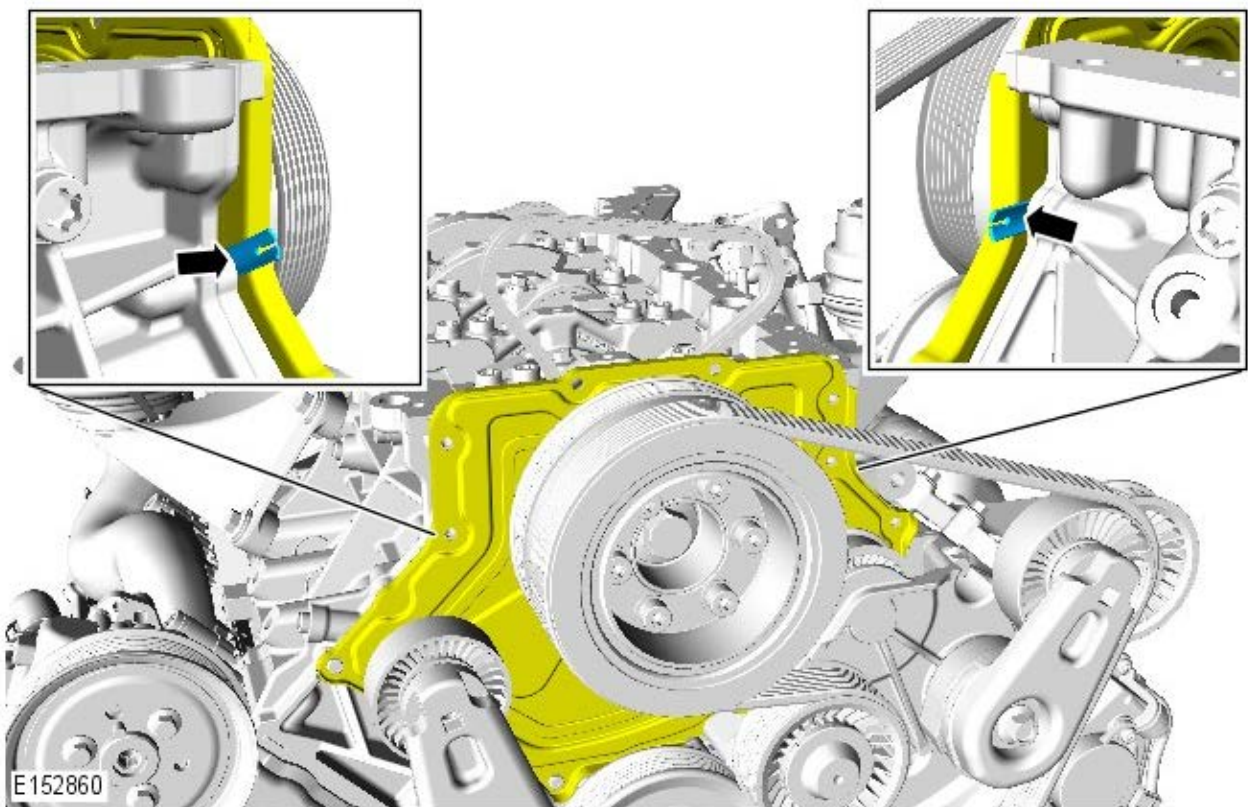
1. • Torque: 11 Nm

2. Torque: 10 Nm




3.  NOTE: Engine shown removed for clarity.

Using a folded cable tie, pack the two areas between the front cover plate and the cylinder block as illustrated. Care must be taken to avoid bending the front cover.

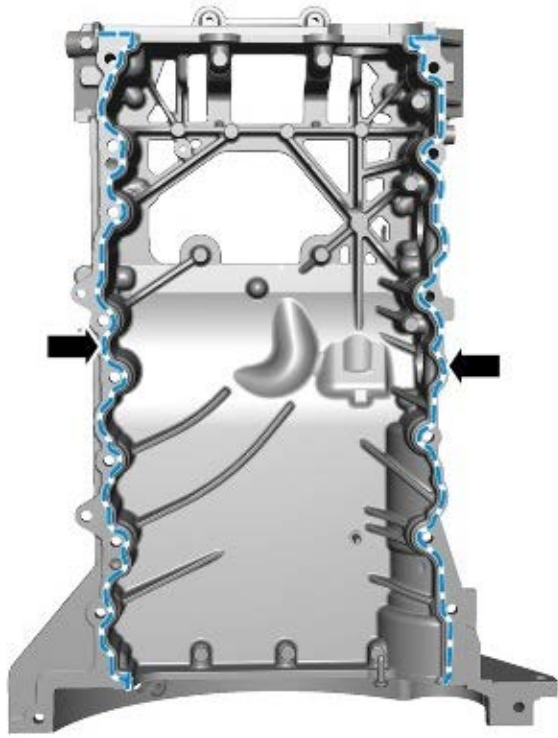


4. CAUTIONS:

 Make sure that the mating faces are clean and free of foreign material.

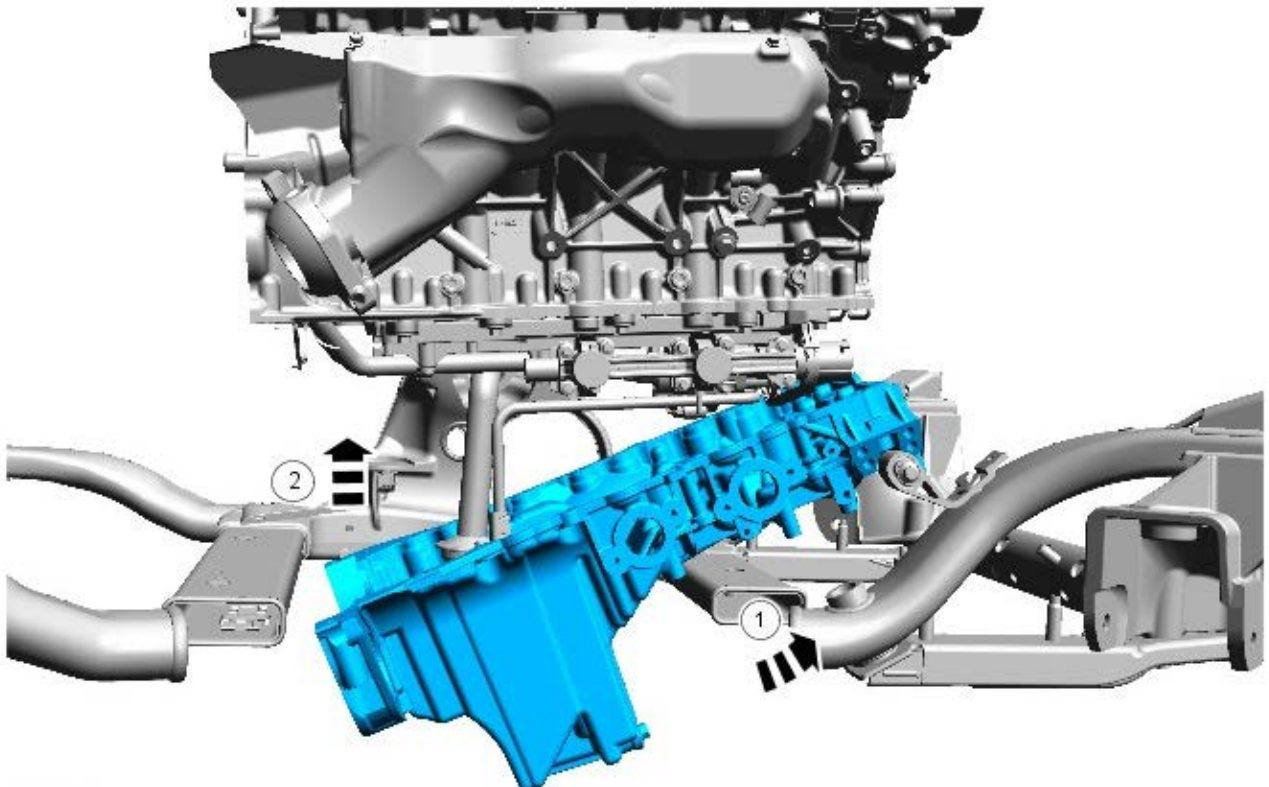
 Use only a plastic scraper when removing the sealing material.

- Apply RTV sealant WSE-M4G323-A6 (Loctite 5901G) to the areas shown, and tighten the bolts within 7 minutes.



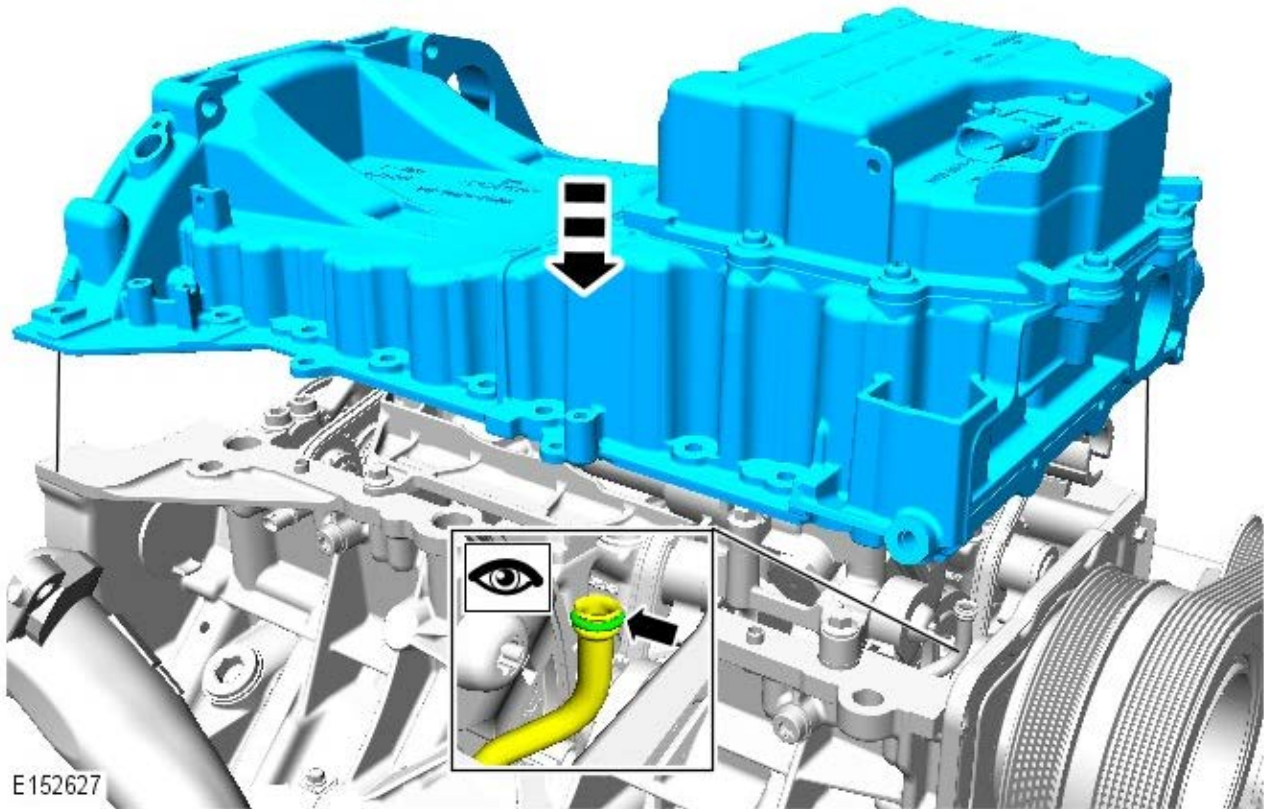
E107654

5.



E150251

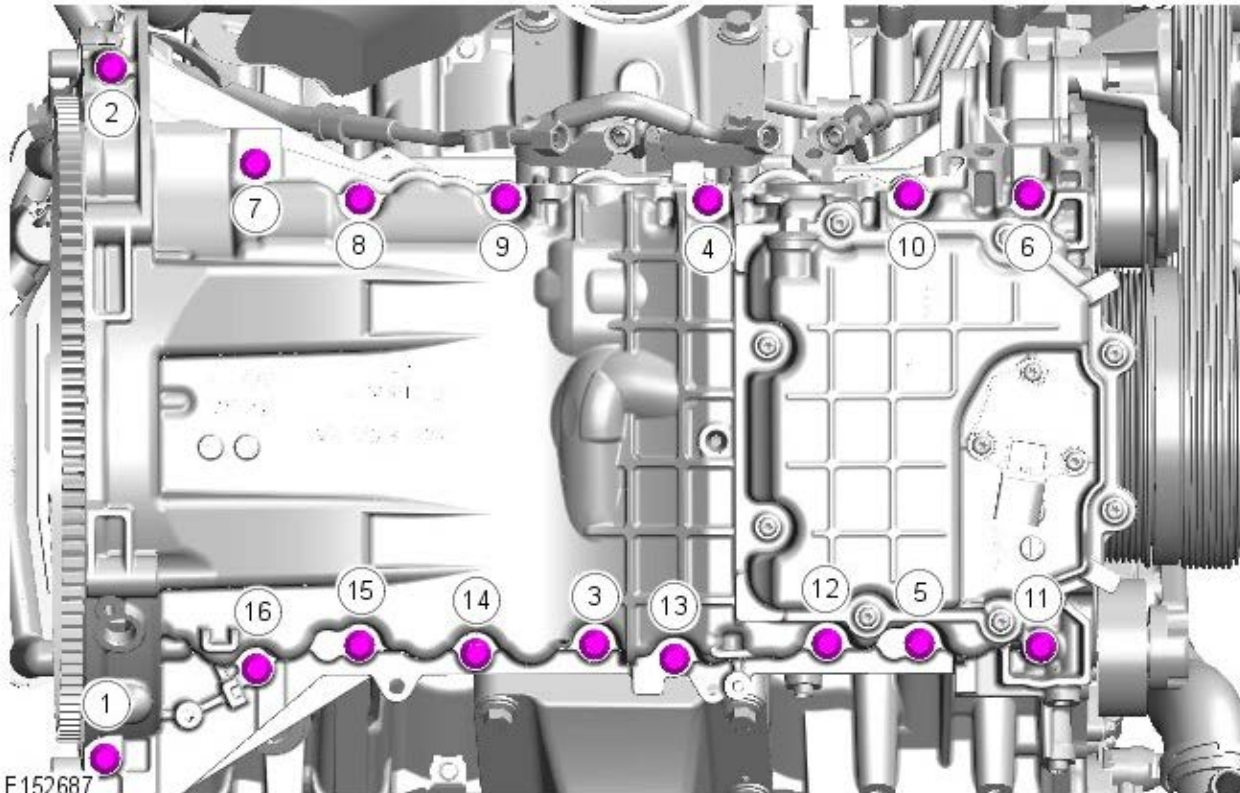
6.




E152627

7.  NOTE: Tighten the bolts in the indicated sequence.

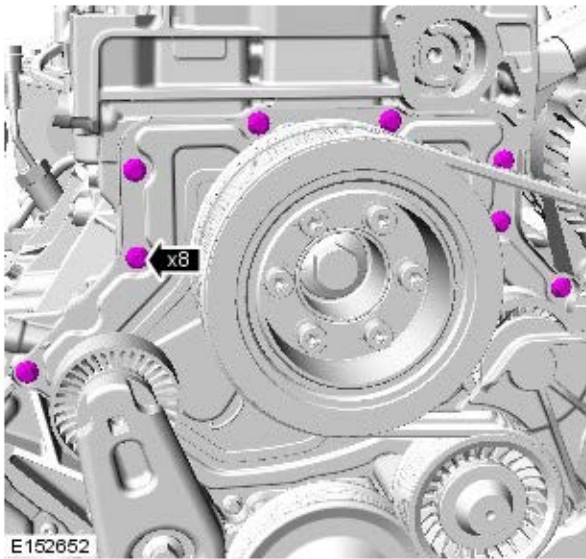
Torque: 25 Nm



E152687

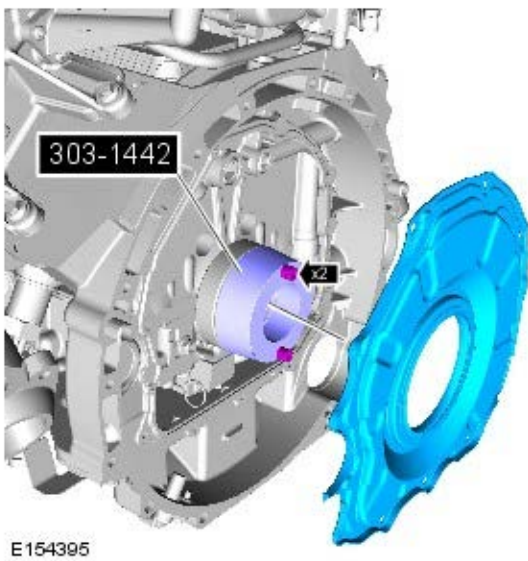
8.  CAUTION: Make sure the front cover spacers are removed before installing the bolts.

Torque: 12 Nm



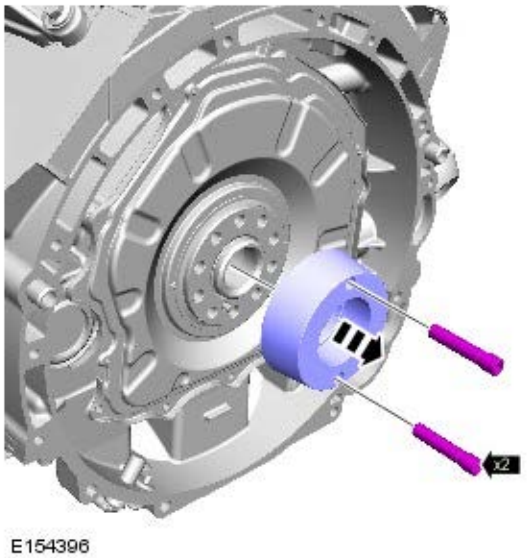
9. Install the special tool.

Special Tool(s): [303-1442](#)



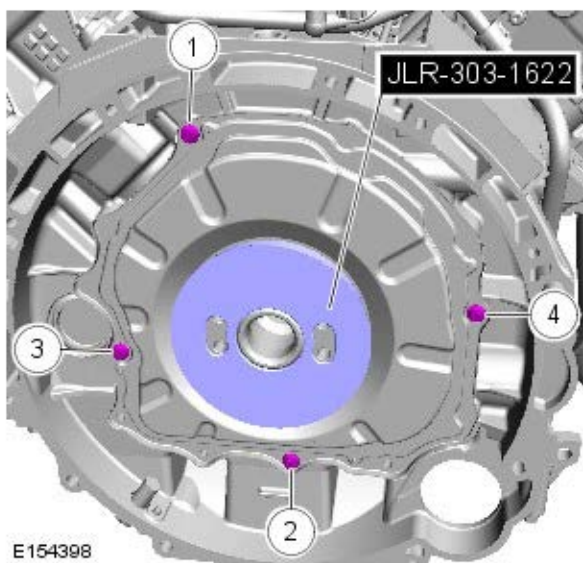
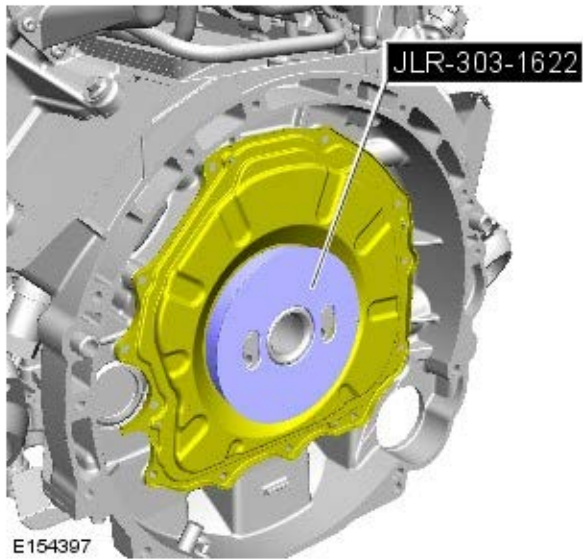
10. Remove the special tool.

Special Tool(s): [303-1442](#)



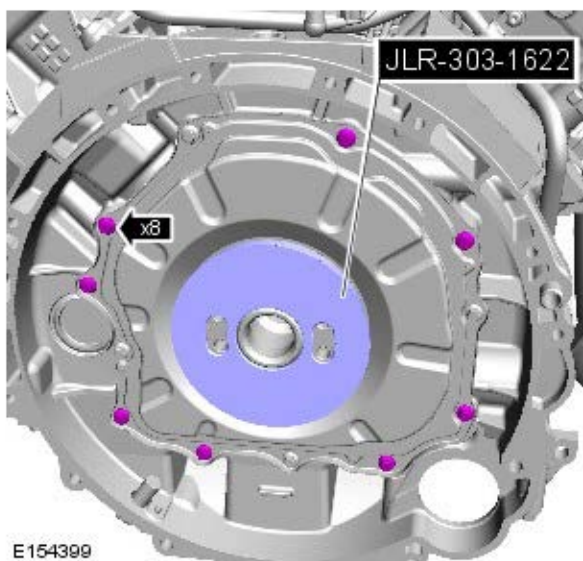
11. Align the engine rear oil seal plate using the special tool.

Special Tool(s): [JLR-303-1622](#)



12.  NOTE: Tighten the bolts in the indicated sequence.

Special Tool(s): [JLR-303-1622](#)
Torque: 11 Nm

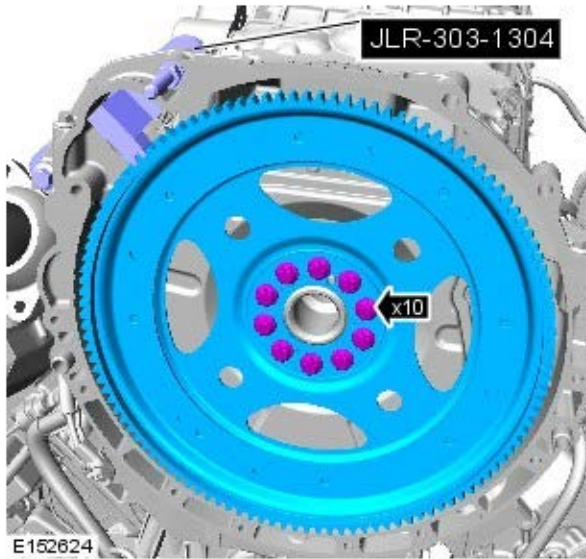


13. Special Tool(s): [JLR-303-1622](#)
Torque: 11 Nm

14. Remove the special tools.

15. CAUTIONS:

 Install all the bolts finger tight before final tightening.



! The bolts can only be used 3 times, mark the bolts with a centre punch. If 2 punch marks are visible, discard the bolts.

NOTES:

△ Make sure the crankshaft and flexplate mating faces are clean before installation.

△ Tighten the retaining bolts working diagonally.

Special Tool(s): [JLR-303-1304](#)

Torque:

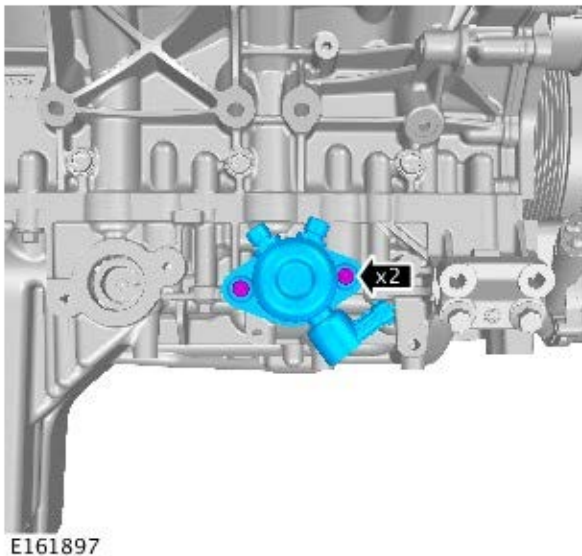
Stage 1: 45 Nm

Stage 2: 90°

16. Remove the special tool.



17. **△** NOTE: Lubricate the fuel rail high-pressure fuel pump bucket with clean engine oil.

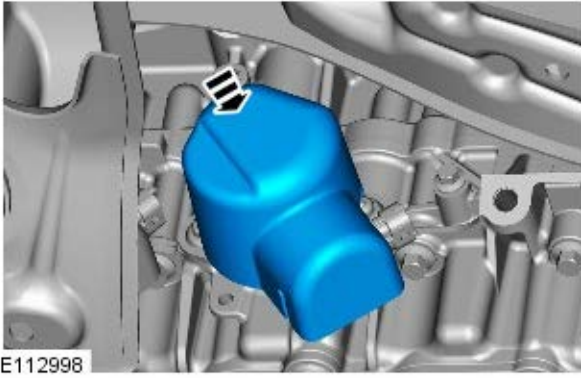


18. **!** CAUTION: Tighten the Torx screws a turn at a time until the correct torque is achieved.

△ NOTE: Lubricate the fuel rail high-pressure fuel pump O-ring seal with clean engine oil.

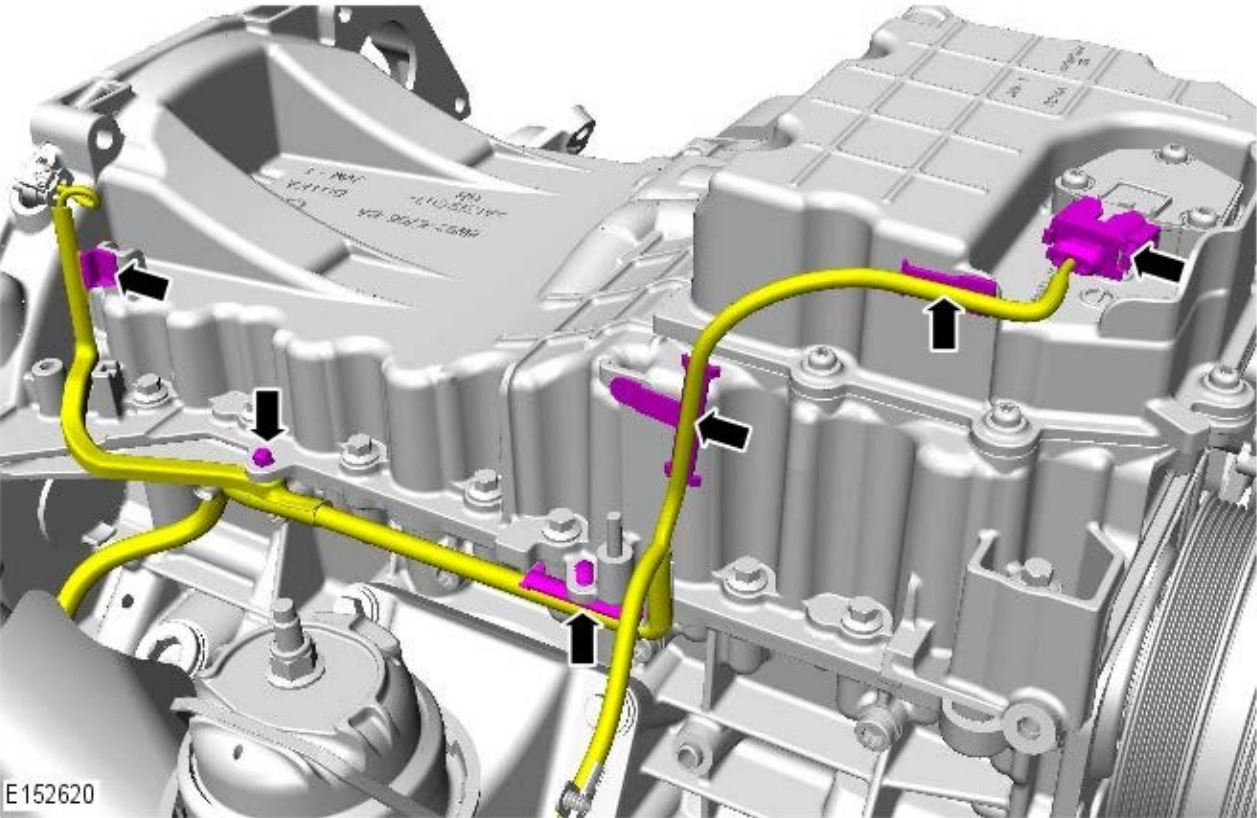
Torque: 12 Nm

19.



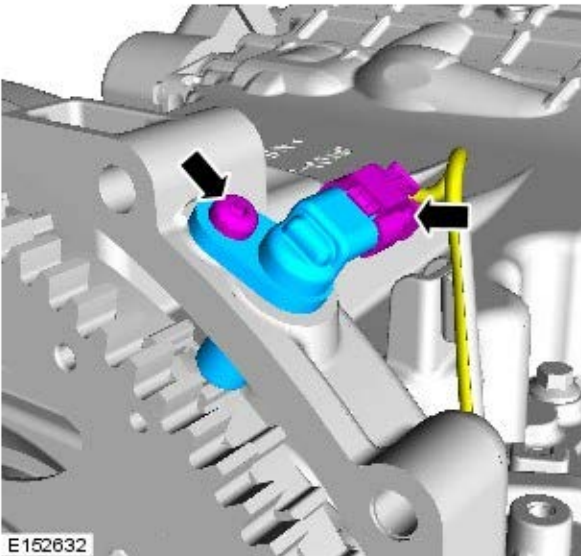
E112998

20.



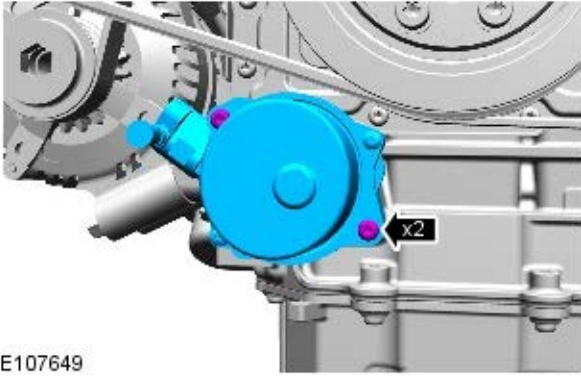
E152620

21. Torque: 10 Nm



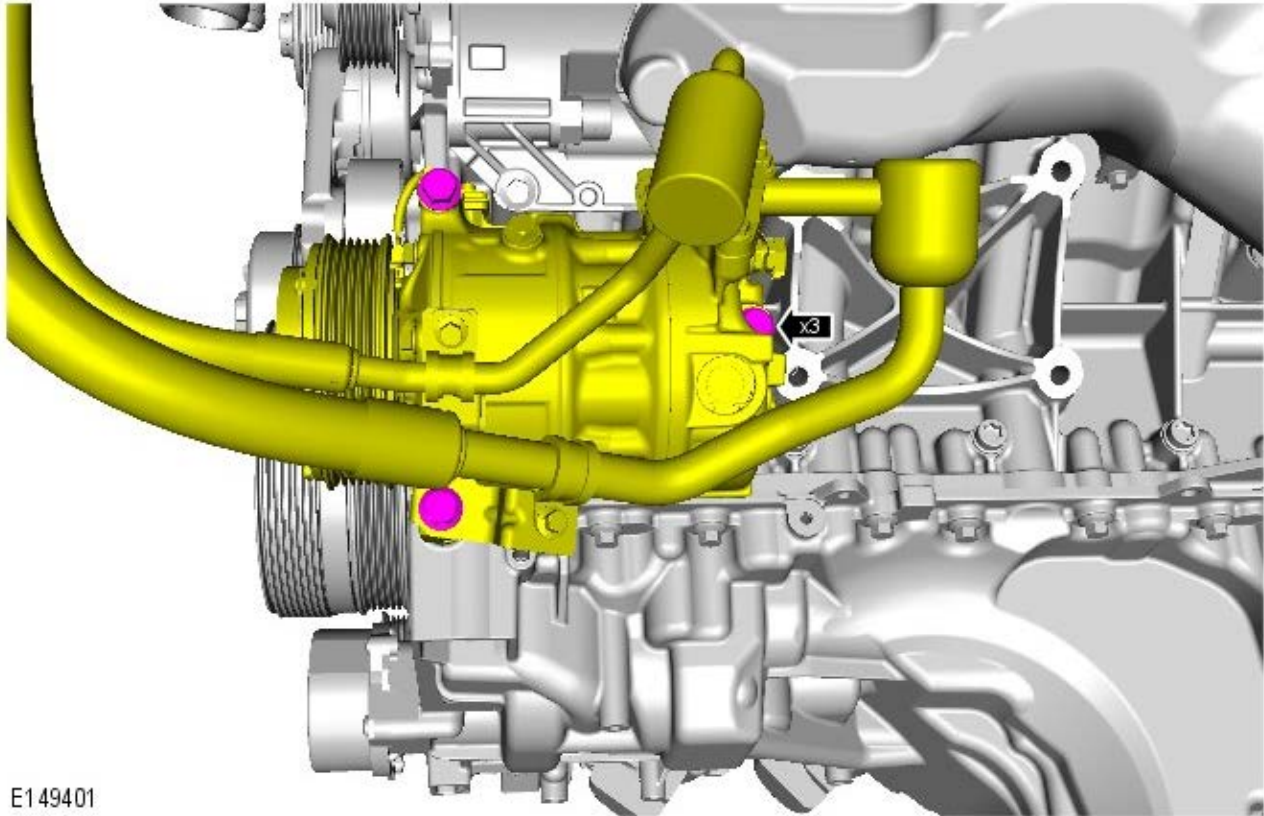
E152632

22. Torque: 12 Nm



E107649

23. Torque: 25 Nm



E149401

24. Refer to: [Transmission - V6 S/C 3.0L Petrol](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, Installation).
25. Refer to: [Axle Assembly](#) (205-03 Front Drive Axle/Differential, Removal and Installation).
26. Refer to: [High Pressure Fuel Pump_1](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Removal and Installation).
27. Refer to: [Starter Motor](#) (303-06B Starting System - V6 S/C 3.0L Petrol, Removal and Installation).
28. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
29. Refer to: [Engine Oil Draining and Filling](#) (303-01B Engine - V6 S/C 3.0L Petrol, General Procedures).

Engine - V6 S/C 3.0L Petrol - Oil Pump

Removal and Installation

Removal

NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.



Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

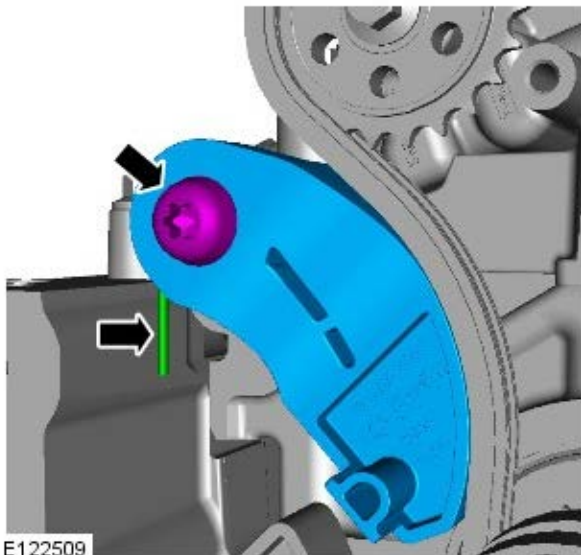
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

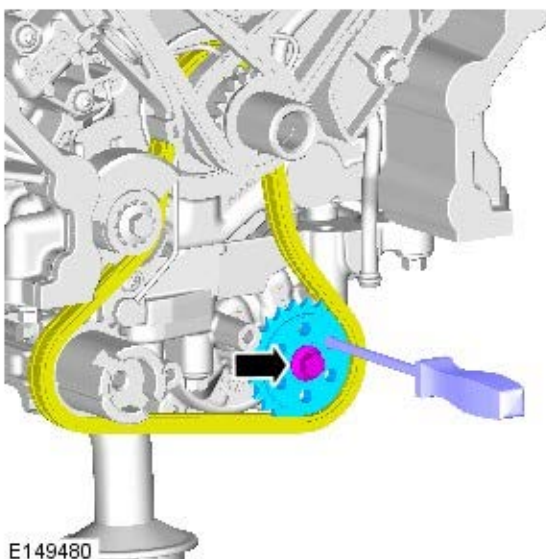
Raise and support the vehicle.

3. Refer to: [Oil Pan Extension](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

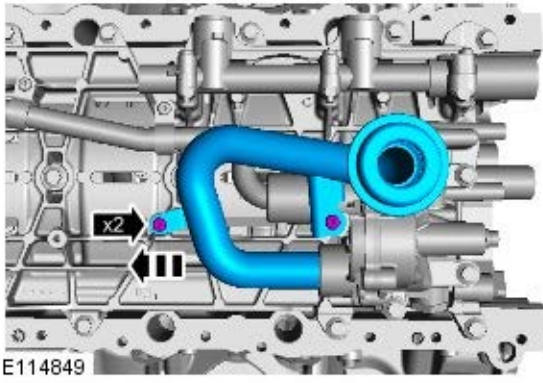
4.



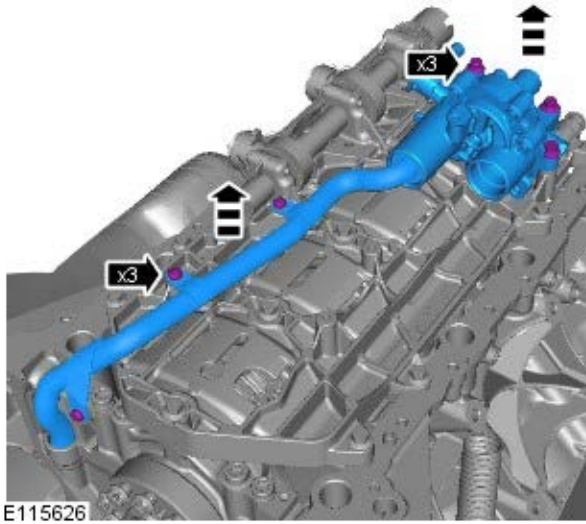
5.



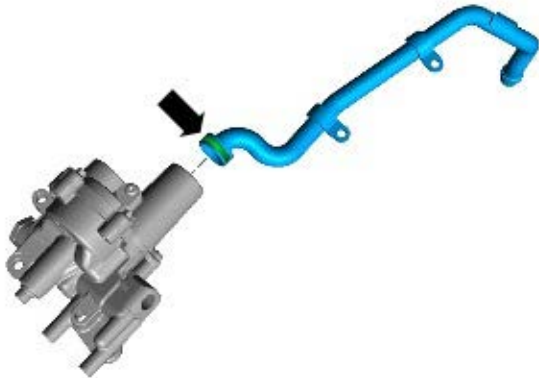
6.  **NOTE:** Remove and discard the O-ring seal.



7.  CAUTION: Remove and discard the O-ring seals.



8.  NOTE: Remove and discard the O-ring seal.



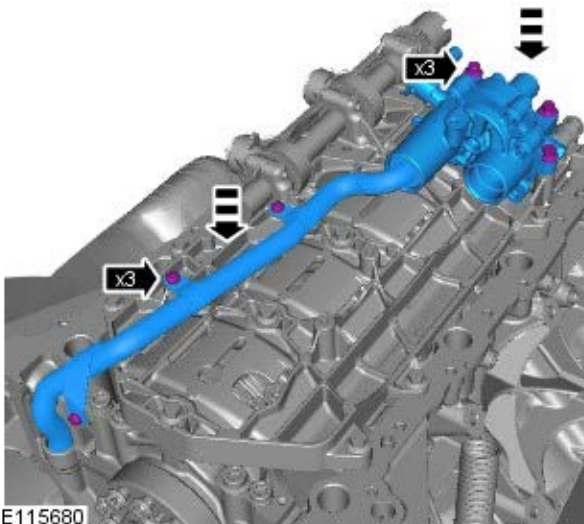
Installation

1. Lubricate and install the new O-ring seals.



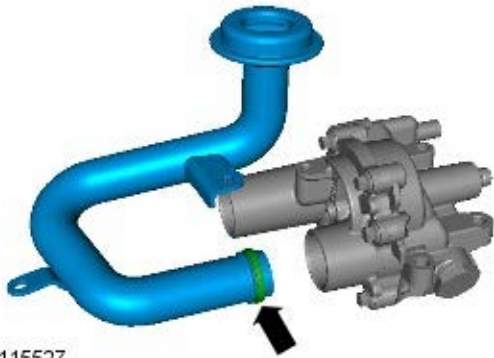
E139628

2. Torque:
M8 25 Nm
M6 12 Nm



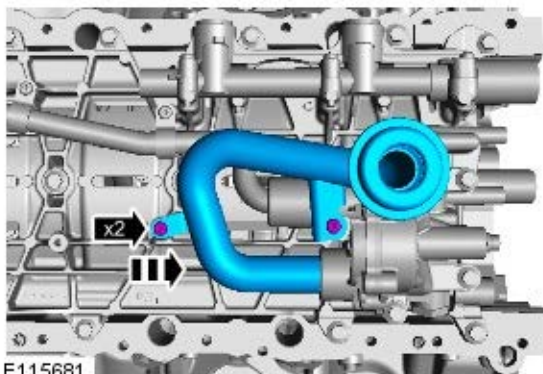
E115680

3. Lubricate and install a new O-ring seal.



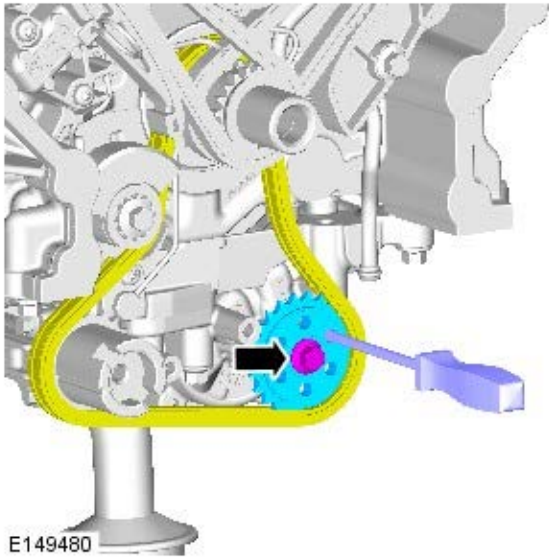
E115527

4. Torque: 12 Nm

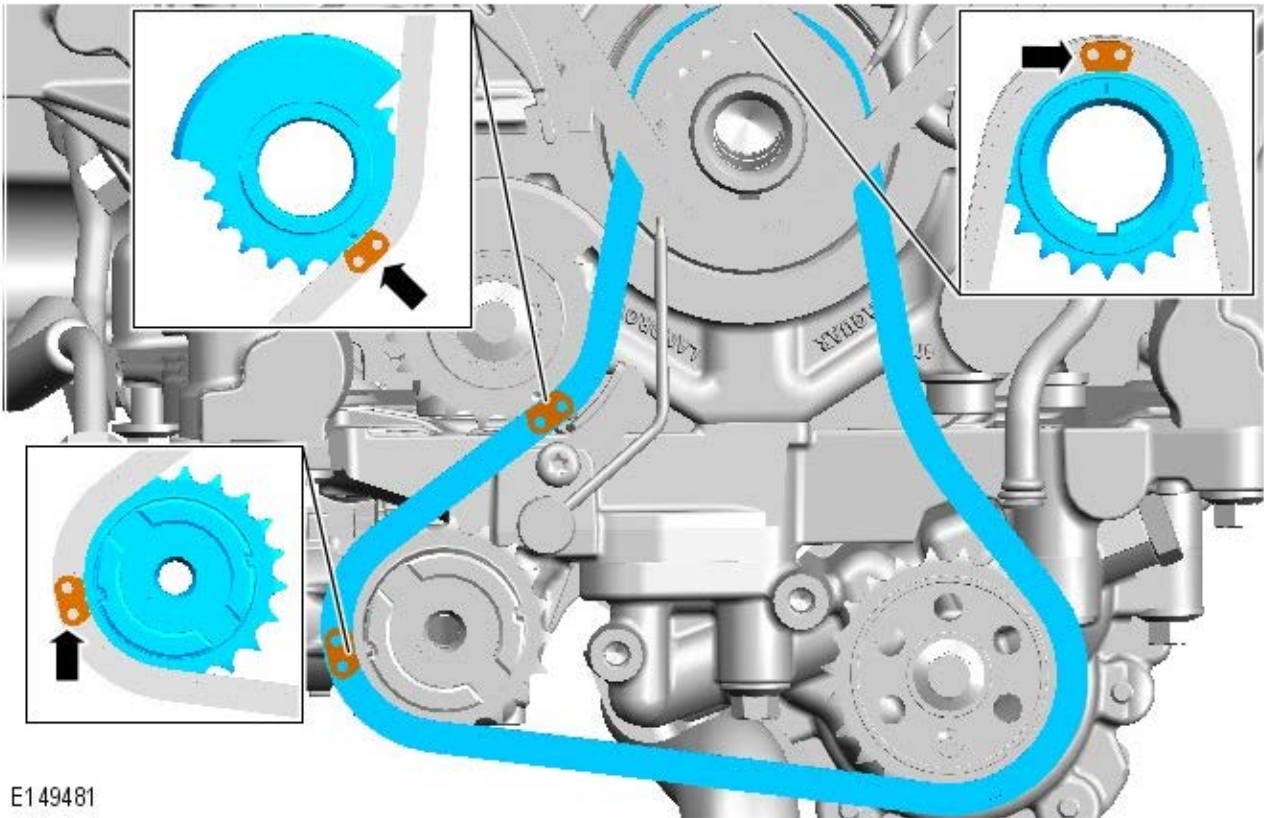



E115681

5. Torque: 21 Nm

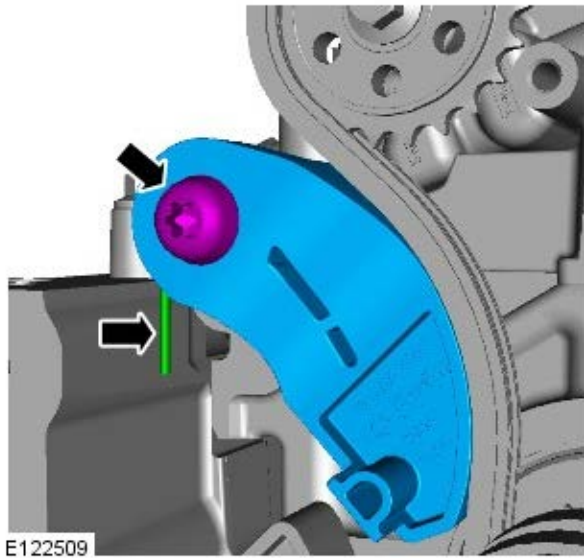


6. Install the lower timing chain making sure the coloured chain links align correctly with the fuel rail high-pressure fuel pumps camshaft and crankshaft sprocket markings.



7.  CAUTION: Make sure that the tensioner spring is correctly located.

Torque: 21 Nm



E122509


8. Refer to: [Oil Pan Extension](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
9. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - V6 S/C 3.0L Petrol - Timing Cover

Removal and Installation

Special Tool(s)

 <p>E107676</p>	<p>303-1433 Lower Timing Cover Alignment tool</p>
--	---


Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

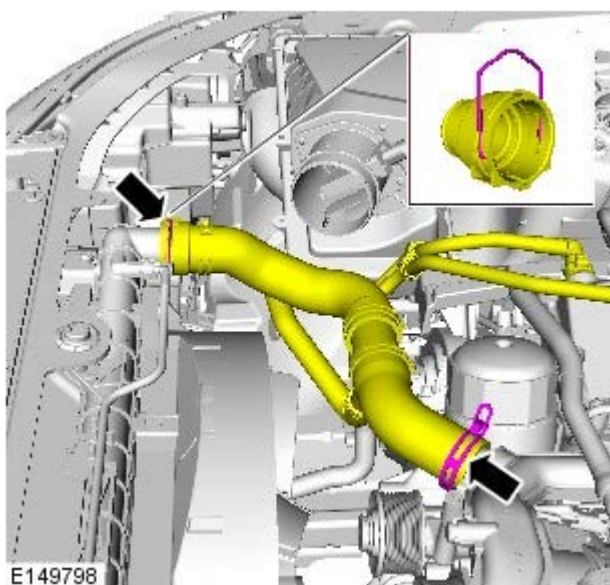
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

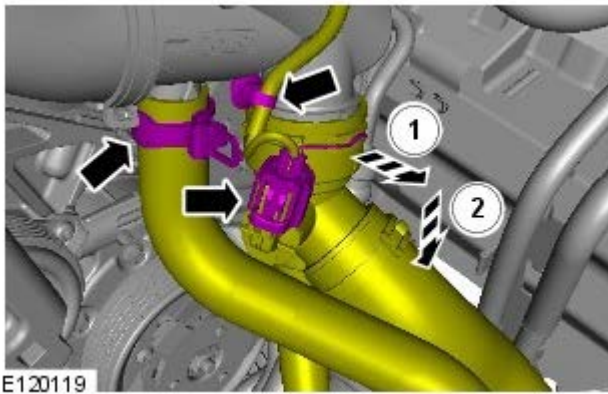
Raise and support the vehicle.

3. Refer to: [Cooling System Partial Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).
4. Refer to: [Crankshaft Pulley](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
5. Refer to: [Valve Cover LH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
6. Refer to: [Valve Cover RH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

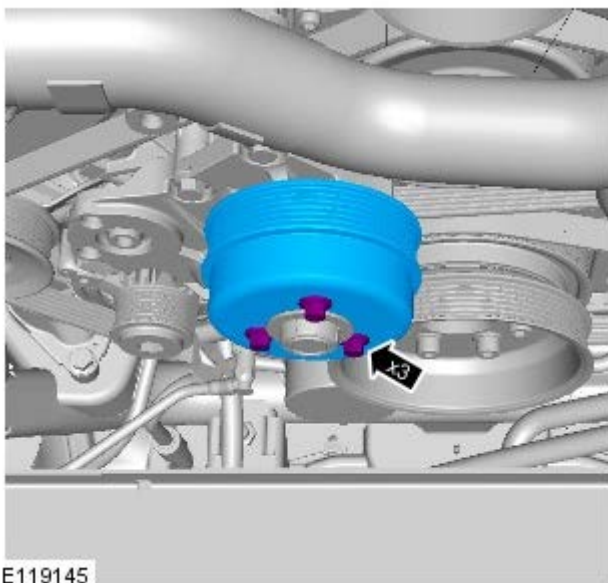
7.



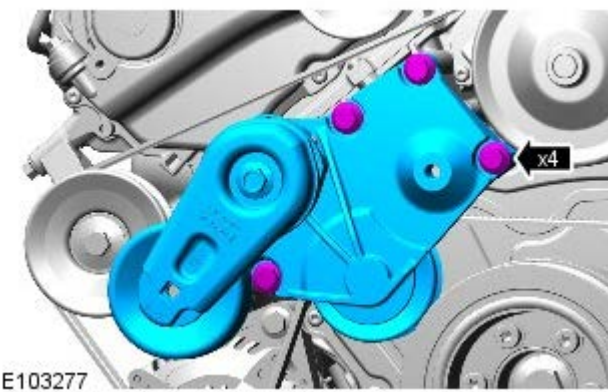
8.



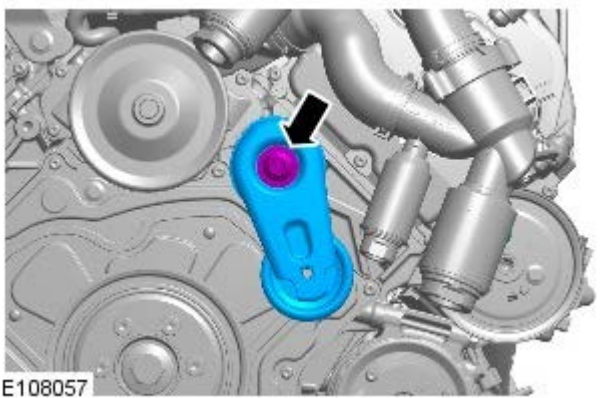
9.



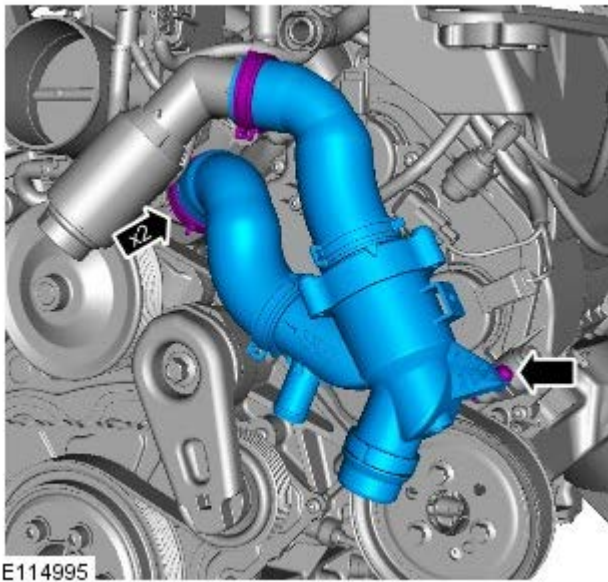
10.



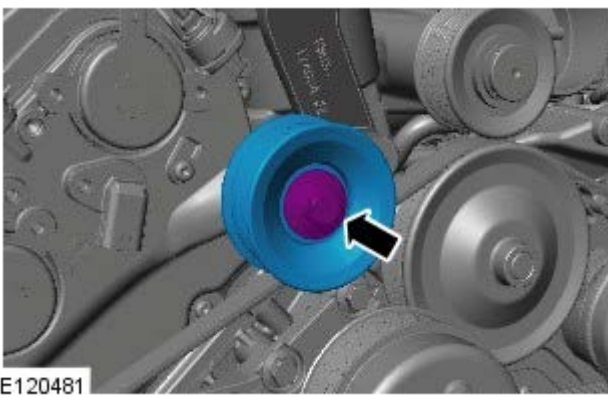
11.



12.



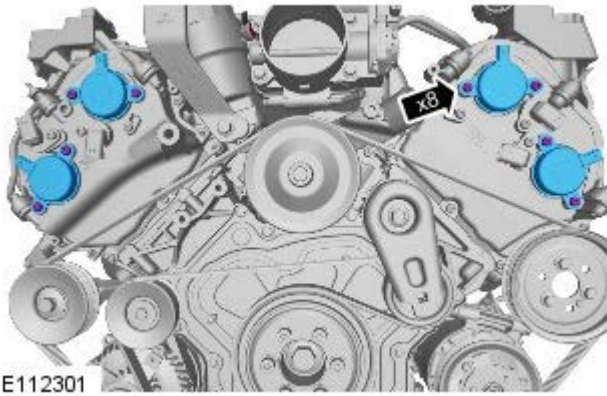
13.



14.

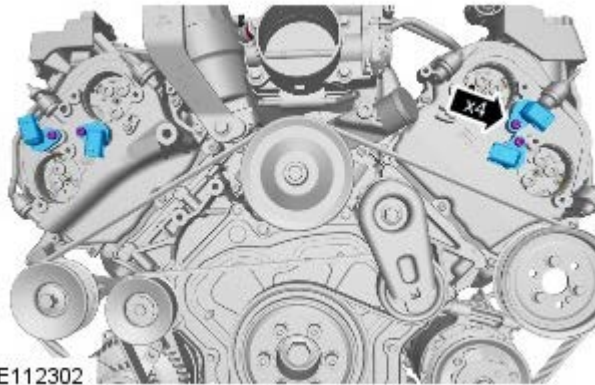


15.

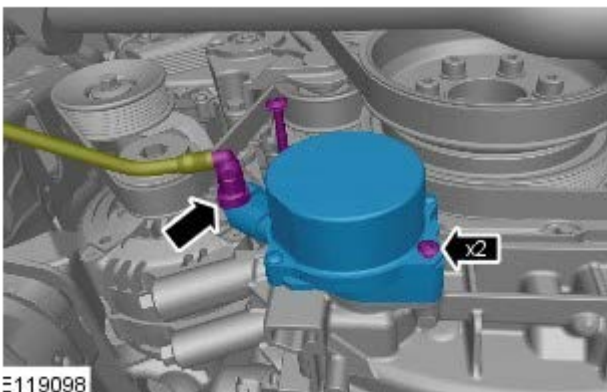


E112301

16.



E112302



E119098

17. CAUTIONS:

⚠ Be prepared to collect escaping oil.


⚠ Discard the seal.

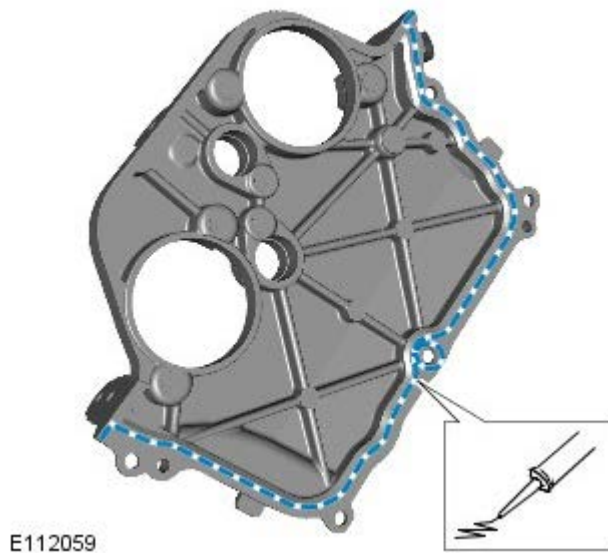
18.




E112055


Installation

1.  CAUTION: Make sure that the mating faces are clean and free of foreign material.
 - Apply RTV sealant WSE-M4G323-A6 (Loctite 5901G) to the areas shown, and tighten the bolts within 7 minutes.

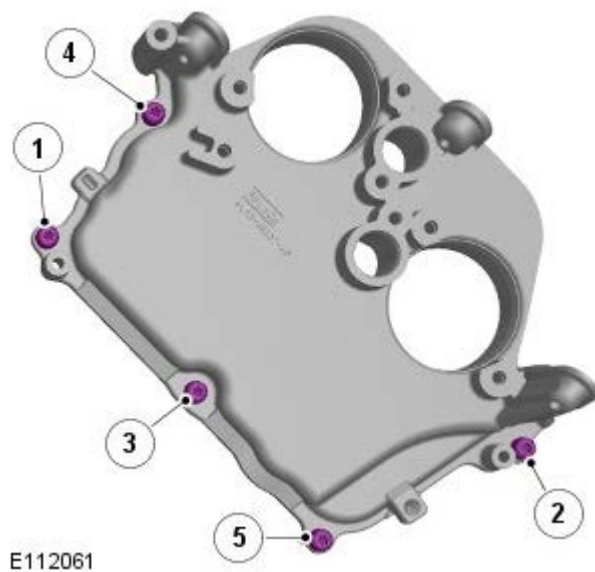


2.  CAUTION: Make sure that the mating faces are clean and free of foreign material.
 - Apply RTV sealant WSE-M4G323-A6 (Loctite 5901G) to the areas shown, and tighten the bolts within 7 minutes.



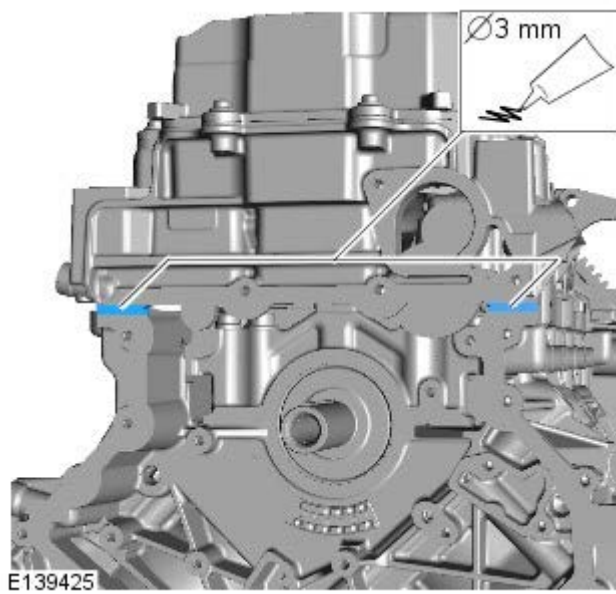
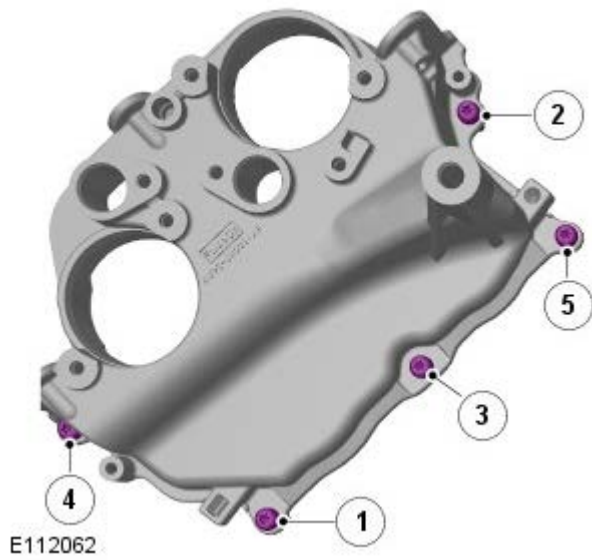
3.  NOTE: Tighten the bolts in the indicated sequence.

Torque: 12 Nm



4.  NOTE: Tighten the bolts in the indicated sequence.

Torque: 12 Nm



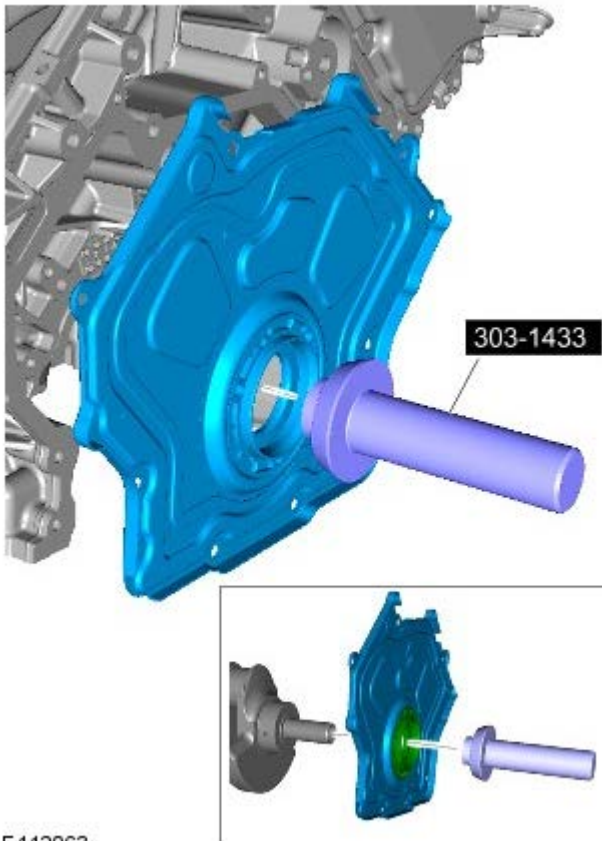
5.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Apply RTV sealant WSE-M4G323-A6 (Loctite 5901G) to the areas shown, and tighten the bolts within 7 minutes.

6.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

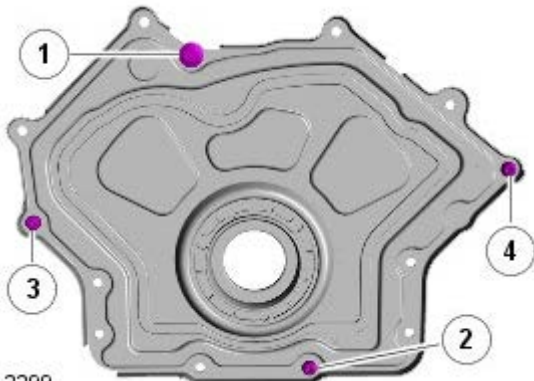
Install the bolts, but do not tighten fully at this stage.

Special Tool(s): [303-1433](#)



E112063

7. Torque:
 M6 12 Nm
 M8 20 Nm



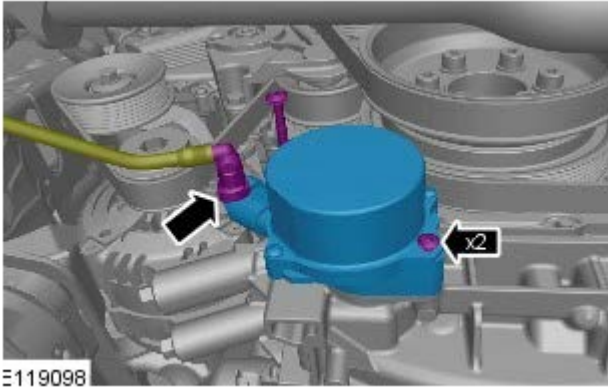
E112299

8. Torque: 12 Nm

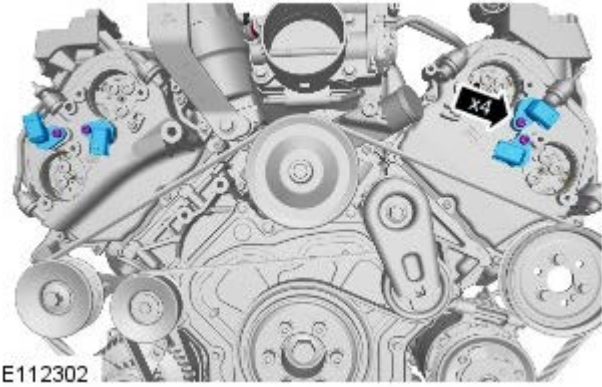


E112300

9.  CAUTION: Install a new seal.



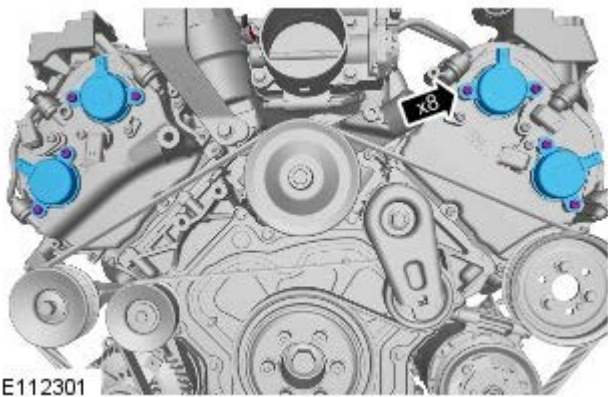
10. Torque: 12 Nm



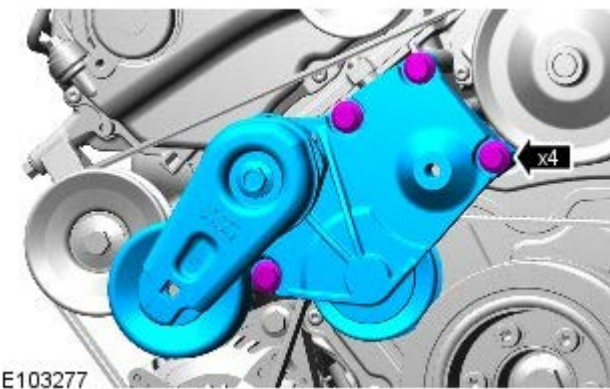
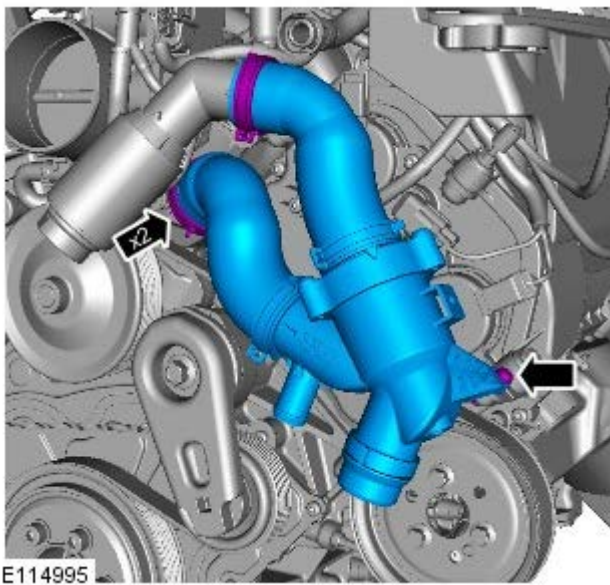
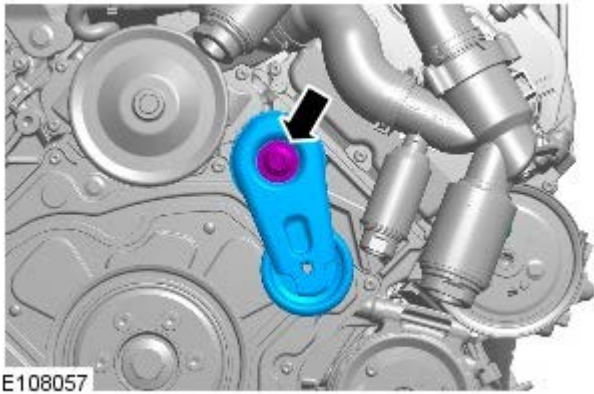
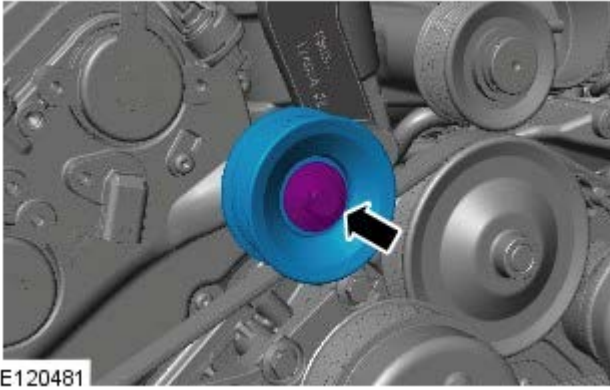
11. Torque: 25 Nm




12. Torque: 12 Nm



13. Torque: 40 Nm



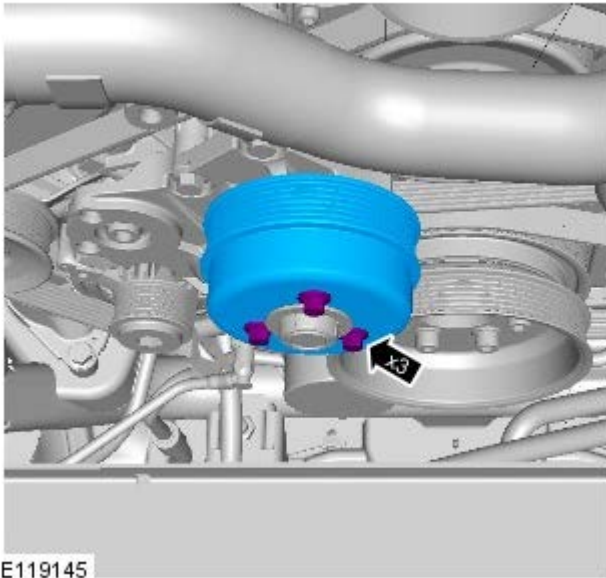
14.  NOTE: Install the bolt finger tight before final tightening.

Torque: 40 Nm

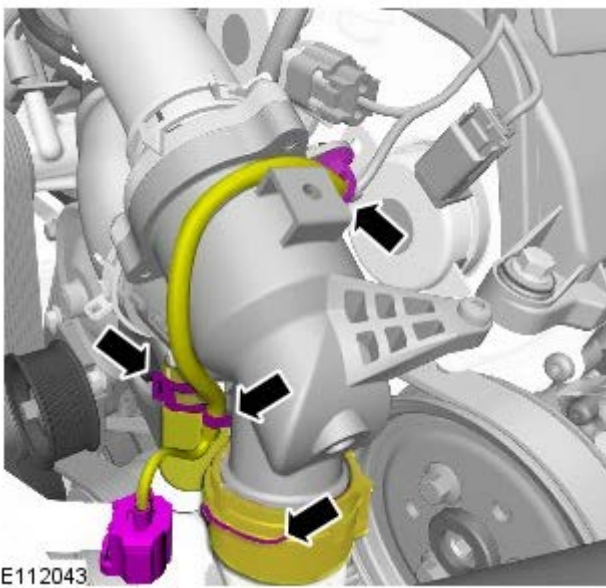
- 15.

16. Torque: 25 Nm

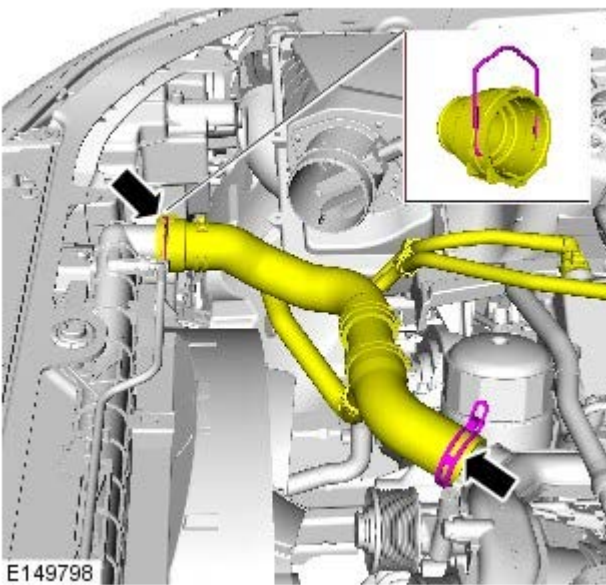
17. Torque: 25 Nm



18.



19.



20. Refer to: [Valve Cover RH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

21. Refer to: [Valve Cover LH](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).






22. Refer to: [Crankshaft Pulley](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
23. Refer to: [Cooling System Partial Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).
24. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - V6 S/C 3.0L Petrol - Timing Drive Components

Removal and Installation

Special Tool(s)

 <p>E115263</p>	<p>303-1445 Timing Tool – Camshaft Alignment</p>
 <p>E115270</p>	<p>303-1452 Camshaft Rotating Tool</p>
 <p>E115271</p>	<p>303-1482 Tensioner Tool</p>
 <p>E152575</p>	<p>JLR-303-1303 Timing Tool</p>
 <p>E152576</p>	<p>JLR-303-1304 Locking Tool</p>

Removal



CAUTION: Check all timing components for wear and install new components if required.

NOTES:




Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

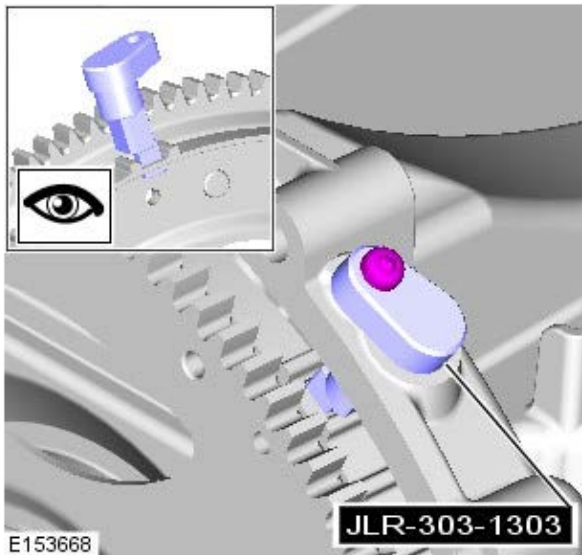
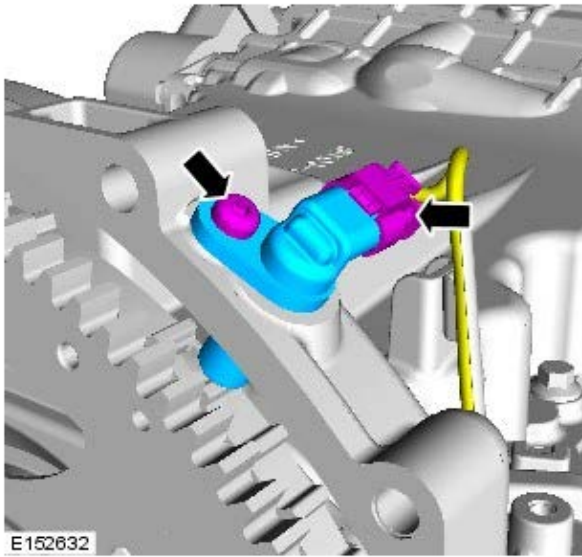
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).


2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.


3. Refer to: [Timing Cover](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

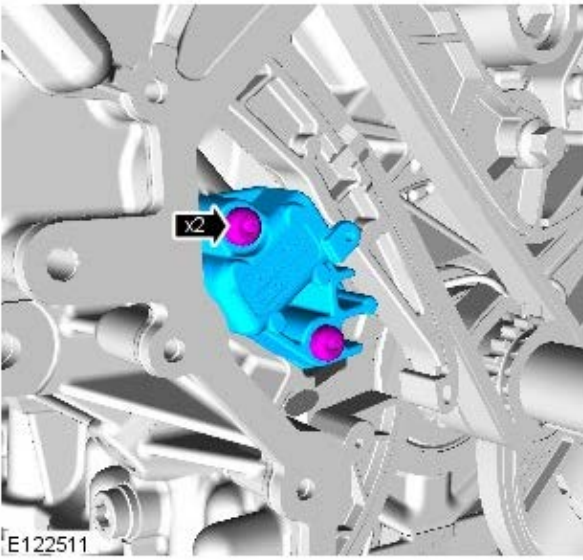
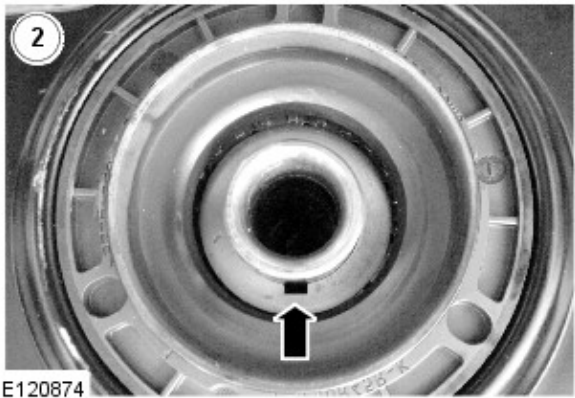
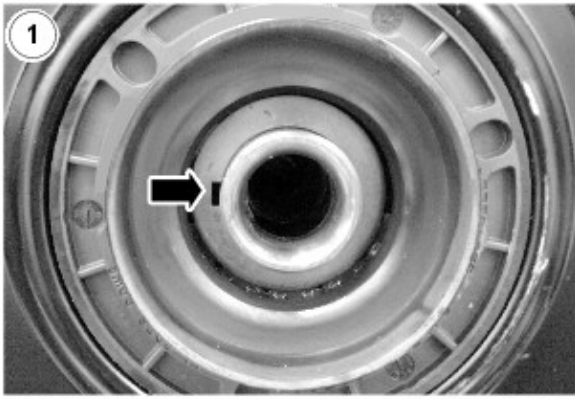
4.



5.  **CAUTION:** Only rotate the crankshaft clockwise.
Install the special tool.

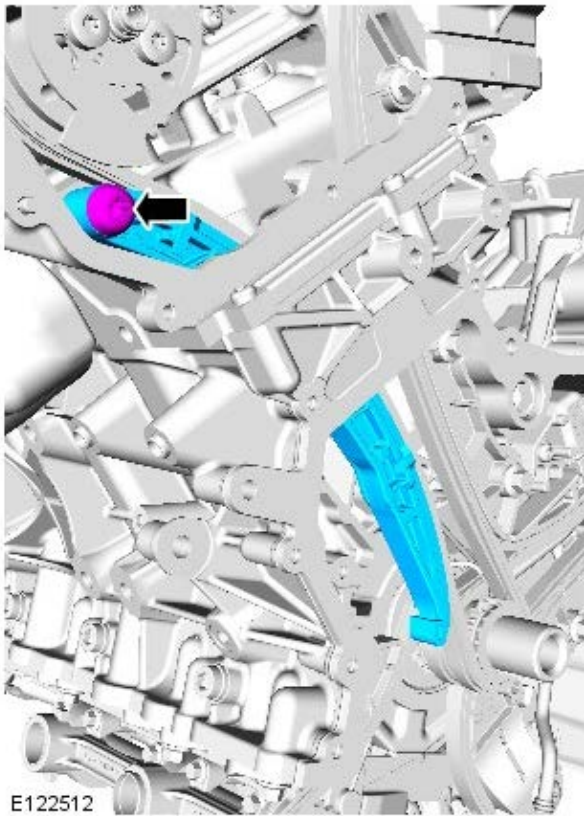
Special Tool(s): [JLR-303-1303](#)

6.  **CAUTION:** If the noted position of the woodruff key is at the 9 o'clock position, then a new flexplate must be installed. If the woodruff key is in the 6 o'clock position then proceed with the next step
Note the position of the crankshaft woodruff key.



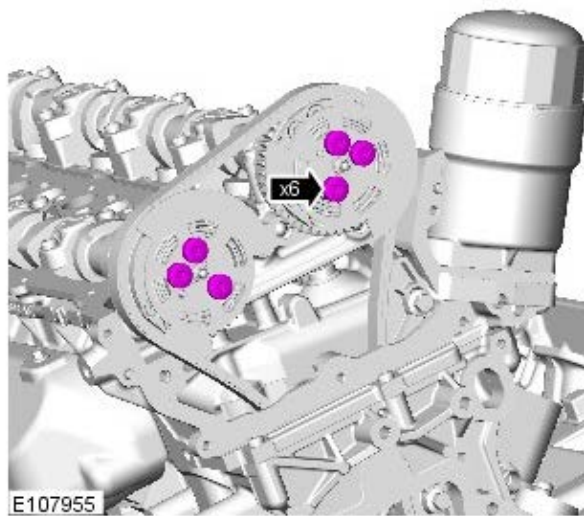
7.

8.




E122512

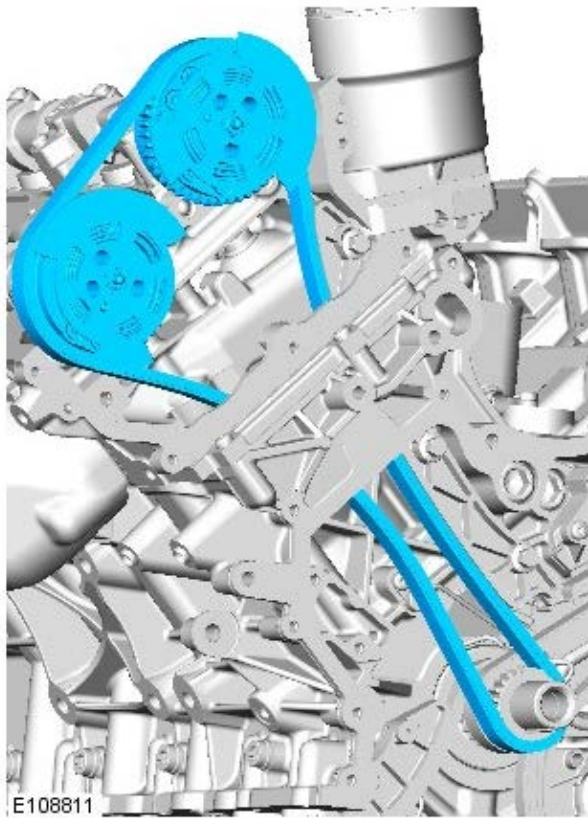
9.



E107955

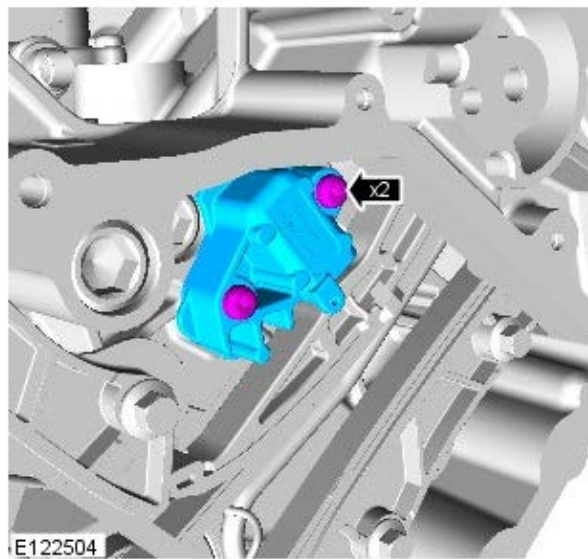
10.  CAUTION: If the variable valve timing (VVT) units are knocked or dropped then the VVT must be replaced.

Remove the timing chain with the VVT units.



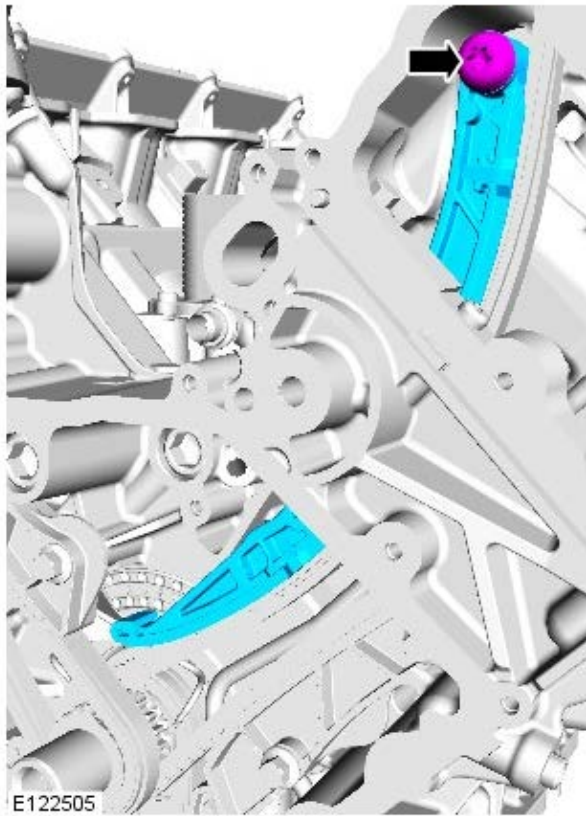
E108811

11.

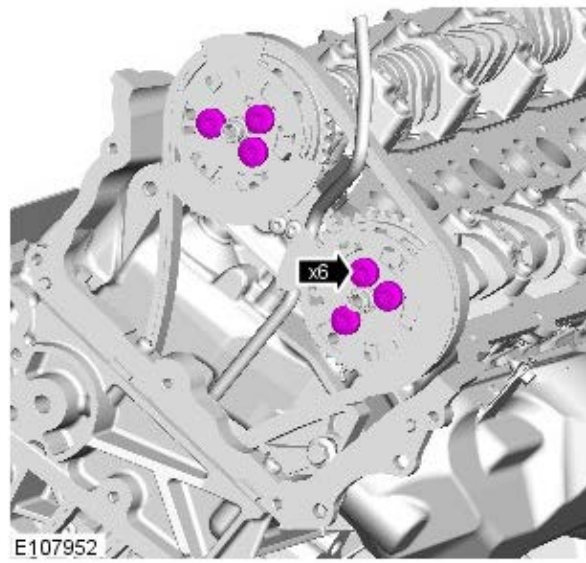



E122504

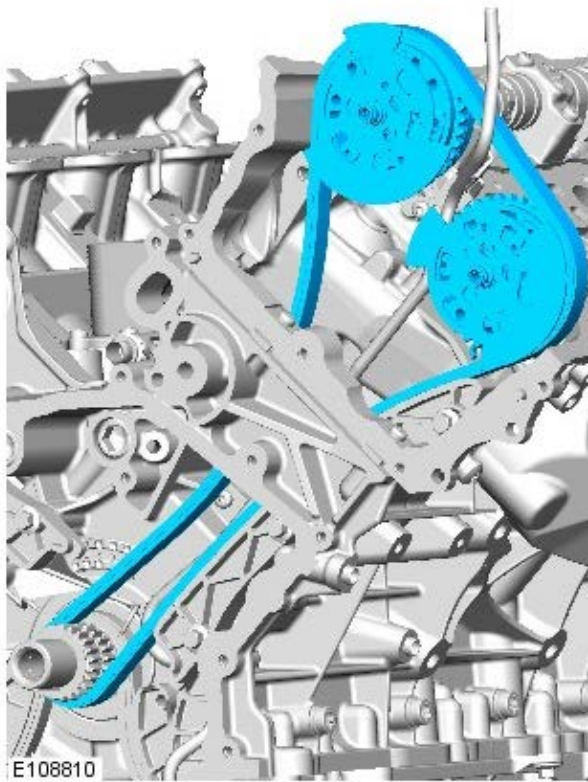
12.



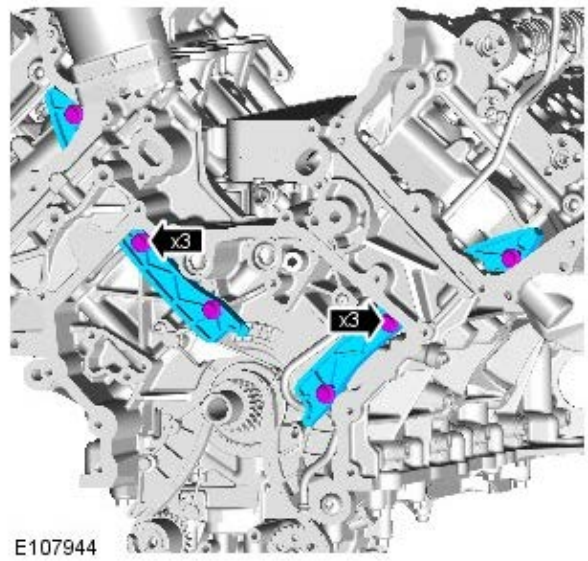
13.



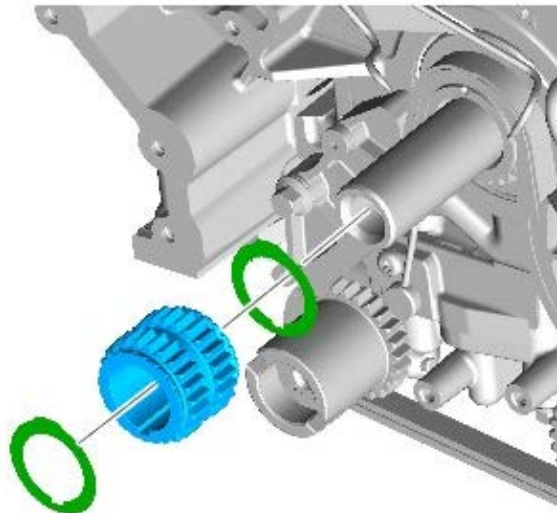
14.  CAUTION: If the VVT is knocked or dropped then the VVT must be replaced.
Remove the timing chain with the VVT units.



15.

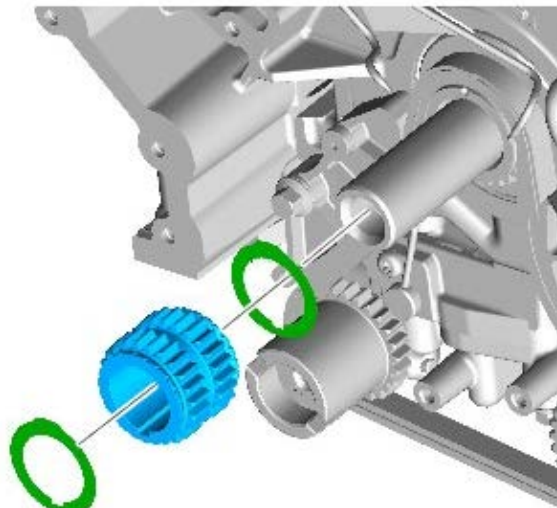


16.  CAUTION: Discard the friction washer.



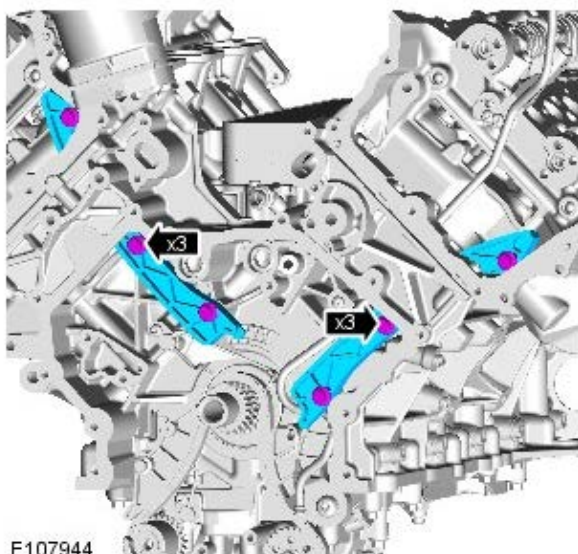
E107945

Installation



E107945

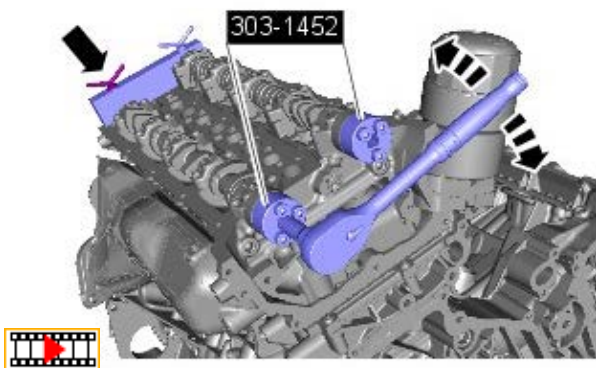
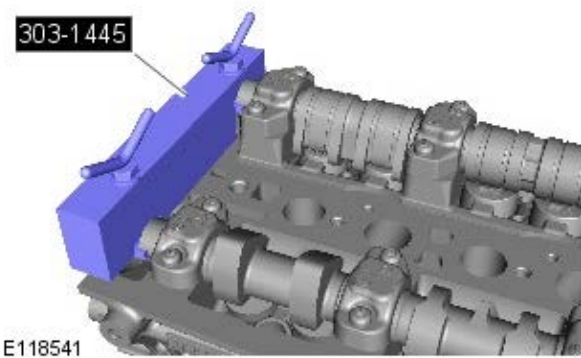
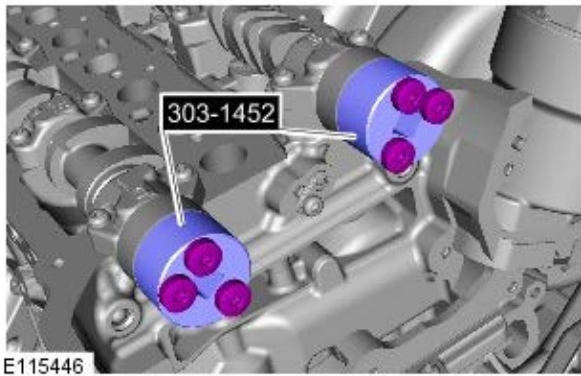
1.  CAUTION: Install a new friction washer.



E107944

2. Torque: 12 Nm

3.
 - Install the special tool to each Camshaft.
 - Special Tool(s): [303-1452](#)
 - Torque: 10 Nm




4.
 - Carefully rotate the camshafts if the position is not as shown.

5.
 - Install the special tool 303-1445 to the rear of the camshafts making sure the key way's are correctly located into each slot on each of the camshafts.

6. CAUTIONS:

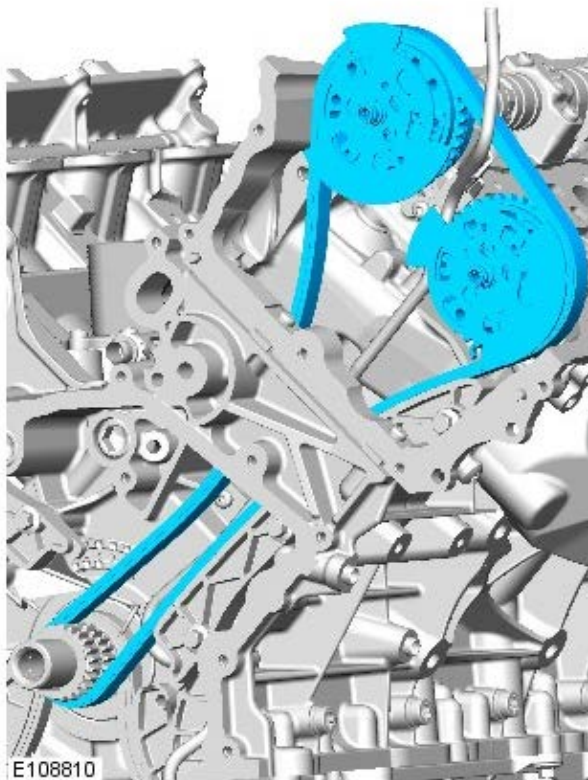
 Do not overturn the camshafts.

 Tighten the wing nuts finger tight. Failure to follow this instruction may result in damage to the components.

- Using a suitable tool, carefully rock the camshaft clockwise then anti-clockwise. Turn the special tool locking nuts until there is no movement left in camshafts.
- Repeat steps 3- 6 for the camshafts on the other cylinder head.

7. CAUTIONS:

 Do not allow the camshaft to rotate.



E108810

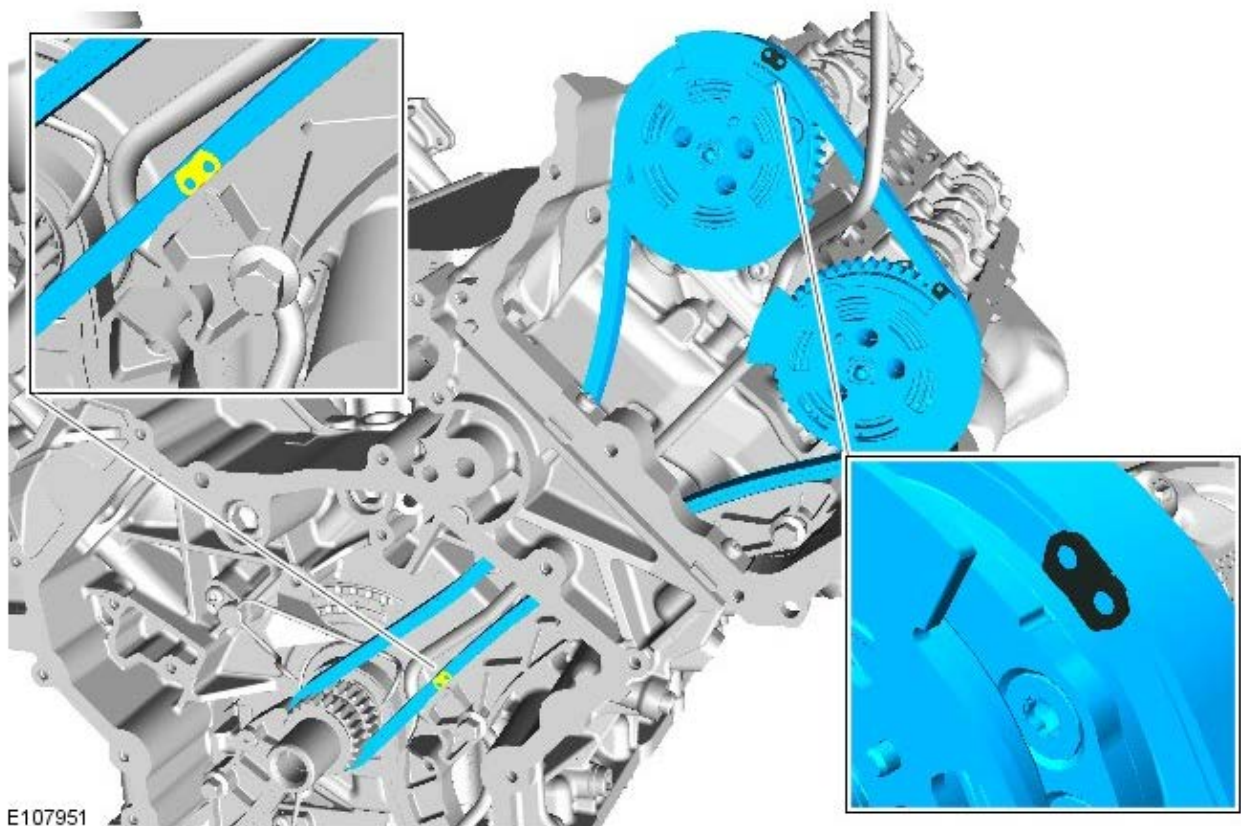
 If the VVT is knocked or dropped then the VVT must be replaced.

 NOTE: Do not tighten at this stage.

- Install the timing chain with the variable valve timing (VVT) units.

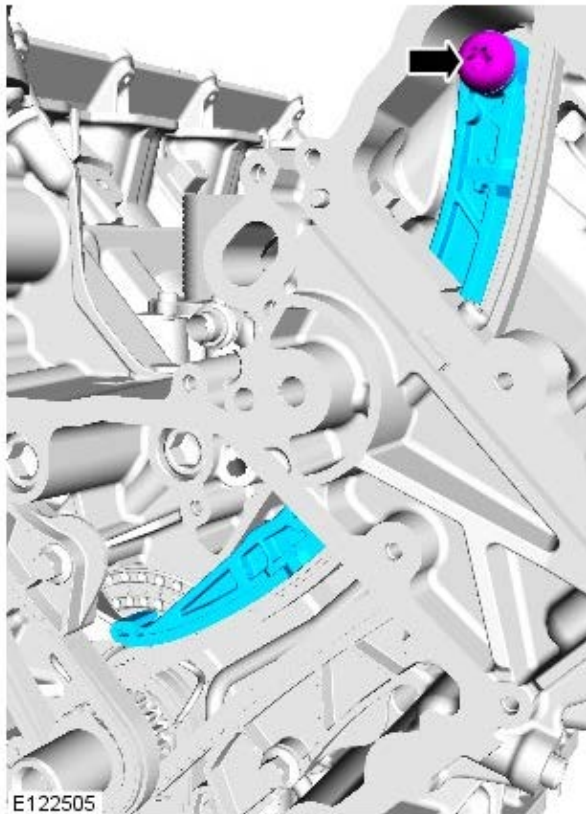
8.

- Make sure that all the timing chain alignment marks are in the positions shown.



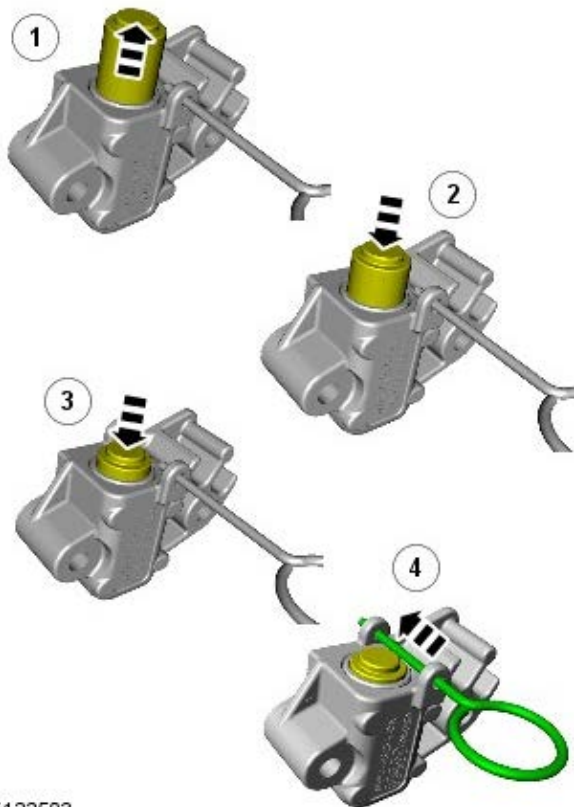
E107951

9. Torque: 25 Nm




E122505

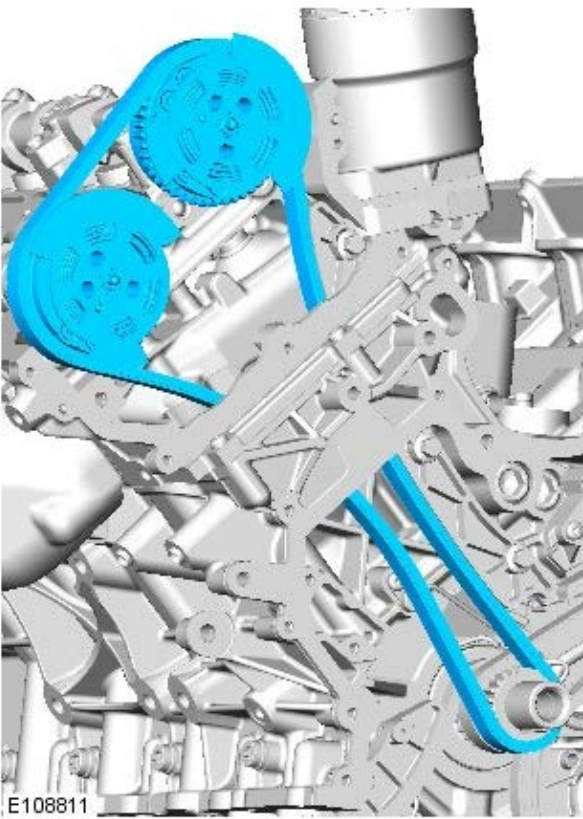
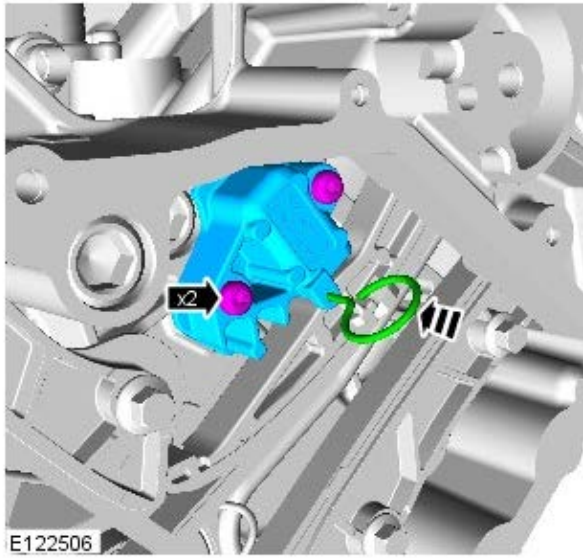
10. Make sure the tensioner piston is fully extended. Then fully depress and lock the tensioner piston with the grenade pin before installation, failure to do this may result in damage to the engine.



E122503

11.  CAUTION: Do not release the timing chain tensioner locking pin at this stage.

Torque: 10 Nm



12. CAUTIONS:



Do not allow the camshafts to rotate.



If the VVT is knocked or dropped then the VVT must be replaced.

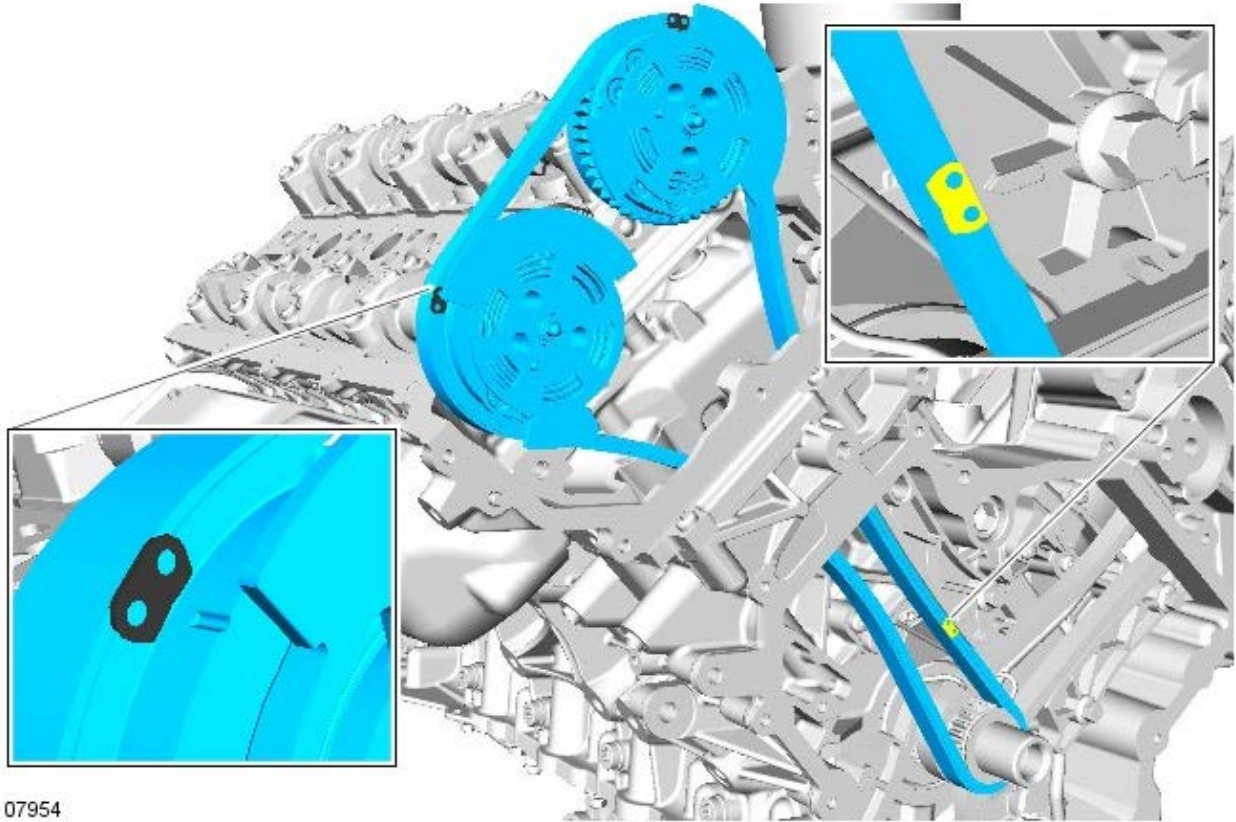


NOTE: Do not tighten at this stage.

- Install the timing chain with the VVT units.

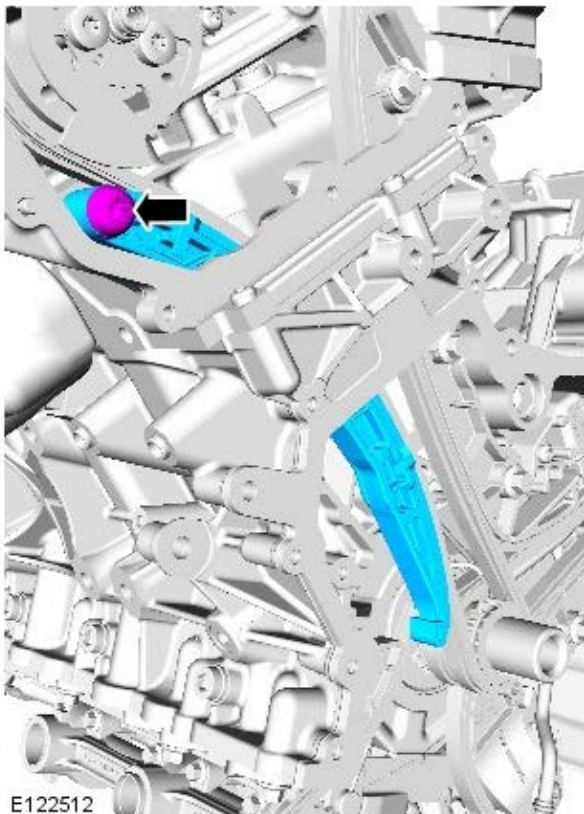
13.

- Make sure that all the timing chain alignment marks are in the positions shown.



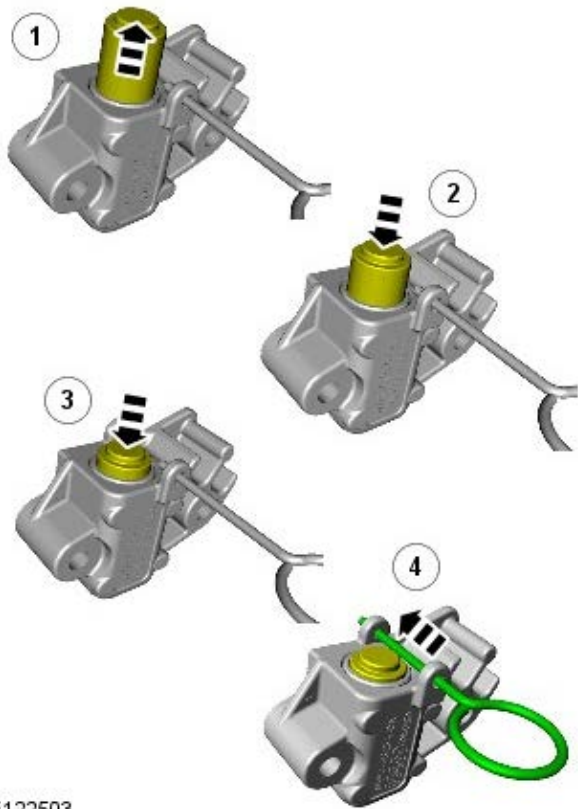
E107954

14. Torque: 25 Nm

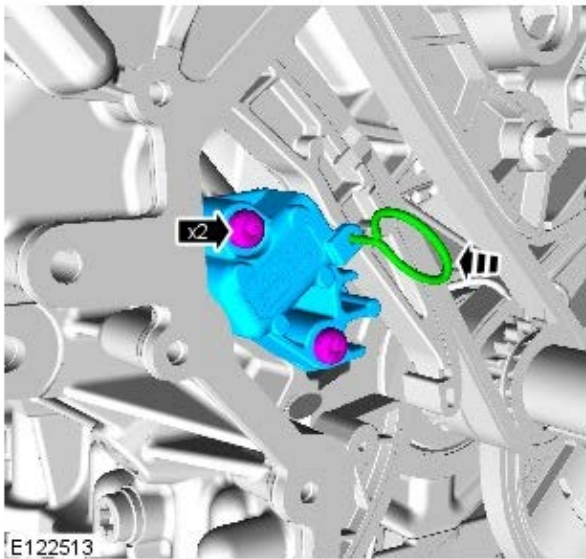


E122512


15. Make sure the tensioner piston is fully extended. Then fully depress and lock the tensioner piston with the grenade pin before installation, failure to do this may result in damage to the engine.



E122503

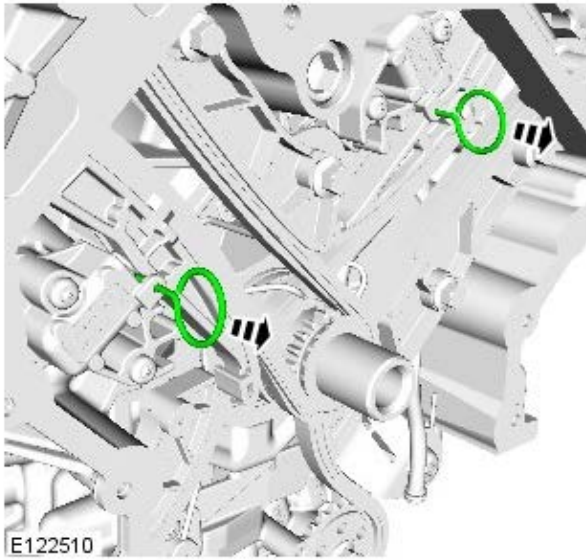



E122513

16.  CAUTION: Do not release the timing chain tensioner locking pin at this stage.

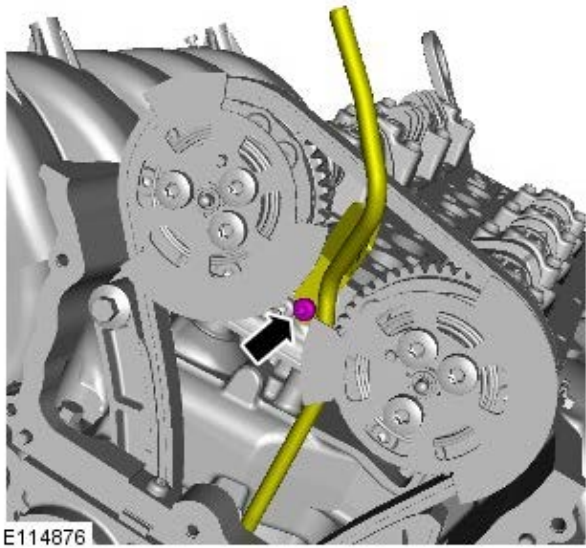
Torque: 10 Nm

- 17.

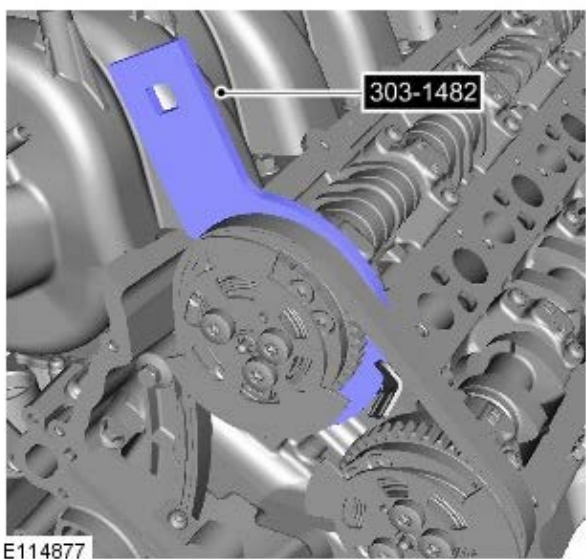


18.  **CAUTION:** Do not use mechanical force.
Make sure that the tensioners are fully deployed.

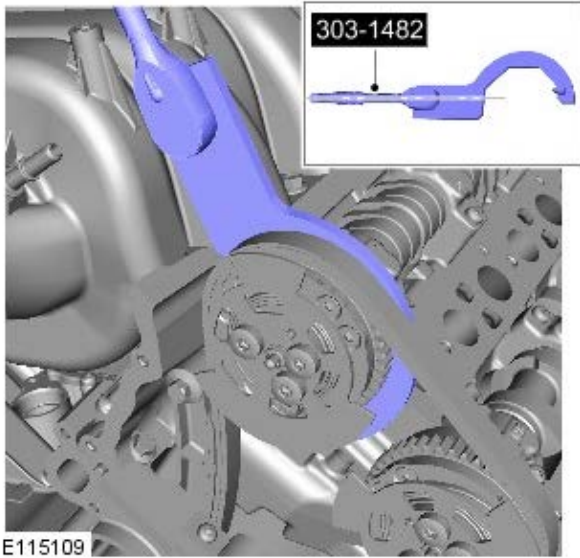
- 19.
- Release and reposition the oil suction tube to one side.



- 20.
- Install the special tool.
 - *Special Tool(s):* [303-1482](#)



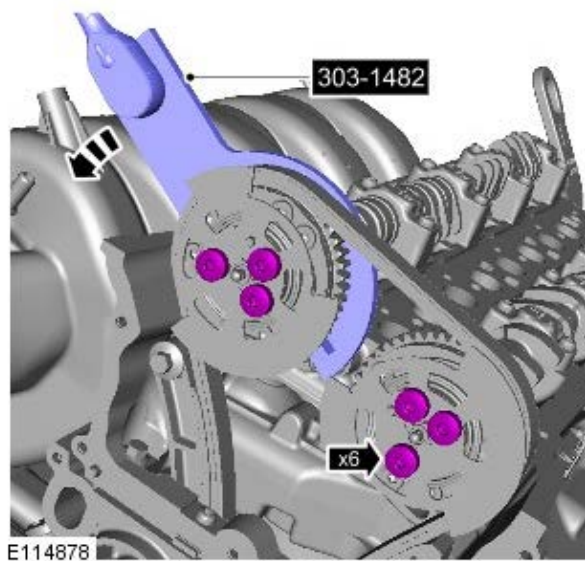
21. **CAUTIONS:**



⚠ Apply the torque to the end of the special tool.

⚠ Make sure that the torque wrench is aligned with the special tool as illustrated in the graphic.

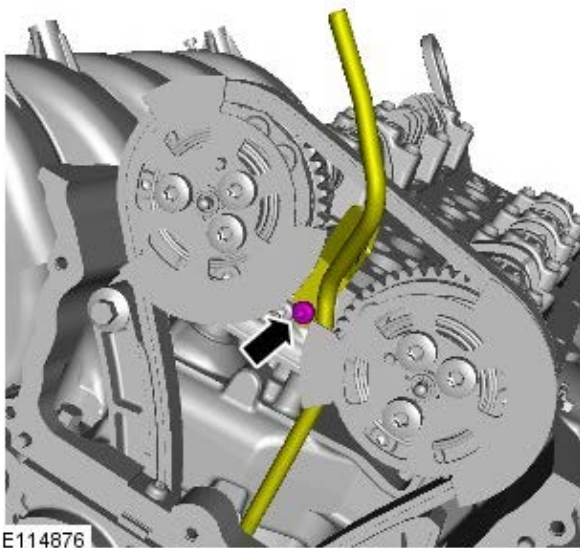
- Install the torque wrench to the special tool.
- *Torque:* 35 Nm



22. ⚠ CAUTION: Make sure that the torque wrench does not move whilst tightening the VVT bolts.

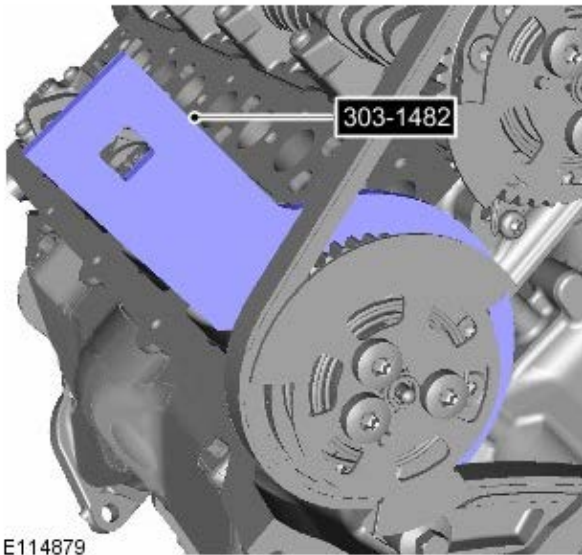
⚠ NOTE: Make sure to tighten the exhaust VVT unit bolts first.

- *Torque:* 32 Nm
- *Special Tool(s):* 303-1482

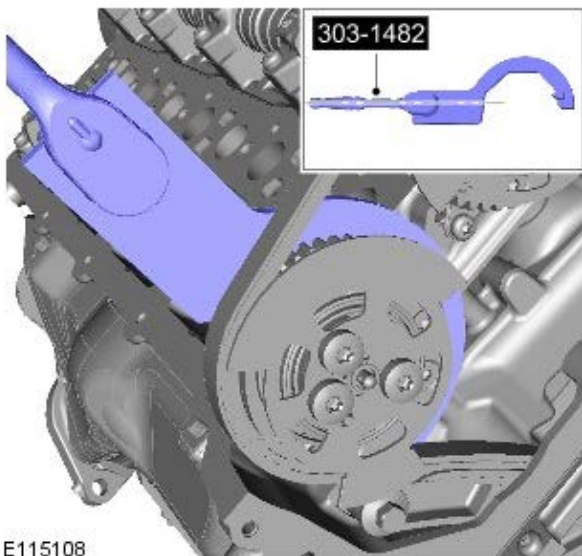


23. • Install the oil suction tube.
• *Torque:* 10 Nm

24. • Install the special tool.
• *Special Tool(s):* 303-1482



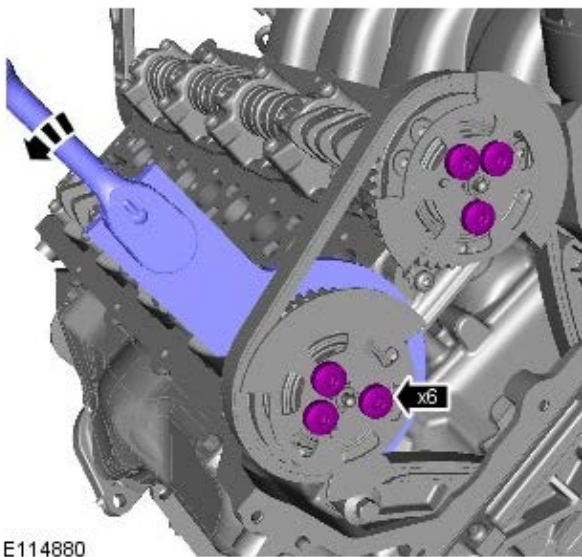
E114879



E115108

25. CAUTIONS:

- ⚠ Apply the torque to the end of the special tool.
- ⚠ Make sure that the torque wrench is aligned with the special tool as illustrated in the graphic.
 - Install the torque wrench to the special tool.
 - Torque: 35 Nm



E114880

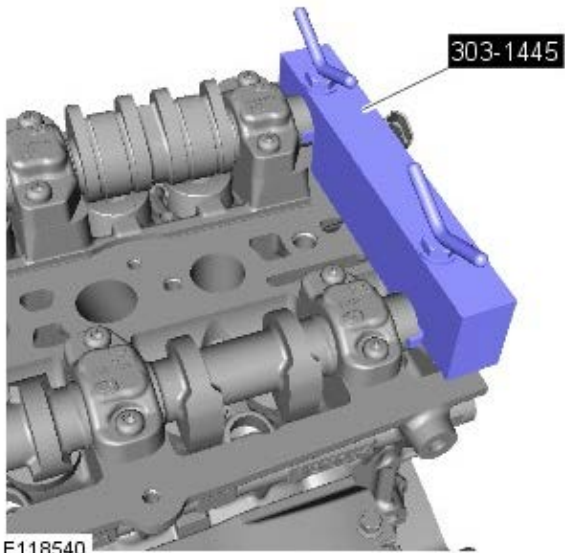
26. ⚠ CAUTION: Make sure that the torque wrench does not move whilst tightening the VVT bolts.

- ⚠ NOTE: Make sure to tighten the inlet VVT unit bolts first.

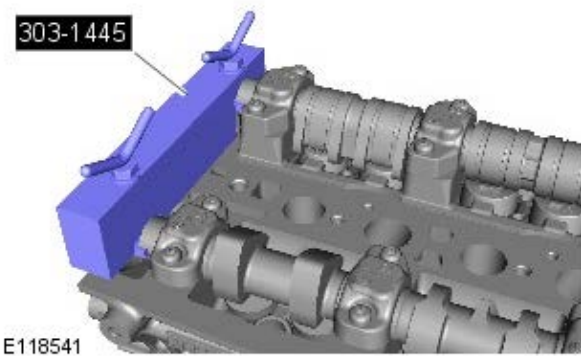
Torque: 32 Nm

27.

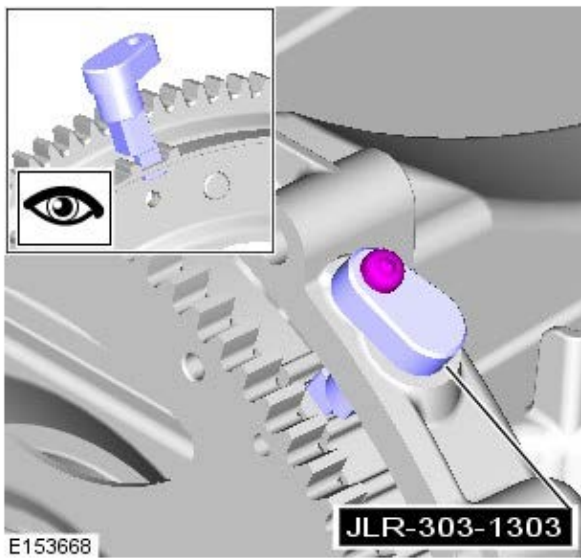
- Remove the special tool.



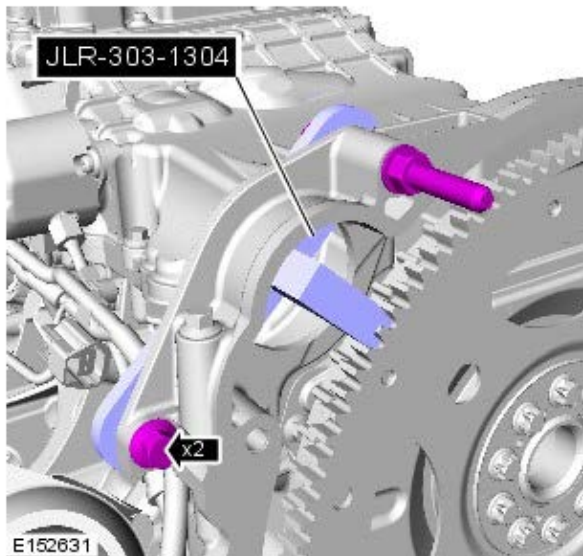
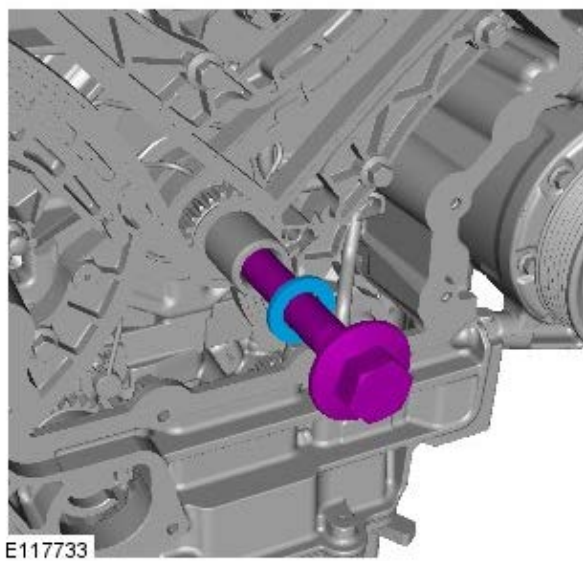
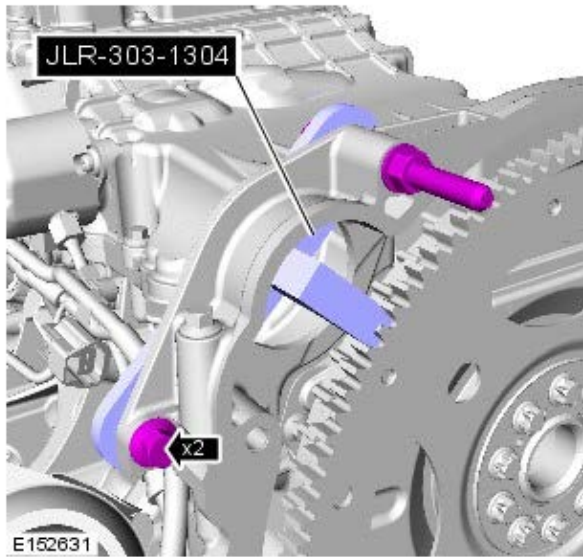
- 28.
- Remove the special tool.




- 29.
- Remove the special tool.
 - *Special Tool(s):* [JLR-303-1303](#)



- 30.
- Install the special tool.
- Special Tool(s):* [JLR-303-1304](#)



31.  CAUTION: Install the crankshaft pulley bolt with an M16 washer to prevent damage to the crankshaft on installation.

Torque: 50 Nm

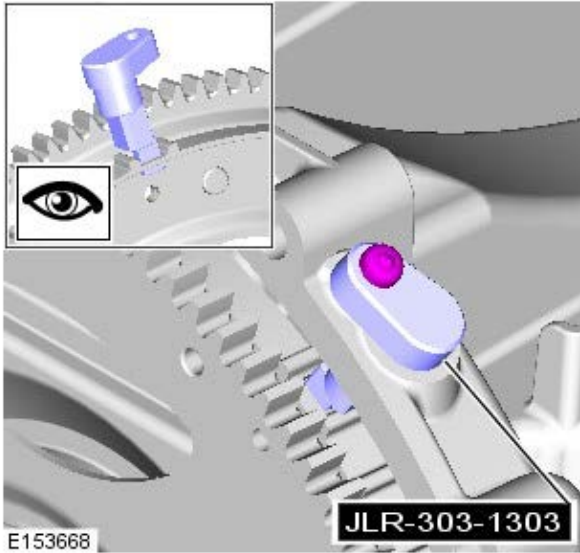
- 32.
- Remove the special tool.

Special Tool(s): [JLR-303-1304](#)

33. Rotate the engine two complete turns clockwise.

34.  CAUTION: Only rotate the crankshaft clockwise.
- Install the special tool.

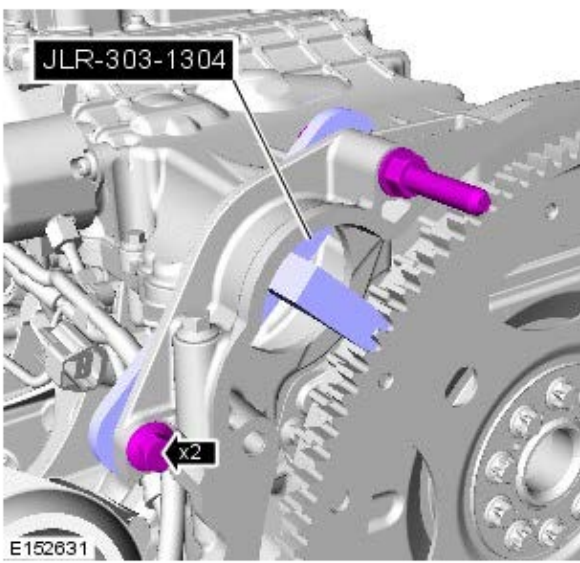
Special Tool(s): [JLR-303-1303](#)



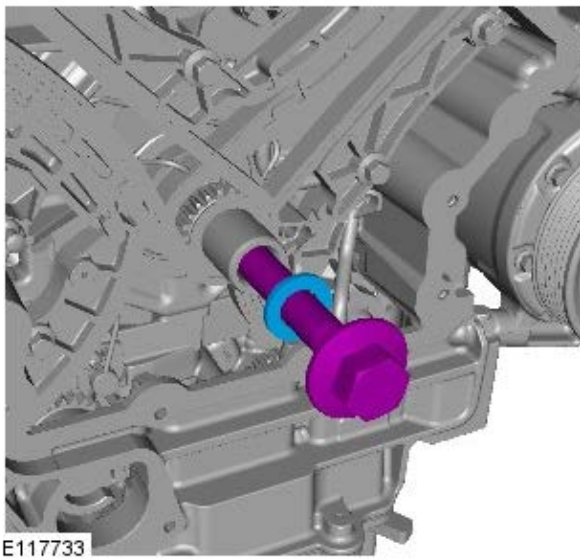
35.

- Install the special tool.

Special Tool(s): [JLR-303-1304](#)



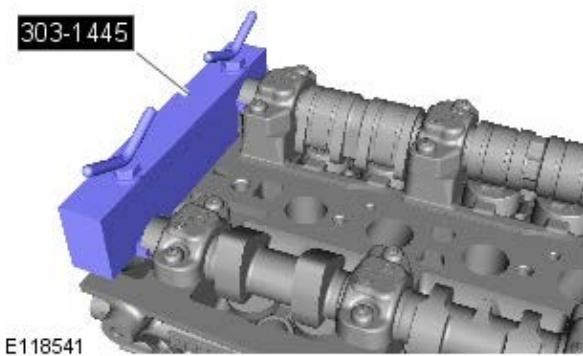
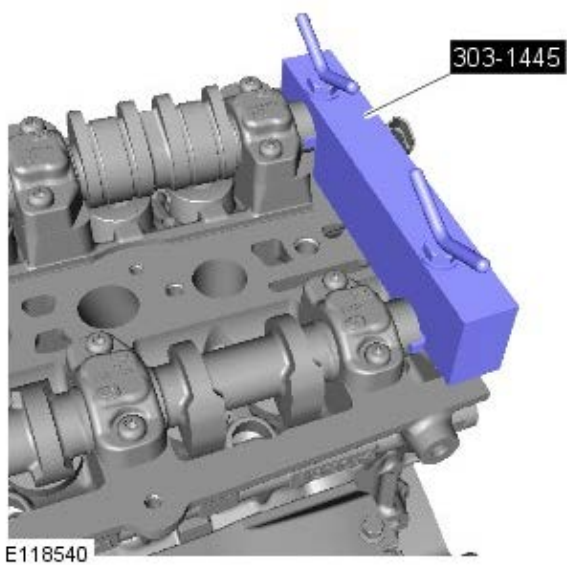
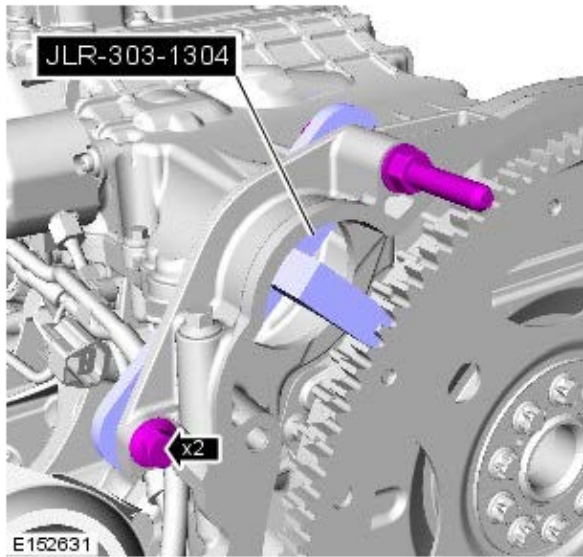
36.




37.


- Remove the special tool.

Special Tool(s): [JLR-303-1304](#)




38. CAUTIONS:

 If the special tool cannot be installed, return to step 22 of the installation until the special tool 303-1445 is installed correctly.

 If directed to step 22, make sure that the VVT unit retaining bolts are loosened prior to installing the special tool(s).

Install the special tool.

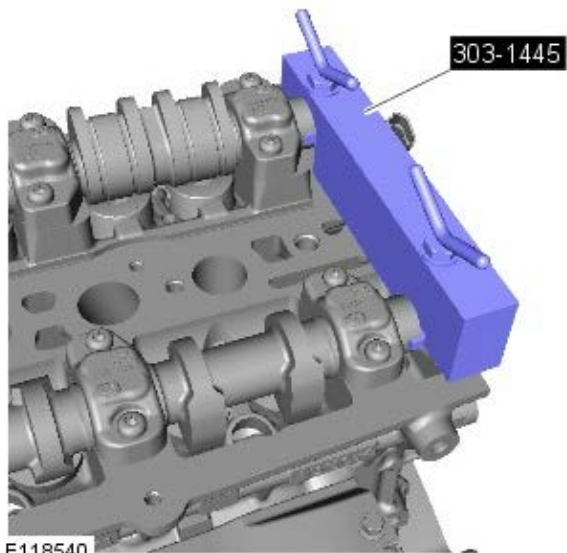
Special Tool(s): [303-1445](#)

39.  CAUTION: If the special tool cannot be installed, the timing chain installation steps must be repeated.

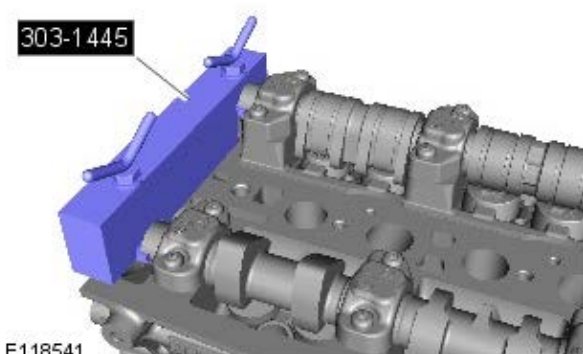
Install the special tool.

40.

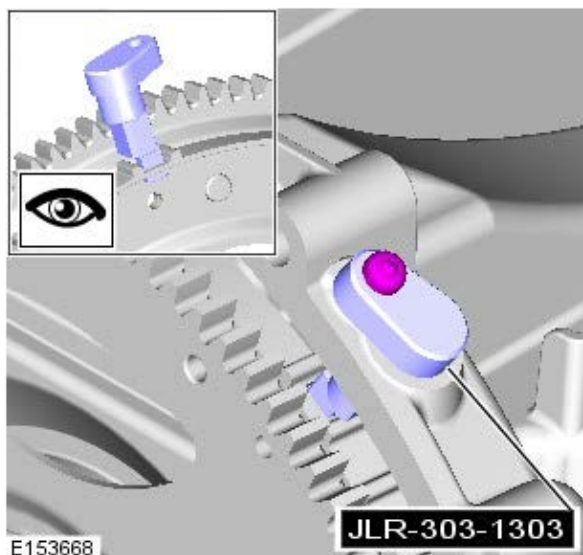
- Remove the special tool.



E118540



E118541



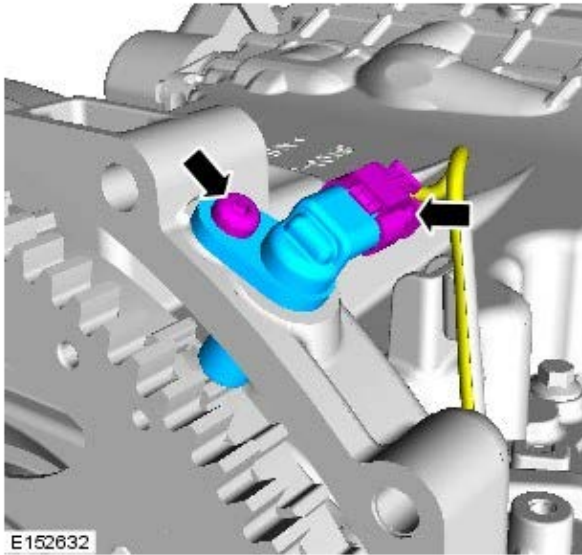
E153668

- 41.
- Remove the special tool.

- 42.
- Remove the special tool.

Special Tool(s): [JLR-303-1303](#)

43. Torque: 10 Nm



44. Refer to: [Timing Cover](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).


45. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - V6 S/C 3.0L Petrol - Valve Cover LH

Removal and Installation

Special Tool(s)

 <p>E116982</p>	<p>303-1446 Valve Cover Alignment Tool</p>
--	--

Removal

NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.



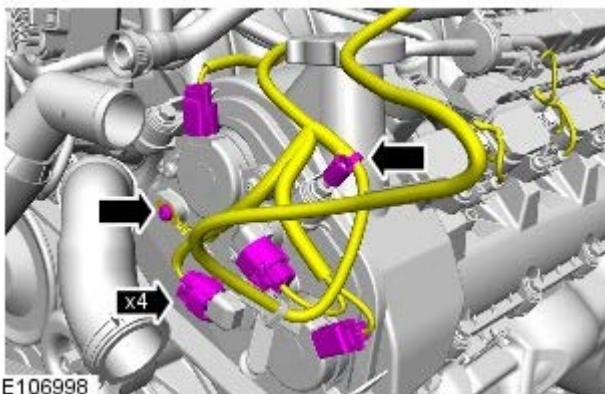
Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

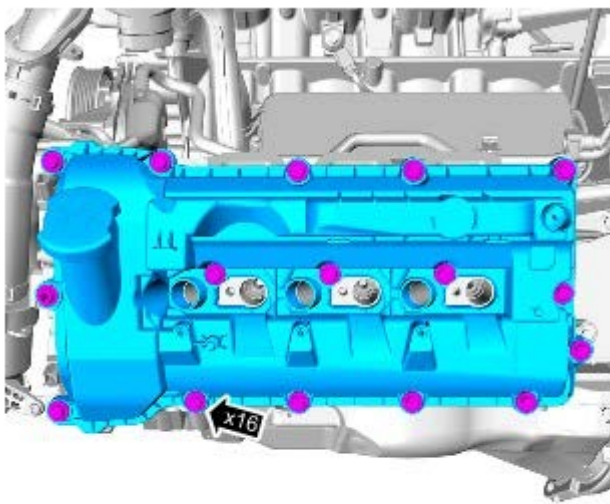
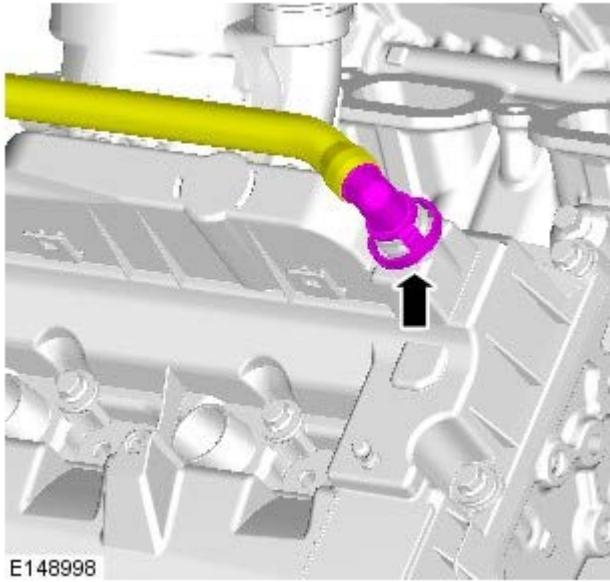
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: [Supercharger](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
3. Refer to: [Air Cleaner Outlet Pipe LH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
4. Refer to: [Fuel Rail LH](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Removal and Installation).

5. *Torque:* 10 Nm

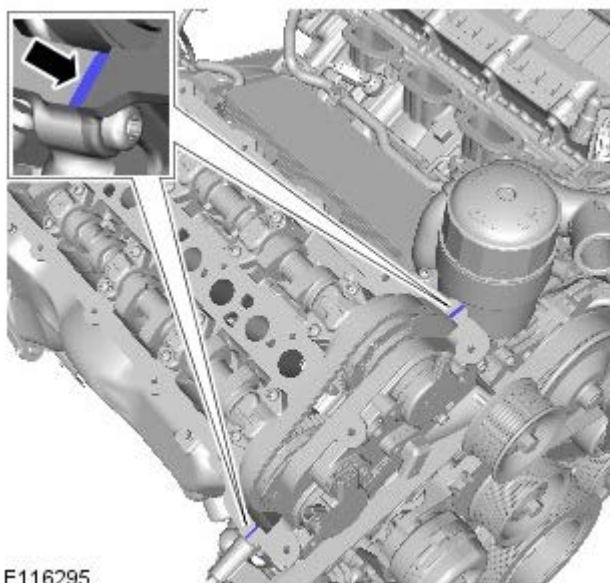


- 6.



E148967


Installation




E116295


7.

1. CAUTIONS:


 Use only a plastic scraper when removing the sealing material.

 Use lint free cloth.

 Make sure that the mating faces are clean and free of corrosion and foreign material.

 Installation of the valve cover and tightening must be carried out within 7 minutes of applying the sealant.

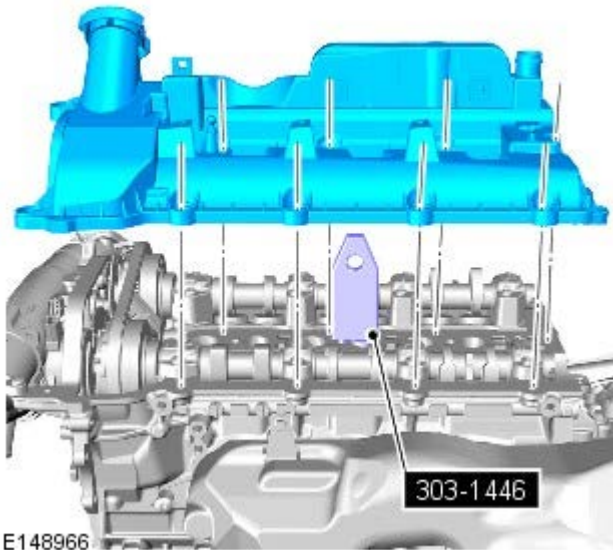
NOTES:

 Apply two beads of silicone gasket sealant (Loctite 5901) as shown on the illustration. The application of the sealant must be 1.5mm diameter 12mm long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head

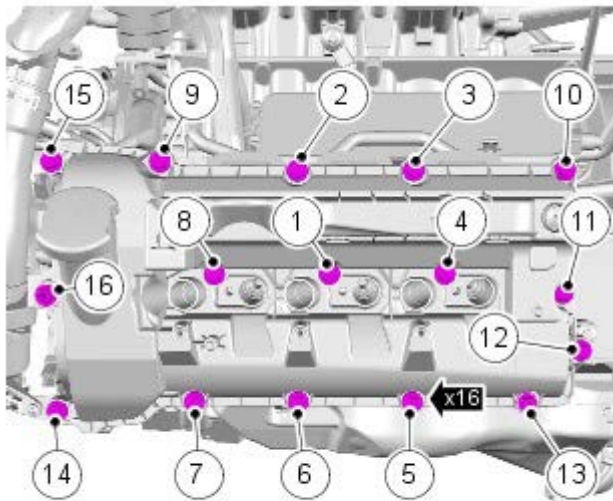
without smearing the sealant or the seals.

 Right-hand shown, Left-hand similar.

2. *Special Tool(s)*: [303-1446](#)



E148966

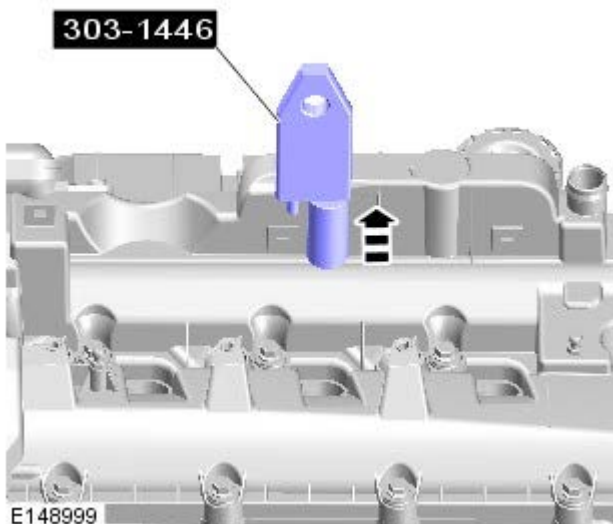


E148968

3.  **NOTE:** Tighten the bolts in the indicated sequence.

Torque: 13 Nm

4. *Special Tool(s)*: [303-1446](#)




E148999

5. To install, reverse the removal procedure.

Engine - V6 S/C 3.0L Petrol - Valve Cover RH

Removal and Installation

Special Tool(s)

 <p>E116982</p>	<p>303-1446 Valve Cover Alignment Tool</p>
--	--

Removal

NOTES:



Removal steps in this procedure may contain installation details.



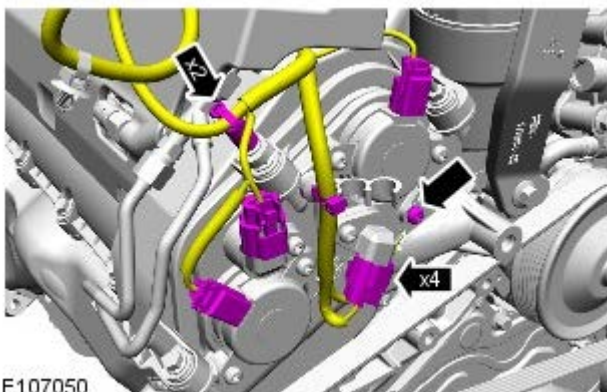
Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

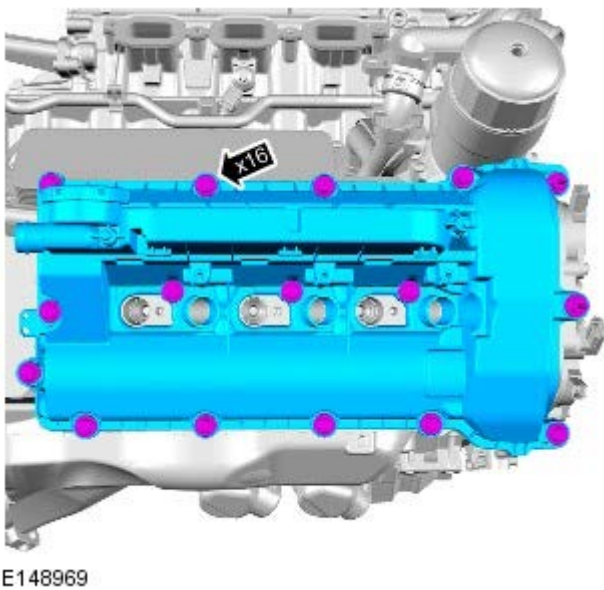
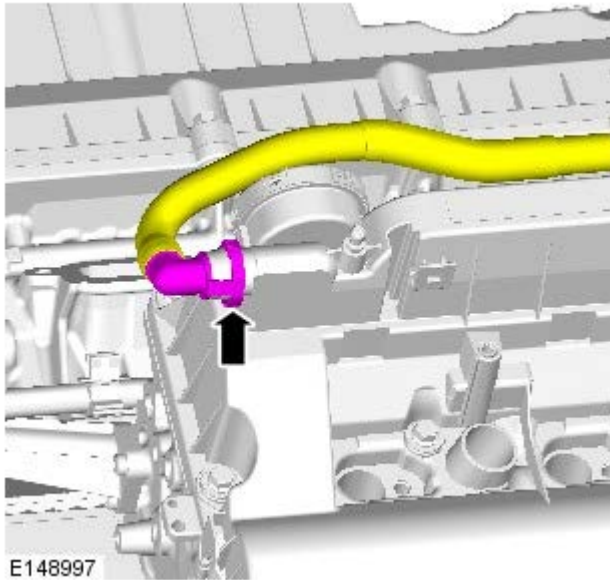
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: [Supercharger](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
3. Refer to: [Air Cleaner Outlet Pipe RH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
4. Refer to: [Fuel Rail RH](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Removal and Installation).

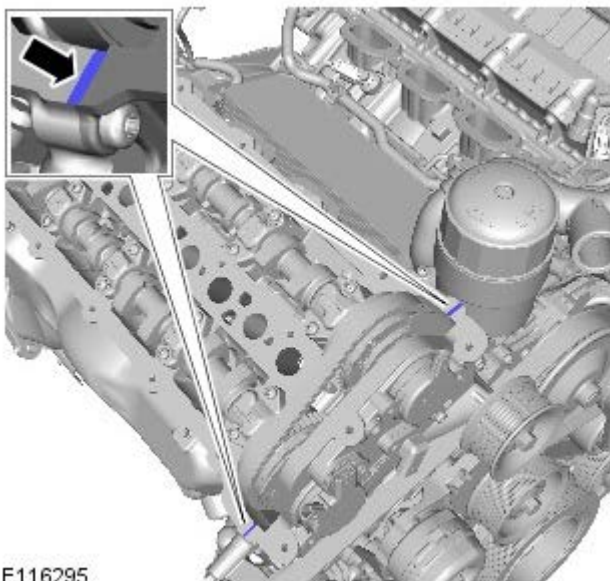
5.



6.




Installation





7.


1. CAUTIONS:

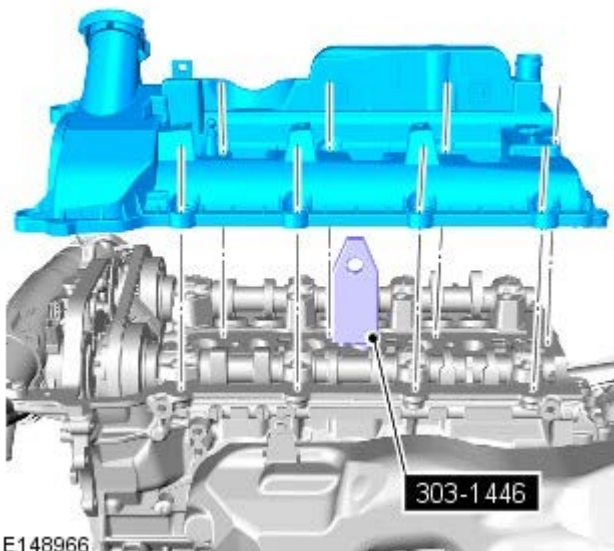
 Use only a plastic scraper when removing the sealing material.


 Use lint free cloth.

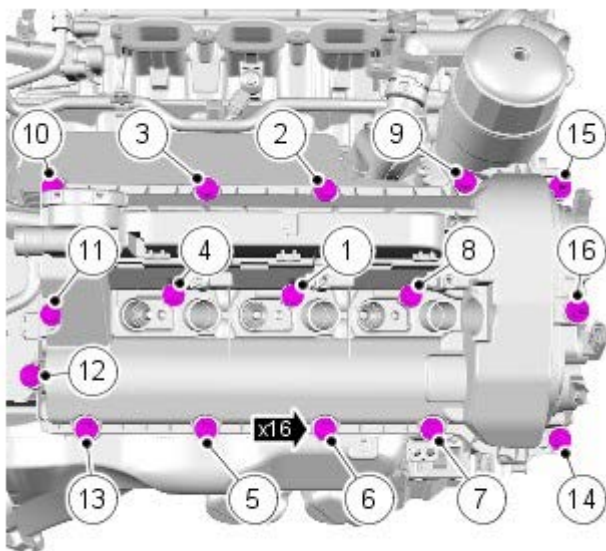
 Make sure that the mating faces are clean and free of corrosion and foreign material.


 Installation of the valve cover and tightening must be carried out within 7 minutes of applying the sealant.

 **NOTE:** Apply two beads of silicone gasket sealant (Loctite 5901) as shown on the illustration. The application of the sealant must be 1.5mm diameter 12mm long. Install the valve cover immediately after applying the sealant. The cover should be fitted directly to the head without smearing the sealant or the seals.

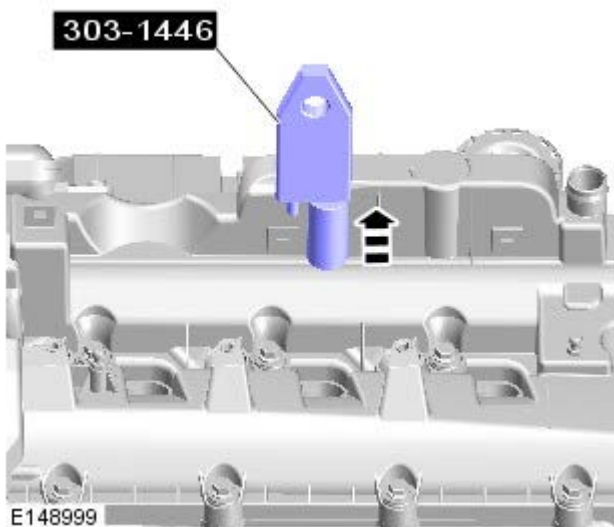


2.  NOTE: LH illustration shown, RH is similar
Special Tool(s): [303-1446](#)



3.  NOTE: Tighten the bolts in the indicated sequence.
Torque: 13 Nm

E148981



4.  NOTE: LH illustration shown, RH is similar.
Special Tool(s): [303-1446](#)

5. To install, reverse the removal procedure.

Engine - V6 S/C 3.0L Petrol - Fuel Pump Camshaft

Removal and Installation


Removal



NOTE: Some illustrations may show the engine removed for clarity.

1. Disconnect the battery ground cable.

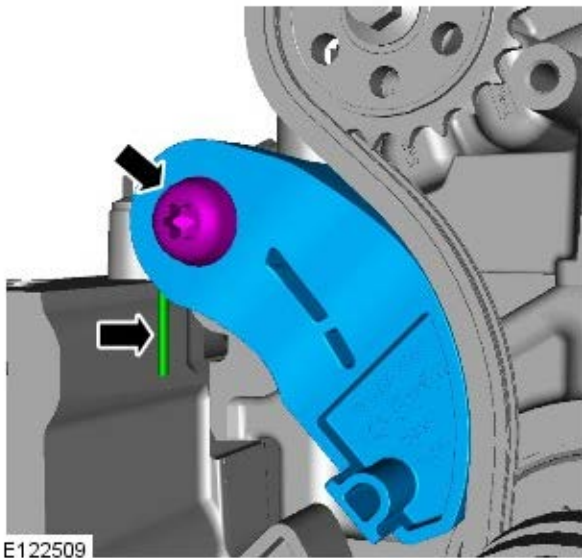
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

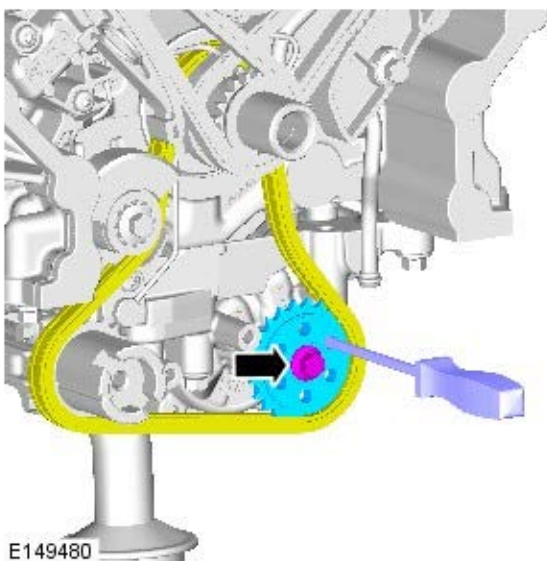
Raise and support the vehicle.

3. Refer to: [Oil Pan Extension](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).

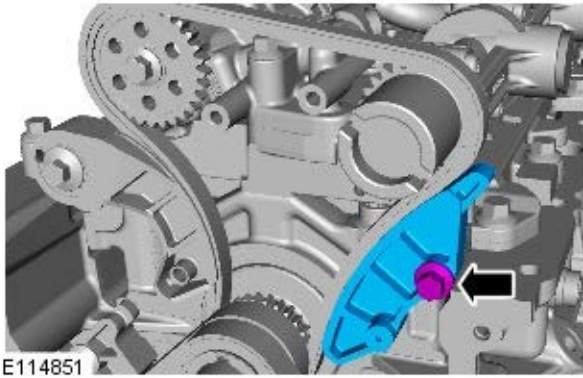
4.




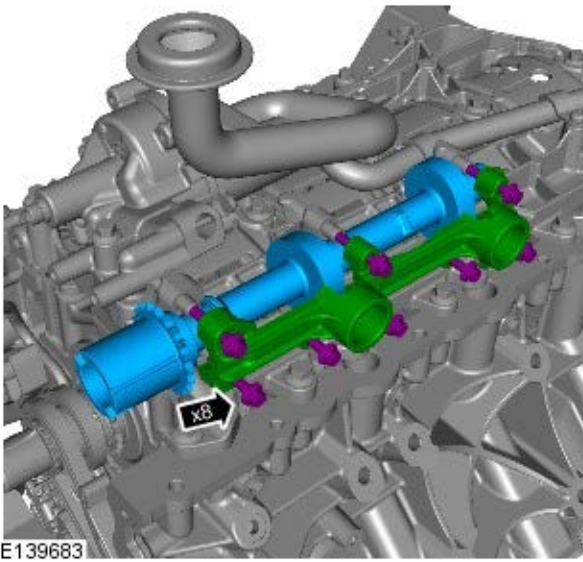
5.




6.

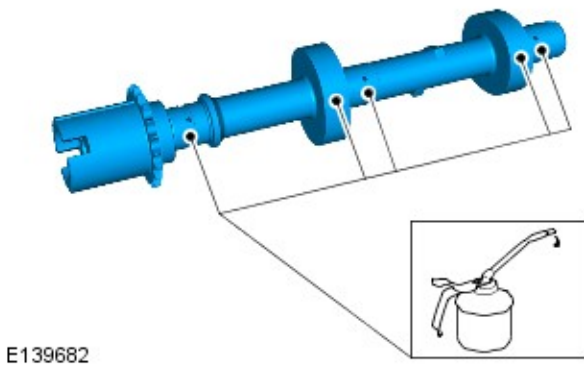


7.  CAUTION: Take extra care when removing the component, prevent damage to the mating faces.



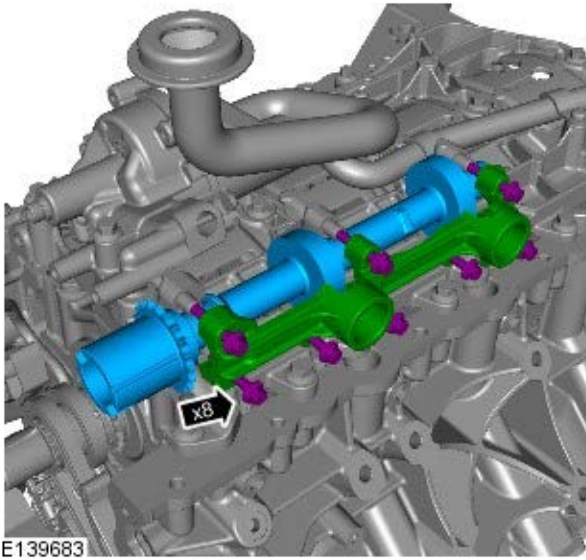
Installation

1.  CAUTION: Make sure that the mating faces are clean and free of foreign material.



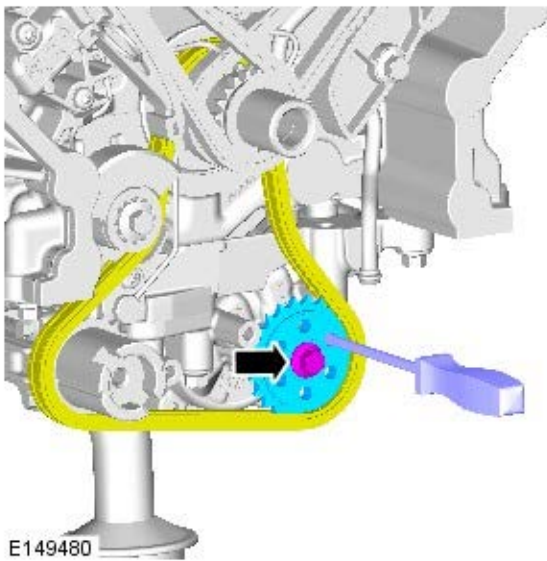
2.  CAUTION: Take extra care not to damage the mating faces.

Torque: 12 Nm



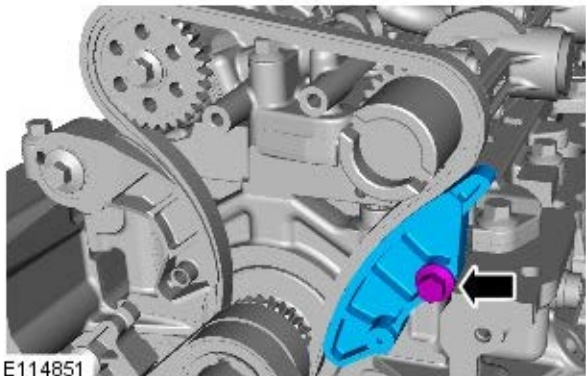
E139683

3. Torque: 21 Nm



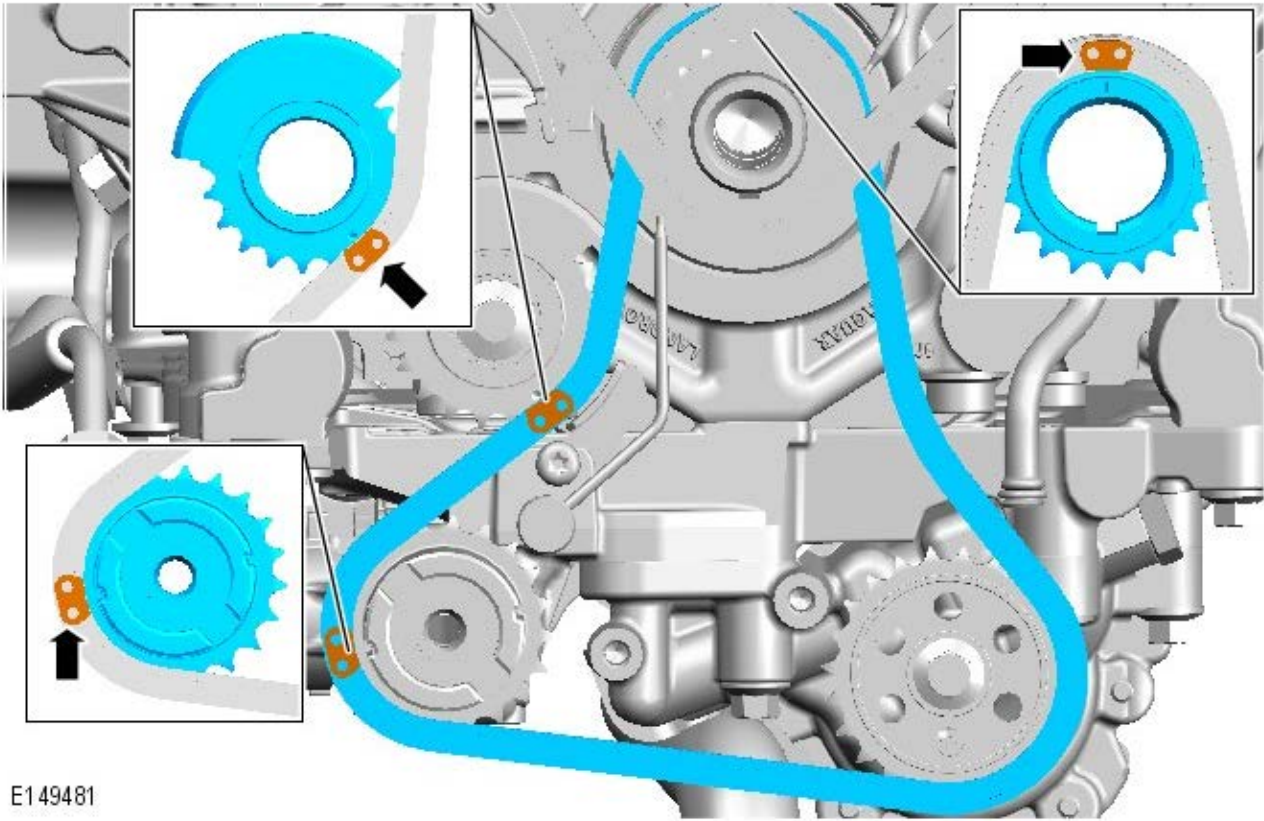
E149480

4. Torque: 12 Nm




E114851

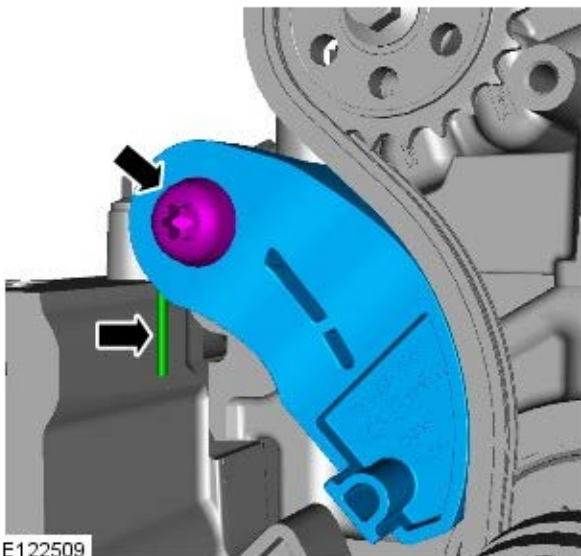
5. Install the lower timing chain making sure the coloured chain links align correctly with the fuel rail high-pressure fuel pumps camshaft and crankshaft sprocket markings.



E149481

6.  CAUTION: Make sure that the tensioner spring is correctly located.

Torque: 21 Nm



E122509


7. Refer to: [Oil Pan Extension](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
8. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Engine - V6 S/C 3.0L Petrol - Lower Timing Cover

Removal and Installation

Special Tool(s)

 <p>E107676</p>	<p>303-1433 Lower Timing Cover Alignment tool</p>
--	---

Removal

NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.



Engine shown removed for clarity.

1. Disconnect the battery ground cable.

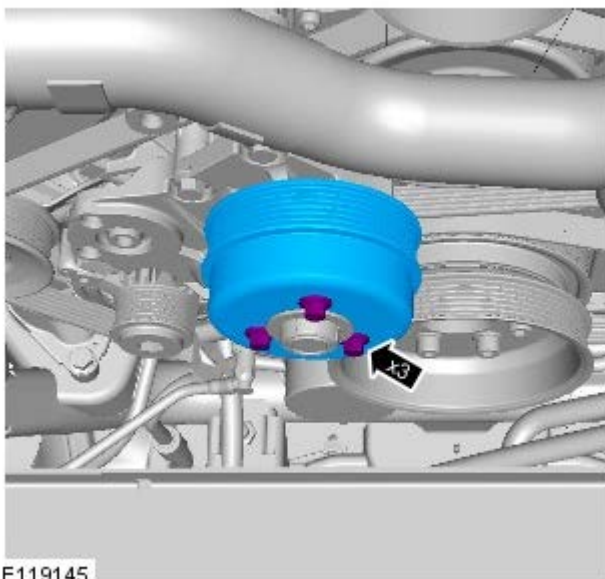
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

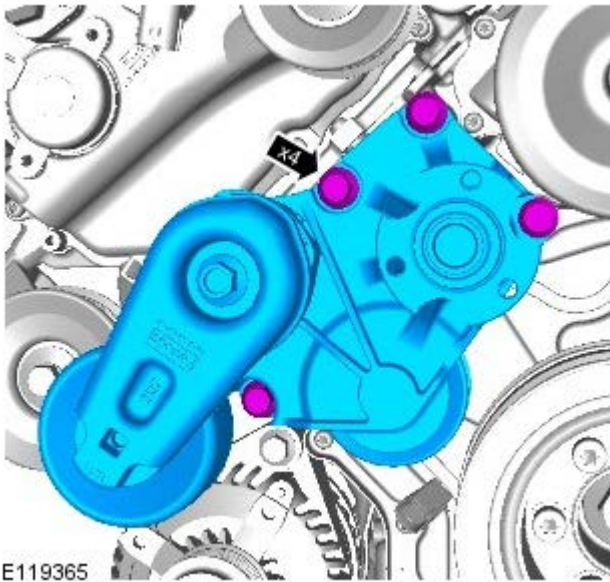
3. Refer to: [Crankshaft Pulley](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
4. Refer to: [Brake Vacuum Pump - V6 S/C 3.0L Petrol](#) (206-07 Power Brake Actuation, Removal and Installation).

5.

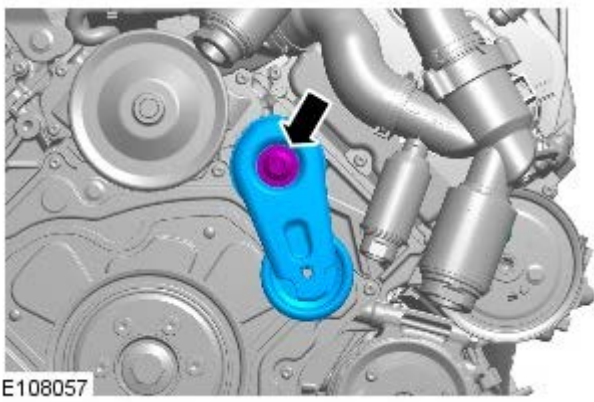


E119145

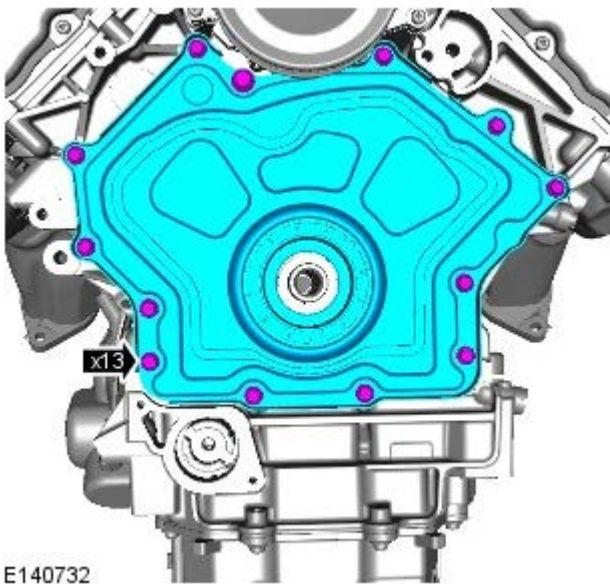
6.



7.

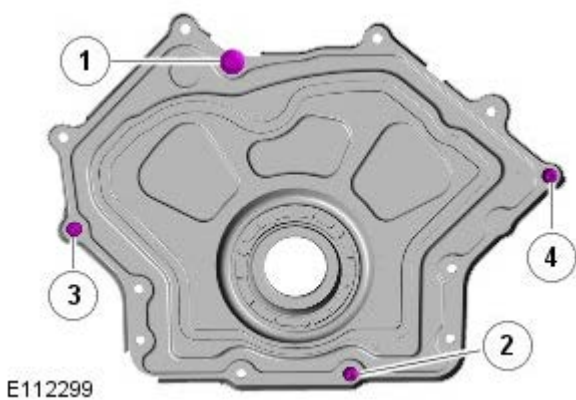
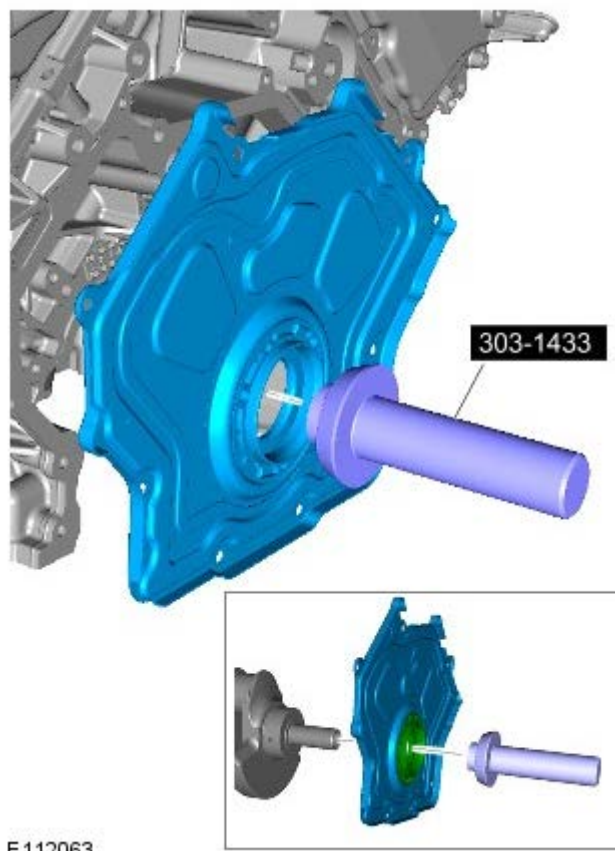
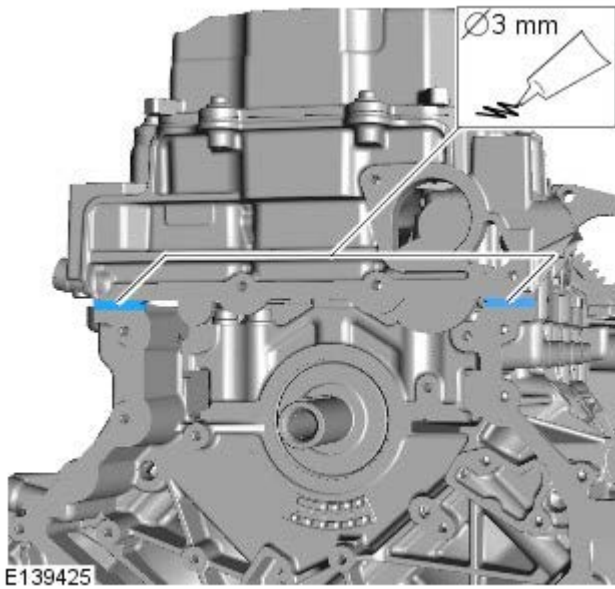



8.



Installation

1. Apply RTV sealant WSE-M4G323-A6 (Loctite 5901G) to the areas shown, and tighten the bolts within 7 minutes.



2.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Install the bolts, but do not tighten fully at this stage.

Special Tool(s): [303-1433](#)

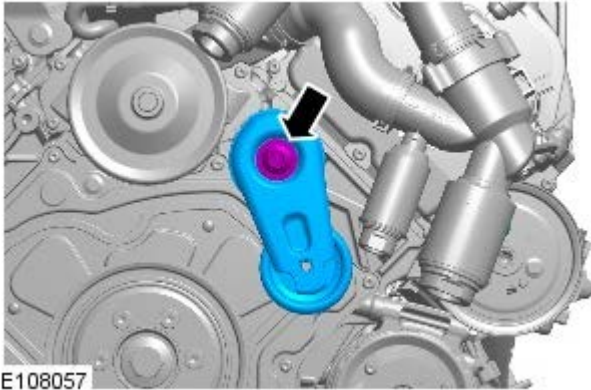
3. Torque:
M6 12 Nm
M8 20 Nm

4. Torque: 12 Nm



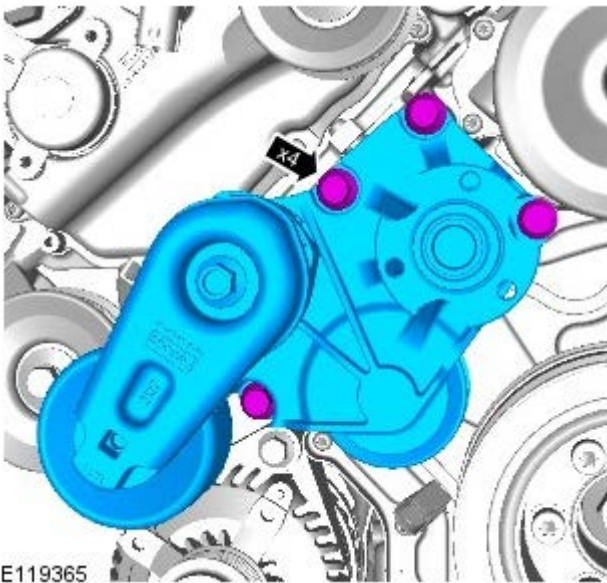
E112300

5. Torque: 40 Nm



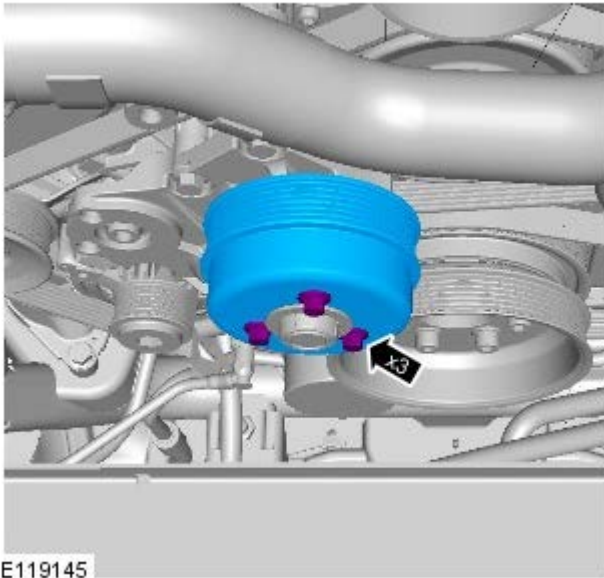
E108057

6. Torque: 25 Nm




E119365

7. Torque: 25 Nm



8. Refer to: [Brake Vacuum Pump - V6 S/C 3.0L Petrol](#) (206-07 Power Brake Actuation, Removal and Installation).
9. Refer to: [Crankshaft Pulley](#) (303-01B Engine - V6 S/C 3.0L Petrol, Removal and Installation).
10. Connect the battery ground cable.

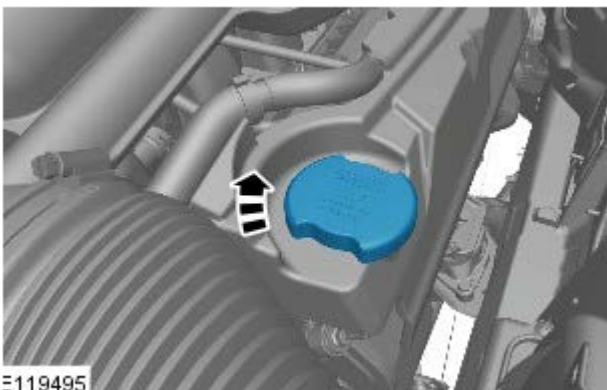
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).


11.  **CAUTION:** Make sure that the vehicle is left for 5 minutes from filling with oil and that the engine oil level is reading at least minimum (by following steps 12 to 20), before starting the engine.

Fill the engine with oil.


Refer to: [Specifications](#) (303-01B Engine - V6 S/C 3.0L Petrol, Specifications).


12. Clean any residual engine oil from the oil filler cap area.



13.  **CAUTION:** Make sure that the vehicle has been left for 5 minutes from filling with oil.
 - Start the engine and allow to run for 10 minutes, stop the engine.
 - Check for leaks.

14. **CAUTIONS:**

 Make sure that the selector lever and the gearshift mechanism are in the park (P) position.

 Make sure that the hood is open.

- Set the ignition to the ON position.

15.

- Press the right-hand directional button to access the instrument cluster menu.



E123926

16.

- Press the right-hand OK button.



E123925

17.

- Press the right-hand directional button to access the Oil Level Display.



E123927

18.

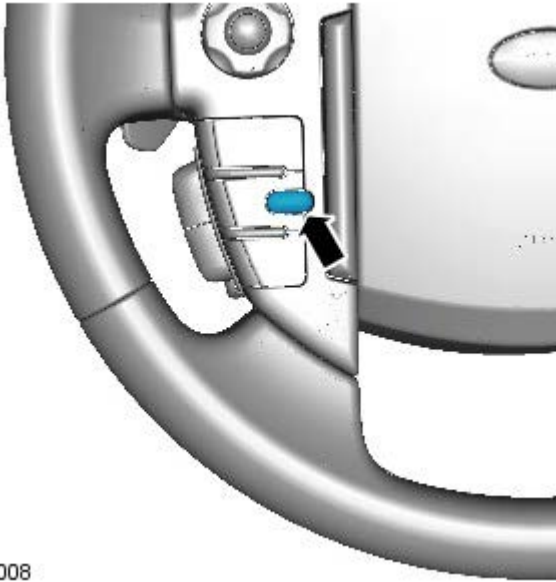
- Press the right-hand OK button and follow the instructions.



E123928

19.

- Press the cruise control cancel button twice within 2 seconds.



E121008



E123929

20.

- The message center display will revert to the normal display in the trip computer.
- Press the right-hand OK button and follow the instructions.
- Check that the oil level display shows an oil level reading.
- Take a reading from the level display and, if necessary, top up with oil as instructed.

21. Turn the ignition off.

22.  **NOTE:** Allow 10 minutes for the engine oil level to stabilize if there has been additional oil top up.

- Turn the ignition on.

23.

- Press the right-hand directional button to access the instrument cluster menu.



E123926

24.

- Press the right-hand OK button.



E123925

25.

- Press the right-hand directional button to access the Oil Level Display.



E123927

26.

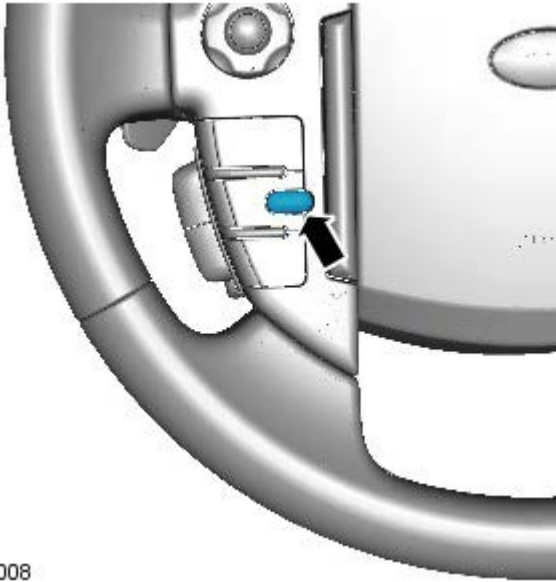
- Scroll through the trip menu to access the engine oil level display.



E123929

27.


- Press the cruise control cancel button twice within 2 seconds.



E121008



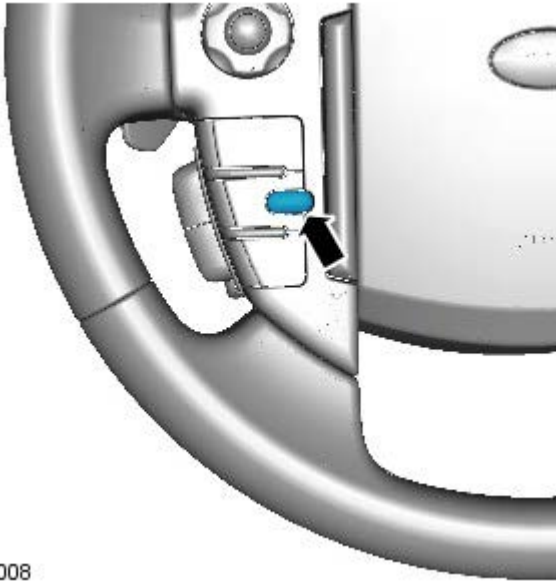
E123929

28.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

- The message center display will revert to the normal display in the trip computer.
- Scroll through the trip menu to access the engine oil level display.
- This display is now the live reading of the engine oil level.
- Take a reading from the level display and, if necessary, top up with oil as instructed.

29.

- Press and hold the cruise control cancel button for more than 2 seconds.




E121008

30.
 - The message center display will revert to the normal display in the trip computer.

31. Turn the ignition off.

32. Turn the ignition on.



33.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

- Scroll through the trip menu to access the engine oil level display.
- Make sure that the average oil level value has now been updated.



E123929

34. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

Engine - V6 S/C 3.0L Petrol - Engine

Removal

Special Tool(s)

 <p>303-1142</p> <p>E46076</p>	<p>303-1142 Viscous Coupling Wrench</p>
 <p>303-1143</p> <p>E55382</p>	<p>303-1143 Viscous Coupling Holding Tool</p>
 <p>E115255</p>	<p>303-1435 Engine Lifting Brackets Rear</p>
 <p>E115254</p>	<p>303-1436 Engine Lifting Bracket Front</p>


NOTES:



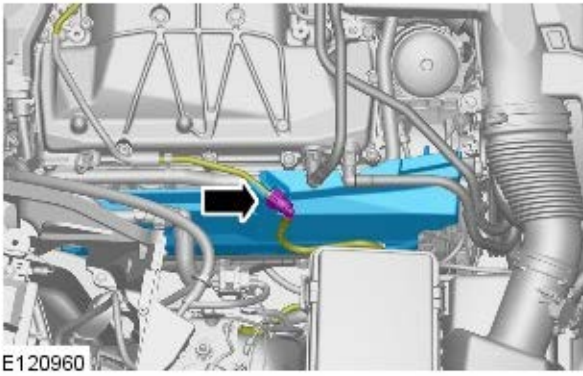
Some variation in the illustrations may occur, but the essential information is always correct.



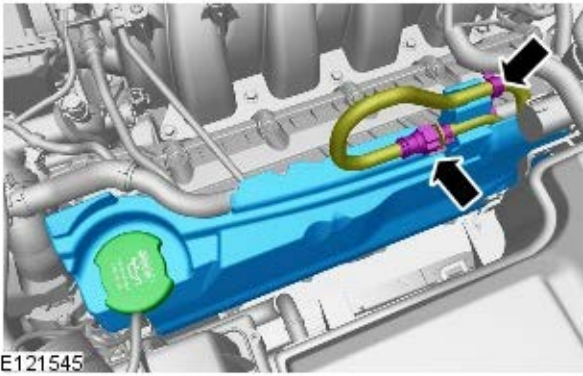
Some components shown removed for clarity.


-  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
- Refer to: [Body - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).

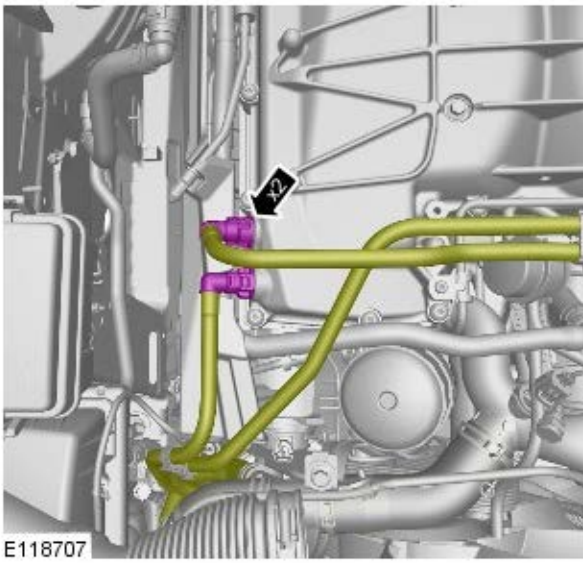
3.




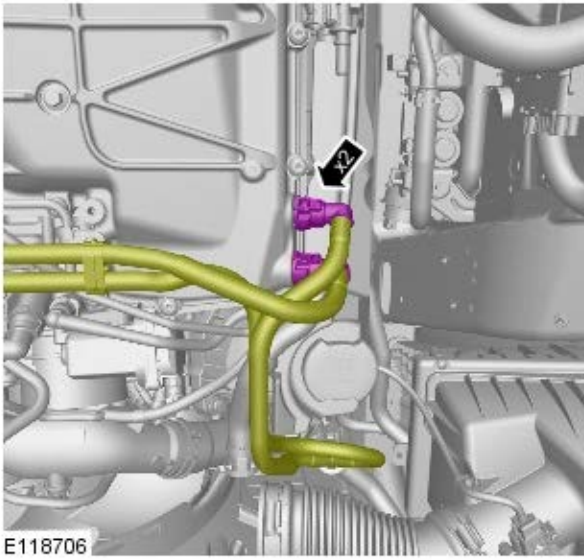
4.



5.  WARNING: Be prepared to collect escaping fluids.

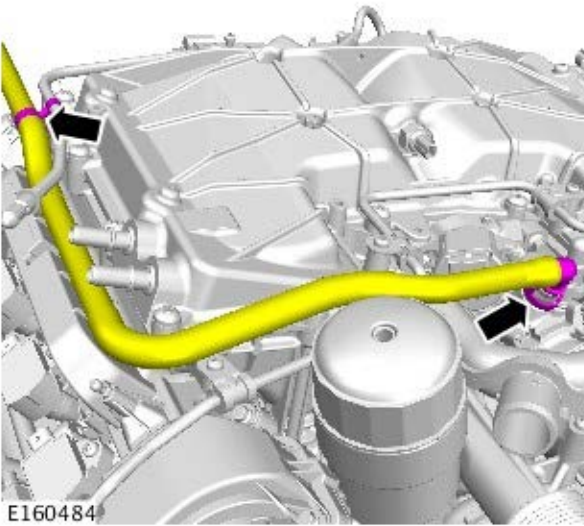


6.  WARNING: Be prepared to collect escaping fluids.



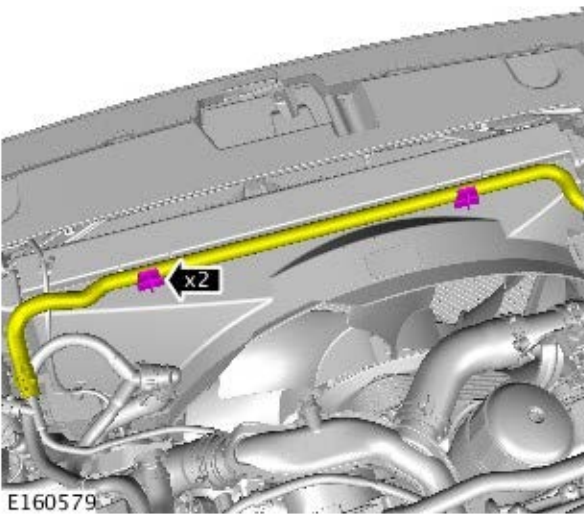
E118706

7.



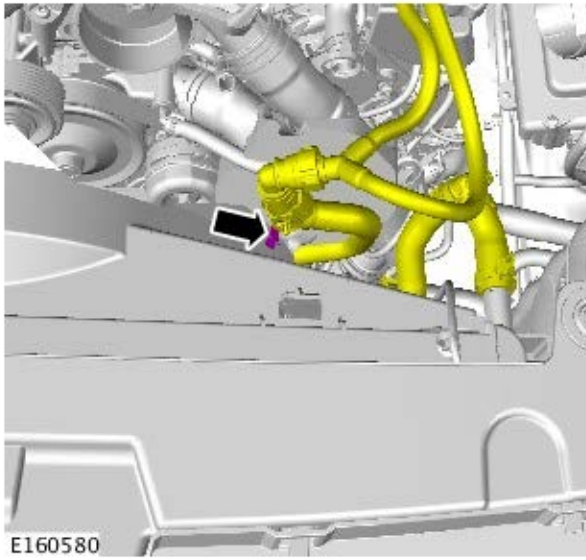
E160484

8.

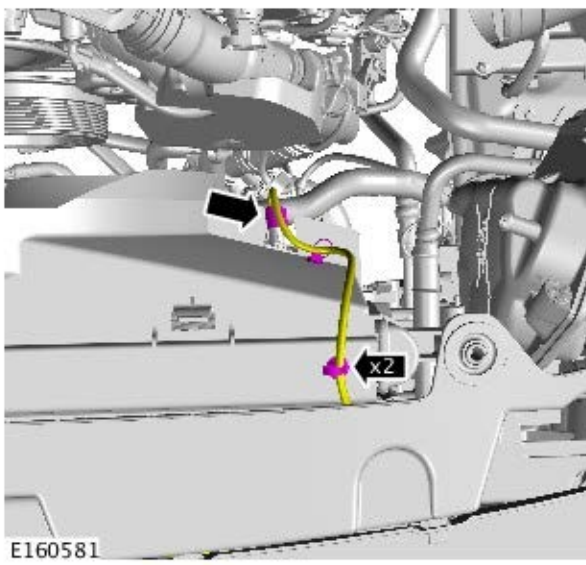


E160579

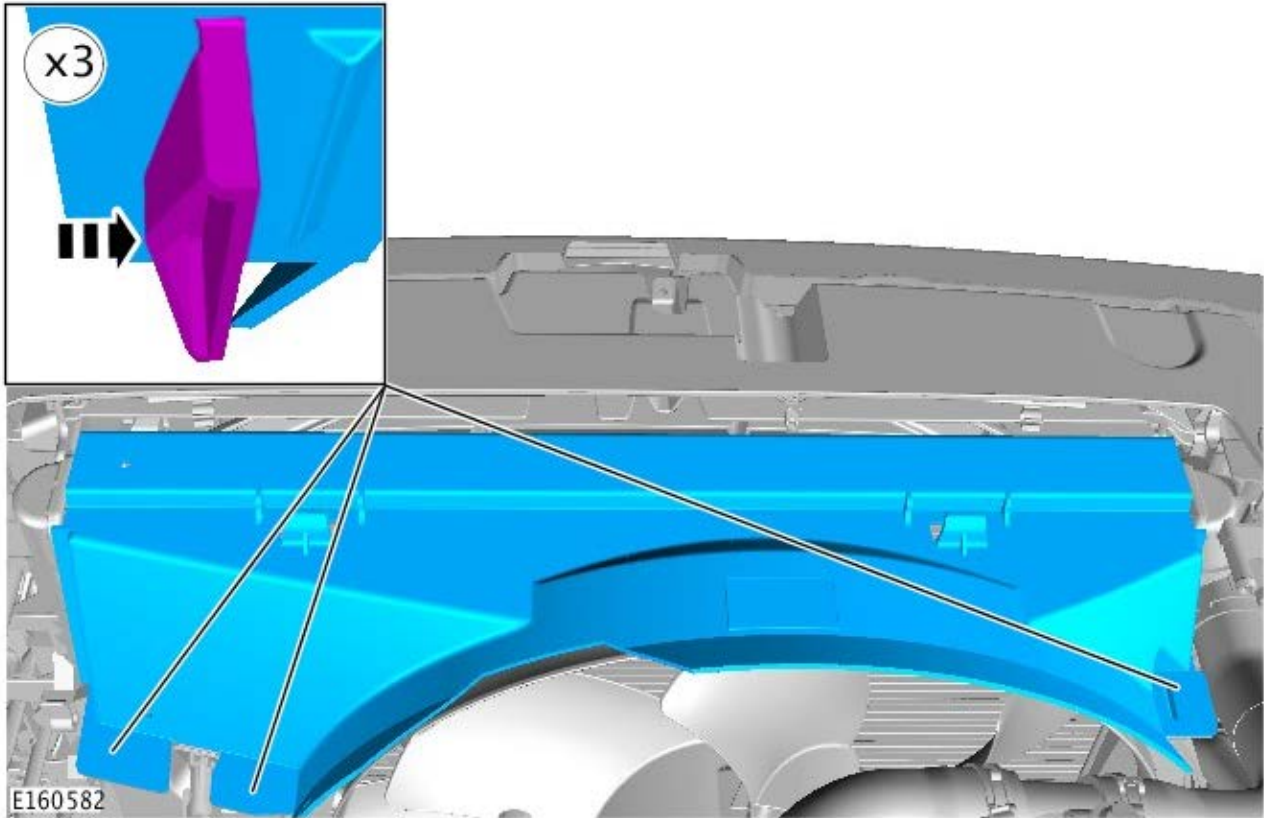
9.



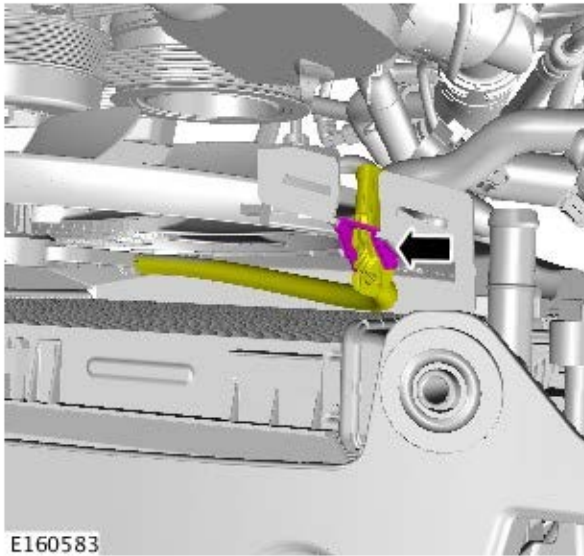
10.




11. Release the retaining tangs.



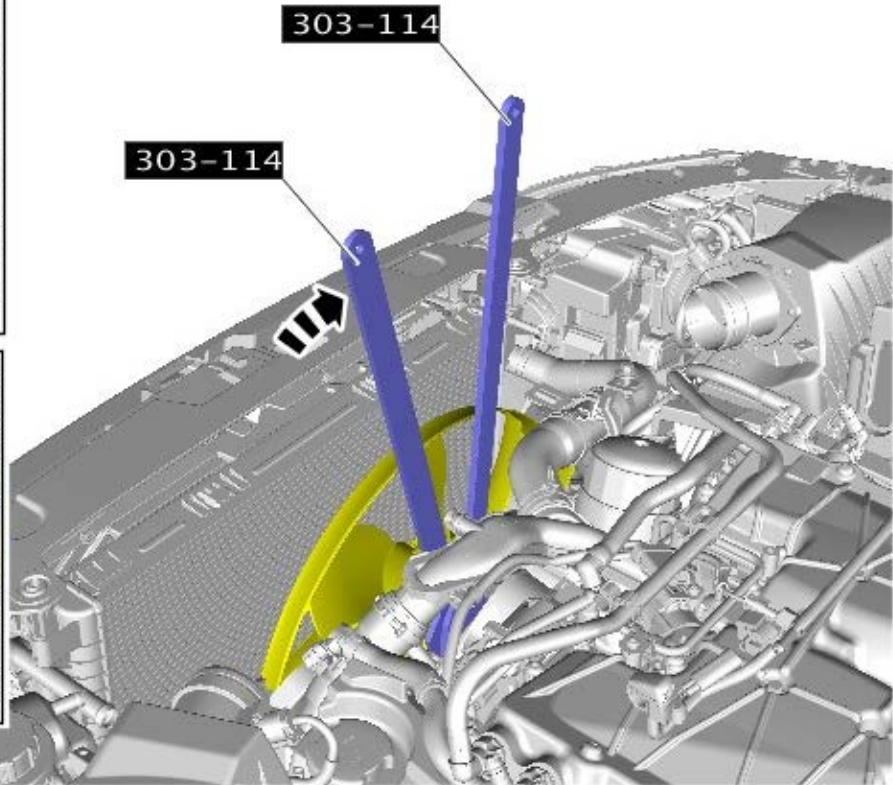
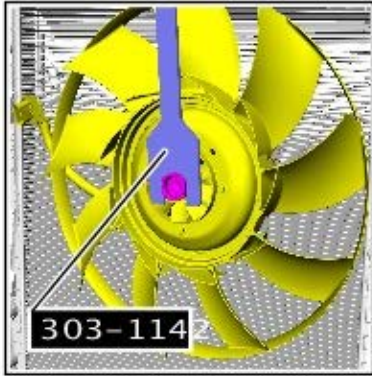
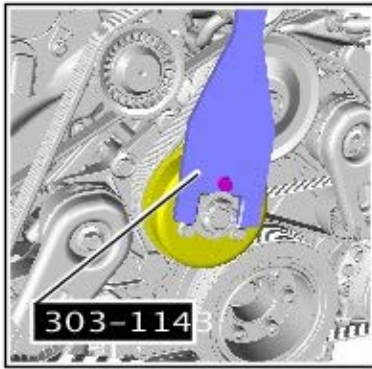
12.



13.  CAUTION: Always protect the cooling pack elements to prevent accidental damage.

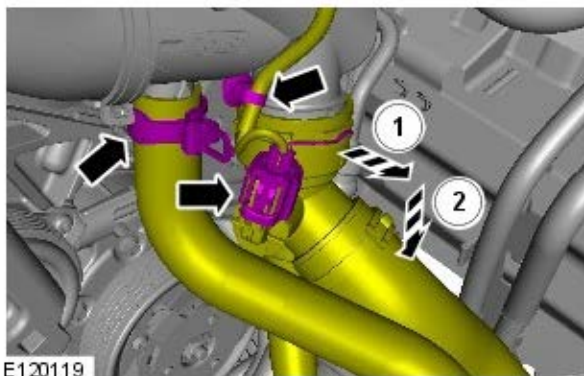
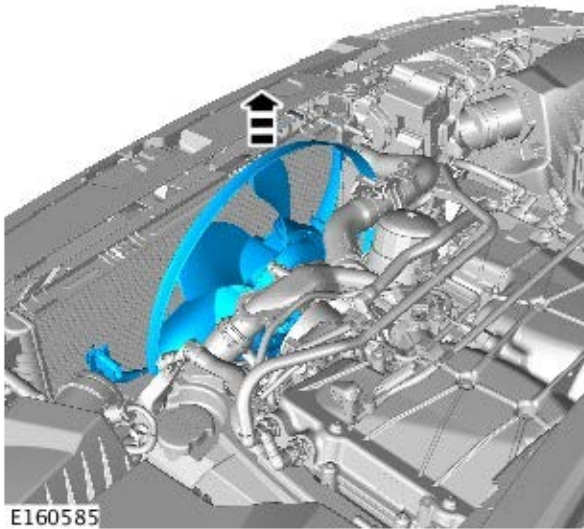
 NOTE: The thread is right handed.


Special Tool(s): [303-1142](#), [303-1143](#)



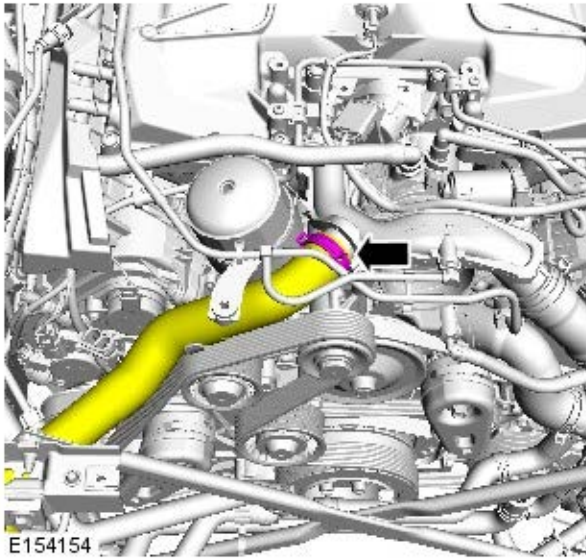
E160584

14.

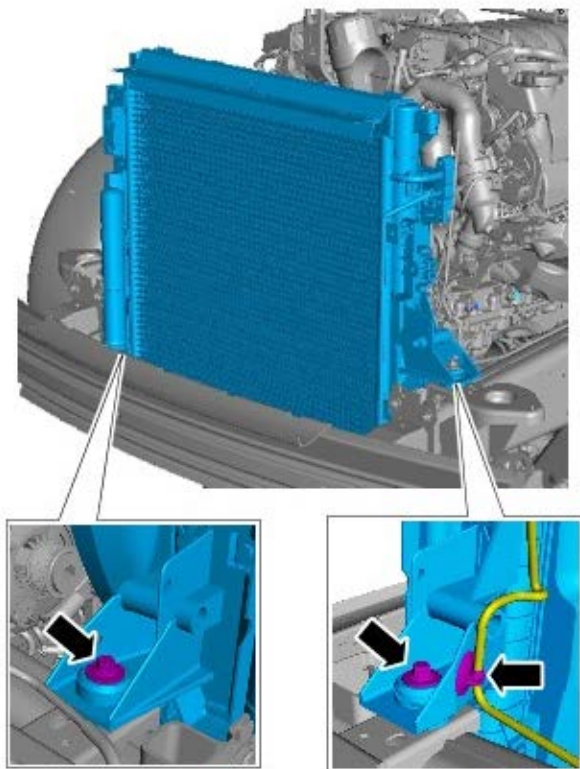


15.  CAUTION: Be prepared to collect escaping coolant.

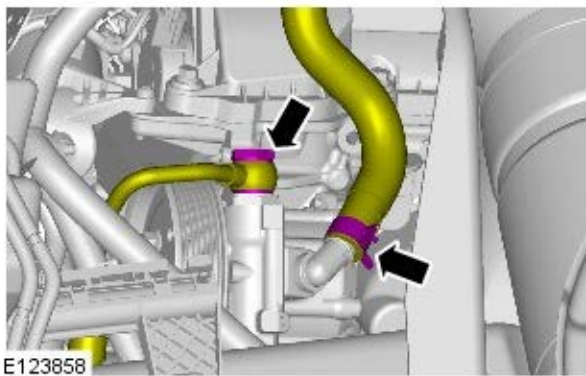
16.




17.




E124068

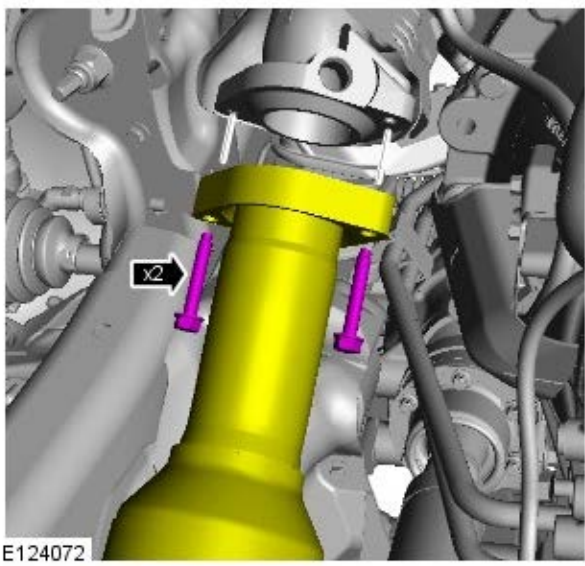
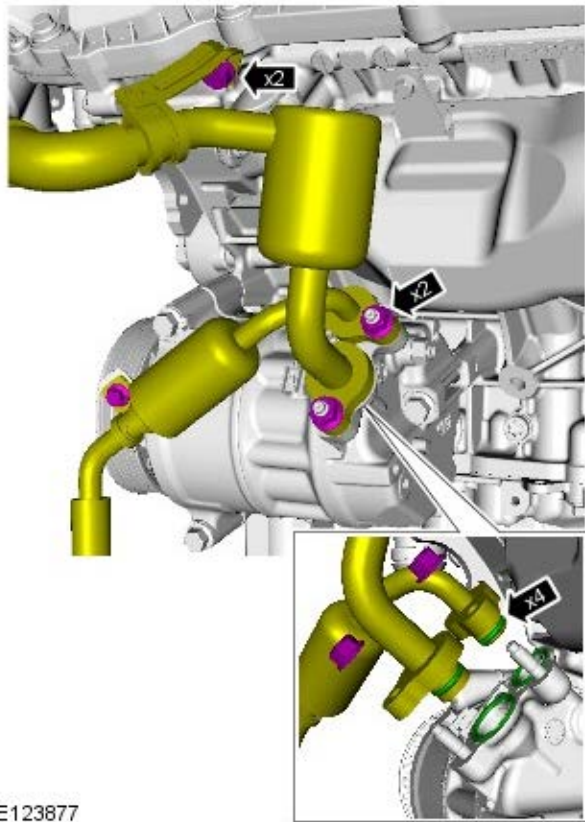
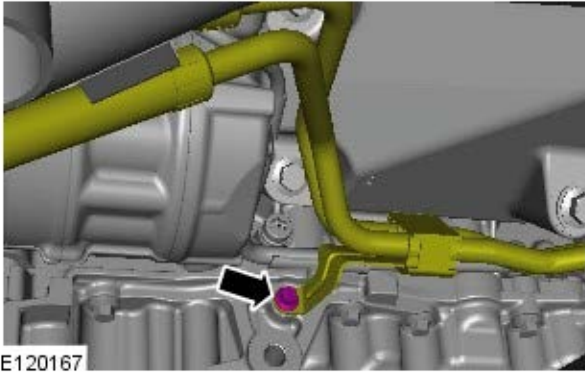



E123858

18.  **WARNING:** Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

 **CAUTION:** Discard the sealing washers.

19.

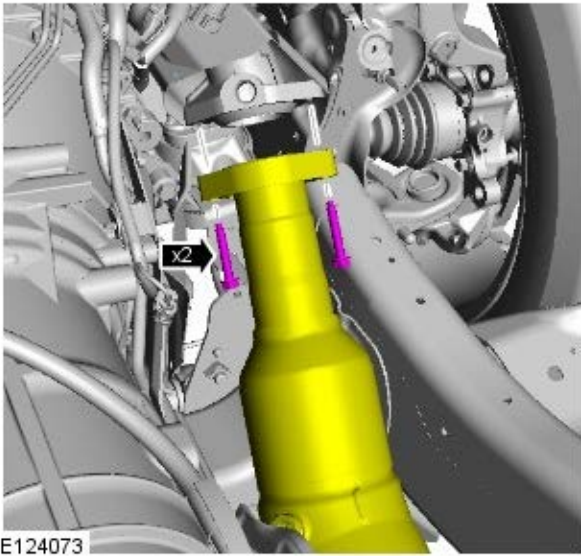


20.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

 NOTE: Remove and discard the 4 O-ring seals.

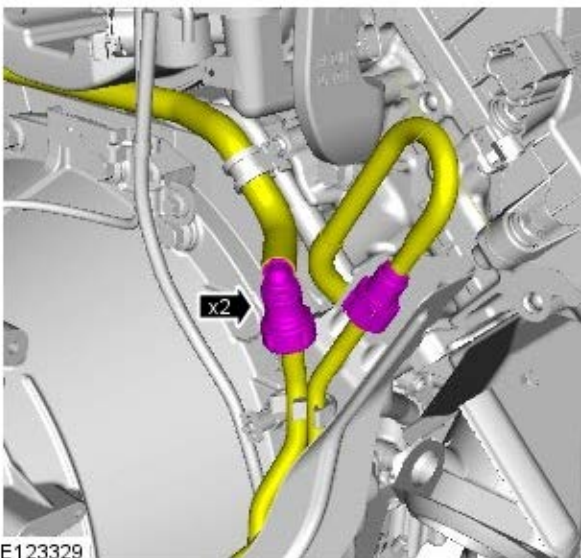
21.

22.



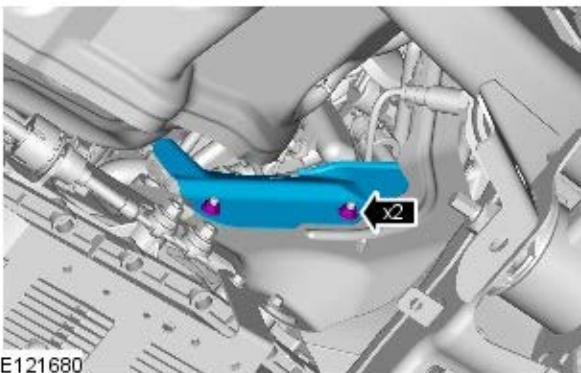
E124073

23.



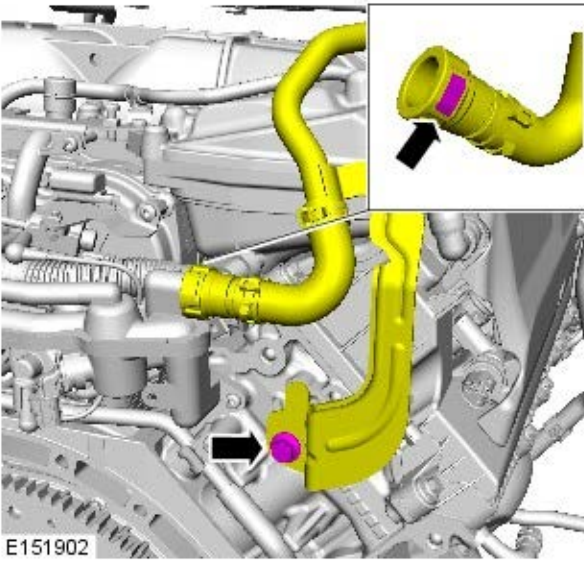
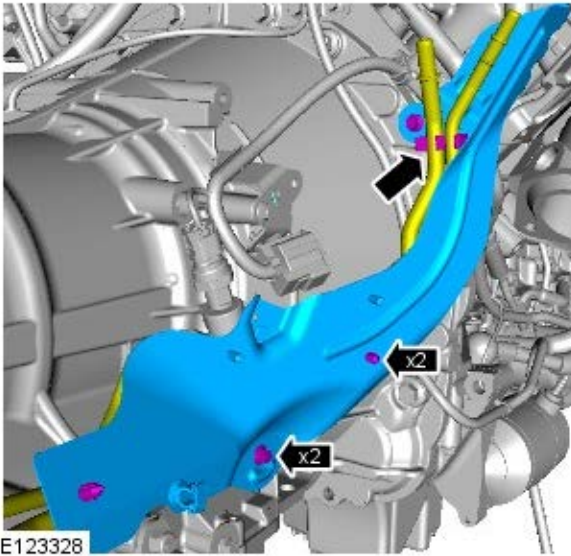
E123329


24.



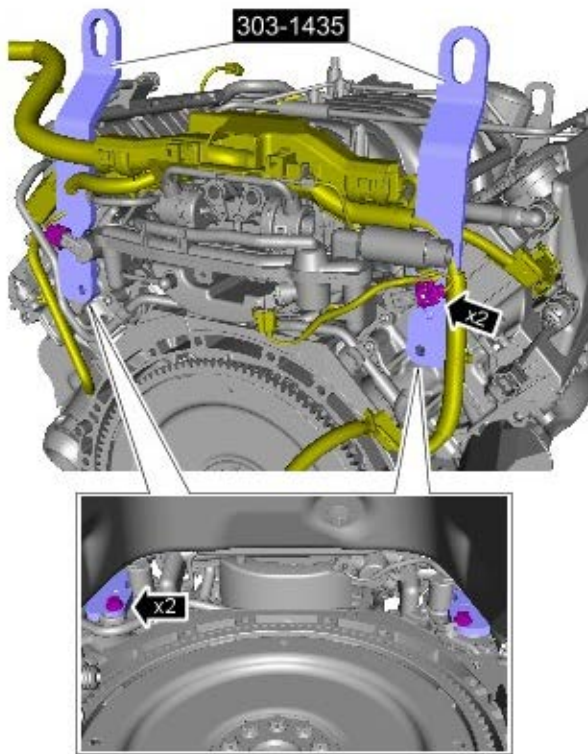
E121680

25.



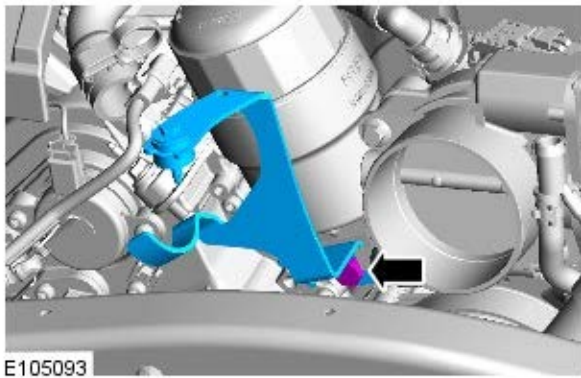
26.  CAUTION: Be prepared to collect escaping coolant.

27. *Special Tool(s):* [303-1435](#)
Torque: 25 Nm



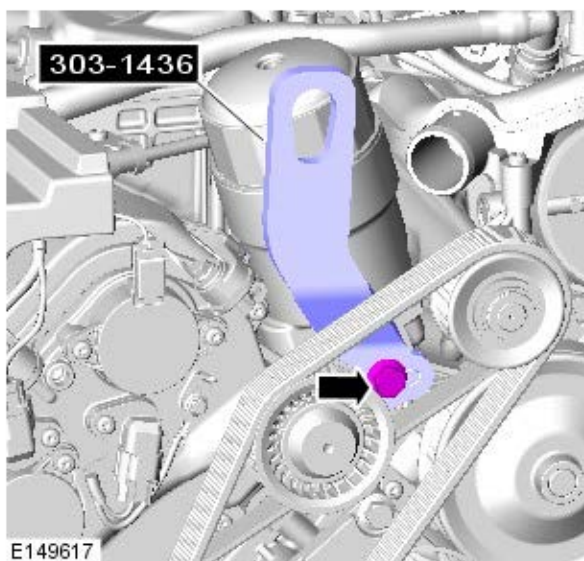
E117619

28.



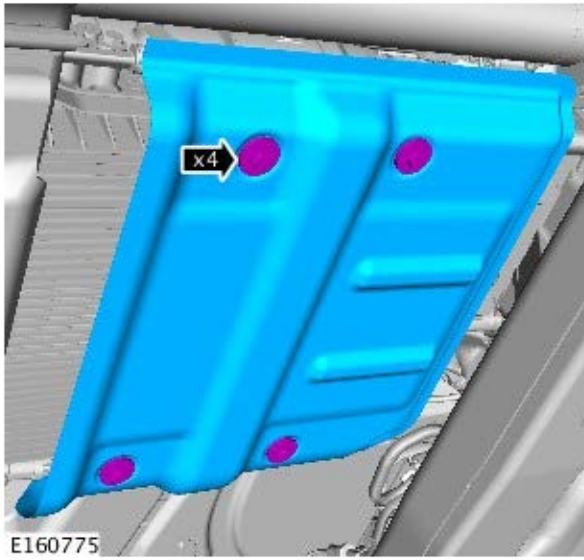
E105093

29. *Special Tool(s):* [303-1436](#)
Torque: 25 Nm

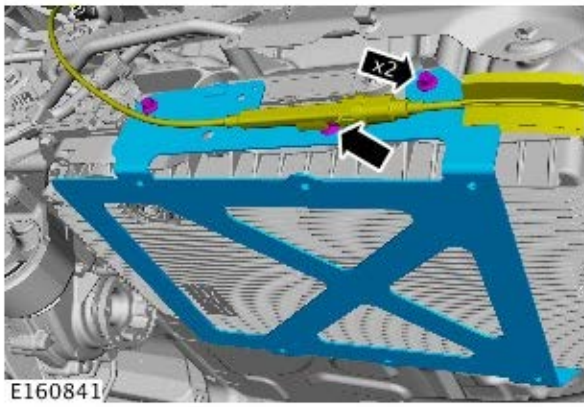


E149617

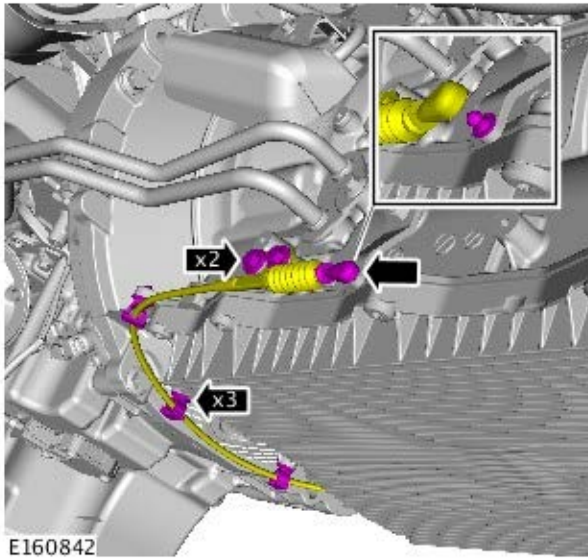
30.



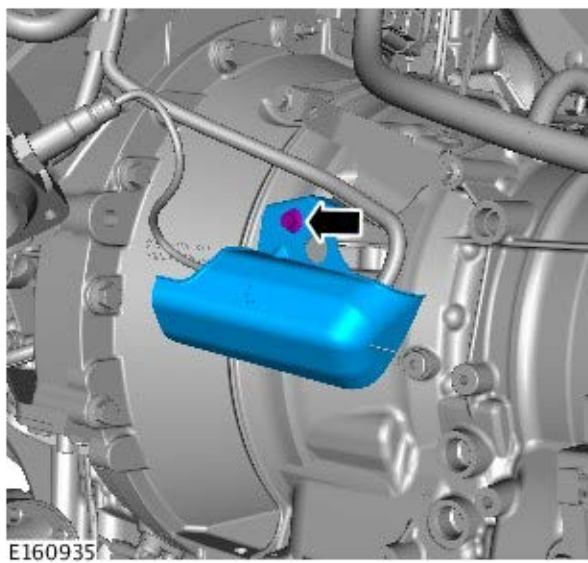
31.



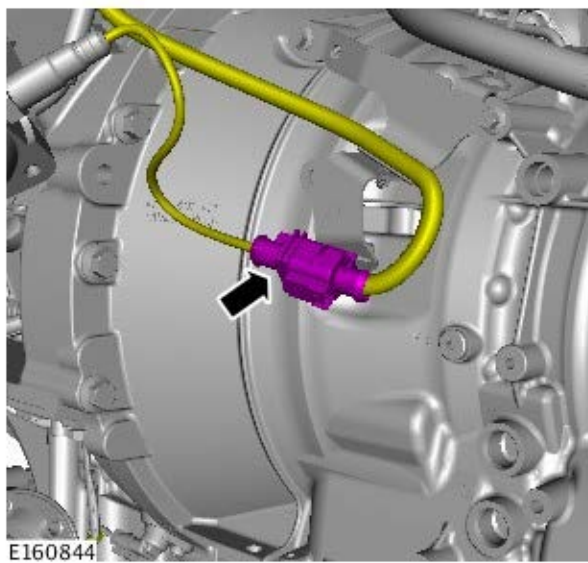
32.



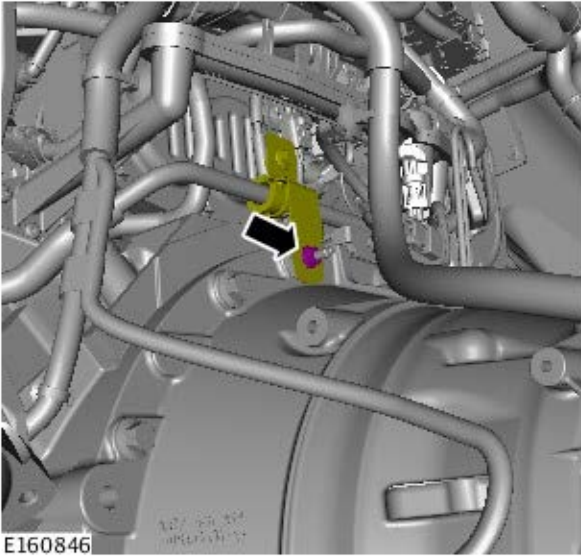
33.



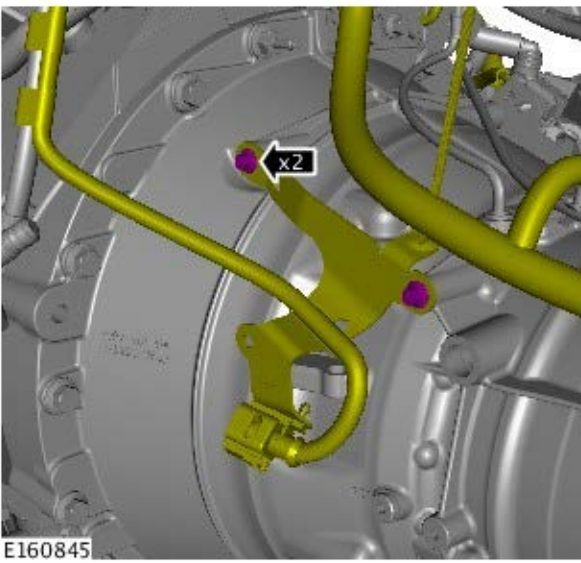
34.



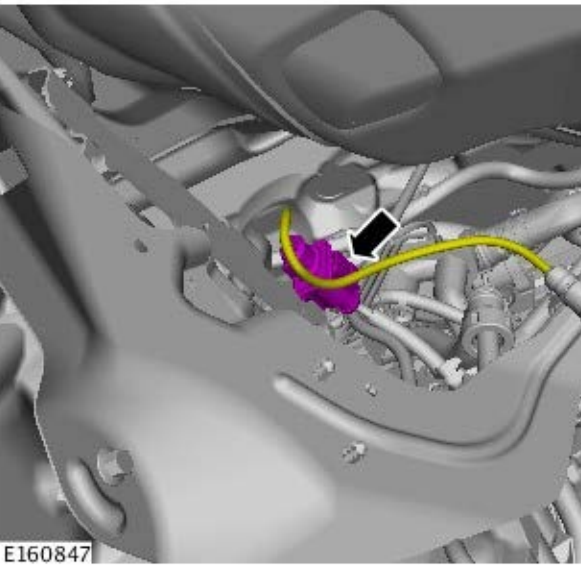
35.



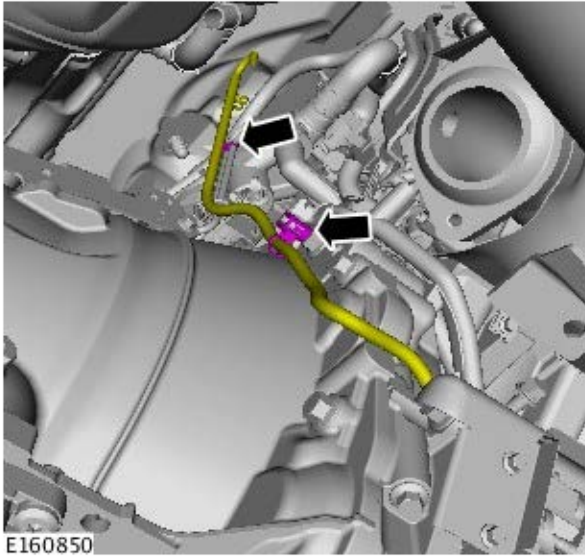
36.



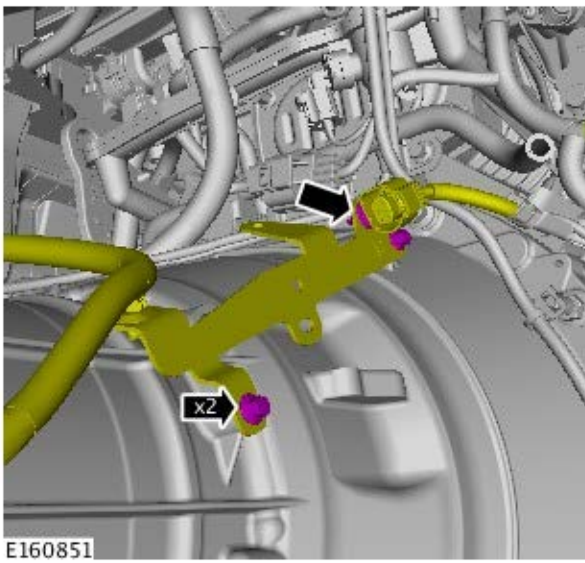
37.



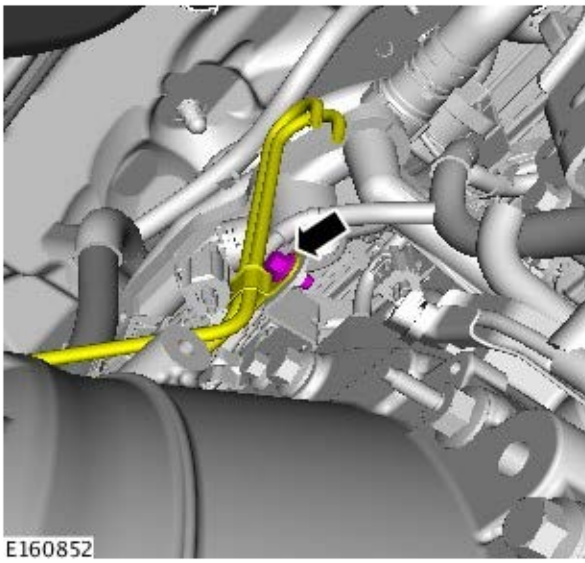
38.



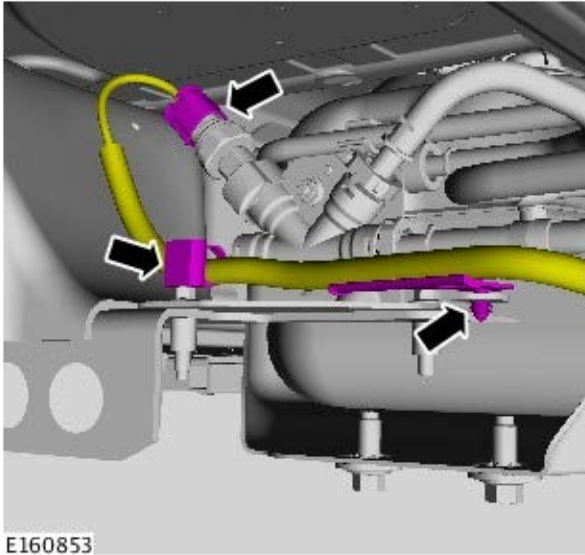
39.



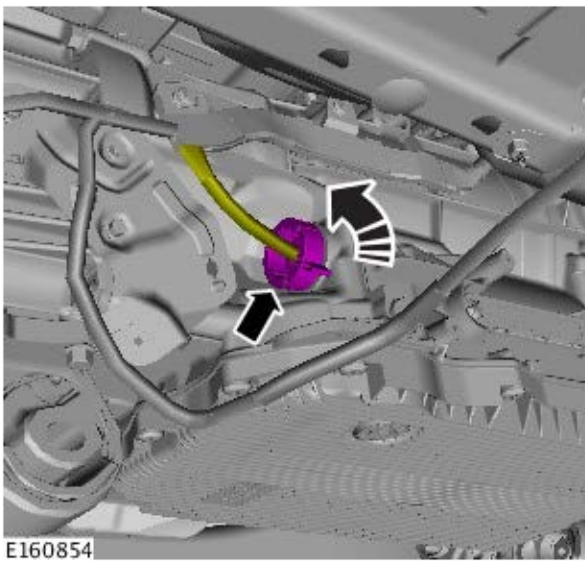
40.



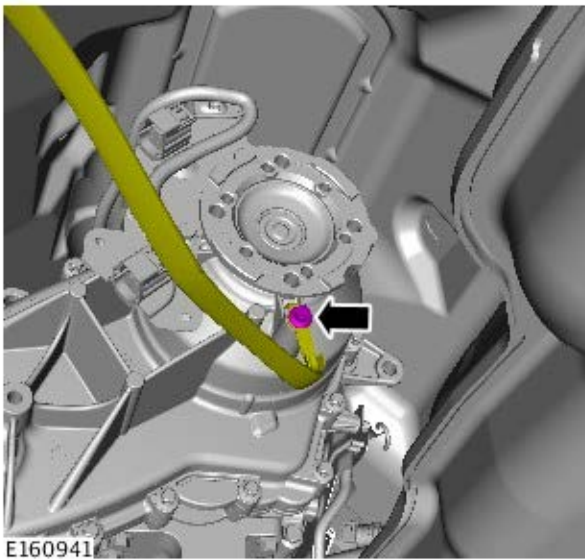
41.



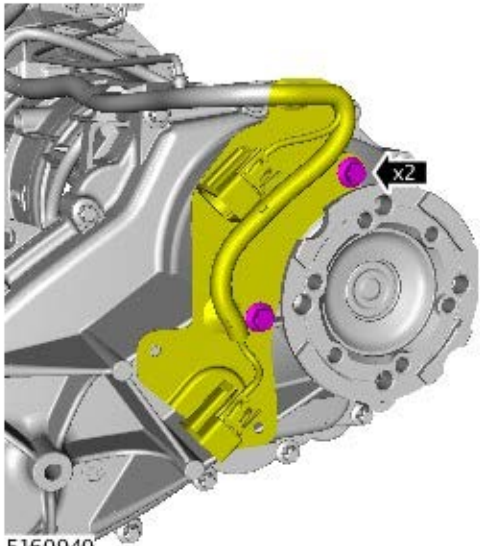
42.



43.

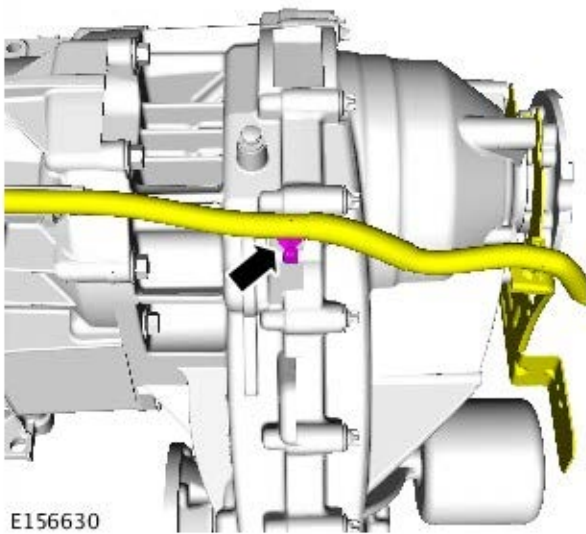


44.



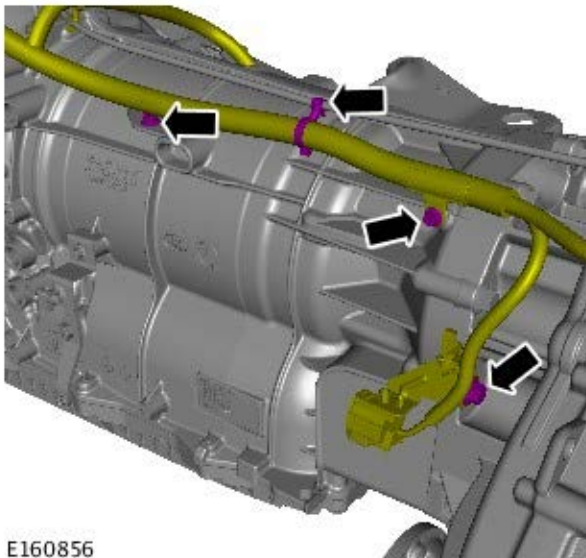
E160940

45.



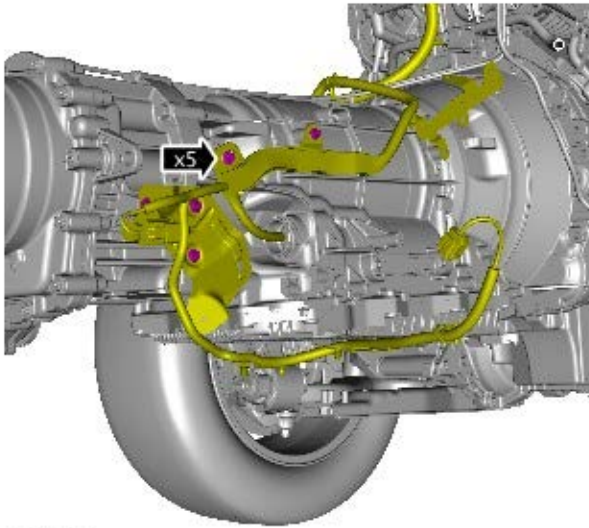
E156630

46.



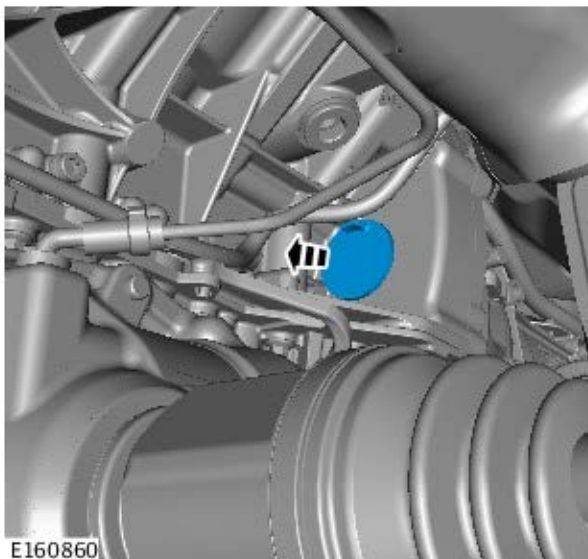
E160856

47.




E160857

48.

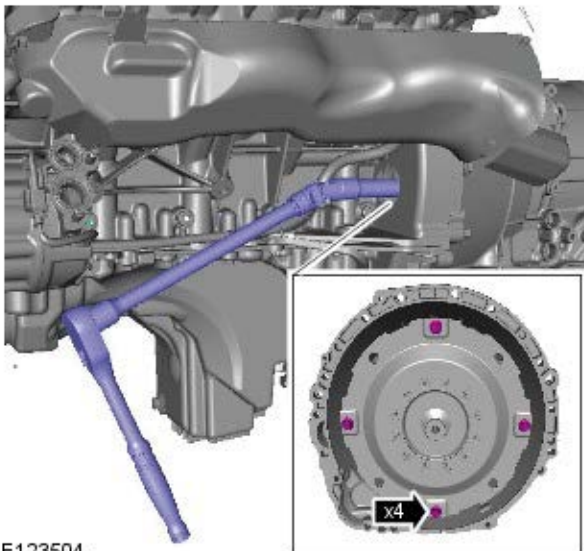


E160860

49. CAUTIONS:

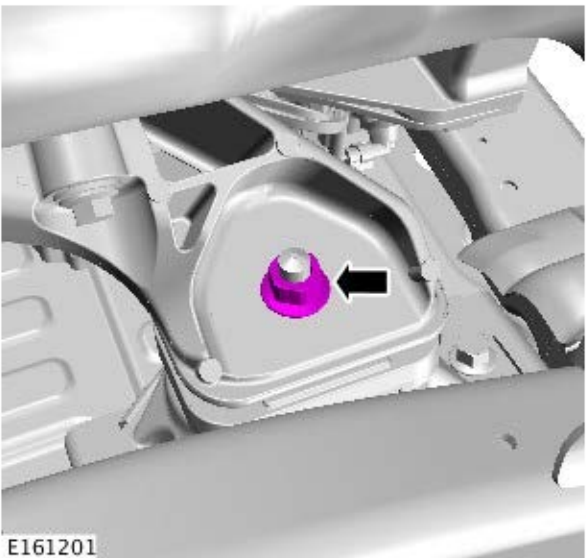
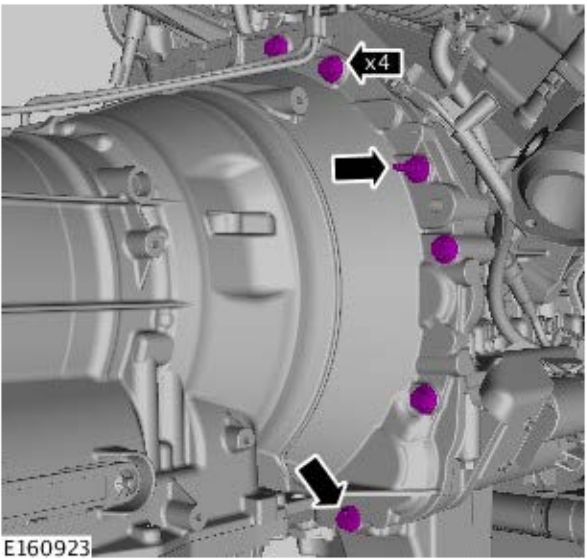
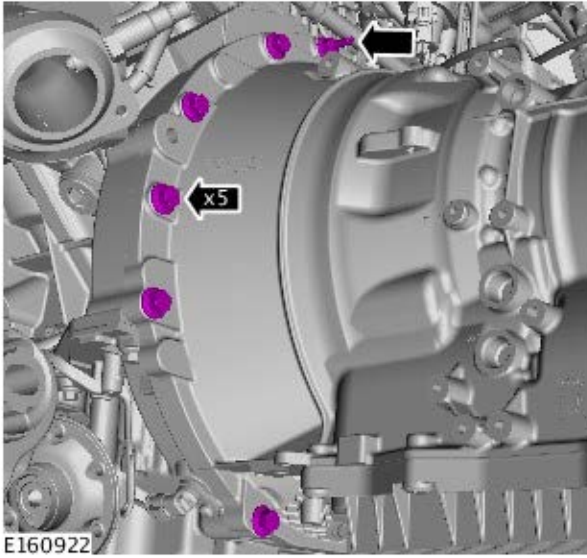
 Only rotate the crankshaft clockwise.

 Discard the bolts.



E123504

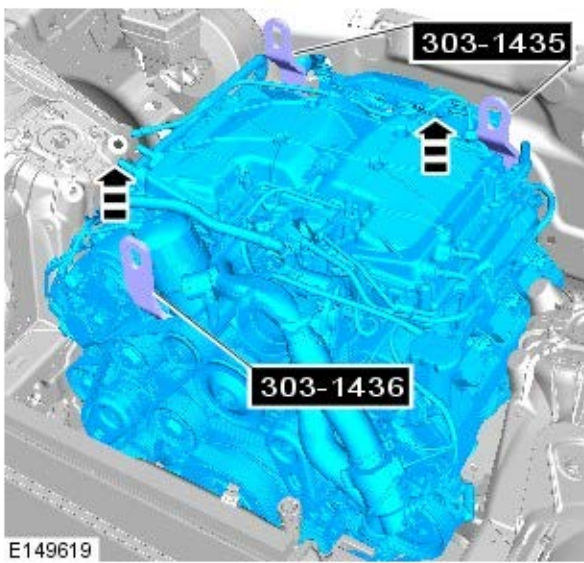
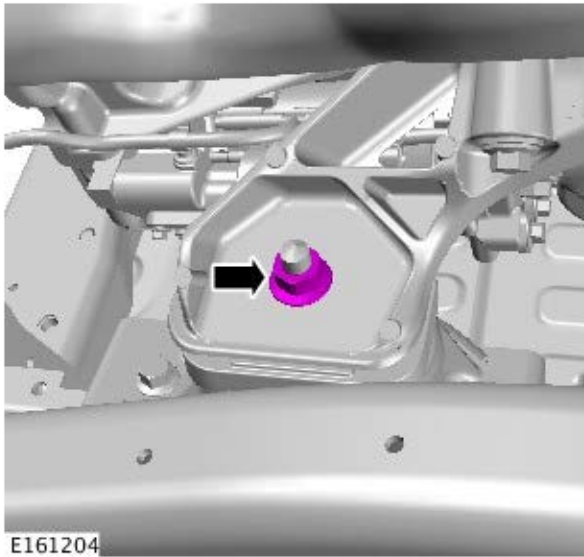
50.  NOTE: Note the fitted position of the bolts prior to removal.



51.  NOTE: Note the fitted position of the bolts prior to removal.

52.

53.



54.  NOTE: This step requires the aid of another technician.

Using a suitable tool, remove the engine.

Special Tool(s): [303-1435](#), [303-1436](#)

Engine - V6 S/C 3.0L Petrol - Engine Installation

Special Tool(s)

 <p>303-1142 E46076</p>	<p>303-1142 Viscous Coupling Wrench</p>
 <p>303-1143 E55382</p>	<p>303-1143 Viscous Coupling Holding Tool</p>
 <p>E115255</p>	<p>303-1435 Engine Lifting Brackets Rear</p>
 <p>E115254</p>	<p>303-1436 Engine Lifting Bracket Front</p>


NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.

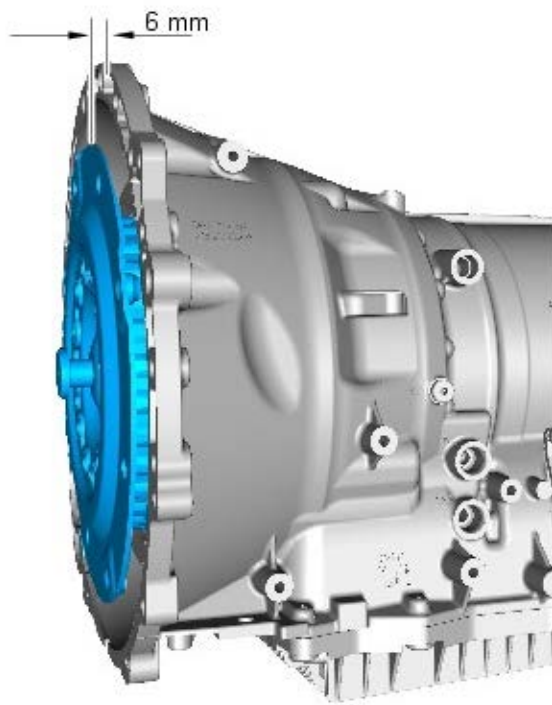


Some components shown removed for clarity.

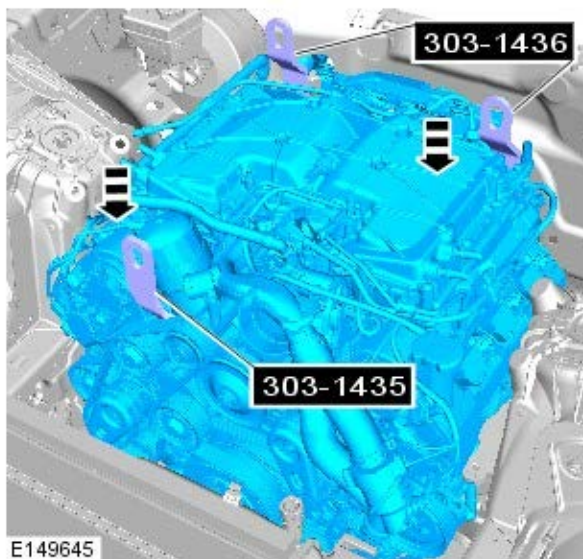
1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2.  **NOTE:** Make sure that the torque converter is fully engaged to the transmission.



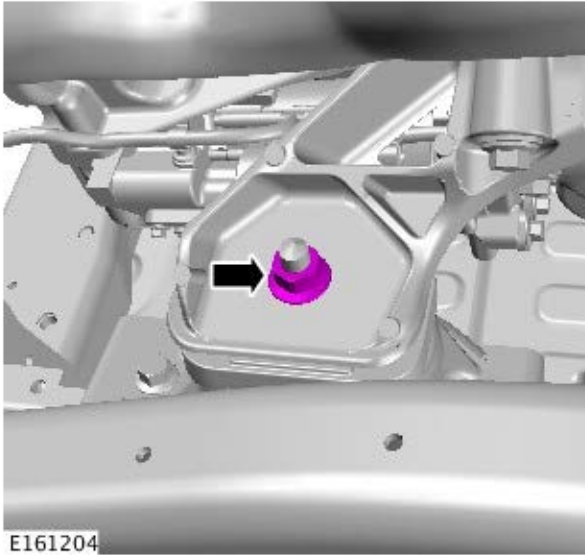
E138283



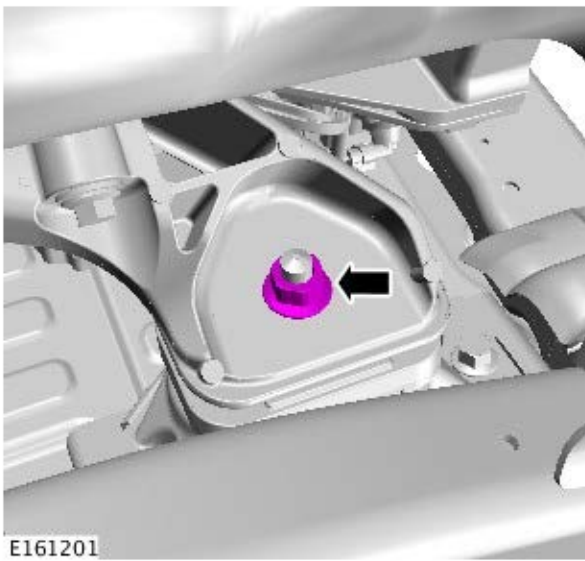
E149645

3.  NOTE: This step requires the aid of another technician.

4. Torque: 100 Nm

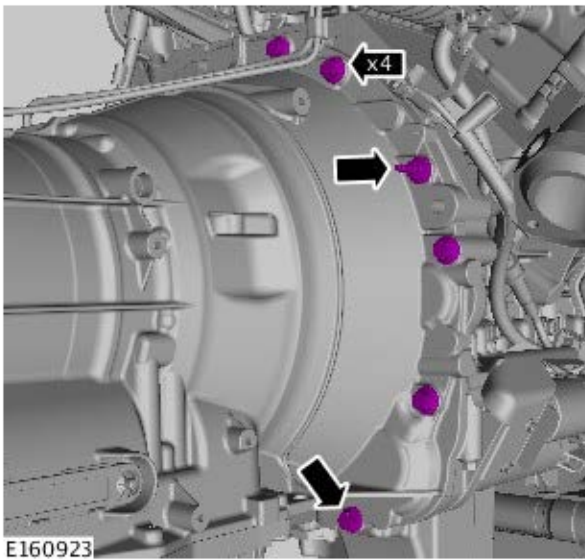



5. Torque: 100 Nm



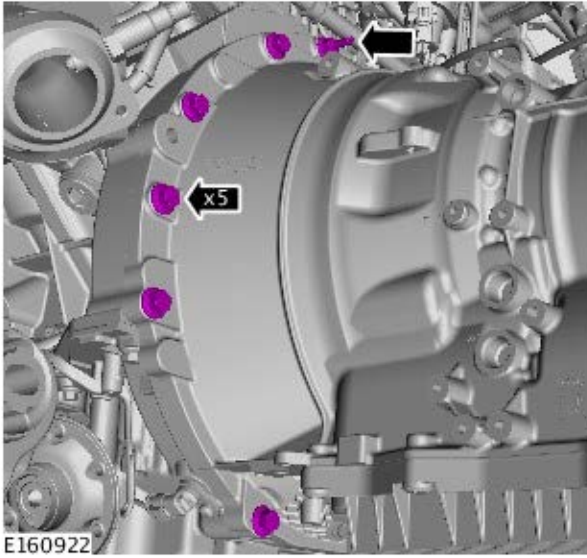
6.  CAUTION: Install the bolts in the noted position.

Torque: 40 Nm




7.  CAUTION: Install the bolts in the noted position.

Torque: 40 Nm



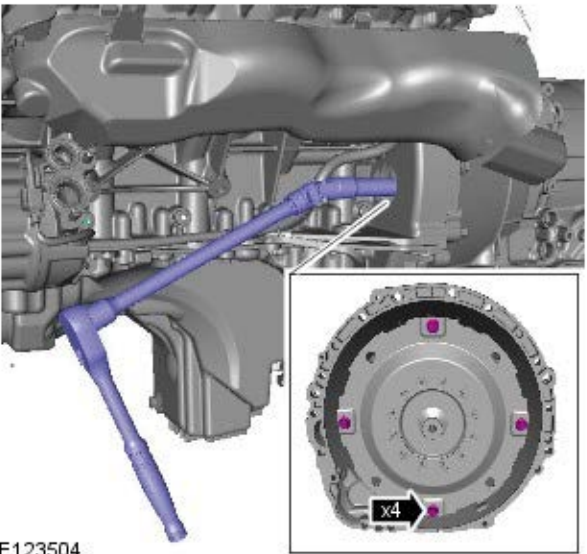
E160922

8. CAUTIONS:

 Only rotate the crankshaft clockwise.

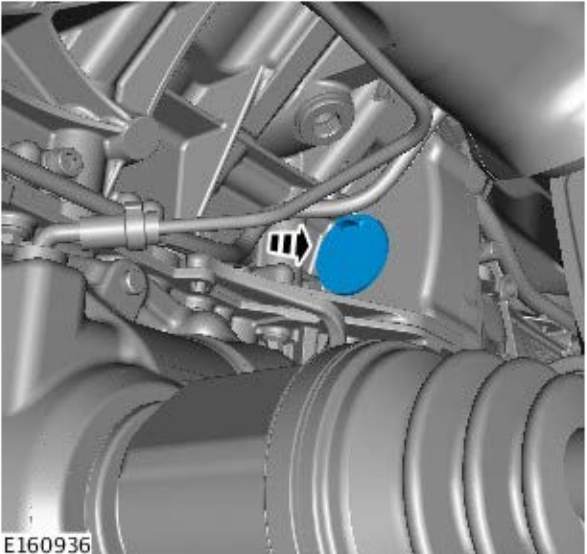
 Install new bolts.

Torque: 63 Nm



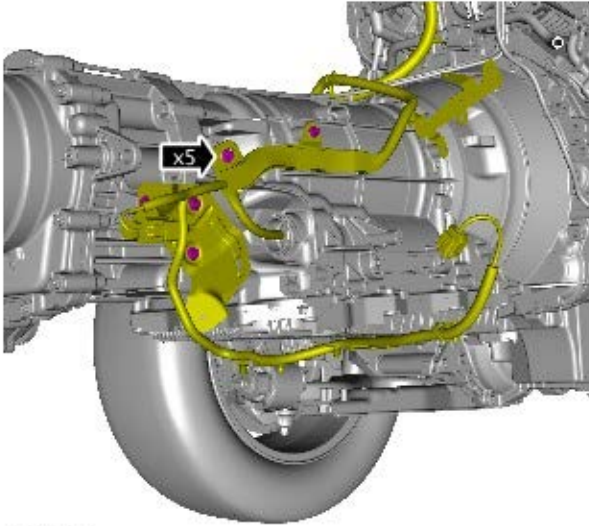
E123504

9.

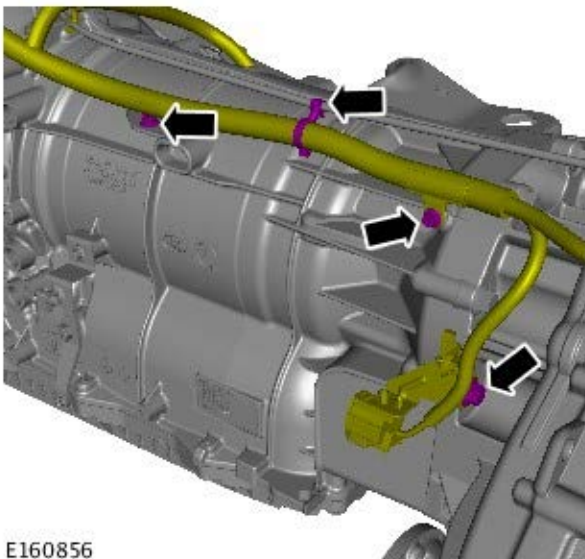


E160936

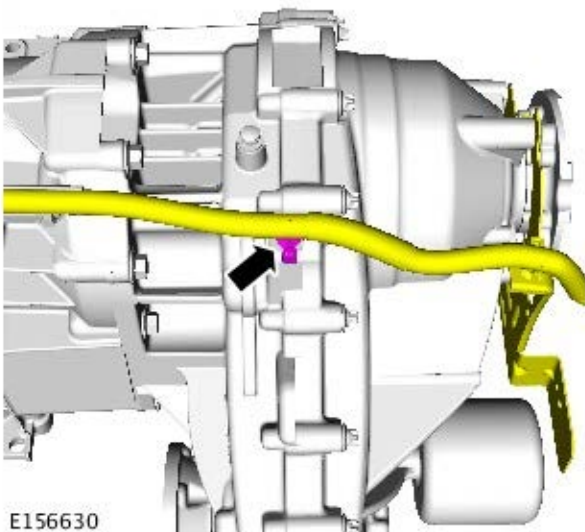
10. Torque: 10 Nm



E160857



E160856

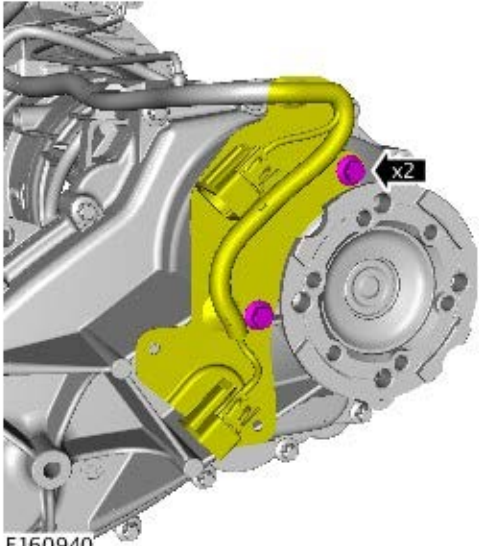


E156630

11. *Torque:*
M10 48 Nm
M6 10 Nm

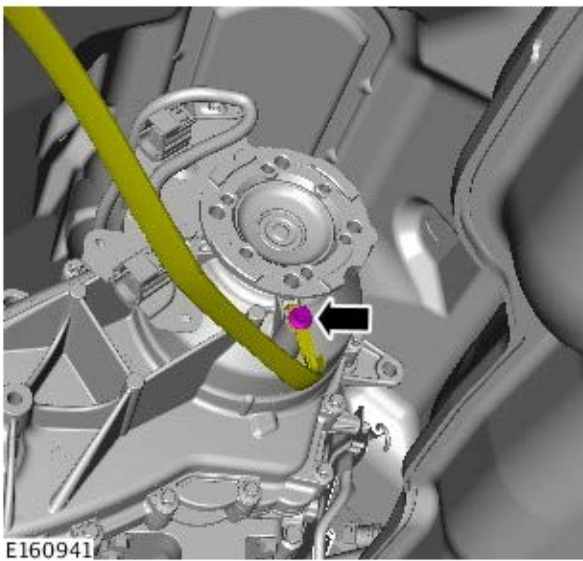
12.

13. *Torque:* 25 Nm



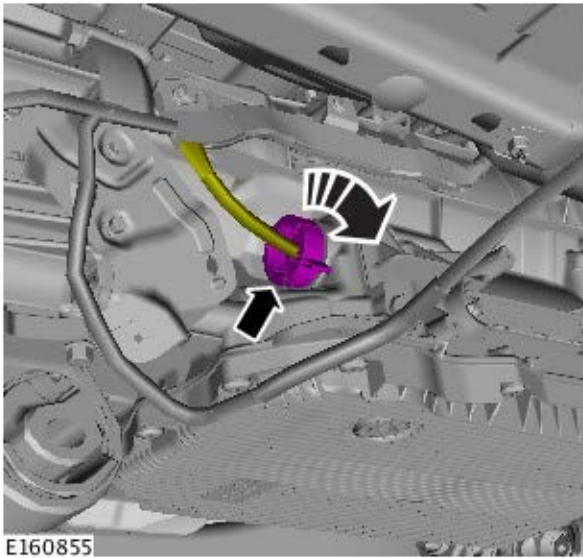
E160940

14. Torque: 25 Nm



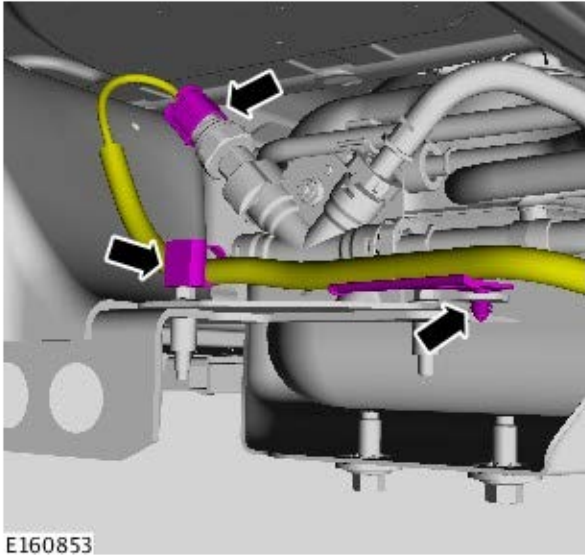
E160941

15.



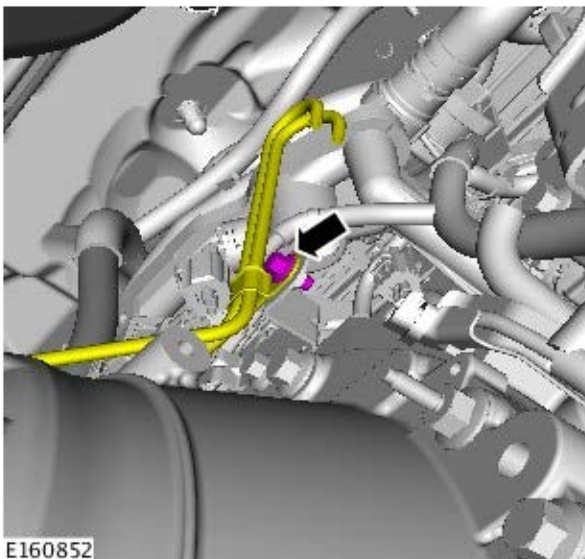
E160855

16.



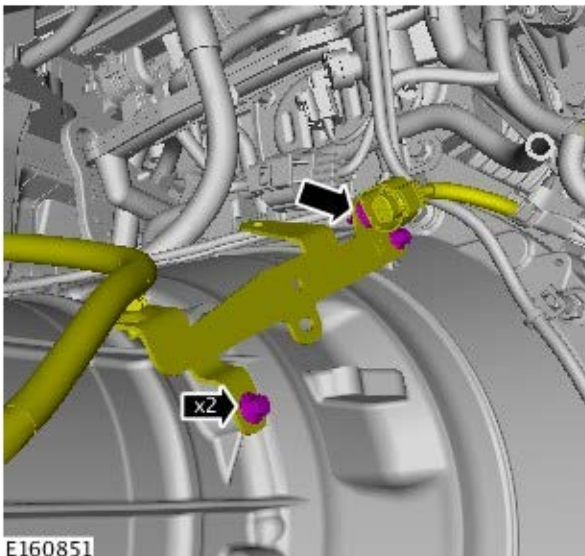
E160853

17. Torque: 10 Nm



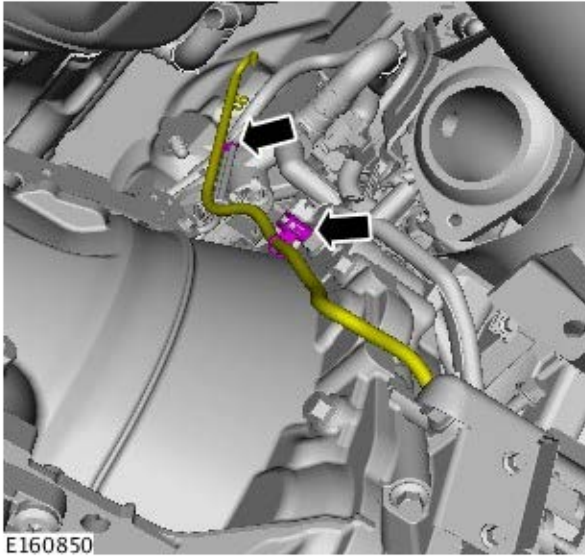
E160852

18. Torque: 10 Nm

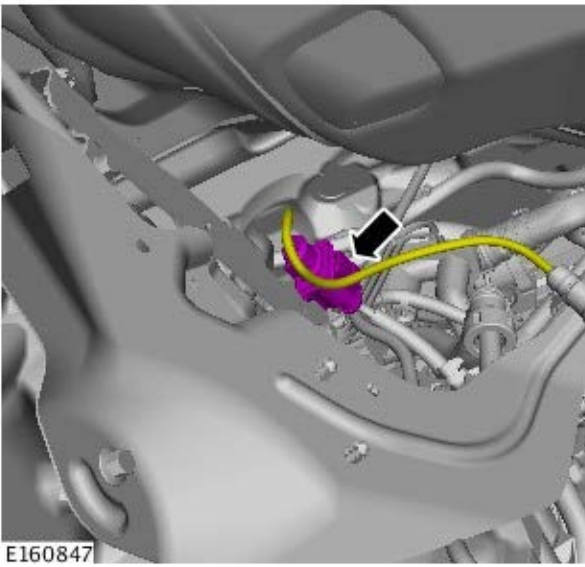


E160851

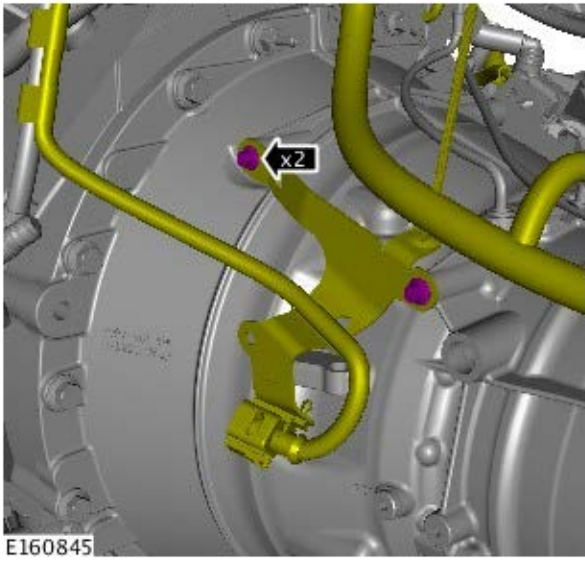
19.



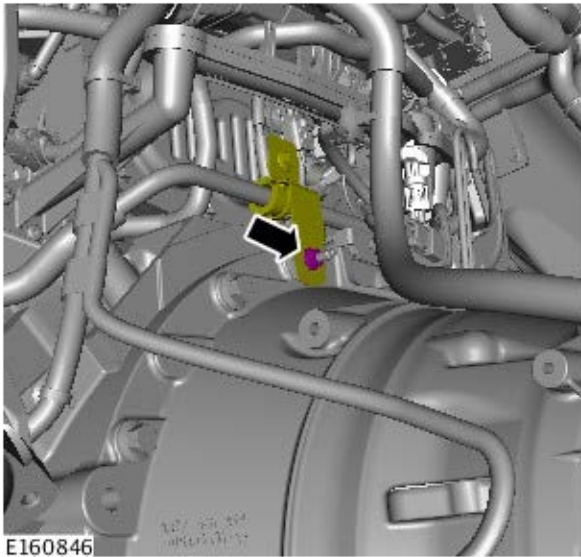
20.



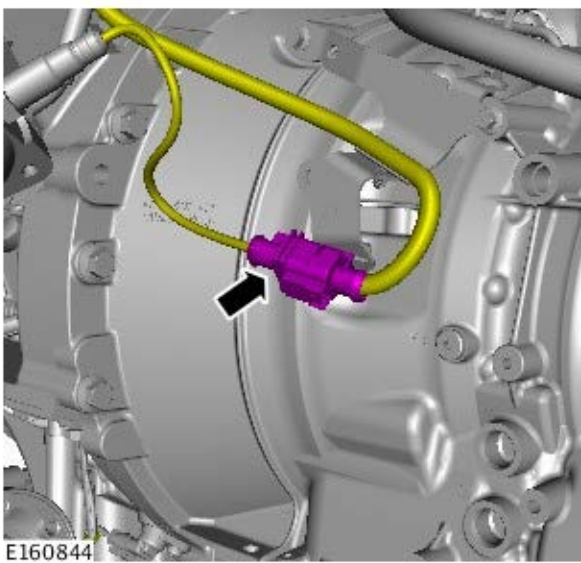
21. Torque: 9 Nm



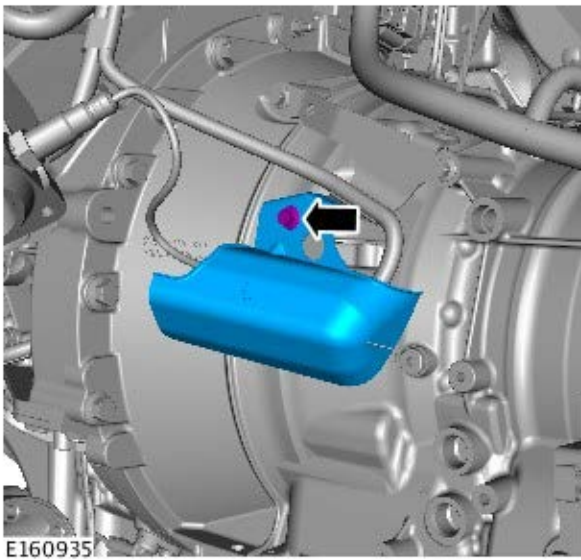
22. Torque: 12 Nm



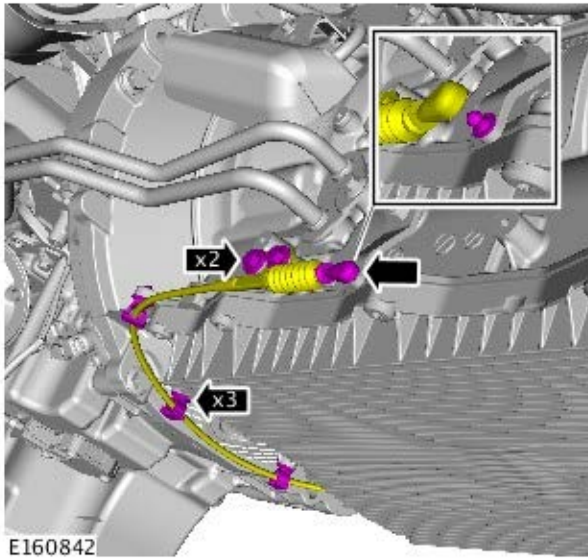
23.



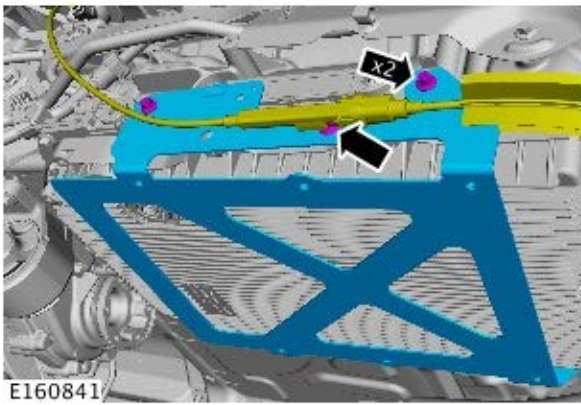
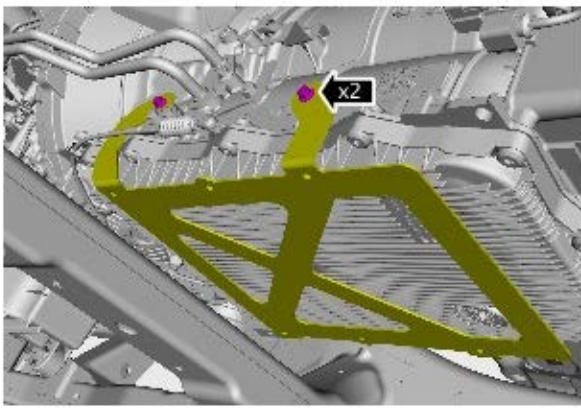
24. Torque: 15 Nm



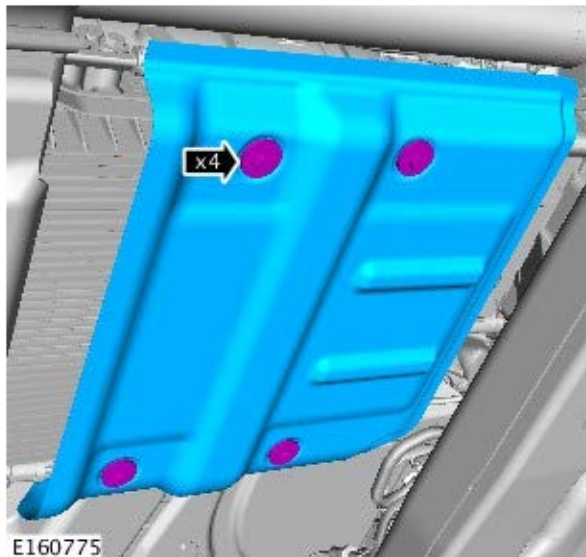
25. Torque: 11 Nm



26. Torque: 9 Nm

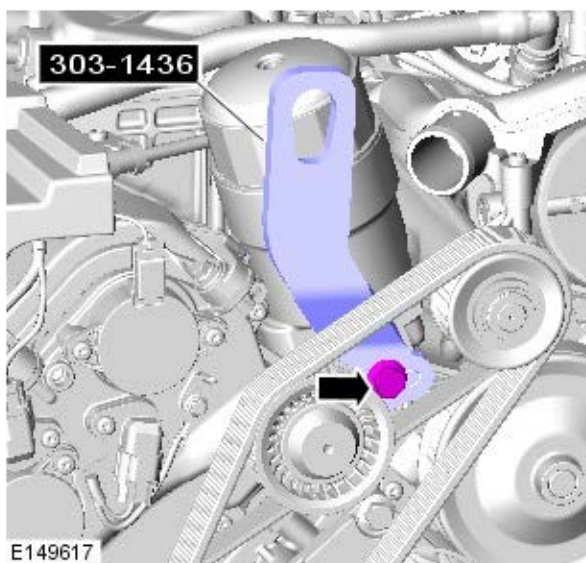


27. Torque: 9 Nm

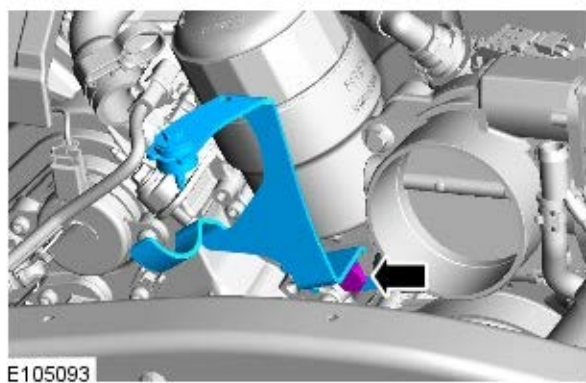


28. Remove the special tool.

Special Tool(s): [303-1436](#)

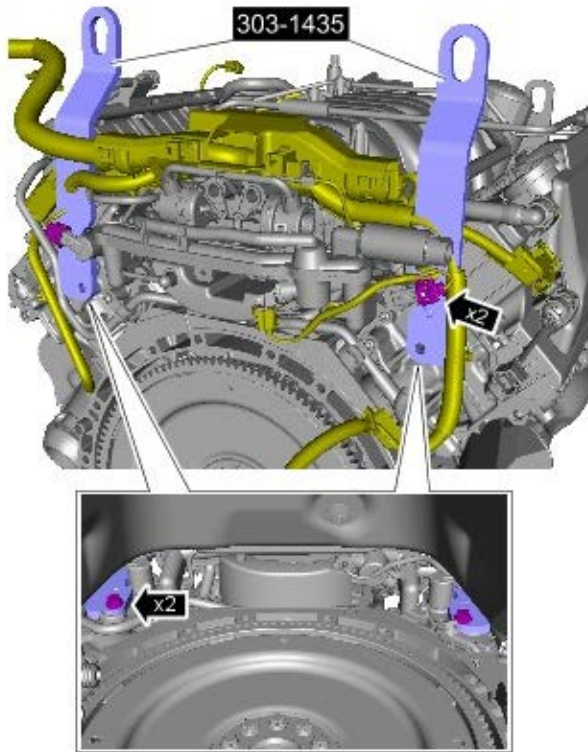


29. *Torque:* 25 Nm

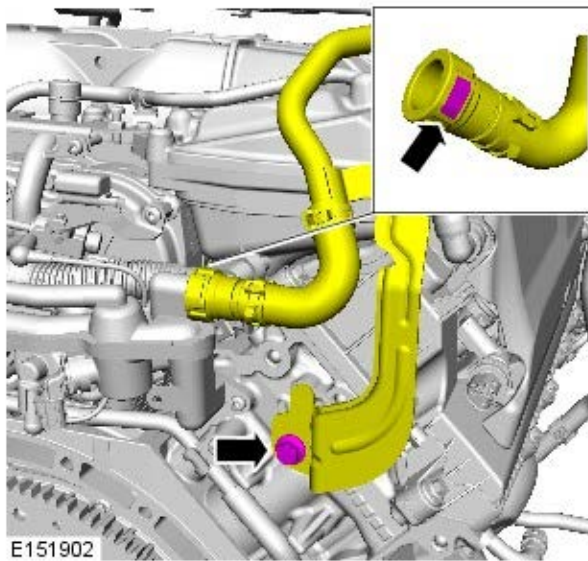


30. Remove the special tools.


Special Tool(s): [303-1435](#)



E117619

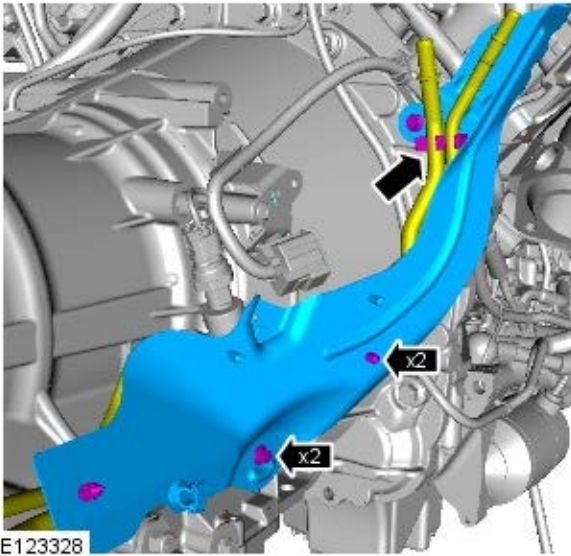


E151902

31.  CAUTION: Be prepared to collect escaping coolant.

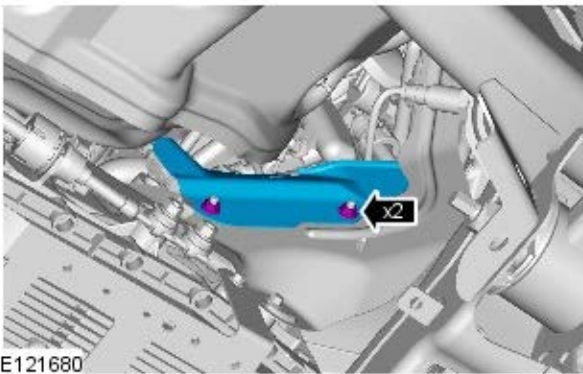
Torque: 25 Nm

32. Torque: 9 Nm



E123328

33. Torque: 10 Nm



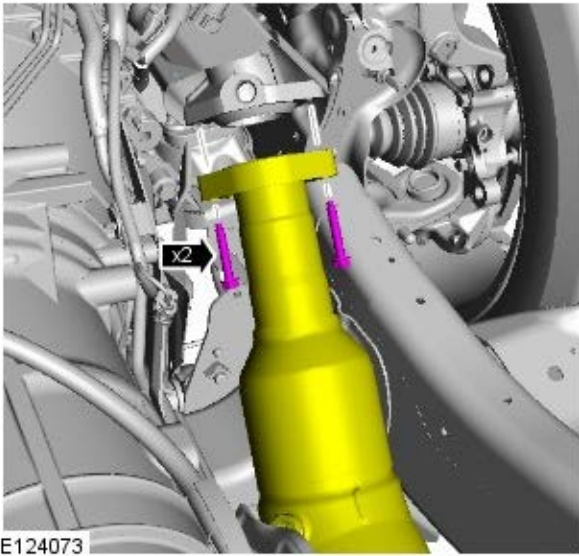
E121680

34.



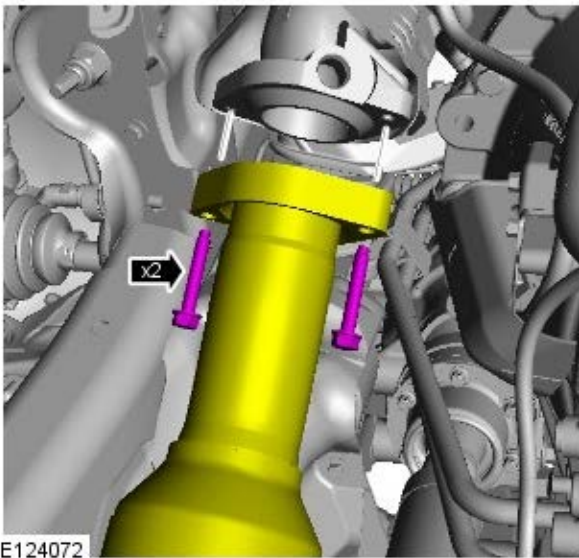
E123329

35. Torque: 22 Nm



E124073

36. Torque: 22 Nm



E124072

37. NOTES:

 Install new O-ring seals.

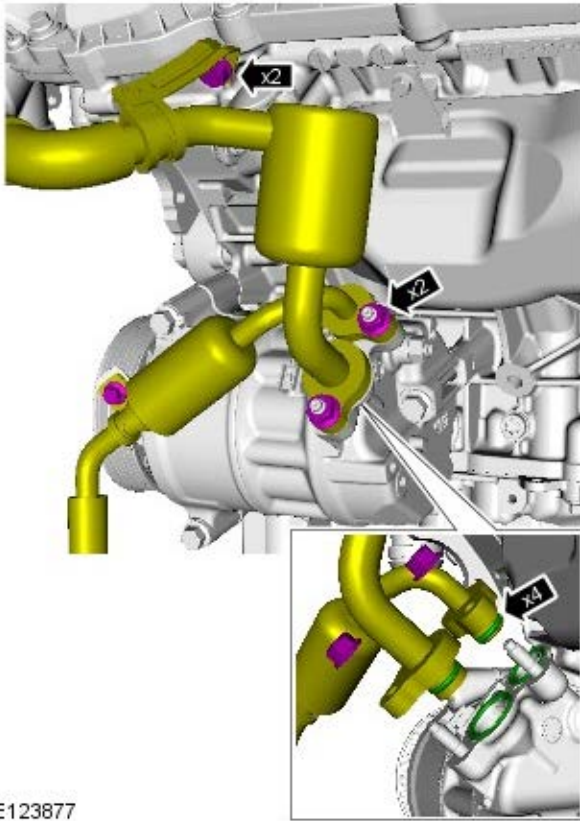
 Remove and discard the blanking plugs.

Torque:

M8 Nut 9 Nm

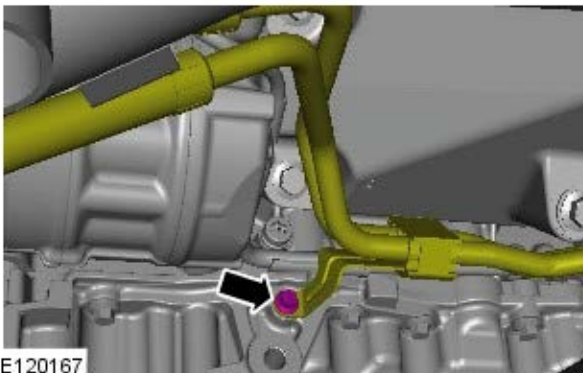
M8 Bolt 25 Nm

M6 Bolt 10 Nm



E123877

38. Torque: 12 Nm



E120167

39. CAUTIONS:



Install new sealing washers.

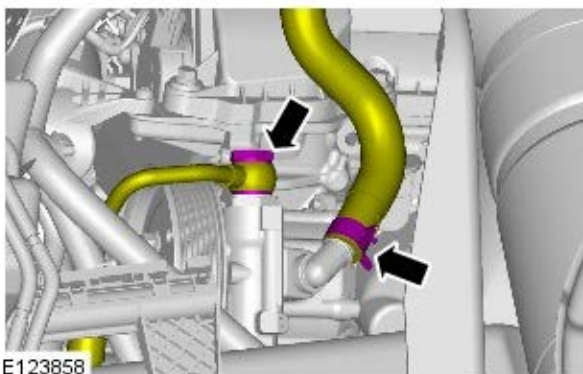


Be prepared to collect escaping fluids.



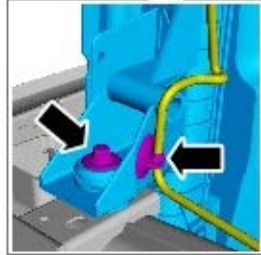
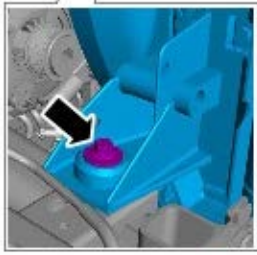
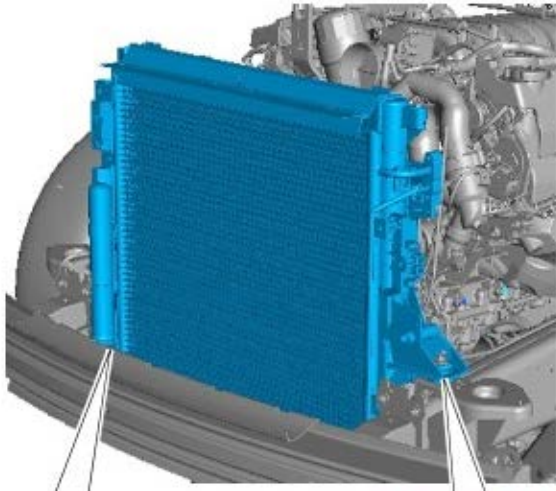
NOTE: Remove and discard the blanking plugs.

Torque: 25 Nm



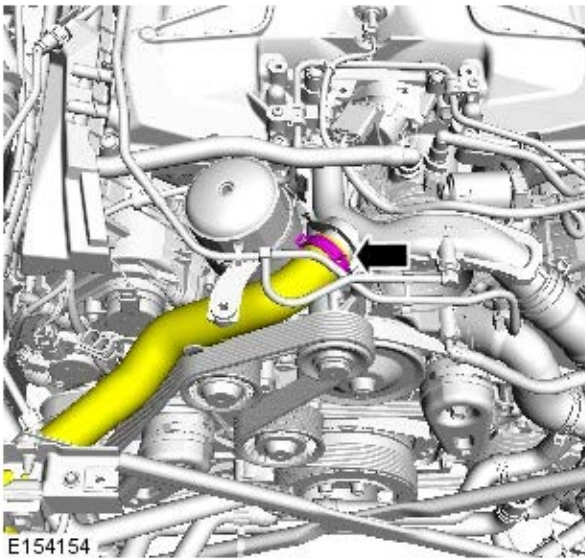
E123858

40. Torque: 25 Nm



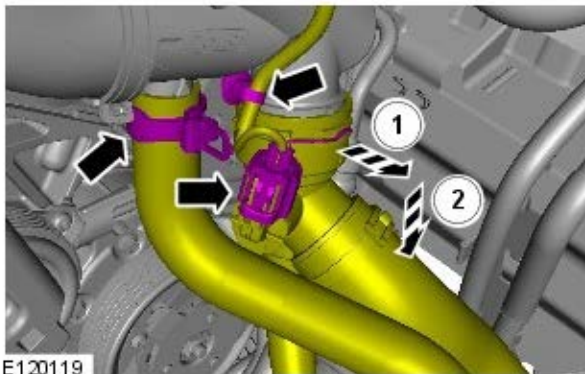
E124068

41.



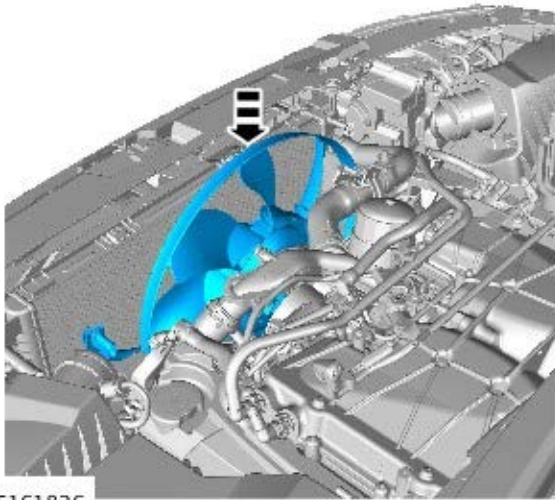
E154154

42.




E120119

43.

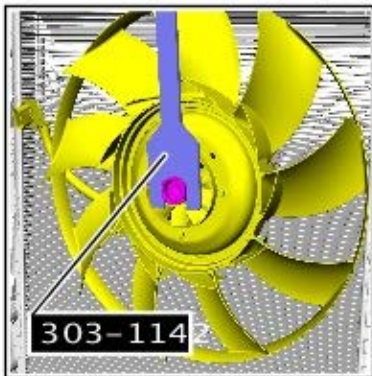
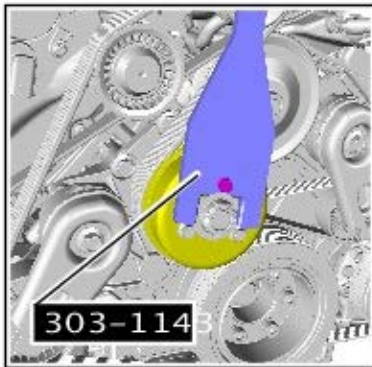


E161826

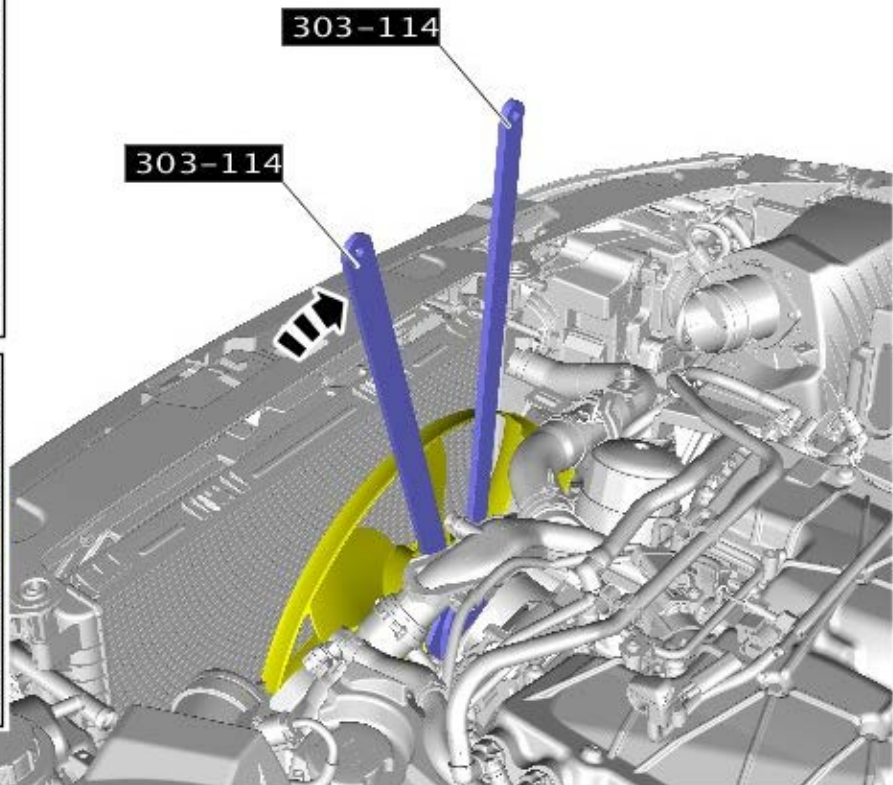
44.  **CAUTION:** Always protect the cooling pack elements to prevent accidental damage.

 **NOTE:** The thread is right handed.

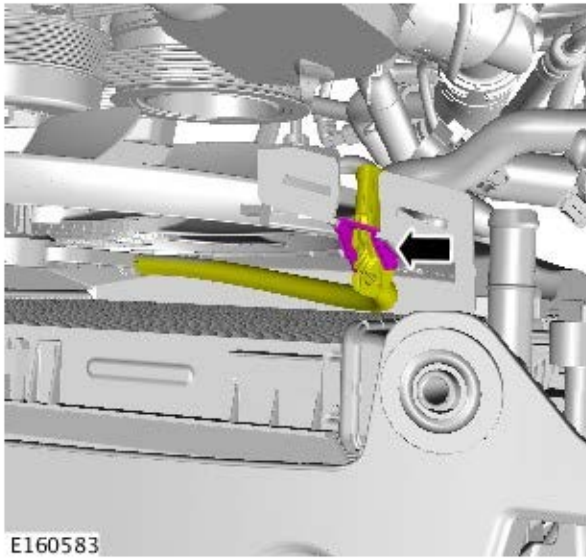
Special Tool(s): [303-1142](#), [303-1143](#)
Torque: [65 Nm](#)



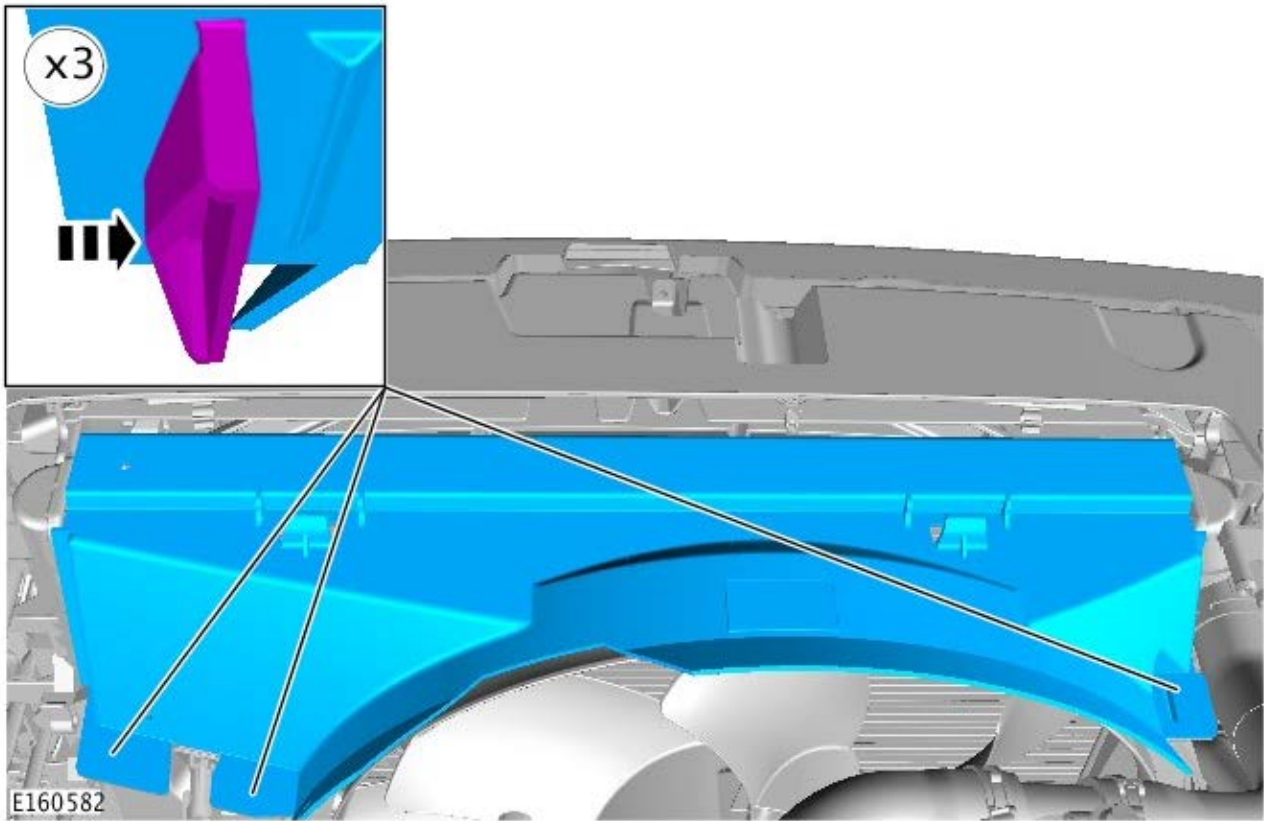
E160584



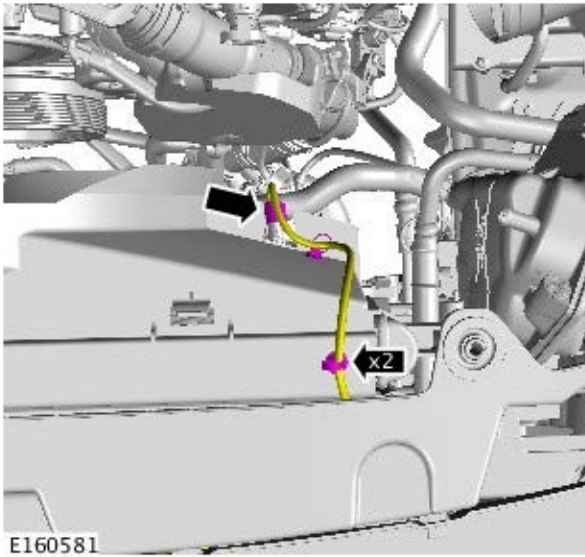
45.



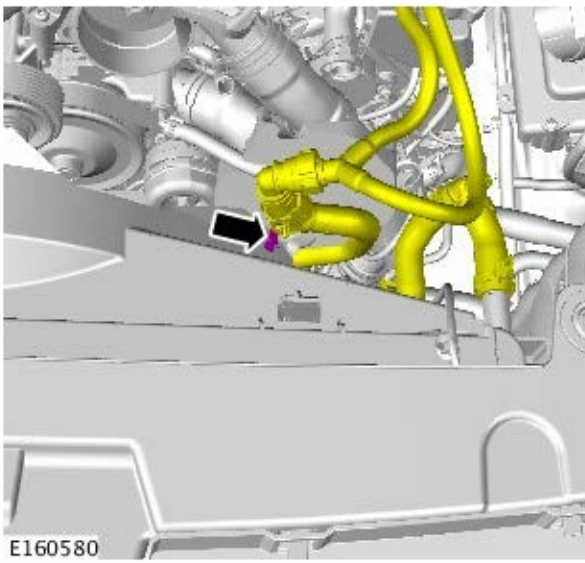
46.



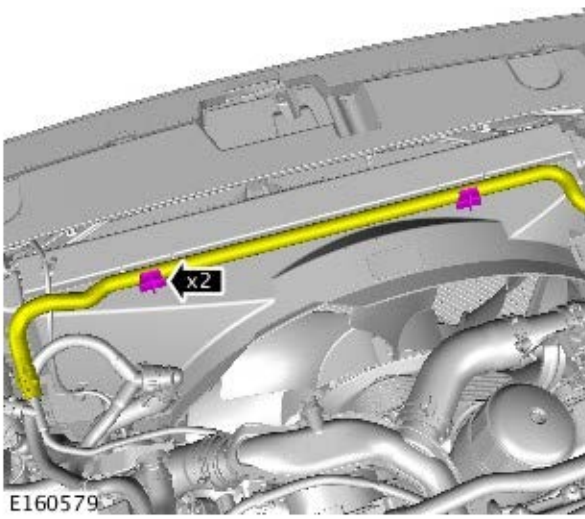
47.



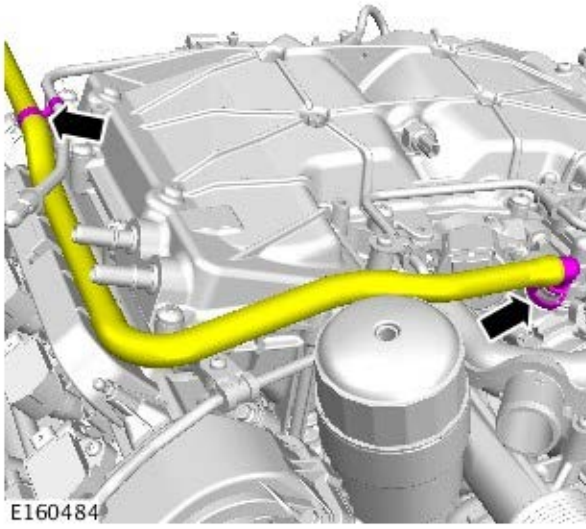
48.



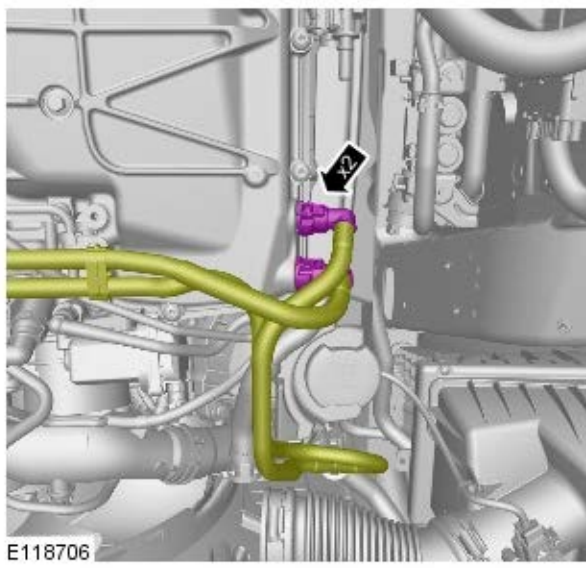
49.



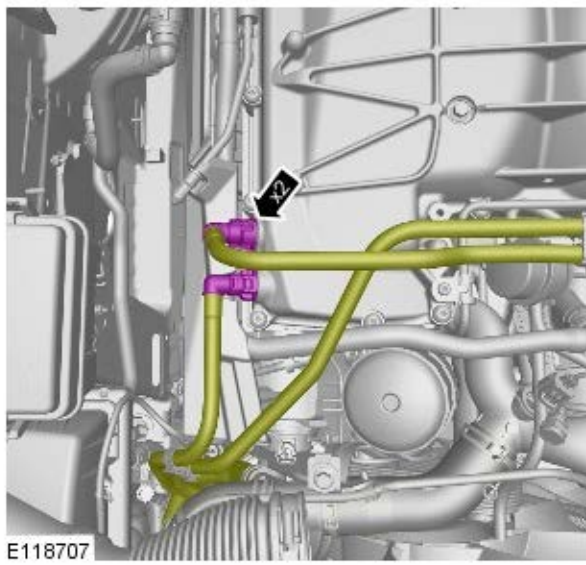
50.



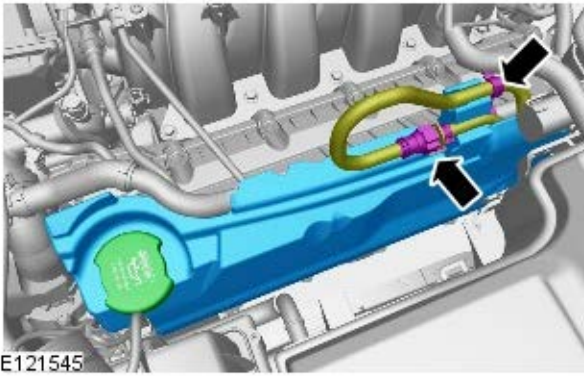
51.



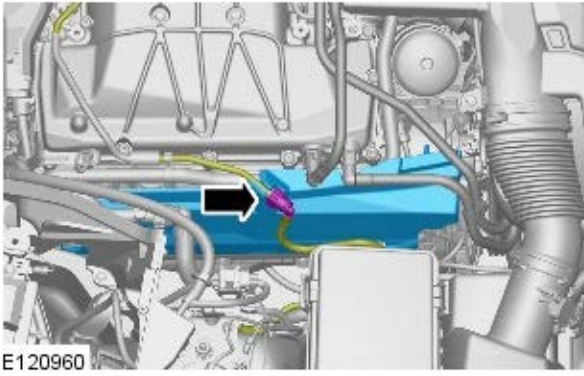
52.



53.



54.



55. Refer to: [Body - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).

Engine Cooling - TDV6 3.0L Diesel -

Description	Specification
Land Rover premium cooling system fluid	WSS M97B44-D
Land Rover premium cooling system flush	EGR-M14P7-A

Capacities

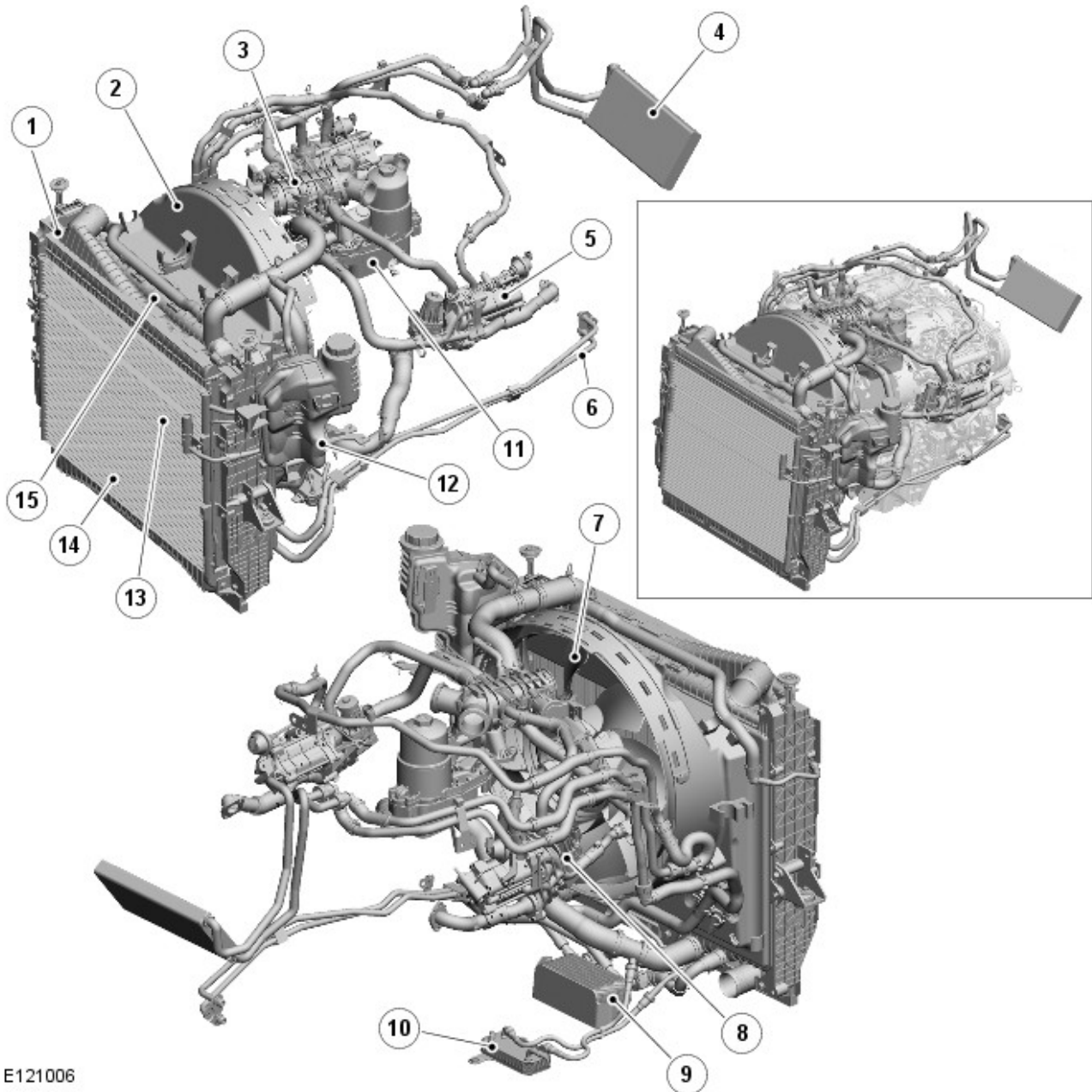
Item	Specification
Vehicles fitted with 4 zone air conditioning (A/C)	16.6L (dry capacity)
Vehicles fitted with 2 zone A/C	15.9L (dry capacity)

Description	Nm	lb-ft	lb-in
Coolant expansion tank bolt	10	7	-
Water outlet assembly bolts	10	7	-
Water inlet hose bolts	10	7	-
Coolant pump bolts	10	7	-
Cooling fan nut	65	48	-
Thermostat housing upper to lower bolts	4	-	35
Fuel cooler bolts	5	-	44
A/C radiator core bolts	5	-	44
Engine cooling module bolts	15	11	-
Cooling fan shroud M6 bolts	5	-	44
Cooling fan shroud M8 bolts	15	11	-
Charge air cooler bolts	15	11	-
Coolant bleed screw(s)	3	-	27

Engine Cooling - TDV6 3.0L Diesel - Engine Cooling - Component Location

Description and Operation

Component Location - without Fuel Fired Burning Heater

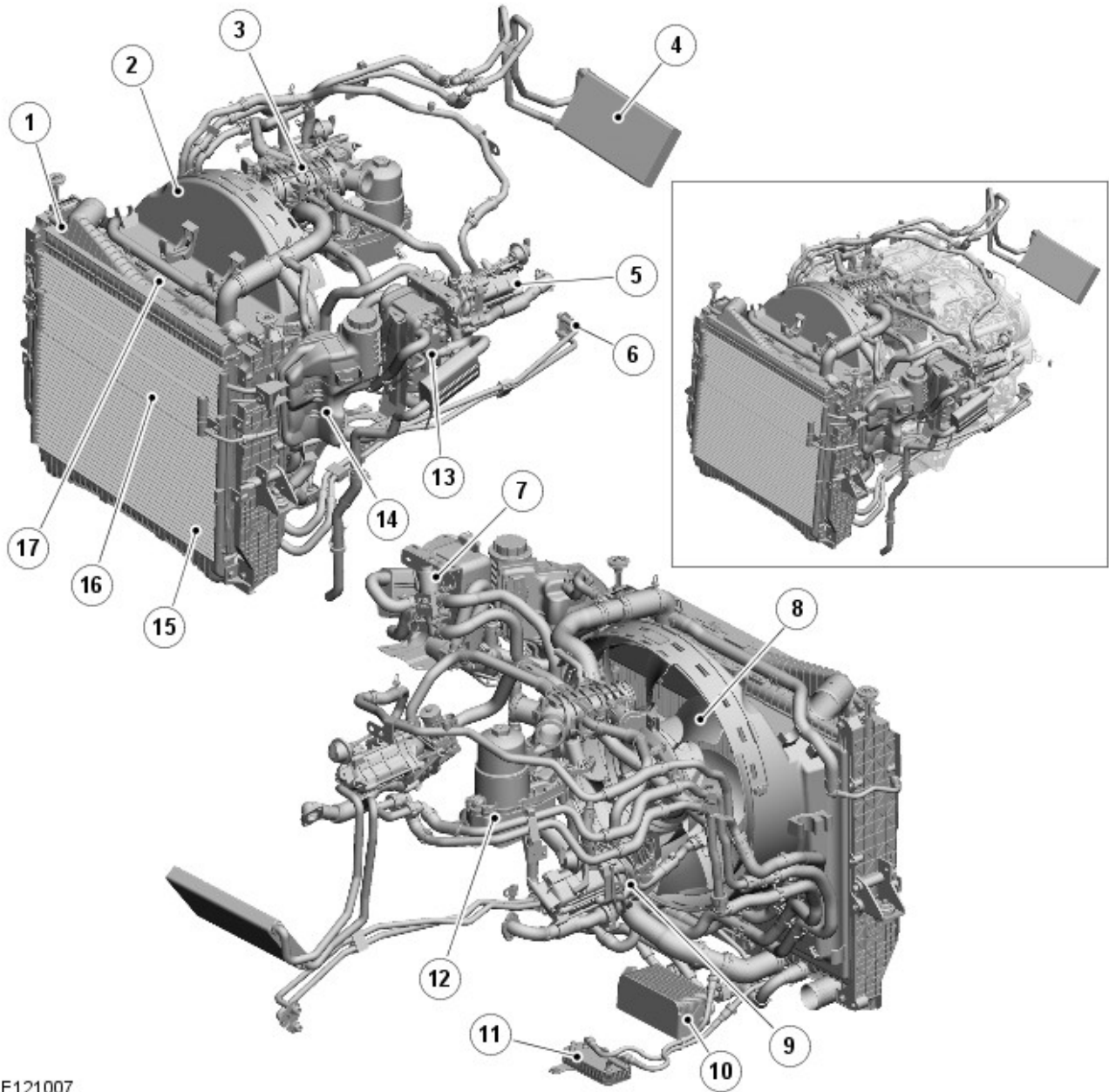


E121006

Item Description

- 1 Intercooler
- 2 Fan cowl
- 3 Throttle body
- 4 Heater core
- 5 LH (left-hand) EGR (exhaust gas recirculation) cooler
- 6 Transmission oil cooler pipes
- 7 Viscous fan
- 8 RH (right-hand) EGR cooler
- 9 Transmission oil cooler
- 10 Fuel sub-cooler
- 11 Engine oil cooler
- 12 Expansion tank
- 13 Fuel cooler
- 14 Condenser
- 15 Radiator

Component Location - with Fuel Fired Burning Heater and Park Heating



E121007

Item Description

- 1 Intercooler
- 2 Fan cowl
- 3 Throttle body
- 4 Heater core
- 5 LHEGR cooler
- 6 Transmission oil cooler pipes
- 7 Park heating valve assembly
- 8 Viscous fan
- 9 RHEGR cooler
- 10 Transmission oil cooler
- 11 Fuel sub-cooler
- 12 Engine oil cooler
- 13 FFBH (fuel fired burning heater)
- 14 Expansion tank
- 15 Condenser
- 16 Fuel cooler
- 17 Radiator

Engine Cooling - TDV6 3.0L Diesel - Engine Cooling - Overview

Description and Operation

OVERVIEW

The engine cooling system maintains the engine within an optimum temperature range under changing ambient and engine operating conditions. It also provides:

- Heating for the passenger compartment.
Refer to: Heating and Ventilation (412-02A, Description and Operation).
- Cooling for:
 - The engine oil
 - The fuel
 - The [EGR \(exhaust gas recirculation\)](#) system
Refer to: Engine Emission Control (303-08B, Description and Operation).
 - The transmission fluid.

Engine Cooling - TDV6 3.0L Diesel - Engine Cooling - System Operation and Component Description

Description and Operation

System Operation

COOLANT CIRCUIT FLOW

When the engine is running the coolant is circulated around the engine cooling system by the coolant pump. From the coolant pump, coolant flows through the cylinder block and the cylinder heads. Some of the coolant in the cylinder block is diverted through the engine oil cooler before returning to the 5-way connector via the water outlet.

From the 5-way connector, the majority of the coolant flows to the pressure relief thermostat, either directly or via the radiator, depending on the temperature of the coolant. From the outlet of the thermostat the coolant flows to the inlet of the coolant pump.

A separate hose from the radiator allows extra-cooled coolant from the radiator to flow through the transmission oil cooler. The coolant from the cooler is returned to the system via a branch in the bottom radiator hose.

Coolant from the water outlet also flows through the [EGR \(exhaust gas recirculation\)](#) coolers and then to the heater core. From the heater core outlet, the coolant flows to the outlet zone of the pressure relief thermostat.

The expansion tank allows expansion of coolant due to temperature increases to pass excess coolant back to the expansion tank. A small hose is connected from the water outlet to the expansion tank for this purpose. As the coolant cools, the coolant is allowed back into the system from the tank via a hose from the expansion tank into the radiator bottom hose.

PRESSURE RELIEF THERMOSTAT (PRT)

The thermostat is closed at temperatures below approximately 82°C (179°F). When the coolant temperature reaches approximately 82°C the thermostat starts to open and is fully open at approximately 96°C (204°F). In this condition the full flow of coolant is directed through the radiator. The thermostat is exposed to 90% hot coolant from the engine on one side and 10% cold coolant returning from the radiator bottom hose on the other side. Hot coolant from the engine passes from the by-pass pipe through four sensing holes in the flow valve into a tube surrounding 90% of the thermostat sensitive area. Cold coolant returning from the engine, cooled by the radiator, conducts through 10% of the sensitive area.

In cold ambient temperatures, the engine temperature is raised by approximately 10°C (50°F) to compensate for the heat loss of 10% exposure to the cold coolant returning from the bottom hose.

The by-pass flow valve is held closed by a light spring. It operates to further aid heater warm-up. When the main valve is closed and the engine speed is at idle, the coolant pump does not produce sufficient flow and pressure to open the valve. In this condition the valve prevents coolant circulating through the by-pass circuit and forces the coolant through the heater matrix only. This provides a higher flow of coolant through the heater matrix to improve passenger comfort in cold conditions. When the engine speed increases above idle, the coolant pump produces a greater flow and pressure than the heater circuit can take. The pressure acts on the by-pass flow valve and overcomes the valve spring pressure, opening the valve and limiting the pressure in the heater circuit. The valve modulates to provide maximum coolant flow through the heater core and yet allowing excess coolant to flow into the by-pass circuit to provide the engine's cooling needs at higher engine speeds.

COOLING FAN

For additional airflow through the radiator matrix, particularly when the vehicle is stationary, there is an engine driven electro-viscous fan unit fitted to the rear of the radiator. The fan is used for engine cooling and for [A/C \(air conditioning\)](#) system cooling. This unit functions as a normal viscous fan, but with electronic control over the level of engagement of the clutch. The [ECM \(engine control module\)](#), which determines the required fan speed, controls the level of clutch engagement. The [ECM](#) determines engagement based on the coolant, charge air, ambient and transmission oil temperatures and the [A/C](#) pressure. The fan is mounted using a left hand thread.

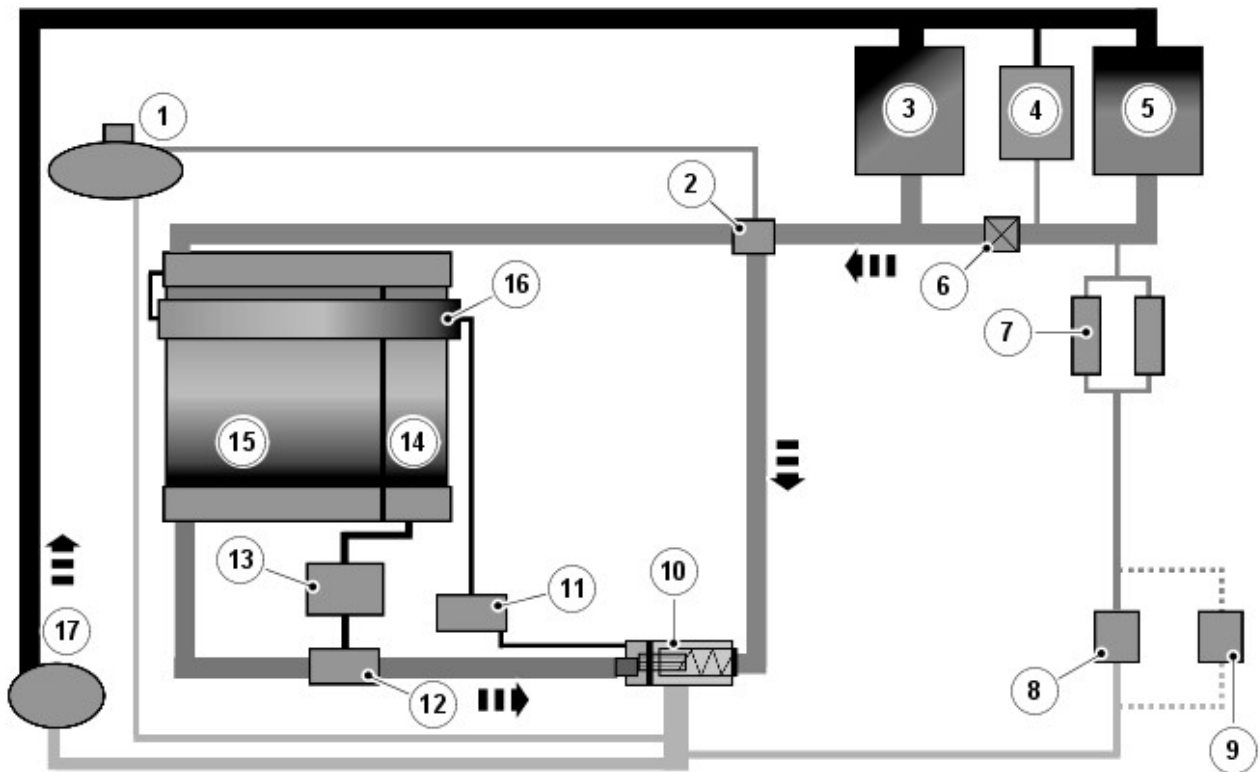
The viscous fan unit is electronically controlled by the [ECM](#) to optimize fan speed for all operating conditions.



NOTE: If the electrical connections to the viscous fan are disconnected the fan will 'idle' and overheating may result. The [ECM](#) stores the appropriate fault codes in this case.

SCHEMATIC FLOW DIAGRAMS

ENGINE COOLING WITHOUT FUEL FIRED BURNING HEATER

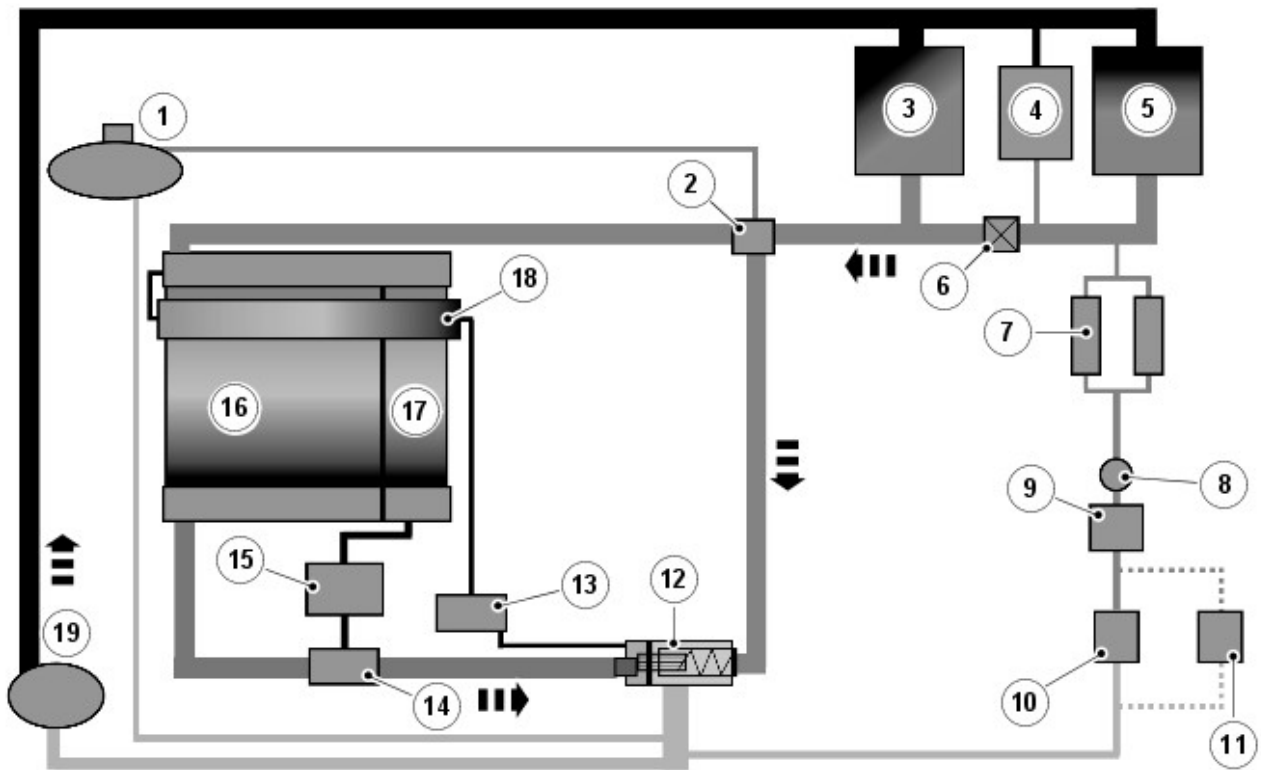


E107588

Item Description

- 1 Expansion tank
- 2 Degas connector
- 3 Cylinder head
- 4 Engine oil cooler
- 5 Cylinder head
- 6 Static bleed point
- 7 EGR coolers
- 8 Cabin heater
- 9 Rear heater
- 10 Pressure Relief Thermostat (PRT)
- 11 Fuel cooler
- 12 Venturi connector
- 13 Transmission oil cooler
- 14 Transmission oil sub-cooler
- 15 Radiator
- 16 Fuel sub-cooler
- 17 Water pump

ENGINE COOLING WITH FUEL FIRED BURNING HEATER - SCHEMATIC FLOW DIAGRAM

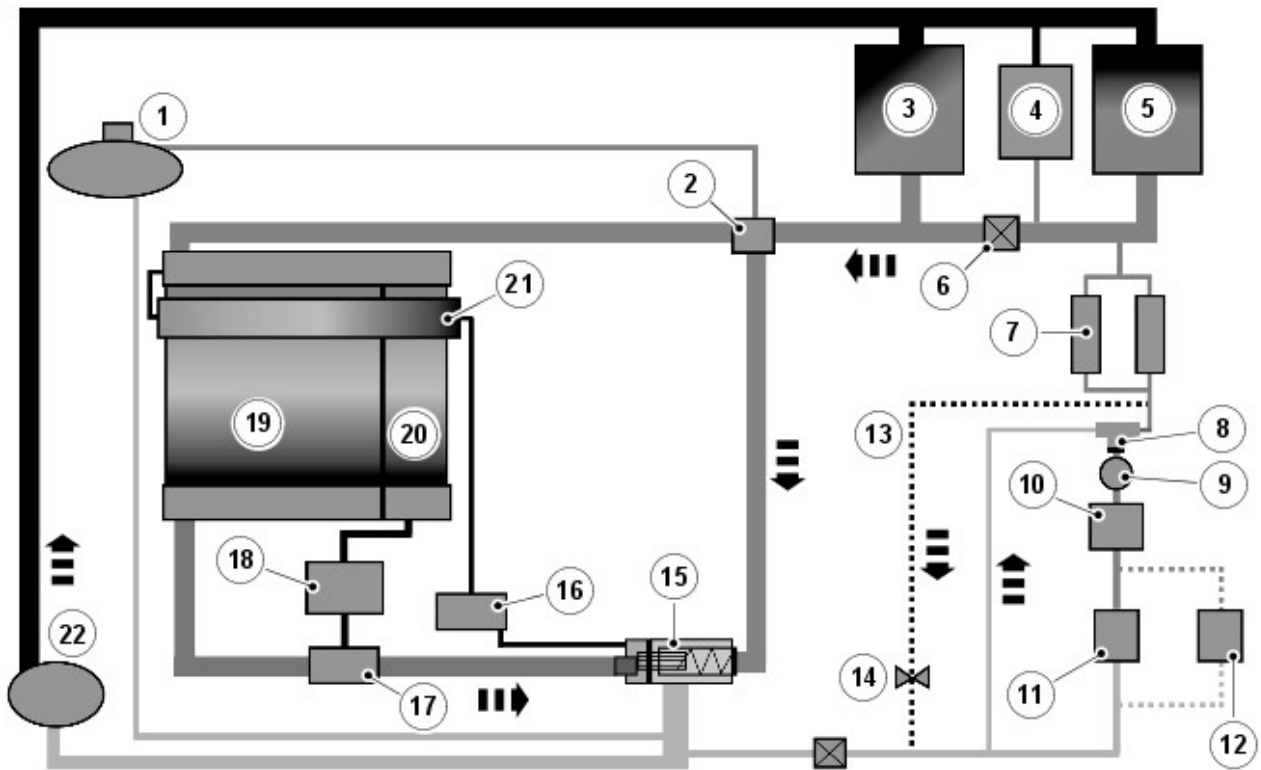


E107589

Item Description

- 1 Expansion tank
- 2 Degas connector
- 3 Cylinder head
- 4 Engine oil cooler
- 5 Cylinder head
- 6 Static bleed point
- 7 EGR coolers
- 8 Pump
- 9 FFBH (fuel fired burning heater)
- 10 Cabin heater
- 11 Rear heater
- 12 PRT
- 13 Fuel cooler
- 14 Venturi connector
- 15 Transmission oil cooler
- 16 Radiator
- 17 Transmission oil sub-cooler
- 18 Fuel sub-cooler
- 19 Water pump

ENGINE COOLING WITH FUEL FIRED BURNING HEATER AND PARK HEATING - SCHEMATIC FLOW DIAGRAM



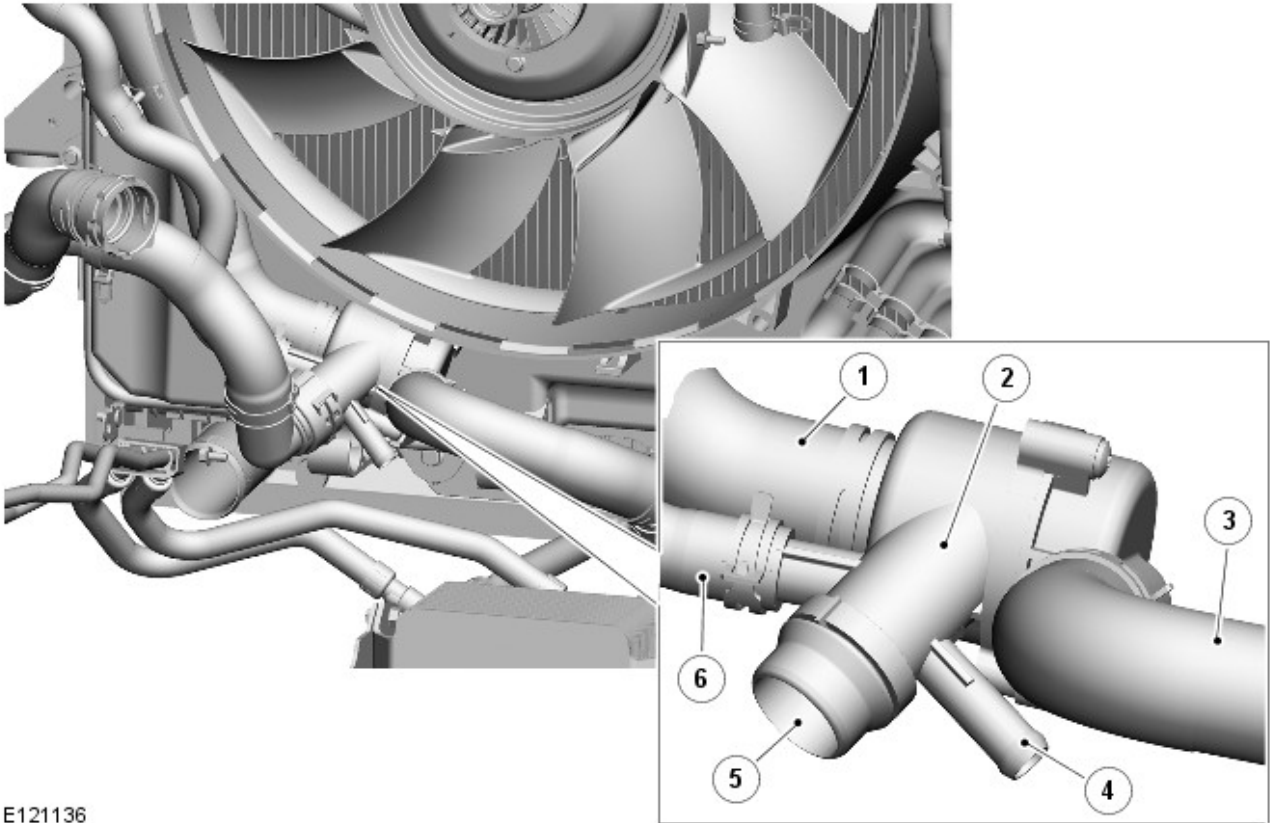
E107590

Item Description

- 1 Expansion tank
- 2 Degas connector
- 3 Cylinder head
- 4 Engine oil cooler
- 5 Cylinder head
- 6 Static bleed point
- 7 EGR coolers
- 8 3-way valve
- 9 Pump
- 10 FFBH (fuel fired burning heater)
- 11 Cabin heater
- 12 Rear heater
- 13 Heater by-pass
- 14 Restrictor
- 15 PRT
- 16 Fuel cooler
- 17 Venturi connector
- 18 Transmission oil cooler
- 19 Radiator
- 20 Transmission oil sub-cooler
- 21 Fuel sub-cooler
- 22 Water pump

Component Description

PRESSURE RELIEF THERMOSTAT (PRT)



E121136

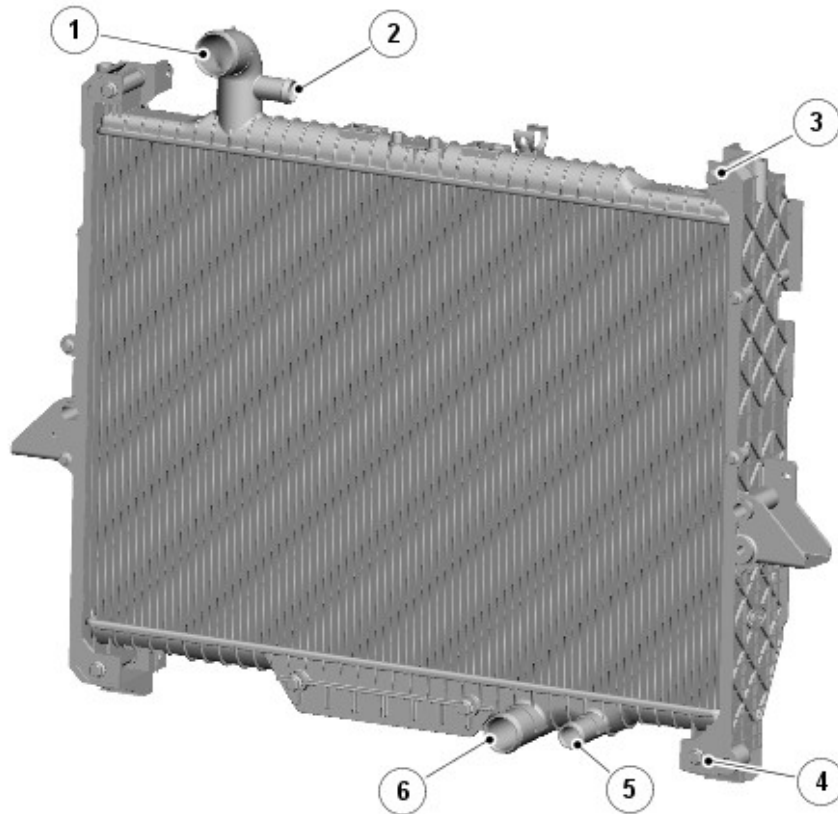
Item Description

- 1 Connection to radiator top hose
- 2 PRT body
- 3 Connection from radiator bottom hose
- 4 Heater core return connection
- 5 Connection to cylinder block water inlet
- 6 Connection to expansion tank

A plastic thermostat housing is located behind the radiator. The housing has 5 connections which locate the radiator bottom hose, top hose from the 5-way connector, coolant pump feed hose to the cylinder block and return feed from the heater core. The housing contains a wax element and a spring loaded by-pass flow valve.

The thermostat is used to maintain the coolant at the optimum temperature for efficient combustion and to aid engine warm-up.

RADIATOR



E121137

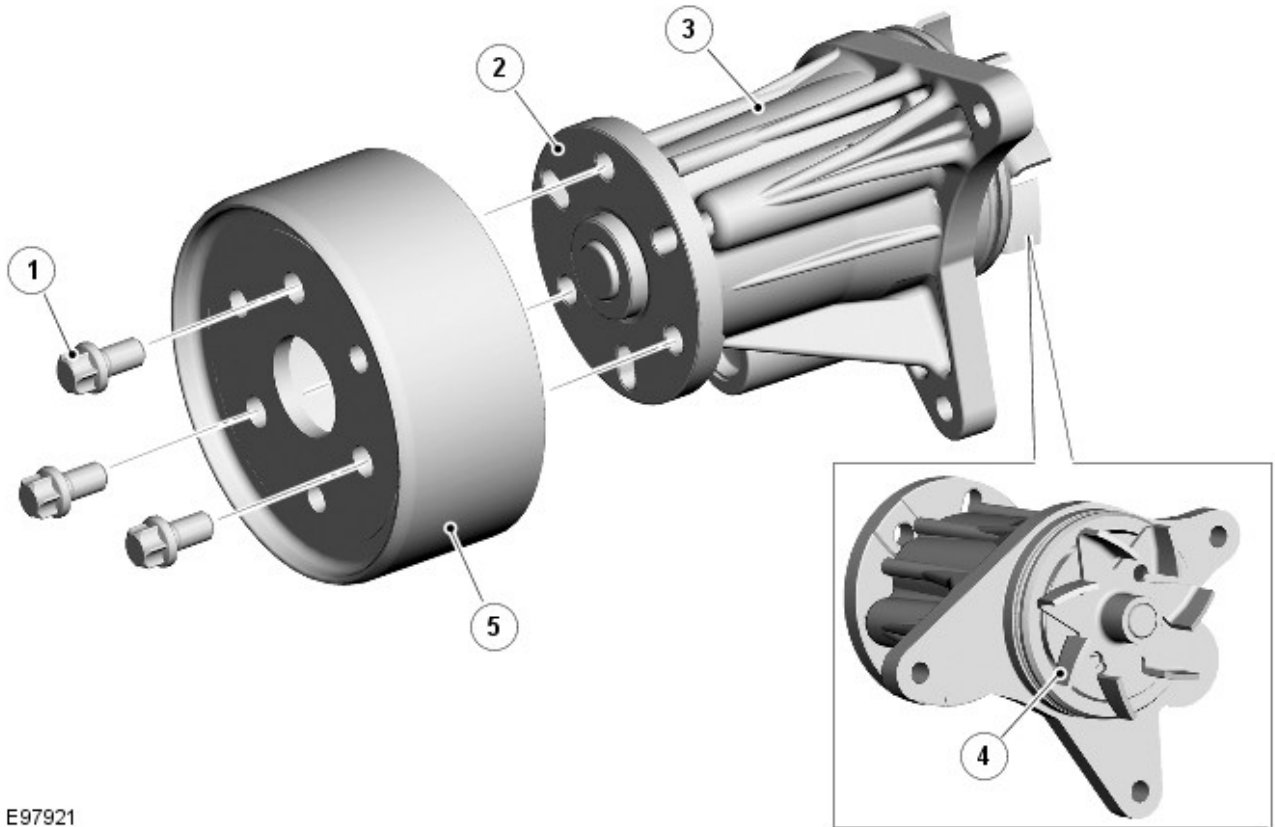
Item Description

- 1 Coolant inlet
- 2 Coolant outlet to fuel cooler
- 3 Support - upper (2 off)
- 4 Support - lower (2 off)
- 5 Coolant outlet to transmission oil cooler
- 6 Coolant outlet to pressure relief thermostat

The radiator is a vertical-flow type with an aluminum core and plastic end tanks. The radiator is located in the vehicle by locating spigots and supports integrated into the cooling pack end frames. The lower supports are installed in rubber bushes in the upper chassis rails. The upper locating spigots are installed in rubber bushes in the front end carrier. Coolant inlet and outlet connections are incorporated into the upper and lower end tanks respectively.

The lower end tank also has a connection for coolant outlet to the transmission fluid cooler.

COOLANT PUMP



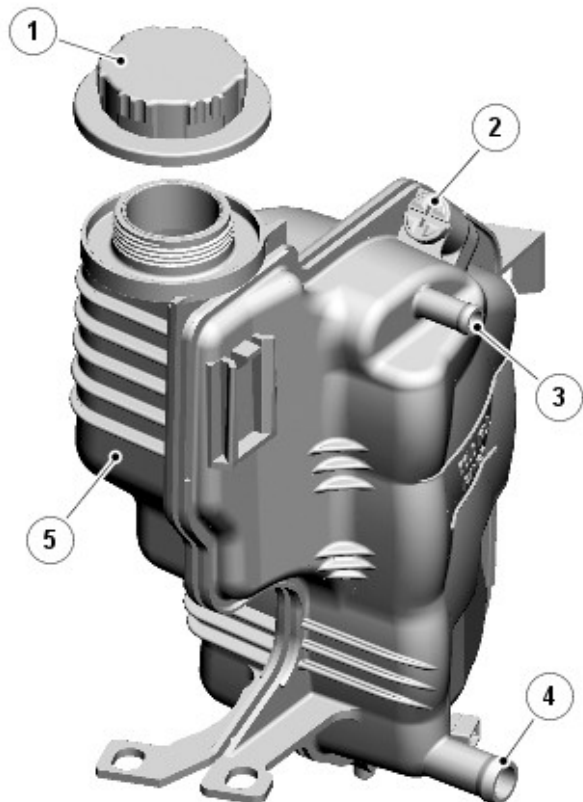
E97921

Item Description

- 1 Bolt (3 off)
- 2 Drive hub
- 3 Housing
- 4 Impeller
- 5 Pulley

The coolant pump has a housing that supports a shaft with an impeller attached to one end and a drive hub at the other. The housing is attached to the front of the cylinder block with the impeller located in a pumping chamber. The pump is driven by a pulley attached to the drive hub and driven by the accessory drive belt. For additional information refer to Accessory Drive 303-05B.

EXPANSION TANK



E121138

Item Description

- 1 Filler cap
- 2 Bleed screw
- 3 Vent hose connection
- 4 Expansion hose connection
- 5 Expansion tank

A pressurized expansion tank system is used which continuously separates the air from the cooling system and replenishes the system through a hose connected between the expansion tank and the heater return hose. A continuous vent into the expansion tank, through a hose connected to the engine's coolant outlet connector, prevents air locks from forming in the cooling system.

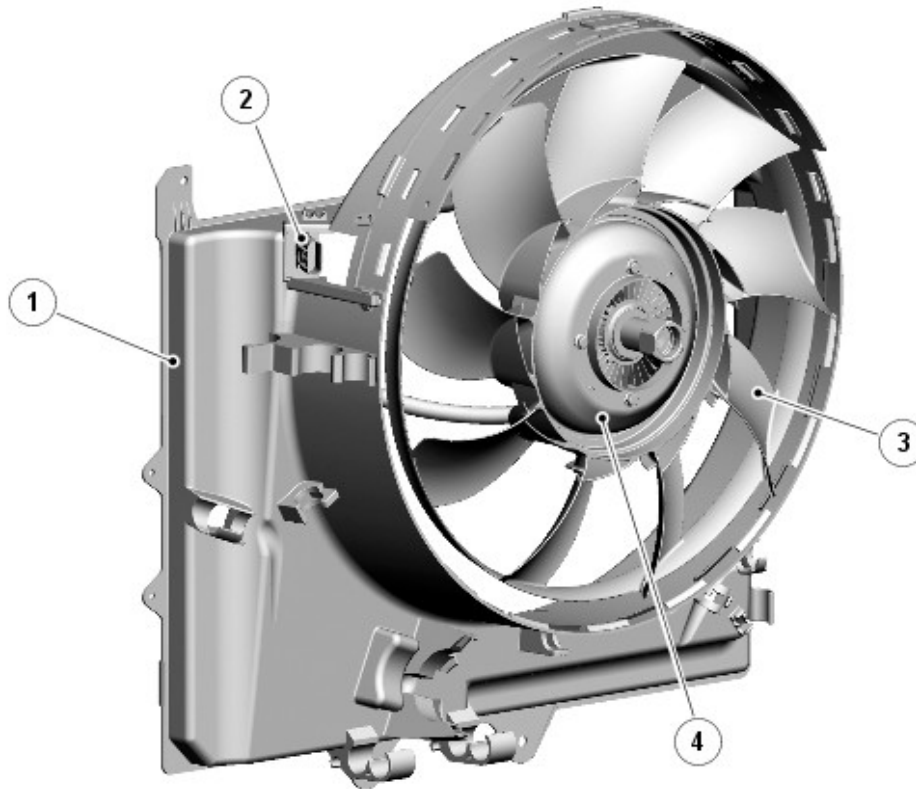
The expansion tank is installed behind the top right corner of the radiator. A filler cap, bleed screw and level sensor are incorporated into the expansion tank. MAX and MIN level markings are molded into the interior of the tank below the filler cap.

The expansion tank provides the following functions:

- Service fill
- Coolant expansion during warm-up
- Air separation during operation
- System pressurization by the filler cap

The expansion tank has an air space of approximately 0.5 to 1 liter (1.06 to 2,11 US pints), above the MAX level, to allow for coolant expansion.

COOLING FAN



E121139

Item Description

- 1 Shroud
- 2 Electrical connector
- 3 Fan
- 4 Viscous unit

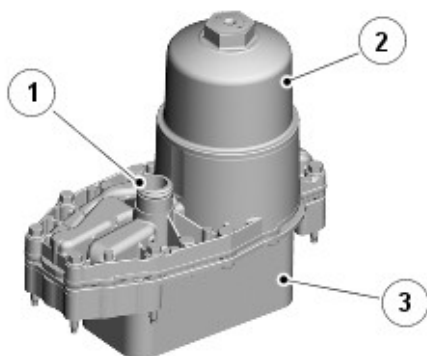
To control the cooling fan, the **ECM** sends a **PWM (pulse width modulation)** signal to the cooling fan module (integral to the **ECM**). The frequency of the **PWM** signal is used by the cooling fan module to determine the output voltage supplied to the fan motor.

The **ECM** varies the duty cycle of the **PWM** signal between 0 and 100% to vary the fan speed. If the **PWM** signal is outside the 0 to 100% range, the cooling fan module interprets the signal as an open or short circuit and runs the fans at maximum speed to ensure the engine and transmission do not overheat.

The **ECM** operates the fan in response to inputs from the **ECT (engine coolant temperature)** sensor, the transmission oil temperature sensor, the charge air temperature sensor, the **A/C** switch and the **A/C** pressure sensor.

The speed of the cooling fan is also influenced by vehicle road speed. The **ECM** adjusts the speed of the cooling fans, to compensate for the ram effect of vehicle speed, using the **CAN (controller area network)** road speed signal received from the **ABS (anti-lock brake system)** module.

ENGINE OIL COOLER



E115007

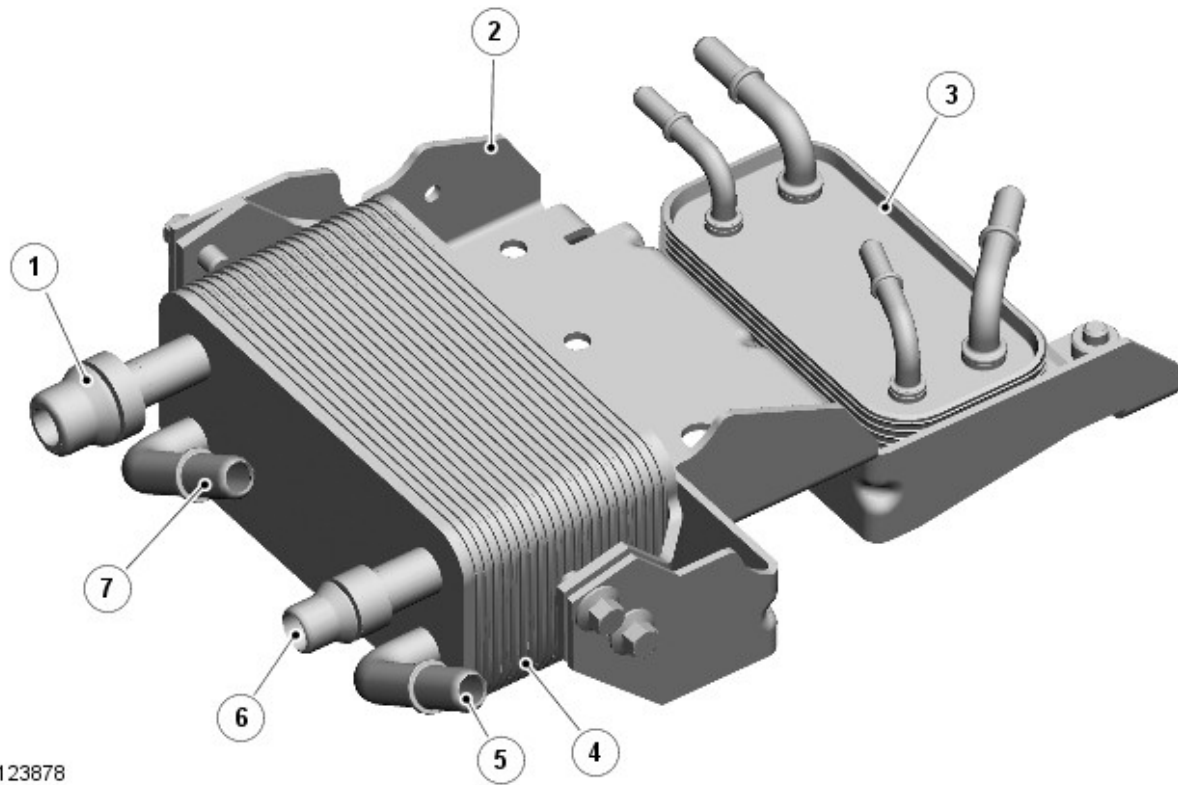
Item Description

- 1 Coolant outlet
- 2 Engine oil filter
- 3 Engine oil cooler

The engine oil cooler is attached to a common adapter assembly located in the vee of the cylinder block. Inlet and

outlet ports for engine oil, and an inlet port for coolant, are incorporated into the cylinder block mating face of the adapter assembly. A metal gasket seals the joint between the adapter assembly and the cylinder block. From the cylinder block, coolant flows through the adapter assembly and into the cooler. After passing through the cooler, the coolant then flows into the engine coolant water outlet.

TRANSMISSION FLUID COOLER



E123878

Item Description

- 1 Coolant inlet from radiator
- 2 Mounting bracket
- 3 Fuel cooler
- 4 Transmission fluid cooler
- 5 Transmission fluid inlet
- 6 Coolant outlet to radiator bottom hose
- 7 Transmission fluid outlet

The transmission fluid cooler is located on chassis cross member behind the radiator, sharing a bracket with the fuel cooler. The cooler is connected to the cooling system with two hoses and receives cooled fluid from the lower section of the radiator, which flows through the cooler, reducing the temperature of the transmission fluid.

ENGINE COOLANT

The coolant is silicate free and must not be mixed with conventional engine coolant.

Engine Cooling - TDV6 3.0L Diesel - Engine Cooling

Diagnosis and Testing

Principle of Operation

For a detailed description of the engine cooling system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (303-03 Engine Cooling - TDV6 3.0L Diesel)

Engine Cooling (Description and Operation),
 Engine Cooling (Description and Operation),
 Engine Cooling (Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Coolant leaks • Coolant hoses • Coolant expansion tank • Radiator • Heater core • Accessory drive belt • Viscous fan 	<ul style="list-style-type: none"> • Fuses • Harnesses • Loose or corroded connector(s) • Engine Coolant Temperature (ECT) sensor

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Coolant loss	<ul style="list-style-type: none"> • Hoses • Hose connections • Radiator • Water pump • Heater core • Gaskets • Engine casting cracks • Engine block core plugs 	<ul style="list-style-type: none"> • Carry out a visual inspection. If there are no obvious leaks, carry out a cooling system pressure test. Rectify any leaks as necessary
Overheating	<ul style="list-style-type: none"> • Low/contaminated coolant • Thermostat • Viscous fan • ECT sensor • Restricted air flow over the radiator 	<ul style="list-style-type: none"> • Check the coolant level and condition. Carry out a cooling system pressure test. Rectify any leaks as necessary • Test the thermostat and rectify as necessary • Test the viscous fan operation, make sure the viscous fan rotates freely. Rectify as necessary • Check for obstructions to the air flow over the radiator. Rectify as necessary
Engine not reaching normal temperature	<ul style="list-style-type: none"> • Thermostat • Viscous fan • Thermostat • Electric fan • Fan speed module 	<ul style="list-style-type: none"> • Test the thermostat and rectify as necessary • Test the viscous fan operation, make sure the viscous fan rotates freely

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (PCM) (100-00,

Description and Operation).

Engine Cooling - TDV6 3.0L Diesel - Cooling System Draining, Filling and Bleeding


General Procedures

Draining




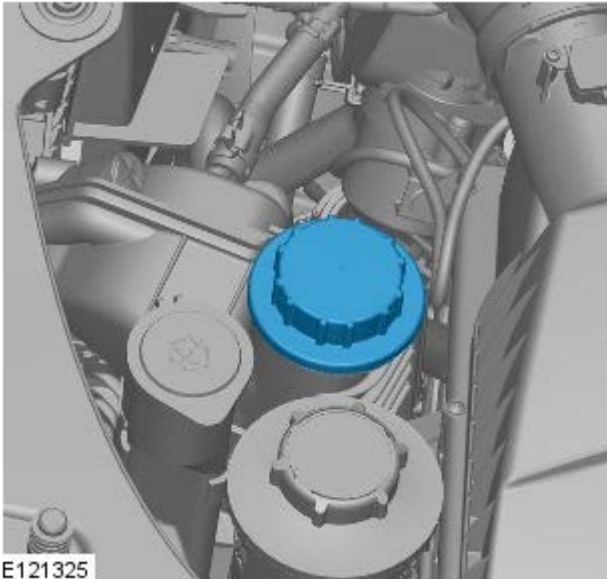
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).

2.  WARNING: Make sure to support the vehicle with axle stands.

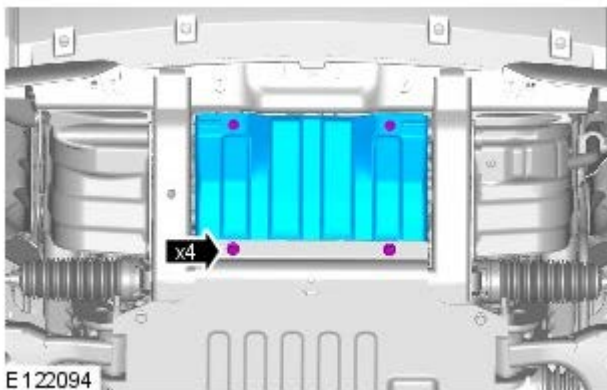
Raise and support the vehicle.

3.  WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.



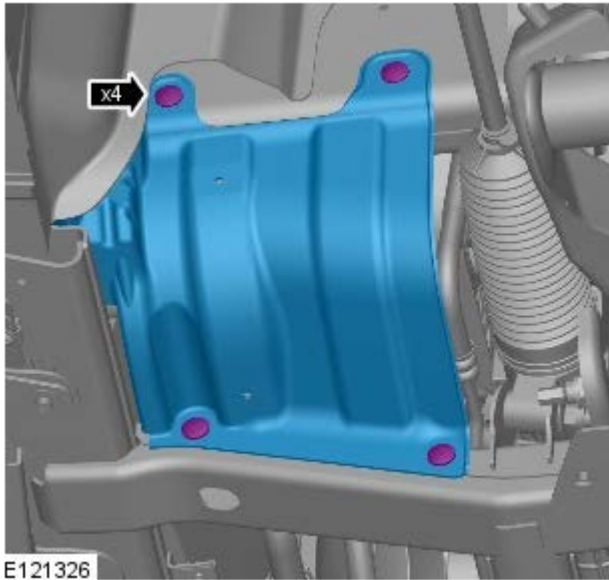
E121325


4. Remove the 4 bolts.



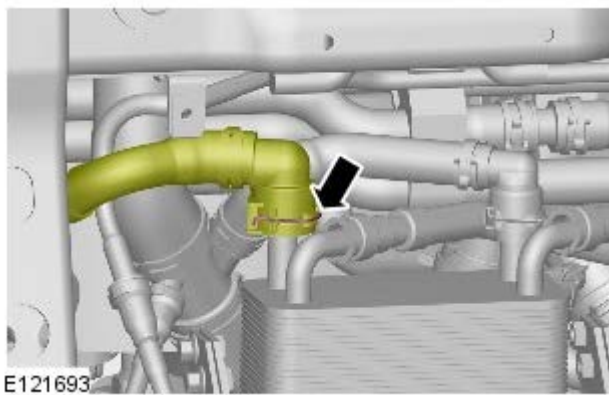
E122094

- 5.

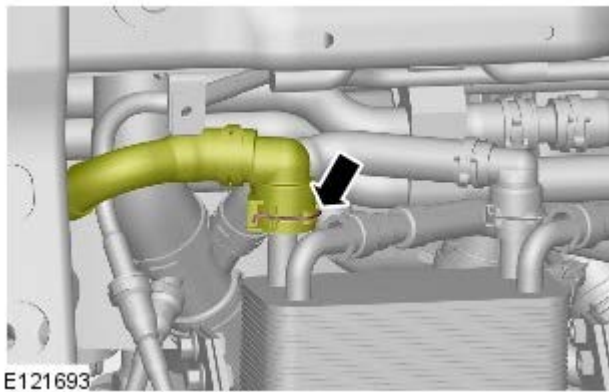



6.  CAUTION: Be prepared to collect escaping coolant.

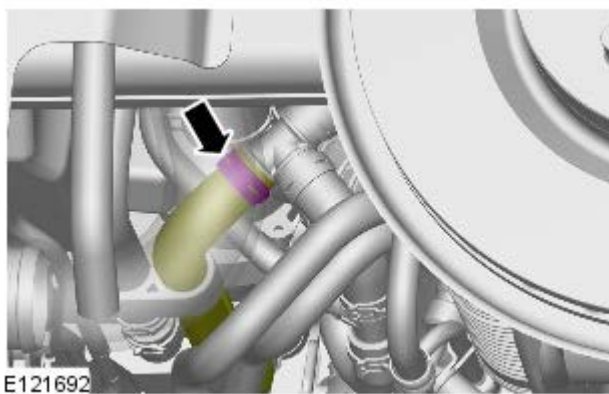
Position a container to collect the fluid.



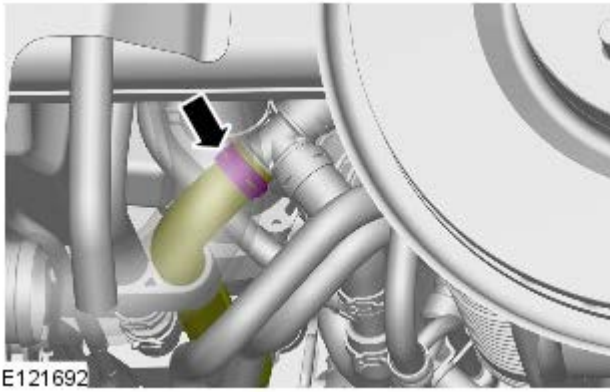
7. Connect the transmission fluid cooler coolant hose.



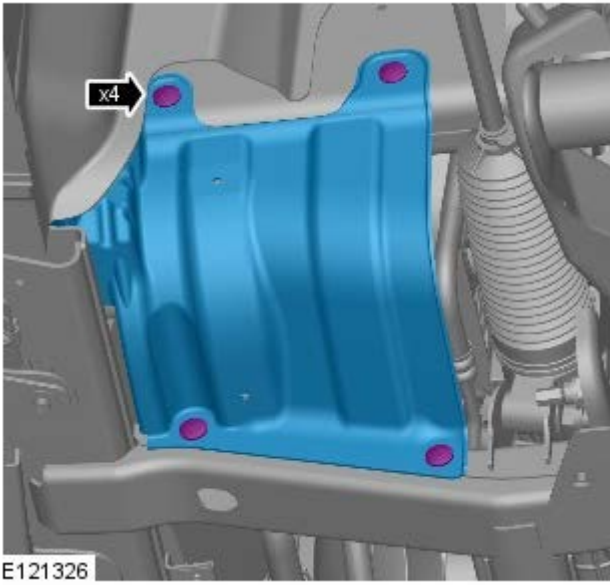
8.  CAUTION: Be prepared to collect escaping coolant.



9. Install the coolant hose.

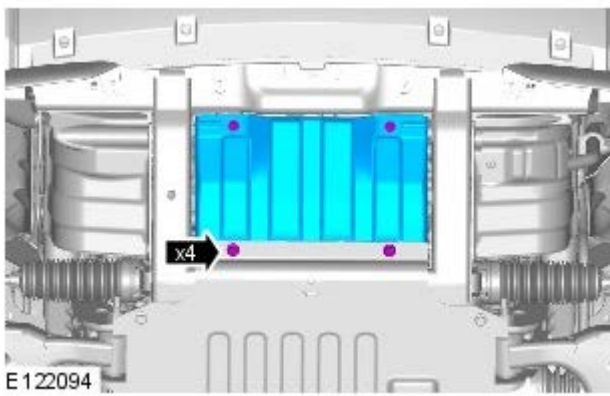


10. Install the LH splash shield.

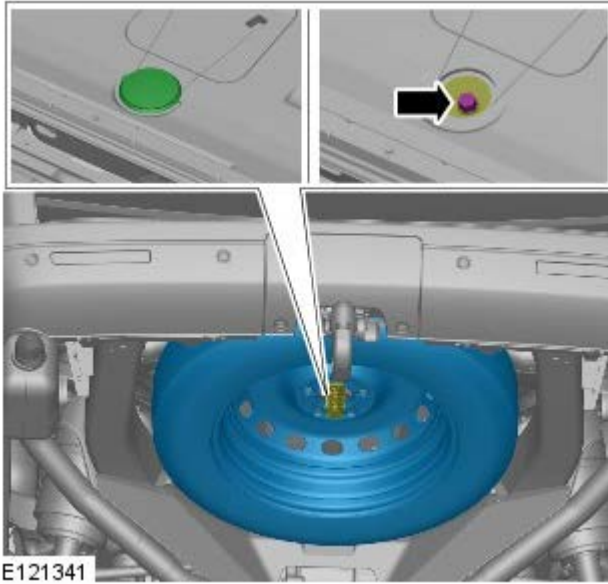



11.

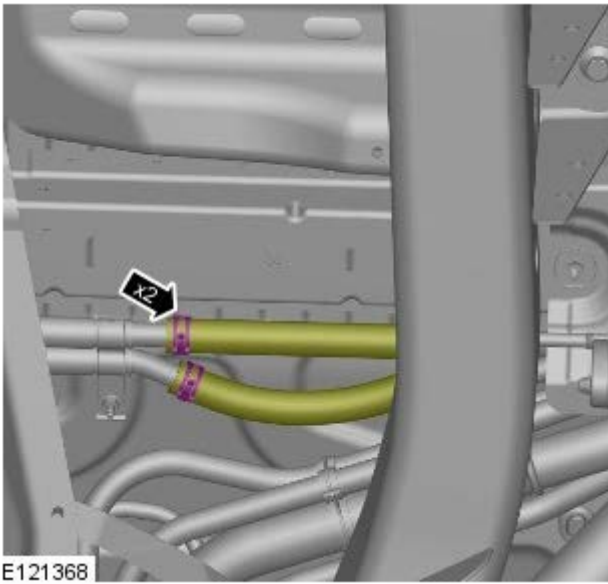
- Install the radiator access panel.
- *Torque: 10 Nm*



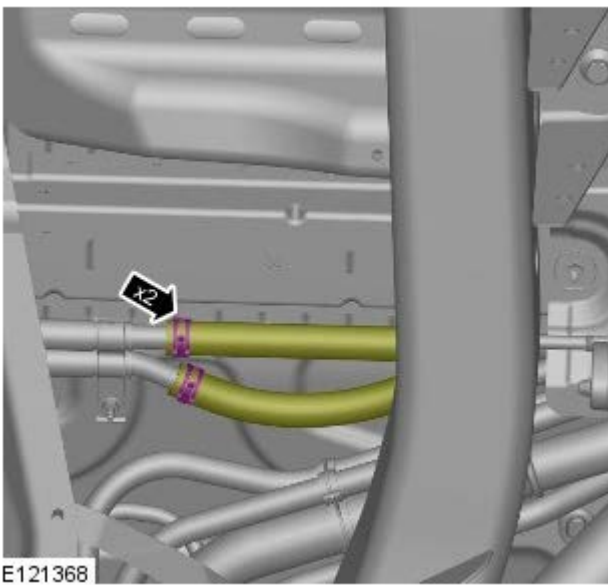
12. Remove the spare wheel and tire.



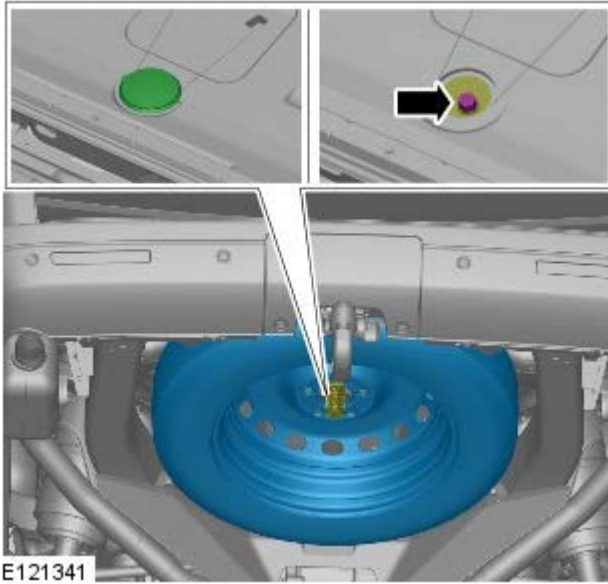
13.  CAUTION: Be prepared to collect escaping coolant.



14. Install the coolant hoses.



15. Install the spare wheel and tire.



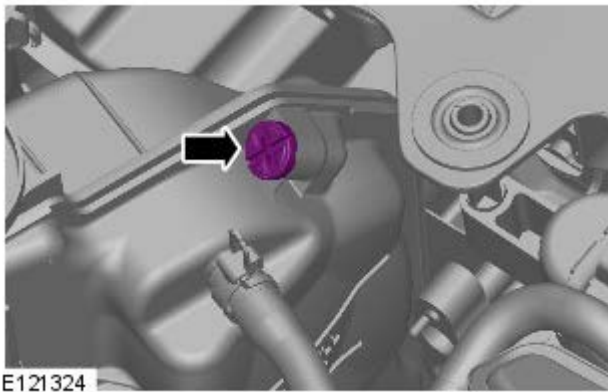
Filling



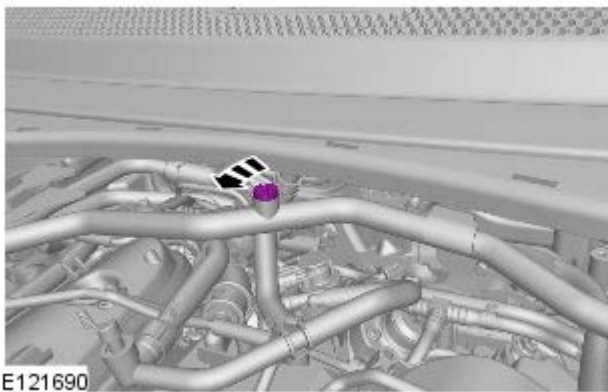
NOTE: Removal steps in this procedure may contain installation details.

1. Lower the vehicle.

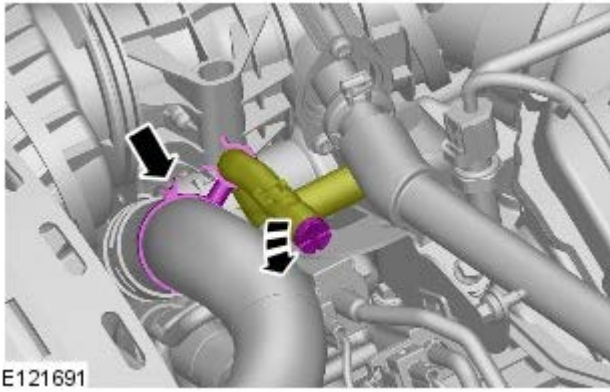
2.



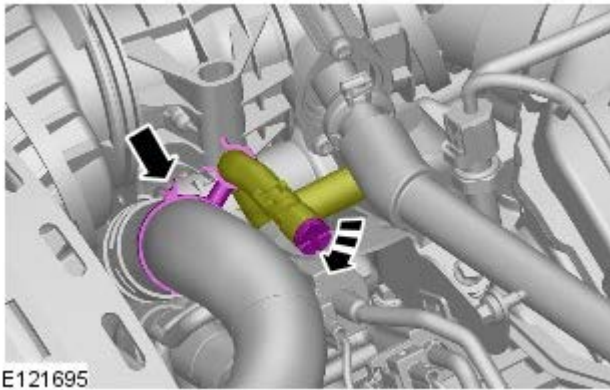
3.



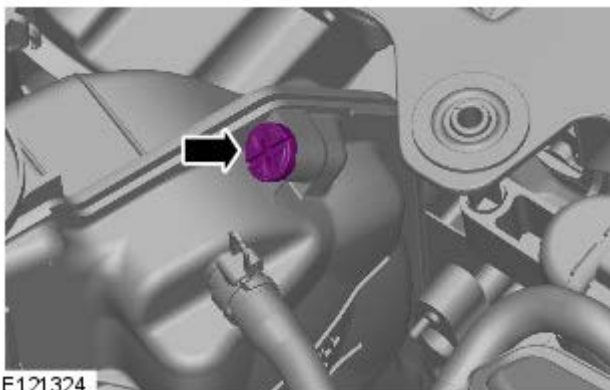
4.



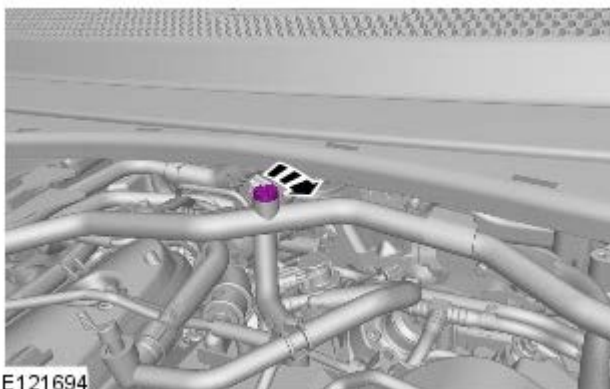
E121691



E121695




E121324




E121694

5. CAUTIONS:

 Anti-freeze concentration must be maintained at 50%.

 Be prepared to collect escaping coolant.


Fill the coolant expansion tank until coolant appears through the bleed ports.

6.  CAUTION: Be prepared to collect escaping coolant.

Fill the coolant expansion tank until coolant appears through the bleed ports.

7. Set the heater controls to maximum.

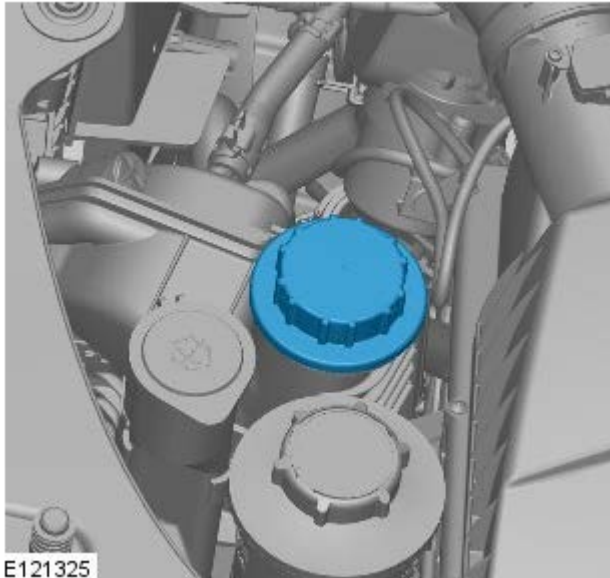
8. Start the engine and continue to fill the coolant until the maximum level is reached.


9.  CAUTION: Be prepared to collect escaping coolant.

Fill the coolant expansion tank until coolant appears through the bleed ports.

10. Increase engine speed to 2500rpm and cycle between this and idle.


11. Continue to top-up with coolant with the engine at idle.



12.  CAUTION: Correct installation of the Coolant expansion tank cap can be obtained by tightening the cap until an audible click is heard.

13. Allow the engine to idle, until hot air is emitted at the face registers.


14. Once the front heater is warm, check if the rear heater is warm (if equipped). If no heat is felt, increase the engine speed to 3000 rpm for 30 seconds and return to idle.


15.  CAUTION: Switch off the engine and allow the coolant temperature to go cold.


16. Visually check the engine and cooling system for signs of coolant leakage.

17.  WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

CAUTIONS:

 Since injury such as scalding could be caused by escaping steam or coolant, make sure the vehicle cooling system is cool prior to carrying out this procedure

 Make sure the coolant level remains above the "COLD FILL RANGE" lower level mark.

 NOTE: When the cooling system is warm, the coolant will be approximately 10mm above the upper level mark on the expansion tank with the cap removed.

Check and top-up the coolant if required.

18. Install the engine cover.

Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).

Engine Cooling - TDV6 3.0L Diesel - Auxiliary Radiator

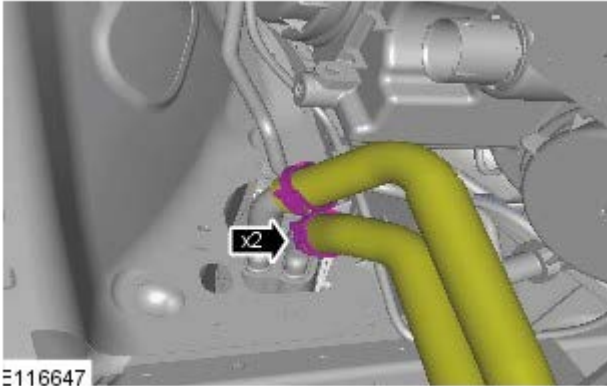
Removal and Installation

Removal




NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Battery Disconnect and Connect (414-01, General Procedures).
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 3.0L Diesel, General Procedures).



E116647

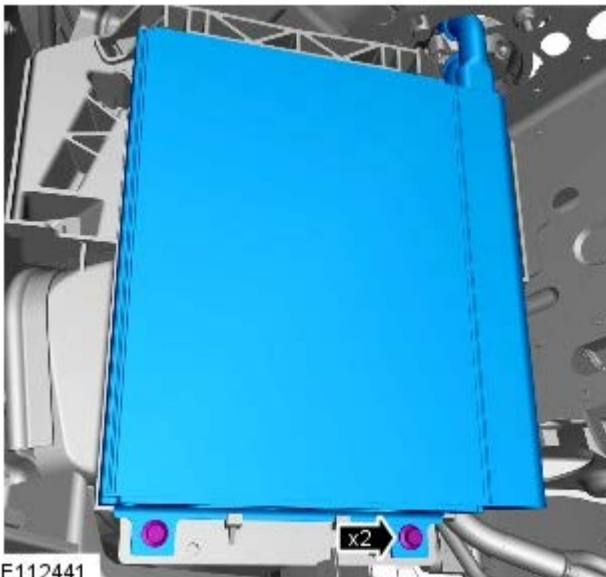
3.  CAUTION: Be prepared to collect escaping coolant.

4.  WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

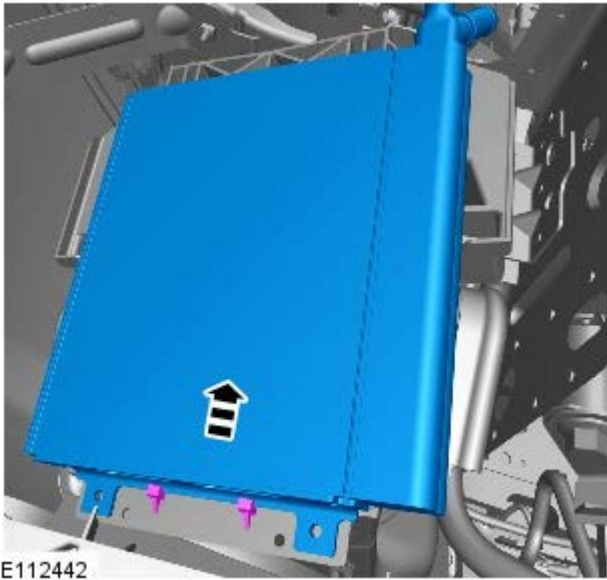
5. Refer to: Fender Splash Shield (501-02, Removal and Installation).

6. Torque: 7 Nm



E112441

- 7.



E112442

Installation

1. To install, reverse the removal procedure.

Engine Cooling - TDV6 3.0L Diesel - Coolant Expansion Tank

Removal and Installation

Removal

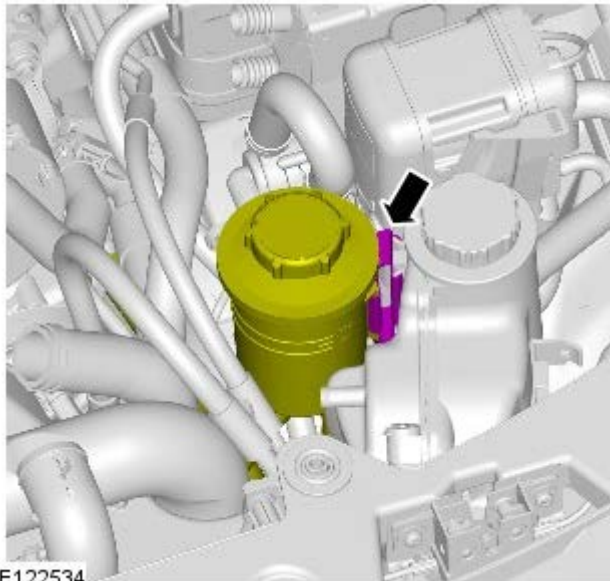


NOTE: Removal steps in this procedure may contain installation details.


1.  WARNING: Make sure to support the vehicle with axle stands.

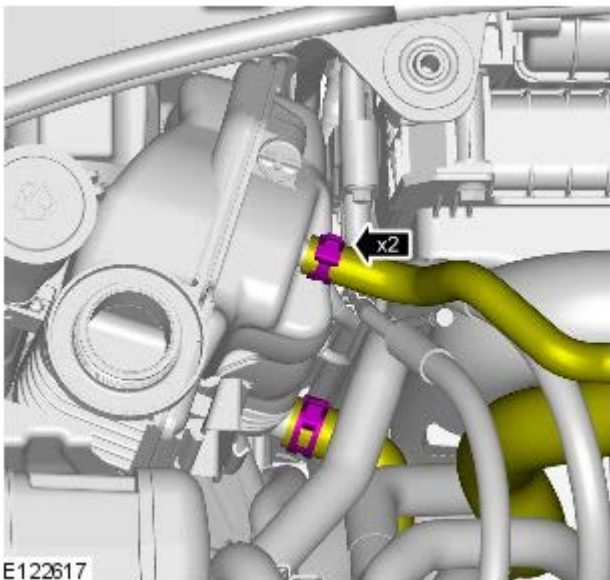
Raise and support the vehicle.

2.



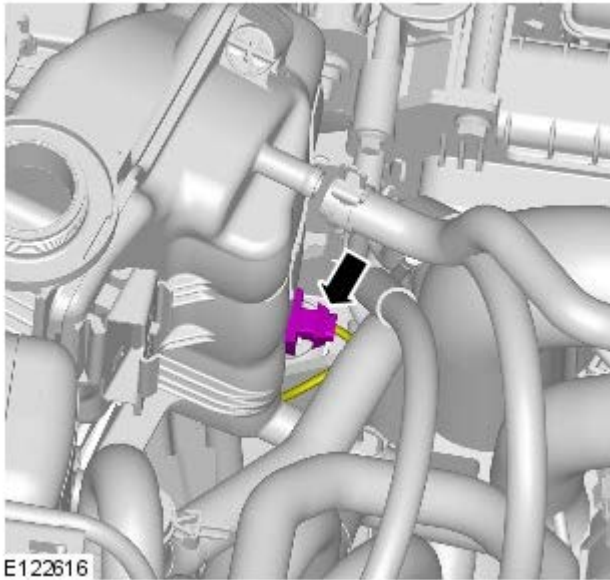
E122534

3.  CAUTION: Be prepared to collect escaping coolant.

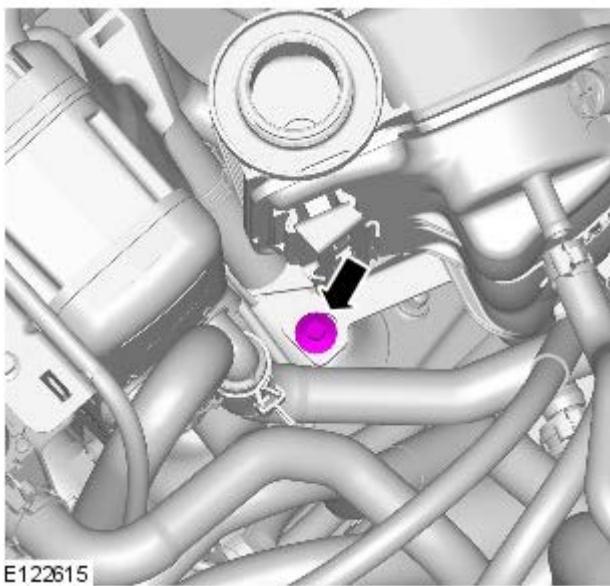


E122617

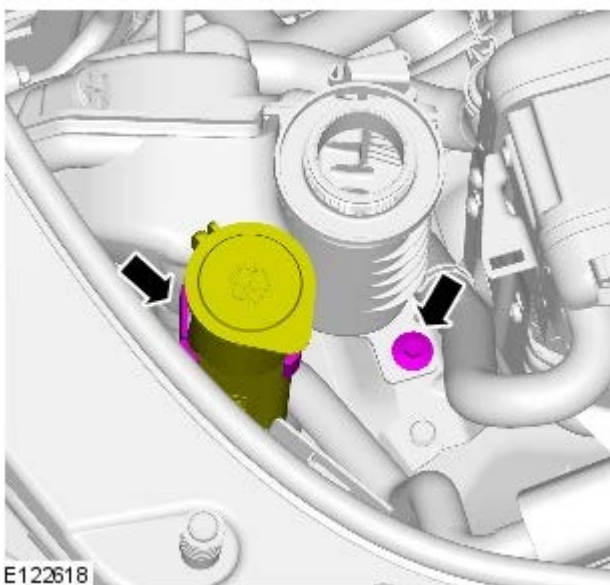
4.




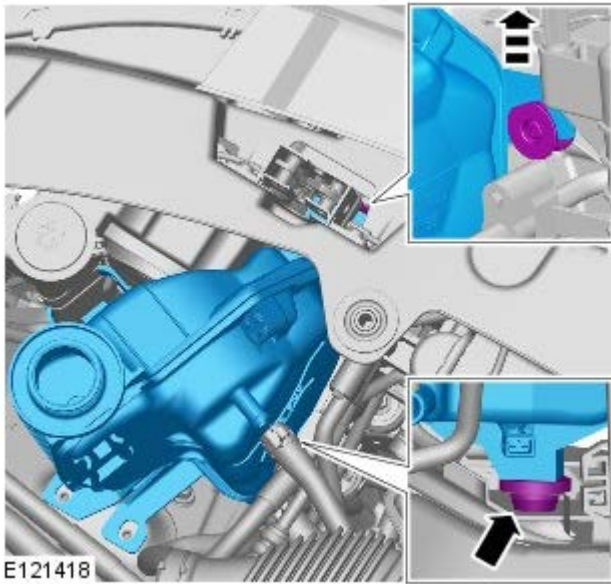
5. Torque: 10 Nm




6. Torque: 10 Nm

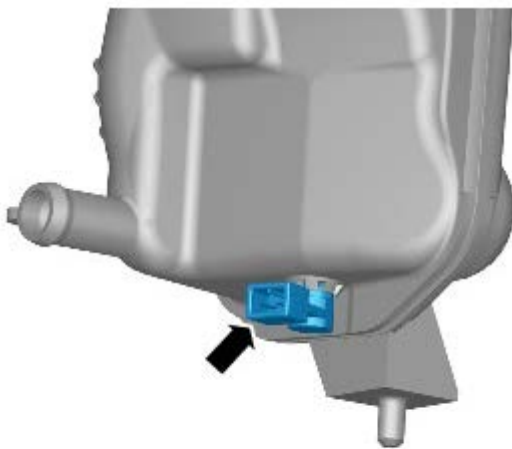


7.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



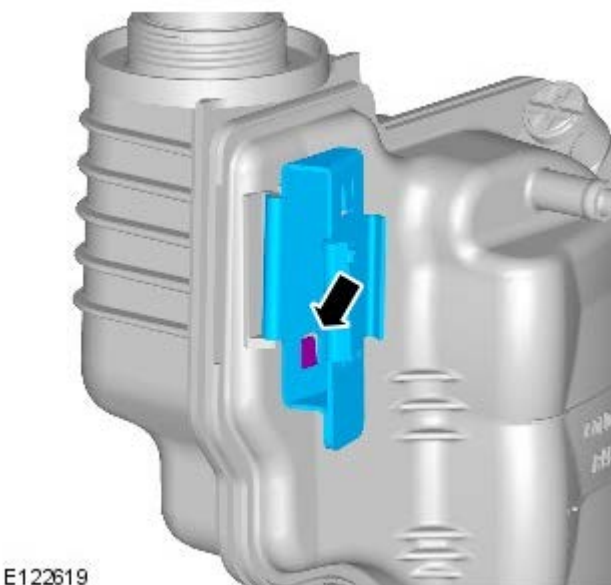
E121418

8.  NOTE: Do not disassemble further if the component is removed for access only.



E121420

- 9.



E122619

Installation

1. To install, reverse the removal procedure.

Engine Cooling - TDV6 3.0L Diesel - Coolant Pump

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

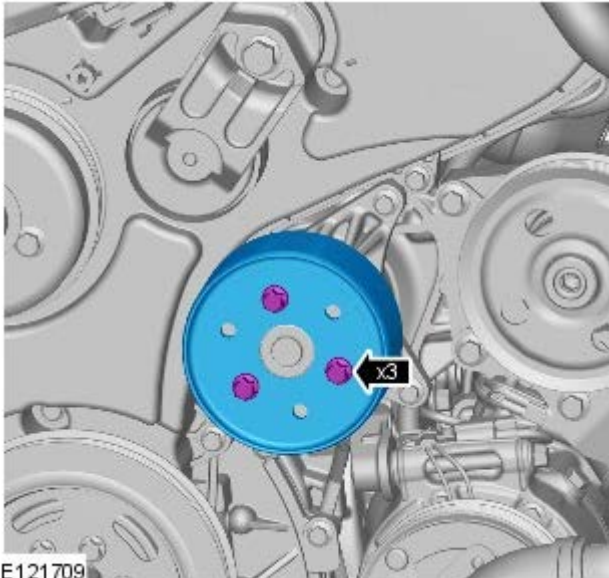
1. Refer to: Specifications (414-00, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

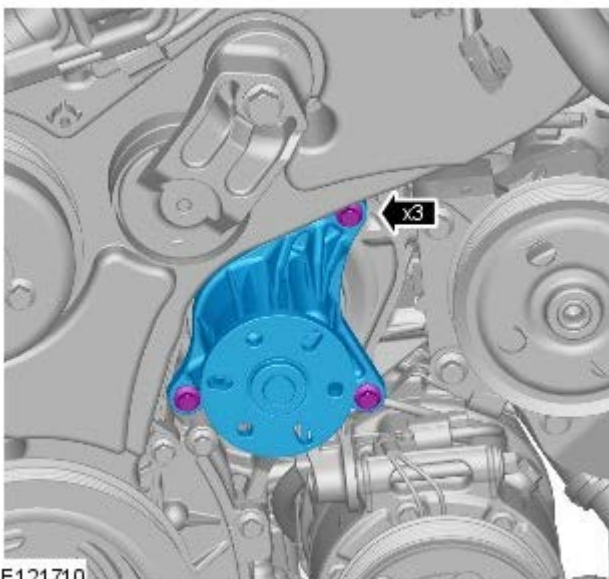
3. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).

4. Refer to: Accessory Drive Belt (303-05, Removal and Installation).



5.  **CAUTION:** Discard the bolts.

- Using a suitable 6mm bar, retain the coolant pump pulley.
- *Torque:* 25 Nm



6.  **CAUTION:** Discard the seal.

- *Torque:* 10 Nm

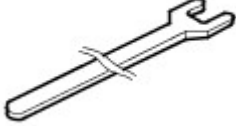

Installation

1. To install, reverse the removal procedure.

Engine Cooling - TDV6 3.0L Diesel - Cooling Fan

Removal and Installation

Special Tool(s)

 <p>303-1142</p> <p>E46076</p>	<p>303-1142 Viscous Coupling Wrench</p>
 <p>303-1143</p> <p>E55382</p>	<p>303-1143 Viscous Coupling Holding Tool</p>

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

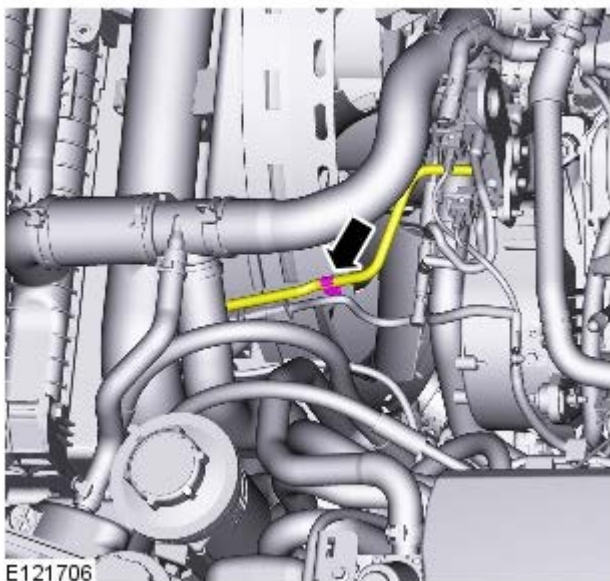
Refer to: Specifications (414-00, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

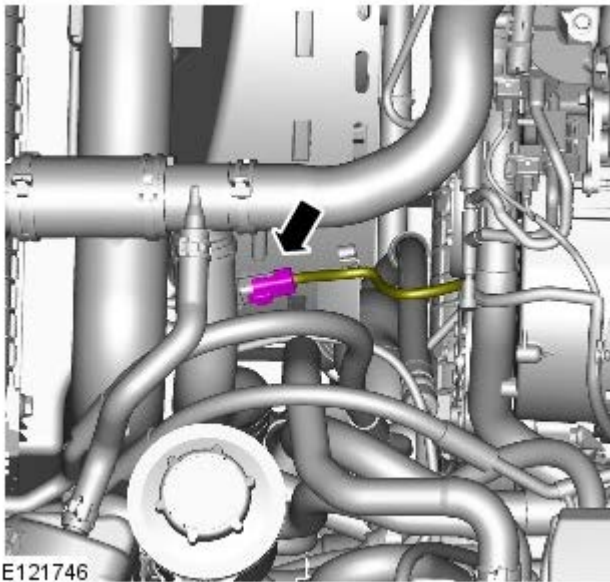
Raise and support the vehicle.

3. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).

4.

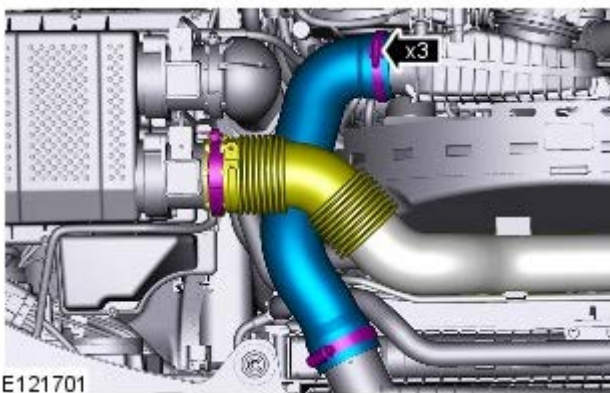


5.



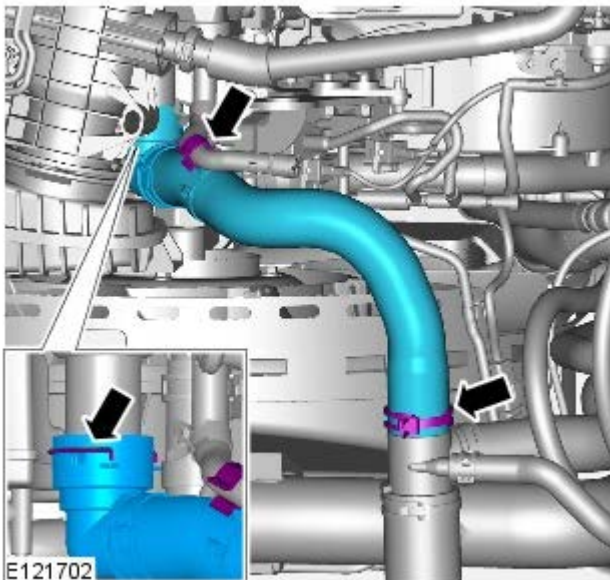
E121746

6. Torque: 3.5 Nm



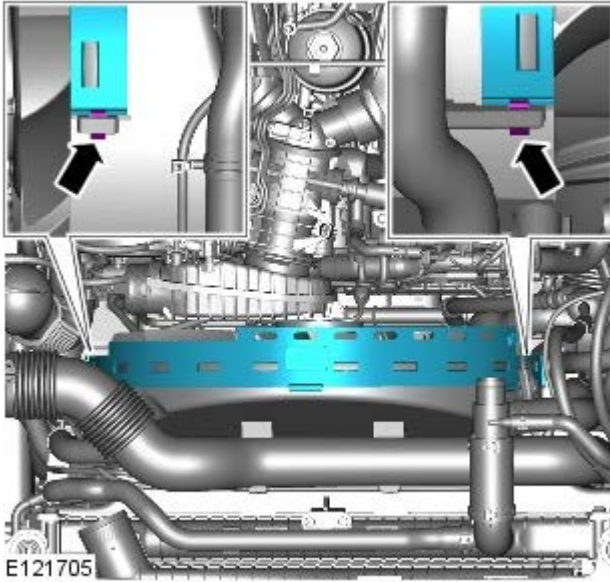
E121701

7.

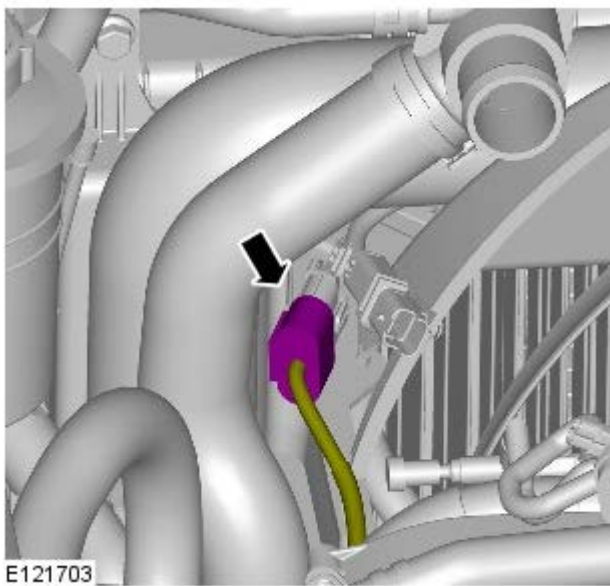


E121702

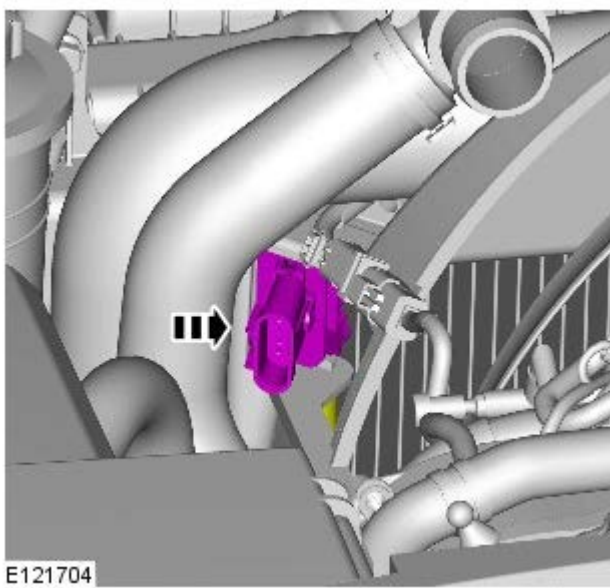
8.



9.

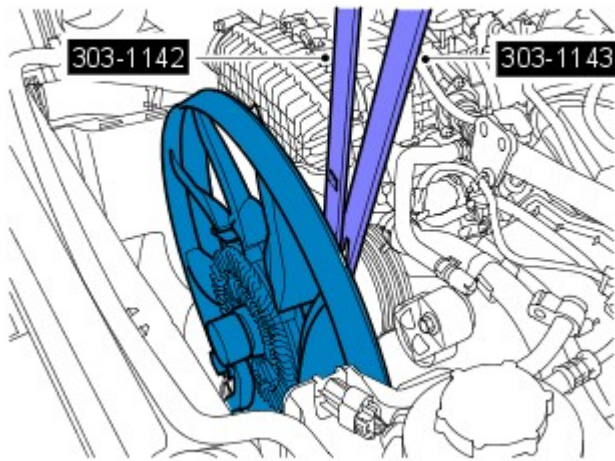


10.



11.  CAUTION: Always protect the cooling pack elements to prevent accidental damage.

NOTES:



E121707

Installation

1. To install, reverse the removal procedure.

⚠ The thread is left handed.

⚠ Some variation in the illustrations may occur, but the essential information is always correct.

Special Tool(s): [303-1142](#), [303-1143](#)

Torque: 65 Nm

Engine Cooling - TDV6 3.0L Diesel - Cooling Fan Shroud

Removal and Installation

Removal



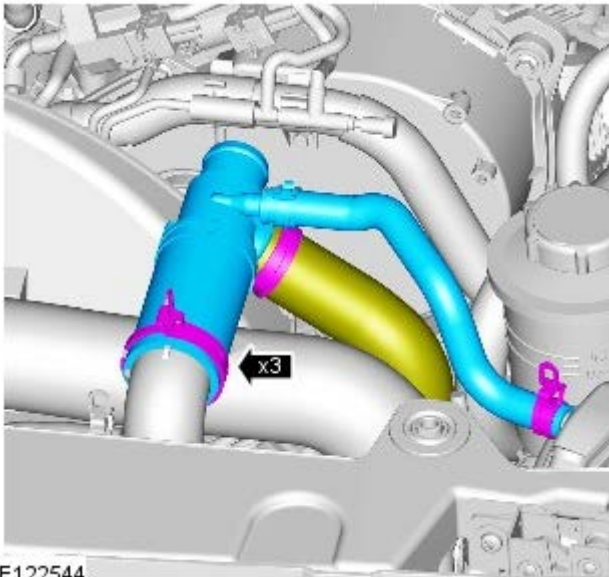
NOTE: Removal steps in this procedure may contain installation details.

All vehicles


1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

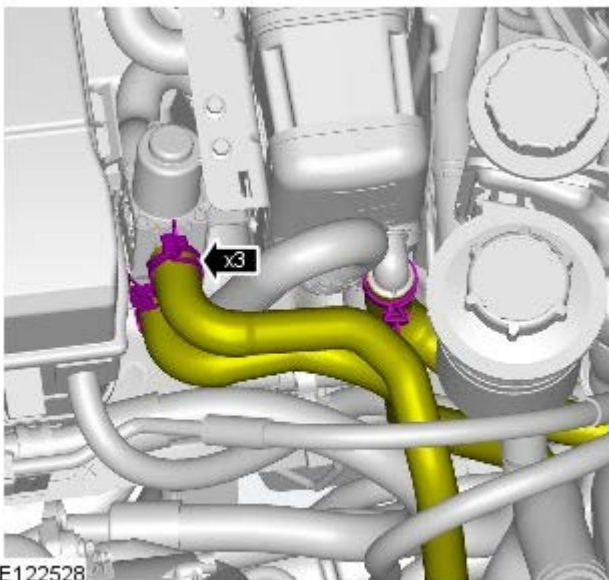
2. Refer to: Cooling Fan (303-03, Removal and Installation).
3. Refer to: Turbocharger Bypass Valve (303-04, Removal and Installation).
4. Refer to: Transmission Fluid Cooler - 3.0L Diesel (307-02, Removal and Installation).




E122544

5.  **CAUTION:** Be prepared to collect escaping coolant.

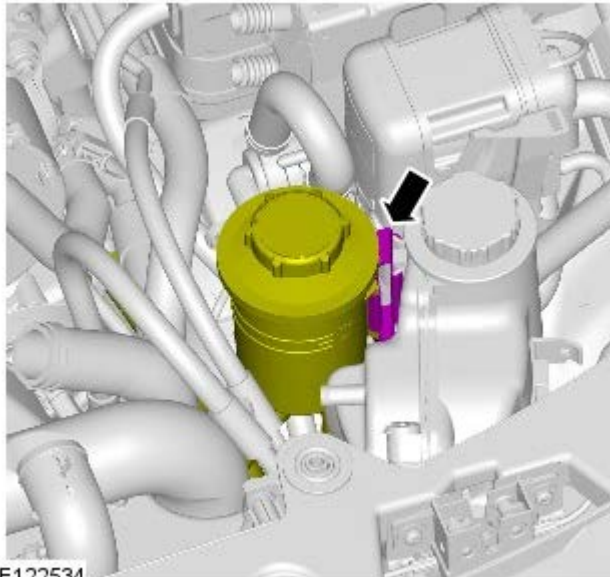
Vehicles with fuel fired booster heater




E122528

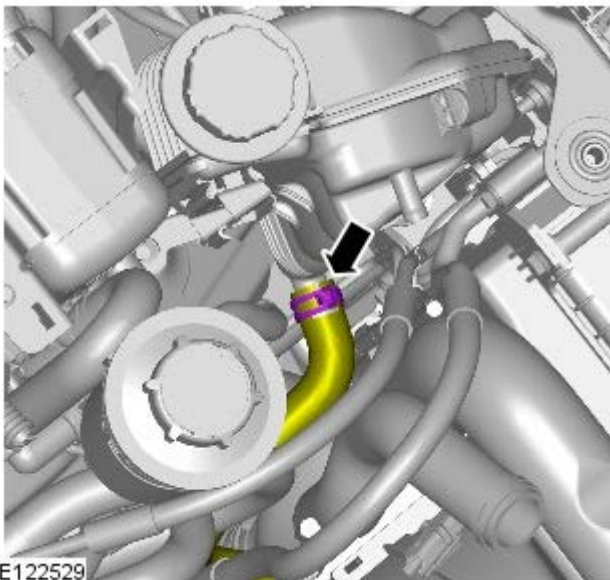
6.  **CAUTION:** Be prepared to collect escaping coolant.

All vehicles





E122534

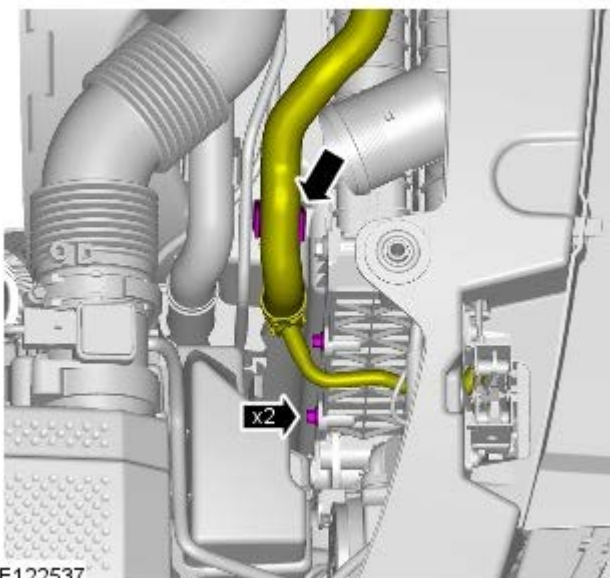
7.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



E122529

8.  CAUTION: Be prepared to collect escaping coolant.

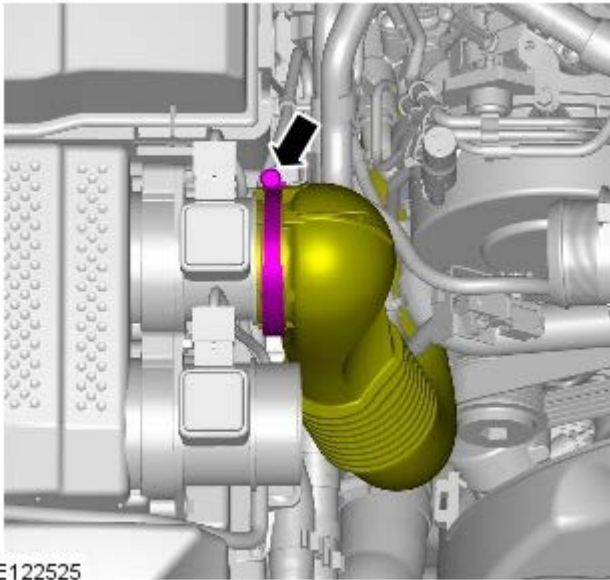
 NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



E122537

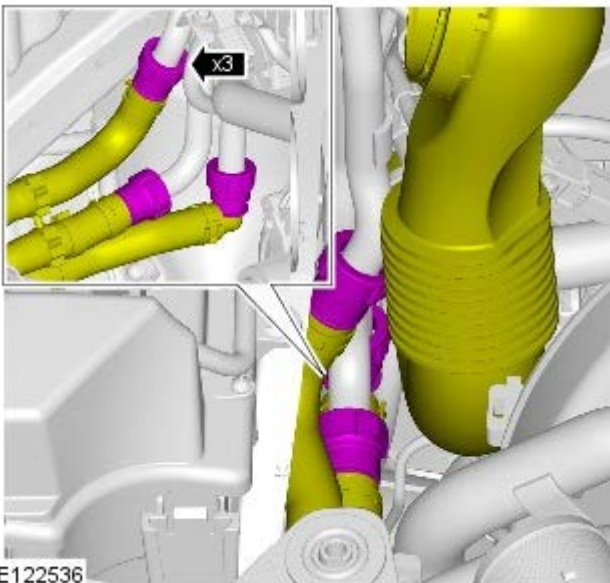
9. Torque: 5 Nm

10. Torque: 3.5 Nm




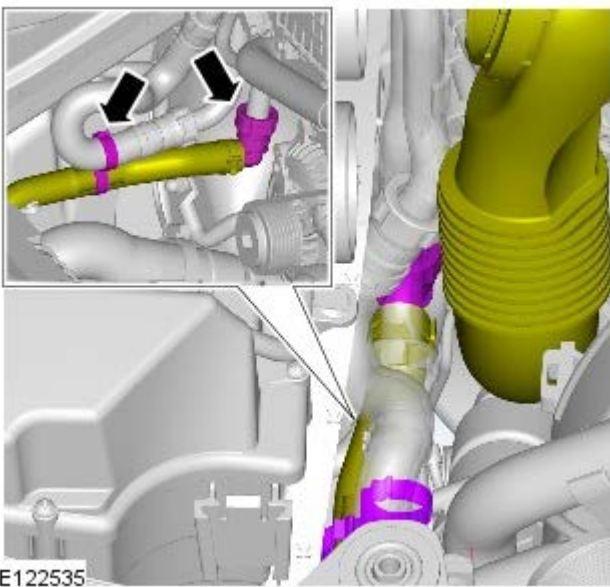
Vehicles with fuel fired booster heater

11.  CAUTION: Be prepared to collect escaping coolant.

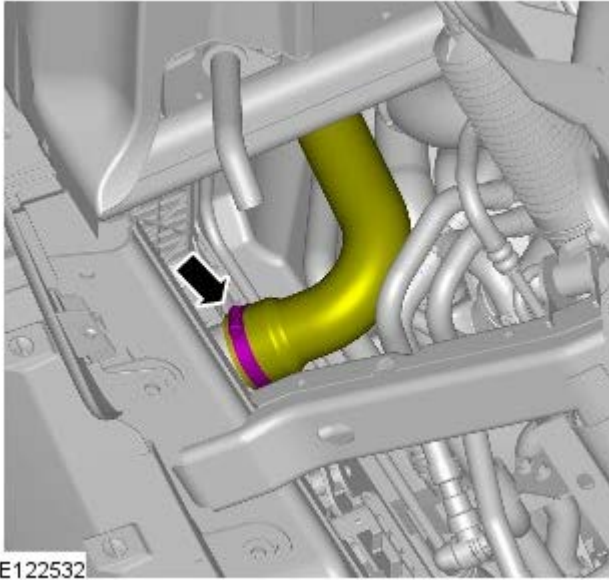


All vehicles

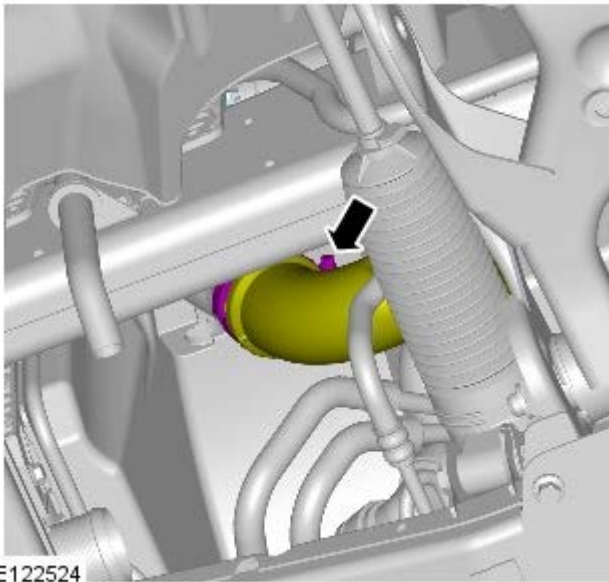
12.  CAUTION: Be prepared to collect escaping coolant.



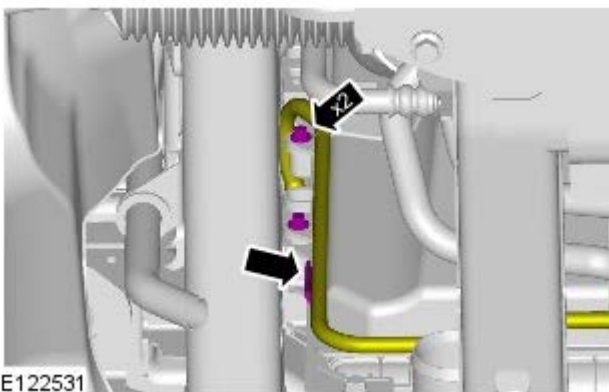
13.





14.

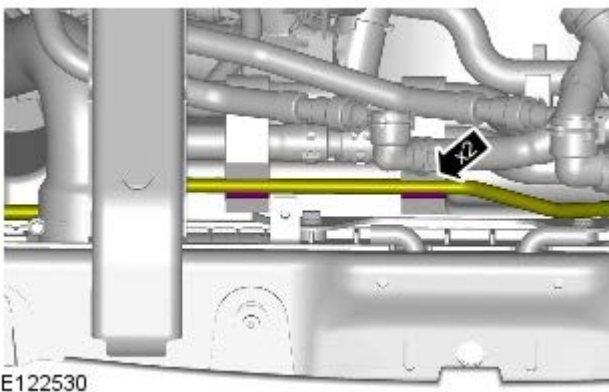
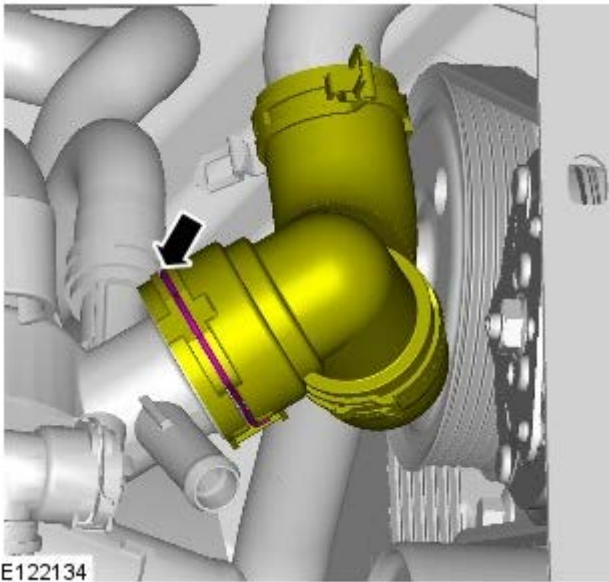
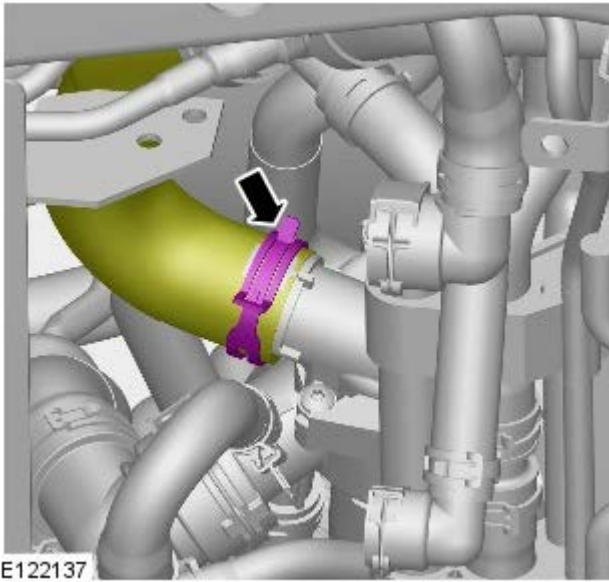



15. Torque: 5 Nm




16.  CAUTION: Be prepared to collect escaping coolant.

 NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

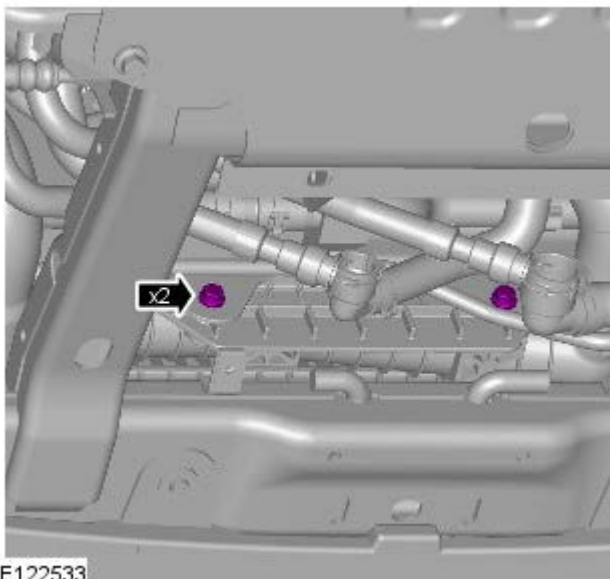


17.  CAUTION: Be prepared to collect escaping coolant.

 NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

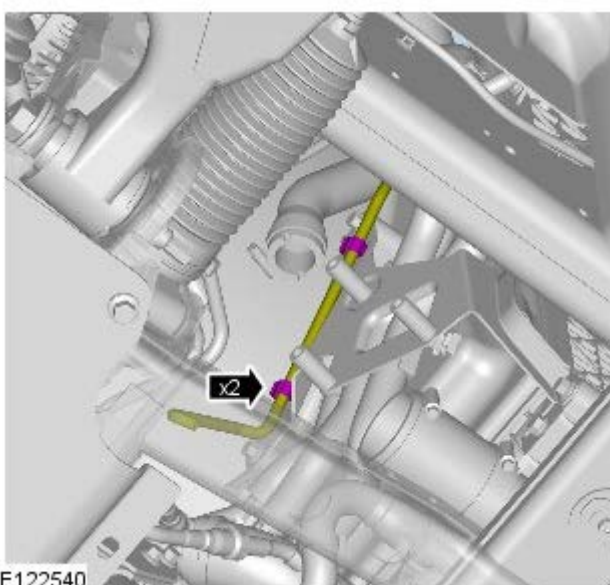
18.

19. Torque: 15 Nm



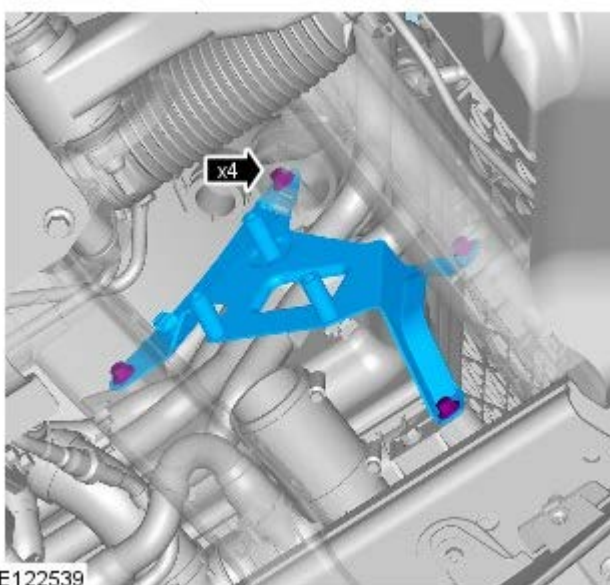
E122533

20.



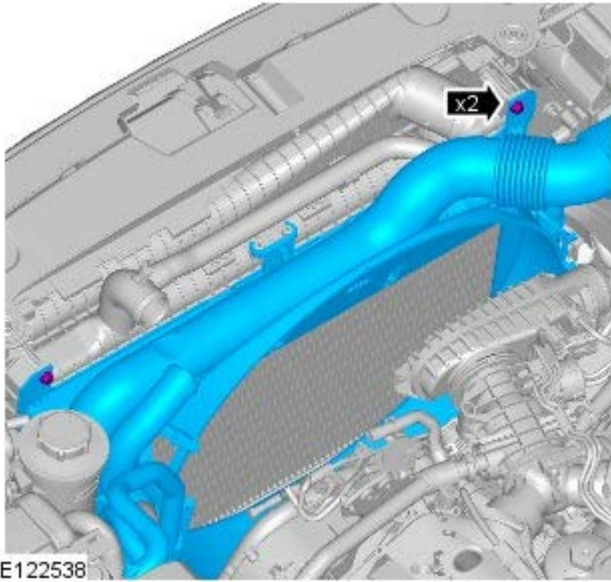
E122540

21. Torque: 15 Nm




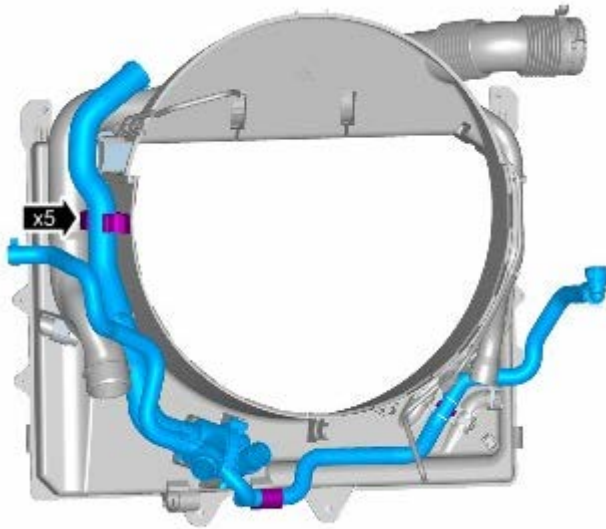
E122539

22. Torque: 15 Nm



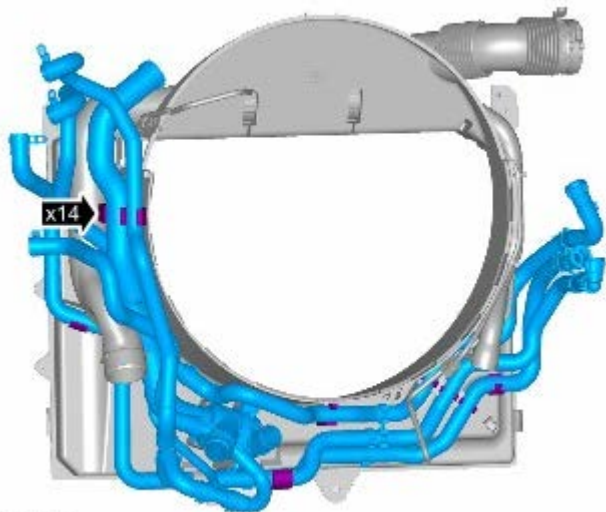
E122538

23.  NOTE: Do not disassemble further if the component is removed for access only.



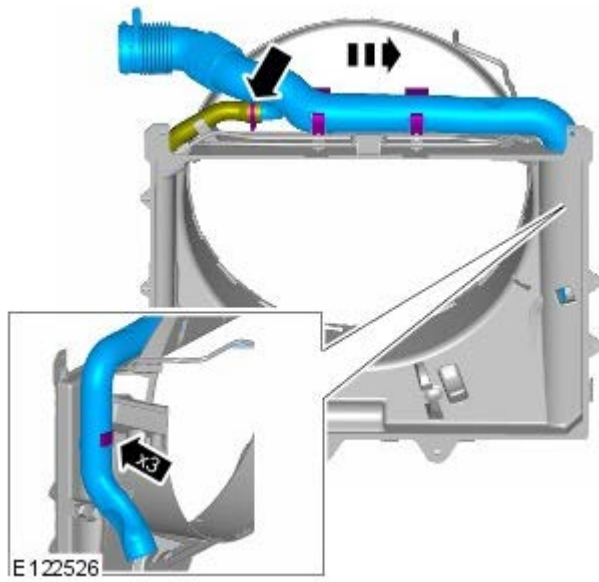
E122541

- Vehicles with fuel fired booster heater
24.

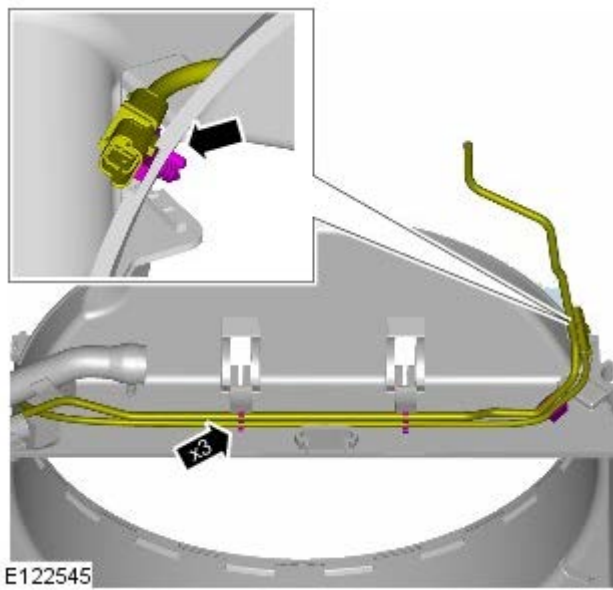


E122542

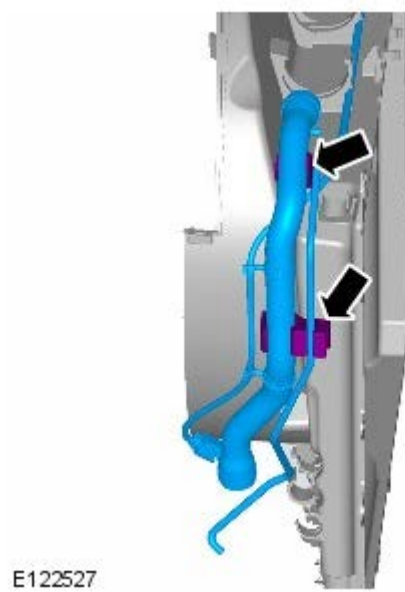
- All vehicles
25.



26.



27.



Installation

1. To install, reverse the removal procedure.


Engine Cooling - TDV6 3.0L Diesel - Radiator

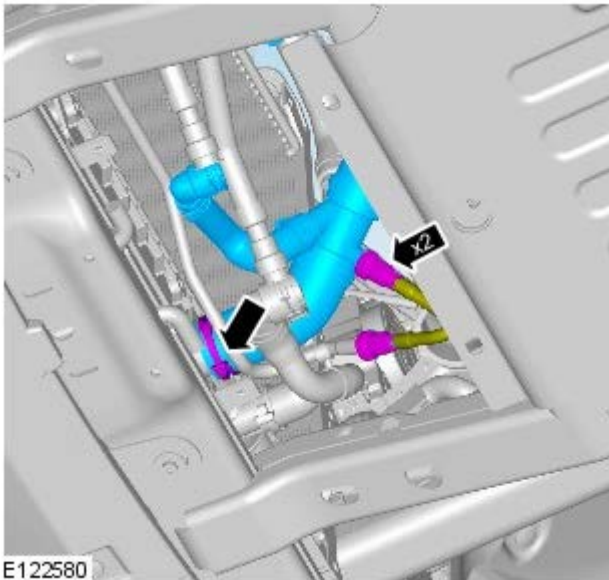
Removal and Installation

Removal




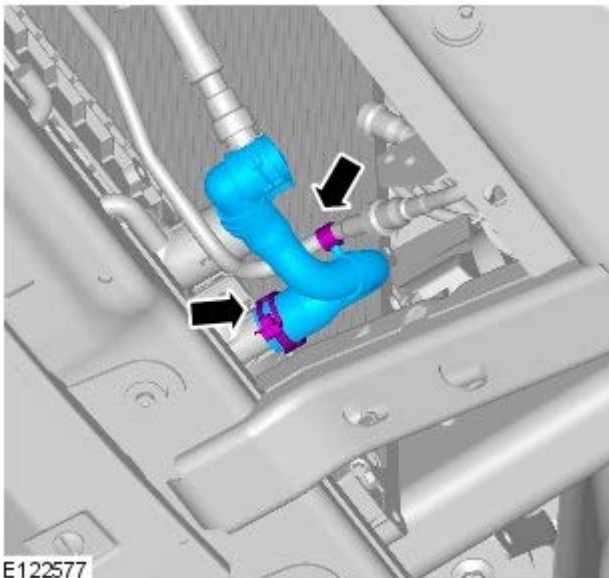
NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00, General Procedures).
3. Refer to: Cooling Fan Shroud (303-03, Removal and Installation).
4. Refer to: Radiator Grille (501-08, Removal and Installation).




E122580

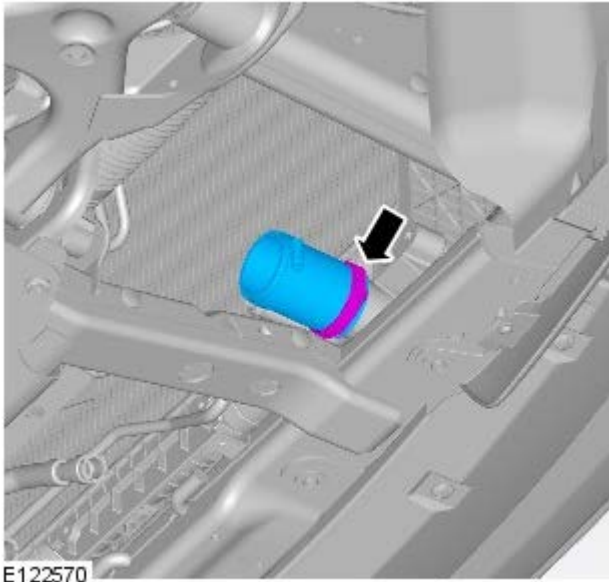
5.  **CAUTION:** Be prepared to collect escaping coolant.



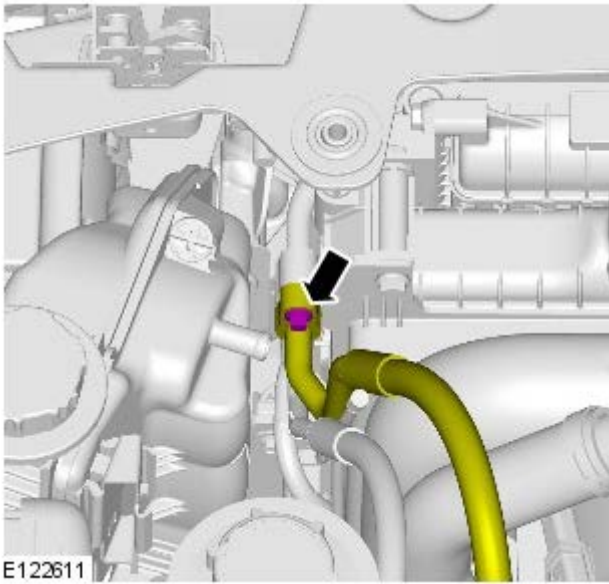
E122577

6.  **CAUTION:** Be prepared to collect escaping coolant.

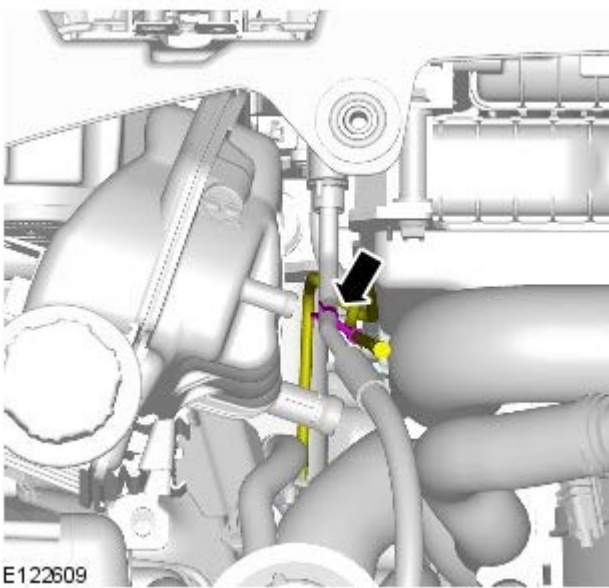
7.



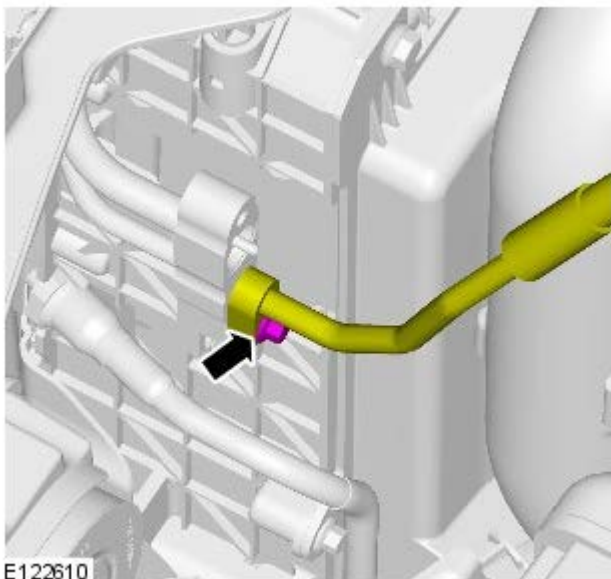
8. Torque: 6 Nm



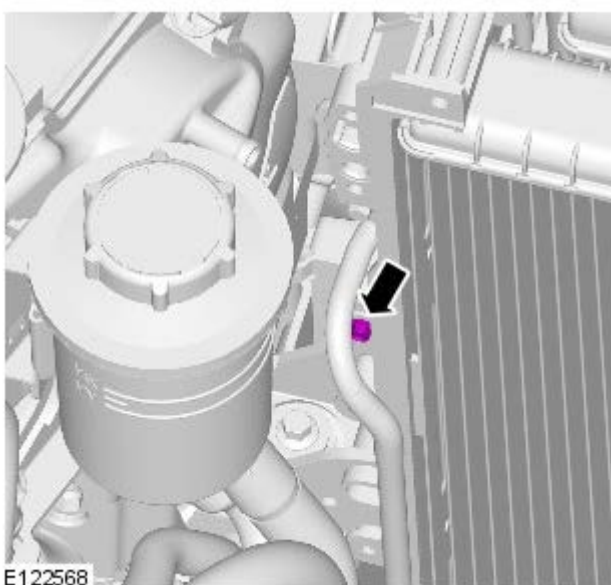
9.



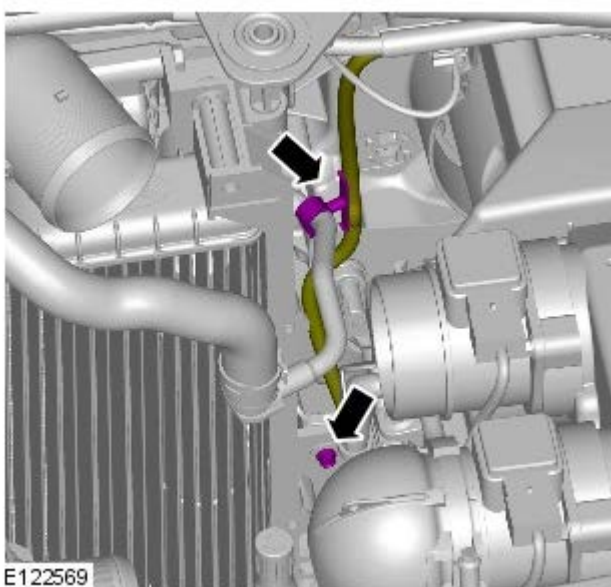
10. Torque: 6 Nm



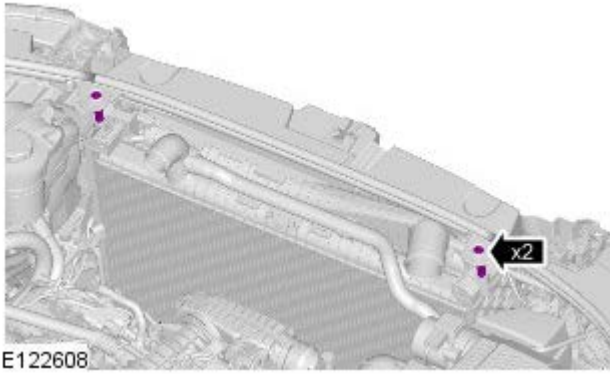
11. Torque: 5 Nm



12. Torque: 5 Nm

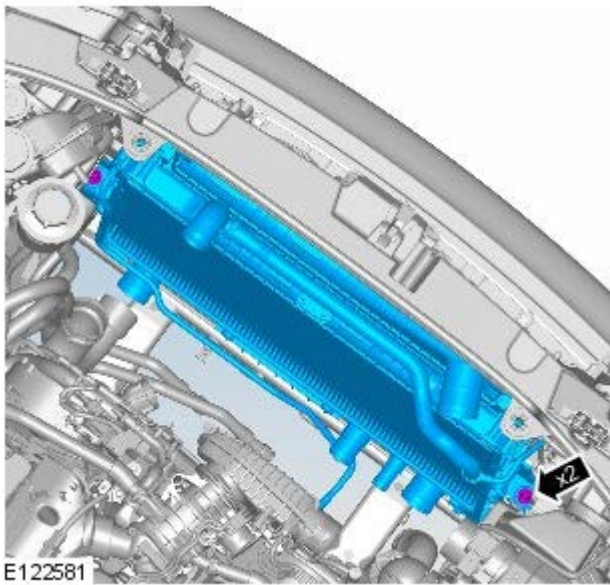



13.

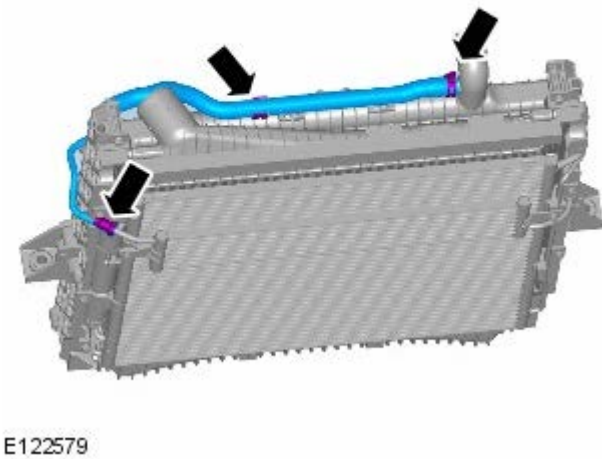


14.  CAUTION: Always protect the cooling pack elements to prevent accidental damage.

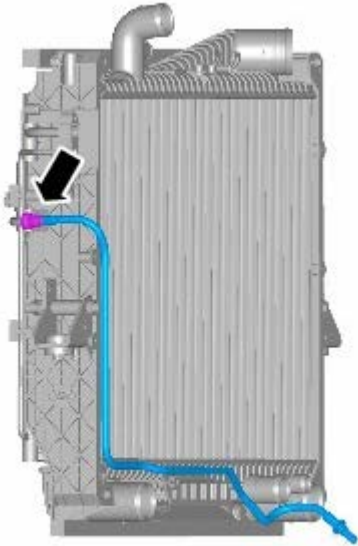
Torque: 25 Nm



15.  NOTE: Do not disassemble further if the component is removed for access only.

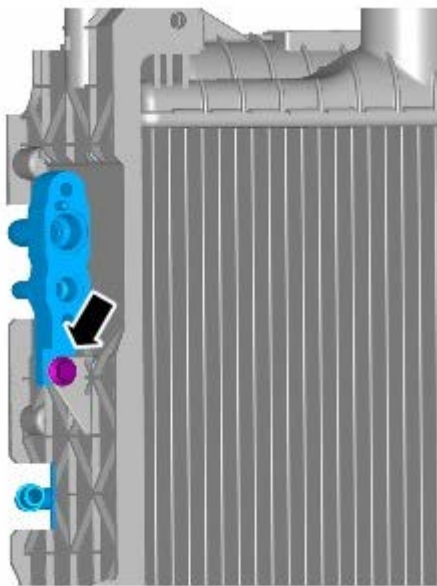


- 16.



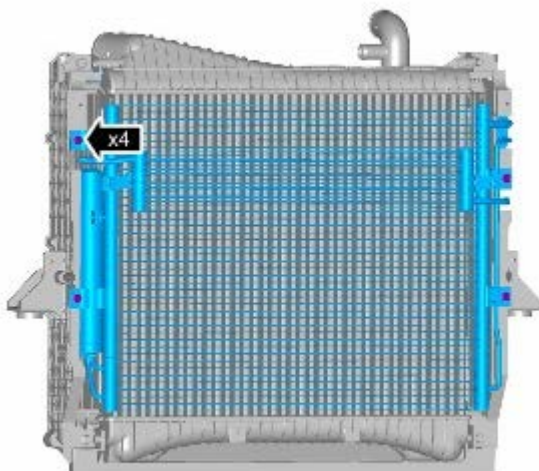
E122578

17. Torque: 5 Nm



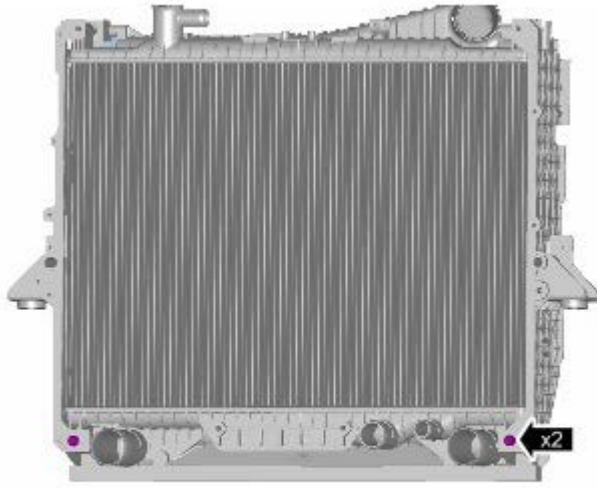
E122572

18. Torque: 5 Nm



E122573

19. Torque: 15 Nm



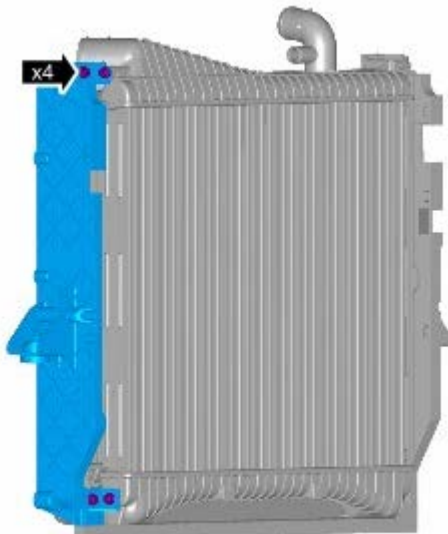
E122575

20. Torque: 15 Nm



E122574

21. Torque: 15 Nm



E122576

Installation

1. To install, reverse the removal procedure.


Engine Cooling - TDV6 3.0L Diesel - Thermostat

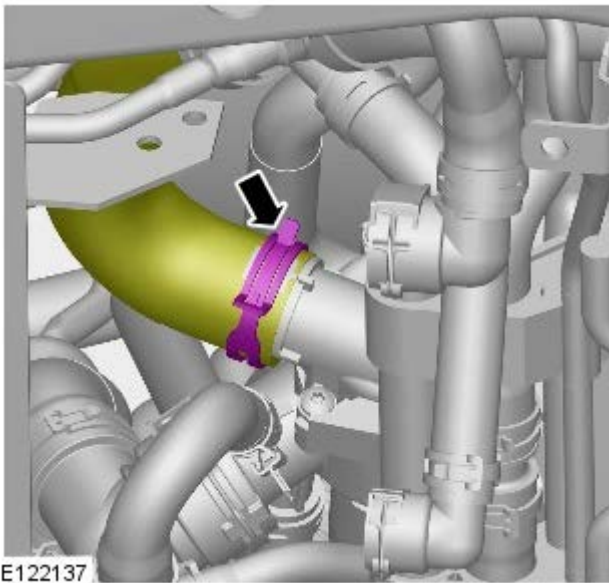
Removal and Installation


Removal

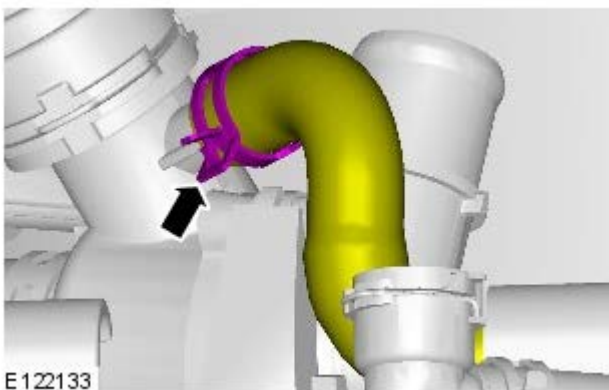



NOTE: Removal steps in this procedure may contain installation details.


1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
3. Refer to: Transmission Fluid Cooler - 3.0L Diesel (307-02, Removal and Installation).

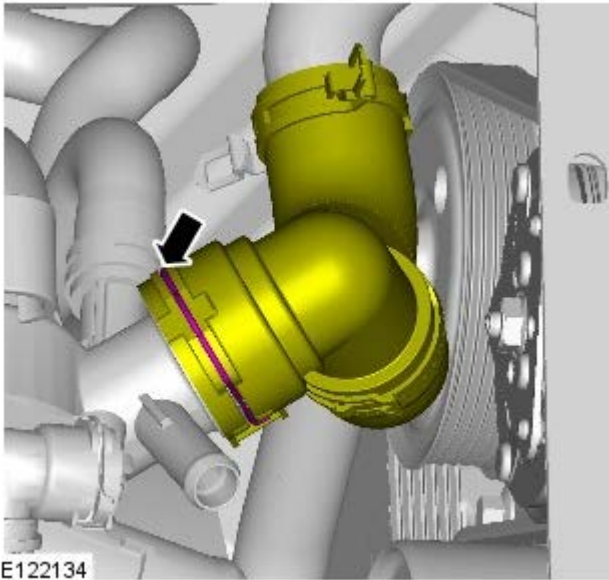


4.  **CAUTION:** Be prepared to collect escaping coolant.

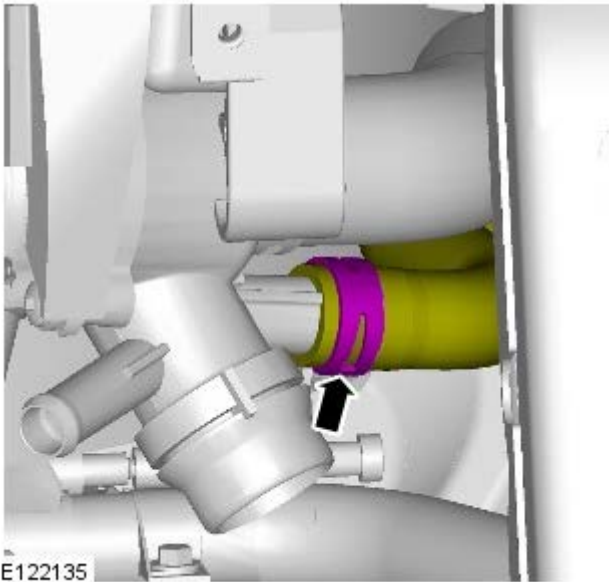


5.  **CAUTION:** Be prepared to collect escaping coolant.

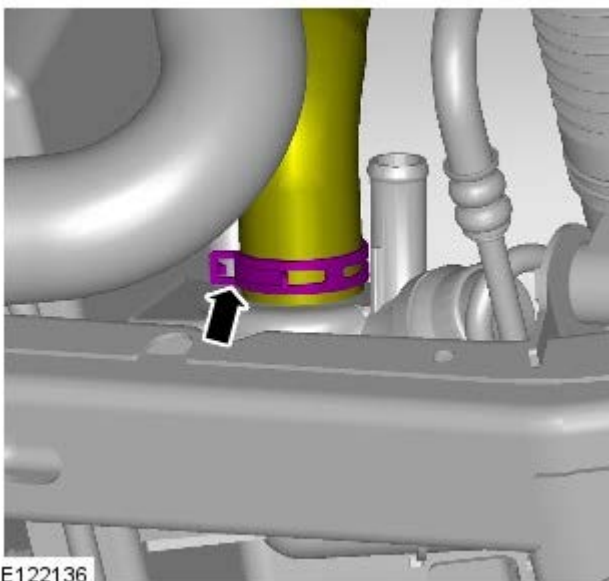
6.  **CAUTION:** Be prepared to collect escaping coolant.




E122134




E122135

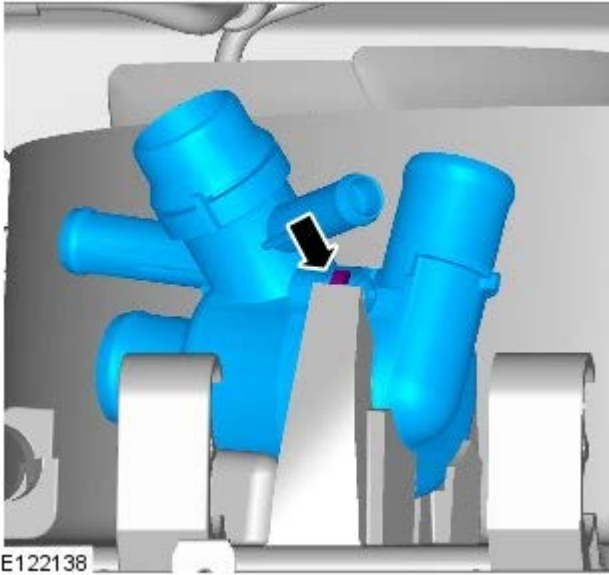


E122136

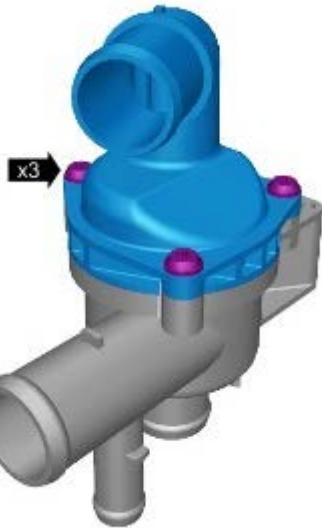
7.  CAUTION: Be prepared to collect escaping coolant.

8.  CAUTION: Be prepared to collect escaping coolant.

9.

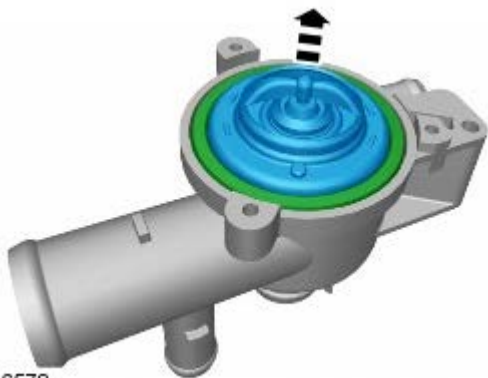


10. Torque: 4 Nm



E116577

11.  CAUTION: Discard the seal.



E116578

Installation

1. To install, reverse the removal procedure.

Engine Cooling - V6 S/C 3.0L Petrol -**Lubricants**

Description	Specification
Anti-freeze	Havoline Extended Life Coolant (XLC)
Anti-freeze concentration	50%

Capacities

Item	Litres
Vehicles fitted with 2 zone air conditioning.	9.35
Vehicles fitted with 4 zone air conditioning.	10.80

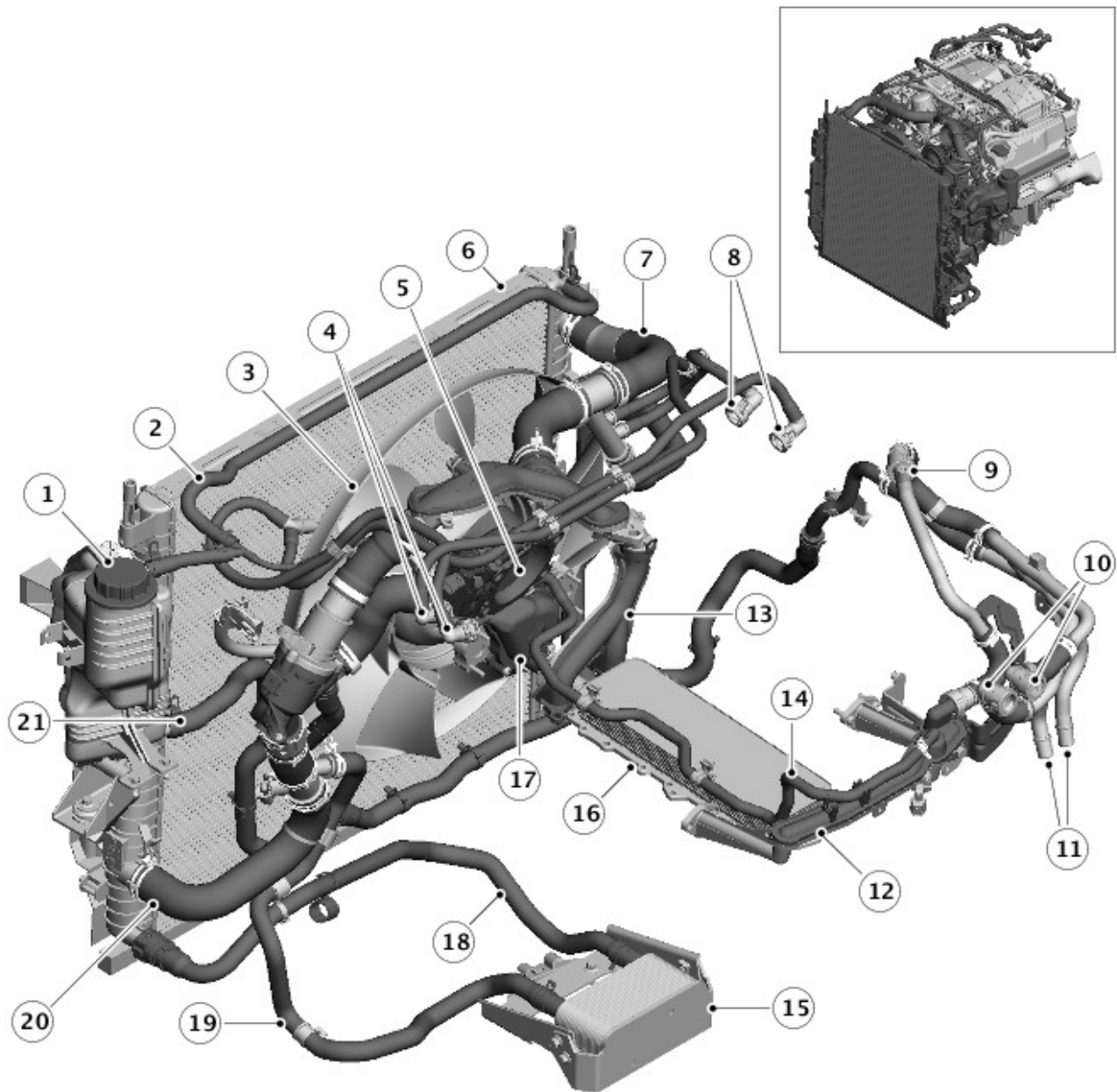
Torque Specifications

Description	Nm	lb-ft	lb-in
Coolant expansion tank retaining bolt	10	7	-
Cooling fan retaining nut	65	48	-
Thermostat housing retaining bolt	10	7	-
Coolant pump retaining bolts	12	9	-
Radiator air deflector retaining bolts	9	-	80
Refrigerant line to condenser core retaining bolts	10	7	-
Radiator retaining bolts	25	18	-
Condenser core to radiator bolts	10	7	-
Coolant bleed screw(s)	3	-	27

Engine Cooling - V6 S/C 3.0L Petrol - Engine Cooling

Description and Operation

COMPONENT LOCATION



E160385

Item	Part Number	Description
1	-	Coolant expansion tank
2	-	Bleed hose
3	-	Viscous cooling fan
4	-	Connections for supercharger charge air coolers
5	-	Electric throttle
6	-	Radiator
7	-	Radiator upper hose
8	-	Connections for supercharger charge air coolers
9	-	Bleed screw
10	-	Heater system supply and return hoses
11	-	Fuel Fired Booster Heater (FFBH) supply and return connections (where fitted)
12	-	Heater manifold
13	-	Outlet tube
14	-	Electric throttle heater hose
15	-	Transmission oil cooler
16	-	Engine oil cooler Thermostat

17	-	Coolant Pump Expansion Tank
18	-	Transmission oil cooler supply hose
19	-	Transmission oil cooler return hose
20	-	Radiator lower hose
21	-	Coolant supply/expansion hose

OVERVIEW

The engine cooling system maintains the engine within an optimum temperature range under changing ambient and engine operating conditions. The system is a pressurized expansion tank system with continuous bleeds to separate air from the coolant and prevent the formation of air locks. The engine cooling system also provides:

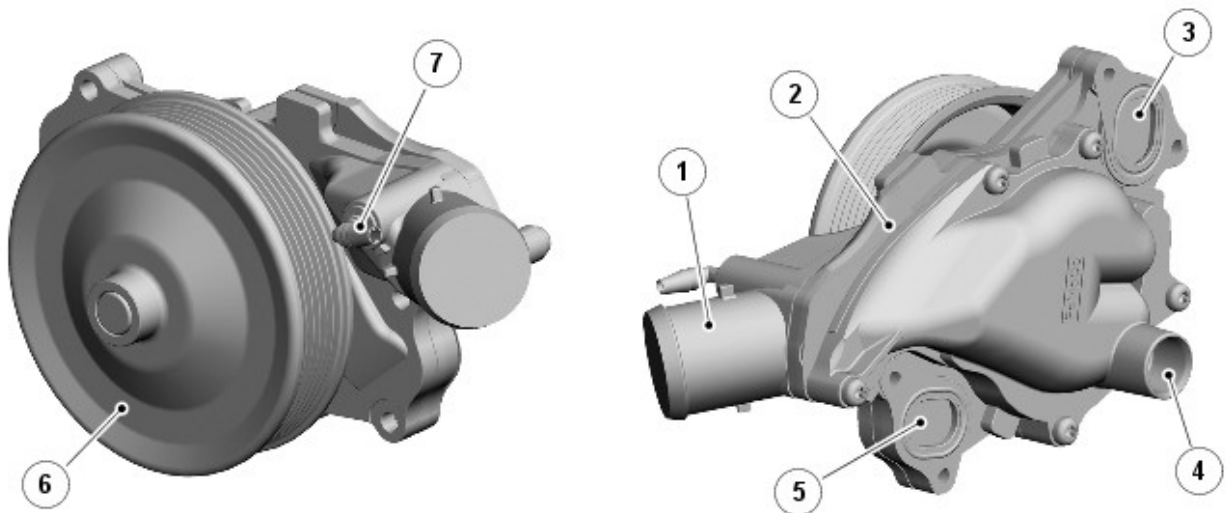
- Heating for:
 - The passenger compartment.
 - The throttle body.
- Cooling for:
 - The engine oil cooler.
 - The transmission fluid cooler.

The primary components of the engine cooling system are the:

- Coolant pump.
- Thermostat.
- Radiator.
- Cooling fan.
- Expansion tank.
- Outlet tube and heater manifold.
- Connecting hoses and pipes.

DESCRIPTION

Coolant Pump



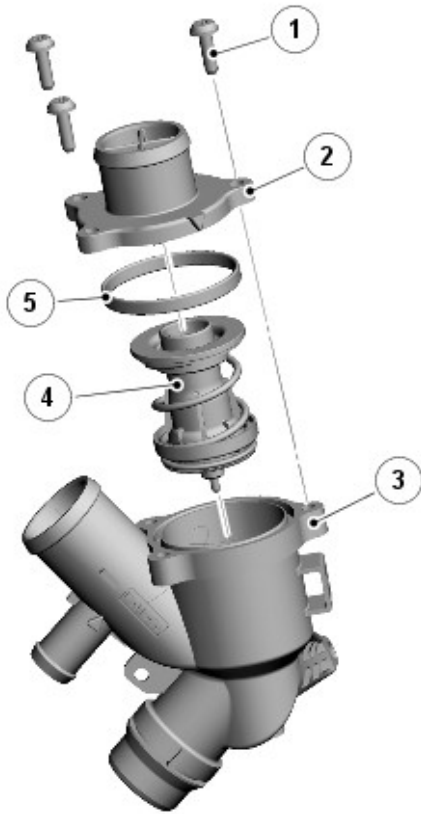
E115013

Item	Part Number	Description
1	-	Inlet connection
2	-	Coolant pump body
3	-	Outlet flange to right cylinder head
4	-	Outlet to engine oil cooler
5	-	Outlet flange to left cylinder head
6	-	Pulley
7	-	Bleed pipe connection (containing check valve)

The body of the coolant pump contains an impeller attached to a shaft supported in a bearing assembly. The impeller is driven by a pulley, pressed on to the front of the shaft, which is driven by the accessory drive belt. For additional information, refer to: [Accessory Drive](#) (303-05B Accessory Drive - V6 S/C 3.0L Petrol, Description and Operation).

Two coolant outlet flanges attach the coolant pump to the front of the cylinder block. A pipe connects a further coolant outlet to a pipe from the engine oil cooler. A bleed connector is installed in the front of the coolant pump, adjacent to the coolant inlet connection from the thermostat. A check valve is incorporated into the bleed connection.

Thermostat



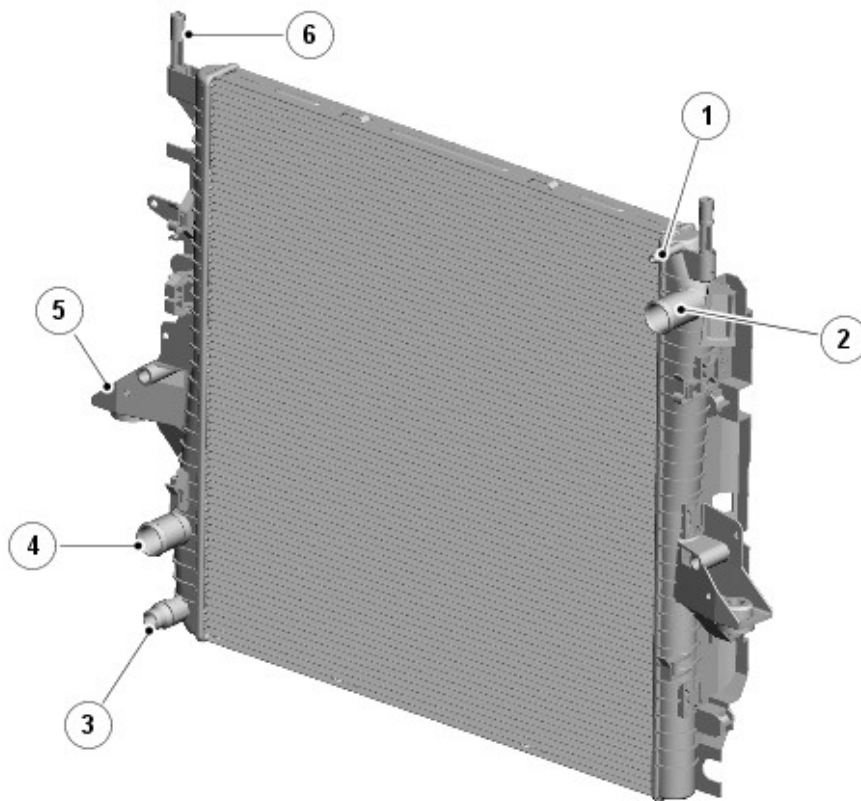
E115014

Item	Part Number	Description
1	-	Bolt (3 off)
2	-	Upper body
3	-	Lower body
4	-	Thermostat
5	-	Seal

The thermostat is a multi-stage device located in the coolant pump inlet to provide fast response and control of the engine outlet temperature.

The thermostat allows rapid engine warm-up by preventing coolant flow through the radiator and by limiting coolant flow through the cylinder block when the engine is cold. During warm-up and at engine speeds above approximately 1800 rev/min, a by-pass valve opens to control the coolant flow and pressure, to protect the engine components. When the thermostat opening reaches 6 mm (0.24 in.), the by-pass flow is shut-off. When the thermostat opening exceeds 6 mm (0.24 in.), the radiator coolant flow is further controlled up to the point where the thermostat is fully open. At this point maximum radiator coolant flow is achieved to provide maximum cooling.

Radiator



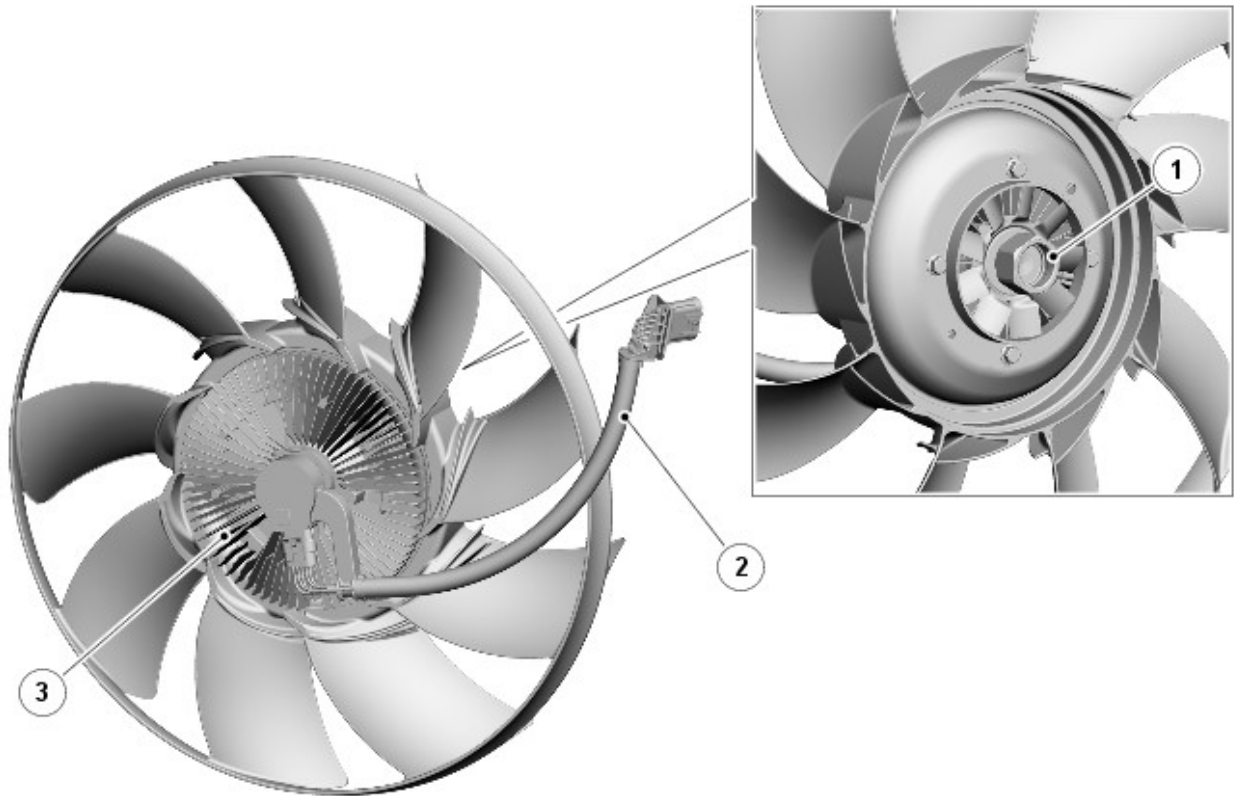
E121154

Item	Part Number	Description
1	-	Bleed hose connection
2	-	Upper hose connection
3	-	Transmission fluid cooler supply hose connection
4	-	Lower hose connection
5	-	Radiator lower support (2 off)
6	-	Radiator upper support (2 off)

The radiator is an aluminum cross flow type with plastic end tanks. Upper and lower supports locate the radiator in the radiator support assembly and the front crush siderails respectively.

Connections are incorporated into the end tanks for the upper and lower hoses, the supply hose of the transmission fluid cooler and a bleed hose.

Cooling Fan



E118879

Item	Part Number	Description
1	-	Securing nut
2	-	Harness
3	-	Electro-viscous drive unit

For additional airflow through the radiator, particularly when the vehicle is stationary or moving slowly, there is an engine driven electro-viscous cooling fan. The cooling fan functions as a normal viscous fan, but with electronic control over the level of engagement of the viscous clutch. The [ECM \(engine control module\)](#) controls the level of engagement to optimize fan speed for all operating conditions.

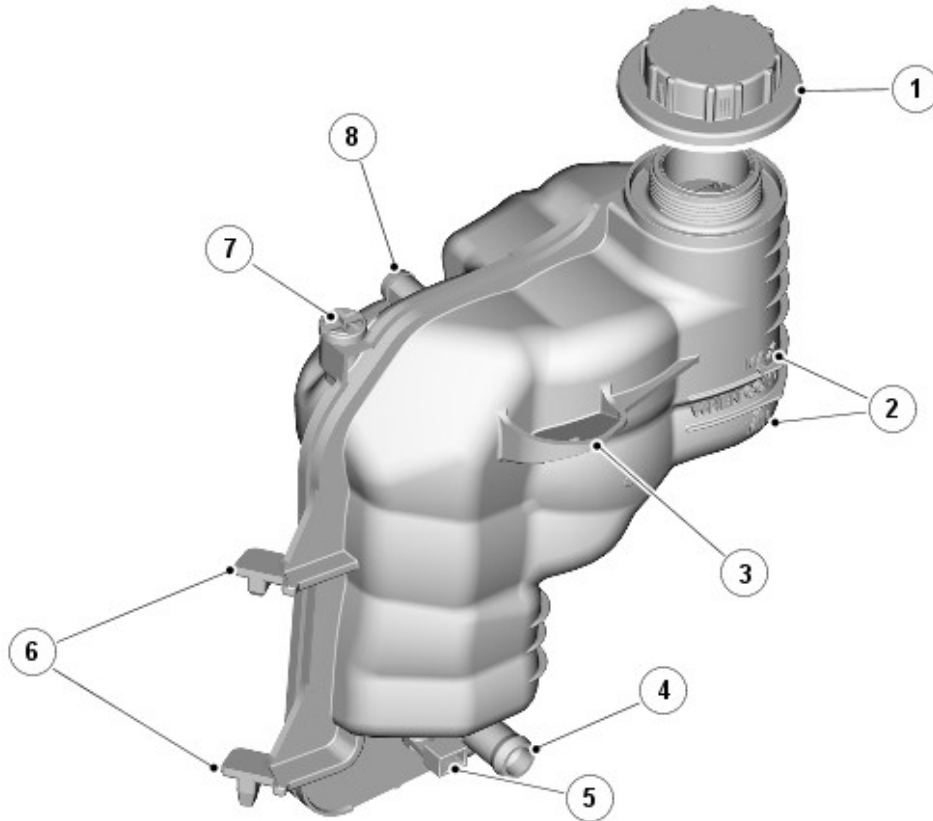
A securing nut attaches the cooling fan to a drive pulley, which is mounted on the front of the engine and driven by the accessory drive system.



NOTE: The securing nut has a LH (left-hand) thread.

The blades of the cooling fan are located in a fan cowl attached to the rear of the radiator frame. Brushes around the circumference of the aperture in the fan cowl provide a seal with the blade shroud. An electrical connector in the top left corner of the fan cowl provides the interface between the cooling fan harness and the vehicle wiring.

Expansion Tank



E145082

Item	Part Number	Description
1	-	Filler cap
2	-	MAX and MIN level markings
3	-	Mounting lug
4	-	Supply hose connection
5	-	Coolant level sensor
6	-	Mounting lugs
7	-	Bleed screw
8	-	Vent hose connection

A pressurized expansion tank system is used which continuously separates the air from the cooling system and replenishes the system through a hose connected between the expansion tank and the thermostat. A continuous vent into the expansion tank, through a hose connected to the radiator, prevents air locks from forming in the cooling system.

The expansion tank is attached to the front end carrier in the front left corner of the engine compartment. A filler cap, bleed screw and level sensor are incorporated into the expansion tank. MAX and MIN level markings are molded into the exterior of the tank.

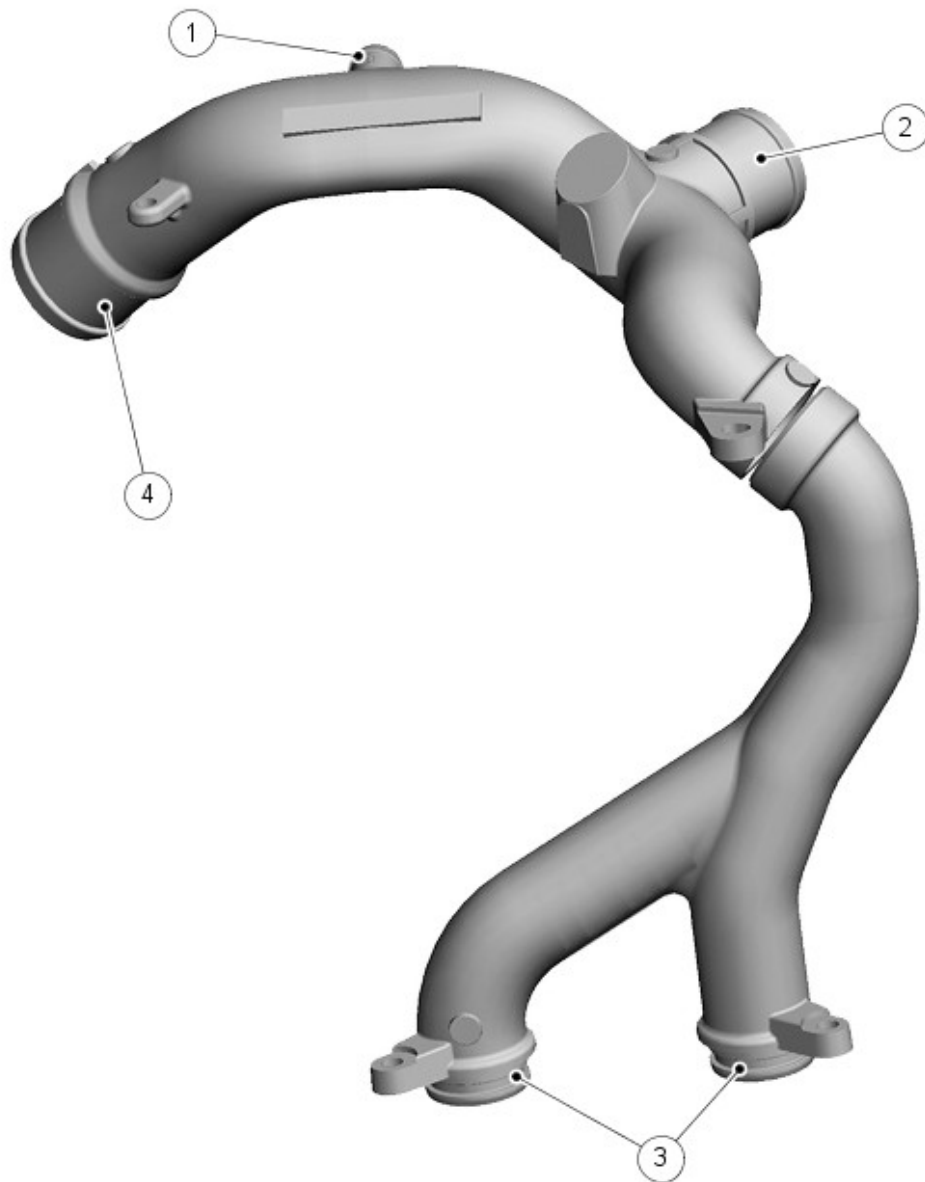
The expansion tank provides the following functions:

- Service fill.
- Coolant expansion during warm-up.
- Air separation during operation.
- System pressurization by the filler cap.

The expansion tank has an air space of approximately 0.5 to 1 liter (1.06 to 2,11 US pints), above the MAX level, to allow for coolant expansion.

Outlet Tube and Heater Manifold

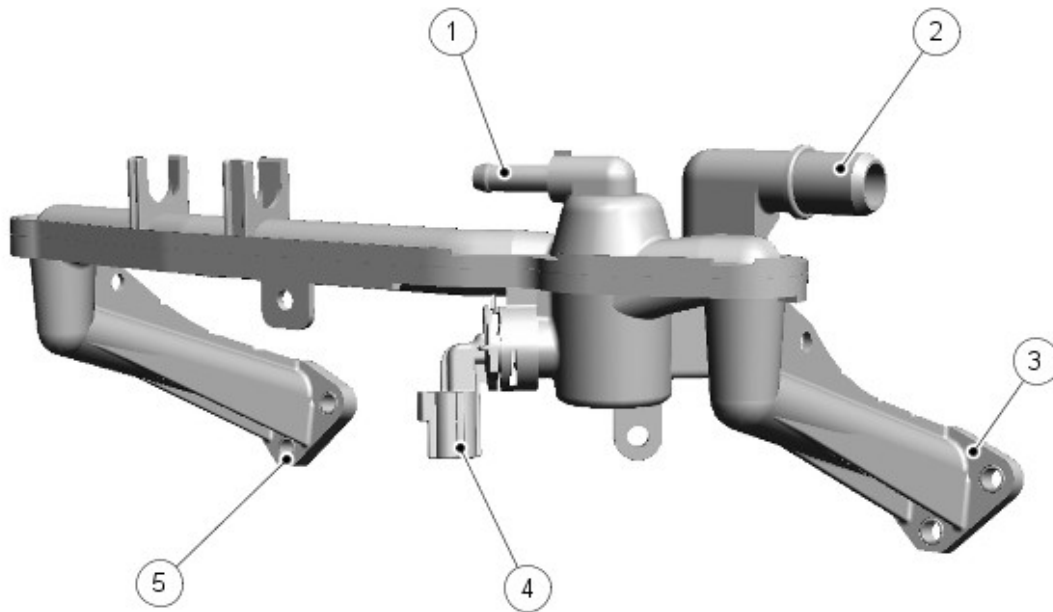
Outlet Tube



E152317

Item	Part Number	Description
1	-	Bleed spigot (fitted with blanking plug)
2	-	Radiator upper hose connection
3	-	Cylinder block connections
4	-	Thermostat hose connection

Heater Manifold



E152341

Item	Part Number	Description
1	-	Electric throttle heater Hose connection
2	-	Heater core supply hose connection
3	-	Right cylinder head connection
4	-	Engine coolant temperature sensor
5	-	Left cylinder head connection

The coolant is silicate free and must not be mixed with conventional engine coolant.

Coolant Circuit Flow

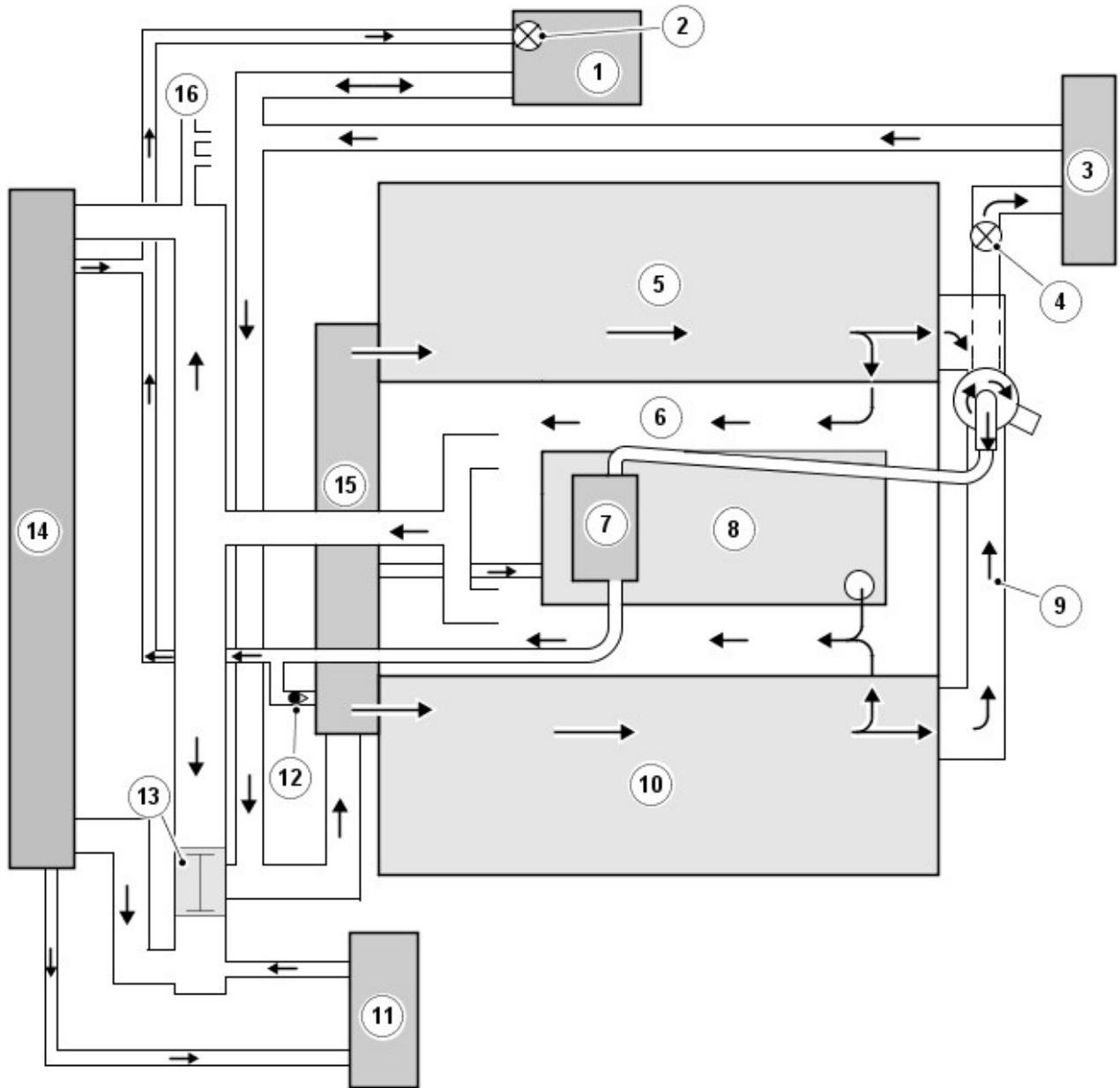
When the engine is running, the coolant is circulated around the engine cooling system by the coolant pump. From the coolant pump, coolant flows through the cylinder heads and the engine oil cooler into the cylinder block and the heater manifold.

In the cylinder block, the coolant flows forwards to the outlet tube. When the coolant is cold, the thermostat is closed and the coolant flows direct from the outlet tube back to the coolant pump. Once the coolant reaches operating temperature the thermostat begins to open, to control system temperature, and coolant flows from the outlet tube to the coolant pump via the radiator. When the thermostat is open, the coolant flow through the radiator also generates a coolant flow through the transmission fluid cooler.

From the heater manifold the coolant flows through the electric throttle and the heater core, in parallel circuits that are unaffected by the position of the thermostat. From the electric throttle, the coolant merges with bleed coolant from the coolant pump and the outlet tube and flows to the expansion tank. From the heater core, the coolant flows back to the inlet of the coolant pump.

Expansion and contraction of the coolant is accommodated by an air space in the expansion tank and the compliance of the flexible hoses.

Engine Cooling Flow Diagram



E145207

Item	Part Number	Description
1	-	Expansion tank
2	-	Bleed screw
3	-	Heater system
4	-	Bleed screw
5	-	Right cylinder head
6	-	Cylinder block
7	-	Electric throttle
8	-	Engine oil cooler
9	-	Heater manifold
10	-	Left cylinder head
11	-	Transmission oil cooler
12	-	Check valve
13	-	Thermostat
14	-	Radiator
15	-	Coolant pump
16	-	Connections to supercharger charge air coolers

OPERATION

Thermostat

The thermostat begins to open at 95 - 97 °C (203 - 207 °F) and is fully open at 109 °C (228 °F).

Coolant Level Sensor

If the coolant level in the expansion tank decreases below a predetermined value, the coolant level sensor connects a ground to the **CJB (central junction box)**, which sends a message to the IC (instrument cluster) on the high speed **CAN (controller area network)** bus to display a warning message.

Engine Cooling Fan

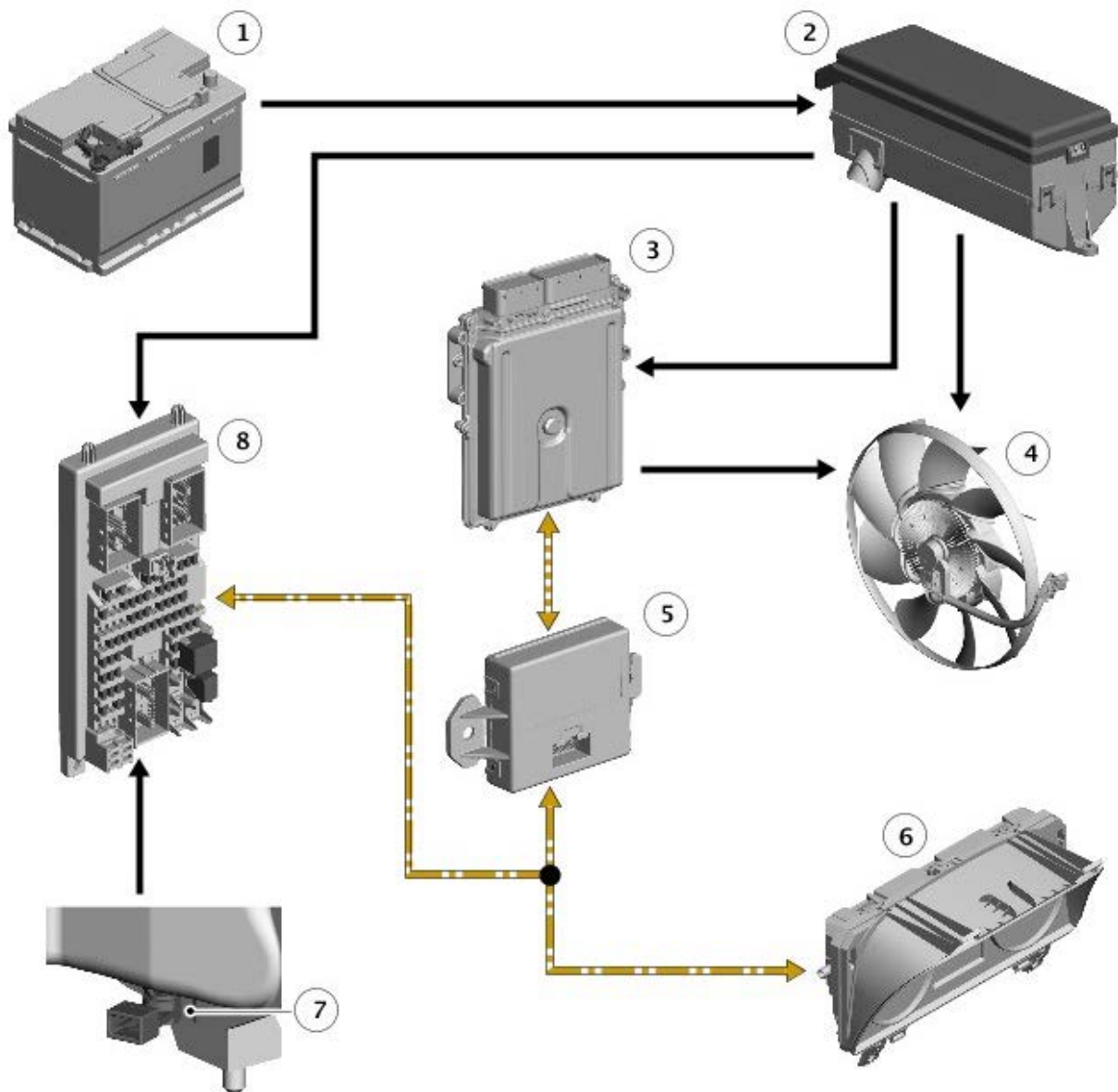
The **ECM** determines when to operate the cooling fan from the **ECT (engine coolant temperature)** sensor input and a cooling fan request from the ATCM (automatic temperature control module). The **ECM** also adjusts the fan speed to compensate for the ram effect of vehicle speed.

Viscous Cooling Fan

To control the viscous cooling fan, the **ECM** sends a **PWM (pulse width modulation)** signal to the fan control module. The **ECM** varies the duty cycle of the **PWM** signal between 0 and 100% to vary the clutch engagement and thus fan speed. If the **PWM** signal is outside the 0 to 100% range, the fan control module interprets the signal as an open or short circuit and runs the fan at minimum speed to ensure the fan does not overspeed.

If the electrical connections to the viscous fan are disconnected the fan will idle and the engine may overheat. If **ECM** detects a cooling fan fault it stores the appropriate **DTC (diagnostic trouble code)** and signals the IC on the high speed **CAN** powertrain bus to display a warning message.

CONTROL DIAGRAM



E160386



A = Hardwired; D = High Speed CAN Bus; N = Medium Speed CAN Bus

Item	Part Number	Description
1	-	Battery
2	-	Engine Junction Box (EJB)

- 3 - Engine Control Module (ECM)
- 4 - Viscous cooling fan
- 5 - Gateway Module (GWM)
- 6 - Instrument Cluster (IC)
- 7 - Coolant level sensor
- 8 - Central Junction Box (CJB)

Engine Cooling - V6 S/C 3.0L Petrol - Engine Cooling

Diagnosis and Testing

Principles of Operation

For a detailed description of the engine cooling system and operation, refer to the relevant Description and Operation section in the workshop manual. REFER to:

[Engine Cooling](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Description and Operation),
[Engine Cooling](#) (303-03 Engine Cooling - V6 S/C 3.0L Petrol, Description and Operation),
[Engine Cooling](#) (303-03 Engine Cooling - V6 S/C 3.0L Petrol, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Coolant leaks • Coolant hoses • Coolant expansion tank • Radiator • Heater core • Primary drive belt • Viscous fan 	<ul style="list-style-type: none"> • Fuses • Harnesses • Loose or corroded connector(s) • Engine coolant temperature (ECT) sensor

3. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the symptom chart.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Cause	Action
Coolant loss	<ul style="list-style-type: none"> • Hoses • Hose connections • Radiator • Water pump • Heater core • Gaskets • Engine casting cracks • Engine block core plugs 	Carry out a visual inspection. If there are no obvious leaks, carry out a pressure test. Rectify as necessary. Refer to the relevant section of the workshop manual
Overheating	<ul style="list-style-type: none"> • Low/contaminated coolant • Thermostat • Viscous fan • Engine coolant temperature sensor • Restricted air flow over the radiator 	Check the coolant level and condition. Check the thermostat and rectify as necessary. Carry out a cooling system pressure test. Refer to the relevant section of the workshop manual. Check the viscous fan operation, make sure the viscous fan rotates freely. Check for obstructions to the air flow over the radiator
Engine not reaching normal temperature	<ul style="list-style-type: none"> • Thermostat • Viscous fan • Thermostat • Electric fan • Fan speed module 	Check the thermostat operation. Check the viscous fan operation, make sure the viscous fan is not seized

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-

00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: V6 3.0L S/C Petrol, DTC: Engine Control Module \(ECM\)](#)
(100-00 General Information, Description and Operation).

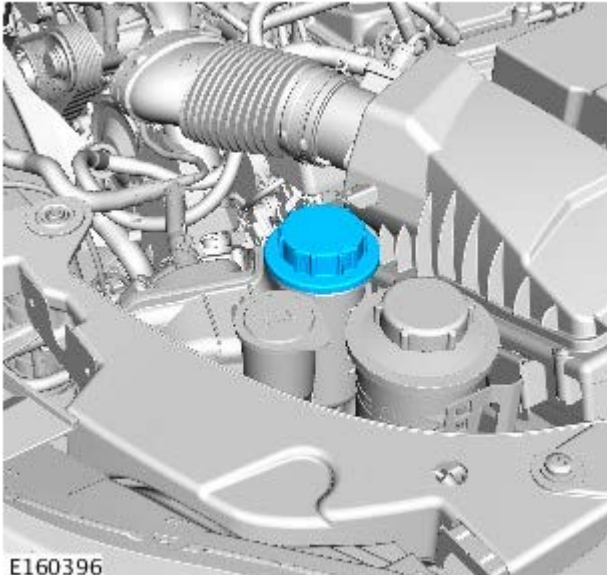
Engine Cooling - V6 S/C 3.0L Petrol - Cooling System Draining and Vacuum Filling

General Procedures


Draining

1.  **WARNING:** Make sure to support the vehicle with axle stands.


Raise and support the vehicle.



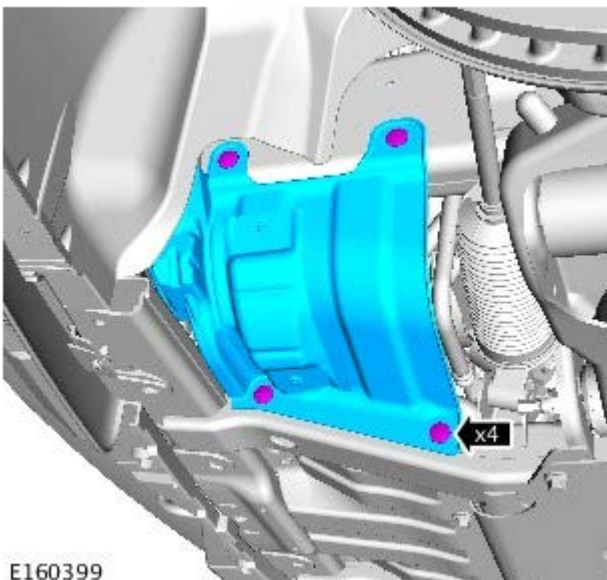
2. **WARNINGS:**


 Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn. Cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow this instruction may result in personal injury.

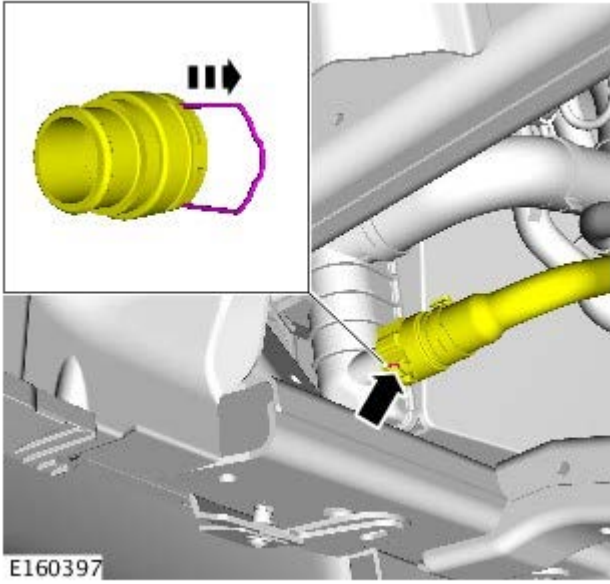
 Be prepared to collect escaping fluids.

 Since injury such as scalding could be caused by escaping steam or coolant, make sure the vehicle cooling system is cool prior to carrying out this procedure.

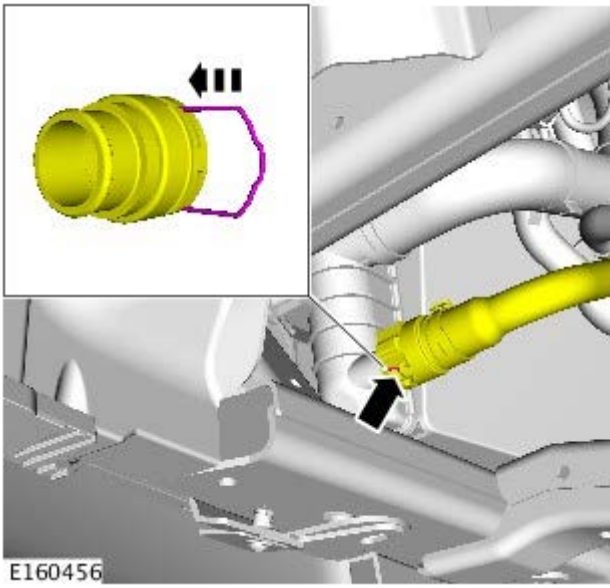
- 3.



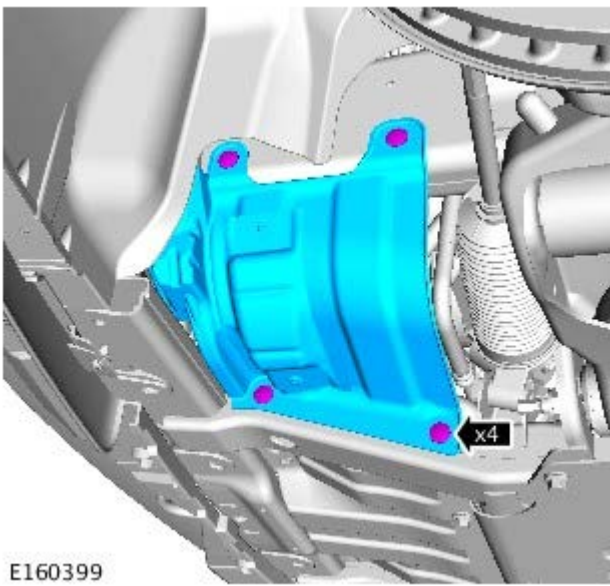
4.  **CAUTION:** Be prepared to collect escaping coolant.



5.




6.



Filling

1. Lower the vehicle.

2.  CAUTION: Anti-freeze concentration must be maintained at 50%.
- Install the cooling system vacuum refill adaptor to the expansion tank.
 - Install the vacuum filler gauge to the cooling system vacuum refill adaptor.
 - Install the venturi tube assembly to the vacuum filler gauge.

3. NOTES:



Make sure the coolant supply valve is in the closed position on the vacuum filler gauge assembly.



The coolant vacuum fill tool needs an air pressure of 6 to 8 bar (87 to 116 psi) to operate correctly.



Small diameter or long airlines may restrict airflow to the coolant vacuum fill tool.

- Connect a regulated compressed air supply to the venturi tube assembly.

4. Position the evacuated air hose into a container.

5. Open the air supply valve.



6. NOTE: Make sure the coolant supply hose is positioned into a container of fifty percent mixture of Land Rover Premium Cooling System Fluid or equivalent, meeting Land Rover specification Halvoline XLC and fifty percent water. Make sure no air can enter the supply hose.

Open the coolant supply valve for 2 seconds to prime the coolant supply hose.

7. Apply air pressure progressively until the arrow on the vacuum filler gauge reaches the green segment.

8. Disconnect the compressed air supply line.



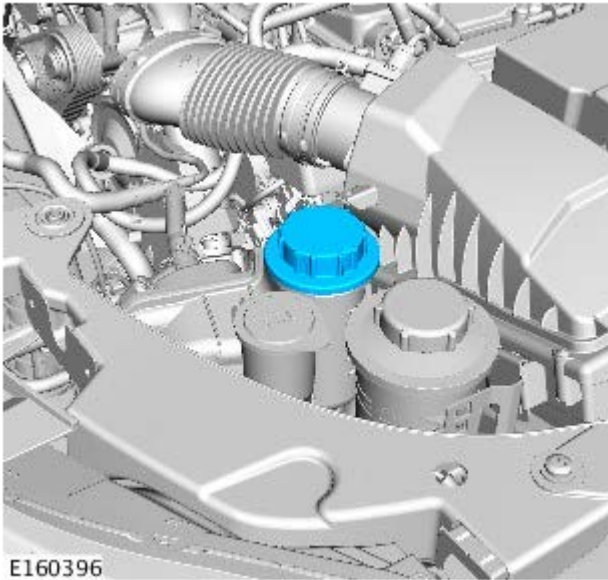
9. NOTE: Close the coolant supply valve when the coolant expansion tank MAX mark is reached or coolant movement has ceased.

Open the coolant supply valve and allow the coolant to be drawn into the system.


10. Remove the vacuum filler gauge and cooling system vacuum refill adaptor assembly.



11. CAUTION: Correct installation of the coolant expansion tank cap can be obtained by tightening the cap until an audible click is heard.




12. Set the heater controls to maximum.

13.  **CAUTION:** Observe the engine temperature gauge. If the engine starts to over-heat switch off immediately and allow to cool. Failure to follow this instruction may cause damage to the vehicle

Start the engine and idle until hot air is emitted at the face registers.

14. Switch the heater off.

15. Raise the engine speed to 2000 RPM for eight minutes.


16.  **CAUTION:** Switch off the engine and allow the coolant temperature to go cold.


Switch the engine off.


17. Visually check the engine and cooling system for signs of coolant leakage.

18.  **WARNING:** When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

CAUTIONS:

 Since injury such as scalding could be caused by escaping steam or coolant, make sure the vehicle cooling system is cool prior to carrying out this procedure.

 Make sure the coolant level remains above the "COLD FILL RANGE" lower level mark.

 **NOTE:** When the cooling system is warm, the coolant will be approximately 10mm above the upper level mark on the expansion tank with the cap removed.

Check and top-up the coolant if required.

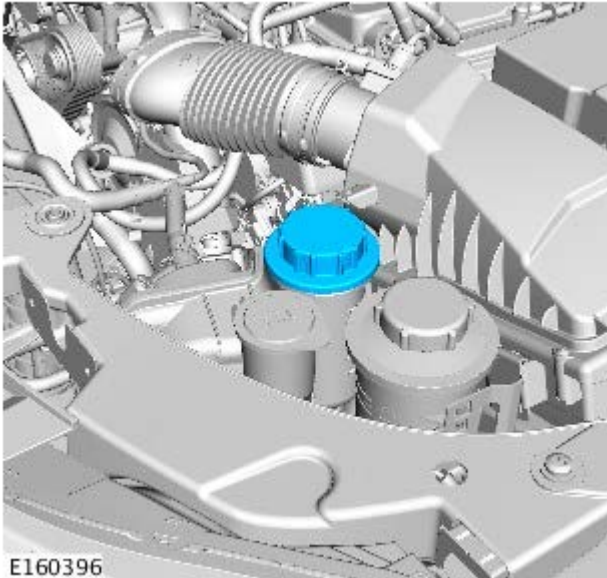
Engine Cooling - V6 S/C 3.0L Petrol - Cooling System Draining, Filling and Bleeding

General Procedures


Draining

1.  **WARNING:** Make sure to support the vehicle with axle stands.


Raise and support the vehicle.



2. **WARNINGS:**

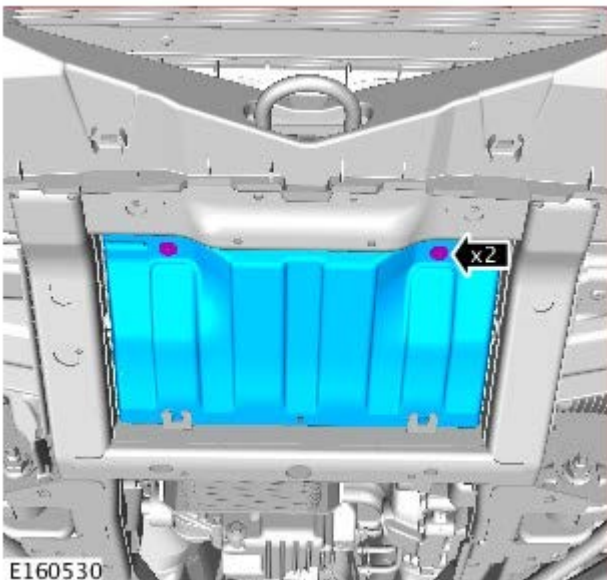
 Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn. Cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow this instruction may result in personal injury.

 Be prepared to collect escaping fluids.

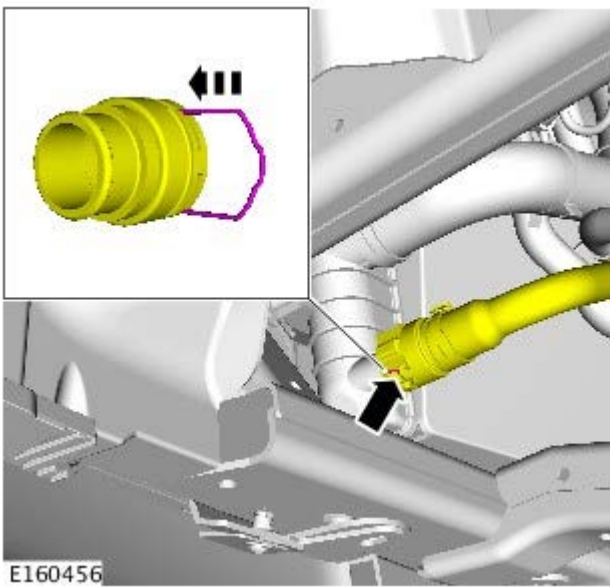
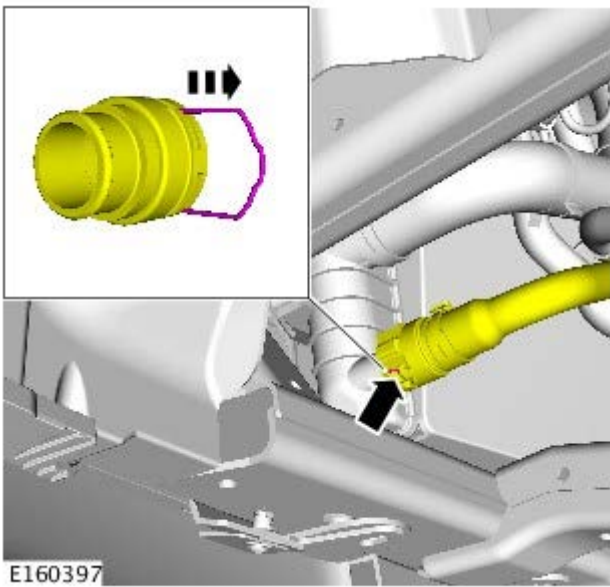
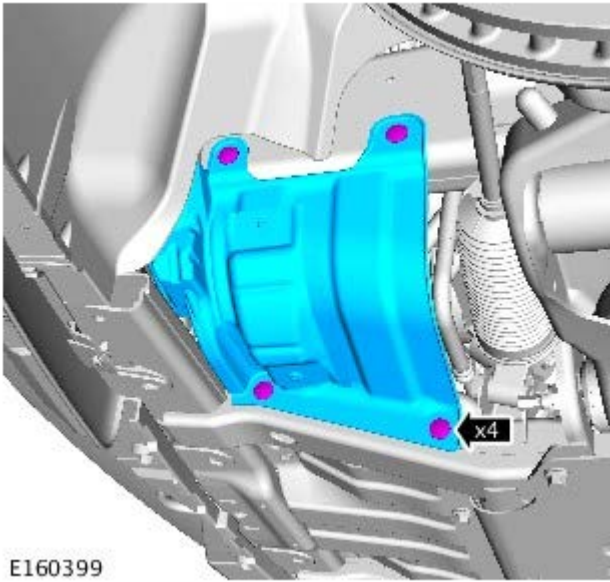
 Since injury such as scalding could be caused by escaping steam or coolant, make sure the vehicle cooling system is cool prior to carrying out this procedure.


3. Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

- 4.




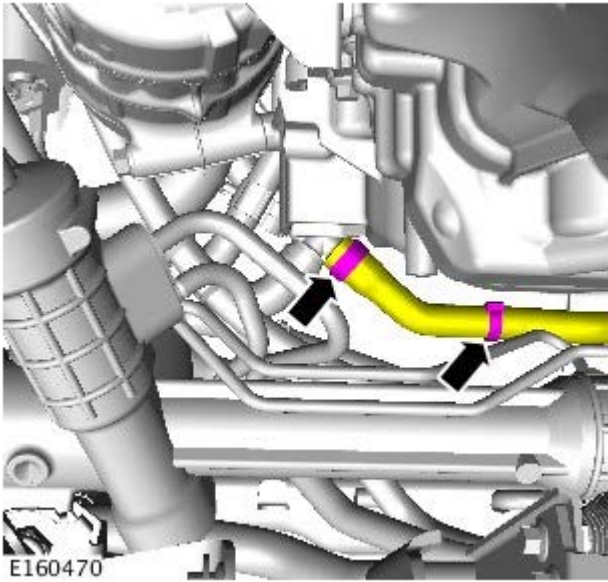
- 5.



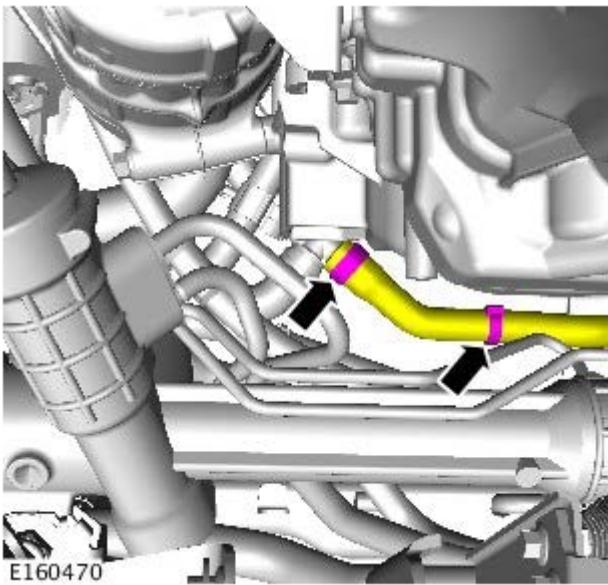
6.  CAUTION: Be prepared to collect escaping coolant.


7.

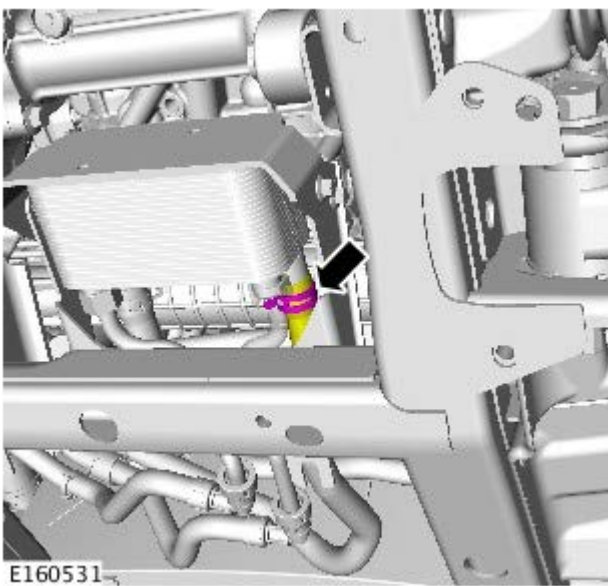
8.  CAUTION: Be prepared to collect escaping coolant.



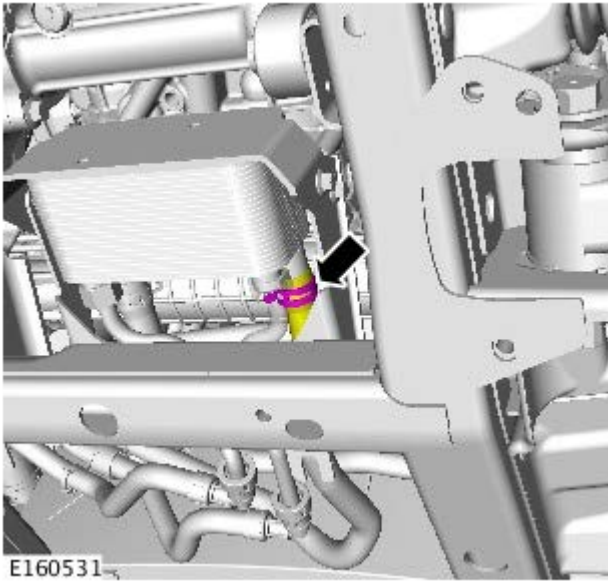
9.



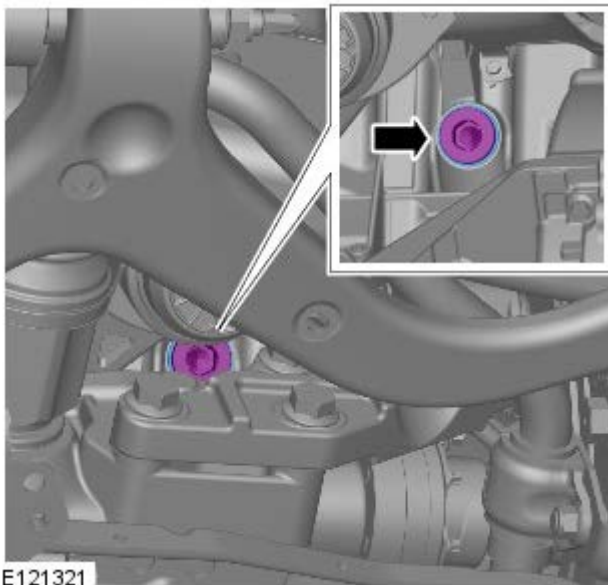
10.  CAUTION: Be prepared to collect escaping coolant.



11.



E160531

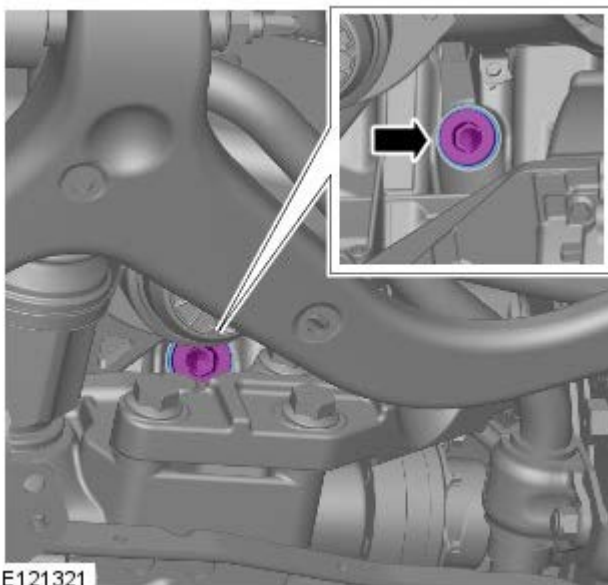


E121321

12. CAUTIONS:

 Be prepared to collect escaping coolant.

 Discard the seal.

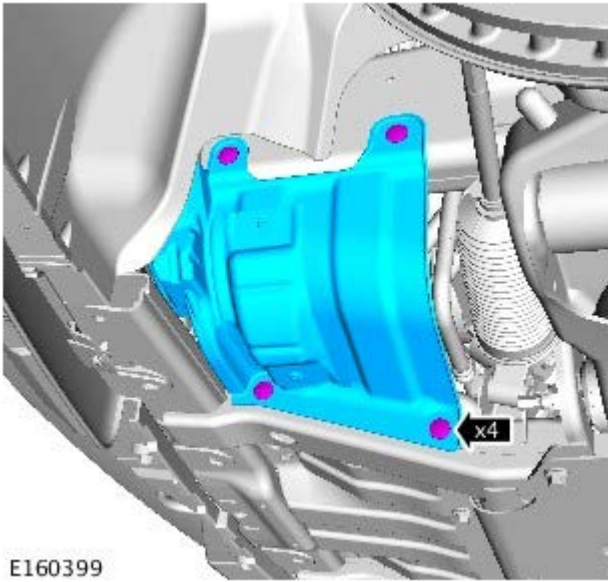


E121321

13.  CAUTION: Install a new seal.

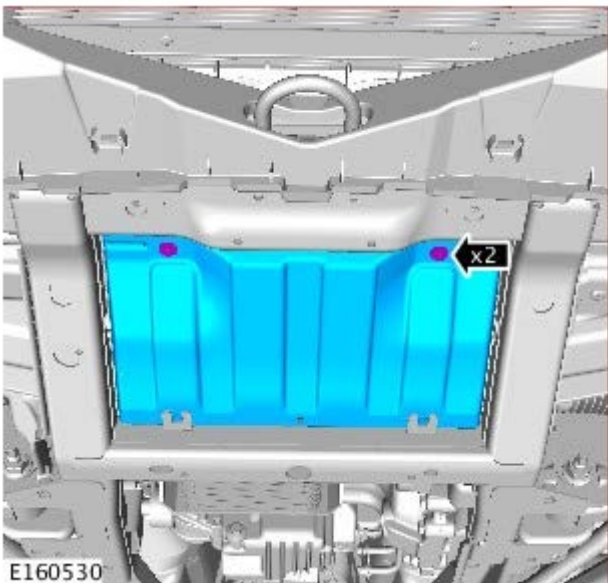
Torque: 50 Nm

14.



E160399

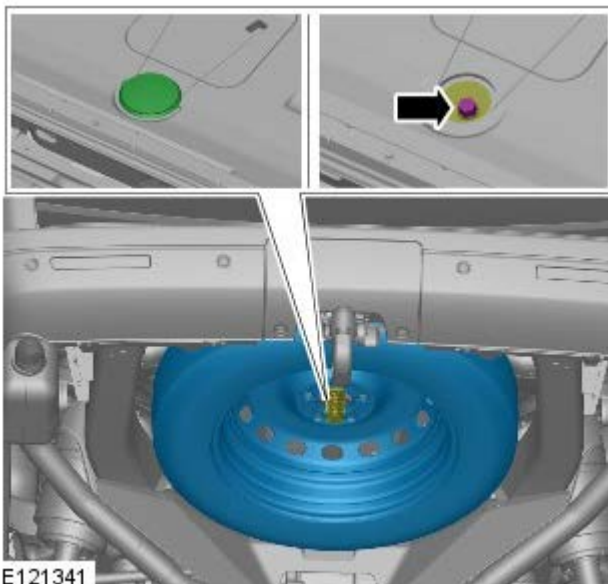
15. Torque: 10 Nm



E160530

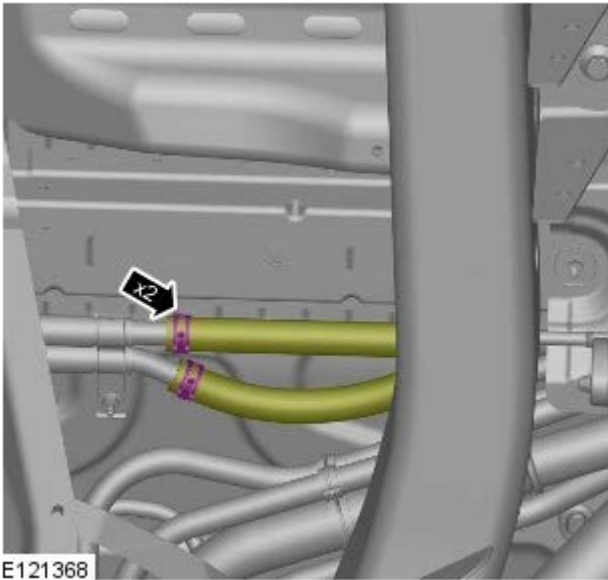
16. Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

17.



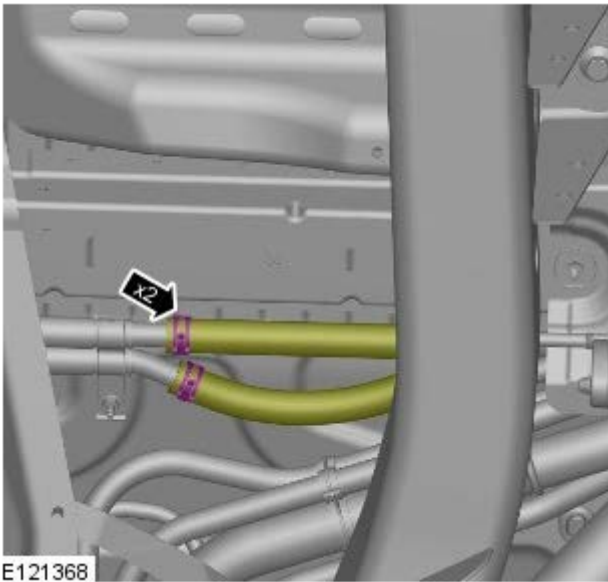
E121341

18.  CAUTION: Be prepared to collect escaping

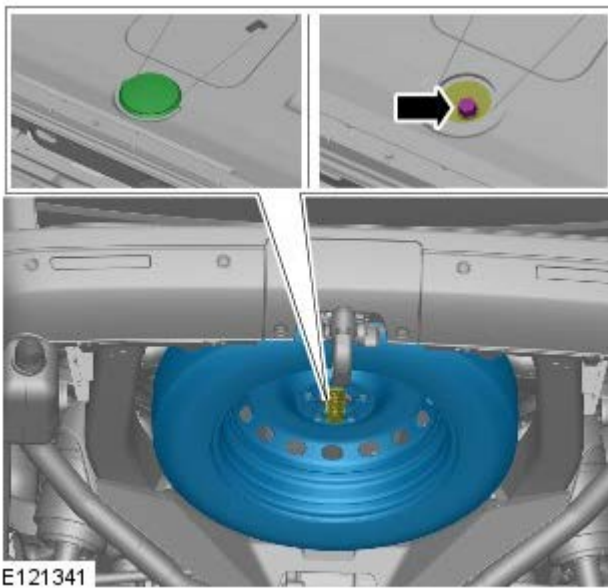


coolant.

19.



20.



Filling

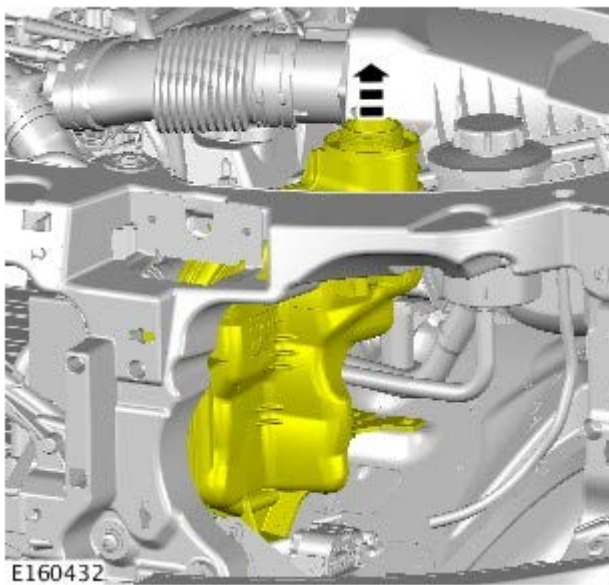
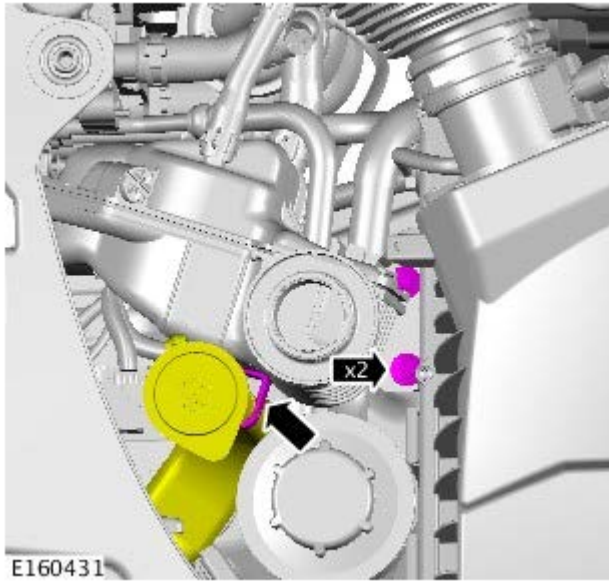
1. Remove the left headlamp.


Refer to: [Headlamp Assembly](#) (417-01 Exterior Lighting,

Removal and Installation).

2. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

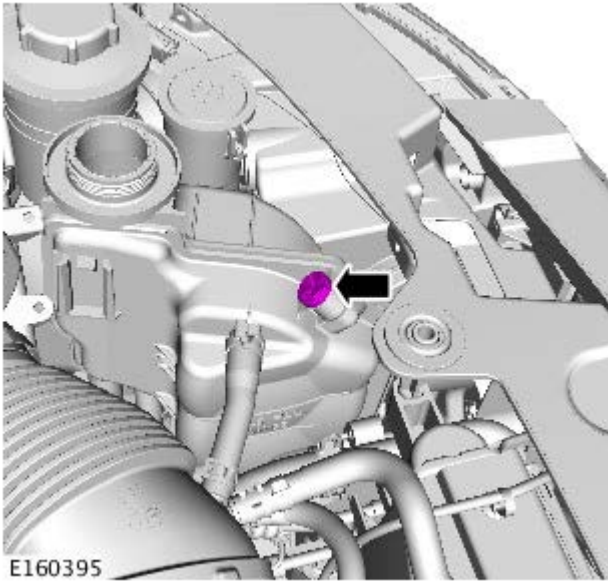
3. *Torque:* 9 Nm



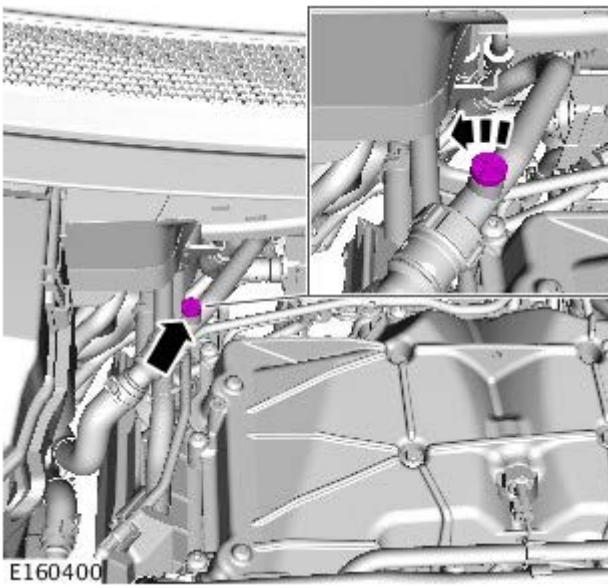
4.  NOTE: Keep the coolant expansion tank vertical.

Raise the expansion tank 30mm (1.18 inch) from its original position.

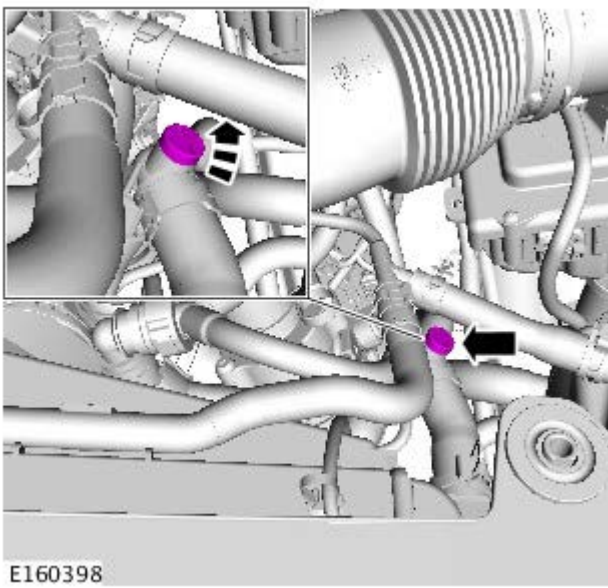
5.  NOTE: Loosen but do not fully remove .



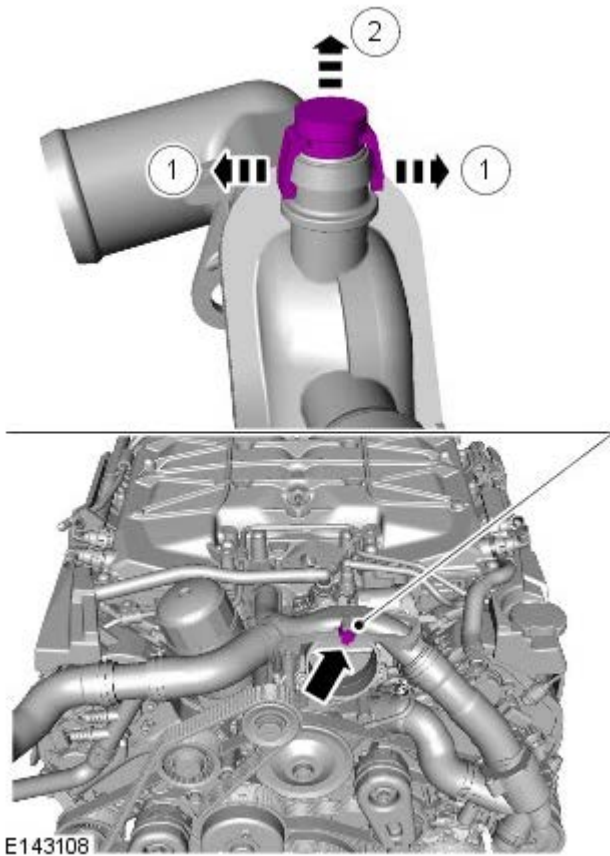
6.



7.



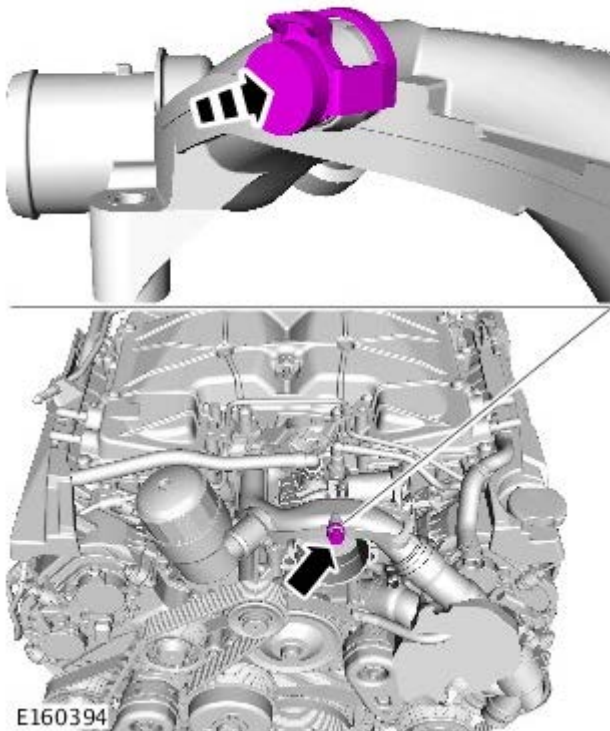
8.



E143108

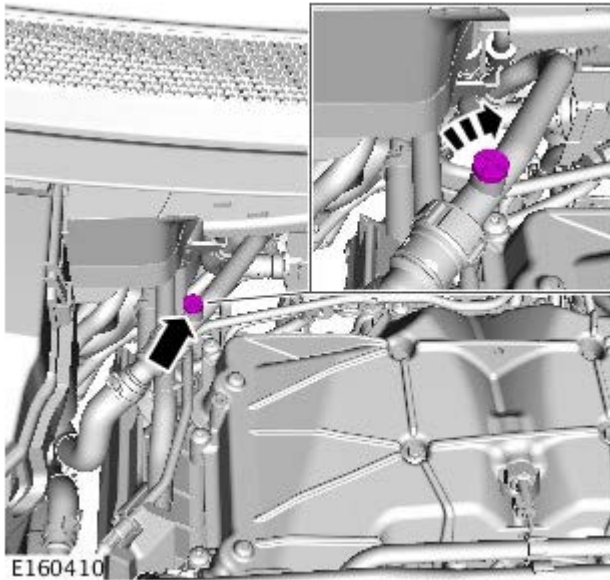
9.  **CAUTION:** Anti-freeze concentration must be maintained at 50%.

- Fill the coolant expansion tank to the rim and continue until coolant is visible from the outlet.
- Once coolant is visible from the outlet, close the bleeding point.

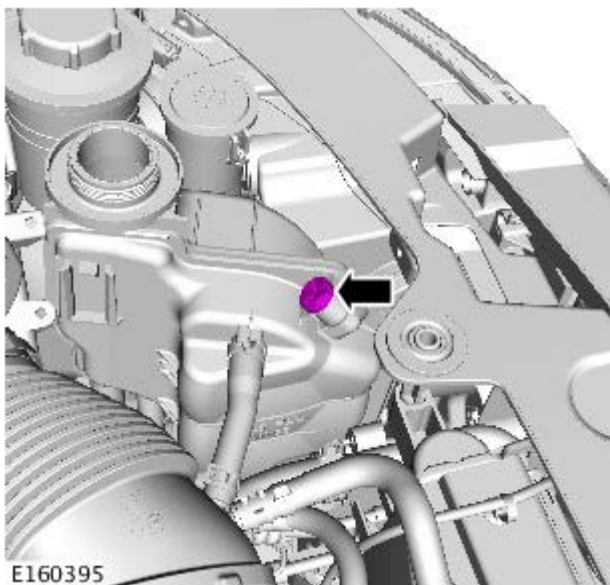


E160394

- 10.
- Fill the coolant expansion tank to the rim and continue until coolant is visible from the outlet.
 - Once coolant is visible from the outlet, close the bleeding point.



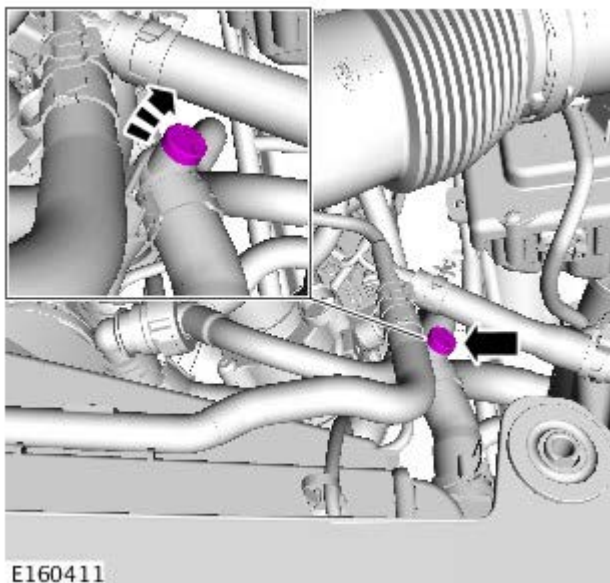
11. Close the bleeding point.



12. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

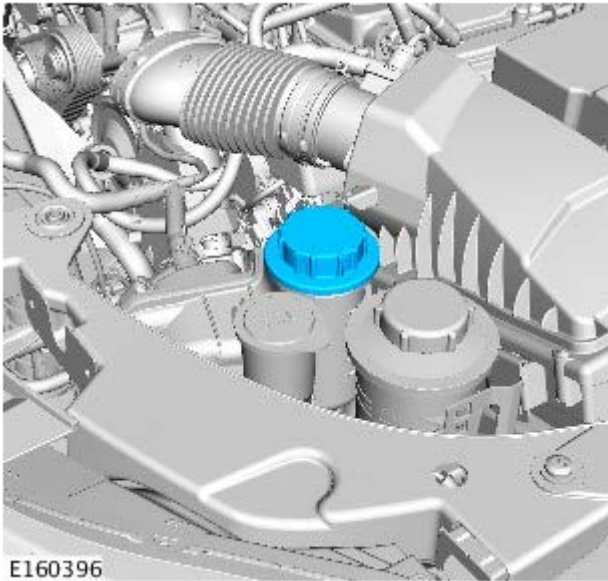
13.


- Start and run the engine.
- Continue to top-up with coolant with the engine at idle.
- Once coolant is visible from the outlet, close the bleeding point.




14. Switch off the engine and wait for a minimum of 1 minute.

15. Set the heater controls to maximum.
16.
 - Start and run the engine.
 - Hold the engine speed at 2000 rpm until the coolant level in the expansion tank drops.
17. Increase the engine speed from idle to 3500 rpm until hot air is emitted from the front and rear face vents.
18. Continue filling the cooling system expansion tank until the coolant level becomes static within the COLD FILL RANGE.
19. Add coolant to the expansion tank until the coolant level is 40 mm (1.57 inch) above the COLD FILL RANGE upper mark.



20.  **CAUTION:** Correct installation of the coolant expansion tank cap can be obtained by tightening the cap until an audible click is heard.


21. Run the at engine at idle, until hot air is emitted from the front and rear face vents.

22.  **CAUTION:** Switch off the engine and allow the coolant temperature to go cold.

Switch the engine off and allow to cool.

23. Install the coolant expansion tank.

24.  **WARNING:** When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

 **CAUTION:** Since injury such as scalding could be caused by escaping steam or coolant, make sure the vehicle cooling system is cool prior to carrying out this procedure.

Check and top up the coolant to the COLD FILL RANGE upper mark.

25. Install the left headlamp.

Refer to: [Headlamp Assembly](#) (417-01 Exterior Lighting, Removal and Installation).

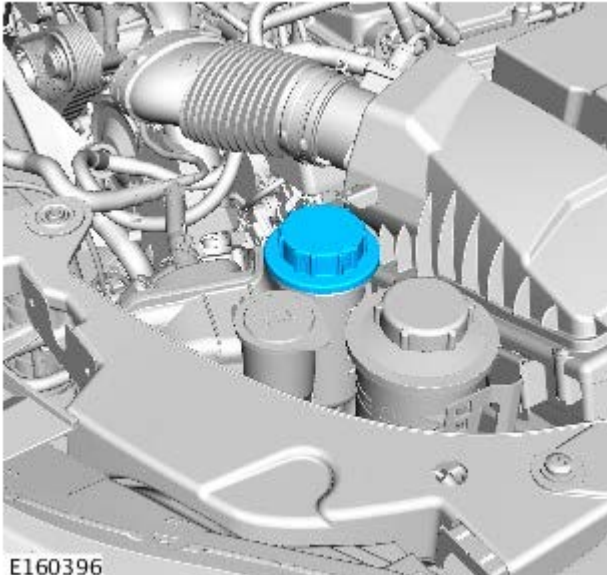
Engine Cooling - V6 S/C 3.0L Petrol - Cooling System Partial Draining, Filling and Bleeding

General Procedures


Draining

1.  **WARNING:** Make sure to support the vehicle with axle stands.


Raise and support the vehicle.



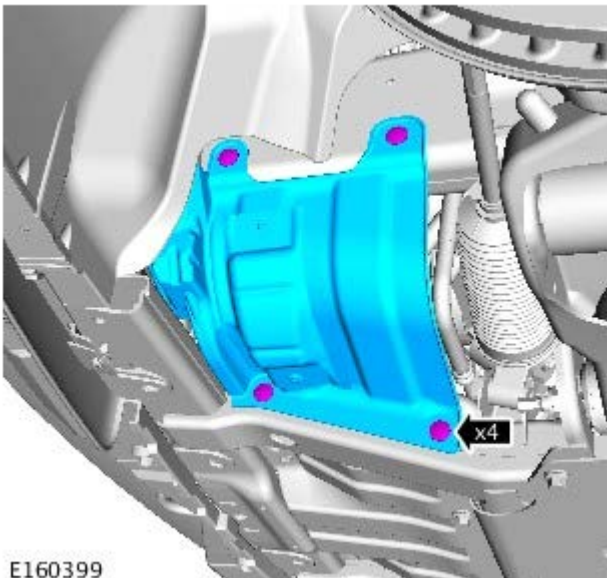
2. **WARNINGS:**


 Release the cooling system pressure by slowly turning the coolant expansion tank cap a quarter of a turn. Cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow this instruction may result in personal injury.

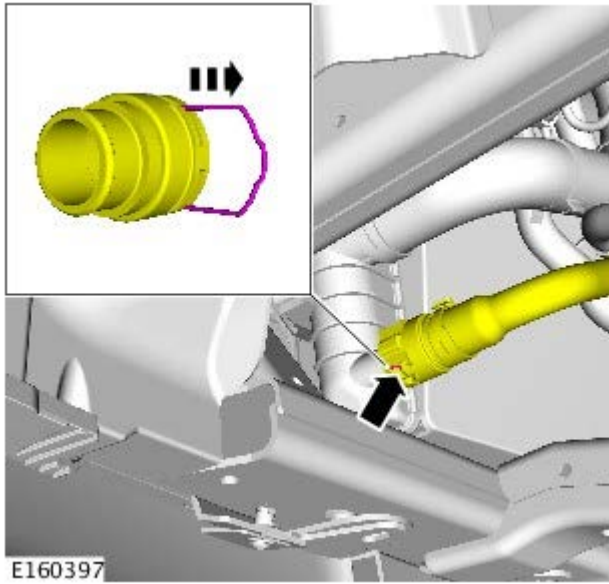
 Be prepared to collect escaping fluids.

 Since injury such as scalding could be caused by escaping steam or coolant, make sure the vehicle cooling system is cool prior to carrying out this procedure.

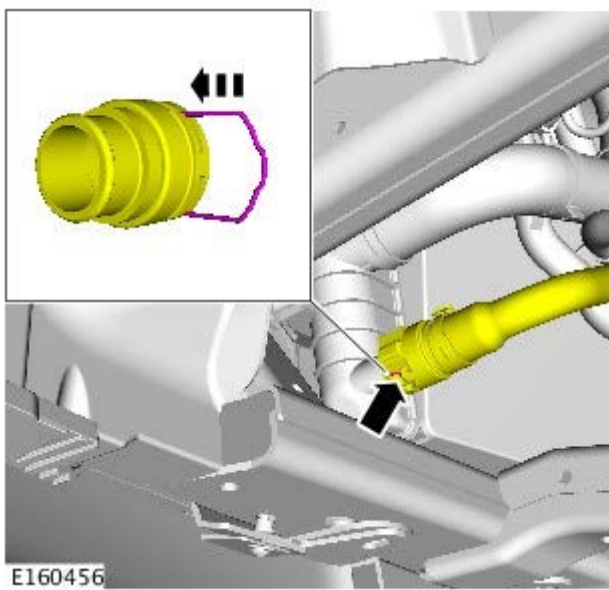
- 3.



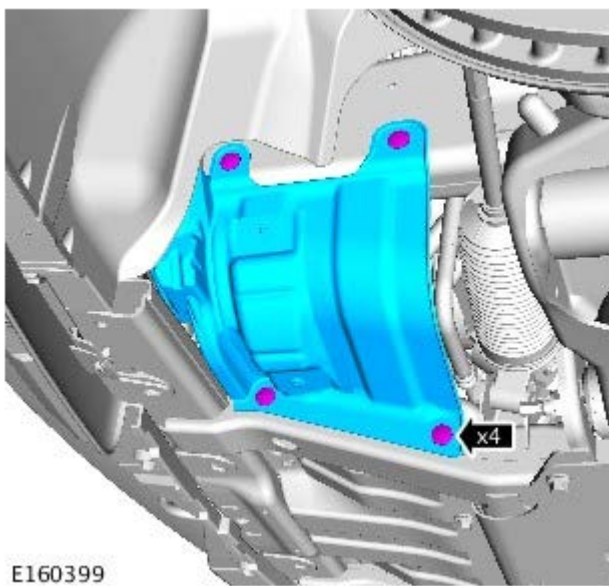
4.  **CAUTION:** Be prepared to collect escaping coolant.



5.



6.



Filling

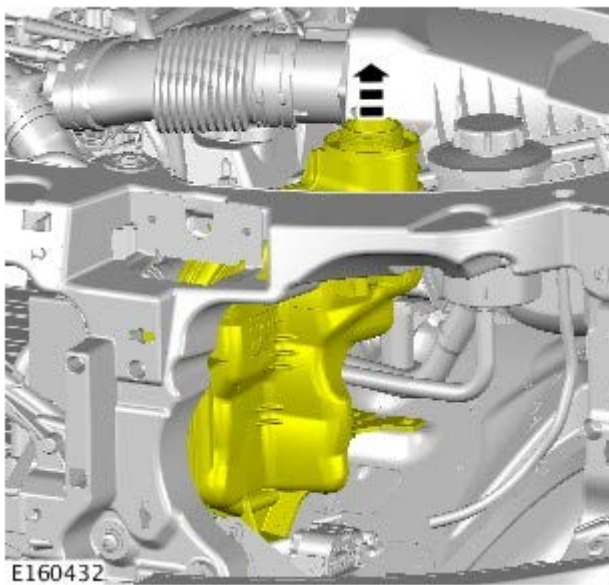
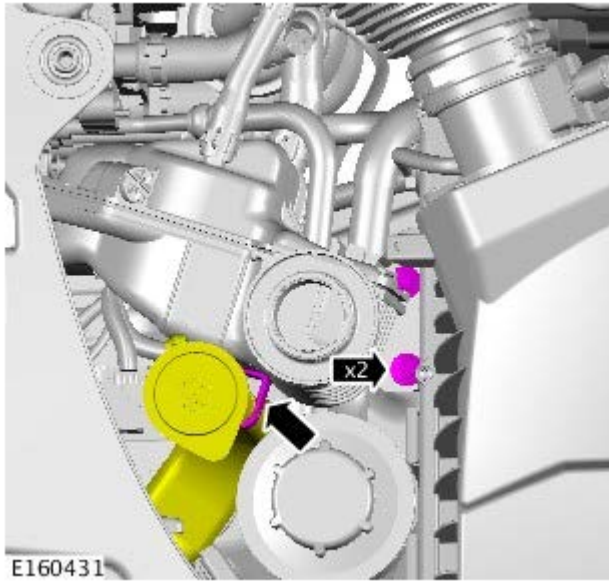
1. Remove the left headlamp.


Refer to: [Headlamp Assembly](#) (417-01 Exterior Lighting,

Removal and Installation).

2. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

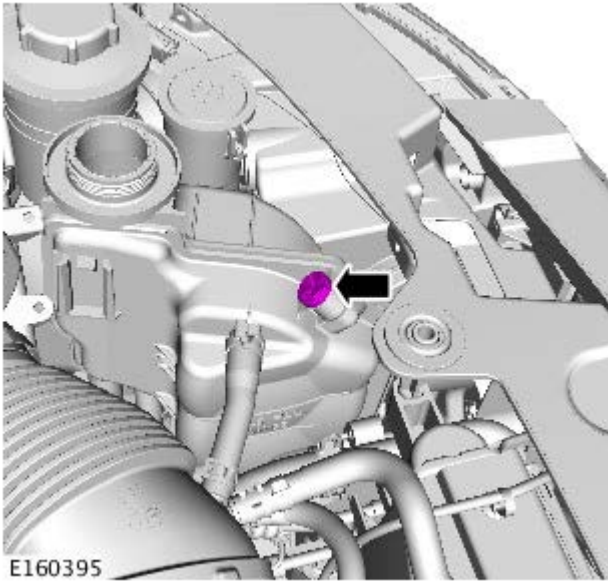
3. Torque: 9 Nm



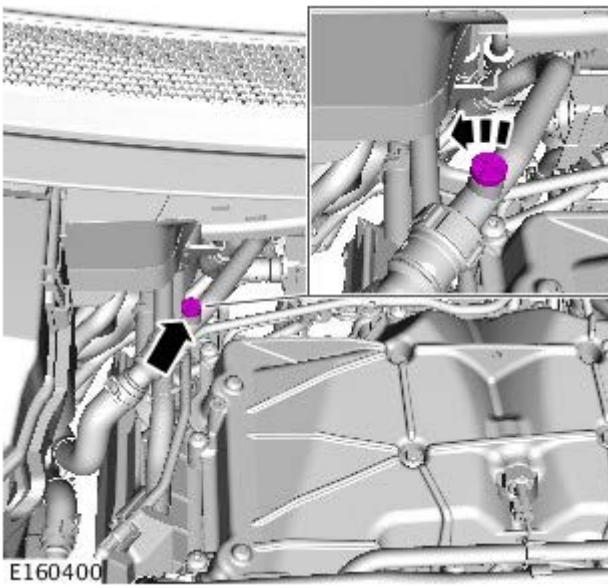
4.  NOTE: Keep the coolant expansion tank vertical.

Raise the expansion tank 30mm (1.18 inch) from its original position.

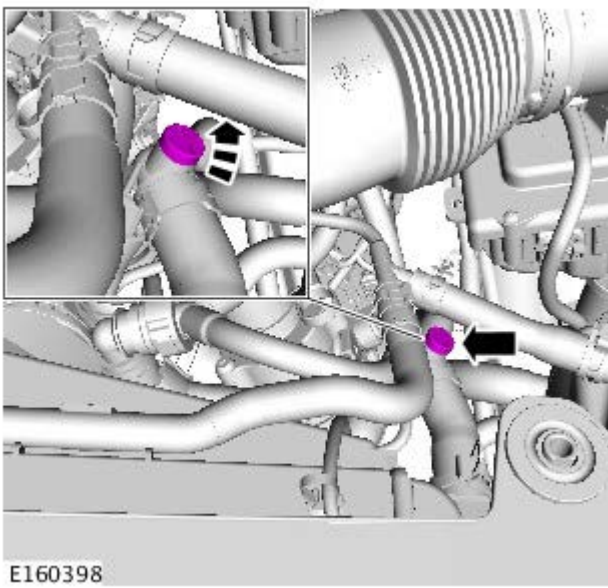
5.  NOTE: Loosen but do not fully remove .



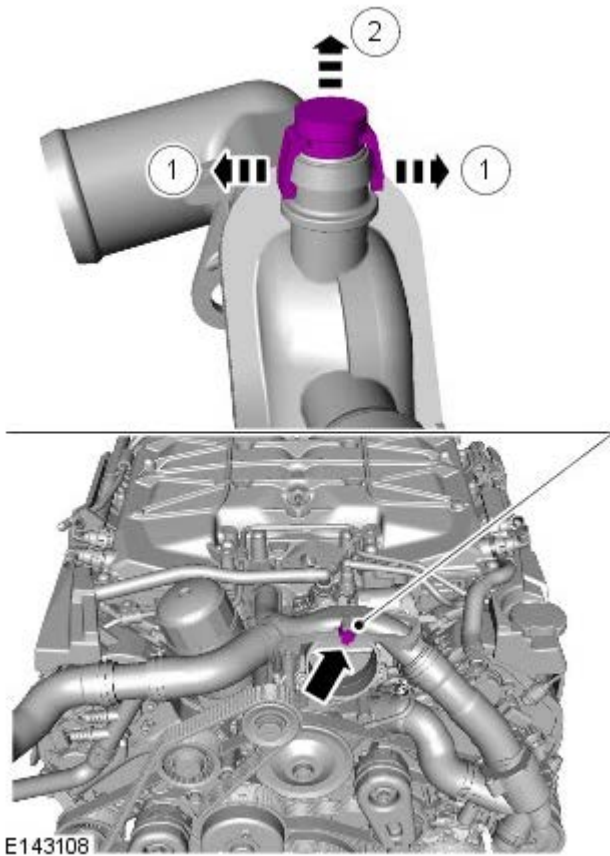
6.



7.



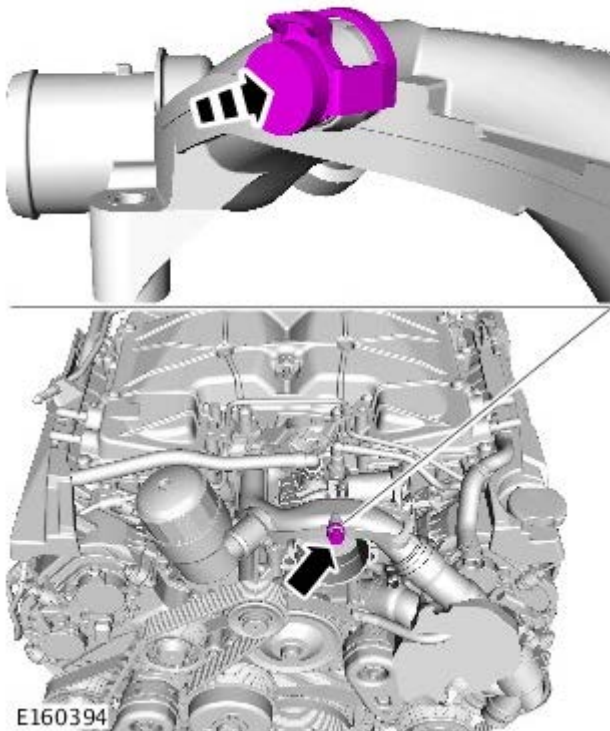
8.



E143108

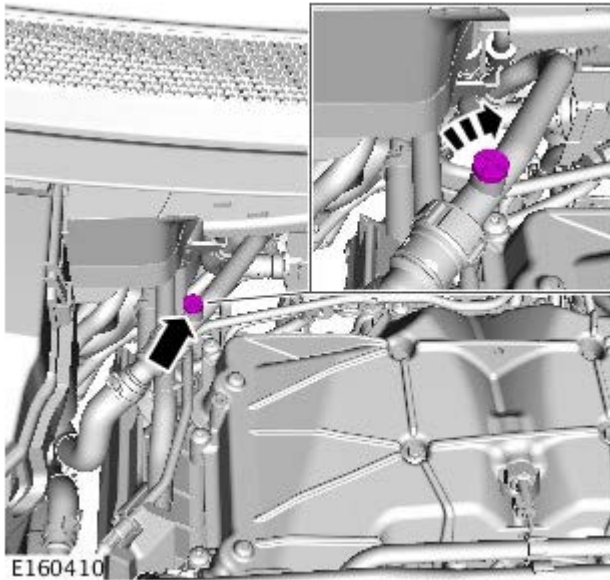
9.  **CAUTION:** Anti-freeze concentration must be maintained at 50%.

- Fill the coolant expansion tank to the rim and continue until coolant is visible from the outlet.
- Once coolant is visible from the outlet, close the bleeding point.

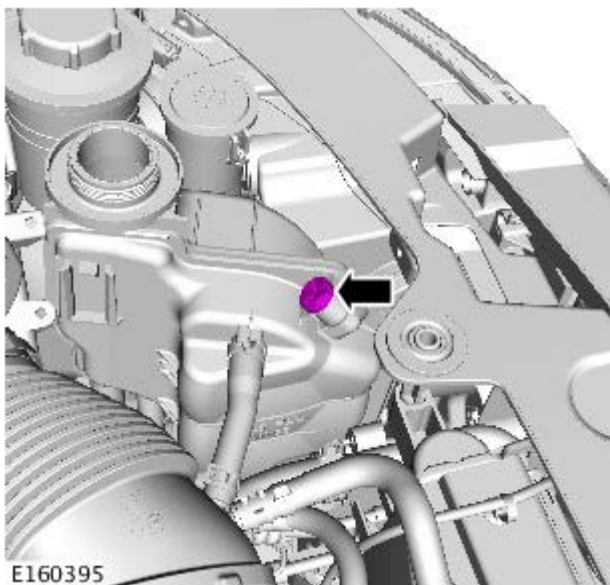


E160394

- 10.
- Fill the coolant expansion tank to the rim and continue until coolant is visible from the outlet.
 - Once coolant is visible from the outlet, close the bleeding point.



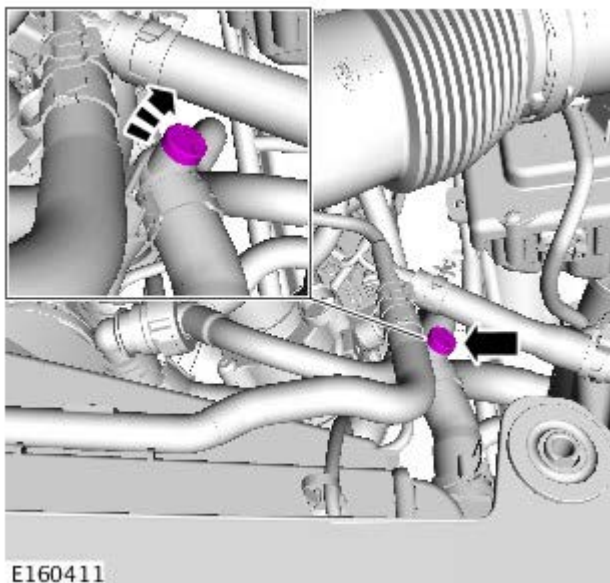
11. Close the bleeding point.



12. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

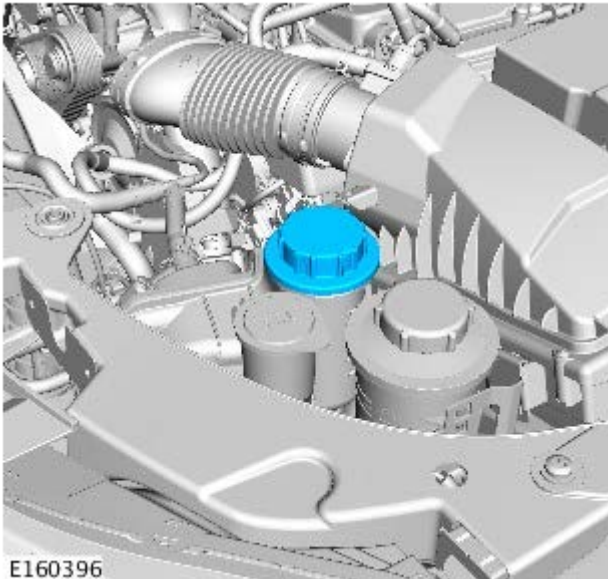
13.


- Start and run the engine.
- Continue to top-up with coolant with the engine at idle.
- Once coolant is visible from the outlet, close the bleeding point.




14. Switch off the engine and wait for a minimum of 1 minute.

15. Set the heater controls to maximum.
16.
 - Start and run the engine.
 - Hold the engine speed at 2000 rpm until the coolant level in the expansion tank drops.
17. Increase the engine speed from idle to 3500 rpm until hot air is emitted from the front and rear face vents.
18. Continue filling the cooling system expansion tank until the coolant level becomes static within the COLD FILL RANGE.
19. Add coolant to the expansion tank until the coolant level is 40 mm (1.57 inch) above the COLD FILL RANGE upper mark.



20.  **CAUTION:** Correct installation of the coolant expansion tank cap can be obtained by tightening the cap until an audible click is heard.


21. Run the at engine at idle, until hot air is emitted from the front and rear face vents.

22.  **CAUTION:** Switch off the engine and allow the coolant temperature to go cold.

Switch the engine off and allow to cool.

23. Install the coolant expansion tank.

24.  **WARNING:** When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

 **CAUTION:** Since injury such as scalding could be caused by escaping steam or coolant, make sure the vehicle cooling system is cool prior to carrying out this procedure.

Check and top up the coolant to the COLD FILL RANGE upper mark.

25. Install the left headlamp.

Refer to: [Headlamp Assembly](#) (417-01 Exterior Lighting, Removal and Installation).

Engine Cooling - V6 S/C 3.0L Petrol - Coolant Expansion Tank

Removal and Installation

Removal

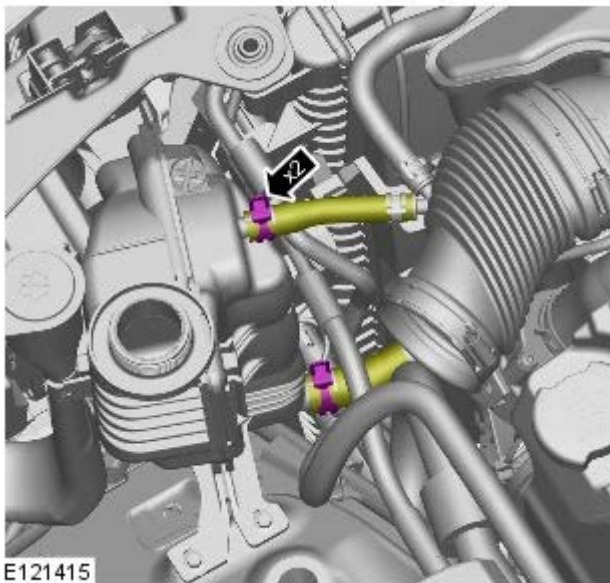


NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Refer to: [Air Cleaner LH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).



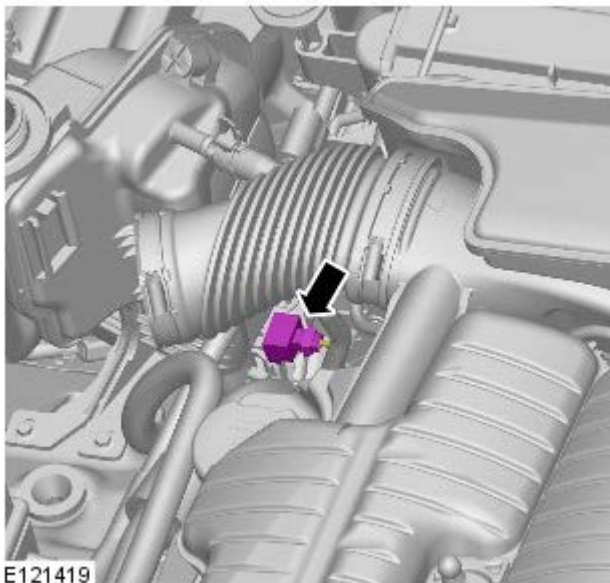
3. **CAUTIONS:**




Be prepared to collect escaping coolant.

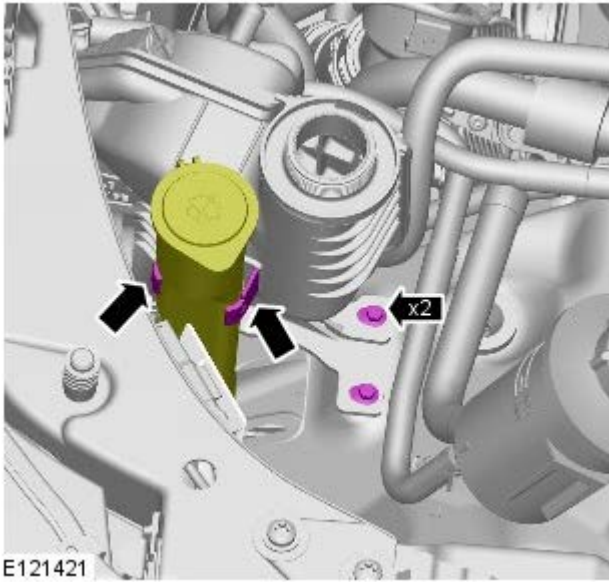


Clamp the hoses to minimize coolant loss.



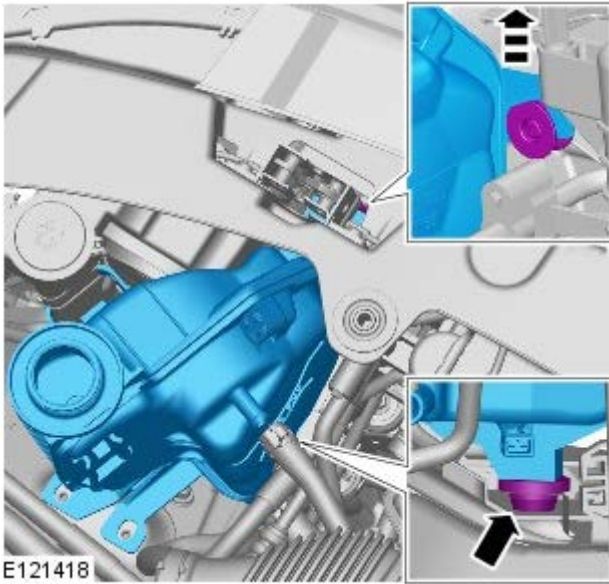
4.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

5. *Torque:* 10 Nm




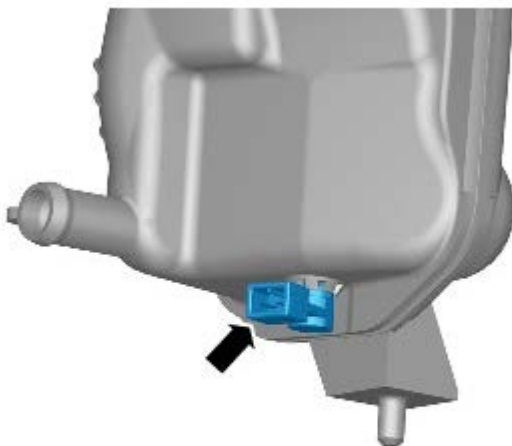
E121421

6.



E121418

7.  NOTE: Do not disassemble further if the component is removed for access only.



E121420

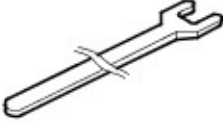

Installation

1. To install, reverse the removal procedure.

Engine Cooling - V6 S/C 3.0L Petrol - Cooling Fan

Removal and Installation

Special Tool(s)

 <p>303-1142</p> <p>E46076</p>	<p>303-1142 Viscous Coupling Wrench</p>
 <p>303-1143</p> <p>E55382</p>	<p>303-1143 Viscous Coupling Holding Tool</p>

Removal


NOTES:



Removal steps in this procedure may contain installation details.

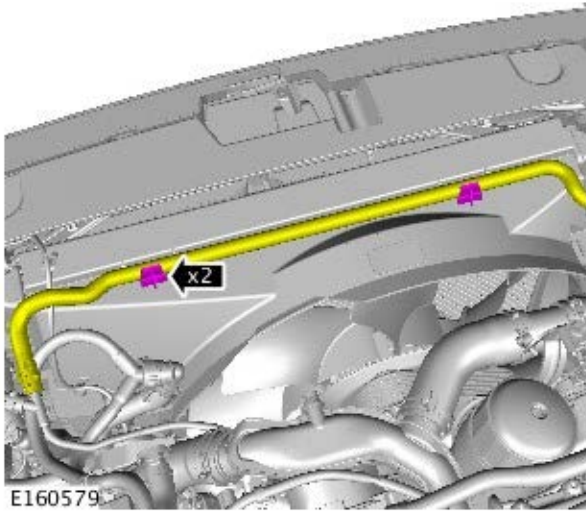


Some variation in the illustrations may occur, but the essential information is always correct.

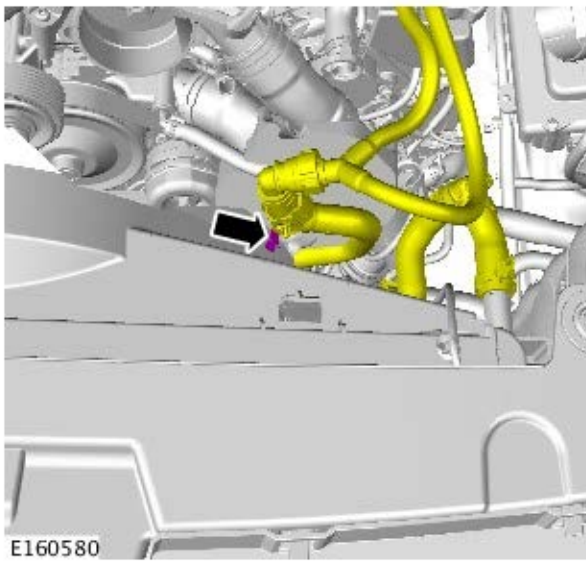
1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
3. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
4. Refer to: [Air Cleaner Outlet Pipe LH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
5. Refer to: [Air Cleaner Outlet Pipe RH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

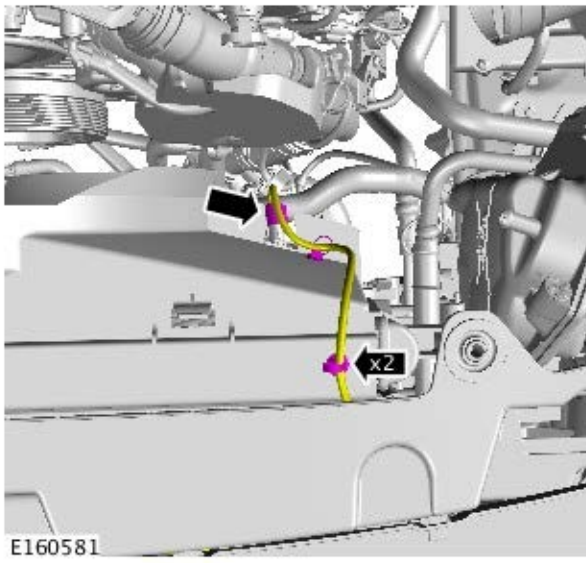
6.



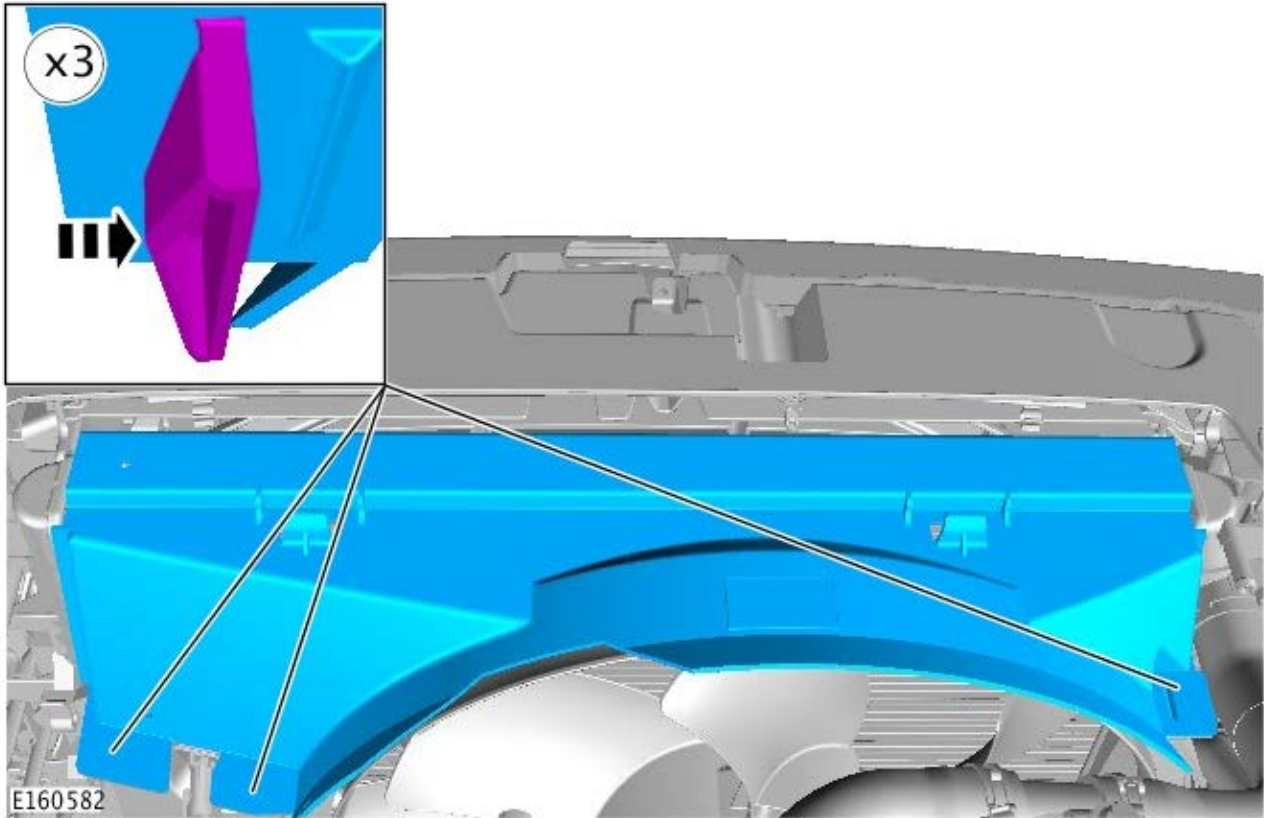
7.



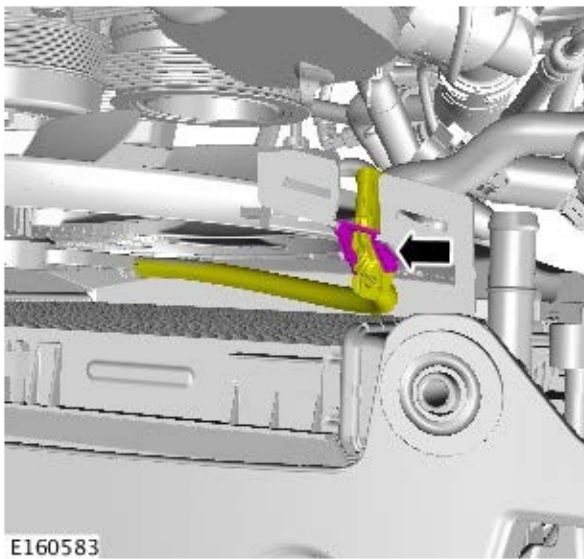
8.




9. Release the retaining tangs.



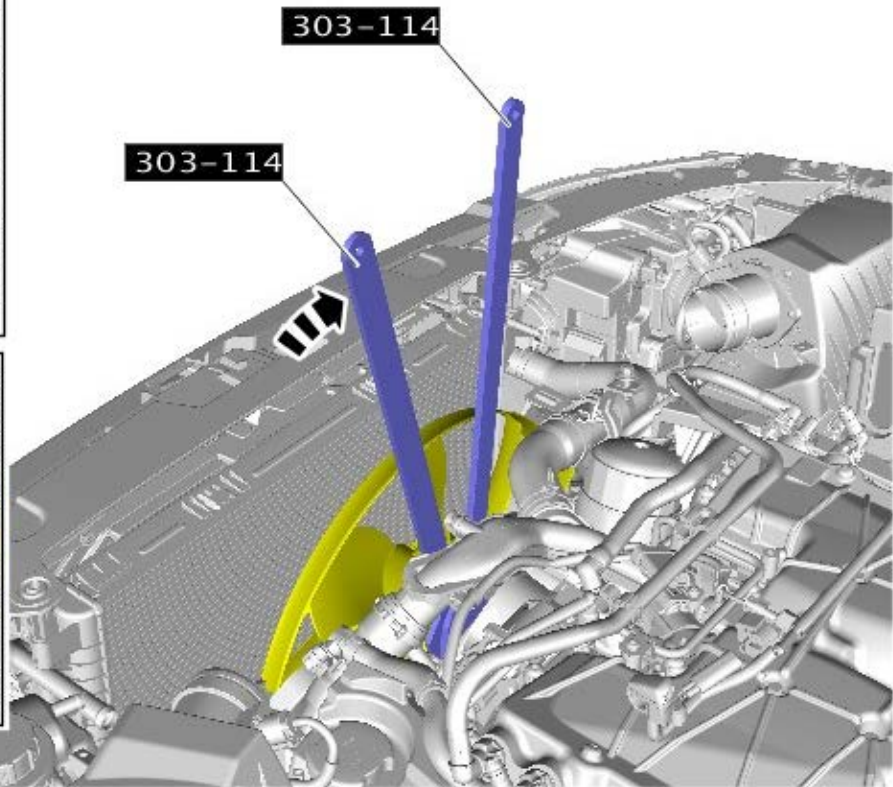
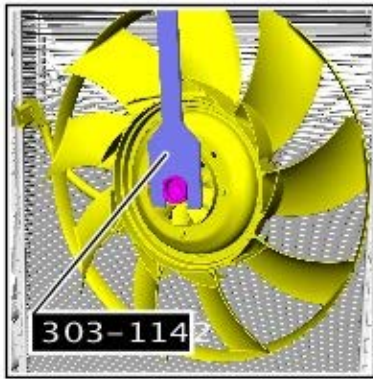
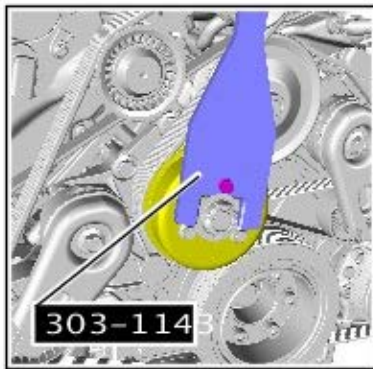
10.



11.  CAUTION: Always protect the cooling pack elements to prevent accidental damage.

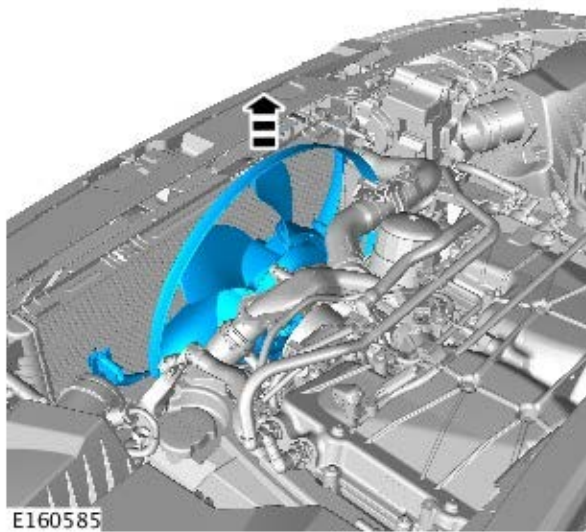
 NOTE: The thread is right handed.

Special Tool(s): [303-1142](#), [303-1143](#)
Torque: 65 Nm



E160584

12.



Installation

1. To install, reverse the removal procedure.

Engine Cooling - V6 S/C 3.0L Petrol - Coolant Pump

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

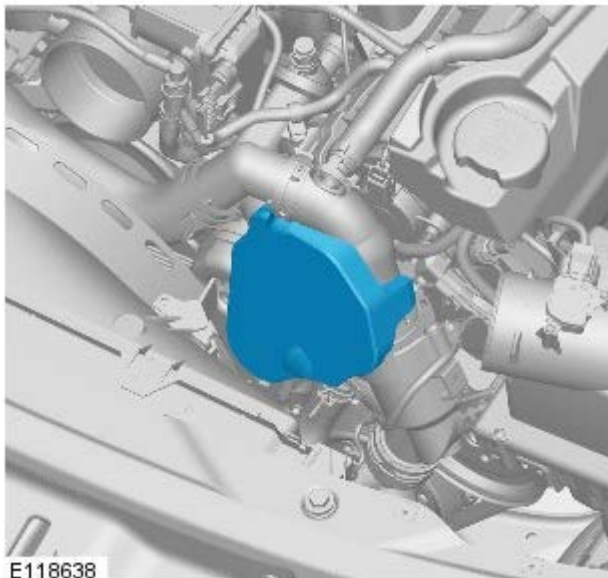
Refer to: Specifications (414-00, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

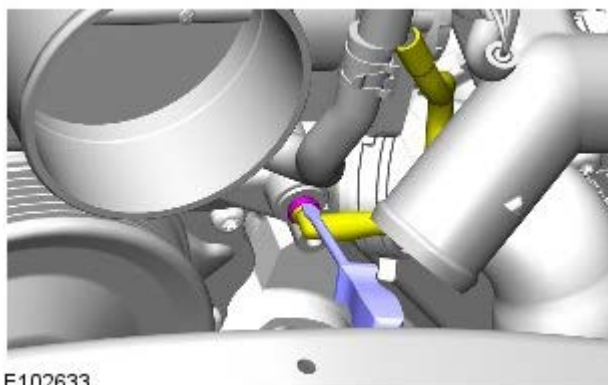
Raise and support the vehicle.

3. Refer to: Cooling System Partial Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03B, General Procedures).
4. Refer to: Accessory Drive Belt (303-05 Accessory Drive - V8 S/C 5.0L Petrol, Removal and Installation).

5.

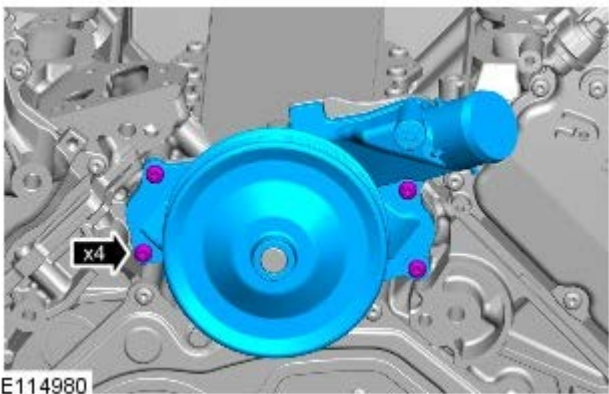
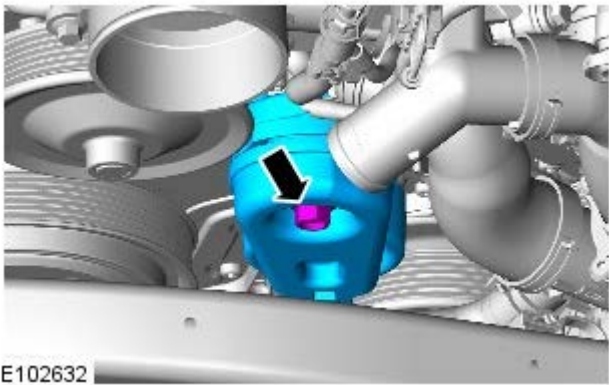
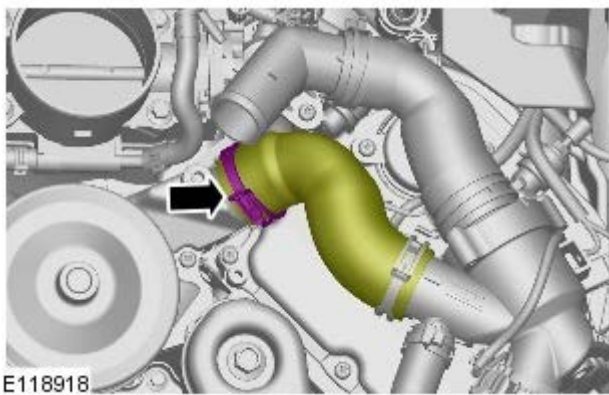
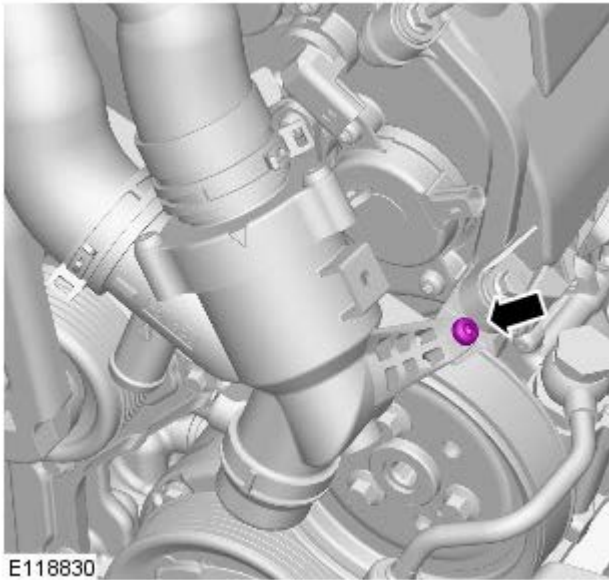


6.




7.


- Torque: 10 Nm




8. NOTES:


 The retaining clips cannot be removed from the pipe.

 Some variation in the illustrations may occur, but the essential information is always correct.

9.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

- Torque: 40 Nm

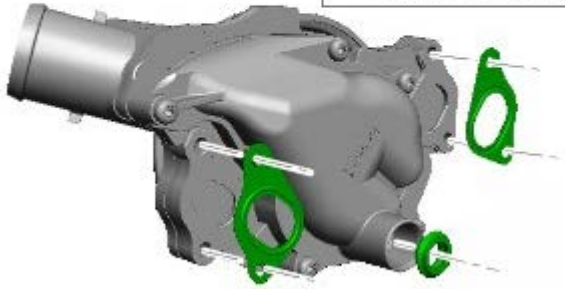
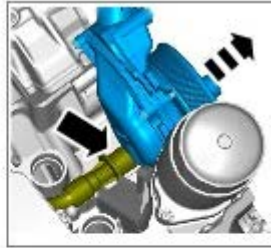
10.  WARNING: Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.

 CAUTION: Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

 NOTE: Engine shown removed for clarity.

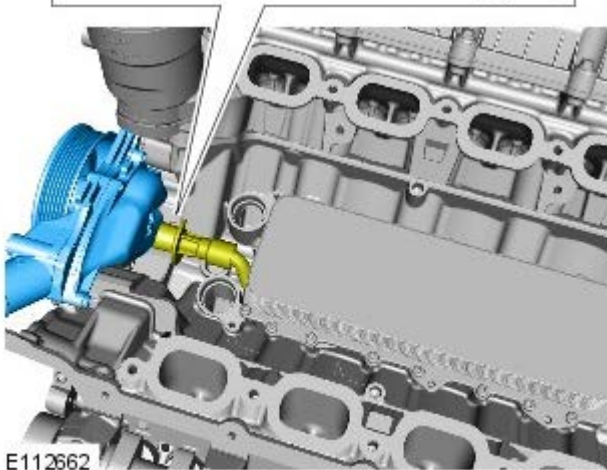
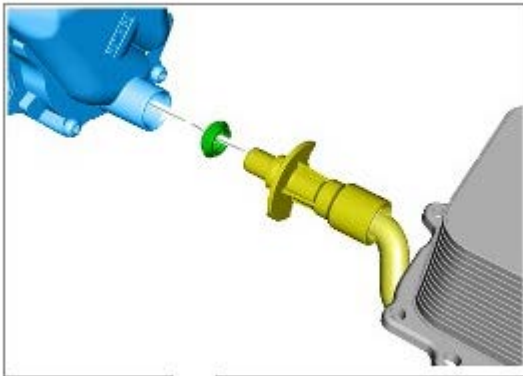
- Torque: 12 Nm

11. CAUTIONS:



E102636

Installation



E112662

 Note the fitted position of the component prior to removal.

 A new O-ring seal is to be installed.

 NOTE: Install new gaskets.

1.  NOTE: Engine shown removed for clarity.

2. To install, reverse the removal procedure.

Engine Cooling - V6 S/C 3.0L Petrol - Radiator

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some components shown removed for clarity.

1. Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).



2. **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

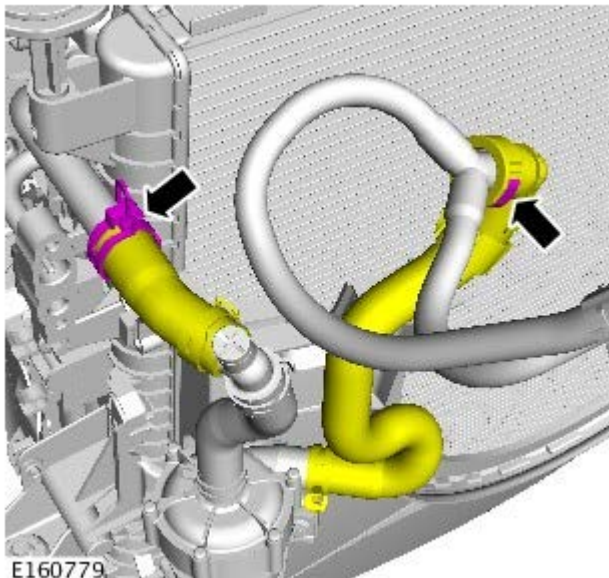
3. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

4. Refer to: [Cooling System Partial Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).

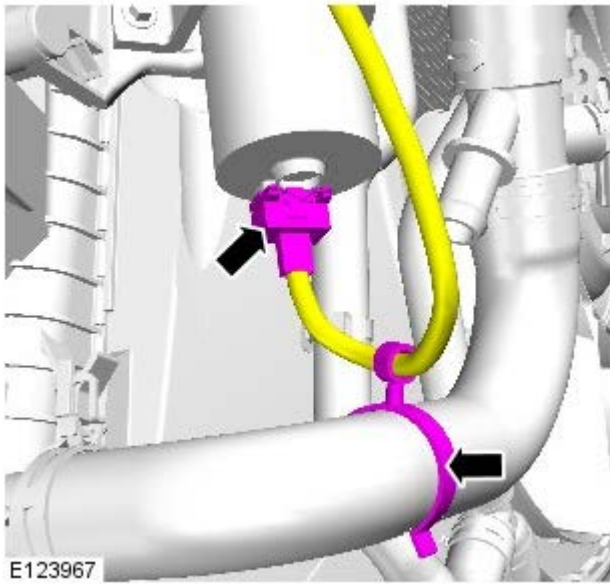
5. Refer to: [Cooling Fan](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).

6. Refer to: [Coolant Expansion Tank](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).

7.

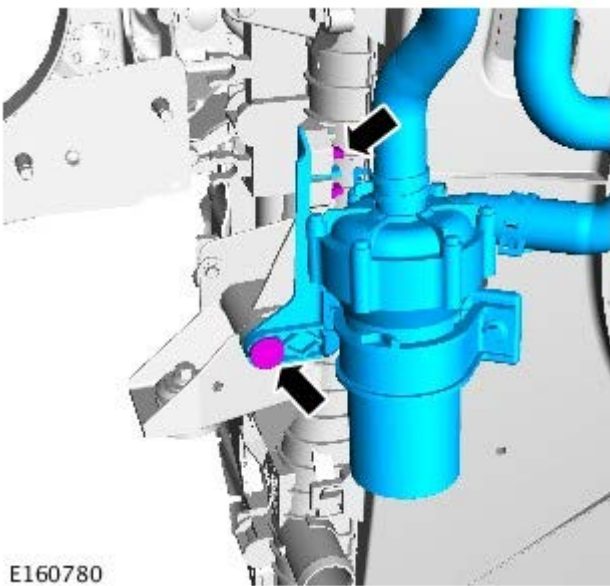


8.



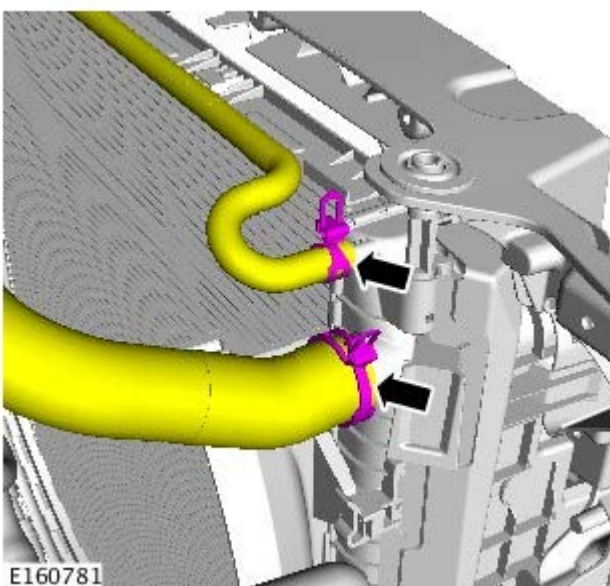
E123967

9.



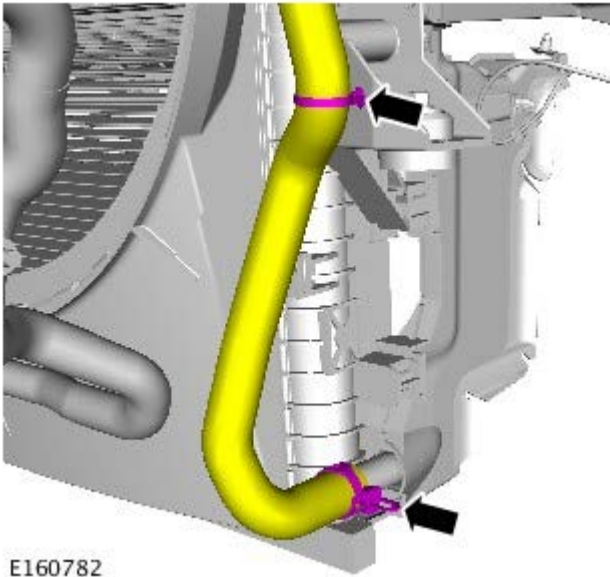
E160780

10.



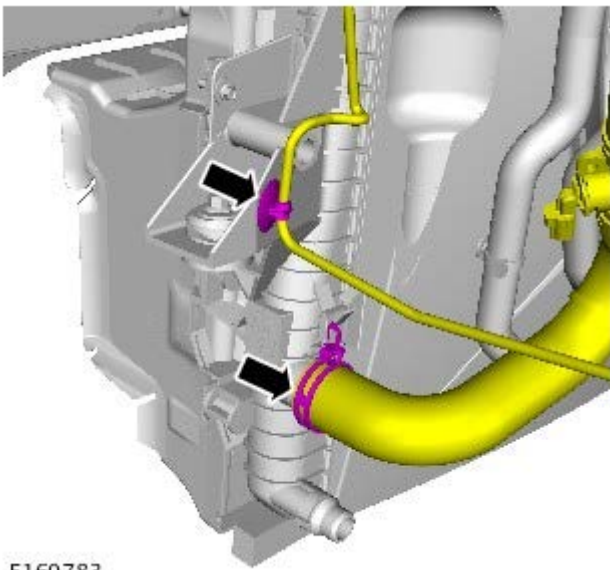
E160781

11.



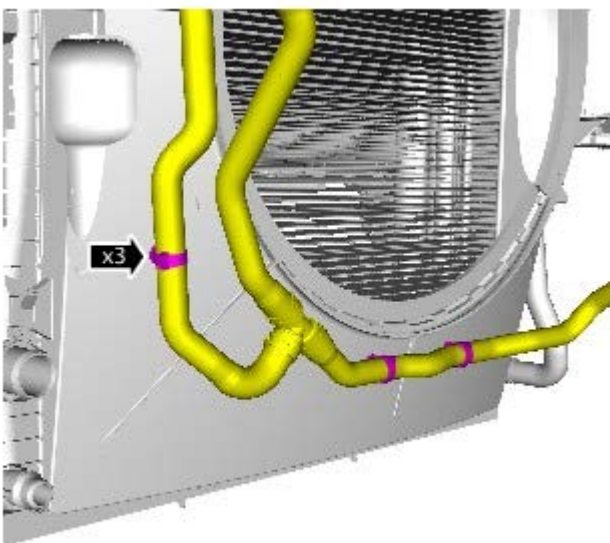
E160782

12.



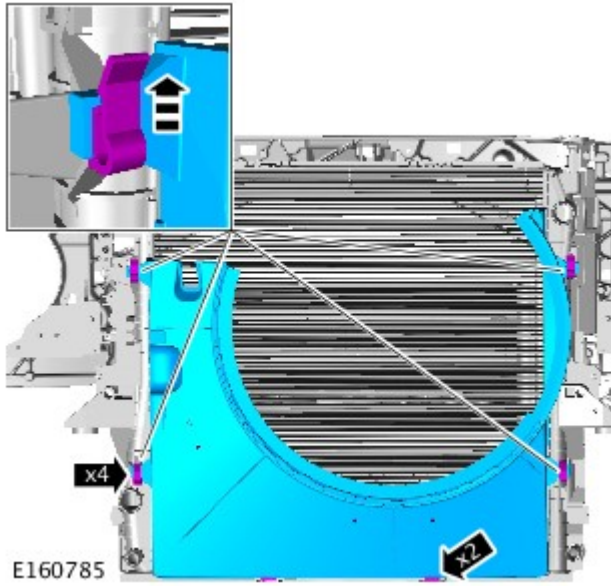
E160783

13.

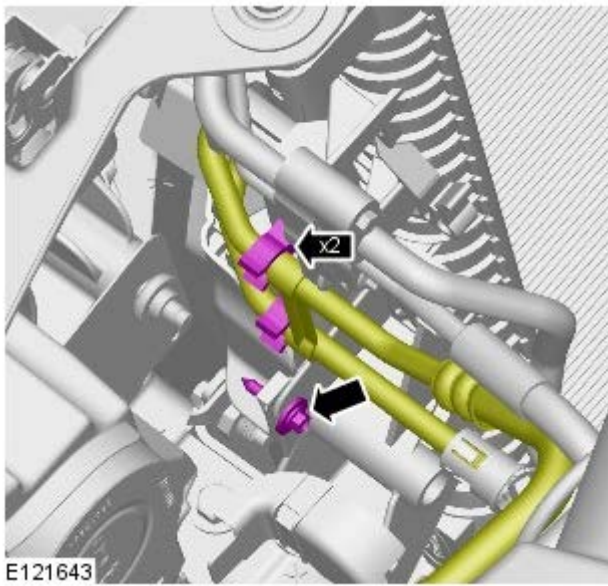


E160784

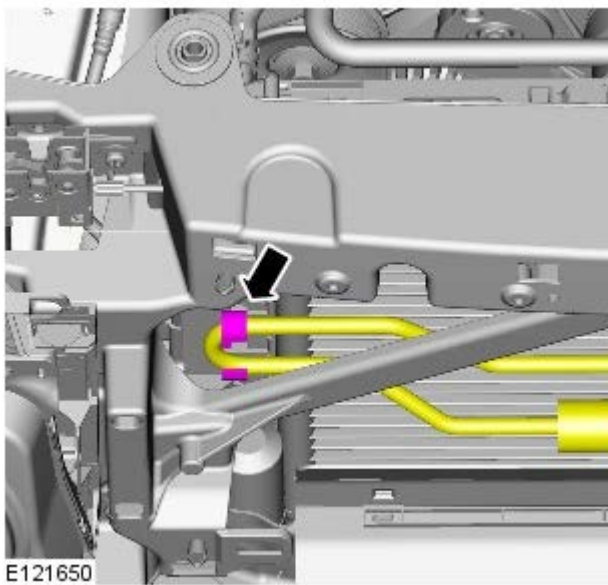
14.



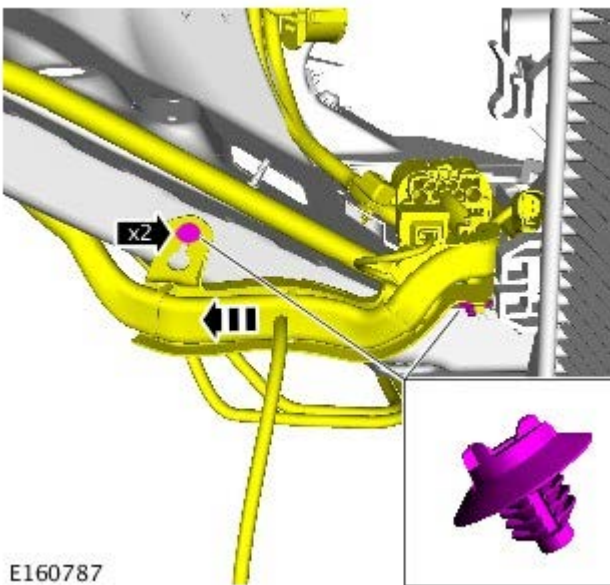
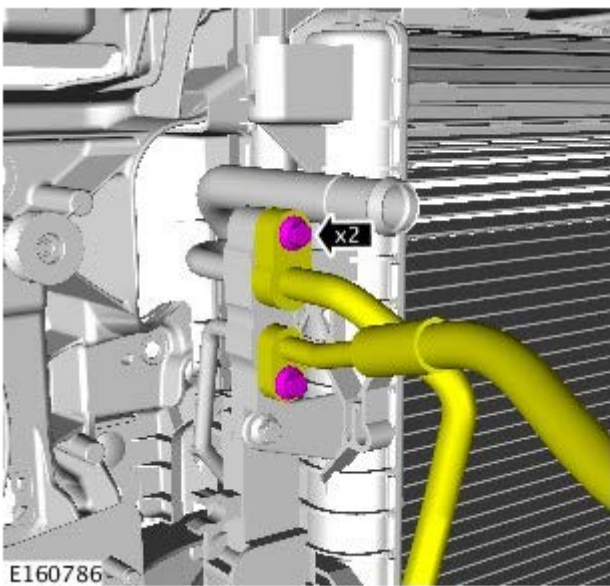
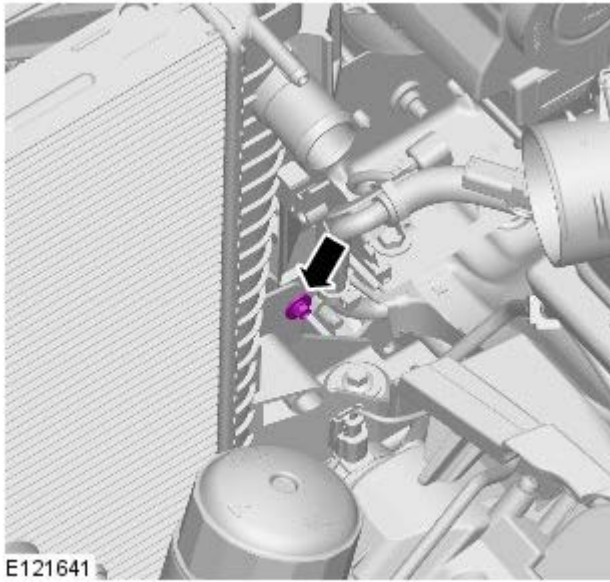
15. Torque: 9 Nm



16.



17. Torque: 9 Nm



18. NOTES:

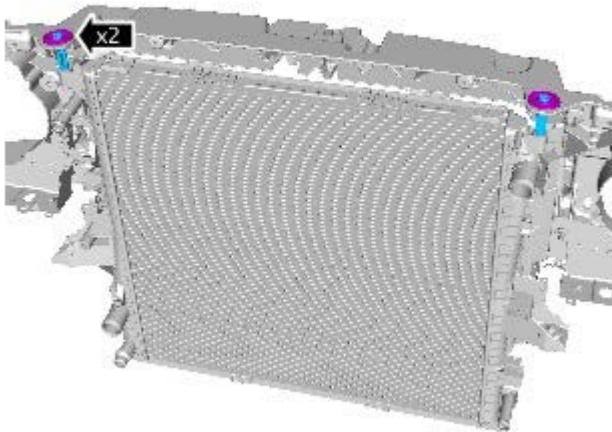
 Install new O-ring seals.

 Lubricate the O-ring seals with clean refrigerant oil.

Torque: 10 Nm

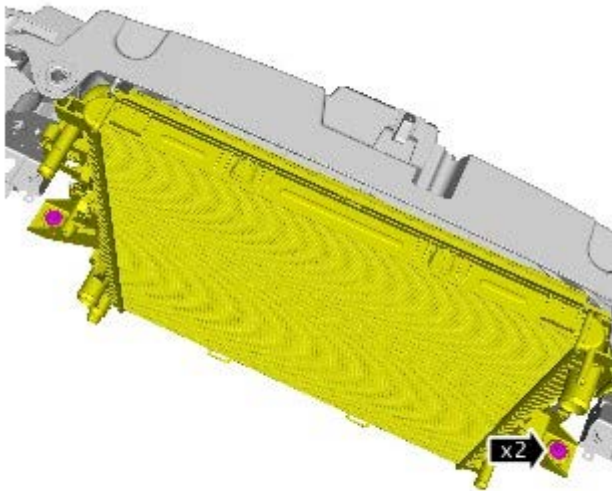
19.

20.



E160788


21. Torque: 25 Nm



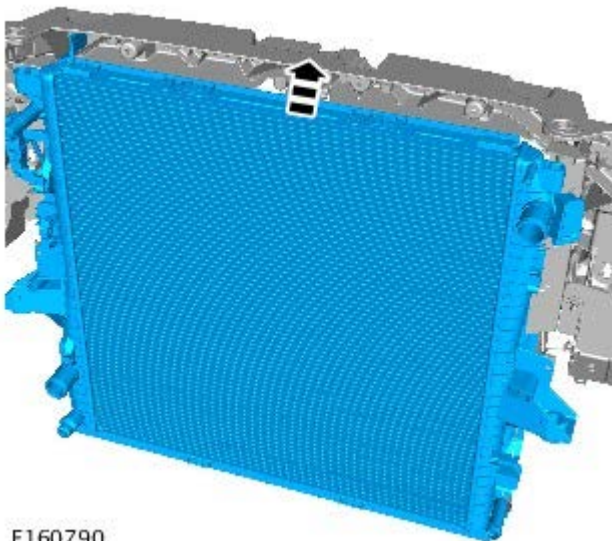
E160789

22.  CAUTION: Always protect the cooling pack elements to prevent accidental damage.

NOTES:

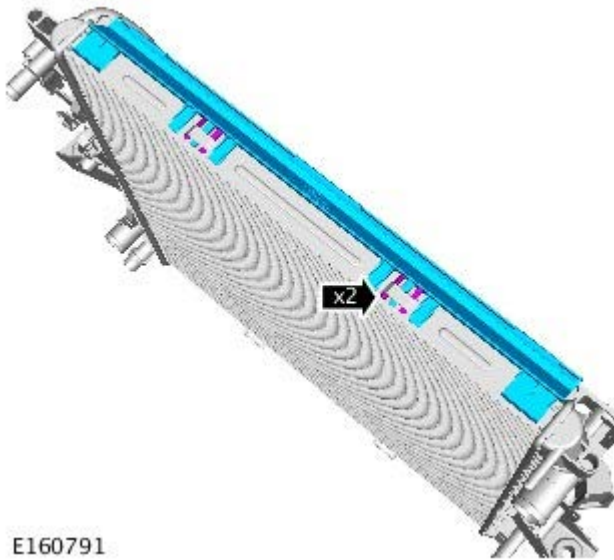
 This step requires the aid of another technician.

 Do not disassemble further if the component is removed for access only.



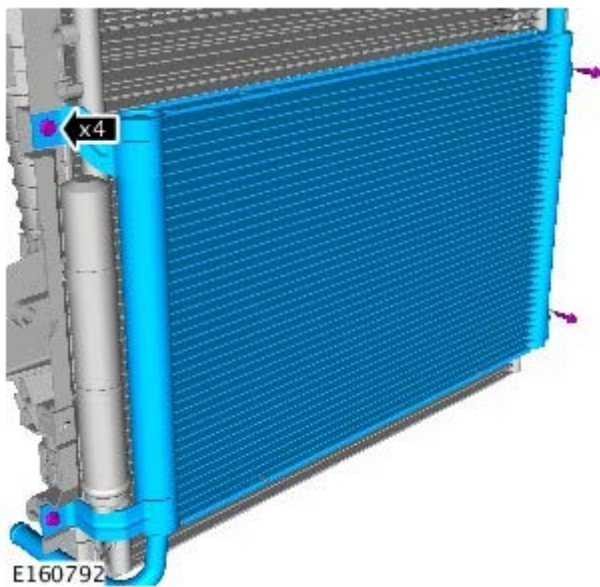
E160790

23.



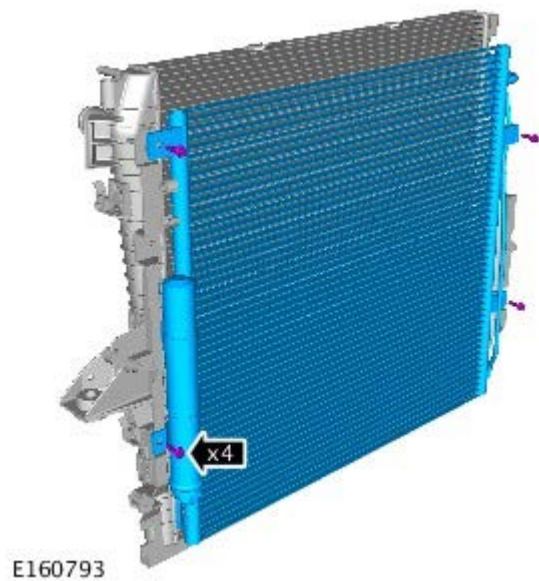
E160791

24. Torque: 10 Nm




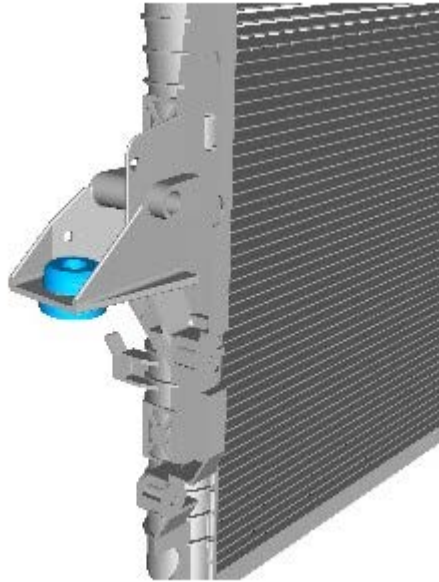
E160792

25. Torque: 10 Nm



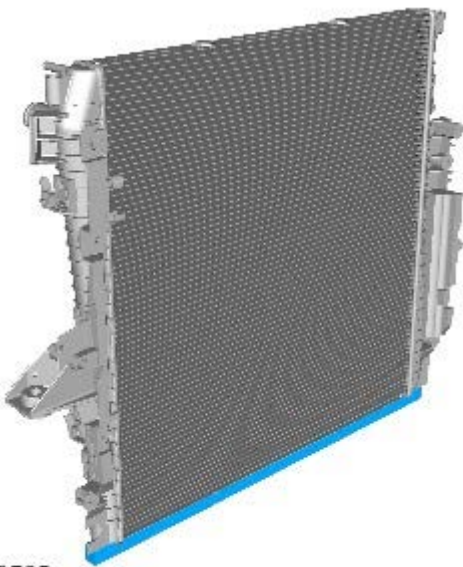
E160793

26.  NOTE: Repeat the procedure for the other side.



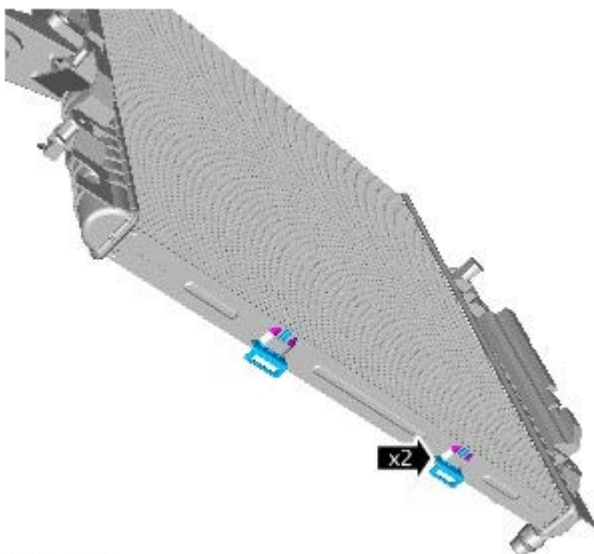
E160794

27.  CAUTION: Make sure that a new component is installed.



E160795

- 28.



E160796

Installation

1. To install, reverse the removal procedure.


Engine Cooling - V6 S/C 3.0L Petrol - Thermostat Housing

Removal and Installation

Removal

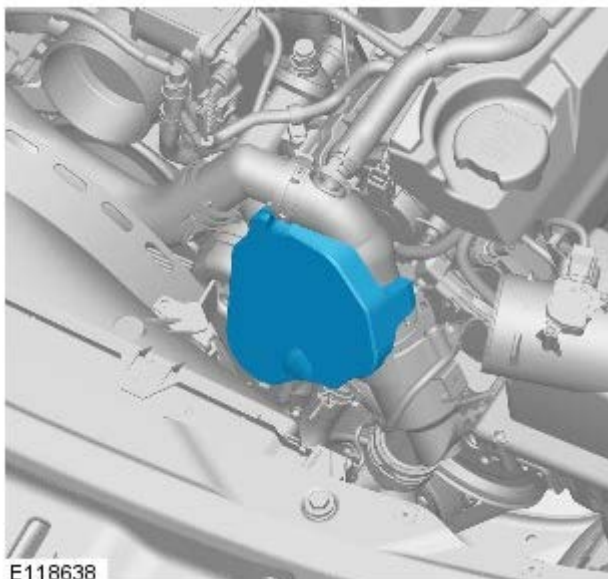



NOTE: Removal steps in this procedure may contain installation details.

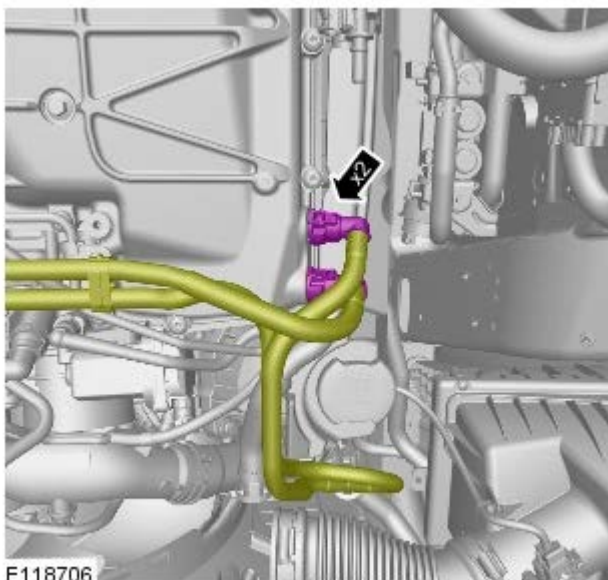
1.  **WARNING:** Make sure to support the vehicle with axle stands.

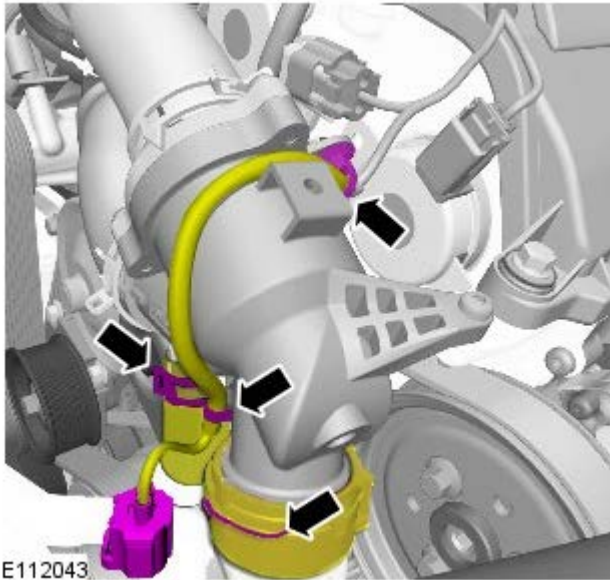
Raise and support the vehicle.
2. Refer to: Cooling System Partial Draining, Filling and Bleeding - V8 S/C 5.0L Petrol (303-03B, General Procedures).
3. Refer to: Air Cleaner Outlet Pipe T-Connector (303-12 Intake Air Distribution and Filtering - V8 S/C 5.0L Petrol, Removal and Installation).
4. Refer to: [Air Cleaner Outlet Pipe LH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).


5.

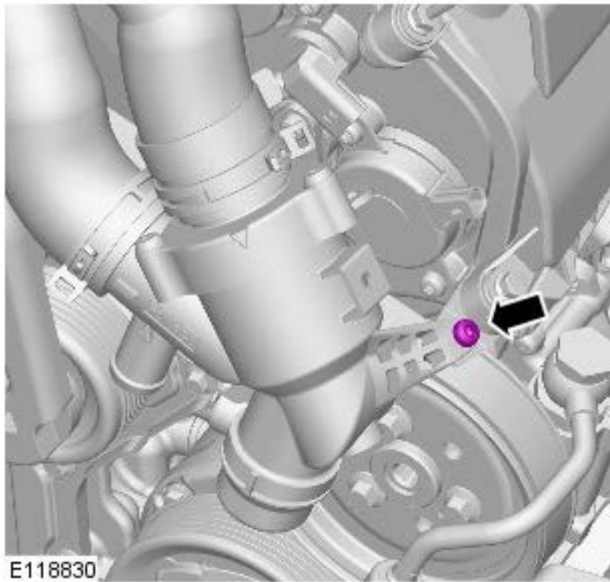



6.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.



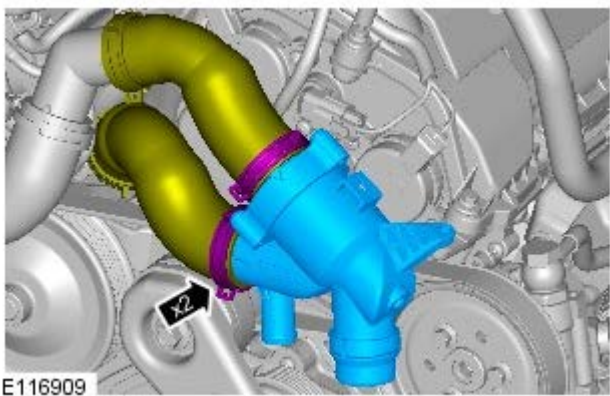


7.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.





8.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Torque: 10 Nm



9. NOTES:

 Some variation in the illustrations may occur, but the essential information is always correct.

 The retaining clips cannot be removed from the pipe.

Installation

1. To install, reverse the removal procedure.

Supercharger Cooling - V6 S/C 3.0L Petrol -

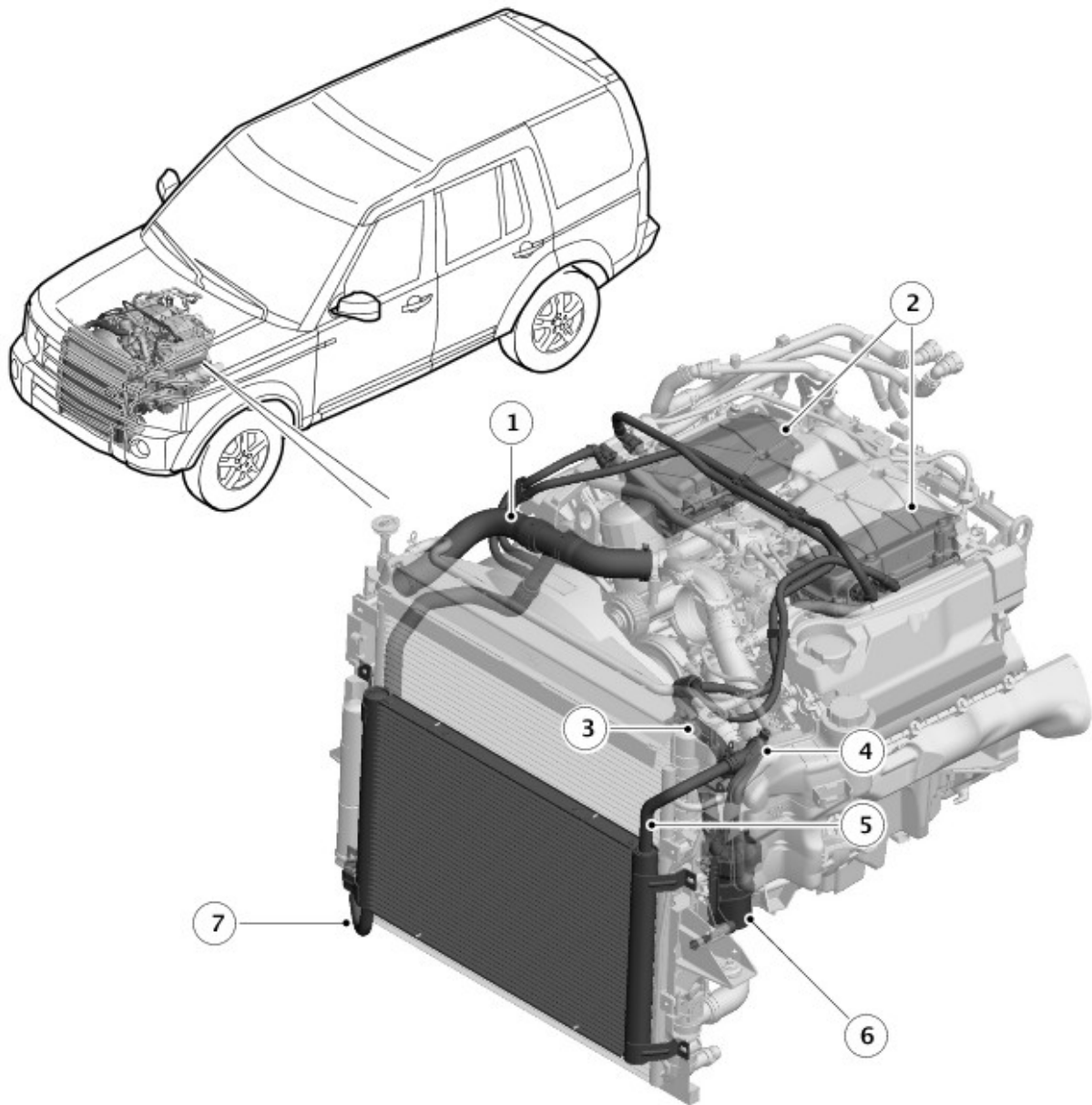
Torque Specifications

Description	Nm	lb-ft
Charge air cooler coolant pump mounting bracket bolts	6	4
Charge air cooler radiator to radiator bolts	10	7

Supercharger Cooling - V6 S/C 3.0L Petrol - Supercharger Cooling

Description and Operation

COMPONENT LOCATION



E160402

Item	Part Number	Description
1	-	Radiator upper hose
2	-	Supercharger charge air coolers
3	-	Hose - coolant feed to air charge coolers
4	-	Bleed screw
5	-	Charge air radiator inlet connection
6	-	Charge air coolant pump
7	-	Charge air radiator outlet connection

OVERVIEW

The supercharger cooling system uses engine coolant to cool the pressurized charge air from the supercharger. The supercharger cooling system consists of:

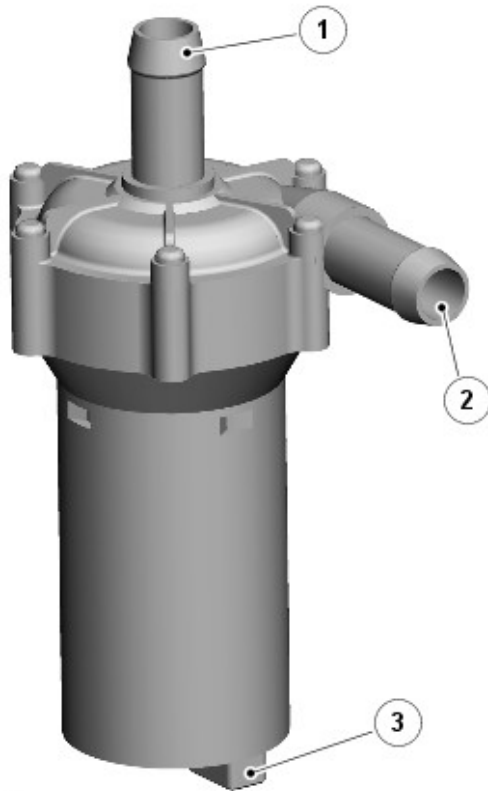
- A charge air coolant pump.
- A charge air radiator.
- Two charge air coolers.
- Connecting hoses and pipes.

The supercharger cooling system is operationally independent of the engine cooling system, but connected to it at the

radiator upper hose. The connection with the engine cooling system accommodates thermal expansion and retraction of the coolant in the supercharger cooling system, and enables filling and draining of the supercharger cooling system.

DESCRIPTION

Charge Air Coolant Pump

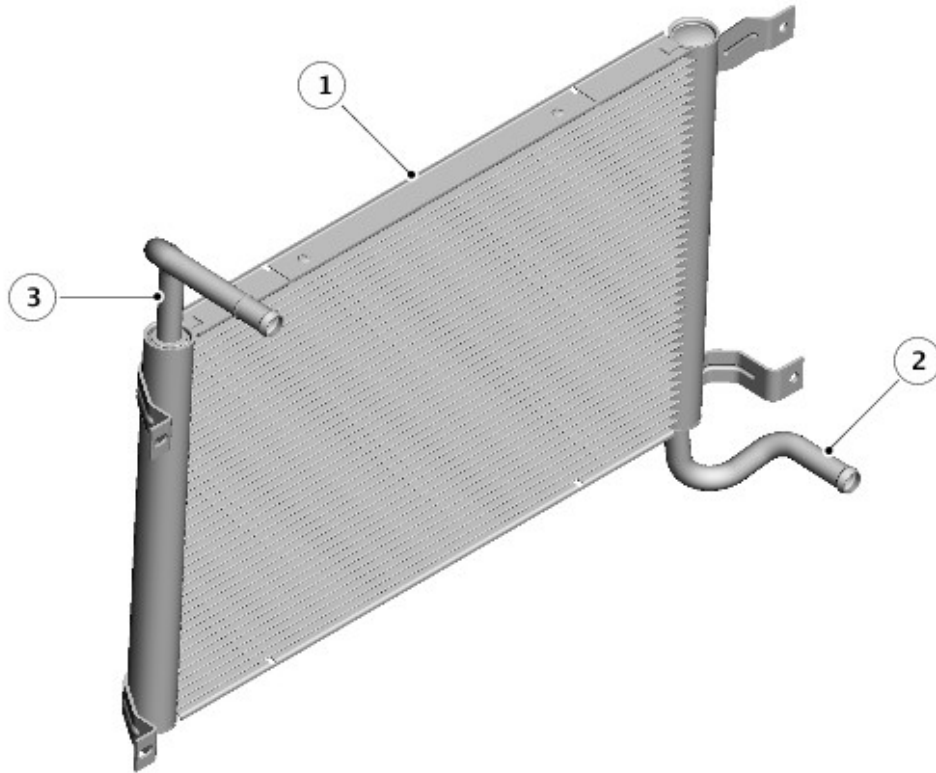


E120372

Item	Part Number	Description
1	-	Coolant Intake Connection
2	-	Coolant Outlet Connection
3	-	Electrical Connector

The charge air coolant pump is an electric pump attached to the rear left side of the engine cooling fan shroud. Hoses connect the intake of the charge air coolant pump to the left charge air radiator, and the outlet to the charge air coolers. An electrical connector provides the interface between the motor of the charge air coolant pump and the vehicle wiring.

Charge Air Radiators



E160405

Item	Part Number	Description
1	-	Charge air radiator
2	-	Charge air radiator outlet connection
3	-	Charge air radiator inlet connection

The charge air radiator is located at the front of the cooling pack. The charge air radiator is attached to the radiator using four fixing screws.

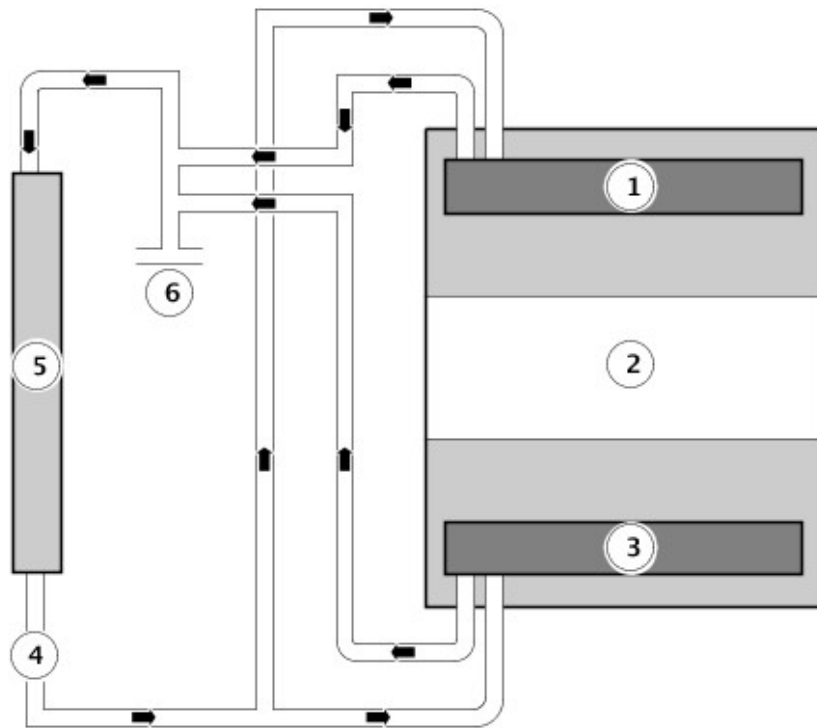
Charge Air Coolers

A charge air cooler is installed in each intake manifold.

For additional information, refer to: [Intake Air Distribution and Filtering](#) (303-12A Intake Air Distribution and Filtering - TDV6 3.0L Diesel, Description and Operation).

OPERATION

Supercharger Cooling Flow Diagram



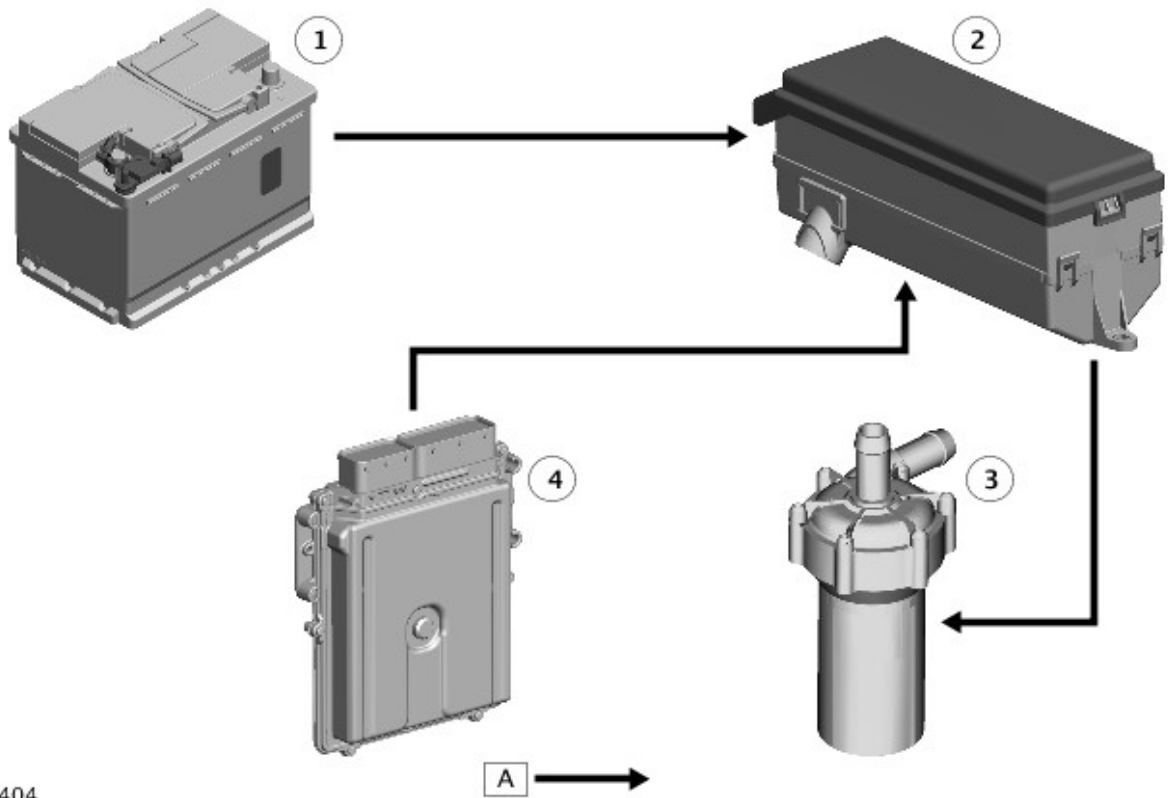
E160403

Item	Part Number	Description
1	-	Right charge air cooler
2	-	Engine
3	-	Left charge air cooler
4	-	Charge air coolant pump
5	-	Charge air radiator
6	-	Radiator upper hose

Electrical power for the charge air coolant pump is supplied from the charge air coolant pump relay in the [EJB \(engine junction box\)](#). When the relay is energized, it connects power from the battery to the charge air coolant pump. Operation of the relay is controlled by the [ECM \(engine control module\)](#). The charge air coolant pump relay is energized continuously while the ignition is in power mode 6.

When the charge air coolant pump is running, coolant flows from the pump outlet through the charge air coolers, the charge air radiators and back to the pump intake.

CONTROL DIAGRAM



E160404

A = Hardwired

Item	Part Number	Description
1	-	Battery
2	-	Engine Junction Box (EJB) (charge air coolant pump relay)
3	-	Charge air coolant pump
4	-	Engine Control Module (ECM)

Supercharger Cooling - V6 S/C 3.0L Petrol - Supercharger Cooling

Diagnosis and Testing

Principle of Operation

For a detailed description of the supercharger cooling system and operation, refer to the relevant Description and Operation section in the workshop manual. REFER to:

[Supercharger Cooling](#) (303-03C Supercharger Cooling - V6 S/C 3.0L Petrol, Description and Operation),
[Supercharger Cooling](#) (303-03 Supercharger Cooling - V6 S/C 3.0L Petrol, Description and Operation),
[Supercharger Cooling](#) (303-03 Supercharger Cooling - V6 S/C 3.0L Petrol, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Coolant leaks • Coolant hoses • Coolant expansion tank • Radiator • Heater core • Primary drive belt • Viscous fan 	<ul style="list-style-type: none"> • Fuses • Harnesses • Loose or corroded connector(s) • Engine coolant temperature (ECT) sensor

3. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the symptom chart.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: V6 3.0L S/C Petrol, DTC: Engine Control Module \(ECM\)](#) (100-00 General Information, Description and Operation).

Supercharger Cooling - V6 S/C 3.0L Petrol - Coolant Pump

Removal and Installation

Removal



WARNING: Since injury such as scalding could be caused by escaping steam or coolant, make sure the vehicle cooling system is cool prior to carrying out this procedure.



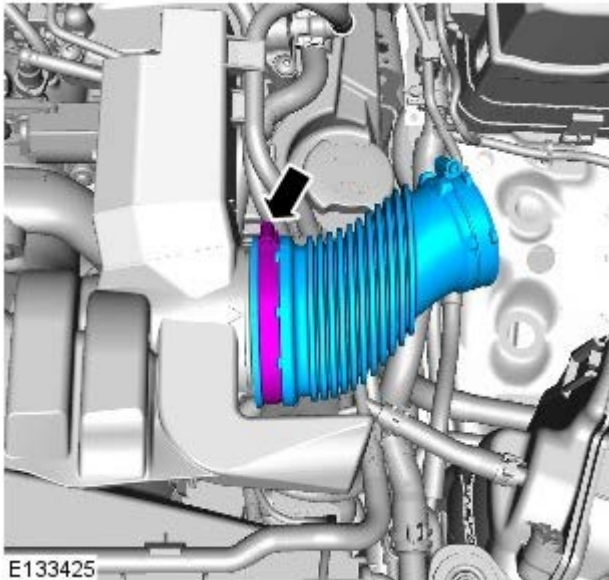
CAUTION: Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.



NOTE: This procedure covers the removal and installation of the supercharger auxiliary coolant pump.

1. Refer to: Specifications (414-00, Specifications).
2. Refer to: Engine Cover - 5.0L NA V8 - AJ133/5.0L SC V8 - AJ133 (501-05, Removal and Installation).
3. Refer to: Air Cleaner LH (303-12 Intake Air Distribution and Filtering - 5.0L SC V8 - AJ133, Removal and Installation).

4.



5. CAUTIONS:



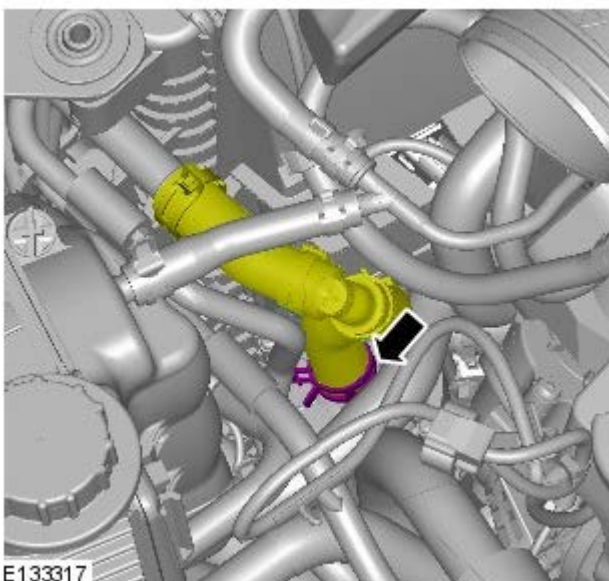
Be prepared to collect escaping coolant.



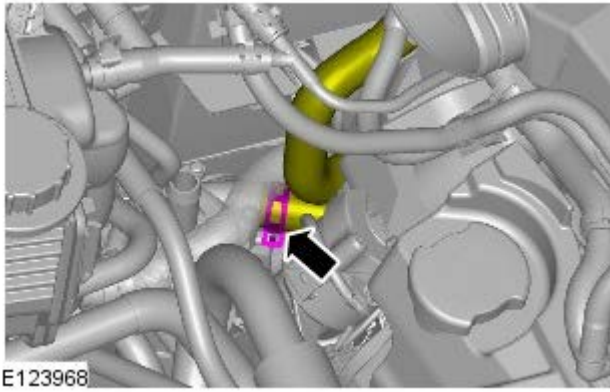
Make sure that all openings are sealed. Use new blanking caps.




NOTE: Clamp both auxiliary coolant pump coolant hoses to minimize coolant loss.



6.  **CAUTION:** Be prepared to collect escaping

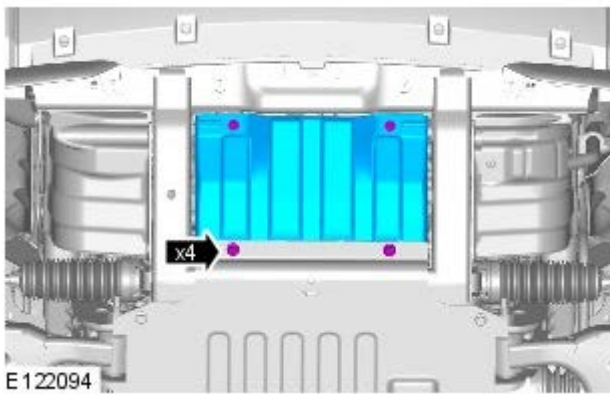


coolant.

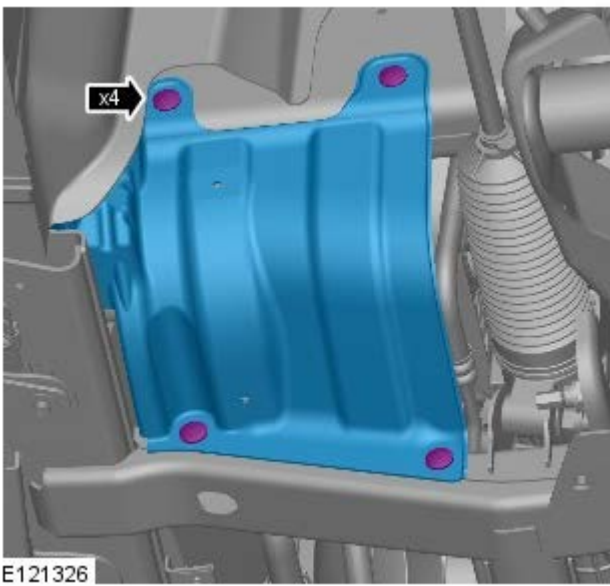
7.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

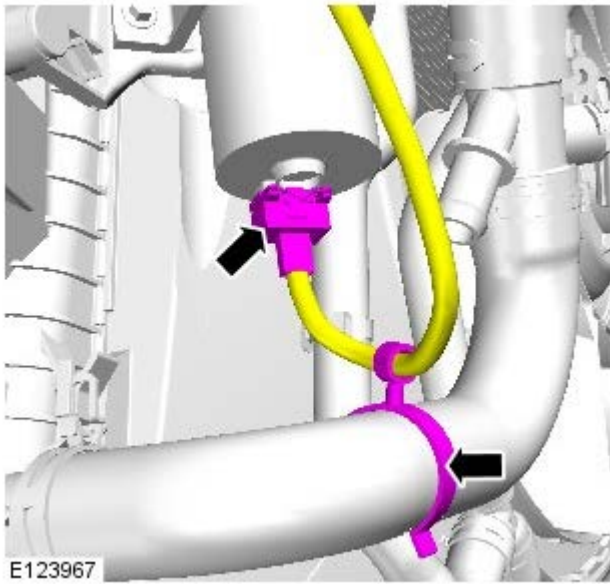
8.



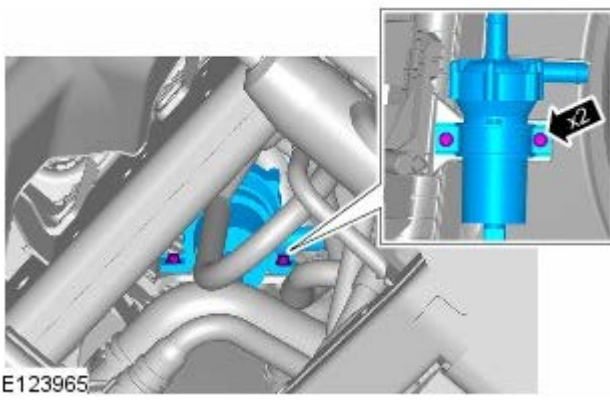
9.



10.

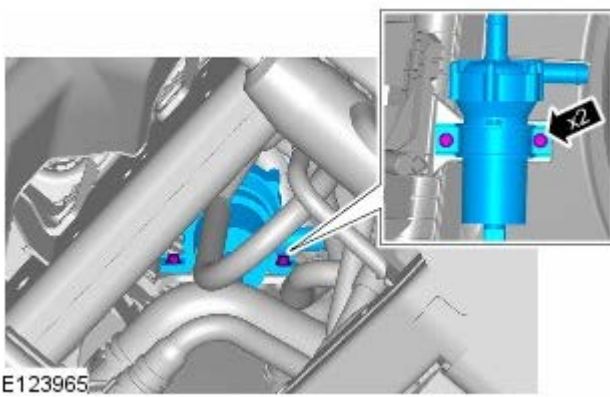


11.

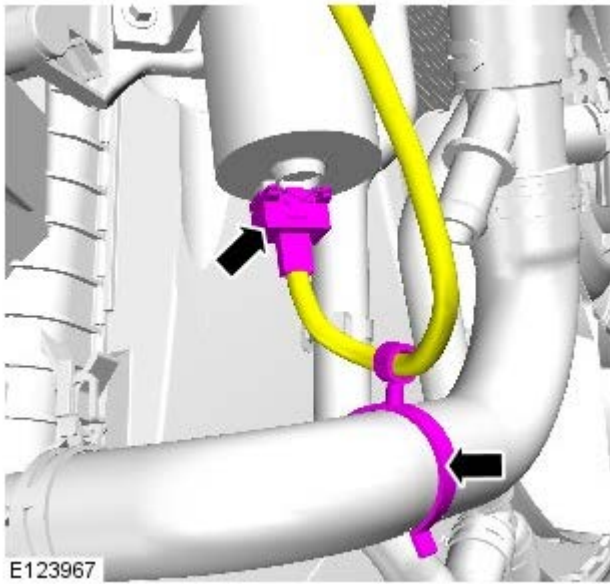


Installation

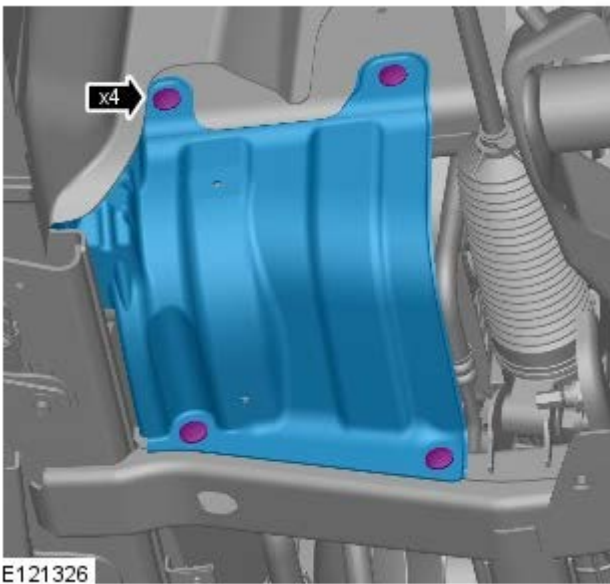
1. Torque: 6 Nm



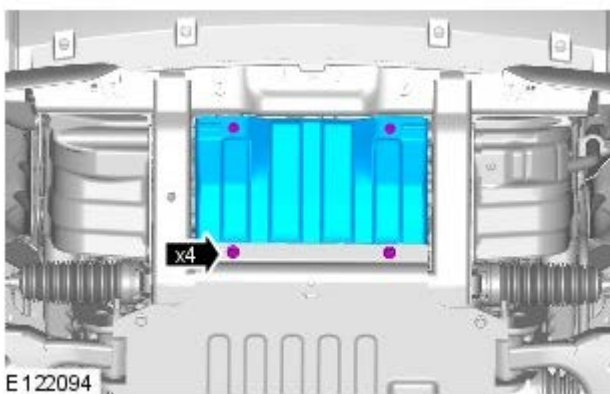
2.



3.

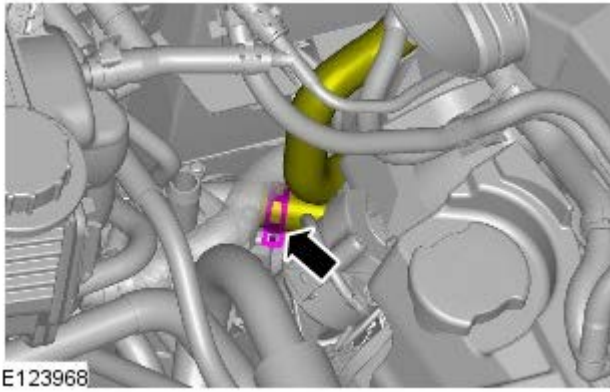


4. Torque:
M6 10 Nm
M10 62 Nm

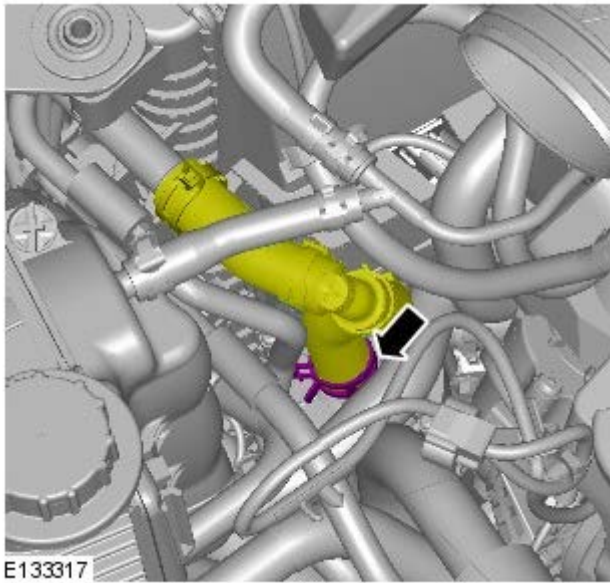


5. Lower the vehicle.

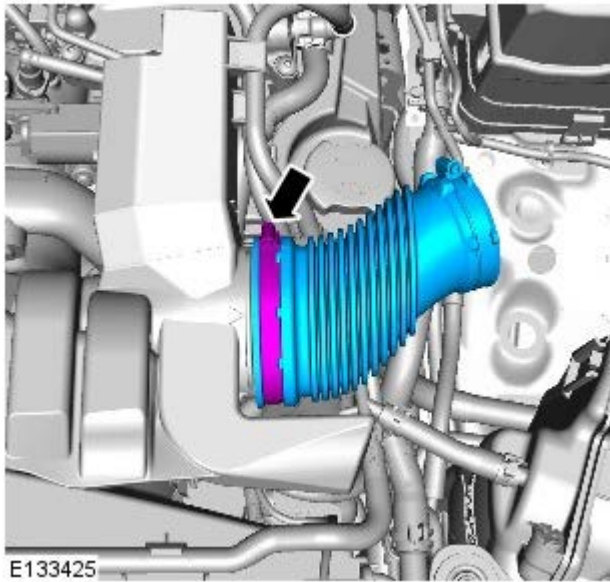
6.



7.

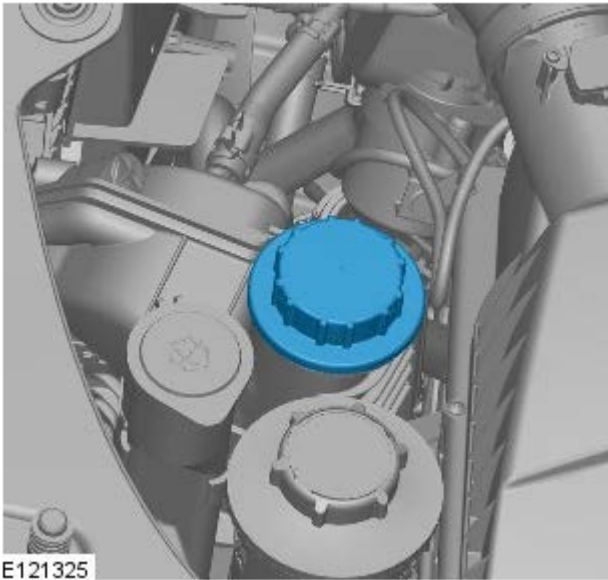


8. Torque: 3.5 Nm



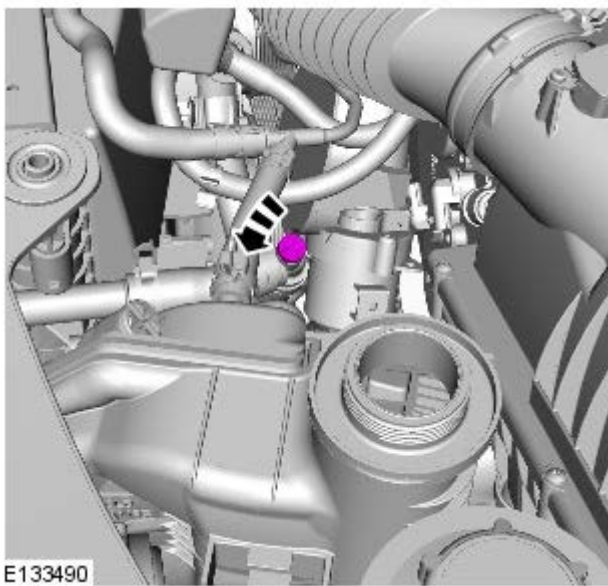
9. Refer to: Air Cleaner LH (303-12 Intake Air Distribution and Filtering - 5.0L SC V8 - AJ133, Removal and Installation).

10.





E121325

11. When coolant runs from the bleed point bubble-free, tighten the bleed screw.



E133490

12. Check and top-up the coolant.
13. Refer to: Specifications (414-00, Specifications).
14.  **CAUTION:** Damage to the charge air cooler coolant pump will occur if the pump is allowed to cavitate.
 **NOTE:** With the ignition on the charge air coolant pump will run, to aid coolant bleed. Make sure the charge air coolant pump is primed prior to running the pump.
Start the engine and allow to run for 30 seconds, stop the engine.
15. Check and top-up the coolant.
16. Refer to: Engine Cover - 5.0L NA V8 - AJ133/5.0L SC V8 - AJ133 (501-05, Removal and Installation).

Supercharger Cooling - V6 S/C 3.0L Petrol - Radiator

Removal and Installation

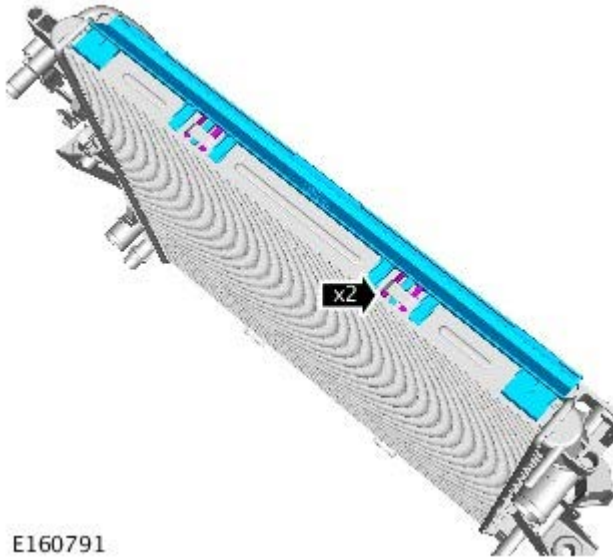
Removal



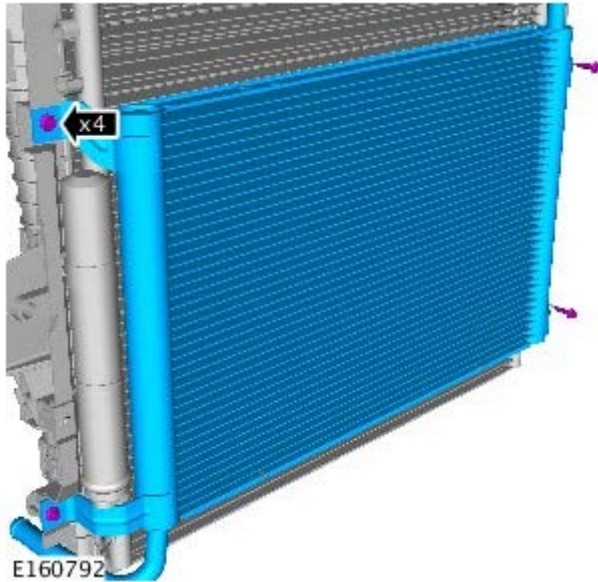
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Radiator](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).

2.



3. Torque: 10 Nm



Installation

1. To install, reverse the removal procedure.

Fuel Charging and Controls - TDV6 3.0L Diesel -

Torque Specification



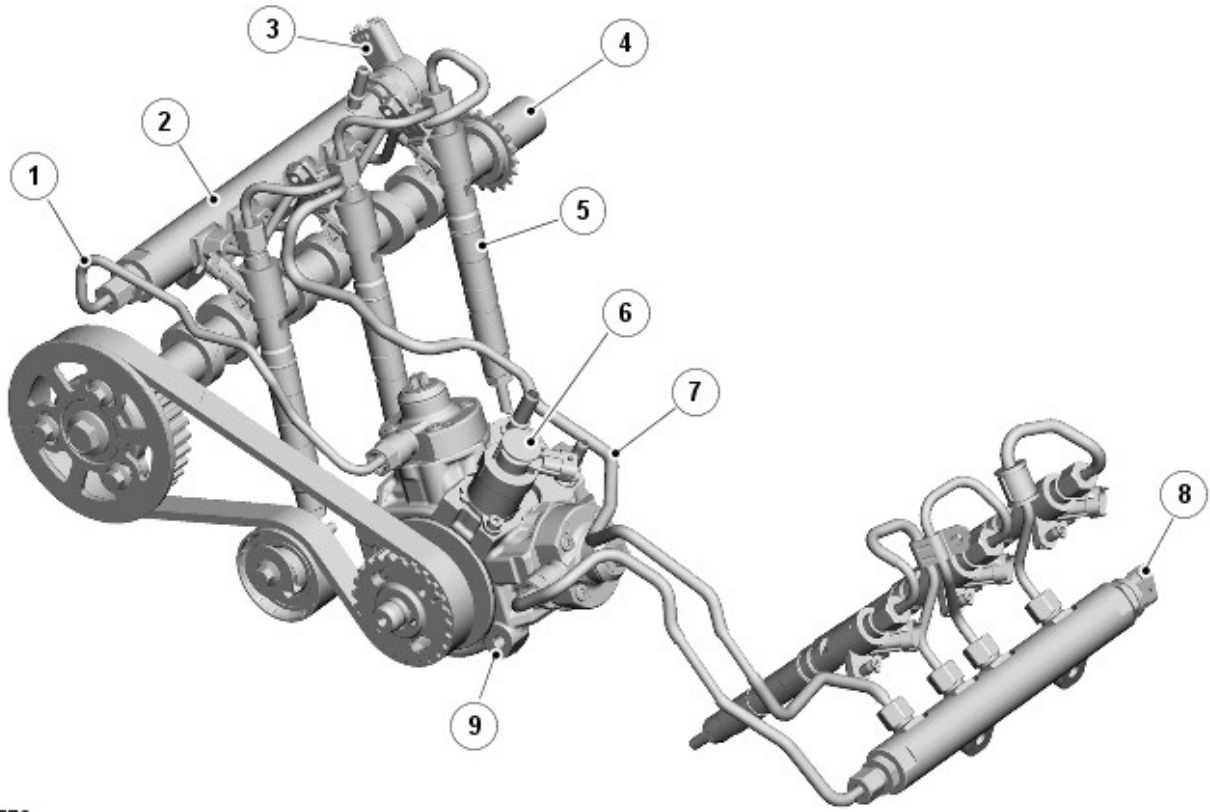
NOTE: A = refer to procedure for the correct torque sequence.

Description	Nm	lb-ft	lb-in
Fuel injection pump cradle bolts	23	16	-
Fuel injection pump retaining bolts	23	16	-
Fuel injection pump bracket	9	-	80
Fuel injection pump sprocket bolt	50	37	-
Inlet manifold retaining bolts	9	-	80
Fuel injection pump belt rear cover retaining bolts	9	-	80
Camshaft rear end accessory drive (READ) pulley hub retaining bolt	A	-	-
Fuel injection pump belt tensioner retaining bolt	23	16	-
Camshaft READ pulley retaining bolt	A	-	-
Fuel rail bracket retaining bolts	23	16	-
Fuel injector retaining bolts	10	-	-
Fuel rail retaining bolts	25	-	-
High-pressure fuel line bracket retaining bolts	9	-	80
High-pressure fuel line union nuts	A	-	-
Fuel rail supply tube union nuts	A	-	-
Fuel crossover line union nuts	A	-	-
Exhaust gas recirculation (EGR) valve retaining bolts	9	-	80

Fuel Charging and Controls - TDV6 3.0L Diesel - Fuel Charging and Controls - Component Location

Description and Operation

Component Location



E107576

Item Description

- 1 High Pressure (HP) fuel supply
- 2 Common fuel rail
- 3 Fuel pressure control valve
- 4 Exhaust camshaft
- 5 Injectors
- 6 Fuel volume control valve
- 7 Fuel rail balance pipe
- 8 Fuel pressure sensor
- 9 High Pressure (HP) fuel pump

Fuel Charging and Controls - TDV6 3.0L Diesel - Fuel Charging and Controls - Overview

Description and Operation

OVERVIEW

The 3.0L V6 diesel engine is equipped with a High Pressure (HP) common rail fuel injection system. With this fuel injection process, a HP pump delivers a uniform level of pressure to the shared fuel lines (the common rails), which serve all 6 fuel injectors. Pressure is controlled to the optimum level for smooth operation.

The common rail system supports a pre and pilot injection depending on engine operating conditions, which reduces combustion noise levels, more commonly referred to as 'diesel knock'.

Fuel injection pressure is generated independently of engine speed and fuel injection events.

The fuel injection timing and volume are calculated by the Engine Control Module (ECM), which then energizes the appropriate piezo actuated injector. The common rail fuel injection system has the following features:

- High fuel injection pressures of up to 2000 bar (29007 lbf/in²) for greater atomization of fuel (increasing performance and lowering emissions).
- Variable injection to optimize combustion in all engine operating conditions
- Low tolerances and high precision throughout the life of the system.

The fuel system is divided into two sub systems:

- Low Pressure (LP) system
- HP system.

The LP system features the following components:

- In-tank fuel pump
- Fuel pressure regulator (integral to the fuel delivery module)
- Fuel filter
- Return pipes
- Injector return pipes
- Fuel coolers (engine and vehicle).

The LP system is regulated to 0.5 bar (7.25 lbf/in²).

The HP system features the following components:

- HP pump
- Fuel rails and diverter rail
- HP fuel pipes
- Injectors.

Fuel Charging and Controls - TDV6 3.0L Diesel - Fuel Charging and Controls - System Operation and Component Description

Description and Operation

System Operation

ENGINE STARTING

During starting, the fuel rail pressure must be at least 150 bar (2175 lbf/in²). Should the pressure be below this figure, the injectors will not operate, resulting in the vehicle not starting.

ENGINE STOPPING

To stop the engine the ECM stops energizing the actuators in the fuel injectors, therefore, no fuel is injected and the engine speed drops to zero.

Refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - TDV6 3.0L Diesel, Description and Operation).

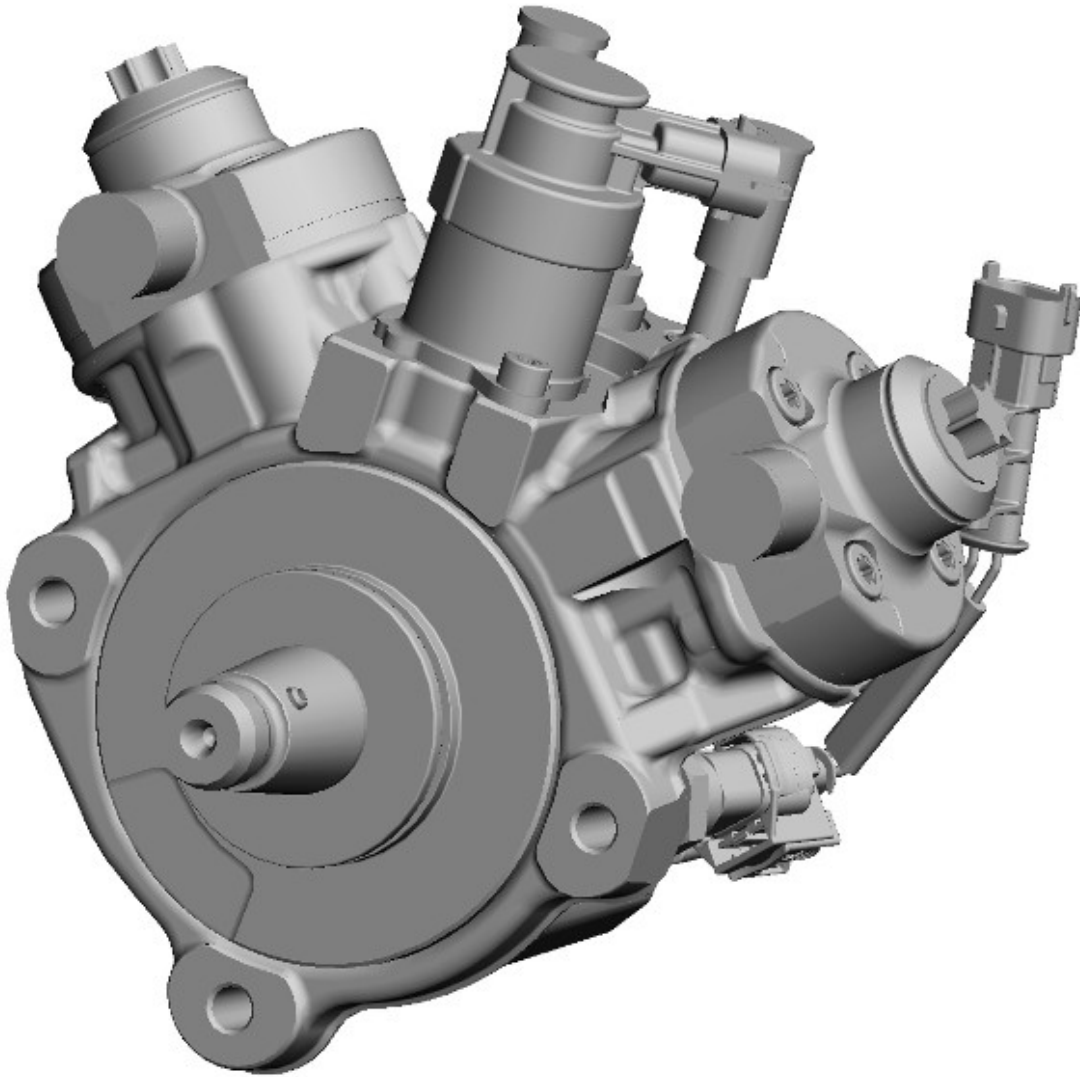
HP FUEL PUMP

When the HP fuel pump is rotated, pressure is created when the volume control valve is open and the Pressure Control Valve (PCV) is closed. Both valves are electronically controlled by the ECM to allow variable fuel delivery and pressure control. When the [ECM \(engine control module\)](#) actuates the piezo actuators, the fuel rail pressure drop is off-set by additional fuel being delivered to the fuel rails by the PCV. The fuel pressure in the system is reduced within a few seconds after the engine has stopped as the pressure control valve no longer has the holding current it requires, and therefore opens. No residual pressure remains in the system and the fuel is returned to the LP fuel return line to the fuel filter through the open PCV.

Component Description

LOW PRESSURE (LP) SYSTEM

LP Fuel Pump



E150521

The electric fuel pump is located inside the fuel tank. Fuel is pumped from the tank via the in-tank fuel pump, to the HP pump via the fuel filter.

Refer to: Fuel Tank and Lines (310-01 Fuel Tank and Lines - TDV6 3.0L Diesel, Description and Operation).

Fuel Filter

The fuel filter assembly is located in front of the fuel tank and is mounted on a bracket which is attached to the top face of the transfer box chassis cross member.

Fuel returning from the HP pump passes through the fuel cooler before returning to the filter to maintain the fuel at an optimum temperature. The returning fuel is re-circulated through the filter to help prevent waxing in cold operating conditions. Fuel pressure and fuel delivery is maintained by the in-tank pump and regulator via the tank fuel feed line.

The filter has an air bleed return to the fuel tank which returns excess air and fuel to the tank.

The filter element has a capacity of 200cm³ (12.2in³). The filtration element has the capacity to filter particulate matter larger than 5 microns.

The fuel filter is also fitted with a water sensor to detect when moisture which has collected in the filter has reached an unacceptable level.

Refer to: Fuel Tank and Lines (310-01 Fuel Tank and Lines - TDV6 3.0L Diesel, Description and Operation).

Fuel Cooler

An air blast fuel cooler is located off the engine crossmember at the front of the engine oil pan. The fuel cooler has 2 connections; one is an inlet which allows heated fuel from the HP pump to be cooled, the second allows the cooled fuel to be fed from the cooler into the supply pipe from the LP fuel pump in the fuel tank, via a 'Y' connector back to the fuel filter.

HIGH PRESSURE (HP) SYSTEM

HP Fuel Pump

The HP pump is a 2 piston radial plunger pump. The pump has the ability to produce a maximum pressure of 2000 bar (29007 lbf/in²). The housing is cast from iron, the flange is cast from aluminum.

The HP pump is driven from the left cylinder bank exhaust camshaft via a toothed belt. The drive from the belt rotates a cam within the pump which operates a plunger within each pumping element. A procedure and special tools are required for pump or belt replacement to time the pump.

The HP pump comprises 2 HP pumping elements, a fuel volume control valve, an internal transfer pump and a fuel temperature sensor.

The fuel is delivered to the internal transfer pump via the external fuel filter and an electric fuel pump which is located in the fuel tank.

The fuel volume control valve is mounted on the HP pump, and located in the feed port between the HP pump elements and the internal transfer pump. The fuel volume control valve is a variable position solenoid-operated valve that is controlled by the ECM. The fuel volume control valve determines the amount of fuel that is delivered from the internal transfer pump to the HP pumping elements. When there is no signal to the fuel volume control valve, the valve is closed and there is no fuel delivery.

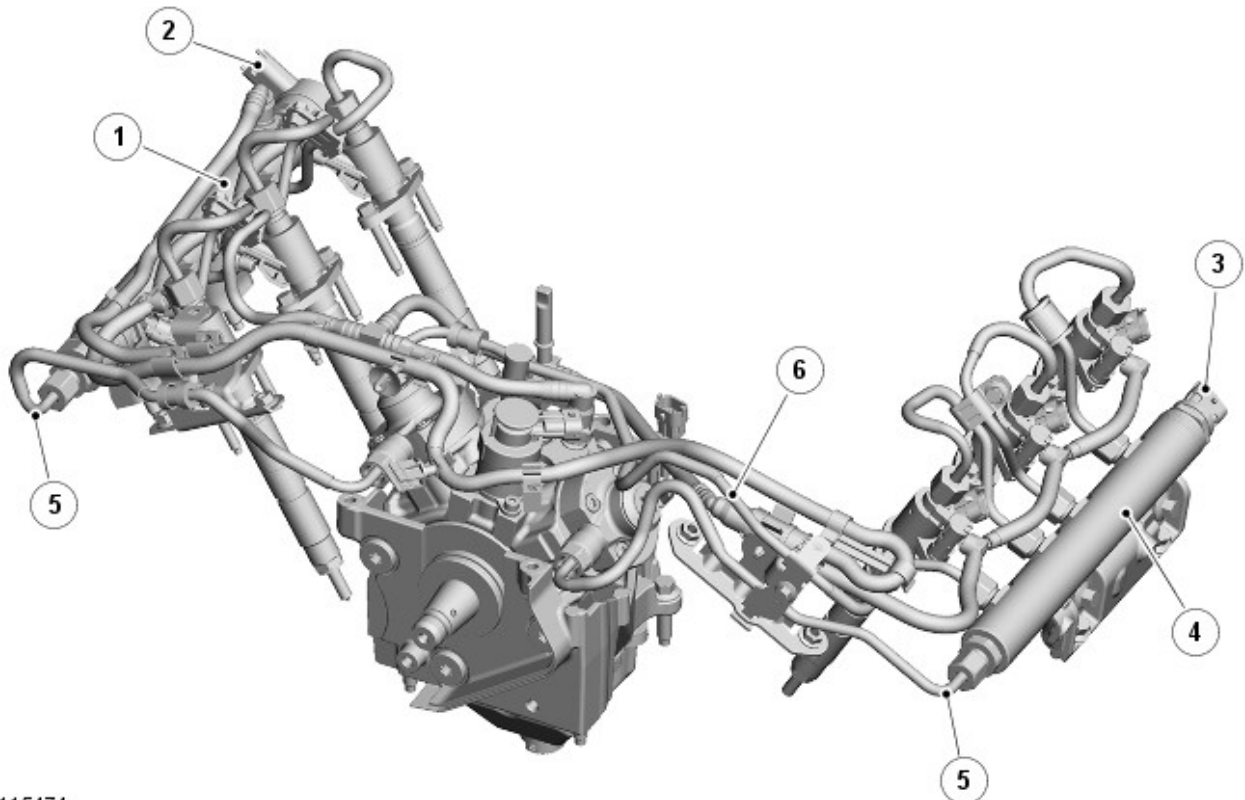
The fuel from the internal transfer pump is passed to the HP pumping elements at a constant pressure known as transfer pressure. The transfer pressure is controlled by an internal pressure relief valve. Once the fuel enters each of the HP pump elements the pressure rises rapidly, with each element providing a HP supply to one of the fuel rails. The HP is controlled by the HP regulator valve and the Fuel Rail Pressure and Temperature sensor FRPT.

A controlled amount of fuel is allowed to leak-off from the internal transfer pump. This fuel is delivered to the pump internal components to provide cooling and lubrication and is passed back the fuel filter via the LP feed line.

The fuel pressure control valve is located in one of the fuel rails. The fuel pressure is monitored by a pressure sensor located in the other fuel rail. The ECM controls the fuel pressure control valve using the received signals from the pressure sensor. Reducing the pressure in the fuel rails via the pressure control valve results in fuel returning from the fuel rails to the LP fuel return to the fuel filter.

The fuel temperature sensor is located on the rear of the HP pump. It measures the fuel temperature in the LP side of the HP pump. The ECM continually monitors this signal to determine the fuel temperature to prevent overheating of the fuel system. The ECM will also make fine adjustments to fuel injection quantity to adjust for fuel temperature.

Fuel Rails



E115474

Item Description

- 1 Left fuel rail
- 2 Fuel pressure control valve
- 3 Fuel pressure sensor
- 4 Right fuel rail

5 HP fuel connection from HP pump

6 Fuel rail balance pipe

The fuel rails are steel fabrications and are similar in their construction. Two fuel rails are used with each rail supplying high pressure fuel to 3 fuel injectors.

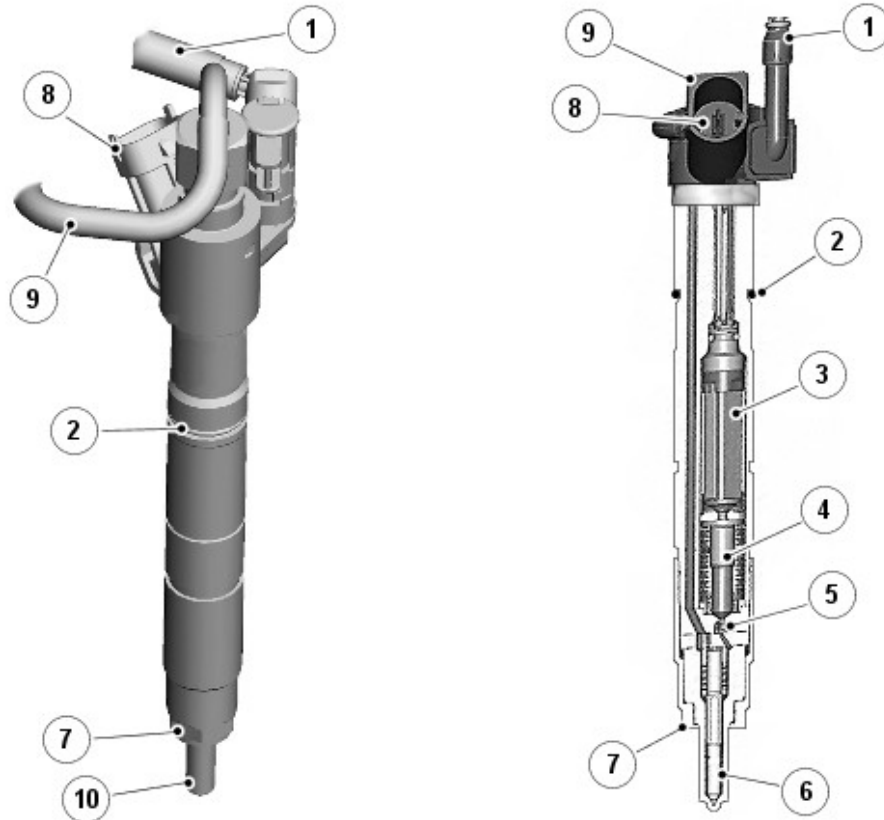
Each rail has 5 threaded connections which provide for the attachment of the high pressure fuel supply from the HP pump, the balance pipe and connections for the 3 injectors supplied with fuel from that rail.

The fuel pressure in the rails is detected by a fuel pressure sensor which is located in the end of the right rail. The left rail houses a pressure control valve. The ECM controls the pressure control valve using signals from the pressure sensor.

The FRPT is a piezo-resistive type sensor containing an actuating diaphragm. Deflection of the diaphragm provides a proportional signal (output) voltage to the ECM, dependant on the fuel pressure within the fuel rail.

Both rails are connected together with a balance pipe which ensures the pressure in both rails is equal, even though each rail is supplied from a different pumping element in the HP pump.

Fuel Injectors



E115475

Item Description

- 1 Fuel return
- 2 O-ring seal
- 3 Piezo stack actuator
- 4 Hydraulic coupler
- 5 Control valve
- 6 Nozzle body
- 7 Copper sealing washer
- 8 Electrical connector
- 9 HP feed
- 10 Nozzle

Six fuel injectors are used in the fuel system. A piezo actuator in each injector is electronically controlled by the ECM to operate the injector in response to engine speed and load conditions.

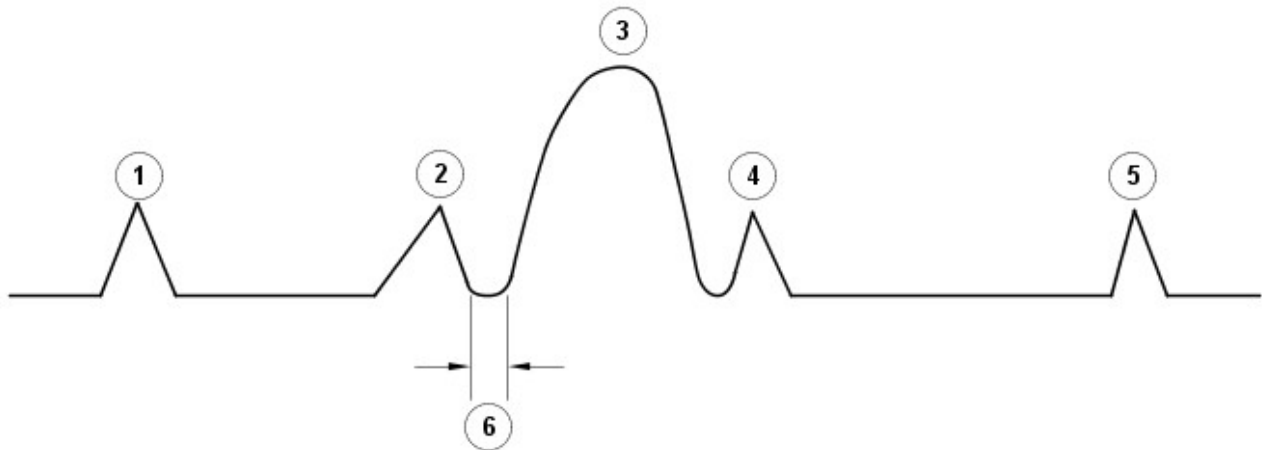
Two variants of fuel injector are installed on the 3.0 TDV6 engine, 155kW vehicles have a unique low flow fuel injector installed. Injectors should not be swapped between 155kW and 188kW engines due to the injector nozzles being different. Low flow fuel injector nozzles are not capable of sufficient fuel supply to the 188kW engine.

Each injector has an electrical connector which connects the injector to the engine harness. A fuel connection on the top of the injector provides for the HP fuel inlet from the HP pump. A second fuel connection allows fuel leakage within the injector to return to the HP pump.

Each injector is located in a machined hole in the cylinder head and is sealed in the cylinder head with a copper sealing washer and an O-ring seal. The injector is retained in the cylinder head with a clamp plate and 2 bolts. If an injector is removed or replaced, a new copper sealing washer and a clamp plate must be used when refitting the

injector.

The injector can operate up to 5 times during one combustion cycle depending on engine speed and load. The injection sequence can occur as follows:



E107577

1. Pilot injection - occurs before the main injection and improves fuel and air mixing
2. Pre-injection - shortens the main injection's ignition delay and therefore reduces the generation of nitrous oxides
3. Main injection - delivers the required engine torque
4. After injection - occurs after the Main injection and assists the re-burn of any remaining particulate matter
5. Post injection - helps manage the temperature of the exhaust gas for more effective exhaust-gas after-treatment
6. Injection delay 0.4 ms.

Each injector is calibrated to the [ECM](#) and applicable the cylinder to which it is fitted. Therefore, if an injector is removed it must be refitted to the cylinder from which it was removed. If a new injector is fitted, a calibration routine using Land Rover approved diagnostic equipment must be performed to calibrate the injector unique code to the [ECM](#).

The operating voltage of the injector is between 110 and 163 volts depending on engine speed and load and care must be taken when working in the vicinity of the injectors. The voltage increases linearly from 200 to 2000 bar.

Each injector has an electrical resistance value of between 150 - 250 kOhms.



CAUTION: Each injector operation is controlled by a charge and discharge cycle allowing energy to dissipate in, and recover from the injector. Never disconnect the wiring connection when the engine is running. The injector can remain open thus causing engine damage.

Fuel Charging and Controls - TDV6 3.0L Diesel - Fuel Charging and Controls

Diagnosis and Testing

Principles of Operation

For a detailed description of the fuel charging and controls system and operation, refer to the relevant Description and Operation section of the workshop manual.

REFER to: Fuel Charging and Controls (303-04 Fuel Charging and Controls - TDV6 3.0L Diesel, Description and Operation).

Inspection and Verification



WARNING: Make sure that all suitable safety precautions are observed when carrying out any work on the fuel system. Failure to observe this warning may result in personal injury.

CAUTIONS:



Make sure that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in damage to the vehicle.



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Low/contaminated fuel • Fuel supply/return line(s) • Fuel tank and filler pipe • Fuel leak(s) • Fuel filler cap • Fuel filter • Push connect fittings • Fuel rail • Fuel pump • Exhaust Gas Recirculation (EGR) system 	<ul style="list-style-type: none"> • Fuses • Glow plug indicator • Inertia fuel shutoff switch • Fuel pump module • Sensor(s) • Engine Control Module (ECM) • Fuel volume control valve • Fuel pressure control valve • Fuel Rail Pressure (FRP) sensor • Fuel temperature sensor • Fuel injector(s) • Exhaust Gas Recirculation (EGR) system

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Engine cranks, but does not start	<ul style="list-style-type: none"> • Inertia fuel shutoff switch • Low/contaminated fuel • Air leakage • Low-pressure fuel system fault • Fuel pump module (lift pump) fault • Blocked fuel filter • Fuel volume regulator blocked/contaminated • Fuel pressure control valve blocked/contaminated • Fuel pump fault 	<ul style="list-style-type: none"> • Check that the inertia switch has not tripped <ul style="list-style-type: none"> - Using the manufacturer approved diagnostic system, check the Restraints Control Module (RCM) for related DTCs and refer to the relevant DTC index • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Check the intake air system for leaks • Check the lift pump operation • Check the low-pressure fuel system for leaks/damage • Check the fuel filter • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the fuel pump

	<ul style="list-style-type: none"> • Crankshaft position (CKP) sensor 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the CKP sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
Difficult to start	<ul style="list-style-type: none"> • Glow plug system fault (very cold conditions) • Low/contaminated fuel • Air leakage • Fuel pump module (lift pump) fault • Low-pressure fuel system fault • Blocked fuel filter • Fuel volume control valve blocked/contaminated • Fuel pressure control valve blocked/contaminated • Exhaust Gas Recirculation (EGR) valve(s) fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the glow plug circuits for short circuit to ground, short circuit to power, open circuit, high resistance • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Check the intake air system for leaks • Check the lift pump operation • Check the low-pressure fuel system for leaks/damage • Check the fuel filter • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the EGR system
Rough idle	<ul style="list-style-type: none"> • Intake air system fault • Low/contaminated fuel • Low-pressure fuel system fault • Blocked fuel filter • Fuel volume control valve blocked/contaminated • Fuel pressure control valve blocked/contaminated • Exhaust Gas Recirculation (EGR) valve(s) fault 	<ul style="list-style-type: none"> • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Check the low-pressure fuel system for leaks/damage • Check the fuel filter • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the EGR system
Lack of power when accelerating	<ul style="list-style-type: none"> • Intake air system fault • Restricted exhaust system • Low fuel pressure • Exhaust Gas Recirculation (EGR) valve(s) fault • Turbocharger actuator fault 	<ul style="list-style-type: none"> • Check the intake air system for leakage or restriction • Check for a blockage/restriction in the exhaust system, install new components as necessary • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the EGR system • Check turbocharger actuator
Engine stops/stalls	<ul style="list-style-type: none"> • Air leakage • Low/contaminated fuel • Low-pressure fuel system fault • High pressure fuel leak • Fuel volume control valve blocked/contaminated • Fuel pressure control valve blocked/contaminated • Exhaust Gas Recirculation (EGR) valve fault 	<ul style="list-style-type: none"> • Check the intake air system for leaks • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Check the fuel system for leaks/damage • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the EGR system
Engine judders	<ul style="list-style-type: none"> • Low/contaminated fuel • Air ingress • Low-pressure fuel system fault • Fuel metering valve blocked/contaminated • Fuel volume control valve 	<ul style="list-style-type: none"> • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Check the intake air system for leaks • Check the low-pressure fuel system for leaks/damage • Check the high pressure fuel system for leaks • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the

	<ul style="list-style-type: none"> blocked/contaminated • Fuel pressure control valve blocked/contaminated • High pressure fuel leak • Fuel pump fault 	<ul style="list-style-type: none"> relevant DTC index • Check the fuel pump
Excessive fuel consumption	<ul style="list-style-type: none"> • Low-pressure fuel system fault • Fuel volume control valve blocked/contaminated • Fuel pressure control valve blocked/contaminated • Fuel temperature sensor leak • High pressure fuel leak • Injector(s) fault • Exhaust Gas Recirculation (EGR) valve(s) fault 	<ul style="list-style-type: none"> • Check the low-pressure fuel system for leaks/damage • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the fuel temperature sensor, fuel pump, etc for leaks • Check the EGR system

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (PCM) (100-00, Description and Operation).

Fuel Charging and Controls - TDV6 3.0L Diesel - Fuel Injection

Component Cleaning

General Procedures

WARNINGS:



Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1700 bar (24,656 lb-sq-in). Failure to follow this instruction may result in personal injury.



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.



Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.



Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.



Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.



Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

CAUTIONS:



Before using the cleaning fluid, protect all electrical components and connectors with lint-free non-flocking material.



Make sure that all parts removed from the vehicle are placed on the lint-free non-flocking material.



Make sure that any protective clothing worn is clean and made from lint-free non-flocking material.



Make sure that clean non-plated tools are used. Clean tools using a new brush that will not lose its bristles and fresh cleaning fluid, prior to starting work on the vehicle.



Use a steel topped workbench and cover it with clean, lint-free non-flocking material.



Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.







NOTE: Pneumatic vacuum gun

1. Using a new brush that will not lose its bristles, brush cleaning fluid onto the components being removed and onto the surrounding area.
2. Using a pneumatic vacuum gun, remove all traces of cleaning fluid and foreign material.
3. Dispose of any used cleaning fluid and the brush after completing the repair.

Fuel Charging and Controls - TDV6 3.0L Diesel - Fuel Injection Pump

Removal and Installation

Special Tool(s)

 <p>303-1145/2 E60429</p>	<p>303-1145/2 Remover, Camshaft Rear Pulley Bolt</p>
 <p>E117205</p>	<p>310-138A Holding Tool, Fuel Pump Pulley</p>
 <p>E117206</p>	<p>310-139A Holding Tool, Fuel Pump Pulley</p>
 <p>E123916</p>	<p>JLR-303-1523 Remover/Installer, Camshaft Rear Pulley</p>

Removal

NOTES:



Removal steps in this procedure may contain installation details.

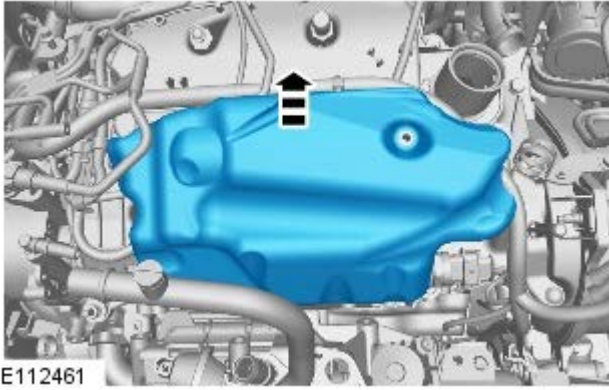


Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).
2. Refer to: Engine Cover - TDV6 3.0L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).

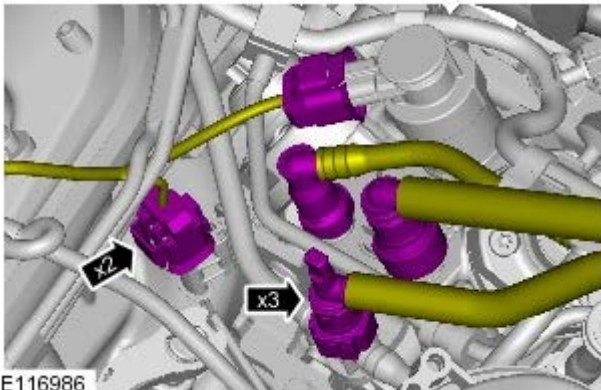


3. **NOTE:** Left-hand shown, right-hand similar.




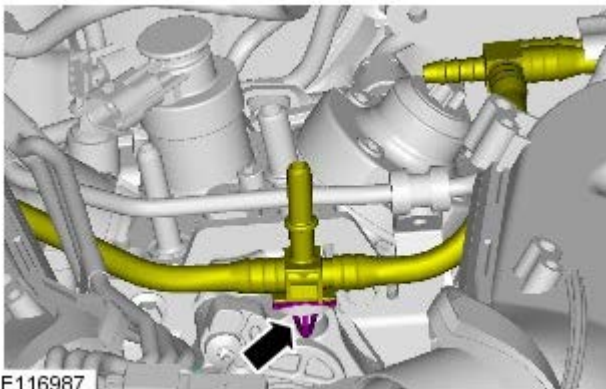
E112461

4. Refer to: Fuel Injection Component Cleaning (303-04 Fuel Charging and Controls - TDV8 3.6L Diesel, General Procedures).
5. Refer to: Rear End Accessory Drive (READ) (303-05 Accessory Drive - TDV6 3.0L Diesel, Removal and Installation).
6. Refer to: Crankcase Vent Oil Separator (303-08 Engine Emission Control - TDV6 3.0L Diesel, Removal and Installation).




E116986

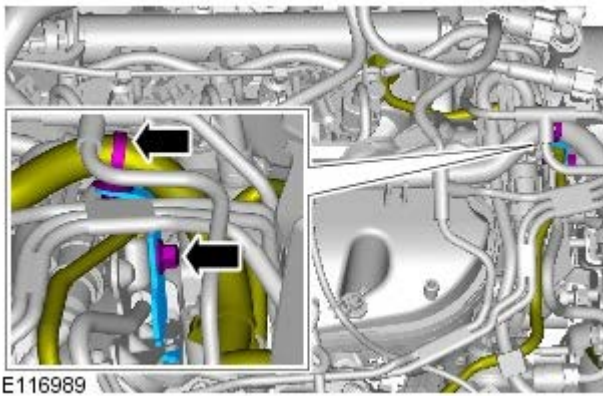
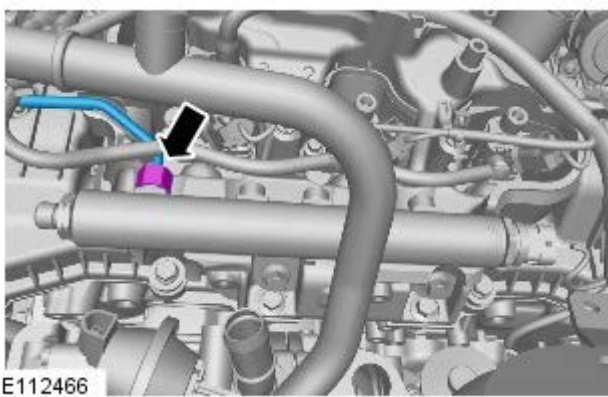
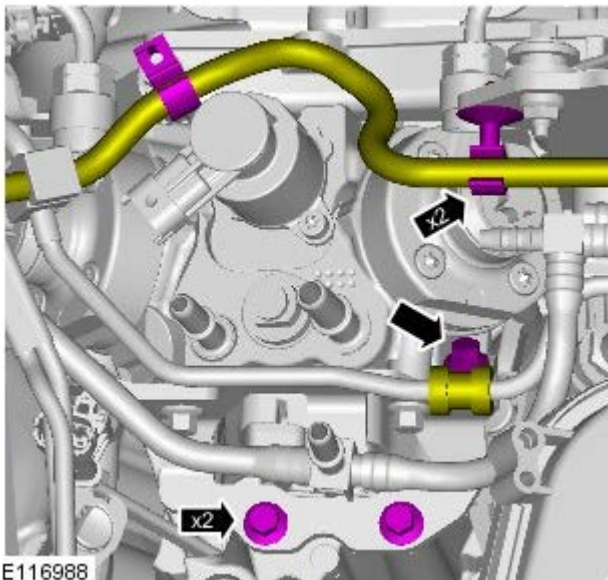
7.  CAUTION: Be prepared to collect escaping fuel.



E116987

8.  CAUTION: Be prepared to collect escaping fuel.


- 9.



10. CAUTIONS:

 Be prepared to collect escaping fuel.

 Discard the component.

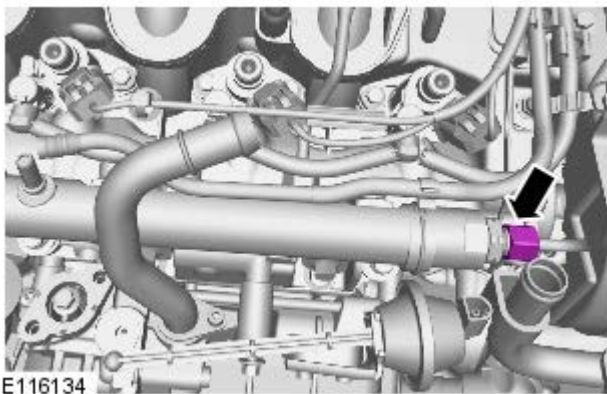
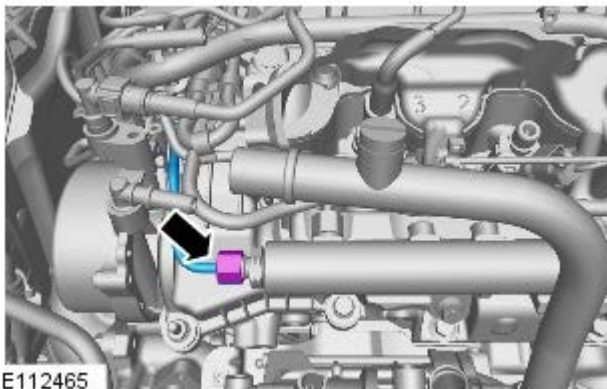
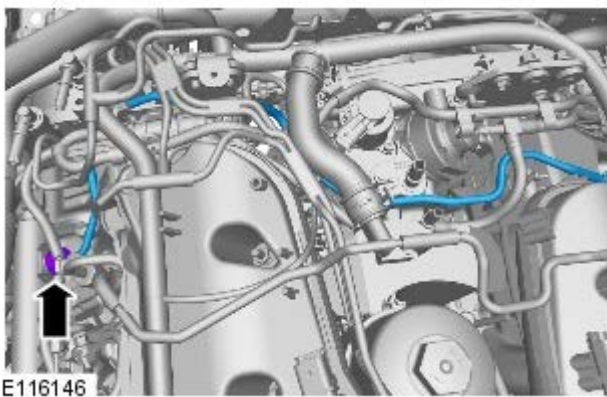
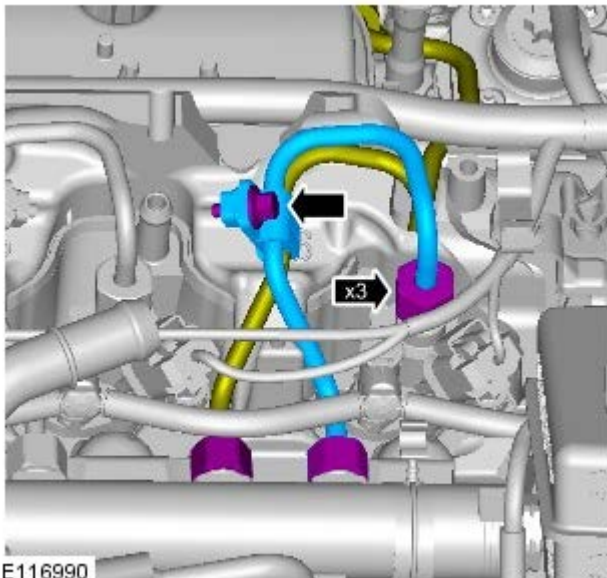
 NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

11.

12. CAUTIONS:

 Be prepared to collect escaping fuel.


 Discard the component.





13. CAUTIONS:


 Be prepared to collect escaping fuel.

 Discard the component.

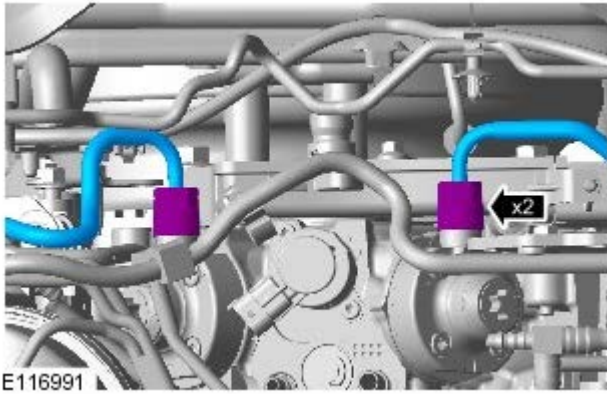
14.  CAUTION: Be prepared to collect escaping fuel.

 NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

15.  CAUTION: Be prepared to collect escaping fuel.

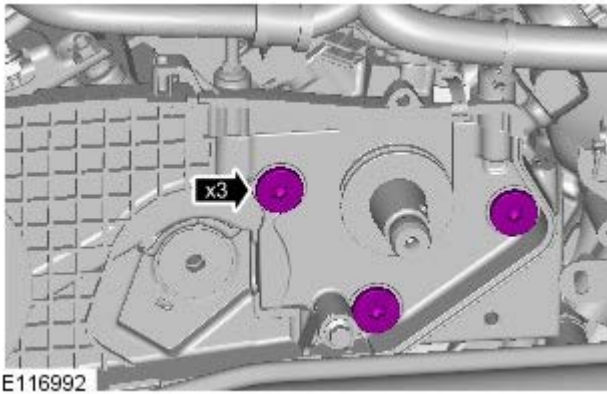
 NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

16. CAUTIONS:

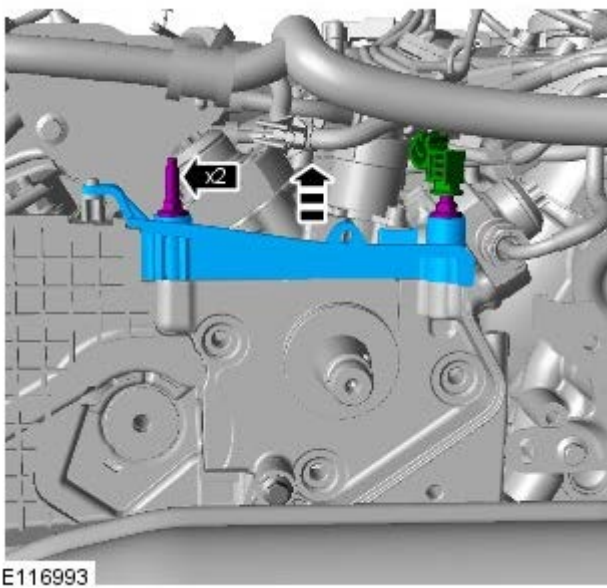


⚠ Be prepared to collect escaping fuel.

⚠ Discard the components.

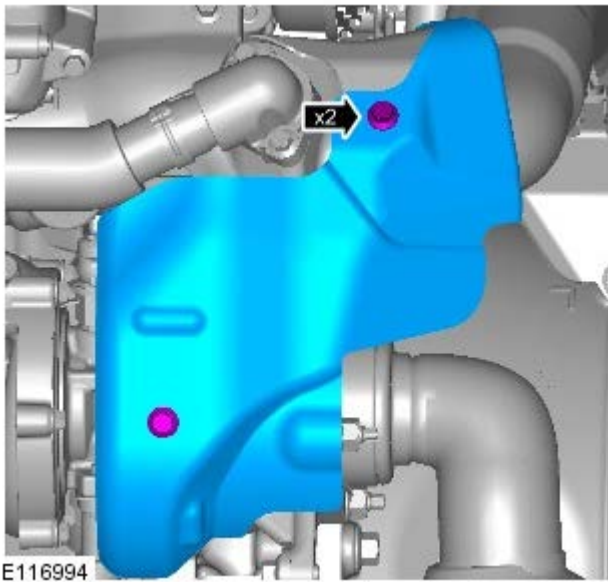


17. ⚠ NOTE: Fuel injection pump pulley shown removed for clarity.

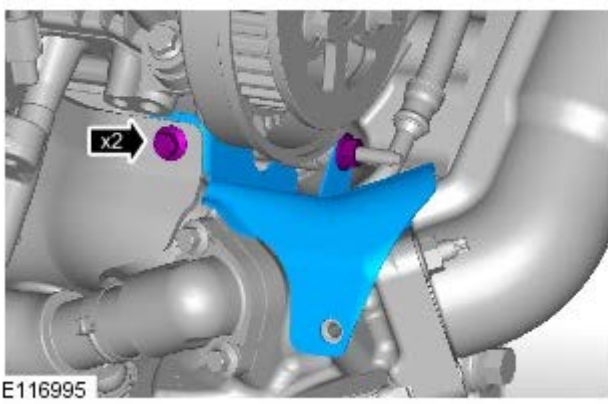


18. ⚠ NOTE: Fuel injection pump pulley shown removed for clarity.

19.



20.



21. *Special Tool(s):* [JLR-303-1523](#)
Torque: 10 Nm



22. *Special Tool(s):* [JLR-303-1523](#)



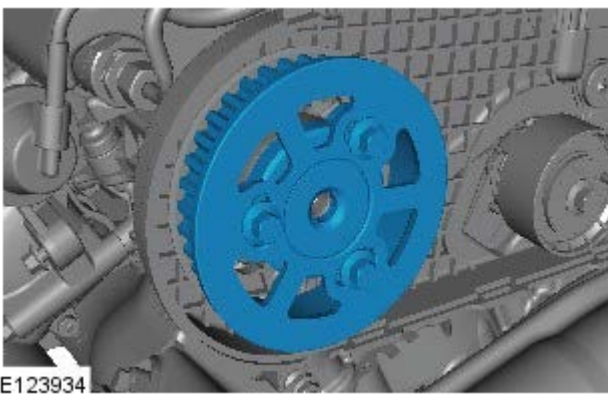
23. Remove the rear camshaft pulley retaining bolt.

Special Tool(s): [303-1145/2](#)

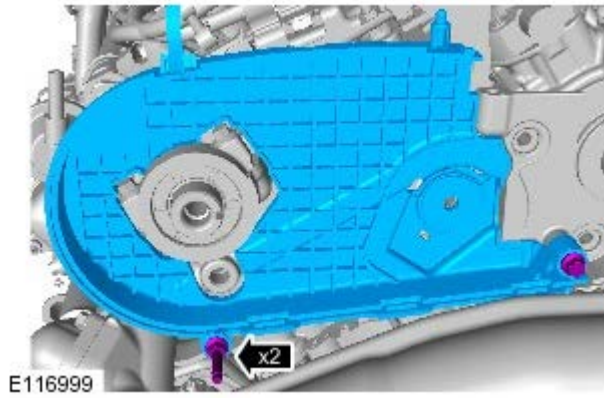


24. Remove the special tools.

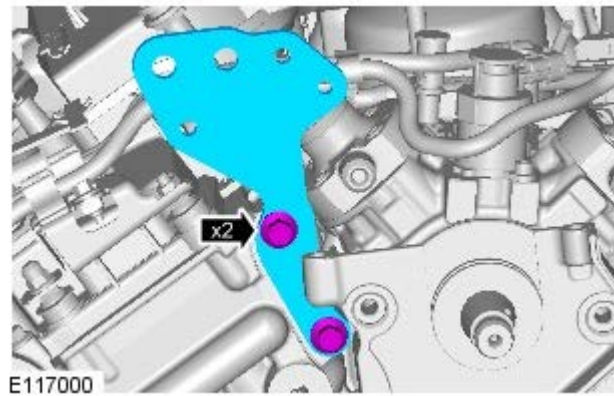
25.



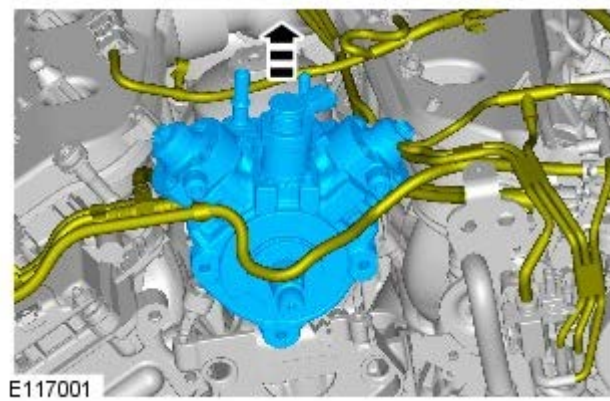
26.



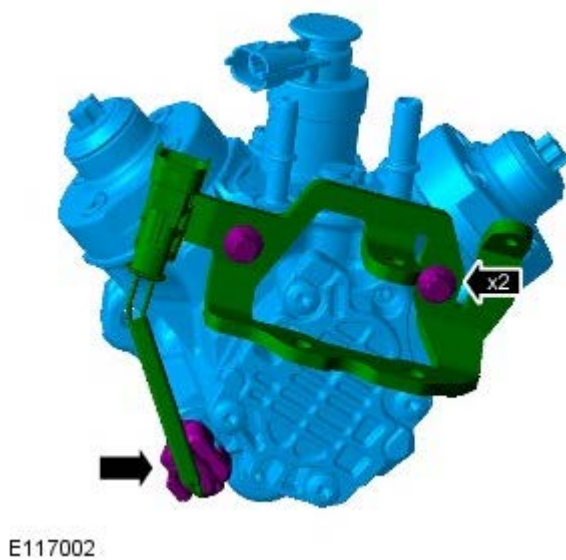
27.



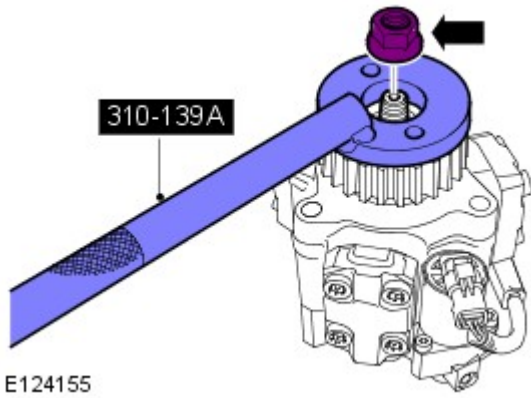
28.



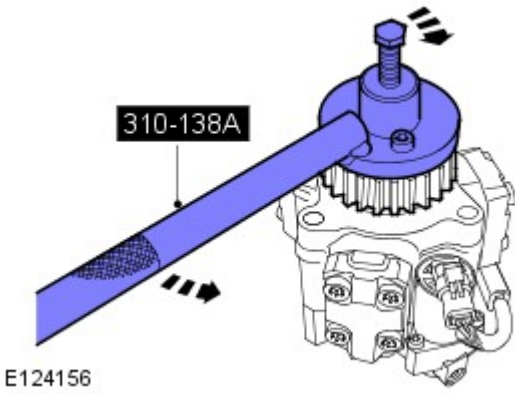
29.  NOTE: Do not disassemble further if the component is removed for access only.



30. *Special Tool(s):* [310-139A](#)

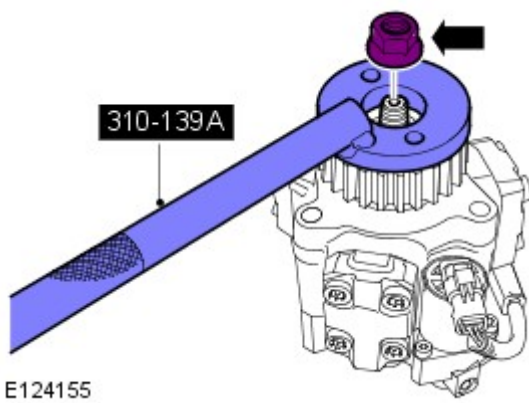


31. *Special Tool(s):* [310-138A](#)

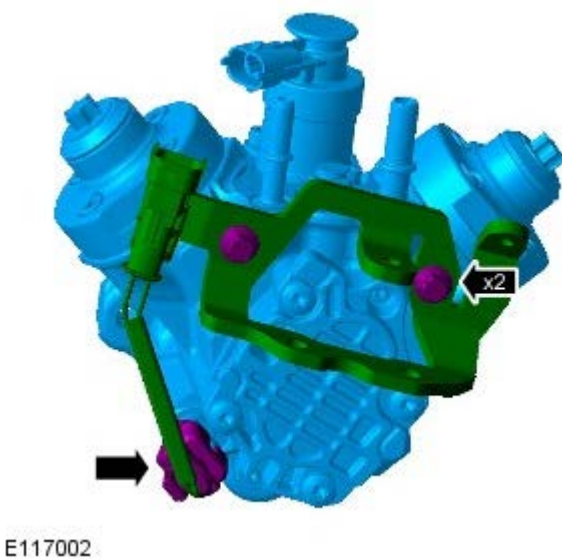


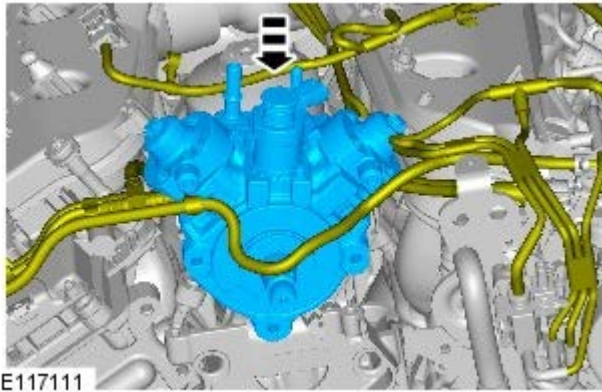
Installation

1. *Special Tool(s):* [310-139A](#)
Torque: 50 Nm

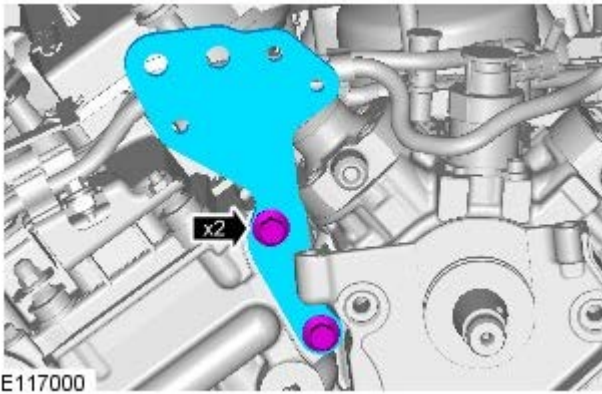


2. *Torque:* 3 Nm

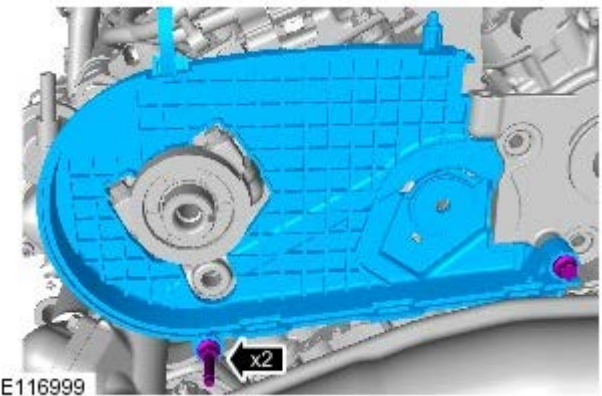




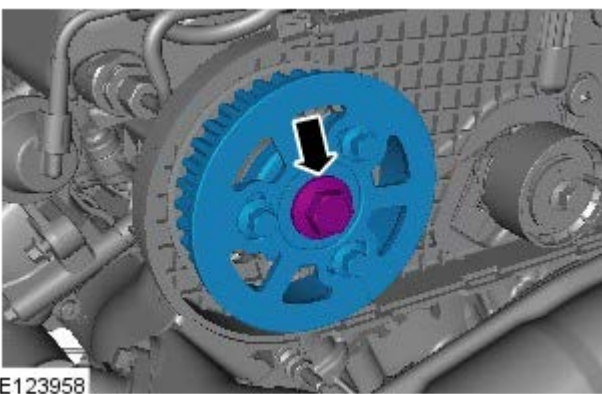
3.



4. Torque: 23 Nm



5. Torque: 10 Nm



6. CAUTIONS:

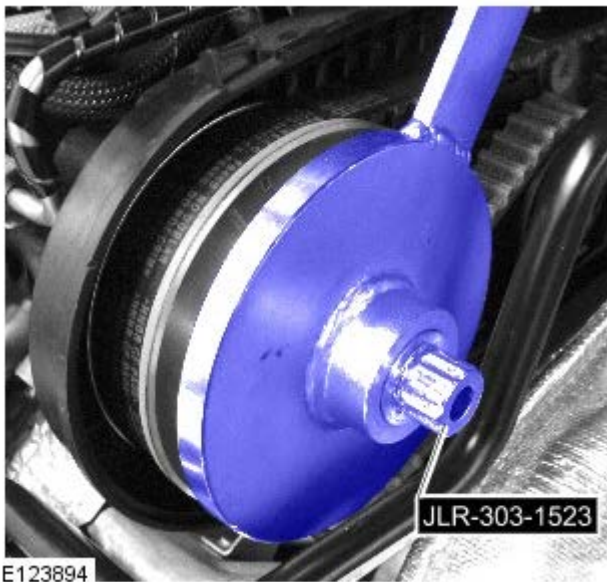
⚠ Apply loctite 242 (ESK-M4G247-A1) to the new camshaft pulley bolt.

⚠ Install the bolt finger tight.

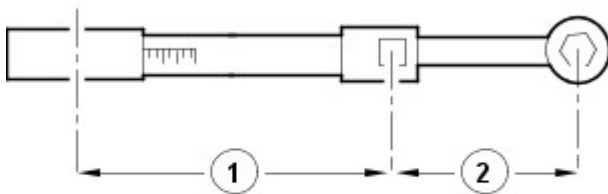
7. Torque: 10 Nm



E123893




E123894




E37107

8.

9.  **CAUTION:** Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.

- Calculate the setting for the torque wrench:
- **Stage 1:** Multiply the required torque by the effective length of the torque wrench (1).
- **Stage 2:** Add the effective length of the special tool (2) to the effective length of the torque wrench.
- **Stage 3:** Divide the total of stage 1 by the total of stage 2.
- **Stage 4:** Set the torque wrench to the figure arrived at in stage 3.

10.  **CAUTION:** Make sure the torque wrench setting procedure is followed correctly. Failure to follow this instruction may result in damage to the vehicle.

Torque:

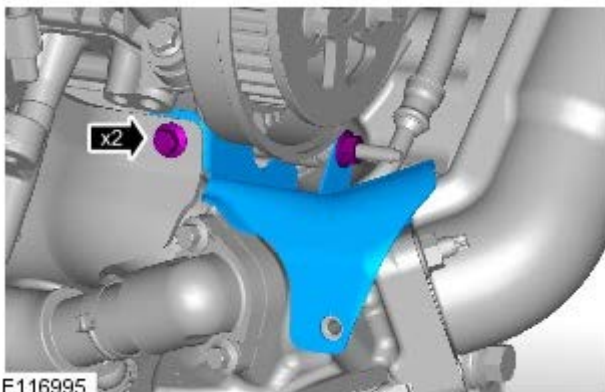
Stage 1: 80 Nm
 Stage 2: 80°



E123895

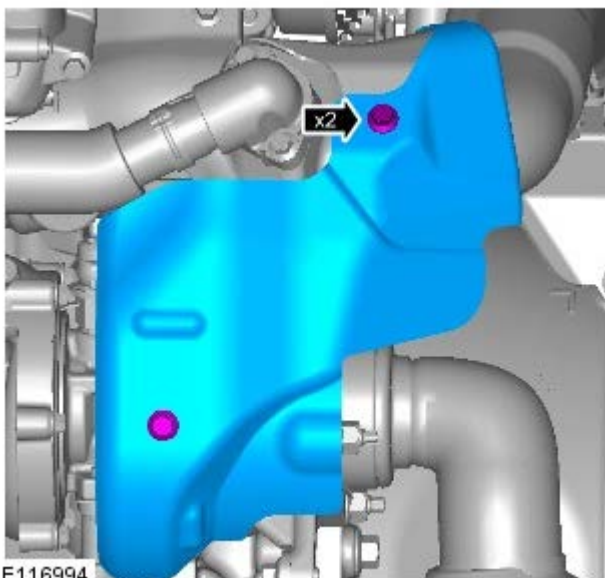
11. Remove the special tools.

12. Torque: 10 Nm




E116995

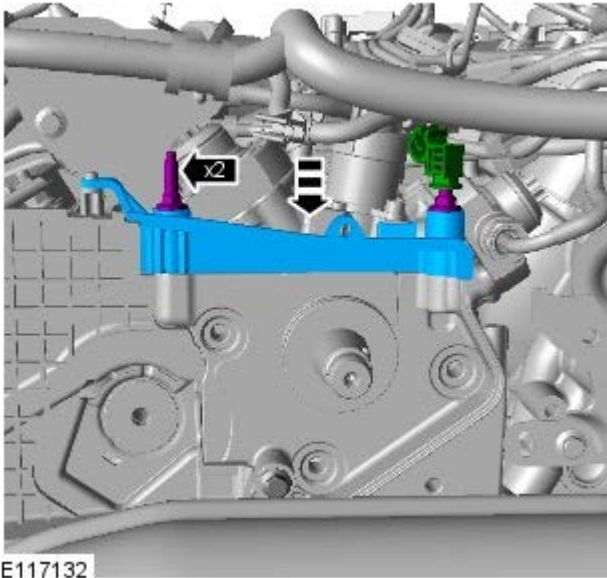
13. Torque: 10 Nm



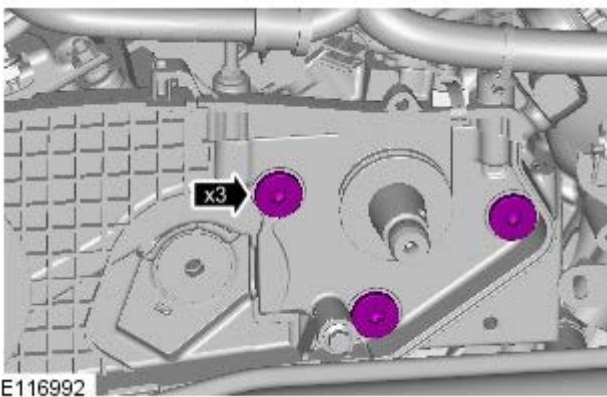
E116994

14.  NOTE: Fuel injection pump pulley shown removed for clarity.

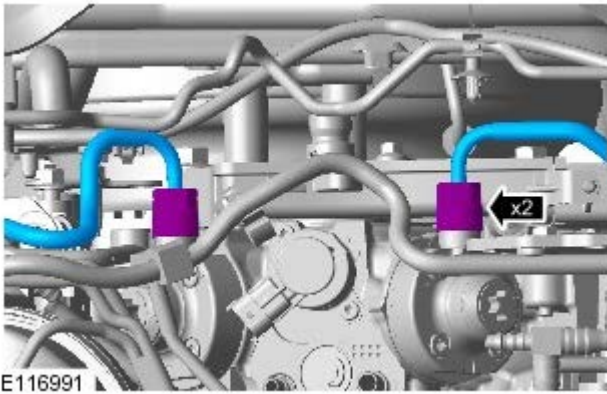
Torque: 10 Nm



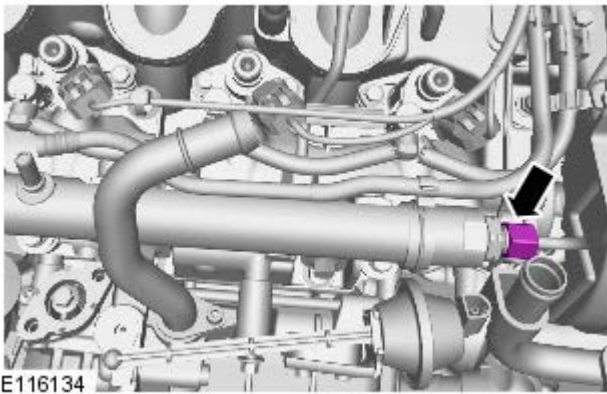
E117132




E116992



E116991




E116134

15.  NOTE: Fuel injection pump pulley shown removed for clarity.


Torque: 23 Nm

16. CAUTIONS:


 Tighten the fuel supply line unions finger tight.

 Make sure that a new component is installed.

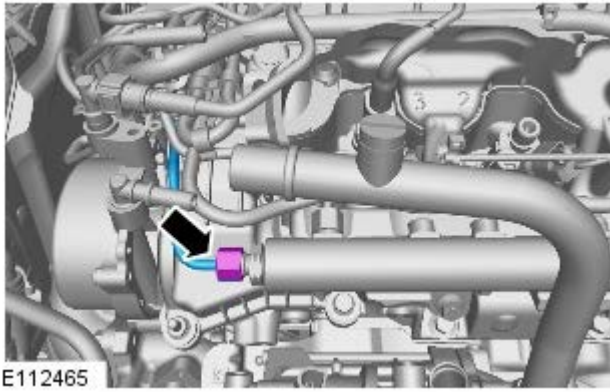
17. CAUTIONS:

 Make sure that a new component is installed.

 Tighten the fuel supply line unions finger tight.


 NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

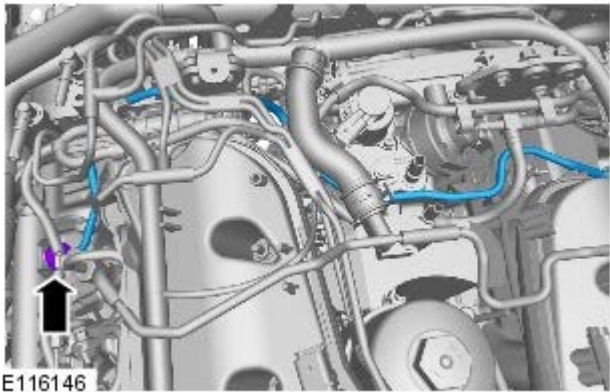
18. CAUTIONS:




 Make sure that a new component is installed.

 Tighten the fuel supply line unions finger tight.

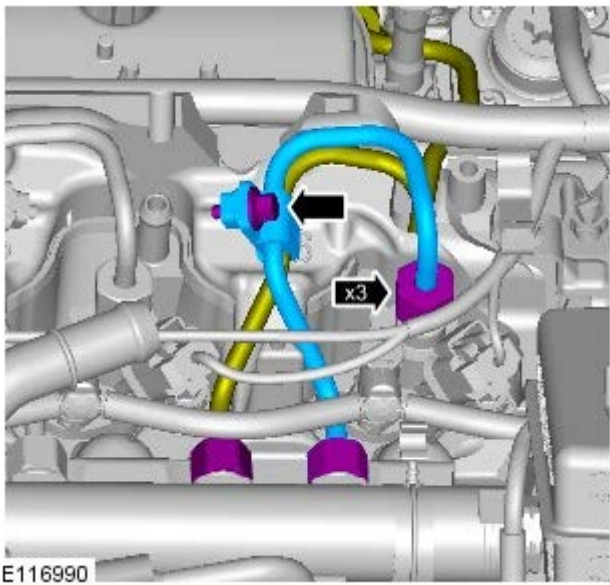
 NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



19. CAUTIONS:

 Make sure that a new component is installed.

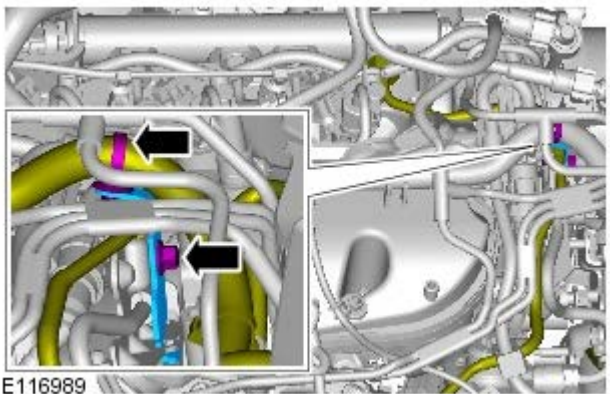
 Tighten the fuel supply line unions finger tight.



20. CAUTIONS:

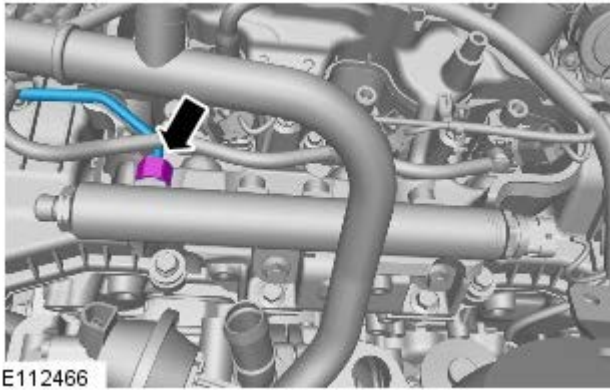
 Tighten the fuel supply line unions finger tight.


 Make sure that new components are installed.




21. Torque: 10 Nm

22. CAUTIONS:

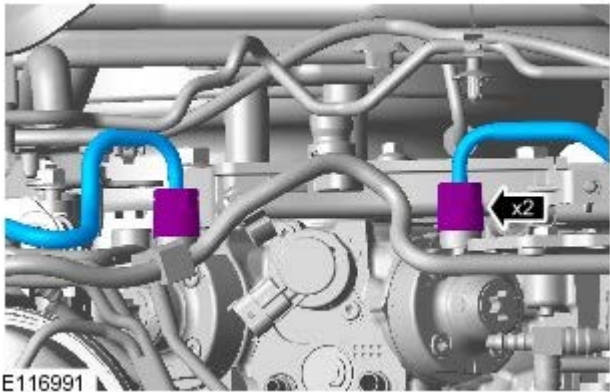



 Make sure that a new component is installed.

 Tighten the fuel supply line unions finger tight.

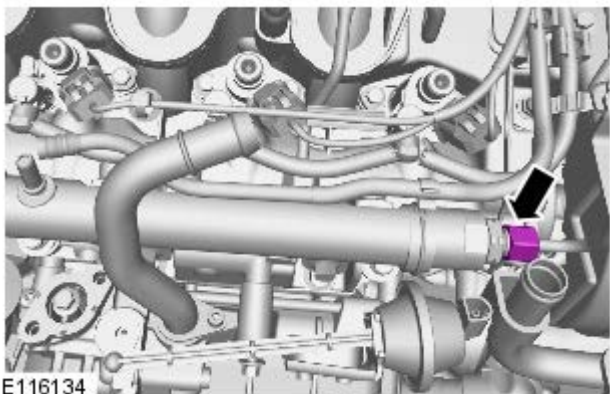
 NOTE: Some variation in the illustrations may occur, but the essential information is always correct.


23. Tighten the high-pressure fuel lines union to 15Nm.



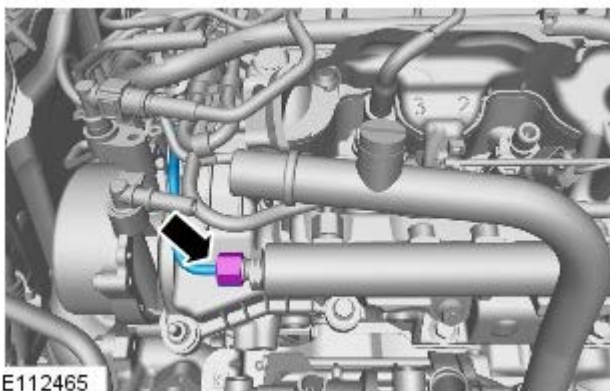
24.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Tighten the high-pressure fuel lines union to 15Nm.

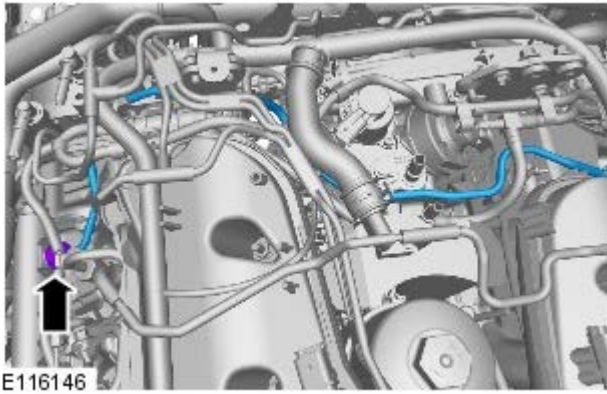


25.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

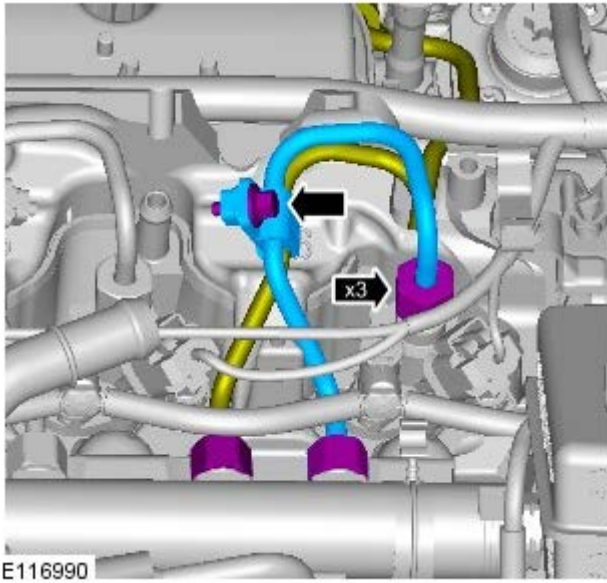
Tighten the high-pressure fuel lines union to 15Nm.




26. Tighten the high-pressure fuel lines union to 15Nm.

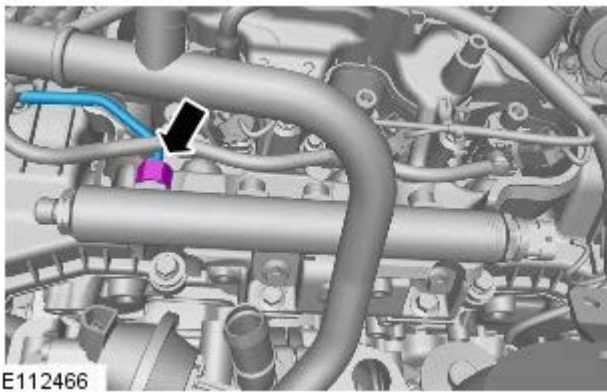


27. Tighten the high-pressure fuel lines union to 15Nm.

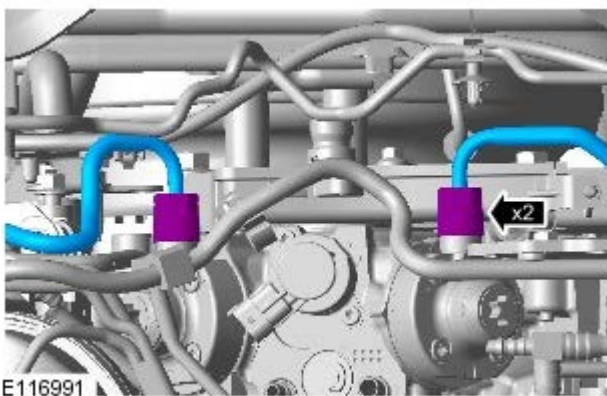


28.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

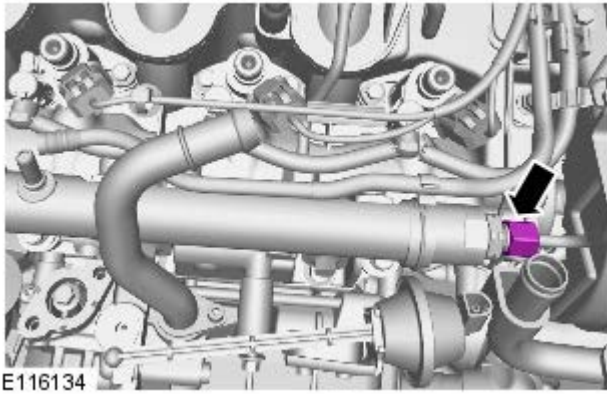
Tighten the high-pressure fuel lines union to 15Nm.



29. Tighten the high-pressure fuel line union to 35Nm.

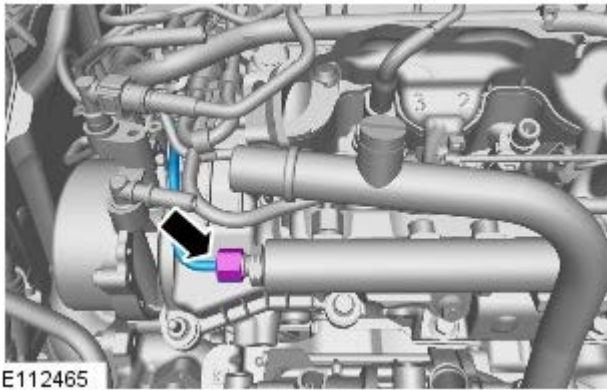



30.  NOTE: Some variation in the illustrations



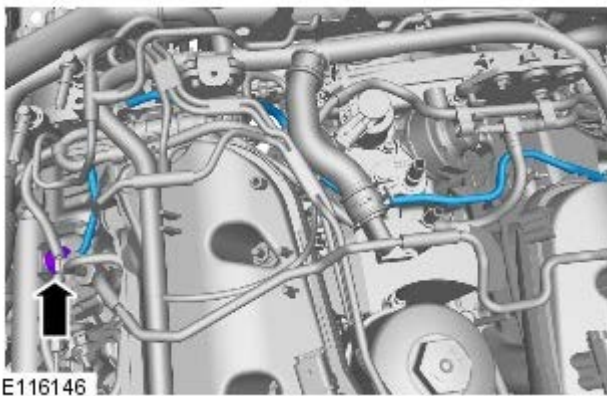
may occur, but the essential information is always correct.

Tighten the high-pressure fuel line union to 35Nm.

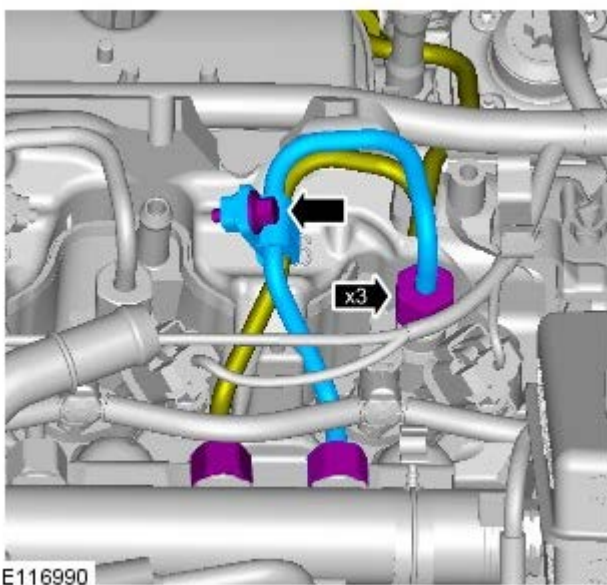


31.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Tighten the high-pressure fuel line union to 35Nm.

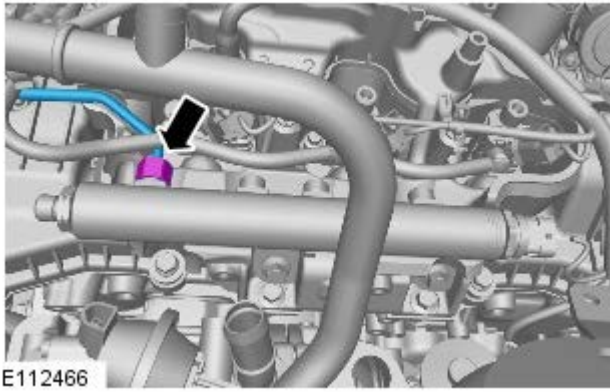


32. Tighten the high-pressure fuel line union to 35Nm.



33. Tighten the high-pressure fuel line union to 35Nm.

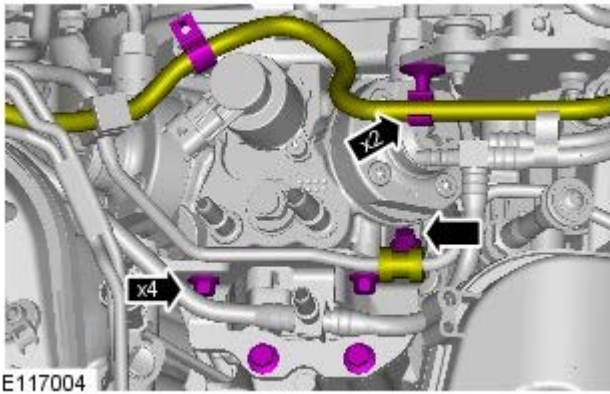
34.  NOTE: Some variation in the illustrations



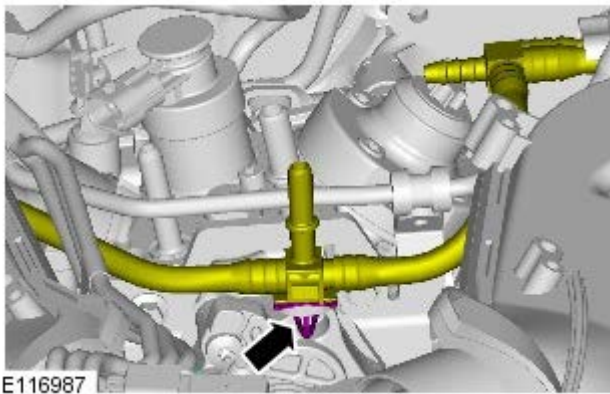
may occur, but the essential information is always correct.

Tighten the high-pressure fuel line union to 35Nm.

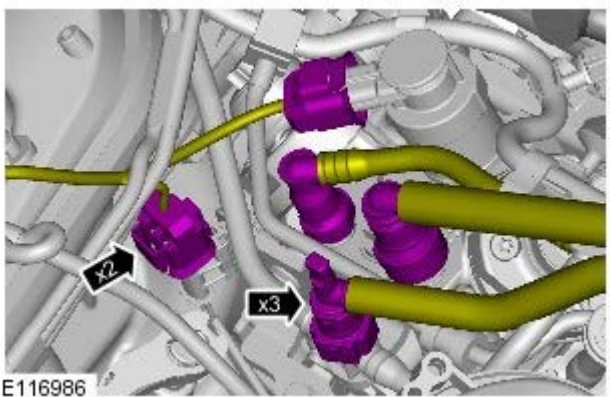
35. Torque: 10 Nm



36.



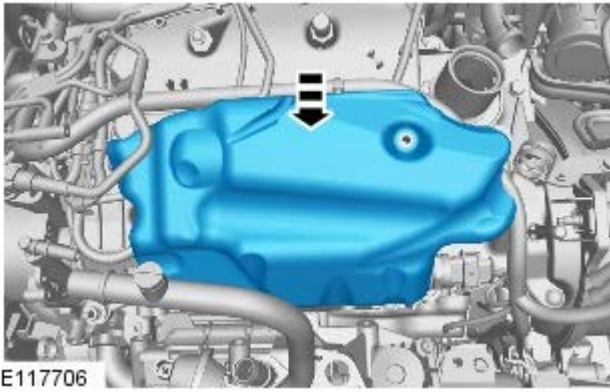
37.



38. Refer to: Crankcase Vent Oil Separator (303-08 Engine Emission Control - TDV6 3.0L Diesel, Removal and Installation).

39. Refer to: Rear End Accessory Drive (READ) (303-05 Accessory Drive - TDV6 3.0L Diesel, Removal and Installation).

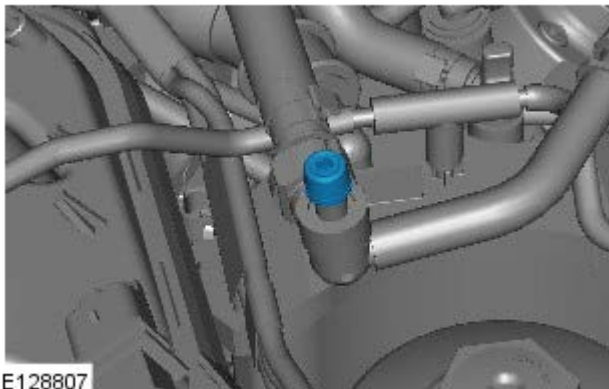




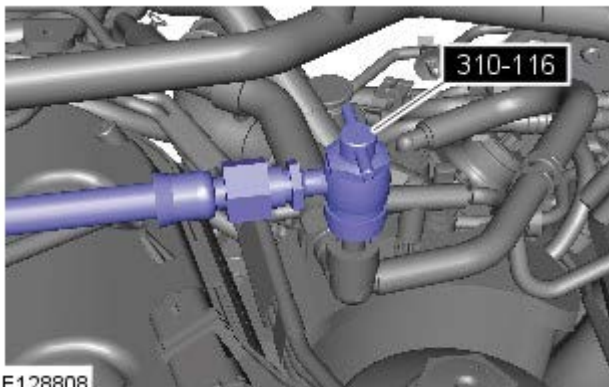
40. NOTE: Left-hand shown, right-hand similar.

41. Refer to: Specifications (414-01 Battery, Mounting and Cables, Specifications).

42.




E128807



E128808

43. NOTES:

 The gauge component of the special tool must be removed before installing to the Schrader valve.

 Using a suitable container, place the end of the special tool into it to collect any fluid.

Install the pipe from special tool 310-116 to the Schrader valve.


44.

1.  NOTE: A minimum of 12 litres of fuel in the fuel tank is required for the following Steps.

Make sure the fuel tank has a sufficient amount of fuel to carry out the following Steps.

2. NOTES:

 Do not start the vehicle.

 Allow 15 seconds between **each** ignition cycle (between each ignition **ON** and ignition **OFF**) to allow the fuel tank pump to pump fuel to the fuel injection pump correctly.

Turn the ignition on and off four times.

3. Crank the engine until it starts.

4. Remove the special tool and suitable container.

5. Install the Schrader valve cap.

6. Refer to: Engine Cover - TDV6 3.0L Diesel (501-05 Interior Trim and Ornamentation, Removal and

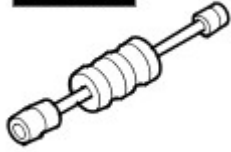


Installation).

7. Road test the vehicle for at least 10 miles (16 Km).
8. Check the diagnostic trouble codes (DTC)s using the approved diagnostic tool. Clear or repair as necessary.

Fuel Charging and Controls - TDV6 3.0L Diesel - Fuel Injectors LH

Removal and Installation

Special Tool(s)

 <p>100-012</p> <p>E54135</p>	<p>100-012 Slide Hammer</p>
 <p>E116924</p>	<p>310-213 Fuel Injector Removal Adapter</p>
 <p>E124125</p>	<p>JLR-310-237 Remover, Fuel Injector</p>

Removal



WARNING: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install new blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

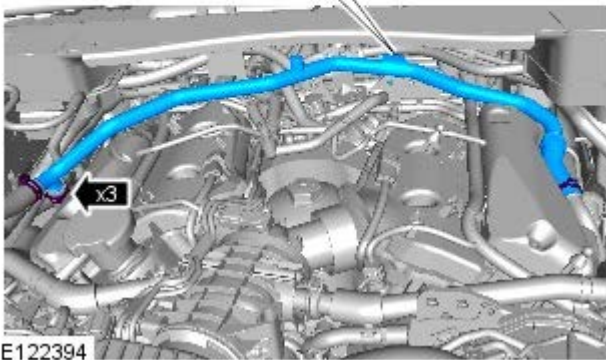


NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Fuel Injection Component Cleaning (303-04, General Procedures).
2. Disconnect the battery earth lead.
3. Refer to: Engine Cover - TDV6 3.0L Diesel (501-05, Removal and Installation).
4. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).

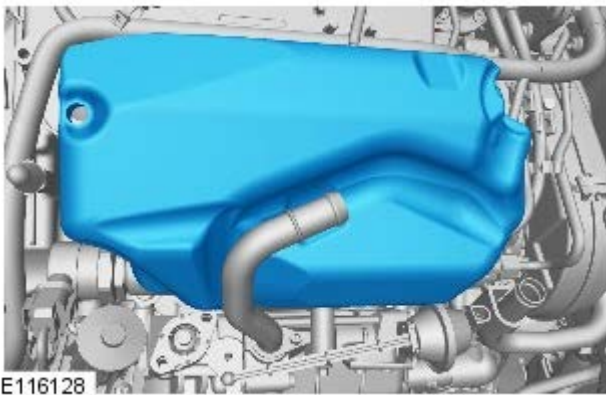


5. **CAUTION:** Be prepared to collect escaping coolant.



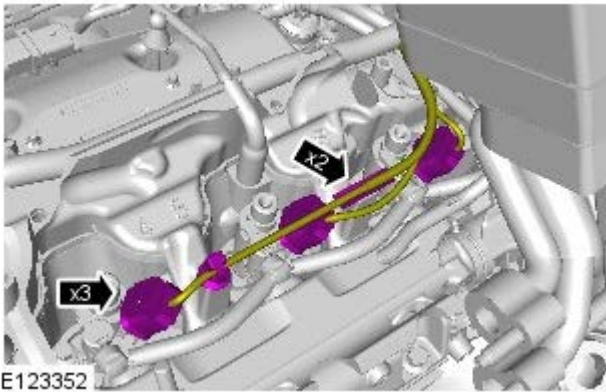
E122394

6.

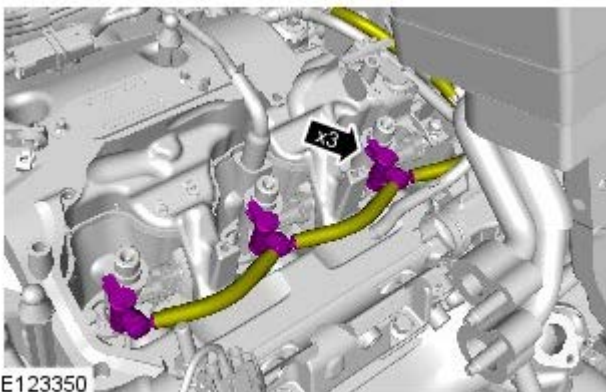


E116128

7.




E123352




E123350

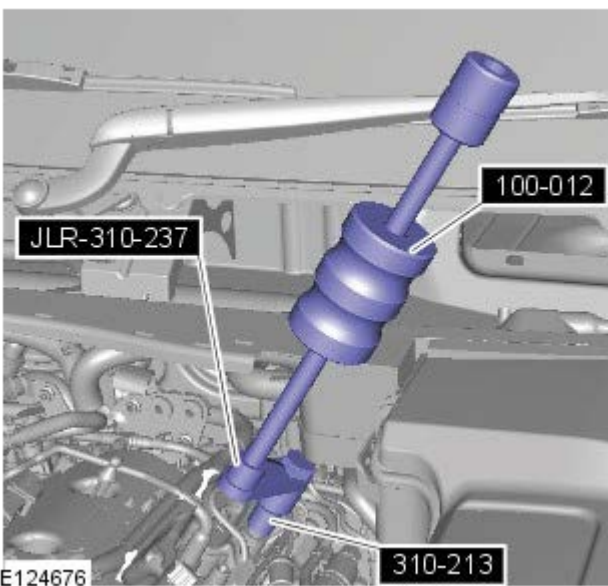
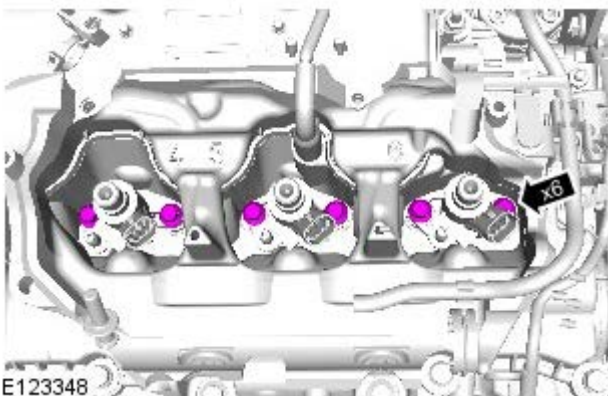
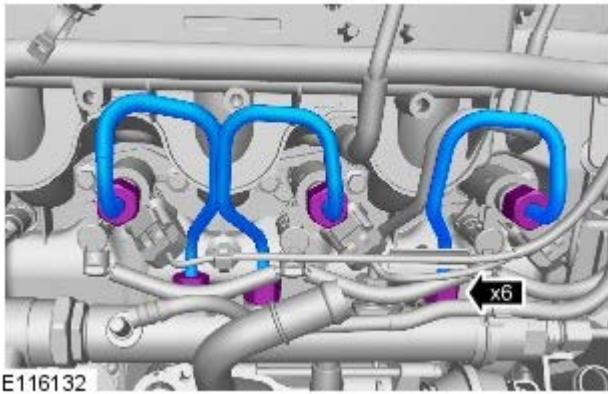
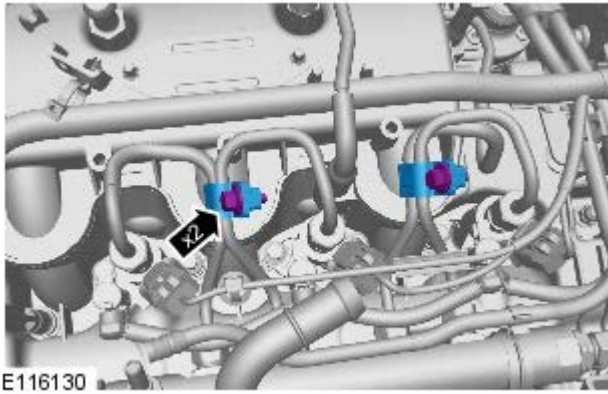
8. CAUTIONS:

 Be prepared to collect escaping fuel.




 Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

 NOTE: Make sure that the fuel injector return line has a maximum of 8 uses.

9.



10. CAUTIONS:

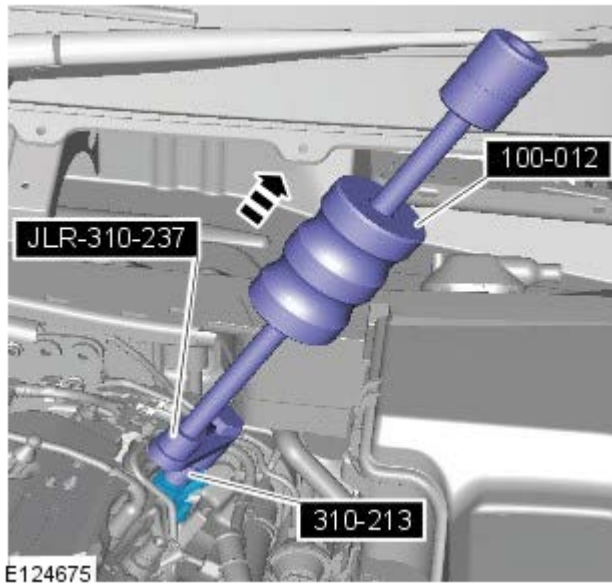
-  Be prepared to collect escaping fuel.
-  Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean.
-  Remove and discard the high-pressure fuel supply lines.

11.

12. Install the special tool.

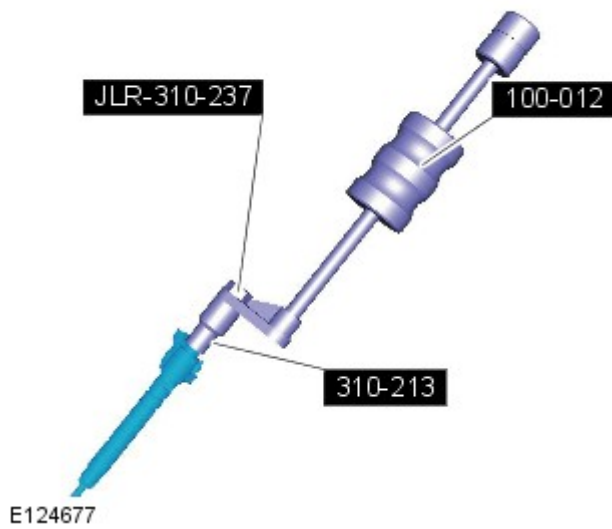
13.

- Special Tool(s): [JLR-310-237](#)
- Special Tool(s): [310-213](#)

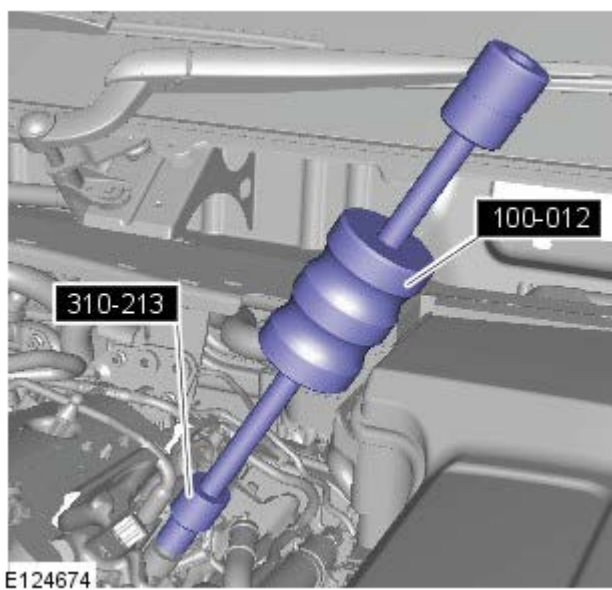


- *Special Tool(s):* [100-012](#)

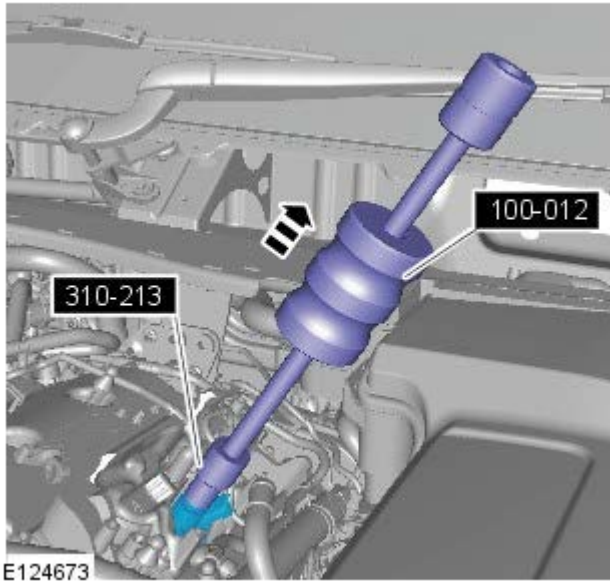
14. Remove the special tool.



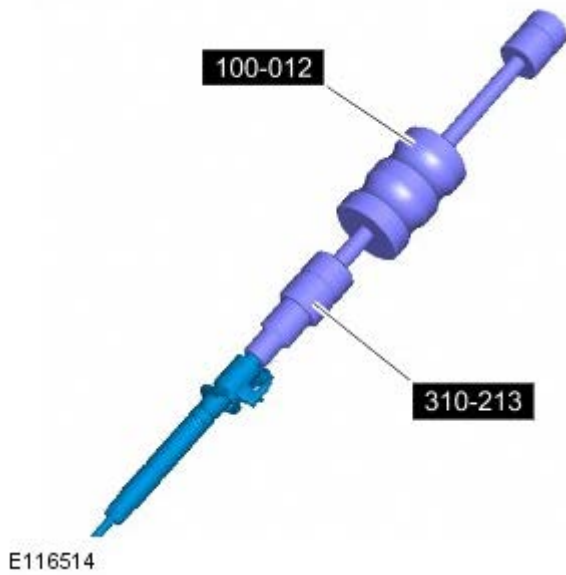
15. Install the special tool.



- 16.
- *Special Tool(s):* [310-213](#)
 - *Special Tool(s):* [100-012](#)

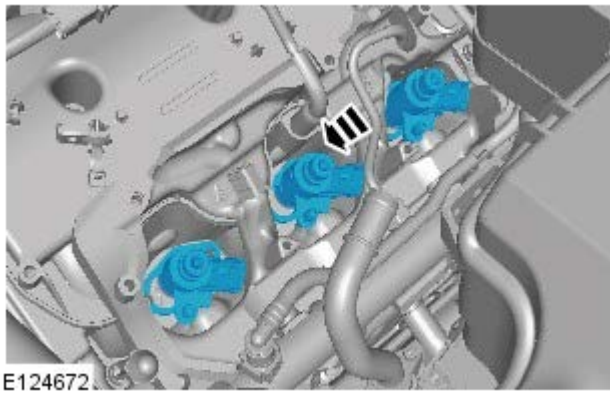



17. Remove the special tool.



18. Repeat the above procedure for the remaining injectors.

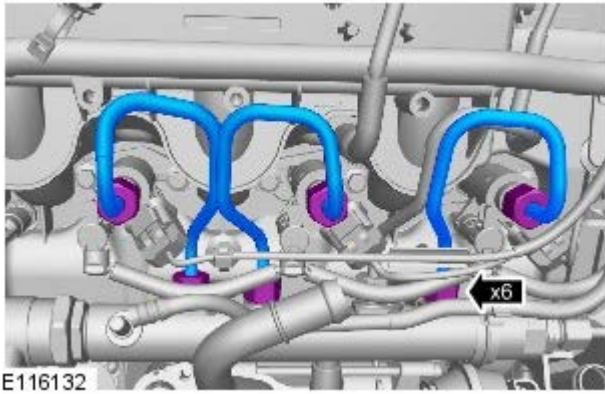
Installation



1.  **CAUTION:** Make sure that the area around the open fuel injector ports are clean and free of foreign material and lubricant prior to installing the fuel injector.

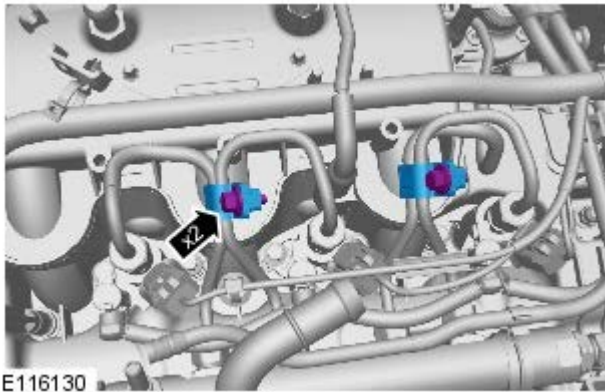
2. **CAUTIONS:**


1.  **CAUTION:** Make sure that a new component is installed.



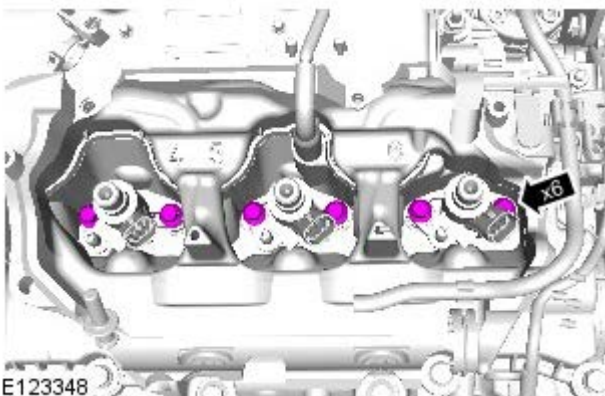
 Only tighten the unions finger-tight at this stage.

3. Torque: 10 Nm



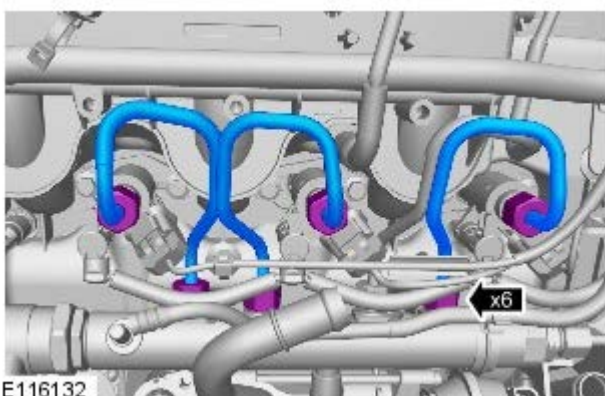
4.  NOTE: Tighten the retaining bolts evenly and progressively.

Torque: 9 Nm



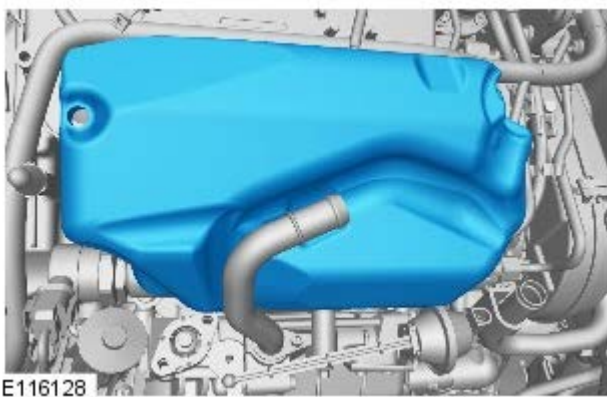
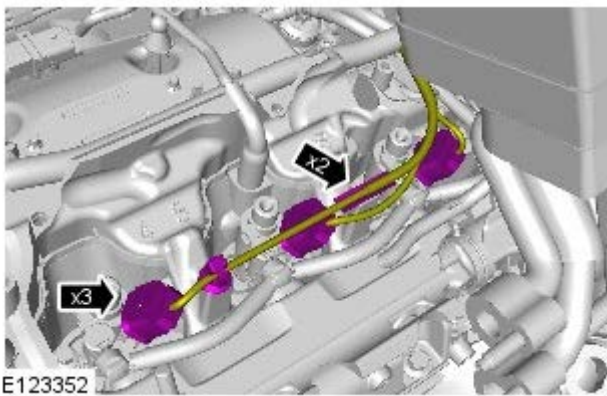
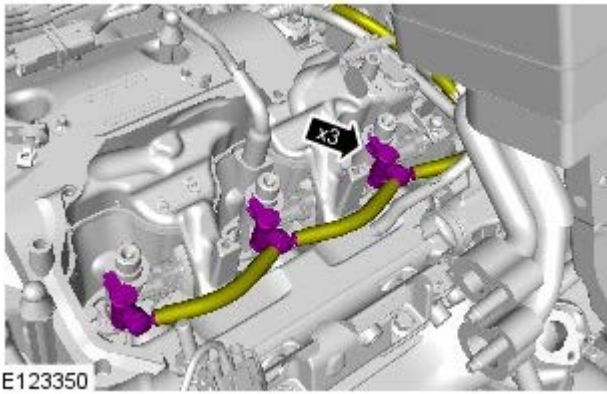
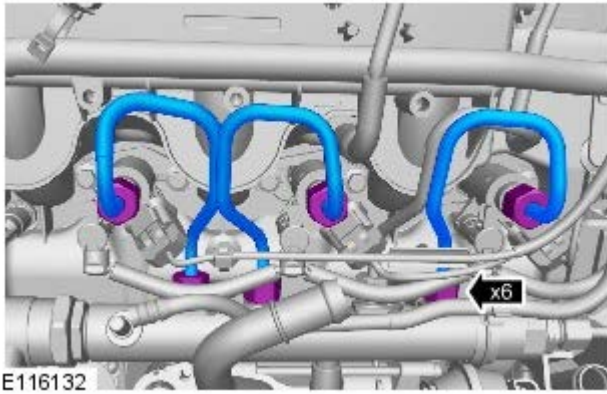
5.


- Stage 1: Tighten the high-pressure fuel supply line unions at the fuel rail to 15Nm.
- Stage 2: Tighten the high-pressure fuel supply line unions at the injector to 15Nm.



6.

- Stage 1: Tighten the high-pressure fuel supply line unions at the fuel rail to 35Nm.
- Stage 2: Tighten the high-pressure fuel supply line unions at the injector to 35Nm.

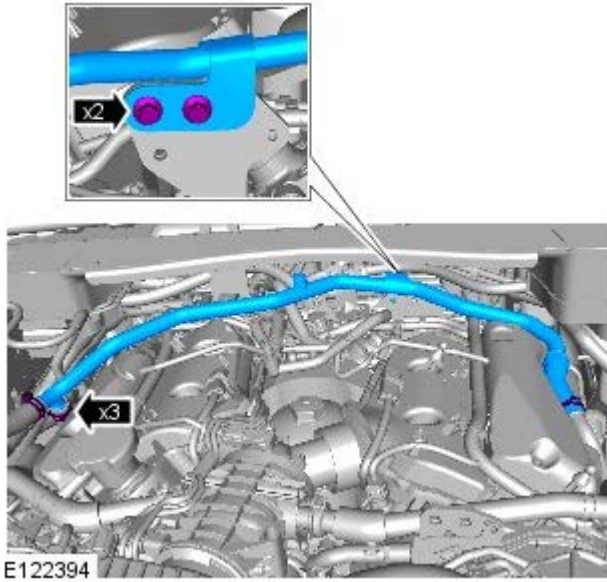


7.  NOTE: Make sure that the fuel injector return line has a maximum of 8 uses.

8.

9.

10. Torque: 10 Nm

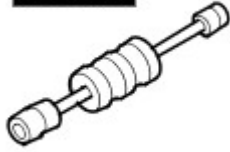




11. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
12. Refer to: Engine Cover - TDV6 3.0L Diesel (501-05, Removal and Installation).
13. Connect the battery earth lead.
14. If a new unit is installed, configure using the approved diagnostic tool.

Fuel Charging and Controls - TDV6 3.0L Diesel - Fuel Injectors RH

Removal and Installation

Special Tool(s)

 <p>100-012</p> <p>E54135</p>	<p>100-012 Slide Hammer</p>
 <p>E116924</p>	<p>310-213 Fuel Injector Removal Adapter</p>
 <p>E124125</p>	<p>JLR-310-237 Remover, Fuel Injector</p>

Removal



WARNING: Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install new blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

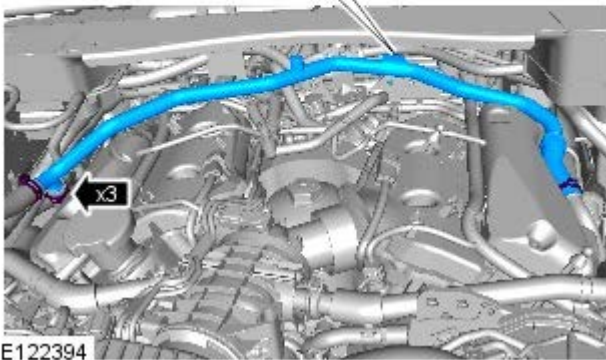


NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Fuel Injection Component Cleaning (303-04, General Procedures).
2. Disconnect the battery earth lead.
3. Refer to: Engine Cover - TDV6 3.0L Diesel (501-05, Removal and Installation).
4. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).

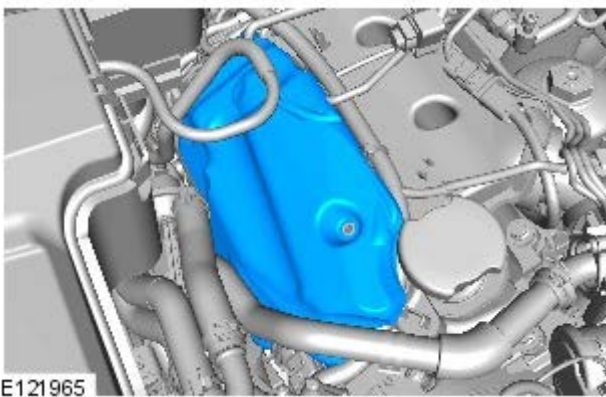


5. **CAUTION:** Be prepared to collect escaping coolant.



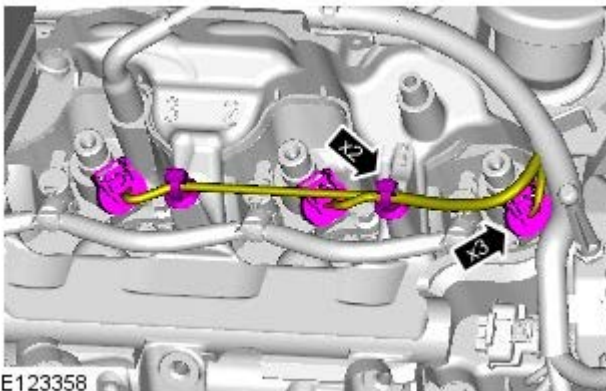
E122394

6.



E121965


7.




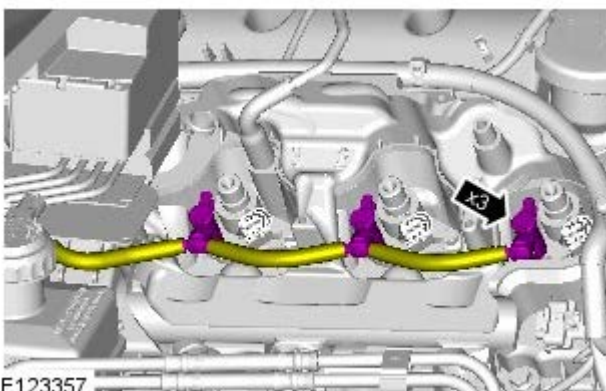
E123358

8. CAUTIONS:

 Be prepared to collect escaping fuel.

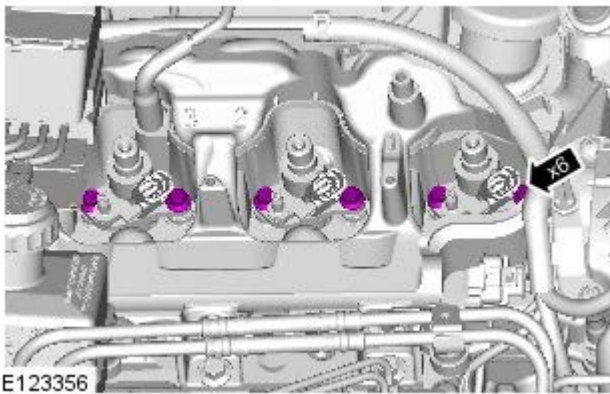
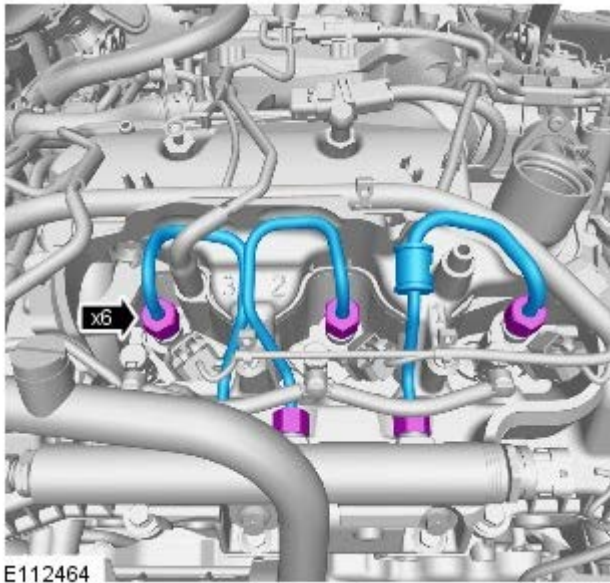
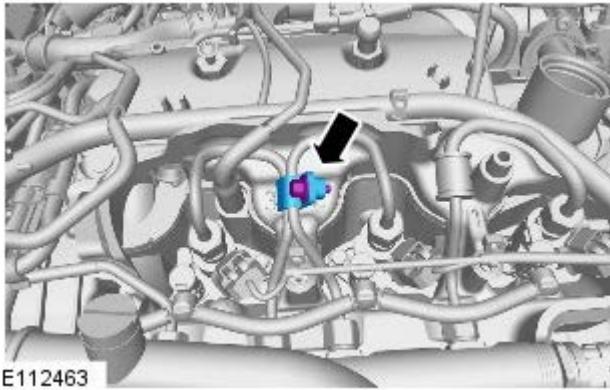
 Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

 NOTE: Make sure that the fuel injector return line has a maximum of 8 uses.






E123357

9.



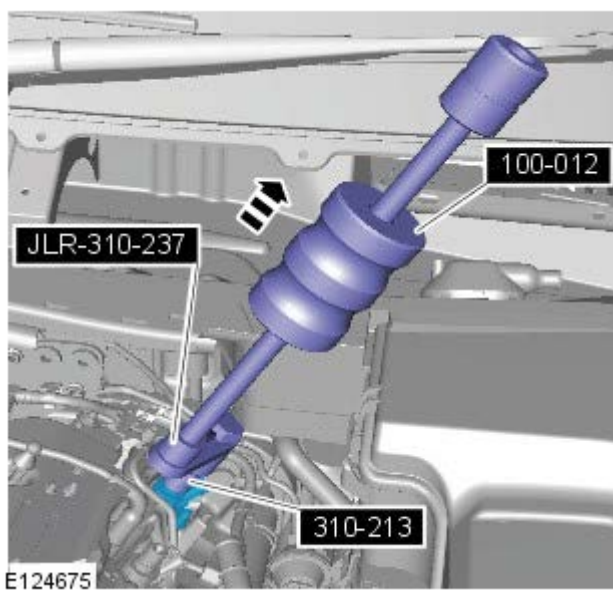
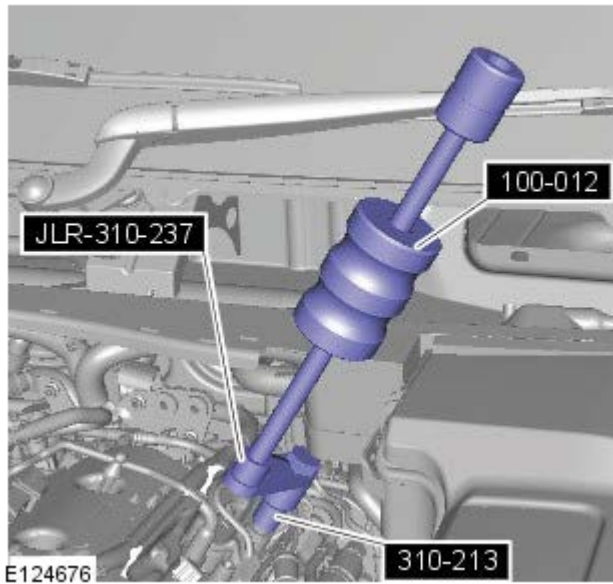
10. CAUTIONS:

-  Be prepared to collect escaping fuel.
-  Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean.
-  Remove and discard the high-pressure fuel supply lines.

11.

12.  CAUTION: LH illustration shown, RH is similar.

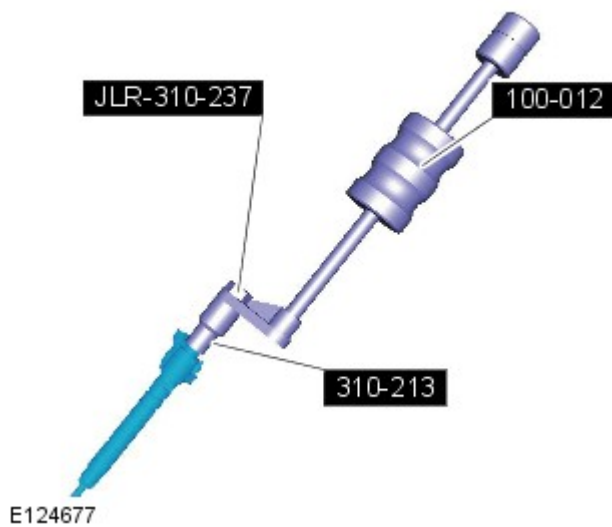
Install the special tool.



13.  CAUTION: LH illustration shown, RH is similar.

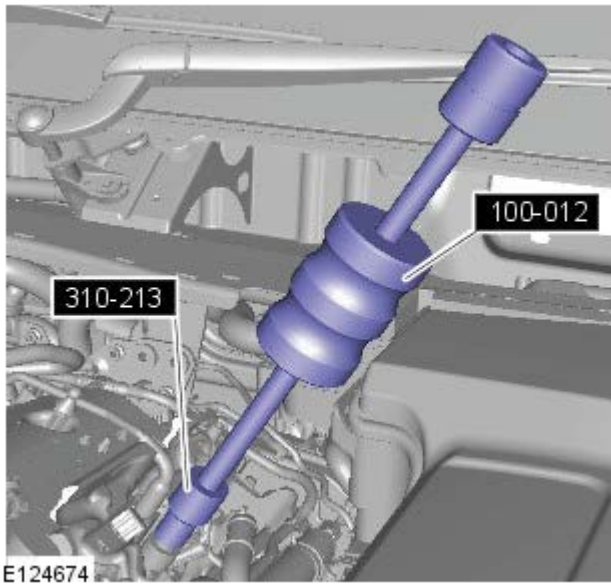
- Special Tool(s): [100-012](#)
- Special Tool(s): [JLR-310-237](#)
- Special Tool(s): [310-213](#)

14. Remove the special tool.

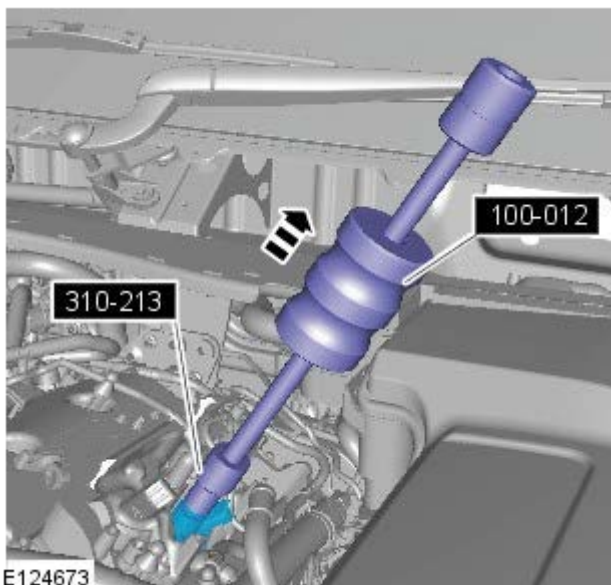


15.  CAUTION: LH illustration shown, RH is similar.

Install the special tool.



E124674

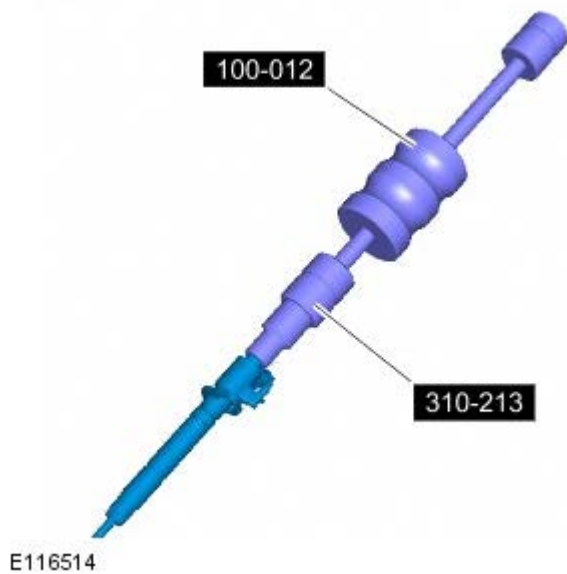


E124673

16.  CAUTION: LH illustration shown, RH is similar.

- Special Tool(s): [310-213](#)
- Special Tool(s): [100-012](#)

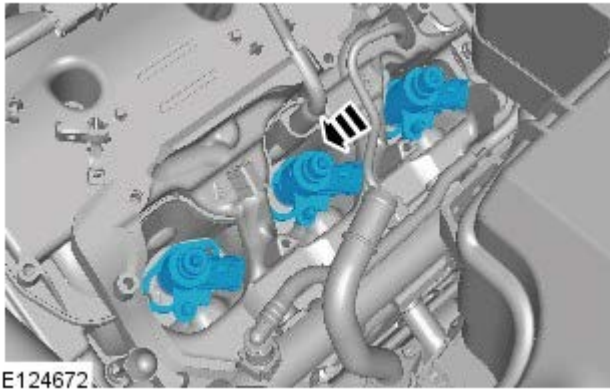
17. Remove the special tool.




E116514

18. Repeat the above procedure for the remaining injectors.

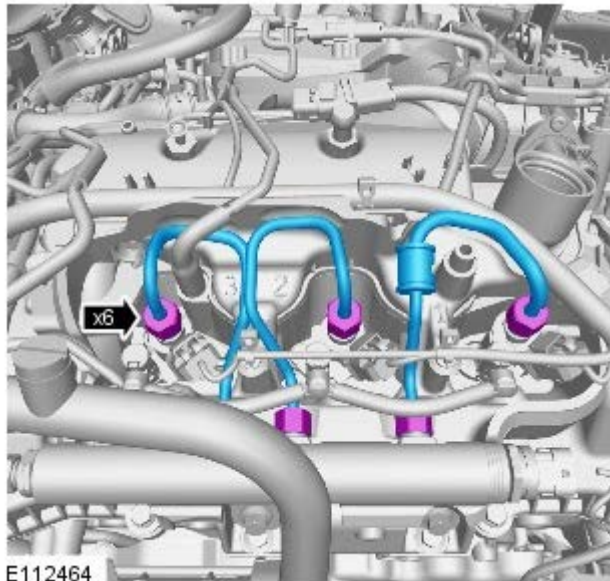
Installation




1. CAUTIONS:


 Make sure that the area around the open fuel injector ports are clean and free of foreign material and lubricant prior to installing the fuel injector.

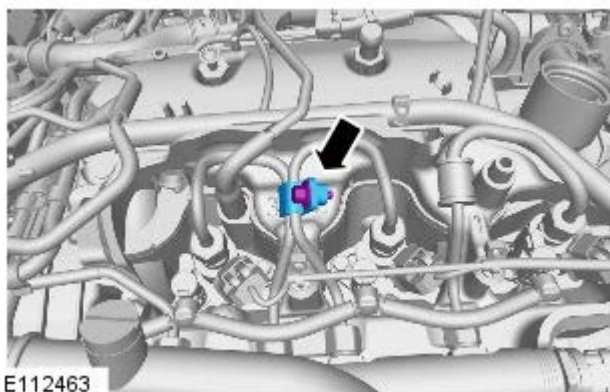
 LH illustration shown, RH is similar.



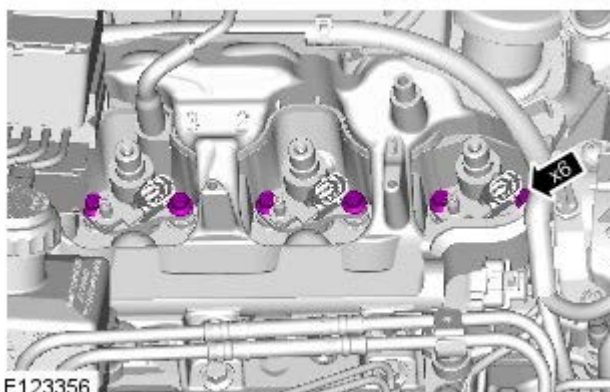
2. CAUTIONS:


 Make sure that a new component is installed.

 Only tighten the unions finger-tight at this stage.



3. Torque: 10 Nm

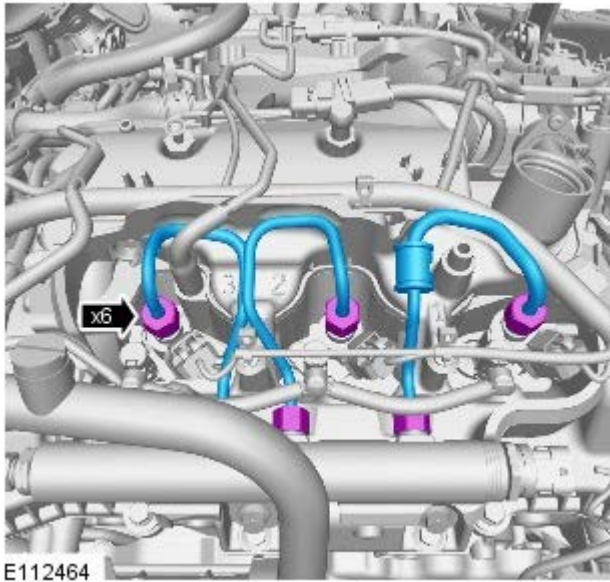


4.  NOTE: Tighten the retaining bolts evenly and progressively.

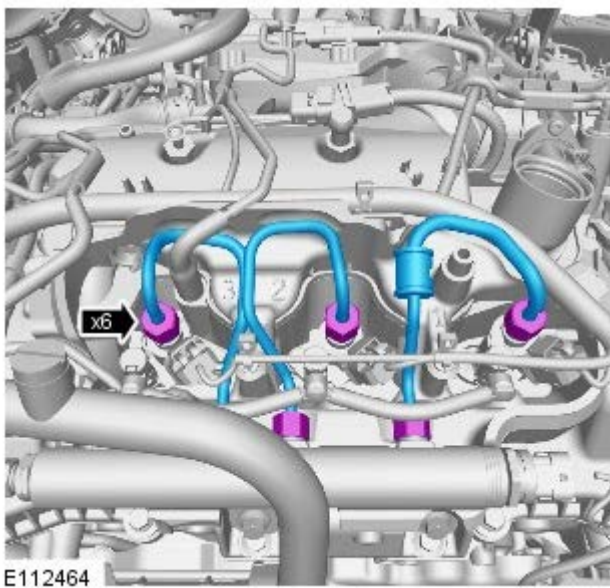
Torque: 9 Nm

5.

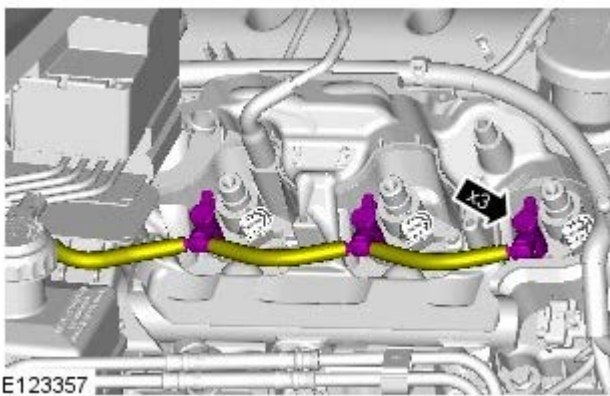
- Stage 1: Tighten the high-pressure fuel supply line unions at the fuel rail to




- 15Nm.
- Stage 2: Tighten the high-pressure fuel supply line unions at the injector to 15Nm.

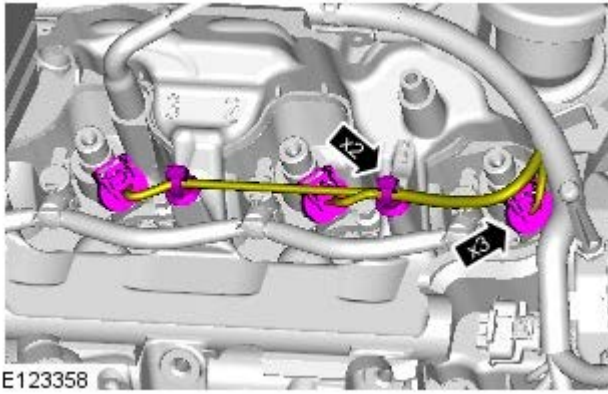


- 6.
- Stage 1: Tighten the high-pressure fuel supply line unions at the fuel rail to 35Nm.
- Stage 2: Tighten the high-pressure fuel supply line unions at the injector to 35Nm.

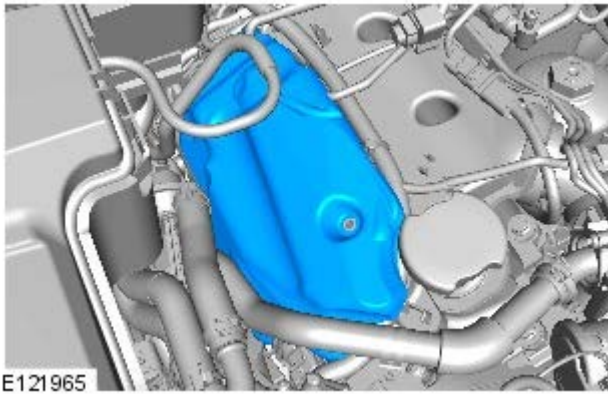


- 7.  NOTE: Make sure that the fuel injector return line has a maximum of 8 uses.

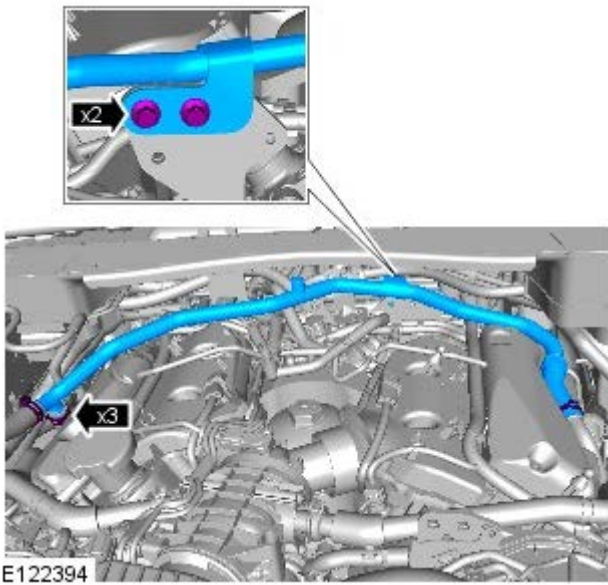
8.



9.



10. Torque: 10 Nm



11. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
12. Refer to: Engine Cover - TDV6 3.0L Diesel (501-05, Removal and Installation).
13. Connect the battery earth lead.
14. If a new unit is installed, configure using the approved diagnostic tool.


Fuel Charging and Controls - TDV6 3.0L Diesel - Fuel Rail LH

Removal and Installation

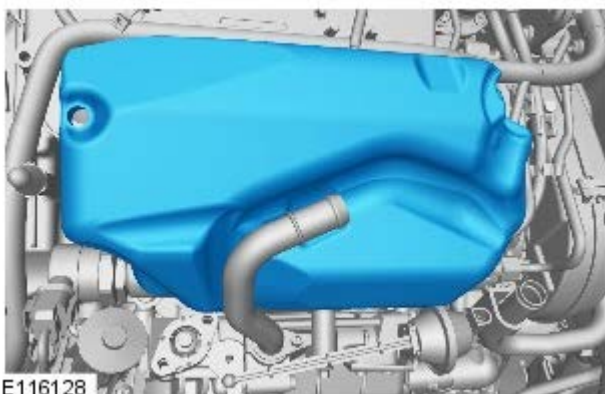
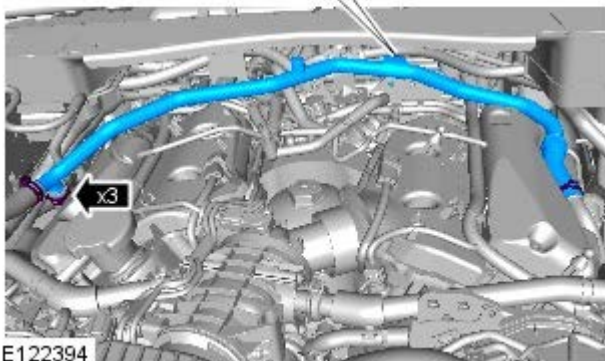
Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

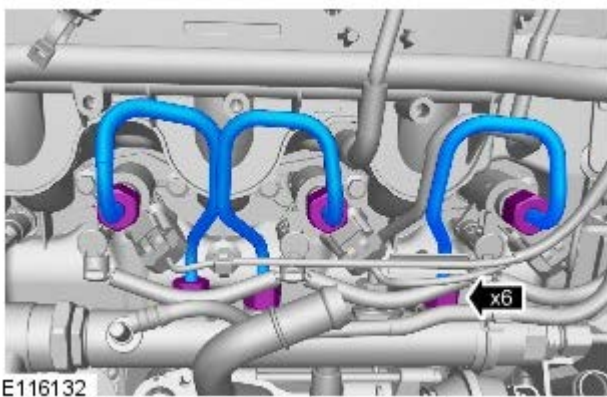
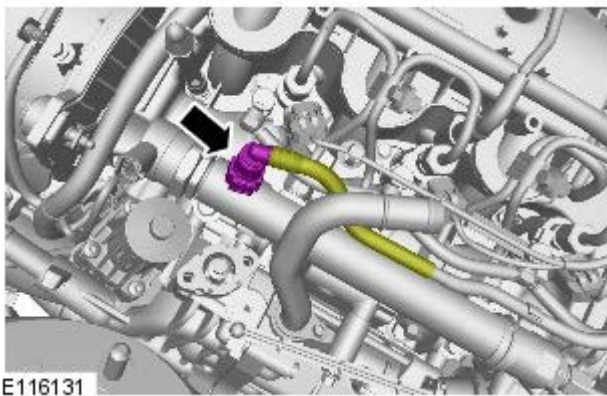
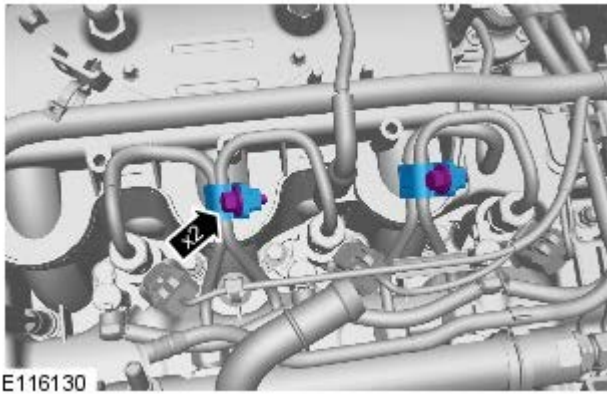
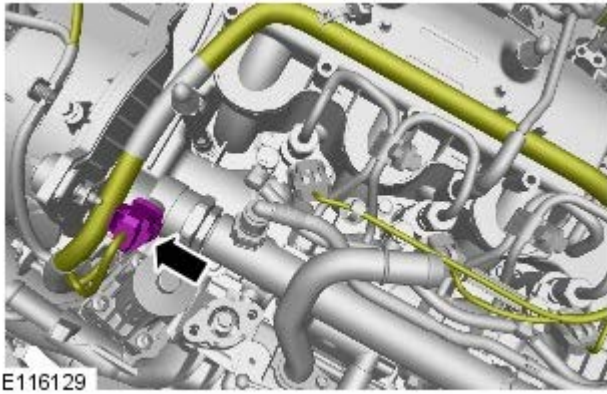
1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Disconnect the battery ground cable.
3. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Refer to: [Fuel Injection Component Cleaning](#) (303-04A Fuel Charging and Controls - TDV6 3.0L Diesel, General Procedures).

5.



6.  NOTE: Left-hand shown, right-hand similar.


7.



8.


9. CAUTIONS:

 Be prepared to collect escaping fuel.

 Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.


10. CAUTIONS:

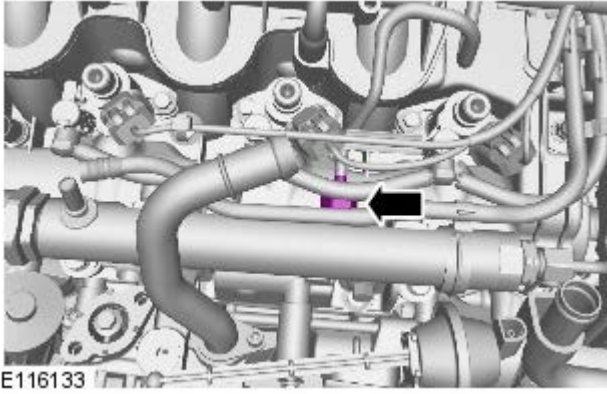
 Be prepared to collect escaping fuel.

 Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

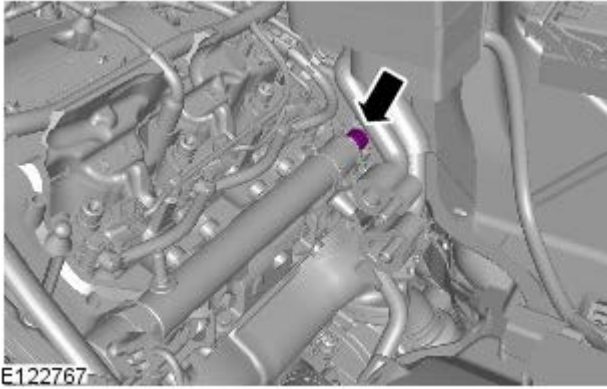
11. CAUTIONS:

 Be prepared to collect escaping fuel.

 Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open




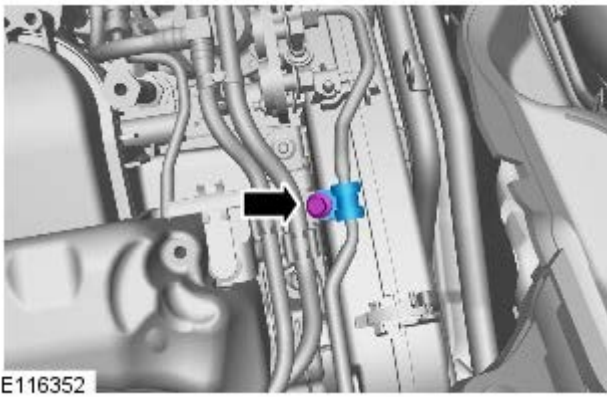
connections to prevent contamination.



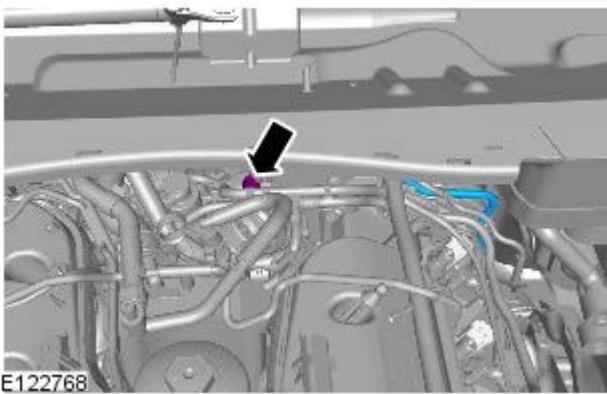
12. CAUTIONS:

 Be prepared to collect escaping fuel.


 Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

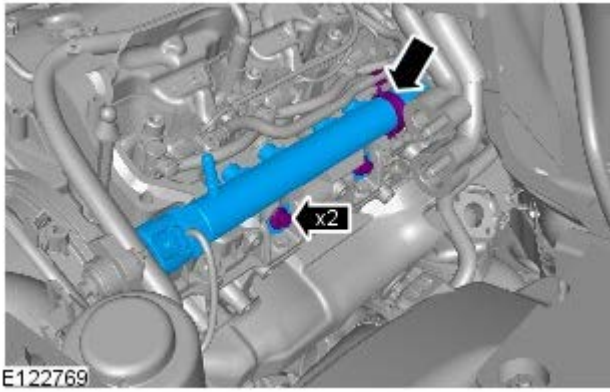


13.

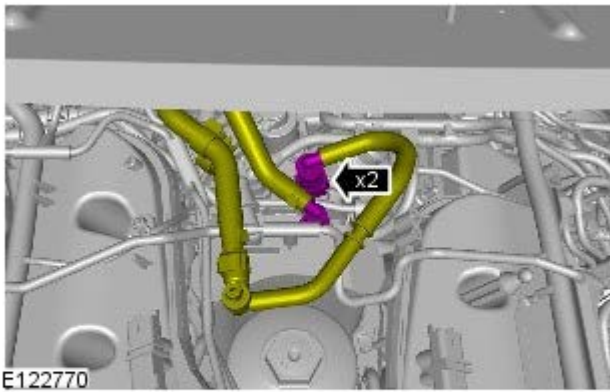
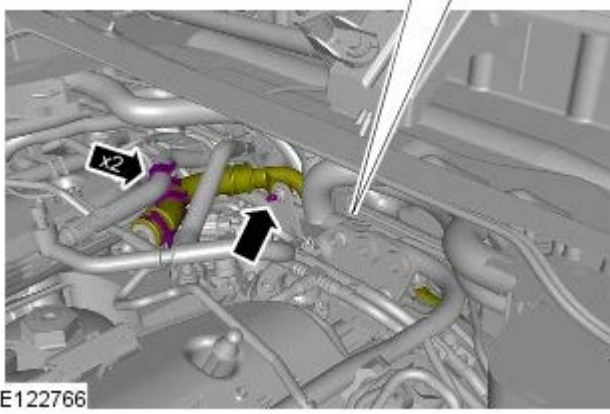
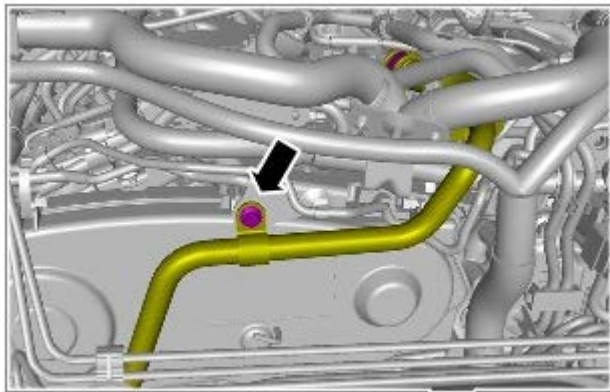


14.  CAUTION: Be prepared to collect escaping fuel.

15.  CAUTION: Be prepared to collect escaping fuel.

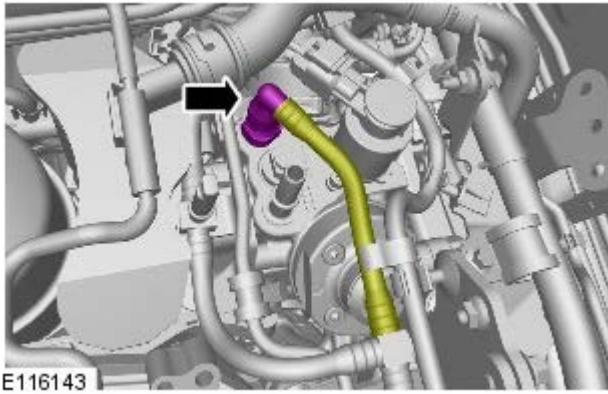


16.

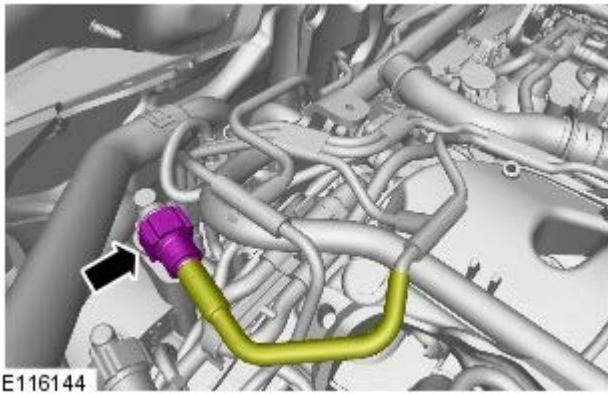


17.  CAUTION: Be prepared to collect escaping fuel.

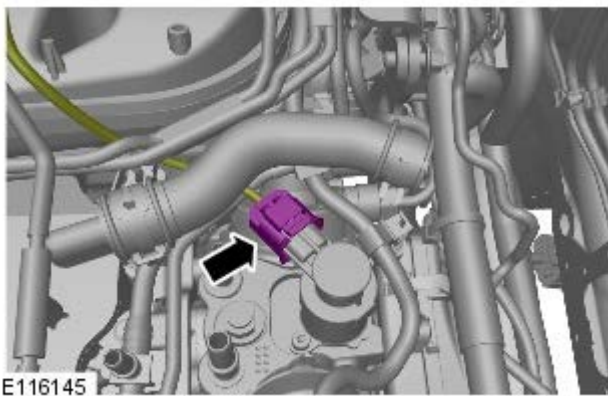
18.  CAUTION: Be prepared to collect escaping fuel.



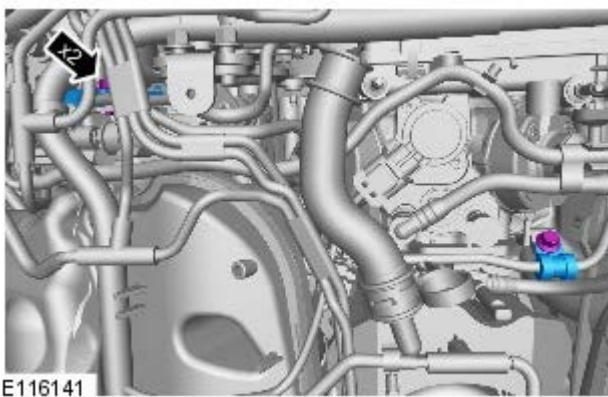
19.




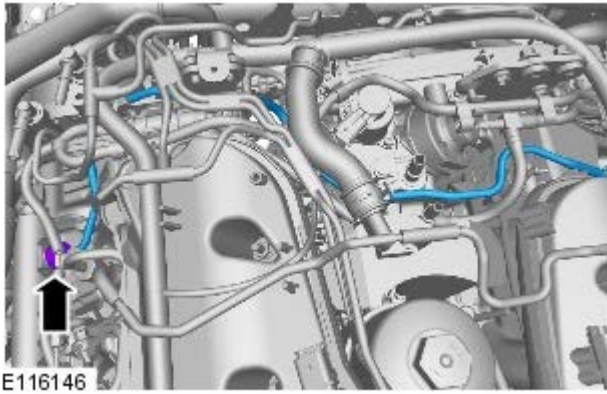
20.



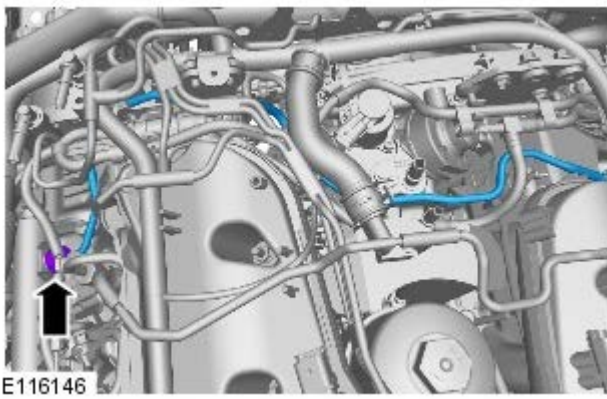
21.



22.  CAUTION: Be prepared to collect escaping fuel.



Installation

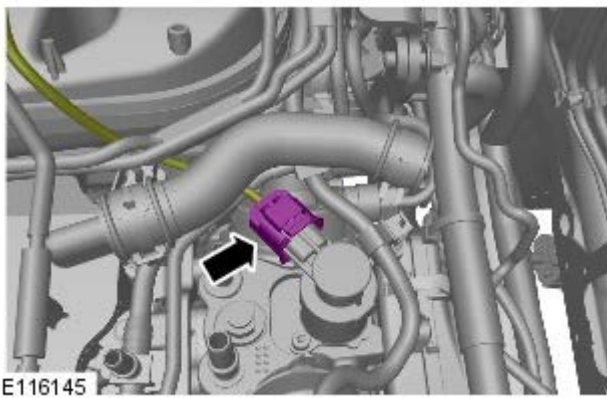


1. CAUTIONS:

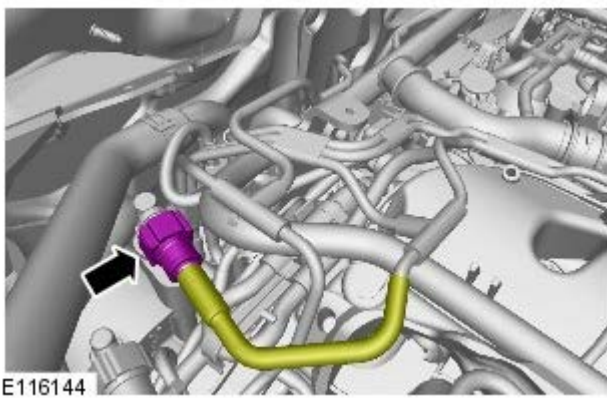
 Make sure that a new component is installed.

 Tighten the fuel supply line unions finger tight.

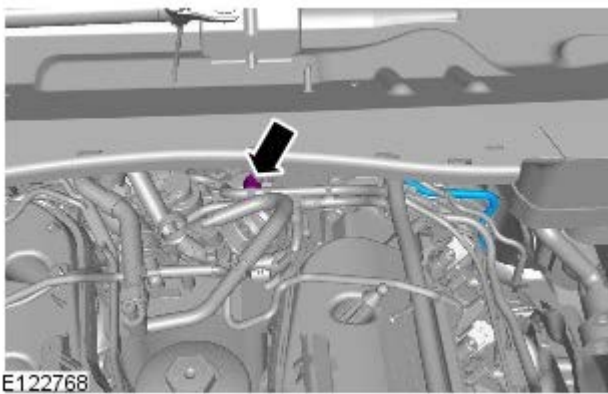
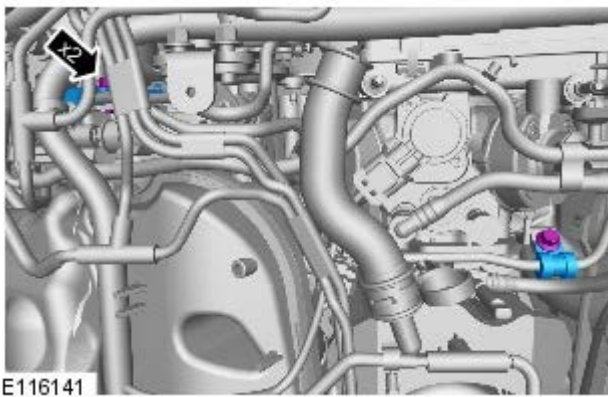
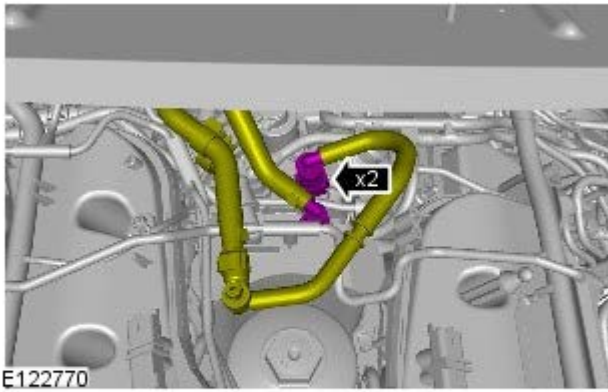
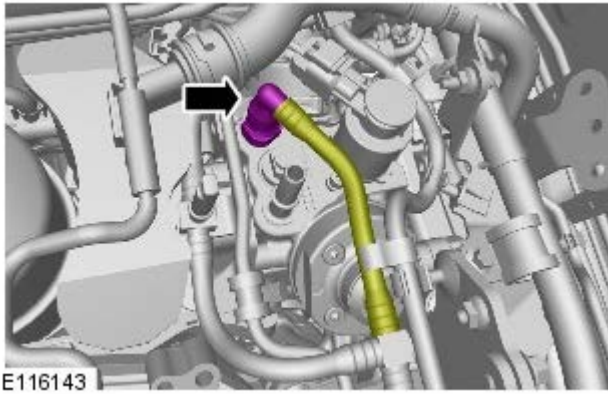
2.




3.




4.




5.

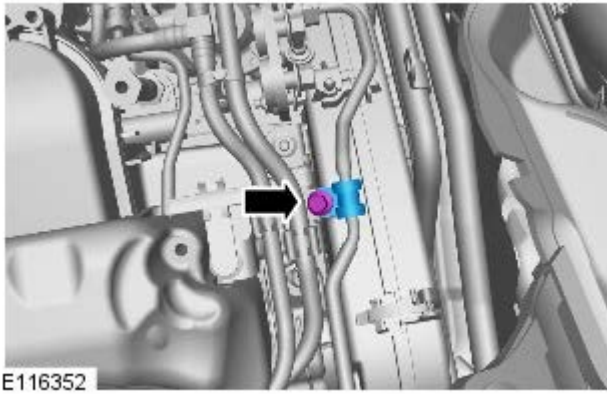
6.  CAUTION: Only tighten the bolts finger-tight at this stage.

7. CAUTIONS:

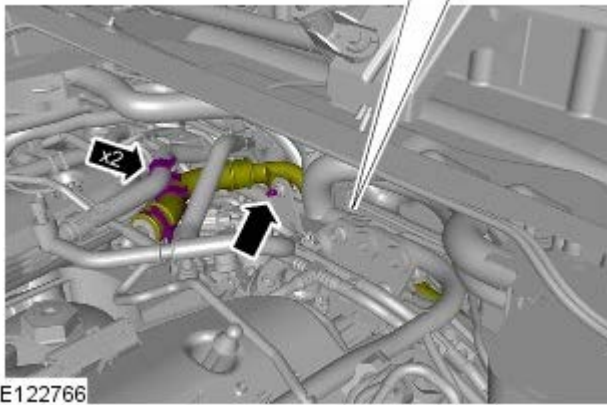
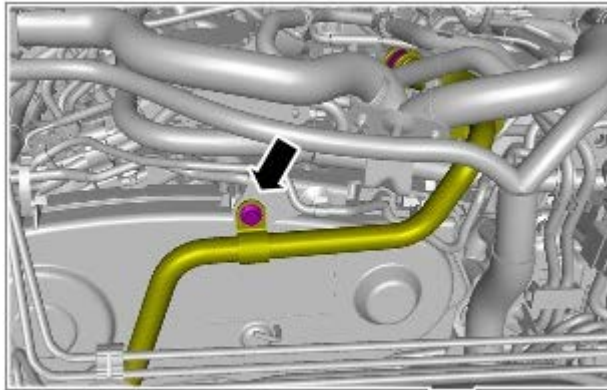
 Make sure that a new component is installed.

 Tighten the fuel supply line unions finger-tight.

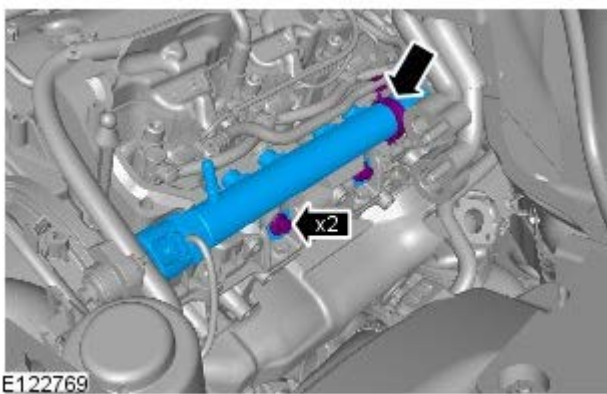
8.  CAUTION: Only tighten the bolts finger-tight at this stage.



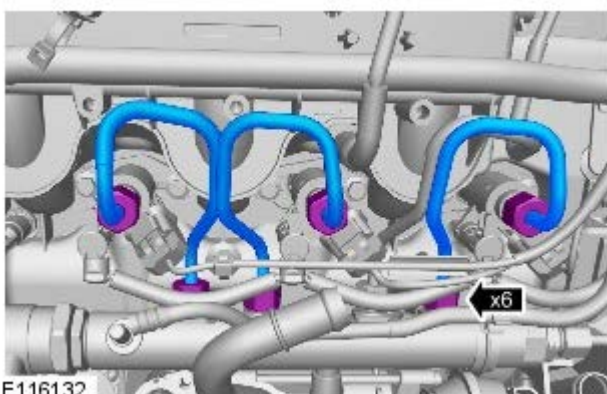
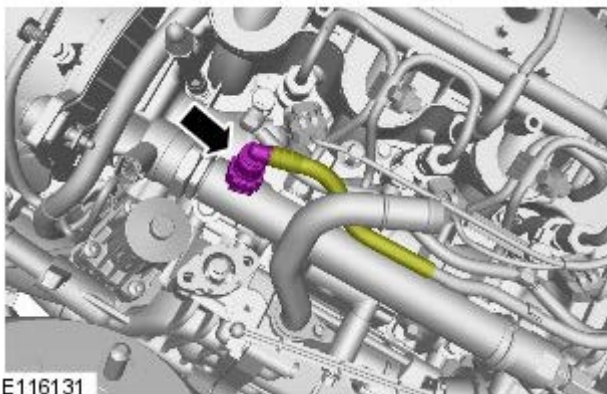
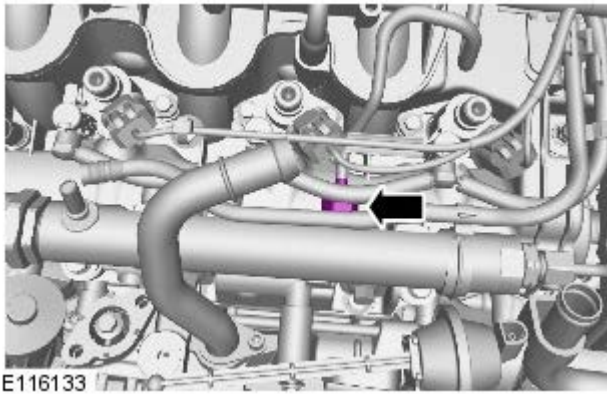
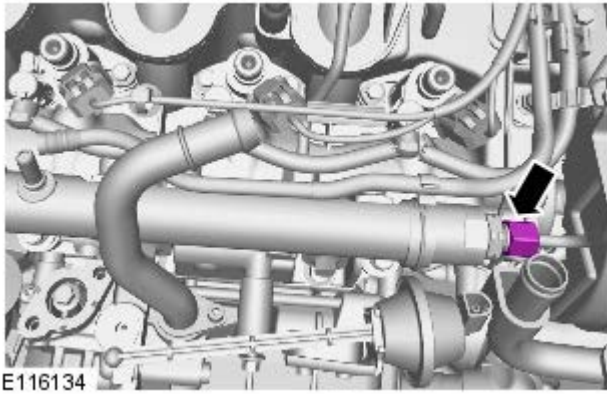
9. Torque: 10 Nm



10. Torque: 24 Nm




11.  CAUTION: Tighten the fuel supply line unions finger tight.




12.  CAUTION: Tighten the fuel supply line unions finger tight.

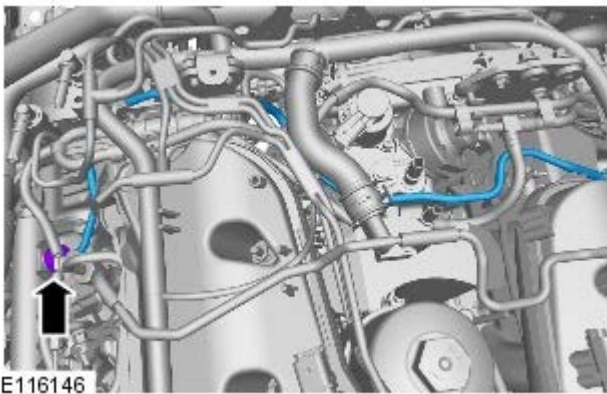
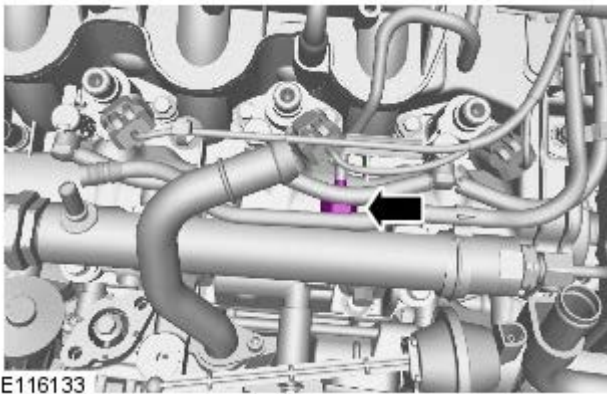
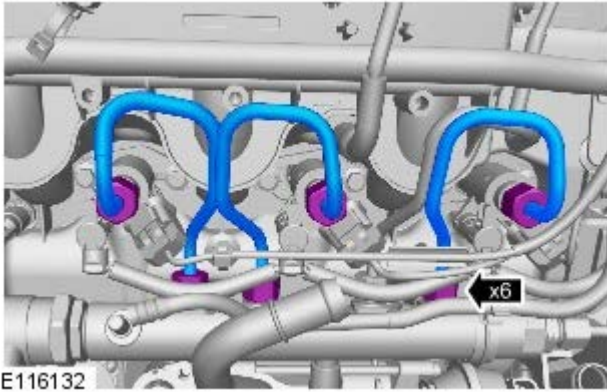
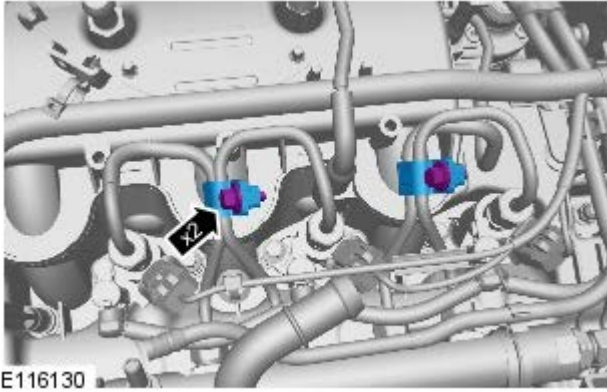
13.

14. CAUTIONS:

 Make sure that a new component is installed.

 Tighten the fuel supply line unions finger tight.

15.  CAUTION: Only tighten the bolt finger-tight at this stage.



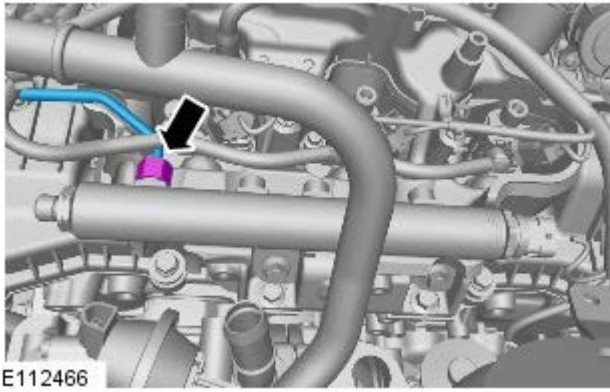
16.

- Stage 1: Tighten the high-pressure fuel supply line unions at the fuel rail to 15Nm.
- Stage 2: Tighten the high-pressure fuel supply line unions at the injector to 15Nm.

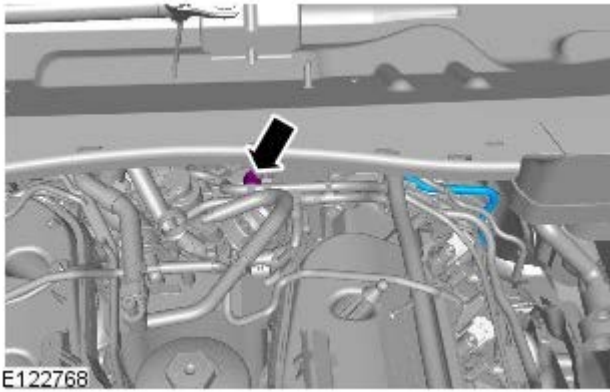
17. Tighten the high-pressure fuel lines union to 15Nm.

18. Tighten the high-pressure fuel lines union to 15Nm.

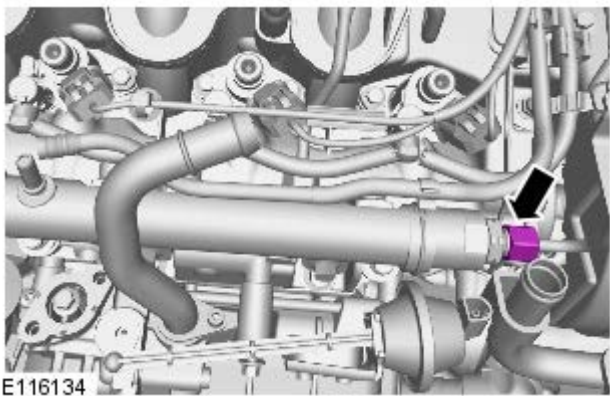
19. Tighten the high-pressure fuel lines union to 15Nm.



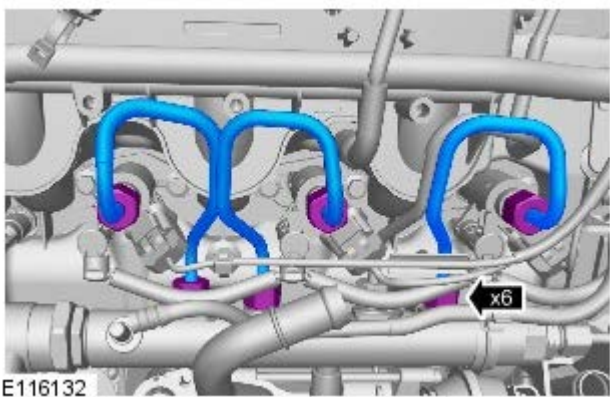
20. Tighten the high-pressure fuel lines union to 15Nm.



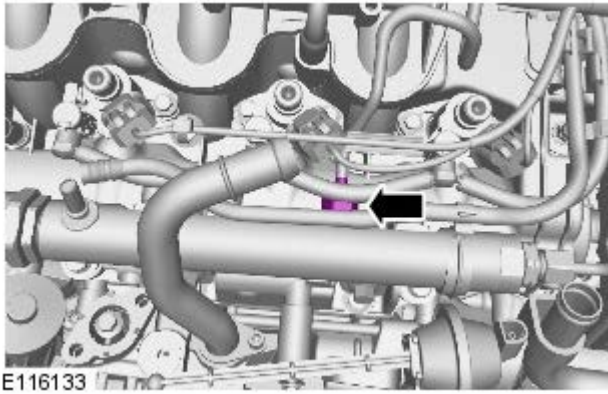
21. Tighten the high-pressure fuel lines union to 15Nm.



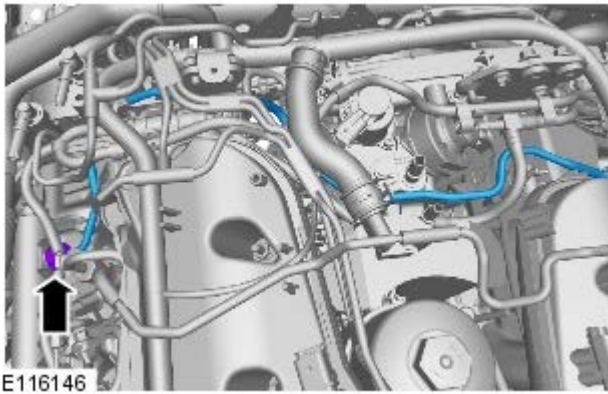
- 22.
- Stage 1: Tighten the high-pressure fuel supply line unions at the fuel rail to 35Nm.
 - Stage 2: Tighten the high-pressure fuel supply line unions at the injector to 35Nm.



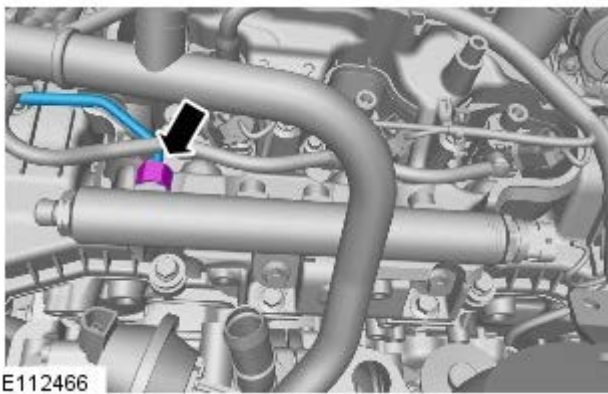
23. Tighten the high-pressure fuel line union to 30 Nm.



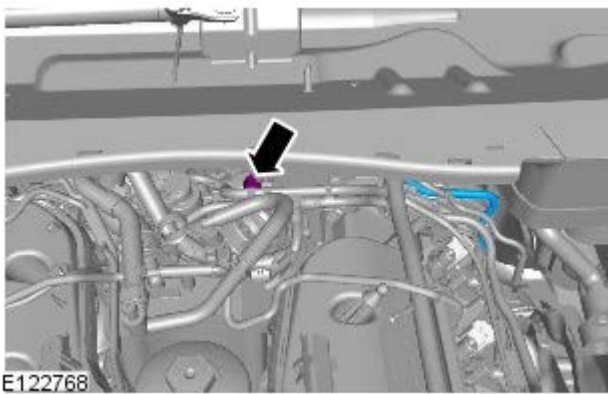
24. Tighten the high-pressure fuel line union to 30 Nm.



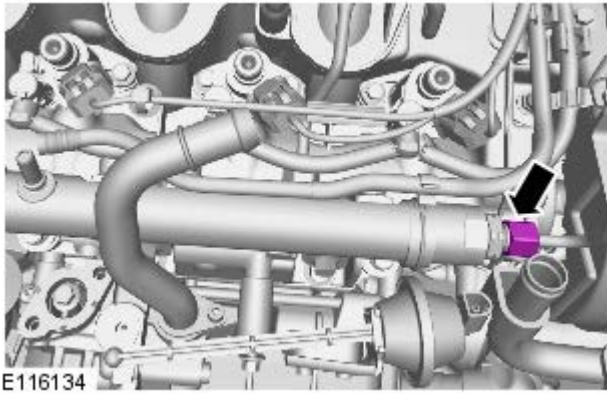
25. Tighten the high-pressure fuel line union to 30 Nm.



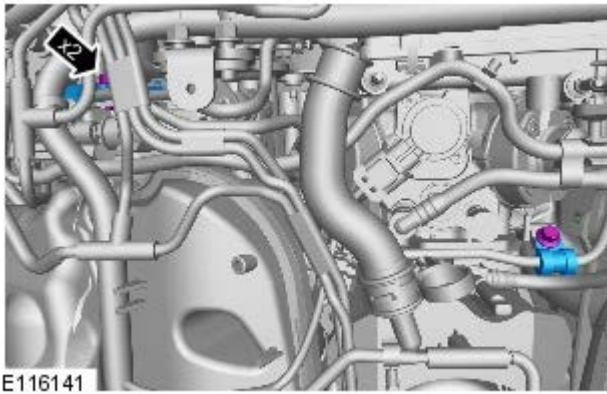
26. Tighten the high-pressure fuel line union to 30 Nm.



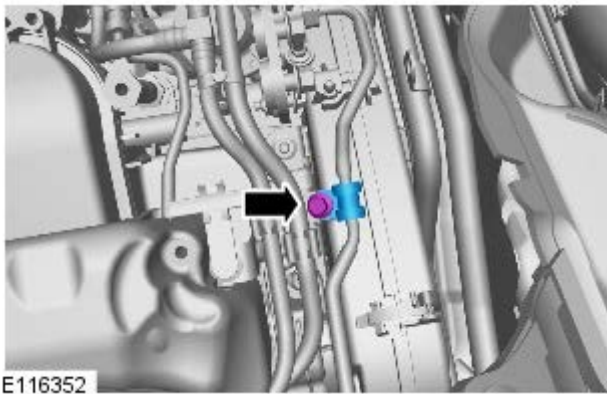
27. Tighten the high-pressure fuel line union to 30 Nm.



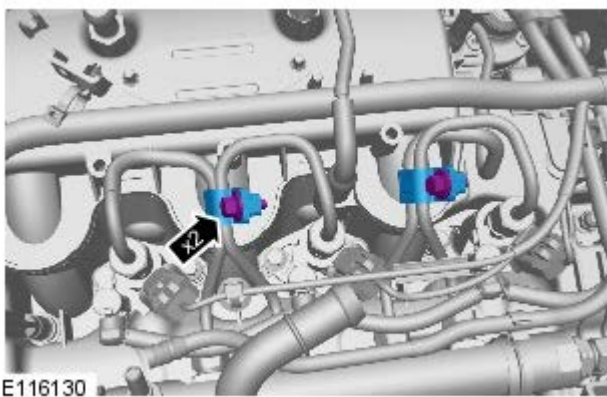
28. Torque: 10 Nm



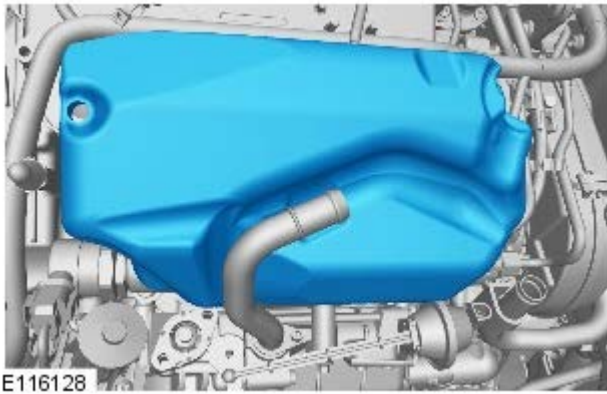
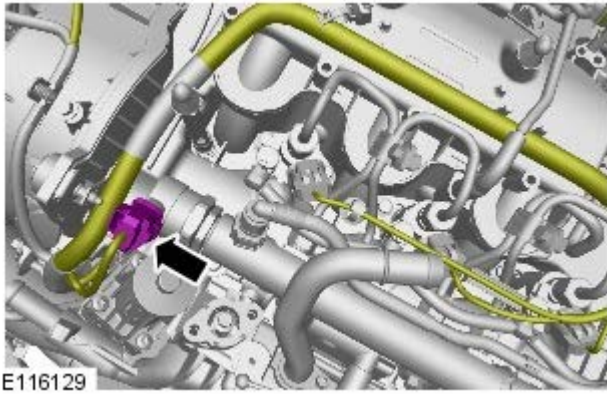
29. Torque: 10 Nm



30. Torque: 10 Nm

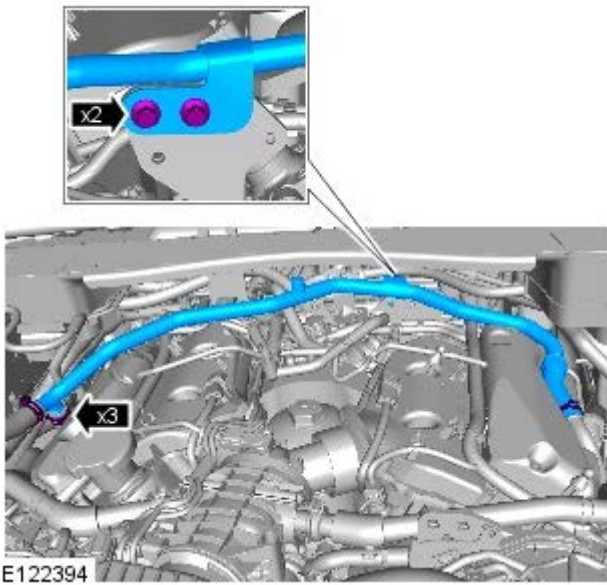


31.



32.  NOTE: Left-hand shown, right-hand similar.

33.



34. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

35. Connect the battery ground cable.

Fuel Charging and Controls - TDV6 3.0L Diesel - Fuel Rail RH

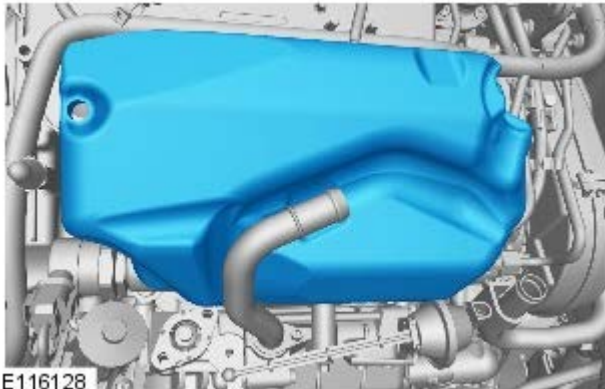
Removal and Installation

Removal

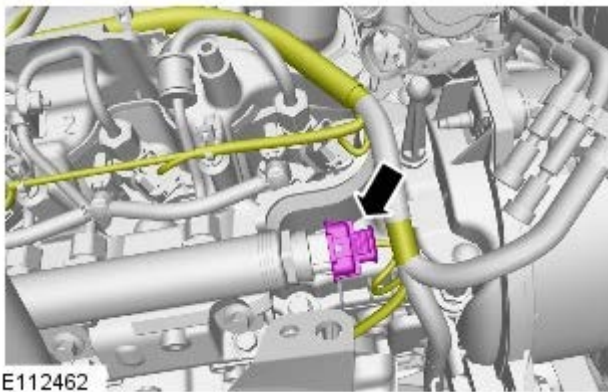


NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

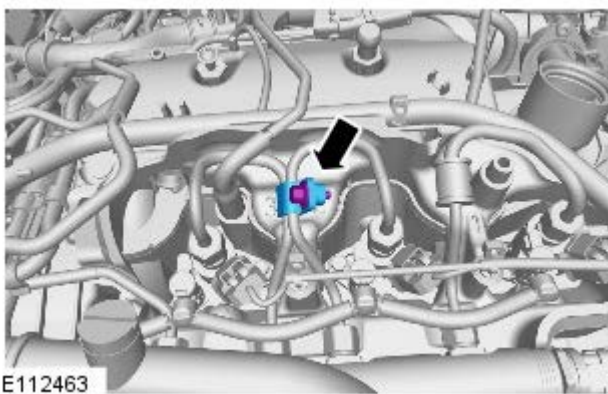
1. Disconnect the battery ground cable.
- 2.
3. Refer to: Fuel Injection Component Cleaning (303-04, General Procedures).



4.  NOTE: Left-hand shown, right-hand similar.



- 5.

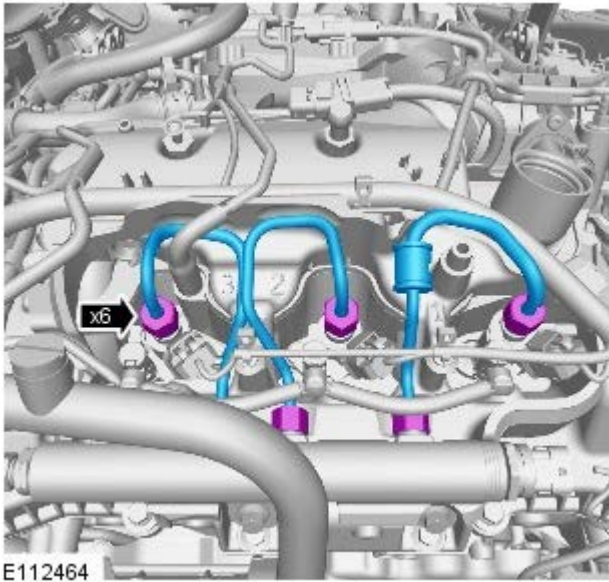



- 6.

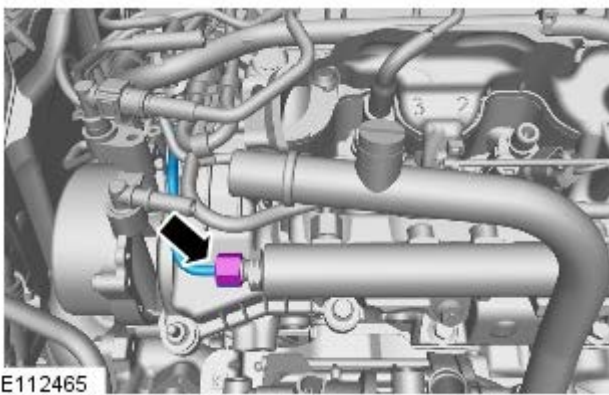
7. CAUTIONS:

 Be prepared to collect escaping fuel.

 Discard the component.




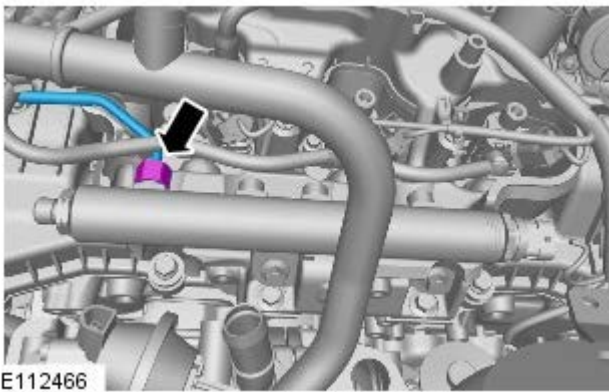
 Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.



8. CAUTIONS:


 Be prepared to collect escaping fuel.


 Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

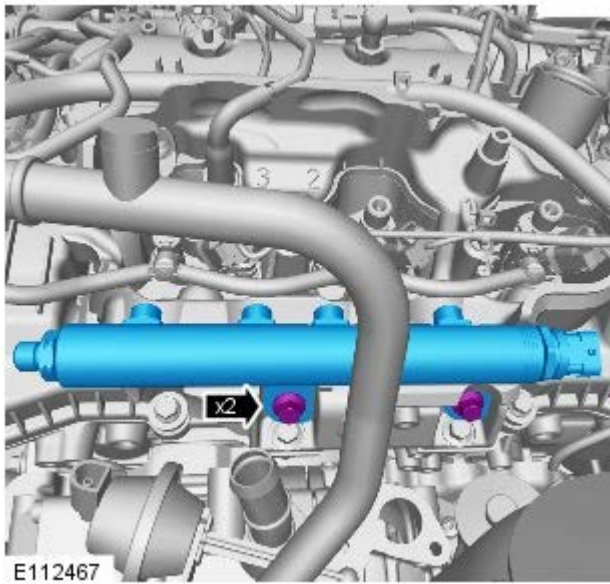


9. CAUTIONS:

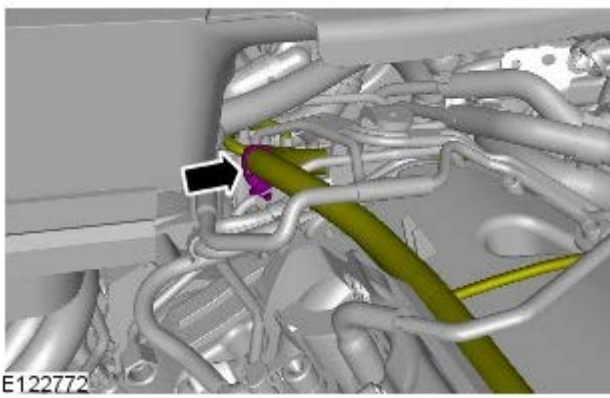
 Be prepared to collect escaping fuel.

 Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

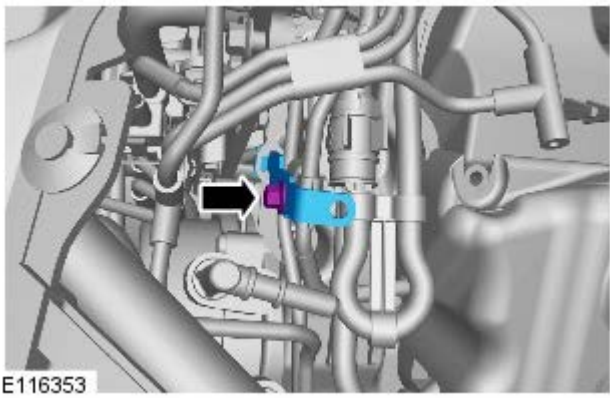
10.  CAUTION: Be prepared to collect escaping fuel.



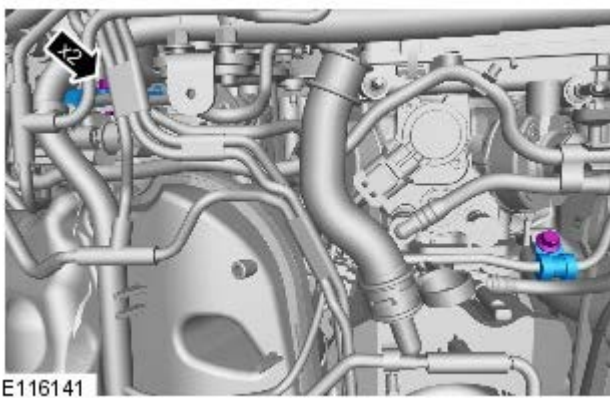
11.



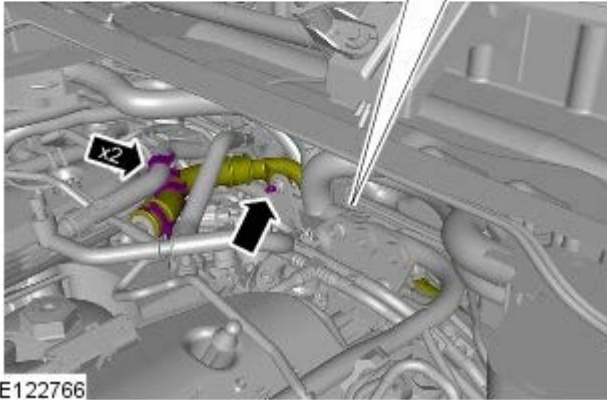
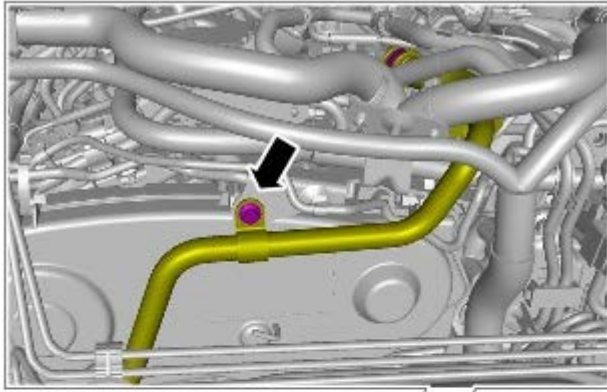
12.



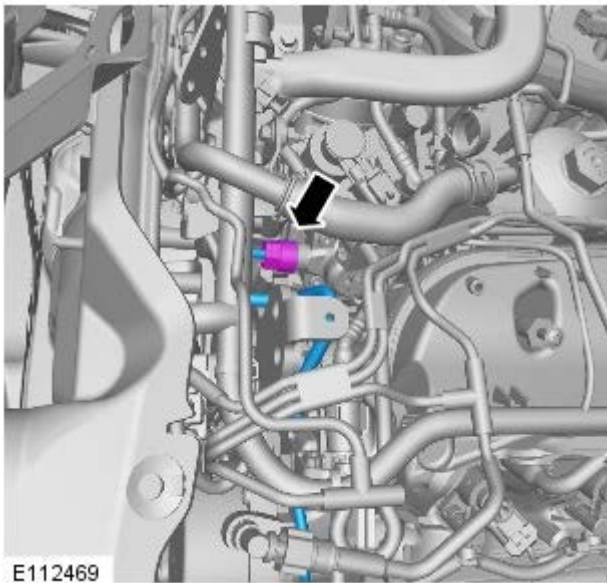
13.



14.



E122766




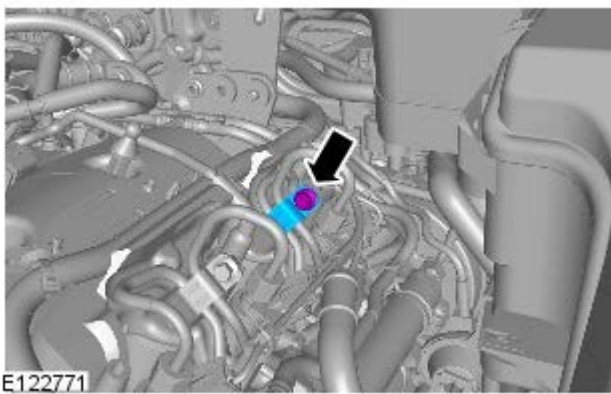
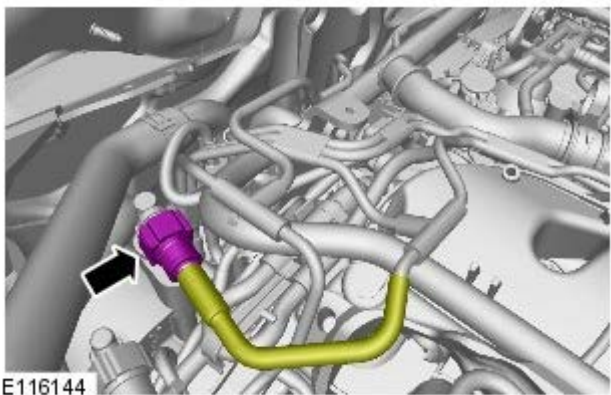
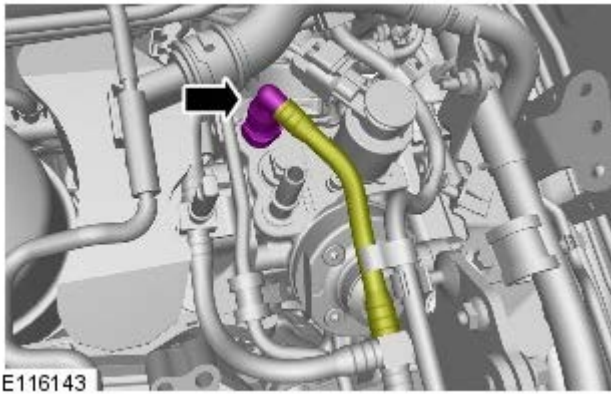
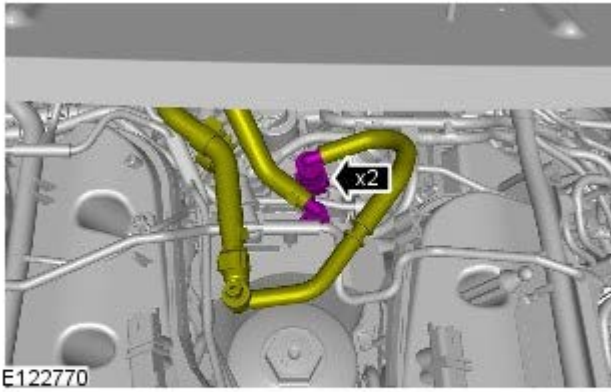
E112469


15. CAUTIONS:

 Be prepared to collect escaping fuel.

 Discard the component.

16.  CAUTION: Be prepared to collect escaping fuel.

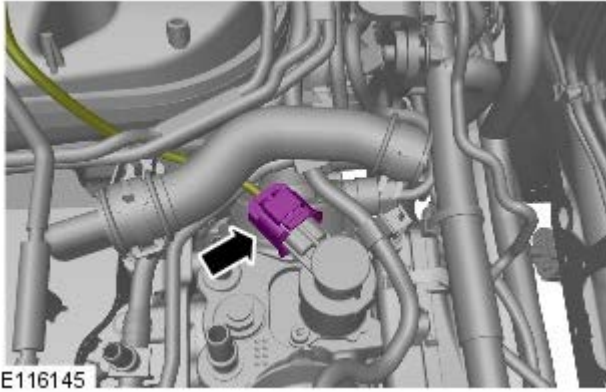


17.  CAUTION: Be prepared to collect escaping fuel.

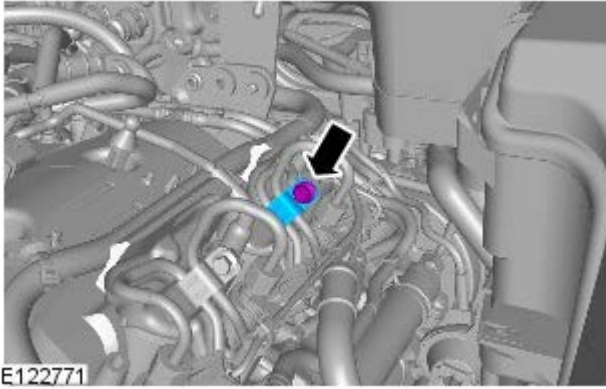
18.

19.

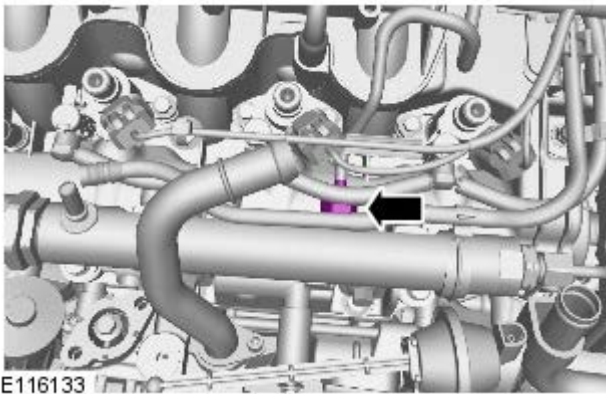
20.



21.



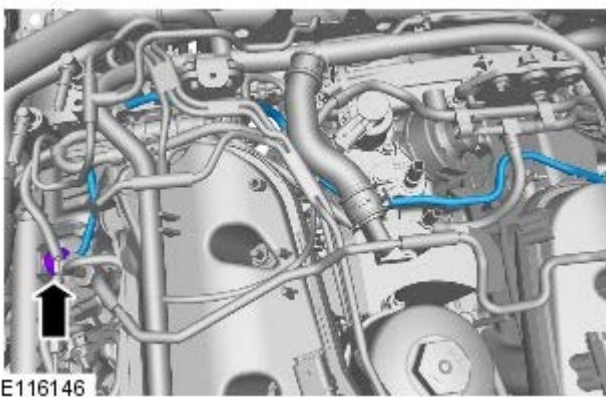
22.



23. CAUTIONS:


 Be prepared to collect escaping fuel.

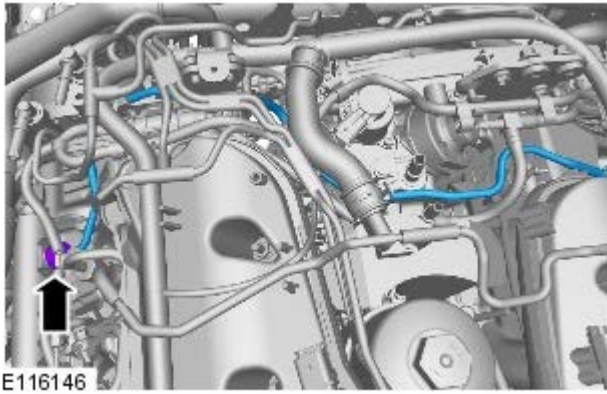
 Discard the component.



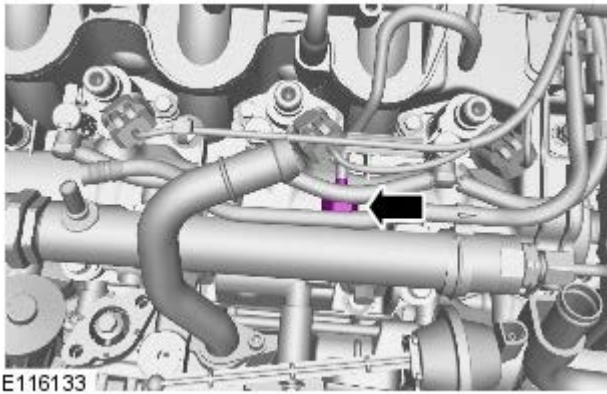
Installation


1. CAUTIONS:

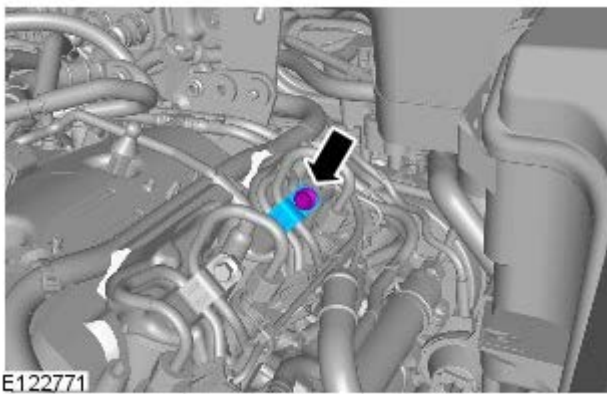
 Make sure that a new component is installed.




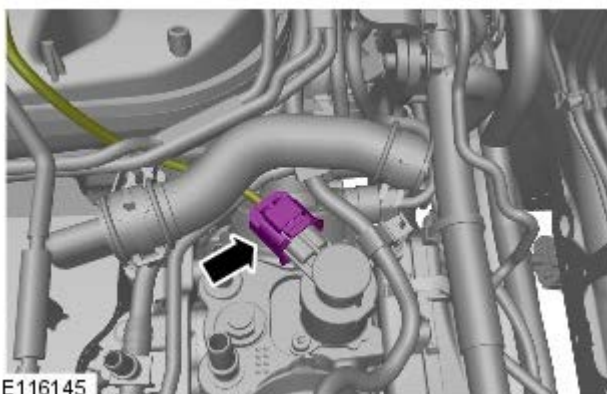
 Tighten the fuel supply line unions finger tight.



2.  CAUTION: Only tighten the unions finger-tight at this stage.

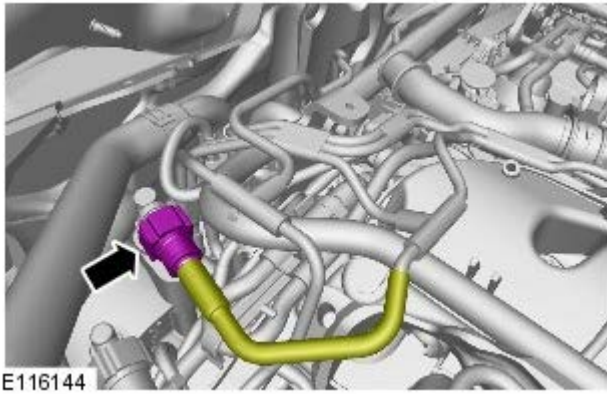


3.  CAUTION: Only tighten the bolt finger-tight at this stage.

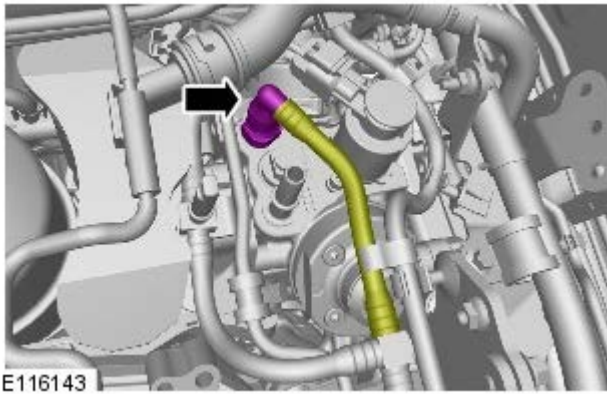


4.

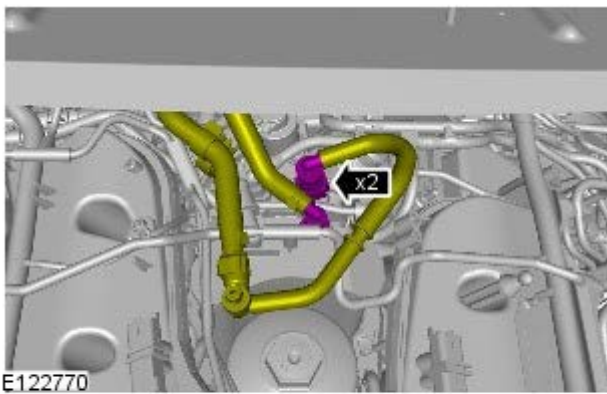
5.




6.



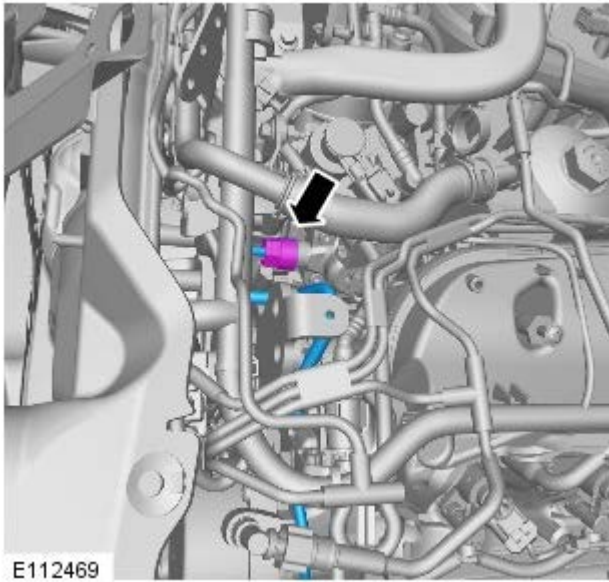
7.



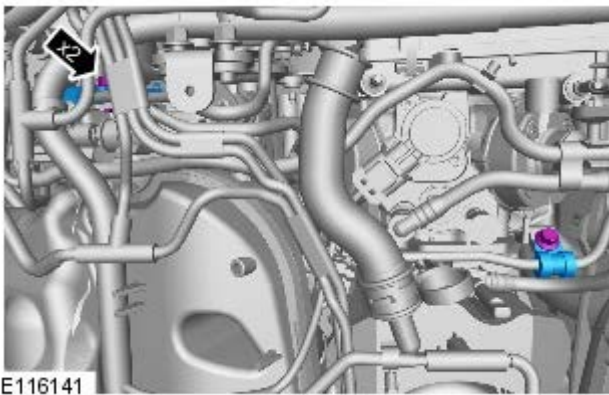
8. CAUTIONS:

 Make sure that a new component is installed.

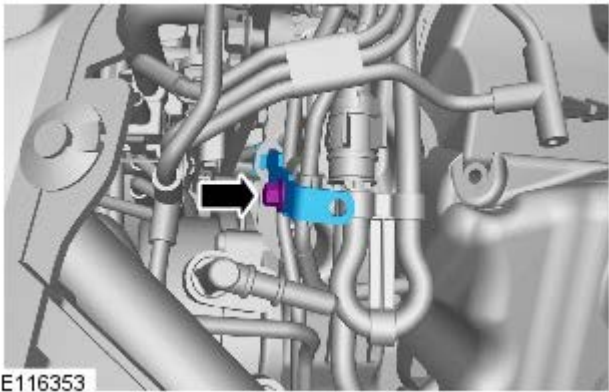
 Tighten the fuel supply line unions finger tight.



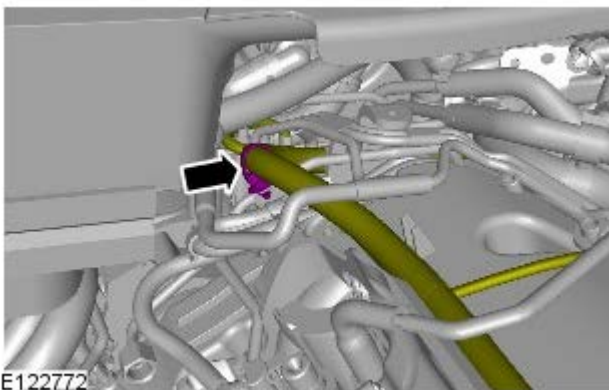
E112469




E116141




E116353



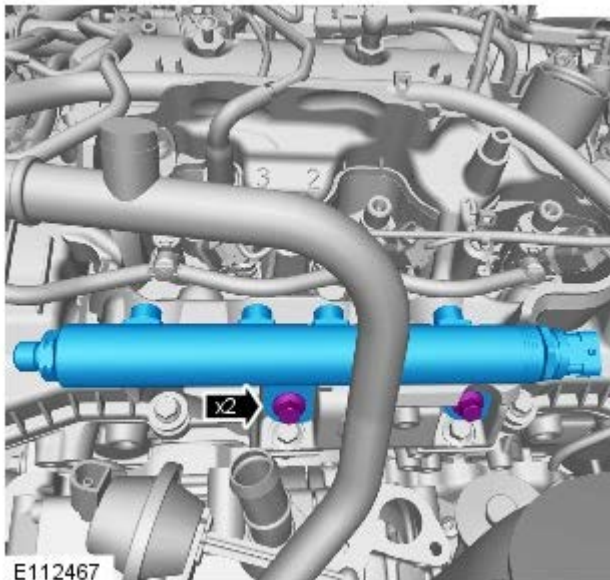
E122772

9.  CAUTION: Only tighten the bolts finger-tight at this stage.

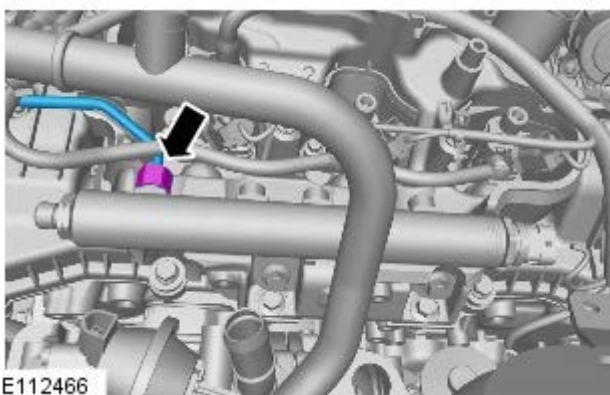
10.  CAUTION: Only tighten the bolts finger-tight at this stage.

11.

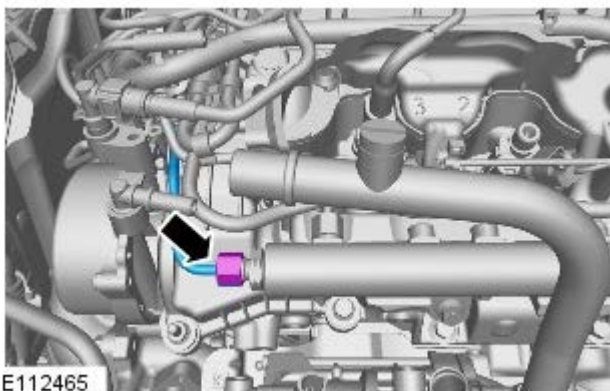
12. Torque: 24 Nm



E112467




E112466




E112465


13. CAUTIONS:

 Tighten the fuel supply line unions finger tight.

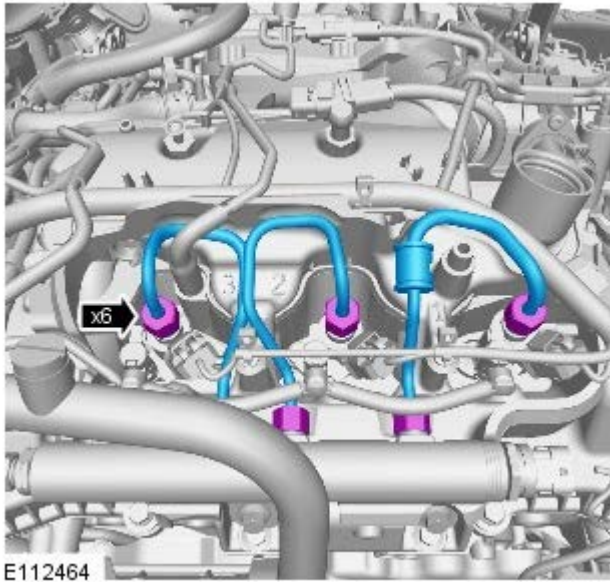
 Make sure that a new component is installed.

14.  CAUTION: Tighten the fuel supply line unions finger tight.

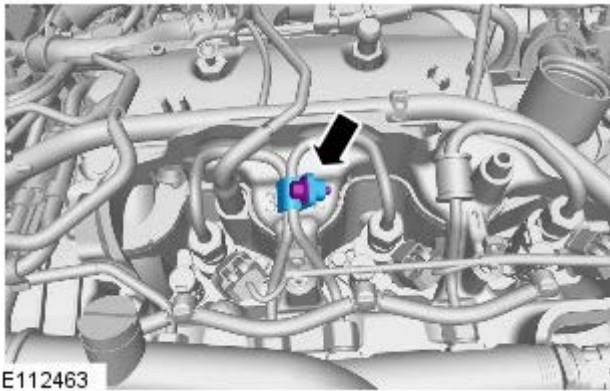
15. CAUTIONS:

 Make sure that a new component is installed.

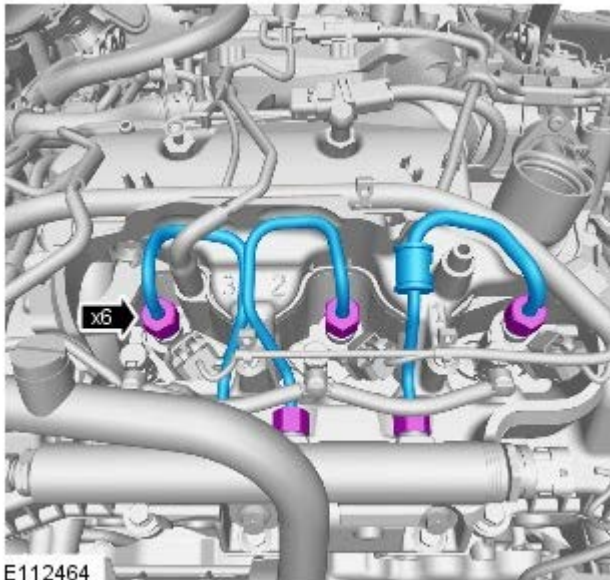
 Tighten the fuel supply line unions finger tight.




E112464



E112463

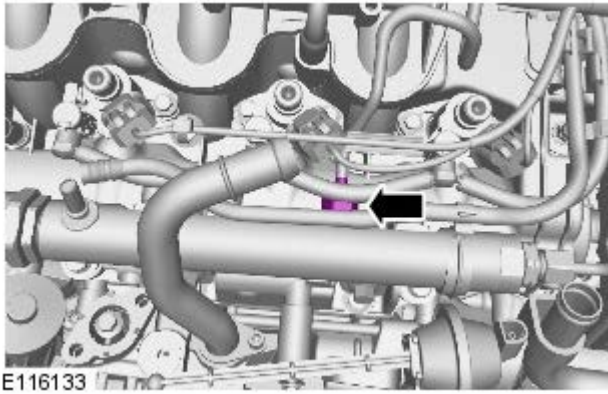


E112464

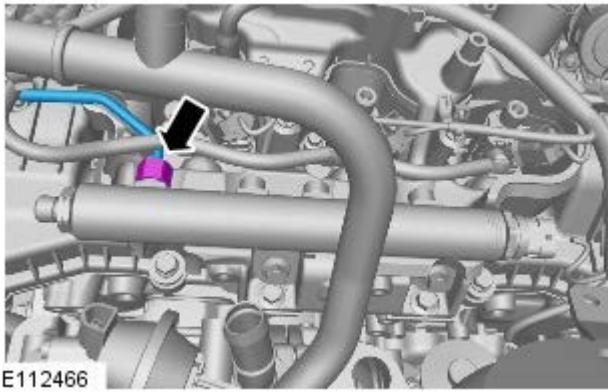
16.  CAUTION: Only tighten the bolt finger-tight at this stage.

- 17.
- Stage 1: Tighten the high-pressure fuel supply line unions at the fuel rail to 15Nm.
 - Stage 2: Tighten the high-pressure fuel supply line unions at the injector to 15Nm.

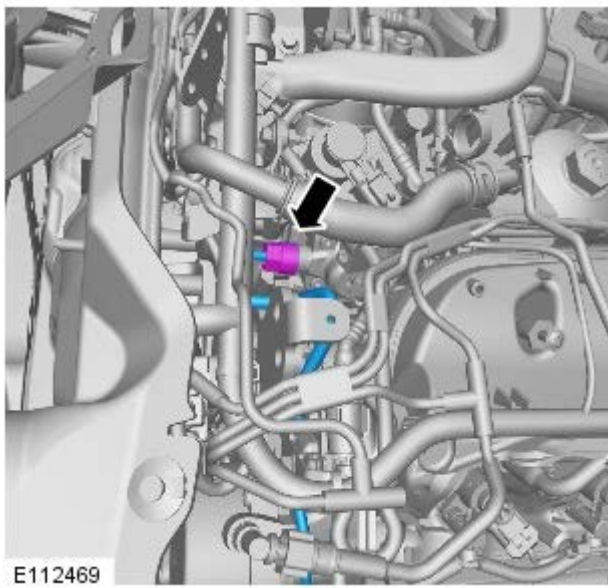
18. Tighten the high-pressure fuel lines union to 15Nm.



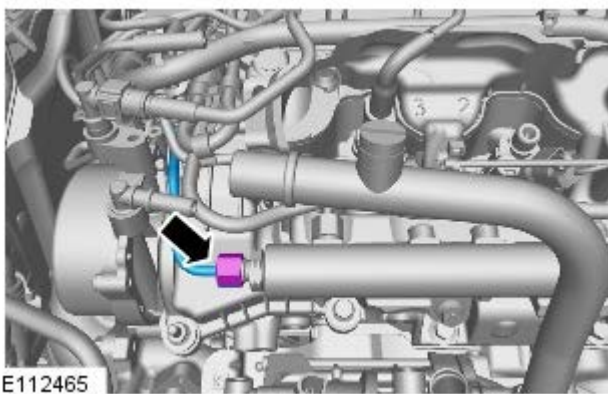
19. Tighten the high-pressure fuel lines union to 15Nm.



20. Tighten the high-pressure fuel lines union to 15Nm.

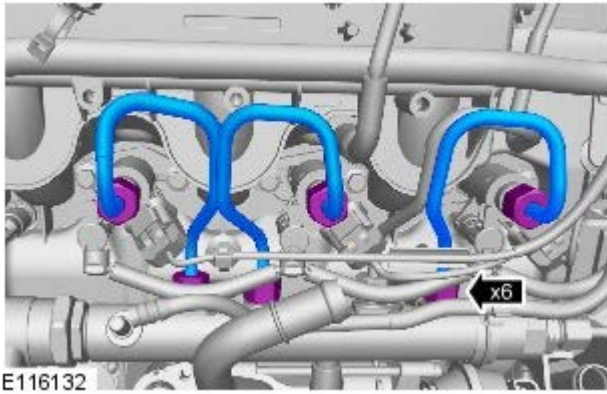


21. Tighten the high-pressure fuel lines union to 15Nm.

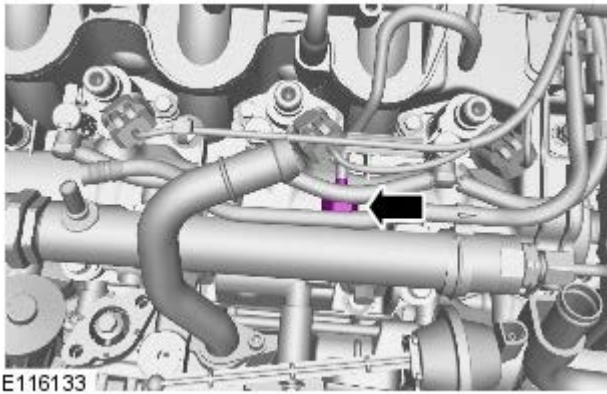


22.

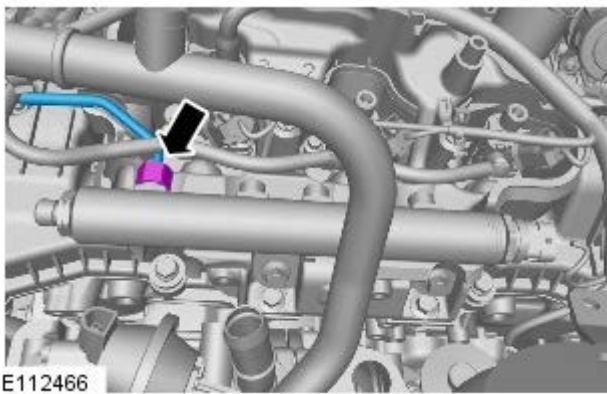
- Stage 1: Tighten the high-pressure fuel supply line unions at the fuel rail to



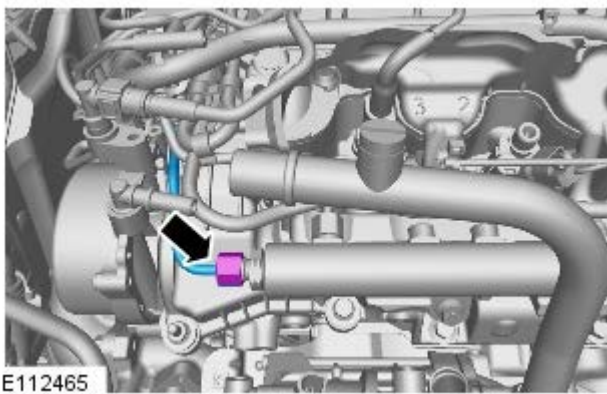
- 35Nm.
- Stage 2: Tighten the high-pressure fuel supply line unions at the injector to 35Nm.



- 23. Tighten the high-pressure fuel line union to 30Nm.

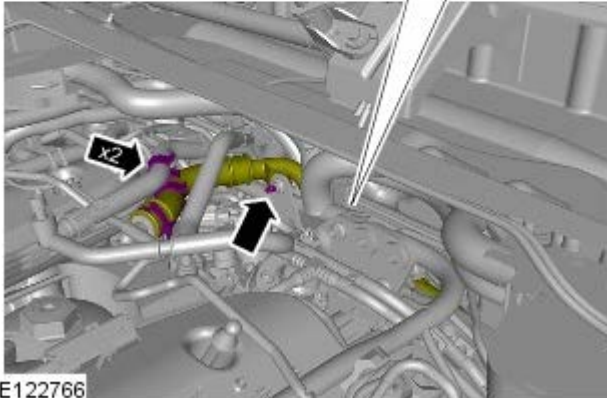
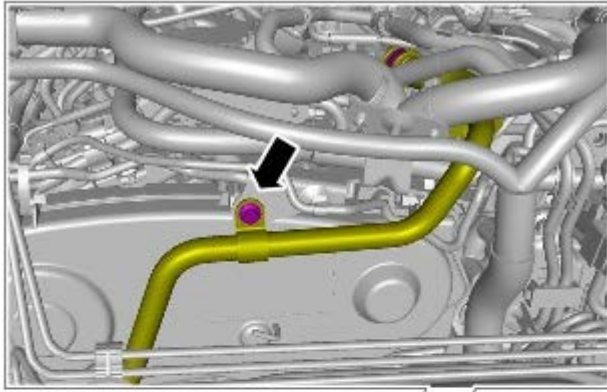


- 24. Tighten the high-pressure fuel line union to 30Nm.



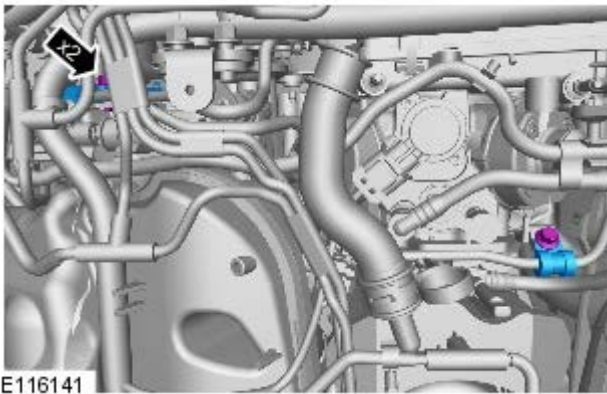
- 25. Tighten the high-pressure fuel line union to 30Nm.

- 26.



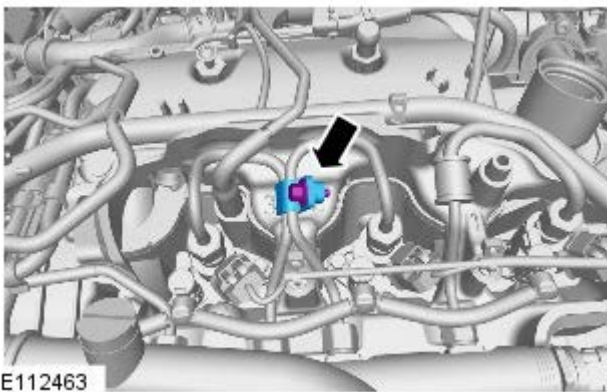
E122766

27. Torque: 10 Nm



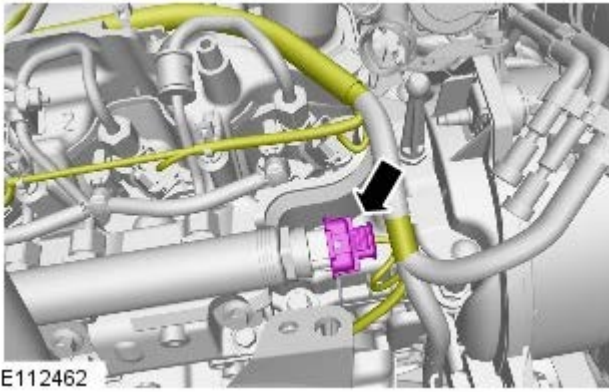
E116141

28. Torque: 10 Nm

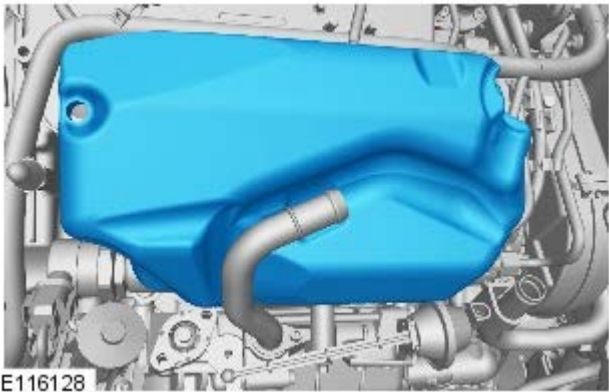


E112463

29.



E112462



E116128

30.  NOTE: Left-hand shown, right-hand similar.

31.

32. Connect the battery ground cable.

Fuel Charging and Controls - TDV6 3.0L Diesel - Intake Air Shutoff Throttle

Removal and Installation

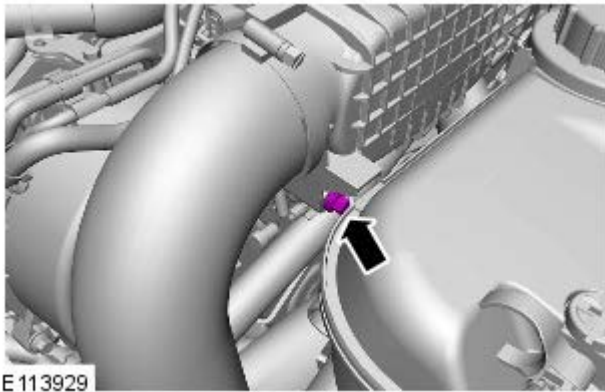
Removal



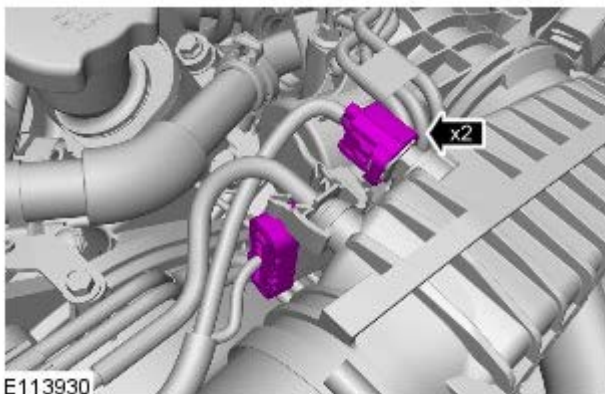
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Engine Cover - 3.0L V6 - TdV6 (501-05 Interior Trim and Ornamentation, Removal and Installation).

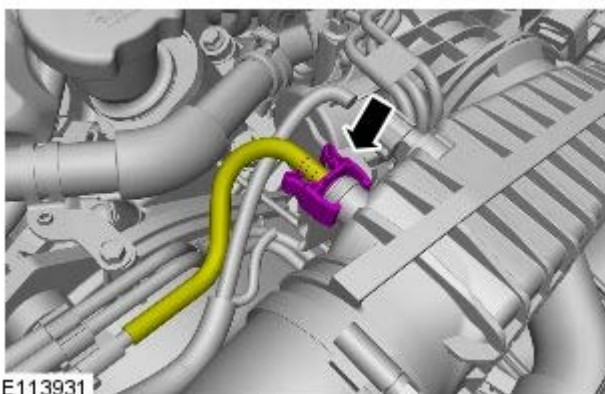
2. Torque: 10 Nm



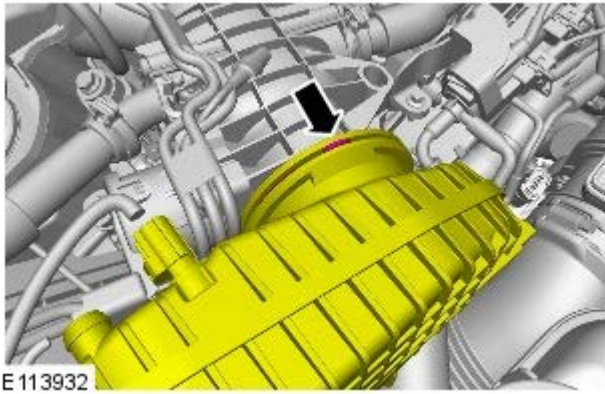
- 3.



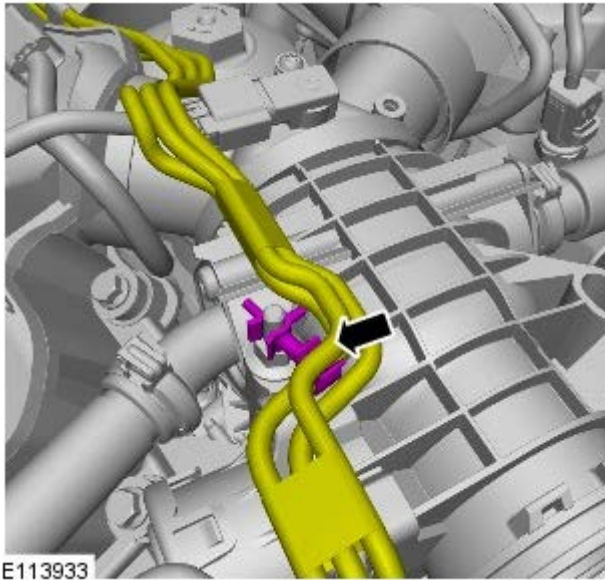
- 4.



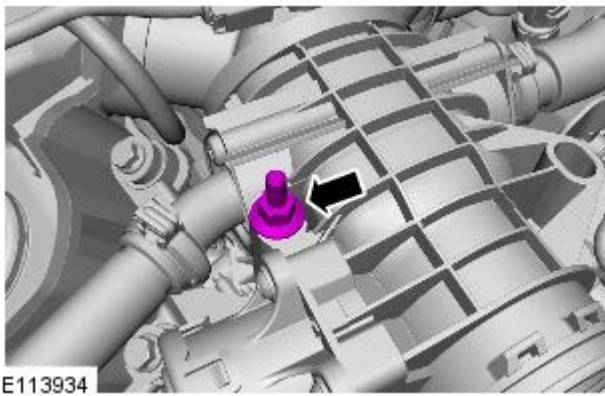
- 5.



6.



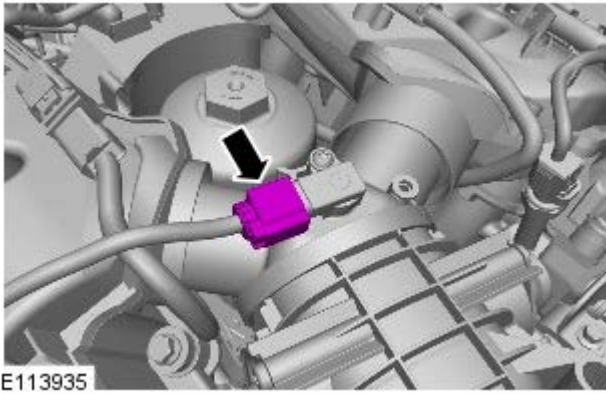
7. Torque: 10 Nm



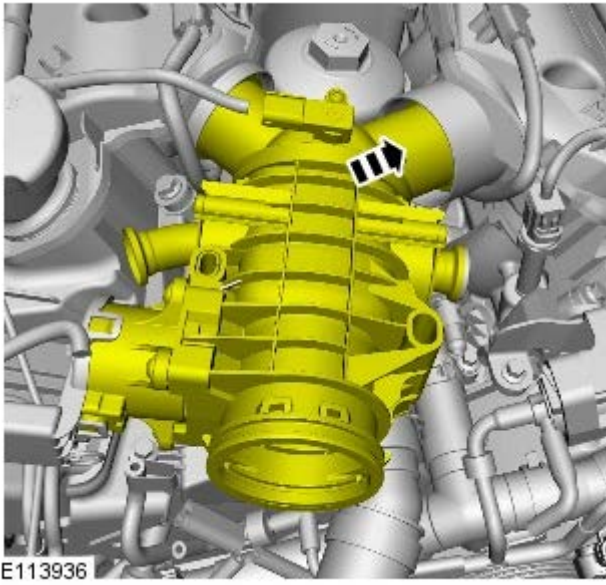
8. Refer to: Exhaust Gas Recirculation (EGR) Valve Outlet Tube LH (303-08 Engine Emission Control - 3.0L V6 - TdV6, Removal and Installation).

9. Refer to: Exhaust Gas Recirculation (EGR) Valve Outlet Tube RH (303-08 Engine Emission Control - 3.0L V6 - TdV6, Removal and Installation).

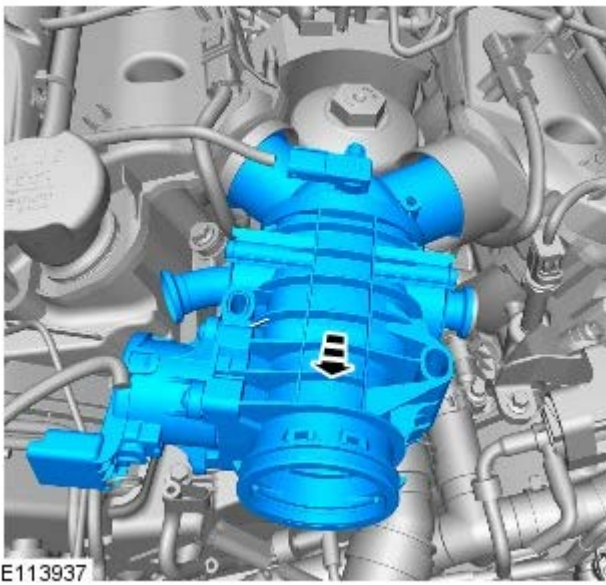
10.



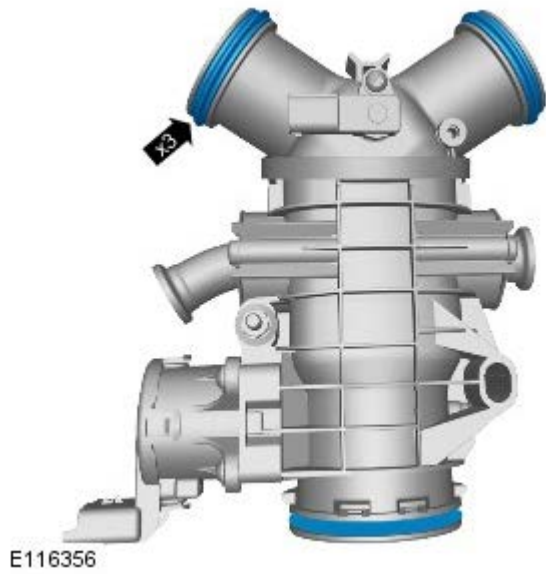
11.



12.



13.  CAUTION: Install the new seals.



E116356

Installation

1. To install, reverse the removal procedure.
2. If a new unit is installed, configure using the approved diagnostic tool.

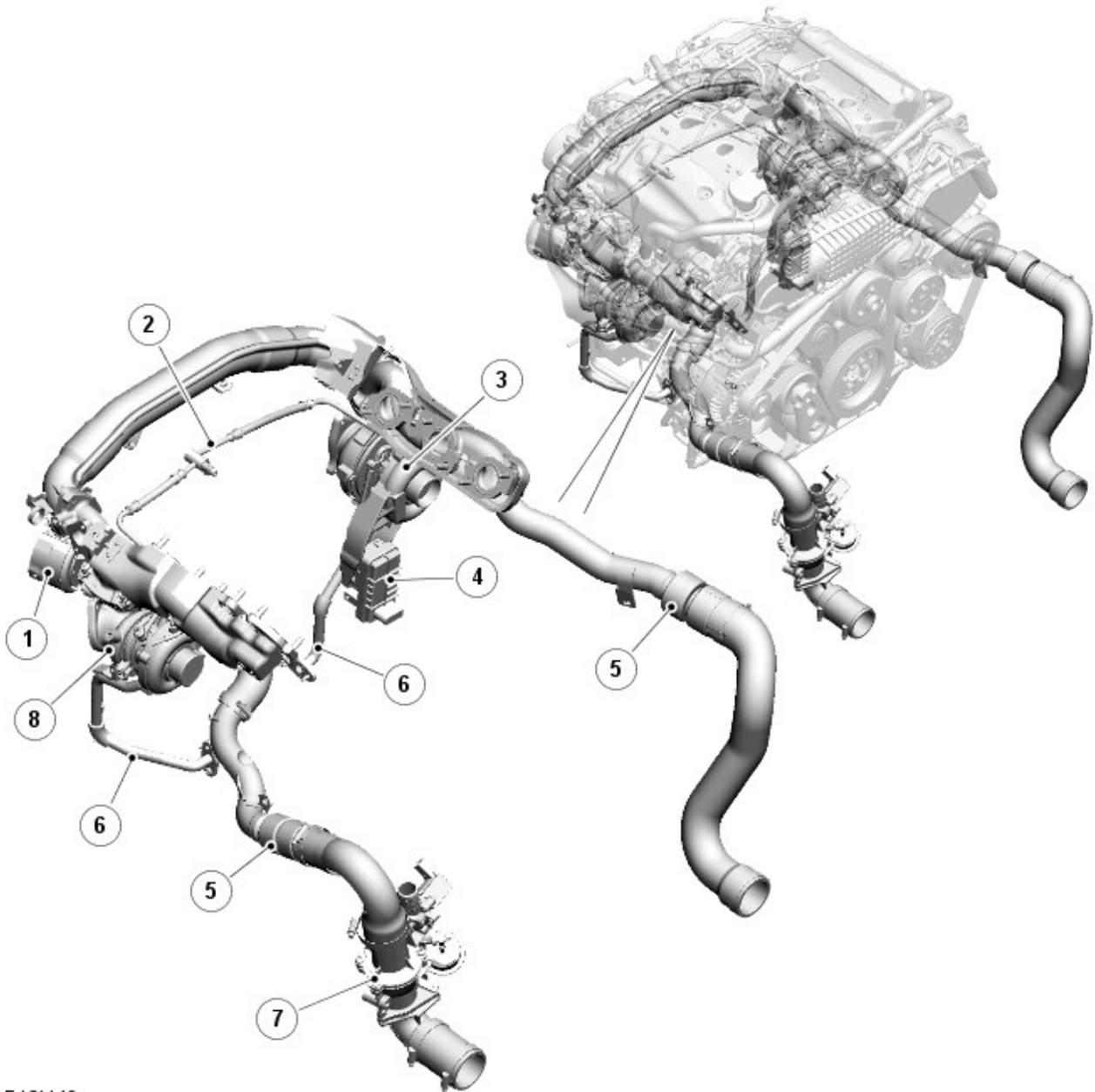
Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel -**Torque Specification**

Description	Nm	lb-ft	lb-in
Exhaust manifold threaded stud	13	10	-
Exhaust manifold retaining nuts	24	18	-
Turbocharger oil return tube to turbocharger retaining bolt	9	-	80
Turbocharger oil return tube to engine retaining bolt	9	-	80
Turbocharger bracket retaining bolts	23	17	-
Turbocharger to exhaust manifold retaining nuts	24	18	-
Exhaust manifold heatshield retaining bolt	11	8	-
Exhaust heatshield retaining bolt	9	-	80
Exhaust heatshield retaining nut	10	-	7
Turbocharger oil supply tube retaining bolt	9	-	80
Turbocharger oil supply tube union bolt	30	22	-
Exhaust gas recirculation (EGR) valve retaining bolts	9	-	80
EGR valve tube to exhaust manifold retaining bolts	9	-	80

Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel - Turbocharger - Component Location

Description and Operation

COMPONENT LOCATION



E121149

Item Description

- 1 Secondary turbocharger turbine shut-off valve
- 2 Turbocharger oil supply
- 3 Primary turbocharger (variable vane)
- 4 Primary turbocharger control module (variable vane actuator)
- 5 Charge air tube
- 6 Turbocharger oil drain
- 7 Secondary turbocharger recirculation valve and shut-off valve
- 8 Secondary turbocharger (fixed vane)

Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel - Turbocharger - Overview

Description and Operation

INTRODUCTION

The 3.0L V6 diesel engine uses two turbochargers; a fixed vane type (secondary) and a variable vane (primary) type. The fixed vane turbocharger is fitted to the **RH (right-hand)** cylinder bank and the variable vane turbocharger is fitted to the **LH (left-hand)** cylinder bank.

Both turbochargers are used in a parallel sequential turbocharging system which enables the engine to achieve quick throttle response at low engine speeds and efficient use of exhaust gas energy at high engine speeds.

The variable vane turbocharger has an **ECM (engine control module)** controlled electronic rotary actuator. The rotary actuator adjusts the turbine vanes to optimize the exhaust gas flow and velocity onto the turbine wheel to maintain the required boost pressure.

The parallel sequential turbocharging system comprises the two turbochargers and the **ECM**. The primary variable nozzle turbine operates through the entire engine speed range but is at its most efficient at engine speeds of up to 2800 rpm. At engine speeds above 2800 rpm under load, the fixed vane secondary turbine comes into operation, with both of the turbochargers now running in a parallel bi-turbo mode.

Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel - Turbocharger - System Operation and Component Description

Description and Operation

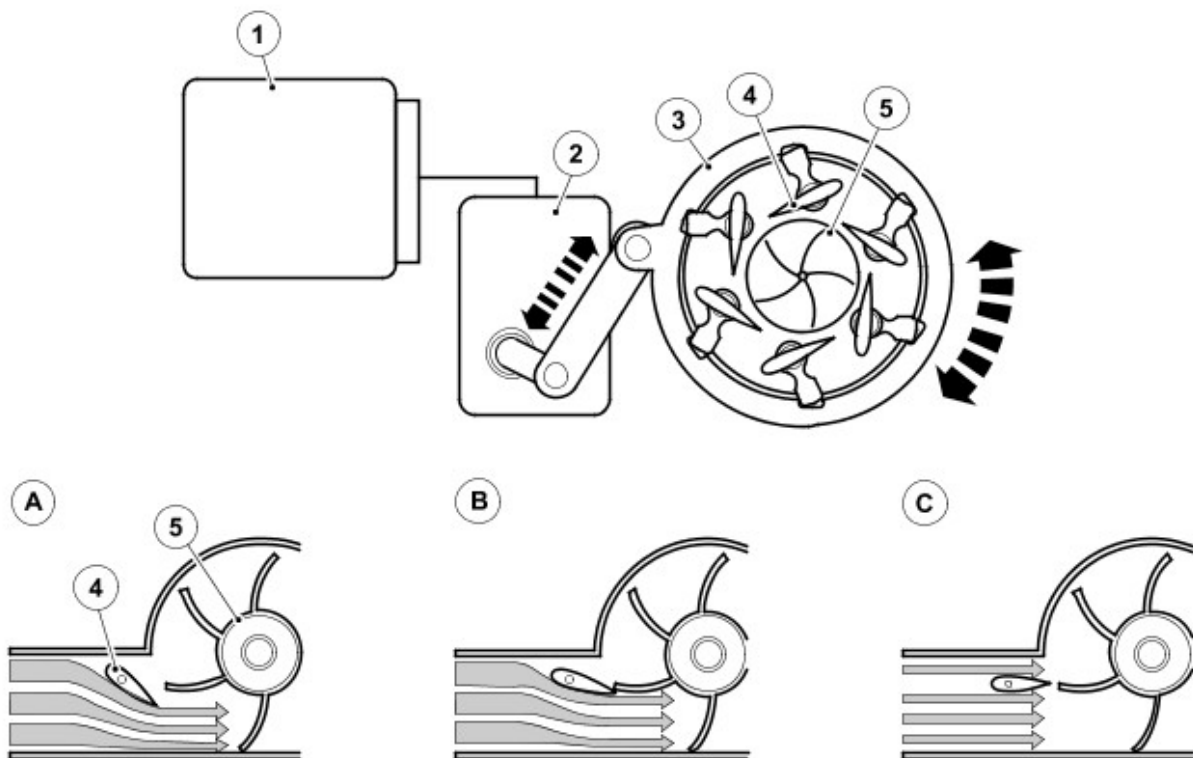
System Operation

TURBOCHARGERS

The turbine wheel of the turbocharger uses the engine's exhaust gasses to drive the compressor wheel. The compressor wheel draws in fresh air which is supplied to the engine cylinders in a compressed form.

The primary variable vane turbocharger allows the optimum inlet geometry (inlet area and flow angle) to be used over a wide range of engine operating conditions. This allows a rapid speed of response and higher boost pressures at low engine speeds. The variable vane angle determines both the inlet area as well as the flow angle, as controlled by the [ECM \(engine control module\)](#). The variable vanes allow efficient use of the exhaust gas energy which in turn improves turbocharger and engine efficiency.

Principles of Variable Vane Operation



E107579

Item Description

- A Low engine speed
- B Intermediate engine speed
- C High engine speed
- 1 [ECM](#)
- 2 Electronic rotary actuator
- 3 Turbine housing
- 4 Variable vanes
- 5 Compressor wheel

The variable vanes in the primary turbocharger are controlled by the [ECM](#). The [ECM](#) controls a rotary electronic actuator attached to the primary turbocharger which is used to adjust the pitch angle of the vanes by rotating the turbine housing. The electronic rotary actuator also provides the [ECM](#) with a feedback signal to determine the pitch angle of the vanes.

The variable vanes in the primary turbocharger improve the exhaust gas power transfer to the turbine wheel which in turn drives the compressor wheel. At low engine speeds this greatly assists the increase in turbocharger boost pressure.

As engine speed, and therefore the exhaust gas velocity, increases, the vanes are opened. The amount of opening is determined by the [ECM](#) to ensure that the power transfer from the turbine wheel to the compressor wheel is within the turbocharger speed and boost pressure requirements.

At high engine speed and exhaust gas flow, the [ECM](#) increases the vane opening to avoid overspeed of the turbines and provide a smooth high speed operation. At this point the dual mode boosting system comes into affect by

utilizing the secondary (fixed vane) turbocharger.

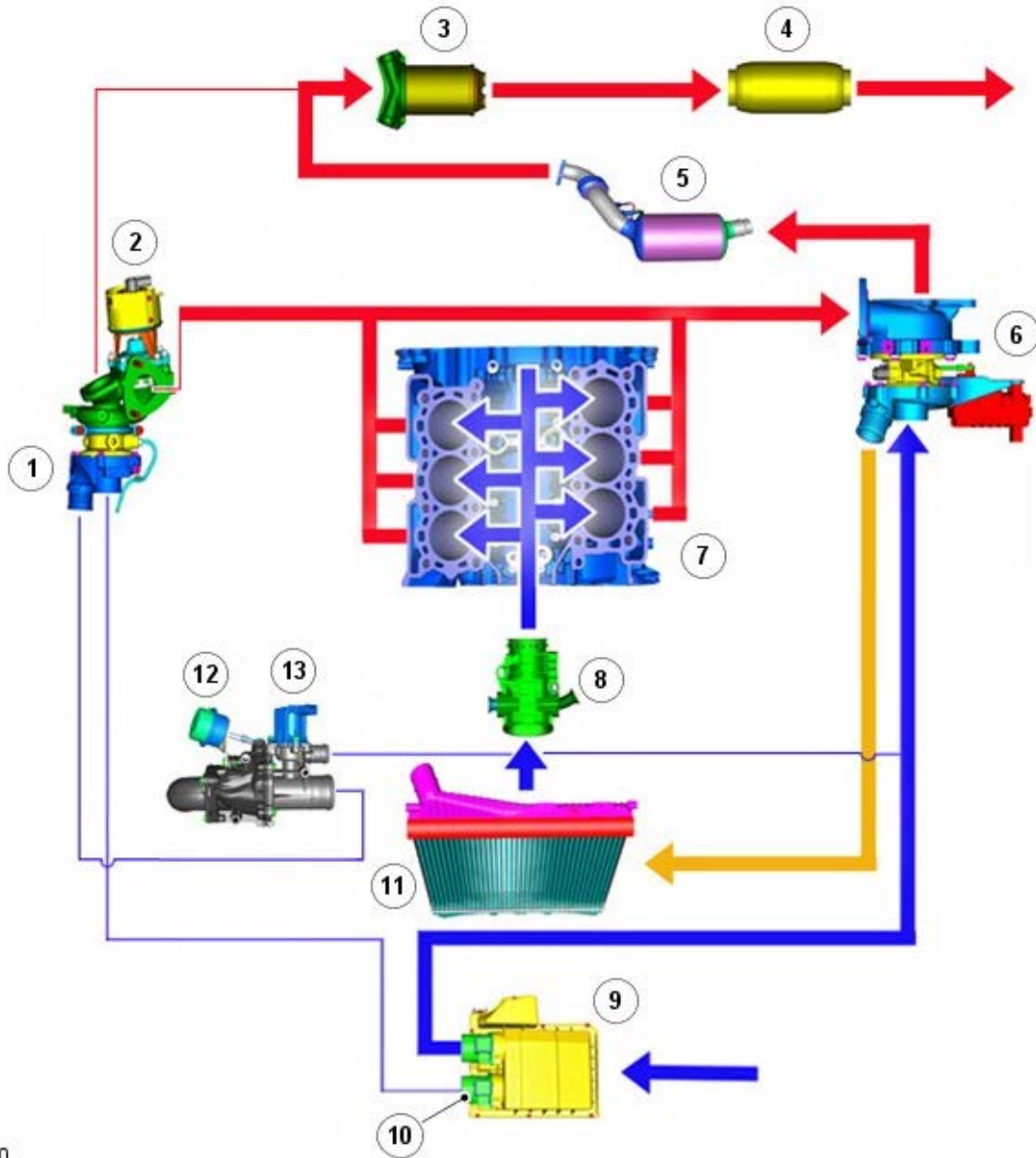
The fixed vane turbocharger incorporates an outlet temperature sensor, which is located adjacent the oxygen sensor in the close coupled catalytic converter and, an outlet pressure sensor which receives inputs from the APP (accelerator pedal position) and ECM.

Refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.0L Diesel, Description and Operation).

Dual Mode Boosting

The dual mode boosting system comprises two turbochargers and software within the ECM. The two turbochargers can operate in two modes; mono turbocharger operation or bi-turbocharger operation.

Mono Turbocharger Schematic Diagram



E107580

Item Description

- 1 Fixed vane turbine
- 2 Turbine shut-off valve
- 3 DPF (diesel particulate filter)
- 4 Flexible center resonators
- 5 Catalytic converter
- 6 Variable vane turbocharger
- 7 Engine
- 8 Throttle
- 9 Air filter
- 10 MAF (mass air flow) meter
- 11 Charge air cooler

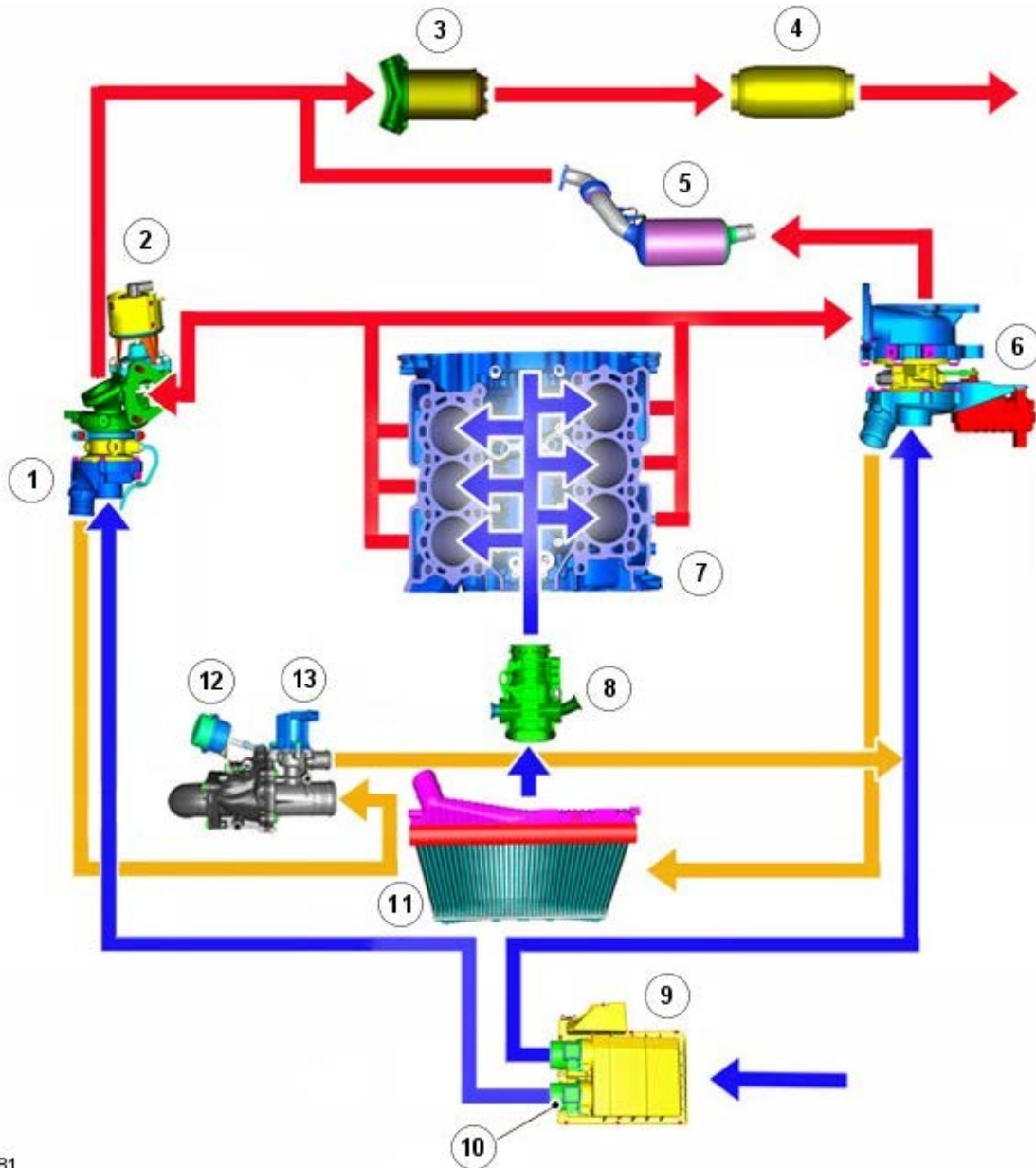
12 Compressor shut-off valve

13 Recirculation valve

Fresh air is drawn through the air filter and the MAF meter to the primary turbocharger compressor. The compressed air is then passed through the charge air cooler and into the engine.

The turbine shut-off valve on the secondary turbocharger is closed and therefore exhaust gasses are unable to operate the secondary turbocharger turbine. In this condition all turbocharging boost pressure is produced by the primary turbocharger.

Bi-Turbocharger Switching Schematic Diagram



E107581

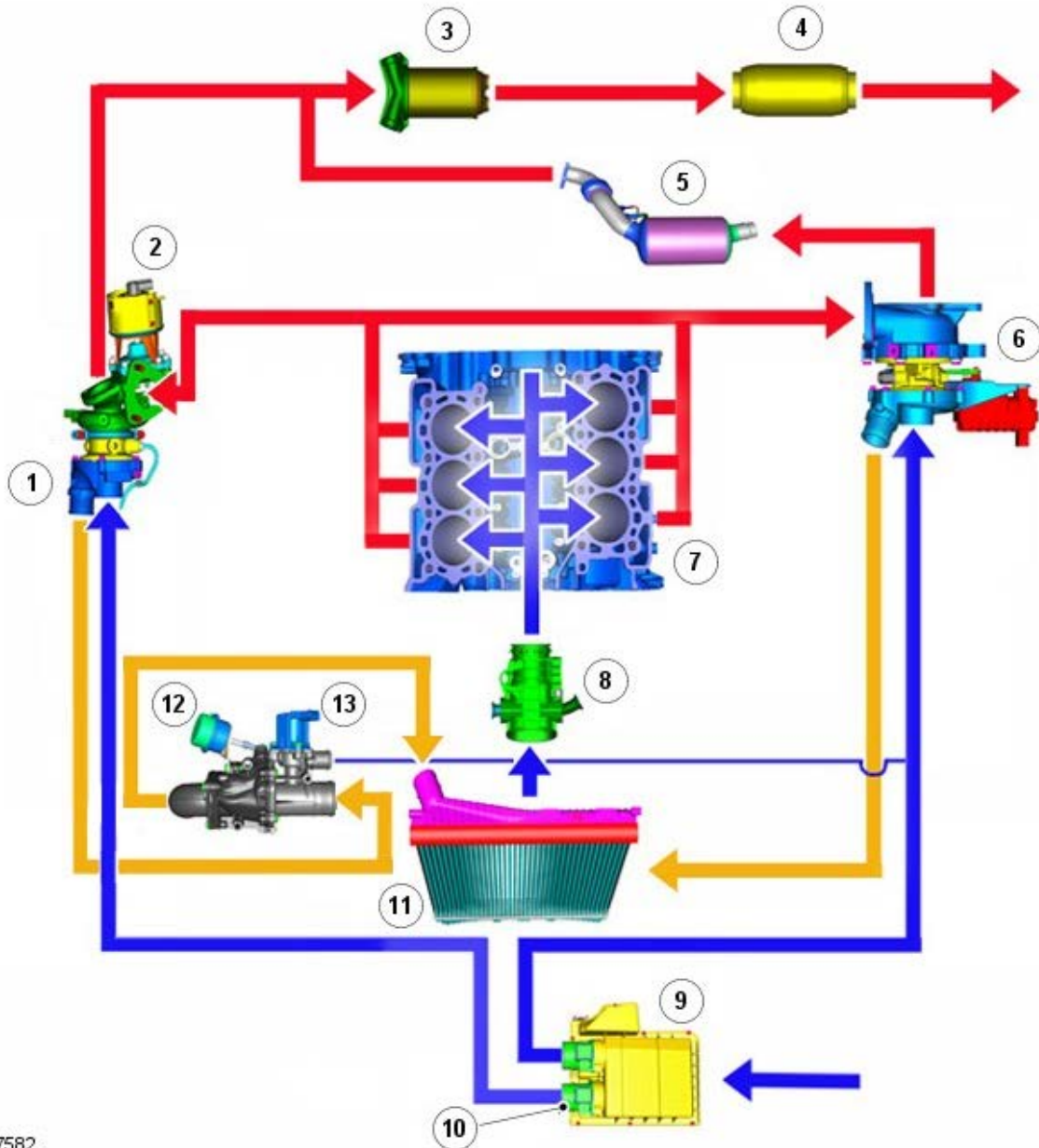
Item Description

- 1 Fixed vane turbine
- 2 Turbine shut-off valve
- 3 DPF
- 4 Flexible center resonators
- 5 Catalytic Converter
- 6 Variable vane turbocharger
- 7 Engine
- 8 Throttle
- 9 Air filter
- 10 MAF meter
- 11 Charge air cooler
- 12 Compressor shut-off valve
- 13 Recirculation valve

When the engine operating parameters approach the limits (approximately 2800 rpm under load) of the primary turbocharger, dual mode boosting control software within the ECM begins the switch to parallel bi-turbocharger operation. The secondary turbocharger is brought into operation by the opening of the turbine shut-off valve which allows exhaust gasses to flow through the turbine.

Initially, the secondary turbocharger does not produce a boost pressure to equal that of the primary turbocharger. Therefore, the initial boost pressure from the secondary turbocharger is fed via the recirculation valve into the clean air inlet for the primary turbocharger. As the secondary turbocharger boost pressure output increases, the recirculation valve is then closed and the compressor shut-off valve opened to increase the boost pressure from the secondary turbocharger which is directed into the charge air cooler.

Bi-Turbocharger Schematic Diagram



E107582

Item Description

- 1 Fixed vane turbine
- 2 Turbine shut-off valve
- 3 DPF
- 4 Flexible center resonators
- 5 Catalytic Converter
- 6 Variable vane turbocharger
- 7 Engine
- 8 Throttle
- 9 Air filter
- 10 MAF meter
- 11 Charge air cooler
- 12 Compressor shut-off valve

13 Recirculation valve

When the secondary turbocharger has reached the required operating parameters, the recirculation valve is closed and the compressor shut-off valve is opened. The ECM will maintain the engine operating in bi-turbocharger operation with both primary and secondary turbochargers contributing to the air charge induction. When the dual mode boosting software determines that the engine operating parameters no longer require the use of dual mode boosting, the system switches back to mono turbocharger operation.

If the engine idles for more than 3 minutes, the secondary turbocharger is actuated to ensure correct lubrication. This is achieved by pressurizing the turbine shaft bearing cavities through a pipe, which is connected to the air intake system and periodically opening the turbine shut-off valve to operate the turbocharger.

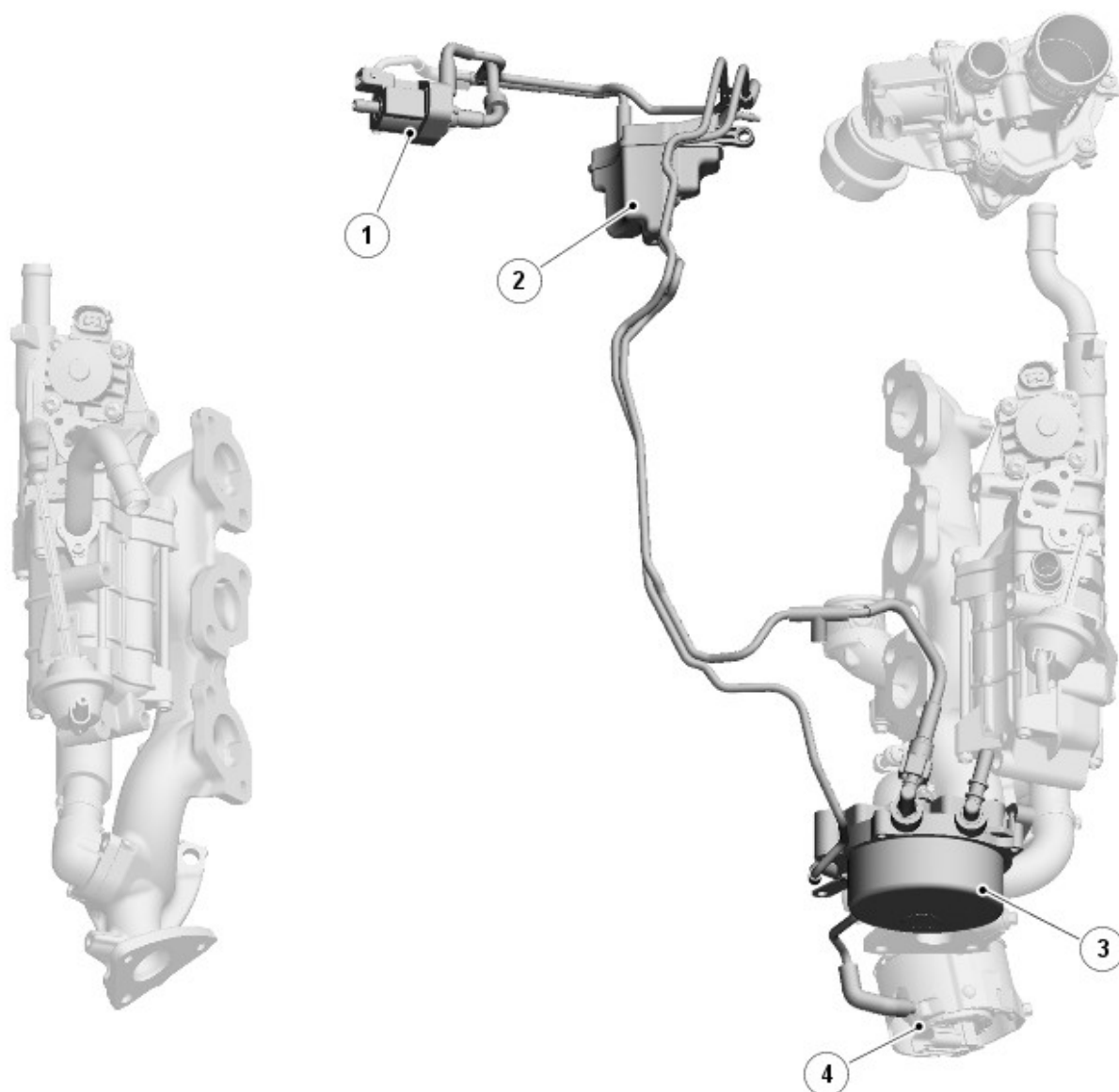


CAUTION: Ensure both ends of the pipe are securely connected to the secondary turbo and the air intake system to prevent damage to the turbo components.

Turbine and Compressor Shut-off Valve Control

The secondary turbocharger turbine shut-off valve and compressor shut-off valve are controlled by the ECM through a vacuum system. The secondary turbo turbine shut-off valve also incorporates a position sensor.

Secondary Turbocharger Turbine Shut-off Valve Vacuum Control



E117413

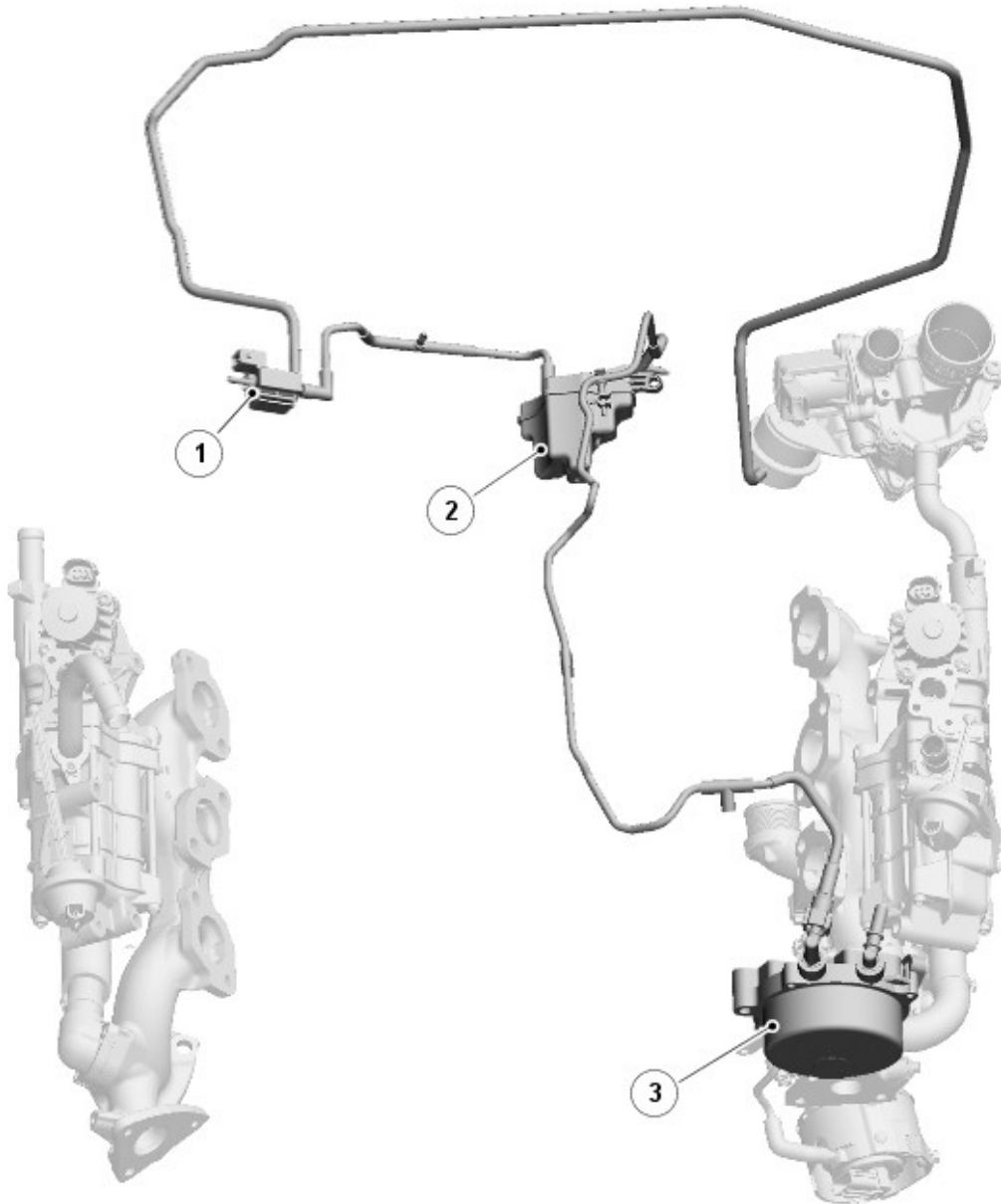
Item Description

- 1 Secondary turbine shut-off solenoid valve
- 2 Vacuum reservoir
- 3 Vacuum pump
- 4 Secondary turbine shut-off valve

If vacuum is lost to the shut-off valve it will default to the closed position. The position sensor will inform the ECM,

which will initiate mono-turbo mode, restricted performance and record **DTC (diagnostic trouble code)**.

Compressor Shut-off Valve Vacuum Control



E117414

Item Description

- 1 Compressor shut-off valve solenoid valve
- 2 Vacuum reservoir
- 3 Vacuum pump

If the system develops a fault, for example an air leak, the compressor shut-off valve will default to the closed position. In the default position, mono-turbo operation and restricted engine torque is initiated.



NOTE: When fault finding the vacuum system, always check for trapped/split/disconnected pipework. Any vacuum fault will cause the engine to default to limited torque mode.

Component Description

Each turbocharger consists of two turbo elements, a turbine wheel and compressor wheel, enclosed separately in cast housings and mounted on a common shaft, which rotates in two semi-floating bearings.

VARIABLE VANE TURBOCHARGER (PRIMARY)

The variable vane turbocharger is attached to the **LH (left-hand)** exhaust manifold and secured to 3 studs on a flange on the manifold with nuts. On production, no gasket is used to seal the joint between turbocharger and the manifold. In-service vehicles will require a service gasket to be fitted if the joint between the turbocharger and the manifold is disturbed.

A second flange on the turbocharger has 3 integral studs and provides for the attachment of the **LH** catalytic converter inlet pipe. Three nuts secure the inlet pipe to the flange studs and a gasket seals the joint between the

components.

The compressor end of the turbocharger has two hose connections. The central connection provides a clean air supply from the air filter to the compressor. The second connection on the outside of the housing provides for a pipe connection from the turbocharger to the charge air cooler.

The turbocharger is a conventional design with both the turbine wheel and the compressor wheel sharing a common shaft which is supported on bearings. The turbocharger receives an engine oil feed via a pipe from the cylinder block. The pipe supplies both turbochargers with an oil supply for lubrication purposes. An oil drain pipe from the turbocharger allows oil to drain from the turbocharger into the cylinder block.

An integral bracket houses the variable vane electronic rotary actuator. The rotary actuator is connected to an eccentric lever which moves the turbine housing to adjust the position of the vanes. When the rotary actuator operates a boss is rotated, which in turn moves the lever and changes rotary motion into linear motion. The lever is connected to the outside of the turbine housing and the linear motion is converted back to rotary motion of the housing. Operation of the electronic rotary actuator is controlled by the [ECM](#).

FIXED VANE TURBOCHARGER (SECONDARY)

The fixed vane turbocharger is attached to the [RH \(right-hand\)](#) exhaust manifold and is secured to 3 studs on a flange on the manifold with nuts. On production, no gasket is used to seal the joint between turbocharger and the manifold. In-service vehicles will require a service gasket to be fitted if the joint between the turbocharger and the manifold is disturbed.

A second flange on the turbocharger has 2 integral studs and provides for the attachment of the [RH](#) exhaust system downpipe. Two nuts secure the downpipe to the flange studs and a gasket seals the joint between the downpipe and the turbocharger.

The compressor end of the turbocharger has two hose connections; the central connection provides the clean air supply from the air filter. The second connection on the outside of the turbocharger housing allows the connection from the turbocharger to the charge air cooler.

Attached to the rear of the turbocharger is a turbine shut-off valve. The valve is vacuum operated and electronically controlled by the [ECM](#). The valve is closed when the system is operating in mono-turbocharger mode, diverting exhaust gasses from the [RH](#) exhaust manifold, via the exhaust cross-over duct to the [LH](#) exhaust manifold. When bi-turbocharger operation is required, the [ECM](#) electronically operates the valve allow vacuum to open the shut-off valve allowing exhaust gasses from the [RH](#) exhaust manifold to drive the turbine of the fixed vane turbocharger.

Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel - Turbocharger

Diagnosis and Testing

Principles of Operation

For a detailed description of the fuel charging and controls system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (303-04 Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel)

Turbocharger (Description and Operation),
Turbocharger (Description and Operation),
Turbocharger (Description and Operation).

Inspection and Verification



WARNING: The following tests may involve working in close proximity to hot components. Make sure adequate protection is used. Failure to follow this instruction may result in personal injury.



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Intake air system • Hose(s) / hose connections • Turbochargers • General engine condition 	<ul style="list-style-type: none"> • Circuit(s) • Engine Control Module (ECM) • Turbocharger actuators • Electrical connections and harnesses

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Poor performance (off-boost)	<ul style="list-style-type: none"> • Low/contaminated fuel • Restricted intake air system • General engine condition • Engine Control Module (ECM) failure 	<ul style="list-style-type: none"> • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Check the intake air system for restriction • Check the engine condition, compressions, etc, if there are indications of a mechanical fault • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index
No boost	<ul style="list-style-type: none"> • Electrical connections and harnesses • Restricted intake air system • Charge air cooler restricted/leaking • Turbocharger actuator failure(s) • Turbocharger failure(s) • Engine Control Module (ECM) failure 	<ul style="list-style-type: none"> • Check the electrical connections and harnesses • Check the intake air system for restriction/leakage • Check the turbocharger actuators and circuits • Check the turbochargers for wear. Disconnect the turbocharger intake and outlet pipework and turn the turbochargers by hand. Any roughness indicates a fault. Check any up and down movement in the turbocharger shafts. Excessive movement indicates a fault. If in doubt, compare the suspect unit with a new turbocharger • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index
No boost/excessive	<ul style="list-style-type: none"> • Turbocharger failure(s) 	<ul style="list-style-type: none"> • Disconnect the turbocharger intake and outlet pipework and turn the turbochargers by hand. Any roughness indicates a

noise		fault. Check any up and down movement in the turbocharger shafts. Excessive movement indicates a fault. If in doubt, compare the suspect unit with a new turbocharger
-------	--	---

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (PCM) (100-00, Description and Operation).

Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel - Turbocharger LH

Removal and Installation

Removal

NOTES:

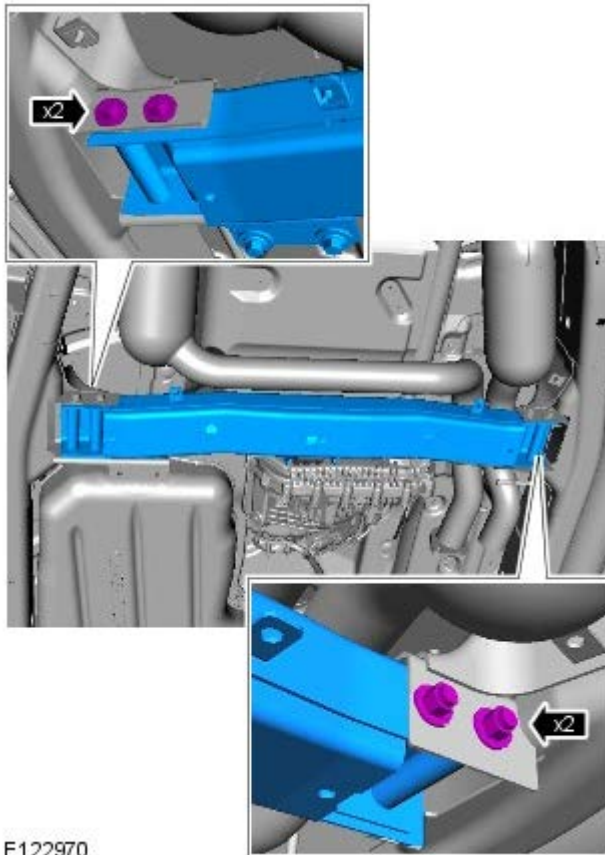


Some variation in the illustrations may occur, but the essential information is always correct.




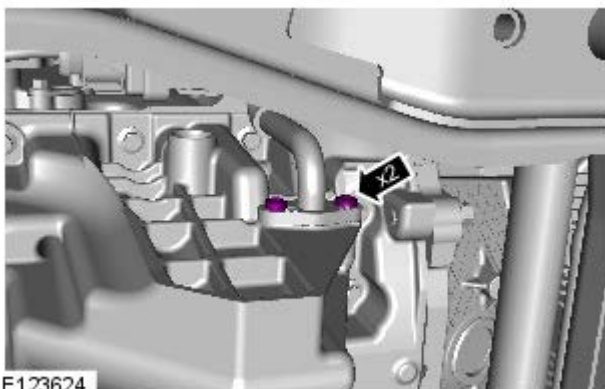
Removal steps in this procedure may contain installation details.

1. Refer to: Exhaust System (309-00, Removal and Installation).



E122970

2.  CAUTION: Only tighten the bolts finger tight at this stage.



E123624

3. CAUTIONS:



Make sure that all openings are sealed. Use new blanking caps.



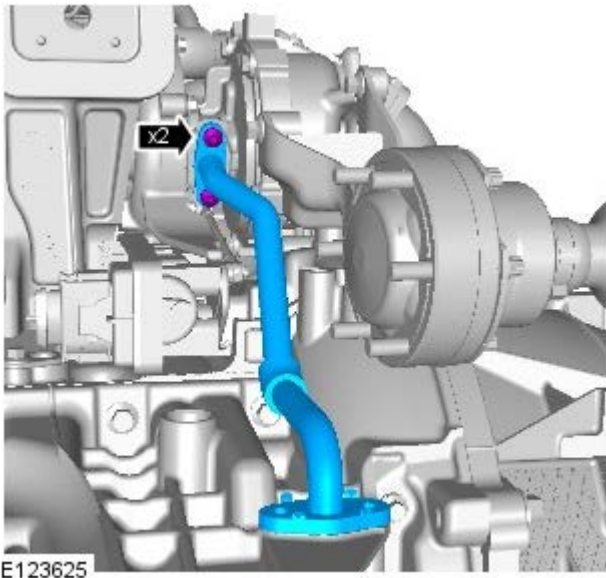
Make sure that the area around the component is clean and free of foreign material.

Torque: 9 Nm


4. CAUTIONS:



Make sure that the area around the component is clean and free of foreign material.



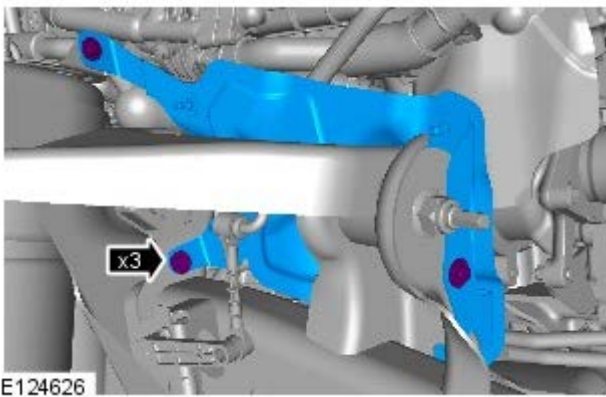
material.

 Make sure that all openings are sealed. Use new blanking caps.

 NOTE: Engine shown removed for clarity.

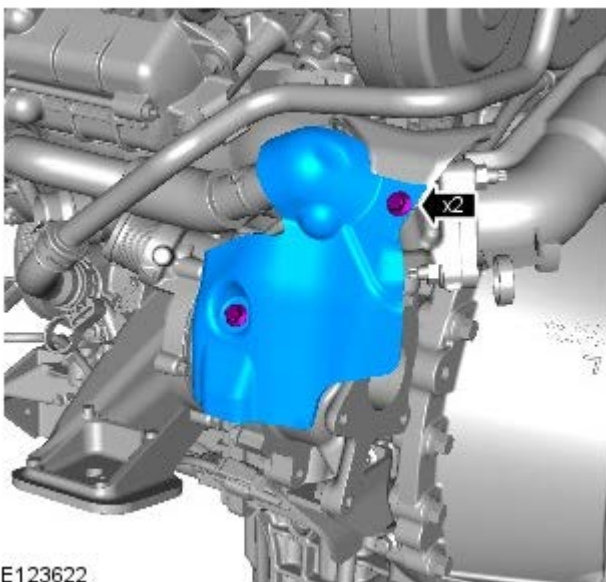
Torque: 9 Nm

5. Refer to: Body - Diesel (502-02, Removal and Installation).



6.  NOTE: The heatshield consists of 3 parts.

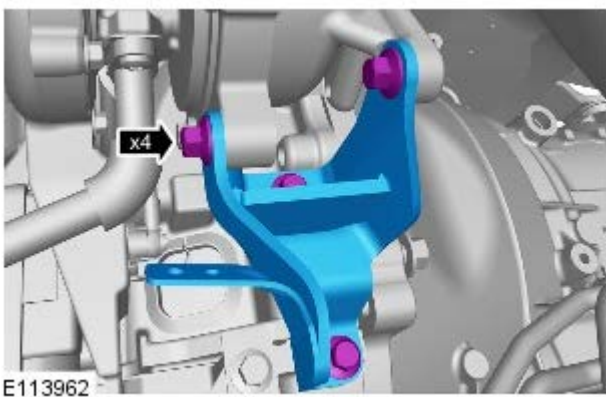
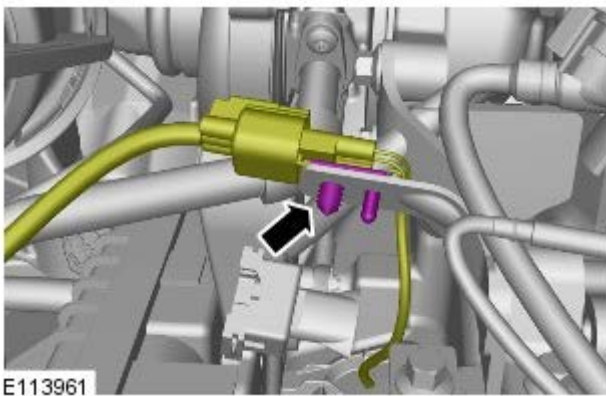
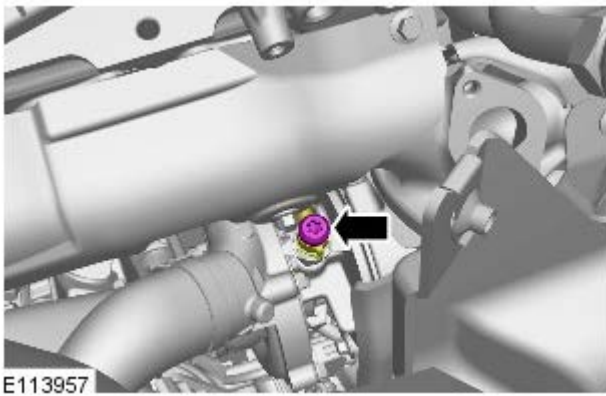
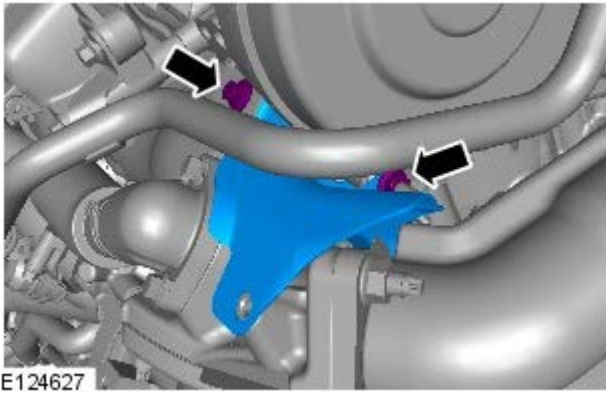
Torque: 9 Nm




7.  NOTE: Engine shown removed for clarity.

Torque: 9 Nm

8. Torque: 9 Nm



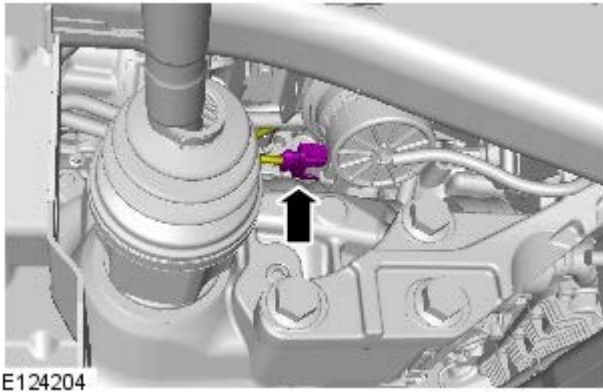
9.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

Torque: 30 Nm

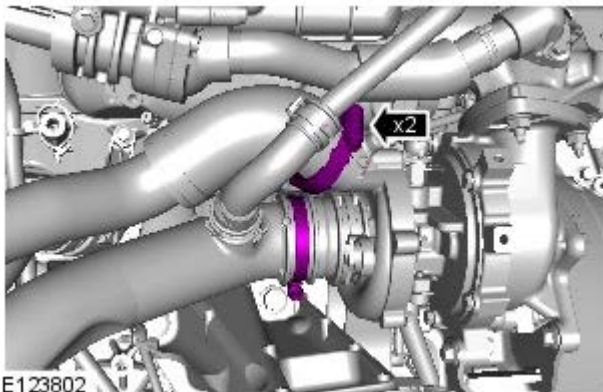
10.

11. Torque: 32 Nm

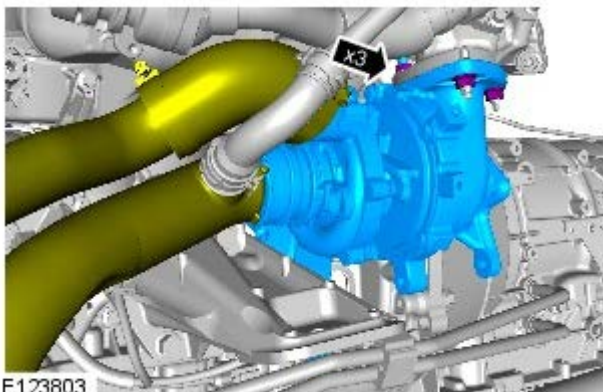
12.



E124204




E123802




E123803


13.  NOTE: Engine shown removed for clarity.


14.  WARNING: Make sure that new nuts are installed.

CAUTIONS:

 Make sure that the area around the component is clean and free of foreign material.

 Discard the nuts.

 Make sure that all openings are sealed. Use new blanking caps.

 Install a new turbocharger to exhaust manifold gasket every time the turbocharger is removed.

NOTES:

 Remove and discard the gasket.

 Engine shown removed for clarity.

Torque: 24 Nm

Installation

1. To install reverse the removal procedure.

Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel - Turbocharger RH

Removal and Installation

Removal

NOTES:




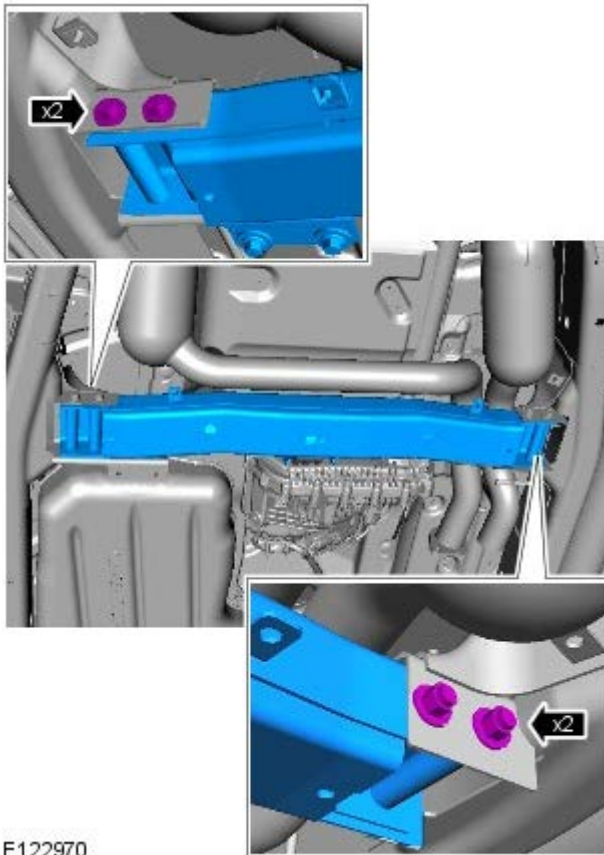
Some variation in the illustrations may occur, but the essential information is always correct.



Removal steps in this procedure may contain installation details.

1. Refer to: [Exhaust System](#) (309-00A Exhaust System - TDV6 3.0L Diesel, Removal and Installation).

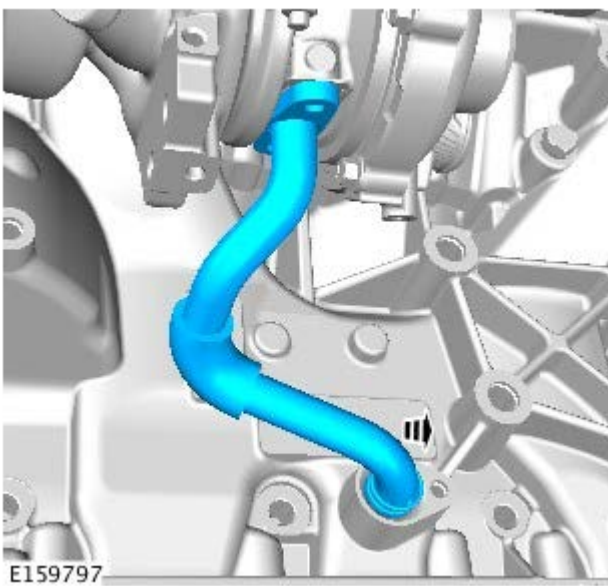
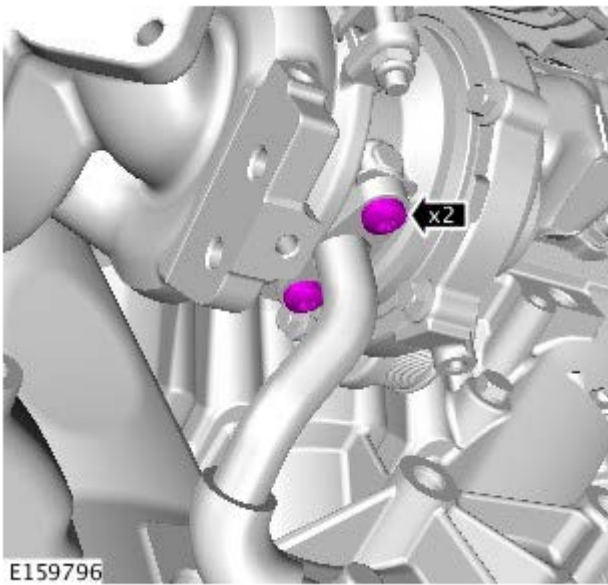
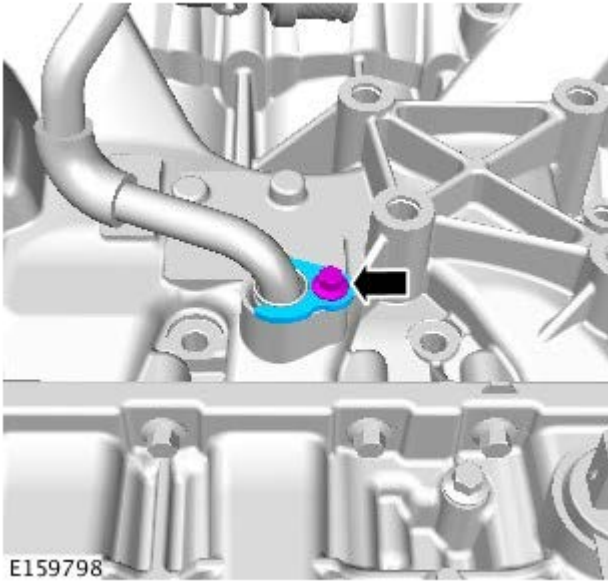
2.  CAUTION: Only tighten the bolts finger tight at this stage.



E122970

3. Refer to: [Body - TDV6 3.0L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation).
4. Refer to: [Starter Motor](#) (303-06A Starting System - TDV6 3.0L Diesel, Removal and Installation).

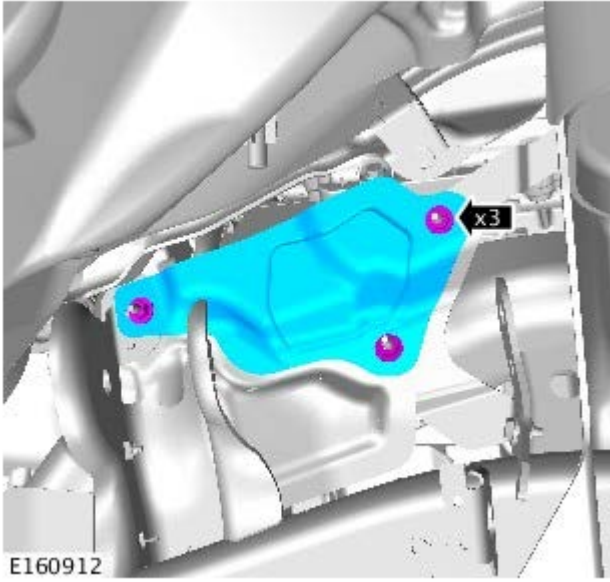
5. Torque: 9 Nm



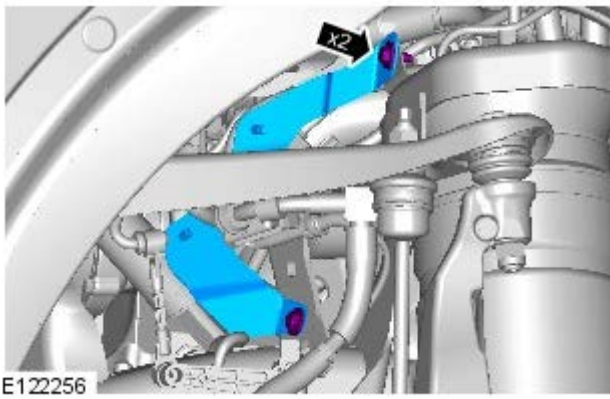
6.  NOTE: Engine shown removed for clarity.
Torque: 9 Nm

7.  NOTE: Install new gaskets.

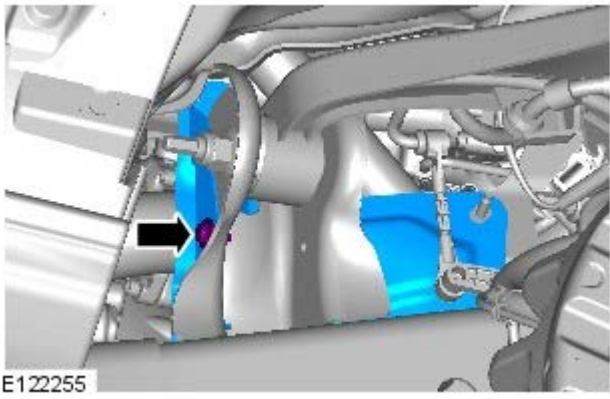
8. Torque: 9 Nm



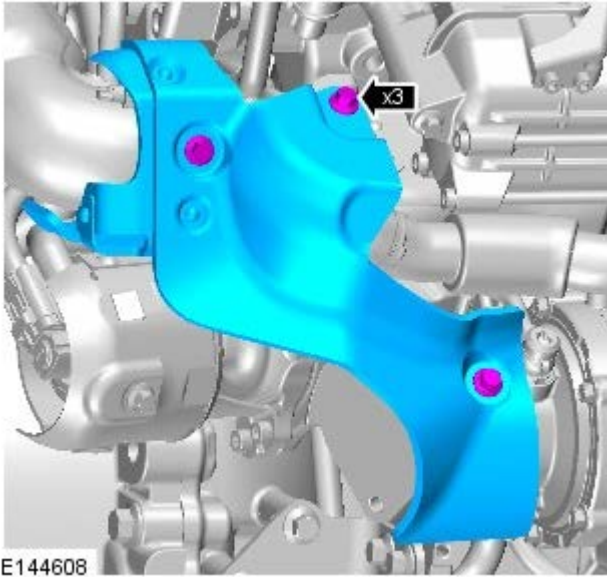
9. Torque: 9 Nm



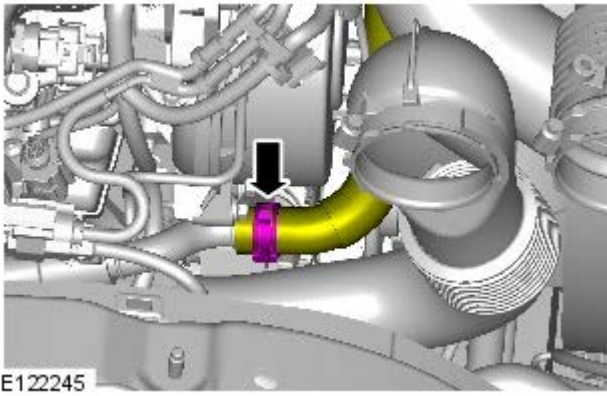
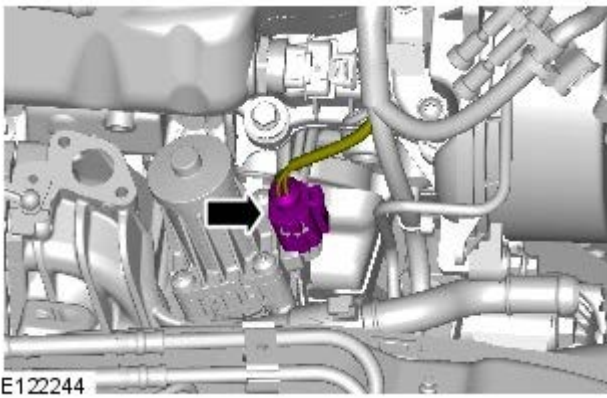
10.



11. Torque: 9 Nm




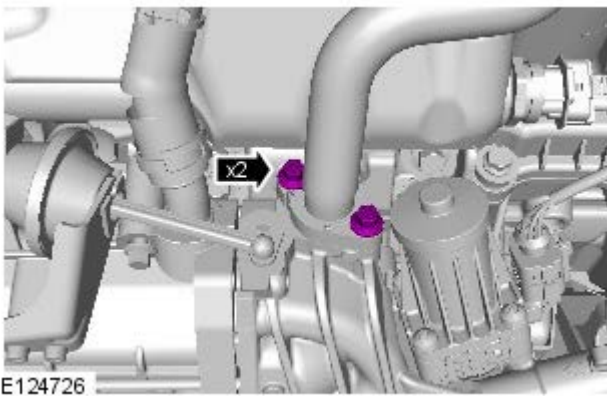
12.



13. CAUTIONS:

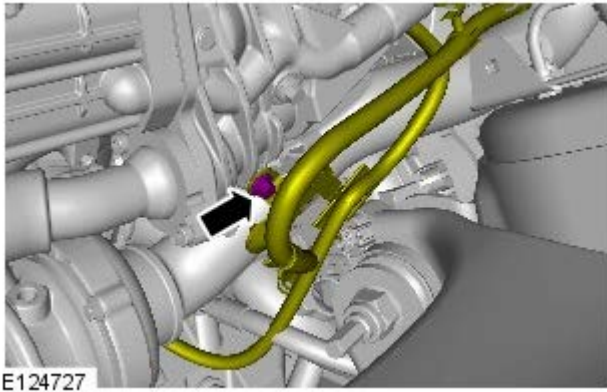
 Be prepared to collect escaping coolant.

 Make sure that all openings are sealed.
Use new blanking caps.

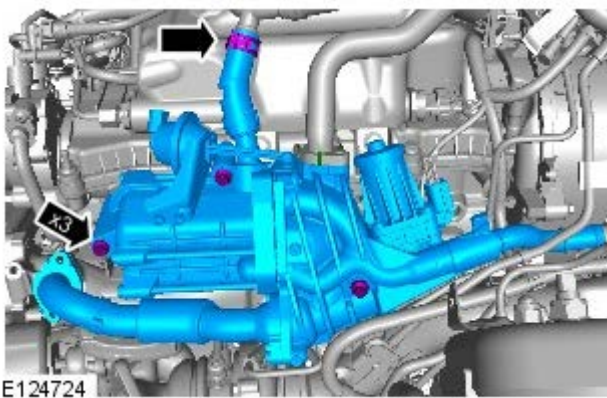
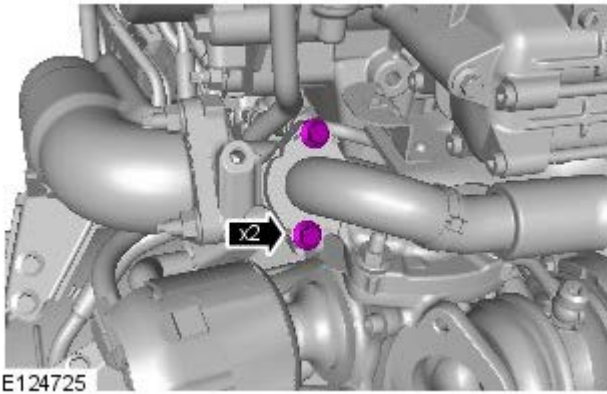



14. Torque: 10 Nm

15. Torque: 10 Nm



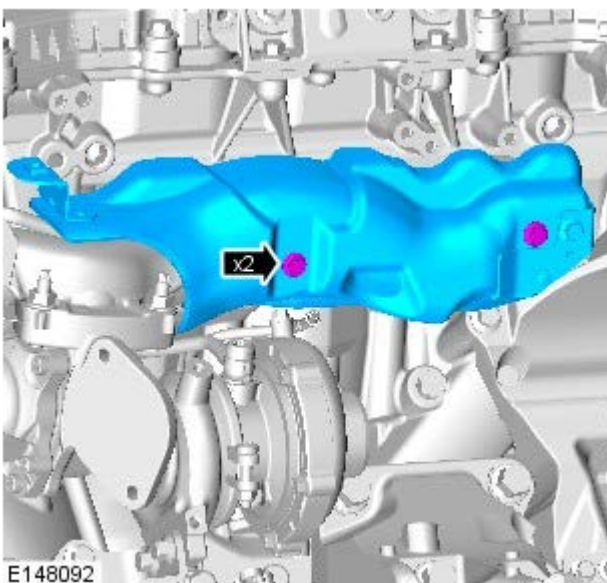
16. Torque: 10 Nm



17.  CAUTION: Be prepared to collect escaping coolant.

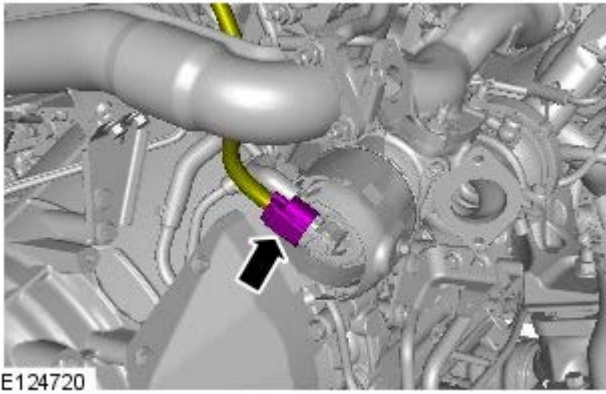
 NOTE: Install new gaskets.

Torque: 10 Nm



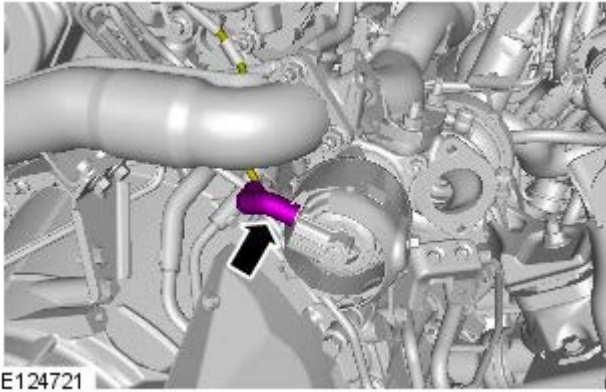
18. Torque: 11 Nm

19.

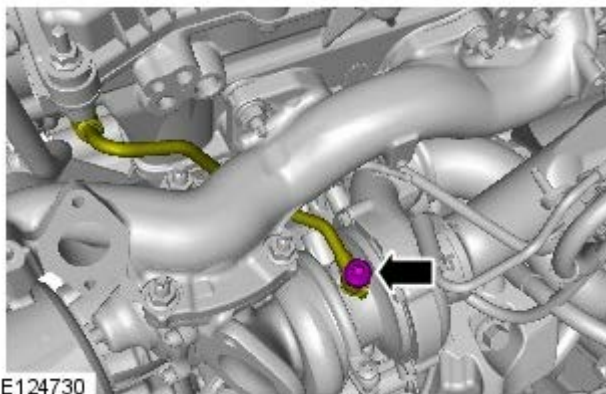


E124720

20.




E124721




E124730

21. CAUTIONS:

 Be prepared to collect escaping oil.

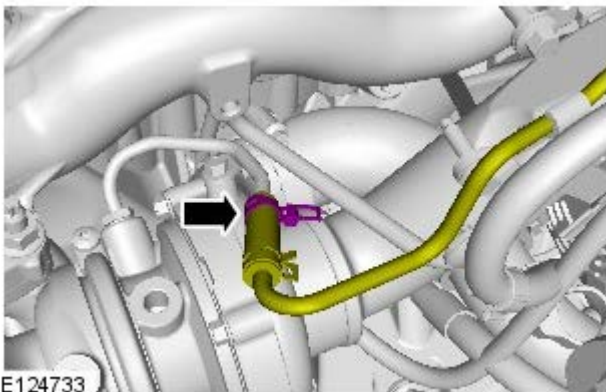
 Make sure that all openings are sealed. Use new blanking caps.

 Make sure that the area around the component is clean and free of foreign material.


 Make sure that new sealing washers are installed.

 Make sure that a new bolt is installed.

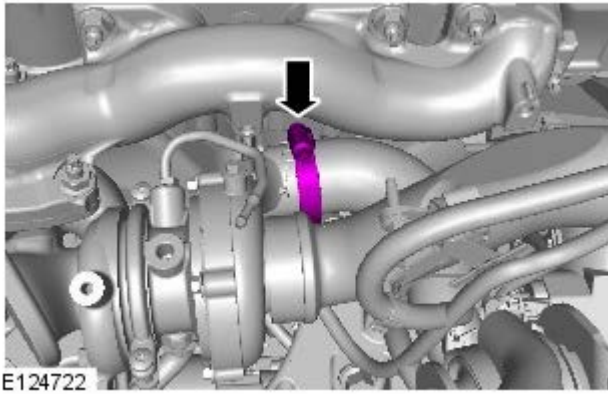
Torque: 30 Nm



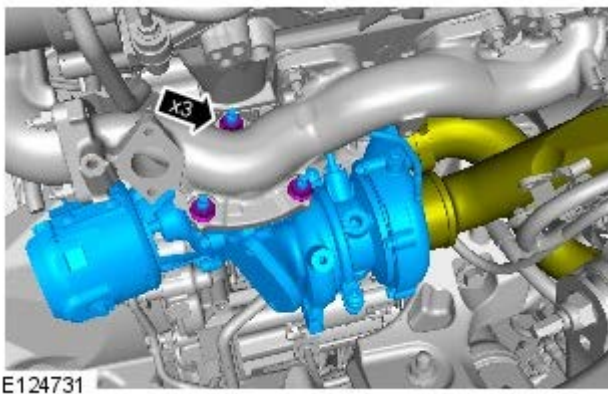
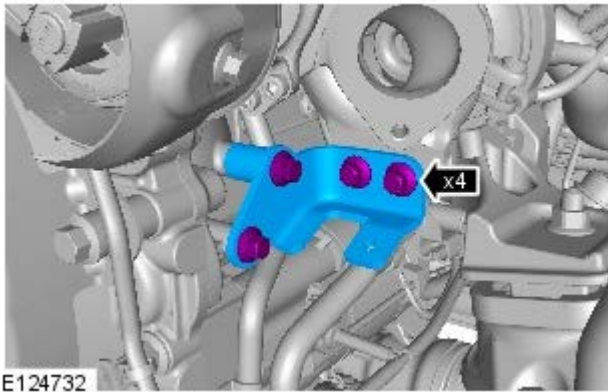
E124733

22.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

23.




24. Torque: 32 Nm





25.  **WARNING:** Make sure that new nuts are installed.

CAUTIONS:

 Discard the nuts.

 Make sure that all openings are sealed. Use new blanking caps.

 Make sure that the area around the component is clean and free of foreign material.

 Install a new turbocharger to exhaust manifold gasket every time the turbocharger is removed.

 **NOTE:** Remove and discard the gasket.

Torque: 24 Nm

Installation

1. To install, reverse the removal procedure.
2. If a new unit is installed, configure the fixed vane turbocharger actuator using the approved diagnostic tool.


Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel - Fixed Vane Turbocharger Actuator

Removal and Installation

Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

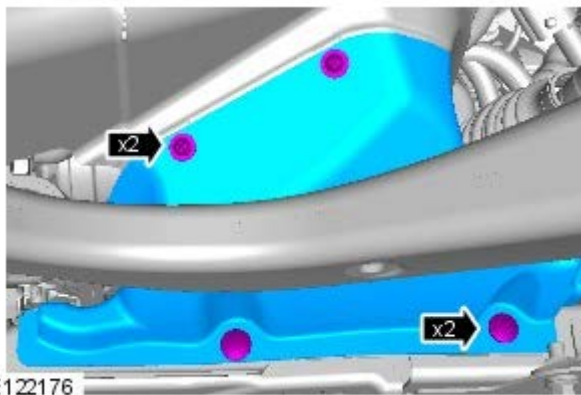
1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Refer to: Exhaust System (309-00, Removal and Installation).

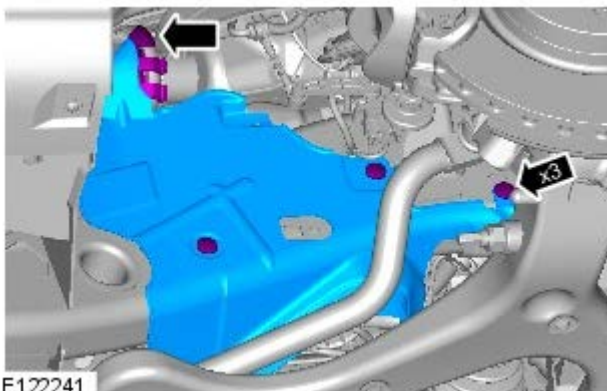
3. Remove the RH front wheel and tire.

4.



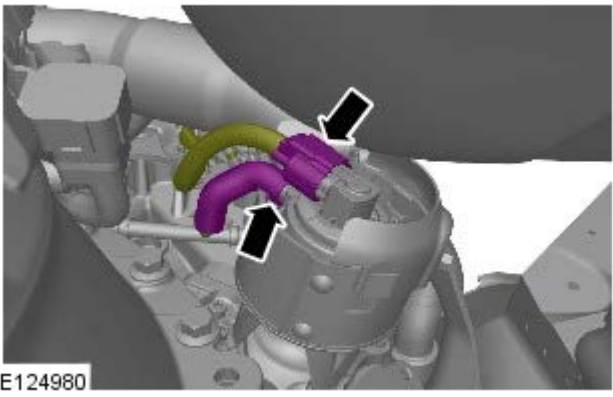
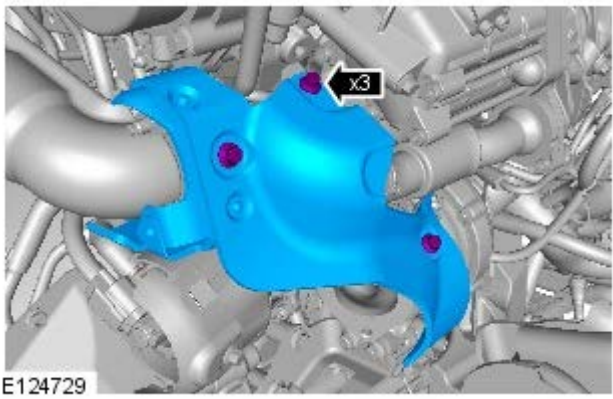
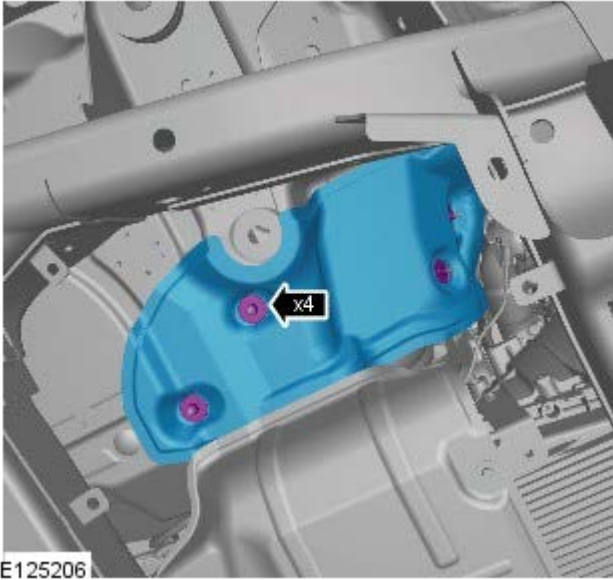
E122176

5.



E122241

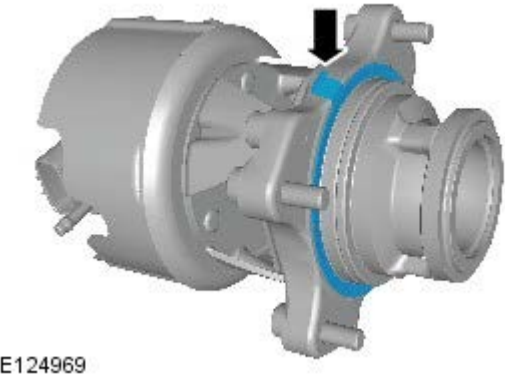
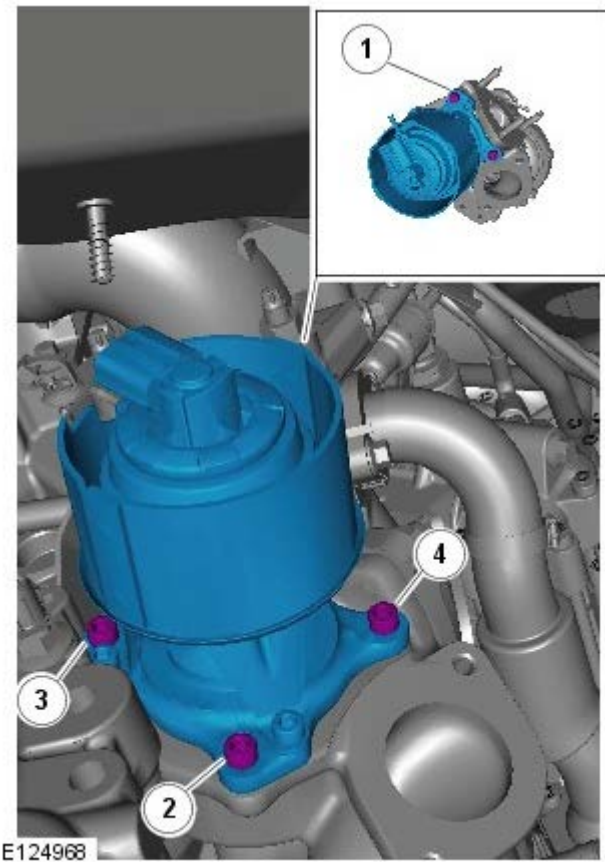
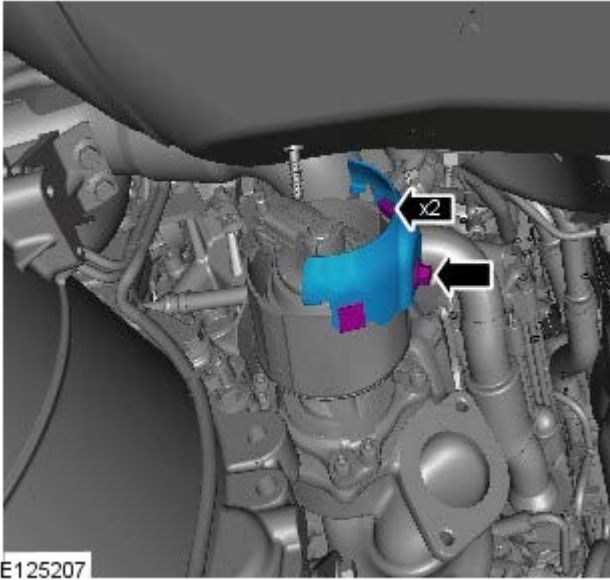
6.



7.  NOTE: Engine shown removed for clarity.

8.

9.



10. CAUTIONS:

 Remove the Torx screws evenly and progressively.

 Make sure component mating faces are not damaged during removal.

Using a suitable 130mm T30 Torx socket, remove the retaining bolts.

11. NOTES:

 Make a note of the orientation of the gasket tang.

 Remove and discard the gasket using the gasket tang.

12. NOTES:



E124972


 Remove and discard the gasket.

 Turbocharger shown removed for clarity.

Installation




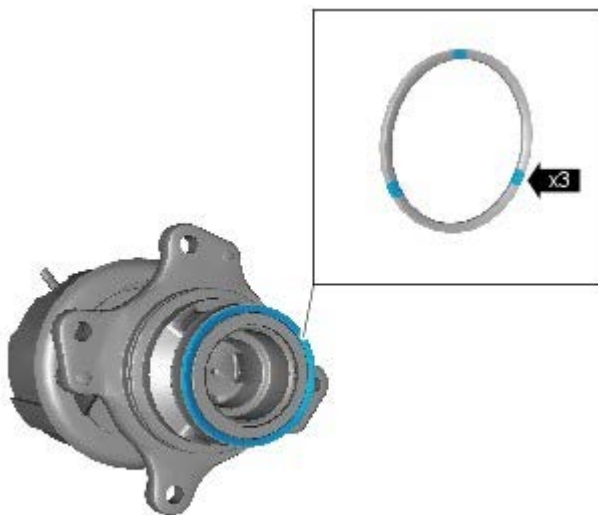
E124969

1.  CAUTION: Make sure that the mating faces are clean and free of corrosion and foreign material.


NOTES:

 Install a new gasket.

 Make sure that the gasket tang is installed in the correct orientation as noted in the removal step.




E124970

2.  CAUTION: Make sure that the mating faces are clean and free of corrosion and foreign material.

NOTES:

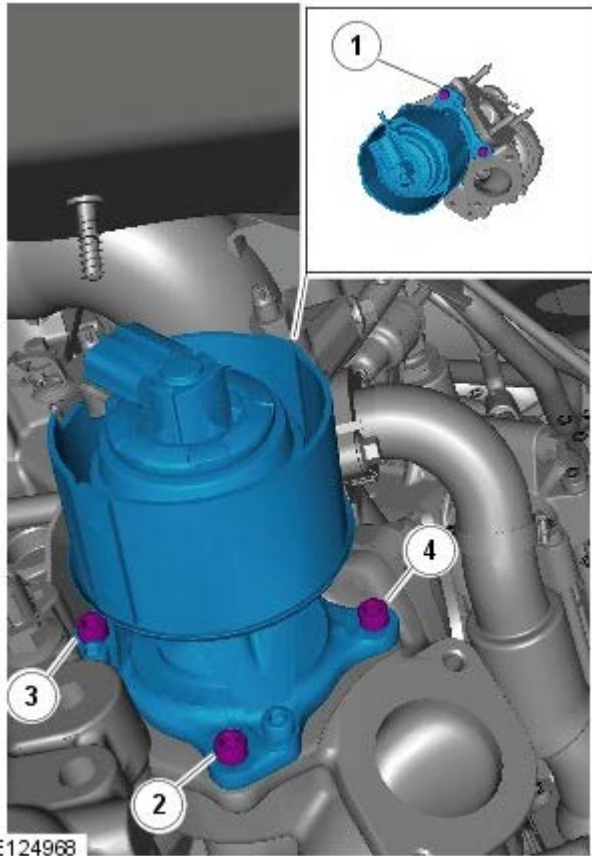
 Install a new gasket.

 Apply a small amount of grease in the areas indicated to allow the gasket to remain in the position for installation.

3. CAUTIONS:

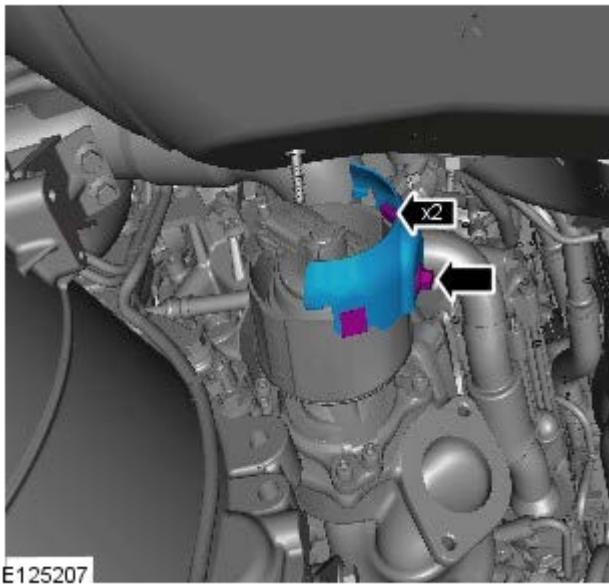
 Install all the bolts finger tight before final tightening.

 Tighten the Torx screws evenly and progressively.

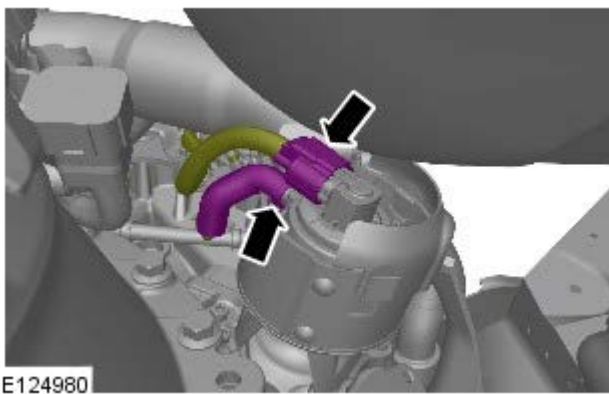


Using a suitable 130mm T30 Torx socket, Install the retaining bolts.

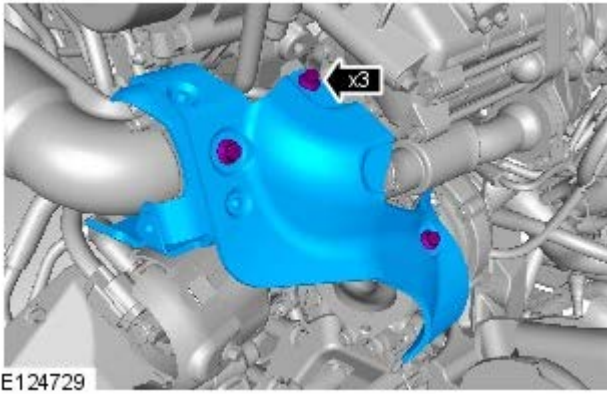
4. Torque: 9 Nm



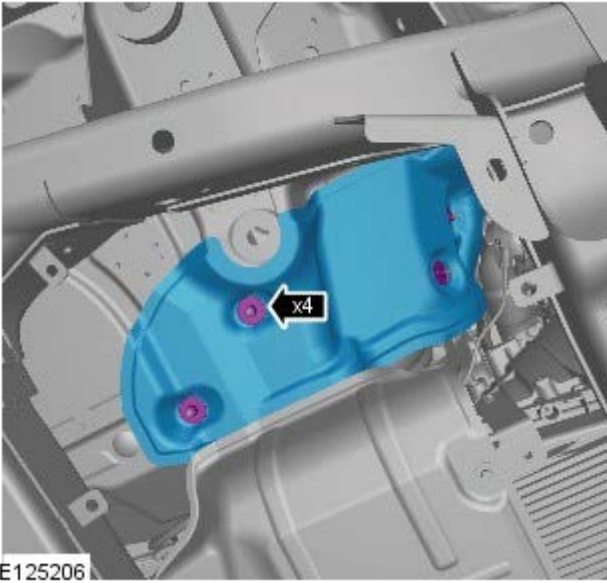
5.



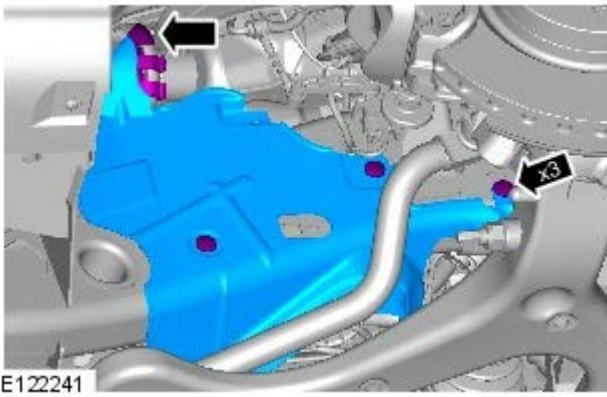
6. Torque: 9 Nm



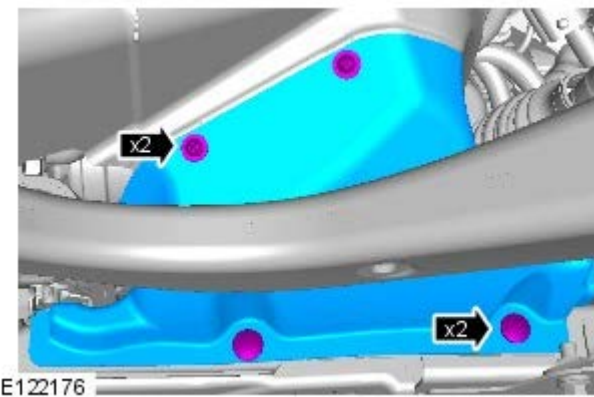
7. Torque: 10 Nm



8.



9.



10. Install the RH front wheel and tire.

11. Refer to: Exhaust System (309-00, Removal and

Installation).

12. If a new fixed vane turbocharger actuator is installed, carry out the reset procedure for the fixed vane turbocharger actuator using approved diagnostic tool.


Fuel Charging and Controls - Turbocharger - TDV6 3.0L Diesel - Turbocharger Bypass Valve

Removal and Installation

Removal

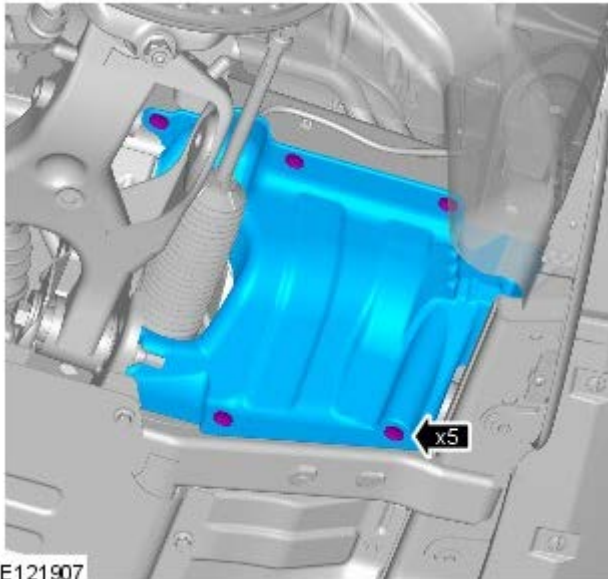


NOTE: Removal steps in this procedure may contain installation details.

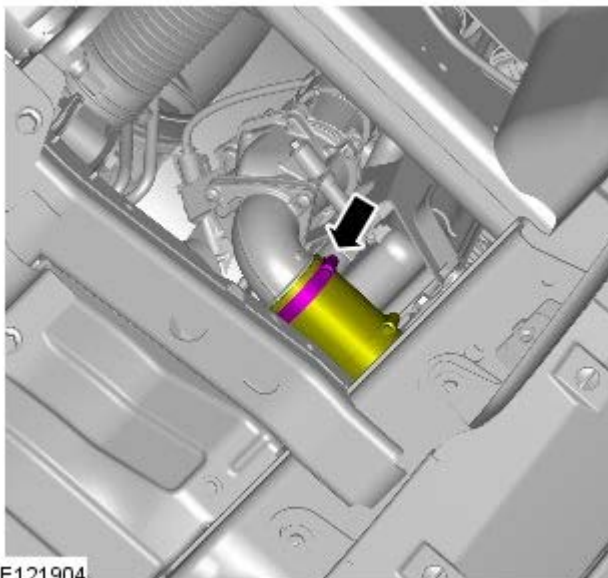
1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

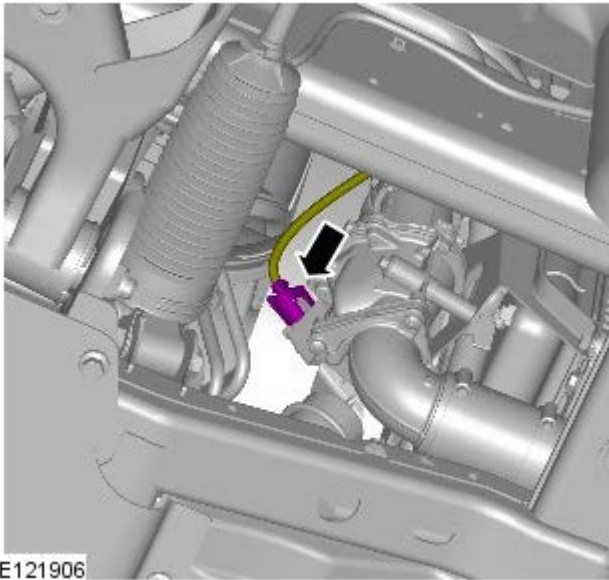
2.



3. Torque: 5 Nm

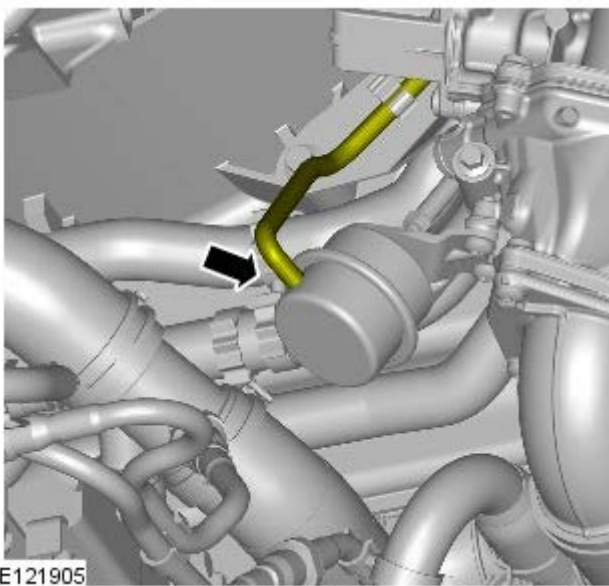


4.



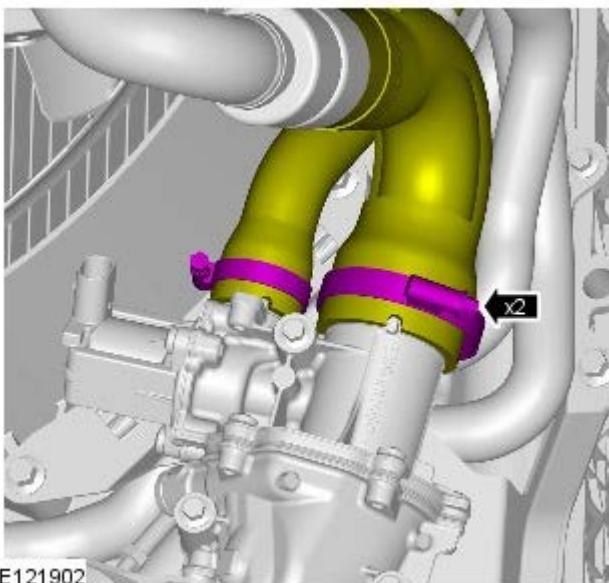
E121906

5.



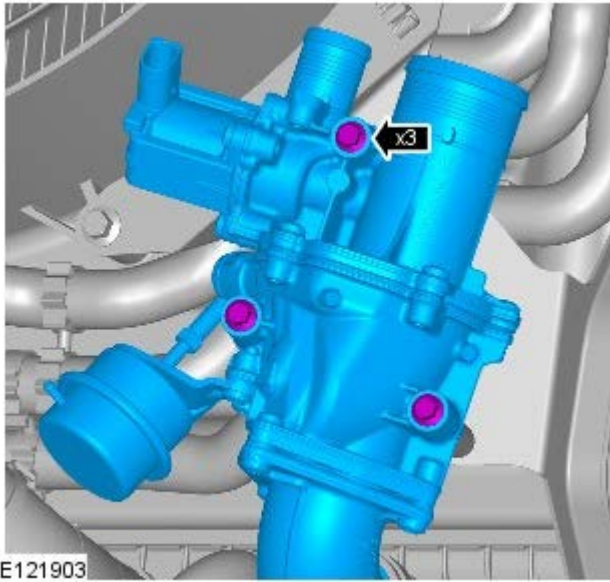
E121905

6. Torque: 5 Nm



E121902

7. Torque: 10 Nm



Installation

1. To install, reverse the removal procedure.

Fuel Charging and Controls - V6 S/C 3.0L Petrol -

WARNINGS:



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.



CAUTION: Before disconnecting or removing components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.



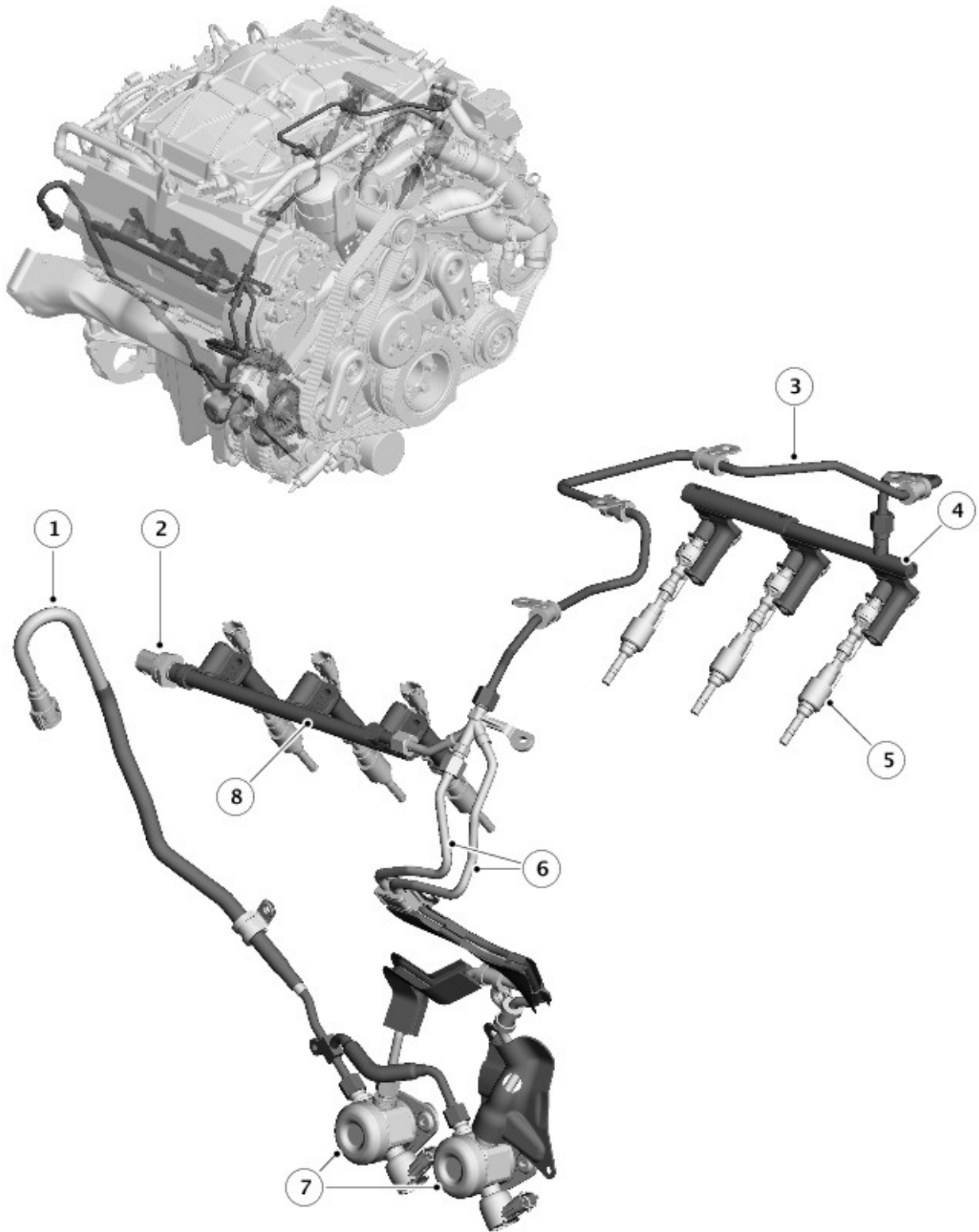
NOTE: Tighten the fuel rail high pressure fuel pump fuel line unions and fuel rail crossover pipe unions as it is instructed in service manual.

Description	Nm	lb-ft	lb-in
Ignition coil-on-plugs retaining bolts	7	-	62
Spark plugs	20	15	-
Fuel rail retaining bolt	Stage 1 - 20 Stage 2 - 30	Stage 1 - 15 Stage 2 - 22	-
Fuel rail crossover pipe unions	21	15	-
Fuel rail crossover pipe retaining bolts	8	6	-
Fuel pressure regulator	33	24	-
Fuel rail high pressure fuel pump fuel line unions	21	15	-
Fuel rail high pressure fuel pump fuel line M8 bolt	25	18	-
Fuel rail high pressure fuel pump fuel line M6 bolt	11	8	-
Fuel rail high pressure fuel pump fuel line M5 nut	6	-	53
Fuel rail high pressure fuel pump fuel line shield M10 bolt	29	21	-
Fuel rail high-pressure fuel pump fuel line shield M6 bolt	11	8	-
Fuel rail high pressure fuel pump torx bolts	11	8	-
Throttle body retaining bolts	10	7	-
Steering gear retaining bolts	100	74	-
Steering column lower universal joint assembly bolts	35	26	-
Thermostat housing to cylinder head coolant pipe retaining bolt	10	7	-
Accessory drive belt idler pulley bracket retaining bolts	25	18	-

Fuel Charging and Controls - V6 S/C 3.0L Petrol - Fuel Charging and Controls

Description and Operation

COMPONENT LOCATION



E160292

Item	Part Number	Description
1	-	Low Pressure (LP) fuel line
2	-	Fuel Rail Pressure and Temperature (FRPT) sensor
3	-	Crossover tube
4	-	Left fuel rail

5	-	Fuel injector (6 off)
6	-	High Pressure (HP) fuel lines
7	-	HP fuel pumps
8	-	Right fuel rail

OVERVIEW

The fuel charging and controls system is a petrol DI (direct injection) system controlled by the [ECM \(engine control module\)](#).

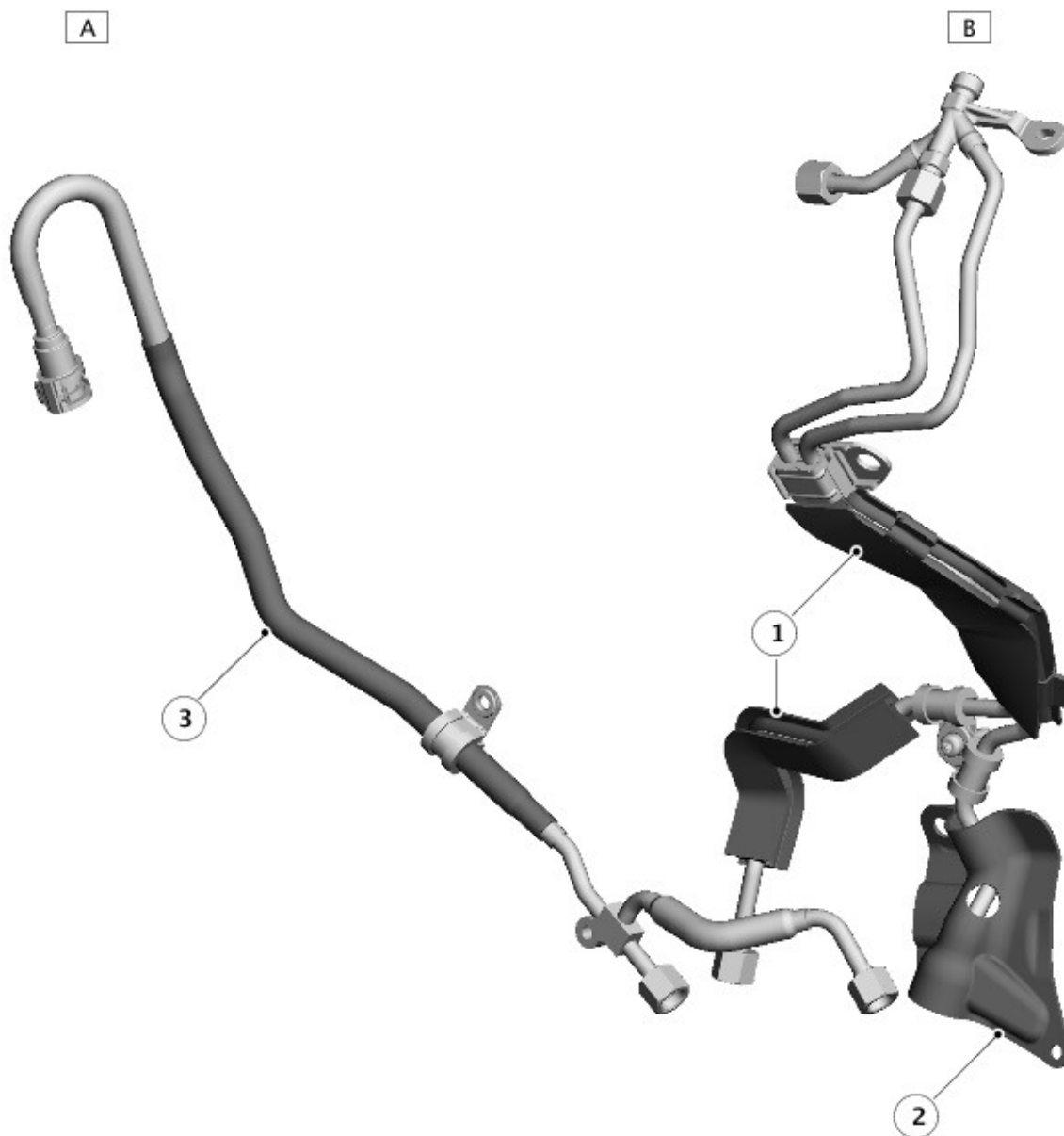
The fuel charging and controls system consists of:

- LP (low pressure) and HP (high pressure) fuel lines.
- Two HP fuel pumps.
- Two fuel rails and a crossover tube.
- A FRPT (fuel rail pressure and temperature) sensor.
- Six fuel injectors.

LP fuel from the pump in the fuel tank is pressurized by the HP fuel pumps and supplied to the fuel injectors via the fuel rails and crossover tube. The [ECM](#) controls the fuel injectors and HP fuel pumps to inject the required volume of fuel into the combustion chambers.

COMPONENT DESCRIPTION

Low and High Pressure Fuel Lines



E160293

A = LP fuel lines, B = HP fuel lines.

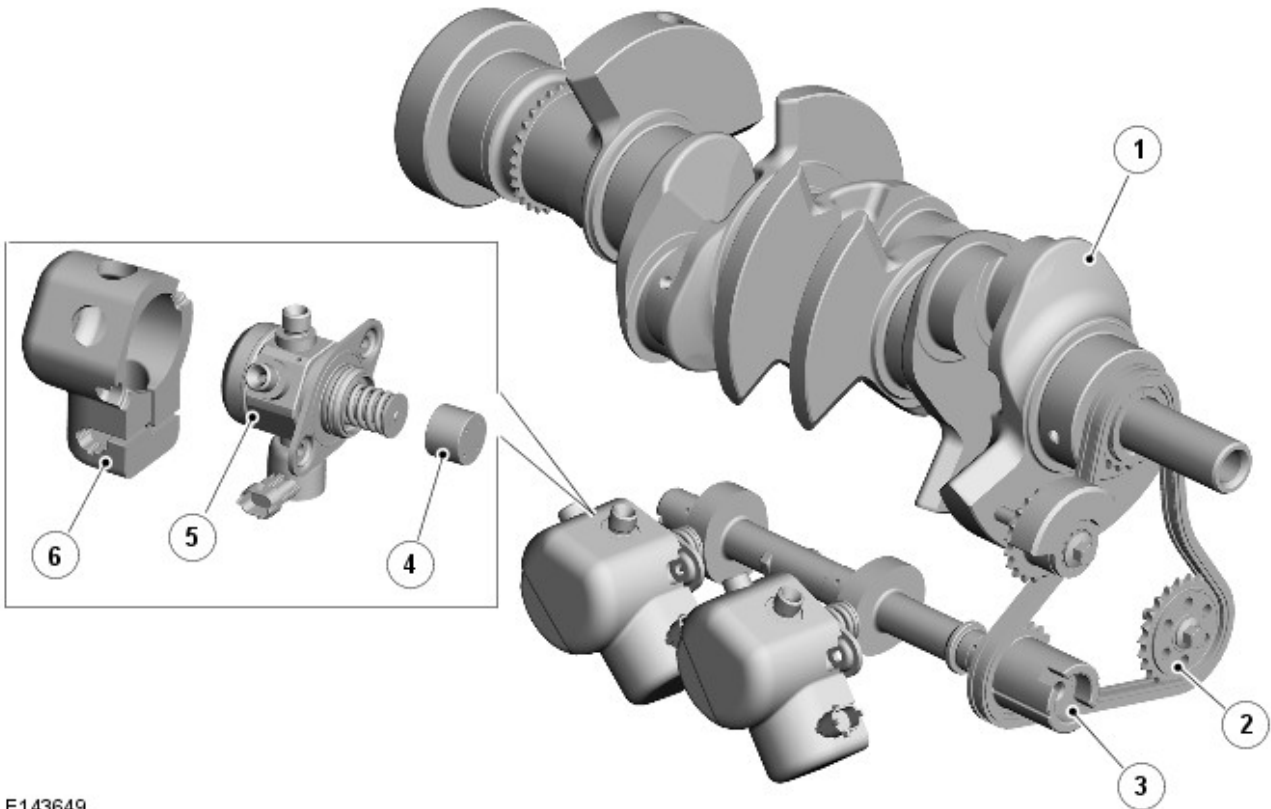
Item	Part Number	Description
------	-------------	-------------

- 1 - Acoustic covers
- 2 - Fuel pipe cover
- 3 - Heat reflective and insulation sleeve

The LP fuel line connects the HP fuel pumps to the fuel delivery line from the fuel tank and lines system. A double latch quick release connector at the start of the LP fuel line connects with the fuel line from the fuel tank mounted fuel pump module. The connector is secured to a bracket on the charge air cooler. P-clips secure the LP fuel line to the rear of each cylinder head and to the right side of the cylinder block. A heat reflective and insulation sleeve is installed on the LP fuel line where it runs behind the right exhaust manifold.

The HP fuel lines connect the HP fuel pumps to the right fuel rail and the crossover tube. Two P-clips and a pipe clamp attach the HP fuel lines to the cylinder block and the right cylinder head respectively. An integral bracket on the front HP fuel line is attached to a stud on the front-upper right camshaft cover. A pipe cover is installed on the bottom of the front HP fuel line and acoustic covers are fitted to both HP fuel lines.

High Pressure Fuel Pumps



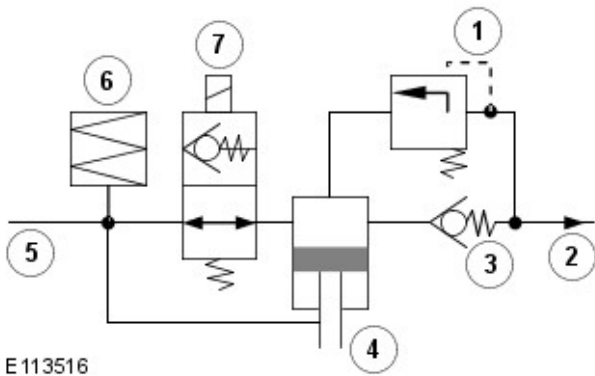
E143649

Item	Part Number	Description
1	-	Crankshaft
2	-	Auxiliary drive chain
3	-	Auxiliary shaft
4	-	Tappet
5	-	HP fuel pump
6	-	Acoustic cover

The two HP (high pressure) fuel pumps are identical mechanically-driven pumps installed on the right side of the oil pan body, behind the generator. An O-ring seal, seals each of the HP fuel pumps in the oil pan. The front HP fuel pump is identified as No. 1 pump; the rear HP fuel pump is identified as No. 2 pump. An acoustic cover is installed on each of the HP fuel pumps.

The HP fuel pumps are single-plunger pumps. The plunger of each pump extends through the sump body and the carrier of the auxiliary shaft. A tappet on the end each plunger is operated by a two-lobe cam on the auxiliary shaft. A spring installed on the outside of the plunger ensures the plunger and tappet remain in contact with the cam.

The auxiliary shaft is driven by the crankshaft, via the auxiliary drive chain, at engine speed. The auxiliary shaft is timed to match the pump delivery strokes with crankshaft position.



Item	Part Number	Description
1	-	Pressure Relief Valve (PRV)
2	-	To HP fuel lines
3	-	Check valve
4	-	Plunger
5	-	From LP fuel lines
6	-	Damper chamber
7	-	Fuel metering valve

In addition to the plunger, each HP fuel pump contains:

- A damper chamber.
- A fuel metering valve.
- A check valve.
- A PRV.

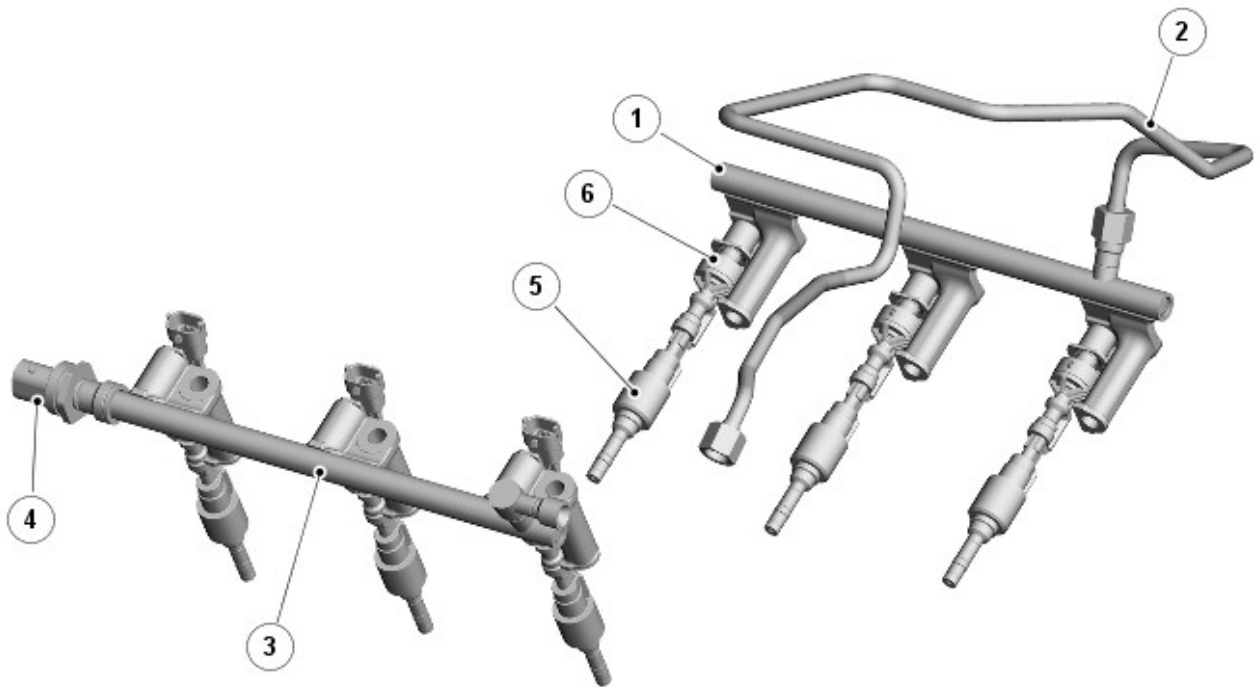
The damper absorbs pressure pulses from the LP fuel system.

The fuel metering valve regulates the output pressure from the HP fuel pump. The fuel metering valve is a normally open solenoid valve controlled by the ECM. During the inlet stroke of the plunger the fuel metering valve is de-energized, which allows LP (low pressure) fuel into the pumping chamber. The ECM energizes the fuel metering valve closed during the delivery stroke of the plunger, which forces the fuel in the pumping chamber through the check valve into the HP (high pressure) lines. By changing the closing point of the fuel metering valve, the ECM can determine the volume of fuel output during the delivery stroke, and thus the pressure in the HP side of the system.

The check valve prevents the return of HP fuel to the pumping chamber during the inlet stroke of the plunger.

The PRV (pressure relief valve) protects the HP side of the system from excessive pressure if there is a failure of the fuel metering valve. If the pump delivery pressure increases to 250 bar (3625 lbf/in²), the PRV opens and returns fuel to the inlet side of the plunger.

Fuel Rails and Crossover Tube



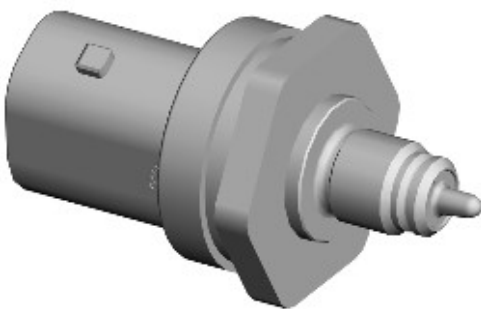
E143650

Item	Part Number	Description
1	-	Left fuel rail
2	-	Crossover tube
3	-	Right fuel rail
4	-	Fuel Rail Pressure and Temperature (FRPT) sensor
5	-	Fuel injector (6 off)
6	-	Hold down spring (6 off)

The fuel rails and crossover tube are made from stainless steel. Bolts attach each fuel rail to the related cylinder head. The crossover tube connects the front high pressure line to the left fuel rail, which ensures there is equal pressure in the two fuel rails. Four P-clips attach the crossover tube to the top of the charge air cooler.

The rear of the right fuel rail incorporates a threaded boss for installation of the FRPT (fuel rail pressure and temperature) sensor.

Fuel Rail Pressure and Temperature Sensor

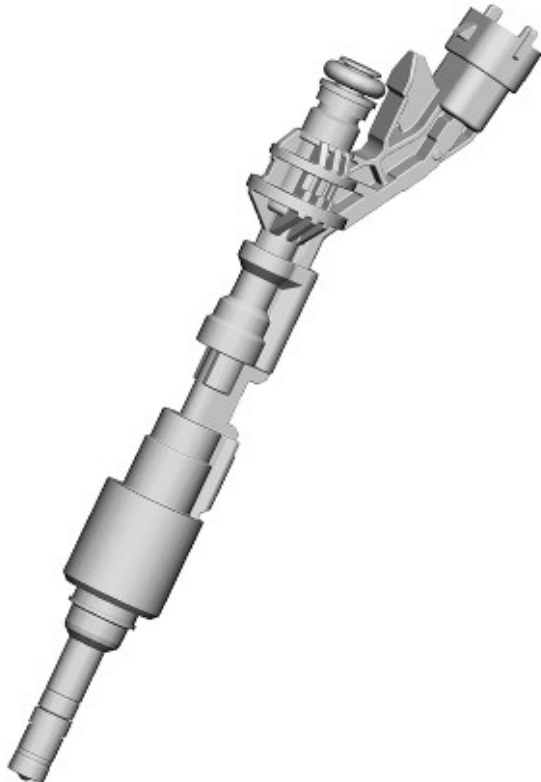


E143651

The FRPT (fuel rail pressure and temperature) sensor provides the [ECM](#) with a continuous signal of fuel rail pressure. The FRPT sensor is installed in the rear of the right fuel rail. The FRPT sensor is screwed into a threaded boss in the fuel rail.

The FRPT sensor contains a steel diaphragm fitted with strain gages, which are incorporated into a Wheatstone bridge. The output from the Wheatstone bridge is processed by the ECM to determine a pressure value and [NTC \(negative temperature coefficient\)](#).

Fuel Injectors



E113519

The fuel injectors spray fuel from the fuel rail directly into the combustion chambers. The fuel injectors are installed close to the center of the combustion chambers, between the inlet and exhaust valves and next to the spark plug.

The fuel injectors are a push fit in the fuel rails and the cylinder heads. On each fuel injector, an O-ring seal, seals the head of the fuel injector in the fuel rail. A teflon ring seals the nozzle of the fuel injector in the cylinder head.

Each fuel injector contains a solenoid-operated needle valve, which opens when the solenoid winding is energized. While the needle valve is open, fuel is sprayed into the combustion chamber. The solenoid winding is connected to a power feed and a ground from the **ECM**, which operates the fuel injectors with a two stage power supply. Initially the ECM supplies the fuel injectors with 65 V, then once the boost current reaches 11 A the power supply is switched to battery voltage. The ECM meters the amount of fuel injected into the combustion chambers by adjusting the time that the solenoid winding is energized.

There are six holes around the tip of the nozzle through which the fuel is sprayed. Two of the holes direct fuel below the spark plug. The other four holes direct fuel evenly around the remainder of the combustion chamber.

If a fuel injector fails, the engine will suffer from unstable idle speed, poor **NVH (noise, vibration and harshness)** and poor emissions performance.

OPERATION

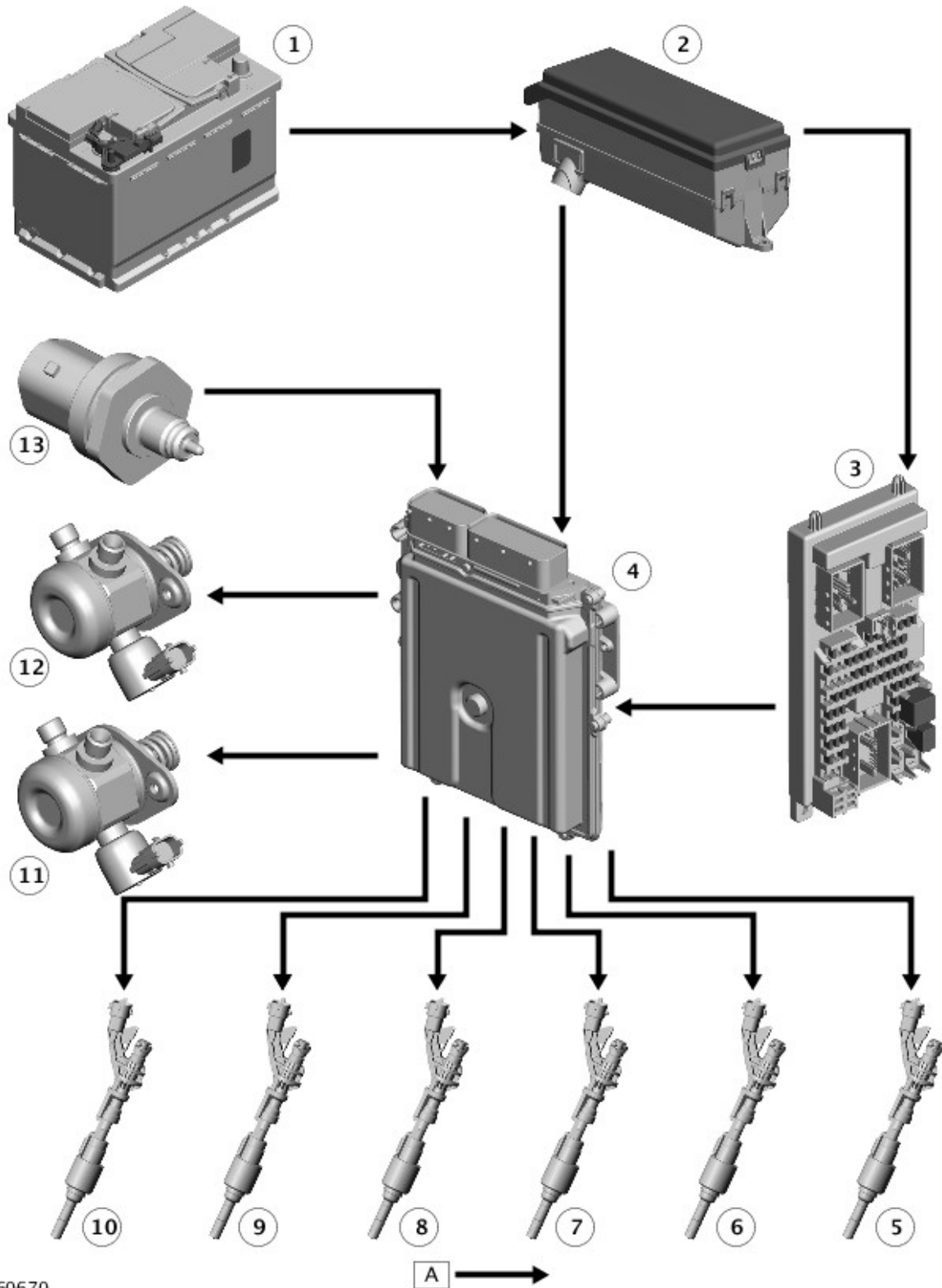
The **ECM** controls the output from the HP (high pressure) fuel pumps to deliver the required volume of fuel at pressures up to 200 bar (2900 lbf/in²).

The ECM uses the signal from the FRPT (fuel rail pressure and temperature) sensor to calculate the time the fuel injectors need to be energized to deliver the correct mass of fuel to the combustion chambers.

CONTROL DIAGRAM



NOTE: A = Hardwired



E160670

Item	Part Number	Description
1	-	Battery
2	-	Engine Junction Box (EJB)
3	-	Central Junction Box (CJB)
4	-	Engine Control Module (ECM)
5	-	No. 1 Fuel injector
6	-	No. 2 Fuel injector
7	-	No. 3 Fuel injector
8	-	No. 4 Fuel injector
9	-	No. 5 Fuel injector
10	-	No. 6 Fuel injector
11	-	No. 1 High Pressure (HP) fuel pump

- 12 - No. 2 HP fuel pump
- 13 - Fuel Rail Pressure and Temperature (FRPT) sensor

Fuel Charging and Controls - V6 S/C 3.0L Petrol - Fuel Charging and Controls

Diagnosis and Testing

Principles of Operation

For a detailed description of the fuel charging and controls system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to:

[Fuel Charging and Controls](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Description and Operation),
[Fuel Charging and Controls](#) (303-04E, Description and Operation),
[Fuel Charging and Controls](#) (303-04E, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Fuel level • Fuel leaks • Damaged fuel lines • Damaged push connect fittings • Fuel contamination/grade/quality • Throttle body • Damaged fuel tank filler pipe cap • Damaged fuel tank filler pipe 	<ul style="list-style-type: none"> • Fuses • Loose or corroded electrical connectors • Harnesses • Sensor(s) • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> • Engine breather system disconnected/restricted • Ignition system • Fuel system • Electronic engine control 	Ensure the engine breather system is free from restriction and is correctly installed. Check for ignition system, fuel system and electronic engine control DTCs and refer to the relevant DTC Index
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> • Evaporative emissions purge valve • Fuel pump • Spark plugs • HT short to ground (tracking) check rubber boots for cracks/damage • Ignition system 	Check for evaporative emissions, fuel system and ignition system related DTCs and refer to the relevant DTC Index
Difficult cold start	<ul style="list-style-type: none"> • Engine coolant level/anti-freeze content • Battery • Electronic engine controls • Fuel pump • Purge valve 	Check the engine coolant level and condition. Ensure the battery is in a fully charged and serviceable condition. Check for electronic engine controls, engine emissions, fuel system and evaporative emissions system related DTCs and refer to the relevant DTC Index
Difficult hot start	<ul style="list-style-type: none"> • Injector leak 	Check for injector leak, install new injector as required.

	<ul style="list-style-type: none"> • Electronic engine control • Purge valve • Fuel pump • Ignition system 	Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> • Injector leak • Electronic engine control • Purge valve • Fuel pump • Ignition system 	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index
Engine stalls soon after start	<ul style="list-style-type: none"> • Breather system disconnected/restricted • ECM relay • Electronic engine control • Ignition system • Air intake system restricted • Air leakage • Fuel lines 	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine control, ignition system and fuel system related DTCs and refer to the relevant DTC Index. Check for blockage in air filter element and air intake system. Check for air leakage in air intake system
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> • Fuel pressure, fuel pump, fuel lines • Injector leak • Air leakage • Electronic engine control • Throttle motor • Restricted accelerator pedal travel (carpet, etc) • Ignition system • Transmission malfunction 	Check for fuel system related DTCs and refer to the relevant DTC Index. Check for injector leak, install new injector as required. Check for air leakage in air intake system. Ensure accelerator pedal is free from restriction. Check for electronic engine controls, ignition, engine emission system and transmission related DTCs and refer to the relevant DTC Index
Engine backfires	<ul style="list-style-type: none"> • Fuel pump/lines • Air leakage • Electronic engine controls • Ignition system • Sticking variable camshaft timing (VCT) unit 	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls, ignition system and VCT system related DTCs and refer to the relevant DTC Index
Engine surges	<ul style="list-style-type: none"> • Fuel pump/lines • Electronic engine controls • Throttle motor • Ignition system 	Check for fuel system failures. Check for electronic engine controls, throttle system and ignition system related DTCs and refer to the relevant DTC Index
Engine detonates/knocks	<ul style="list-style-type: none"> • Fuel pump/lines • Air leakage • Electronic engine controls • Sticking VCT unit 	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls and VCT system related DTCs and refer to the relevant DTC Index
No throttle response	<ul style="list-style-type: none"> • Electronic engine controls • Throttle motor 	Check for electronic engine controls and throttle system related DTCs and refer to the relevant DTC Index
Poor throttle response	<ul style="list-style-type: none"> • Breather system disconnected/restricted • Electronic engine control • Transmission malfunction • Traction control event • Air leakage 	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine controls, transmission and traction control related DTCs and refer to the related DTC Index. Check for air leakage in intake air system

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: V6 3.0L S/C Petrol, DTC: Engine Control Module \(ECM\)](#) (100-00 General Information, Description and Operation).

Fuel Charging and Controls - V6 S/C 3.0L Petrol - Fuel Injection Component Cleaning

General Procedures

General Equipment

Pneumatic vacuum gun

Cleaning

WARNINGS:



Do not carry out any repairs to the fuel system with the engine running. Failure to follow this instruction may result in personal injury.



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.



Place the vehicle in a well ventilated, quarantined area and arrange 'No Smoking/Petrol Fumes' signs about the vehicle.



Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.



Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

CAUTIONS:



Before using the cleaning fluid, protect all electrical components and connectors with lint-free non-flocking material.



Make sure that all parts removed from the vehicle are placed on the lint-free non-flocking material.



Make sure that any protective clothing worn is clean and made from lint-free non-flocking material.



Make sure that clean non-plated tools are used. Clean tools using a new brush that will not lose its bristles, prior to starting work on the vehicle.



Use a steel topped workbench and cover it with clean, lint-free non-flocking material.



Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

1. Using a new brush that will not lose its bristles, brush the components being removed and the surrounding area.
2. Using a pneumatic vacuum gun, remove all traces of foreign material.

General Equipment: [Pneumatic vacuum gun](#)

Fuel Charging and Controls - V6 S/C 3.0L Petrol - Fuel Injection Component Cleaning Using Pressure Cleaner

General Procedures

Cleaning

WARNINGS:



If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.



Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.



Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.



Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

CAUTIONS:



Make sure that any protective clothing worn is clean and made from lint-free non-flocking material.




Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

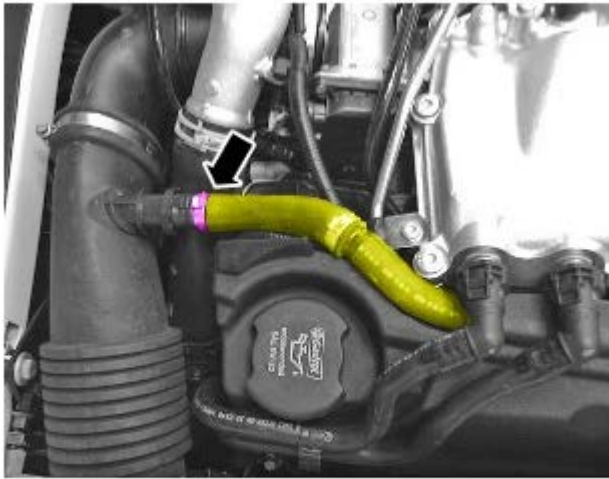


Before using the cleaning fluid, protect all electrical components and connectors with lint-free non-flocking material.



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.


-  CAUTION: Make sure the correct additive is used in this step. Failure to carry out this instruction may cause damage to the vehicle.
 - Open the fuel filler door and remove the cap.
 - Empty the fuel additive into the fuel filler pipe.
 - Install the fuel filler cap and close the fuel filler door.
2. Refer to: Engine Cover - V8 5.0L Petrol/V8 S/C 5.0L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Release the breather from the air intake elbow.



E138648

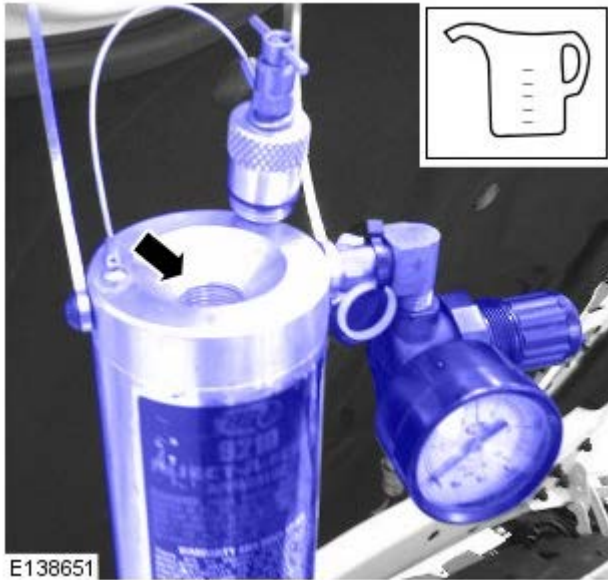


E138649

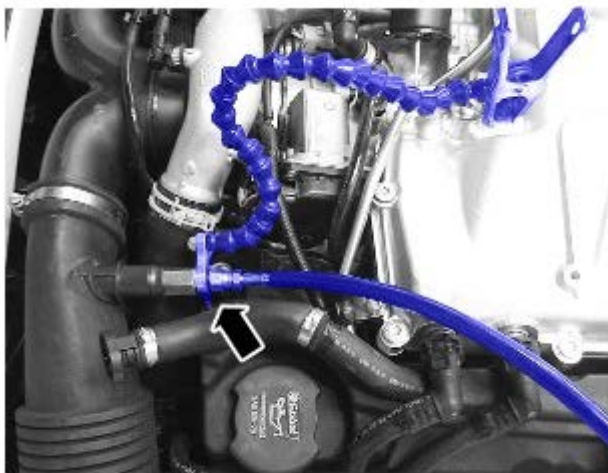
4.  **CAUTION:** Make sure the correct additive is used in this step. Failure to carry out this instruction may cause damage to the vehicle.

Install the cleaning equipment to a suitable location under the hood.

5.
 - Remove the cleaning equipment filler cap.
 - Empty the induction system cleaning fluid into the cleaning equipment.
 - Install the filler cap.



6. Position the intake system cleaning tool into intake elbow and secure with the clamp.



7.
 - Connect a suitable compressed air line to the cleaning equipment.
 - Set the pressure to 4 bar.



8. Start and run the engine.

9.
 - Open the ball valve on the cleaning equipment and allow the cleaning fluid



E138653

- to spray into the intake elbow.
- Raise the engine speed to 1200 rpm and hold until the cleaning fluid spray has stopped.

10.

- Close the ball valve.
- Release the air pressure in the cleaning equipment.
- Disconnect the air line.

11. Connect the breather to the air intake elbow.



E138648

12. Refer to: Engine Cover - V8 5.0L Petrol/V8 S/C 5.0L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation).

13.

- Start the engine.
- Allow the engine to idle for 30 seconds.
- Raise the engine speed to 1500 rpm and hold for 3 minutes until a temperature of 70°C is achieved.
- Allow the engine to idle for 30 seconds.
- Switch off the engine.

14. Connect the approved diagnostic equipment to the vehicle.

15. Follow on screen prompts and check for DTC's (Diagnostic Trouble Codes).
16. Clear the DTC's following the on screen procedure.
17. Disconnect the approved diagnostic equipment from the vehicle.

Fuel Charging and Controls - V6 S/C 3.0L Petrol - Fuel Injectors

Removal and Installation

Removal

1. Refer to: [Fuel Rail RH](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Removal and Installation).
Refer to: [Fuel Rail LH](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Removal and Installation).


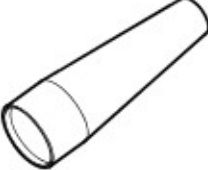
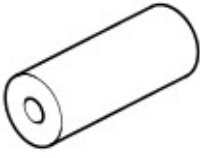
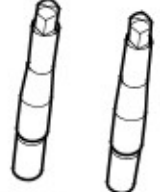
Installation

1. To install, reverse the removal procedure.

Fuel Charging and Controls - V6 S/C 3.0L Petrol - Fuel Rail LH

Removal and Installation

Special Tool(s)

 <p>E114526</p>	<p>310-197 Remover, Fuel Injector</p>
 <p>E107680</p>	<p>310-198 Installer, Teflon Seal</p>
 <p>E107681</p>	<p>310-199 Re-shape Tool, Teflon Seal</p>
 <p>E107682</p>	<p>310-200-01 Fuel Rail Installation Guide Pins - Threaded</p>

Removal

CAUTIONS:



Make sure that tools and equipment are clean and free of foreign material and lubricant.



Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

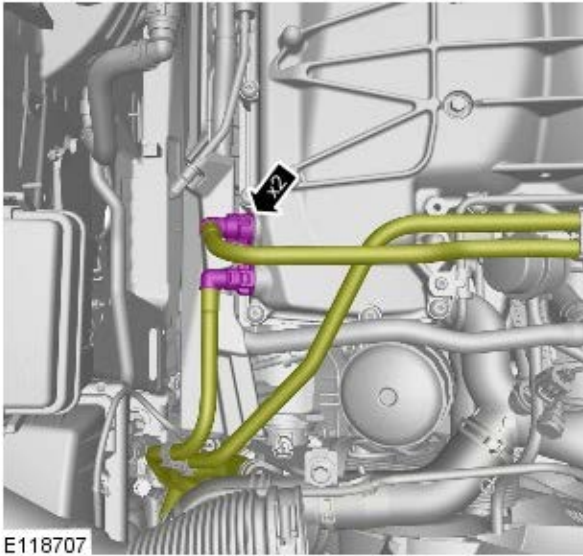



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

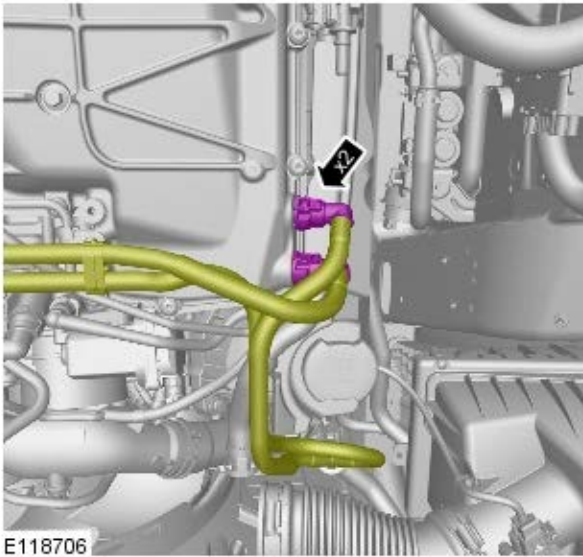
1. Refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Fuel System Pressure Release - V6 S/C 3.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).
3. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
5. Disconnect the battery ground cable.


Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

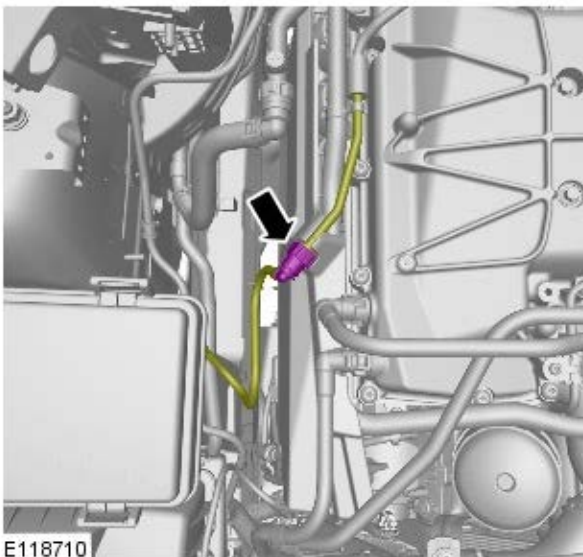
6. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).



7.  CAUTION: Be prepared to collect escaping coolant.

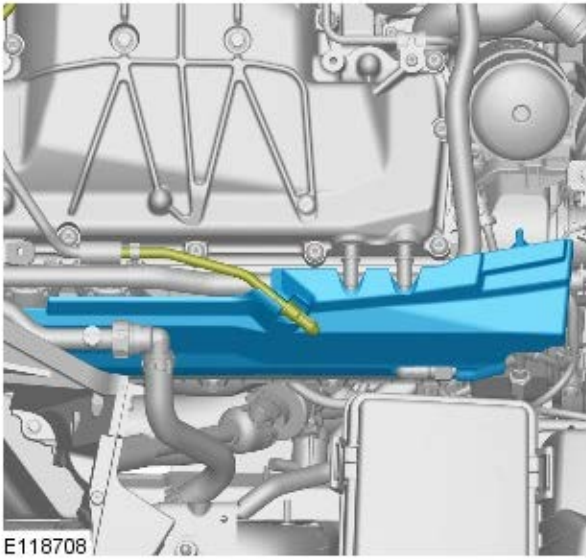


8.  CAUTION: Be prepared to collect escaping coolant.



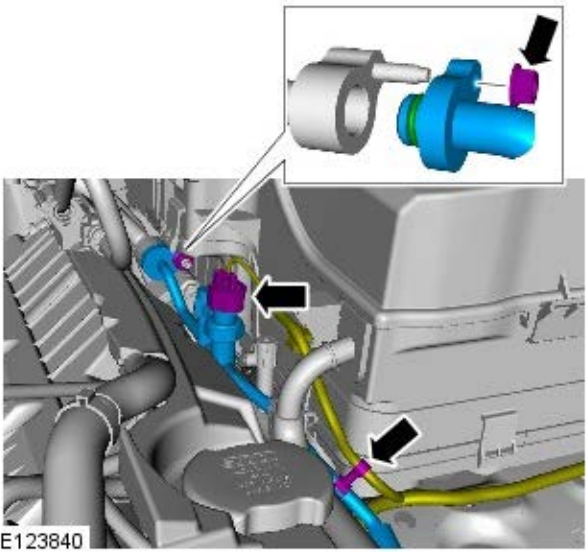
- 9.

- 10.



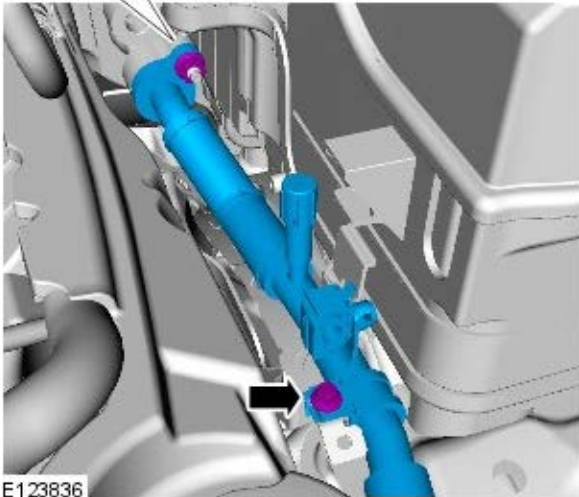
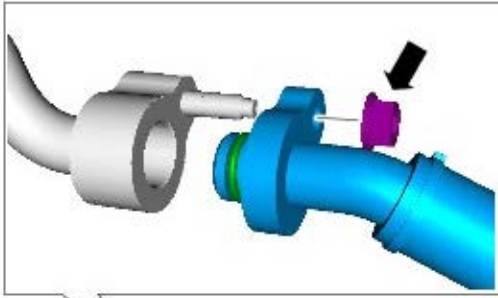
E118708

11.

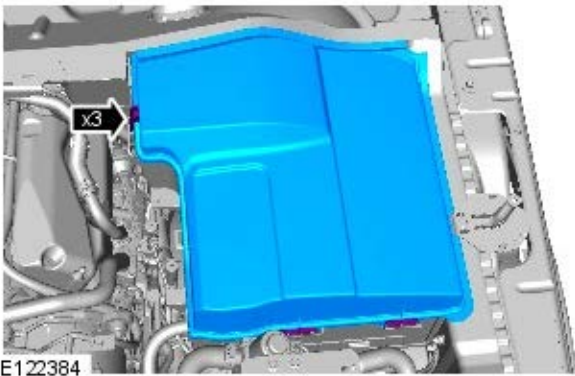


E123840

12.

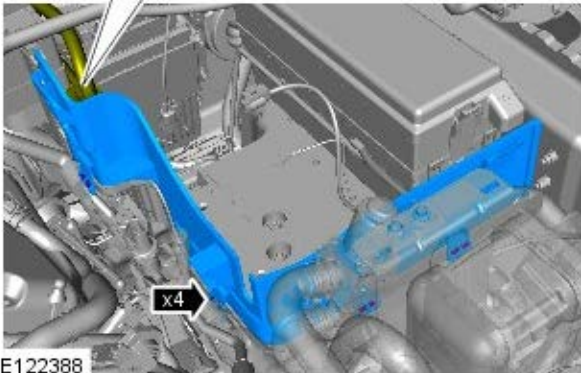
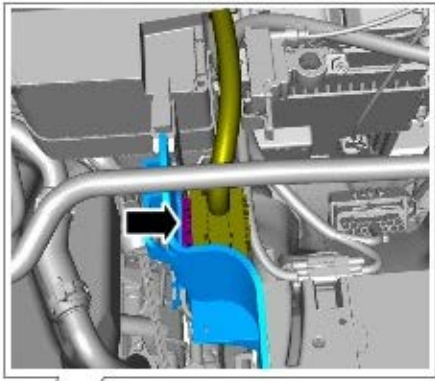


13.

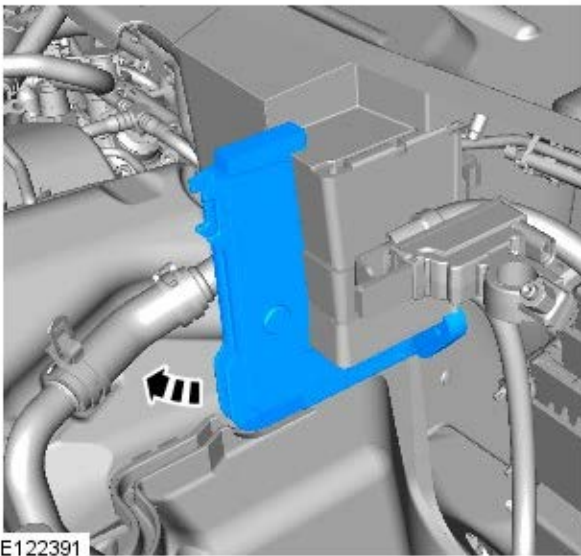


14. Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

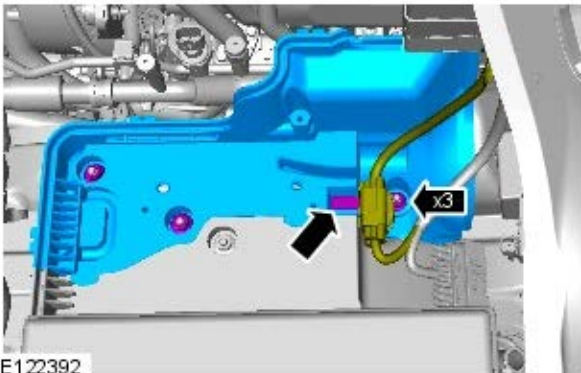
15.  NOTE: Right-hand shown, Left-hand similar.



E122388



E122391

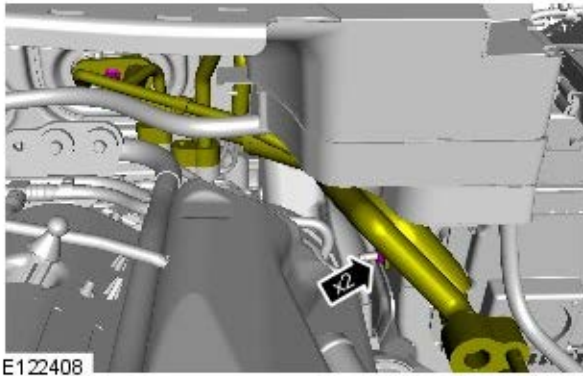


E122392

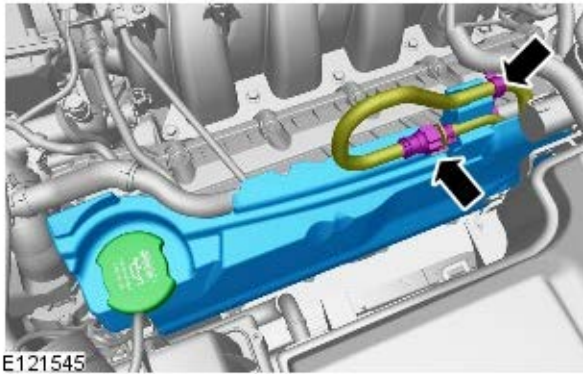
16.  NOTE: Right-hand shown, Left-hand similar.

17.

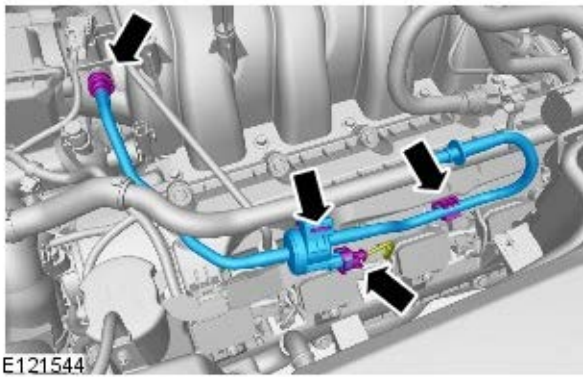
18.



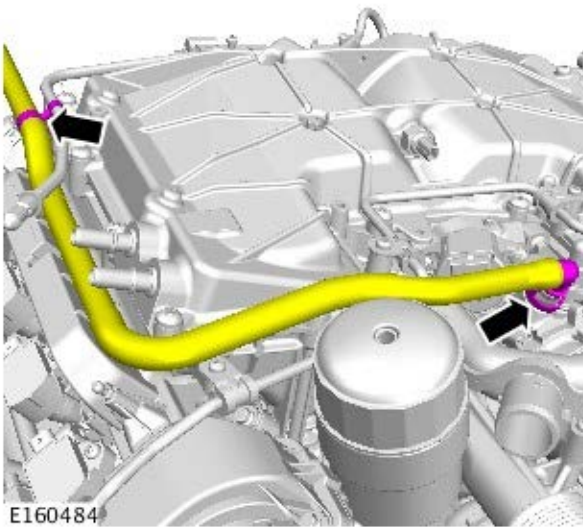
19.




20.



21.



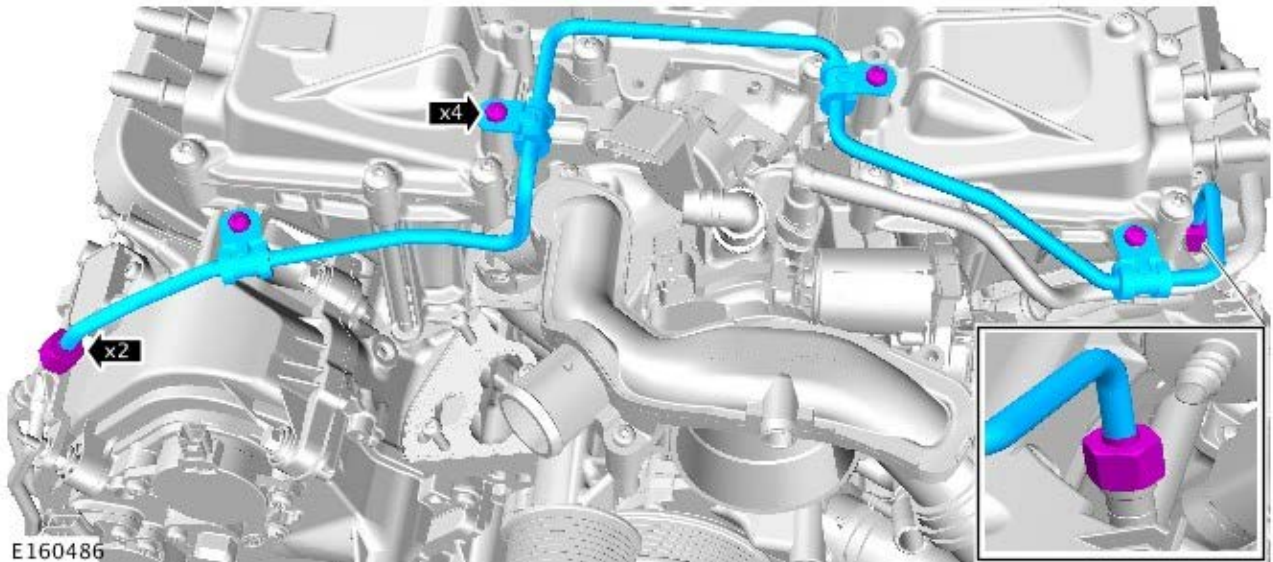
22.  **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

CAUTIONS:

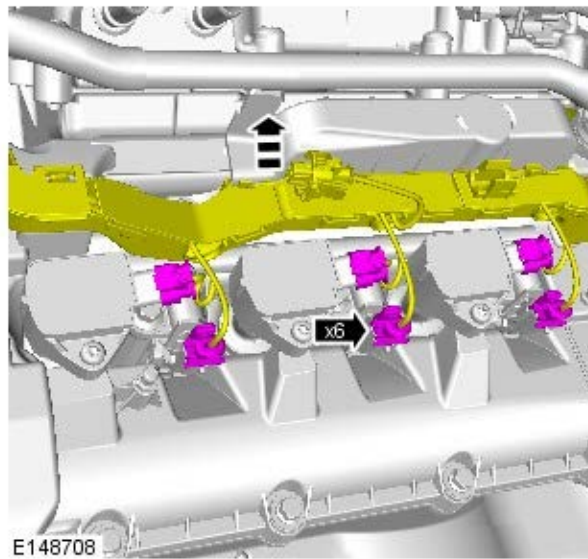
 Make sure that the fuel line union does not rotate.

 Be prepared to collect escaping fluids.

 Make sure that all openings are sealed. Use new blanking caps.

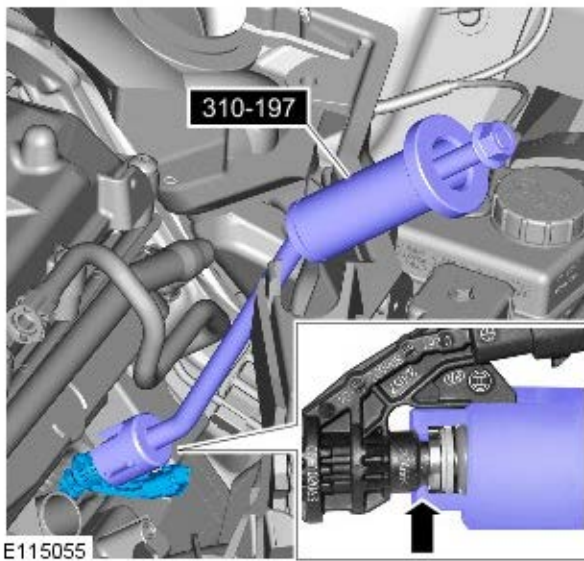
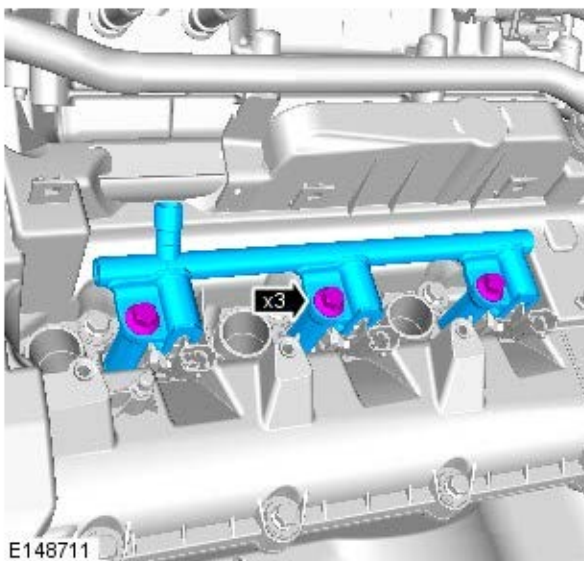
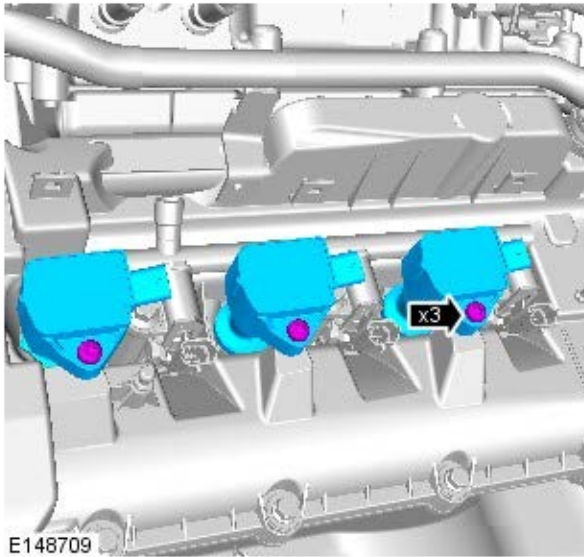



23.




24. Refer to: [Fuel Injection Component Cleaning](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, General Procedures).


25.



26.  CAUTION: Make a note of the fuel injector clamp alignment to the fuel rail prior to removal.

27. CAUTIONS:

 Make sure that the special tool is located correctly to the fuel injector prior to removing the fuel injector.


 Make sure that the special tool is held square to the fuel injector during removal.


 Make sure that all open ports are covered to prevent any foreign material ingress.

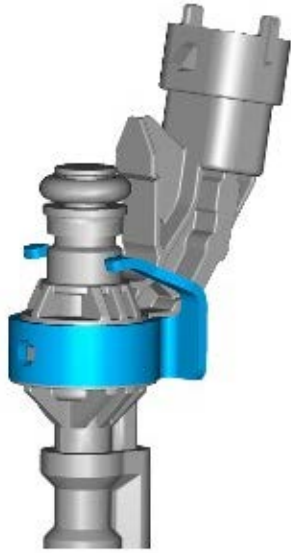
 NOTE: RH illustration shown, LH is similar.

Special Tool(s): [310-197](#)

28. CAUTIONS:

 If new fuel injectors are installed, a new injector clamp must be installed.

 If the fuel injector is being removed without a






E115057

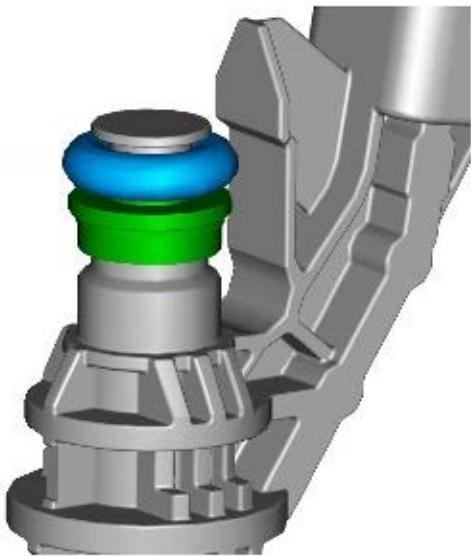
new component being installed, the fuel injector clamp must remain with the fuel injector it is removed with.




29. CAUTIONS:

-  Do not use a knife to remove the Teflon seal as damage could occur to the fuel injector.
-  Do not cut the Teflon seal too deep as damage could occur to the fuel injector.
-  Pinch the Teflon seal to allow the tool to cut the Teflon seal without damaging the fuel injector.

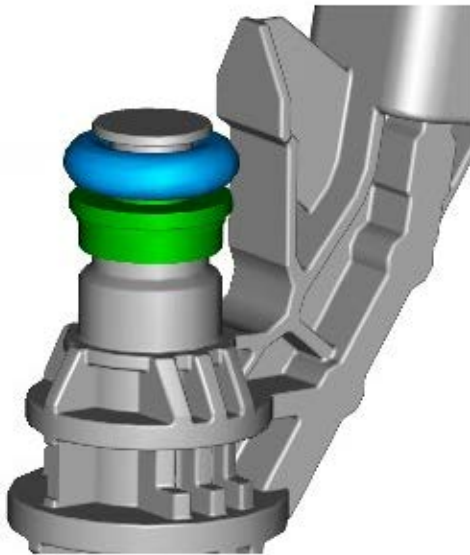
E115058



E115059

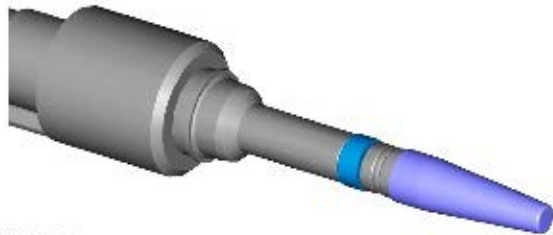
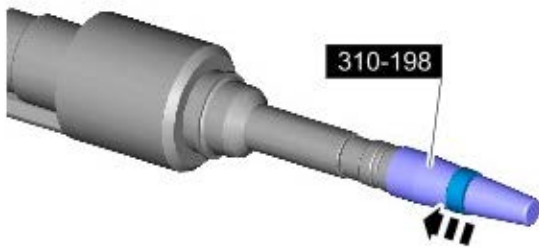
30.  CAUTION: Do not use any sharp tools to remove the O-ring seal as damage could occur to the fuel injector.

Installation



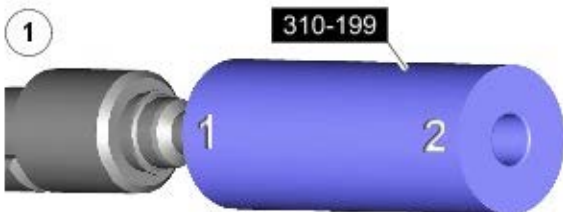
E115059

2. *Special Tool(s):* [310-198](#)




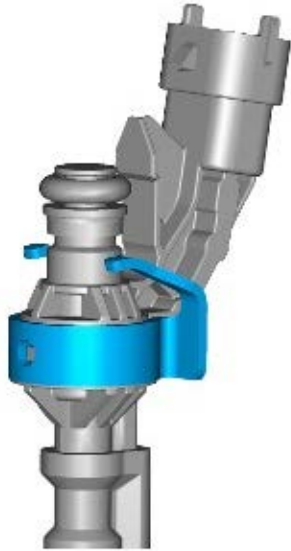
E115060

3. *Special Tool(s):* [310-199](#)

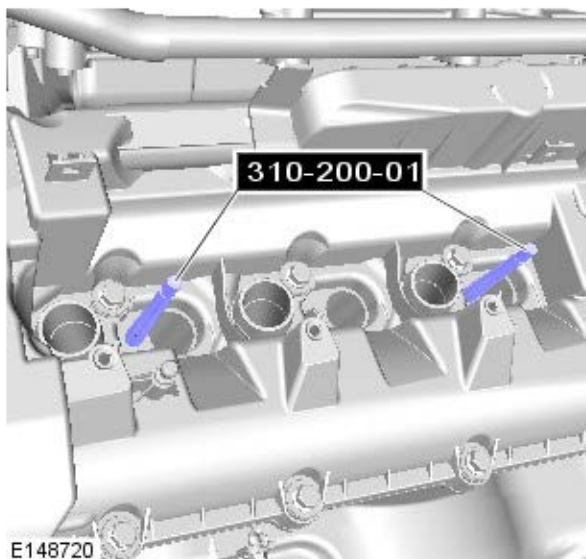


E115062

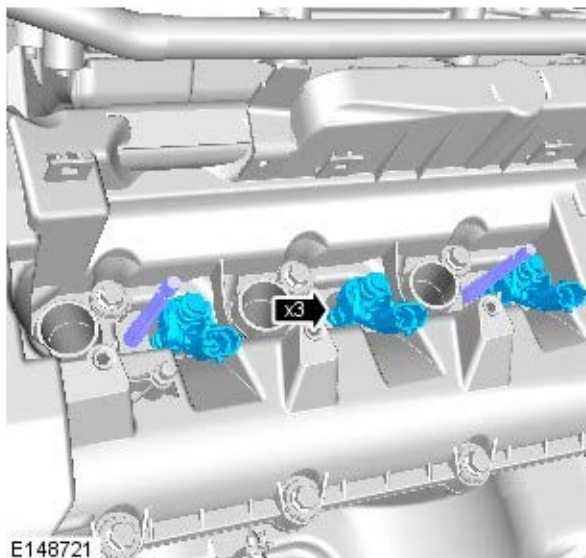
4.  CAUTION: If the original fuel injector is being installed, the original fuel injector clamp must be installed with the fuel injector it was removed with.



E115057



E148720





E148721

5.  CAUTION: If a new cylinder head has been installed then the special tool 310-200-02 without the thread must be used to install the fuel rail.


Special Tool(s): [310-200-01](#)


6. CAUTIONS:

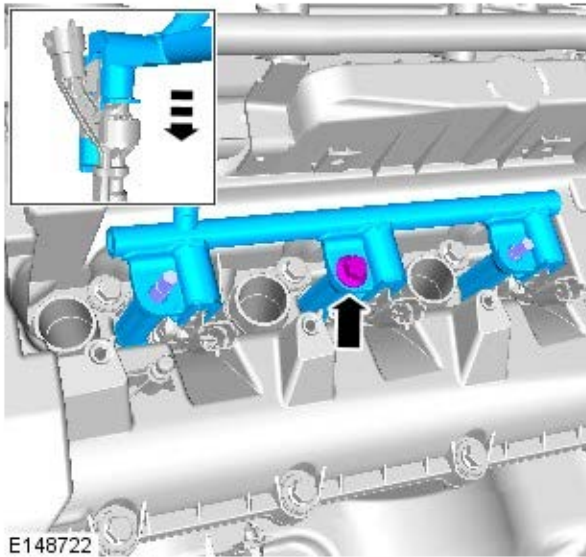
 Make sure that the area around the open fuel injector ports are clean and free of foreign material and lubricant prior to installing the fuel injector.

 When installing the fuel injector(s), make sure that the Teflon seal is clean and free of foreign material and lubricant.

7. CAUTIONS:


 If new fuel injectors are installed, a new injector clamp must be installed.

 Make sure that the fuel injector is aligned and



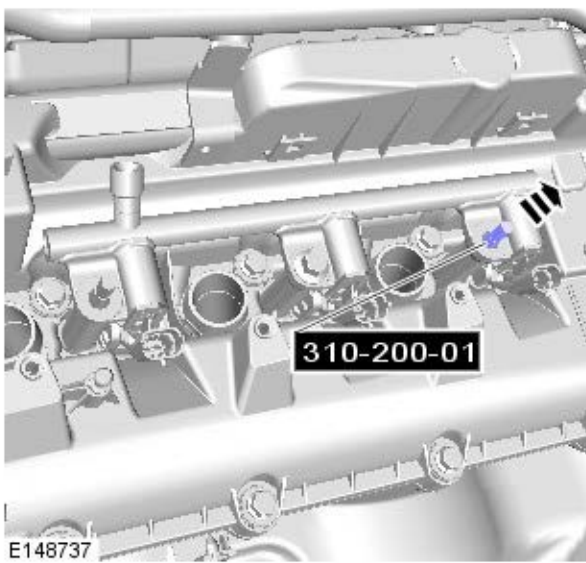
installed into the fuel rail correctly, as noted in the removal step.

 Tighten the fuel rail retaining bolts a turn at a time until the correct torque is achieved.

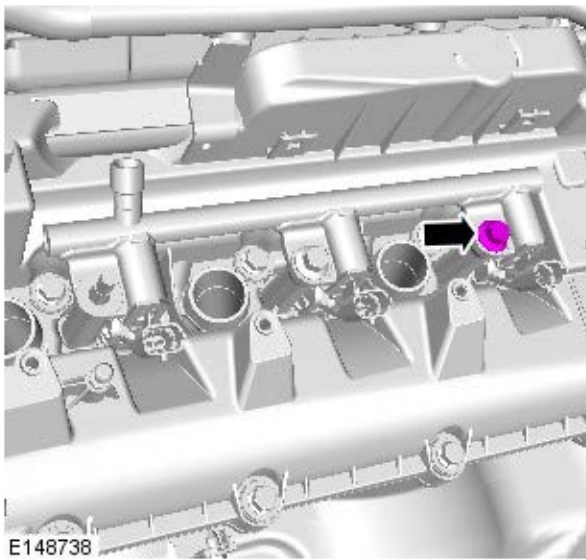
 NOTE: Lubricate the fuel injector O-ring seals with clean engine oil.

Torque: 20 Nm

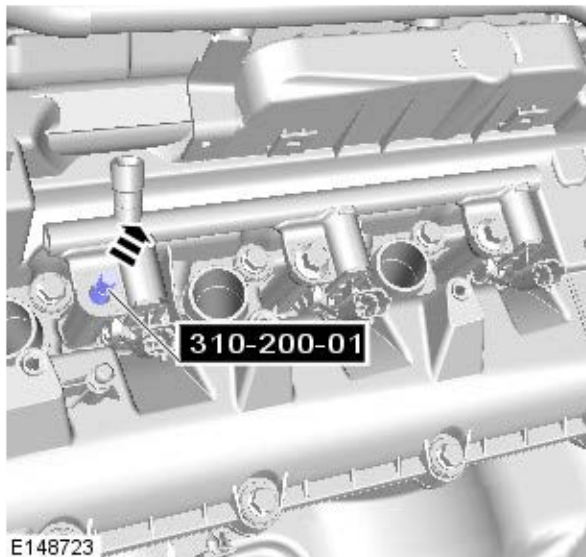
8. *Special Tool(s):* [310-200-01](#)



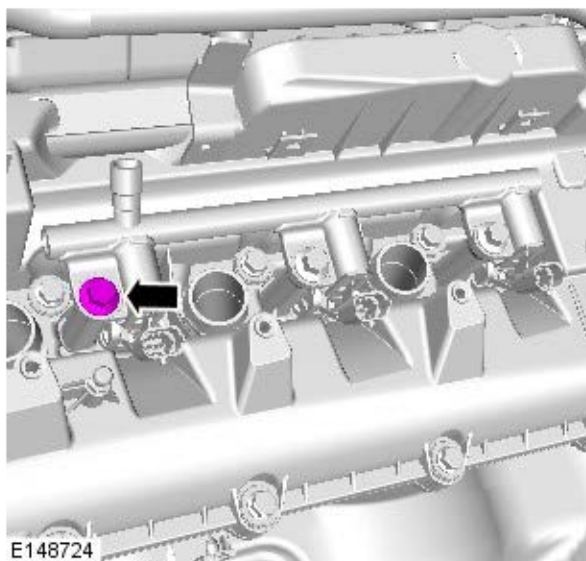
9. *Torque:* 20 Nm




10. *Special Tool(s):* [310-200-01](#)

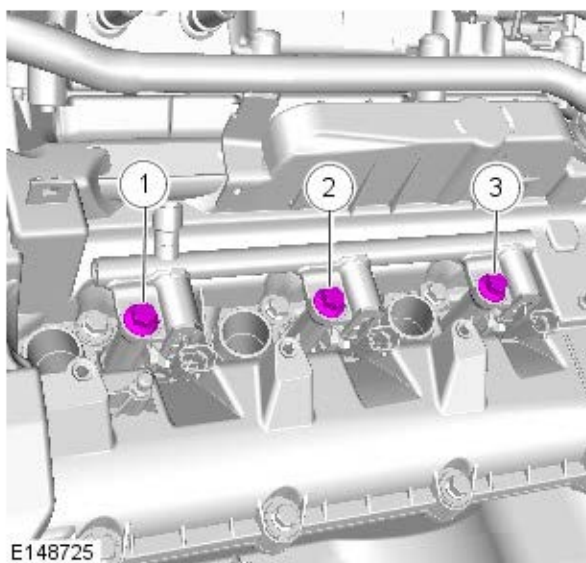


11. Torque: 20 Nm

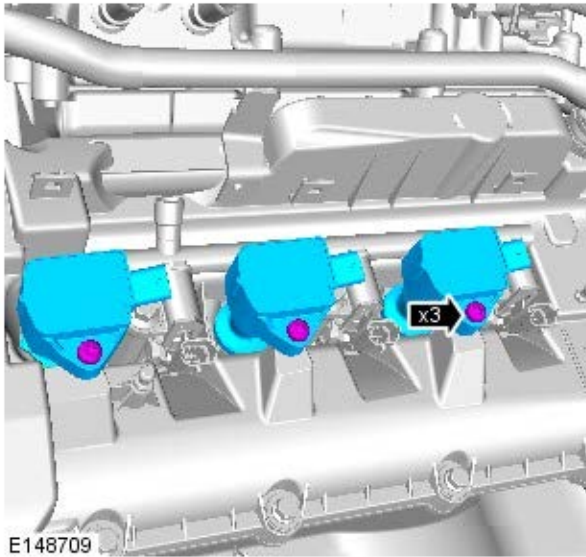


12.  NOTE: Tighten the bolts in the indicated sequence.

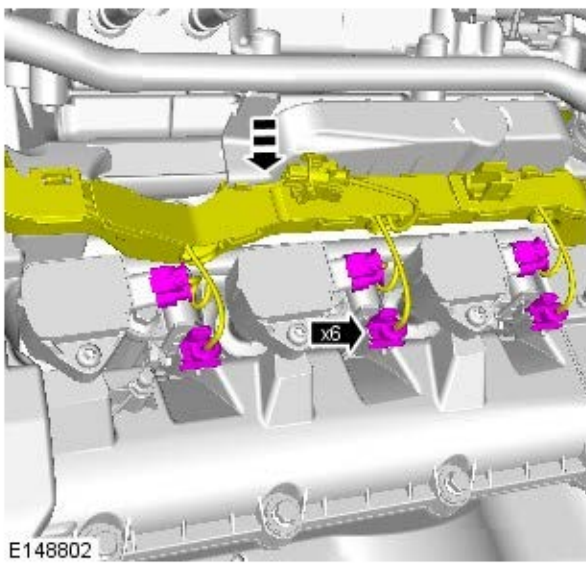
Torque:
Bolt 2 30 Nm
Bolt 3 30 Nm
Bolt 1 30 Nm



13. Torque: 7 Nm



14.



15.  CAUTION: Lubricate only the union threads with clean engine oil.

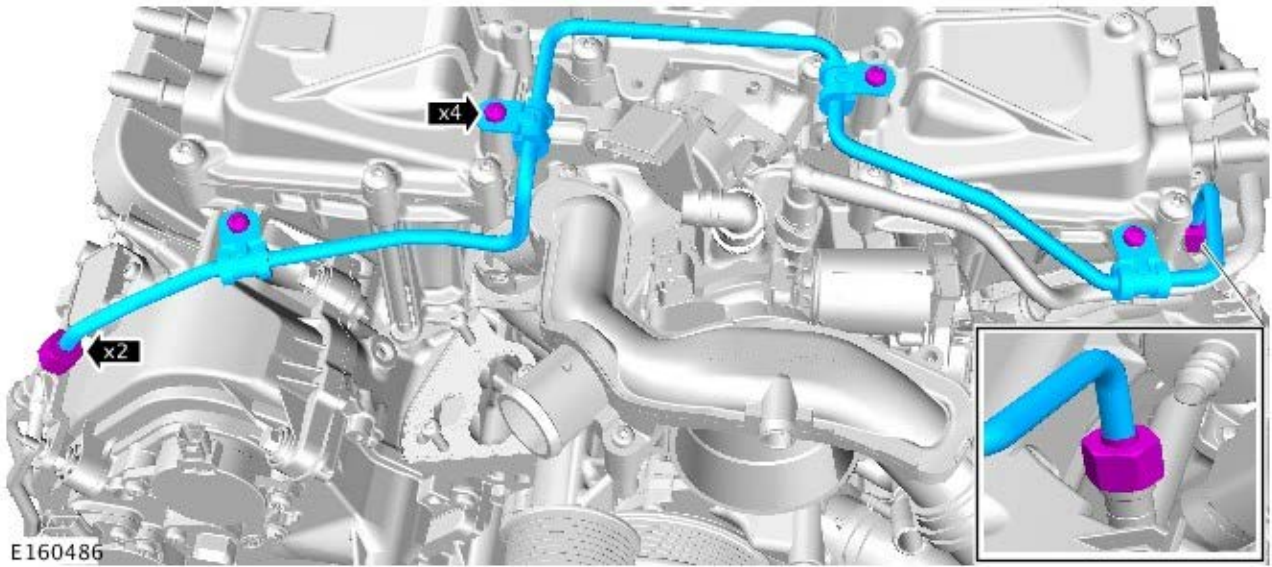
NOTES:



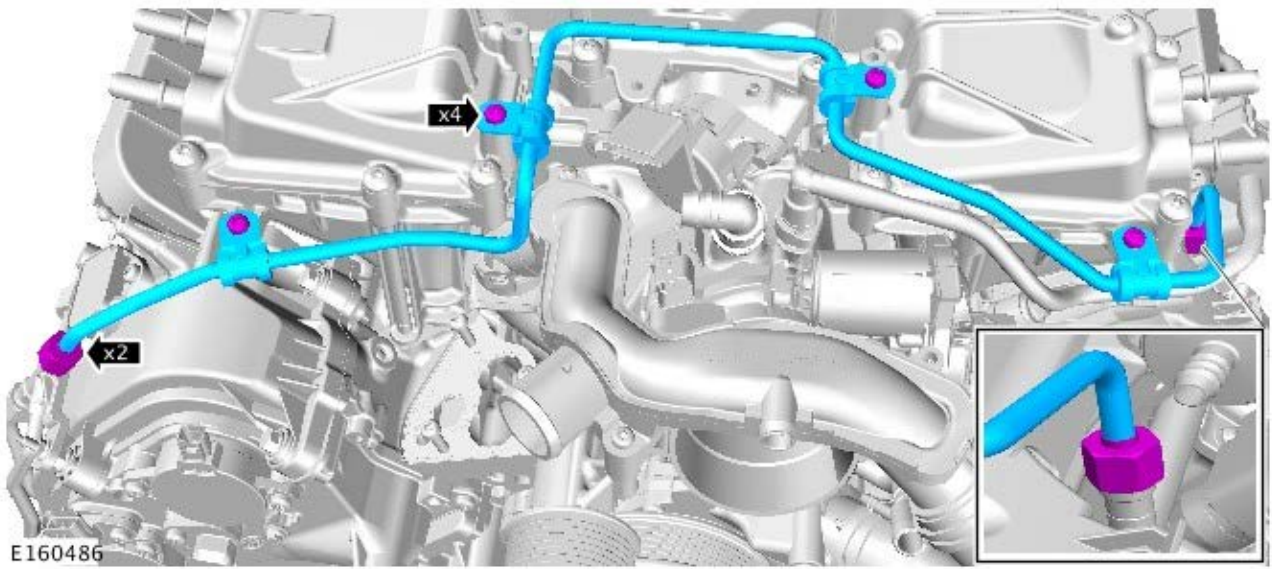
Do not tighten at this stage.



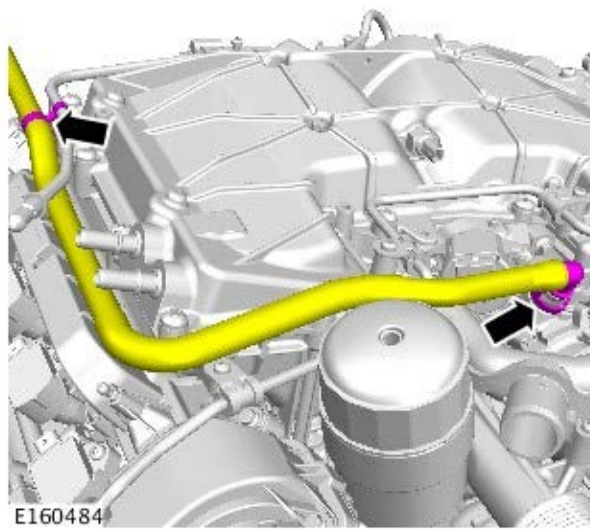
Remove and discard the blanking caps.



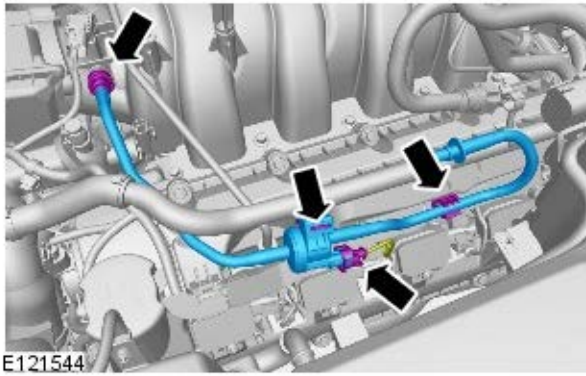
16. Torque:
Unions 21 Nm
Bolts 8 Nm



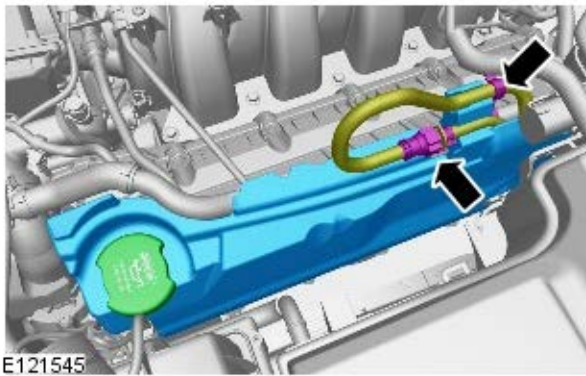
17.



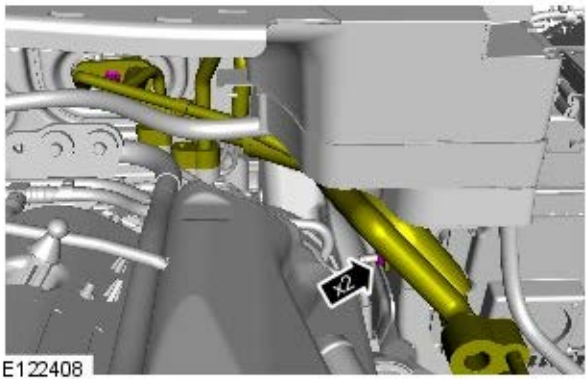
18.



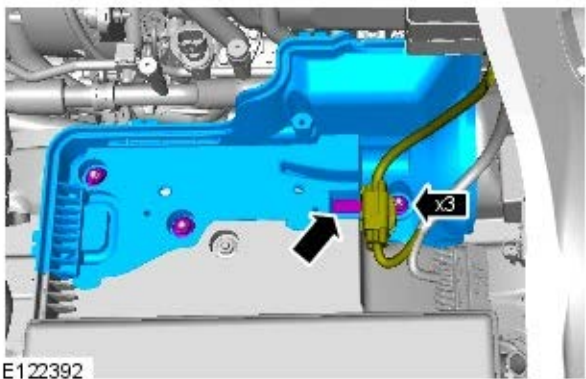
19.



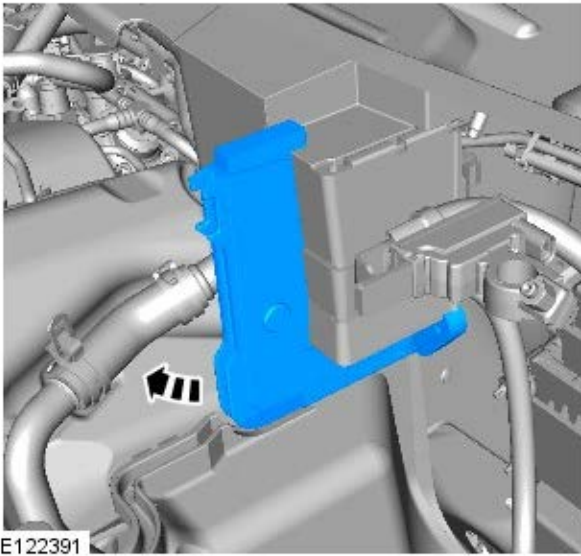
20. Torque: 12 Nm



21. Torque: 12 Nm

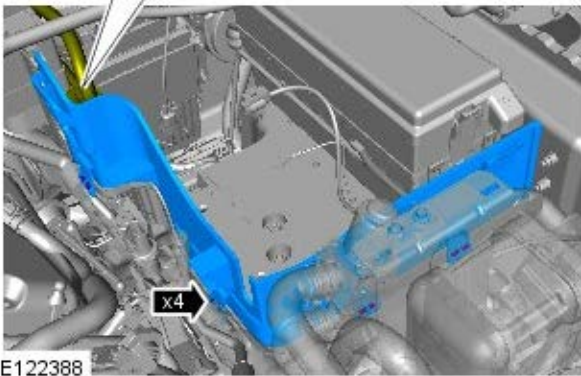
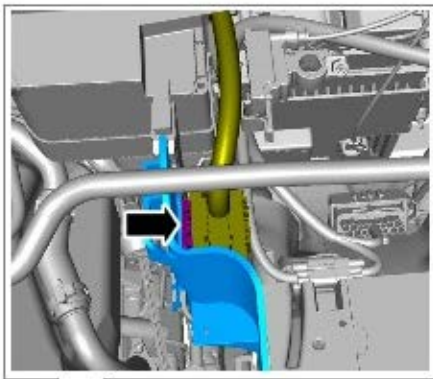


22.  NOTE: Right-hand shown, Left-hand similar.



E122391

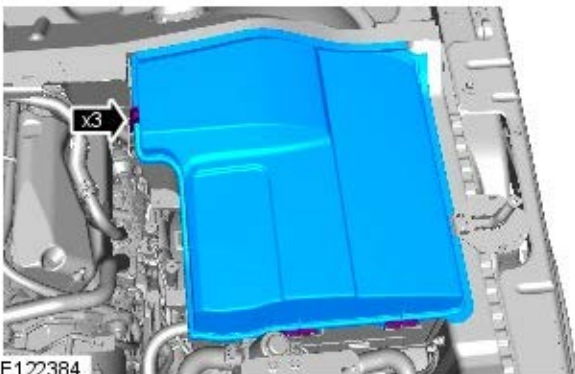
23.  NOTE: Right-hand shown, Left-hand similar.



E122388

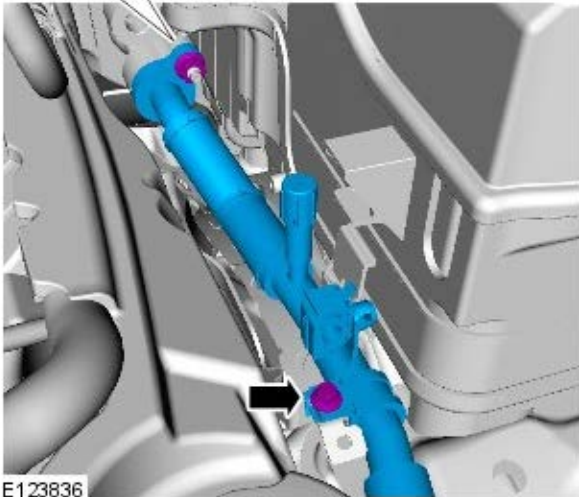
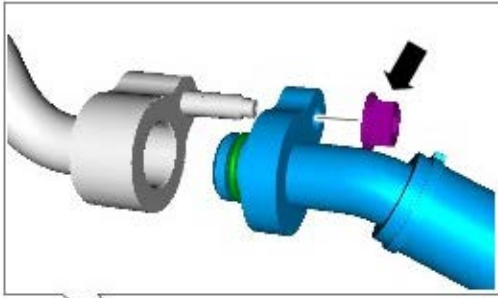
24. Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

25.



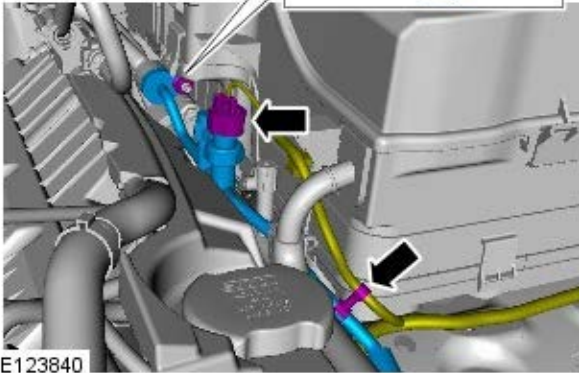
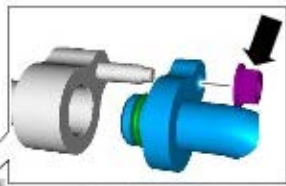
E122384

26. Torque: 12 Nm



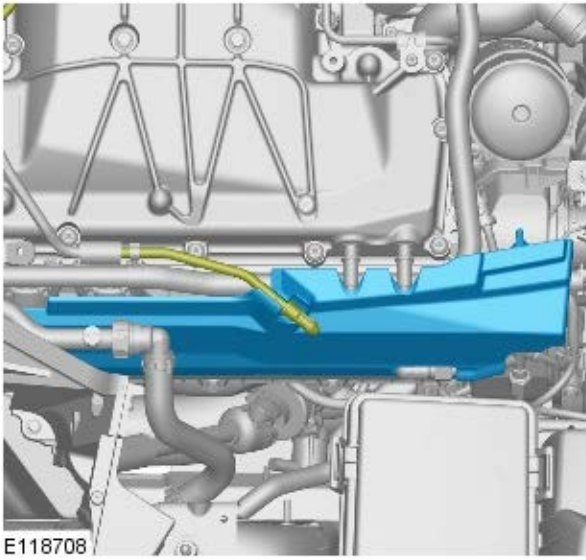
E123836

27. Torque: 12 Nm

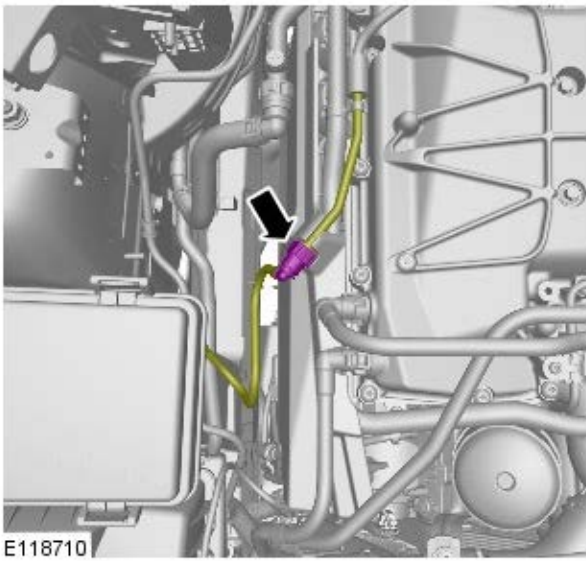


E123840

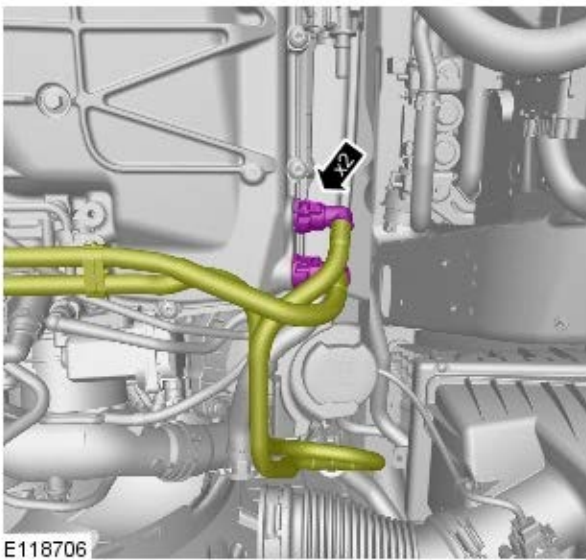
28.



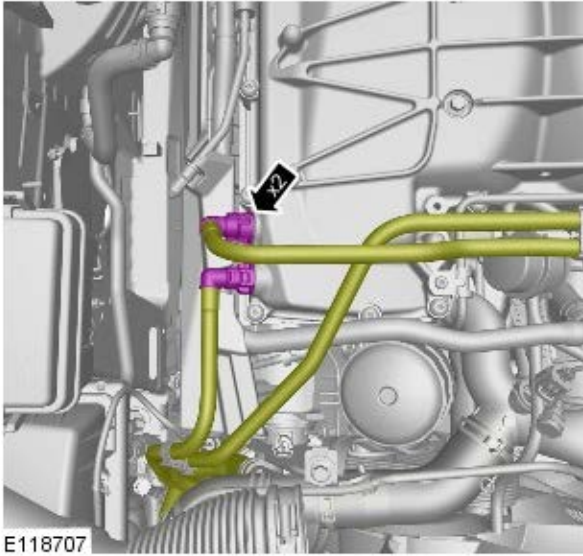
29.



30.



31.




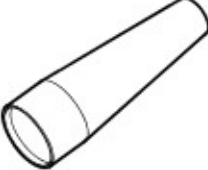
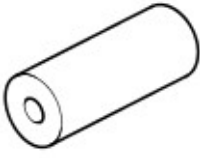
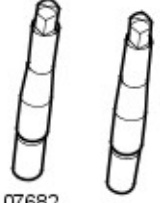
32. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
33. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).
34. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
35. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

Fuel Charging and Controls - V6 S/C 3.0L Petrol - Fuel Rail RH

Removal and Installation

Special Tool(s)

 E114526	310-197 Remover, Fuel Injector
 E107680	310-198 Installer, Teflon Seal
 E107681	310-199 Re-shape Tool, Teflon Seal
 E107682	310-200-01 Fuel Rail Installation Guide Pins - Threaded

Removal

CAUTIONS:



Make sure that tools and equipment are clean and free of foreign material and lubricant.



Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.



Some components shown removed for clarity.



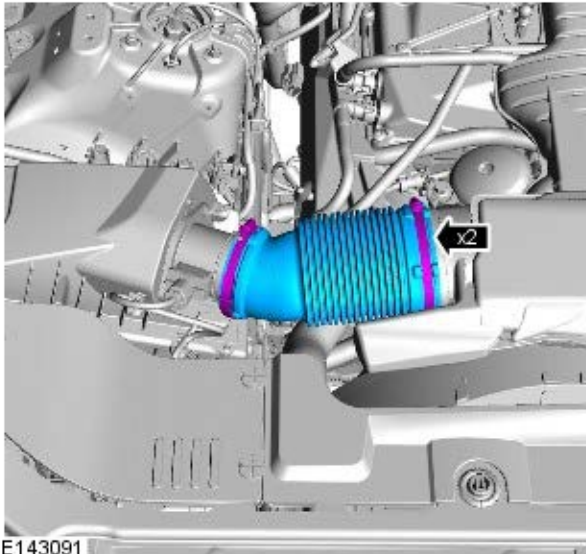
Removal steps in this procedure may contain installation details.

1. Refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Fuel System Pressure Release - V6 S/C 3.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).
3. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

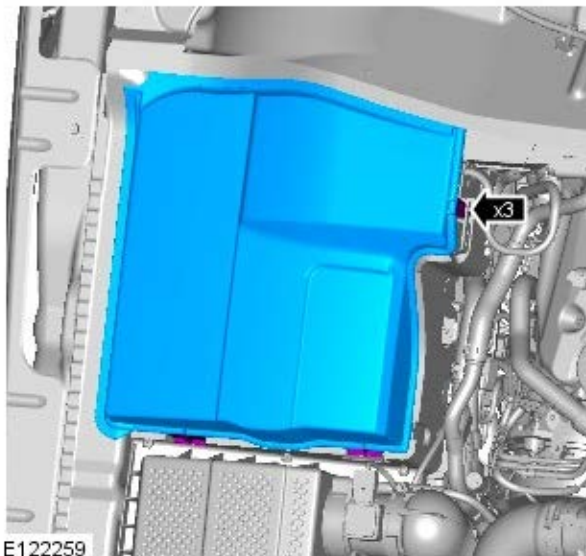
- Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

6.



- Refer to: [Air Cleaner RH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

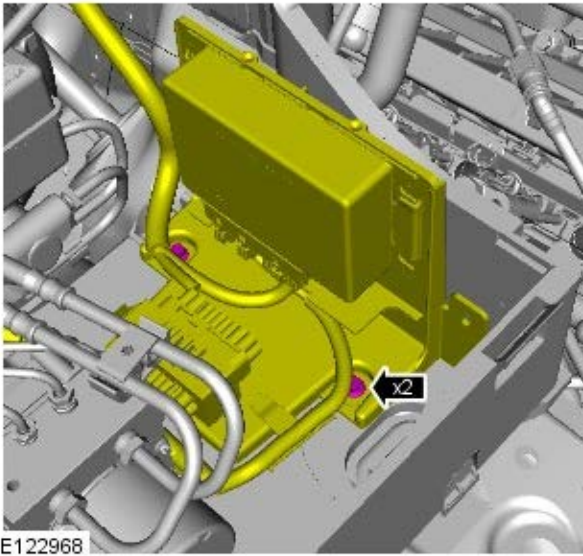
8.



-  NOTE: Left-hand drive vehicles.

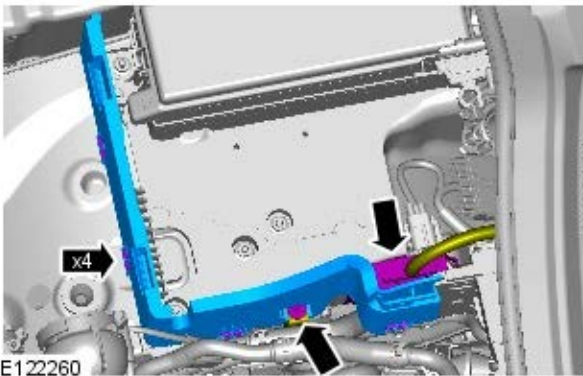
Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

-  NOTE: Right-hand drive vehicles.



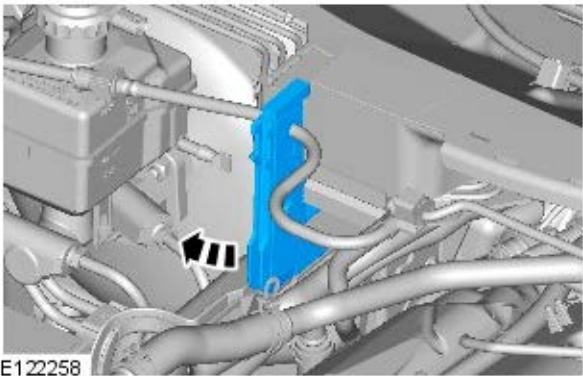
E122968

11.



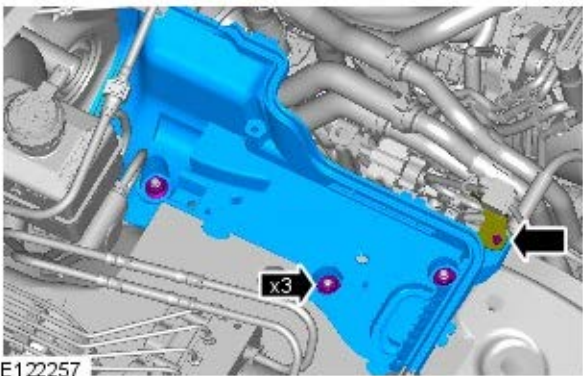
E122260

12.



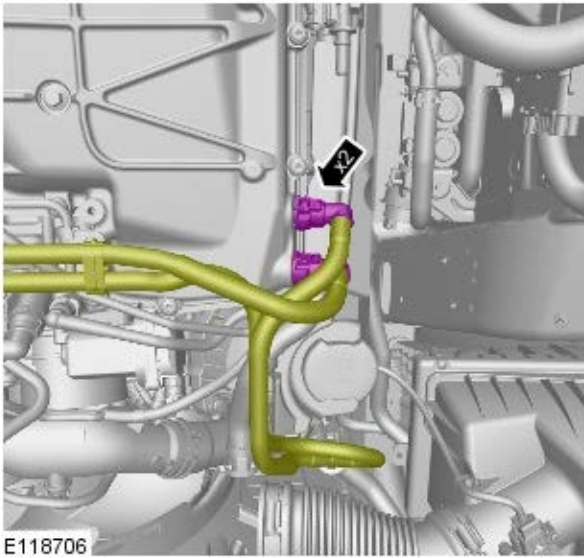
E122258

13.

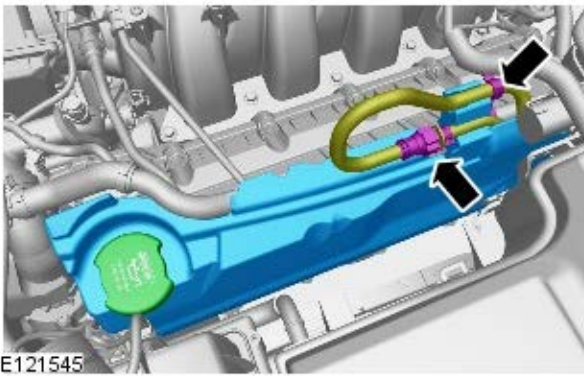


E122257

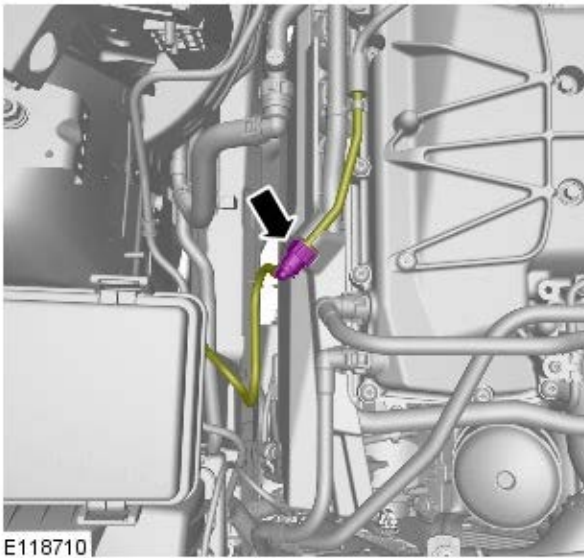
14.  CAUTION: Be prepared to collect escaping coolant.




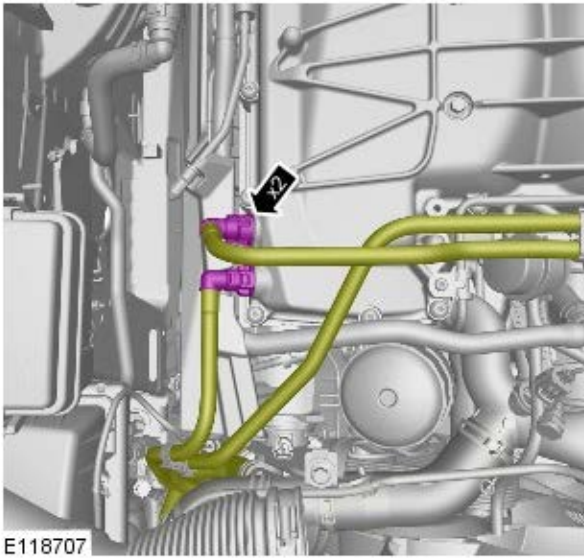
15.



16.

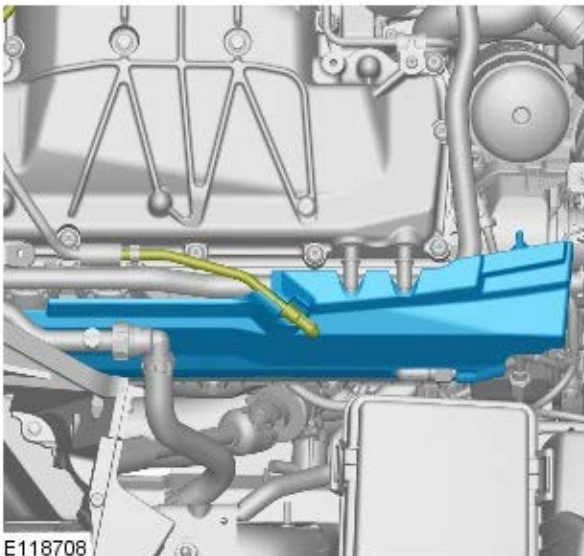


17.  CAUTION: Be prepared to collect escaping coolant.



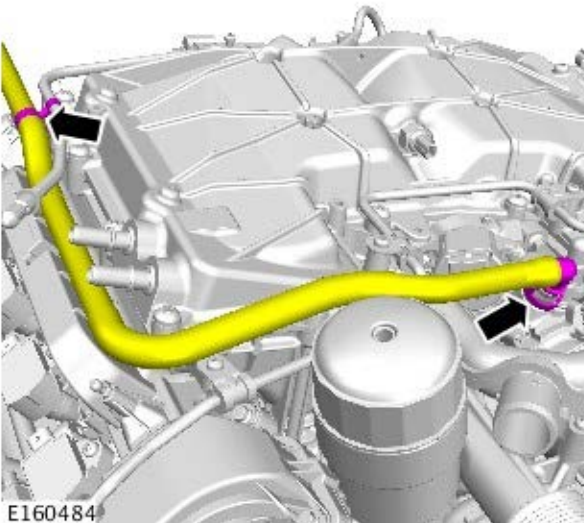
E118707

18.




E118708

19.



E160484

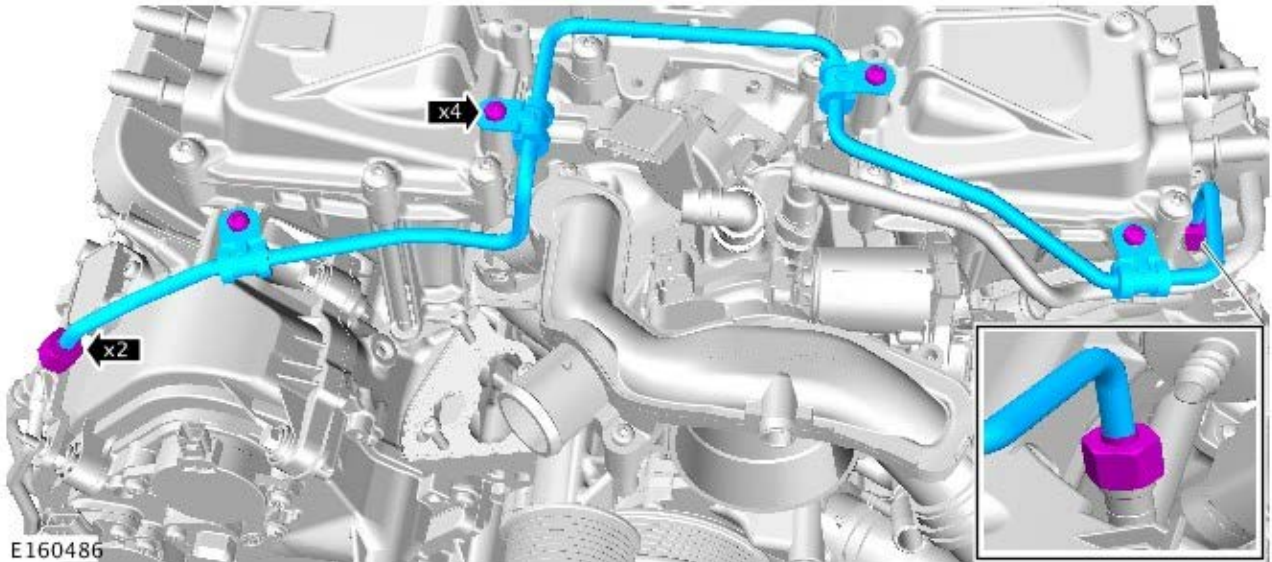
20.  **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

CAUTIONS:

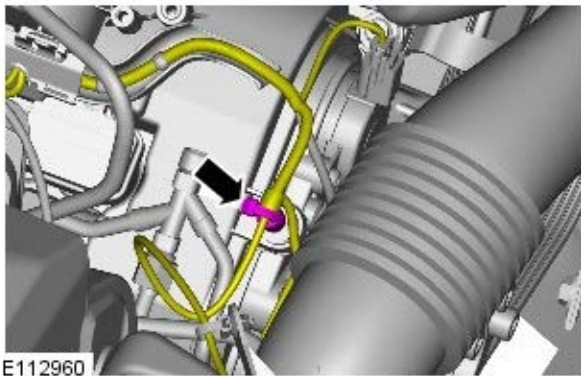
 Make sure that the fuel line union does not rotate.

 Be prepared to collect escaping fluids.

 Make sure that all openings are sealed. Use new blanking caps.



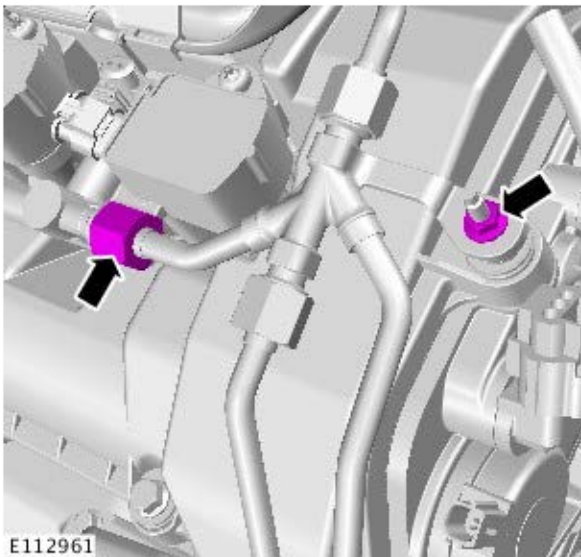
21.




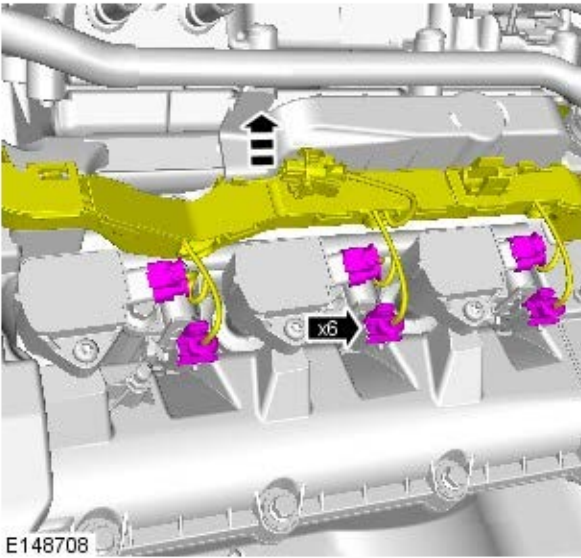
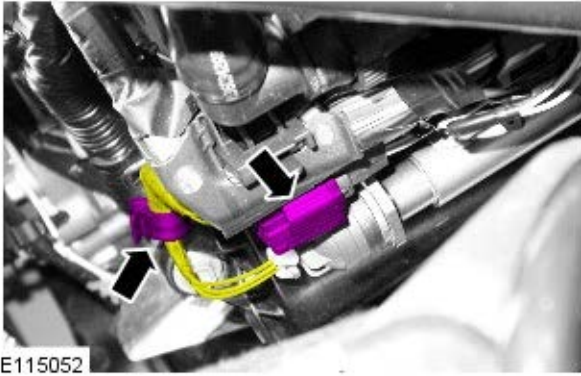
22. CAUTIONS:

 Be prepared to collect escaping fluids.

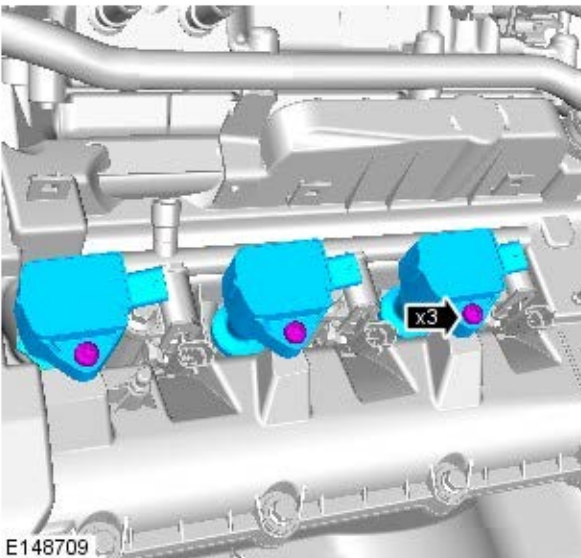
 Make sure that all openings are sealed. Use new blanking caps.




23.  NOTE: If equipped.



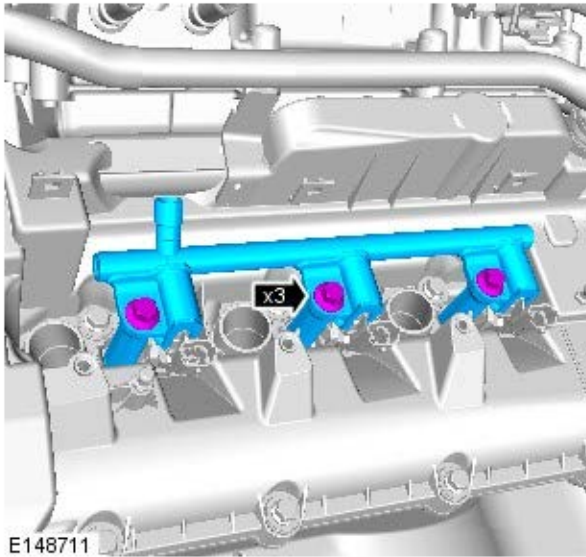
24.  NOTE: LH illustration shown, RH is similar.



25.  NOTE: LH illustration shown, RH is similar.

26.  CAUTION: Make a note of the fuel injector clamp alignment to the fuel rail prior to removal.

 NOTE: LH illustration shown, RH is similar.



E148711


27.  CAUTION: Be prepared to collect escaping fuel.


 NOTE: Do not disassemble further if the component is removed for access only.



E145603

28. NOTES:


 Do not disassemble further if the component is removed for access only.

 If equipped.

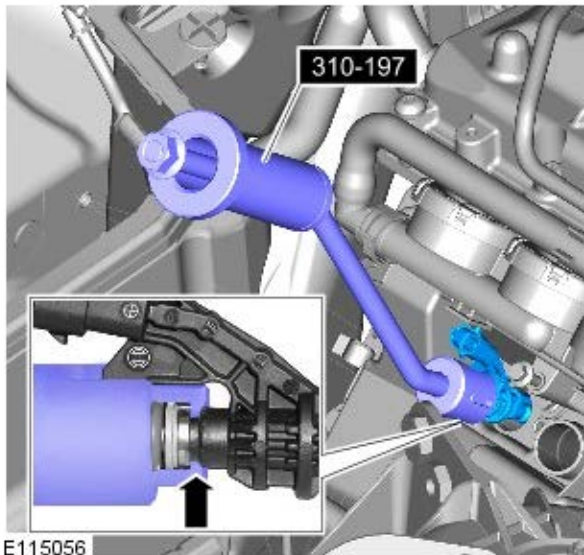


E145604

29. CAUTIONS:

 Make sure that the special tool is located correctly to the fuel injector prior to removing the fuel injector.

 Make sure that the special tool is held square

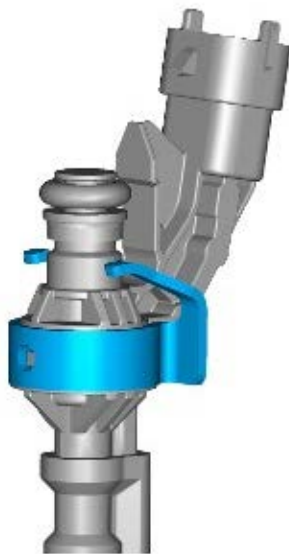


E115056


to the fuel injector during removal.

 Make sure that all open ports are covered to prevent any foreign material ingress.

Special Tool(s): [310-197](#)




E115057

30.  CAUTION: If the fuel injector is being removed without a new component being installed, the fuel injector clamp must remain with the fuel injector it is removed with.





E115058

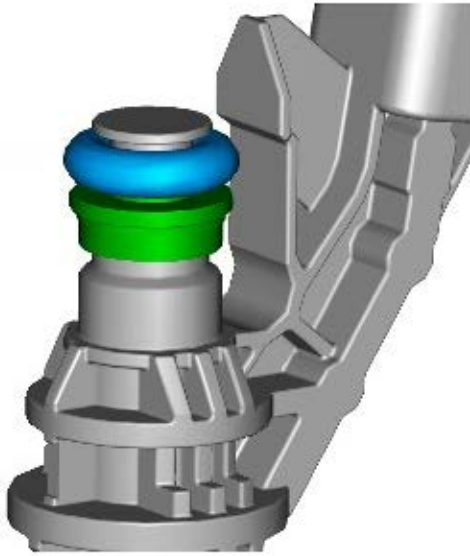
31. CAUTIONS:

 Do not use a knife to remove the Teflon seal as damage could occur to the fuel injector.


 Do not cut the Teflon seal too deep as damage could occur to the fuel injector.

 Pinch the Teflon seal to allow the tool to cut the Teflon seal without damaging the fuel injector.

32.  CAUTION: Do not use any sharp tools to remove the O-ring seal as damage could occur to the fuel injector.

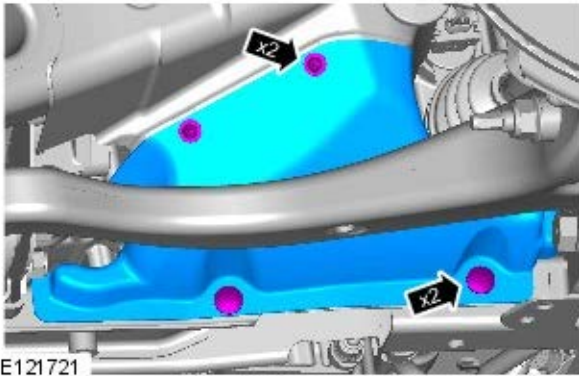


E115059

33.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

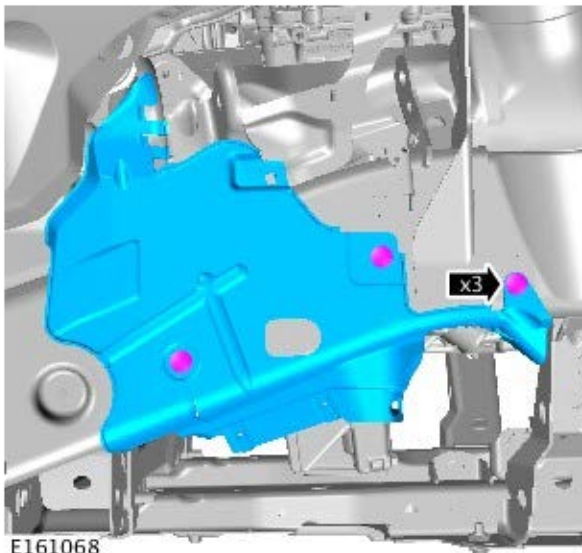
Raise and support the vehicle.

34.



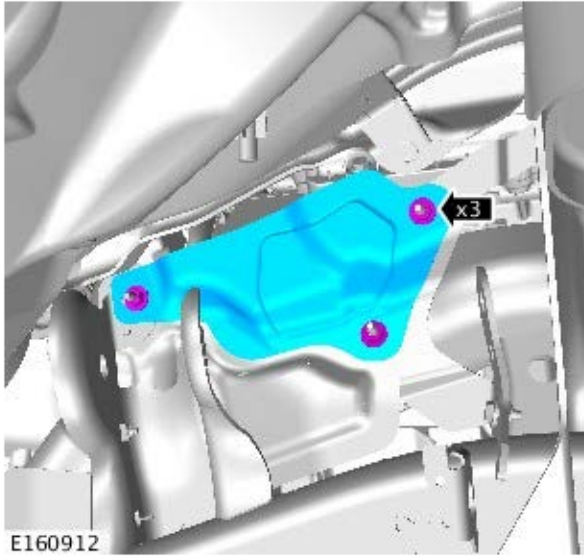
E121721

35.

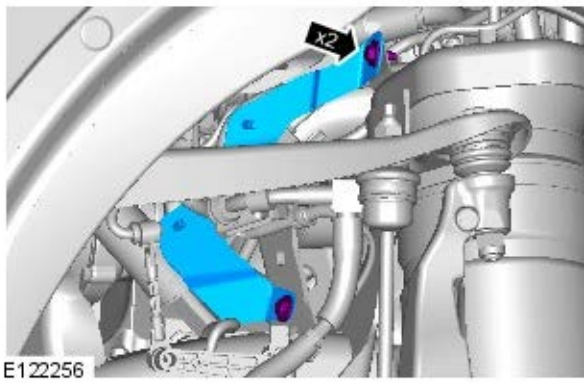


E161068

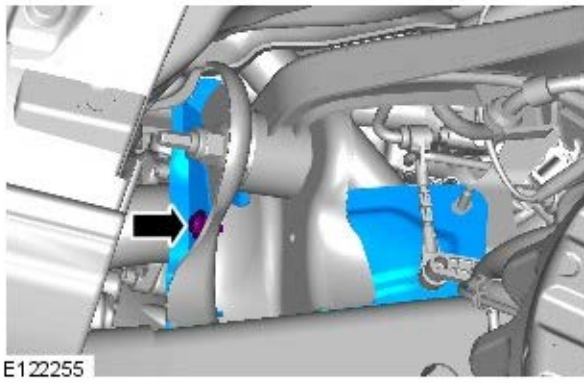
36.



37.

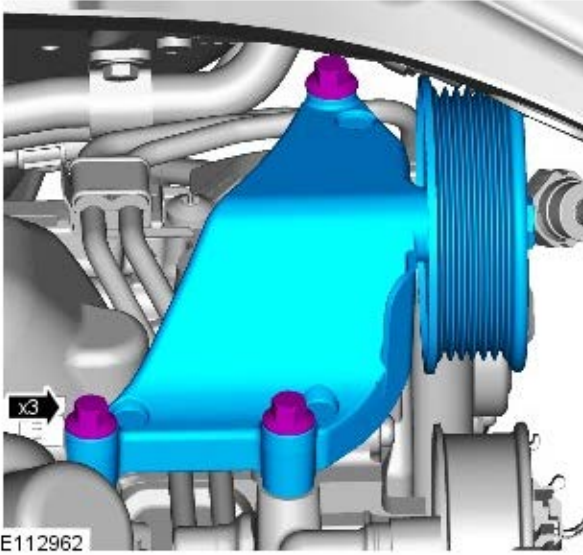


38.

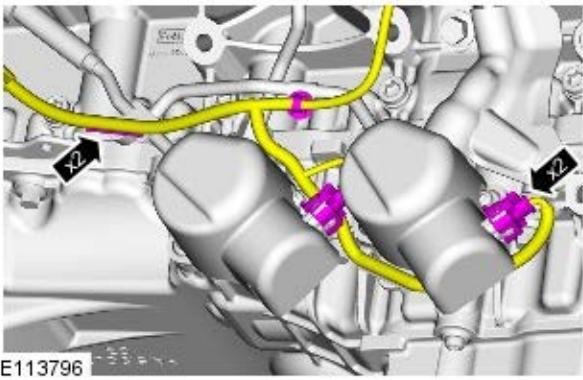


39. Refer to: [Generator](#) (414-02A Generator and Regulator - V6 S/C 3.0L Petrol, Removal and Installation).

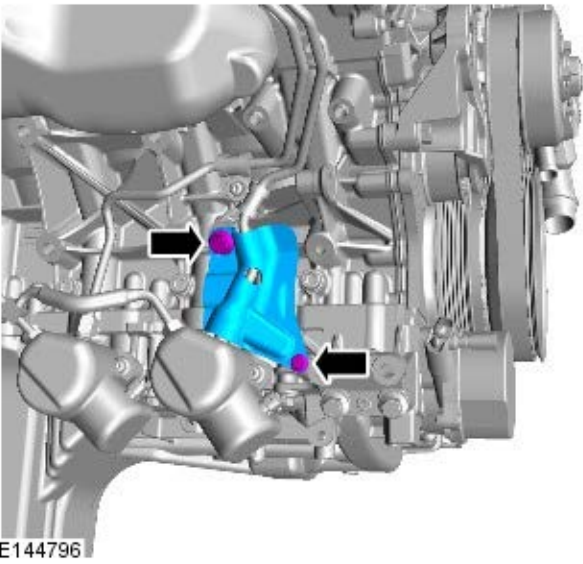
40.



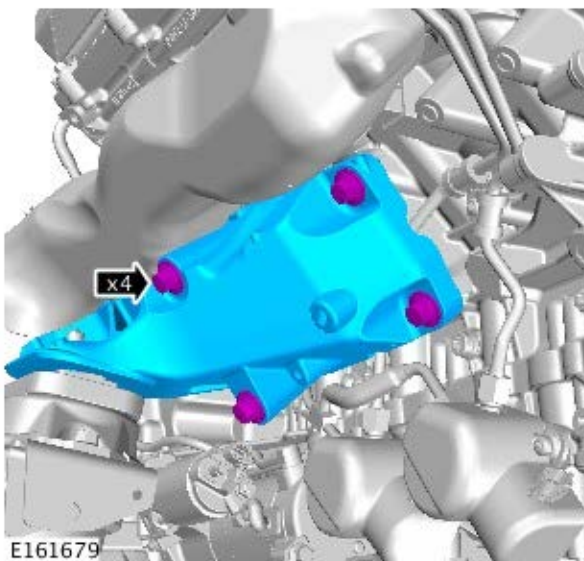
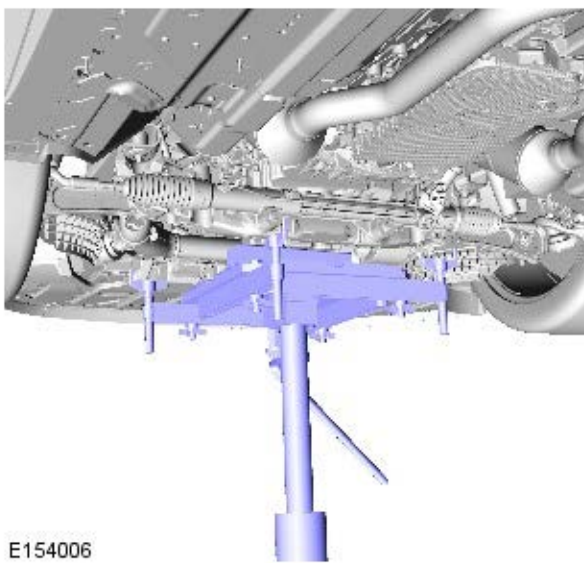
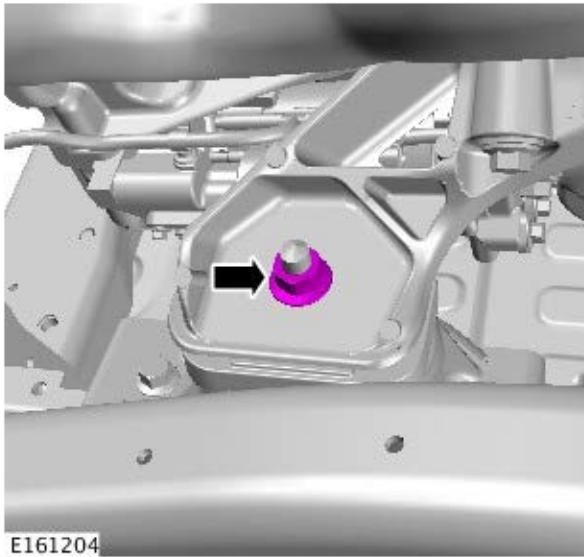
41.




42.




43.

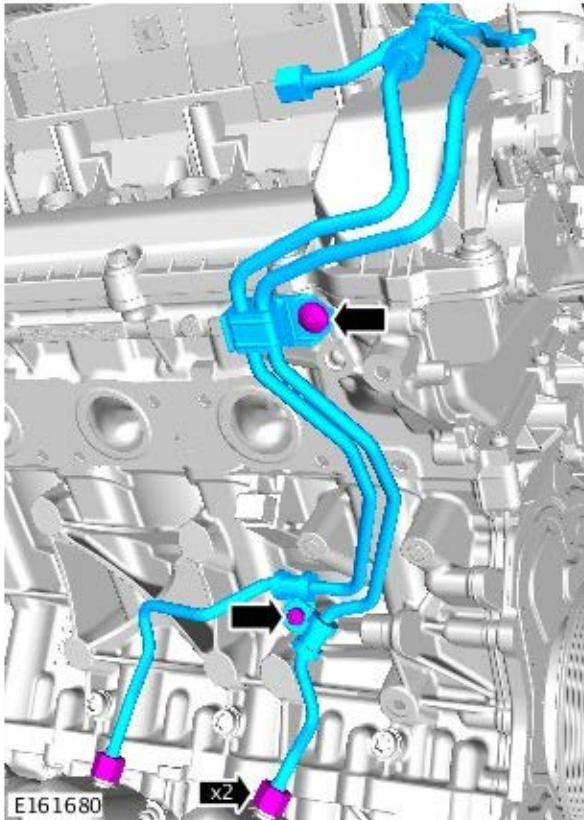


44.  CAUTION: Use a wooden block to protect the oil pan when supporting the engine.
Using a suitable hydraulic jack, support the engine.

45.

46.  WARNING: Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

CAUTIONS:



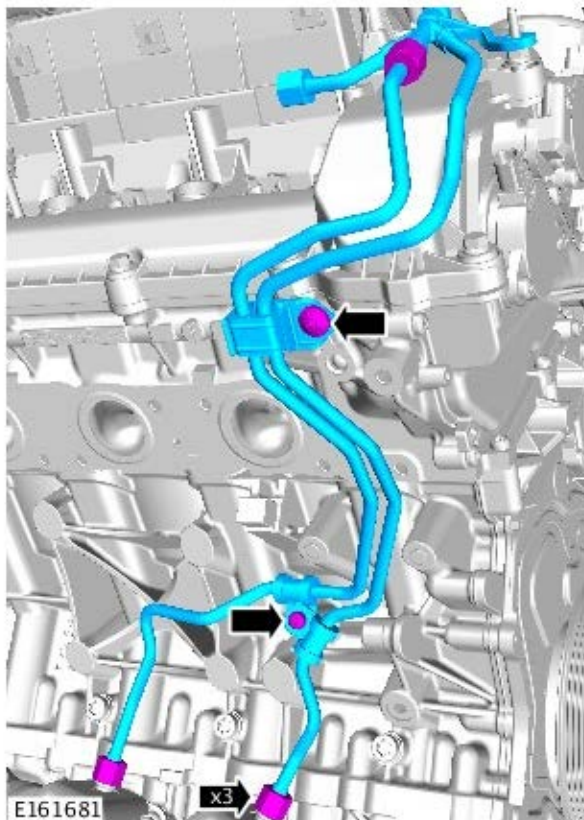
 Remove and discard the high-pressure fuel supply lines.


 Be prepared to collect escaping fluids.

 Make sure that all openings are sealed. Use new blanking caps.

 NOTE: Engine shown removed for clarity.

Installation



-  CAUTION: Lubricate only the union threads with clean engine oil.

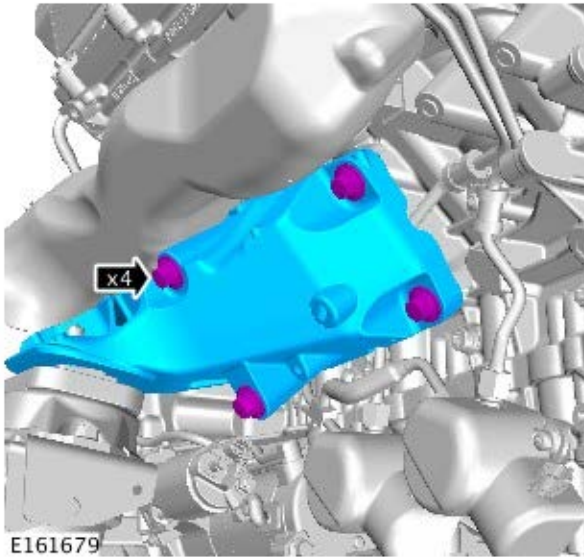
NOTES:

 Engine shown removed for clarity.

 Install the bolts and unions finger tight before final tightening.

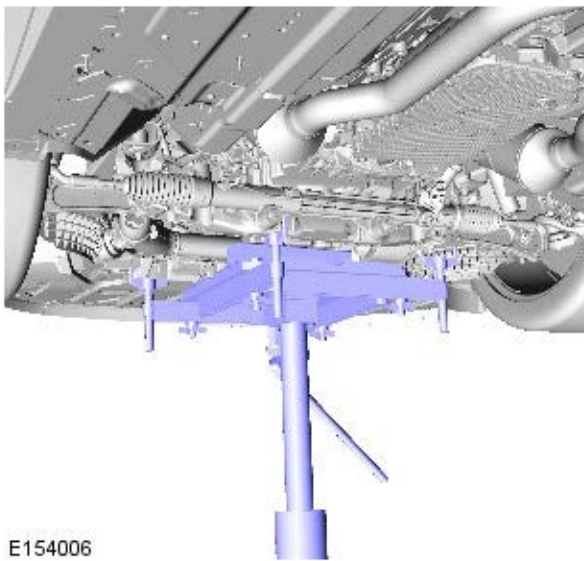
 Remove and discard the blanking caps.

- Torque:
 - Stage 1: 45 Nm
 - Stage 2: 60°



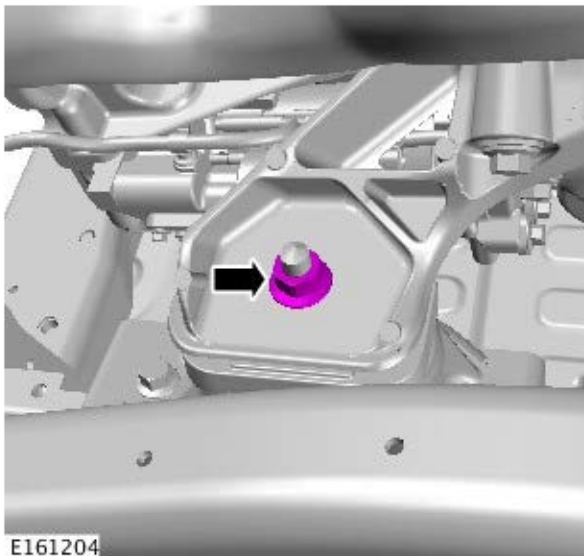
E161679

3. Remove the special tool.



E154006

4. Torque: 100 Nm

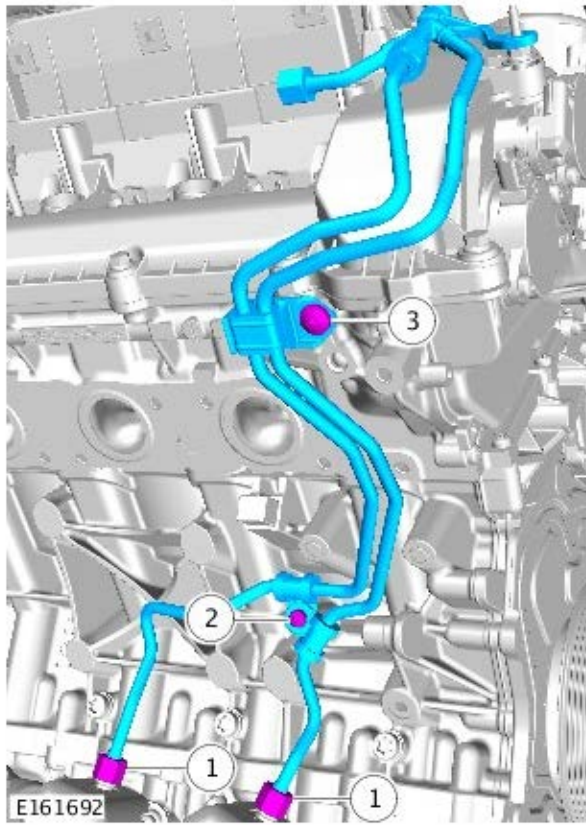


E161204

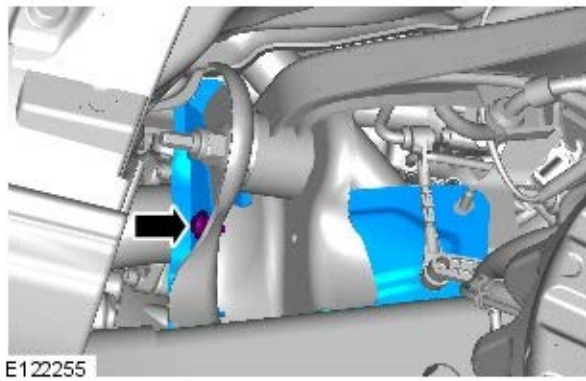
5.  NOTE: Some components shown removed for clarity.

Torque:

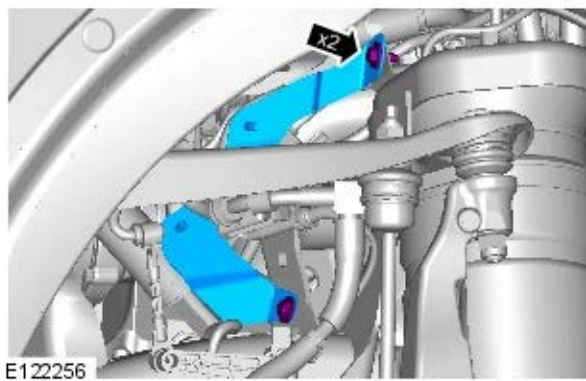
- Unions (1) 21 Nm
- M6 (2) 11 Nm
- M8 (3) 25 Nm



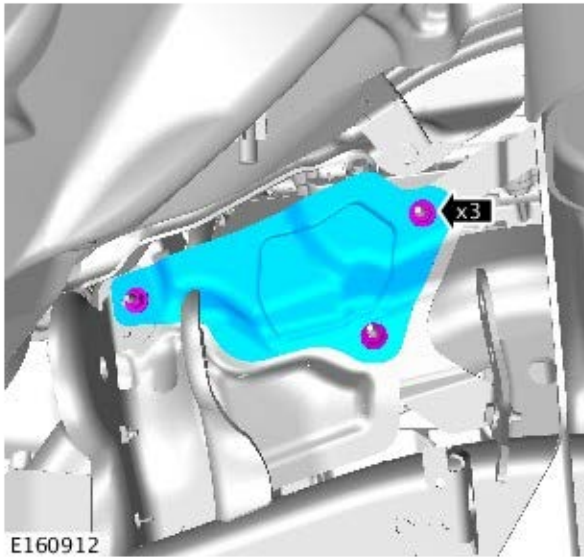
6. Torque: 10 Nm



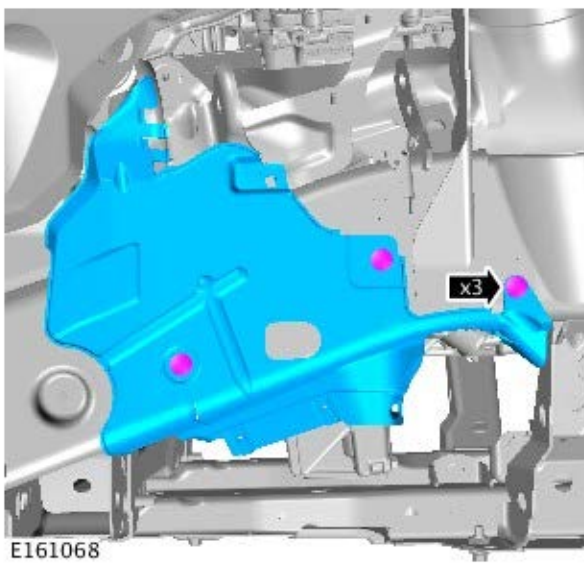
7. Torque: 10 Nm



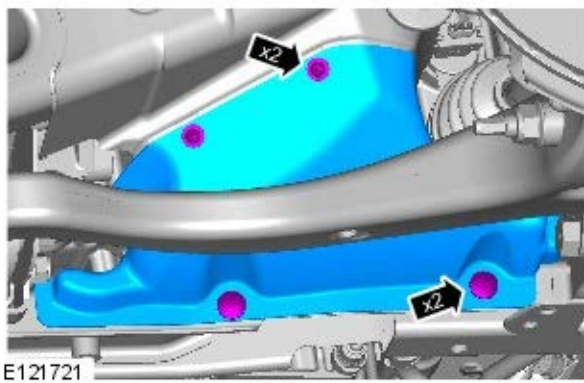
8. Torque: 10 Nm



9.

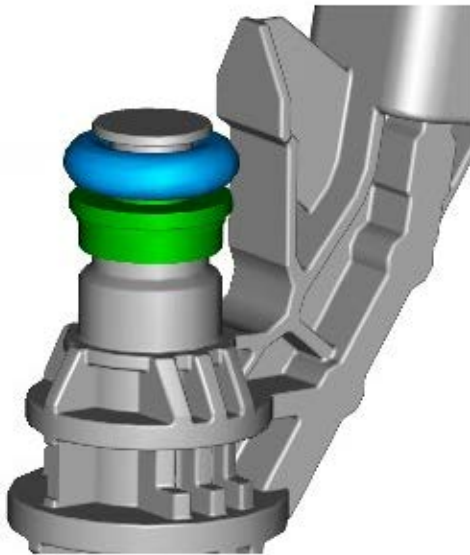


10.



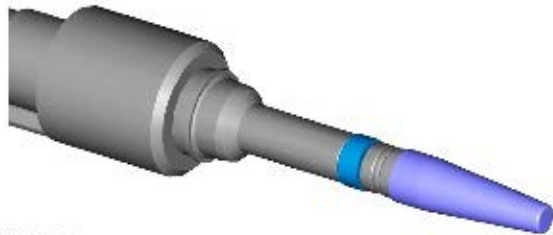
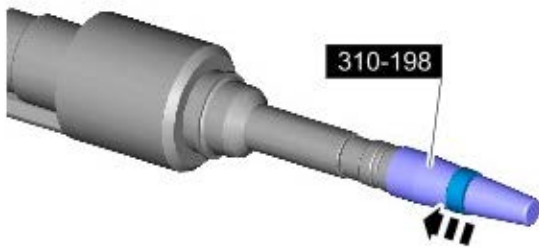
11. Lower the vehicle.

12.



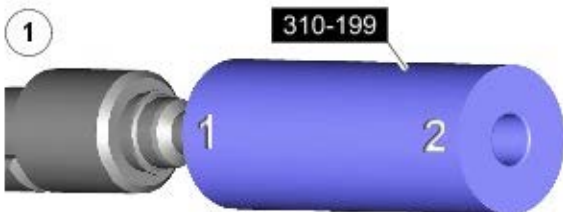
E115059

13. *Special Tool(s):* [310-198](#)




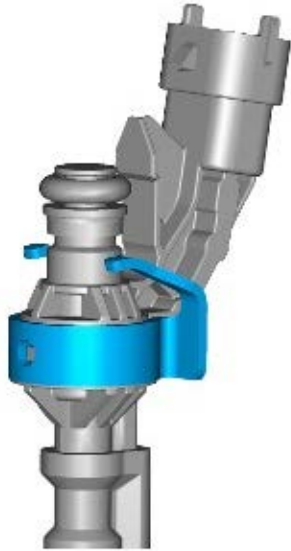
E115060

14. *Special Tool(s):* [310-199](#)

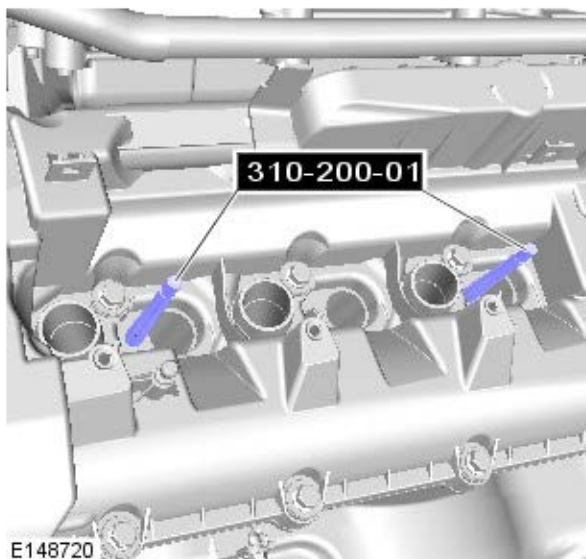


E115062


15.  CAUTION: If the original fuel injector is being installed, the original fuel injector clamp must be installed with the fuel injector it was removed with.



E115057



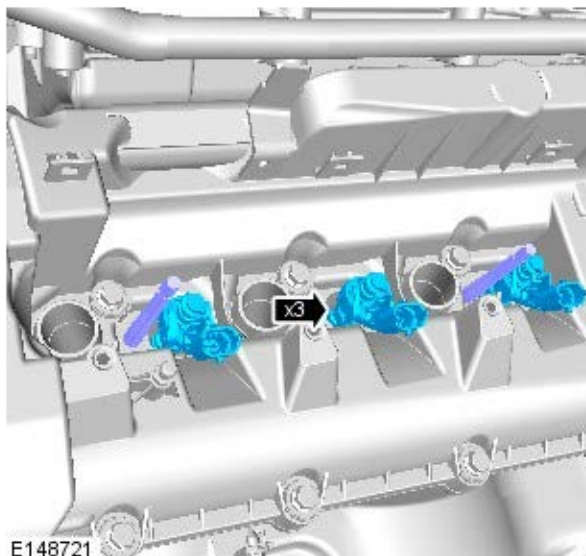
E148720

16.  CAUTION: If a new cylinder head has been installed then the special tool 310-200-02 without the thread must be used to install the fuel rail.



NOTE: LH illustration shown, RH is similar.

Special Tool(s): [310-200-01](#)



E148721

17. CAUTIONS:




Make sure that the area around the open fuel injector ports are clean and free of foreign material and lubricant prior to installing the fuel injector.



When installing the fuel injector(s), make sure that the Teflon seal is clean and free of foreign material and lubricant.

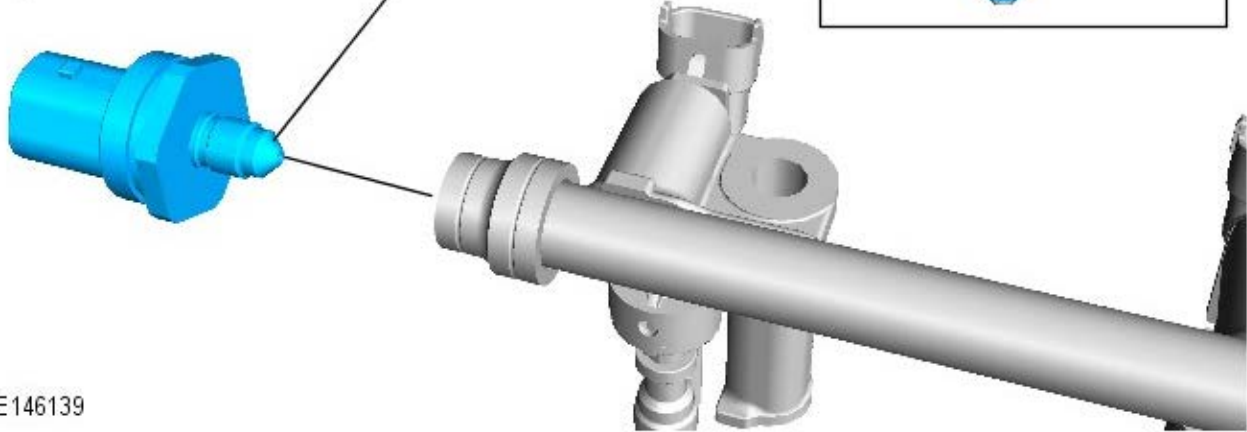
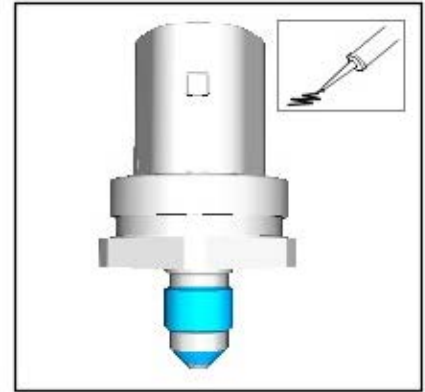
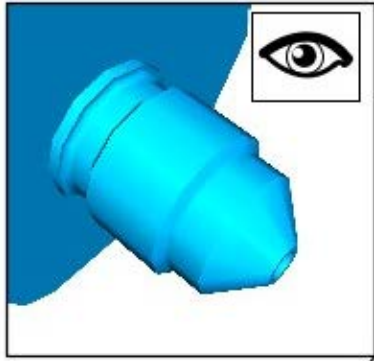


NOTE: LH illustration shown, RH is similar.

18.  NOTE: If equipped.

Lubricate with Molycote W15 as shown.

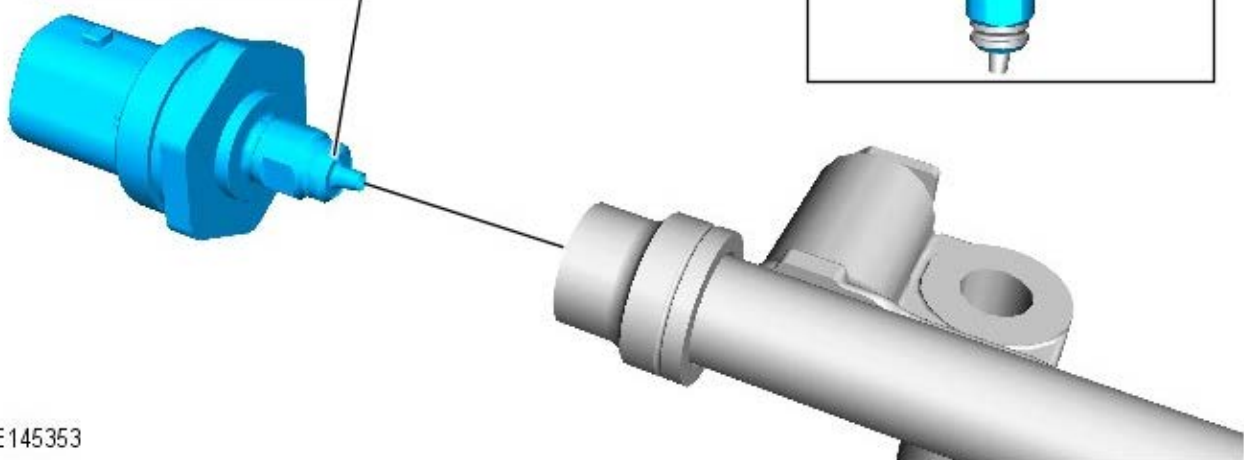
Torque: 33 Nm



E146139

19. Lubricate with Molycote W15 as shown.

Torque: 38 Nm

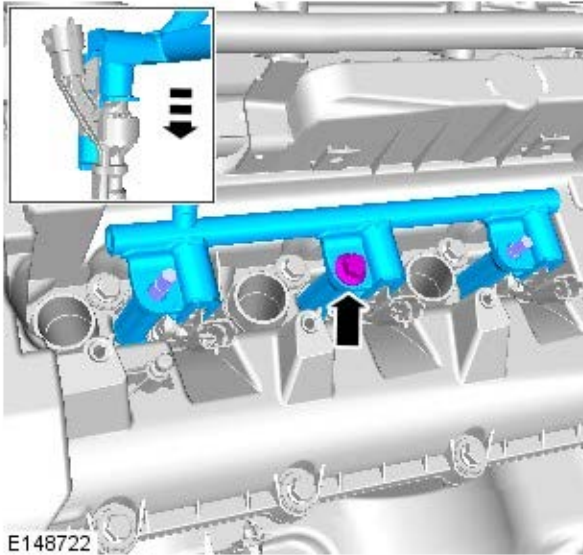



E145353


20. CAUTIONS:



If new fuel injectors are installed, a new injector clamp must be installed.



 Make sure that the fuel injector is aligned and installed into the fuel rail correctly, as noted in the removal step.

 Tighten the fuel rail retaining bolts a turn at a time until the correct torque is achieved.

NOTES:

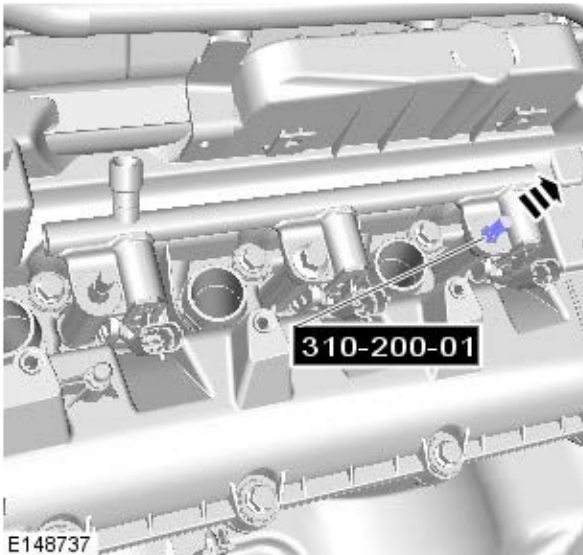
 Lubricate the fuel injector O-ring seals with clean engine oil.

 LH illustration shown, RH is similar.

Torque: 20 Nm

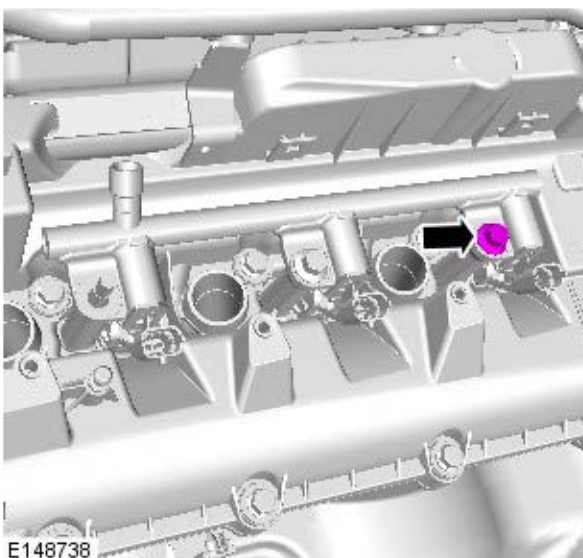
21.  NOTE: LH illustration shown, RH is similar.

Special Tool(s): [310-200-01](#)



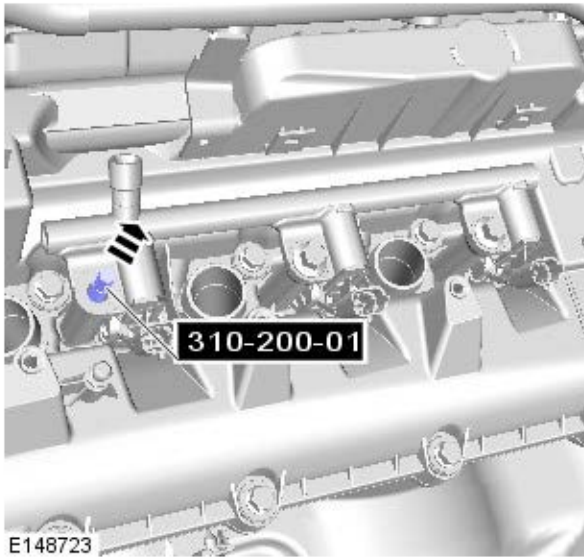
22.  NOTE: LH illustration shown, RH is similar.

Torque: 20 Nm

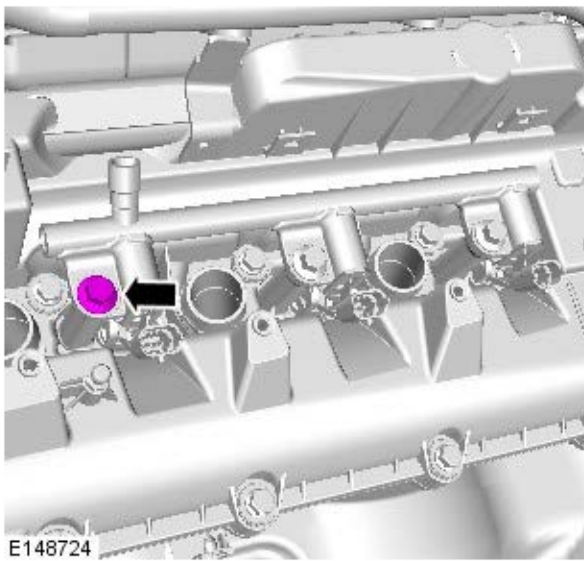




23.  NOTE: LH illustration shown, RH is similar.

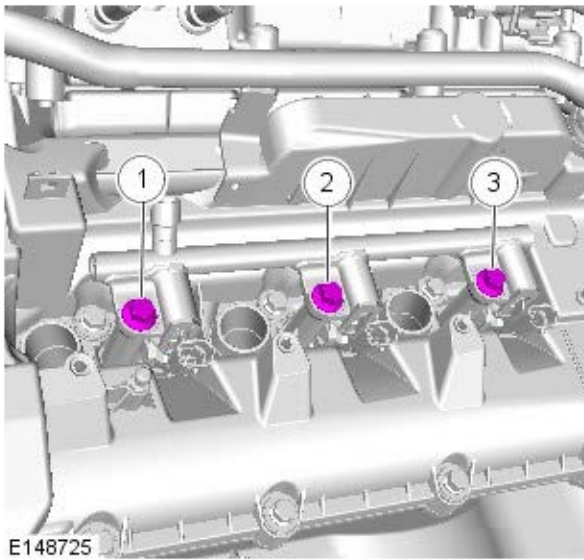
Special Tool(s): [310-200-01](#)



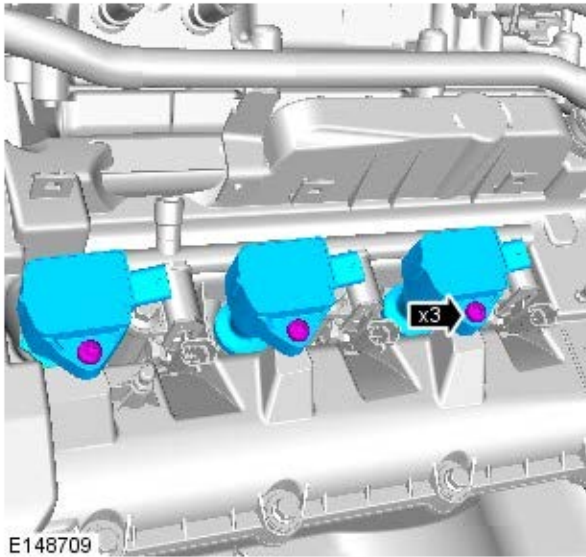
24.  NOTE: LH illustration shown, RH is similar.
Torque: 20 Nm



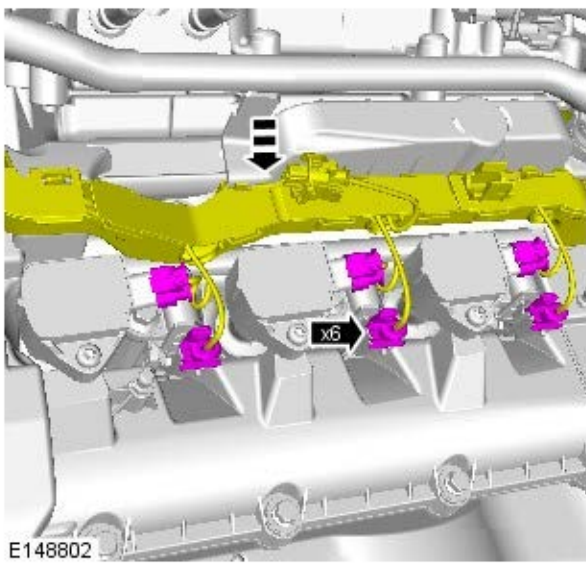
25. NOTES:
-  Tighten the bolts in the indicated sequence.
 -  LH illustration shown, RH is similar.
- Torque:
- Bolt 2 30 Nm
 - Bolt 3 30 Nm
 - Bolt 1 30 Nm




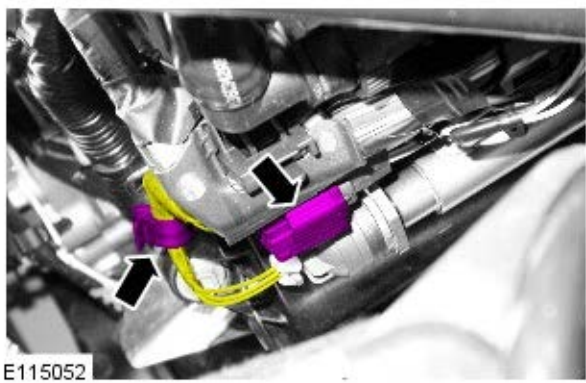
26.  NOTE: LH illustration shown, RH is similar.
Torque: 8 Nm



27.  NOTE: LH illustration shown, RH is similar.

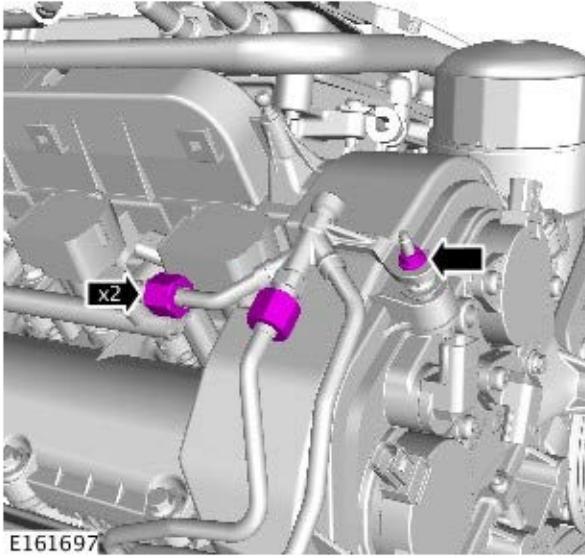


28.  NOTE: If equipped.




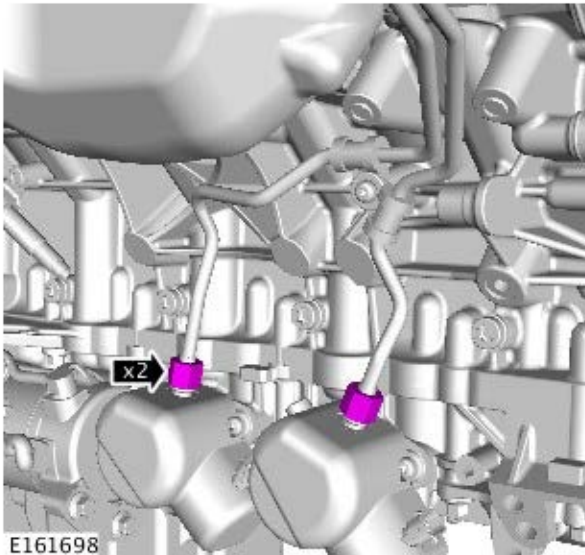
29.  NOTE: Remove and discard the blanking caps.

Torque:
 Unions 21 Nm
 Nut 6 Nm



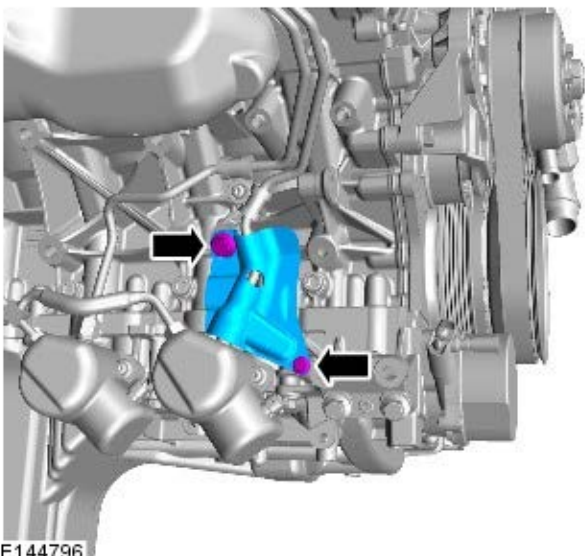
E161697

30.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.



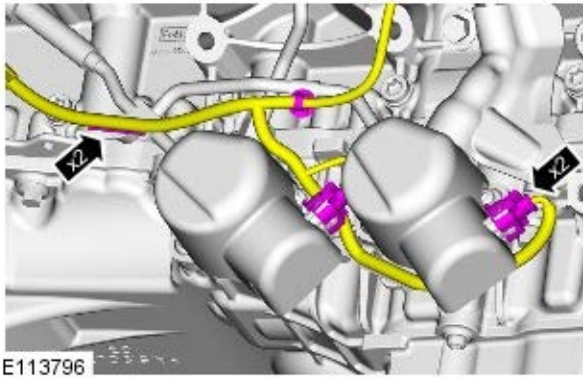
E161698

31.  **NOTE:** Some components shown removed for clarity.
Torque: 21 Nm

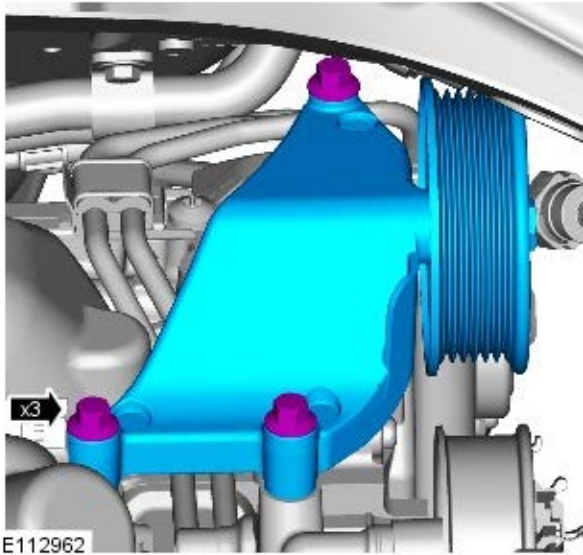


E144796

32. *Torque:*
M6 12 Nm
M10 29 Nm



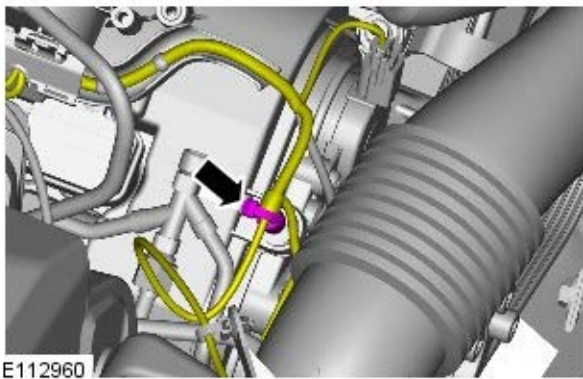
34. Torque: 25 Nm



35. Refer to: [Generator](#) (414-02A Generator and Regulator - V6 S/C 3.0L Petrol, Removal and Installation).

36. Lower the vehicle.

37.



38.  CAUTION: Lubricate only the union threads with clean engine oil.

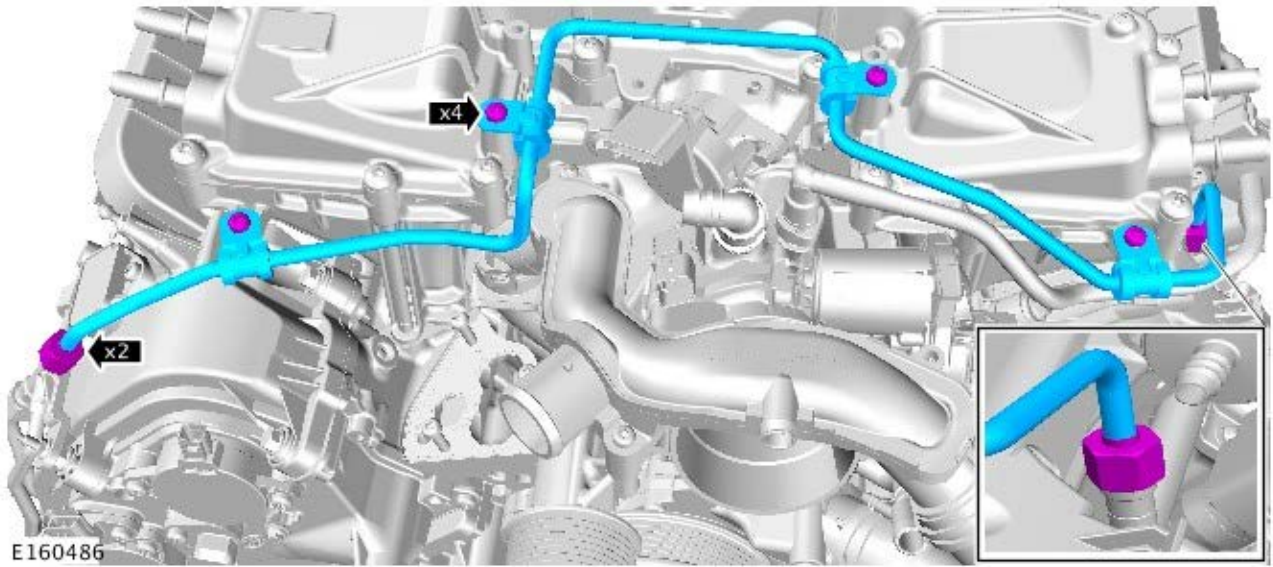
NOTES:



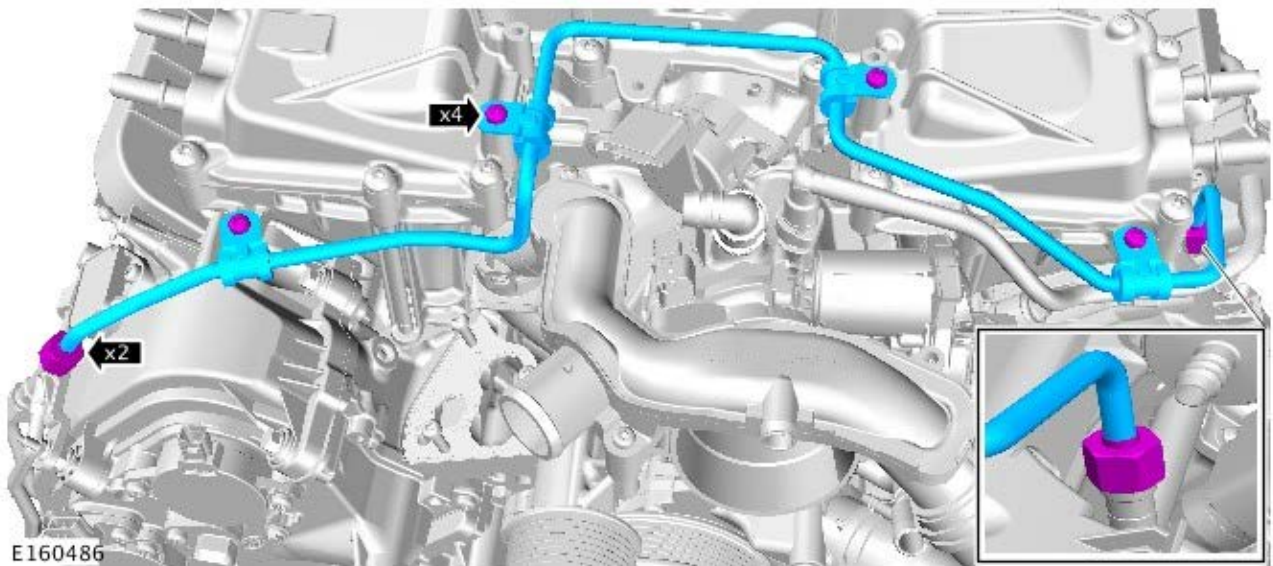
Install the bolts and unions finger tight before final tightening.



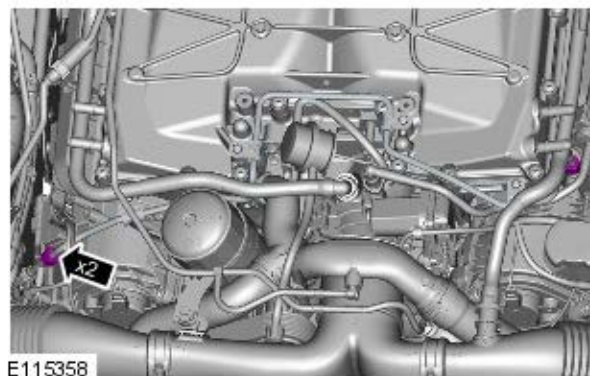
Remove and discard the blanking caps.



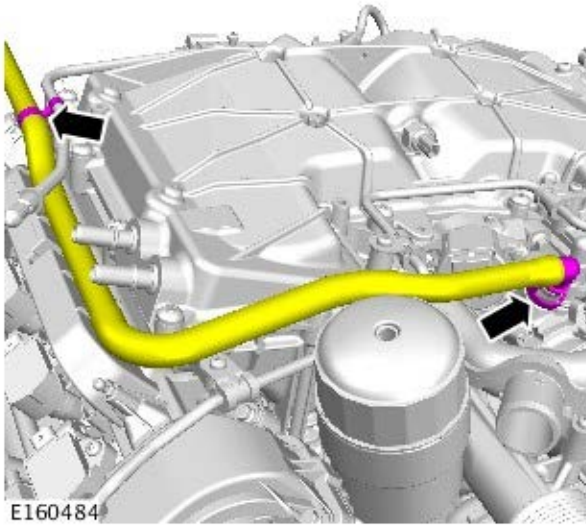
39. Torque:
Unions 21 Nm
Bolts 12 Nm



40. Torque: 21 Nm

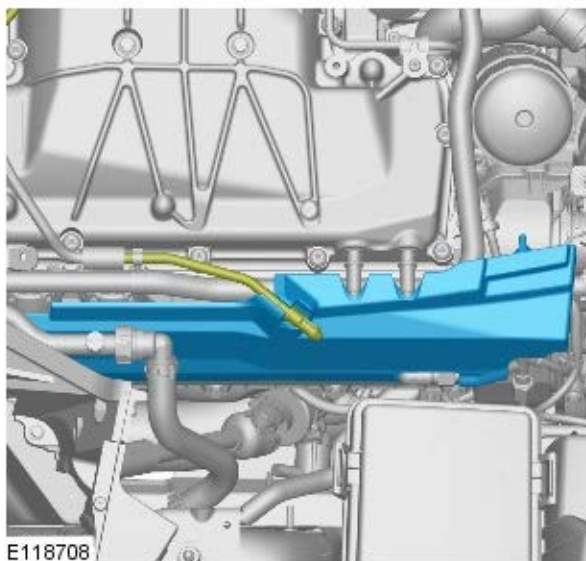


41.



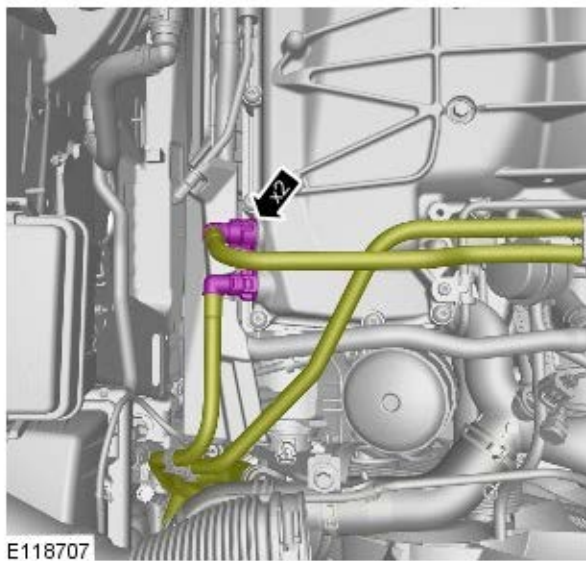
E160484

42.



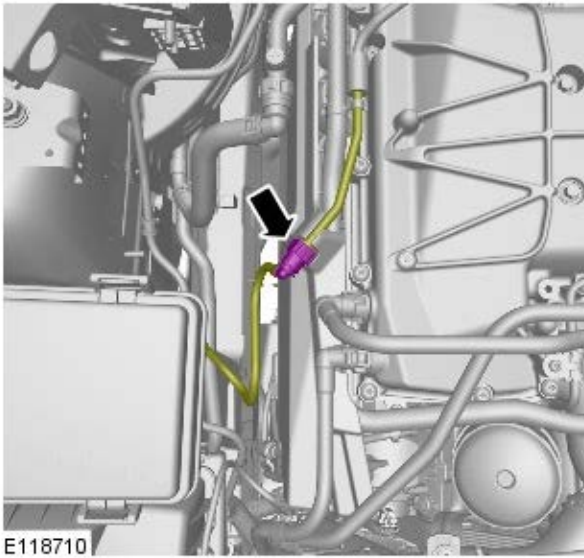
E118708

43.

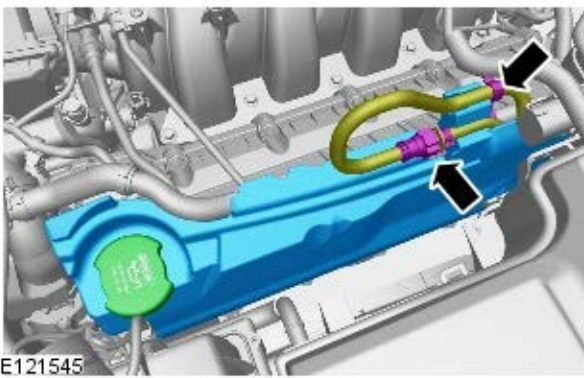


E118707

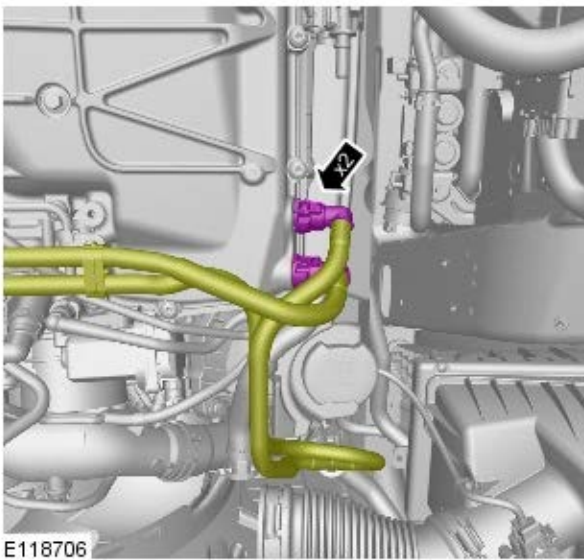
44.



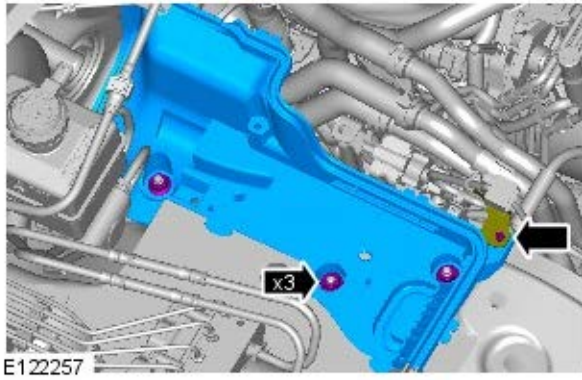
45.



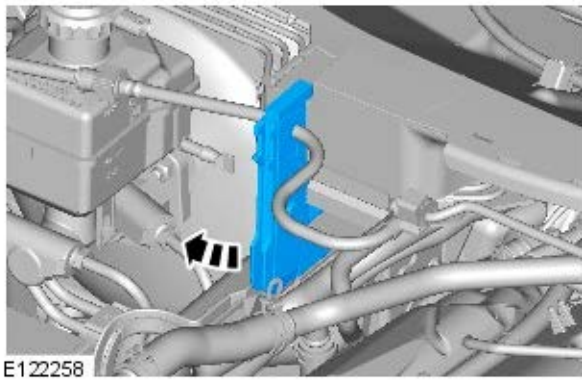
46.



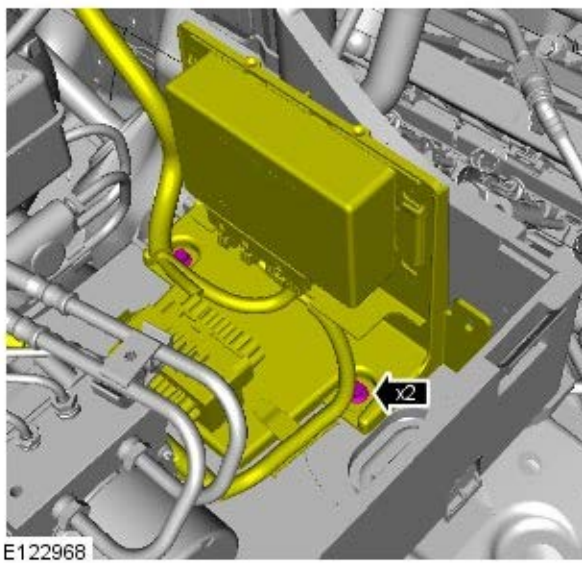
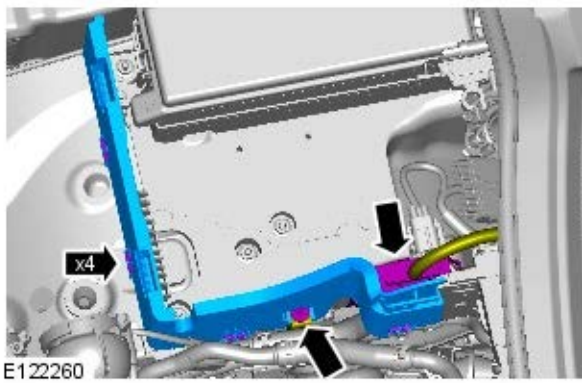
47. Torque: 12 Nm



48.



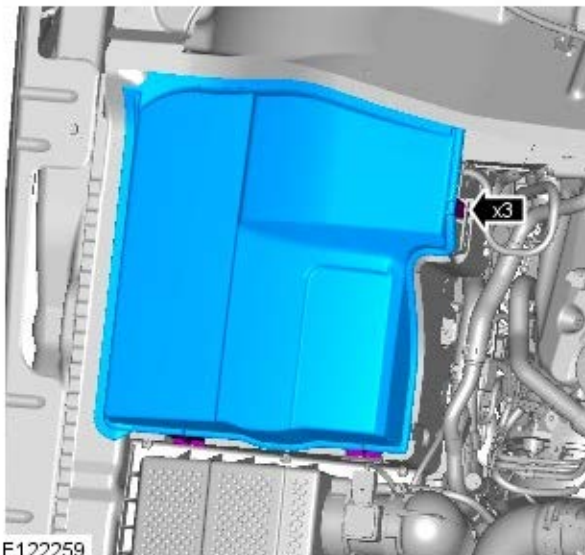
49.



50.  NOTE: Right-hand drive vehicles.
Torque: 9 Nm

51.  NOTE: Left-hand drive vehicles.

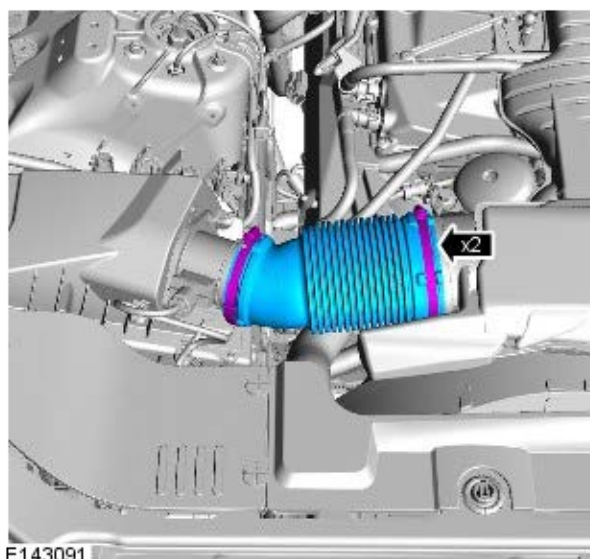
Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).



52.  NOTE: All vehicles.

53. Refer to: [Air Cleaner RH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

54. Torque: 3.5 Nm



55. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

56. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

57. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

Fuel Charging and Controls - V6 S/C 3.0L Petrol - High Pressure Fuel Pump 1

Removal and Installation

Removal



CAUTION: Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.



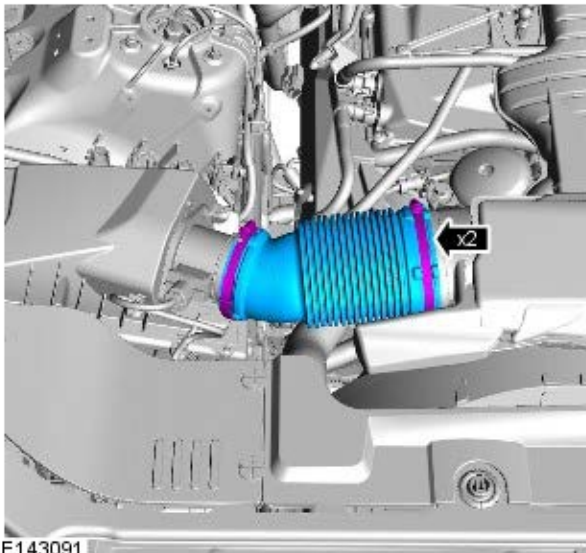
Removal steps in this procedure may contain installation details.


1. Refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Fuel System Pressure Release - V6 S/C 3.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).
3. Disconnect the battery ground cable.

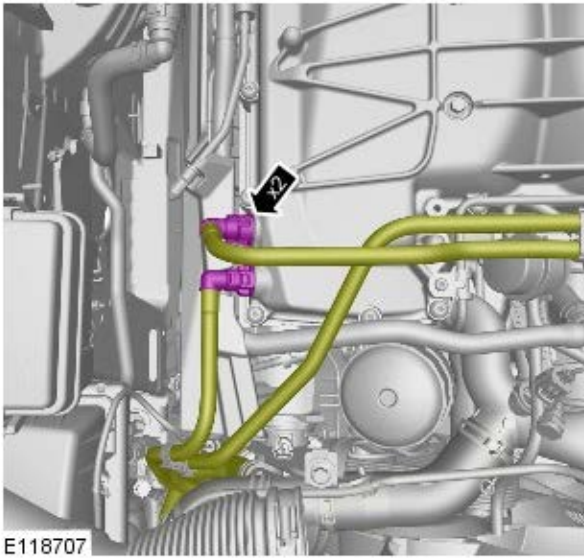
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

4. Refer to: [Engine Oil Draining and Filling](#) (303-01B Engine - V6 S/C 3.0L Petrol, General Procedures).
5. Refer to: [Fuel Injection Component Cleaning](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, General Procedures).
6. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

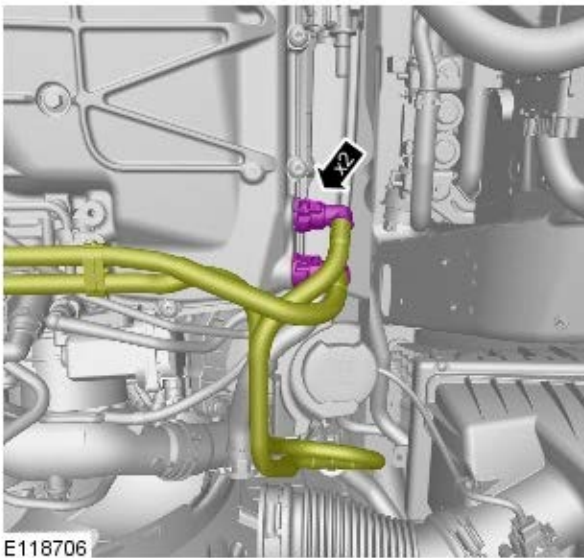
7.



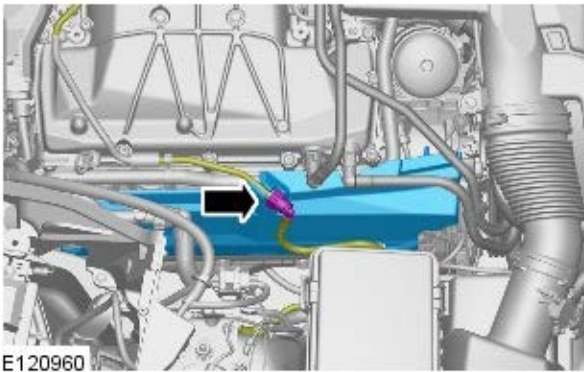
8.  **CAUTION:** Be prepared to collect escaping coolant.




E118707



E118706

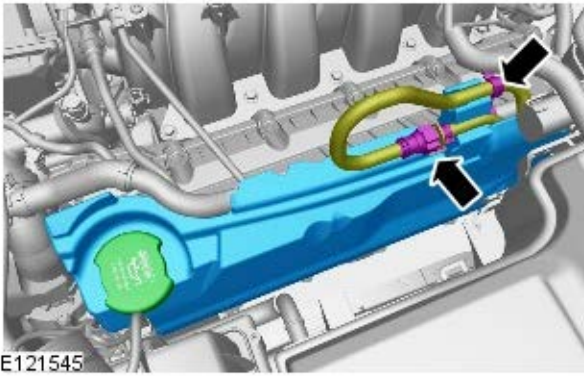


E120960

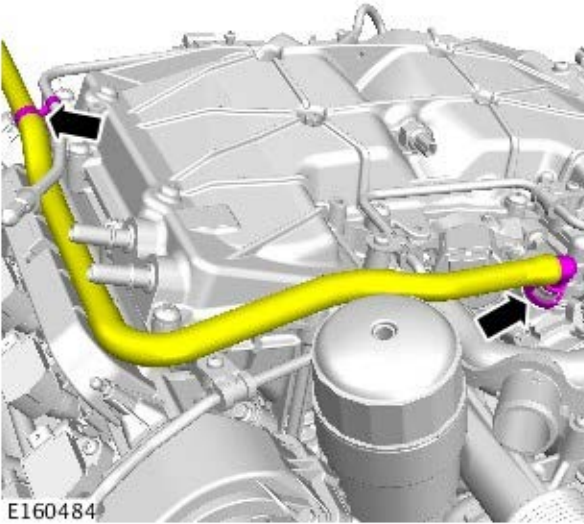
9.  **WARNING:** Be prepared to collect escaping fluids.

10.

11.



12.



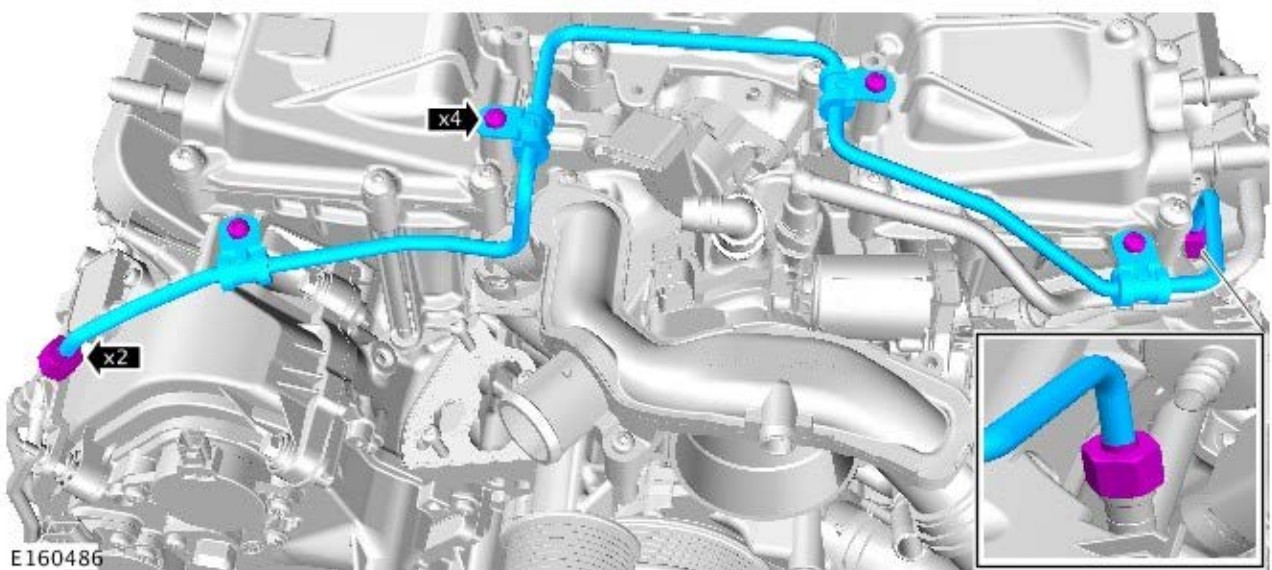
13. CAUTIONS:



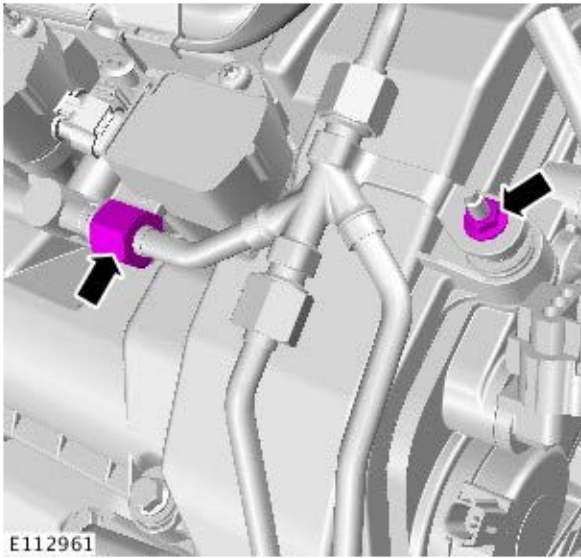
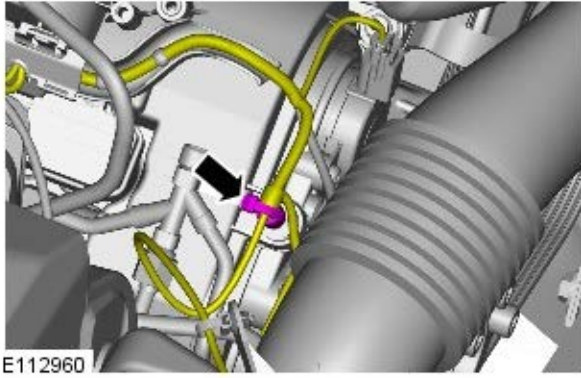
Be prepared to collect escaping fluids.



Make sure that all openings are sealed. Use new blanking caps.



14.



15. CAUTIONS:



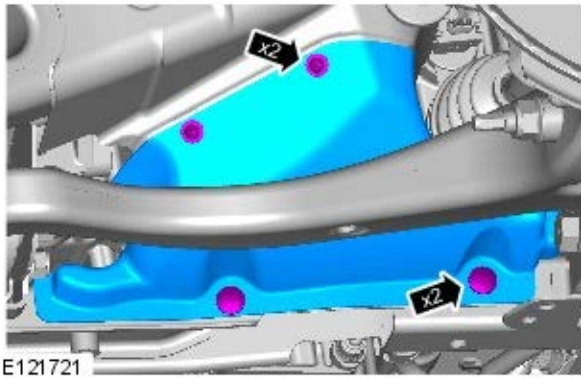
Be prepared to collect escaping fluids.



Make sure that all openings are sealed. Use new blanking caps.

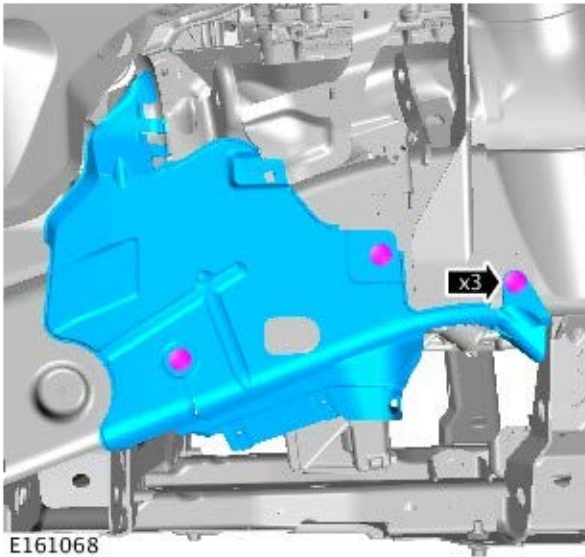
16.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

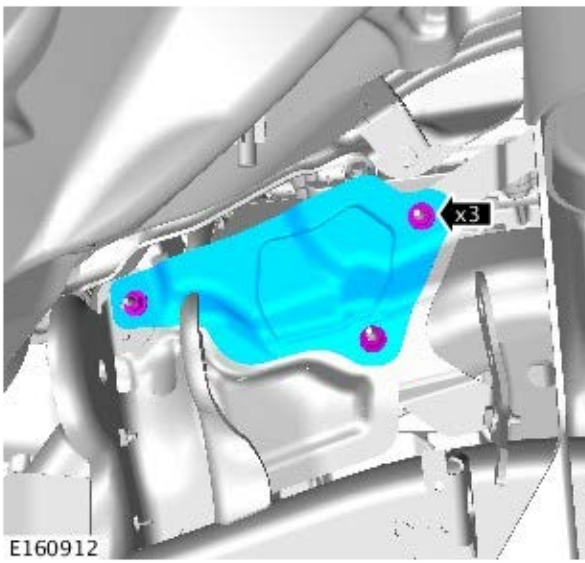


17.

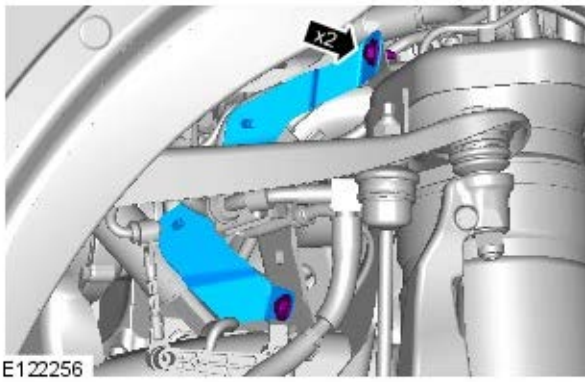
18.



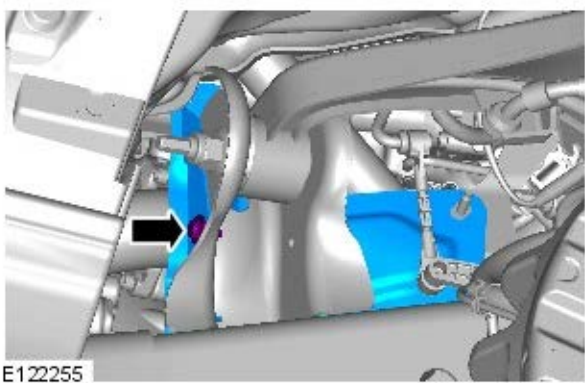
19.



20.

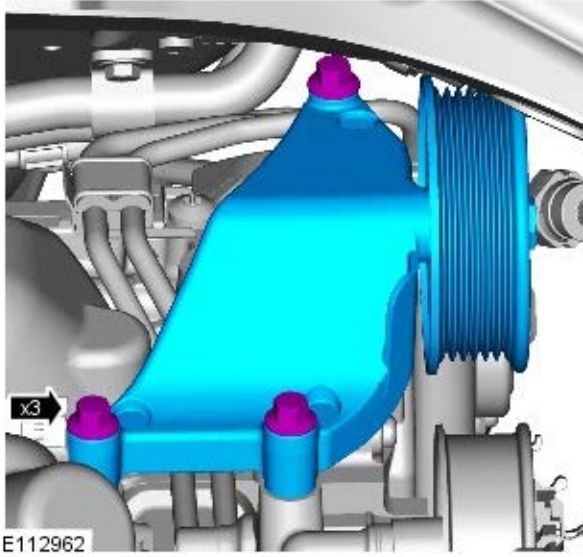


21.




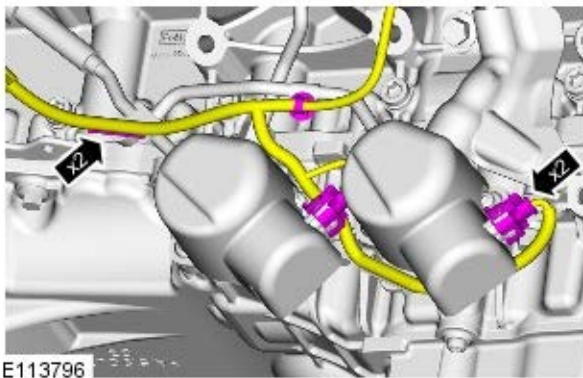
22. Refer to: [Generator](#) (414-02A Generator and Regulator - V6 S/C 3.0L Petrol, Removal and Installation).

23.



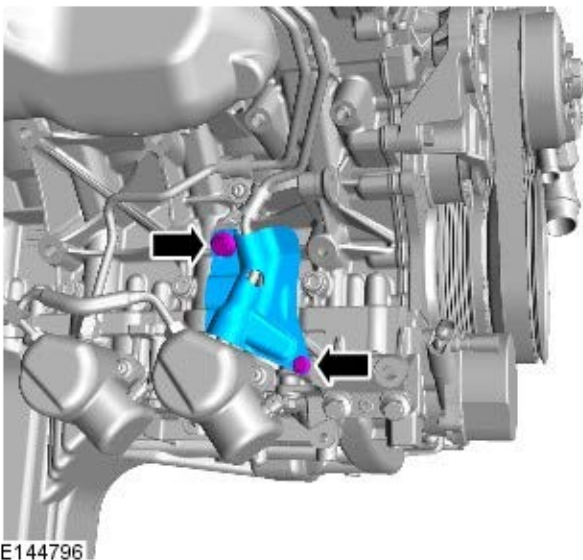
E112962

24.  NOTE: Engine shown removed for clarity.



E113796

25.

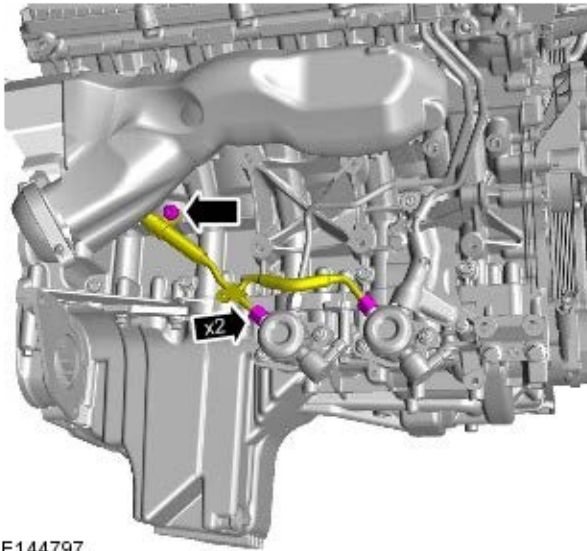


E144796

26. CAUTIONS:

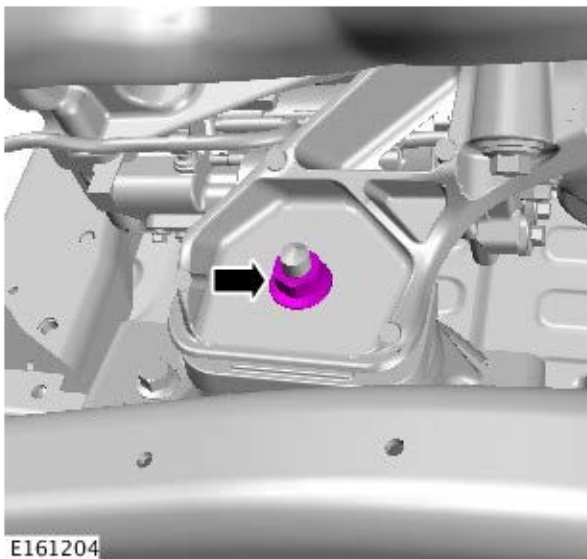
 Be prepared to collect escaping fluids.

 Make sure that all openings are sealed. Use new blanking caps.

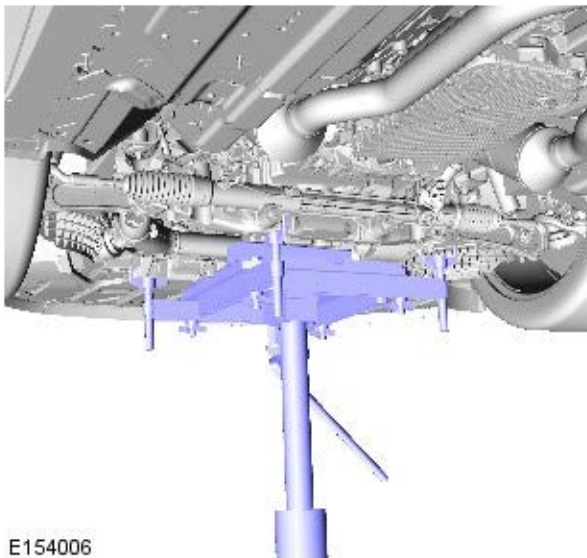


E144797


27.



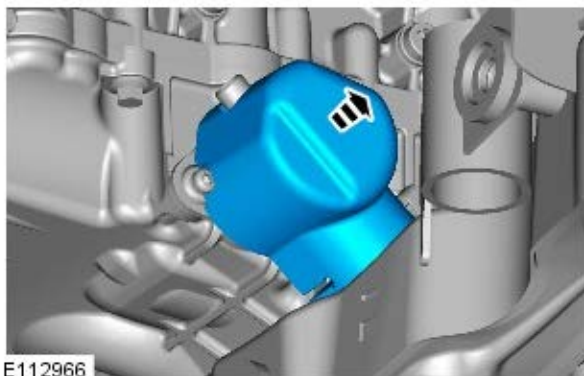
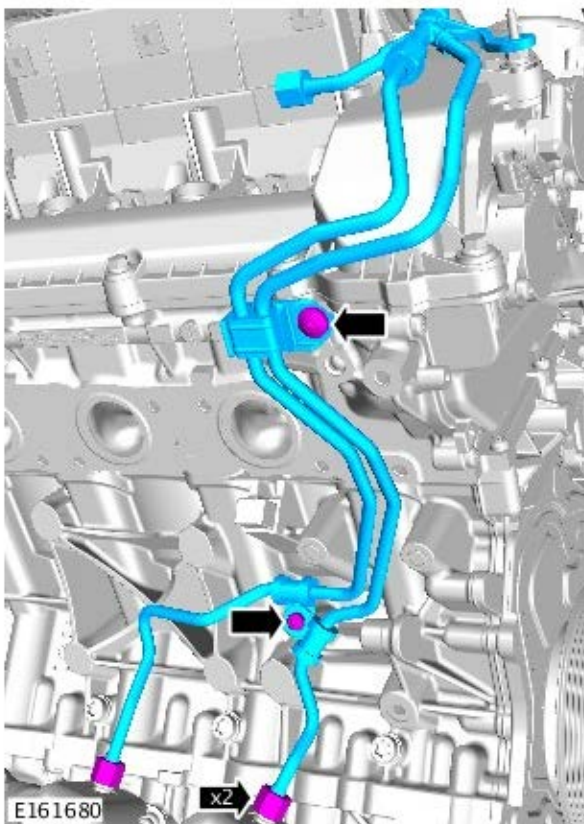
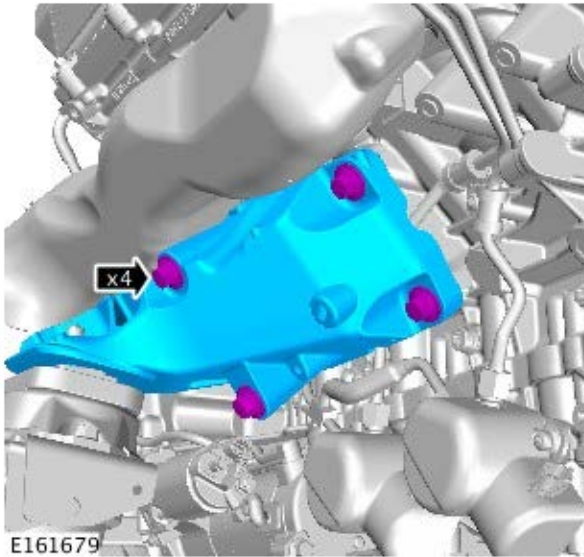
E161204




E154006

28.  CAUTION: Use a wooden block to protect the oil pan when supporting the engine.
Using a suitable hydraulic jack, support the engine.

29.



30.  **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

CAUTIONS:


 Remove and discard the high-pressure fuel supply lines.

 Be prepared to collect escaping fluids.

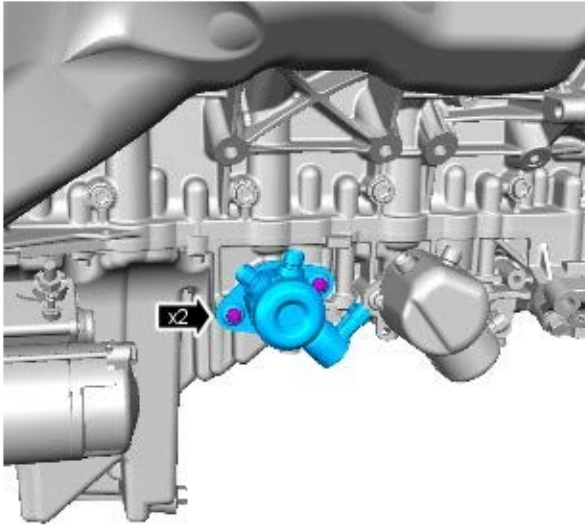
 Make sure that all openings are sealed. Use new blanking caps.

 **NOTE:** Engine shown removed for clarity.

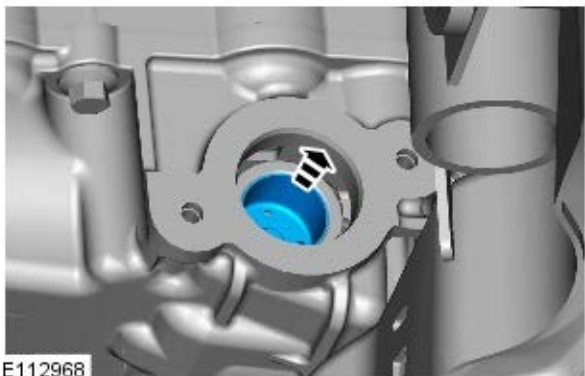
31.

32.  **CAUTION:** Be prepared to collect escaping fluids.

Loosen the Torx screws a turn each at a time.

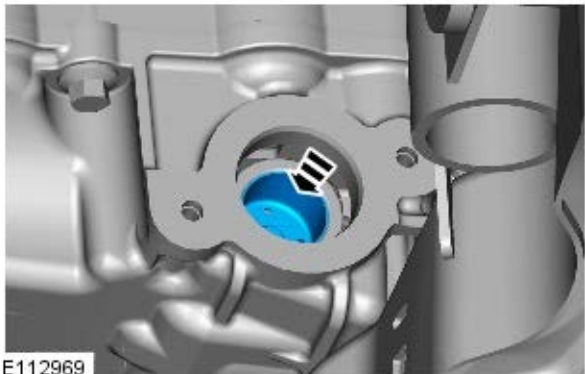


E144831





E112968


Installation




E112969

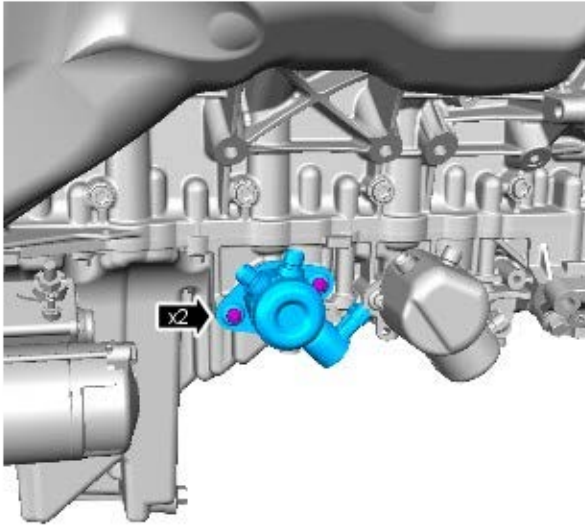
33.  CAUTION: Be prepared to collect escaping fluids.

1.  NOTE: Lubricate the fuel rail high-pressure fuel pump bucket with clean engine oil.

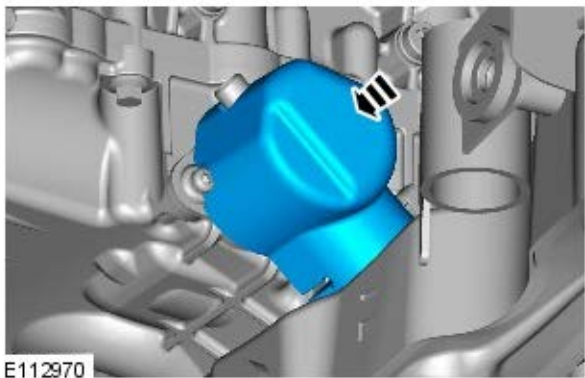
2.  CAUTION: Tighten the Torx screws a turn at a time until the correct torque is achieved.

-  NOTE: Lubricate the fuel rail high-pressure fuel pump O-ring seal with clean engine oil.

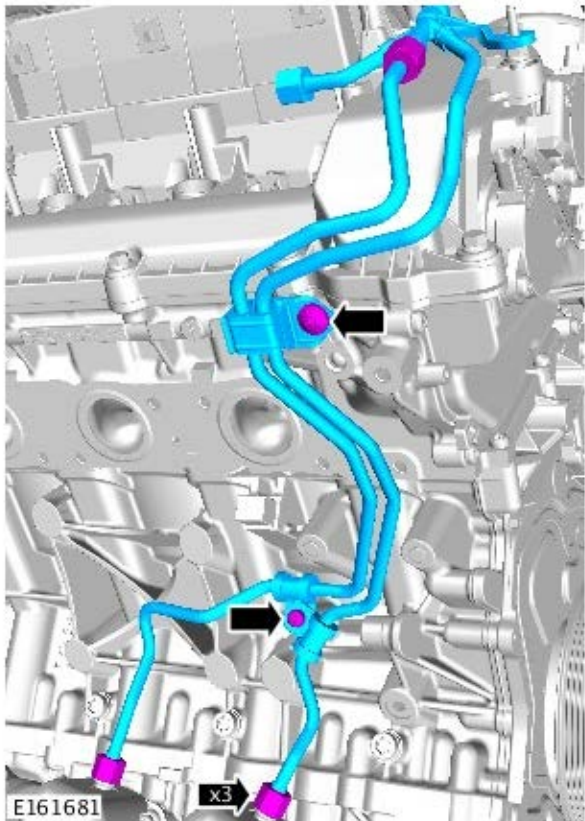
Torque: 12 Nm



E144831




E112970



E161681

3.

4.  CAUTION: Lubricate only the union threads with clean engine oil.

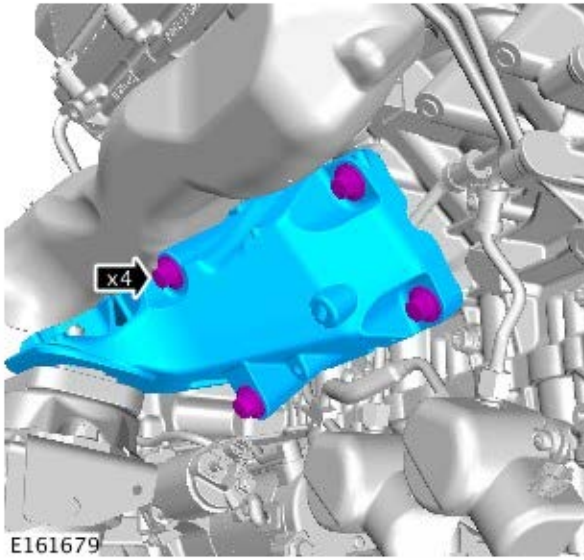
NOTES:

 Engine shown removed for clarity.

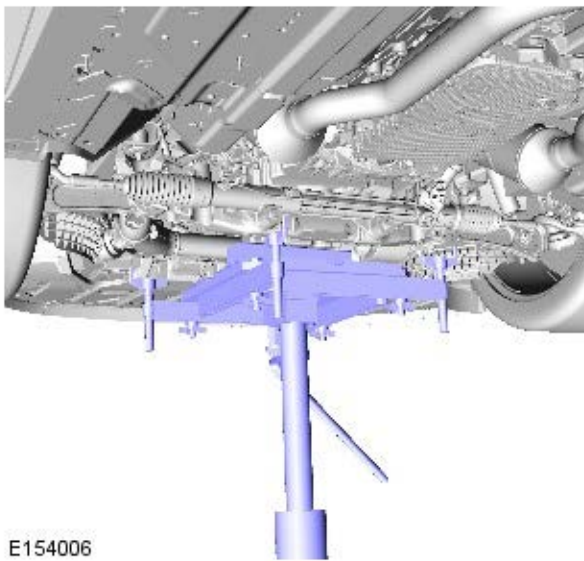
 Install the bolts and unions finger tight before final tightening.

 Remove and discard the blanking caps.

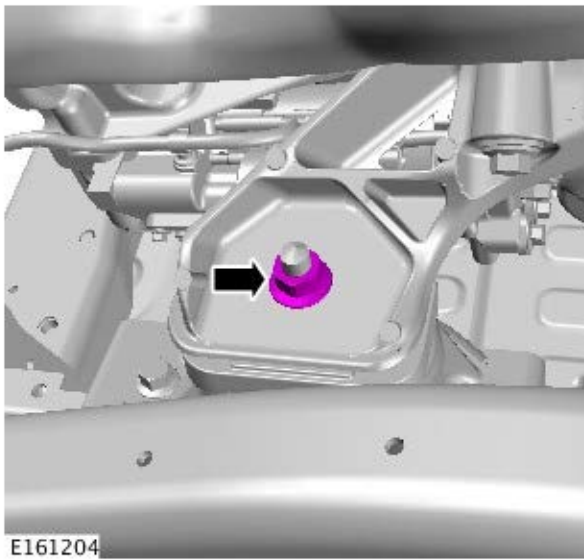
5. *Torque:*
 Stage 1: 45 Nm
 Stage 2: 60°




6. Remove the special tool.

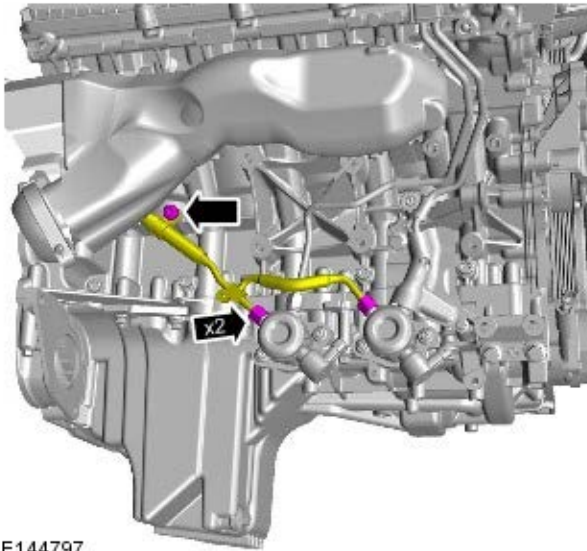


7. Torque: 100 Nm



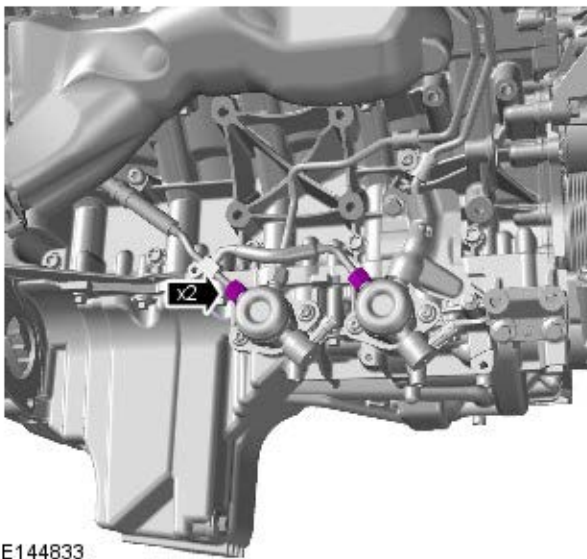
8.  NOTE: Remove and discard the blanking caps.

Torque:
Unions 20 Nm
M6 12 Nm



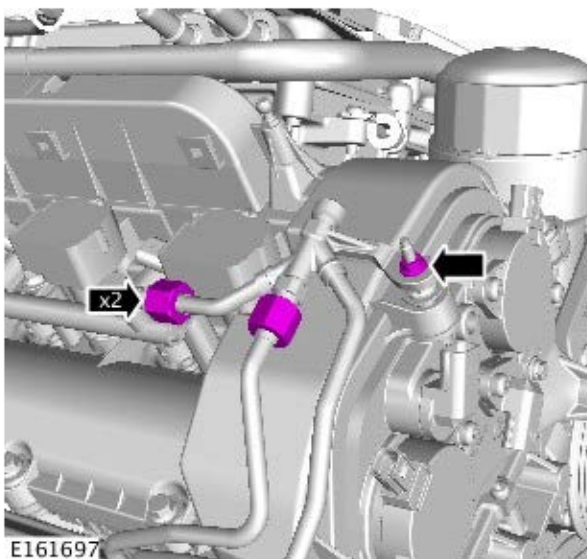
E144797

9. Torque: 21 Nm



E144833

10. Lower the vehicle.



E161697

11. NOTES:



Do not tighten at this stage.

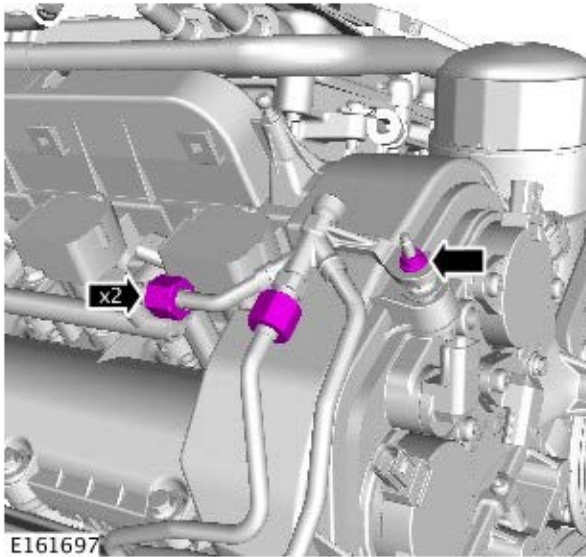



Remove and discard the blanking caps.



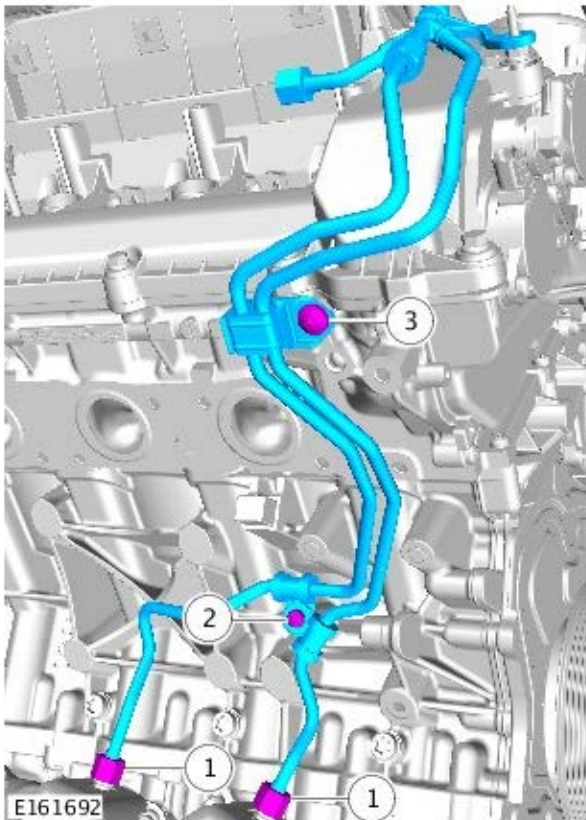
Only tighten the union finger-tight at this stage.

12. Torque:
Unions 21 Nm
Nut 6 Nm



13.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.



14.  **NOTE:** Some components shown removed for clarity.

Torque:

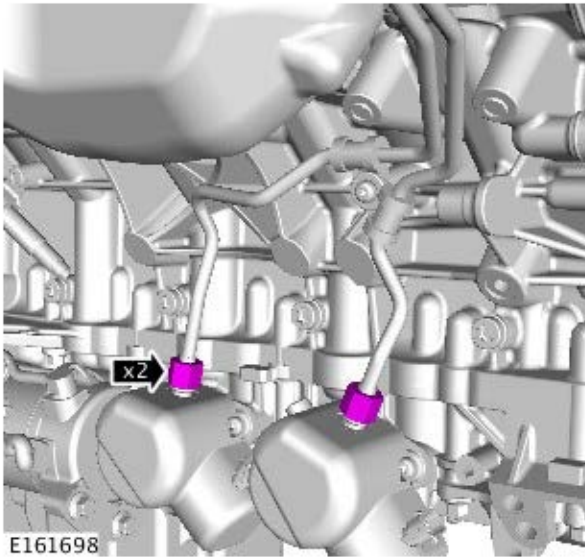
Unions (1) 21 Nm

M6 (2) 11 Nm

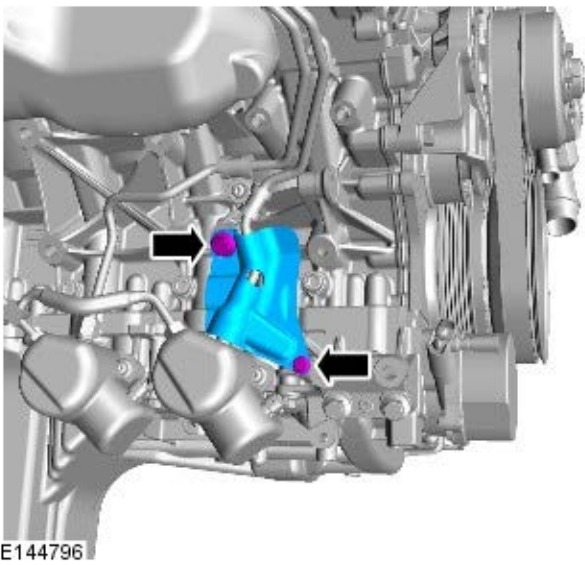
M8 (3) 25 Nm


15.  **NOTE:** Some components shown removed for clarity.

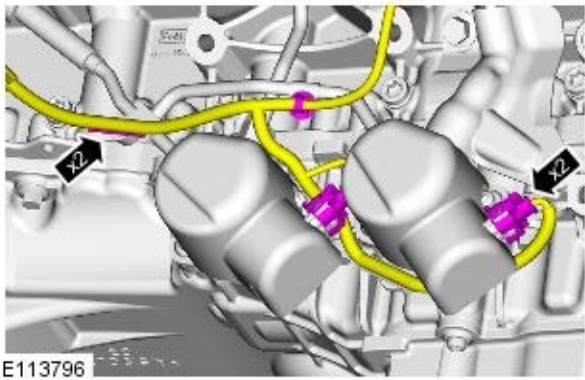
Torque: 21 Nm



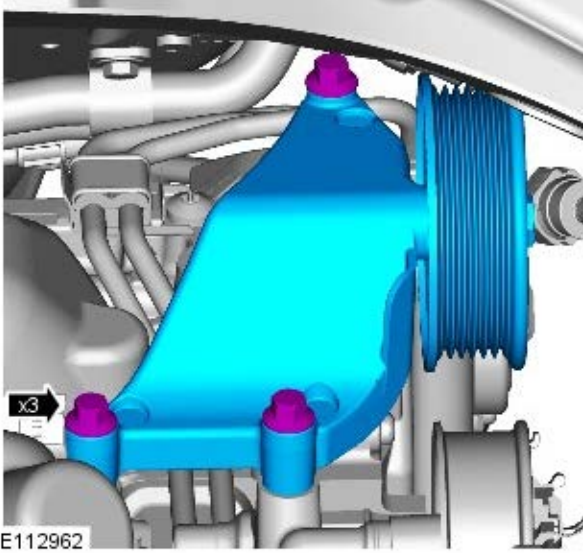
16. Torque:
M6 12 Nm
M10 29 Nm



17.  NOTE: Engine shown removed for clarity.

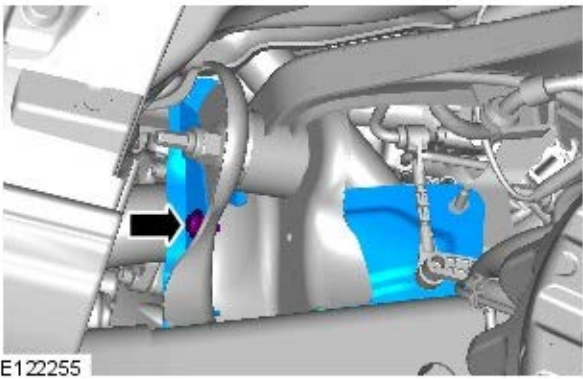


18. Torque: 25 Nm

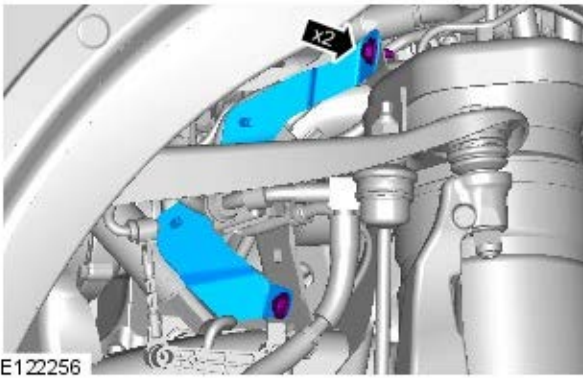


19. Refer to: [Generator](#) (414-02A Generator and Regulator - V6 S/C 3.0L Petrol, Removal and Installation).

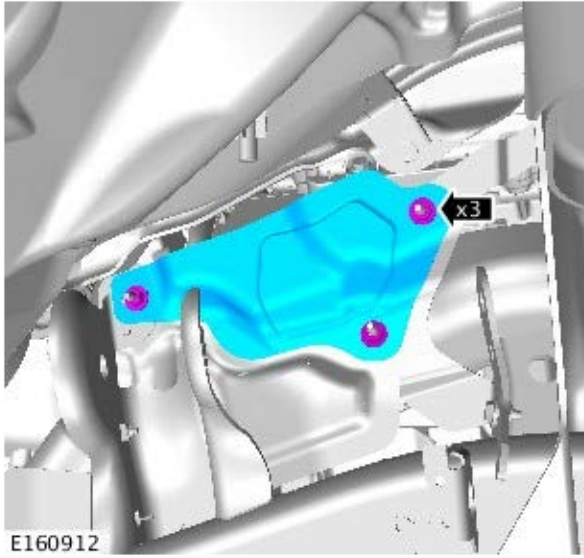
20. Torque: 10 Nm



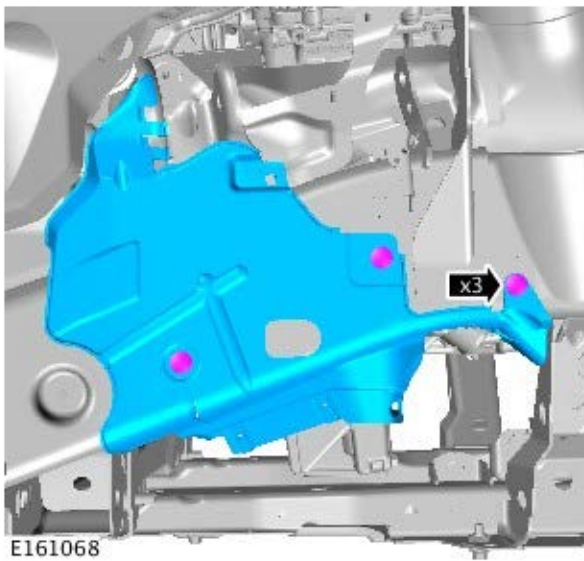
21. Torque: 10 Nm



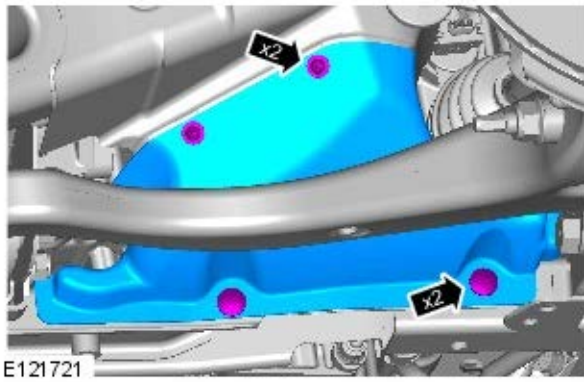
22. Torque: 10 Nm



23.

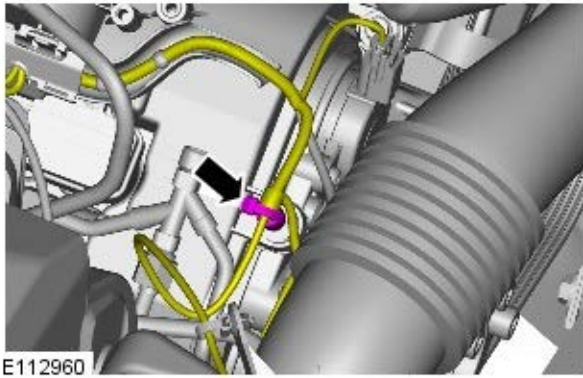


24.



25. Lower the vehicle.


26.

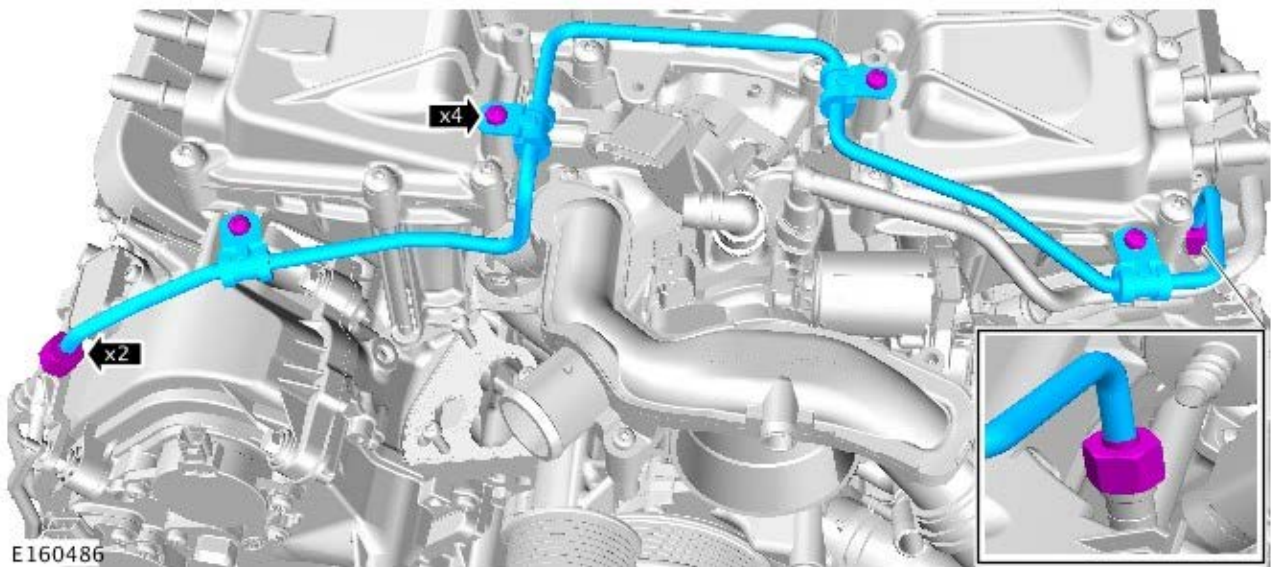


27.  CAUTION: Lubricate only the union threads with clean engine oil.

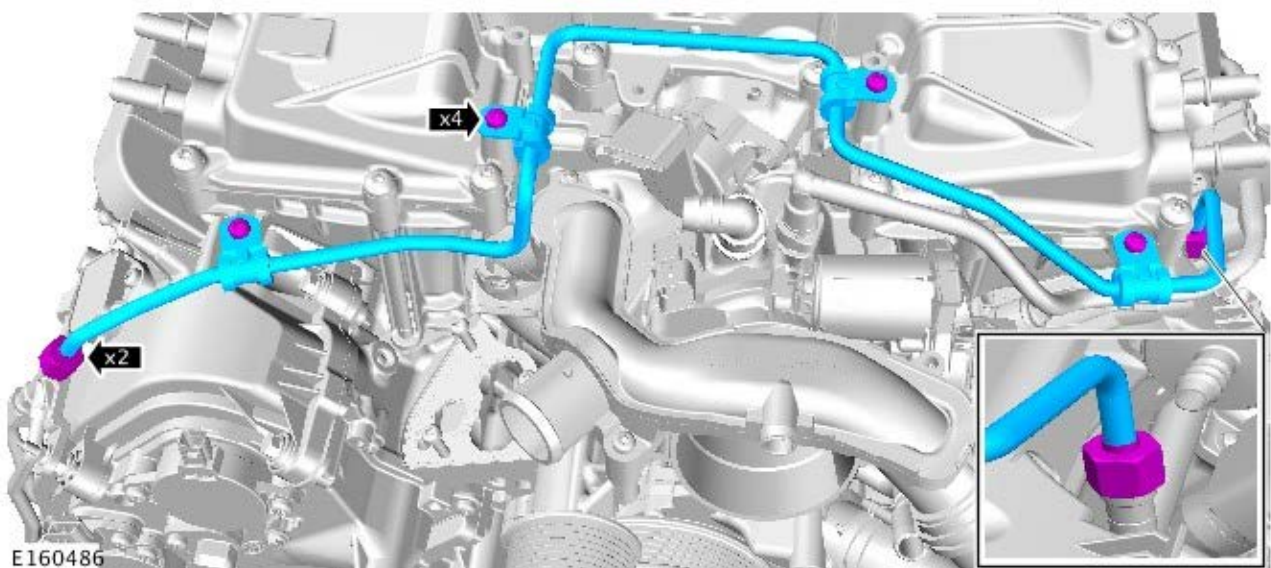
NOTES:

 Do not tighten at this stage.

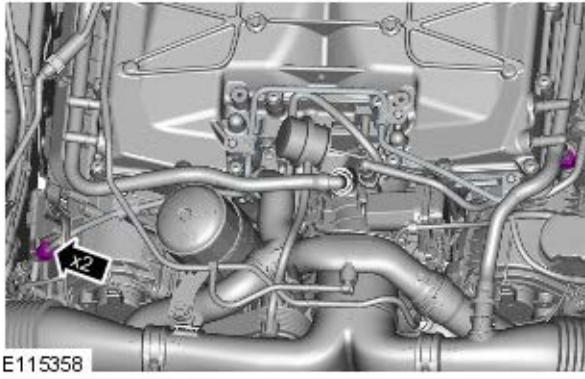
 Remove and discard the blanking caps.



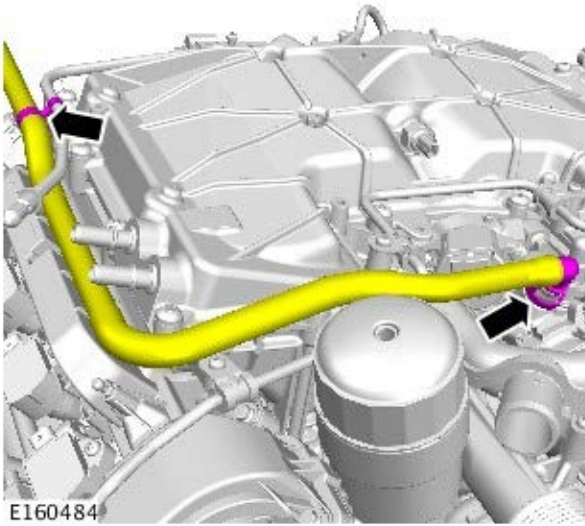
28. Torque:
Unions 21 Nm
Bolts 8 Nm



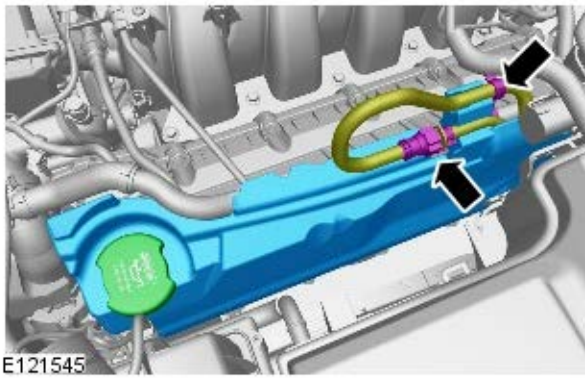
29. Torque: 21 Nm



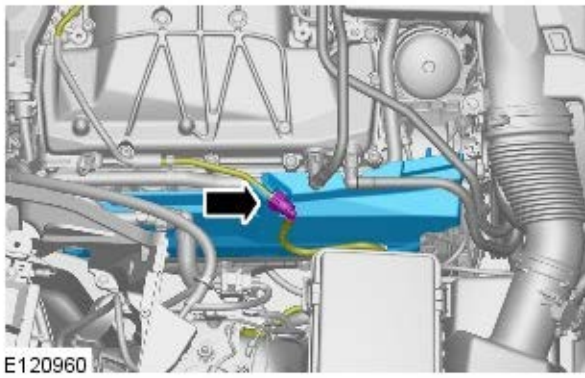
30.



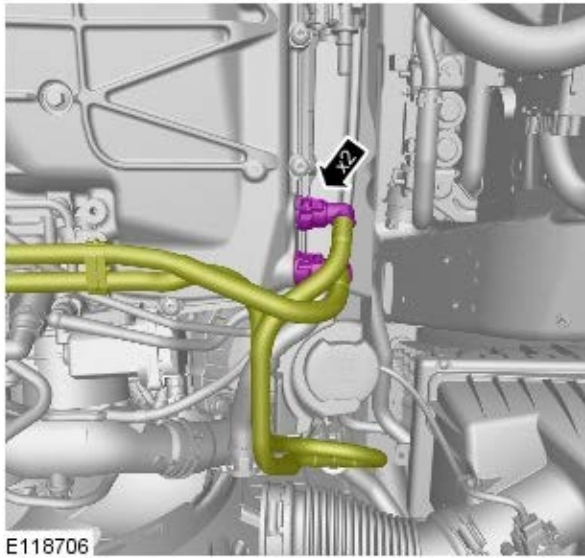
31.



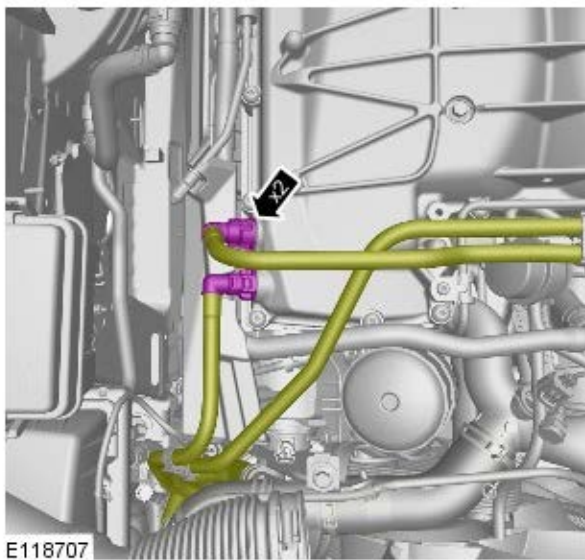
32.



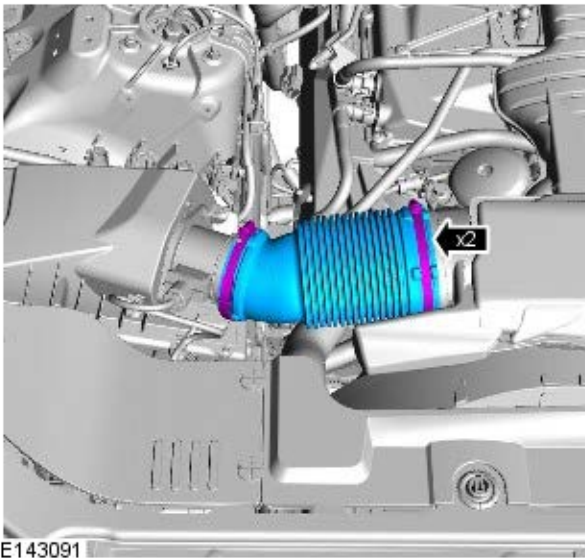
33.



34.



35. Torque: 3.5 Nm



36. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

37. Refer to: [Engine Oil Draining and Filling](#) (303-01B Engine - V6 S/C 3.0L Petrol, General Procedures).

38. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Fuel Charging and Controls - V6 S/C 3.0L Petrol - High Pressure Fuel Pump 2

Removal and Installation

Removal



CAUTION: Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.



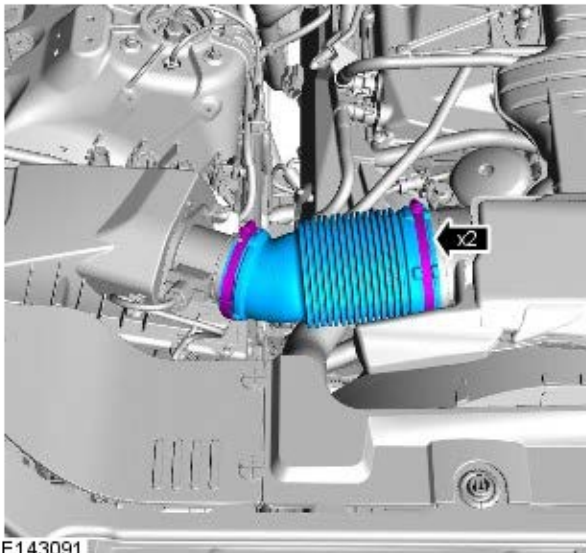
Removal steps in this procedure may contain installation details.

1. Refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Fuel System Pressure Release - V6 S/C 3.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).
3. Disconnect the battery ground cable.

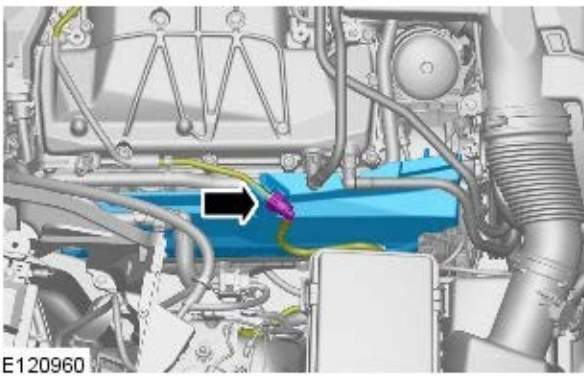
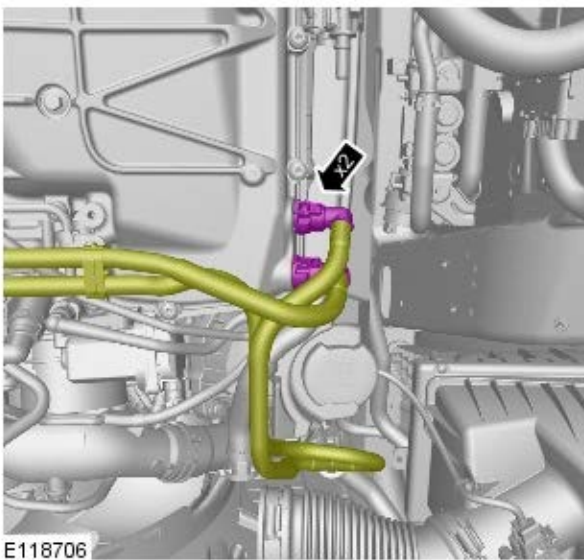
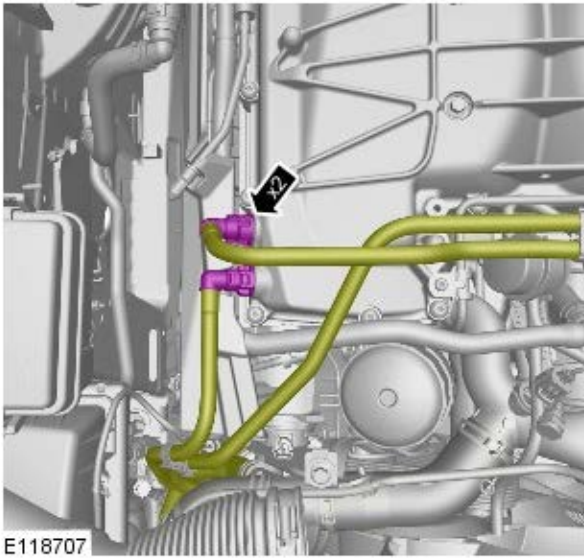
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).


4. Refer to: [Engine Oil Draining and Filling](#) (303-01B Engine - V6 S/C 3.0L Petrol, General Procedures).
5. Refer to: [Fuel Injection Component Cleaning](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, General Procedures).
6. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

7.



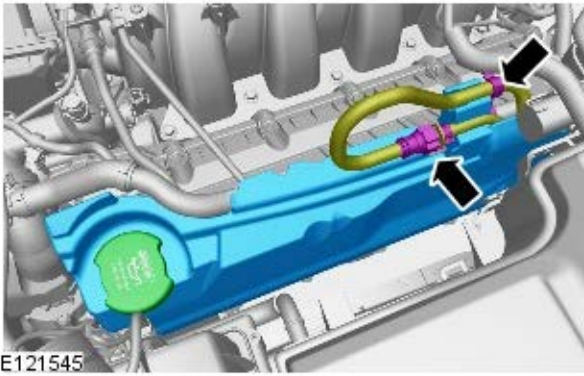
8. **CAUTION:** Be prepared to collect escaping coolant.



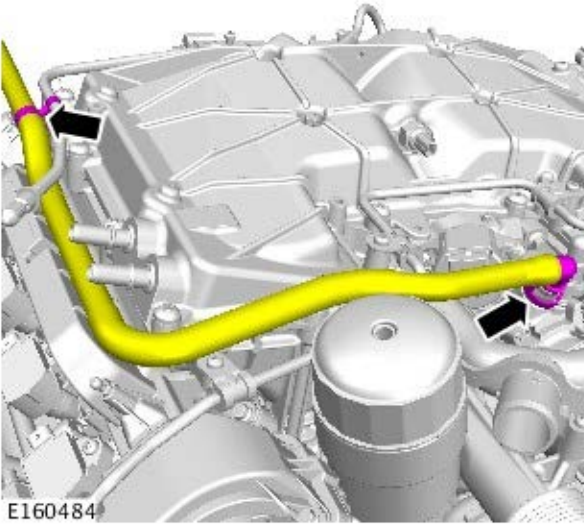
9.  **WARNING:** Be prepared to collect escaping fluids.

10.

11.



12.



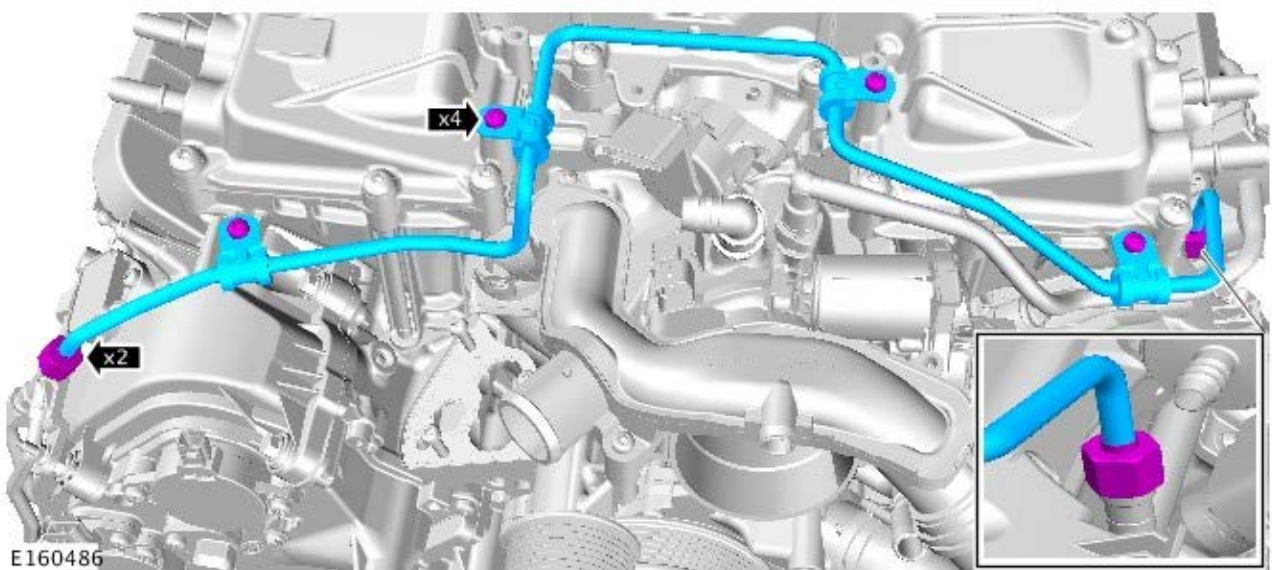
13. CAUTIONS:



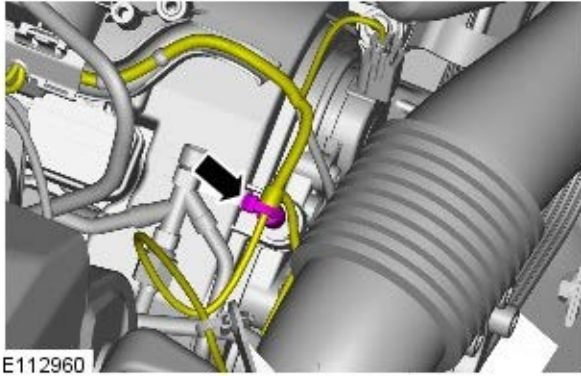
Be prepared to collect escaping fluids.



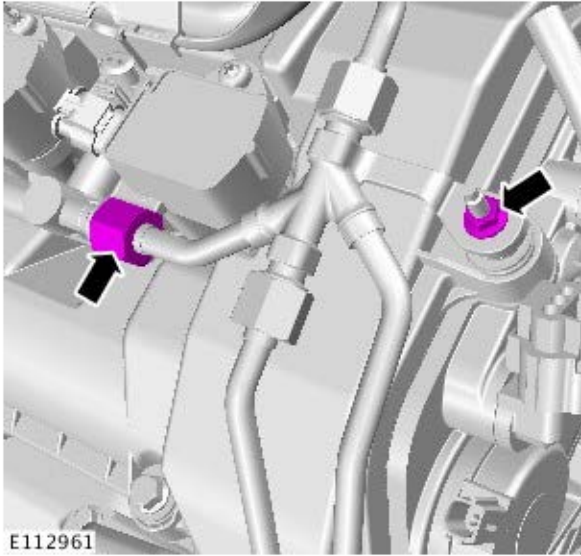
Make sure that all openings are sealed. Use new blanking caps.



14.



E112960



E112961


15. CAUTIONS:



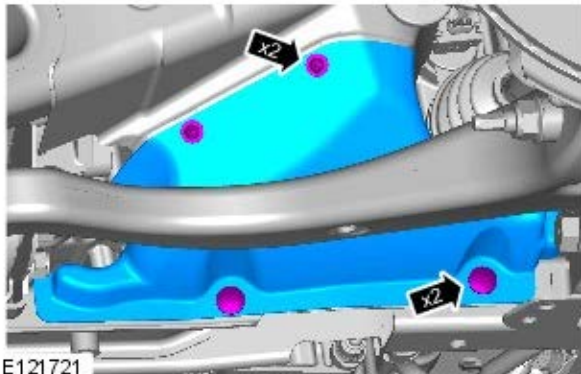
Be prepared to collect escaping fluids.



Make sure that all openings are sealed. Use new blanking caps.

16.  **WARNING:** Make sure to support the vehicle with axle stands.

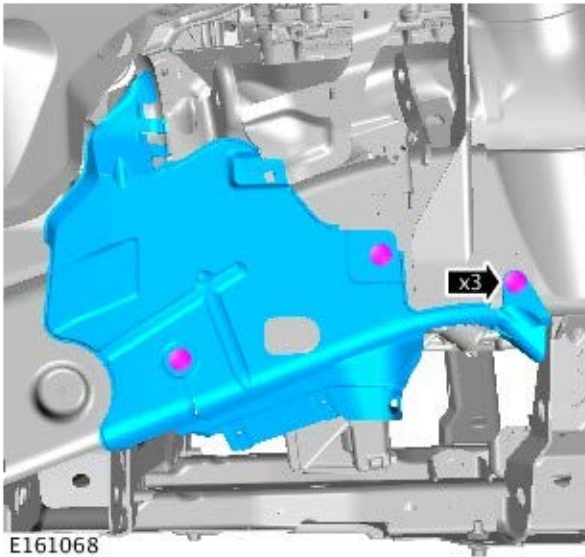
Raise and support the vehicle.



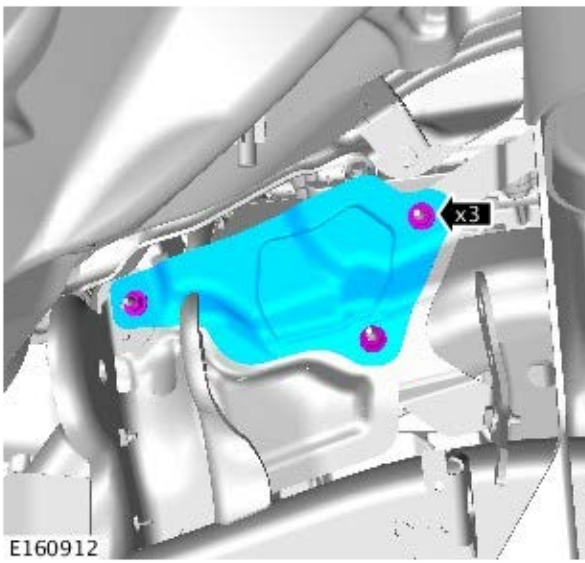
E121721

17.

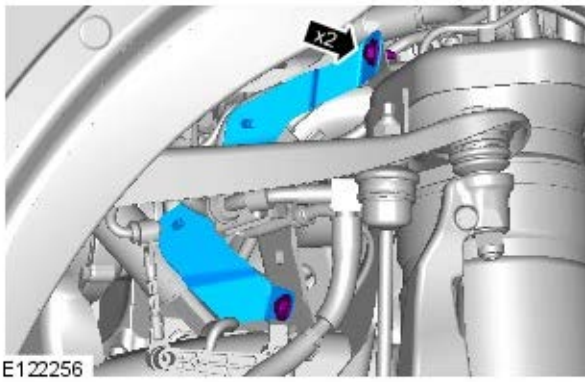
18.



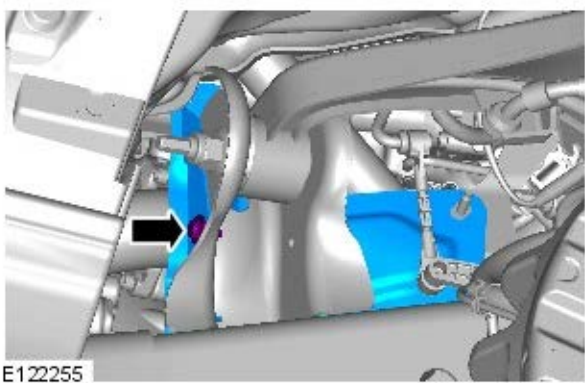
19.



20.

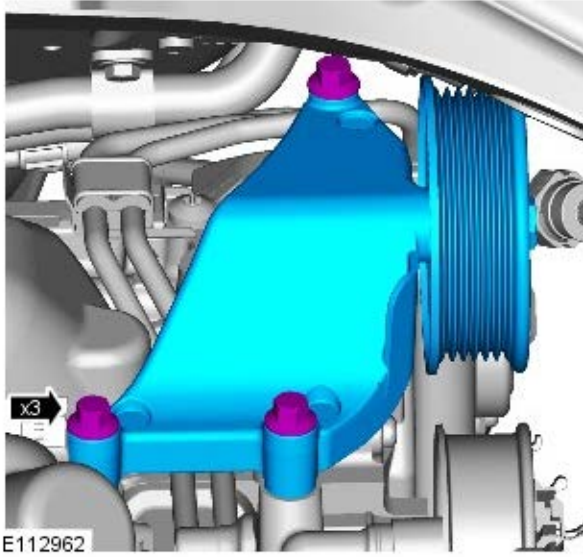


21.




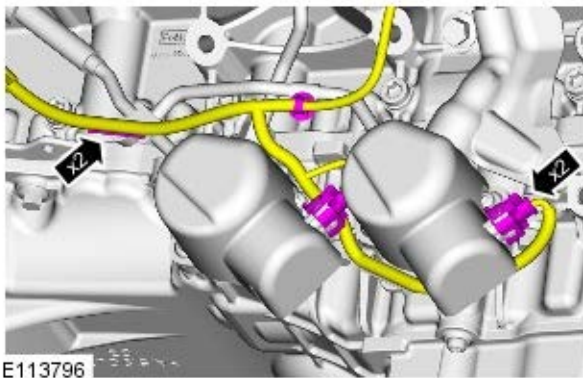
22. Refer to: [Generator](#) (414-02A Generator and Regulator - V6 S/C 3.0L Petrol, Removal and Installation).

23.



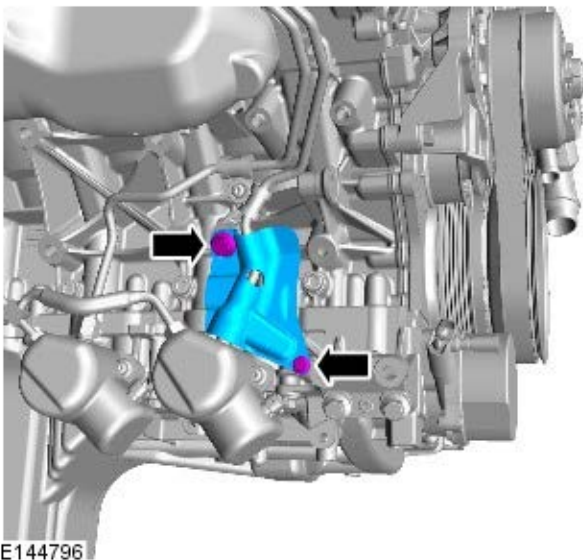
E112962

24.  NOTE: Engine shown removed for clarity.



E113796

25.

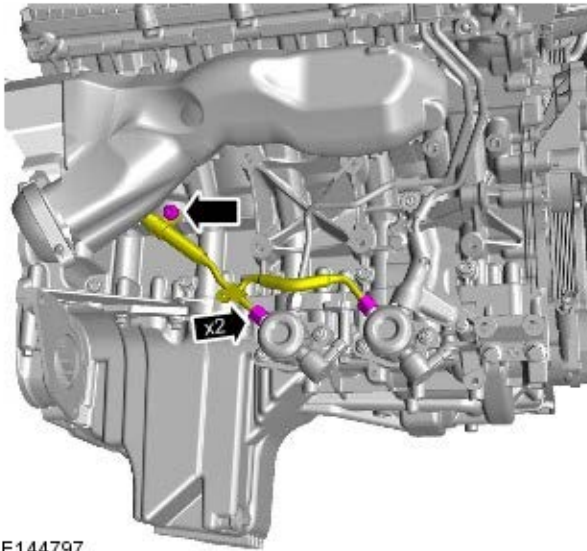


E144796

26. CAUTIONS:

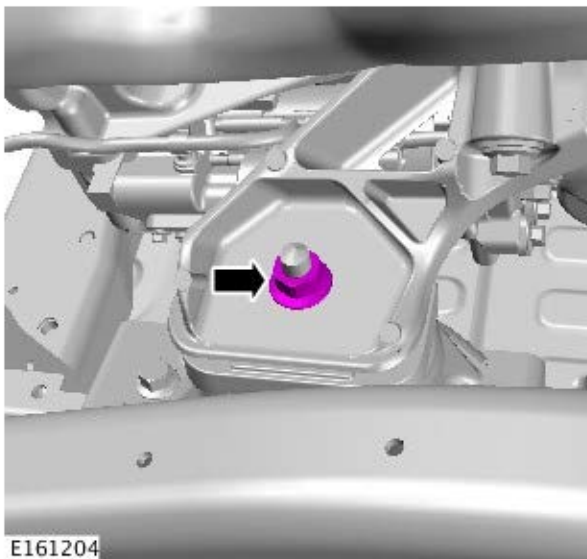
 Be prepared to collect escaping fluids.

 Make sure that all openings are sealed. Use new blanking caps.

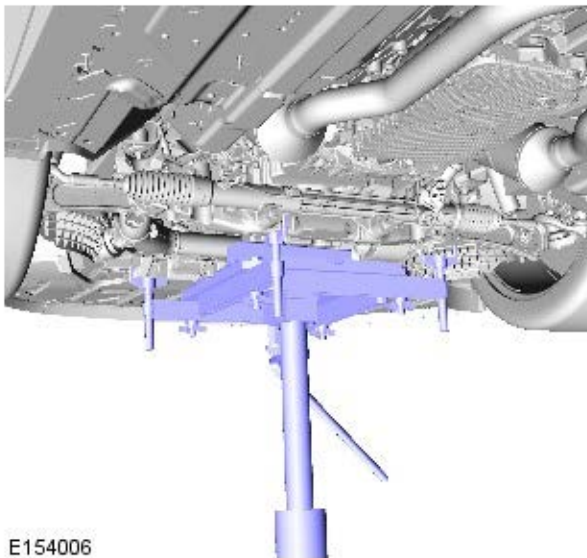


E144797


27.



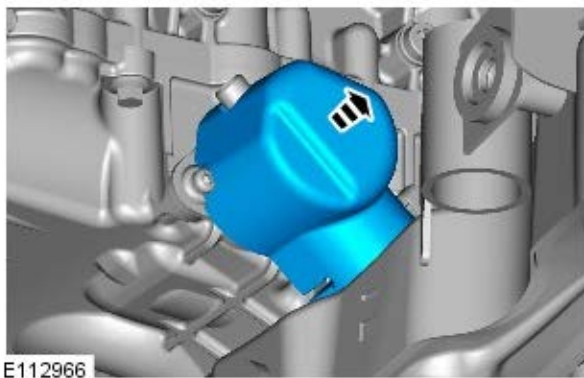
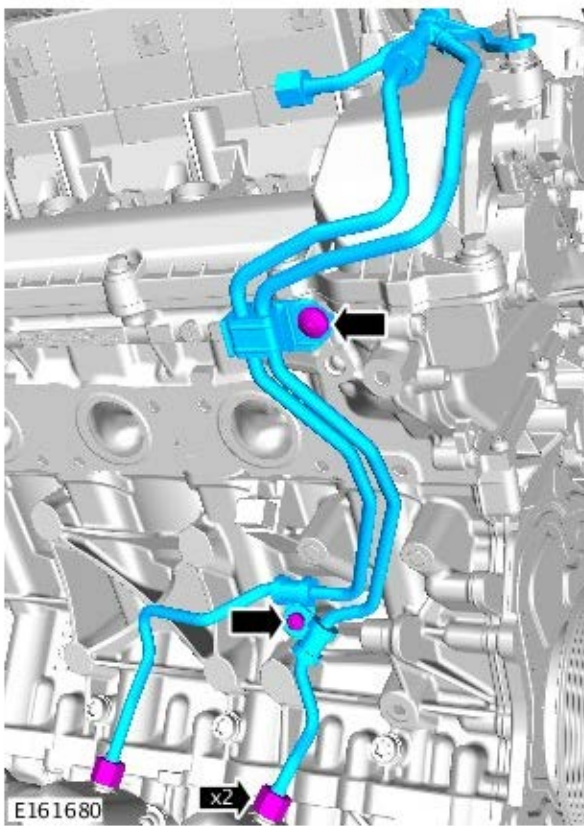
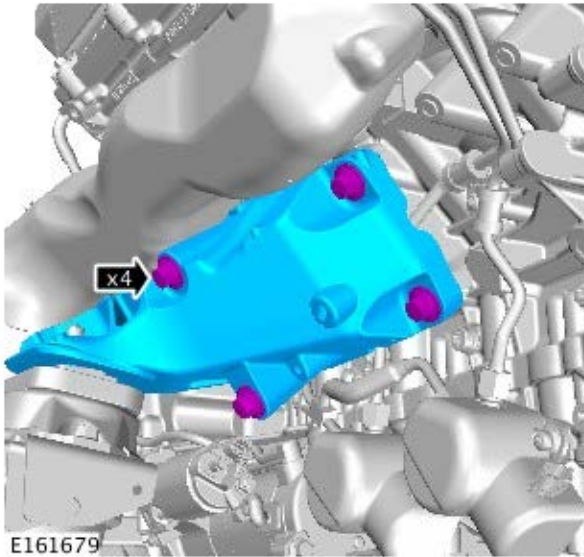
E161204




E154006

28.  CAUTION: Use a wooden block to protect the oil pan when supporting the engine.
Using a suitable hydraulic jack, support the engine.

29.



30.  **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

CAUTIONS:


 Remove and discard the high-pressure fuel supply lines.

 Be prepared to collect escaping fluids.

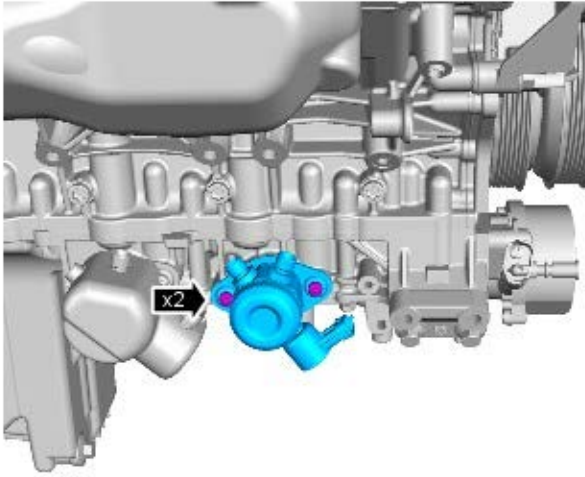
 Make sure that all openings are sealed. Use new blanking caps.

 **NOTE:** Engine shown removed for clarity.

31.

32.  **CAUTION:** Be prepared to collect escaping fluids.

Loosen the Torx screws a turn each at a time.



E144830





E112996


Installation




E112997

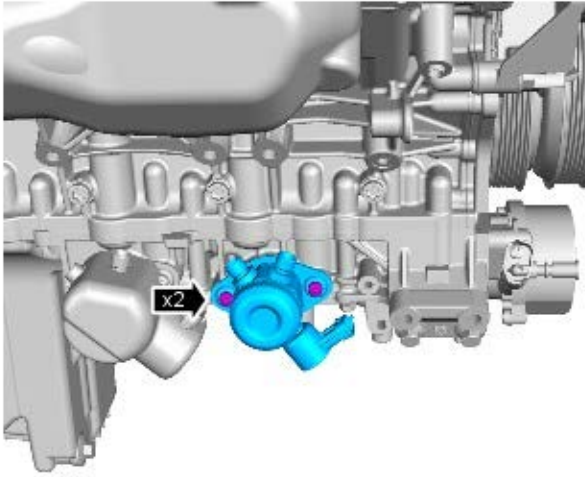
33.  CAUTION: Be prepared to collect escaping fluids.

1.  NOTE: Lubricate the fuel rail high-pressure fuel pump bucket with clean engine oil.

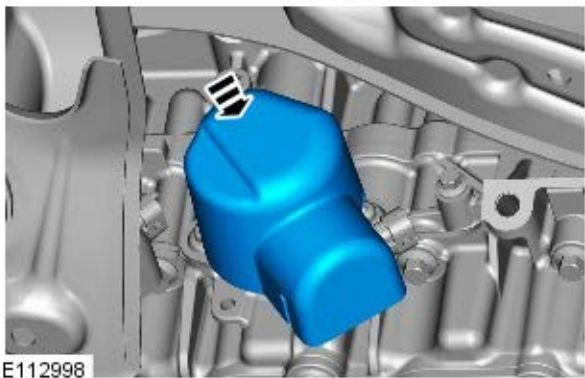
2.  CAUTION: Tighten the Torx screws a turn at a time until the correct torque is achieved.

 NOTE: Lubricate the fuel rail high-pressure fuel pump O-ring seal with clean engine oil.

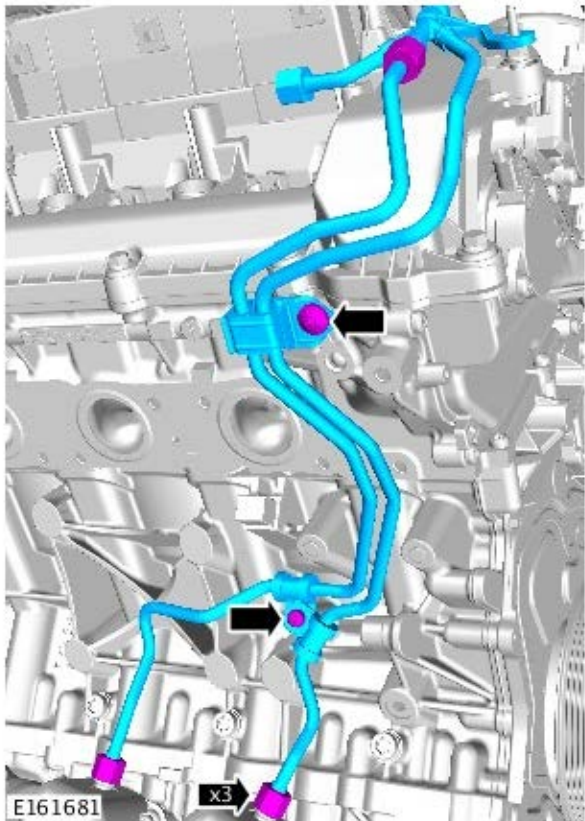
Torque: 12 Nm



E144830




E112998



E161681

3.

4.  CAUTION: Lubricate only the union threads with clean engine oil.

NOTES:



Engine shown removed for clarity.

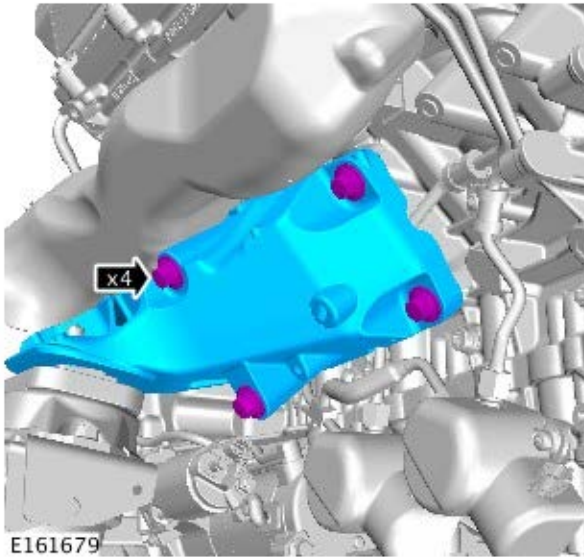


Install the bolts and unions finger tight before final tightening.

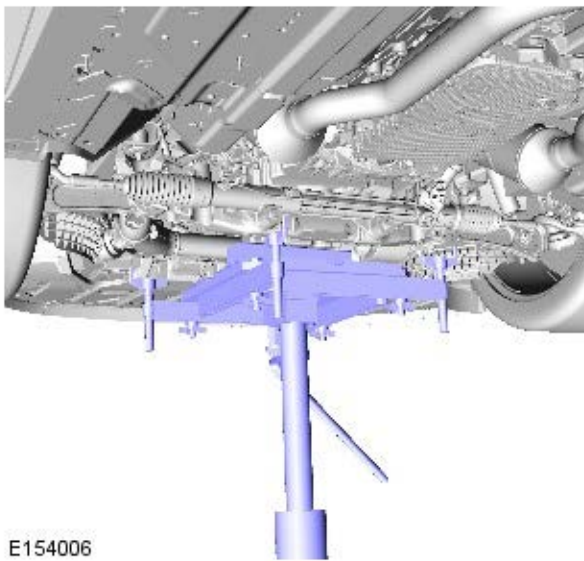


Remove and discard the blanking caps.

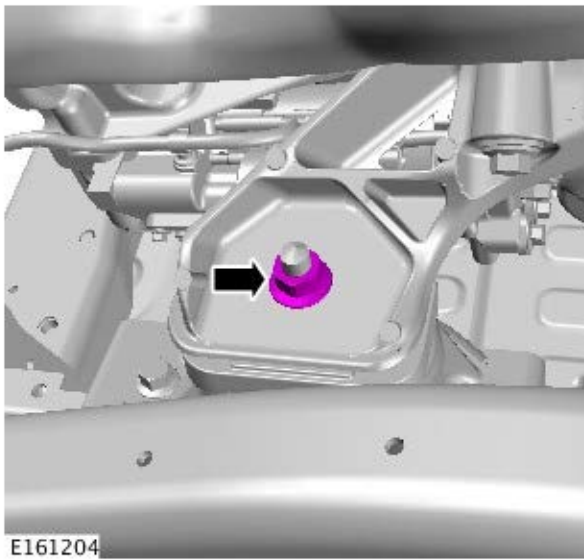
5. *Torque:*
 Stage 1: 45 Nm
 Stage 2: 60°




6. Remove the special tool.

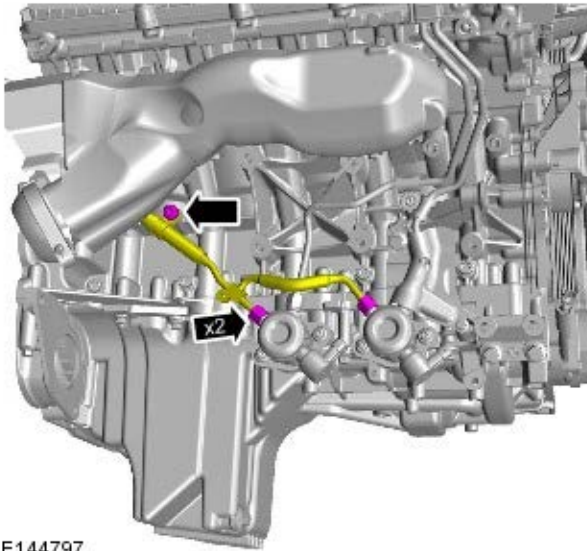


7. Torque: 100 Nm



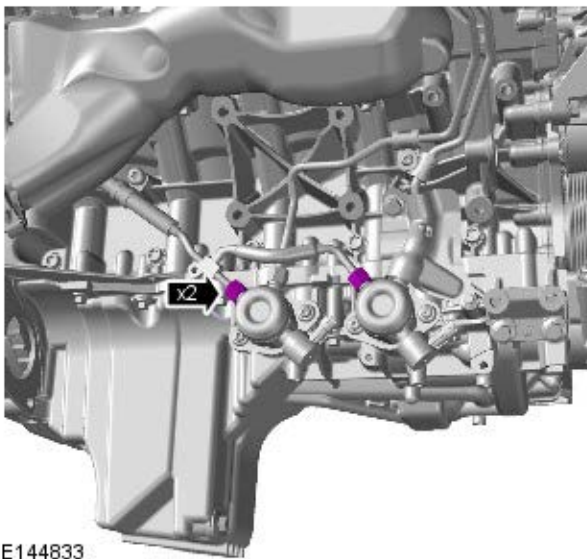
8.  NOTE: Remove and discard the blanking caps.

Torque:
Unions 20 Nm
M6 12 Nm



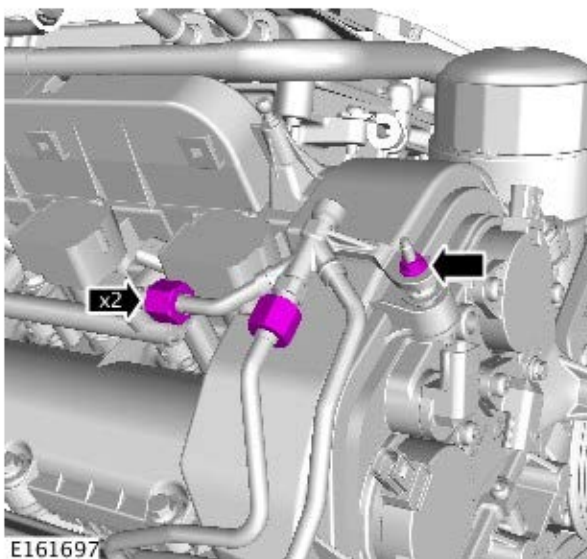
E144797

9. Torque: 21 Nm



E144833

10. Lower the vehicle.



E161697

11. NOTES:



Do not tighten at this stage.

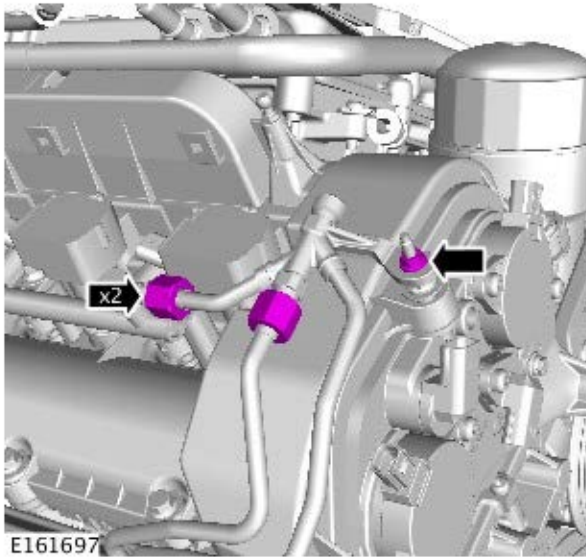



Remove and discard the blanking caps.



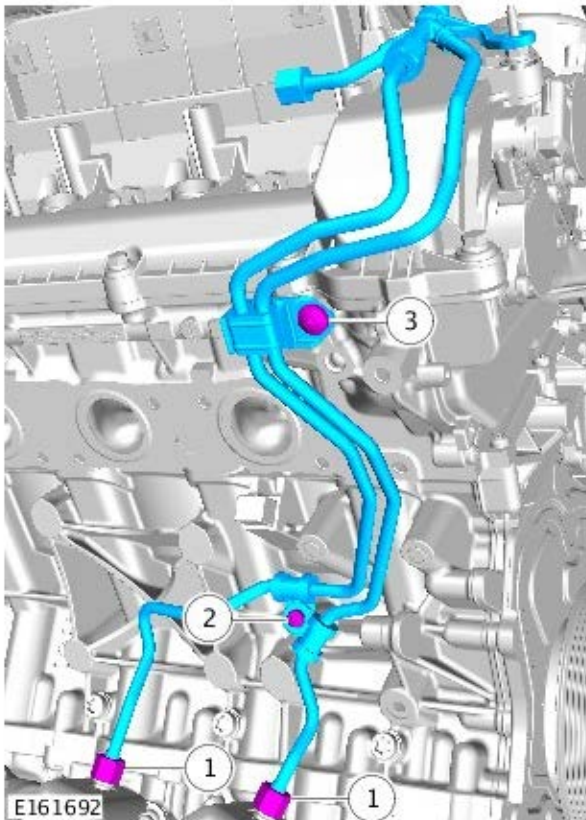
Only tighten the union finger-tight at this stage.

12. Torque:
Unions 21 Nm
Nut 6 Nm



13.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.



14.  **NOTE:** Some components shown removed for clarity.

Torque:

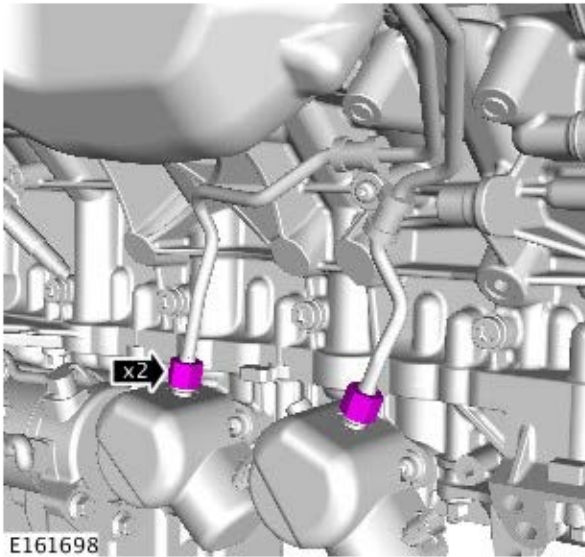
Unions (1) 21 Nm

M6 (2) 11 Nm

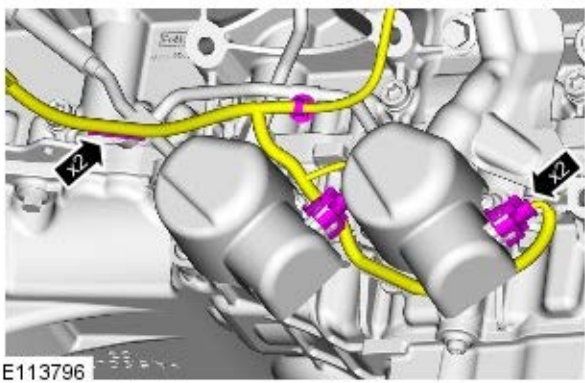
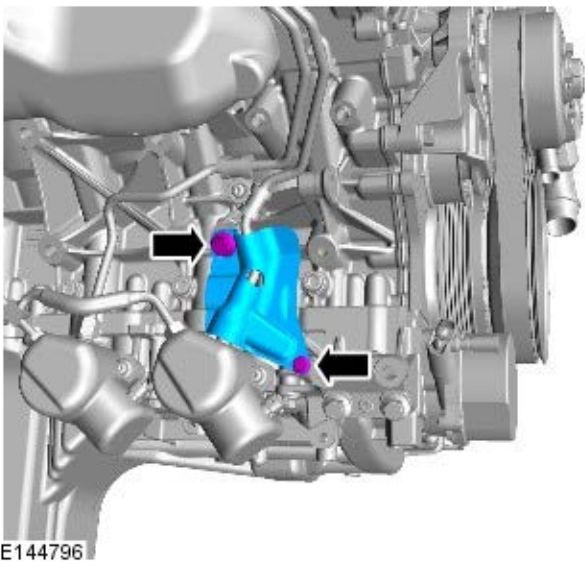
M8 (3) 25 Nm


15.  **NOTE:** Some components shown removed for clarity.

Torque: 21 Nm

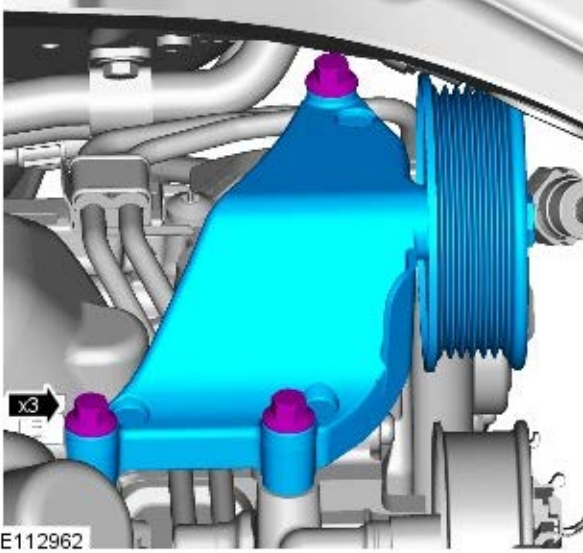


16. Torque:
M6 12 Nm
M10 29 Nm



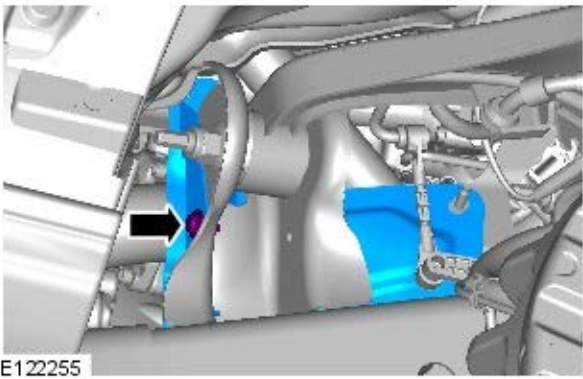
17.  NOTE: Engine shown removed for clarity.

18. Torque: 25 Nm

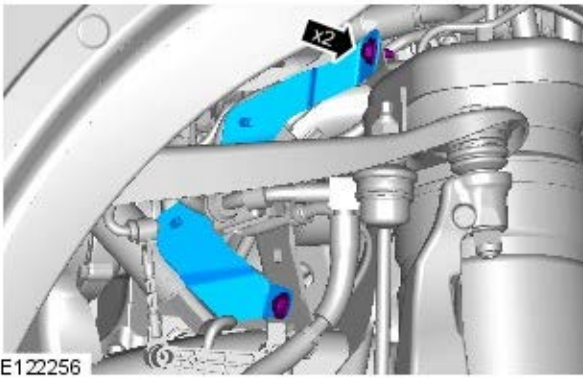


19. Refer to: [Generator](#) (414-02A Generator and Regulator - V6 S/C 3.0L Petrol, Removal and Installation).

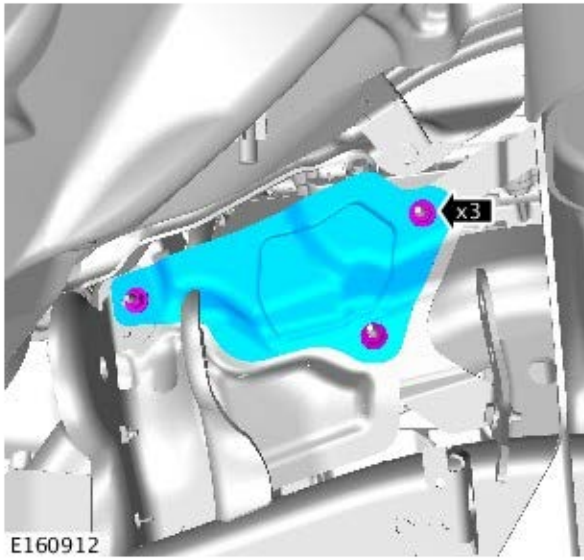
20. Torque: 10 Nm



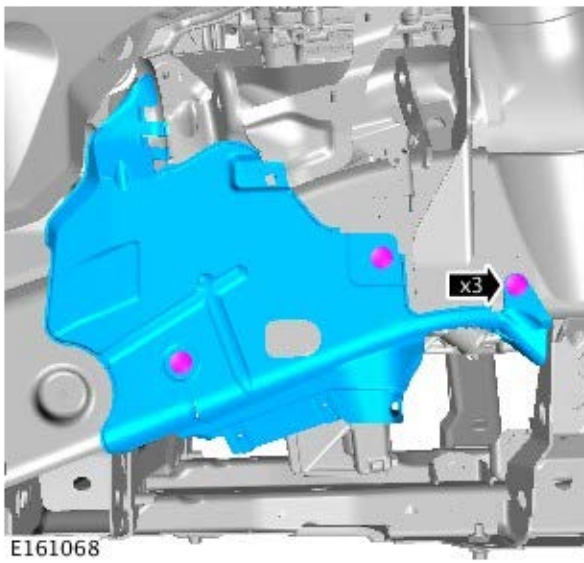
21. Torque: 10 Nm



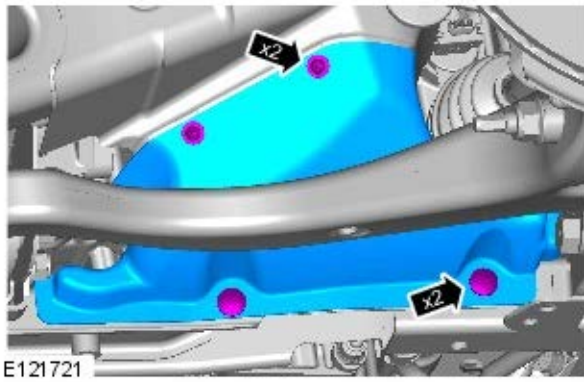
22. Torque: 10 Nm



23.

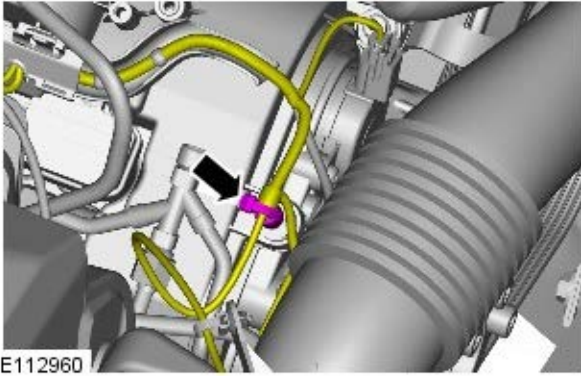


24.



25. Lower the vehicle.

26.




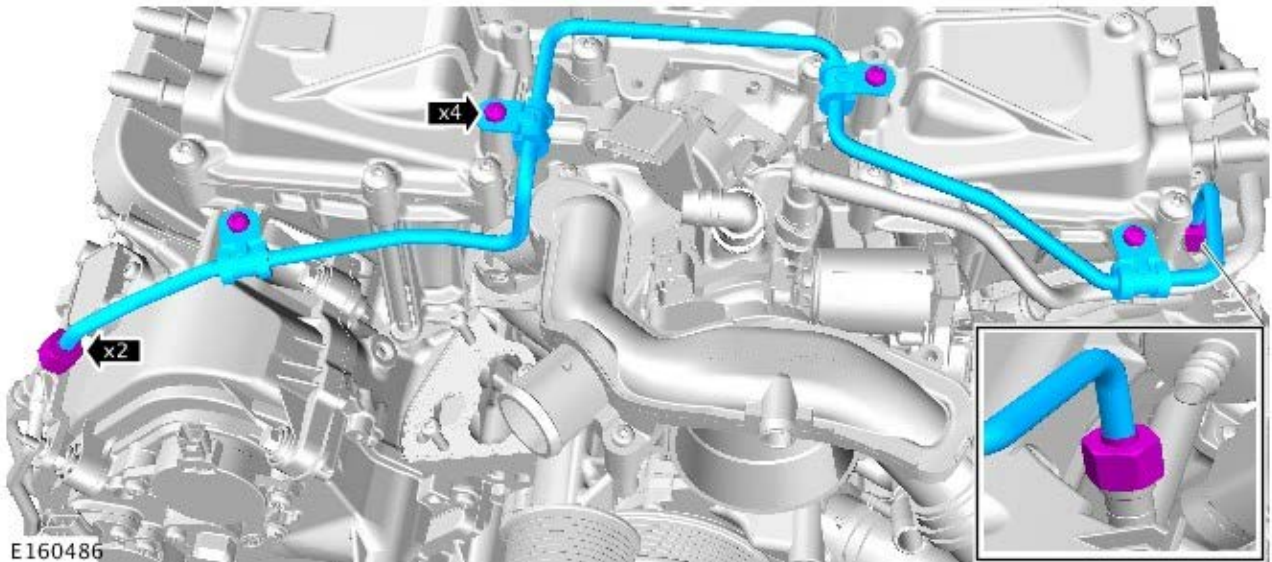
E112960

27.  CAUTION: Lubricate only the union threads with clean engine oil.

NOTES:

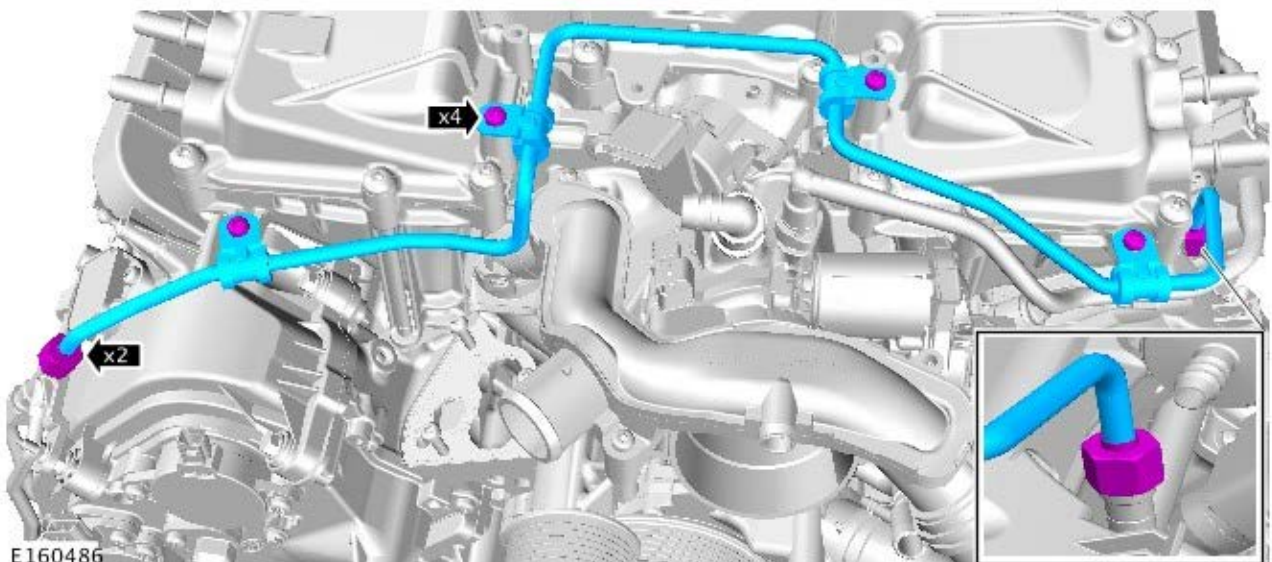
 Do not tighten at this stage.

 Remove and discard the blanking caps.



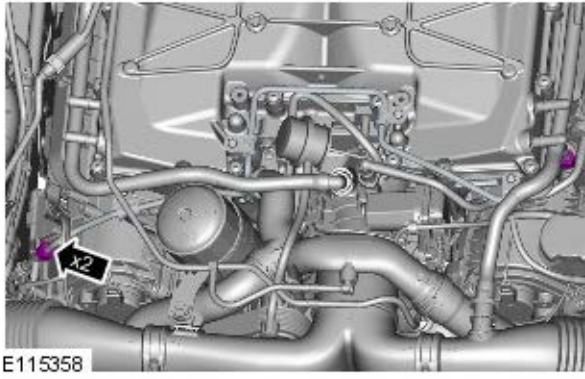
E160486

28. Torque:
Unions 21 Nm
Bolts 8 Nm

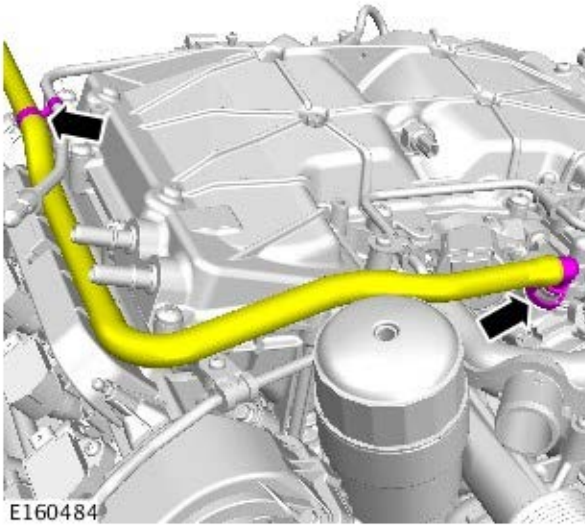


E160486

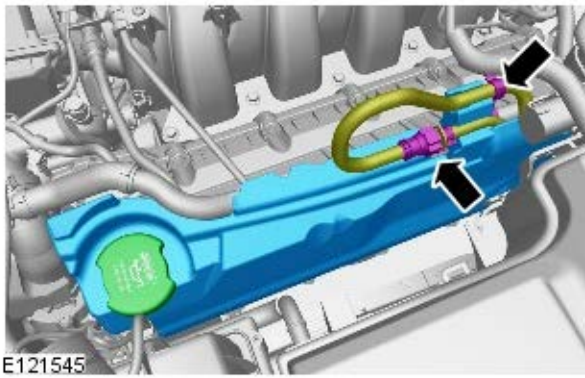
29. Torque: 21 Nm



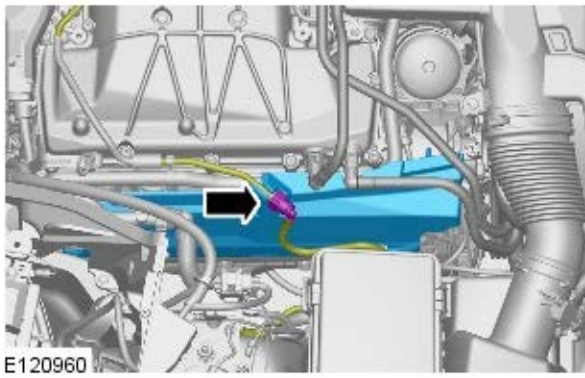
30.



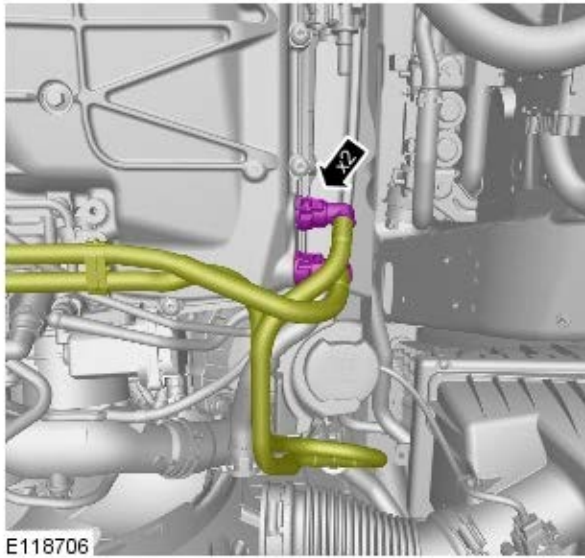
31.



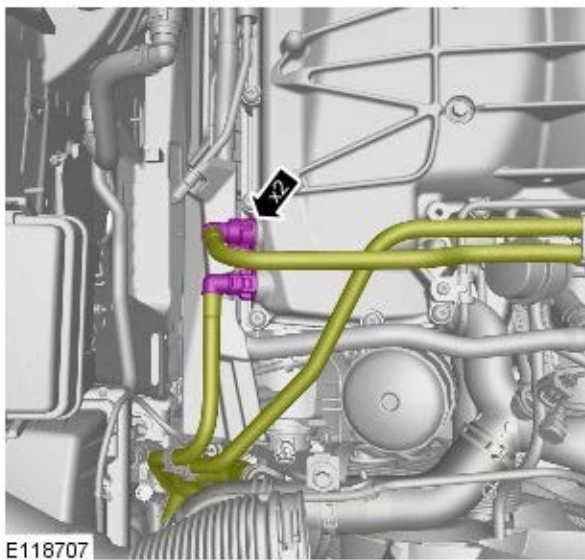
32.



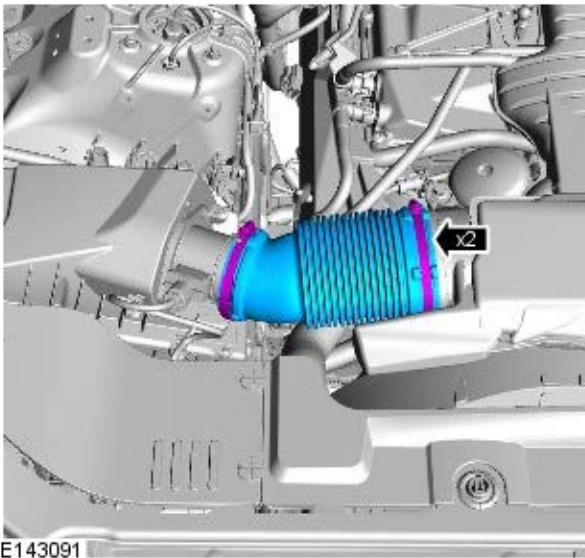
33.



34.



35. Torque: 3.5 Nm



36. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

37. Refer to: [Engine Oil Draining and Filling](#) (303-01B Engine - V6 S/C 3.0L Petrol, General Procedures).

38. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Fuel Charging and Controls - V6 S/C 3.0L Petrol - Fuel Pump Driver Module (FPDM)

Removal and Installation

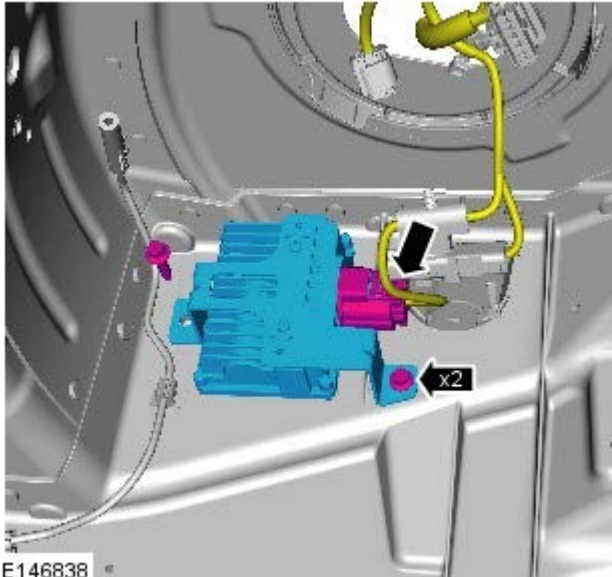
Removal



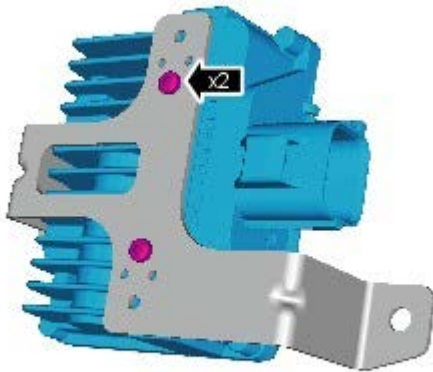
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Fuel Tank (310-01B, Removal and Installation).

2. Torque: 10 Nm



3. Torque: 3 Nm



E146839

Installation



1. NOTE: If a new component has been installed, configure using Land Rover approved diagnostic equipment.

To install, reverse the removal procedure.

Fuel Charging and Controls - V6 S/C 3.0L Petrol - Throttle Body

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

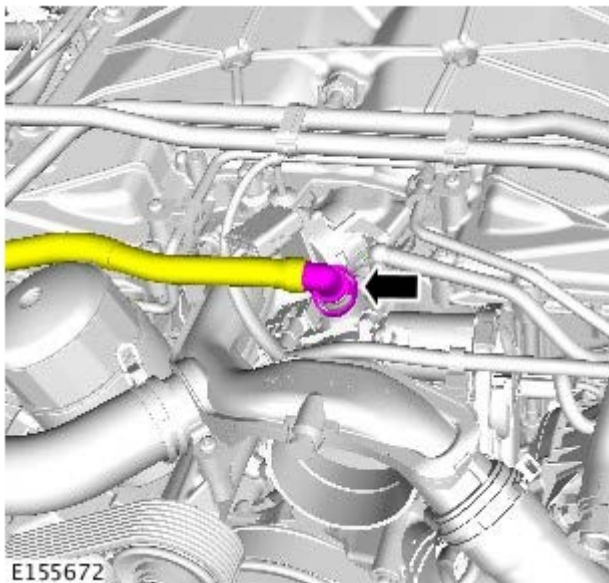
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

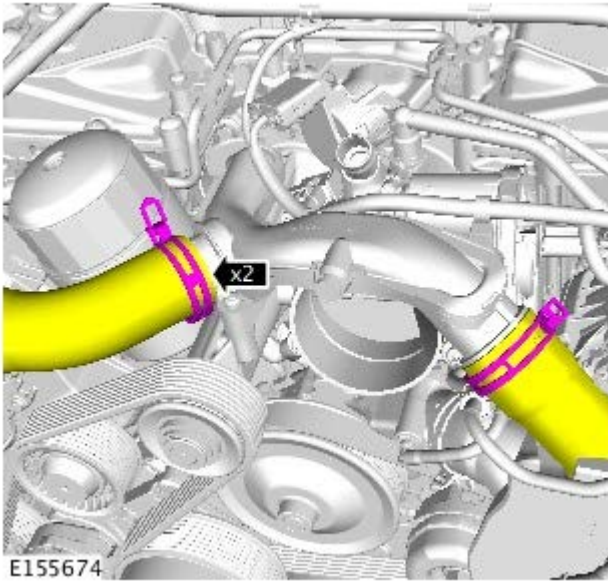
Raise and support the vehicle.

3. Refer to: [Cooling System Partial Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).

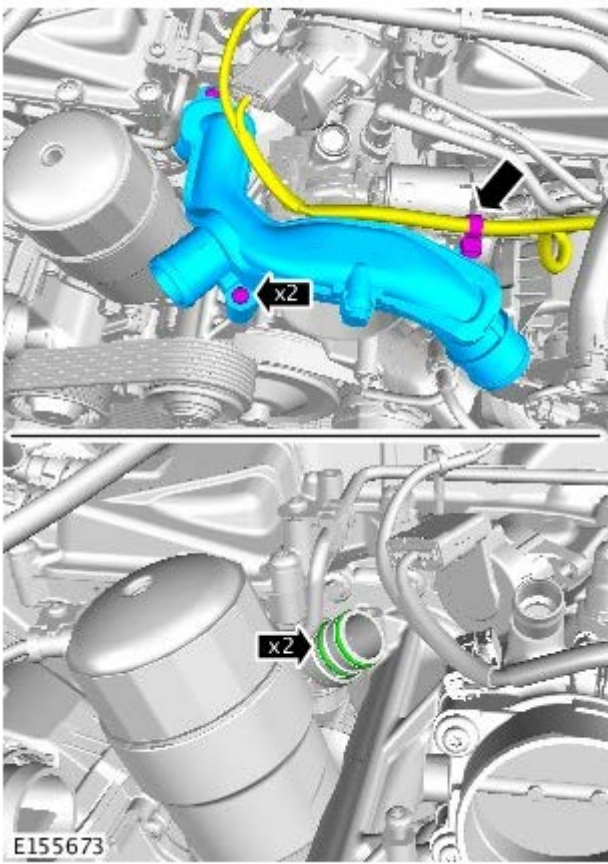
4.



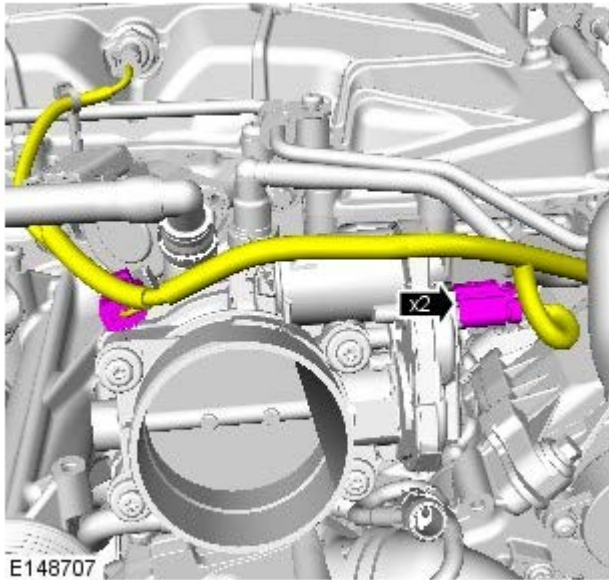
5.



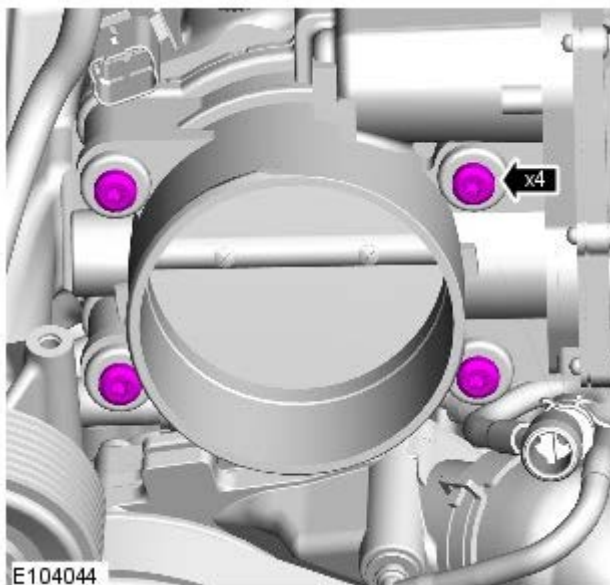
6. Torque: 10 Nm




7.




8. Torque: 10 Nm

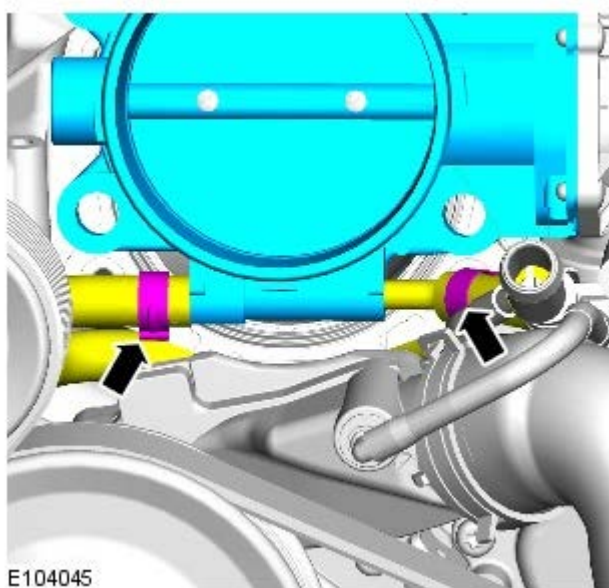


9. CAUTIONS:

 Do not attempt to clean the throttle body bore, build up of deposits reduces air leakage past the throttle plate at the fully closed position.

 Take extra care when removing the throttle body, failure to follow this instruction may result in damage to the manifold absolute pressure (MAP) sensor.

- Remove and discard the gasket.
- Install a new gasket.
- Clean the components mating faces.



Installation

1. To install, reverse the removal procedure.
2. Using the approved diagnostic equipment, clear the

powertrain control module (PCM) adaptations.

Accessory Drive - TDV6 3.0L Diesel -

Torque Specification

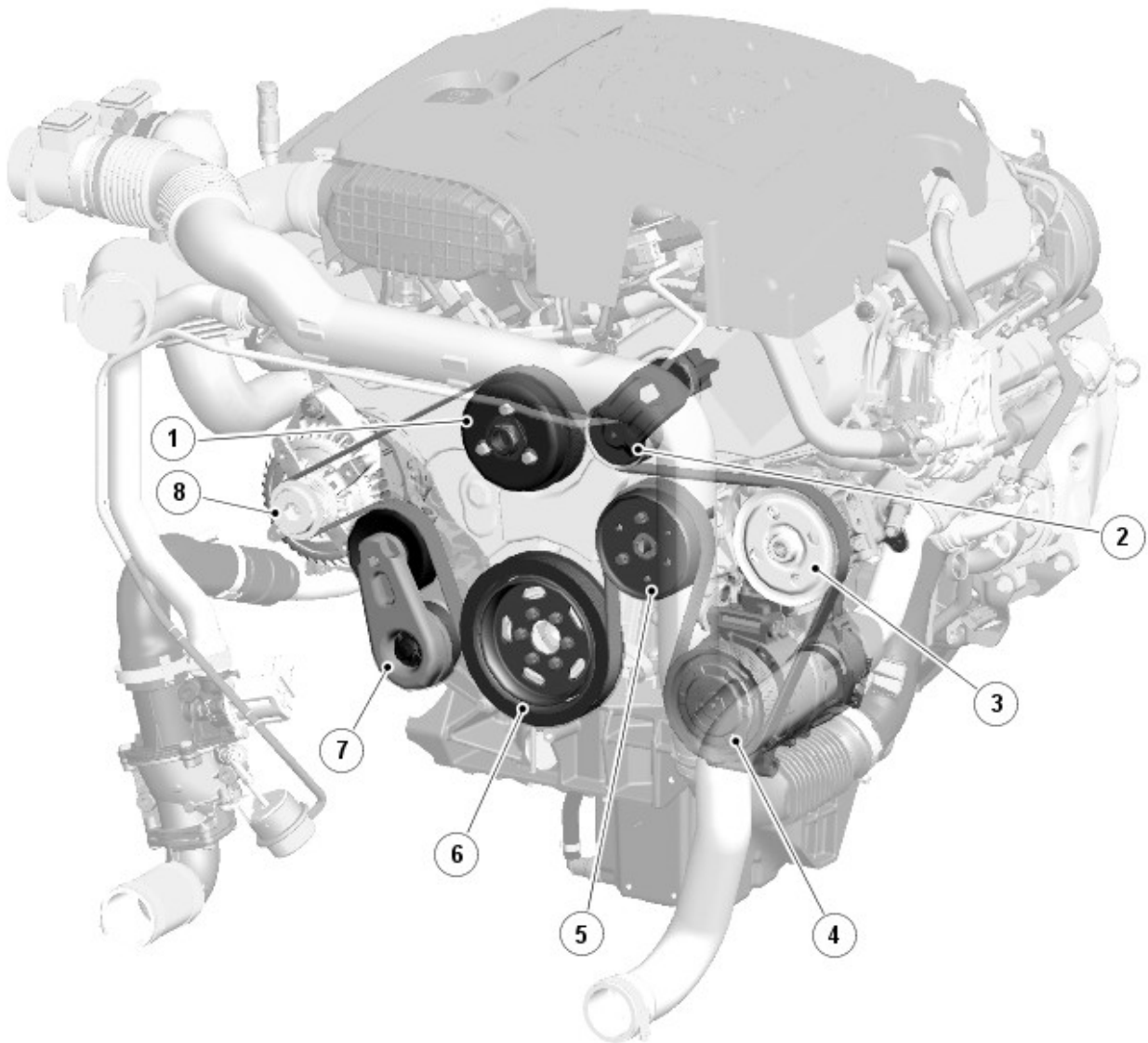


NOTE: **A** = refer to procedure for correct torque sequence

Description	Nm	lb-ft	lb-in
Accessory drive belt tensioner retaining bolt	47	35	-
Accessory drive belt idler pulley retaining bolt	50	37	-
Fuel injection pump sprocket retaining nut	A	-	-
Camshaft rear hub bolt	Stage 1 - 80 Stage 2 - 80 degrees	Stage 1 - 59 Stage 2 - 80 degrees	-
Camshaft rear pulley retaining bolts	23	17	-
Rear end accessory drive belt (READ) belt tensioner retaining bolt	23	17	-

Accessory Drive - TDV6 3.0L Diesel - Accessory Drive - Component Location

Description and Operation



E107566

Item Description

- 1 Viscous fan pulley
- 2 Idler
- 3 Power steering pump
- 4 [A/C \(air conditioning\)](#) compressor
- 5 Coolant pump
- 6 Crankshaft pulley
- 7 Belt tensioner
- 8 Generator

Accessory Drive - TDV6 3.0L Diesel - Accessory Drive - Overview

Description and Operation

OVERVIEW

The crankshaft pulley drives a six ribbed poly V belt which in turn drives all of the engine mounted accessories.

Accessory Drive - TDV6 3.0L Diesel - Accessory Drive - System Operation and Component Description

Description and Operation

System Operation

OPERATION

The crankshaft pulley is attached to and rotates with the crankshaft. The pulley provides the drive for the accessory drive vee belt which in turn provides rotational power for the front mounted accessories such as the generator, power steering pump, coolant pump and the [A/C \(air conditioning\)](#) compressor.

The crankshaft pulley is a combined pulley and torsional vibration damper.

Component Description

DESCRIPTION

The accessory drive belt, which is a maintenance free poly-V type belt, is automatically pre-loaded by the belt tensioner and routed over idlers in order to maintain sufficient friction around the drive wheels. This ensures slip-free drive of the accessory components.

The torsional vibration damper incorporates compressed rubber between its inner and outer diameters to reduce peak levels of torsional vibration within the crankshaft.

The belt tensioner is calibrated to provide the correct amount of tension to the belt for a given drive system. Unless a spring within the tensioner assembly breaks, or some other mechanical part of the tensioner fails, there is no need to check the tensioner for correct tension.

The accessory drive belt should be inspected at every routine service for excessive wear and damage.

The belt tensioner consists of an idler pulley, which is free to rotate on a bearing located at the end of a spring-loaded pivot arm.

Accessory Drive - TDV6 3.0L Diesel - Accessory Drive

Diagnosis and Testing

Principles of Operation

For a detailed description of the accessory drive system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (303-05 Accessory Drive - TDV6 3.0L Diesel)

- Accessory Drive (Description and Operation),
- Accessory Drive (Description and Operation),
- Accessory Drive (Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection

Mechanical
<ul style="list-style-type: none"> • Auxiliary drive belt condition (cracking/damage/contamination) • Idler assembly • Generator • Engine cooling fan • Tensioner assembly • Engine coolant pump • Power steering pump • Air Conditioning (A/C) compressor • Torsional vibration damper • Tensioner assembly • Auxiliary drive belt • Security/correct installation of the fuel injection pump cover • Fuel injection pump belt condition (cracking/damage/contamination) • Fuel injection pump belt tensioner assembly • Fuel injection pump • Fuel injection pump belt

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.



CAUTION: If the engine is run without the accessory drive belts connected to eliminate driven components, diagnostic trouble codes, (DTCs) may be set which must be cleared before the vehicle is returned to the owner. The engine should not be run for more than 2-3 minutes with the belts disconnected. Failure to follow this instruction may result in damage to the vehicle.

4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart (accessory drive belt)

Symptom	Possible Causes	Action
Noise	<ul style="list-style-type: none"> • Auxiliary drive belt condition • Auxiliary drive belt tension • Pulleys misaligned • Driven components (including tensioners) 	<ul style="list-style-type: none"> • Check the auxiliary drive belt condition (see visual inspection) • Check the auxiliary drive belt tensioner function • Check the pulley alignment • Check the driven components for excessive resistance to rotation
Auxiliary drive belt does not hold tension	<ul style="list-style-type: none"> • Belt condition • Tensioner fault 	<ul style="list-style-type: none"> • Check the auxiliary drive belt condition (see visual inspection) • Check the auxiliary drive belt tensioner function

Symptom Chart (fuel injection pump belt)

Symptom	Possible Causes	Action
Noise	<ul style="list-style-type: none"> • Fuel injection pump belt condition • Fuel injection pump belt fouling cover • Fuel injection pump belt tensioner bearing failure • Fuel injection pump failure 	<ul style="list-style-type: none"> • Check the fuel injection pump belt condition (see visual inspection) • Check the fuel injection pump belt cover for indications of fouling (this may indicate a pump misalignment), refer to the relevant workshop manual section • The fuel injection pump belt tensioner must be renewed if the belt is removed, making a check of the bearing impractical • Remove the fuel injection pump belt, check the fuel injection pump pulley for security. Check the fuel injection pump for excessive resistance to rotation (excessive resistance in the pump will cause the pulley securing nut to loosen as a design feature). Check for diagnostic trouble codes (DTCs) indicating a pump malfunction
Fuel injection pump belt does not hold tension	<ul style="list-style-type: none"> • Fuel injection pump belt condition • Tensioner fault 	<ul style="list-style-type: none"> • Check the fuel injection pump belt condition (see visual inspection) • Check the tensioner function
Loss of drive (with no drive to the fuel injection pump, the engine will not run)	<ul style="list-style-type: none"> • Fuel injection pump belt broken / stripped teeth • Drive pulleys loose 	<ul style="list-style-type: none"> • Investigate the cause of the fuel injection pump belt breakage/damage (a belt broken at a 45 degree angle normally indicates a shear, a break straight across the belt normally indicates that the belt has been crimped). • Check the fuel injection pump for excessive resistance to rotation (excessive resistance in the pump will cause the pulley securing nut to loosen as a design feature). Check for DTCs indicating a pump malfunction

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (PCM) (100-00, Description and Operation).

Accessory Drive - TDV6 3.0L Diesel - Accessory Drive Belt

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.


1. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

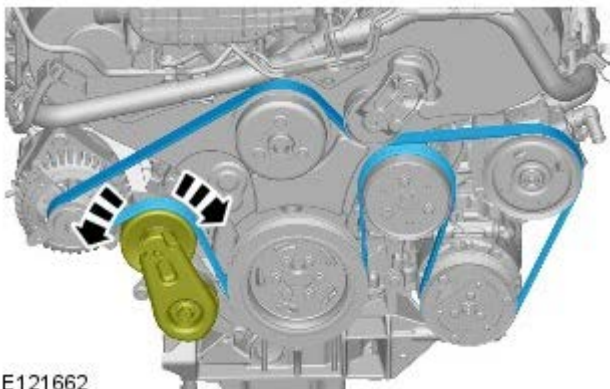
2. Refer to: Cooling Fan Motor and Shroud (303-03, Removal and Installation).



E121664


3.  **NOTE:** Note the fitted position of the accessory drive belt.


Installation



E121662

1. **CAUTIONS:**

 Make sure that the accessory drive belt is correctly located on each pulley.

 Clean and inspect the accessory drive belt pulleys for damage.

 **NOTE:** Engine shown removed for clarity.

To install, reverse the removal procedure.

Accessory Drive - TDV6 3.0L Diesel - Accessory Drive Belt Idler Pulley

Removal and Installation

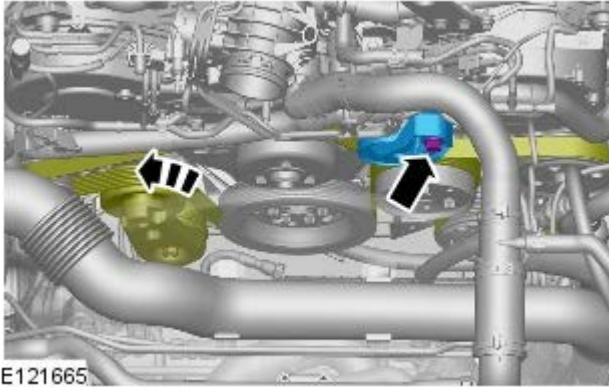
Removal



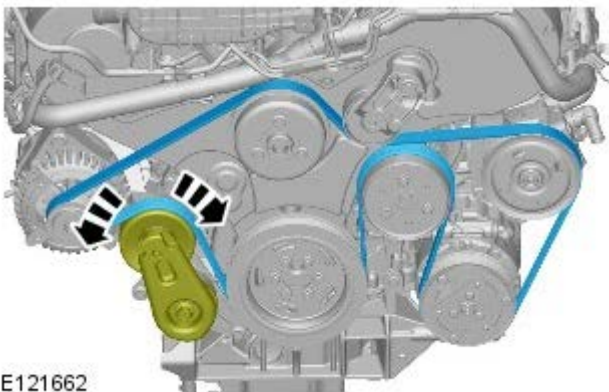
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Cooling Fan Motor and Shroud (303-03, Removal and Installation).


2. Torque: 50 Nm




Installation



1. CAUTIONS:

 Clean and inspect the accessory drive belt pulleys for damage.

 Make sure that the accessory drive belt is correctly located on each pulley.

 NOTE: Engine shown removed for clarity.

To install, reverse the removal procedure.

Accessory Drive - TDV6 3.0L Diesel - Accessory Drive Belt Tensioner

Removal and Installation

Removal

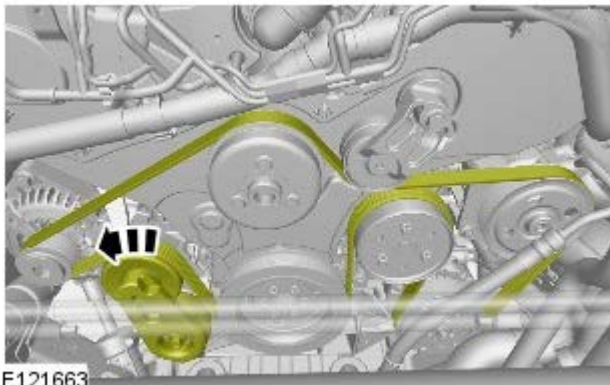


NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

2. Refer to: Cooling Fan Motor and Shroud (303-03, Removal and Installation).

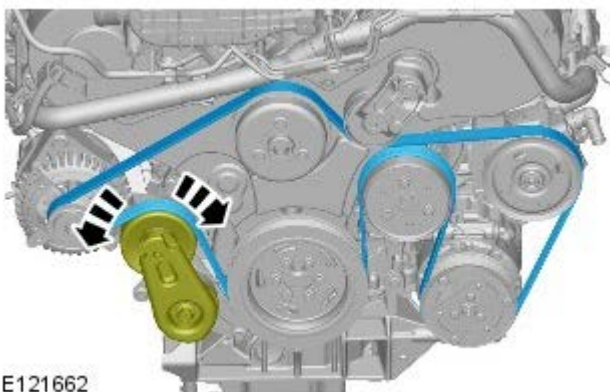


3. **NOTE:** Note the fitted position of the accessory drive belt.



4.
 - Torque: 47 Nm

Installation



1. **CAUTIONS:**

Make sure that the accessory drive belt is correctly located on each pulley.

Clean and inspect the accessory drive belt pulleys for damage.

NOTE: Engine shown removed for clarity.

To install, reverse the removal procedure.

Accessory Drive - TDV6 3.0L Diesel - Fuel Injection Pump Pulley

Removal and Installation

Removal

1. Refer to: Fuel Injection Pump (303-04C, Removal and Installation).

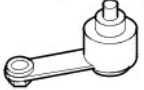

Installation

1. To install, reverse the removal procedure.

Accessory Drive - TDV6 3.0L Diesel - Rear End Accessory Drive (READ)

Removal and Installation

Special Tool(s)

 <p>303-1117 Timing Peg, Automatic Transmission</p> <p>E54540</p>	
 <p>E116926</p>	<p>310-212 Rear End Accessory Drive (READ) belt Timing Tool</p>

Removal

WARNINGS:


 Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 Do not carry out any repairs to the fuel system with the engine running. The fuel pressure within the system can be as high as 1650 bar (23,931 lb-sq-in). Failure to follow this instruction may result in personal injury.


 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.


CAUTIONS:

 Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

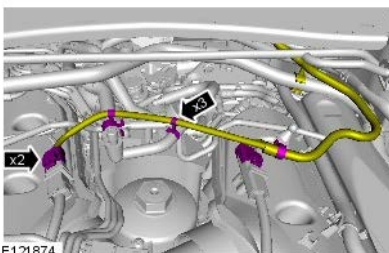
 Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 Do not disassemble or clean inside the fuel pump, even with an ultrasonic cleaner. Always install a new fuel pump when required.

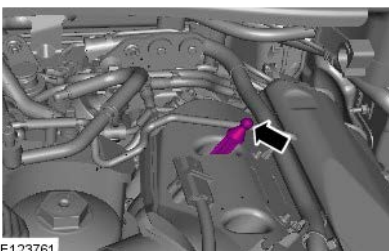
1. Disconnect the battery ground cable.
Refer to: Specifications (414-00, Specifications).
2. Refer to: Engine Cover - 3.0L V6 - TdV6 (501-05, Removal and Installation).
3.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
4. Refer to: Starter Motor (303-06, Removal and Installation).
5. Lower the vehicle.

6.



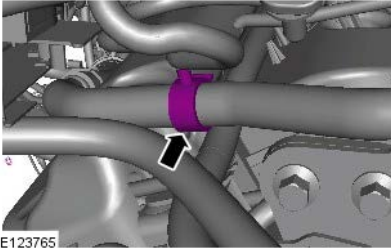
E121874

7.

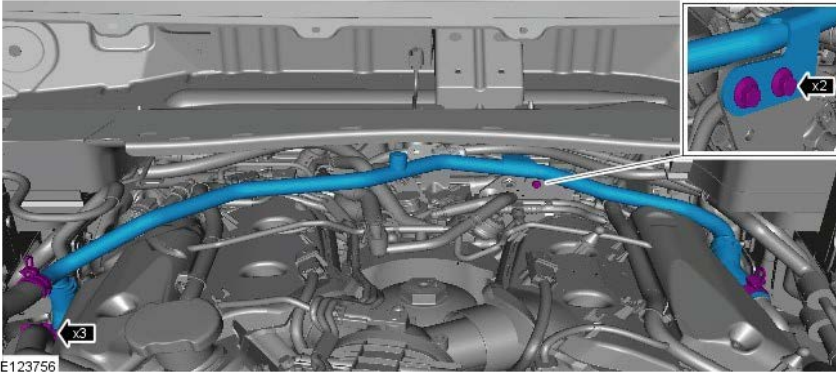


E123761

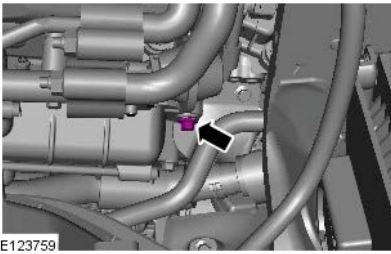
8.  **NOTE:** Engine shown removed for clarity.



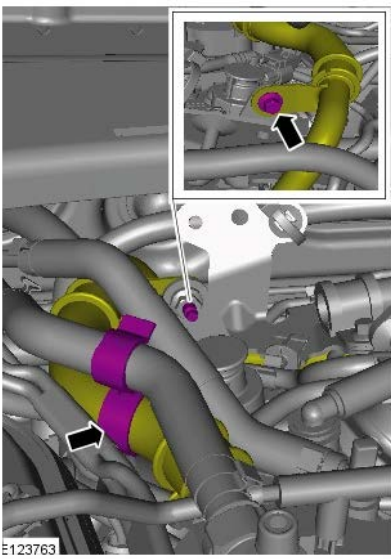
9.



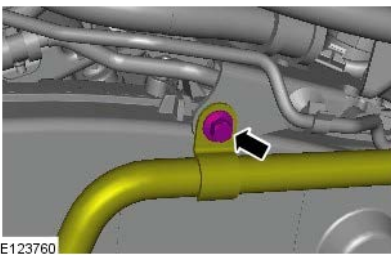
10.



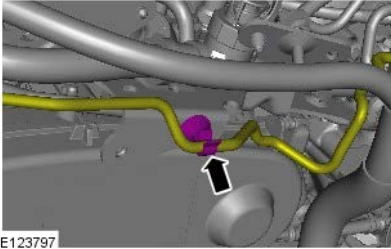
11.



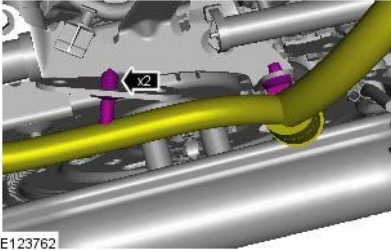
12.  NOTE: Engine shown removed for clarity.



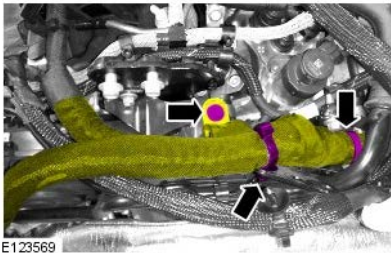
13.  NOTE: Engine shown removed for clarity.



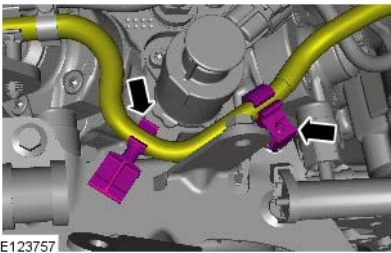
14.  NOTE: Engine shown removed for clarity.



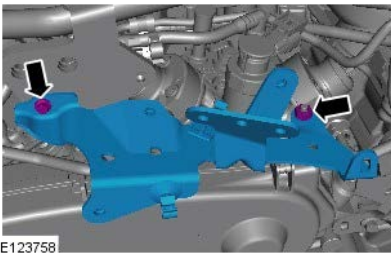
15.  NOTE: Engine shown removed for clarity.



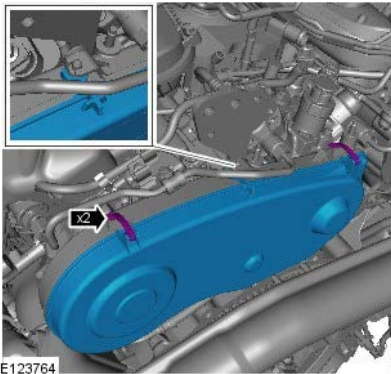
16.  NOTE: Engine shown removed for clarity.



17.  NOTE: Engine shown removed for clarity.



18.



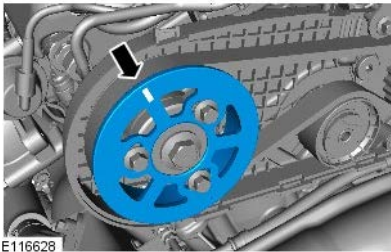
19.  CAUTION: Only rotate the crankshaft clockwise.

NOTES:


 This step requires the aid of another technician.

 Engine shown removed for clarity.

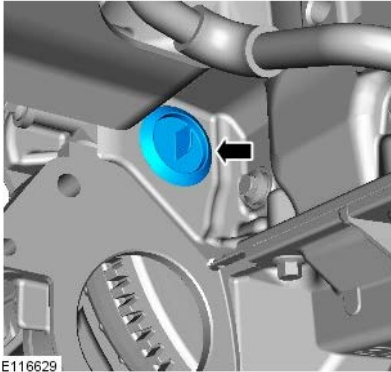
Rotate the crankshaft until the mark on the rear camshaft pulley is in the illustrated position.



E116628

20.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.

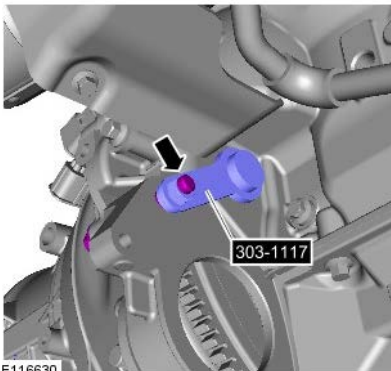
21.



E116629

22.

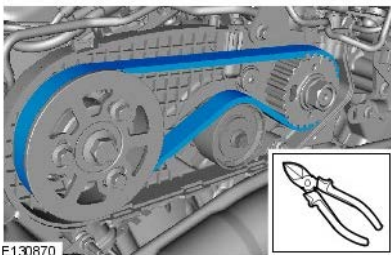
- Install the special tool.
- *Special Tool(s):* [303-1117](#)



E116630

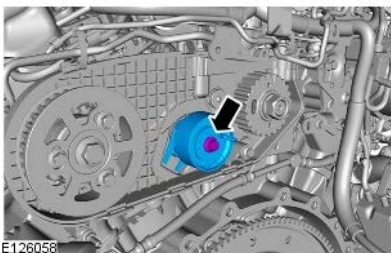
23. Lower the vehicle.

24.  **NOTE:** Engine shown removed for clarity.



E130870

25.  **NOTE:** Engine shown removed for clarity.



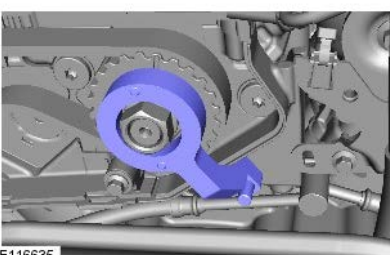
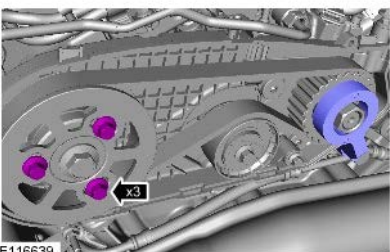
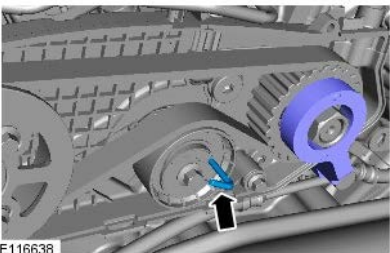
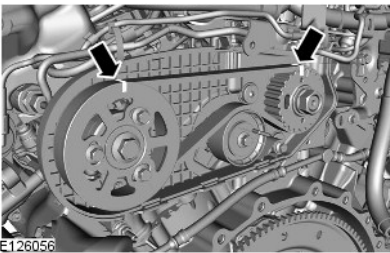
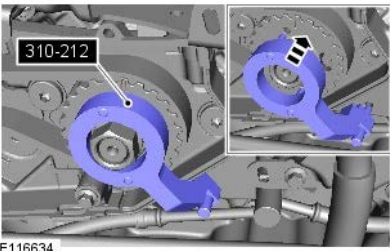
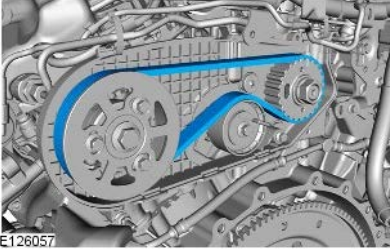
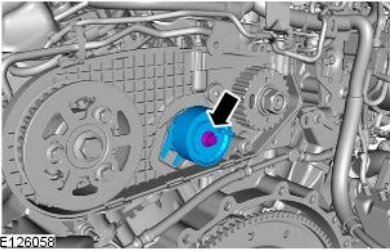
E126058

Installation

1.  **CAUTION:** Make sure that the READ belt tensioner tang is correctly located to the READ belt rear cover. Failure to follow this instruction may result in damage to the engine.

-  **NOTE:** Make sure that the rear end accessory drive (READ) belt tensioner locking pin is not removed until the READ belt tensioner is fully installed.

- *Torque:* 23 Nm



2. CAUTION: Do not install the new READ belt to the pulleys with the READ belt tensioner installed. Failure to follow this instruction may result in damage to the READ belt.

NOTES:

- The READ rotates in a counter-clockwise direction when viewed from the rear of the engine.
- Make sure the new READ belt is correctly seated onto the camshaft and fuel pump pulleys.

3. NOTE: Engine shown removed for clarity.
Install the special tool.

Special Tool(s): [310-212](#)

4. NOTE: Make sure that the READ belt tensioner locking pin is not removed until the READ belt tensioner is fully installed.

Make sure that the READ belt is aligned with the marks on the rear camshaft pulley and READ pulley as illustrated.

5. NOTE: Engine shown removed for clarity.

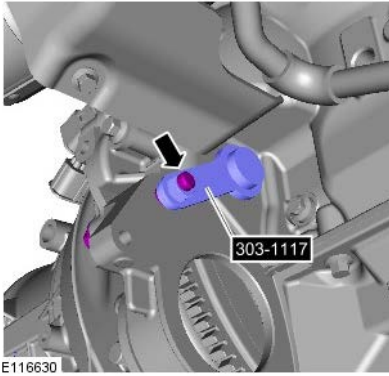
6. NOTE: Engine shown removed for clarity.
Torque: **23 Nm**

7. NOTE: Engine shown removed for clarity.
• Remove the special tool.

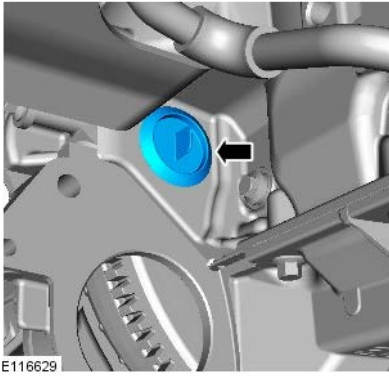
8. WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

9. Remove the special tool.

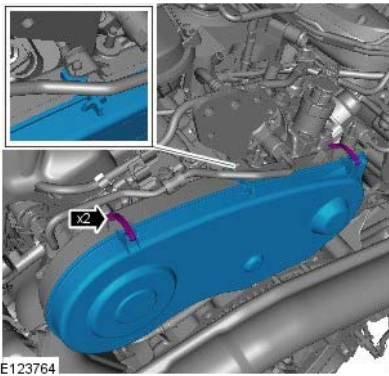



10.

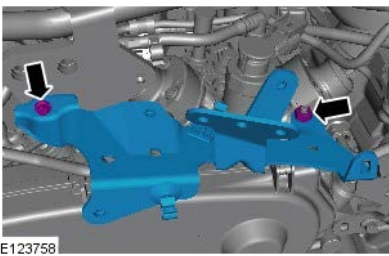


11. Lower the vehicle.

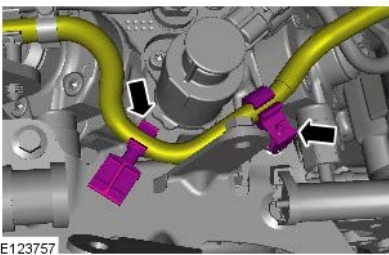
12.



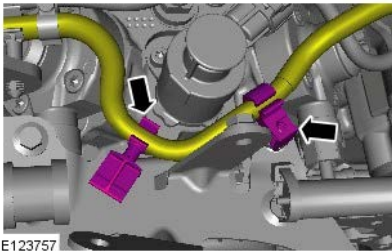
13.  NOTE: Engine shown removed for clarity.
• Torque: 10 Nm




14.  NOTE: Engine shown removed for clarity.

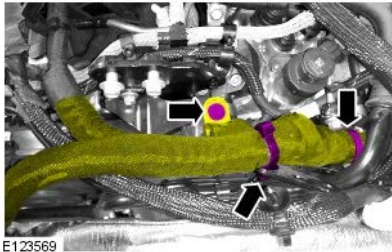


15.  NOTE: Engine shown removed for clarity.




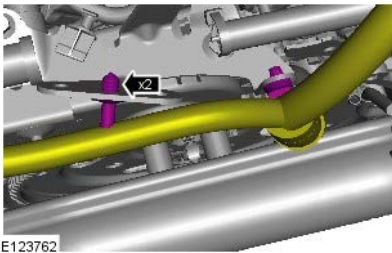
E123757

16.  NOTE: Engine shown removed for clarity.
- Torque: 5 Nm



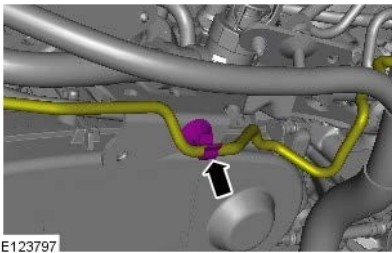
E123569

17.  NOTE: Engine shown removed for clarity.




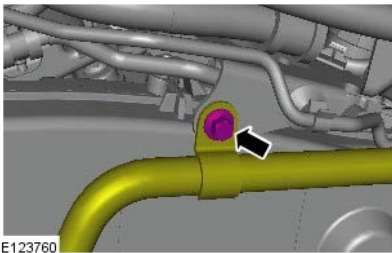
E123762

18.  NOTE: Engine shown removed for clarity.



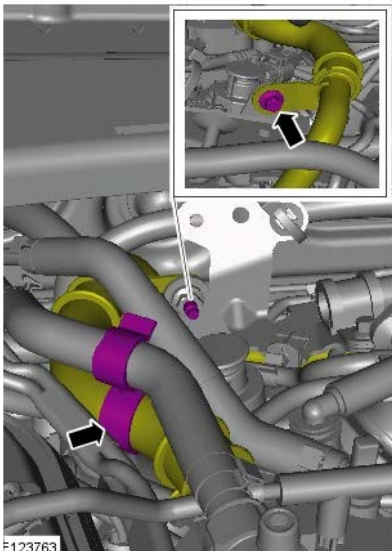
E123797

19.  NOTE: Engine shown removed for clarity.
- Torque: 10 Nm



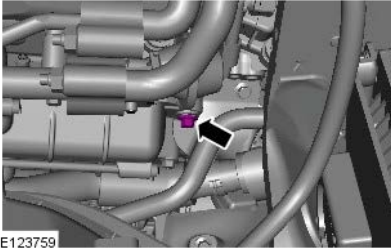
E123760

20.
 - Torque: 10 Nm



E123763

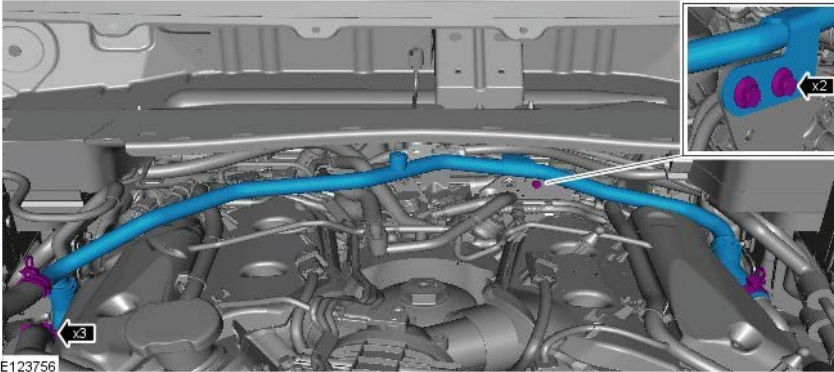
21.
 - Torque: 10 Nm



E123759

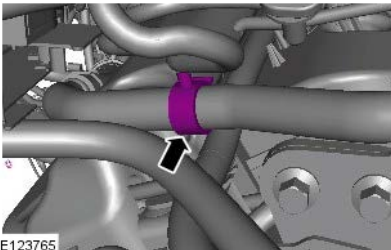
22.

- Torque: 10 Nm



E123756

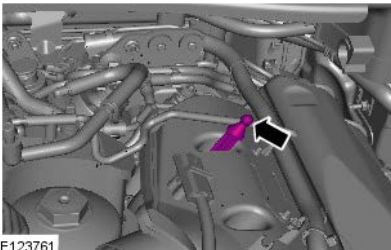
23.  NOTE: Engine shown removed for clarity.



E123765

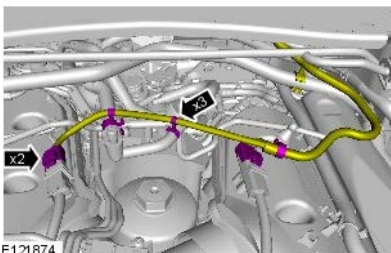
24.

- Torque: 5 Nm




E123761

25.



E121874

26.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.

27. Refer to: Starter Motor (303-06, Removal and Installation).

28. Lower the vehicle.

29. Refer to: Engine Cover - 3.0L V6 - TdV6 (501-05, Removal and Installation).

30. Connect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

31. Check and top-up the coolant.

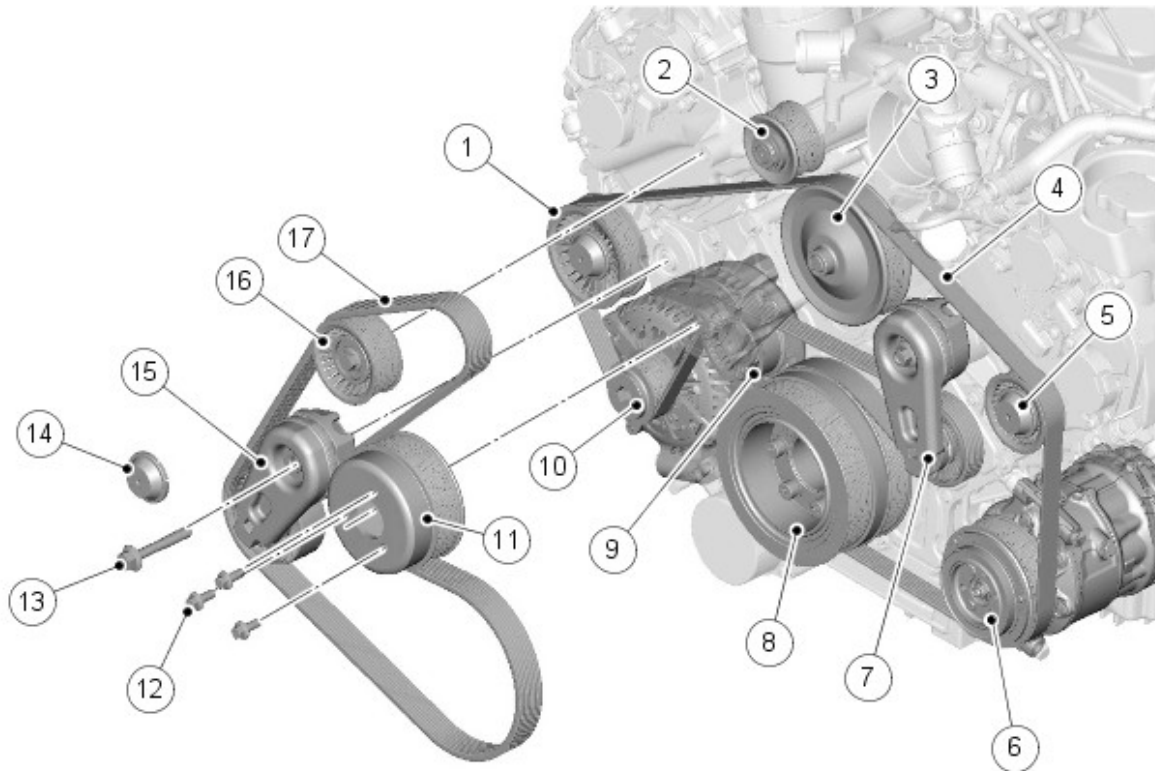
Accessory Drive - V6 S/C 3.0L Petrol -

Description	Nm	lb-ft	lb-in
Accessory drive belt tensioner retaining bolt	47	35	-
Accessory drive belt idler pulley retaining bolt to tensioner bracket - vehicles with supercharger	40	30	-
Supercharger belt tensioner bracket retaining bolt	25	19	-
Supercharger belt tensioner retaining bolt	40	30	-
Supercharger belt idler pulley retaining bolt to tensioner bracket	40	30	-

Accessory Drive - V6 S/C 3.0L Petrol - Accessory Drive

Description and Operation

COMPONENT LOCATION



E152896

Item	Part Number	Description
1	-	Idler pulley
2	-	Supercharger
3	-	Coolant pump
4	-	Primary drive belt
5	-	Idler pulley
6	-	A/C (air conditioning) compressor
7	-	Primary drive belt tensioner
8	-	Crankshaft pulley/torsional vibration damper
9	-	Idler pulley
10	-	Generator
11	-	Viscous cooling fan pulley
12	-	M8 bolt (3 off)
13	-	M10 bolt
14	-	Cover
15	-	Secondary drive belt tensioner
16	-	Idler pulley
17	-	Secondary drive belt

OVERVIEW

The accessory drive is a belt system powered by a pulley attached to the front of the crankshaft. The crankshaft pulley, which incorporates a torsional vibration damper, drives primary and secondary drive belts. A belt tensioner is incorporated into each belt run to maintain the drive belts at the correct tension. Together with idler pulleys, the belt tensioners also guide the drive belts clear of obstructions and set the correct 'wrap-around' of the accessory component drive pulleys to ensure a slip-free drive.

Primary Drive Belt

The primary drive belt is a six-ribbed poly-V belt that drives the:

- Coolant pump.
- [A/C \(air conditioning\)](#) compressor.
- Generator.

Secondary Drive Belt

The secondary drive belt is an eight-ribbed poly-V belt that drives the pulley of the viscous cooling fan. In addition, the secondary drive belt also drives the supercharger.

Belt Tensioners

Each belt tensioner consists of an idler pulley on the end of a spring loaded pivot arm. The pivot arm can be turned for removal and installation of the belt. Each belt tensioner is calibrated to automatically maintain the correct tension in the related drive belt.

Accessory Drive - V6 S/C 3.0L Petrol - Accessory Drive

Diagnosis and Testing

Principles of Operation

For a detailed description of the accessory drive belts and operation, refer to the relevant Description and Operation section in the Workshop Manual. REFER to:

[Accessory Drive](#) (303-05B Accessory Drive - V6 S/C 3.0L Petrol, Description and Operation),
[Accessory Drive](#) (303-05B, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is NOT acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection

Mechanical
<ul style="list-style-type: none"> • Drive belt condition (cracking/damage/contamination) • Idler assembly • Generator • Engine cooling fan • Tensioner assembly • Engine coolant pump • Air conditioning (A/C) compressor • Torsional vibration damper • Dynamic response pump • Tensioner assembly • Accessory drive belt

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart



CAUTION: If the engine is run without the accessory drive belts connected to eliminate driven components, diagnostic trouble codes, (DTCs) may be set which must be cleared before the vehicle is returned to the owner. The engine should not be run for more than 2-3 minutes with the belts disconnected. Failure to follow this instruction may result in damage to the vehicle.

Symptom	Possible Causes	Action
Noise	<ul style="list-style-type: none"> • Belt condition • Belt tension • Pulleys misaligned • Driven components (including tensioners) 	Check the belt condition (see visual inspection). Check the tensioner function. Check the pulley alignment. Check the driven components for excessive resistance to rotation. Rectify as necessary.
Drive belt does not hold tension	<ul style="list-style-type: none"> • Belt condition • Tensioner fault 	Check the belt condition (see visual inspection). Check the tensioner function. Rectify as necessary.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: V6 3.0L S/C Petrol, DTC: Engine Control Module \(ECM\)](#) (100-00 General Information, Description and Operation).

Accessory Drive - V6 S/C 3.0L Petrol - Accessory Drive Belt

Removal and Installation

Removal

NOTES:

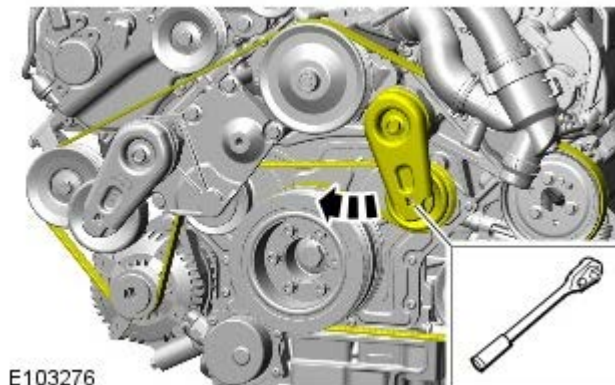



Removal steps in this procedure may contain installation details.



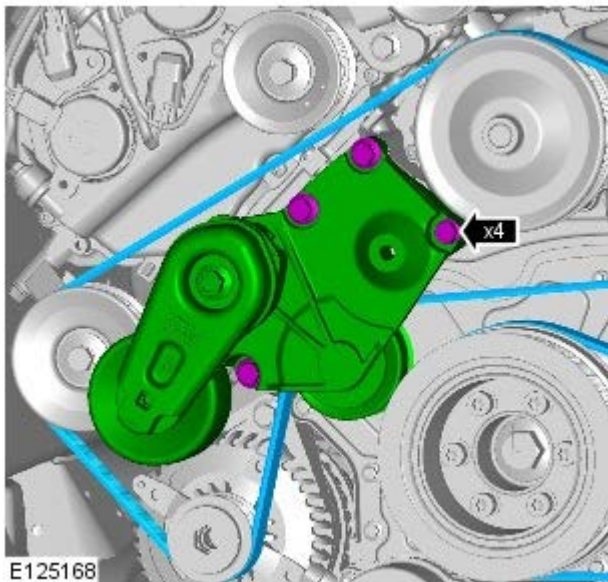
Engine shown removed for clarity.

1. Refer to: Air Cleaner Outlet Pipe LH (303-12B, Removal and Installation).
2. Refer to: Supercharger Belt Idler Pulley (303-05D, Removal and Installation).




3.  **NOTE:** Note the fitted position of the accessory drive belt.

4. *Torque:* 25 Nm



Installation

1.  **CAUTION:** Make sure that the accessory drive belt is correctly aligned to the pulleys. Failure to follow this instruction may result in damage to the vehicle.

To install, reverse the removal procedure.

Accessory Drive - V6 S/C 3.0L Petrol - Accessory Drive Belt Idler Pulley

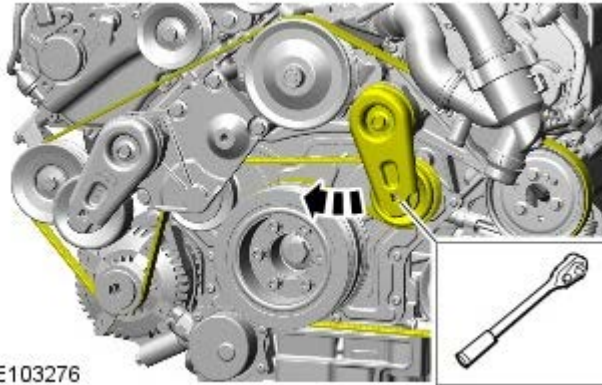
Removal and Installation

Removal




NOTE: Removal steps in this procedure may contain installation details.

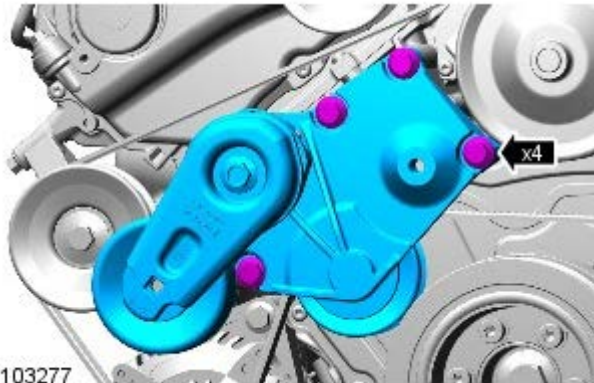
1. Refer to: Supercharger Belt Idler Pulley (303-05D, Removal and Installation).



E103276

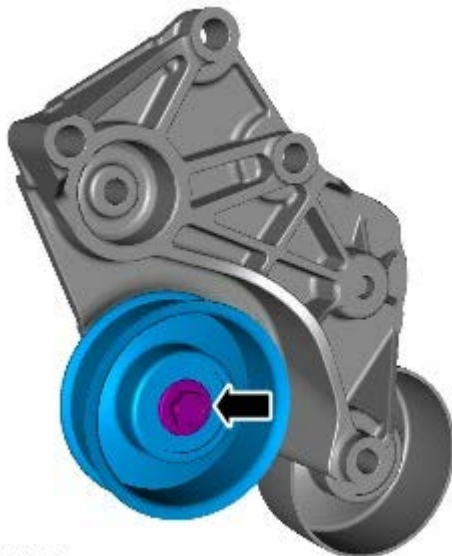
2.  **NOTE:** Note the fitted position of the accessory drive belt.

3. Torque: 25 Nm




E103277

4. Torque: 40 Nm



E114481

Installation

1.  CAUTION: Make sure that the accessory drive belt is correctly located on each pulley.

To install, reverse the removal procedure.

Accessory Drive - V6 S/C 3.0L Petrol - Accessory Drive Belt Tensioner

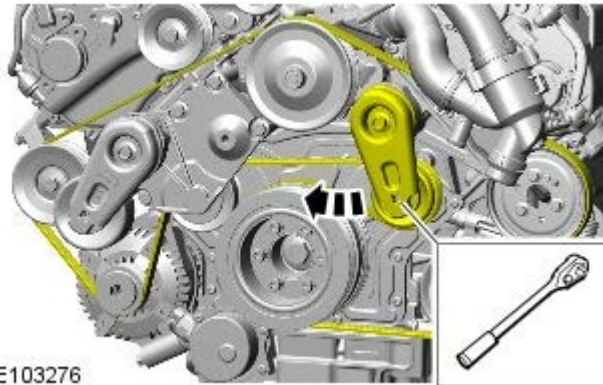
Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Air Cleaner Outlet Pipe T-Connector (303-12B, Removal and Installation).
2. Refer to: Air Cleaner Outlet Pipe LH (303-12B, Removal and Installation).



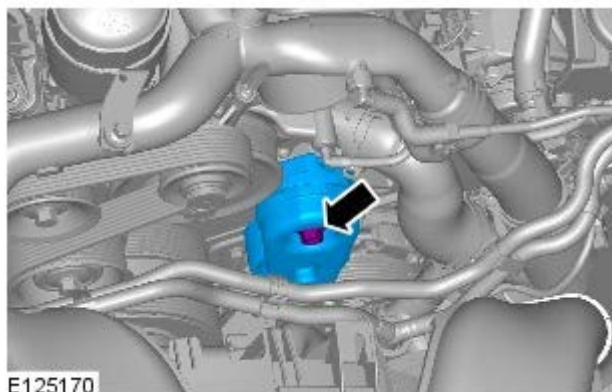
3. NOTES:



Engine shown removed for clarity.




Note the fitted position.



4. NOTE: Install the bolt finger tight before final tightening.

Torque: 47 Nm

Installation

1.  CAUTION: Make sure that the accessory drive belt is correctly located on each pulley.

To install, reverse the removal procedure.

Accessory Drive - V6 S/C 3.0L Petrol - Supercharger Belt Idler Pulley

Removal and Installation

Removal

NOTES:



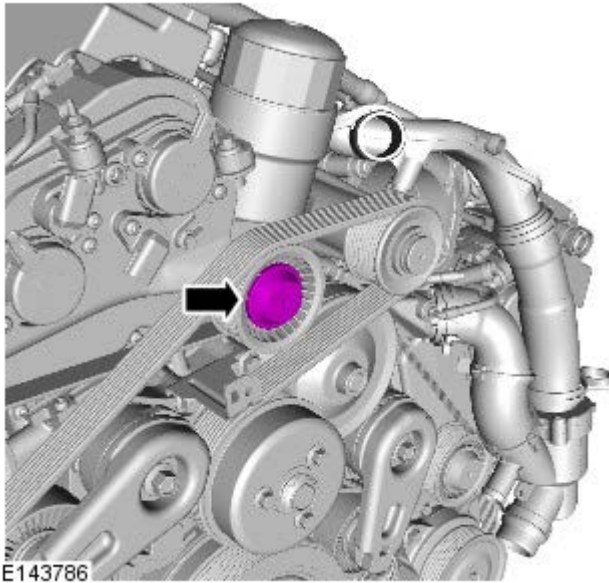
Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

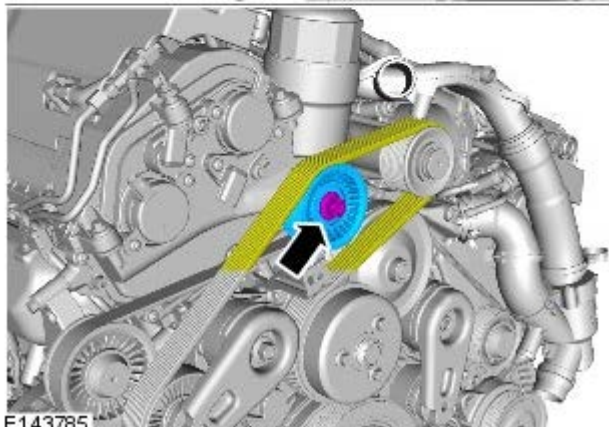
1. Refer to: Cooling Fan (303-03B, Removal and Installation).

2.




E143786

3. Torque: 40 Nm



E143785

Installation

1.  CAUTION: Make sure the supercharger belt is correctly aligned to the pulleys. Failure to follow this instruction may result in damage to the vehicle.

To install, reverse the removal procedure.

Accessory Drive - V6 S/C 3.0L Petrol - Supercharger Belt Tensioner

Removal and Installation

Removal

NOTES:



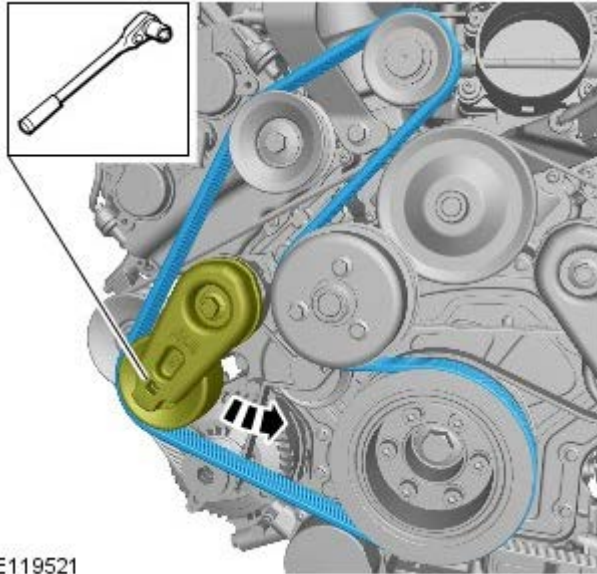
Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

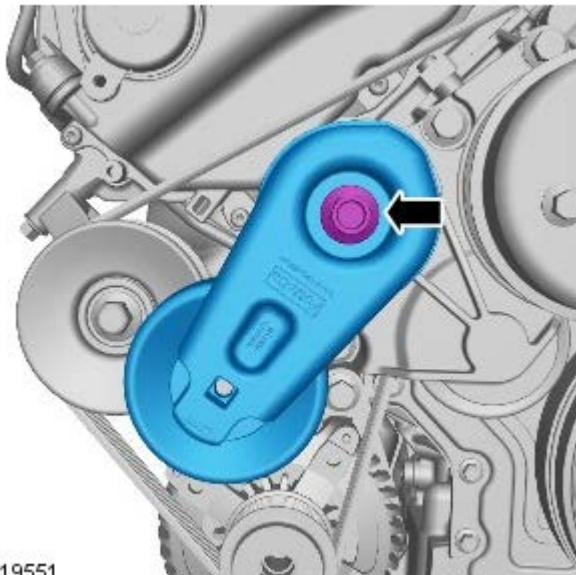
1. Refer to: Cooling Fan (303-03B, Removal and Installation).

2.



E119521

3. Torque: 40 Nm



E119551

Installation

1. CAUTIONS:



Make sure the supercharger belt is correctly aligned to the pulleys. Failure to follow this instruction may result in damage to the vehicle.



Clean and inspect the accessory drive belt pulleys for damage.

To install, reverse the removal procedure.

Accessory Drive - V6 S/C 3.0L Petrol - Supercharger Belt

Removal and Installation

Removal

NOTES:



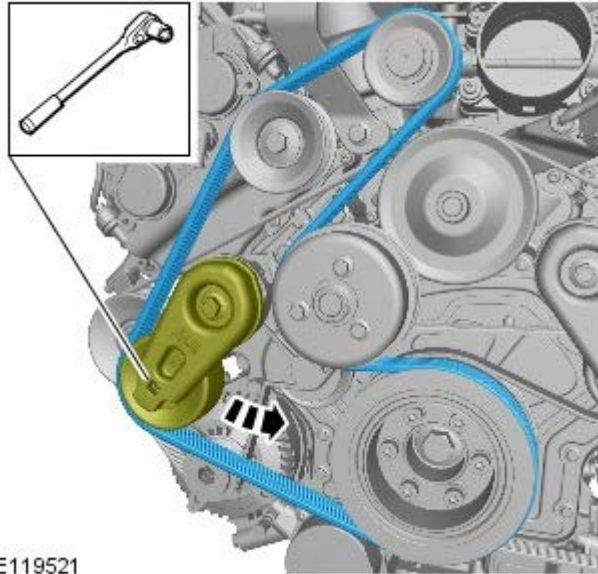
Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.


1. Refer to: Cooling Fan (303-03B, Removal and Installation).

2.



E119521

Installation

-  **CAUTION:** Make sure that the accessory drive belt is correctly aligned to the pulleys. Failure to follow this instruction may result in damage to the vehicle.

To install reverse the removal procedure.

Starting System - TDV6 3.0L Diesel -

Description	Nm	lb-ft	lb-in
Starter motor to oil pan bolts	47	35	-
Battery positive terminal integral connector retaining nut	10	7	-
Solenoid terminal integral connector nut	7	-	62

Starting System - TDV6 3.0L Diesel - Starting System

Diagnosis and Testing

Principles of Operation

For a detailed description of the starting system and operation, refer to the relevant description and operation section of the workshop manual. REFER to: (303-06 Starting System - TDV6 3.0L Diesel)

Starting System (Description and Operation),
Starting System (Description and Operation),
Starting System (Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is NOT acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Starter motor • Engine (turns freely) 	<ul style="list-style-type: none"> • Battery • Fuses • Starter relay • Wiring harness • Damaged, loose or corroded connectors • Ignition switch • Generator • Transmission control module • Engine control module

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for diagnostic trouble codes (DTCs) and refer to the DTC index
5. Check DDW for open campaigns. Refer to the corresponding bulletins and SSM's which may be valid for the specific customer complaint and carry out the recommendations as needed.

Symptom Chart


Symptom	Possible Causes	Action
The engine does not crank (starter motor does not turn)	<ul style="list-style-type: none"> • Gear selector not in P or N position (vehicles with automatic transmission) • Battery • Starter relay • Invalid key code received by central junction box • Brake pedal switch failure • Harness/connectors • Starter motor • Ignition switch • Generator • Transmission control module • Engine control module • Engine seized 	Make sure the gear selector is in the P or N position and correctly adjusted. Check the battery condition and state of charge. Check for DTCs indicating an immobilizer or brake pedal switch failure. Check the starter motor relay, ignition switch and generator circuits. Refer to the electrical guides. Check for TCM and ECM DTCs. Check that the engine turns freely
The engine does not crank (starter motor does turn)	<ul style="list-style-type: none"> • Starter motor installation • Starter motor • Flywheel/drive plate ring gear 	Check the starter motor installation (fasteners tight, starter motor square to engine, etc). Check the flywheel/drive plate ring gear teeth for damage, foreign objects, etc
Engine	<ul style="list-style-type: none"> • Battery 	Check the battery condition and state of charge. Check the starter motor

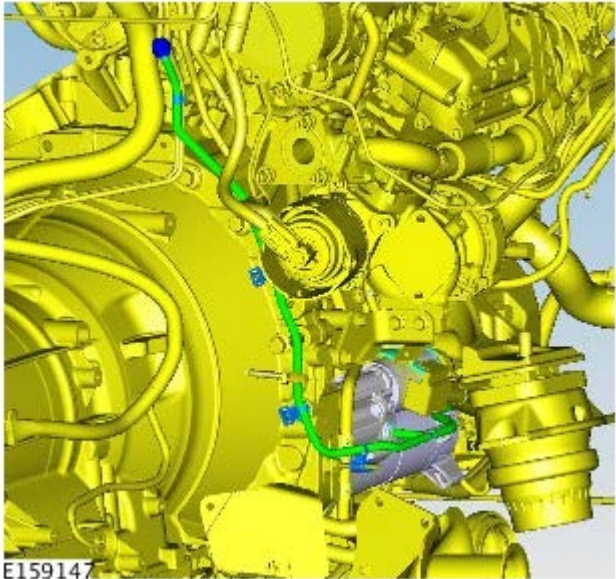

cranks too slowly	<ul style="list-style-type: none"> • Harness/connectors • Starter motor • Oil grade 	circuits. Refer to the electrical guides. Check the engine oil grade and condition
Engine cranks too fast	<ul style="list-style-type: none"> • Low engine compression 	Check the engine compressions
Excessive starter motor noise	<ul style="list-style-type: none"> • Starter motor • Flywheel/drive plate ring gear • Starter motor installation/casing 	Check the starter motor installation (fasteners tight, motor square to engine, etc). Check the starter motor casing condition. Check the flywheel/drive plate ring gear teeth for damage, foreign objects, etc
The engine does not crank (starter motor 'clicks')	<ul style="list-style-type: none"> • Low battery voltage • Battery failure • Water ingress starter motor breather tube • High resistance through connectors, terminals, megafuses, cables, and installation to the starter motor • Failure of starter motor ring gear • Failure of flywheel ring gear 	GO to Pinpoint Test A .

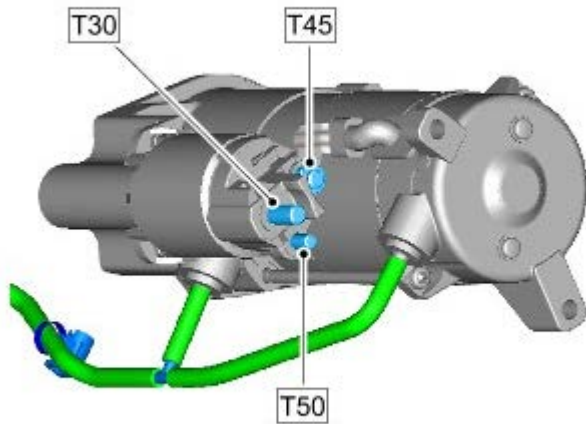
DTC index

For a list of diagnostic trouble codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - TDV6 3.0L Diesel](#), [DTC: Engine Control Module \(ECM\)](#) (100-00 General Information, Description and Operation).

PINPOINT TEST A : STARTER MOTOR PRIOR APPROVAL TEST PROCEDURE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: PRE CHECKS (MANUFACTURER APPROVED BATTERY TESTER)	
	1 Please refer to workshop manual section 414-01 and carry out the diagnosis and testing using the manufacturer approved test equipment. Record the information using the battery care report sheet
	Have the battery care routines using the manufacturer approved test equipment been carried out and has the information using the battery care report sheet been recorded? Yes Proceed to next step No Carry out the battery care routines using the manufacturer approved test equipment. Record the information using the battery care report sheet Proceed to next step
A2: PRE CHECKS (GENERAL WEATHER CONDITIONS)	
	 NOTE: The results of this test step may be required by dealer technical support
	1 Confirm with the customer and record the weather conditions and ambient temperature (as accurately as possible) at the time of failure
	2 Confirm and record the weather conditions and ambient temperature (as accurately as possible) at the time of test
	Have the weather conditions and ambient temperature been recorded Yes Proceed to next step No Record the weather conditions and ambient temperature Proceed to next step
A3: CHECK FOR RELATED STARTER MOTOR, IMMOBILIZER DIAGNOSTIC TROUBLE CODES	

	<p>1 Using the manufacturer approved diagnostic system, check for starter motor or immobilizer, related DTCs and refer to the relevant DTC index</p>
	<p>Are starter motor or immobilizer, related DTCs logged? Yes Carry out any repair action as required Clear the DTC and retest No Proceed to next step</p>
<p>A4: CHECK INSTALLATION OF STARTER MOTOR BREATHER TUBE</p>	
 <p>E159147</p>	<p>1 Please refer to workshop manual and check the starter motor breather tube is installed and routed correctly. The shepherds crook needs to be positioned correctly to prevent water ingress to the starter motor</p>
	<p>Is the starter motor breather tube installed and routed correctly? Yes Proceed to next step No Install the breather tube and route it correctly Attempt 10 starts to the vehicle. If the vehicle does NOT start during any of the 10 attempts. Install new starter motor If the vehicle DOES start during all of the 10 attempts Proceed to next step</p>
<p>A5: STARTER MOTOR CHECKS</p>	
<p> NOTE: This test will require the technician to listen for audible result, high surrounding noise may hinder the outcome</p>	
	<p>1 Set the ignition ON</p>
	<p>2 Depress the brake pedal</p>
	<p>3 Depress the start button</p>
	<p>Was there an audible click when the start button was pressed and did the vehicle start? (Audible click will not be heard if the vehicle starts) Yes Proceed to next step No Set the ignition OFF. Repeat this starter motor check a further 10 times. Record the result for number of none click tests If there was an audible click when the start button was pressed during the 10 test cycle. Proceed to next step</p>
<p>A6: CHECK CONNECTIONS ON THE STARTER MOTOR</p>	
	<p>1 Please refer to workshop manual section 303-06 specification section</p>



E158114

	2 Gain access to the starter motor
	3 Refer to the electrical circuit diagrams and check the battery power supply and terminal to the starter motor (battery positive cable nut T30 permanent feed B1)
	4 Refer to the electrical circuit diagrams and check the operating supply and terminal to the starter motor (switch lead to the starter motor solenoid nut T50)
	5 Refer to the electrical circuit diagrams and check the power feed stud on the starter motor (T45 terminal)
	6 Refer to the electrical circuit diagrams and inspect connections for signs of becoming loose, water ingress, and terminals/stud for damage and/or corrosion
	Are terminal/stud connections to starter motor, loose, damaged or corroded? Yes Rectify as required Re-check the system is operating correctly Return vehicle to the customer No Proceed to next step

A7: VOLTAGE DROP GROUND CIRCUIT

WARNING: During this test be aware of hot or moving parts. Failure to follow this instruction may result in personal injury

NOTES:

You will require assistance during this test

You may require extended test leads for the multimeter

	1 Connect the multimeter between the battery negative terminal and the starter motor ground (where bolted to the bell housing)
	2 Set the multimeter to read DC voltage. Set the ignition ON. Depress the brake pedal. Depress the start button and record the reading
	Is reading equal to or below 0.6 volts? Yes Proceed to next step No Refer to the electrical circuit diagrams and check ground circuit between battery negative terminal and starter motor for corrosion and high resistance Rectify as required Re-check the system is operating correctly Return vehicle to the customer

A8: VOLTAGE DROP POWER CIRCUIT

WARNING: During this test be aware of hot or moving parts. Failure to follow this instruction may result in

personal injury

NOTES:



You will require assistance during this test



You may require extended test leads for the multimeter

	1 Connect the multimeter between the battery positive terminal and the power feed stud on the starter motor (T45 terminal)
	2 Set the multimeter to read DC voltage. Set the ignition ON. Depress the brake pedal. Depress the start button and record the reading
	Is reading equal to or below 0.8 volts? Yes Proceed to next step No Refer to the electrical circuit diagrams and check power circuit between battery positive terminal and the power feed stud on the starter motor (T45 terminal) including mega fuses, for corrosion and high resistanceRectify as requiredRe-check the system is operating correctlyReturn vehicle to the customer

A9: VOLTAGE AT STARTER MOTOR (T50)



WARNING: During this test be aware of hot or moving parts. Failure to follow this instruction may result in personal injury

NOTES:



You will require assistance during this test



You may require extended test leads for the multimeter

	1 Check the operating supply voltage to the starter motor (T50)
	2 Connect the multimeter between the starter motor (T50) terminal and ground
	3 Set the multimeter to read DC voltage. Set the ignition ON. Depress the brake pedal. Depress the start button and record the reading
	Is the reading between 9 & 12 volts during cranking? Yes Proceed to next step No Refer to the electrical circuit diagrams and check starter relay circuit for open circuit, high resistanceRectify as requiredRe-check the system is operating correctlyReturn vehicle to the customer

A10: VOLTAGE AT STARTER MOTOR SOLENOID (T45)



WARNING: During this test be aware of hot or moving parts. Failure to follow this instruction may result in personal injury



NOTE: You will require assistance during this test

	1 Check the operating supply voltage to the starter motor (T45)
	2 Connect the multimeter between the starter motor (T45) terminal and ground
	3 Set the multimeter to read DC voltage. Set the ignition ON. Depress the brake pedal. Depress the start button and record the reading
	Is the reading between 6 & 9 volts during cranking? Yes Proceed to next step No Check and install new starter motor and breather tube

A11: STARTER MOTOR VISUAL INSPECTION



WARNING: During this test isolate the vehicle battery. Failure to follow this instruction may result in personal injury

	1 Remove the starter motor
	2 Visually inspect the starter motor ring gear for failure
	3 Visually inspect the flywheel ring gear for failure
	<p>Was there evidence of failure to the starter motor of flywheel ring gear</p> <p>Yes</p> <p>Check and install new parts as required Re-check the system is operating correctly Return vehicle to the customer</p> <p>No</p> <p>Contact dealer technical support with all of the recorded values from the above tests</p>

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - TDV6 3.0L Diesel , DTC: Engine Control Module \(ECM\)](#) (100-00 General Information, Description and Operation).

Starting System - TDV6 3.0L Diesel - Starter Motor

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

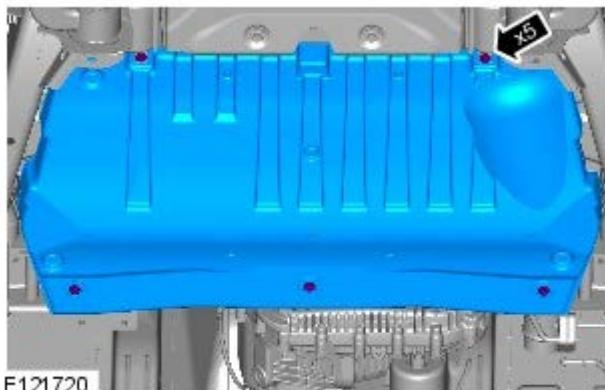
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

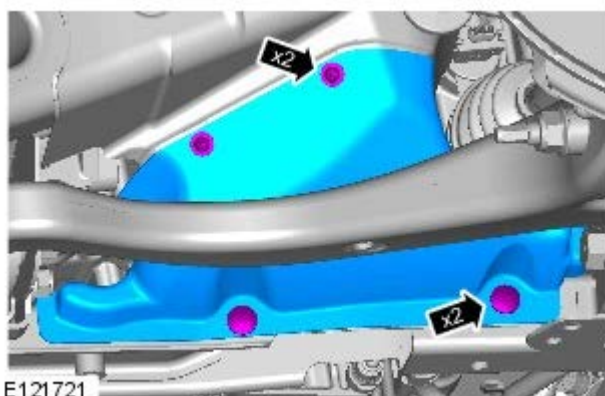
Raise and support the vehicle.

3. Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

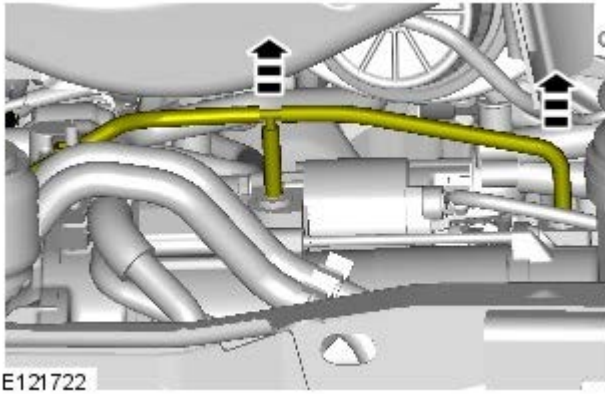
4. Torque: 62 Nm



- 5.

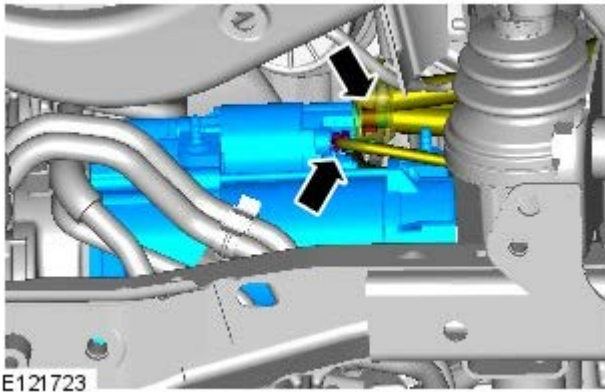


- 6.




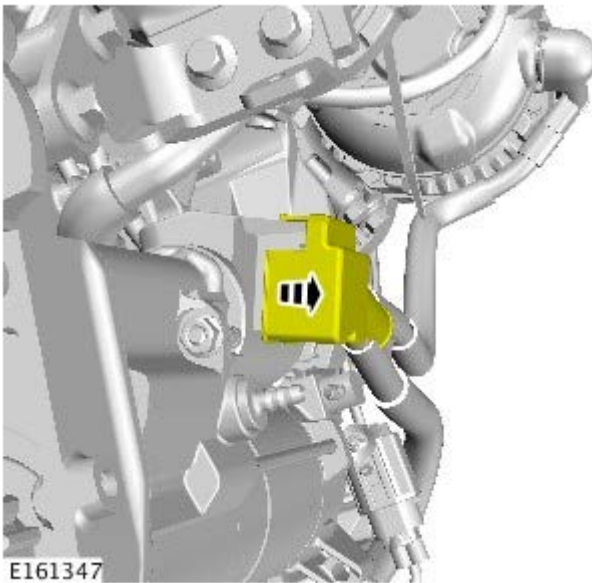
E121722

7. Torque:
M8 10 Nm
M6 7 Nm




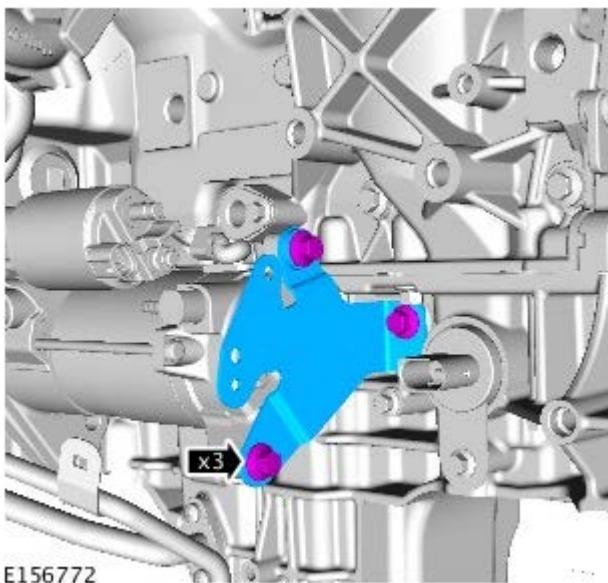
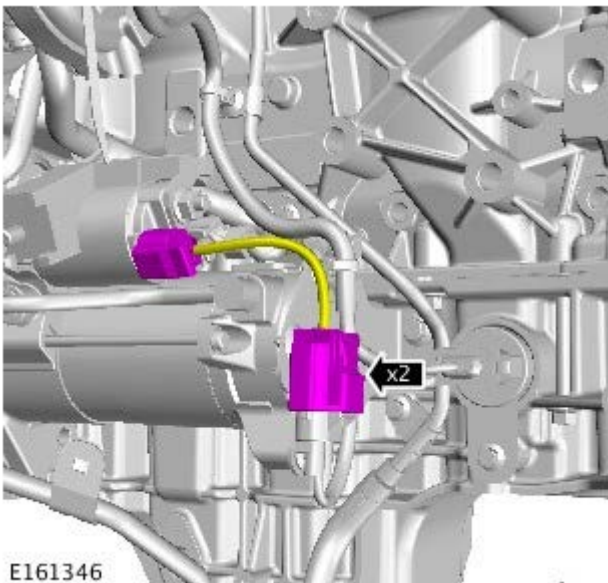
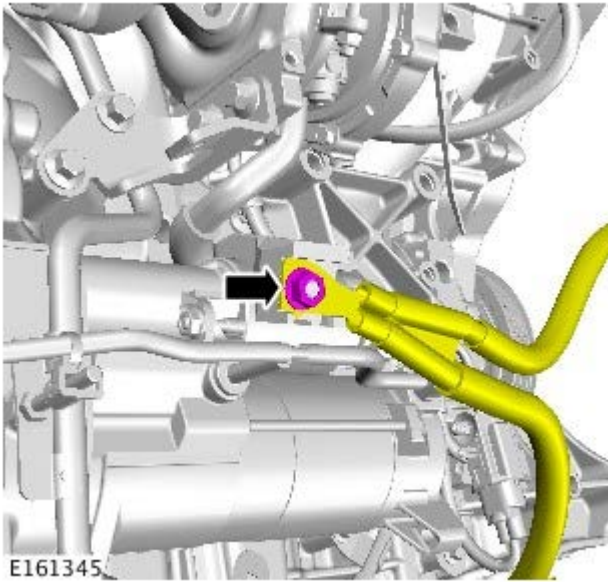
E121723


8.  NOTE: If equipped with TSS.




E161347

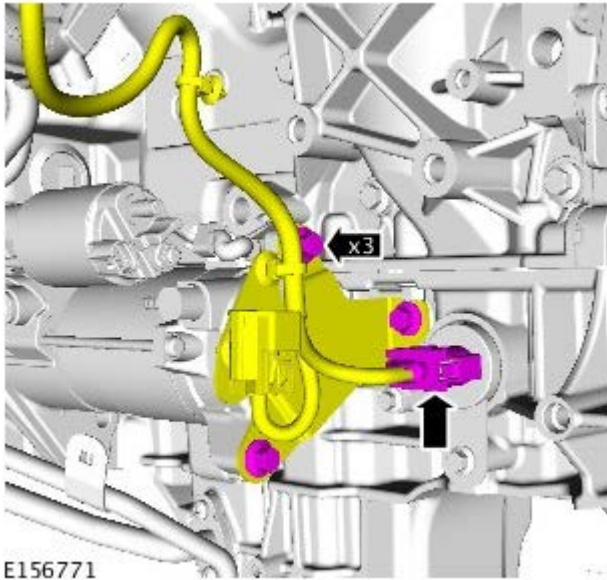
9.  NOTE: If equipped with TSS.
Torque: 10 Nm



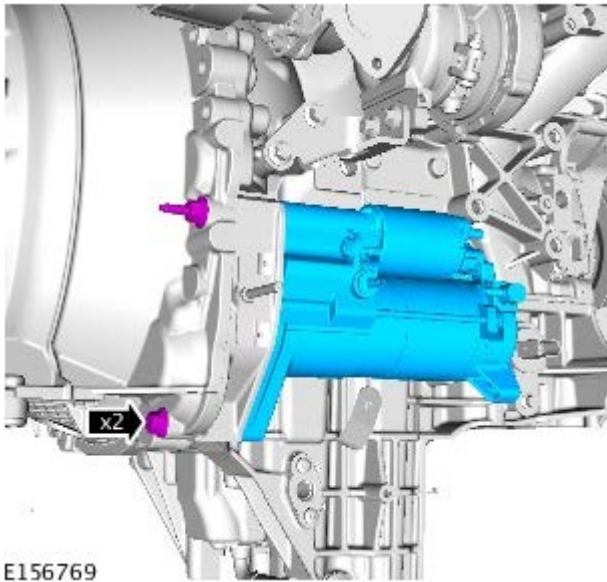
10.  NOTE: If equipped with TSS.

11. Torque: 47 Nm

12.  NOTE: If equipped with TSS.
Torque: 47 Nm




E156771



E156769

Installation

13.  NOTE: Some components shown removed for clarity.
Torque: 47 Nm

1. To install, reverse the removal procedure.

Starting System - V6 S/C 3.0L Petrol -

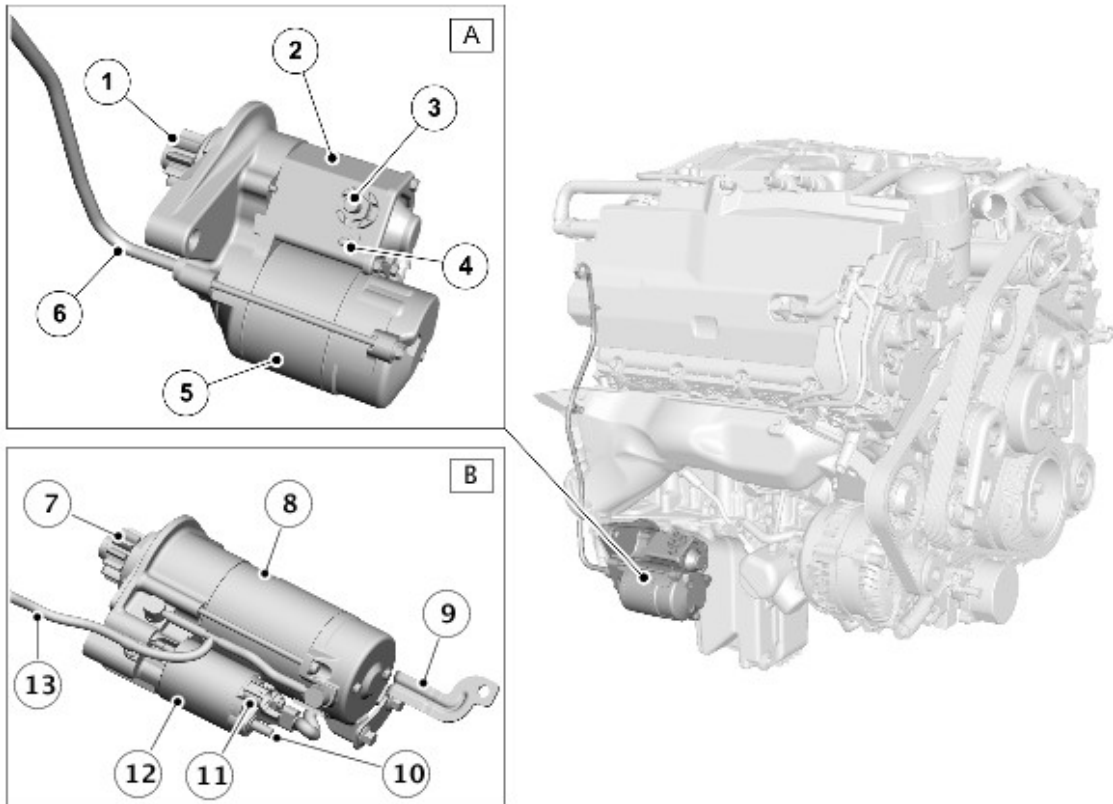
Description	Nm	lb-ft	lb-in
Starter motor retaining bolts	47	-	416
Battery positive terminal connector retaining nuts	10	-	89
Heat shield retaining bolts	4	-	35
Solenoid terminal connector retaining nut	4	-	35
Starter motor mounting bracket bolts	47		416

Starting System - V6 S/C 3.0L Petrol - Starting System

Description and Operation

COMPONENT LOCATION

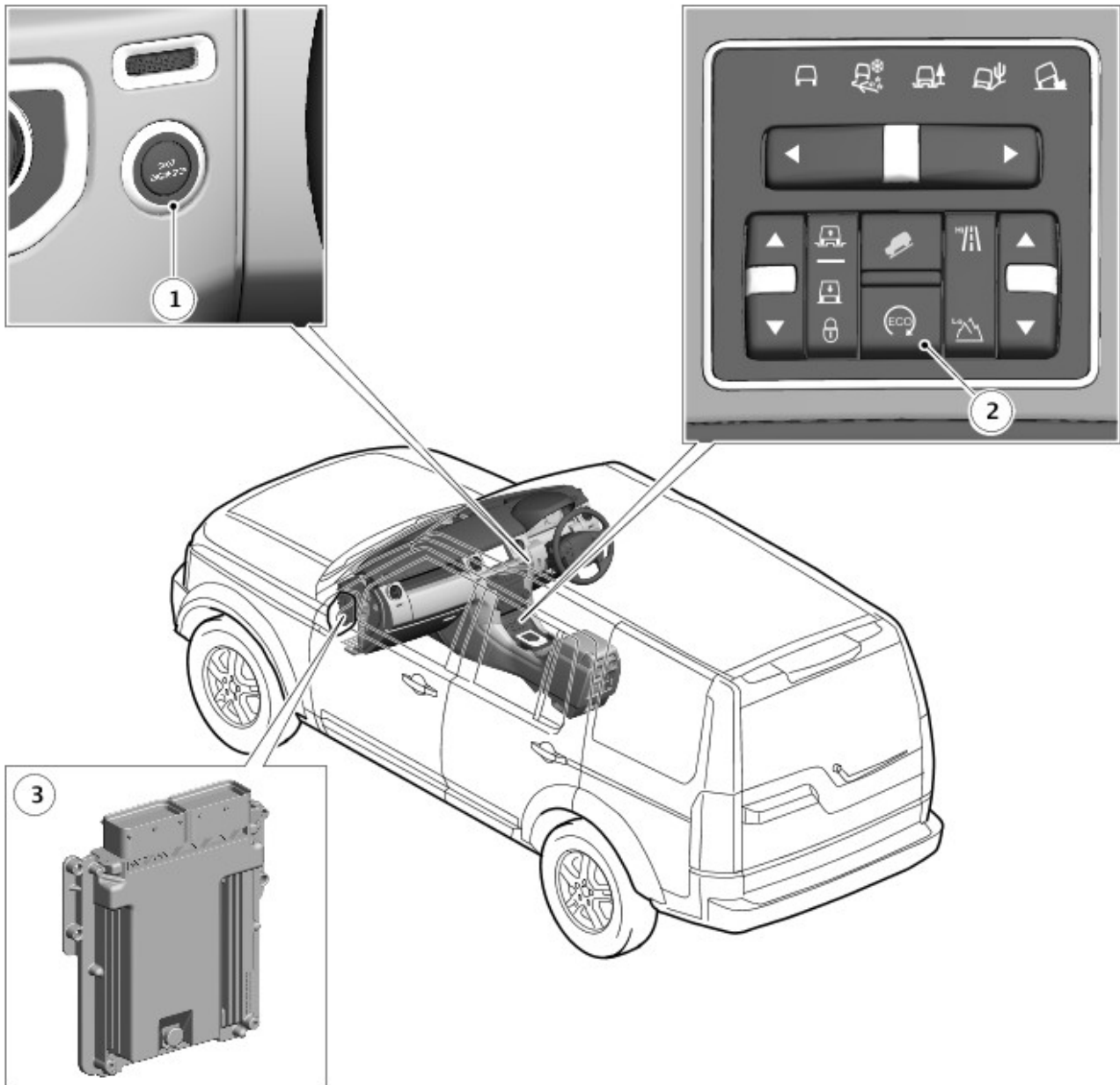
Starter Motor



E153068

Item	Part Number	Description
A	-	Non TSS (tandem solenoid starter) motor
B	-	TSS motor
1	-	Pinion gear
2	-	Solenoid
3	-	Motor electrical connection
4	-	Solenoid electrical connection
5	-	Motor
6	-	Breather tube
7	-	Pinion gear
8	-	Motor
9	-	Support bracket
10	-	Motor electrical connection
11	-	Solenoid electrical connection
12	-	Solenoid
13	-	Breather tube

Stop/Start System



E160453

Item	Part Number	Description
1	-	Stop/start switch
2	-	ECO switch
3	-	Engine Control Module (ECM).

OVERVIEW

The starting system consists of an electric starter motor that engages with the ring gear on the crankshaft drive plate. Operation of the starter motor is controlled by the [ECM \(engine control module\)](#).

In some markets the starting system incorporates a stop/start system. The system is controlled by the ECM using [CAN \(controller area network\)](#) messages and signals from other system components and modules to determine the correct conditions for system operation. The stop/start system automatically stops and re-starts the engine when appropriate conditions are met. This reduces the amount of time the engine is running at idle speed which improves economy and reduces engine emissions.

The stop/start system is automatically enabled each time the ignition is switched on. The driver can disable the system using an ECO switch.

The stop/start system stops the engine when it is not needed, this is known as ECO stop. The engine will restart automatically when vehicle parameters are met and the driver releases the brake pedal, this is known as ECO start.

To accommodate the increased electrical loads, vehicles fitted with the stop/start system are equipped with two batteries.

For additional information, refer to: [Battery and Cables](#) (414-01 Battery, Mounting and Cables, Description and Operation).

DESCRIPTION

Vehicles without the stop/start system use a conventional starter motor. Vehicles with the stop/start system use a TSS (tandem solenoid starter) motor. The TSS motor can restart the engine if it is still rotating, allowing the engine to be started quickly in any situation.

The starter motor is located on the rear right side of the oil pan. The rear of the starter motor is attached to a support bracket on the oil pan. The starter motor incorporates a snorkel breather pipe to assist with ventilation and sealing, during water submergence.

VEHICLES WITHOUT STOP/START

The starter motor is rated at 1.4 kW and comprises a series wound motor, an overrunning clutch and pinion, and a solenoid.

Power to operate the motor is supplied a 400 A megafuse. Power to operate the solenoid is supplied from the starter relay in the [EJB \(engine junction box\)](#).

VEHICLES WITH STOP/START

The TSS motor is rated at 2.0 kW and comprises a series wound motor, an overrunning clutch and pinion, a pinion gear shift solenoid and a motor rotation solenoid.

Power to operate the motor is supplied from a 400A megafuse.. Power to operate the solenoids is supplied from the starter motor relay and the starter pinion relay in the EJB.

ECO Switch

On vehicles with stop/start, the ECO switch is integrated into the Terrain Response® switchpack in the floor console. An amber [LED \(light emitting diode\)](#) in the ECO switch remains illuminated while the stop/start system is active. Selection of the ECO switch is transmitted from the Terrain Response® switchpack to the [ECM](#) on the HS (high speed) [CAN](#) bus.

Warning Indicator



E147783

On vehicles with stop/start, an ECO warning indicator is located in the IC (instrument cluster). The warning indicator comes on when the engine stops during a stop/start cycle, then goes off when the engine restarts. The warning indicator is controlled by a HS CAN bus message from the ECM.

OPERATION

Vehicles Without Stop/Start

When the engine stop/start switch is pressed, if the KVM (keyless vehicle module) detects a valid smart key in the vehicle the [CJB \(central junction box\)](#) transmits a hardwired crank request to the [ECM](#).

For additional information, refer to: [Passive Anti-Theft System \(PATS\) Module](#) (419-01B Anti-Theft - Passive, Removal and Installation).

When the ECM receives a crank request from the CJB it energizes the starter relay, provided the [TCS \(transmission control switch\)](#) is in P (park) or N (neutral) and the brake pedal is pressed. The energized starter relay supplies battery power to the starter solenoid, which energizes and causes the pinion gear to engage with the ring gear. When the starter solenoid is energized it also closes high-current contacts, which connects battery power via 400 A megafuse to the motor to turn the engine.

Vehicles With Stop/Start

At the beginning of a drive cycle, when the engine stop/start switch is pressed the starting system operates in the same way as on vehicles without stop/start, up to the point that the [ECM](#) energizes the starter relay. At that point, on the stop/start system, the ECM energizes both the starter pinion relay and the starter motor relay. The energized starter motor relay supplies battery power to the pinion gear shift solenoid in the starter, which energizes and causes the pinion gear to engage with the ring gear. The energized starter pinion relay supplies battery power to the motor rotation solenoid in the starter, which energizes and closes high-current contacts, which connects battery power via

400 A megafuse to the motor to turn the engine.

During a drive cycle, with the stop/start system enabled and the TCS in D (drive) or S (sport), the ECM performs an ECO stop when one of the following occurs:

- The vehicle stops from a speed greater than 4 km/h (2.5 mph) and sufficient brake pressure is applied to the brake pedal to ensure the vehicle is stationary
- The vehicle is stationary and N is selected on the TCS.



NOTE: On a gradient an ECO stop will only occur if the driver applies a minimum of 7 bar (101.5 lbf/in²) + / - 3 bar (43.5 lbf/in²) brake pressure and will not occur at all on gradients about in excess of 1 in 4.34 (23%).

The green ECO warning indicator in the IC (instrument cluster) illuminates to advise that the engine has shut down. Other warning indicators normally associated with an engine shut down, for example the ignition and low oil pressure warning indicators, are suppressed so will not illuminate during an ECO stop.

The following conditions will prevent an ECO stop:

- A steering wheel paddle switch has been used to select a gear (transmission command shift mode).
- The ambient air temperature is outside the range of 0 to 40 °C (32 to 104 °F).
- The engine coolant temperature is outside the range of 20 to 110 °C (68 to 230 °F).
- Brake vacuum is less than the threshold value.
- The pressure altitude derived from the barometric pressure sensor in the ECM is more than approximately 2800 m (9150 feet).
- The hood is open.
- The driver door is open.
- The driver seatbelt is not fastened.
- High demand from the climate control system requires the engine to be running, for example windshield demist selected.
- The battery charge is low.
- A Terrain Response® special program is active.
- Hill descent control is active.
- The level in the fuel tank is too low.
- ECO stop/start is disabled using the ECO switch.

While the vehicle is stationary, if a condition that prevented an ECO stop is removed the ECM automatically performs an ECO stop. The ECM automatically restarts the engine when one of the following occurs:



NOTE: When the brake pedal is released during an ECO restart the ABS (anti-lock brake system) control module briefly applies the brakes to hold the vehicle stationary until the engine has restarted.

- The brake pedal is released with D or S selected on the TCS.
- The accelerator pedal is pressed.
- A paddle switch is used to select a gear.
- R (reverse) is selected on the TCS.
- Climate control system demand increases.
- The vehicle speed exceeds approximately 1 km/h (0.5 mph).
- The battery charge becomes low.
- Brake vacuum reduces below the threshold value.
- ECO stop/start is disabled using the ECO switch.

The following will prevent an ECO restart, and require use of the engine stop/start switch to restart the engine:

- The hood is open.
- The driver door is open.
- The driver seatbelt is not fastened.

STOP/START STRATEGY

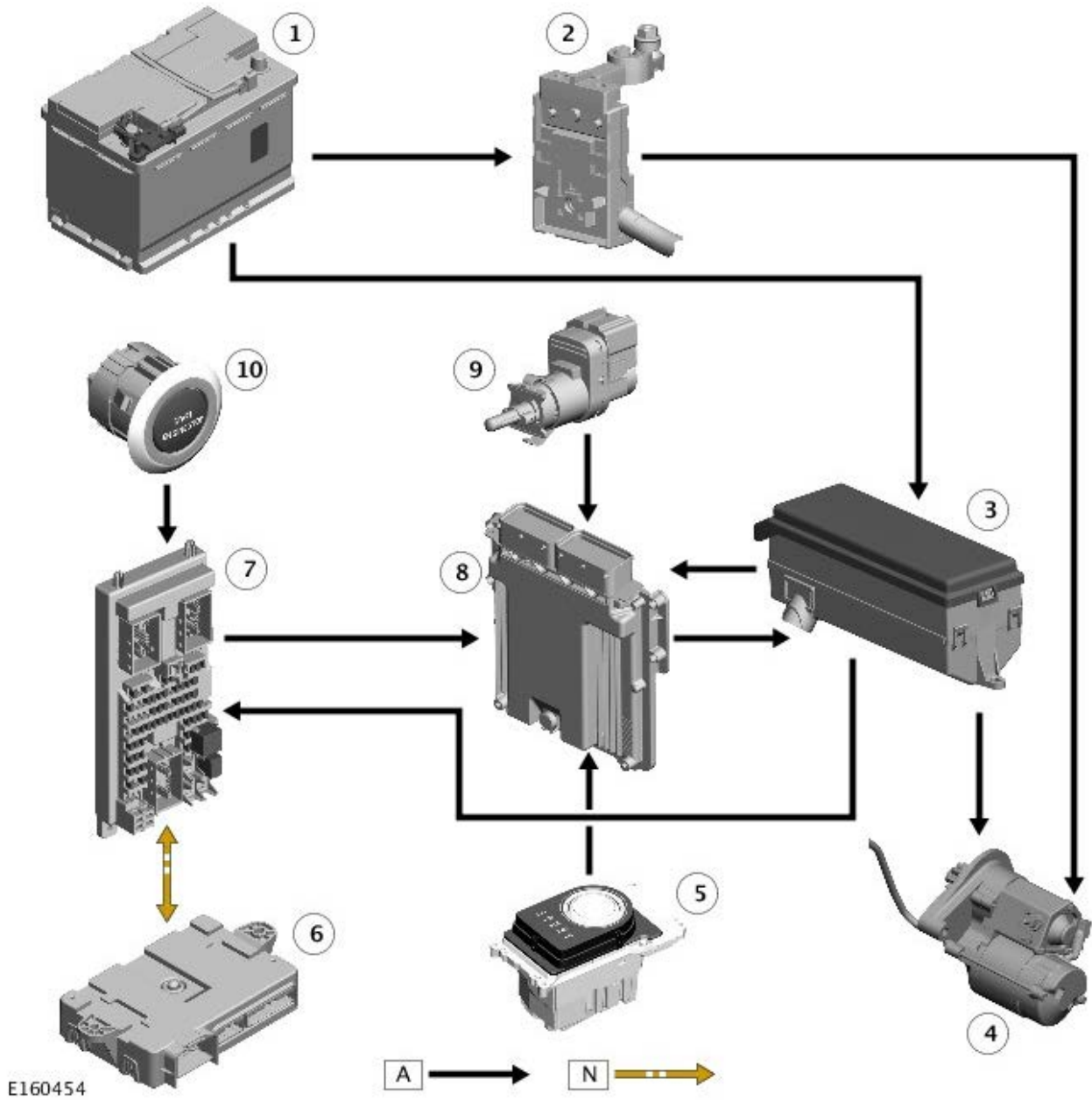
Operating the motor and the pinion gear individually allows meshing of the pinion gear with the drive plate ring gear, even if the engine is still turning. This allows instant restarts under all conditions.

Engine speed 250 rev/min or more: When an ECO stop is initiated and the ECM then detects an engine restart parameter, it operates the starter motor to first accelerate the pinion gear up to the ring gear speed, then engages the pinion gear with the ring gear and energizes the motor to rotate the engine up to starting speed. The ECM also activates the fueling and engine systems to restart the engine.

Engine speed less than 250 rev/min: When an ECO stop is initiated and the ECM then detects an engine restart parameter, it operates the starter motor to first engage the pinion gear with the ring gear, then energizes the motor to rotate the engine up to starting speed. The ECM also activates the fueling and engine systems to restart the engine.

CONTROL DIAGRAM

Vehicles Without Stop/Start



A = Hardwired; N = Medium Speed CAN Bus

Item	Part Number	Description
1	-	Battery
2	-	Megafuse
3	-	Engine Junction Box (EJB)
4	-	Starter Motor
5	-	Transmission Control Switch (TCS)
6	-	Keyless Vehicle Module (KVM)
7	-	Central Junction Box (CJB)
8	-	Engine Control Module (ECM)
9	-	Brake pedal switch
10	-	Stop/start switch

Vehicles With Stop/Start

- 11 - Keyless Vehicle Module (KVM)
- 12 - Central Junction Box (CJB)
- 13 - Transmission Control Switch (TCS)
- 14 - Stop/start switch
- 15 - Engine Control Module (ECM)
- 16 - Ambient Air Temperature (AAT) sensor
- 17 - Accelerator Pedal Position (APP) sensor

Starting System - V6 S/C 3.0L Petrol - Starting System

Diagnosis and Testing

Principles of Operation

For a detailed description of the starting system and operation, refer to the relevant Description and Operation section in the workshop manual. REFER to:

[Accessory Drive](#) (303-05B Accessory Drive - V6 S/C 3.0L Petrol, Description and Operation),
[Starting System](#) (303-06 Starting System - V6 S/C 3.0L Petrol, Description and Operation),
[Starting System](#) (303-06 Starting System - V6 S/C 3.0L Petrol, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Starter motor • Engine (turns freely) • Drive plate ring gear 	<ul style="list-style-type: none"> • Battery • Fuse(s) • Wiring harness(es) • Damaged, loose or corroded connectors • Ignition switch • Starter relay • Transmission Control Module (TCM) • Engine Control Module (ECM) • Eco Switch

3. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the symptom chart.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.
5. Check DDW for open campaigns. Refer to the corresponding bulletins and SSM's which may be valid for the specific customer complaint and carry out the recommendations as needed.

Symptom Chart

Symptom	Possible Causes	Action
The engine does not crank (starter motor does not turn)	<ul style="list-style-type: none"> • Gear selector not in P or N position (vehicles with automatic transmission) • Battery • Starter relay • Invalid key code received by Central Junction Box (CJB) • Harness/Connectors • Starter motor • Ignition switch • Generator • Transmission Control Module (TCM) • Engine Control Module (ECM) • Engine seized 	Make sure the gear selector is in the P or N position and correctly adjusted. Check the battery condition and state of charge. Check for DTCs indicating an immobilizer fault. Check the starter motor relay, ignition switch and generator circuits. Refer to the electrical guides. Check for TCM and ECM DTCs. Check that the engine turns freely.
The engine does not crank (starter motor does)	<ul style="list-style-type: none"> • Starter motor installation • Starter motor • Drive plate ring gear 	Check the starter motor installation (fasteners tight, starter motor square to engine, etc). Check the drive plate ring gear teeth for damage, foreign objects.

turn)		
Engine cranks too slowly	<ul style="list-style-type: none"> • Battery • Harness/Connectors • Starter motor • Oil grade 	Check the battery condition and state of charge. Check the starter motor circuits. Refer to the electrical guides. Check the engine oil grade and condition.
Engine cranks too fast	<ul style="list-style-type: none"> • Low engine compression 	Check the engine compressions.
Excessive starter motor noise	<ul style="list-style-type: none"> • Starter motor • Flywheel/Drive plate ring gear • Starter motor installation/casing 	Check the starter motor installation (fasteners tight, motor square to engine, etc). Check the starter motor casing condition. Check the drive plate ring gear teeth for damage, foreign objects.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: V6 3.0L S/C Petrol, DTC: Engine Control Module \(ECM\)](#) (100-00 General Information, Description and Operation).

Starting System - V6 S/C 3.0L Petrol - Starter Motor

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

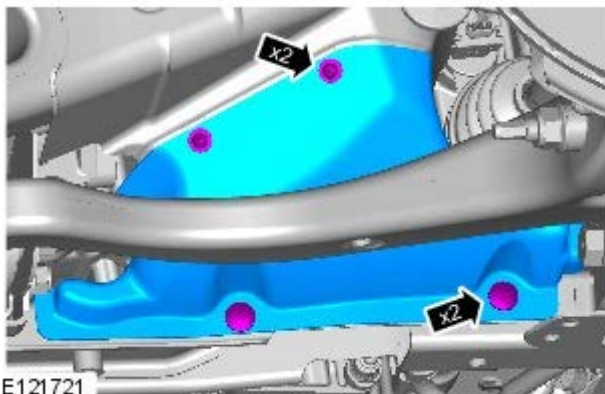
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

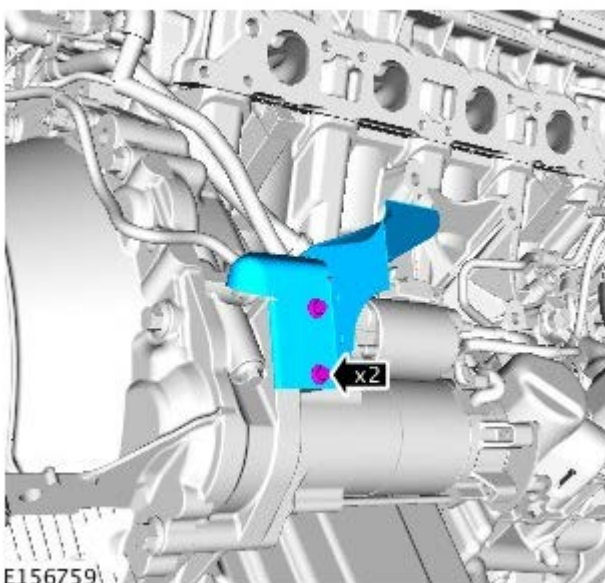
3. Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).

4.

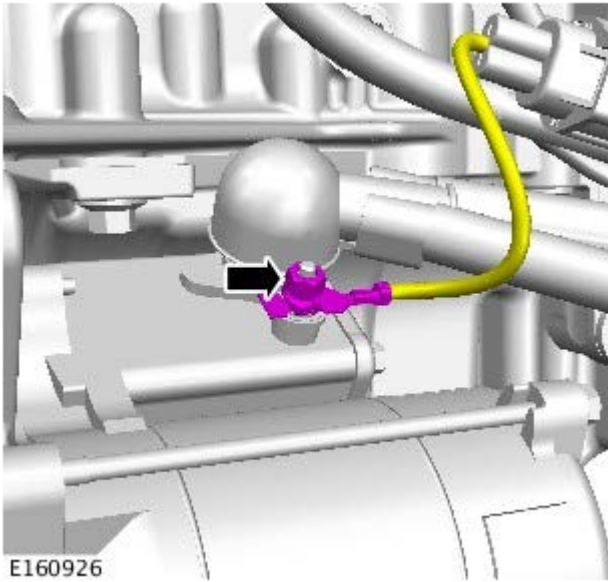


5.  **NOTE:** If equipped with TSS.

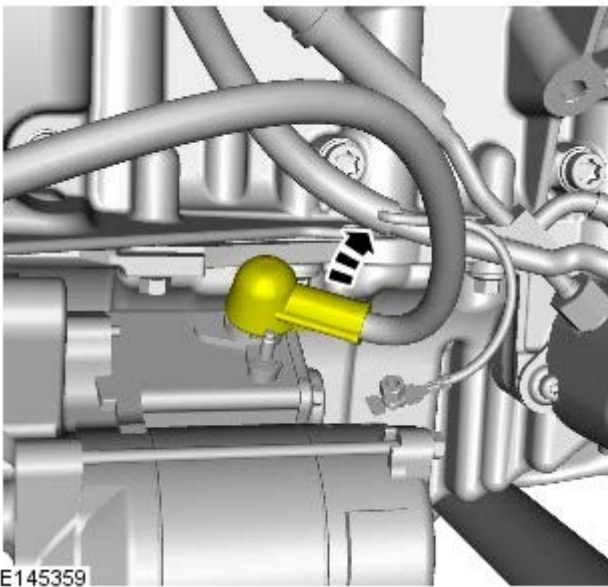
Torque: 6 Nm



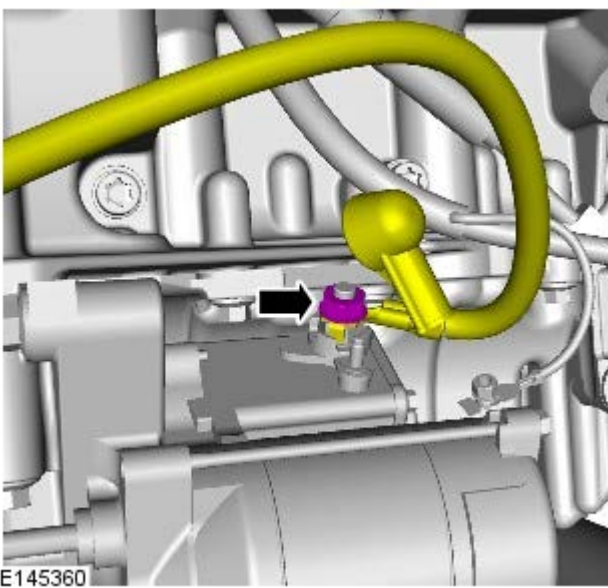
6. Torque: 7 Nm




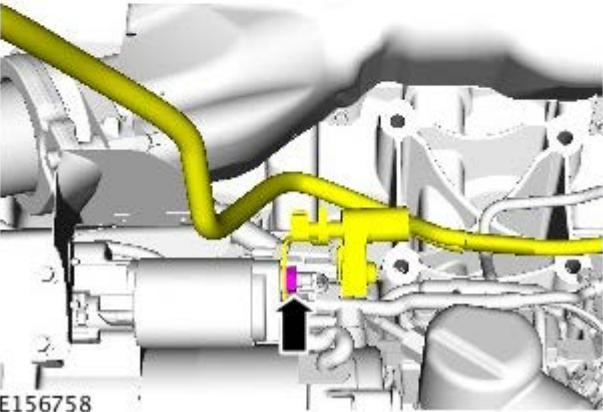
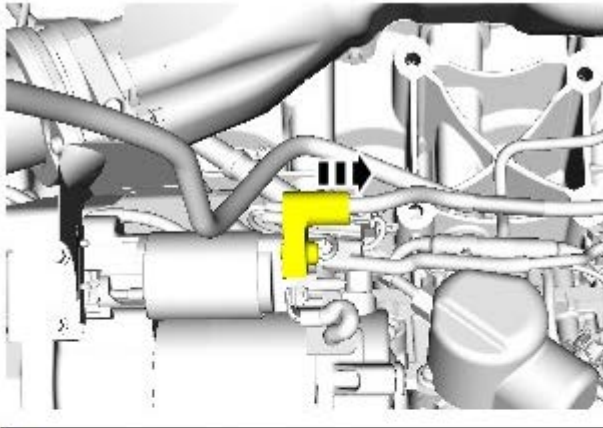
7.



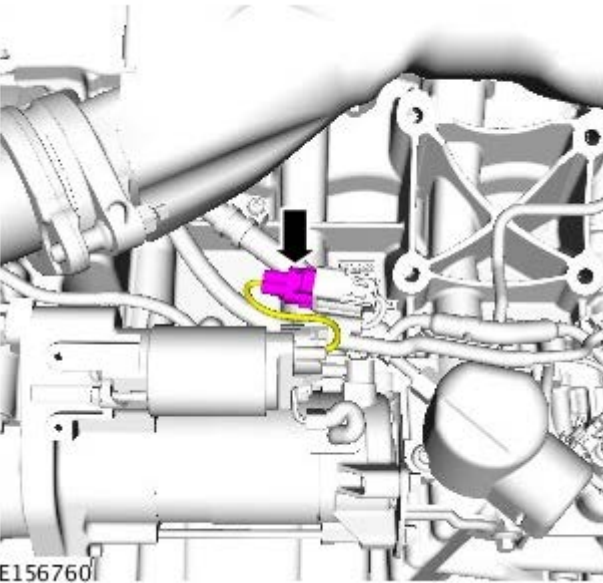
8. Torque: 10 Nm




9.  NOTE: If equipped with TSS.
Torque: 10 Nm



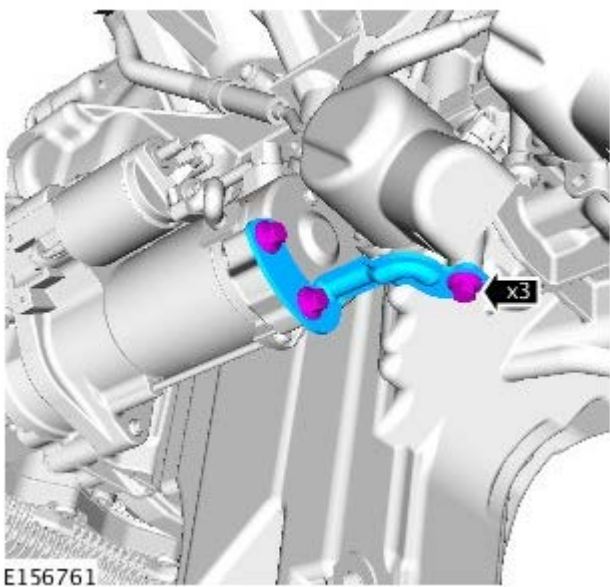
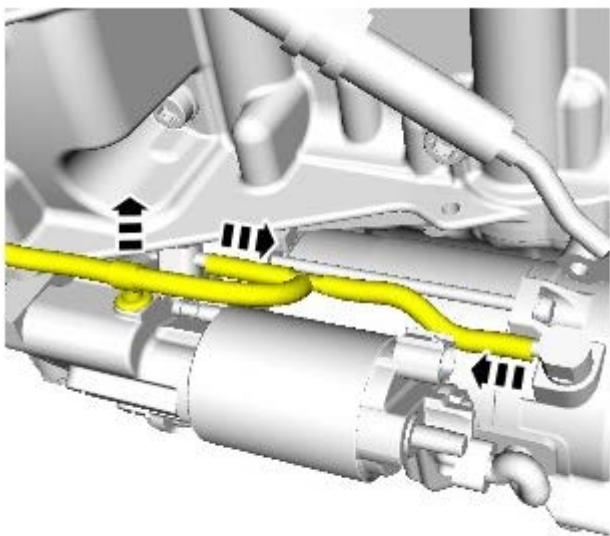
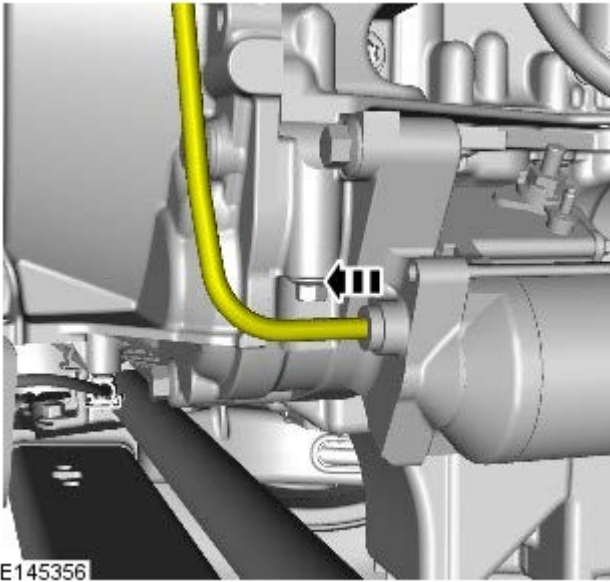
E156758





E156760

10.  NOTE: If equipped with TSS.

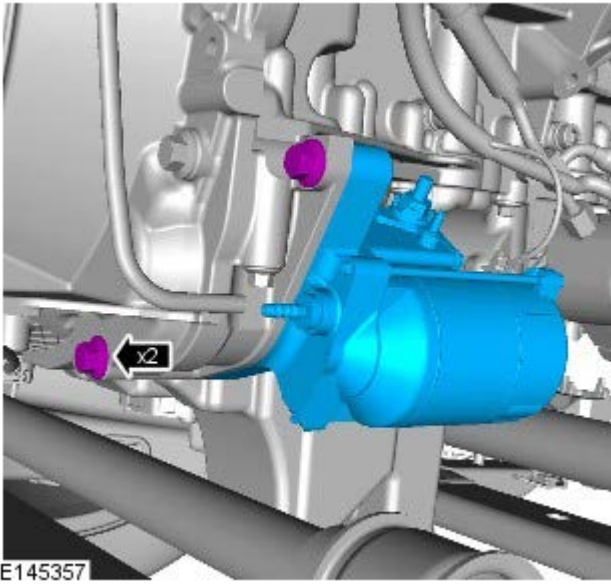
11.



12.  NOTE: If equipped with TSS.

13.  NOTE: If equipped with TSS.
Torque: 47 Nm

14. Torque: 47 Nm



Installation

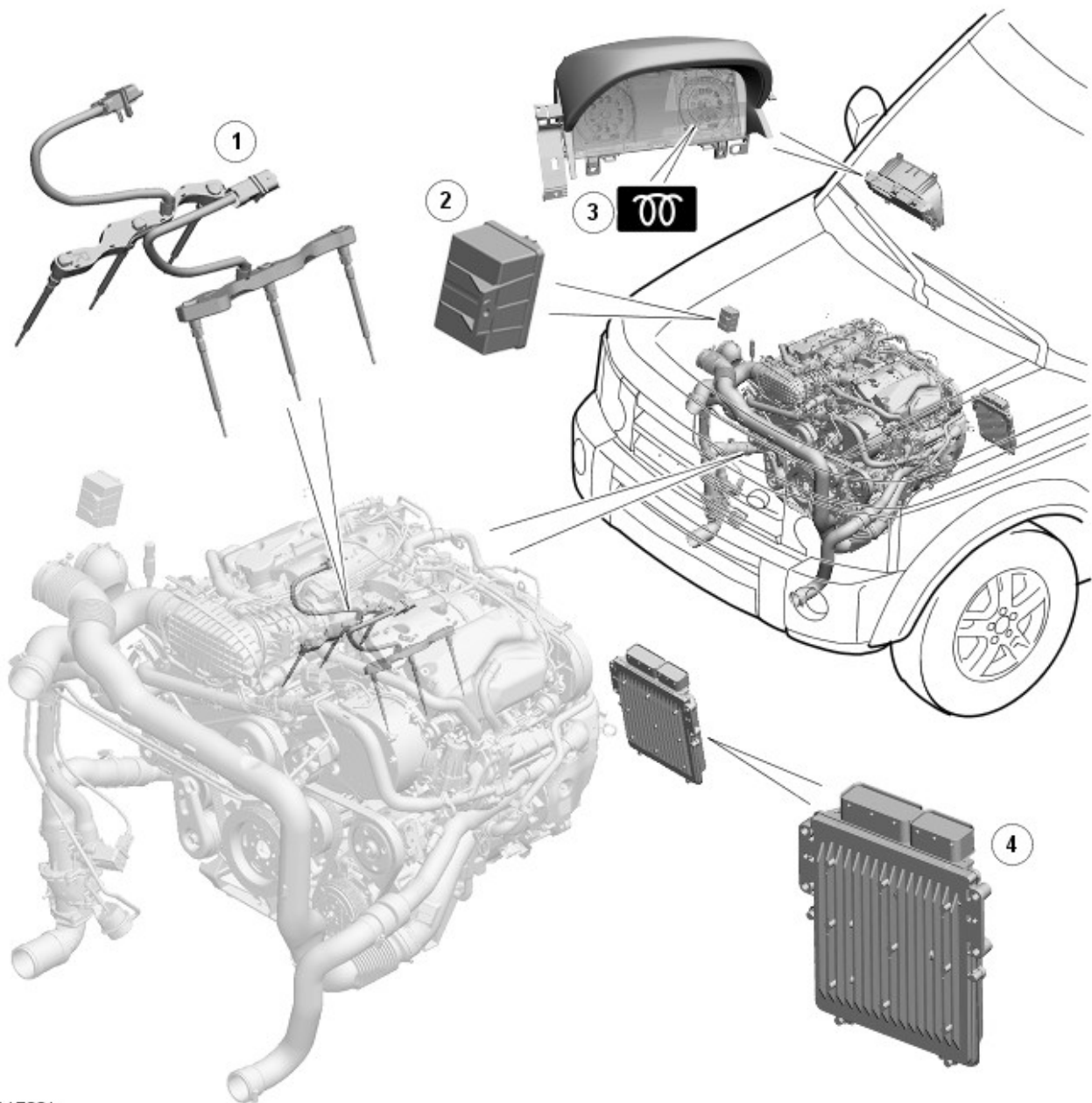
1. To install, reverse the removal procedure.

Glow Plug System - TDV6 3.0L Diesel -

Description	Nm	lb-ft	lb-in
Glow plug	10	-	89

Glow Plug System - TDV6 3.0L Diesel - Glow Plug System - Component Location

Description and Operation



E117321

Item Description

- 1 Glow plugs
- 2 Glow plug module
- 3 Glow plug warning lamp
- 4 [ECM \(engine control module\)](#)

Glow Plug System - TDV6 3.0L Diesel - Glow Plug System - Overview

Description and Operation

OVERVIEW

The glow plug system includes a glow plug installed in the inlet side of each cylinder and a glow plug module. The glow plugs heat the combustion chambers before and during cranking, to aid cold starting, and after the engine starts to reduce emissions and engine noise when idling with a cold engine.

The glow plugs are connected for each bank by a common harness which is connected into the main engine harness. The harness for each bank connects into a connector block which attaches to each of the glow plugs for that bank. The glow plugs are connected directly to the glow plug module which is controlled by glow plug software contained within the [ECM \(engine control module\)](#).

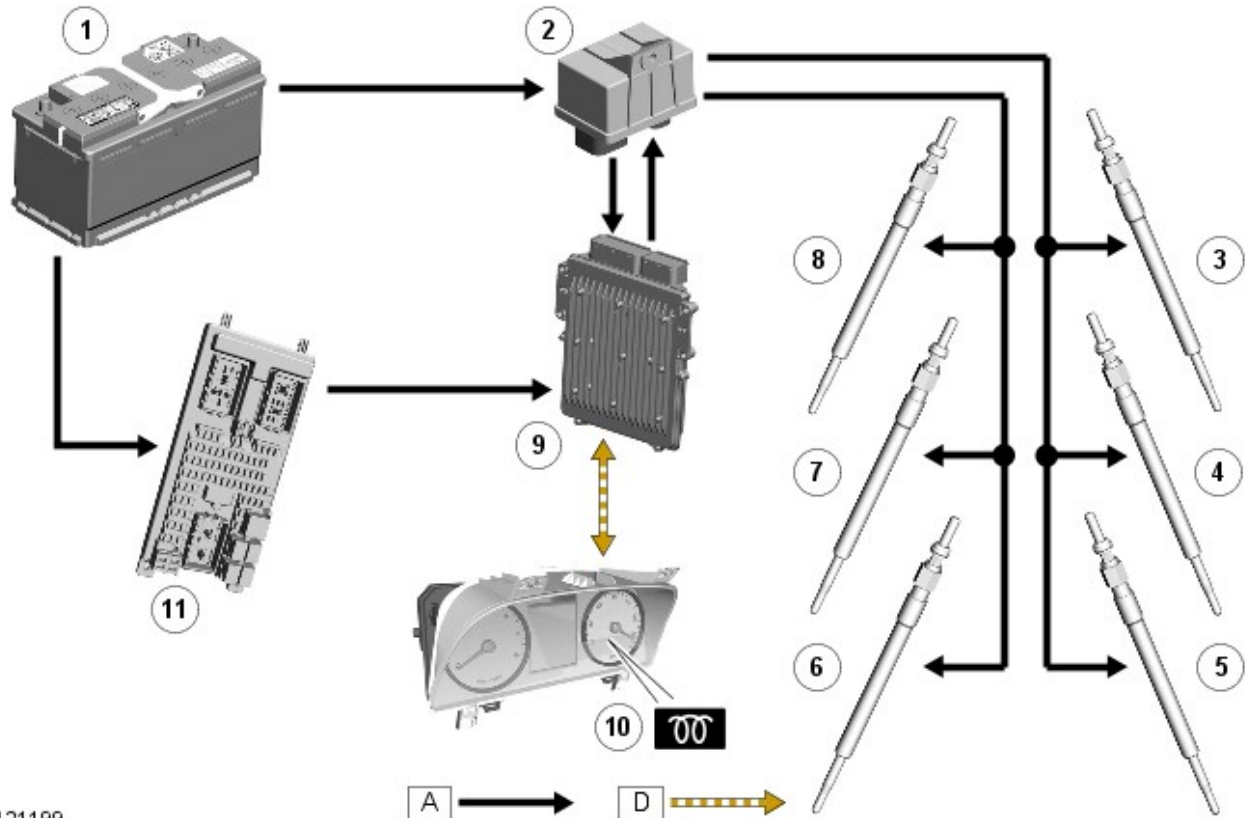
Glow Plug System - TDV6 3.0L Diesel - Glow Plug System - System Operation and Component Description

Description and Operation

Control Diagram



NOTE: **A** = Hardwired; **D** = High Speed CAN (controller area network)



E121199

Item Description

- 1 Battery
- 2 Glow plug module
- 3 Glow plug
- 4 Glow plug
- 5 Glow plug
- 6 Glow plug
- 7 Glow plug
- 8 Glow plug
- 9 [ECM \(engine control module\)](#)
- 10 Instrument cluster (glow plug warning indicator)
- 11 [CJB \(central junction box\)](#)

System Operation

System Operation

There are three phases of glow plug heating:

- Pre heating
- Crank heating
- Post heating

The [ECM](#) determines the heating times from the [ECT \(engine coolant temperature\)](#). The lower the engine coolant temperature, the longer the heating times.

When the ignition is switched to power mode 9, the [ECM](#) calculates any required heating times and, if heating is required, energizes the glow plug relays in the [CJB](#). When pre heating is required, the [ECM](#) also sends a message to the instrument cluster, on the high speed [CAN](#), to request illumination of the glow plug indicator. The glow plug indicator remains illuminated for the duration of the pre heating phase, or until the ignition is switched to crank, whichever occurs first. If required, the [ECM](#) keeps the glow plug relays energized during cranking and for the duration of any post heating phase.

The **ECM** monitors the drive circuit of the glow plug relay for plausibility of operation, continuity, and short and open circuits. If a fault is detected, the **ECM** stores a related fault code.

Pre Heating

Pre-heat is the length of time the glow plugs operate prior to engine cranking. The **ECM** controls the pre-heat time based on **ECT** sensor output and barometric pressure. If the **ECT** sensor fails, the **ECM** will use a predefined temperature as a default value. The pre-heat duration is extended if the coolant temperature is low.

The **ECM** receives the corresponding temperature signal from the **ECT** sensor.

The preheating period is dependent on the temperature signal (low temperature = longer preheating period).

The driver is informed that preheating is in operation by the glow plug indicator light in the instrument cluster coming on. The preheating times become longer as the coolant temperature falls.

The **BARO (barometric pressure)** also has an influence on activation and deactivation of the glow plugs in the event of large altitude differences.

Crank Heating

Crank heating is carried out at every start where the coolant temperature is below the predefined threshold of 20°C. Crank heating begins if the engine speed exceeds 80 rpm for longer than 50ms, or the starter is active for longer than 4 sec. If the coolant temperature sensor is defective, a default temperature of 0°C is used.

Post Heating

Post heat is the length of time the glow plugs operate after the engine starts. The **ECM** controls the post heating time based on **ECT** sensor output. The post heat phase reduces engine noise, improves idle quality and reduces hydrocarbon emissions.

Preheating is followed by the post heating phase once the engine has started. The post heating phase depends upon how the vehicle is driven.

In addition to **ECT**, **BARO** and engine speed, the injected fuel quantity is significant in this context. For example, if the injected fuel quantity is less than 70 mg per piston stroke and the coolant temperature is below -20°C, post heating is performed.

Component Description

Glow Plug

The ceramic sheathed element glow plugs are made from a heat-resistant, electrically conductive ceramic material. The ceramic sheathed-element glow plugs outer layer is heated directly and is self regulating. The self regulation allows the resistance of the sheathed element to automatically increase as the heat increases preventing the glow plug from overheating. In addition, during the heating process and under the control of the glow plug relay, the glow plugs can be operated above their nominal voltages. This permits heat-up speeds of 1000°C per second. The sheathed-element glow plugs reach a maximum glow temperature of 1300°C and can hold a temperature of 1150°C for several minutes after the first-start glow or at intervening times.

Each cylinder bank has a separate harness connecting the three glow plugs. The harness connects into the engine wiring harness and each harness has a connector block which attaches to each of the glow plugs for that bank.

The glow plug module receives a battery voltage feed via a 250A fusible and a 60A fuse in the engine compartment fusebox. Operation of the glow plug module is controlled by the **ECM**, which also controls the illumination of the glow plug indicator in the instrument cluster.

The system has been designed as a low-voltage glow system. At 7 volts, the nominal voltage of the sheathed-element glow plugs is significantly lower than the 12 volts of the main electrical circuit. The electronic glow plug module matches the voltage to the sheathed-element glow plugs and controls their glow temperature precisely to the specific requirements of the engine. This produces the optimum glow temperature even when the main circuit voltage is interrupted during engine starting. The lower power consumption of the ceramic glow plugs and their time-staggered activation reduce to a minimum the peak load on the main circuit during the cold start and immediate post-start periods.

In the event of glow plug failure, the engine may be difficult to start and excessive smoke emissions may be observed after starting.

Glow Plug System - TDV6 3.0L Diesel - Glow Plug System

Diagnosis and Testing

Principles of Operation

For a detailed description of the glow plug system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (303-07 Glow Plug System - TDV6 3.0L Diesel)

Glow Plug System (Description and Operation),
Glow Plug System (Description and Operation),
Glow Plug System (Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



1. Verify the customer concern.
2. Visually inspect for obvious signs of electrical damage.

Visual Inspection

Electrical
<ul style="list-style-type: none"> • Glow plug warning indicator • Fuses • Glow plug relays • Engine management control relay • Wiring harness(es) • Electrical connector(s) • Glow plug(s) • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Poor starting (extreme weather conditions)	<ul style="list-style-type: none"> • Glow plugs inoperative/inefficient • Fuel temperature too low 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the glow plugs circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check for glow plug DTCs
High cold-engine emissions	<ul style="list-style-type: none"> • After-glow phase inoperative 	 <p>NOTE: After-glow is designed to function at engine temperatures below 50°C (122°F), and below 2,500rpm</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the glow plugs circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check for glow plug DTCs
High cold-engine noise, vibration or harshness	<ul style="list-style-type: none"> • After-glow phase inoperative 	 <p>NOTE: After-glow is designed to function at engine temperatures below 50°C (122°F), and below 2,500rpm</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the glow plugs circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Check for glow plug DTCs

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (PCM) (100-00, Description and Operation).

Glow Plug System - TDV6 3.0L Diesel - Glow Plugs

Removal and Installation

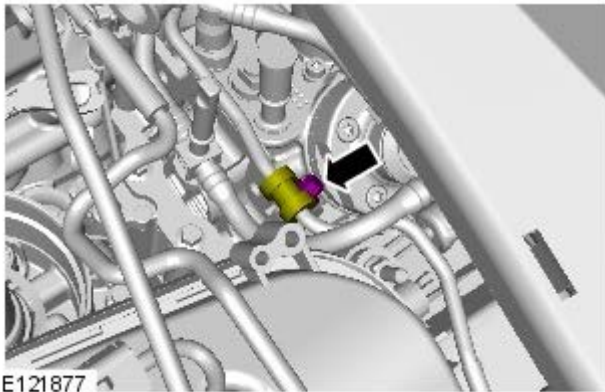
Removal



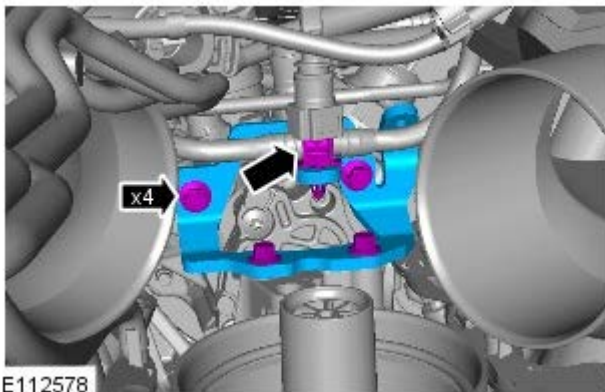
NOTE: Removal steps in this procedure may contain installation details.


1. Disconnect the battery ground cable.
Refer to: Specifications (414-01, Specifications).
2. Refer to: Intake Air Shutoff Throttle (303-04, Removal and Installation).
3. Refer to: Crankcase Vent Oil Separator (303-08, Removal and Installation).
4. Refer to: Oil Filter Element (303-01, Removal and Installation).

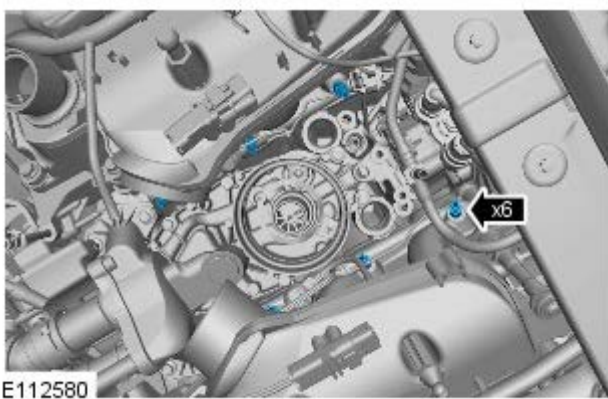
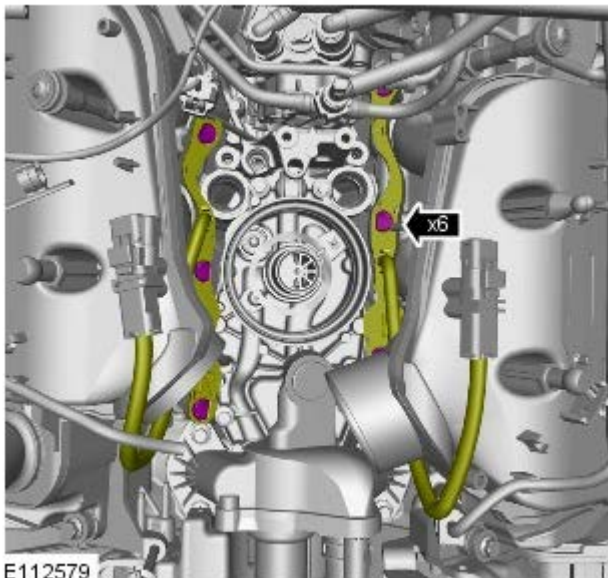
5.



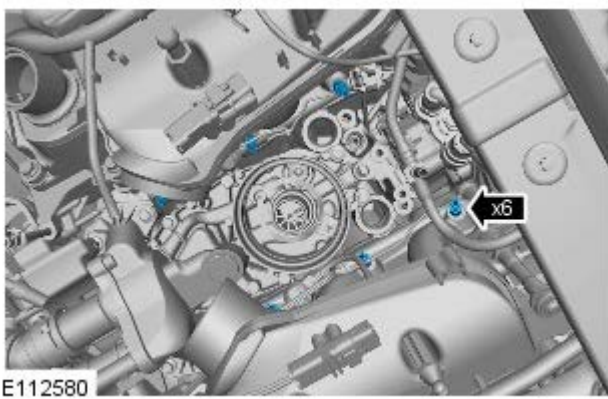
6.



7.  CAUTION: Take extra care not to damage the component.







Installation




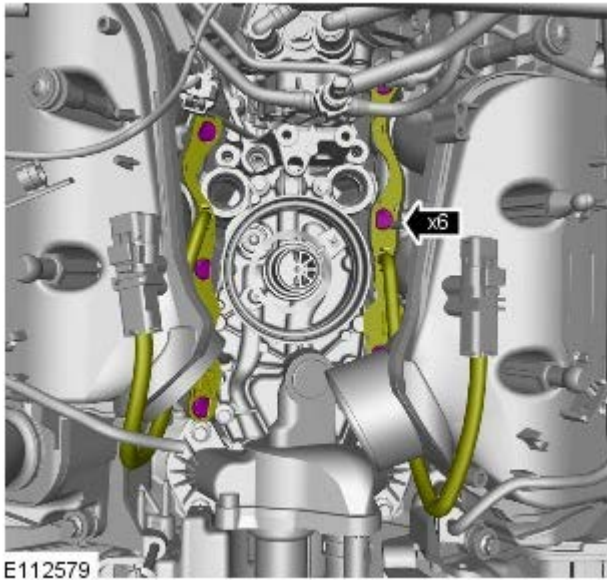
8.

1. CAUTIONS:

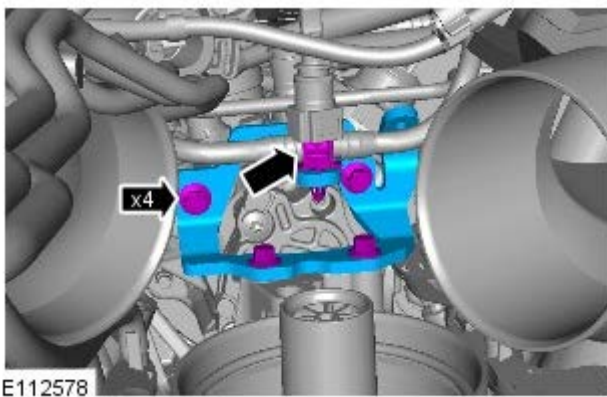
-  Take extra care when handling the component.
-  Fixings must be started by hand to avoid damaging threads.
-  If accidentally dropped or knocked install a new module.
-  Make sure the engine is cold before this procedure is carried out. Failure to follow this instruction may result in damage to the vehicle.

Torque: 10 Nm

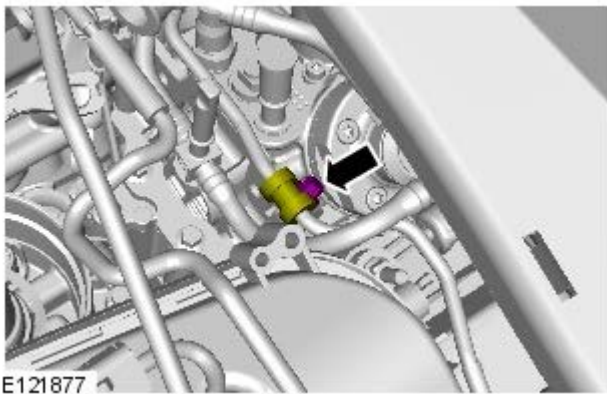
- 2.  CAUTION: Take extra care not to damage the component.



3. Torque: 10 Nm



4. Torque: 10 Nm



5. Refer to: Oil Filter Element (303-01, Removal and Installation).
6. Refer to: Crankcase Vent Oil Separator (303-08, Removal and Installation).
7. Refer to: Intake Air Shutoff Throttle (303-04, Removal and Installation).
8. Connect the battery ground cable.

Refer to: Specifications (414-01, Specifications).

Engine Ignition - V6 S/C 3.0L Petrol -

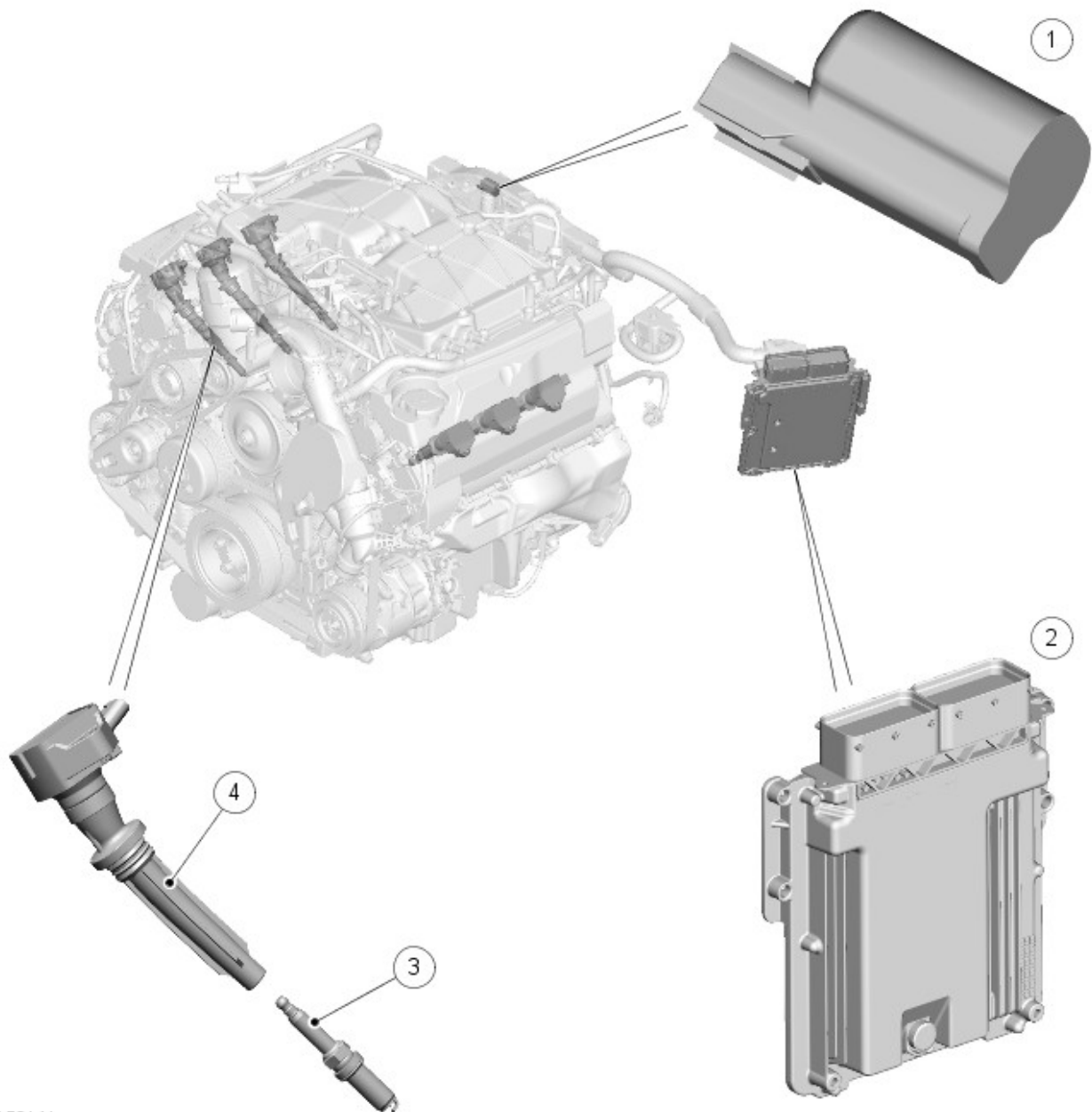
Item	Specification
Firing order	1:2:3:4:5:6
Spark plug type	SILZKAR7C10S
Spark plug gap	0.9 - 1.0 mm (0.035 - 0.039 inches)

Description	Nm	lb-ft	lb-in
Spark plugs	22	16	-
Ignition coil-on-plug retaining bolts	8	6	-

Engine Ignition - V6 S/C 3.0L Petrol - Engine Ignition

Description and Operation

COMPONENT LOCATION



E153141

Item	Part Number	Description
1	-	Radio Frequency Interference (RFI) suppressor
2	-	Engine Control Module (ECM)
3	-	Spark plug (6 off)
4	-	Ignition coil (6 off)

OVERVIEW

The engine ignition system is a coil-on-plug, single spark system controlled by the [ECM \(engine control module\)](#). The spark plugs are installed one per cylinder, between the inlet and exhaust valves. The spark plugs feature an iridium-tripped (IR) centre electrode (CE), and a platinum-tripped (PT) ground electrode (GE). The energy stored in the ignition coil, manifests itself on the spark plug in terms of a voltage differential between the electrodes. When the voltage differential equals the required voltage, then the spark plugs and the stored energy is dissipated. An ignition coil is installed on each spark plug. A RFI (radio frequency interference) suppressor is connected to the power feed to the ignition coils.

DESCRIPTION

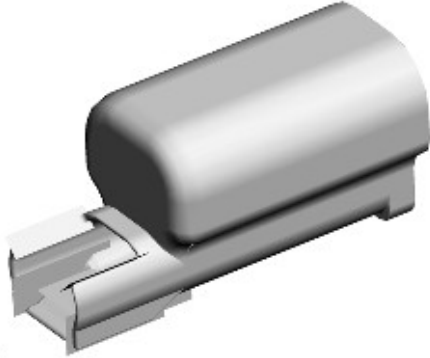
Ignition Coils

The ignition coils are installed in the cylinder head covers, under the [NVH \(noise, vibration and harshness\)](#) covers.

Each ignition coil locates on a spark plug and is secured to the related cylinder head cover with a single screw. Each ignition coil incorporates a three pin electrical connector for connection to the engine harness.

Each ignition coil contains a primary and a secondary winding. The primary winding receives electrical power from the ignition relay in the **EJB (engine junction box)**. A power stage in the primary winding allows the ECM to interrupt the power supply, to induce a voltage in the secondary winding and thus the spark plug. A diode in the ground side of the secondary winding reduces any undesirable switch-on voltage, to prevent misfiring into the intake manifold. The power stage limits the maximum voltage and current in the primary winding, to protect the power stage and limit the voltage in the secondary winding.

RFI Suppressor



E108416

The RFI suppressor is installed on the engine harness carrier at the rear of the engine.

OPERATION

The ignition coils are supplied with electrical power from the **ECM** relay in the **EJB**. The ECM controls the operation of the ECM relay.

The ECM sends a separate signal to each ignition coil to trigger the power stage switching. The ECM calculates the dwell time from the battery voltage and engine speed, to ensure a constant energy level is produced in the secondary coil each time the power stage is switched. This ensures sufficient spark energy is available without excessive primary current flow, which avoids overheating and damage to the ignition coils.

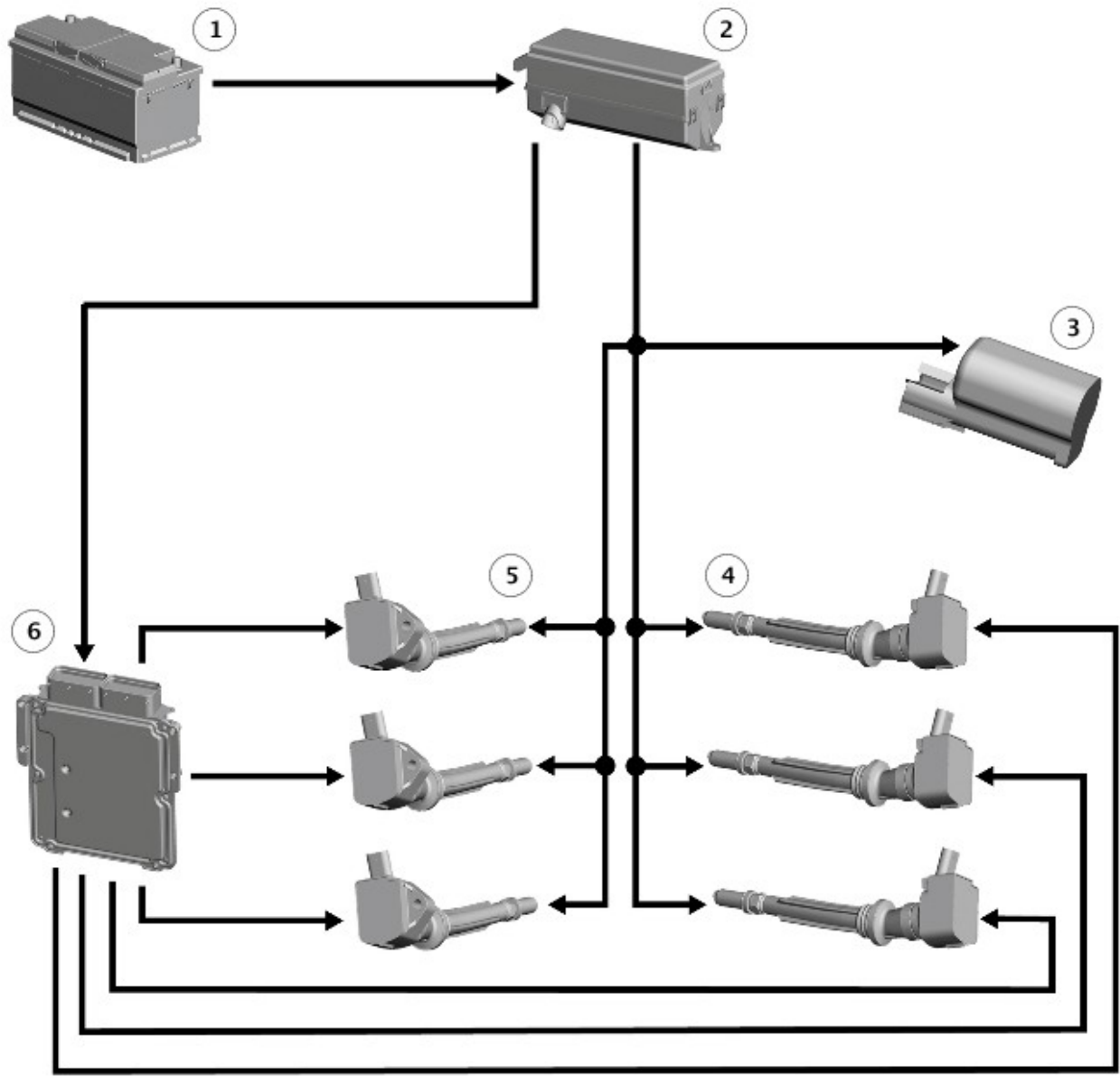
The ECM calculates the ignition timing for individual cylinders from:

- Engine speed
- Camshaft position
- Engine load
- Engine temperature
- The knock control function
- The shift control function
- The idle speed control function

CONTROL DIAGRAM



NOTE: A = Hardwired.



E161732



Item	Part Number	Description
1	-	Battery
2	-	Engine Junction Box (EJB)
3	-	RFI suppressor
4	-	Left cylinder bank ignition coils (3 off)
5	-	Right cylinder bank ignition coils (3 off)
6	-	Engine Control Module (ECM)

Engine Ignition - V6 S/C 3.0L Petrol - Engine Ignition

Diagnosis and Testing

Principles of Operation

For a detailed description of the engine ignition system and operation, refer to the relevant Description and Operation section in the workshop manual. REFER to:

- [Engine Ignition](#) (303-07B Engine Ignition - V6 S/C 3.0L Petrol, Description and Operation),
- [Engine Ignition](#) (303-07C, Description and Operation),
- [Engine Ignition](#) (303-07B Engine Ignition - V6 S/C 3.0L Petrol, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Spark Plug(s) • Fuel level • Fuel contamination/grade/quality 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Loose or corroded electrical connectors • Ignition coil(s) • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the symptom chart.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> • Engine breather system disconnected/restricted • Ignition system • Spark plug(s) • Fuel system • Electronic engine control 	Ensure the engine breather system is free from restriction and is correctly installed. Check for ignition system, fuel system and electronic engine control DTCs and refer to the relevant DTC Index
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> • Evaporative emissions purge valve • Fuel pump • Spark plugs • HT short to ground (tracking) check rubber boots for cracks/damage • Ignition system 	Check for evaporative emissions, fuel system and ignition system related DTCs and refer to the relevant DTC Index
Difficult cold start	<ul style="list-style-type: none"> • Spark plug(s) • Battery • Electronic engine controls • Fuel pump • Purge valve 	Check the engine coolant level and condition. Ensure the battery is in a fully charged and serviceable condition. Check for electronic engine controls, engine emissions, fuel system and evaporative emissions system related DTCs and refer to the relevant DTC Index
Difficult hot start	<ul style="list-style-type: none"> • Injector leak • Electronic engine control • Purge valve • Fuel pump • Ignition system 	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index

Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> Injector leak Electronic engine control Purge valve Fuel pump Ignition system 	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC Index
Engine stalls soon after start	<ul style="list-style-type: none"> Breather system disconnected/restricted ECM relay Electronic engine control Ignition system Air intake system restricted Air leakage Fuel lines 	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine control, ignition system and fuel system related DTCs and refer to the relevant DTC Index. Check for blockage in air filter element and air intake system. Check for air leakage in air intake system
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> Fuel pressure, fuel pump, fuel lines Injector leak Air leakage Electronic engine control Throttle motor Restricted accelerator pedal travel (carpet, etc) Ignition system Transmission malfunction 	Check for fuel system related DTCs and refer to the relevant DTC Index. Check for injector leak, install new injector as required. Check for air leakage in air intake system. Ensure accelerator pedal is free from restriction. Check for electronic engine controls, ignition, engine emission system and transmission related DTCs and refer to the relevant DTC Index
Engine backfires	<ul style="list-style-type: none"> Fuel pump/lines Air leakage Electronic engine controls Ignition system Sticking variable camshaft timing (VCT) unit 	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls, ignition system and VCT system related DTCs and refer to the relevant DTC Index
Engine surges	<ul style="list-style-type: none"> Fuel pump/lines Electronic engine controls Throttle motor Ignition system 	Check for fuel system failures. Check for electronic engine controls, throttle system and ignition system related DTCs and refer to the relevant DTC Index
Engine detonates/knocks	<ul style="list-style-type: none"> Fuel pump/lines Air leakage Electronic engine controls Sticking VCT unit 	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls and VCT system related DTCs and refer to the relevant DTC Index
No throttle response	<ul style="list-style-type: none"> Electronic engine controls Throttle motor 	Check for electronic engine controls and throttle system related DTCs and refer to the relevant DTC Index
Poor throttle response	<ul style="list-style-type: none"> Breather system disconnected/restricted Electronic engine control Transmission malfunction Traction control event Air leakage 	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine controls, transmission and traction control related DTCs and refer to the related DTC Index. Check for air leakage in intake air system

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: V6 3.0L S/C Petrol, DTC: Engine Control Module \(ECM\)](#) (100-00 General Information, Description and Operation).

Engine Ignition - V6 S/C 3.0L Petrol - Ignition Coil-On-Plug

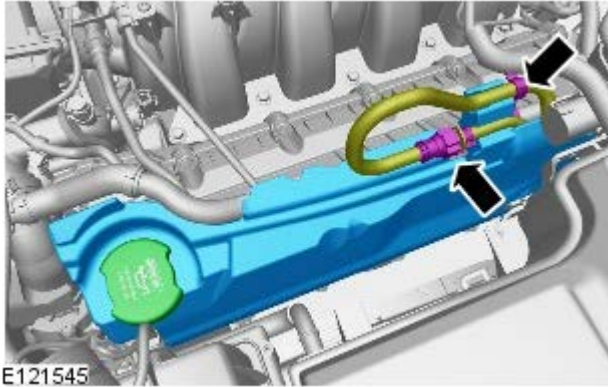
Removal and Installation

Removal



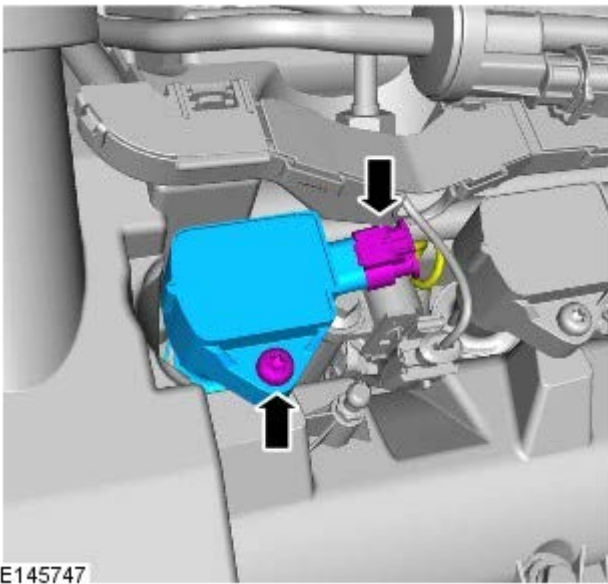
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).



2.  NOTE: LH illustration shown, RH is similar.

3. Torque: 7 Nm



Installation

1. To install, reverse the removal procedure.

Engine Ignition - V6 S/C 3.0L Petrol - Spark Plugs

Removal and Installation

Removal

NOTES:



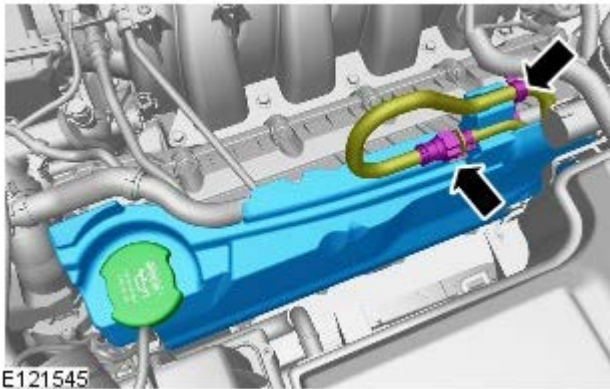
Removal steps in this procedure may contain installation details.



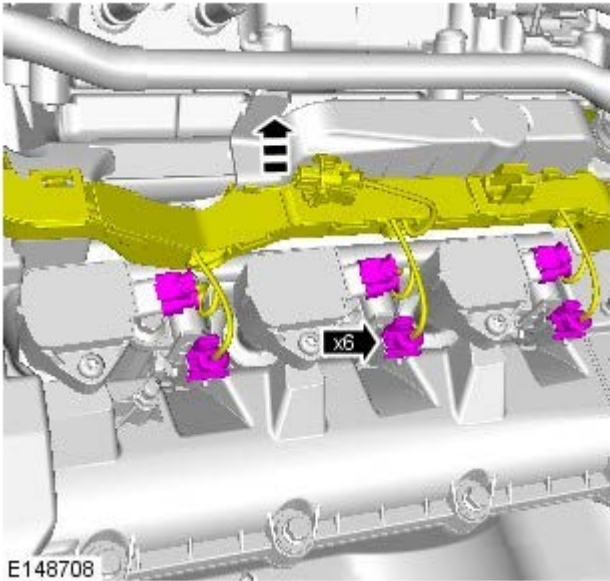
Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

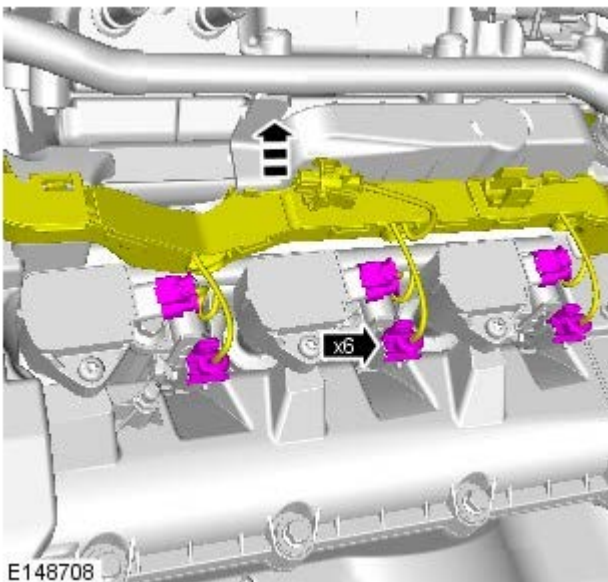
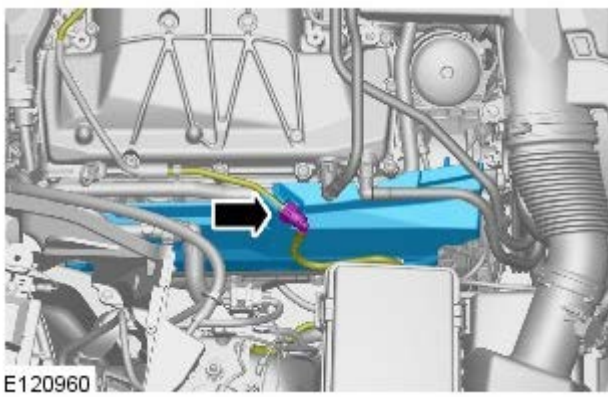
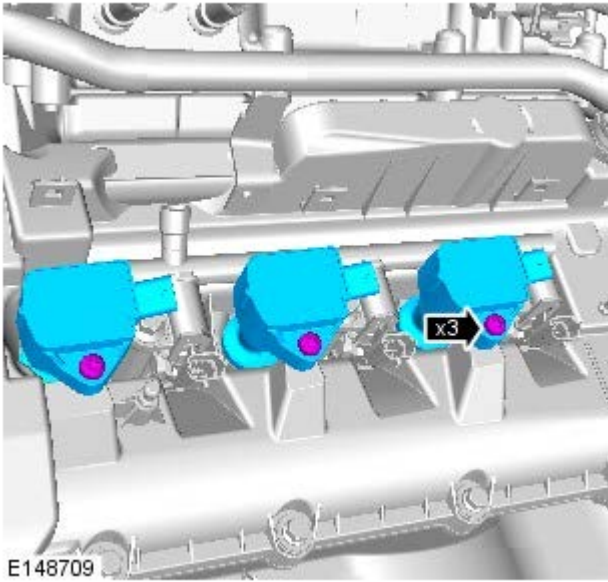
2.



3.



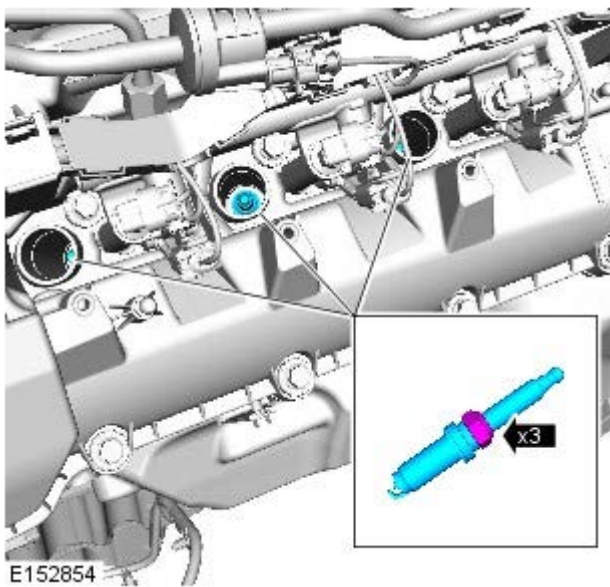
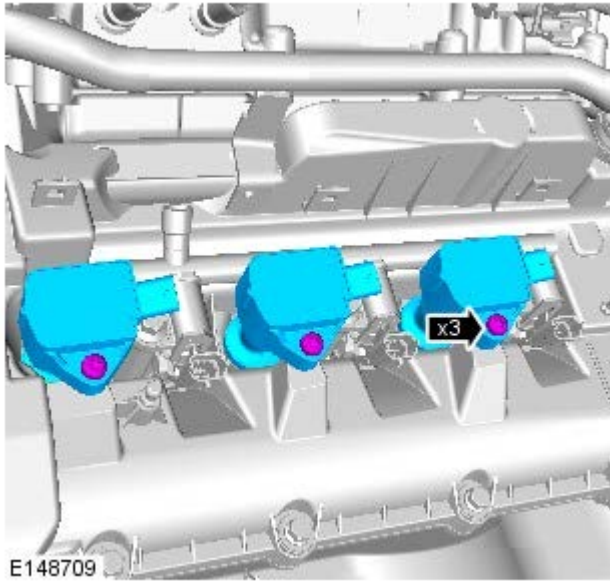
4. Torque: 7 Nm




5.

6.  NOTE: LH illustration shown, RH is similar.

7.  NOTE: LH illustration shown, RH is similar.
Torque: 7 Nm



8. NOTES:

 The step must be carried out on both sides.

 LH illustration shown, RH is similar.

Torque: 20 Nm

Installation

1. To install, reverse the removal procedure.

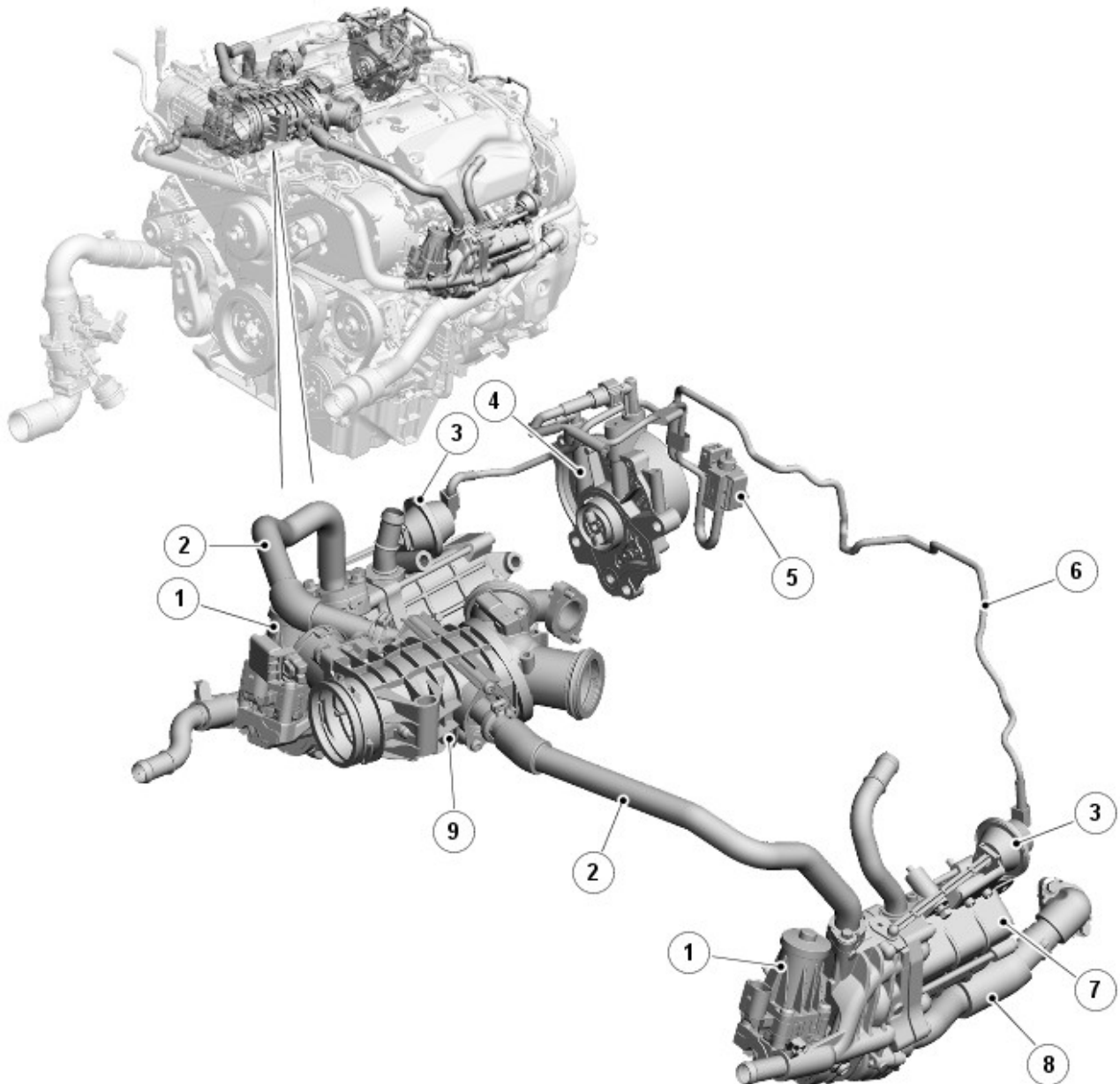
Engine Emission Control - TDV6 3.0L Diesel -

Description	Nm	lb-ft	lb-in
Exhaust gas recirculation (EGR) valve to cylinder head retaining bolts	10	7	89
EGR valve to EGR cooler retaining bolts	10	7	89
EGR valve tube to exhaust manifold retaining bolts	10	7	89
EGR valve cooler mounting bracket retaining bolt	10	7	89
EGR valve outlet tube to EGR valve retaining bolts	10	7	89
EGR valve outlet tube to timing cover retaining bolt	5	4	35

Engine Emission Control - TDV6 3.0L Diesel - Engine Emission Control - Component Location

Description and Operation

EGR (exhaust gas recirculation) Component Location

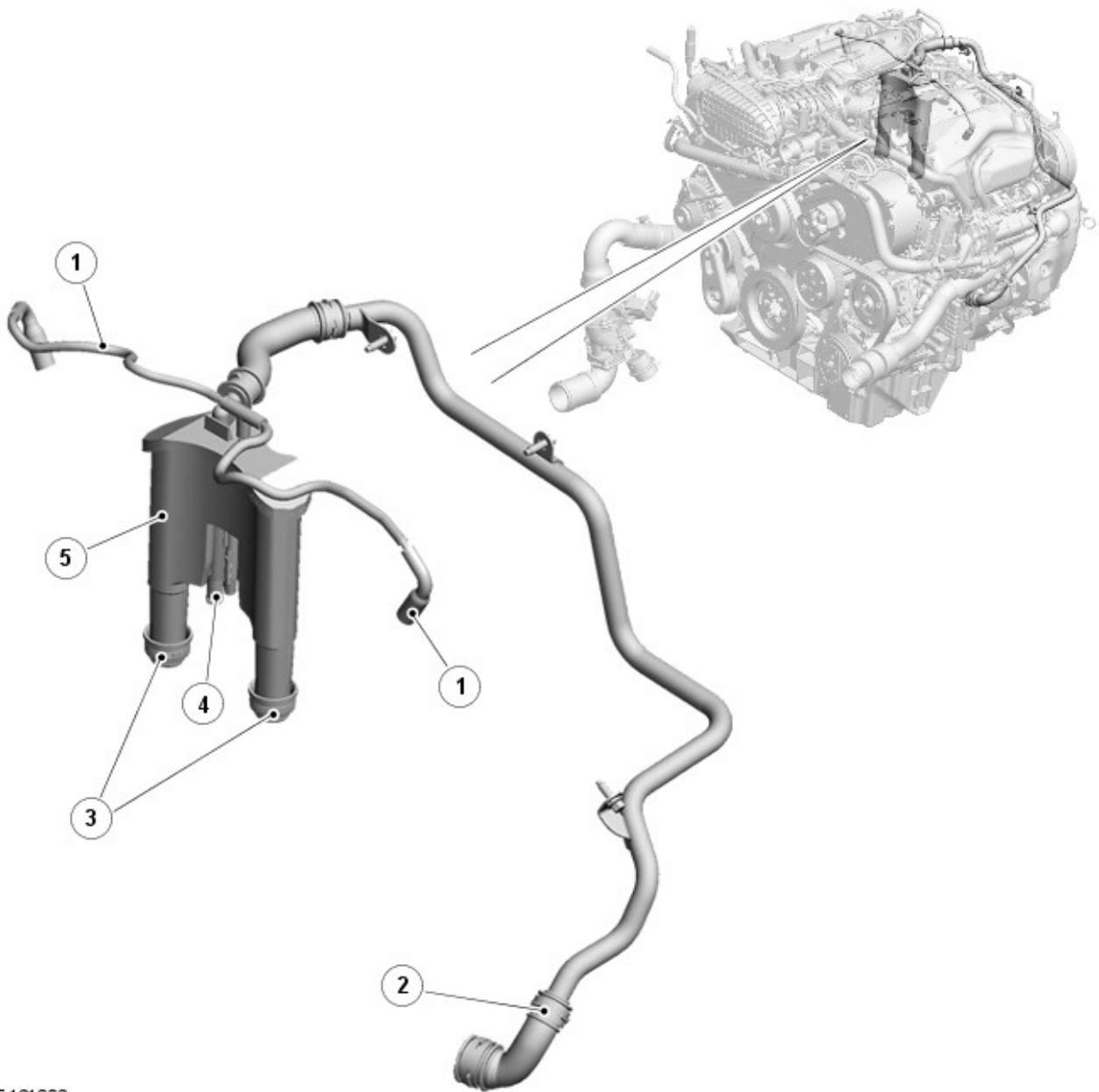


E121201

Item Description

- 1 EGR valve motor
- 2 EGR outlet pipe
- 3 By-pass valve vacuum actuator
- 4 Vacuum pump
- 5 Solenoid valve
- 6 Vacuum pipe (2 off)
- 7 EGR cooler
- 8 EGR inlet pipe from exhaust manifold
- 9 Throttle intake manifold

Crankcase Ventilation Component Location



E121202

Item Description

- 1 Cylinder ventilation scavenger hose (2 off)
- 2 Crankcase gas to air intake hose
- 3 Crankcase breather cylinder block connections
- 4 Oil drain to oil filter housing
- 5 Crankcase breather and oil separator

Engine Emission Control - TDV6 3.0L Diesel - Engine Emission Control - Overview

Description and Operation

OVERVIEW

Exhaust Gas Recirculation (EGR) System

The [EGR \(exhaust gas recirculation\)](#) system is used to control the amount of exhaust gas being recirculated in order to reduce exhaust emissions and combustion noise. [EGR](#) is enabled when the engine is at normal operating temperature and under cruising conditions.

Crankcase Ventilation System

The crankcase ventilation system ensures that all gasses emitted from the crankcase when the engine is running are separated from any oil particles and recirculated via the clean air induction system.

Engine Emission Control - TDV6 3.0L Diesel - Engine Emission Control - System Operation and Component Description

Description and Operation

System Operation

EXHAUST GAS RECIRCULATION (EGR) SYSTEM OPERATION

If small volumes of fuel are injected into a combustion chamber full of pure air, the effect is to create a very lean mixture. This burns at a high temperature, which in turn causes the excess oxygen in the mixture to combine with the naturally occurring nitrogen in the air to create nitrogen oxides (NOx), a noxious class of pollutants associated with acid rain. This is a particular problem for diesel engines at low to medium loads (as the engine has no throttle, the cylinder is replenished with a full charge of 'air' at every induction stroke). Exhaust gas is blended into the intake air charge to create the cylinder charge. As the exhaust gas effectively contains no oxygen, it prevents the formation of a very lean mixture, so lowering combustion temperatures and minimizing the formation of NOx.

At low engine speeds and loads, over 50 percent of the cylinder charge can be made up of recycled exhaust gas. This is routed directly from the exhaust manifold and passes through a gas-water heat exchanger before being supplied to the inlet manifold. The volume of exhaust gas added to the intake charge is regulated by an electronically controlled [EGR \(exhaust gas recirculation\)](#) valve, actuated according to precise engine speed and load by the engine management system.

CRANKCASE VENTILATION SYSTEM OPERATION

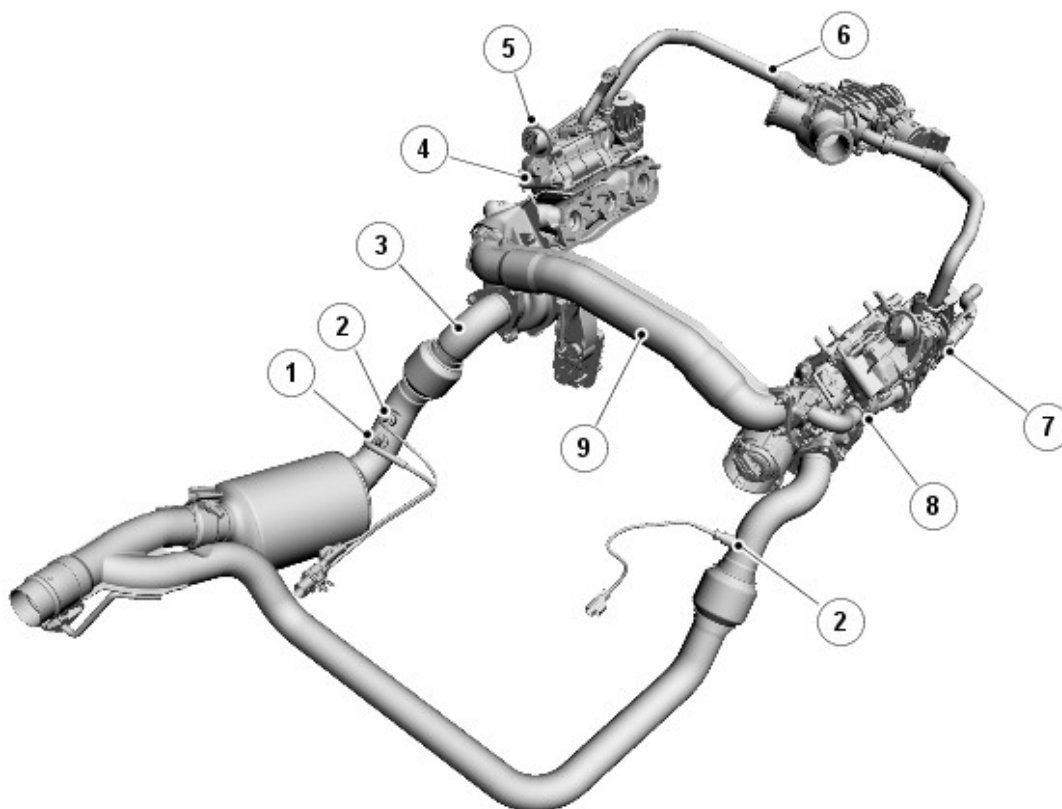
Crankcase gasses are drawn into the oil separator unit from the crankcase and the cylinder head covers (both banks) by a vacuum created by a connection into the air induction system.

The crankcase gasses are circulated around the oil separator where the gas and oil are separated. The gas is returned to the inlet side of the air induction system prior to the primary turbocharger. The collected oil is drained down to the sump via the oil cooler and filter housing on the cylinder block.

Component Description

EXHAUST GAS RECIRCULATION (EGR) SYSTEM

EGR System Control Components



E121203

Item Description

- 1 Oxygen sensor
- 2 Exhaust gas temperature sensor [LH \(left-hand\)](#)
- 3 Exhaust pipe
- 4 [EGR](#) cooler
- 5 By-pass valve vacuum actuator [EGR](#) valve motor

- 6 EGR outlet pipe
- 7 EGR cooler and valve housing
- 8 EGR inlet pipe
- 9 Exhaust system cross-over pipe

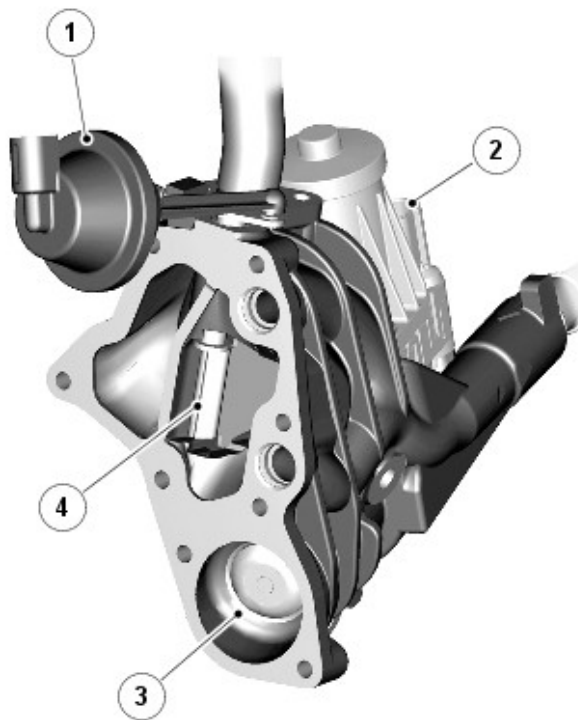
The EGR system comprises an EGR cooler and housing assembly which is bolted to the cylinder head, above the exhaust manifold. Each EGR assembly comprises an EGR cooler, a by-pass housing, a by-pass valve motor and a by-pass valve vacuum actuator.

A pipe is connected to the exhaust manifold and directs exhaust gasses into the by-pass housing. A second pipe from the by-pass housing connects to the throttle intake manifold and passes the cooled exhaust gasses into the intake manifold to mix with the clean air entering the engine from the air filter.

The EGR cooler is attached to the by-pass housing with a gasket and 5 screws. The by-pass housing has an engine coolant connection which allows coolant to flow from the engine oil cooler into the by-pass housing. Engine coolant flows from the by-pass housing into a water jacket within the cooler which in cools the exhaust gasses by heat transfer within the cooler. The engine coolant flows from the cooler through an outlet pipe and is passed back into the cooling system via the heater core.

The by-pass housing contains the EGR valve motor, the EGR valve and the by-pass valve.

By-pass Housing Components



E107585

Item Description

- 1 By-pass valve vacuum actuator
- 2 EGR valve motor
- 3 EGR valve
- 4 By-pass valve

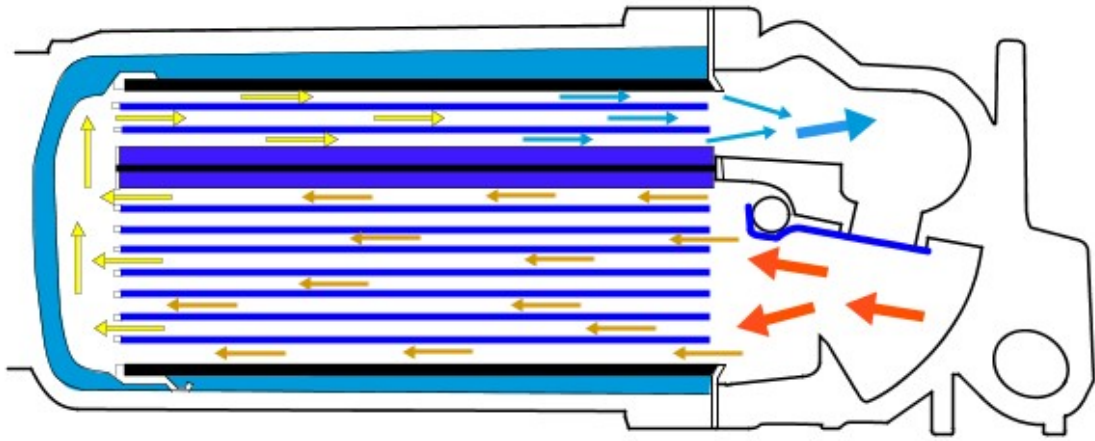
By-Pass Valve

The by-pass valve is a vacuum operated valve which directs the flow of exhaust gasses either through the EGR cooler or by-passes the cooler and directs the gasses directly to the intake manifold.

A vacuum actuator is located on a bracket attached to each EGR cooler. The actuator receives a vacuum which is produced by the vacuum pump located at the rear of the engine. The vacuum actuator is connected to the by-pass valve within the by-pass housing by a connecting rod.

The vacuum supply to the actuator is controlled by the ECM (engine control module). When by-pass control is required, the ECM energizes a vacuum solenoid valve which applies vacuum to the vacuum actuators. The vacuum causes the actuators to move the connecting rods in a linear direction. The linear movement of the rod is transferred to rotary movement of the by-pass valve within the by-pass housing.

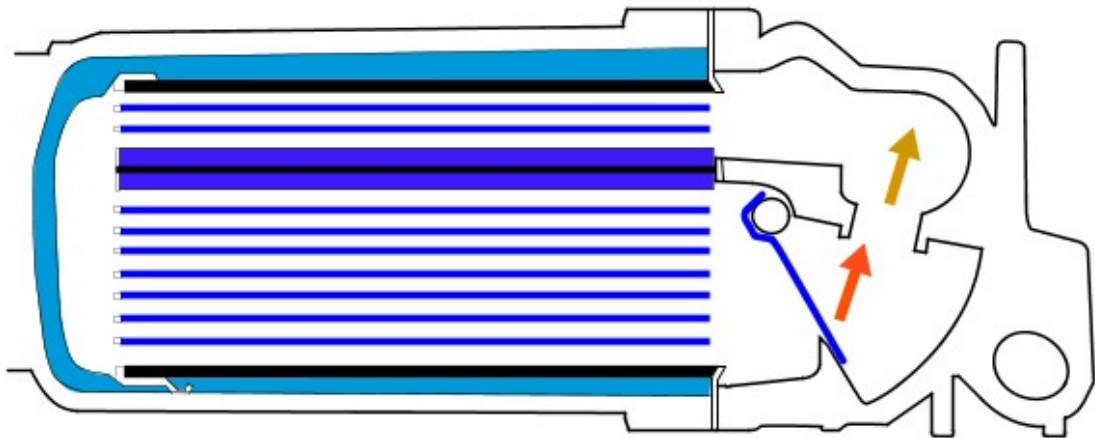
By-Pass Valve Closed



E112407

When the by-pass valve is closed, exhaust gasses are directed through the cooler before being passed to the intake manifold.

By-Pass Valve Open



E112408

When the by-pass valve is open, exhaust gasses are passed directly through the by-pass housing into the intake manifold with no cooling applied to the gasses.

EGR Valve

The EGR valve motor is located on the by-pass housing. A 5 pin connector provides the power, ground and ECM signal and feedback connections for the motor.

The motor is secured to the by-pass housing with 4 torx screws. A pinion gear on the motor spindle drives a geared rack which is connected to the EGR valve in the by-pass housing.

The motor is controlled by the ECM which provides power supply to operate the motor as required. A 5 Volt feedback signal is passed to the ECM which is used to establish motor position for precise control.

CRANKCASE VENTILATION

The crankcase ventilation system comprises an oil breather and separator. The breather receives crankcase directly from the crankcase and also from the cylinder heads.

The breather is connected to the top of the cylinder block with two seals. Two scavenge pipes located on the top of the breather are connected to the cylinder head covers. A breather pipe is connected from the top of the breather to the clean air intake hose at a point prior to the primary turbocharger.

Clean air being drawn into the engine when it is running creates a vacuum in the breather pipe. This vacuum in turn creates a vacuum in the oil breather and separator which draws gasses from the crankcase and cylinder heads into the breather. These gasses are circulated around the breather, allowing oil particles to be separated from the gas. The gasses are drawn into the breather pipe and are mixed with the clean air being drawn into the turbocharger.

The oil particles separated from the gasses accumulate in the oil separator and drain through a third connection at the bottom of the oil breather and separator, through a connection on the oil cooler housing to the oil pan.

Engine Emission Control - TDV6 3.0L Diesel - Engine Emission Control

Diagnosis and Testing

Principles of Operation

For a detailed description of the engine emission control system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (303-08 Engine Emission Control - TDV6 3.0L Diesel)

Engine Emission Control (Description and Operation),
 Engine Emission Control (Description and Operation),
 Engine Emission Control (Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Engine breather system • Oil separator • Exhaust Gas Recirculation (EGR) pipes/hoses (check for cracks) • Exhaust Gas Recirculation (EGR) valve(s) • Exhaust Gas Recirculation (EGR) cooler(s) • Vacuum system 	<ul style="list-style-type: none"> • Fuse(s) • Wiring harness • Loose or corroded electrical connector(s) • Intake air shut off throttle • Exhaust Gas Recirculation (EGR) valve(s) • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Difficult to start	<ul style="list-style-type: none"> • Exhaust Gas Recirculation (EGR) valve stuck open 	<ul style="list-style-type: none"> • Check the Exhaust Gas Recirculation (EGR) valve
Poor/erratic idle		
Lack of power when accelerating		
Engine stops/stalls	<ul style="list-style-type: none"> • Exhaust Gas Recirculation (EGR) valve stuck open • Breather system disconnected/restricted/blocked 	<ul style="list-style-type: none"> • Check the Exhaust Gas Recirculation (EGR) valve • Check the engine breather system • Check the oil separator • Check for Exhaust Gas Recirculation (EGR) DTCs
Excessive fuel consumption	<ul style="list-style-type: none"> • Exhaust Gas Recirculation (EGR) valve stuck open • Exhaust Gas Recirculation (EGR) not operating • Breather system restricted/blocked 	
Excessive black smoke		
Excessive emissions		
Excessive blow-by	<ul style="list-style-type: none"> • Breather system restricted/blocked 	<ul style="list-style-type: none"> • Check the engine breather hoses • Check the oil separator
Engine oil leaks	<ul style="list-style-type: none"> • Breather system restricted/blocked 	<ul style="list-style-type: none"> • Check the engine breather hoses • Check the oil separator

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (PCM) (100-00, Description and Operation).

Engine Emission Control - TDV6 3.0L Diesel - Crankcase Vent Oil Separator

Removal and Installation

Removal

NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.



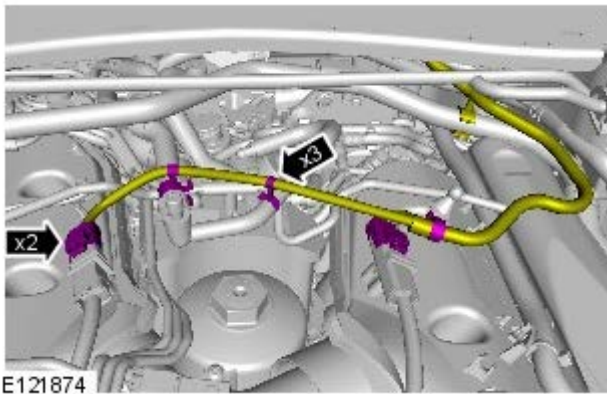
Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

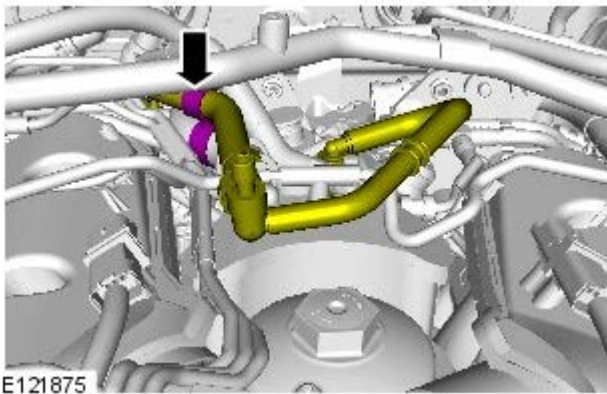
Refer to: Specifications (414-00, Specifications).

2. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).

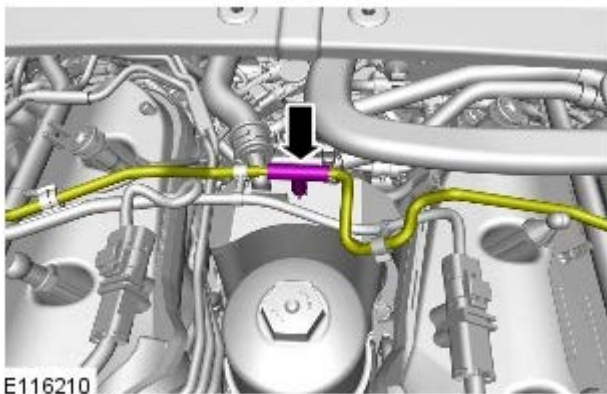
3.



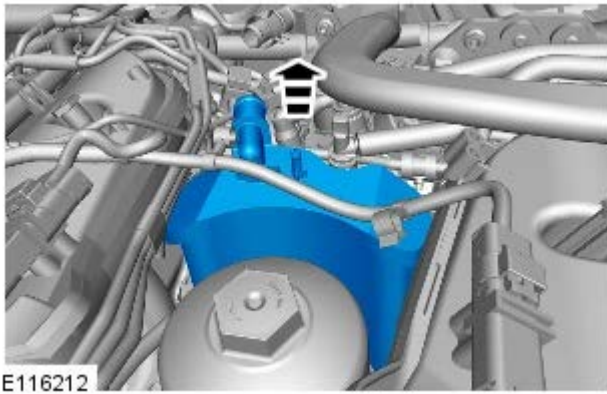
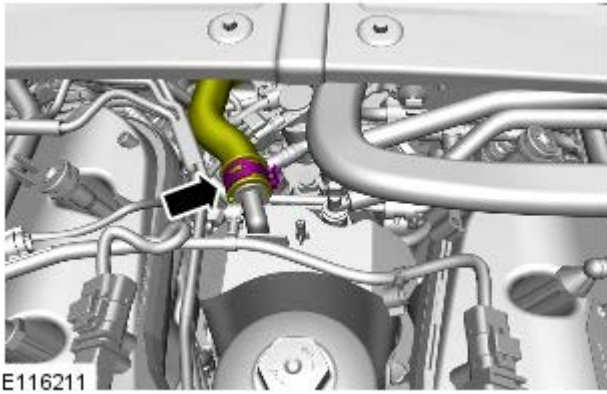
4.




5.



6.



7. CAUTIONS:

 Make sure that all openings are sealed.

 Lubricate the O-ring seals with clean engine oil.

Installation

1. To install, reverse the removal procedure.

Engine Emission Control - TDV6 3.0L Diesel - Exhaust Gas Recirculation (EGR) Valve LH

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

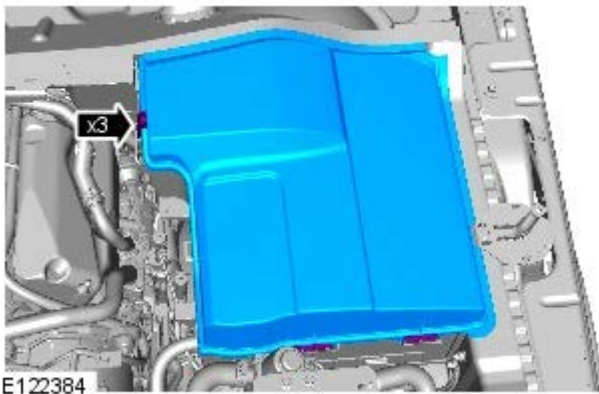
All vehicles

1. Disconnect the battery ground cable.

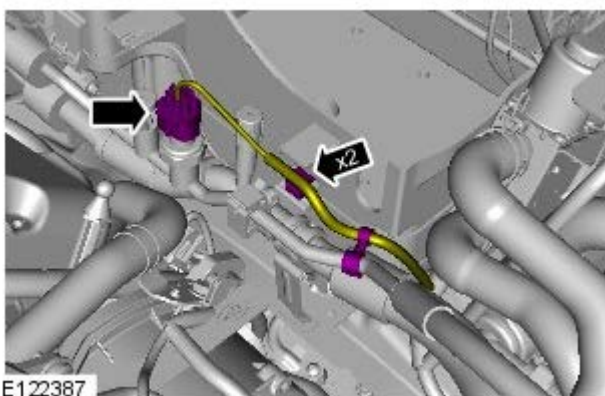
Refer to: Specifications (414-00 Charging System - General Information, Specifications).

2. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
3. Refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 3.0L V6 - TdV6, General Procedures).
4. Refer to: Engine Cover - 3.0L V6 - TdV6 (501-05 Interior Trim and Ornamentation, Removal and Installation).

5.

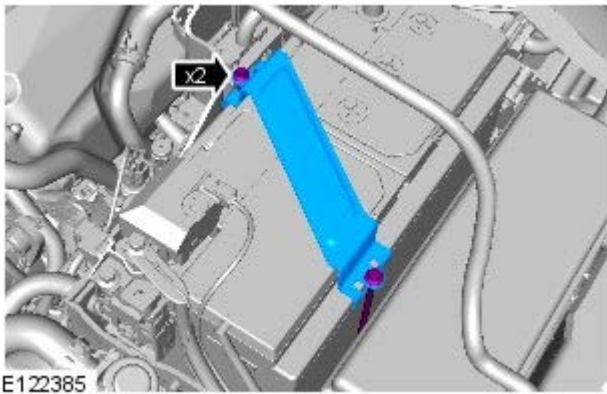


6.

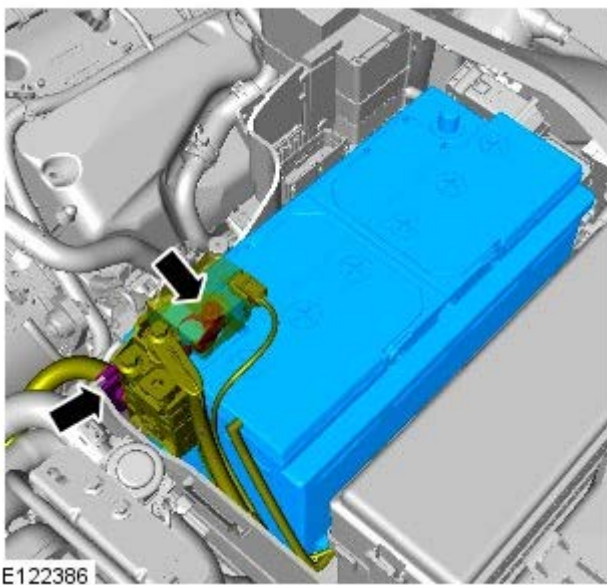


Right-hand drive vehicles

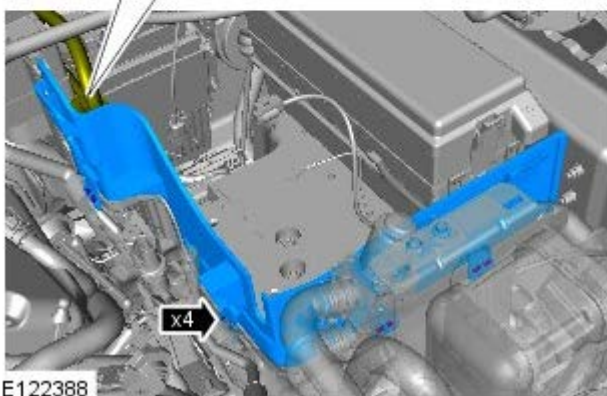
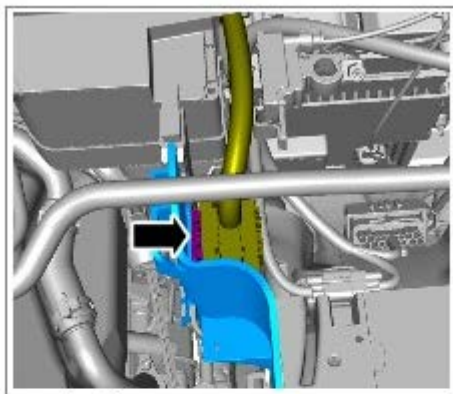
7. Torque: 10 Nm



8. Torque: 10 Nm

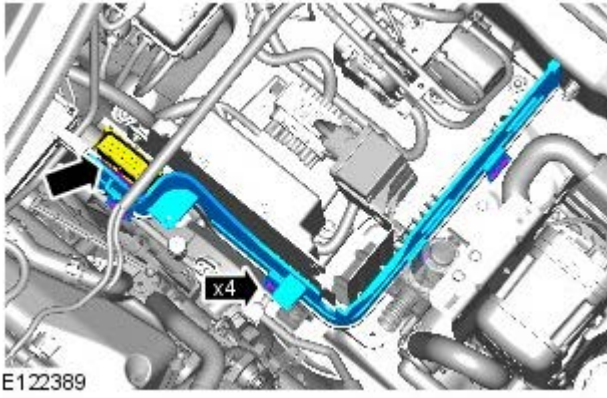


9.

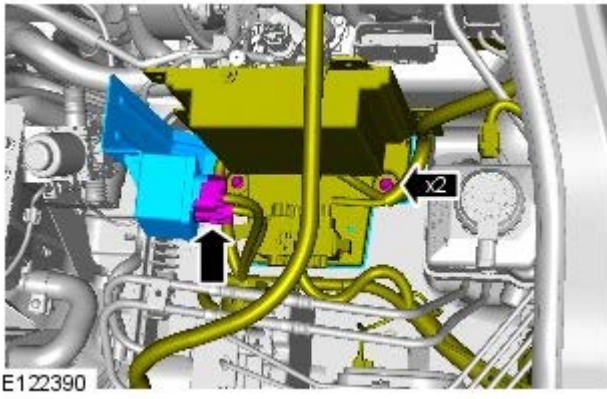


Left-hand drive vehicles

10.

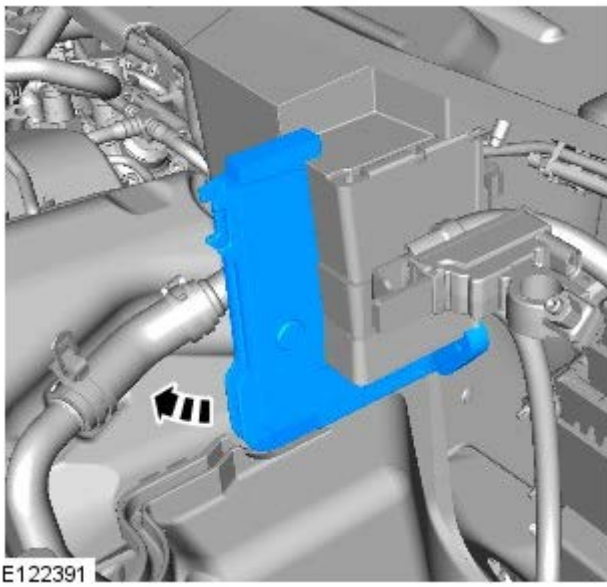


11.

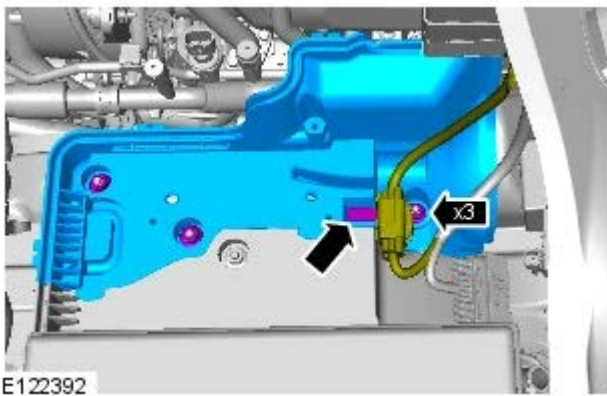


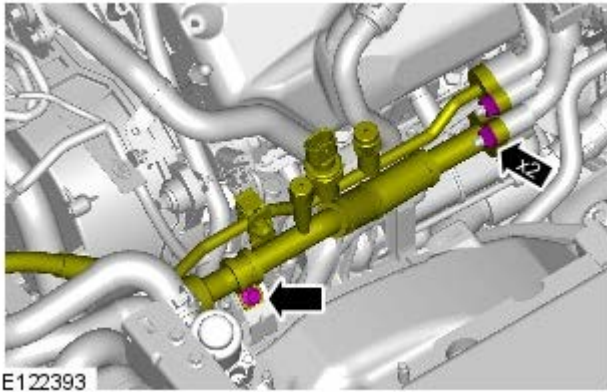
All vehicles


12.



13. Torque: 12 Nm

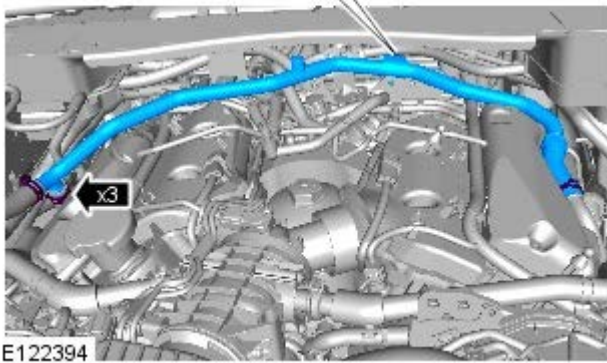




14.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

 NOTE: Install new O-ring seals.

Torque: 10 Nm

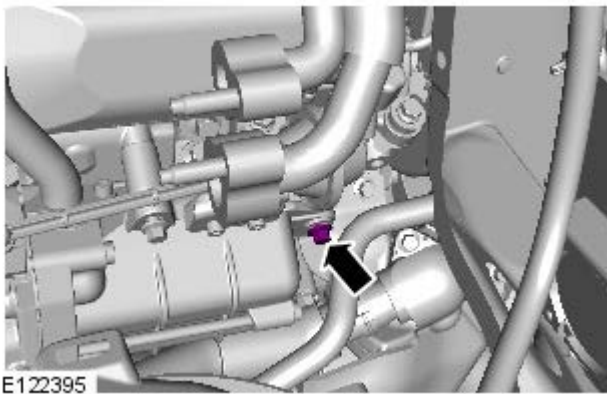


15.  CAUTION: Make sure that all openings are sealed.

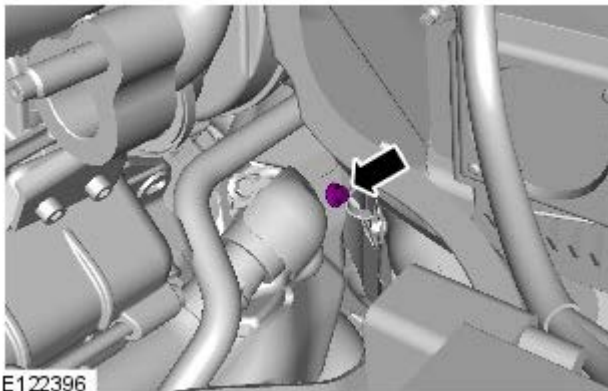
Torque: 10 Nm


16. Refer to: Exhaust Gas Recirculation (EGR) Valve Outlet Tube LH (303-08 Engine Emission Control - 3.0L V6 - TdV6, Removal and Installation).

17. Torque: 10 Nm



18. Torque: 9 Nm

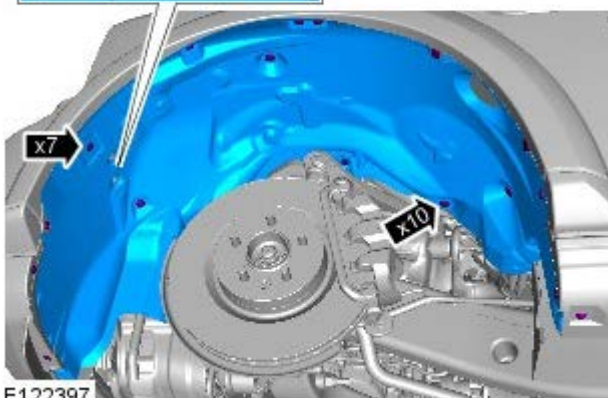
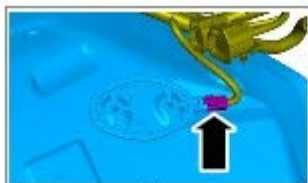


19.  **WARNING:** Make sure to support the vehicle with axle stands.

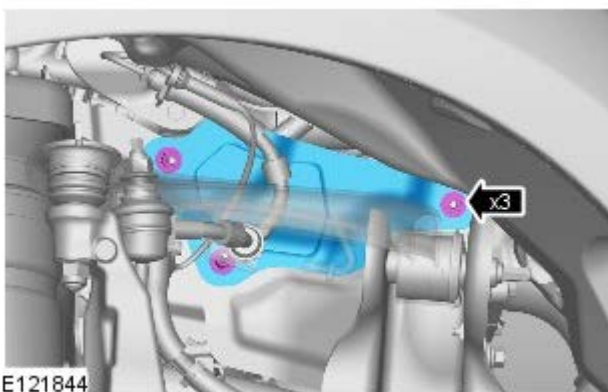
Raise and support the vehicle.

20. Remove the LH front wheel and tire.

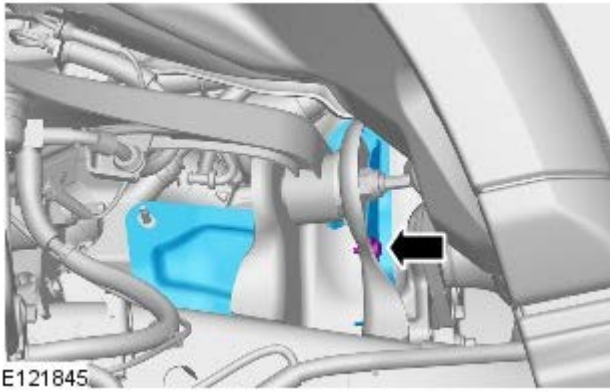
21.



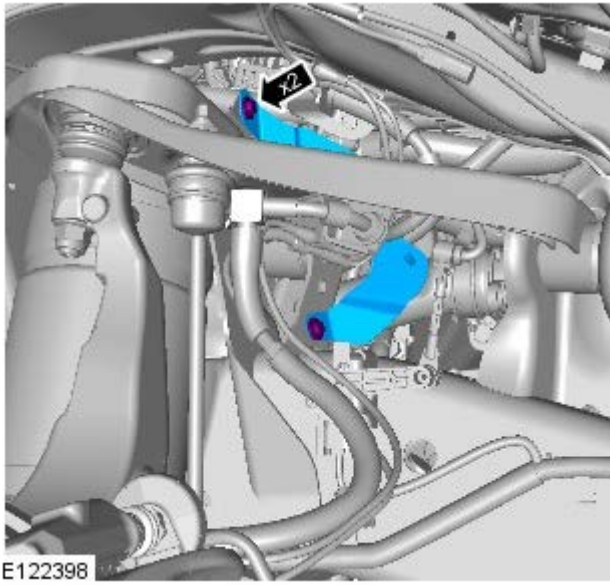
22. Torque: 9 Nm



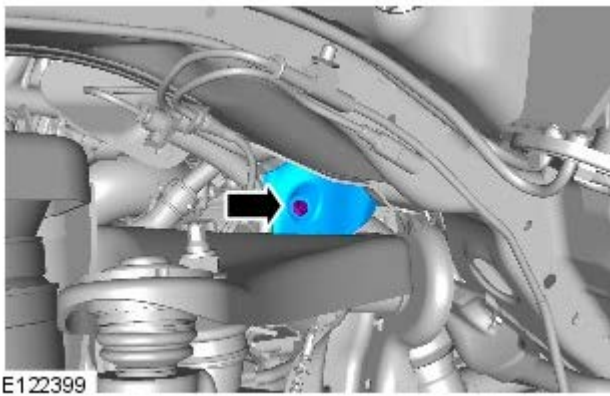
23. Torque: 9 Nm



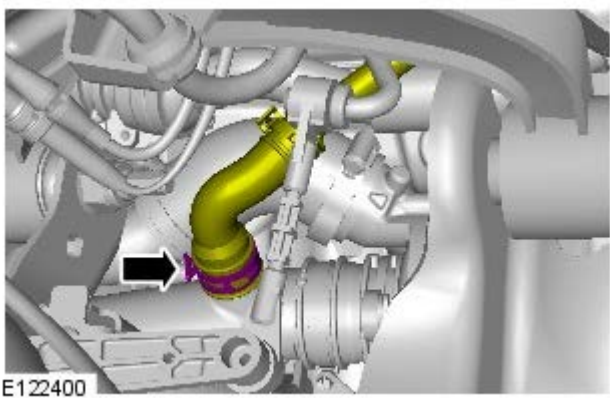
24. Torque: 9 Nm



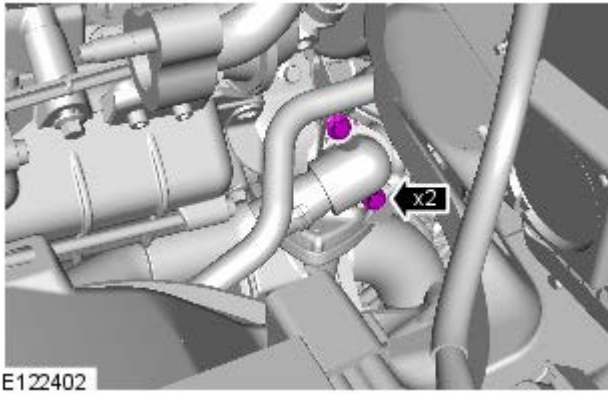
25. Torque: 9 Nm



26.  CAUTION: Make sure that all openings are sealed.

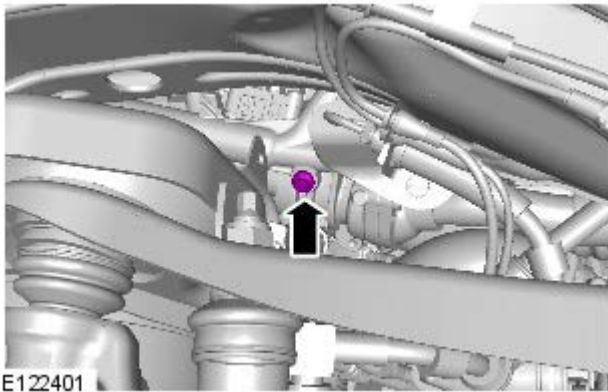


27. Torque: 10 Nm




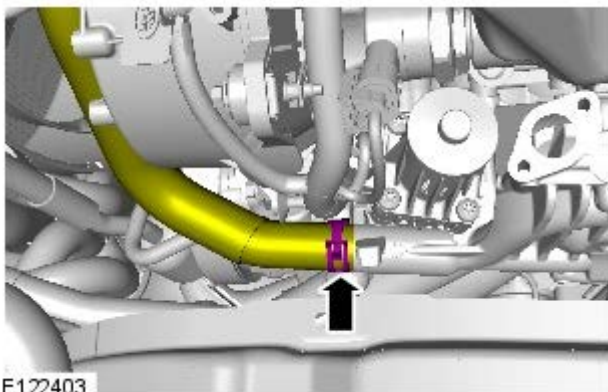
E122402

28. Torque: 10 Nm



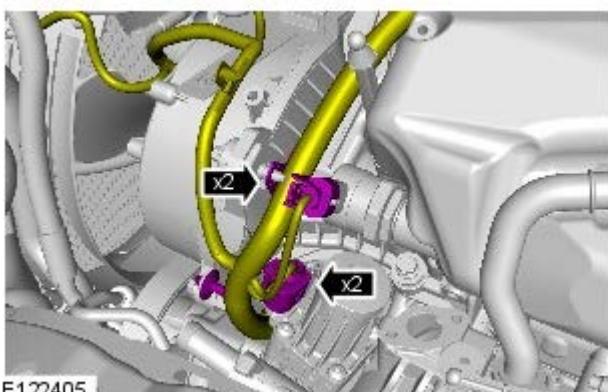
E122401

29.  CAUTION: Make sure that all openings are sealed.




E122403

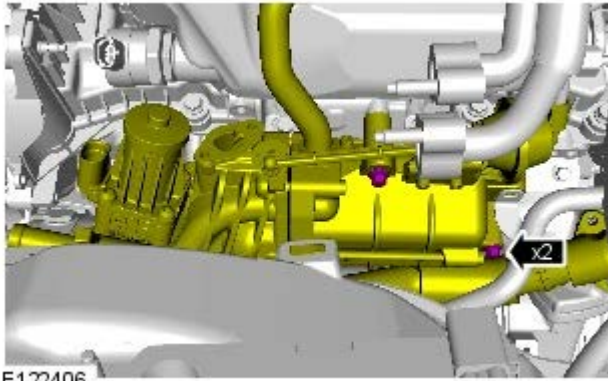
30.



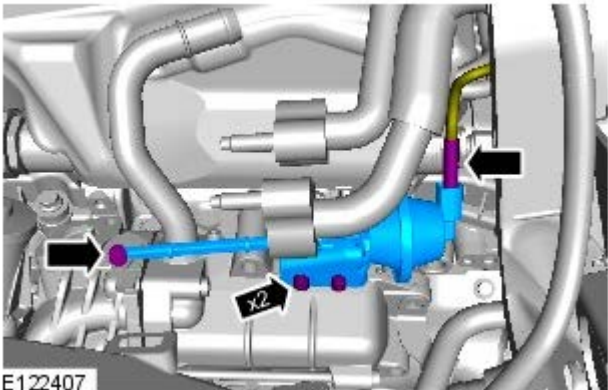
E122405

31.  CAUTION: Make sure that all openings are sealed.

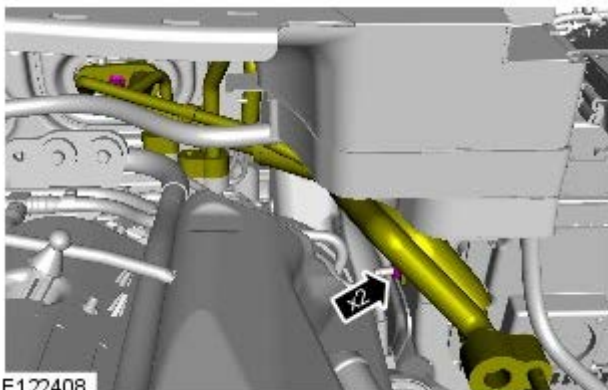
Torque: 10 Nm



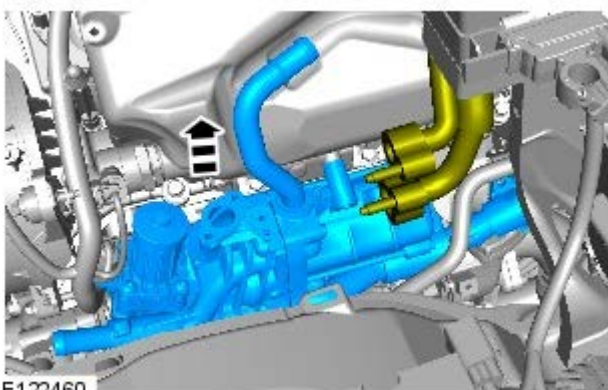
E122406



E122407



E122408



E122460

Installation


32.  CAUTION: Take extra care not to damage the component.

 NOTE: An audible click is heard when the ball joint is fully latched.

Torque: 8 Nm

33. CAUTIONS:

 Install new o-ring seals

 Make sure that all openings are sealed. Use new blanking caps.

Torque: 6 Nm

- 34.

1. To install, reverse the removal procedure.
2. If a new unit is installed, configure using the approved diagnostic tool.

Engine Emission Control - TDV6 3.0L Diesel - Exhaust Gas Recirculation (EGR) Valve RH

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

All vehicles

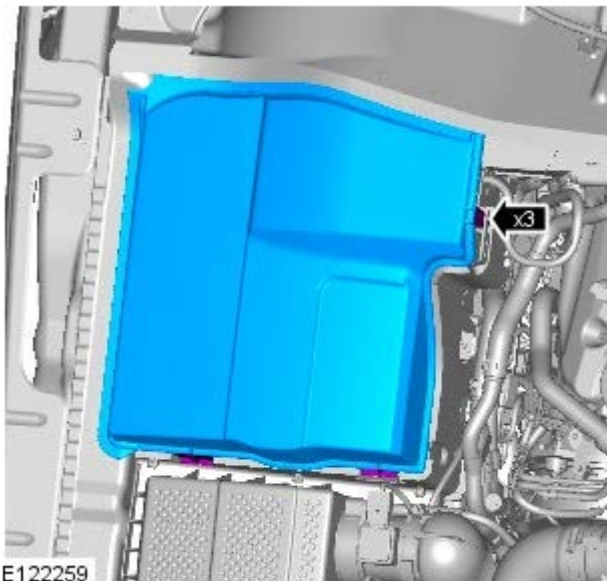
1. Disconnect the battery ground cable.

Refer to: Specifications (414-00 Charging System - General Information, Specifications).

2. Refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - 3.0L V6 - TdV6, General Procedures).

3. Refer to: Engine Cover - 3.0L V6 - TdV6 (501-05 Interior Trim and Ornamentation, Removal and Installation).

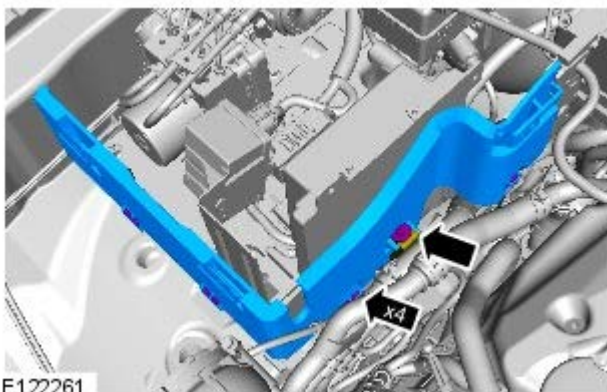
4.



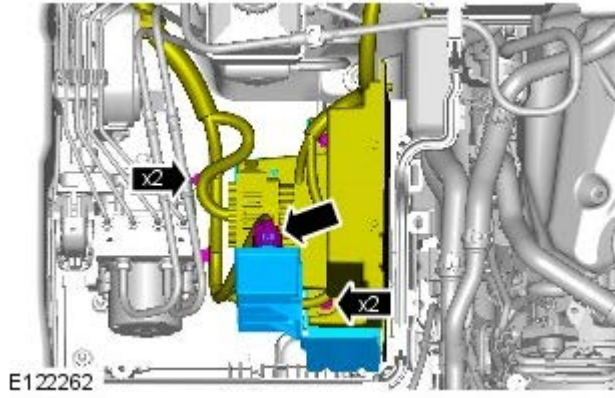
5. Refer to: Air Cleaner (303-12 Intake Air Distribution and Filtering - 3.0L V6 - TdV6, Removal and Installation).

Right-hand drive vehicles

6.

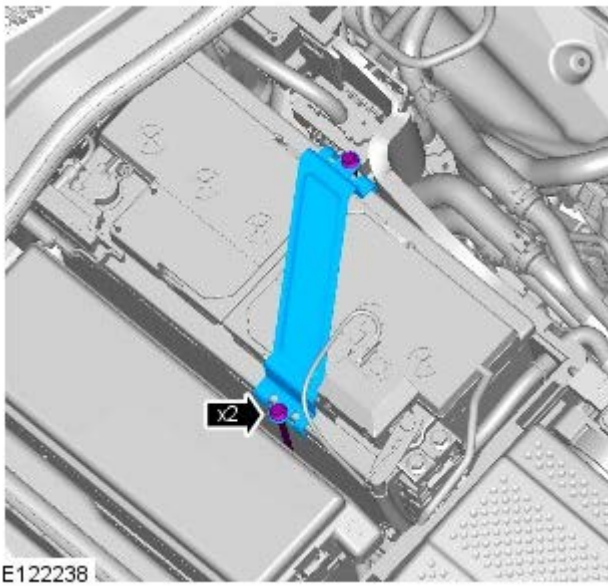


7. Torque: 10 Nm

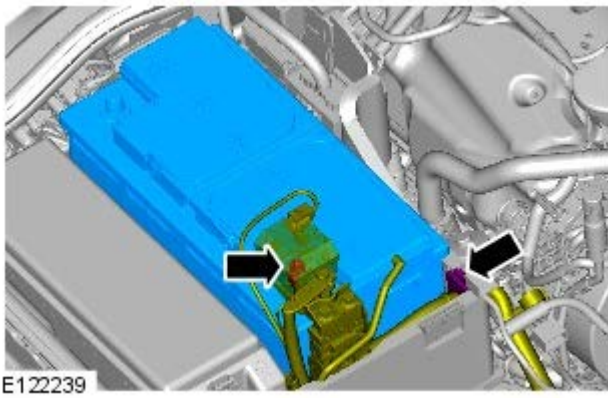


Left-hand drive vehicles

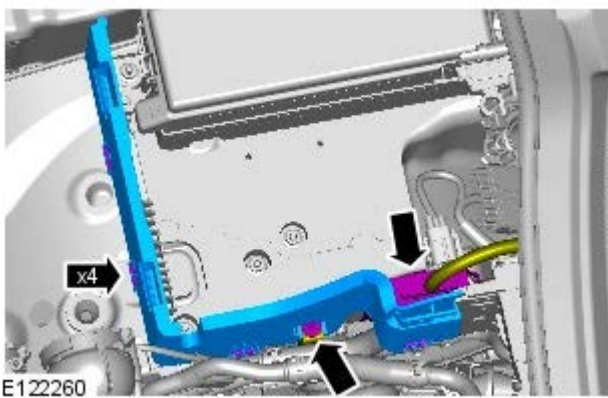
8. Torque: 10 Nm



9. Torque: 10 Nm

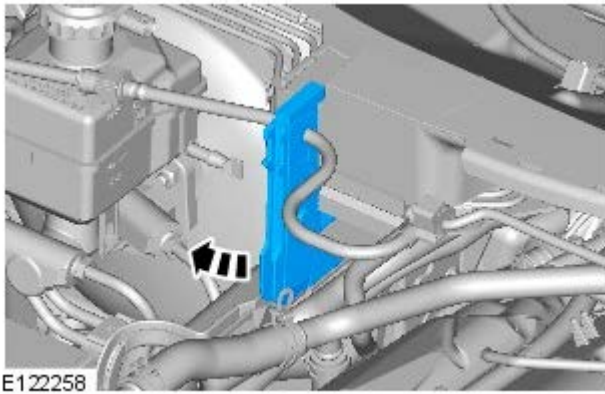


10.

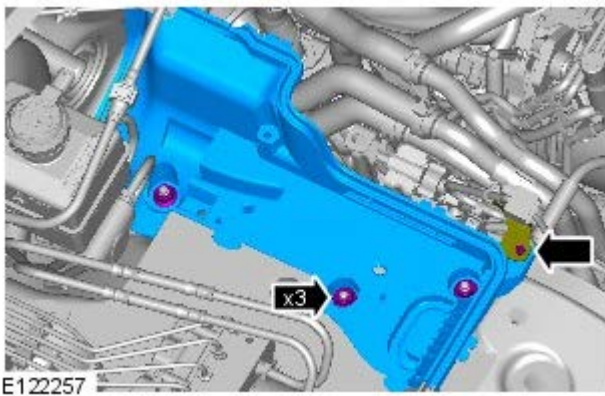


All vehicles

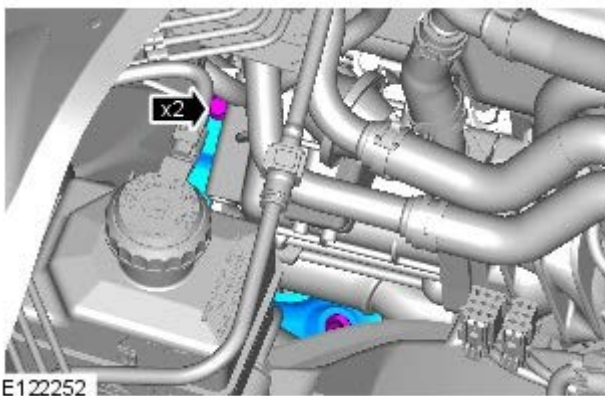
11.



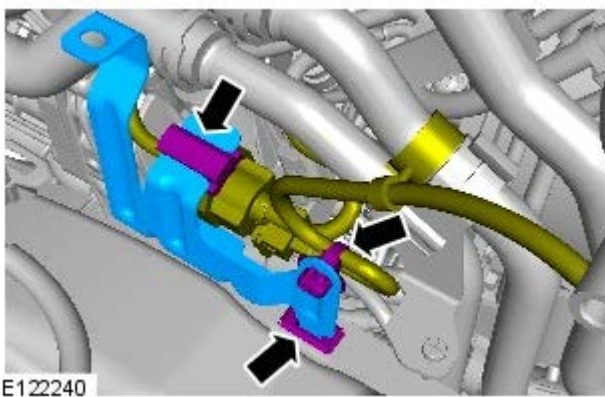
12. Torque: 12 Nm



13. Torque: 9 Nm



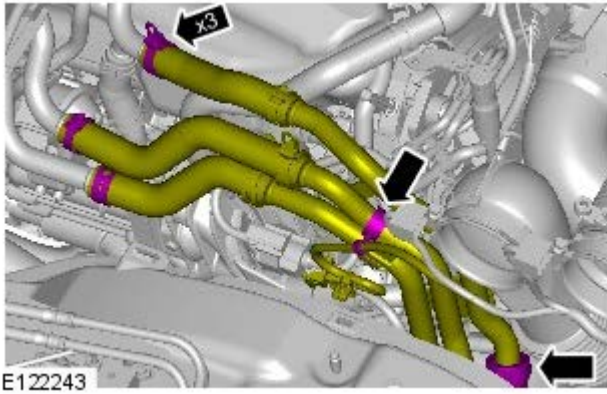
14.



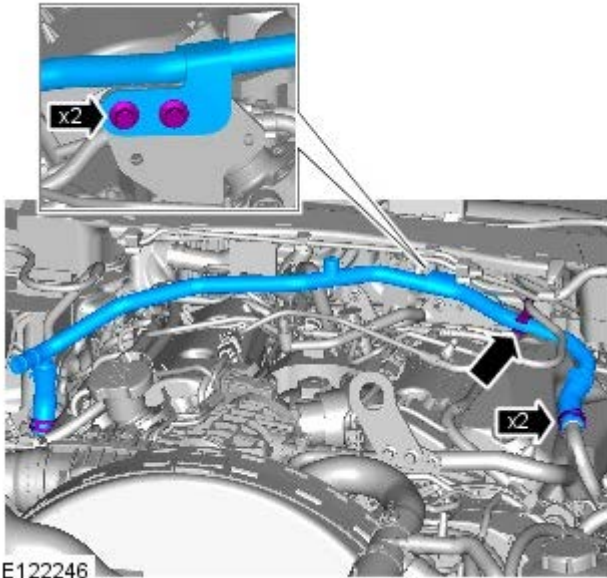
15. CAUTIONS:

 Be prepared to collect escaping fluids.


 Make sure that all openings are sealed.



E122243




E122246

16.  CAUTION: Make sure that all openings are sealed.

Torque: 10 Nm

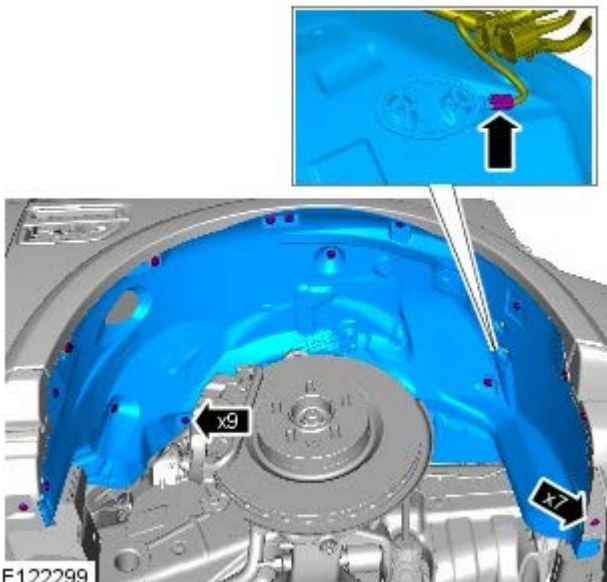
17. Refer to: Exhaust Gas Recirculation (EGR) Valve Outlet Tube RH (303-08 Engine Emission Control - 3.0L V6 - TdV6, Removal and Installation).

18.  WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

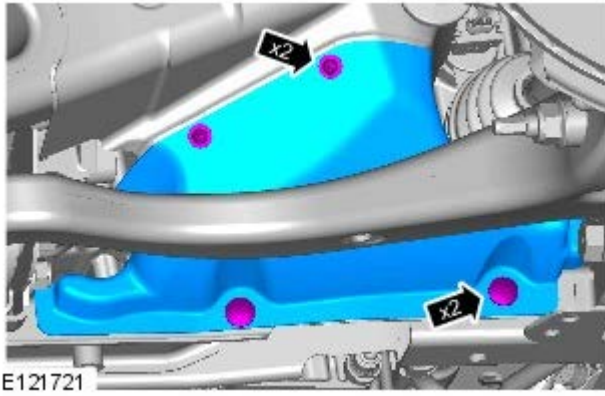
19. Remove the RH front wheel and tire.

20.

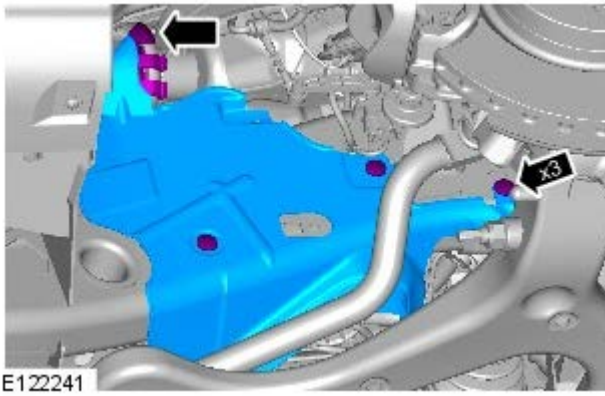


E122299

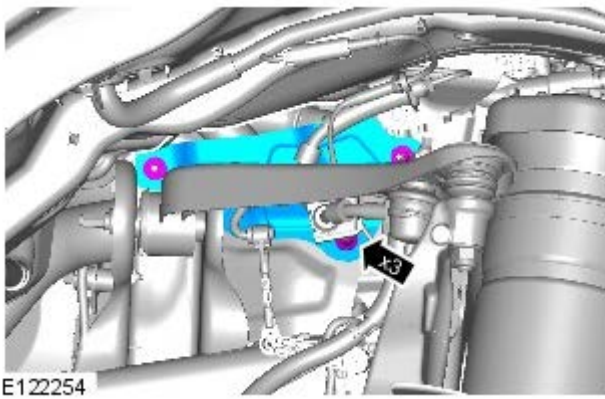
21.



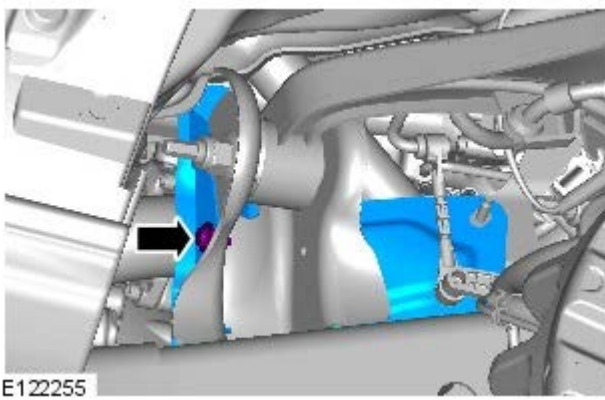
22.



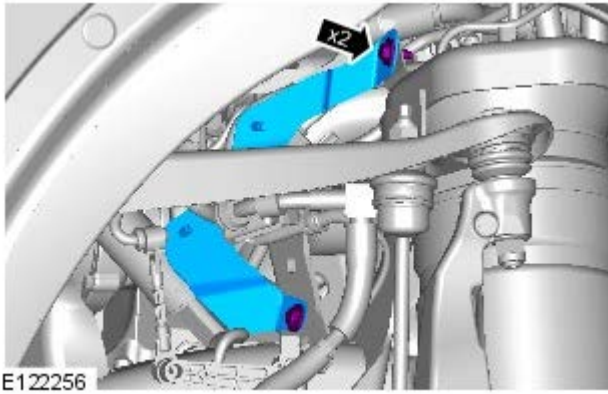
23. Torque: 9 Nm



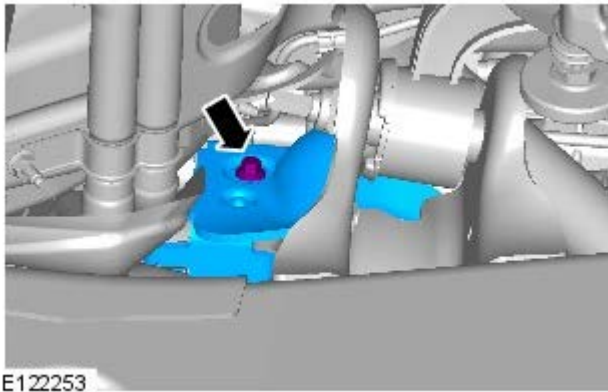
24. Torque: 9 Nm



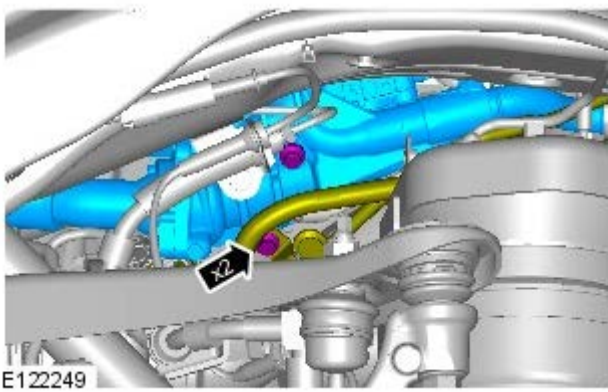
25. Torque: 9 Nm



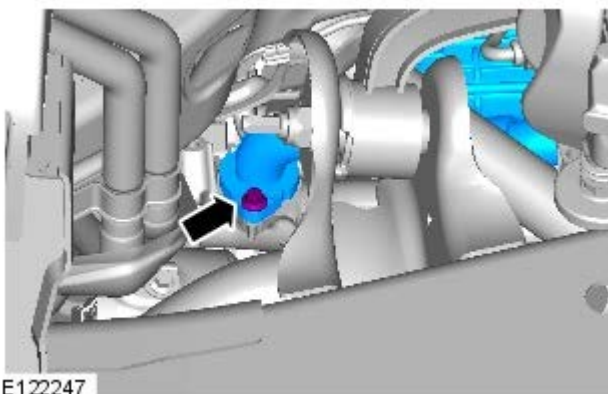
26. Torque: 9 Nm



27. Torque: 10 Nm



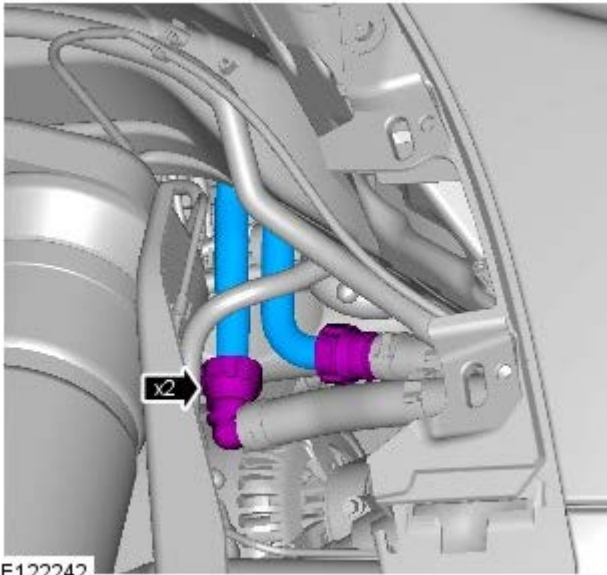
28. Torque: 10 Nm



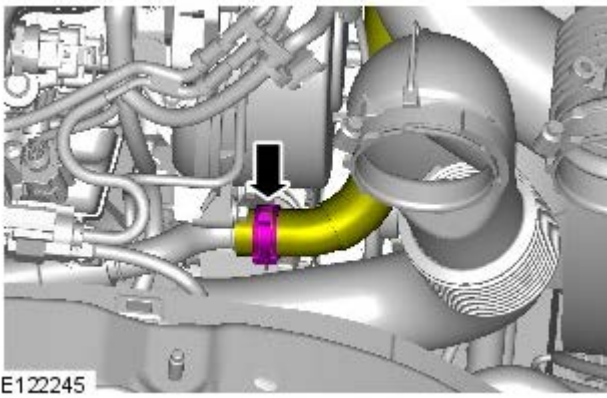
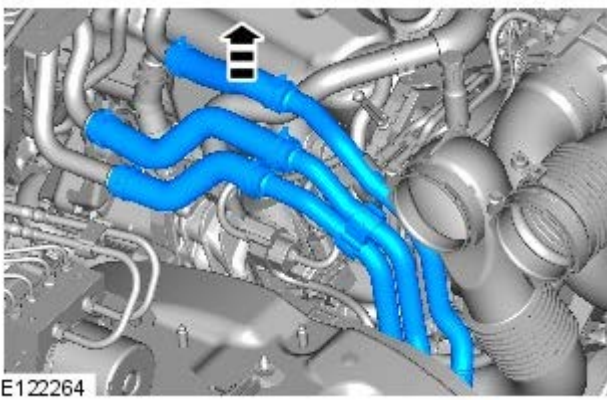
29. CAUTIONS:

 Be prepared to collect escaping fluids.

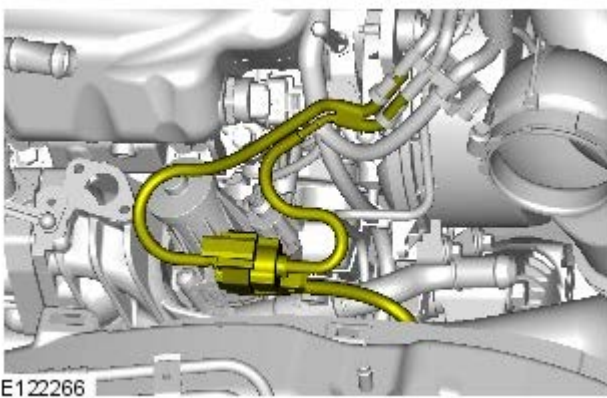
 Make sure that all openings are sealed.



30.

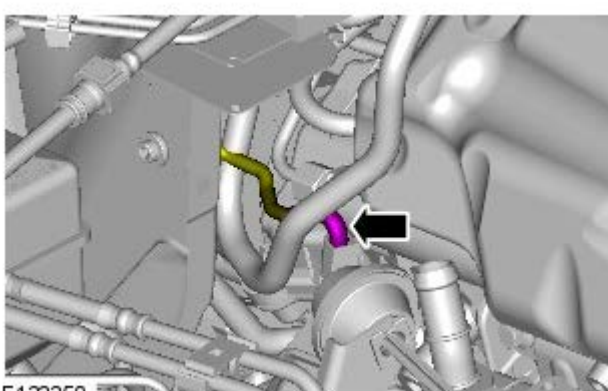
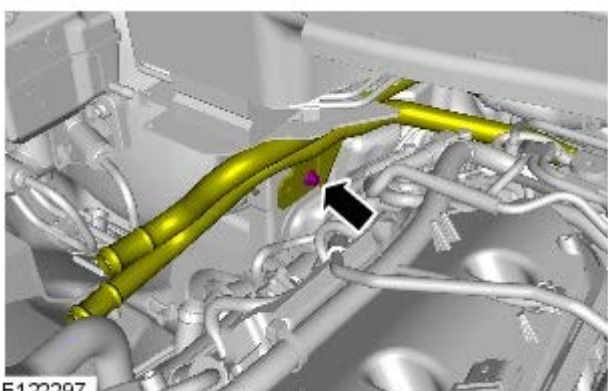
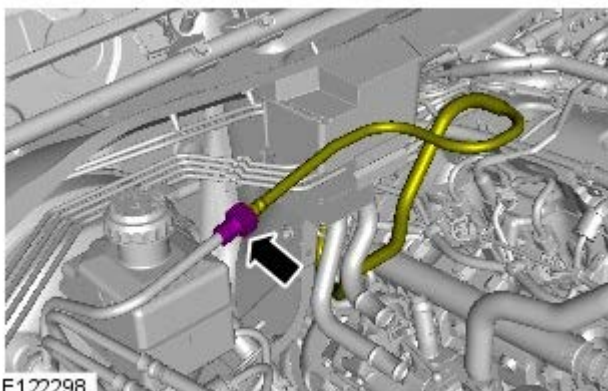
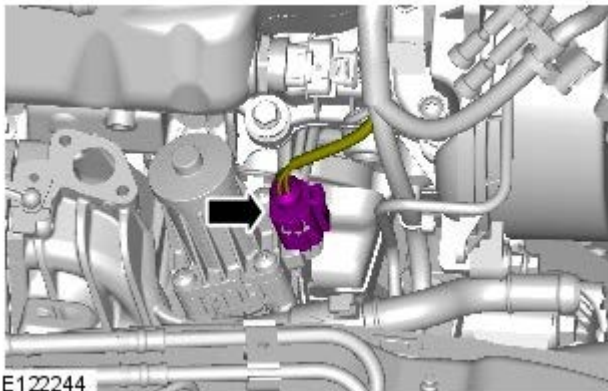


31.  CAUTION: Make sure that all openings are sealed.



32.


33.



34.  CAUTION: Make sure that all openings are sealed.

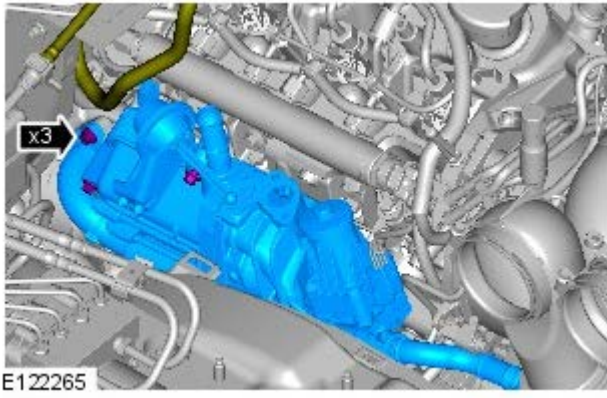
35. Torque: 10 Nm

36.

37.  CAUTION: Make sure that all openings are sealed.

 NOTE: Install a new gasket.

Torque: 10 Nm



Installation

1. To install, reverse the removal procedure.
2. If a new unit is installed, configure using the approved diagnostic tool.

Engine Emission Control - TDV6 3.0L Diesel - Exhaust Gas Recirculation (EGR) Valve Outlet Tube LH

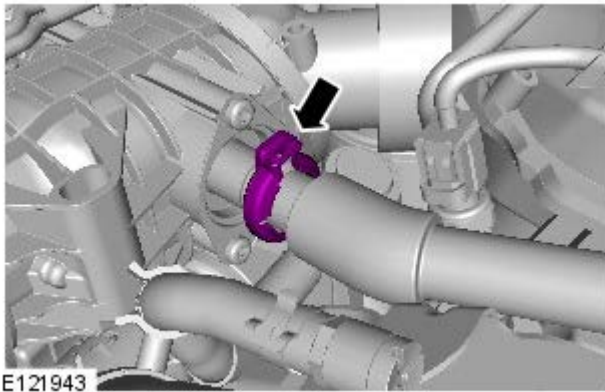
Removal and Installation

Removal

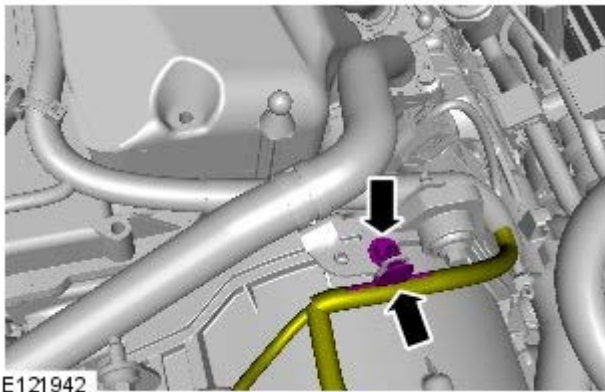


NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

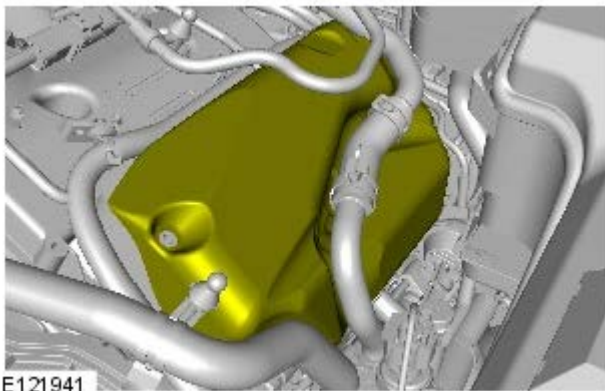
1. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).




2.  NOTE: Discard the retaining clips.



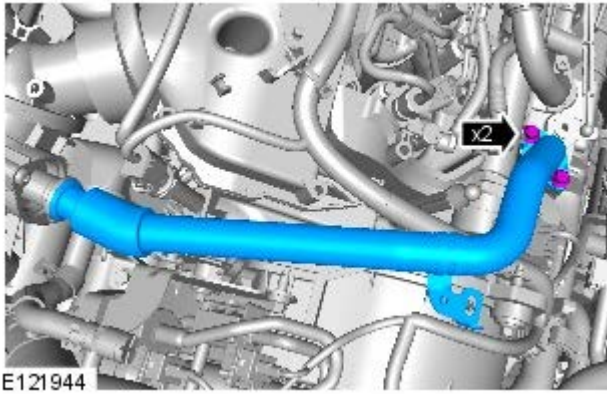
- 3.



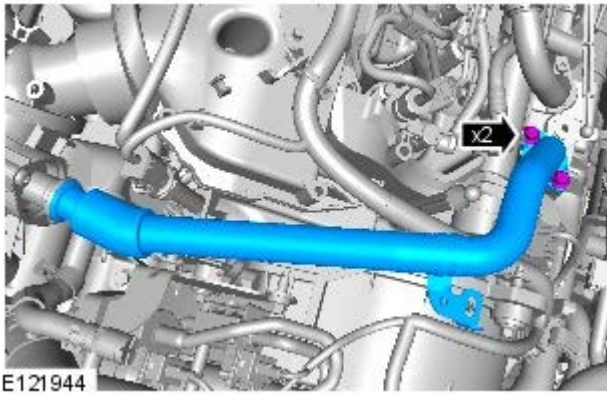
- 4.


5.  CAUTION: Make sure that all openings are sealed.

 NOTE: Discard the gasket.

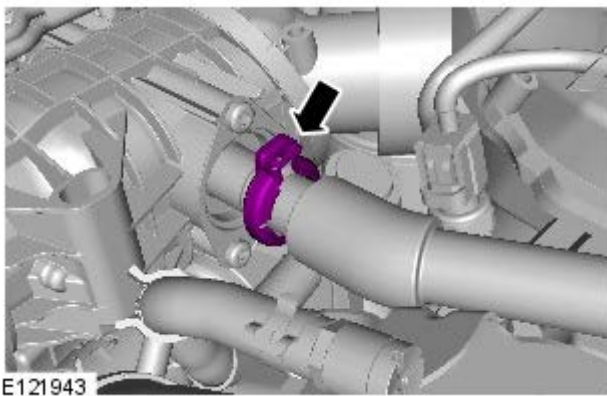



Installation

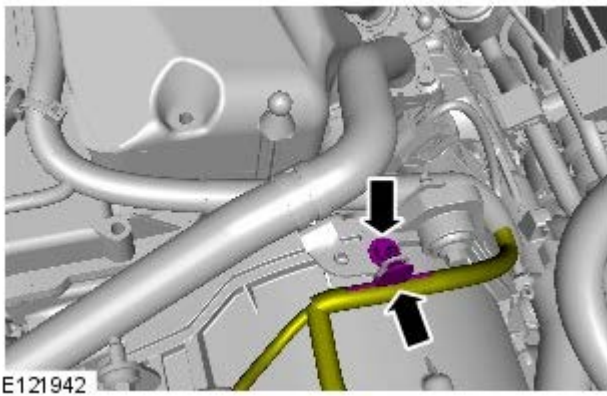


1.  CAUTION: Only tighten the bolts finger-tight at this stage.

 NOTE: Install a new gasket.

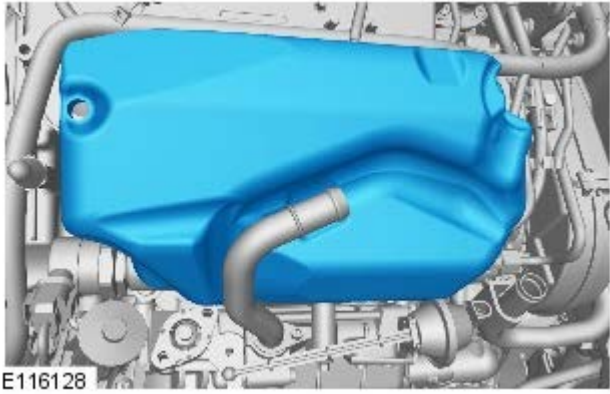
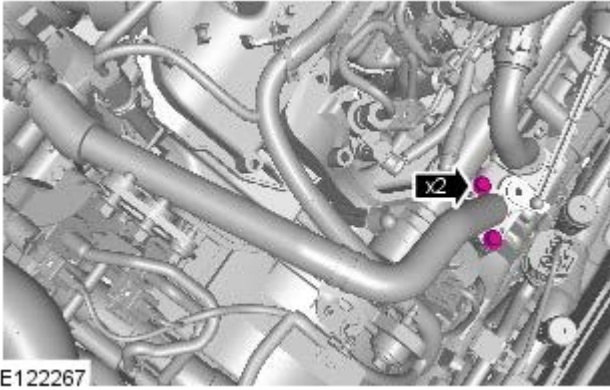


2.  CAUTION: Install a new clamp. Close the clamp to the first audible click by hand. Making sure that the clamp is in a central position to the joint, close to the second audible click using a suitable tool.



3. Torque: 5 Nm

4. Torque: 10 Nm



5.

6. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).

Engine Emission Control - TDV6 3.0L Diesel - Exhaust Gas Recirculation (EGR) Valve Outlet Tube RH

Removal and Installation

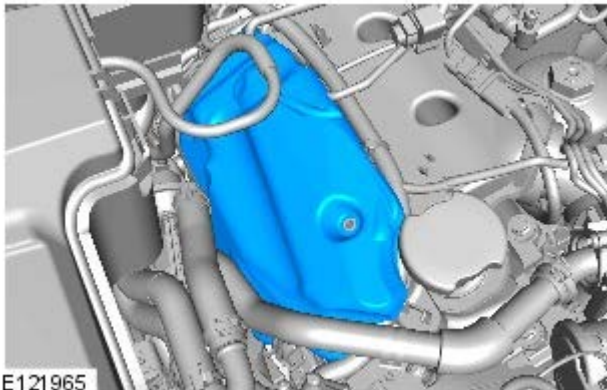
Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

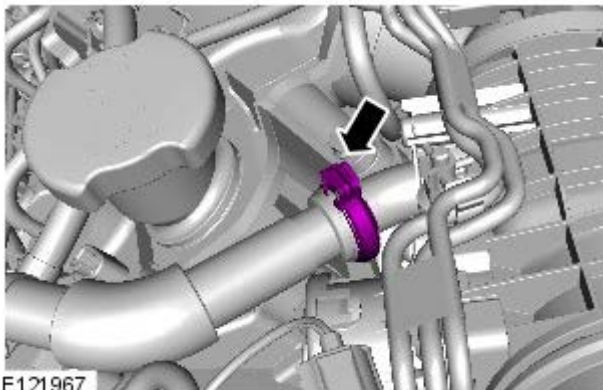
1. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).

2.



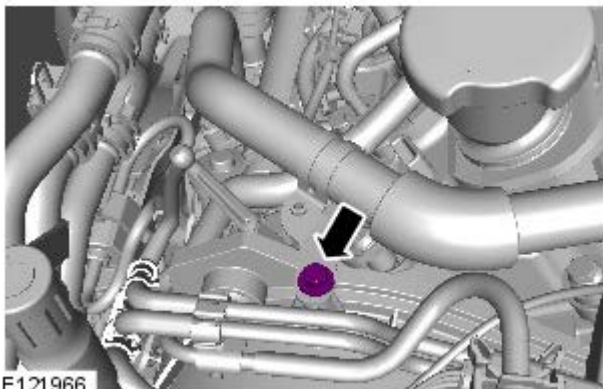
E121965

3.  NOTE: Discard the retaining clips.




E121967

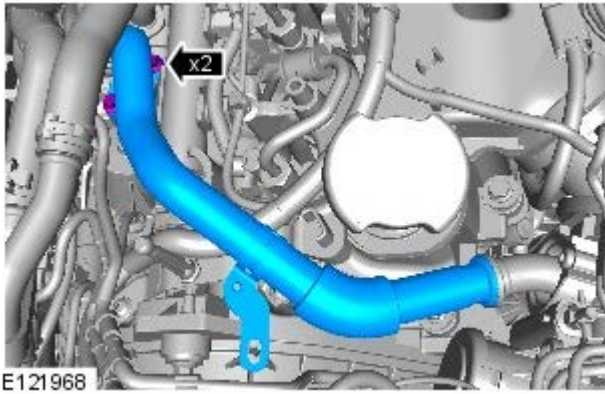
4.



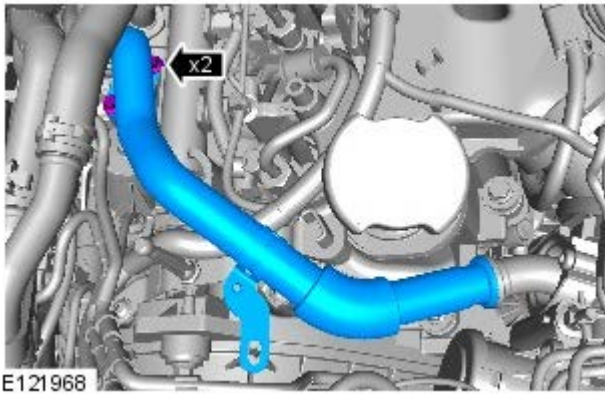
E121966


5.  CAUTION: Make sure that all openings are sealed.

 NOTE: Discard the gasket.

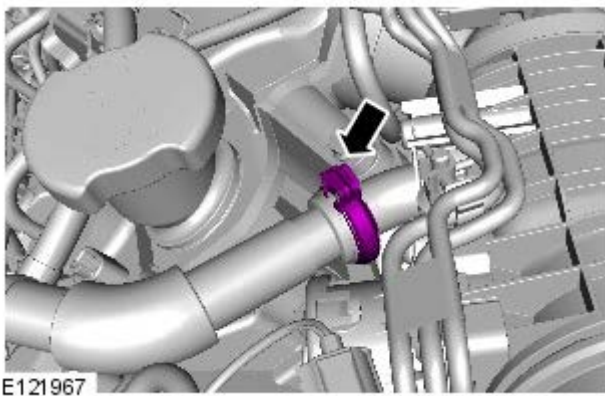



Installation

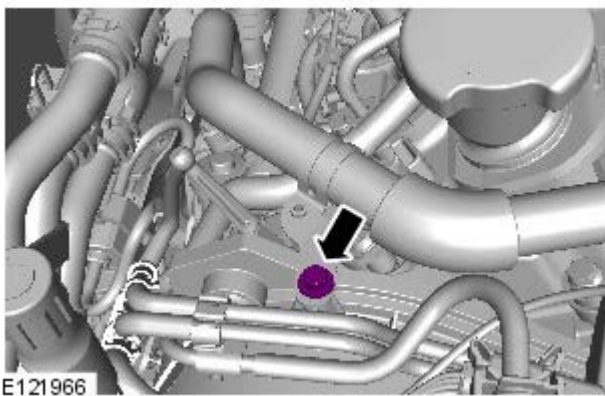


1.  CAUTION: Only tighten the bolts finger-tight at this stage.

 NOTE: Install a new gasket.

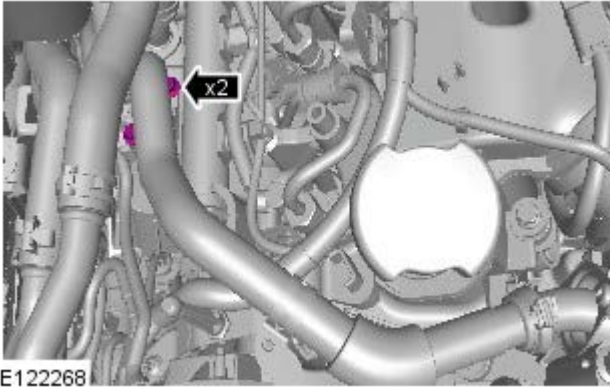


2.  CAUTION: Install a new clamp. Close the clamp to the first audible click by hand. Making sure that the clamp is in a central position to the joint, close to the second audible click using a suitable tool.



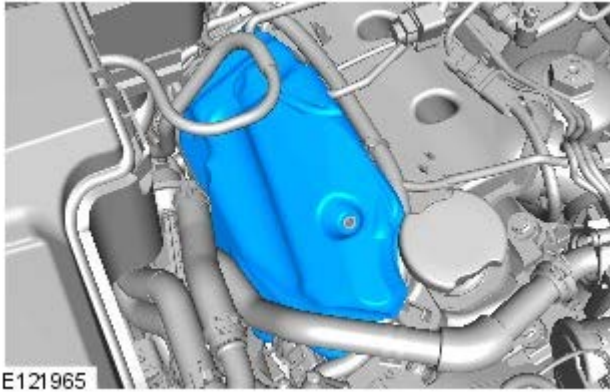
3. Torque: 5 Nm

4. Torque: 10 Nm



E122268

5.



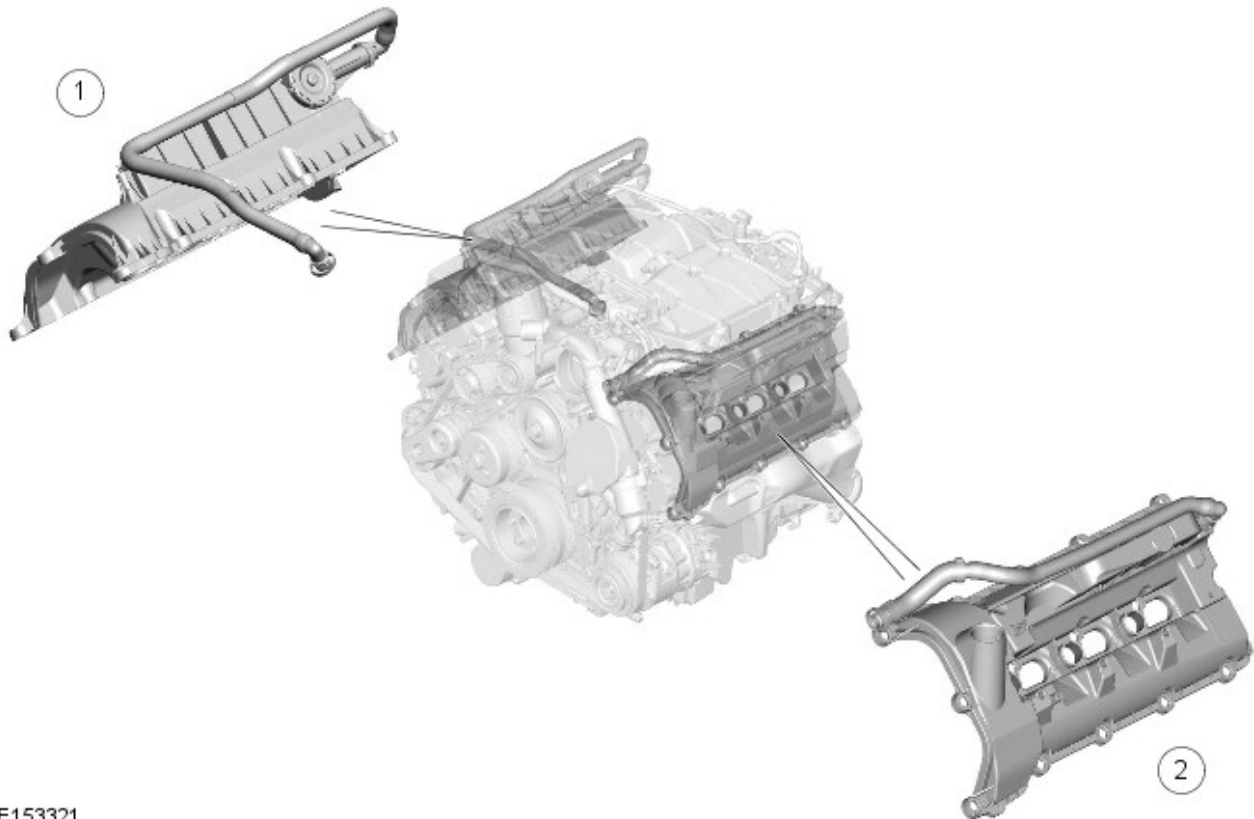
E121965

6. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).

Engine Emission Control - V6 S/C 3.0L Petrol - Engine Emission Control

Description and Operation

COMPONENT LOCATION



E153321

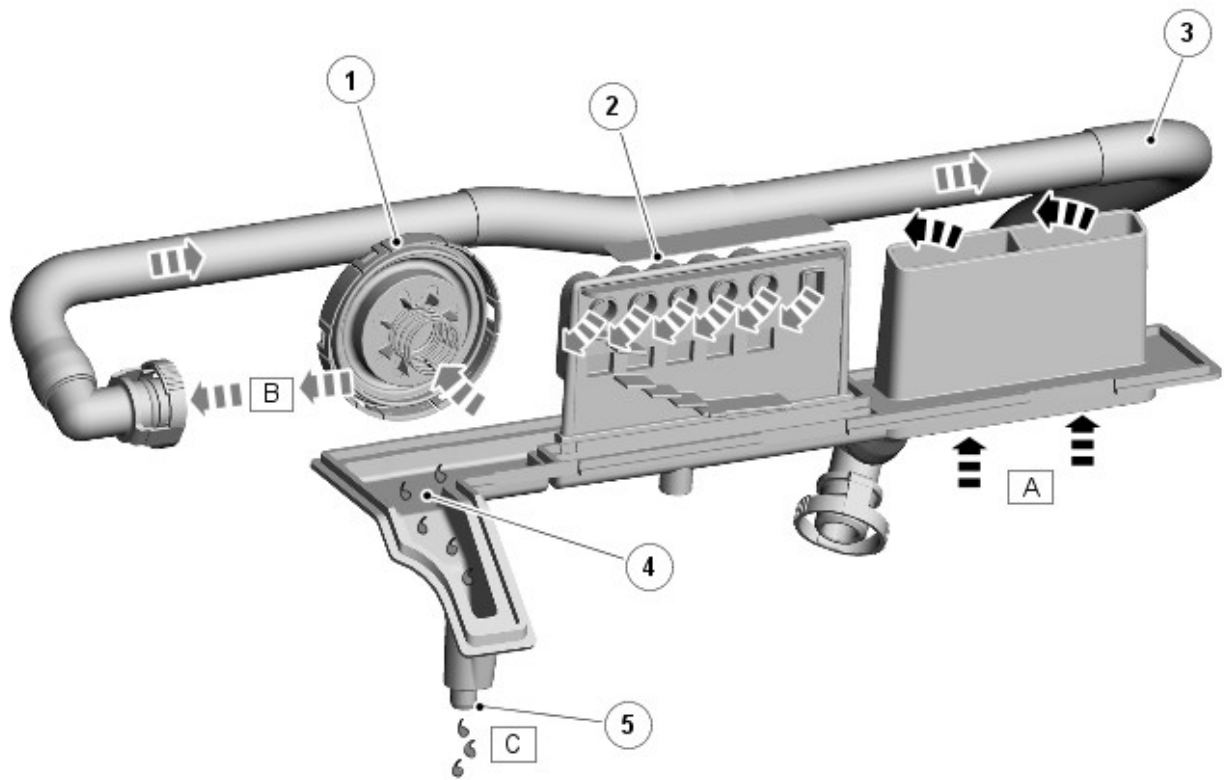
Item	Part Number	Description
1	-	Part load breather
2	-	Full load breather

OVERVIEW

The engine emission control system reduces the level of hydrocarbon emissions released to atmosphere from the engine. The engine emission control system consists of a **PCV (positive crankcase ventilation)** system with part and full load breathers. Piston blow-by gases and metered fresh air are drawn through the breathers into the engine air intake and added to the air charge. The resultant depression in the engine sump, front covers and cylinder head covers reduces the load on the joint seals in those areas.

DESCRIPTION

Part Load Breather



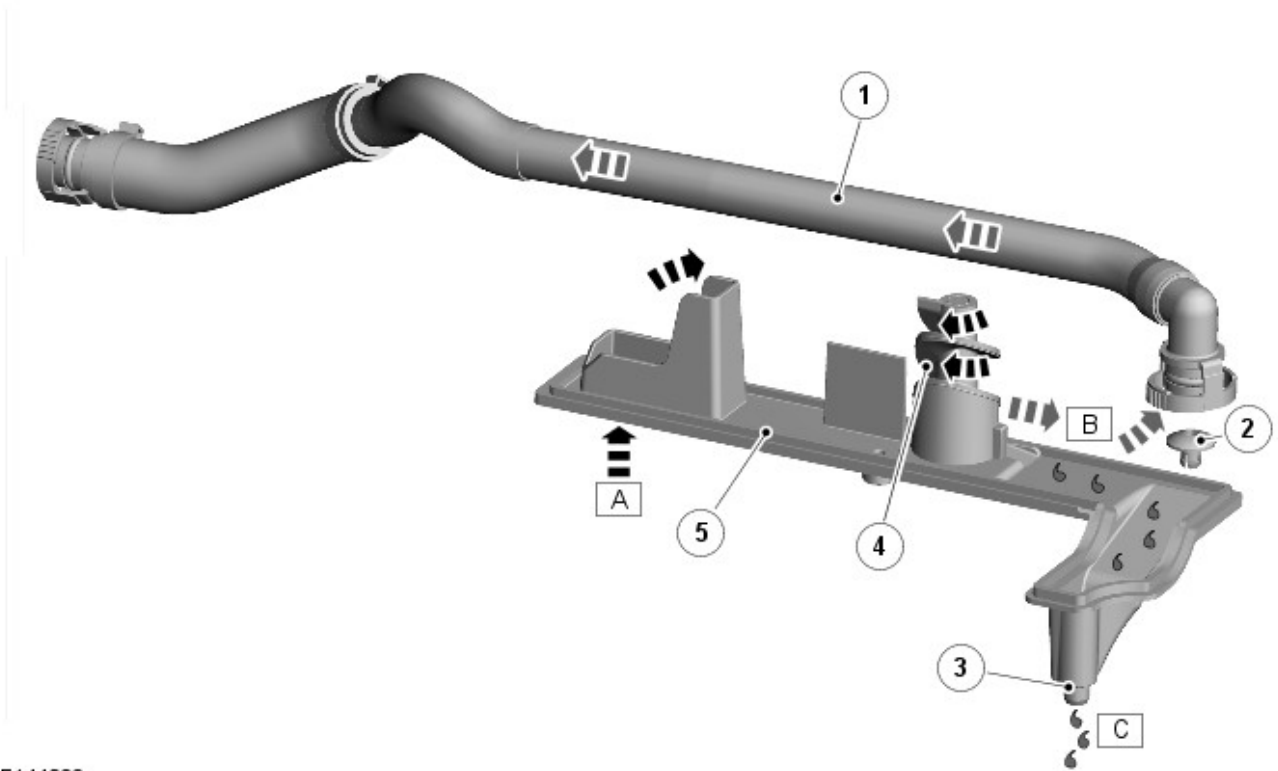
E144022

Item	Part Number	Description
A	-	Gas/Oil vapor
B	-	Gas vapor
C	-	Oil
1	-	Positive Crankcase Ventilation (PCV) valve
2	-	Oil separator
3	-	Flexible hose
4	-	Baffle plate
5	-	Oil drain

The part load breather consists of an oil separator, a [PCV](#) valve and a flexible hose. The oil separator and the PCV valve are installed in the top of the right camshaft cover. The flexible hose connects the right camshaft cover to the inlet of the supercharger.

The oil separator is installed in a channel in the top of the camshaft cover. A baffle plate, which incorporates a gas inlet and an oil drain, is installed over the channel. The PCV valve is installed on the outside of the camshaft cover and connected to the gas outlet from the channel to the flexible hose. The PCV valve regulates the crankcase pressure and crank case flow to optimize engine performance.

Full Load Breather



E144023

Item	Part Number	Description
A	-	Gas/Oil vapor
B	-	Gas vapor
C	-	Oil
1	-	Flexible hose
2	-	Two-way valve
3	-	Oil drain
4	-	Oil separator
5	-	Baffle plate

The full load breather consists of an oil separator, a two-way valve and a flexible hose. The oil separator and the two-way valve are installed in the top of the left camshaft cover. The flexible hose connects the left camshaft cover to the left air duct of the intake air distribution and filtering system.

The oil separator is installed in a channel in the top of the camshaft cover. A baffle plate, which incorporates a gas inlet and an oil drain, is installed over the channel. The two-way valve is installed in the gas outlet from the channel. The two-way valve regulates fresh air flow and improves idle stability.

Engine Emission Control - V6 S/C 3.0L Petrol - Engine Emission Control

Diagnosis and Testing

Principles of Operation

For a detailed description of the engine emission control system and operation, refer to the relevant Description and Operation section in the workshop manual.

REFER to: [Engine Emission Control](#) (303-08B Engine Emission Control - V6 S/C 3.0L Petrol, Description and Operation) /

Engine Emission Control (303-08C, Description and Operation) /

Engine Emission Control (303-08C, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Breather hoses • Positive crankcase ventilation valve(s) • Fuel level • Fuel contamination/grade/quality • Throttle body 	<ul style="list-style-type: none"> • Fuse(s) • Loose or corroded electrical connectors • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported condition is found, correct the cause (if possible) before proceeding to the symptom chart.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Difficult to start cold	<ul style="list-style-type: none"> • Battery • Crankshaft Position (CKP) sensor • Fuel system • Evaporative emissions purge valve 	For battery information, CKP sensor tests, fuel system and purge valve tests, refer to relevant workshop manual section. Refer to the guided diagnostic routine on the approved diagnostic system.
Engine stalls soon after start	<ul style="list-style-type: none"> • Breather system disconnected/restricted • Engine Control Module (ECM) relay • MAF sensor • Ignition system • Air filter restricted • Air leakage • Fuel lines 	Check the engine breather hoses, PCV. Check the Engine Control Module (ECM) relay operation. For MAF sensor, ignition system tests, air intake information and fuel line information, refer to relevant workshop manual section.
Poor throttle response	<ul style="list-style-type: none"> • ECT sensor • MAF sensor • Transmission malfunction • Traction control event • Air leakage • Breather system disconnected/restricted 	For ECT, MAF sensor tests, intake system checks and transmission information, refer to relevant workshop manual section. Check the breather system hoses, PCV.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: V6 3.0L S/C Petrol, DTC: Engine Control Module \(ECM\)](#)

(100-00 General Information, Description and Operation).

Intake Air Distribution and Filtering - TDV6 3.0L Diesel -

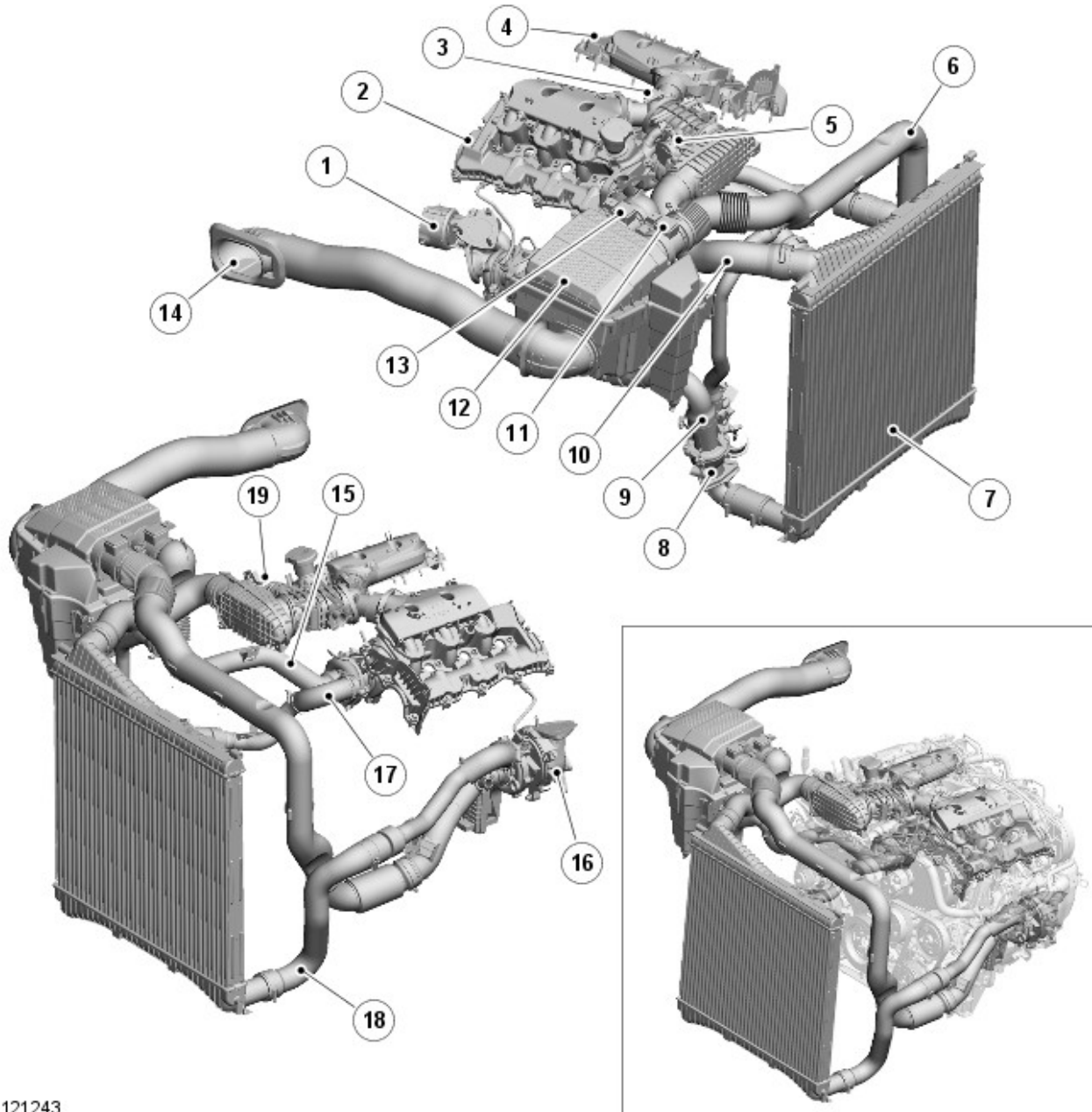
Torque Specification

Description	Nm	lb-ft	lb-in
Air cleaner outlet pipe circlip	3.5	-	31
Charge air cooler to radiator bolts	15	11	-

Intake Air Distribution and Filtering - TDV6 3.0L Diesel - Intake Air Distribution and Filtering - Component Location

Description and Operation

Component Location



E121243

Item Description

- 1 Secondary turbocharger
- 2 RH (right-hand) intake manifold
- 3 Charge air MAPT (manifold absolute pressure and temperature) sensor
- 4 LH (left-hand) intake manifold
- 5 Intake manifold throttle actuator
- 6 Intake air to primary turbocharger pipe
- 7 Charge air cooler
- 8 Compressor shut-off and recirculation valve assembly
- 9 Pipe - Compressed air from secondary turbocharger to charge air cooler
- 10 Charge air cooler to throttle intake manifold pipe
- 11 MAF (mass air flow) / IAT (intake air temperature) sensor (primary turbocharger)
- 12 Air cleaner housing
- 13 MAF sensor (secondary turbocharger)
- 14 Air intake
- 15 Intake air to secondary turbocharger pipe

- 16 Primary turbocharger
- 17 Pipe - Compressed air from secondary turbocharger to charge air cooler
- 18 Pipe - Compressed air from primary turbocharger to charge air cooler
- 19 Charge air temperature sensor

Intake Air Distribution and Filtering - TDV6 3.0L Diesel - Intake Air Distribution and Filtering - Overview

Description and Operation

Authoring Template

OVERVIEW

The intake air distribution and filtering system comprises:

- Two [MAF \(mass air flow\)](#) / [IAT \(intake air temperature\)](#) sensor
- Charge air temperature sensors
- Air cleaner and housing
- Charge air cooler
- Primary and secondary turbochargers.

The system cleans, cools and compresses the intake air. The turbochargers compress the air which is then cooled in the charge air cooler before being mixed with the injected fuel in the cylinder producing a high energy combustion increasing engine performance.

Intake Air Distribution and Filtering - TDV6 3.0L Diesel - Intake Air Distribution and Filtering - System Operation and Component Description

Description and Operation

System Operation

OPERATION

Air is drawn into the air intake system via the air intake vent located on the front **RH (right-hand)** fender of the vehicle. The air passes into the air cleaner housing and passes through the air cleaner. The air cleaner is a pleated, paper type filter which removes dust, pollen etc. from the intake air.

The filtered clean air passes from the air cleaner housing to the turbocharger inlet valve assembly. Depending on engine load and operating conditions, the intake air can be passed to only the primary turbocharger or to both the primary and secondary turbochargers.

Exhaust gasses leaving the exhaust manifolds are used to drive a turbine in the turbocharger which in turn drives a compressor. The rotational speed of the compressor is directly related to the speed of the exhaust gasses leaving the engine. Increased exhaust gas emission drives the turbine, and subsequently the compressor, faster, further compressing the intake air delivered to the engine.

The compression of the air by the turbocharger increases the air pressure. The intake air is passed into the charge air cooler which reduces the air temperature as it passes through the cooler. This in turn increases the volumetric efficiency by increasing intake air charge density. The cooled and compressed air is mixed with the injected fuel in the cylinder producing a high energy combustion increasing engine performance.

Component Description

DESCRIPTION

Air Cleaner and Housing

The air cleaner housing is located in the front **RH** side of the engine compartment. The housing has a water drain. Two **NVH (noise, vibration and harshness)** mounting grommets secure the air cleaner housing.

The air cleaner element is a pleated paper type element with a rubber seal around its perimeter. The seal locates in a groove in the housing and prevents air by-passing the element. The housing upper lid can be removed by removing 4 screws to release the lid.

Charge Air Cooler

The charge air cooler is located at the front of the engine compartment, between the **A/C (air conditioning)** condenser and the engine cooling radiator.

Turbochargers are designed to force more air mass into the engine intake manifold and combustion chambers. This compression process by the turbocharger produces heat which can reduce the performance gains of turbocharging due to reduced density of the intake air and an increase the cylinder combustion temperature. To counteract this, the charge air cooler is used to reduce the intake air temperature which increases the density of the air allowing more air molecules to be delivered to the combustion chamber.

The cooler is a cross flow type cooler and has inlet and outlet connections. The bottom **LH (left-hand)** and **RH** connections are the inlets for the compressed air delivered from the turbocharger compressors. The top **RH** connection is the outlet for the cooled compressed air to be delivered to the throttle intake manifold.

The charge air cooler is an air-to-air type cooler. Heated air from the turbochargers is passed through tubes in the cooler. Ambient air passing over the tubes cools the intake air as it passes through the cooler.

Air Intake Components

The air intake components comprise 3 main components; airbox, intake ducting and a throttle intake manifold.

Airbox

The airbox allows for the connection of the cooled intake air from the charge air cooler to the throttle intake manifold. The air cleaner housing houses a **MAF (mass air flow)** sensor incorporating a temperature sensor which measures the air entering the turbochargers and passes this information to the **ECM (engine control module)**. Refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.0L Diesel, Description and Operation).

There are two ducts from the airbox, one ducts air to the primary turbocharger and the other to the secondary turbocharger. Boost pressure is applied via the secondary ducting to the secondary turbocharger to maintain the correct lubrication during driving conditions where the secondary turbocharger is inactive.

Refer to: Turbocharger (303-04 Fuel Charging and Controls - Turbocharger - 3.0L Diesel, Description and Operation).

Throttle Intake Manifold

The throttle intake manifold is located between the 2 intake manifolds and the airbox. The manifold splits the air entering the engine between the 2 intake manifolds.

The throttle intake manifold houses a [DC \(direct current\)](#) electric throttle actuator which controls a flap in the body of the manifold. The flap is controlled by the [ECM](#) and is constantly adjusted in response to driver inputs via the throttle pedal to precisely control the amount of air allowed into the intake manifolds.
Refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.0L Diesel, Description and Operation).

Pipe connections on either side of the throttle intake manifold allow for the attachment of the exhaust gas outlet pipes from the [EGR \(exhaust gas recirculation\)](#) valves. The ends of the [EGR](#) pipes are specially designed to mix the recirculated exhaust gas with the intake air and provide an even distribution to each side of the engine.
Refer to: Engine Emission Control (303-08 Engine Emission Control - 3.0L Diesel, Description and Operation).

A boost pressure sensor is located on the top of the manifold where the air flow splits for the 2 intake manifolds. The pressure sensor measures the pressure of the intake air as delivered from the one or both of the turbochargers and passes this information to the [ECM](#) for turbocharger control.
Refer to: Electronic Engine Controls (303-14 Electronic Engine Controls - 3.0L Diesel, Description and Operation).

Intake Manifolds

The intake manifolds are an integral part of the cylinder head covers. Each intake manifold is connected to the throttle intake manifold via a push fit, sealed connection. The intake manifolds direct intake air to the inlet valves for each combustion chamber.

Intake Air Distribution and Filtering - TDV6 3.0L Diesel - Intake Air Distribution and Filtering

Diagnosis and Testing

Principles of Operation

For a detailed description of the intake air distribution and filtering system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (303-12 Intake Air Distribution and Filtering - TDV6 3.0L Diesel)

Intake Air Distribution and Filtering (Description and Operation),
Intake Air Distribution and Filtering (Description and Operation),
Intake Air Distribution and Filtering (Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Hoses and ducts condition and installation • Air filter condition and installation • Restricted air intake • Vacuum hoses condition and installation • Pipework to turbocharger condition and installation • Turbocharger condition and installation • Charge air coolers 	<ul style="list-style-type: none"> • Fuse(s) • Wiring harness • Loose or corroded electrical connector(s) • Mass Air Flow (MAF) sensor • Air Charge Temperature (ACT) sensor • Manifold absolute pressure (MAP) sensor • Intake Air Temperature (IAT) sensor • Intake air shut-off throttle solenoid

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Vehicle does not start/hard starting	<ul style="list-style-type: none"> • Restricted/blocked air intake • Restricted/blocked air filter 	<ul style="list-style-type: none"> • Clear the restriction • Install a new air filter as necessary
Poor performance	<ul style="list-style-type: none"> • Turbocharger fault • Throttle body fault • Charge air cooler hoses 	<ul style="list-style-type: none"> • Inspect the turbochargers • Test the intake air shutoff throttle function (make sure the throttle body returns to the open position) • Inspect the charge air cooler hoses
Excessive intake noise	<ul style="list-style-type: none"> • Intake air leak after the turbocharger • Intake pipe disconnected/damaged after the air cleaner • Air cleaner assembly incorrectly assembled/damaged 	<ul style="list-style-type: none"> • Inspect the joint between the air intake elbow and the intake air shutoff throttle. Inspect the joints between the throttle body outlets and the intake manifolds. Inspect the charge air cooler seals • Check the intake system and hoses for correct installation/damage • Check the air cleaner assembly for correct installation/damage

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.
REFER to: Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (PCM) (100-00, Description and Operation).

Intake Air Distribution and Filtering - TDV6 3.0L Diesel - Air Cleaner

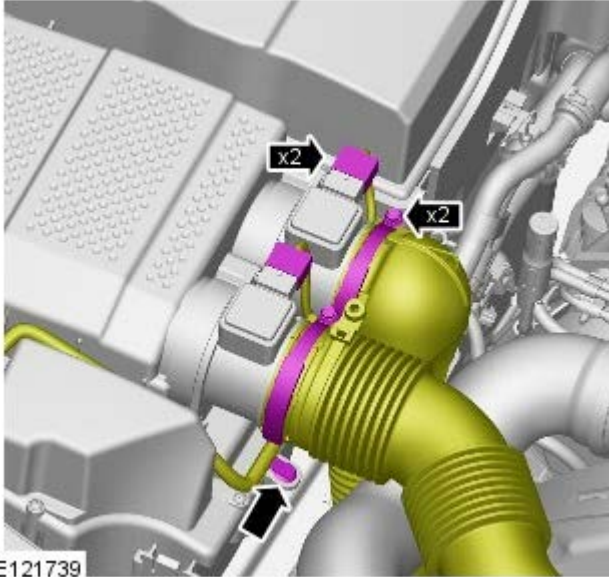
Removal and Installation

Removal

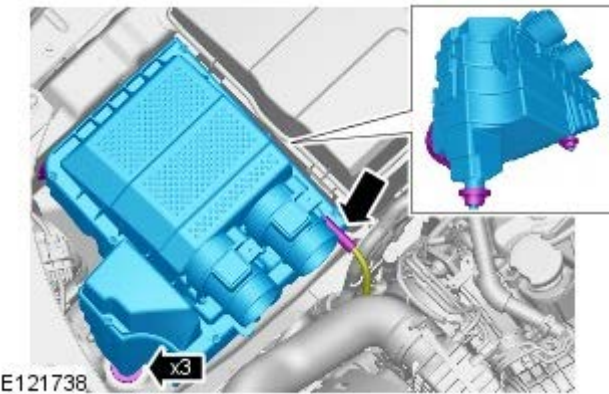


NOTE: Removal steps in this procedure may contain installation details.

1.



2.



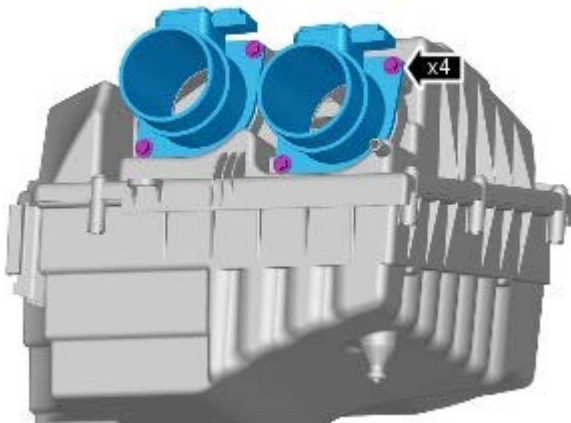
3. NOTES:



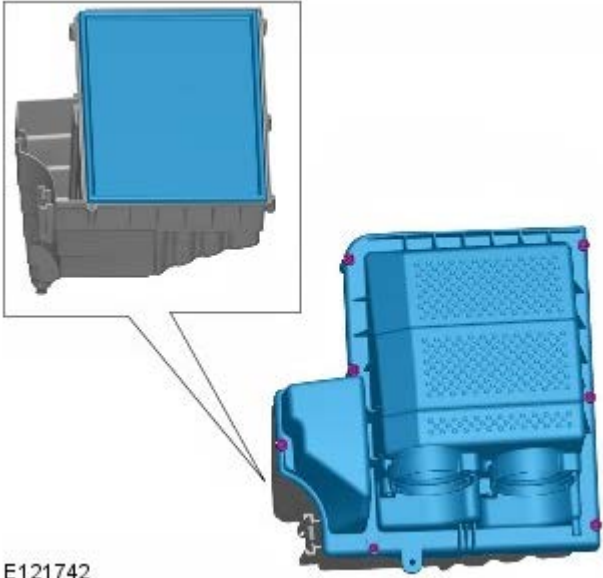
Do not disassemble further if the component is removed for access only.



Remove and discard the O-ring seals.



4.



E121742

Installation

1. To install, reverse the removal procedure.

Intake Air Distribution and Filtering - TDV6 3.0L Diesel - Air Cleaner Element

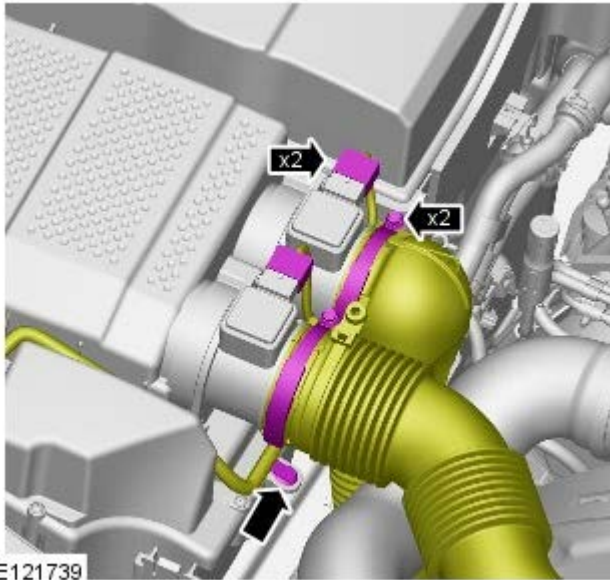
Removal and Installation

Removal

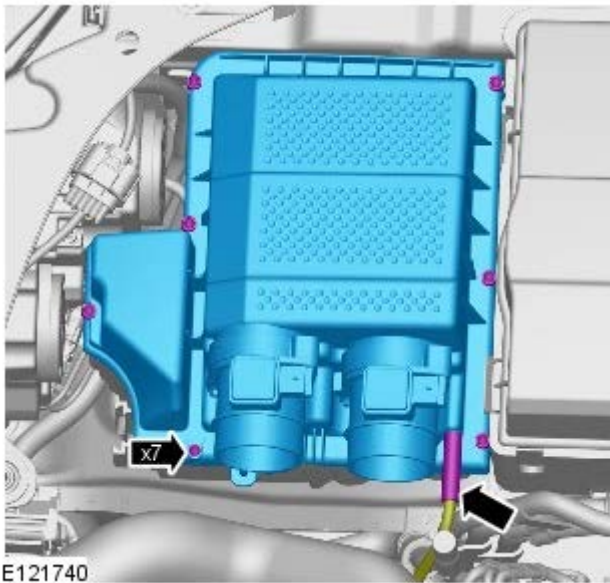


NOTE: Removal steps in this procedure may contain installation details.

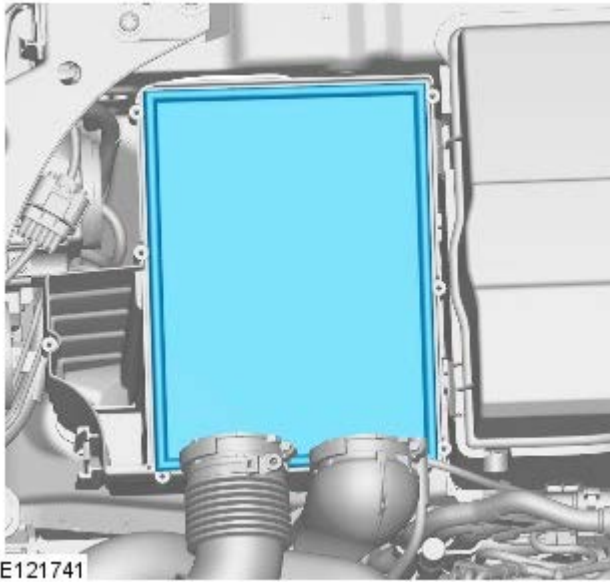
1.



2.



3.



Installation

1. To install, reverse the removal procedure.

Intake Air Distribution and Filtering - TDV6 3.0L Diesel - Charge Air Cooler

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Radiator (303-03, Removal and Installation).

Installation

1. Refer to: Radiator (303-03, Removal and Installation).

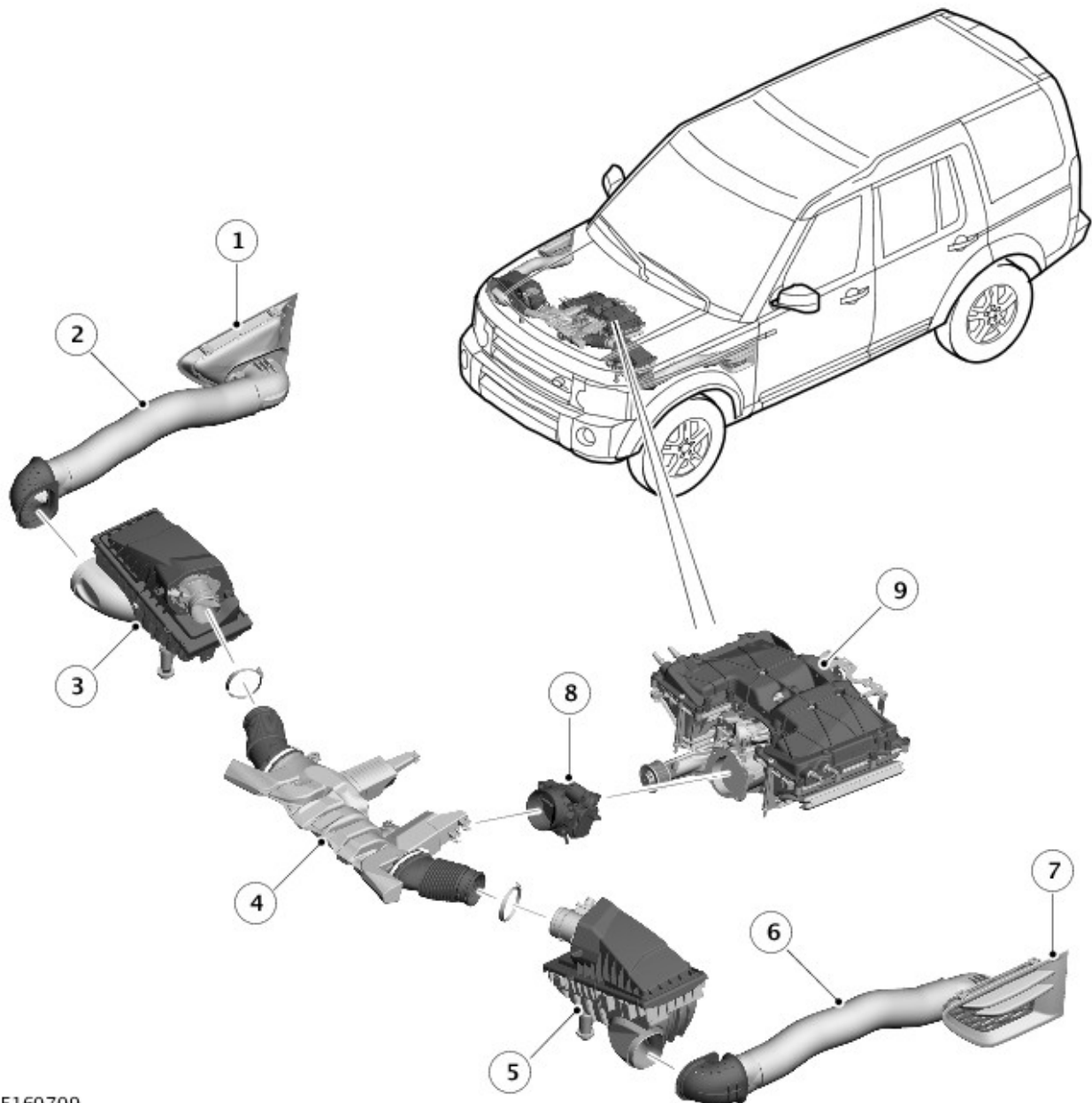
Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol -

Description	Nm	lb-ft	lb-in
Air Cleaner Outlet Pipe T-Connector bolt	10	7	-
Air Cleaner Outlet Pipe T-Connector clip	3.5	-	31
Air Cleaner Outlet clips	3.5	-	31
Supercharger retaining bolts	25	18	-
Charge air cooler lower assembly retaining bolts	25	18	-
Throttle body retaining studs	10	7	-
Charge air cooler top assembly retaining bolts	25	18	-
Manifold absolute pressure and temperature (MAPT) sensor	5	-	44
Coolant outlet pipe	11	8	-

Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol - Intake Air Distribution and Filtering

Description and Operation

COMPONENT LOCATION



E160709

Item	Part Number	Description
1	-	Right intake grilles
2	-	Right dirty air duct
3	-	Right air cleaner
4	-	Clean air ducts
5	-	Left air cleaner
6	-	Left dirty air duct
7	-	Left intake grilles
8	-	Electric throttle
9	-	Supercharger and intake manifolds

OVERVIEW

The intake air distribution and filtering system comprises:

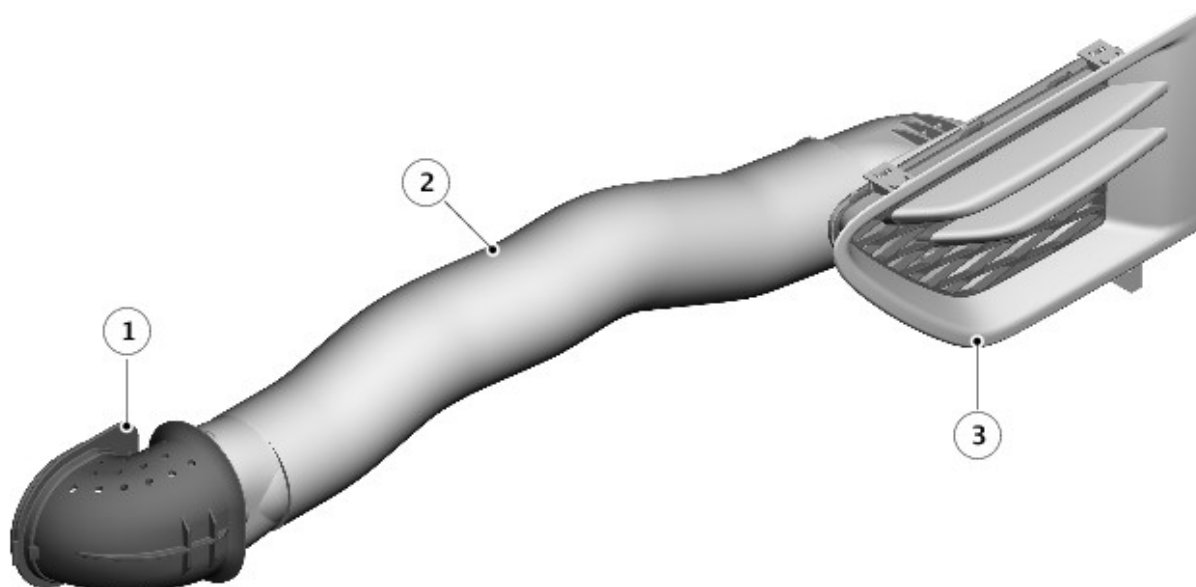
- Two dirty air ducts.
- Two air cleaners.
- Clean air ducts.

- An electric throttle.
- Supercharger and intake manifolds.

Air flows through the dirty air ducts, air cleaners, clean air ducts and electric throttle to the supercharger. The supercharger compresses the air, which is then directed through charge air coolers in the intake manifolds and into the cylinders.

DESCRIPTION

Dirty Air Ducts



E160710

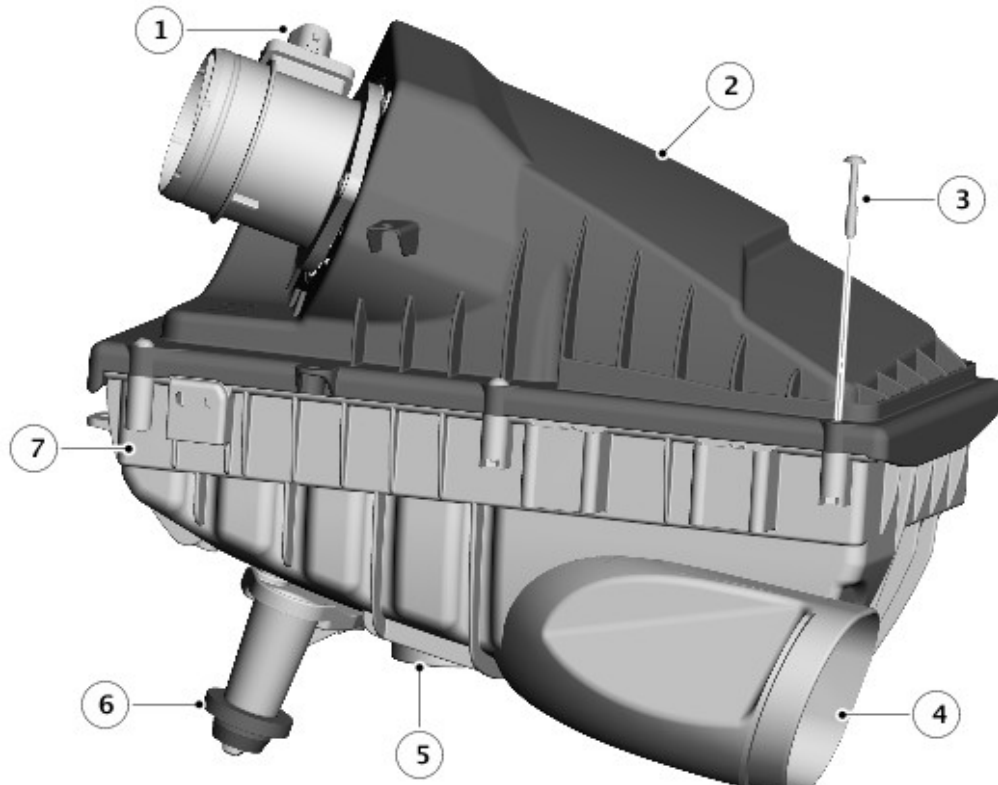
Item	Part Number	Description
1	-	Retaining bracket
2	-	Dirty air duct
3	-	Intake grille

The dirty air ducts are installed in the front fenders to transfer ambient air from under the edges of the hood to the air cleaners.

Each dirty air duct locates in the intake of the related air cleaner. The intake of each dirty air duct is attached to two intake grilles on side of each front fender.

A porous section, covered by a non-porous sleeve to prevent moisture ingress, is incorporated into each dirty air duct to reduce induction noise.

Air Cleaners



E160711

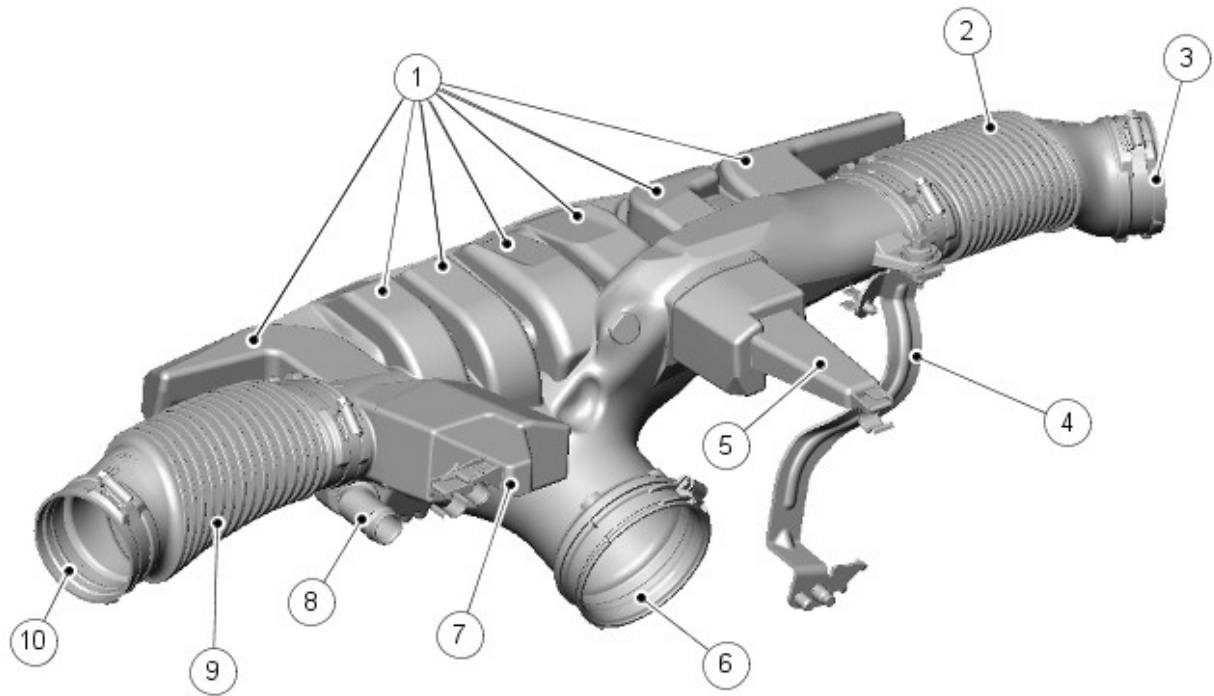
Item	Part Number	Description
1	-	Mass Air Flow and Temperature (MAFT) sensor
2	-	Lid
3	-	Screw (6 off)
4	-	Air intake
5	-	Drain valve
6	-	Isolater
7	-	Base

An air cleaner is located in each front corner of the engine compartment. Two spigots fitted with isolator bushes locate each air cleaner in holes in the related front suspension housing.

Each air cleaner consists of a filter element installed in a base and enclosed with a lid secured by six screws. The filter element is a pleated, paper type with an integral seal. Air intake and outlet connections are incorporated into the base and lid respectively. The bottom of the base incorporates a drain valve to prevent the accumulation of water in the air cleaner.

The air outlet connection of each air cleaner incorporates a [MAFT \(mass air flow and temperature\)](#) sensor. The sensors are connected to the [ECM \(engine control module\)](#). For additional information, refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 S/C 3.0L Petrol, Description and Operation).

Clean Air Ducts



E153550

Item	Part Number	Description
1	-	Resonators
2	-	Right convolute
3	-	Right air intake
4	-	Support bracket
5	-	Resonator
6	-	Air outlet
7	-	Resonator
8	-	Full load breather connector stub
9	-	Left convolute
10	-	Left air intake

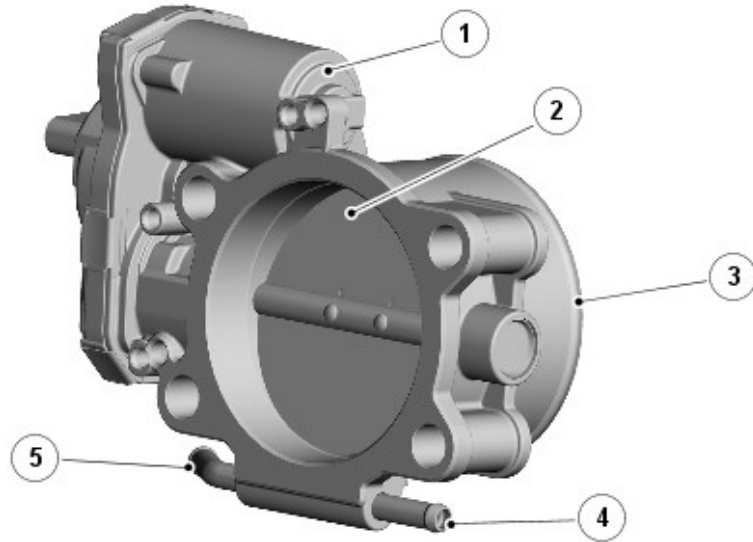
The clean air ducts transfers air from the air cleaner outlets to the electric throttle. Two convolute sections in the clean air ducts accommodate the relative movement between the engine mounted electric throttle and the body mounted air cleaners.

The clean air duct also incorporates the following:

- Resonators, to reduce air induction noise.
- A connector stub for the engine full load breather pipe.

The clean air duct is supported by a bracket attached to the right cylinder head.

Electric Throttle



E144601

Item	Part Number	Description
1	-	Electric motor
2	-	Air intake
3	-	Air outlet
4	-	Coolant supply connection
5	-	Coolant return connection

The electric throttle regulates the air flow into the supercharger.

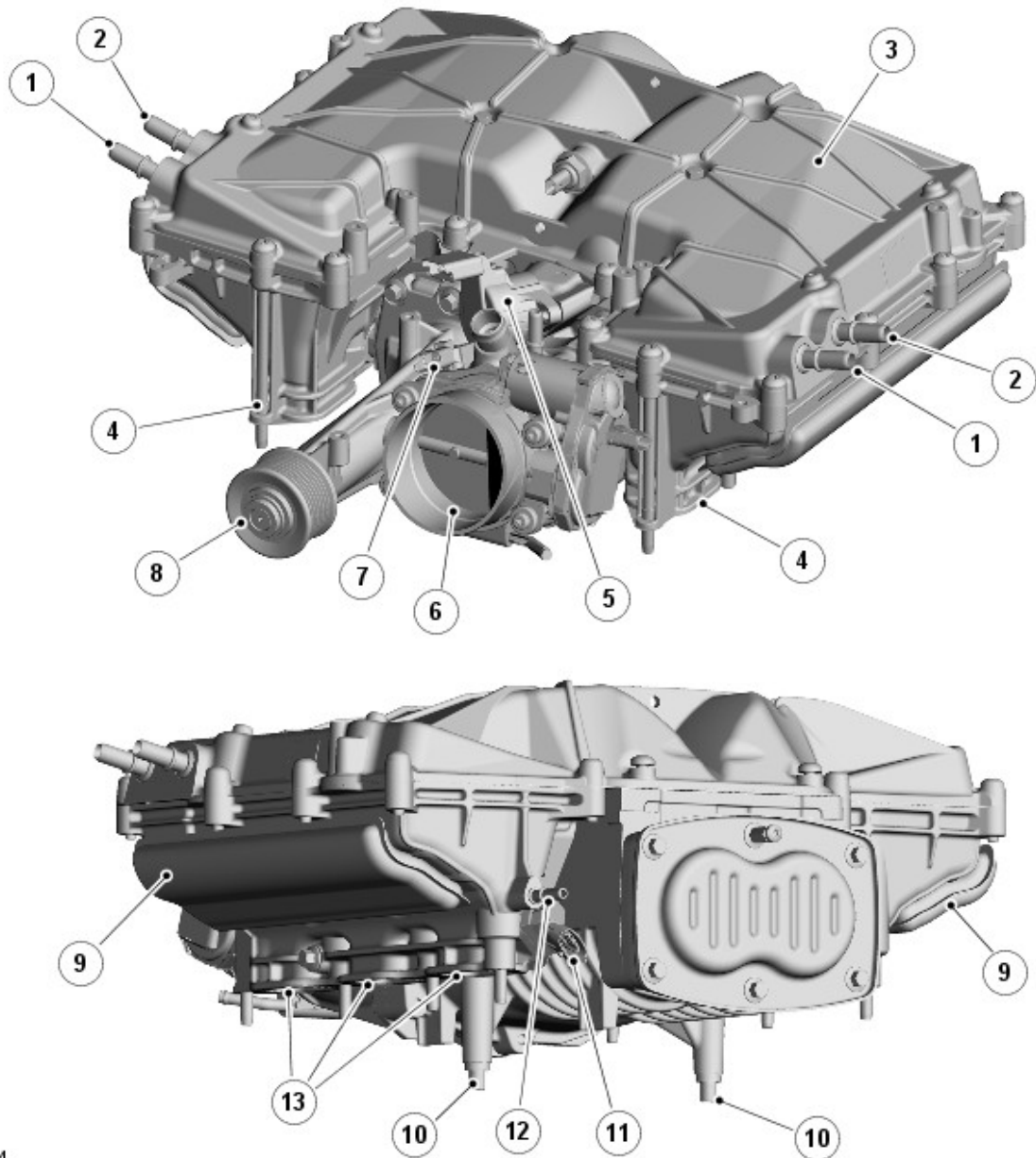
The electric throttle is installed at the front of the engine, between the cylinder heads.

The throttle plate is operated by a **DC (direct current)** electric motor attached to the throttle body. The motor is controlled by the **ECM** and is constantly adjusted in response to driver inputs with the throttle pedal to precisely control the amount of air allowed into the intake manifold.

For additional information, refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 S/C 3.0L Petrol, Description and Operation).

To prevent icing, coolant is circulated across the throttle body through coolant supply and return connections.

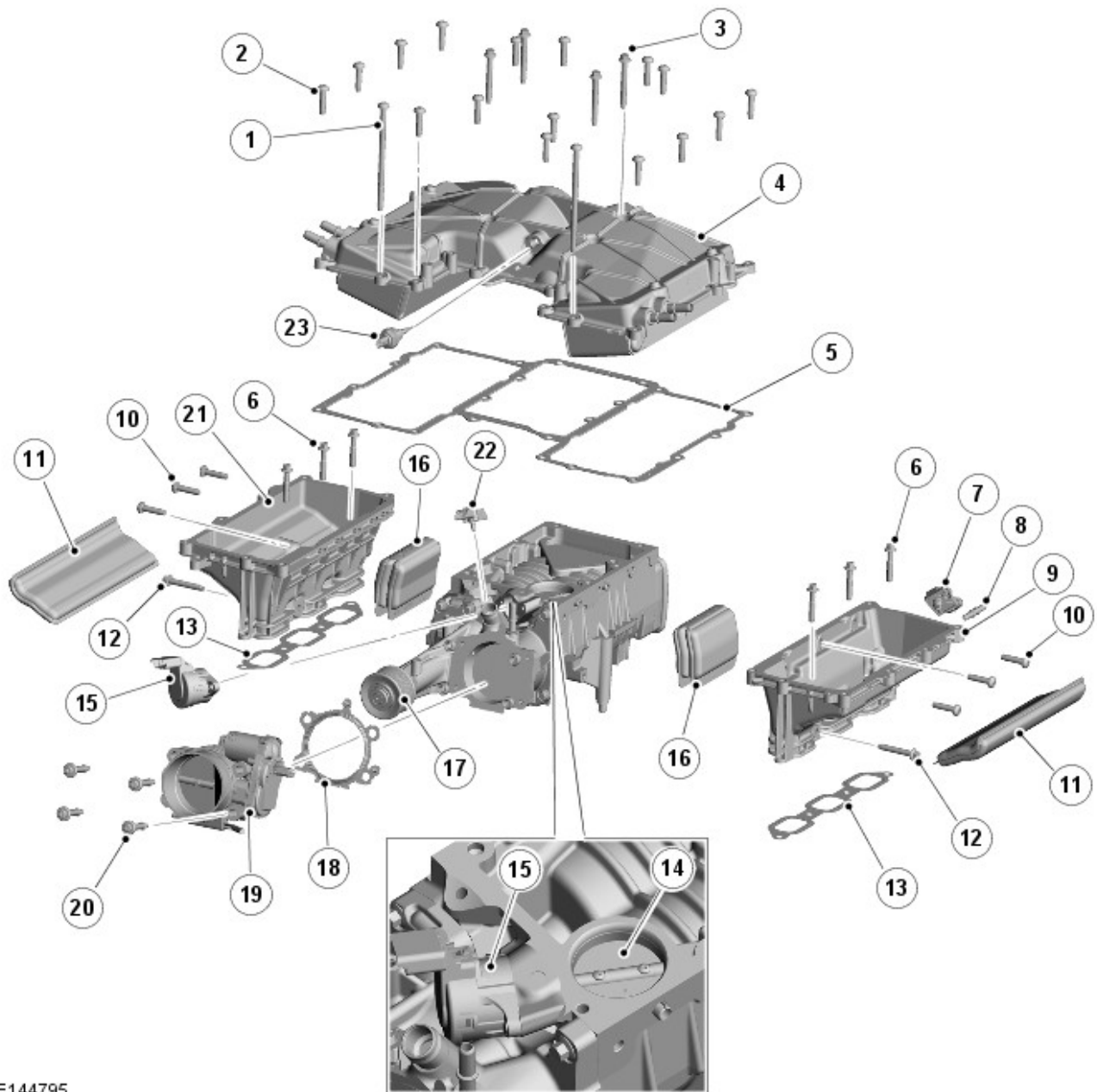
Supercharger and Intake Manifolds - Assembled



E144794

Item	Part Number	Description
1	-	Coolant outlet connections
2	-	Coolant inlet connections
3	-	Charge air cooler tank top
4	-	Intake manifolds
5	-	Supercharger bypass valve actuator
6	-	Inlet port
7	-	Manifold Absolute Pressure (MAP) sensor
8	-	Supercharger pulley
9	-	Noise, Vibration and Harshness (NVH) pads
10	-	Dowel
11	-	Manifold Absolute Pressure and Temperature (MAPT) sensor
12	-	Vacuum connector stub
13	-	Outlet ports

Supercharger and Intake Manifolds - Exploded



E144795

Item	Part Number	Description
1	-	Screw M8 x 35 mm (15 off)
2	-	Screw M8 x 150 mm (2 off)
3	-	Screw M8 x 65 mm (4 off)
4	-	Charge air cooler tank top
5	-	Gasket
6	-	Screw M8 x 45 mm (6 off)
7	-	Charge air cooler tank with Manifold Absolute Pressure and Temperature (MAPT) sensor.
8	-	Vacuum outlet hose connector
9	-	Left intake manifold
10	-	Screw M8 x 35 mm (6 off)
11	-	Gasket
12	-	Screw M8 x 50 mm
13	-	Noise, Vibration and Harshness (NVH) pad (2 off)
14	-	Supercharger bypass Valve
15	-	Supercharger bypass valve actuator
16	-	Noise, Vibration and Harshness (NVH) pad rear (2 off)
17	-	Supercharger pulley
18	-	Gasket
19	-	Electric throttle
20	-	Screw and bush (4 off)
21	-	Right intake manifold

22	-	Manifold Absolute Pressure (MAP) sensor
23	-	Charge air temperature sensor

The supercharger increases the pressure, and thus mass, of the air supplied to the engine, to increase the engine's power output. Two separate intake manifolds direct air from the supercharger to the cylinder intake ports.

The intake manifolds are attached to their related cylinder heads and the sides of the supercharger. Two dowels locate the supercharger in position on the cylinder block. A charge air cooler tank top is installed on top of the supercharger and intake manifolds to form the air duct from the supercharger outlet to the intake manifolds. A charge air cooler is installed in each intake manifold.

A **NVH (noise, vibration and harshness)** pad is attached to the side of each intake manifold. The rear of the right intake manifold incorporates a connection port for the symposer intake pipe. The rear of the left intake manifold incorporates:

- A connector stub for the brake vacuum system.
- A MAPT (manifold absolute pressure and temperature) sensor.

The supercharger is a roots blower with high angle helix rotors driven at 2.5 times engine speed by the secondary belt of the accessory drive.

The two rotors of the supercharger are contained in a housing. The ends of the rotors are supported in bearings in the front cover and the bearing plate. A rear cover seals the bearing plate. A pulley transfers power from the accessory drive to the shaft of one of the rotors.

A **DC** electric actuator on the front cover is attached to the supercharger bypass valve in the housing. The supercharger bypass valve allows air to bypass the rotors, to control the outlet pressure of the supercharger. Operation of the actuator is controlled by a **PWM (pulse width modulation)** signal from the **ECM**. A hall effect position sensor in the actuator returns a 0.5 to 4.5 V signal to the ECM. This allows the ECM to identify the position of the supercharger bypass valve for closed-loop control.

The front cover also incorporates:

- The supercharger air intake and mounting face for the electric throttle.
- A connector stub for the part load breather.
- A MAP (manifold absolute pressure) sensor.
- A connector stub for a hose from the **EVAP (evaporative emission)** canister purge valve.

OPERATION

At closed or partially open throttle positions, the bypass valve is fully open, allowing intake air to bypass the supercharger. This results in little or no pressure increase across the supercharger. Progressive opening of the throttle reduces the depression downstream of the electric throttle. This is sensed by the **ECM** from the **MAP (manifold absolute pressure)** sensor input. The ECM then signals the supercharger bypass valve actuator to progressively close the bypass valve. As the bypass valve closes there is a corresponding increase in the outlet pressure from the supercharger, which increases engine power output.

Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol - Intake Air Distribution and Filtering

Diagnosis and Testing

Principles of Operation

For a detailed description of the intake air distribution and filtering system and operation, refer to the relevant Description and Operation section in the workshop manual.

REFER to: [Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Description and Operation) /

Intake Air Distribution and Filtering (303-12C, Description and Operation) /

Intake Air Distribution and Filtering (303-12C, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Hoses and ducts (damage/connections) • Air cleaner element (contaminated/blocked) • Restricted air intake • Supercharger • Supercharger (cooling fan) drive belt • Supercharger seals and gaskets • Charge air coolers (damage/connection) 	<ul style="list-style-type: none"> • Mass Air Flow (MAF) sensor • Manifold Absolute Pressure (MAP) sensor • Manifold Absolute Pressure/Temperature (MAPT) sensor • Throttle body • Harness (security/damage) • Connections (security/damage)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Vehicle does not start/hard starting/poor performance	<ul style="list-style-type: none"> • Restricted/Blocked air intake • Restricted/Blocked air cleaner element 	Clear the restriction. Replace the air cleaner element as necessary. Refer to the relevant workshop manual section.
Excessive intake noise	<ul style="list-style-type: none"> • Intake pipe disconnected/damaged after the air cleaner • Air cleaner assembly incorrectly assembled/damaged 	Check the intake system and hoses for correct installation/damage. Refer to the relevant workshop manual section.
Lack of boost	<ul style="list-style-type: none"> • Supercharger drive belt broken/slipping • Supercharger fault • Supercharger air intake fault • Major air leakage (after the supercharger) 	Check the supercharger and drive belt. Check the charge air coolers. Refer to the relevant workshop manual section.
Noise	<ul style="list-style-type: none"> • Supercharger drive belt slipping • Supercharger fault • Major air leakage (after the supercharger) 	Check the supercharger and drive belt. Remove the supercharger drive belt and recheck for noise. Turn the supercharger by hand and check for excessive resistance. Check for excessive play at the supercharger pulley. Check the charge air coolers. Refer to the relevant workshop manual section.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: V6 3.0L S/C Petrol, DTC: Engine Control Module \(ECM\)](#) (100-00 General Information, Description and Operation).

Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol - Air Cleaner Outlet Pipe T-Connector

Removal and Installation

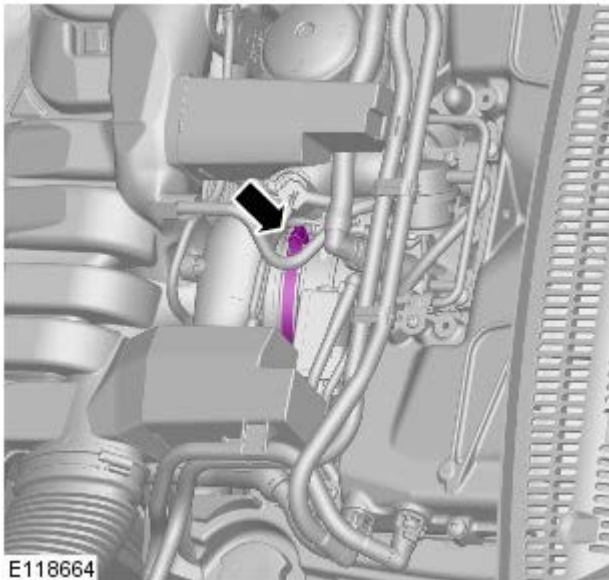
Removal



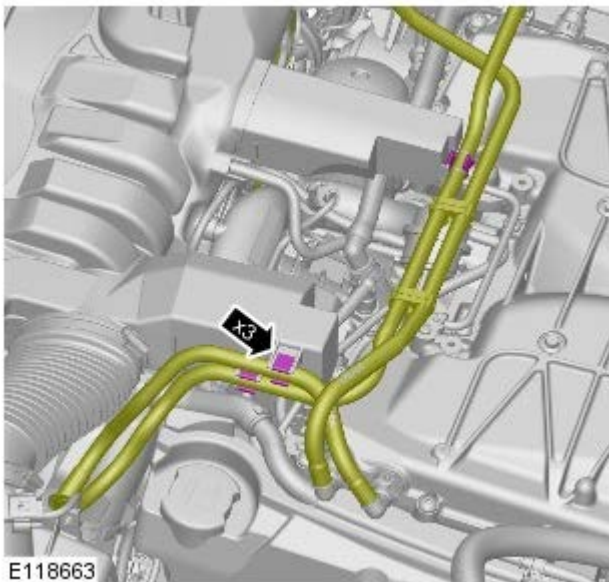
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

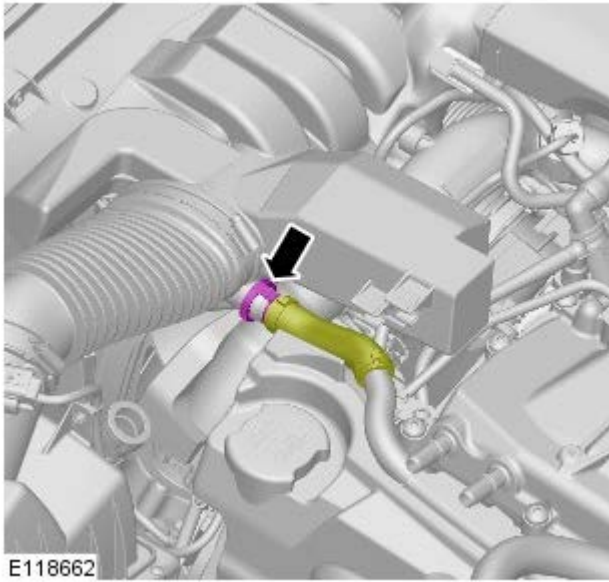
2. Torque: 3.5 Nm



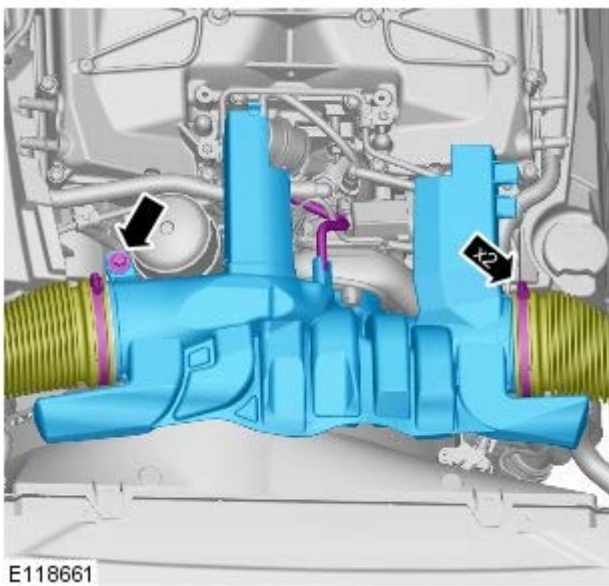
- 3.



- 4.



5. Torque: 10 Nm



Installation

1. To install, reverse the removal procedure.

Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol - Charge Air Cooler

Removal and Installation

Special Tool(s)

 <p>E115261</p>	<p>303-1444-01 Exhaust Manifold Installation Guide Pins - Threaded</p>
--	--

Removal




NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: [Fuel System Pressure Release - V6 S/C 3.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).

2. Disconnect the battery ground cable.

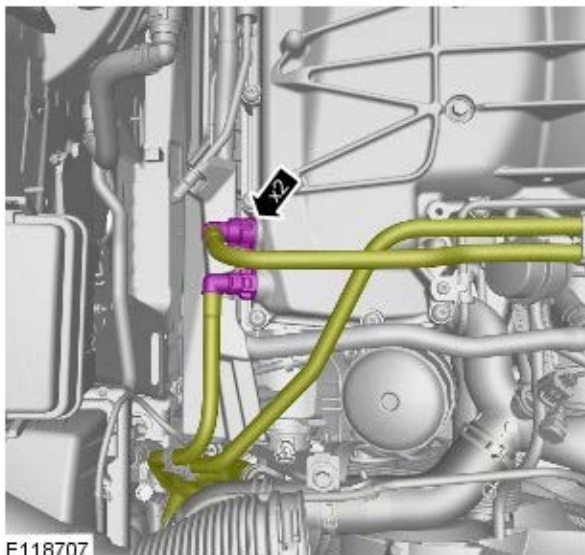
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).


3.  **WARNING:** Make sure to support the vehicle with axle stands.


Raise and support the vehicle.

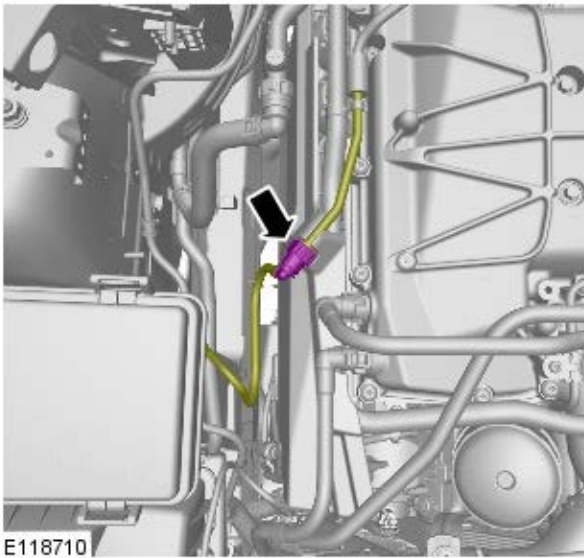
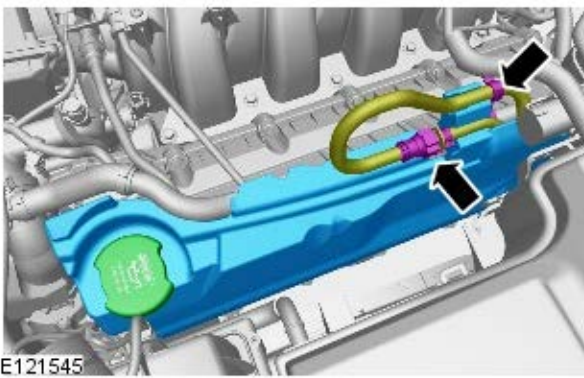
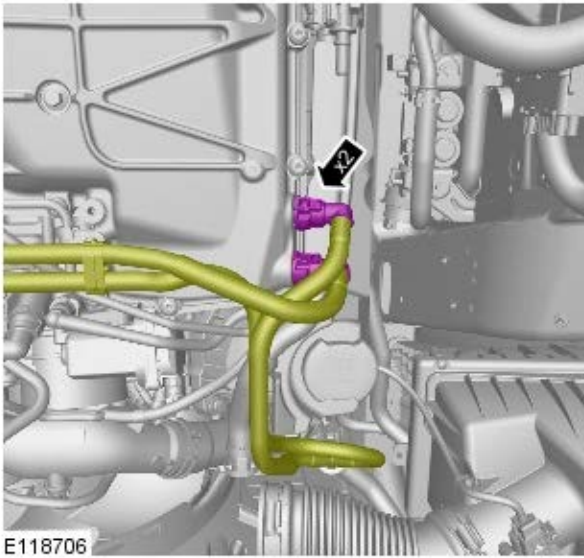
4. Refer to: [Cooling System Partial Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).


5. Refer to: [Fuel Injection Component Cleaning](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, General Procedures).



6.  **CAUTION:** Be prepared to collect escaping coolant.

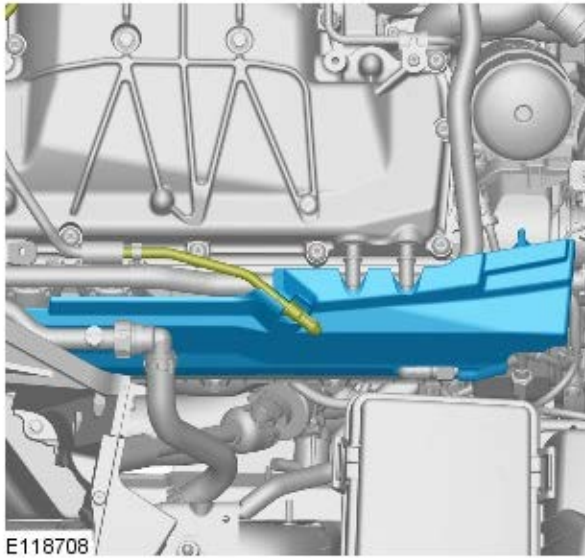
7.  **CAUTION:** Be prepared to collect escaping coolant.



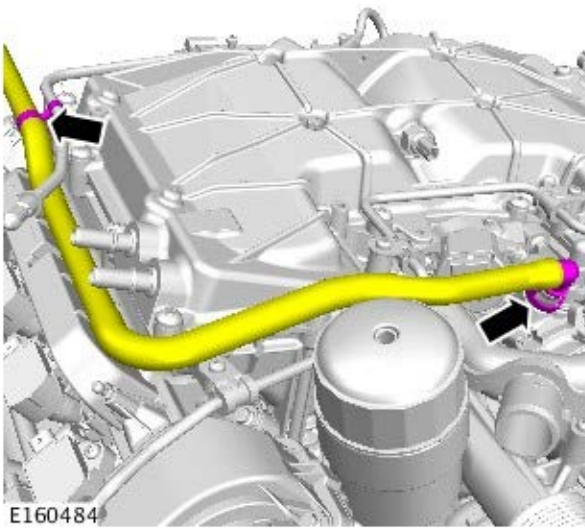
8.  CAUTION: Be prepared to collect escaping fluids.


9.

10.



11.



12.  **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

CAUTIONS:



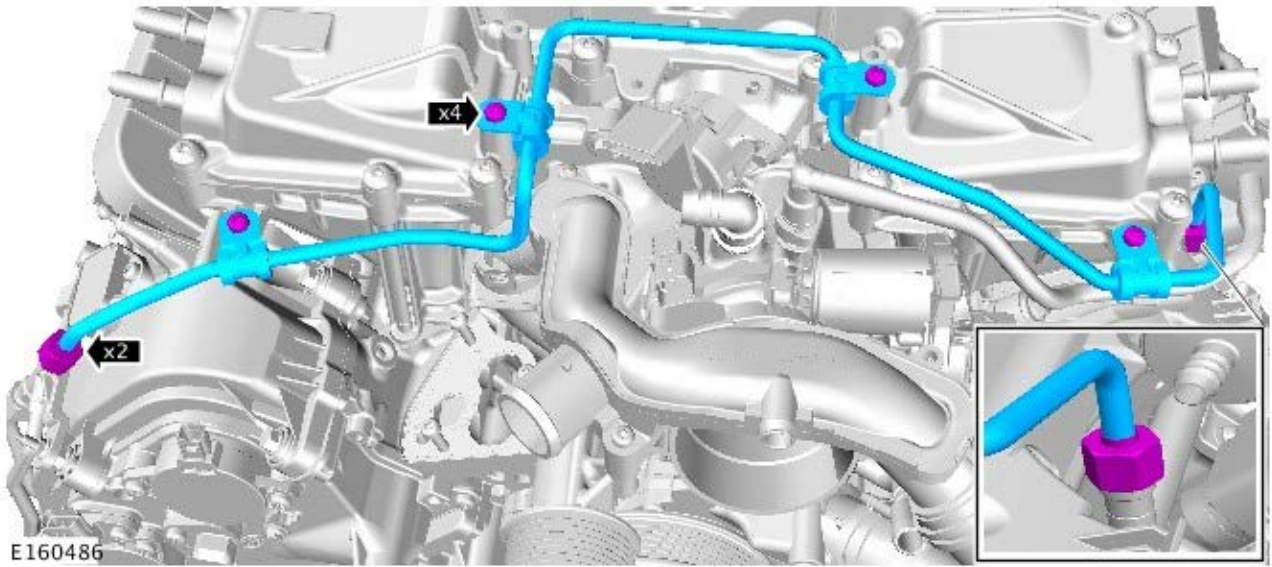
Make sure that the fuel line union does not rotate.



Be prepared to collect escaping fluids.

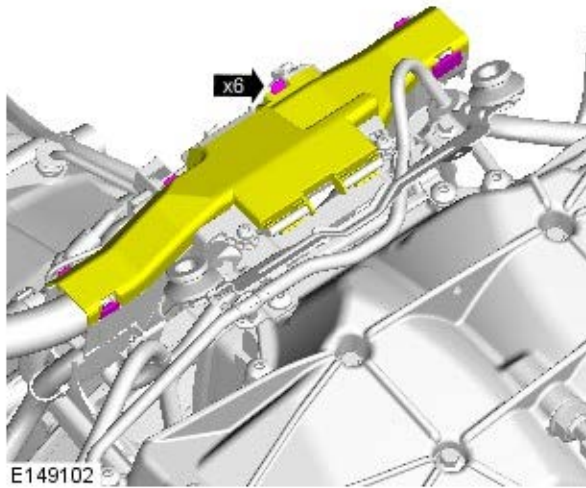


Make sure that all openings are sealed. Use new blanking caps.



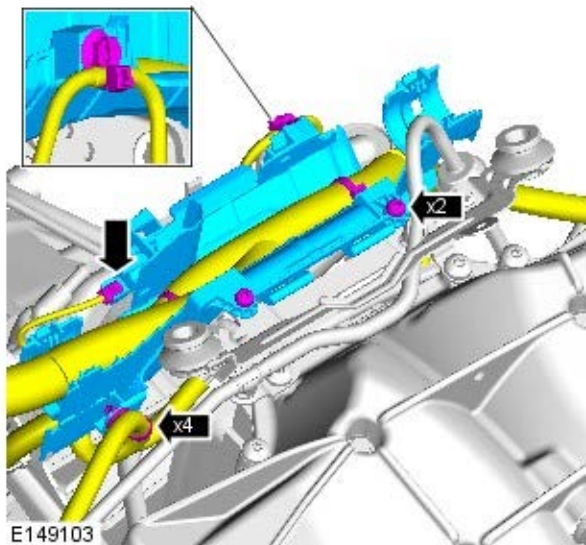
E160486

13.



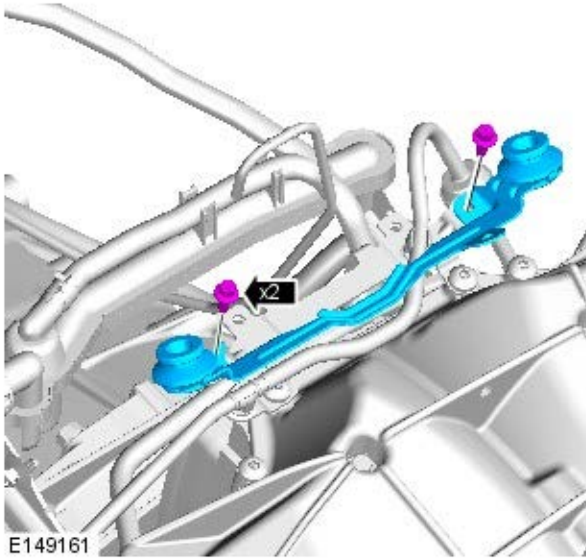
E149102

14.

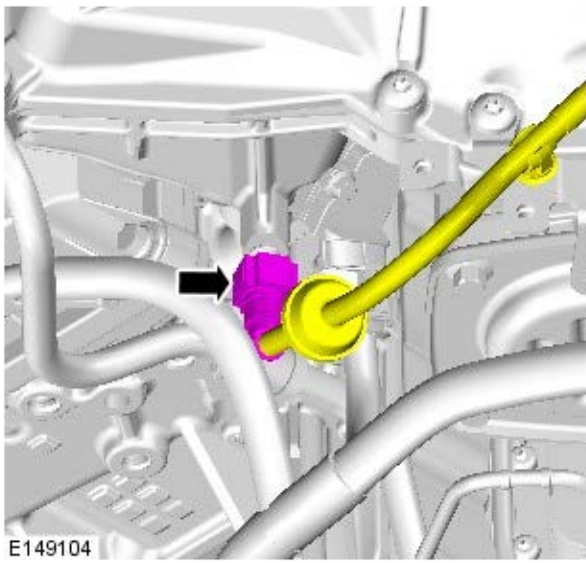


E149103

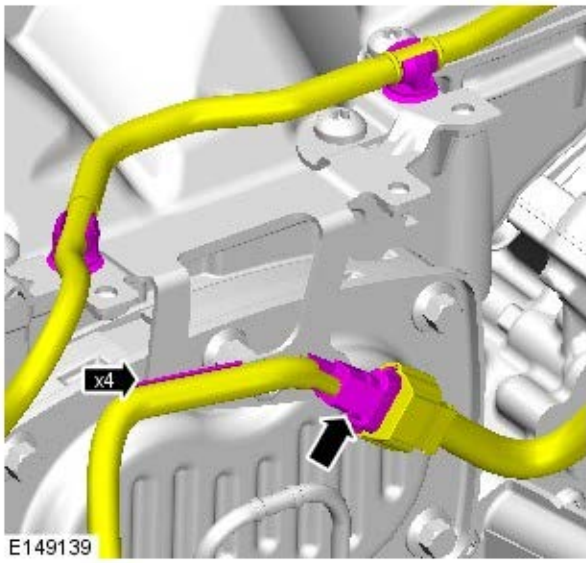
15.



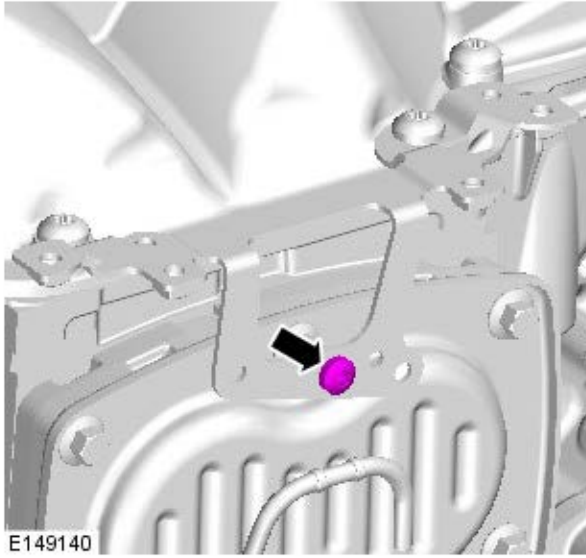
16.



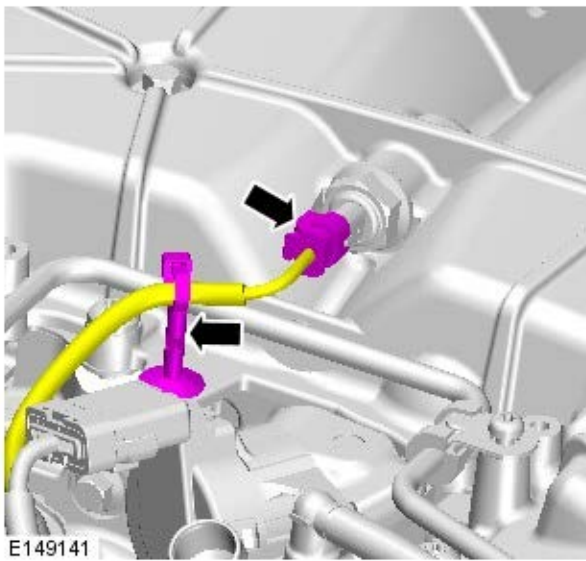
17.




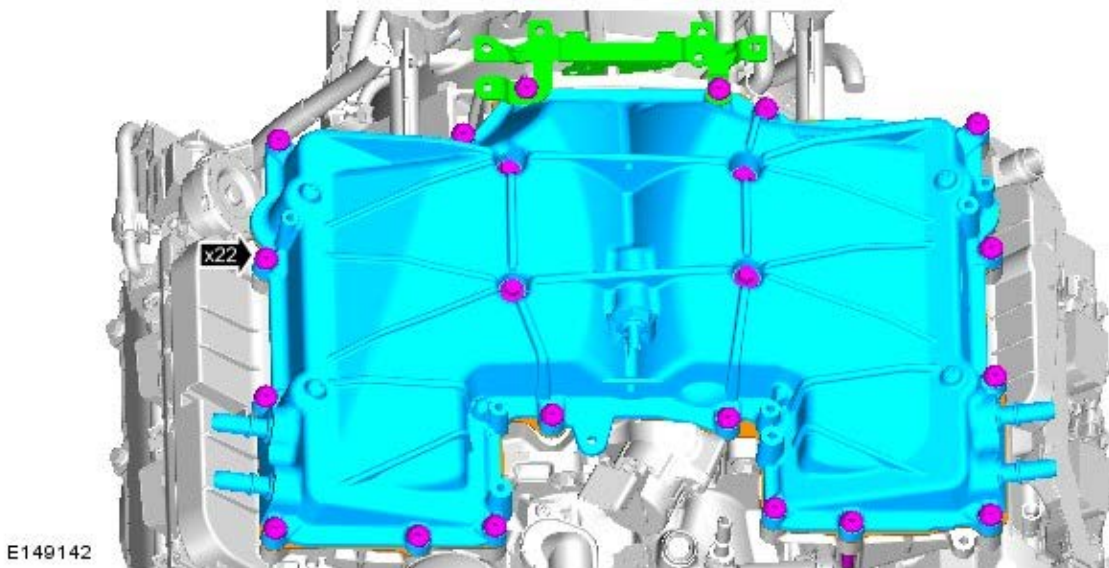
18.




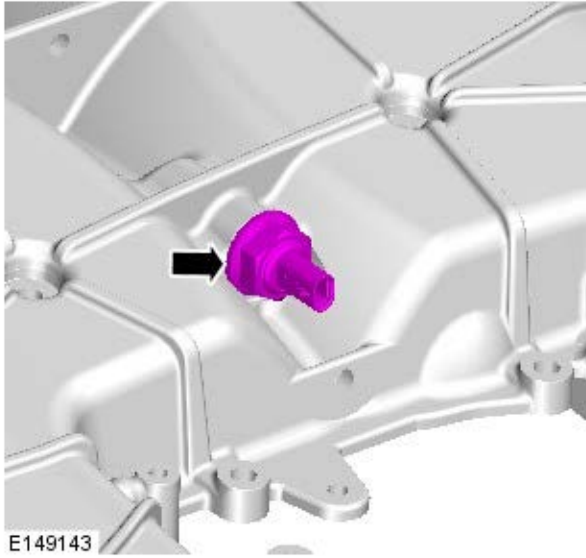
19.



20.  NOTE: The gasket is to be reused unless damaged.

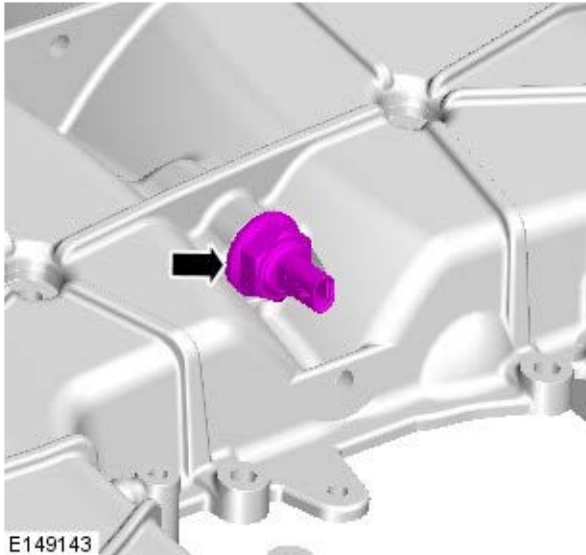


21.  NOTE: Do not disassemble further if the component is removed for access only.



E149143

Installation

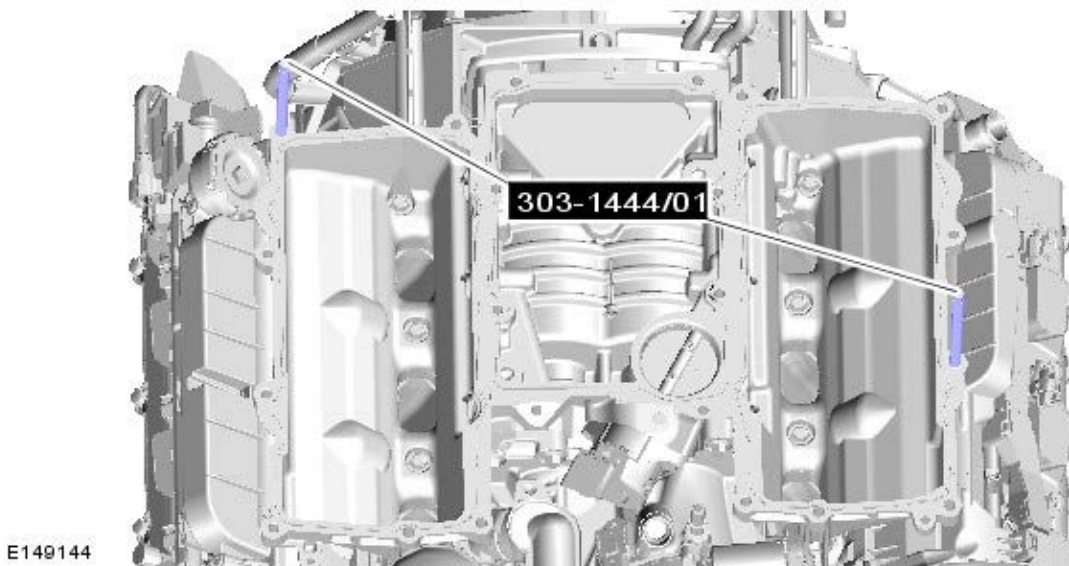


E149143

1.  NOTE: This step is only required if a new component is installed.


Torque: 24 Nm

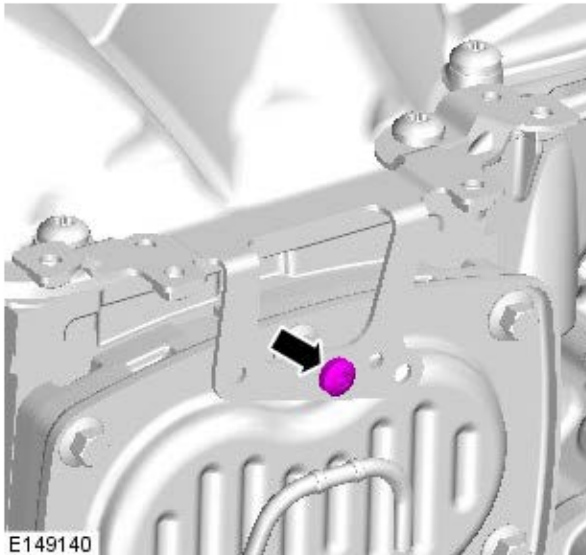
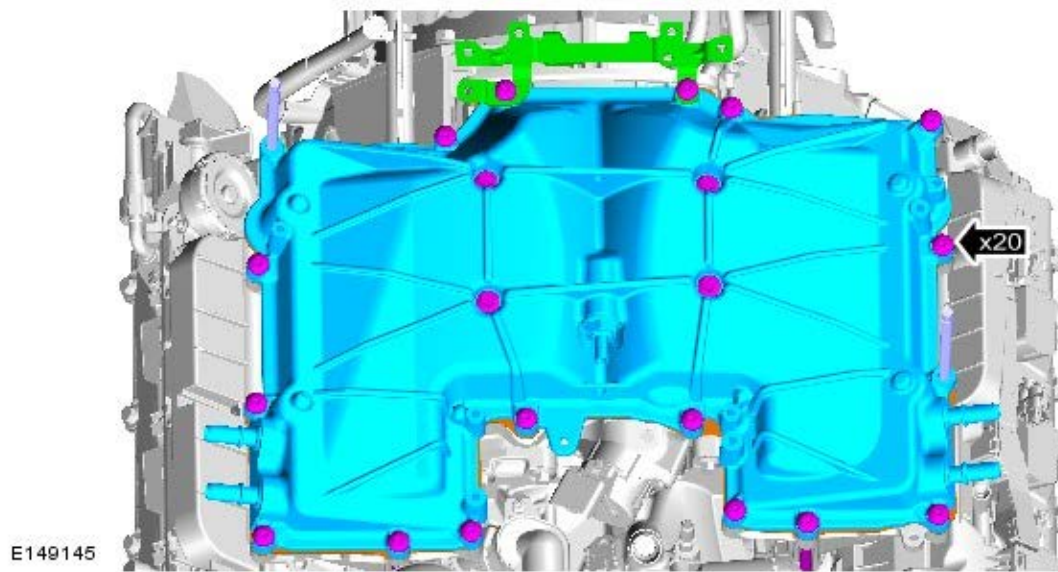
2. Special Tool(s): [303-1444-01](#)



E149144

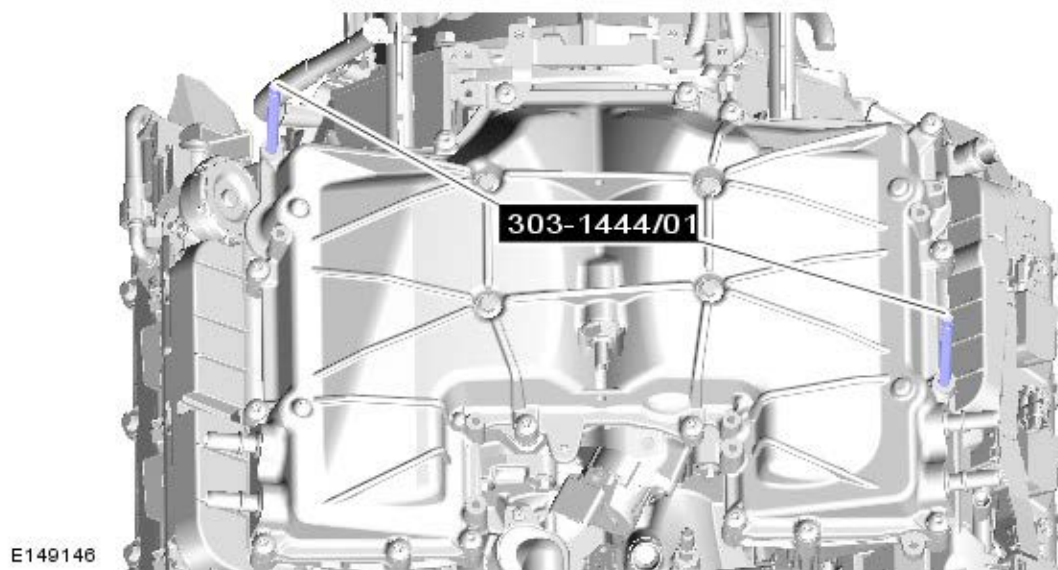
3.  CAUTION: Only tighten the bolts finger-tight at this stage.

 NOTE: The gasket is to be reused unless damaged.

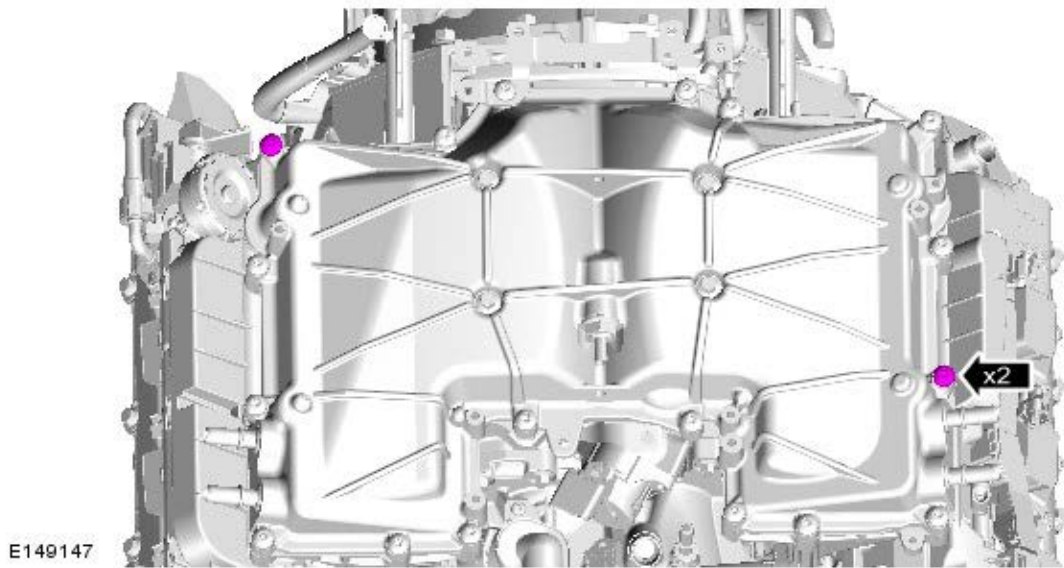


4.  CAUTION: Only tighten the bolt finger-tight at this stage.

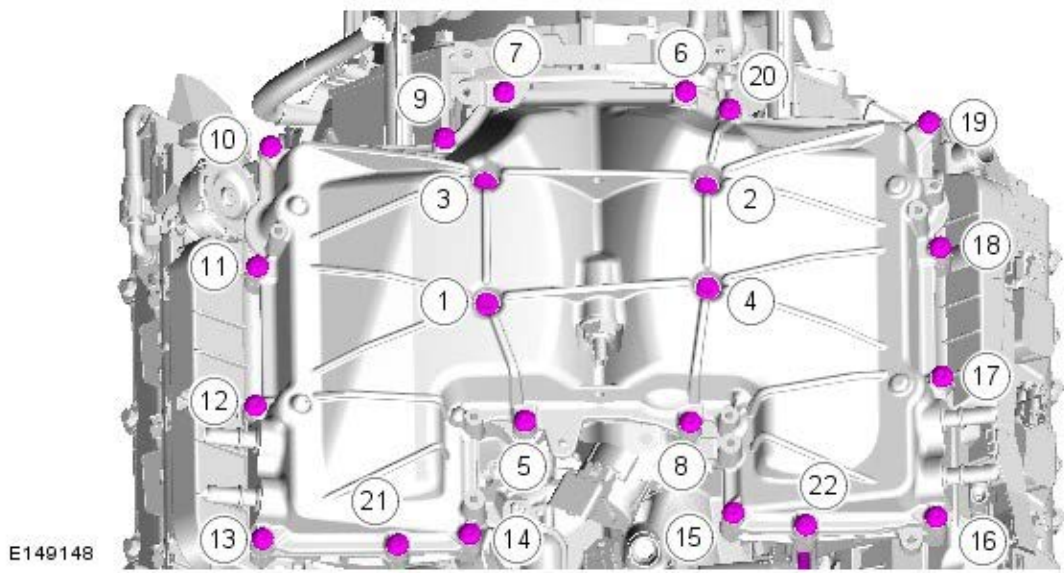
5. Special Tool(s): [303-1444-01](#)



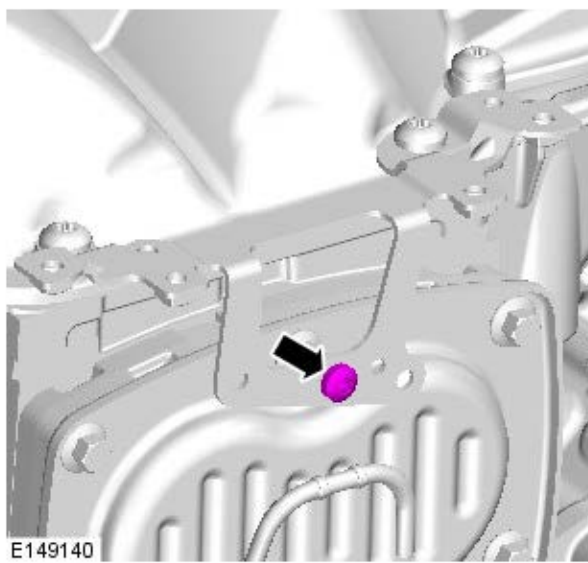
6.  CAUTION: Only tighten the bolts finger tight at this stage.



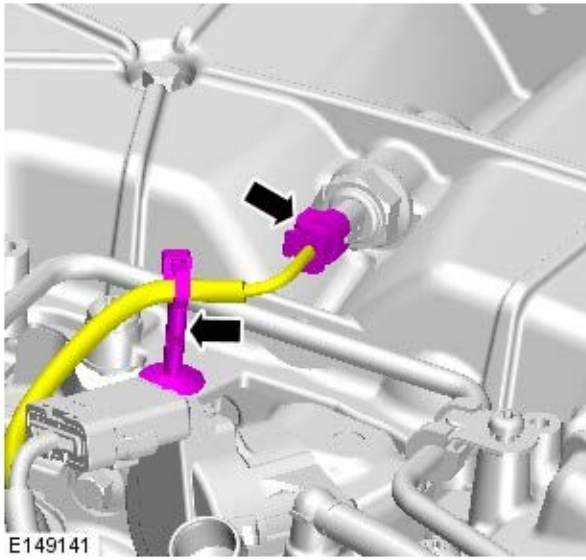
7.  CAUTION: Tighten the bolts in the sequence shown.
Torque: 25 Nm



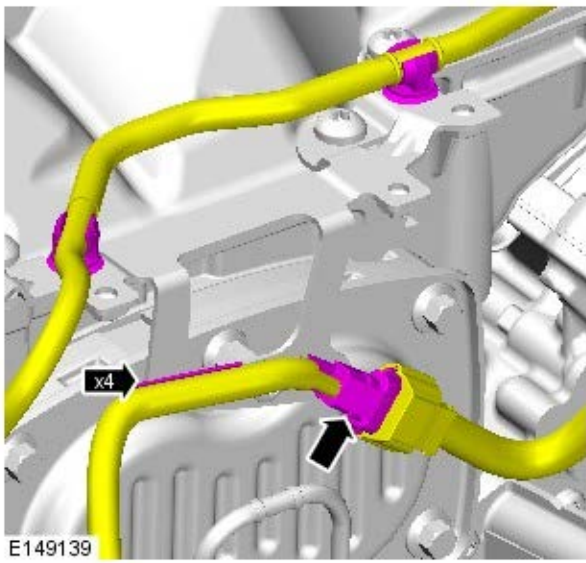
8. Torque: 12 Nm



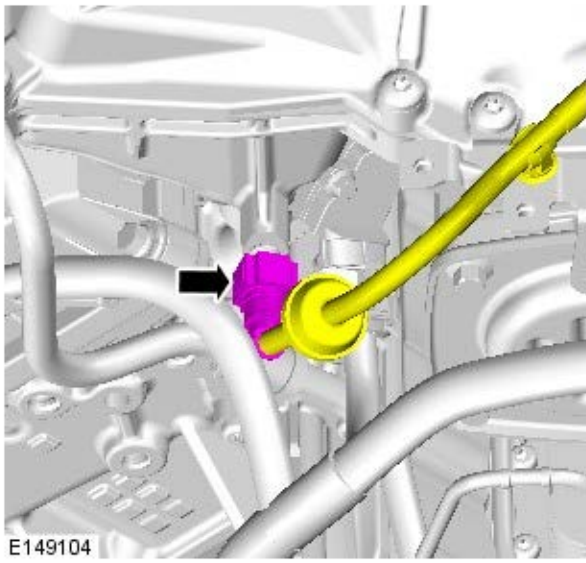
9.



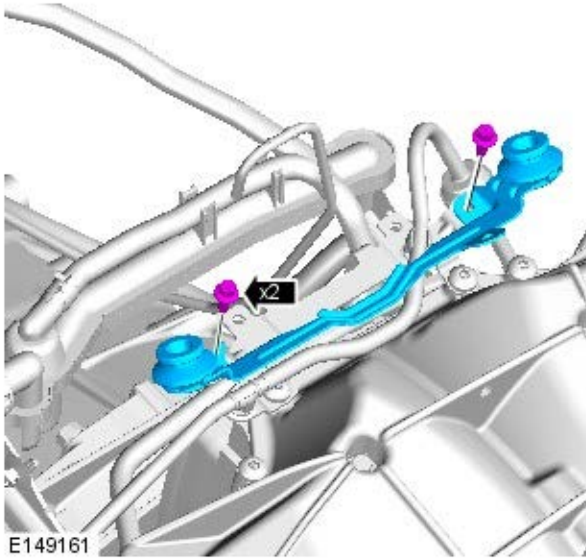
10.



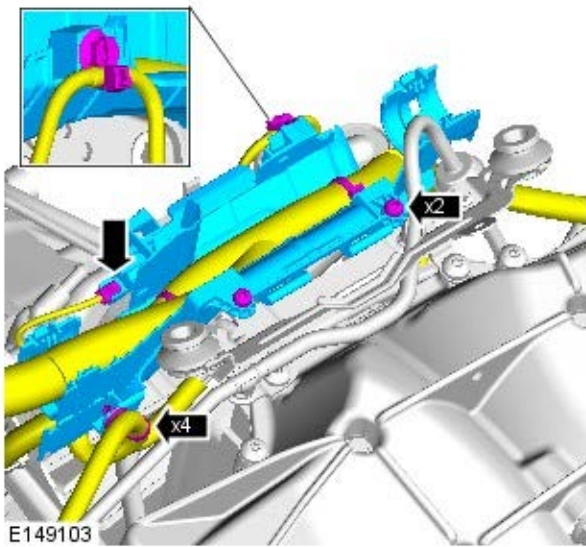
11.



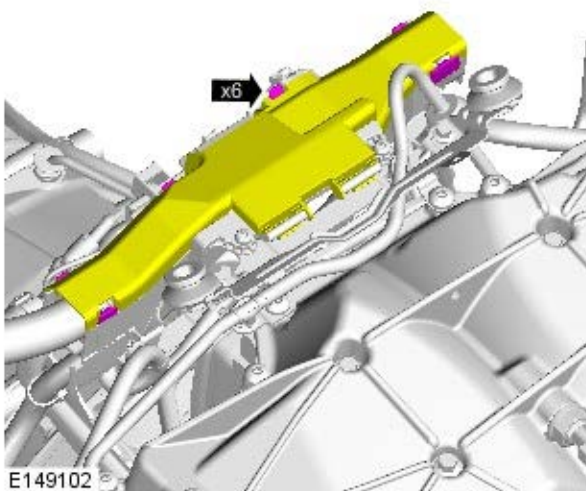
12. Torque: 10 Nm





13. Torque: 10 Nm



14.



15.  **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

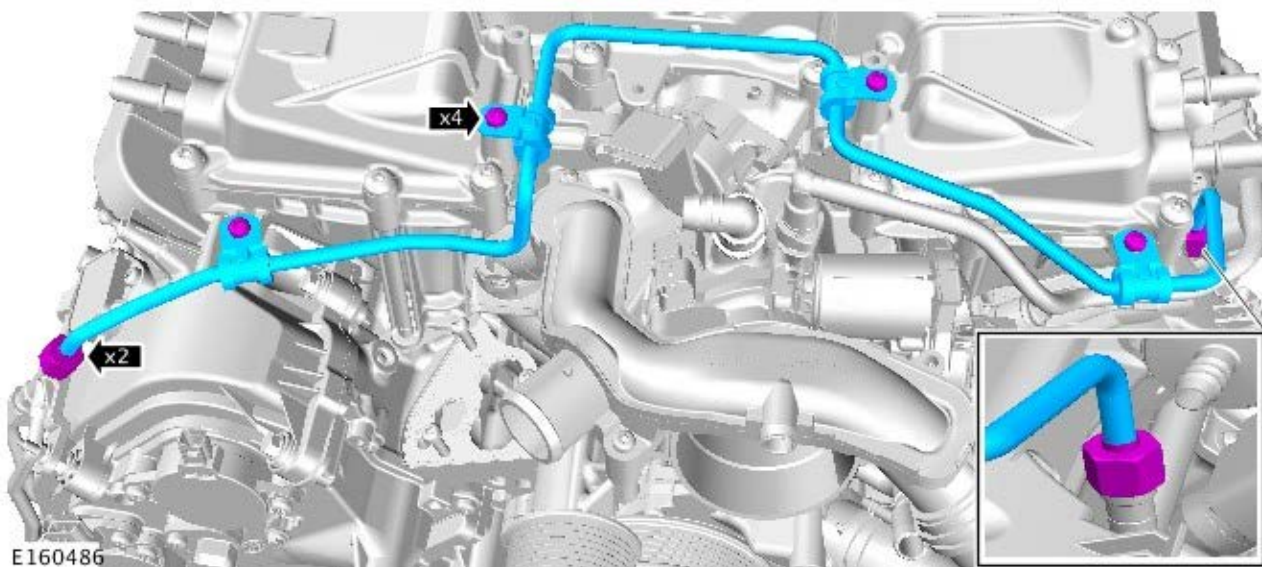
 **CAUTION:** Lubricate only the union threads with clean

engine oil.


NOTES:


 Do not tighten at this stage.

 Remove and discard the blanking caps.

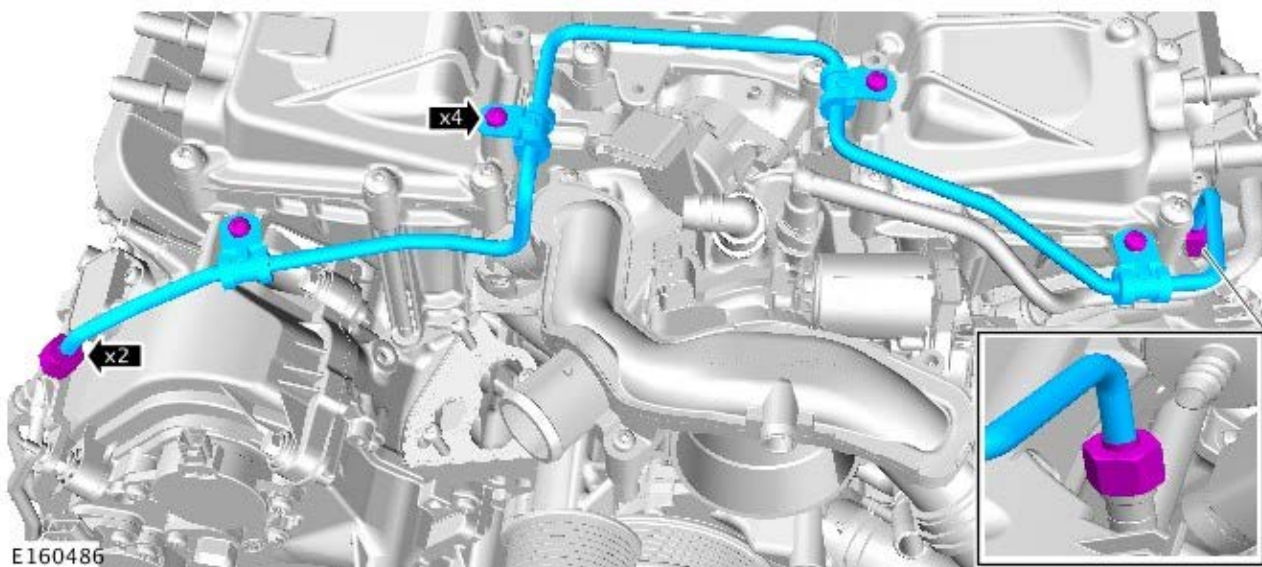


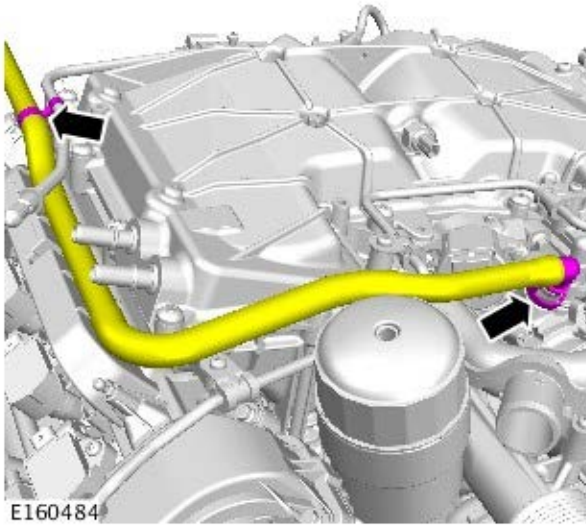
16. WARNINGS:

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

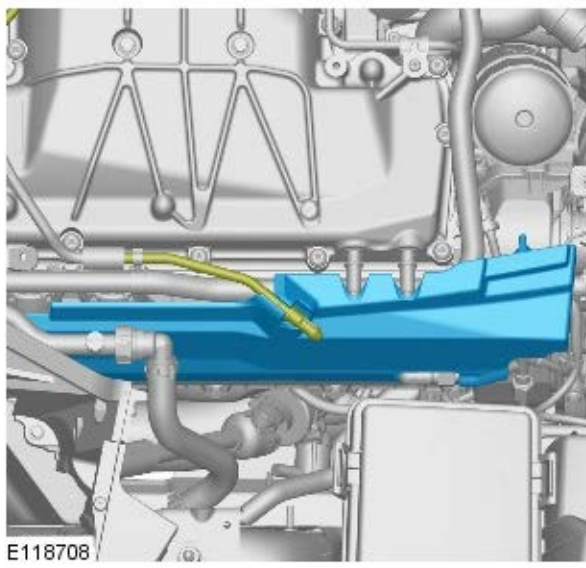
 After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.

Torque:
Union 21 Nm
M6 8 Nm

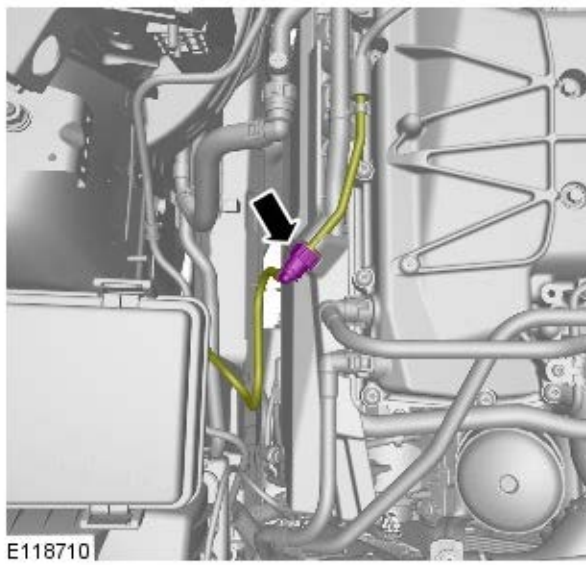




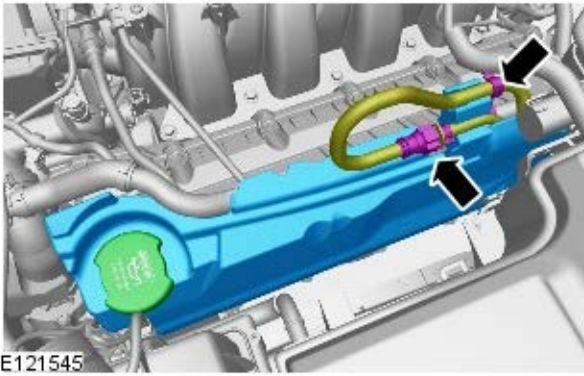
18.



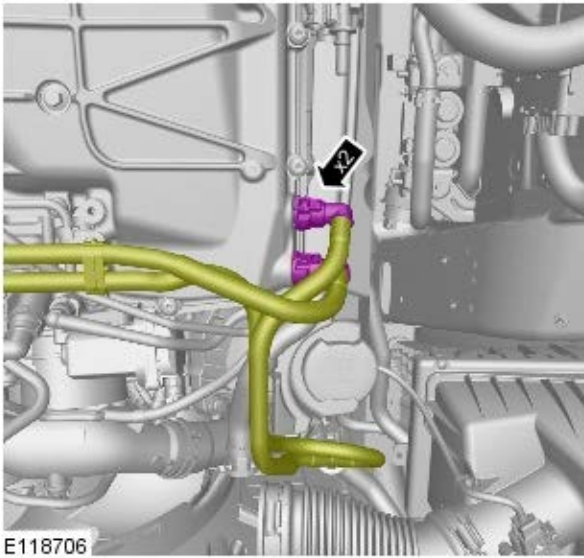
19.



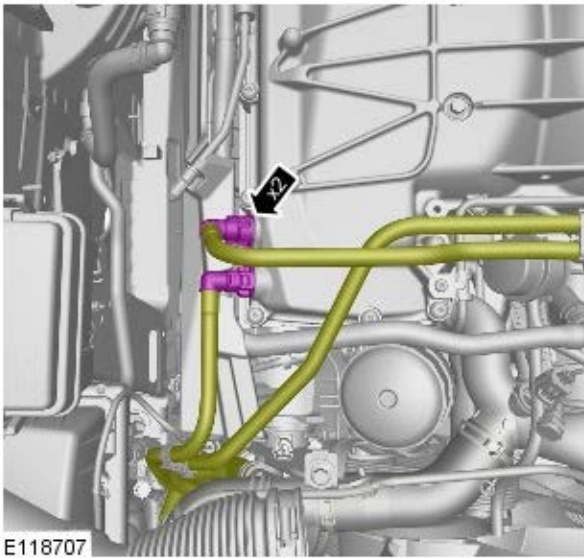
20.



21.



22.



23. Refer to: [Cooling System Partial Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).


24. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol - Supercharger

Removal and Installation

Special Tool(s)

 <p>E115267</p>	<p>303-1449-01 Supercharger Installation Guide Pins - Threaded</p>
 <p>E115267</p>	<p>303-1449-02 Supercharger Installation Guide Pins - Unthreaded</p>

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

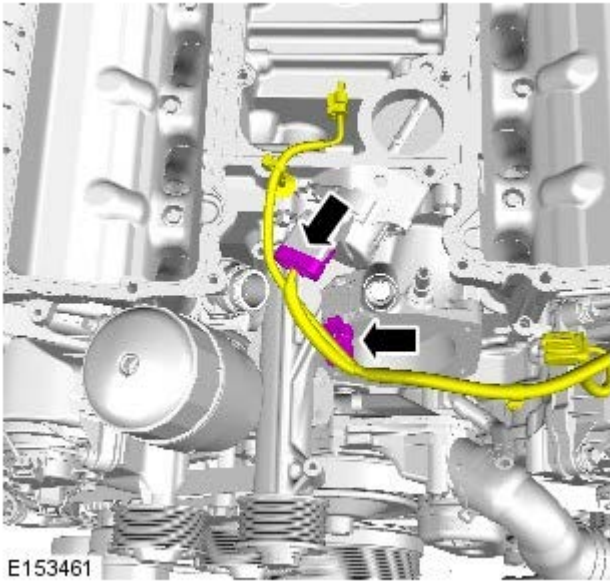
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

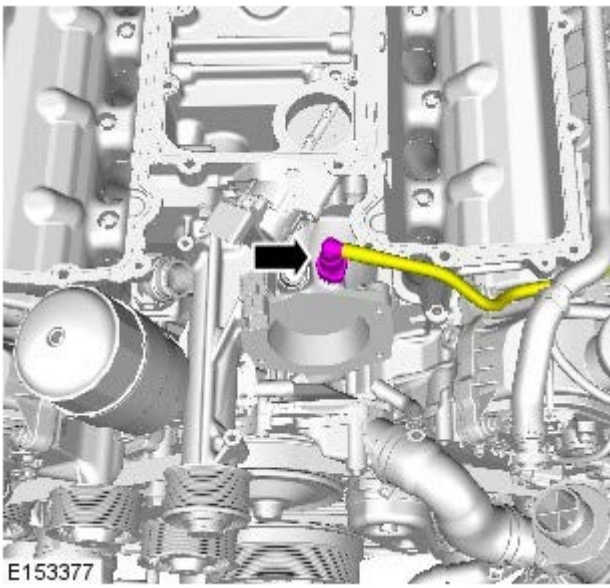
Raise and support the vehicle.

3. Refer to: [Supercharger Belt](#) (303-05B Accessory Drive - V6 S/C 3.0L Petrol, Removal and Installation).
4. Refer to: [Throttle Body](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Removal and Installation).
5. Refer to: [Charge Air Cooler](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
6. Refer to: [Manifold Absolute Pressure \(MAP\) Sensor](#) (303-14B Electronic Engine Controls - V6 S/C 3.0L Petrol, Removal and Installation).

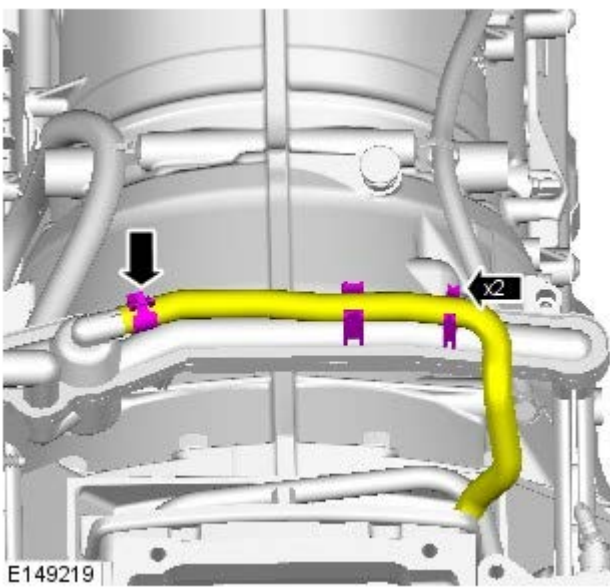
7.



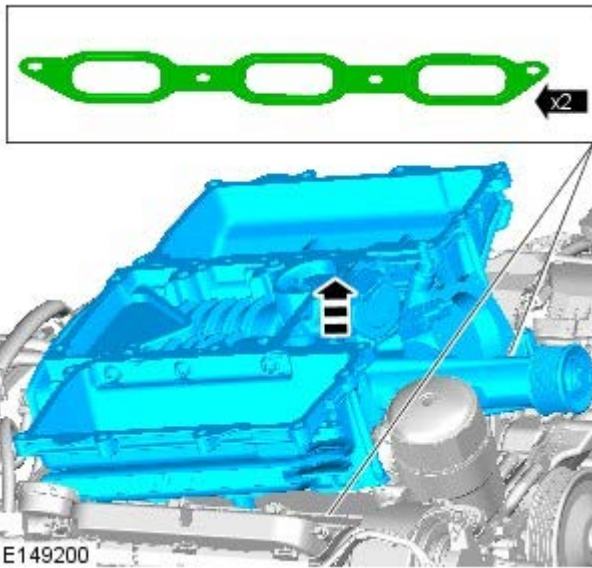
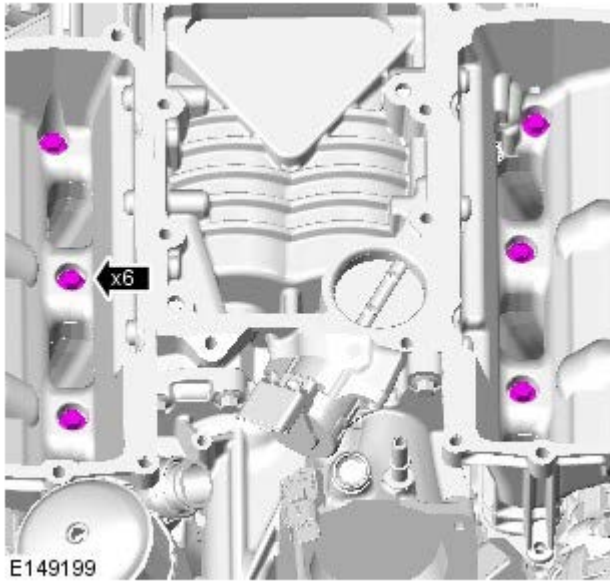
8.




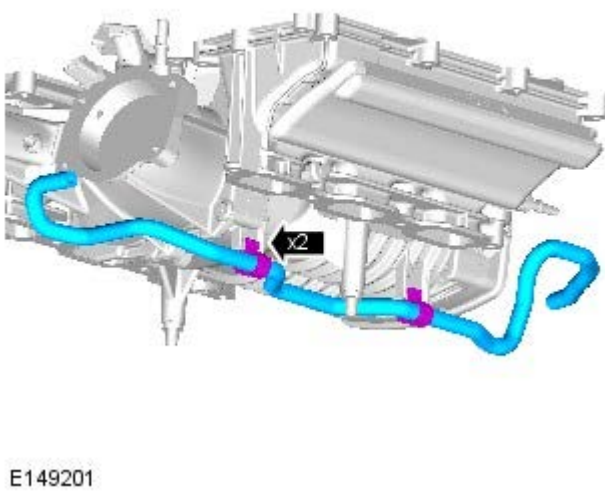
9.




10.

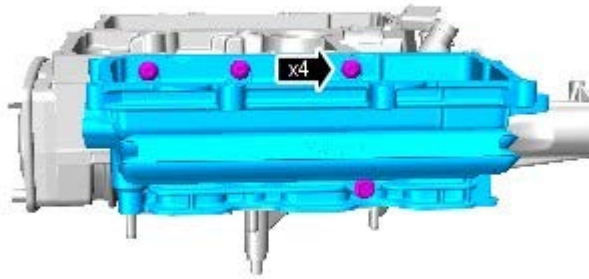


11.  NOTE: Remove and discard the gaskets.



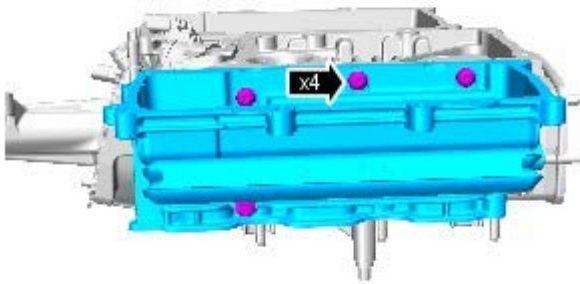
12.  NOTE: Do not disassemble further if the component is removed for access only.

13.



E153535

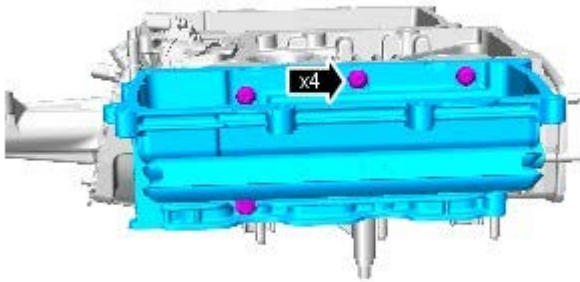
14.



E153534

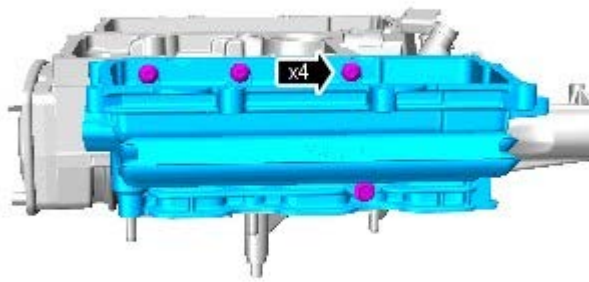
Installation

1. Torque: 25 Nm



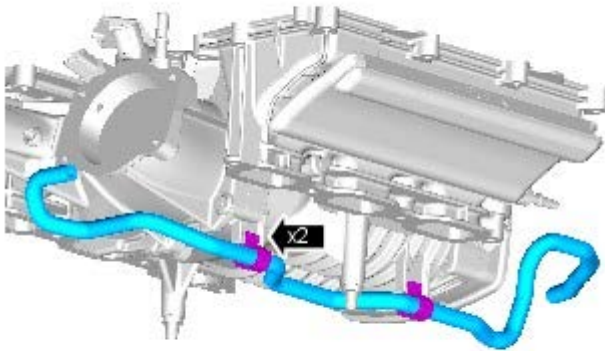
E153534

2. Torque: 25 Nm

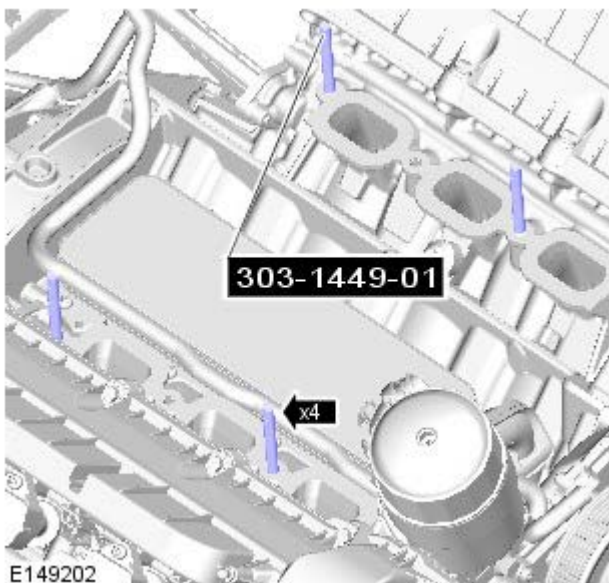


E153535

3.





E149201




E149202

4. CAUTIONS:

 If a new cylinder head has been installed then the special tool 303-1449-02 without the thread must be used to install the supercharger.

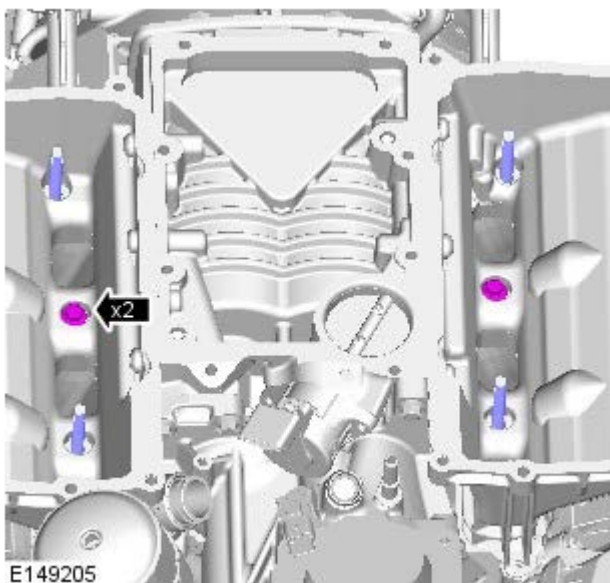
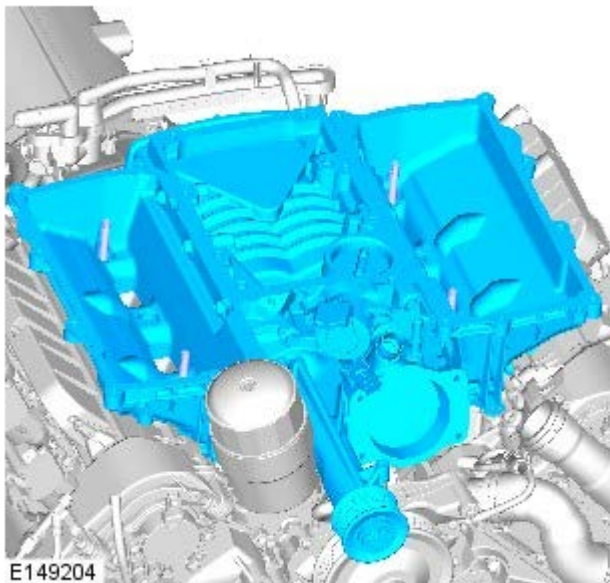
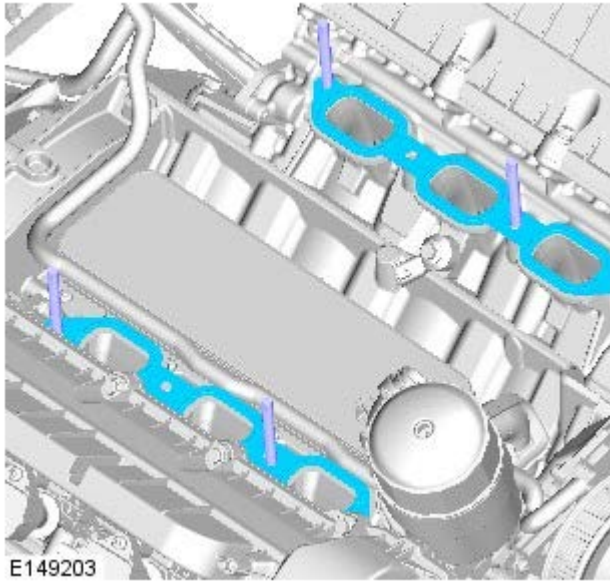
 If a new cylinder head has been installed, then new taprite bolts must be used to install the supercharger.

 NOTE: New taprite bolts when used cut their own threads on the first application.


- Special Tool(s): [303-1449-01](#)
- Special Tool(s): [303-1449-02](#)

5.  CAUTION: Make sure that the mating faces are clean and free of foreign material.

 NOTE: Install new gaskets.



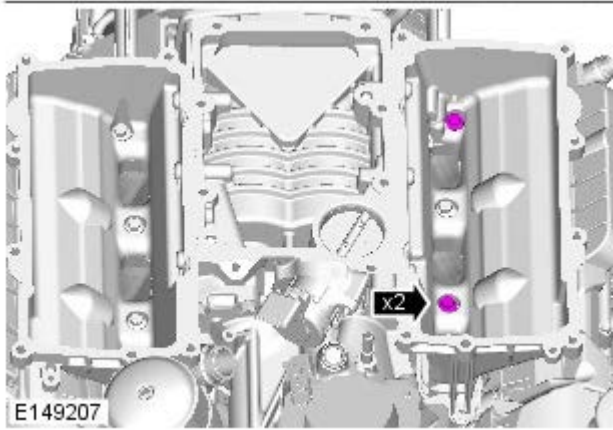
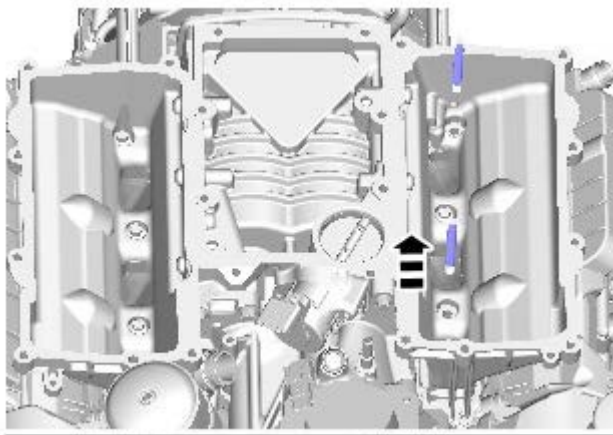
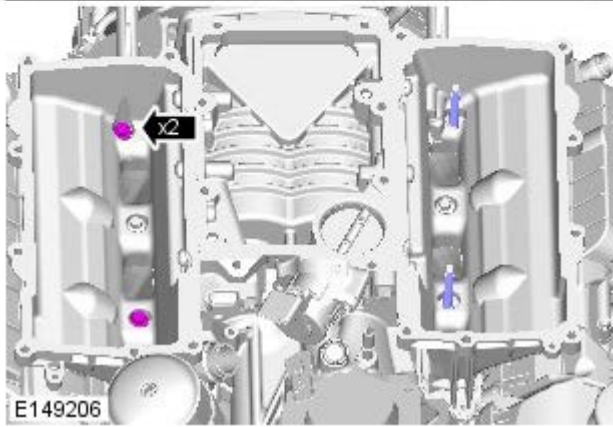
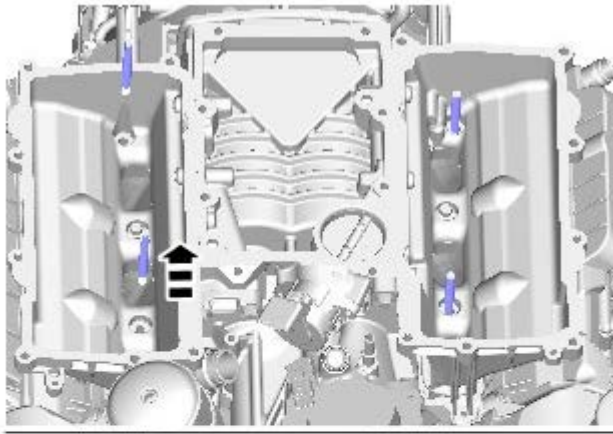
6. CAUTIONS:

 Make sure that the mating faces are clean and free of foreign material.

 Take extra care not to damage the component.

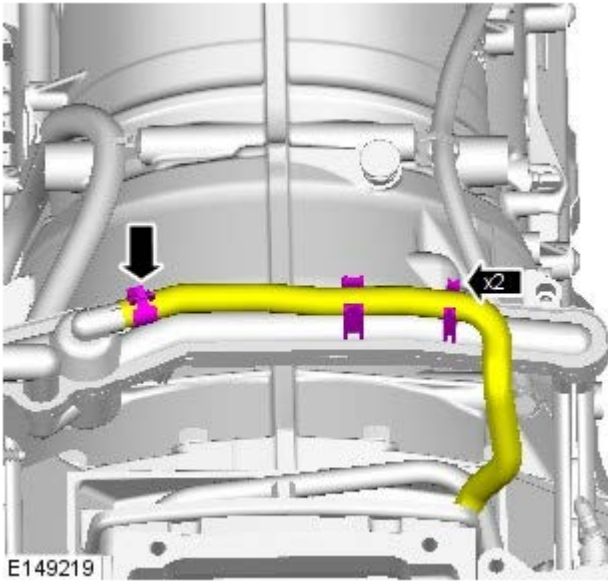
7. Torque: 25 Nm

8. Torque: 25 Nm

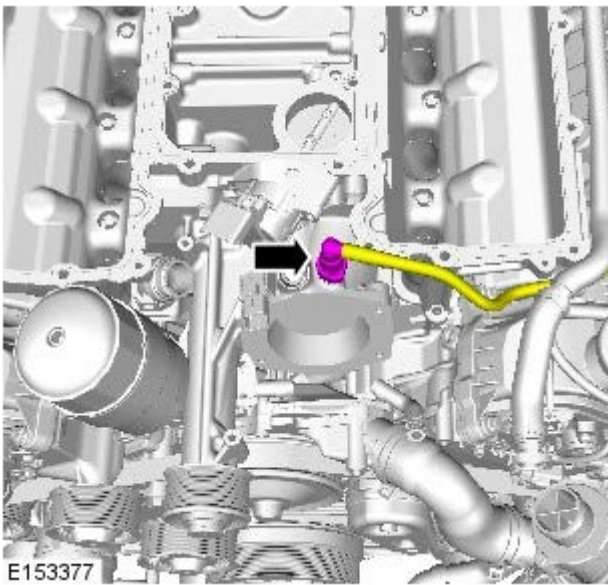


9. Torque: 25 Nm

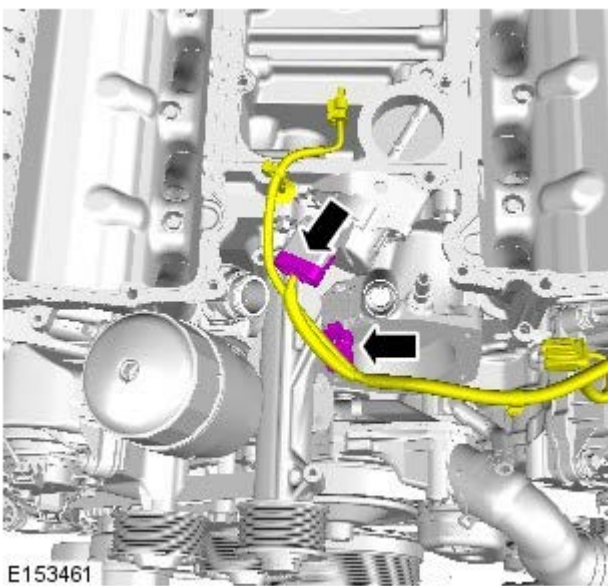
10.



11.



12.



13. Refer to: [Manifold Absolute Pressure \(MAP\) Sensor](#) (303-14B Electronic Engine Controls - V6 S/C 3.0L Petrol, Removal and Installation).

14. Refer to: [Charge Air Cooler](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and

Installation).

15. Refer to: [Throttle Body](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Removal and Installation).
16. Refer to: [Supercharger Belt](#) (303-05B Accessory Drive - V6 S/C 3.0L Petrol, Removal and Installation).
17. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol - Air Cleaner Element

Removal and Installation

Removal

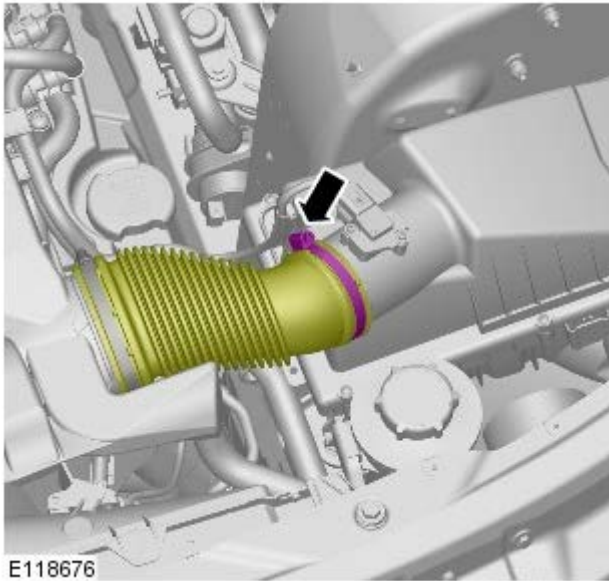
NOTES:



Removal steps in this procedure may contain installation details.



Air cleaner elements must be renewed in pairs.



1. NOTES:

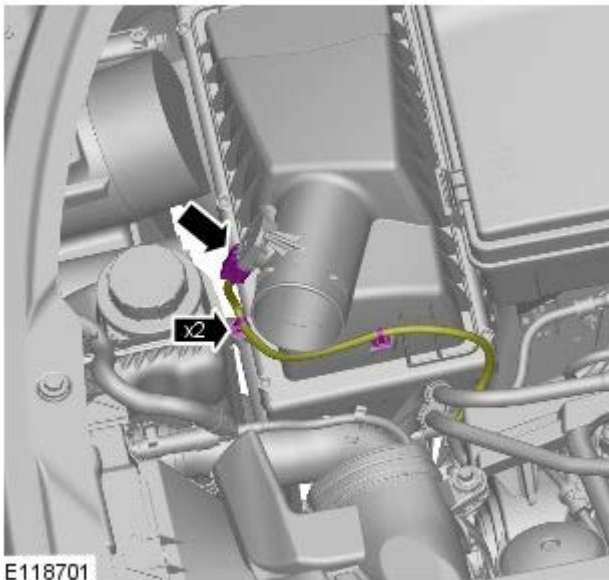


Left-hand shown, right-hand similar.



Some variation in the illustrations may occur, but the essential information is always correct.

Torque: 3.5 Nm



2. NOTES:



Left-hand shown, right-hand similar.



Some variation in the illustrations may occur, but the essential information is always correct.

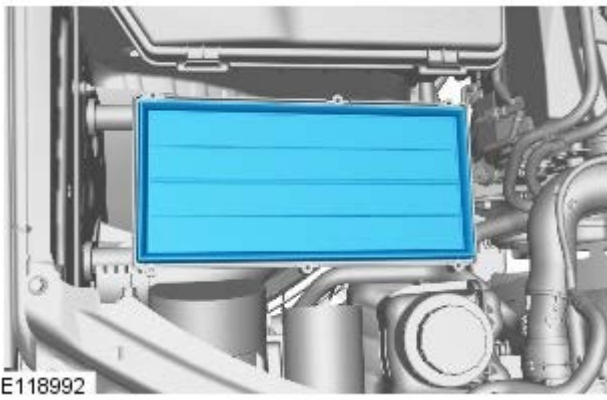
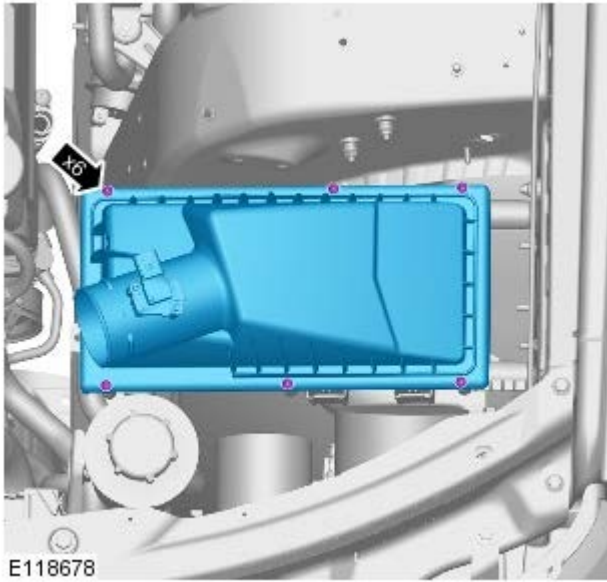
3. NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.



Left-hand shown, right-hand similar.



4. NOTES:

 Some variation in the illustrations may occur, but the essential information is always correct.

 Right-hand shown, left-hand similar.

- Repeat the above procedure for the other side.

Installation

1. To install reverse the removal procedure.

Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol - Air Cleaner LH

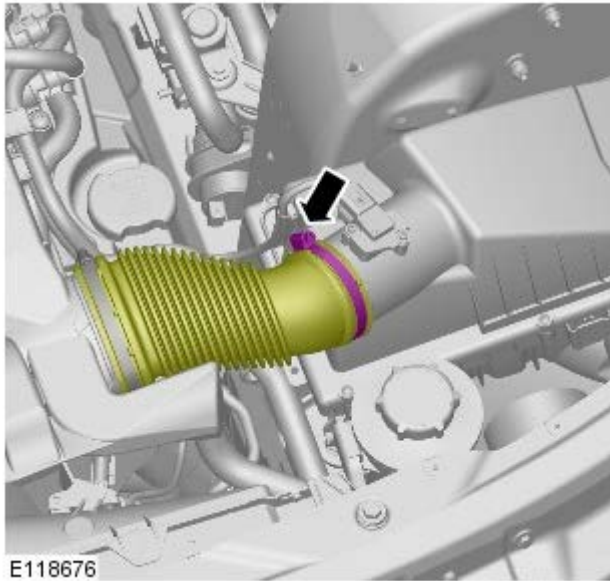
Removal and Installation


Removal

NOTES:

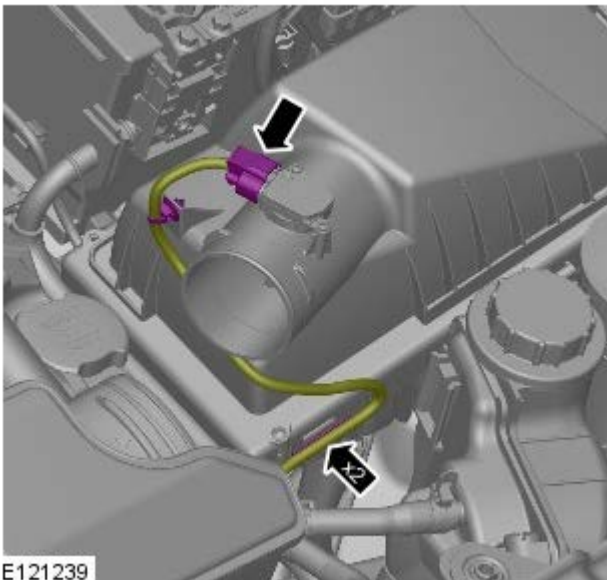
 Removal steps in this procedure may contain installation details.

 The ignition must be switched off.



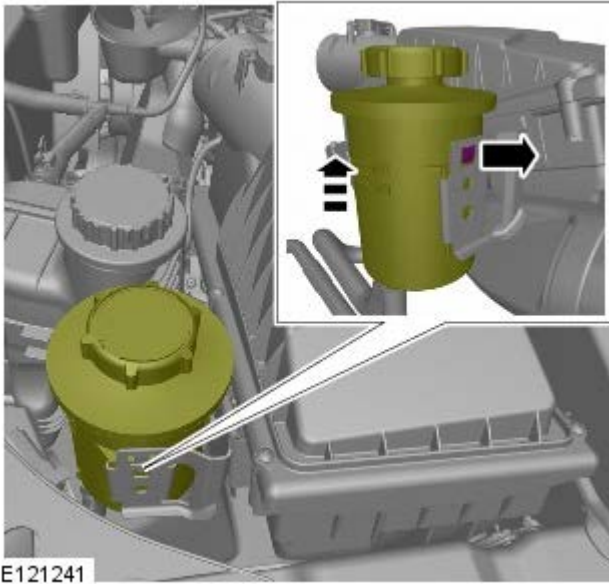
1.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Torque: 3.5 Nm

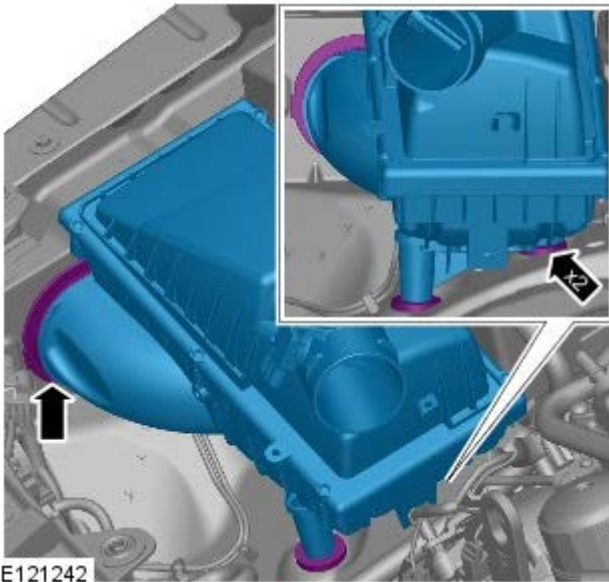


- 2.

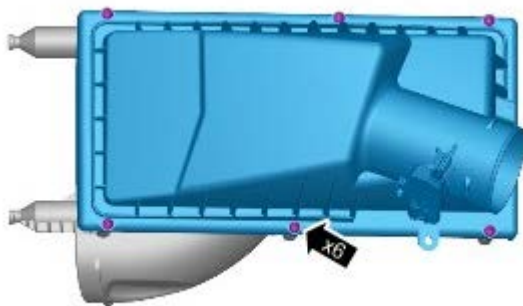
- 3.



E121241



E121242




E118991

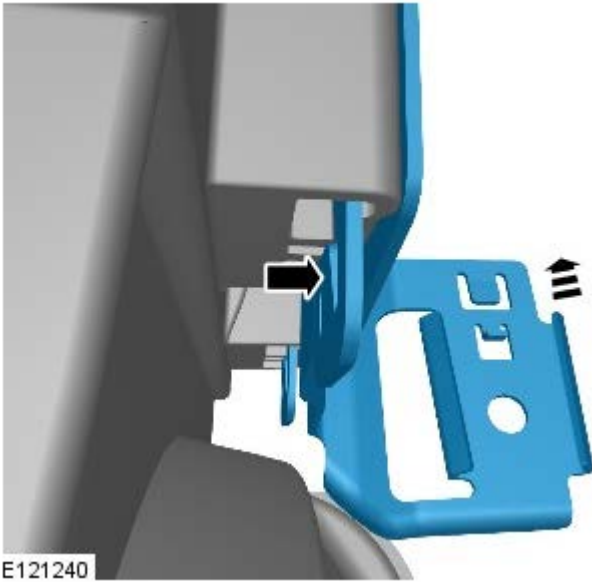
4.  NOTE: Right-hand shown, left-hand similar.

5. NOTES:

 Do not disassemble further if the component is removed for access only.

 Some variation in the illustrations may occur, but the essential information is always correct.

- 6.



E121240

7.



E121597

Installation

1. To install reverse the removal procedure.

Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol - Air Cleaner RH

Removal and Installation

Removal

NOTES:

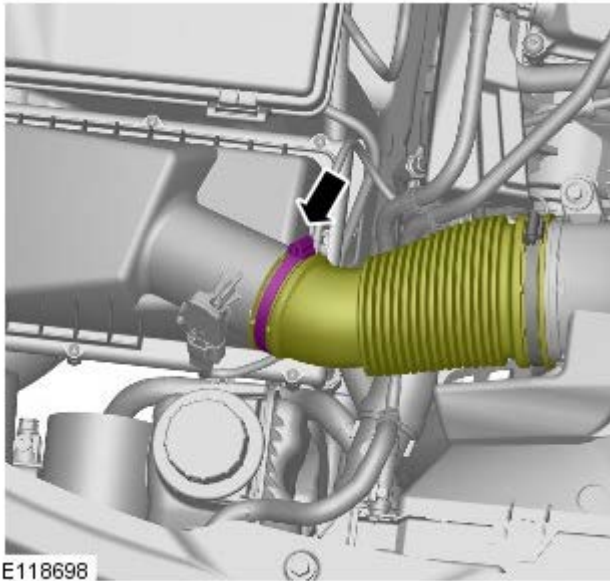


Removal steps in this procedure may contain installation details.

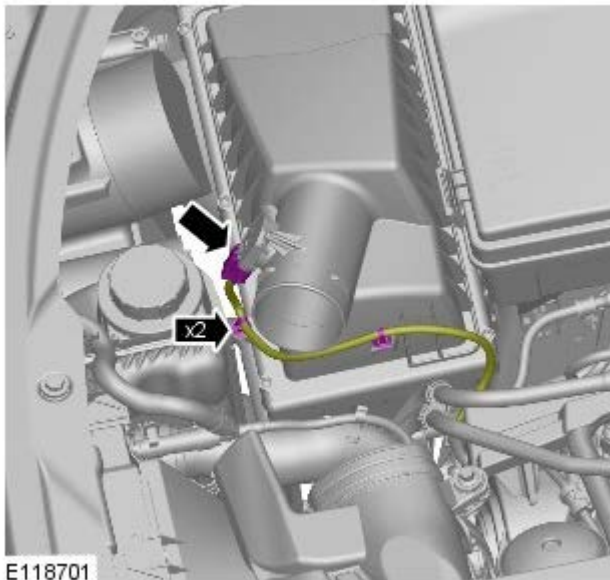


Some variation in the illustrations may occur, but the essential information is always correct.

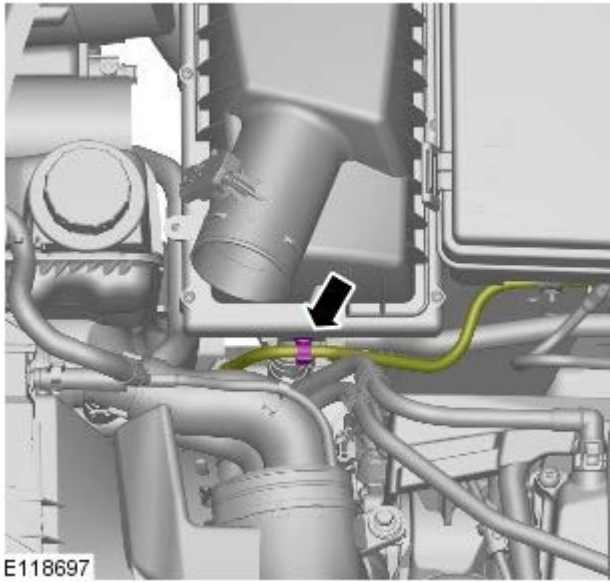
1. Torque: 3.5 Nm



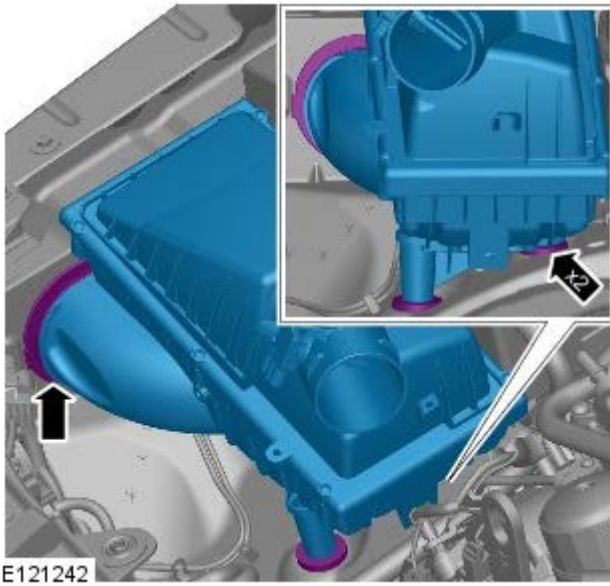
2.




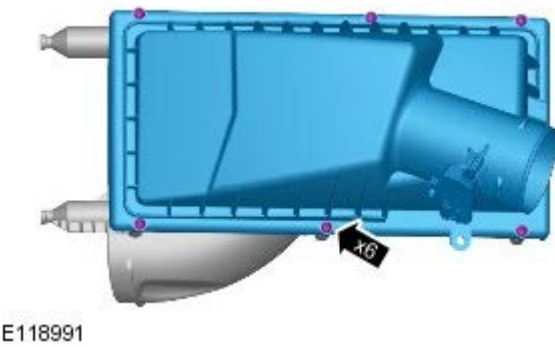
3.



4.



5.  NOTE: Do not disassemble further if the component is removed for access only.



6.



E121597

Installation

1. To install reverse the removal procedure.

Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol - Air Cleaner Outlet Pipe LH

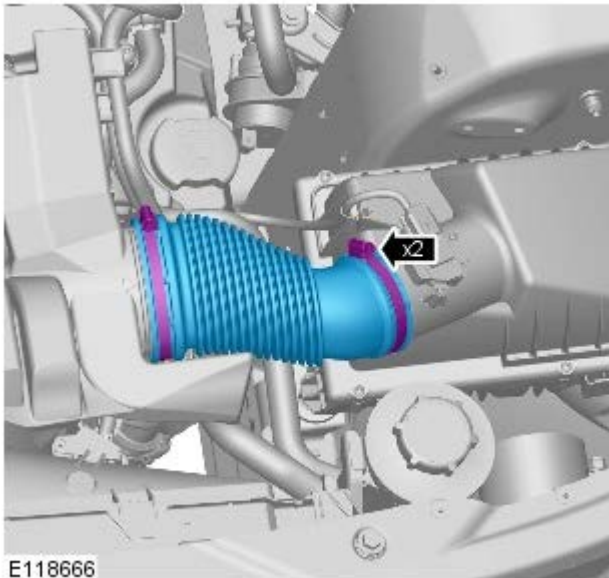
Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Engine Cover - 5.0L (501-05, Removal and Installation).



2. NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Torque: 3.5 Nm

Installation

1. To install reverse the removal procedure.

Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol - Air Cleaner Outlet Pipe RH

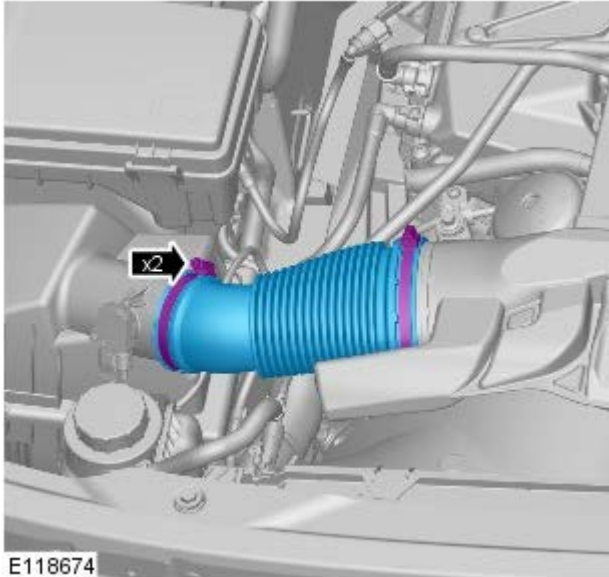
Removal and Installation


Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Engine Cover - 5.0L (501-05, Removal and Installation).



2.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Torque: 3.5 Nm

Installation

1. To install reverse the removal procedure.

This section contains no data

Evaporative Emissions - V6 S/C 3.0L Petrol - Evaporative Emissions

Diagnosis and Testing

Principles of Operation

For a detailed description of the evaporative emission system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (303-13A)

Evaporative Emissions (Description and Operation),
Evaporative Emissions (Description and Operation),
Evaporative Emissions (Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Fuel filler cap and seal • Fuel filler neck • DMTL fresh air filter (restriction, etc) • Fuel tank (leaks, damage, etc) • Fuel lines and joints, etc • Carbon canister • Purge valve • Diagnostic module fuel tank leak (DMTL) pump module 	<ul style="list-style-type: none"> • Fuses • Connectors • Harness • Purge valve • Diagnostic module fuel tank leak (DMTL) pump

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.
5. Where K-Line, Vacutec or other proprietary smoke test equipment is available, it should be utilized to assist with Evaporative Emissions System leak diagnosis.

Symptom Chart

Symptom	Possible Causes	Action
Difficulty in filling fuel tank	<ul style="list-style-type: none"> • Restriction in the vapour line between the fuel tank and the carbon canister outlet/atmospheric port 	Check for restrictions/damage, etc (see visual inspection)
Fuel smell	<ul style="list-style-type: none"> • System leak • Purge valve inoperative 	Check for leaks, check the purge valve operation
'Check Fuel Filler Cap' displayed on Message Center	<ul style="list-style-type: none"> • Fuel filler cap missing/not tightened after refuelling 	Check the fuel filler cap and seal

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

Evaporative Leak OBD Fault Rectification Guide

Determine Which DTC Has Been Stored

Using the manufacturer approved diagnostic system, choose **diagnostic session**, then choose the following symptom paths : **Powertrain/engine system/fuel vapour and odor, Powertrain/engine system/fuel tank, Electrical/instruments/warning lamps/engine malfunction lamp/lamp illuminated, Powertrain/engine system/engine performance/fuel consumption high**



NOTE: This guide covers DTCs that relate to evaporative leak monitoring, as listed in the table below

DTC	Description
P0442-00	DMTL small leak
P0447-00	DMTL COV electrical low (open)
P0448-00	DMTL COV electrical high
P0455-00	DMTL rough leak
P2401-00	DMTL pump electrical low (open)
P2402-00	DMTL pump electrical high
P2404-2F	DMTL noise fault
P2404-29	DMTL reference leak
P2405-00	DMTL reference current low
P2406-00	DMTL reference current high
P2450-00	DMTL COV stuck open
P2451-00	DMTL COV stuck closed
P240B-00	DMTL heater electrical low (open)
P240C-00	DMTL heater electrical high

Attempt To Replicate The Fault Using The "Fuel Leak Check" Forced Test

- Record any DTCs that has been logged
- Using the manufacturer approved diagnostic system, in the **Recommendations** tab run the **Fuel Leak Check** forced test
- For the test to run the fuel level must be between 15% and 85%
- During this procedure the engine must be off
- The possible responses from the test and the associated DTCs are listed below
- If again no fault is found it could suggest that the failure mode is a borderline condition (refer to section 3) or that it was caused by incorrect fitment of the fuel cap or the fuel filler neck is at fault therefore it is important not disturb the fuel cap
- Disconnect purge pipe from the purge valve, observe the condition of connection (the seating and condition of the "O" ring) and then reconnect. Using the manufacturer approved diagnostic system, run **Purge Valve Self Test** (to clean the purge valve) then run the **Fuel Leak Check**
- If the test failed, a smoke test is required to determine the cause of the leak



NOTE: P240B & P240C are not included in the **Fuel Leak Check** forced test (these monitors run at every ignition on and complete within 30 seconds)

Response Description	ID	Equivalent DTC
Function running: Reference leak measurement	1	
Function running: Rough leak measurement	2	
Function running: Small leak measurement	3	
Function running: 2nd ref leak measurement	4	
Function running: COV Cleaning	5	
Function aborted due to conditions: Vbatt conditions not correct (too high/ low)	11	
Function aborted due to conditions: Variation Ref. I (reference current) too high	12	P2404-29
Function aborted due to conditions: DMTL electrical fault	13	P0447, P0448
Function aborted due to conditions: Maximum diagnostic time exceeded	14	
Function aborted due to conditions: Crash detected	15	
Function aborted due to conditions: Refuel detected	20	
Function aborted due to conditions: Filler cap opened	21	
Function aborted due to conditions: Engine start	23	
Function aborted due to conditions: Noisy current measurement	24	P2404-2F
Function aborted due to conditions: Ambient temp outside range	26	
Function aborted due to conditions: Ambient pressure outside range	27	
Function aborted due to conditions: Other conditions	29	
Function complete - Tight system, fault free	30	
Function complete - Fine leak detected	31	P0442
Function complete - Rough leak detected	32	P0455
Function complete - Module error	33	P2401, P2402, P2450, P2451, P2405, P2406, P2404-29
Function complete - Medium leak detected	34	P0442, P0455

Read The "Ranking values" To Determine How Far Away The Result Is From The Failure Threshold

- When the **Fuel Leak Check** forced test has completed the test results (known as ranking values) will be

displayed

10. These should be compared against the limits shown in the table below

11. If the test result is borderline then there is a risk that a failure will occur at a later date (during customer usage of the vehicle)

12. To avoid this the vehicle should be carefully checked for any small leaks

Ranking Value	Normal Result For Tight System	Leak Failure Condition
Rough Leak (40 thou+)	0 > = 50	> = 128
Small Leak (20 thou+)	0 > = 60	> = 128

TRACE THE ROOT CAUSE OF THE FAULT

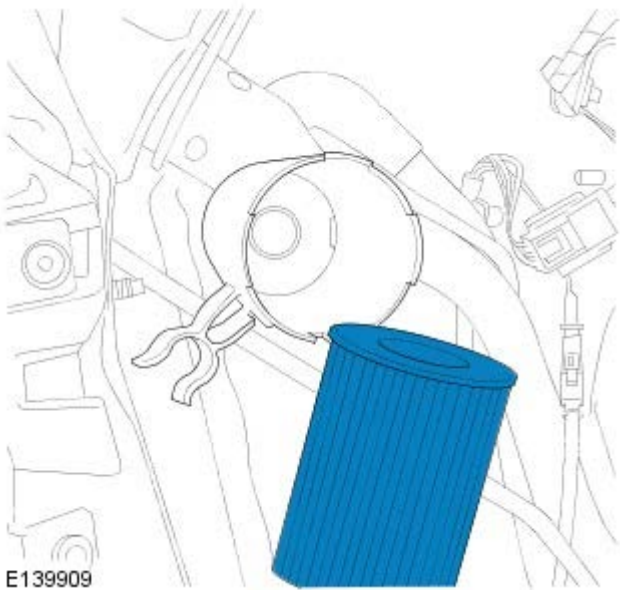
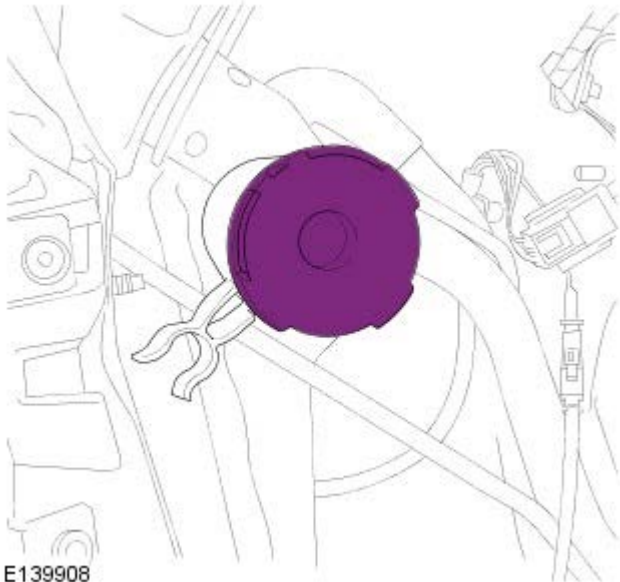
The list below provides some suggested actions to help trace the root cause of the fault

Each action should be followed up with a **Fuel Leak Check** forced test (and ranking value check) in order to determine if any improvement has been made

DTC	Fault Description	Fault Rectification Actions after smoke test
P0442-00	DMTL small leak	<ul style="list-style-type: none"> 1. Inspect / refit filler cap after smoke test (inspect filler neck for correct fitment to pocket so that filler neck protrudes) 2. Run engine at idle; Using the manufacturer approved diagnostic system, run Purge Valve Self Test (to clean the purge valve) 3. Check that the DMTL module wiring connector has been installed correctly and that the seals around the connector body and individual wires are in good condition 4. Check all fuel system connections are correctly installed and secure 5. Visually inspect purge canister, purge pipes, fuel tank and filler neck for any obvious damage 6. Try isolating the purge valve by fitting a blanking plug to the purge pipe 7. Carry out a smoke test 8. Replace the DMTL module
P0447-00	DMTL COV electrical low (open)	<ul style="list-style-type: none"> 1. Check fuse 2. Check that fuse fits tightly into the fuse holder 3. Check that the DMTL module wiring connector has been fitted correctly 4. Check wiring harness continuity between DMTL module and ECU connectors 5. Replace DMTL module
P0448-00	DMTL COV electrical high	<ul style="list-style-type: none"> 1. Check wiring 2. Replace DMTL module
P0455-00	DMTL rough leak	<ul style="list-style-type: none"> 1. Inspect / refit filler cap after smoke test (inspect filler neck for correct fitment to pocket so that filler neck protrudes) 2. Run engine at idle; Using the manufacturer approved diagnostic system, run "Purge Valve Self Test" (to help clean the purge valve) 3. Check that the DMTL module wiring connector has been installed correctly and that the seals around the connector body and individual wires are in good condition (surprisingly, this is a potential leakage path!) 4. Check all fuel system connections are correctly installed and secure 5. Visually inspect purge canister, purge pipes, fuel tank and filler neck for any obvious damage 6. Try isolating the purge valve by fitting a blanking plug to the purge pipe 7. Carry out a smoke test 8. Replace DMTL module
P2401-00	DMTL pump electrical low (open)	<ul style="list-style-type: none"> 1. Check fuse 2. Check that fuse fits correctly into the fuse holder 3. Check that the DMTL module wiring connector has been fitted correctly 4. Check wiring harness continuity between DMTL module and ECU connectors 5. Replace DMTL module
P2402-00	DMTL pump electrical high	<ul style="list-style-type: none"> 1. Check wiring 2. Replace DMTL module
P2404-2F	DMTL noise fault	<ul style="list-style-type: none"> Replace DMTL module
P2404-29	DMTL reference leak	<ul style="list-style-type: none"> Replace DMTL module
P2405-00	DMTL reference current low	<ul style="list-style-type: none"> Replace DMTL module
P2406-00	DMTL reference current high	<ul style="list-style-type: none"> 1. Check for any blockages in the DMTL ventilation pipe & filter 2. Replace DMTL module
P2450-	DMTL COV	<ul style="list-style-type: none"> Replace DMTL module

00	stuck open	
P2451-00	DMTL COV stuck close	<ul style="list-style-type: none"> • Replace DMTL module
P240B-00	DMTL heater electrical low (open)	<ul style="list-style-type: none"> • 1. Check fuse • 2. Check that fuse fits tightly into the fuse holder • 3. Check that the DMTL module wiring connector has been fitted correctly • 4. Check wiring harness continuity between DMTL module and ECU connectors • 5. Replace DMTL module
P240C-00	DMTL heater electrical high	<ul style="list-style-type: none"> • 1. Check wiring • 2. Replace DMTL module

Pre and 10MY Denso/Bosch PCM Systems



CAUTION: The Maximum pressure of the EVAP system is 0.07 bar **do not exceed**

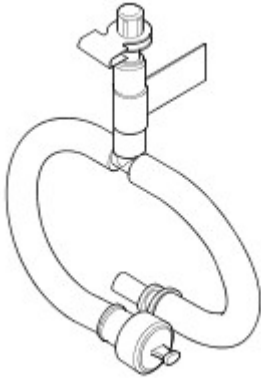


NOTE: Apart from the purge valve connection, it is recommended to smoke test the EVAP system without disturbing any joints associated with the system, this will determine the leak more accurately and quickly

- 1. Remove rear wheel arch liner to access fuel filler neck
- 2. On the fuel filler neck the DMTL filter will be visible as shown in picture. Unclip filter housing from fuel filler neck to gain better access to DMTL filter
- 3. Remove carefully the top of filter to expose filter and remove
- 4. Attach rubber adapter to tip of smoke machine nozzle to ensure tight seal to filter housing. Disconnect the purge pipe from purge valve; this will be an escape point for the smoke to exit
- 5. Allow tester to complete self-test and green READY light to turn ON 2. For best Tester performance; completely unwind Tester's supply hose
- 6. Press **Smoke** on control panel to fill EVAP system with smoke vapour. The control panel **Smoke** light

will light indicating smoke production. The smoke setting is on a 15 minute timer. Pressing the **Smoke** button again turns Tester off. It is normal for the flow meter ball, while in the smoke mode, not to be as steady as when it is in the **Test** mode. Note: The pressure gauge is active only after smoke cycle is complete

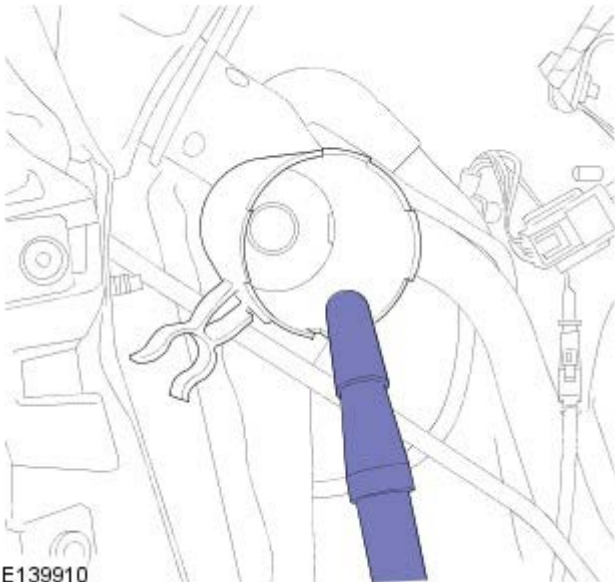
- 7. Continue introducing smoke into the EVAP System until the flow meter's ball stops descending and this assures the system test pressure is met and smoke will appear from the purge pipe, then close off purge pipe with special tool (Test Adapter Hose/EVAP Port 310-142)



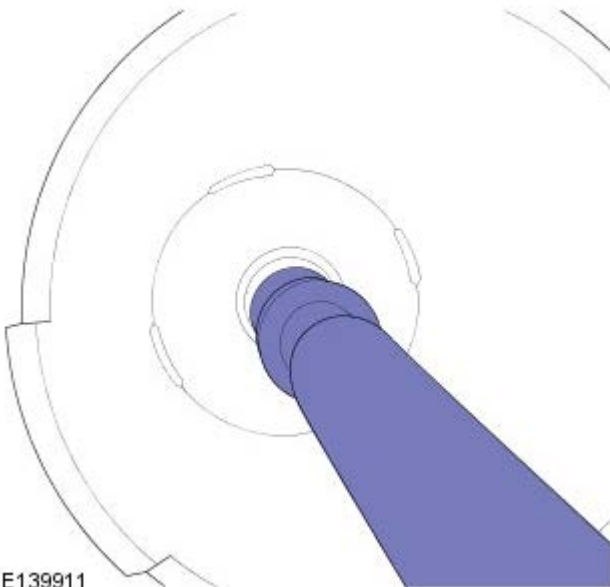
E147697



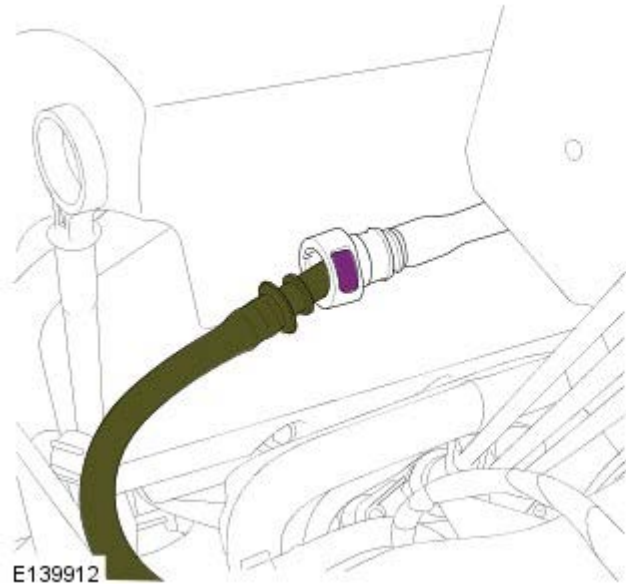
NOTE: Special tool (Test Adapter Hose/EVAP Port 310-142)



E139910



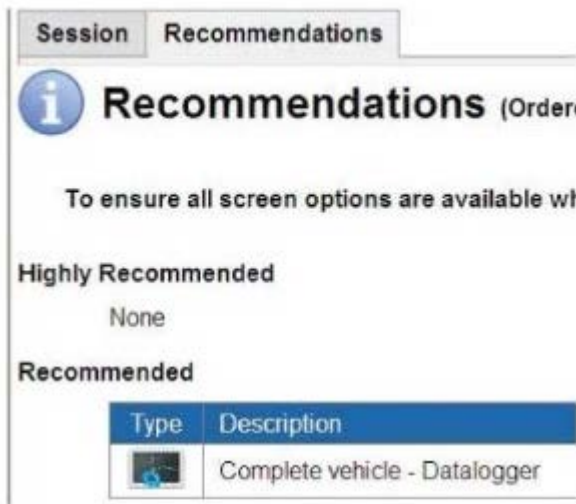
E139911



CAUTION: On some vehicles, the DMTL filter can not be removed, in these instances fill the system through the purge valve and smoke will appear from the filter

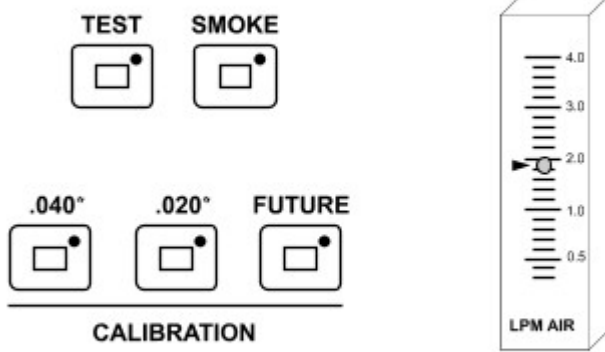
Pre 10MY Vehicles

On pre 10MY DMTL systems, Using the manufacturer approved diagnostic system, select **Measurement application** session then select the **Recommendations** tab which will give you access to **Datalogger**. Then select **Engine systems** then select the **Output state control** data-logger signal **Engine output 1 – diagnostic module – tank leakage -change over valve active** which will close the system. Then select **Engine output 1 – diagnostic module – tank leakage – pump active** this will pressurize the EVAP system



- Engine output 1 - engine management system warning lamp.
- Engine output 1 - malfunction indicator warning lamp.
- Engine output 1 - diagnostics module - tank leakage - test complete.
- Engine output 1 - diagnostics module - tank leakage - heater active.
- Engine output 1 - diagnostics module - tank leakage - pump active.
- Engine output 1 - diagnostics module - tank leakage - changeover valve active.
- Engine output 2 - heated exhaust gas oxygen heater active - bank 2.

E139916



E139913

10MY vehicles

On 10MY vehicles a smoke test application is available so therefore only smoke fill the system and then run the application

- 8. Follow the EVAP system path with the halogen light provided and looks for the smoke exiting the leak(s) or use the UV light provided and look for the dye deposited at the exact location of the leak(s)
- 9. Repair the leak(s) and perform the **Fuel Leak Check** application again or smoke test to verify repair, as well as to make sure there are no additional leaks in the EVAP system

The UltraTraceUV® smoke solution's dye feature is especially helpful when the leak is in an area that is not readily visible, as on the top of the fuel tank or behind a panel. Once you gain access to the area of the leak, wear the yellow UV glasses and shine the UV light provided to identify the exact location of the leak(s). Smoke exiting a very small leak is even easier to see with lower pressure. If you encounter smoke leaking out of an area but find it difficult to pinpoint exactly where the source of the leak is; try reducing the pressure in the system being tested by turning the Tester OFF and allow the pressure to dissipate. The longer a particular leak is allowed to leak, the more fluorescent dye material will be deposited at that leak. With some vapour system leaks, the leak may only present itself under vacuum and not under pressure. If equipment permits, test the system in both states. Purge valve faults [P0441, P0444, P0458 and P0459] should all inhibit DMTL leak test and therefore need to be resolved prior to any DMTL issues. For this reason, when smoke testing the vapour system, it should be sufficient to enter the system at the connection up stream of the purge valve. If no leak is found then testing the remainder of the system up to the purge valve is recommended



NOTE: It may be possible to search for small leaks using a gas analyzer and looking for HC (hydro carbon) spikes. This should enable leaks to be detected in areas of the vapor system that our out of sight of the technician. The solenoid should be deactivated after five minutes to prevent potential damage. Check that connector and individual terminals are sealed correctly

Phase-One – (quantifying the leak)



E139914

- 1. Connect the tester supply hose to vehicle EVAP system. > Refer to appropriate vehicle application

- 2. Determine if the vehicle's EVAP system you are testing is governed by a .020" (0.5 mm) or .040" (1 mm) acceptable leak standard. Press the appropriate calibration standard on the tester's control panel and observe the position of the flow meter ball. > This function automatically turns off in 10 seconds
- 3. Position the flow meter's pointer flag so that it aligns with the measurement observed in step 2 above. > This sets PASS / FAIL mark
- 4. Close vehicle's EVAP Vent Solenoid. > Refer to appropriate vehicle application
- 5. Press TEST on control panel and fill EVAP system. > This introduces 5-minutes of nitrogen gas
- 6. Look for flow meter ball to stop descending indicating that the vehicle system is full. > Fill time 1-4 minutes depending on system volume
- 7. Compare flow meter ball reading to pointer flag. > ABOVE flag = FAIL (go to Phase-Two). > BELOW flag = PASS (test complete)

Testing With Pressure and Vacuum Decay

In addition to quantifying the leak with the Phase-One flow test, the Tester allows you the flexibility of testing the vehicle's EVAP system by using either **Pressure Decay** or **Vacuum Decay** methods. Below are instructions for performing both decay tests

Pressure-Decay Test



NOTE: The Pressure Decay test is best performed immediately after the Phase-one flow test, since the system has already built up pressure

At the completion of the Phase-one flow test, the EVAP system is fully pressurized, since the Phase-one test uses pressure to perform its flow test. Testing pressure decay with the Vacutec® 522B-J/LR is very simple. All you need to do is the following:

1. Allow tester to complete self-test and green **READY** light to turn ON
2. Connect Tester supply hose to vehicle EVAP system
3. Close vehicle's EVAP Vent solenoid > Refer to appropriate vehicle application
4. Press **VACUUM** switch on the tester control panel
 - NOTE: The vacuum switch is on a 30-second timer, which should be sufficient time to draw the appropriate vacuum from the EVAP system. Press VACUUM switch again if additional time is required
5. After vacuum timer turns off, observe the vacuum gauge for any decay (loss of vacuum) indicating a leak in the EVAP system



E139915



NOTE: Disconnect the Tester from the vehicle after the Vacuum Decay Test. The fuel pressure in the vehicle's fuel tank is constantly changing due to the vehicle's fuel volatility and that could cause the Tester's pressure gauge to exceed its maximum reading limits

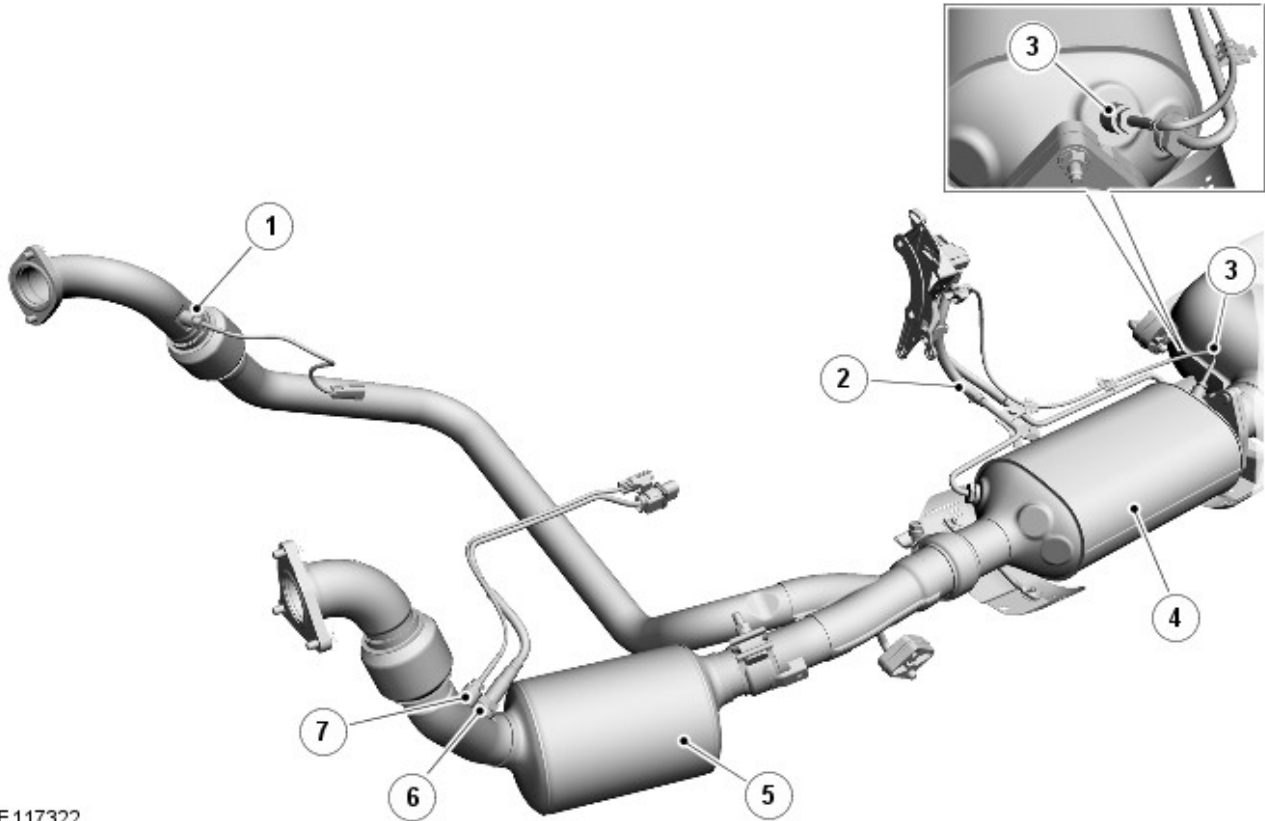
Electronic Engine Controls - TDV6 3.0L Diesel -**Torque Specification**

Description	Nm	lb-ft	lb-in
Camshaft position (CMP) sensor retaining bolt	10	7	-
Crankshaft position (CKP) sensor retaining bolt	5	-	44
Engine control module (ECM) retaining bolts	7	-	62
Engine control module (ECM) retaining nuts	7	-	62
Engine oil pressure (EOP) sensor	14	11	-
Engine oil level sensor retaining bolts	10	7	-
Mass air flow (MAF) sensor	2	-	18
Manifold absolute pressure (MAP) sensor	3	-	27
Exhaust gas temperature sensor RH	35	26	-
Pre catalytic converter temperature sensor	35	26	-
Post catalytic converter temperature sensor	35	26	-
Pre diesel particulate filter (DPF) exhaust gas temperature sensor	35	26	-
Post DPF exhaust gas temperature sensor	35	26	-
Heated oxygen sensor (HO2S)	48	35	-

Electronic Engine Controls - TDV6 3.0L Diesel - Electronic Engine Controls - Component Location

Description and Operation

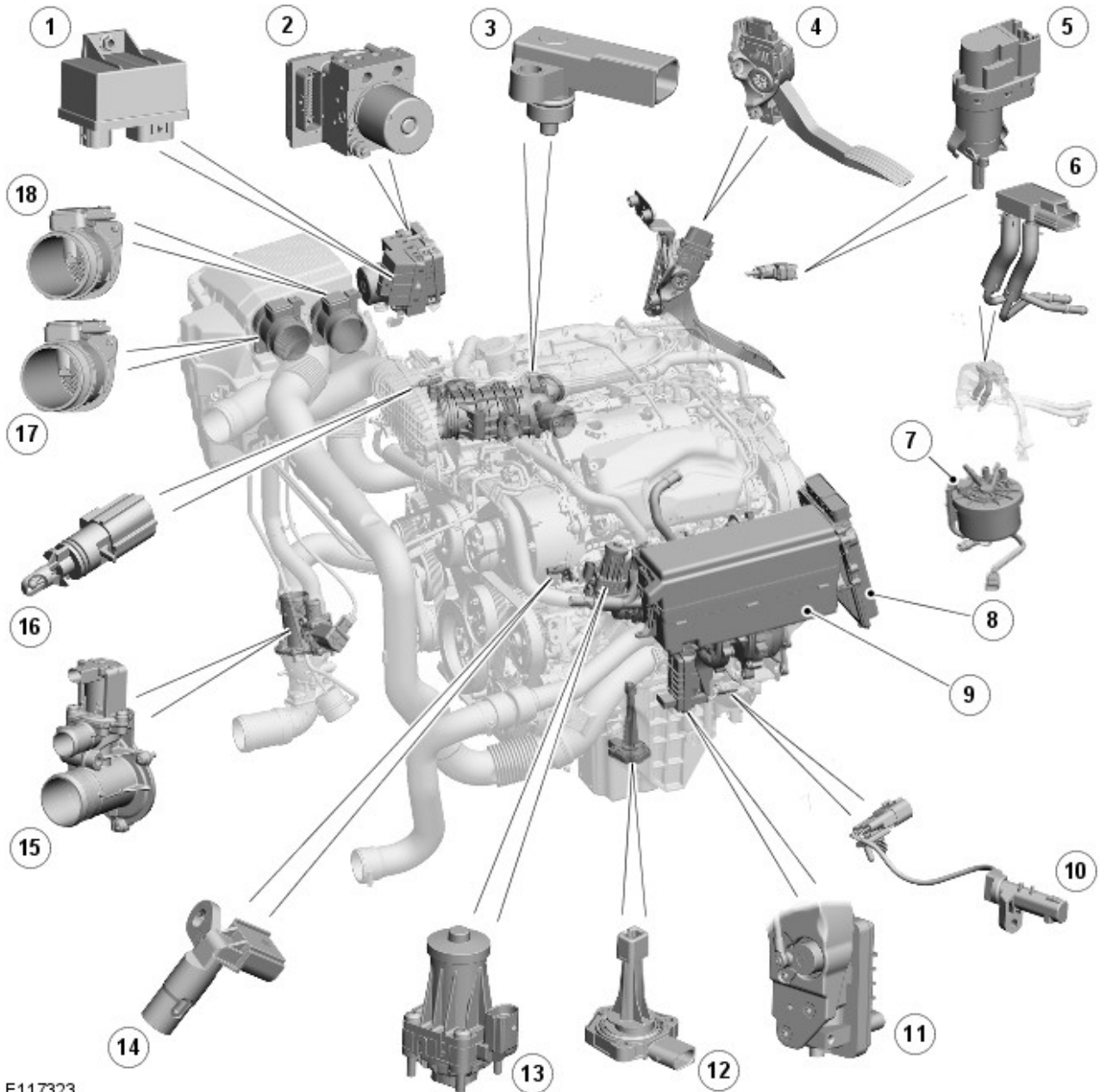
Component Location - Sheet 1 of 3



E117322

Item Description

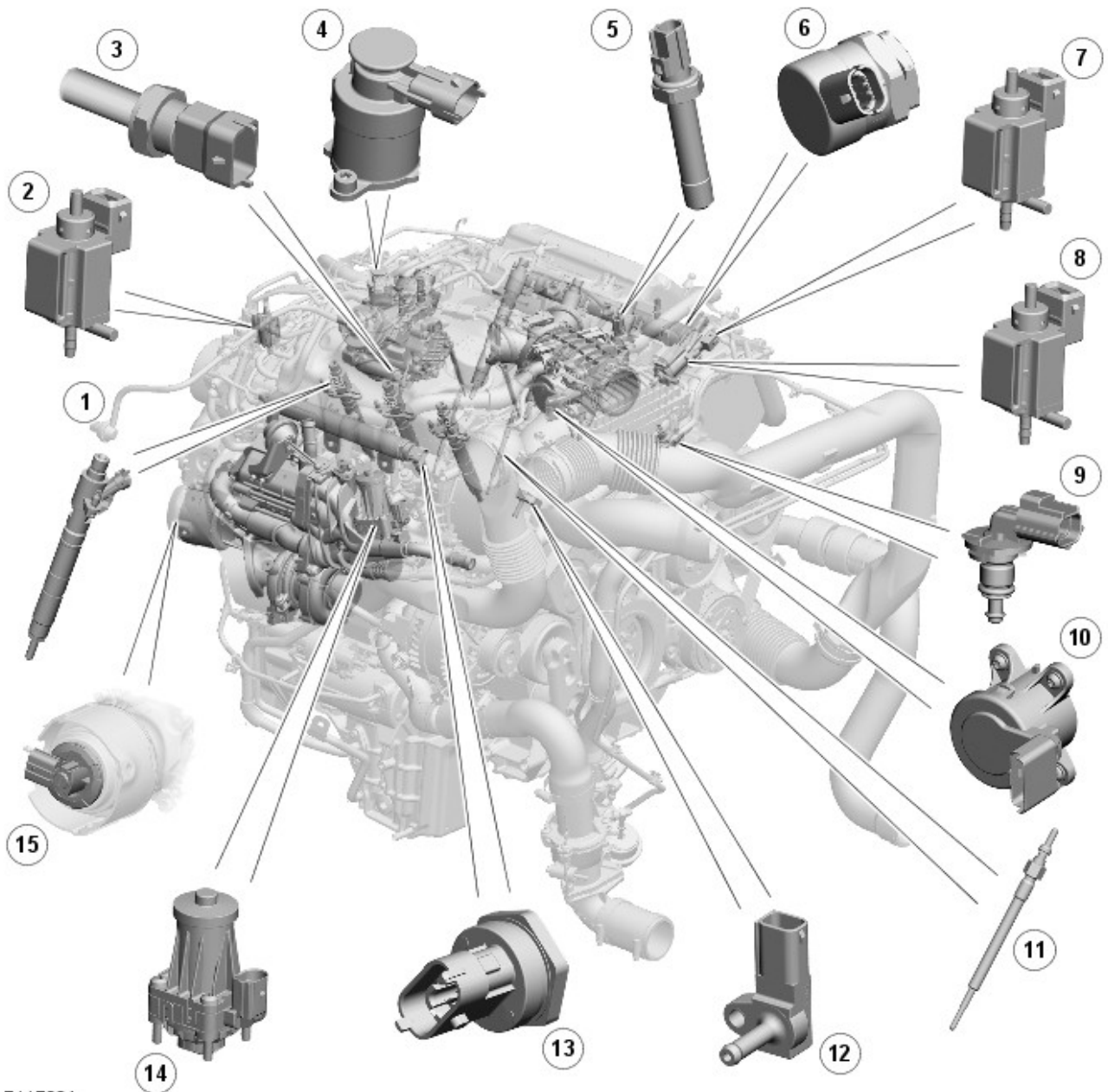
- 1 Exhaust gas temperature sensor
 - 2 [DPF \(diesel particulate filter\)](#) pressure pipes (connected to differential pressure sensor located on top of transmission)
 - 3 [DPF](#) temperature sensors
 - 4 [DPF](#)
 - 5 Catalyst ([RH \(right-hand\)](#) bank)
 - 6 [HO2S \(heated oxygen sensor\)](#)
 - 7 Pre-catalyst temperature sensor
- Component Location - Sheet 2 of 3



E117323

Item Description

- 1 Glow plug module
- 2 [ABS \(anti-lock brake system\)](#) module
- 3 [MAP \(manifold absolute pressure\)](#) sensor
- 4 [APP \(accelerator pedal position\)](#) sensor
- 5 Brake lamp/brake test switch
- 6 Differential pressure sensor
- 7 Water-in-fuel sensor
- 8 [ECM \(engine control module\)](#)
- 9 [EJB \(engine junction box\)](#)
- 10 [CKP \(crankshaft position\)](#) sensor
- 11 Primary turbocharger control module
- 12 Engine oil level/temperature sensor
- 13 [LH \(left-hand\)EGR \(exhaust gas recirculation\)](#) valve
- 14 [CMP \(camshaft position\)](#) sensor
- 15 Secondary turbocharger compressor recirculation valve
- 16 Charge air temperature sensor
- 17 [MAF \(mass air flow\) / IAT \(intake air temperature\)](#) sensor (primary turbocharger)
- 18 [MAF](#) sensor (secondary turbocharger)



E117324

Item Description

- 1 Fuel injector (6 off)
- 2 [EGR](#) cooler bypass vacuum solenoid valve
- 3 High pressure fuel pump inlet temperature sensor
- 4 High pressure fuel pump volume control valve
- 5 Engine oil pressure sensor
- 6 Fuel pressure control valve
- 7 Secondary turbocharger compressor shut-off solenoid valve
- 8 Secondary turbocharger turbine shut-off solenoid valve
- 9 [ECT \(engine coolant temperature\)](#) sensor
- 10 Throttle actuator
- 11 Glow plug (6 off)
- 12 Secondary turbocharger boost pressure sensor
- 13 Fuel pressure sensor
- 14 [RHEGR](#) valve
- 15 Secondary turbocharger turbine shut-off valve and position sensor

Electronic Engine Controls - TDV6 3.0L Diesel - Electronic Engine Controls - Overview

Description and Operation

OVERVIEW

The 3.0L V6 diesel engine has an [ECM \(engine control module\)](#) controlled engine management system. Multiple sensor inputs and precision control of actuators are used by the [ECM](#) to achieve optimum performance during all driving conditions.

The [ECM](#) receives and processes information from the following input sources:

- Oil level sensor
- Secondary turbocharger shut-off sensor
- Secondary turbocharger boost pressure sensor
- Generator
- Differential pressure sensor
- [CMP \(camshaft position\)](#) sensor
- [CKP \(crankshaft position\)](#) sensor
- Fuel rail pressure sensor
- Fuel temperature sensor
- Air charge temperature sensor
- [ECT \(engine coolant temperature\)](#) sensor
- [TP \(throttle position\)](#) sensor
- [MAF \(mass air flow\)](#) sensor
- [MAF/IAT \(intake air temperature\)](#) sensor
- [MAP \(manifold absolute pressure\)](#) sensor
- [EGR \(exhaust gas recirculation\)](#) sensors
- [HO2S \(heated oxygen sensor\)](#)
- Catalyst and Diesel Particulate Filter (DPF) temperature sensors
- Brake lamp switch

The [ECM](#) outputs controlling signals to the following sensors and actuators:

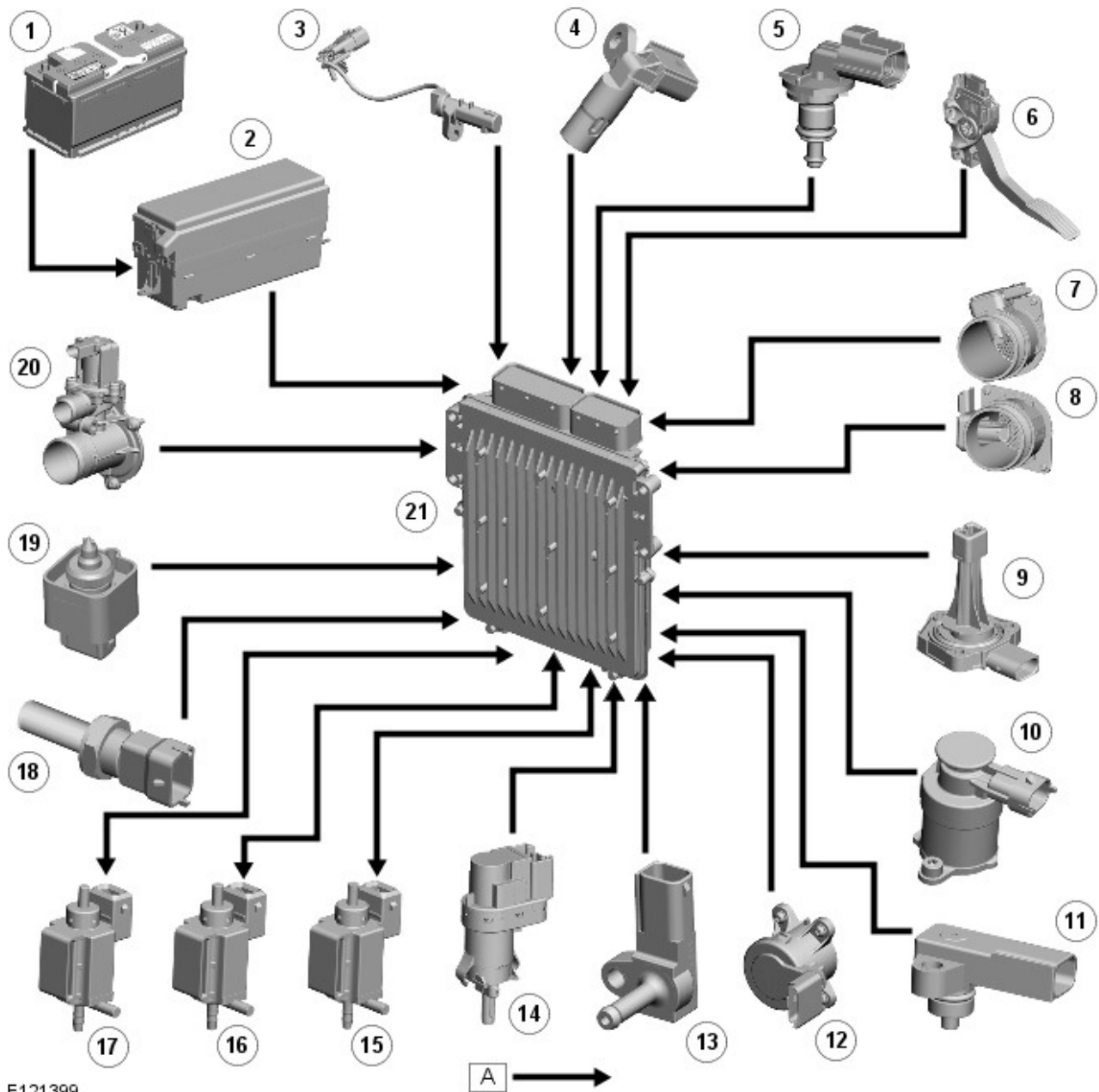
- [A/C \(air conditioning\)](#) compressor clutch solenoid
- [A/C](#) compressor clutch
- Fuel injectors
- Glow plug relay
- Fuel pressure control valve
- Fuel volume control valve
- Fan control module
- Vacuum control valves (EGR cooler by-pass, secondary turbocharger compressor shut-off, secondary turbocharger turbine shut-off)
- [ABS \(anti-lock brake system\)](#) module
- [TCM \(transmission control module\)](#)
- Instrument cluster
- [RCM \(restraints control module\)](#)
- Primary turbocharger control module
- [EGR](#) recirculation valves
- Alternator
- Throttle actuator
- Secondary turbocharger compressor recirculation valve

Electronic Engine Controls - TDV6 3.0L Diesel - Electronic Engine Controls - System Operation and Component Description

Description and Operation

Control Diagram

3.0L V6 Diesel Control Diagram - Sheet 1 of 2



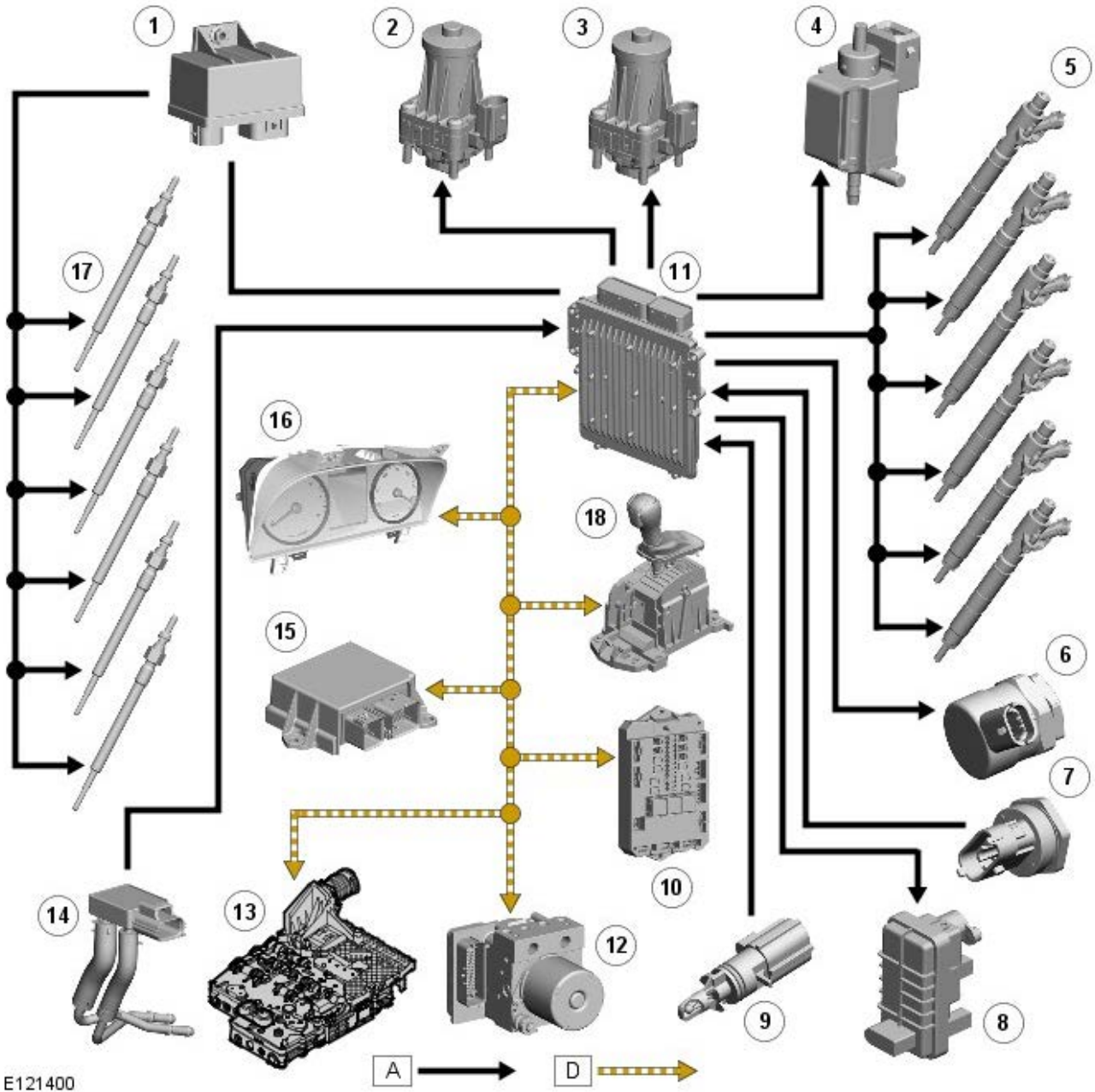
E121399

Item Description

NOTE A = Hardwired

- 1 Battery
- 2 EJB (engine junction box)
- 3 CKP (crankshaft position) sensor
- 4 CMP (camshaft position) sensor
- 5 ECT (engine coolant temperature) sensor
- 6 APP (accelerator pedal position) sensor
- 7 MAF (mass air flow)/IAT (intake air temperature) sensor
- 8 MAF sensor
- 9 Engine oil level/temperature sensor
- 10 High pressure fuel pump volume control valve
- 11 MAP (manifold absolute pressure) sensor
- 12 Throttle actuator
- 13 Secondary turbocharger boost pressure sensor

- 14 Brake lamp/brake test switch
 - 15 EGR (exhaust gas recirculation) solenoid valve
 - 16 Secondary turbocharger turbine shut-off solenoid valve
 - 17 Secondary turbine compressor shut-off solenoid valve
 - 18 High pressure fuel pump inlet temperature sensor
 - 19 Water in fuel sensor
 - 20 Secondary turbocharger recirculation valve
 - 21 ECM (engine control module)
- 3.0L V6 Diesel Control Diagram - Sheet 2 of 2



E121400

Item Description

NOTE **A** = Hardwired; **D** = High Speed CAN (controller area network)

- 1 Glow plug relay
- 2 LH (left-hand) EGR recirculation valve
- 3 RH (right-hand) EGR recirculation valve
- 4 EGR cooler bypass vacuum solenoid valve
- 5 Fuel injector (6 off)
- 6 Fuel pressure control valve
- 7 Fuel pressure sensor
- 8 Primary turbocharger control module
- 9 Charge air temperature sensor
- 10 CJB (central junction box)
- 11 ECM

- 12 ABS (anti-lock brake system) module
- 13 TCM (transmission control module)
- 14 Differential pressure sensor
- 15 RCM (restraints control module)
- 16 Instrument cluster
- 17 Glow plug (6 off)
- 18 Transmission selector

System Operation

OPERATION

The 3.0L V6 diesel engine management system is controlled by an ECM and is able to monitor, adapt and precisely control the fuel injection. The ECM uses multiple sensor inputs and precision control of actuators to achieve optimum performance during all driving conditions.

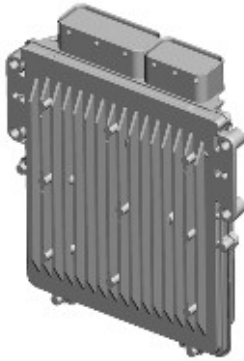
The ECM controls fuel delivery to all six cylinders via a common rail injection system. The common rail system uses a fuel rail to accumulate highly pressurized fuel and feed the six, electronically controlled injectors. The fuel rail is located in close proximity to the injectors, which assists in maintaining full system pressure at each injector at all times.

The ECM uses the drive by wire principle for acceleration control. There are no control cables or physical connections between the accelerator pedal and the engine. Accelerator pedal demand is communicated to the ECM by two potentiometers located in an APP sensor. The ECM uses the two signals to determine the position, rate of movement and direction of movement of the pedal. The ECM then uses this data, along with other engine information from other sensors, to achieve the optimum engine response.

Component Description

DESCRIPTION

Engine Control Module (ECM)



E123673

The ECM is located on a bracket on the passenger side of the engine compartment bulkhead.

The ECM connected to the vehicle harnesses via 2 connectors. The ECM contains data processors and memory microchips. The output signals to the actuators are in the form of ground paths provided by driver circuits within the ECM. The ECM driver circuits produce heat during normal operation and dissipate this heat via the casing. Some sensors receive a regulated voltage supplied by the ECM. This avoids incorrect signals caused by voltage drop during cranking.

The ECM performs self diagnostic routines and stores fault codes in its memory. These fault codes and diagnostics can be accessed using Land Rover approved diagnostic equipment. If the ECM is to be replaced, the new ECM is supplied 'blank' and must be configured to the vehicle using Land Rover approved diagnostic equipment. A 'flash' EEPROM (electrically erasable programmable read only memory) allows the ECM to be externally configured, using Land Rover approved diagnostic equipment, with market specific or new tune information. The current engine tune data can be accessed and read using Land Rover approved diagnostic equipment.

When a new ECM is fitted, it must also be synchronized to other system control modules using Land Rover approved diagnostic equipment. ECM's cannot be 'swapped' between vehicles as they must be 'matched' with security information to other system modules.

The ECM is connected to the engine sensors which allow it to monitor the engine operating conditions. The ECM processes these signals and decides the actions necessary to maintain optimum engine performance in terms of drive ability, fuel efficiency and exhaust emissions. The memory of the ECM is programmed with instructions for how to control the engine. The memory also contains data in the form of maps which the ECM uses as a basis for fueling and emission control. By comparing the information from the sensors to the data in the maps, the ECM is able to calculate the various output requirements. The ECM contains an adaptive strategy which updates the system when components vary due to production tolerances or ageing.

The ECM is connected to other system control modules and receives data from these modules on the high speed CAN bus to enable precise engine control under all vehicle operating conditions.

Crankshaft Position (CKP) Sensor



E116415

The **CKP** sensor is located at the rear of the engine block on the **LH** side. The sensor lead passes through a cover in an aperture on the side of the engine block. The sensor is secured to a bracket on a plate which locates the rear crankshaft oil seal. The sensor tip is aligned with a magnetic trigger reluctor wheel which is attached to the end of the crankshaft. The trigger wheel is a press fit on the end of the crankshaft. The trigger wheel must be carefully aligned to the crankshaft to ensure correct timing. The sensor produces a square wave signal, the frequency of which is proportional to engine speed.

The **ECM** monitors the **CKP** sensor signal and can detect engine over-speed. The **ECM** counteracts engine over-speed by gradually fading out speed synchronized functions. The **CKP** is a Hall effect sensor. The sensor measures the magnetic field variation induced by the magnetized trigger wheel.

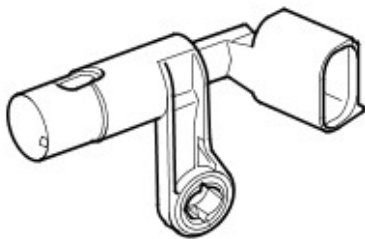
The trigger wheel has a 60 minus 2 tooth pattern. The missing teeth represent 12 degrees of crankshaft rotation and provide a reference point for the angular position of the crankshaft at 21 degrees **BTDC** (before top dead center) on cylinder 1.

When the space with the two missing teeth pass the sensor tip, a gap in the signal is produced which the **ECM** uses to determine the crankshaft position. The air gap between the sensor tip and the ring is important to ensure correct signals are output to the **ECM**. The recommended air gap between the **CKP** and the trigger wheel is 0.4 mm - 1.5 mm.

The **ECM** uses the signal from the **CKP** sensor for the following functions:

- Synchronization
- Determine fuel injection timing
- Produce an engine speed signal which is broadcast on the high speed **CAN** bus for use by other systems.

Camshaft Position (CMP) Sensor



E46902

The **CMP** is located on the front face of the **LH** cylinder head. The sensor tip protrudes through an aperture in the front face of the cylinder head to pick up on a reluctor behind the camshaft pulley. The **CMP** sensor is a Hall effect type sensor.

The **ECM** uses the **CMP** sensor signal to determine if the piston in No. 1 cylinder is at injection **TDC** (top dead center) or exhaust **TDC**. Once this has been established, the **ECM** can then operate the correct injector to inject fuel into the cylinder when the piston is at injection **TDC**.

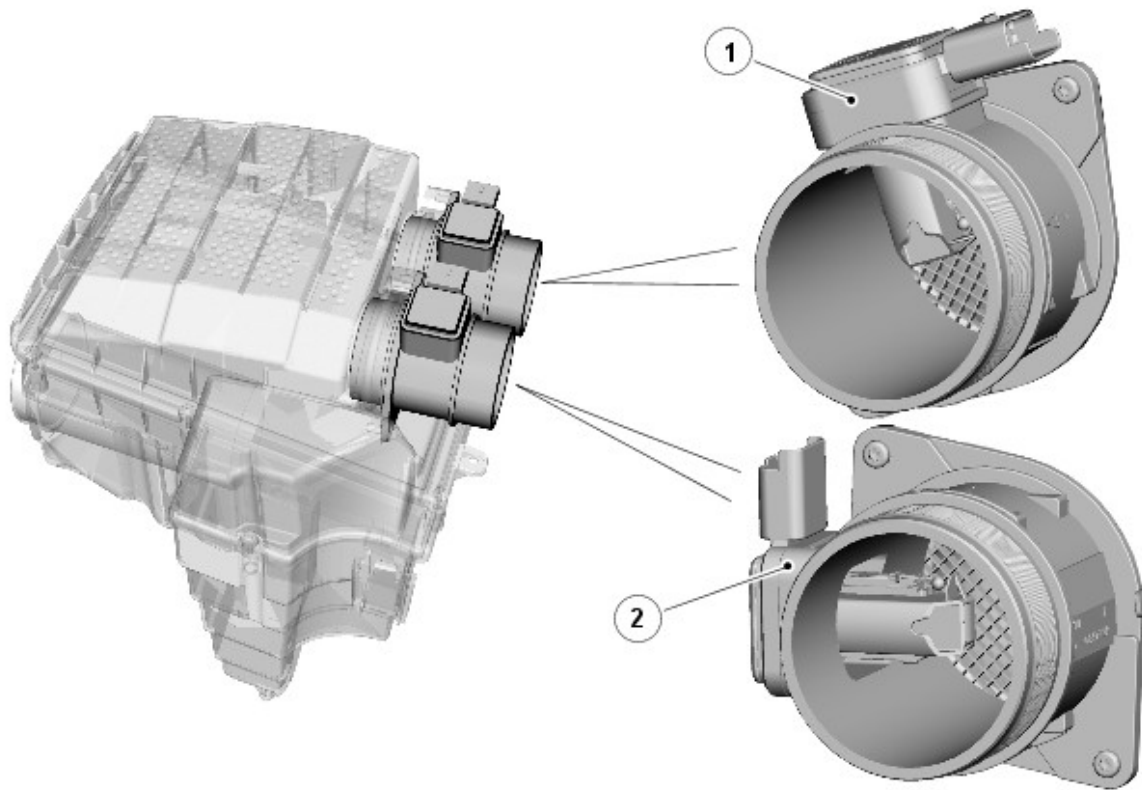
The **CMP** sensor is a Hall effect sensor which used by the **ECM** at engine start-up to synchronize the **ECM** with the **CKP** sensor signal. The **ECM** does this by using the **CMP** sensor signal to identify number one cylinder to ensure the correct injector timing. Once the **ECM** has established the injector timing, the **CMP** sensor signal is no longer used.

The **CMP** sensor receives a 5V supply from the **ECM**. Two further connections to the **ECM** provide ground and signal output.

If a fault occurs, an error is registered in the **ECM**. Two types of failure can occur; no **CMP** sensor signal or a synchronization error of the **CMP** and **CKP** sensors. The error recorded by the **ECM** can also relate to a total failure of the crankshaft signal or crankshaft signal dynamically implausible. Both components should be checked to determine the cause of the fault.

If a fault occurs with the **CMP** sensor when the engine is running, the engine will continue to run but the **ECM** will deactivate boost pressure control. Once the engine is switched off, the engine will crank but will not restart while the fault is present.

Mass Air Flow (MAF) and Inlet Air Temperature (IAT) Sensors



E123727

Item Description

- 1 MAF sensor
- 2 MAF/IAT sensor

The MAF/IAT sensors are located on the inlet air duct directly after the air filter box. Two sensors are fitted; the front sensor, located prior to the intake air to primary turbocharger pipe, is a combined MAF/IAT sensor (4-wire). The rear sensor, located prior to the intake air to secondary turbocharger pipe, is a MAF sensor (3-wire) only.

The MAF sensors work on the hot film principle. Each sensor has 2 sensing elements which are contained within a film. One element is maintained at ambient (air intake) temperature, e.g. 25°Celsius (77°F). The other element is heated to 200°Celsius (392°F) above the ambient temperature, e.g. 225°Celsius (437°F). Intake air entering the engine passes through the MAF sensors and has a cooling effect on the film. The ECM monitors the current required to maintain the 200°Celsius (392°F) differential between the two elements and uses the differential to provide a precise, non-linear, signal which equates to the volume of air being drawn into the engine.

The MAF sensor output is a digital signal proportional to the mass of the incoming air. The ECM uses this data, in conjunction with signals from other sensors and information from stored fueling maps, to determine the precise fuel quantity to be injected into the cylinders. The signal is also used as a feedback signal for the EGR system.

The IAT sensor in the front sensor incorporates a NTC (negative temperature coefficient) thermistor in a voltage divider circuit. The NTC thermistor works on the principle of decreasing resistance in the sensor as the temperature of the intake air increases. As the thermistor allows more current to pass to ground, the voltage sensed by the ECM decreases. The change in voltage is proportional to the temperature change of the intake air. Using the voltage output from the IAT sensor, the ECM can correct the fueling map for intake air temperature. The correction is an important requirement because hot air contains less oxygen than cold air for any given volume.

The MAF sensor receives a 12V supply from the BJB (battery junction box) and a ground connection via the ECM. Two further connections to the ECM provide a MAF signal and IAT signal.

The IAT sensor receives a 3.3V reference voltage from the ECM and shares a ground with the MAF sensor. The signal output from the IAT sensor is calculated by the ECM by monitoring changes in the supplied reference voltage to the IAT sensor voltage divider circuit.

The ECM checks the calculated air mass against the engine speed. If the calculated air mass is not plausible, the ECM uses a default air mass figure which is derived from the average engine speed compared to a stored characteristic map. The air mass value will be corrected using values for boost pressure, atmospheric pressure and air temperature.

If one of the MAF sensors fails the ECM implements the default strategy based on engine speed. In the event of a MAF sensor signal failure, the following symptoms may be observed:

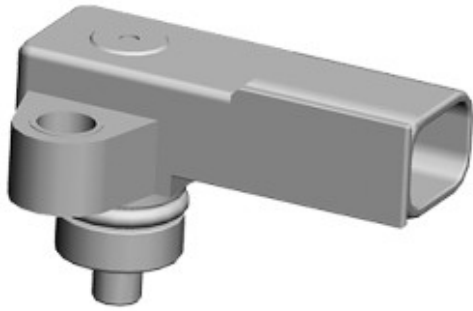
- EGR system off
- Delayed engine response
- Reduced engine performance.

If the IAT sensor fails the ECM uses a default intake air temperature of 40°Celsius (104°F). In the event of an IAT

sensor failure, the following symptom may be observed:

- Under fueling, resulting in reduced engine performance.

Manifold Absolute Pressure (MAP) Sensor



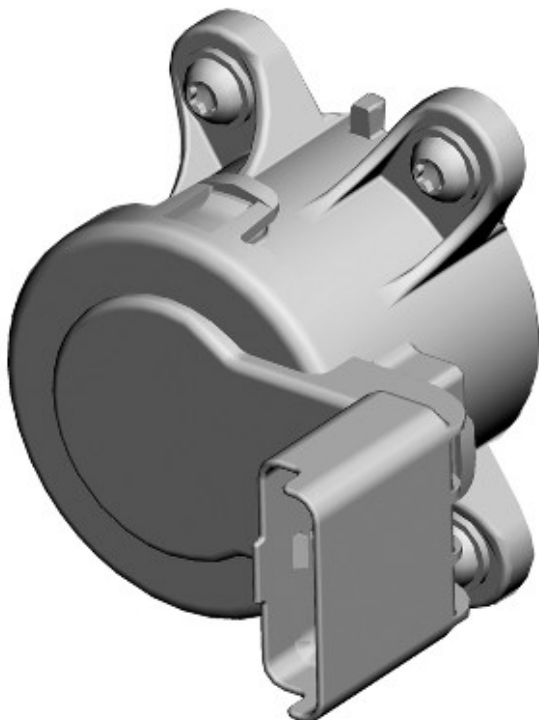
E123688

The MAP sensor is located on top of the throttle intake manifold. The MAP sensor measures the absolute pressure in the intake manifold. The sensor is a semi-conductor type sensor which responds to pressure acting on a membrane within the sensor, altering the output voltage. The sensor receives a 5V reference voltage and a ground from the ECM and returns a signal of between 0.5 - 4.5V to the ECM. A low pressure returns a low voltage signal to the ECM and a high pressure returns a high voltage.

The MAP sensor detects quick pressure changes in the intake manifold after the electric throttle. The signal is used in conjunction with the MAF sensor signal to calculate the injection period.

The ECM monitors the engine MAP sensor for faults and can store fault related codes. These can be retrieved using Land Rover approved diagnostic equipment. If the sensor fails, the ECM uses the MAF/IAT sensor signal value as a substitute.

Electronic Throttle Actuator

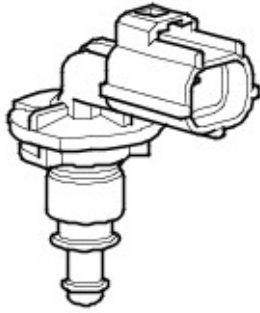


E116417

The electronic throttle actuator is located on the side of the throttle intake manifold.

The electronic throttle actuator controls the volume of air allowed into the inlet manifolds by means of a DC (direct current) motor which controls a flap in the body of the throttle. The actuator is controlled by the ECM which operates the actuator in response to driver inputs from the APP sensor and other engine related sensors to provide the correct air flow to the intake manifolds.

Engine Coolant Temperature (ECT) Sensor



E46905

The **ECT** sensor is located in the **LHEGR** cooler coolant inlet pipe, at the front of the engine. The **ECT** sensor provides the **ECM** and the instrument cluster with engine coolant temperature status.

The **ECM** uses the temperature information for the following functions:

- Fueling calculations
- Limit engine operation if engine coolant temperature becomes too high
- Cooling fan operation
- Glow plug activation time.

The instrument cluster uses the temperature information for generation of engine temperature messages. The engine coolant temperature signal is also transmitted on the medium speed **CAN** bus by the instrument cluster for use by other systems.

The **ECT** sensor circuit consists of an internal voltage divider circuit which incorporates an **NTC** thermistor. As the coolant temperature rises the resistance through the sensor decreases and vice versa. The output from the sensor is the change in voltage as the thermistor allows more current to pass to ground relative to the temperature of the coolant.

The **ECM** compares the signal voltage to stored values and adjusts fuel delivery to ensure optimum drive ability at all times. The engine will require more fuel when it is cold to overcome fuel condensing on the cold metal surfaces inside the combustion chamber. To achieve a richer air/fuel ratio, the **ECM** extends the injector opening time. As the engine warms up the air/fuel ratio is leaned off.

The input to the sensor is a 3.3V reference voltage supplied from the voltage divider circuit within the **ECM**. The ground from the sensor is also connected to the **ECM** which measures the returned current and calculates a resistance figure for the sensor which relates to the coolant temperature.

If the **ECT** sensor fails, the following symptoms may be observed:

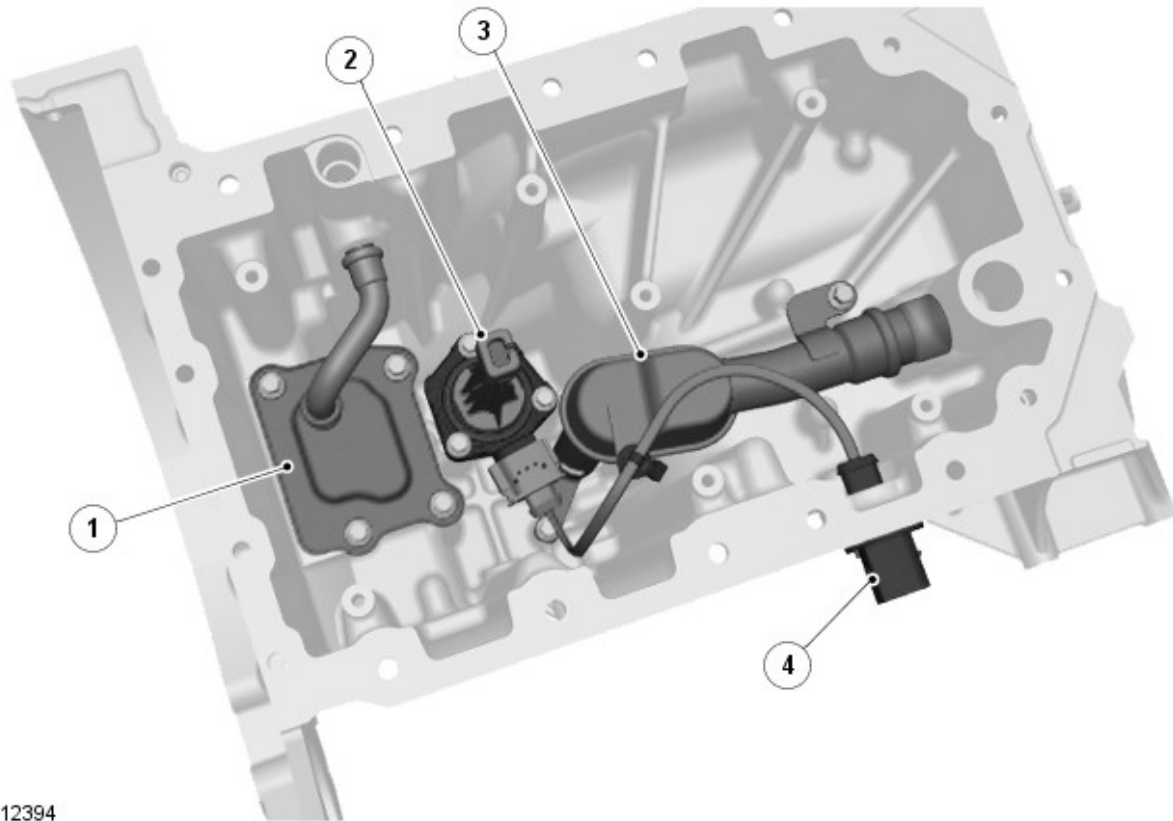
- Difficult cold start
- Difficult hot start
- Engine performance compromised
- Temperature gauge inoperative or inaccurate reading.

In the event of **ECT** sensor signal failure, the **ECM** applies a default value of 80°Celsius (176°F) coolant temperature for fueling purposes. The **ECM** will also permanently operate the cooling fan at all times when the ignition is switched on, to protect the engine from overheating.

The table that follows shows **ECT** sensor values and the corresponding sensor resistance and voltage values.

Temperature (Degrees Celsius)	Resistance (KOhms)	Voltage (Volts)
- 40	925	3.23
- 30	496	3.16
- 20	277	3.06
- 10	160	2.91
-0	96	2.70
10	59	2.42
20	37	2.09
30	24	1.75
40	16	1.41
50	11	1.11
60	7.55	0.86
70	5.34	0.66
80	3.84	0.50
90	2.80	0.38
100	2.08	0.29
110	1.56	0.22
120	1.19	0.17
130	0.918	0.14
140	0.715	0.11
150	0.563	0.08

Engine Oil Level and Oil Temperature Sensor



E 112394

Item Description

- 1 Oil scavenge reservoir
- 2 Engine oil level and temperature sensor
- 3 Oil pick-up pipe
- 4 Engine oil level and temperature sensor electrical connector

The 3.0L V6 diesel engine is not fitted with a conventional dipstick. The dipstick is replaced with an ultrasonic oil level and temperature sensor which is located with 3 bolts on the inside of the oil pan.

The sensor uses ultrasonic pulses to determine the oil level in the oil pan. The level sensor sends an ultrasonic pulse vertically upward and measures the time taken for the pulse to be reflected back to the sensor from the upper surface of the oil. A second reference pulse is also transmitted across a reference distance. The time periods of the first and second pulses are compared and the sensor calculates the oil height in the oil pan. The sensor then converts the results into a **PWM (pulse width modulation)** signal to the **ECM** which converts the frequency of the signal into an oil level height.

The sensor uses an **NTC** type sensor to determine the oil temperature. The sensor measures the oil temperature and converts the sensor signal into a **PWM** signal to the **ECM** which converts the frequency of the signal into an oil temperature.

If the oil level is incorrect or a system fault occurs, a warning message is displayed in the instrument cluster message center. The messages that follow can be displayed in the message center:

Warning	System Status
ENGINE OIL LOW (Amber warning triangle displayed)	The oil is at the minimum level for safe operation. Top-up with 2 liters (3.5 pints) of oil.
ENGINE OIL HIGH (Amber warning triangle displayed)	This warning is displayed when the engine is started, if the oil is above the maximum level for safe operation. Stop the vehicle as soon as safety permits and seek qualified assistance to have the engine oil drained, before driving the vehicle.
ENGINE OIL CRITICALLY LOW (Red warning triangle displayed)	The oil is below the minimum level for safe operation. Stop the vehicle as soon as safety permits and top-up with 2.5 liters (4.4 pints) of oil. Wait for 10 minutes, re-check the oil level reading and top-up again if necessary.
ENGINE OIL LEVEL MONITOR SYSTEM FAULT (Amber warning triangle displayed)	A fault with the oil level monitoring system is indicated. Seek qualified assistance as soon as possible.

Oil Level Check

Check the oil level weekly, when the engine is hot and with the vehicle resting on level ground.

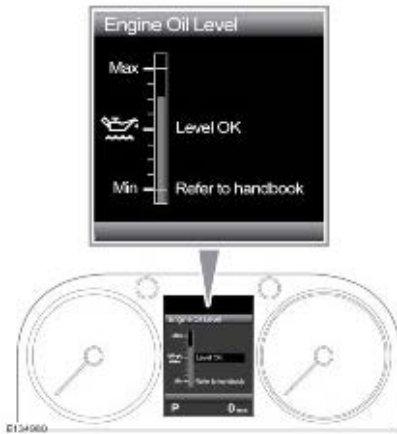


NOTE: Switch off the engine and let the vehicle stand for ten minutes to allow the oil drain back to the oil pan. Do not start the engine.

The oil level can be viewed in the message centre when the ignition is on (power mode 6), the engine stopped and the transmission in Park (P).



NOTE: The system will not give a reading until the oil level has stabilized.



An indication of the oil level is displayed on the gauge. Messages to the right of the gauge give advice of any action that may need to be taken.

If the oil level is within the required operating range, the message **'Level OK'** will be displayed. Do not add any additional oil to the engine.

If the oil level is below the required operating range, a message advising how much oil to add will be displayed. Add the recommended quantity of oil then re-check the level.

If **'Overfilled'** is displayed, seek qualified assistance immediately. Do not drive the vehicle as this will cause serious damage to the engine.

Engine Oil Top-Up

CAUTIONS:



Failure to use oil that meets the required specification, could cause excessive engine wear, a build-up of sludge and deposits and increase pollution. It could also lead to engine failure and invalidation of vehicle warranty.



Overfilling with oil could result in severe engine damage.

Use the procedure that follows to replenish the engine oil level:

- With the ignition on, but the engine not running, unscrew the oil filler cap.
- Add the appropriate quantity of oil (as indicated by the message center oil level display). Wait 10 minutes to allow the oil level stabilize and re-check the level. Clean up any oil spilled during topping up
- Once the correct level is achieved, refit the filler cap and hand-tighten securely until one click is heard.

NOTES:



The approximate quantity of oil required to raise the level from the minimum level of safe operation to the maximum, is 2.0 liters (3.5 pints).

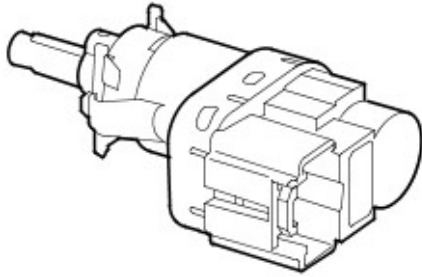


The ignition must be left on during the top-up, so that the electronic dipstick can register and display the new oil level. This enables an accurate level re-check.

Live Reading/Average Reset

A procedure is available to allow the technician to access the actual engine oil level, rather than the average engine oil level which is available to the driver. An additional procedure is also available to reset the average engine oil level. Refer to Engine - 3.0L Diesel - General Procedures - Engine Oil Draining and Filling 303-01B.

Brake Lamp/Brake Test Switch



E46910

The brake lamp/brake test switch is located on the pedal box and is operated by the brake pedal. The 2 pole switch has a normally open circuit switch connected to battery voltage which closes the circuit when the driver has depressed the brake pedal and a normally closed circuit which is connected to ground when the driver depresses the brake pedal. The switch contacts are connected directly to the **ECM** and the **ECM** also receives a brake pressure signal on the high speed **CAN** bus from the **ABS** module.

The **ECM** uses the brake signal for the following:

- To limit fueling during braking
- To inhibit/cancel Speed control if the brakes are applied.

In the event of a brake switch failure, the following symptoms may be observed:

- Speed control inactive
- Increased fuel consumption.

Fuel Pressure Control Valve



E116419

The fuel pressure control valve is incorporated into the forward end of the common fuel rail for the **LH** cylinder bank. The control valve regulates the fuel pressure within the fuel rails and is controlled by the **ECM**. The control valve is a **PWM** controlled solenoid valve.

When the solenoid is de-energized, an internal spring holds an internal valve closed. At fuel pressure of 100 bar (1450 lbf/in²) or higher, the force of the spring is overcome, opening the valve and allowing fuel pressure to decay into the fuel return pipe. When the pressure in the fuel rail decays to approximately 100 bar (1450 lbf/in²) or less, the spring force overcomes the fuel pressure and closes the valve. When the **ECM** energizes the solenoid, the valve is closed allowing the fuel pressure to build. The pressure in the fuel rail in this condition can reach approximately 2000 bar (29000 lbf/in²).

The **ECM** constantly monitors the fuel pressure and activates the fuel pressure control valve accordingly to control the fuel rail pressure within the required parameters. Relieved fuel from the fuel rails is directed through the fuel rail leak-off pipe to the fuel filter return circuit.

The **ECM** controls the fuel rail pressure by operating the control valve solenoid using a **PWM** signal. By varying the duty cycle of the **PWM** signal, the **ECM** can accurately control the fuel rail pressure and hence the pressure delivered to the injectors according to engine load. This is achieved by the control valve allowing a greater or lesser volume of fuel to pass from the high pressure side of the pump to the un-pressurized fuel return line, regulating the pressure on the high pressure side.

The fuel pressure control valve receives a **PWM** signal from the **ECM** of between 0 and 12V. The **ECM** controls the operation of the control valve using the following information to determine the required fuel pressure:

- Fuel rail pressure
- Engine load
- **APP** sensor position
- Engine coolant temperature
- Engine speed.

In the event of a total failure of the fuel pressure control valve, the engine will not start. In the event of a partial failure of the fuel pressure control valve, the **ECM** will activate the solenoid with the minimum duty cycle which

results in the injection quantity being limited.

Fuel Pressure Sensor

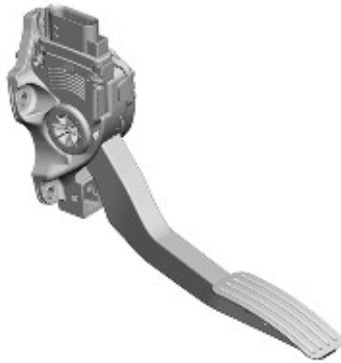


E116418

The fuel pressure sensor is located in the forward end of the common fuel rail for the RH cylinder bank. The sensor is screwed into a threaded port in the end of the fuel rail.

The fuel pressure sensor is a piezo-resistive type sensor containing an actuating diaphragm. Deflection of the diaphragm provides a proportional signal (output) voltage to the ECM, dependant on the fuel pressure within the fuel rails.

Accelerator Pedal Position (APP) Sensor



E116420

The APP sensor allows the ECM to determine the driver requests for vehicle speed, acceleration and deceleration. The ECM uses this information to determine the torque demand from the engine via injection control.

The APP sensor is installed on the pedal box and secured to a bracket with 3 screws.

The APP sensor is incorporated into the pedal box assembly. The APP sensor is a twin track rotary potentiometer type sensor which is integral with the throttle pedal housing.

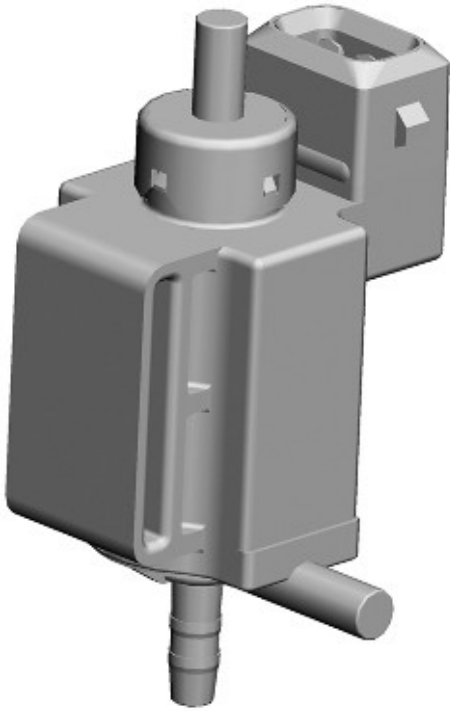
A six pin electrical connector provides the interface with the vehicle harness. The accelerator pedal is connected to a spindle on the RH side of the APP sensor. The APP sensor receives two separate electrical supplies and generates two different outputs.

Both tracks are analogue output signals connected to the ECM. Both signals contain the same positional information, but the secondary track has half the voltage output of the primary track.

If there is a fault with the primary track, the secondary track is used and the vehicle/engine response to pedal demand will be sluggish. If both analogue signals have a fault, the engine adopts a constant high speed of 1300 rpm to allow the vehicle to move. Torque application and reduction of engine speed back to normal idle speed can be subsequently controlled via brake lamp/brake test switch operation.

The ECM constantly checks the range and plausibility of the two signals and stored a fault code if it detects a fault.

EGR Cooler Bypass Vacuum Solenoid Valve



E116421

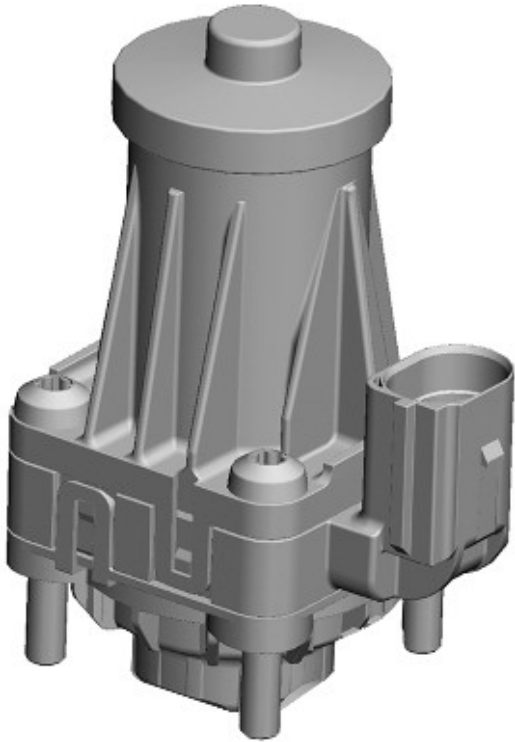
The **EGR** cooler bypass solenoid valve is located on a bracket at the rear of the engine, adjacent to the vacuum pump.

The solenoid valve has a vacuum pipe connection to the vacuum pump which provides the vacuum when the engine is running. Two outlets from the solenoid valve each connect to an **EGR** bypass vacuum actuator.

When the **EGR** cooler bypass solenoid valve is energized, vacuum created by the vacuum pump is applied to each **EGR** bypass vacuum actuator and exhaust gasses by-pass the **EGR** cooler. The default position is for exhaust gas cooling. The actuators move under the influence of the vacuum and move a valve within the **EGR** cooler to divert the exhaust gasses straight through the cooler. This system is used when the engine management system determines that exhaust gas cooling is not required.

The **EGR** cooler bypass solenoid valve receives a 12 volt supply from the **EJB**. The **ECM** controls the operation of the solenoid valve by controlling the ground path for the solenoid.

Exhaust Gas Recirculation (EGR) Valve Motor



E116422

The **EGR** valve motors each receive a 12 volt supply and ground from the **ECM**.

The 12 volt power supply from the **ECM** operates the **EGR** valve motor. Three further wires connect the **EGR** valve to the **ECM** a 5 volt reference voltage, a ground and a position signal feedback.

The valve is used to direct a calculated proportion of exhaust gas back into the combustion chamber.

Engine Oil Pressure Sensor



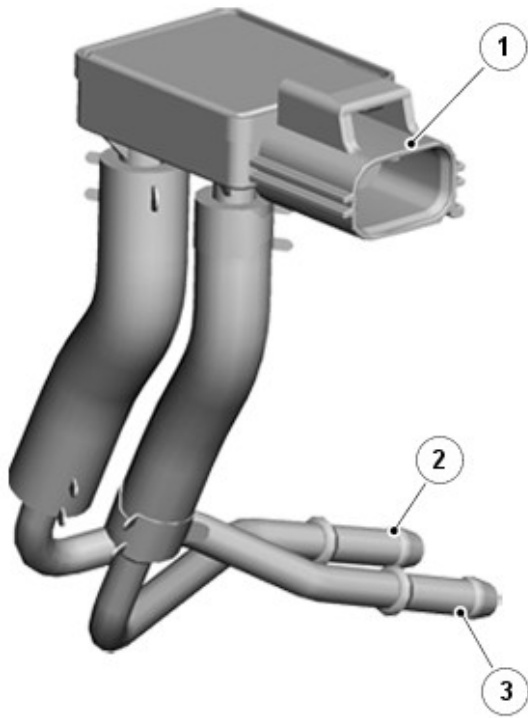
E116423

The engine oil pressure sensor is located in a threaded port in the **LH** cylinder head. The sensor is connected directly to the instrument cluster.

The sensor is not connected to the **ECM** but is supplied with a reference voltage from the instrument cluster. The

sensor ground is through the sensor body and the engine. When the oil pressure falls to below a predetermined threshold, the sensor internal switch contacts close, completing a circuit from the instrument cluster. This circuit is sensed by the instrument cluster which displays an appropriate warning message and warning lamp to alert the driver.

Differential Pressure Sensor



E123690

Item Description

- 1 Electrical connector
- 2 Low pressure connection
- 3 High pressure connection

The differential pressure sensor is located on the rear of the transfer box, adjacent to the [DPF \(diesel particulate filter\)](#).

The differential pressure sensor is used by the [DPF](#) software to monitor the condition of the [DPF](#). Two pipe connections on the sensor are connected by pipes to the inlet and outlet ends of the [DPF](#). The pipes allow the sensor to measure the inlet and outlet pressures of the [DPF](#).

As the amount of particulates trapped by the [DPF](#) increases, the pressure at the inlet side of the [DPF](#) increases in comparison to the [DPF](#) outlet. The [DPF](#) software uses this comparison, in conjunction with other data, to calculate the accumulated amount of trapped particulates.

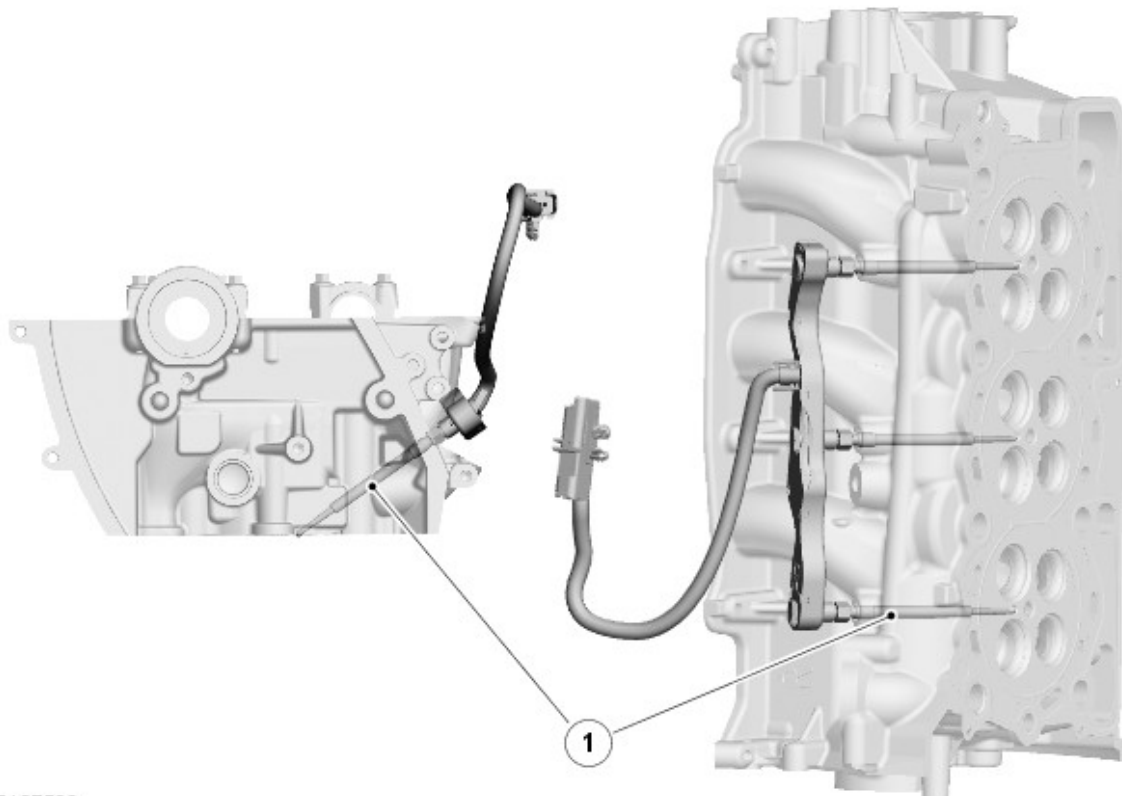
By measuring the pressure difference between the [DPF](#) inlet and outlet air flow the [DPF](#) software can determine if the [DPF](#) is becoming blocked and requires regeneration.

A [DPF](#) is recognized as overloaded if the differential pressure under certain operating conditions exceeds the overload limit calculated by the [ECM](#). The [DPF](#) software may start regeneration attempts but be unable to complete them. These attempts are counted by the [ECM](#) and, if the maximum number of regeneration attempts is reached, a fault entry is recorded in the [ECM](#) at the next ignition on cycle.

The [DPF](#) software performs the following checks using the [DPF](#) differential pressure sensor:

- Sensor plausibility check
- [DPF](#) efficiency
- [DPF](#) overloaded
- [DPF](#) clogged
- Circuit range checks (max. and min.)
- [DPF](#) hose lines (dropped, crossed and blocked)
- [DPF](#) dislodged/damaged
- Monitoring of the maximum regeneration attempts in the lower load range

Glow Plugs



E107586

Item Description

1 Glow plug

Three glow plugs are located in each of the cylinder heads, on the inlet side. The glow plugs and the glow plug module are a vital part of the engine starting strategy. The glow plugs heat the air inside the cylinder during cold starts to assist combustion. The use of glow plugs helps reduce the amount of additional fuel required on start-up, and consequently reduces the emission of black smoke. The use of glow plugs also reduces the amount of injection advance required, which reduces engine noise, particularly when idling with a cold engine.

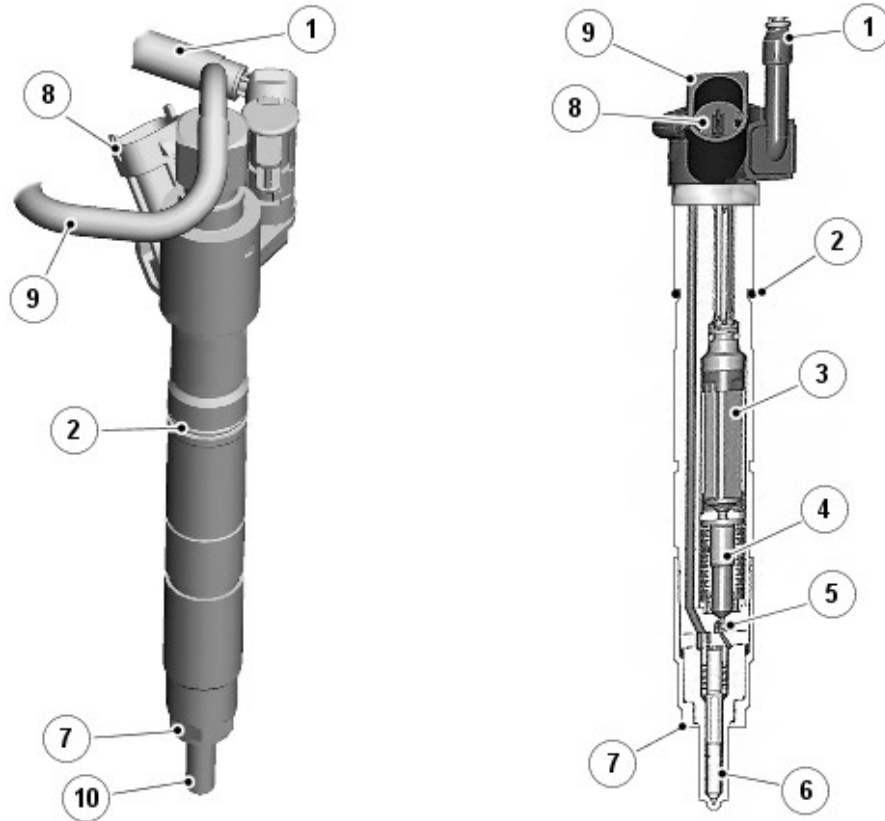
There are three phases of glow plug activity:

- Pre-heat
- During crank
- Post heat.

The ceramic sheathed element glow plugs are made from a heat-resistant, electrically conductive ceramic material. The ceramic sheathed-element glow plugs outer layer is heated directly and is self regulating. The self regulation allows the resistance of the sheathed element to automatically increase as the heat increases preventing the glow plug from overheating. In addition, during the heating process and under the control of the glow plug module, the glow plugs can be operated above their nominal voltages. This permits heat-up speeds of 1000°C per second. The sheathed-element glow plugs reach a maximum glow temperature of 1300°C and can hold a temperature of 1150°C for several minutes after the first-start glow or at intervening times.

The glow plugs are controlled by the [ECM](#) using the glow plug module and external sensor values to control the glow plug operation via internal software.

Fuel Injectors



E115475

Item Description

- 1 Fuel return
- 2 O-ring seal
- 3 Piezo stack actuator
- 4 Hydraulic coupler
- 5 Control valve
- 6 Nozzle body
- 7 Copper sealing washer
- 8 Electrical connector
- 9 High pressure feed
- 10 Nozzle

Six fuel injectors are used in the fuel system. A piezo actuator in each injector is electronically controlled by the [ECM](#) to operate the injector in response to engine speed and load conditions.

Each injector is calibrated to the [ECM](#) and applicable the cylinder to which it is fitted. Therefore, if an injector is removed it must be refitted to the cylinder from which it was removed. If a new injector is fitted, a calibration routine using a Land Rover approved diagnostic equipment must be performed to calibrate the injector unique code to the [ECM](#).

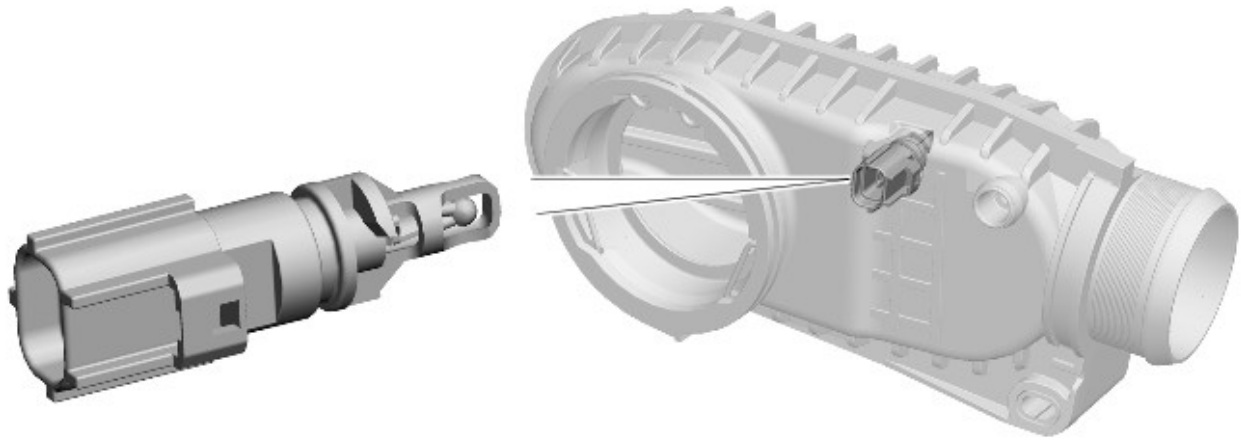
The operating voltage of the injector is between 110 and 163 volts depending on engine speed and load and care must be taken when working in the vicinity of the injectors. The voltage increases linearly with the injector operating pressure from 200 to 2000 bar.

Each injector has an electrical resistance value of between 150 - 250 kOhms.

⚠ CAUTION: Each injector operation is controlled by a charge and discharge cycle allowing energy to dissipate in, and recover from the injector. Never disconnect the wiring connection when the engine is running. The injector can remain open causing engine damage.

Refer to: [Fuel Charging and Controls](#) (303-04A Fuel Charging and Controls - TDV6 3.0L Diesel, Description and Operation).

Charge Air Temperature Sensor



E116759

The charge air temperature sensor is located in the rear of the intake chamber immediately preceding the throttle intake manifold. The sensor is used to measure the intake air temperature from the turbochargers in order to calculate the required amount of fueling.

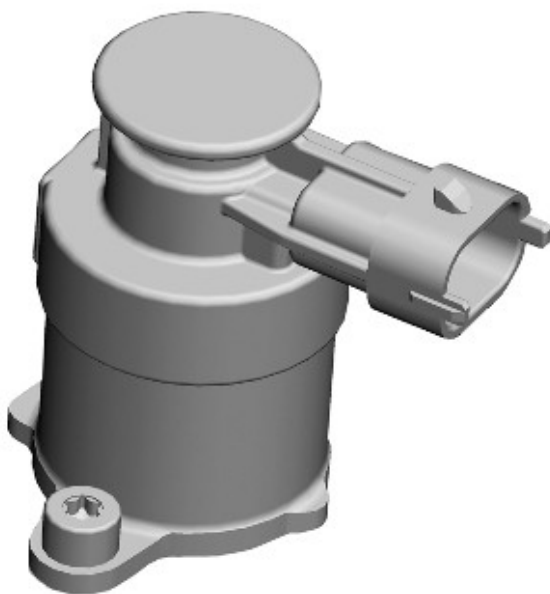
The charge air temperature sensor incorporates a **NTC** thermistor in a voltage divider circuit. The **NTC** thermistor works on the principle of decreasing resistance in the sensor as the temperature of the charge air increases. As the thermistor allows more current to pass to ground, the voltage sensed by the **ECM** decreases. The change in voltage is proportional to the temperature change of the charge air. Using the voltage output from the charge air temperature sensor, the **ECM** can correct the fueling map for charge air temperature. The correction is an important requirement because hot air contains less oxygen than cold air for any given volume.

The charge air temperature sensor receives a 3.3V reference voltage from the **ECM**. The signal output from the charge air temperature sensor is calculated by the **ECM** by monitoring changes in the supplied reference voltage to the charge air temperature sensor voltage divider circuit.

If the charge air temperature sensor fails the **ECM** uses a default charge air temperature of -5°C (23°F). In the event of a charge air temperature sensor failure, any of the following symptoms may be observed:

- Over fueling, resulting black smoke emitting from the exhaust
- Idle speed control inoperative.

High Pressure Fuel Pump Volume Control Valve



E116761

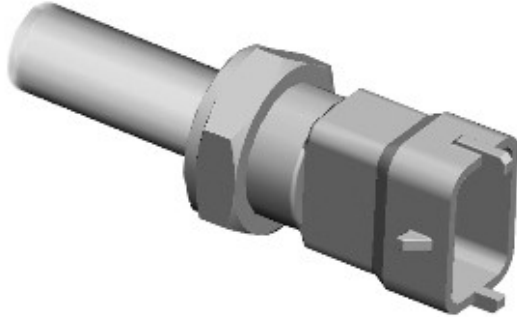
The high pressure fuel pump volume control valve is mounted on the high pressure pump, and located in the feed

port between the high-pressure pump elements and the internal transfer pump. The high pressure fuel pump volume control valve is a variable position solenoid-operated valve that is controlled by the [ECM](#).

The high pressure fuel pump volume control valve is controlled by a [PWM](#) signal from the [ECM](#) to allow a defined amount of 'leak off' from the high pressure fuel pump. The leak off fuel provides cooling and lubrication for the high-pressure pump internal components. The fuel is returned through a leak off pipe to the fuel filter, where it cools and is returned into the fuel filter via the low pressure return line.

The high pressure fuel pump volume control valve determines the amount of fuel that is delivered from the internal transfer pump to the high pressure pumping elements. When there is no signal to the high pressure fuel pump volume control valve, the valve is closed and there is no fuel delivery. The [ECM](#) applies a varying [PWM](#) signal of between 0 to 100% to control the required fuel volume.

High Pressure Fuel Pump Inlet Temperature Sensor



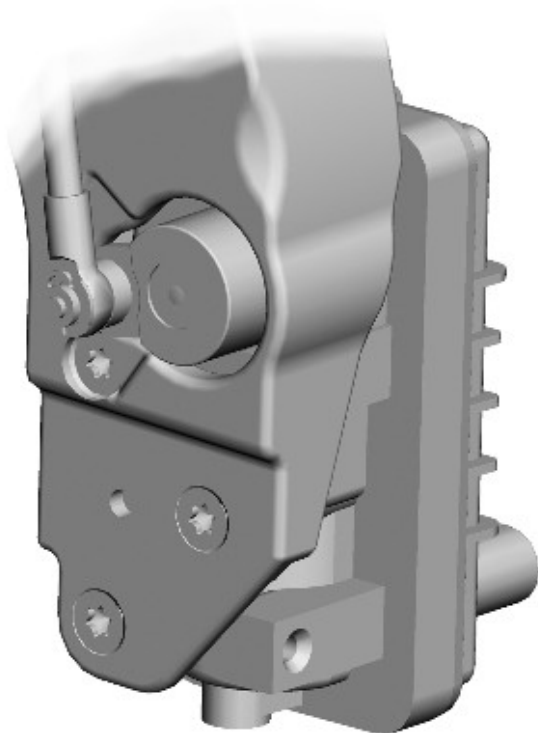
E116762

The high pressure fuel pump inlet temperature sensor is located on the rear of the high pressure fuel pump. It measures the fuel temperature in the low-pressure side of the high pressure fuel pump.

The [ECM](#) continually monitors this signal to determine the fuel temperature to prevent overheating of the fuel system. The [ECM](#) will also make fine adjustments to fuel injection quantity to adjust for fuel temperature.

The inlet temperature sensor is an [NTC](#) thermistor. As the fuel temperature rises the resistance through the sensor decreases and visa versa. The [ECM](#) measures the change in voltage as the thermistor allows more current to pass to ground relative to the fuel temperature.

Primary Turbocharger Control Module



E116424

The primary turbocharger control module is attached to a bracket which is an extension of the turbocharger body.

The primary turbocharger control module comprises a stepper motor which electronically controls the primary turbocharger variable vanes by moving an actuating lever. When the stepper motor drive shaft turns, a position signal is created. The [ECM](#) receives the position signal to determine the angular position of the vanes.

The stepper motor is connected to an output shaft. The output shaft has a connecting rod attached eccentrically which converts the rotary motion of the shaft into linear motion of the connecting rod. The opposite end of the connecting rod is attached to an actuating lever. The actuating lever moves with the connecting rod and adjusts the variable vanes mechanically.

The **ECM** provides the stepper motor with a power and ground for stepper motor operation and also a reference voltage, ground and position signal connections for variable vane position control.

Secondary Turbocharger Boost Pressure Sensor



E116425

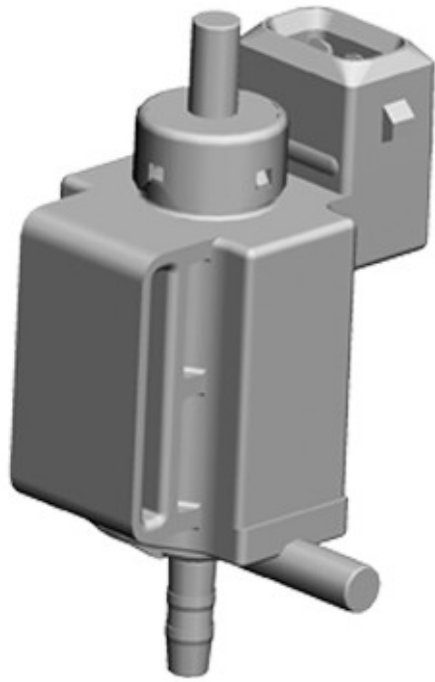
The secondary turbocharger boost pressure sensor is located on the steering pump mounting bracket on the **RH** side of the engine. The sensor is connected via a hose to the charge air outlet pipe from the secondary turbocharger compressor.

The sensor provides a voltage signal to the **ECM** relative to the output charge air pressure from the secondary turbocharger. The boost pressure sensor has a 3 pin connector which is connected to the **ECM** and provides a 5V reference supply from the **ECM**, a signal input to the **ECM** and a ground for the sensor.

The boost pressure sensor uses a diaphragm transducer to measure pressure. The **ECM** uses the boost pressure sensor signal for the following functions:

- Maintain manifold boost pressure
- Reduce exhaust smoke emissions when driving at high altitude
- Control of the **EGR** system
- To help smooth control of the mono to bi and bi to mono turbo transitions
- To aid the air path diagnostics.

Secondary Turbocharger Turbine Shut-off Solenoid Valve



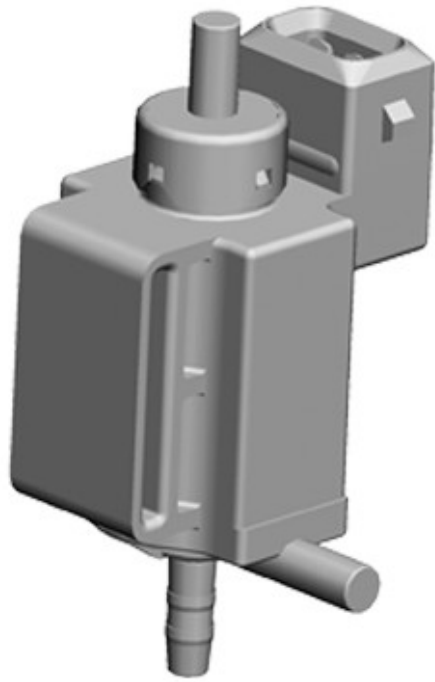
E123687

The secondary turbocharger turbine shut-off solenoid valve is located on a bracket at the front of the engine, above the **LH** front cylinder cover assembly. The bracket is shared with the secondary turbocharger compressor shut-off solenoid valve. The secondary turbocharger turbine shut-off solenoid valve is the innermost of the two solenoid valves.

The secondary turbocharger turbine shut-off solenoid valve receives a vacuum supply from the vacuum pump. The valve is connected by a pipe to the turbine shut-off valve vacuum actuator which is located on the rear of the secondary turbocharger. A position sensor is attached to the turbine shut-off valve vacuum actuator to inform the **ECM** of the turbine shut-off position.

Operation of the valve vacuum actuator is controlled by a **PWM** signal from the **ECM** and the secondary turbocharger turbine shut-off solenoid valve. When the shut-off solenoid is energized by the **ECM** a 4.5V **PWM** current is applied to operate the solenoid, vacuum is then applied to the shut-off valve vacuum actuator. The valve is opened allowing the secondary turbocharger turbine to be driven by the exhaust gasses for as long as the valve is open. When the valve is to be closed the **ECM** applies a 0.5V **PWM** current to the solenoid.

Secondary Turbocharger Compressor Shut-off Solenoid Valve



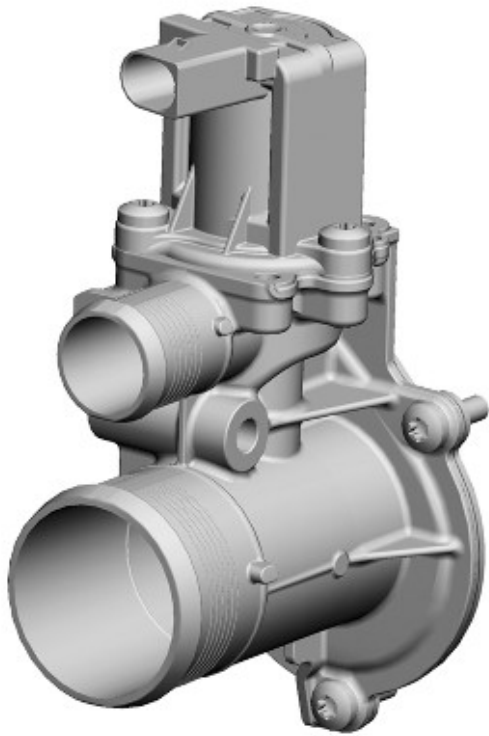
E123687

The secondary turbocharger compressor shut-off solenoid valve is located on a bracket at the front of the engine, above the LH front cylinder cover assembly. The bracket is shared with the secondary turbocharger turbine shut-off solenoid valve. The secondary turbocharger compressor shut-off solenoid valve is the outermost of the two solenoid valves.

The secondary turbocharger compressor shut-off solenoid valve receives a vacuum supply from the vacuum pump. The valve is connected by a pipe to the compressor shut-off vacuum actuator located on the charge air intake manifold tube. When the vacuum is applied to the vacuum actuator, the actuator operates to open the shut-off valve allowing charge air to flow into the air intake pipe.

Operation of the secondary turbocharger compressor shut-off solenoid valve is controlled by a PWM signal from the ECM; 0% is off and 100% is on (solenoid activated). The solenoid valve is opened when bi-turbocharger operation is required allowing compressed charge air from the secondary turbocharger compressor to enter the air intake system.

Secondary Turbocharger Compressor Recirculation Valve



E 116426

The secondary turbocharger compressor recirculation valve motor is located on the compressor recirculation valve housing, adjacent to the compressor shut-off valve. The solenoid valve is attached to the compressor recirculation valve with 3 screws.

The secondary turbocharger compressor recirculation valve motor is controlled by the [ECM](#). The valve is used during operation of the secondary turbocharger. When the [ECM](#) is switching to bi-turbocharger operation, the valve motor is operated which opens the recirculation path to the primary turbocharger. This allows the secondary turbocharger to increase its speed. When the secondary turbocharger has reached its optimum operating speed the recirculation valve motor is operated, closing the recirculation path to the primary turbocharger.

Secondary Turbocharger Turbine Shut-off Valve and Position Sensor

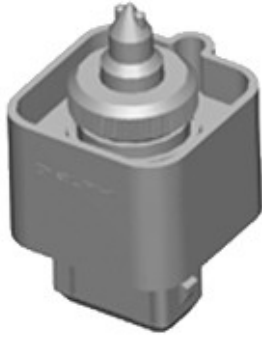


E 116760

The secondary turbocharger turbine shut-off valve and position sensor is located on the turbine vacuum shut-off valve. The sensor has three connections to the [ECM](#); a 5V reference voltage, a ground and a signal return.

The sensor is connected to the turbine shut-off vacuum actuator and senses when the actuator has operated. The sensor returns a 0 - 5V analogue position signal to the [ECM](#) to confirm that the vacuum actuator has operated.

Water-in-fuel Sensor



E123689

The fuel filter element has a water sensor located in its base. The sensor is screwed into a threaded hole in the base of the element. When the filter is replaced at service, the sensor can be unscrewed from the element and installed in the new element. The sensor has an electrical connector located at the side of the element which can be disconnected to assist element removal.

The water-in-fuel sensor is connected to the [ECM](#). When the water in the element reaches 64 cm³ (3.9 in³) the [ECM](#) issues a high speed [CAN](#) bus message to the instrument cluster to display a 'WATER IN FUEL' message in the message center.

Electronic Engine Controls - TDV6 3.0L Diesel - Electronic Engine Controls

Diagnosis and Testing

Principles of Operation

For a detailed description of the electronic engine control system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (303-14 Electronic Engine Controls - TDV6 3.0L Diesel)

Electronic Engine Controls (Description and Operation),
Electronic Engine Controls (Description and Operation),
Electronic Engine Controls (Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Engine oil level • Cooling system coolant level • Fuel level • Fuel contamination/grade/quality • Fuel leaks • Auxiliary drive belt • Sensor installation/condition • Viscous fan and solenoid 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Electrical connector(s) • 5V sensor supply • Sensor(s) • Engine Control Module (ECM) • Transmission Control Module (TCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Engine cranks, but does not start	<ul style="list-style-type: none"> • Inertia fuel shutoff switch • Low/contaminated fuel • Air leakage • Low-pressure fuel system fault • Fuel pump module (lift pump) fault • Blocked fuel filter • Fuel volume regulator blocked/contaminated • Fuel pressure control valve blocked/contaminated • Fuel pump fault • Crankshaft position (CKP) sensor 	<ul style="list-style-type: none"> • Check that the inertia switch has not tripped <ul style="list-style-type: none"> - Using the manufacturer approved diagnostic system, check the Restraints Control Module (RCM) for related DTCs and refer to the relevant DTC index • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Inspect the intake air system for leaks • Inspect the low-pressure fuel system for leaks/damage • Test the lift pump operation • Check the fuel filter • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the fuel pump • Refer to the electrical circuit diagrams and test the CKP sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
Difficult to start	<ul style="list-style-type: none"> • Glow plug system fault (very cold conditions) • Low/contaminated fuel • Air leakage • Fuel pump module (lift pump) fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the glow plug circuits for short circuit to ground, short circuit to power, open circuit, high resistance • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Inspect the intake air system for leaks

	<ul style="list-style-type: none"> • Low-pressure fuel system fault • Blocked fuel filter • Fuel volume control valve blocked/contaminated • Fuel pressure control valve blocked/contaminated • Exhaust Gas Recirculation (EGR) valve(s) fault 	<ul style="list-style-type: none"> • Test the lift pump operation • Inspect the low-pressure fuel system for leaks/damage • Check the fuel filter • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the EGR system
Rough idle	<ul style="list-style-type: none"> • Intake air system fault • Low/contaminated fuel • Low-pressure fuel system fault • Blocked fuel filter • Fuel volume control valve blocked/contaminated • Fuel pressure control valve blocked/contaminated • Exhaust Gas Recirculation (EGR) valve(s) fault 	<ul style="list-style-type: none"> • Inspect the intake air system for leaks • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Inspect the low-pressure fuel system for leaks/damage • Check the fuel filter • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the EGR system
Lack of power when accelerating	<ul style="list-style-type: none"> • Intake air system fault • Restricted exhaust system • Low fuel pressure • Exhaust Gas Recirculation (EGR) valve(s) fault • Turbocharger actuator fault 	<ul style="list-style-type: none"> • Inspect the intake air system for leakage or restriction • Check for a blockage/restriction in the exhaust system, install new components as necessary • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the EGR system • Check turbocharger actuator
Engine stops/stalls	<ul style="list-style-type: none"> • Air leakage • Low/contaminated fuel • Low-pressure fuel system fault • High pressure fuel leak • Fuel volume control valve blocked/contaminated • Fuel pressure control valve blocked/contaminated • Exhaust Gas Recirculation (EGR) valve fault 	<ul style="list-style-type: none"> • Inspect the intake air system for leaks • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Inspect the fuel system for leaks/damage • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the EGR system
Engine judders	<ul style="list-style-type: none"> • Low/contaminated fuel • Air ingress • Low-pressure fuel system fault • Fuel metering valve blocked/contaminated • Fuel volume control valve blocked/contaminated • Fuel pressure control valve blocked/contaminated • High pressure fuel leak • Fuel pump fault 	<ul style="list-style-type: none"> • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Inspect the intake air system for leaks • Inspect the low-pressure fuel system for leaks/damage • Inspect the high pressure fuel system for leaks • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Test the lift pump operation
Excessive fuel consumption	<ul style="list-style-type: none"> • Low-pressure fuel system fault • Fuel volume control valve 	<ul style="list-style-type: none"> • Inspect the low-pressure fuel system for leaks/damage • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index

	<ul style="list-style-type: none"> blocked/contaminated • Fuel pressure control valve blocked/contaminated • Fuel temperature sensor leak • High pressure fuel leak • Injector(s) fault • Exhaust Gas Recirculation (EGR) valve(s) fault 	<ul style="list-style-type: none"> Inspect the fuel temperature sensor, fuel pump, etc for leaks • Check the EGR system
--	--	---

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (PCM) (100-00, Description and Operation).

Electronic Engine Controls - TDV6 3.0L Diesel - Camshaft Position (CMP) Sensor

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

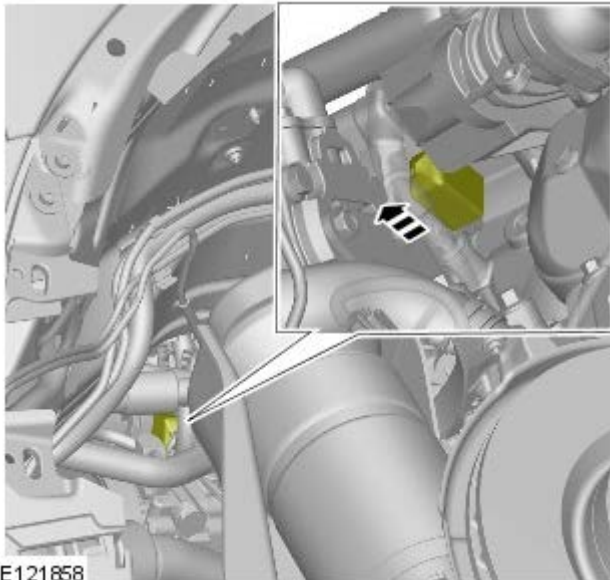
Raise and support the vehicle.

2. Refer to: Cooling Fan (303-03D, Removal and Installation).
3. Remove the LH front wheel and tire.

Torque: 140 Nm

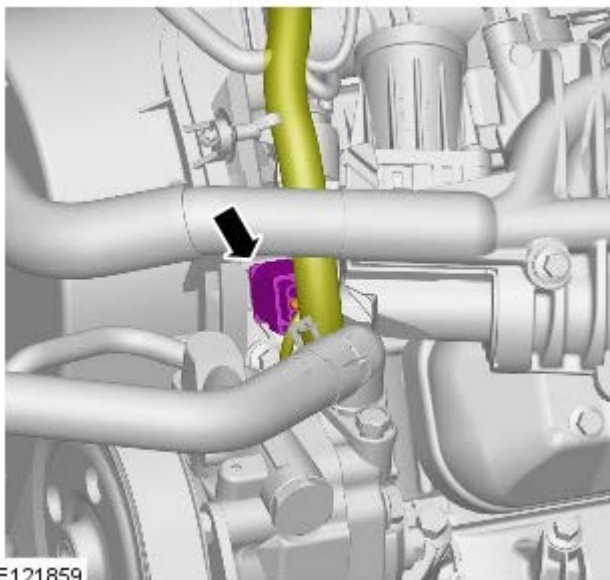
4. Refer to: Fender Splash Shield (501-02, Removal and Installation).

5.



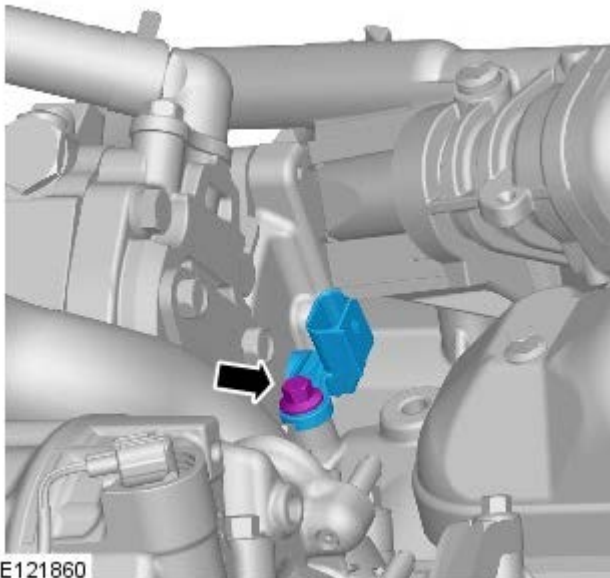
E121858

6.

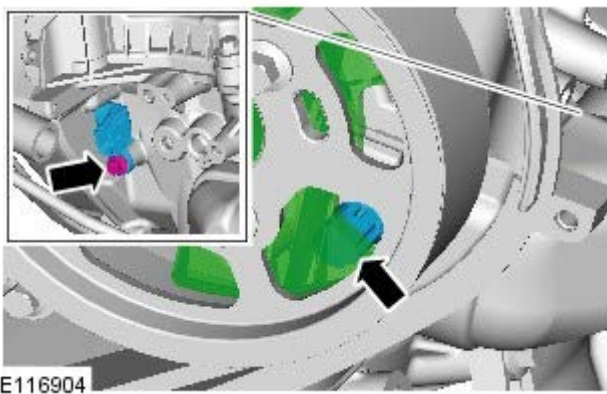


E121859



7.




Installation




1. CAUTIONS:

-  Make sure that the mating faces are clean and free of foreign material.
-  The Camshaft position (CMP) sensor tip must rest on one of the three webs on the back of the camshaft pulley. Incorrect installation may result in the CMP sensor being damaged.

NOTES:

 Only turn the engine in the normal direction of rotation.

 Timing belt left hand cover shown removed for clarity.

Turn the engine until one of the three webs on the back of the camshaft pulley is visible through the CMP sensor housing.

Torque: 10 Nm

2. To install, reverse the removal procedure.

Electronic Engine Controls - TDV6 3.0L Diesel - Crankshaft Position (CKP) Sensor

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

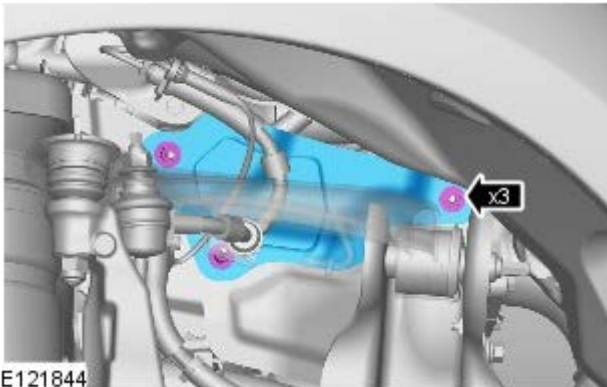
2. Remove the left-hand front wheel and tire.

Torque: 140 Nm

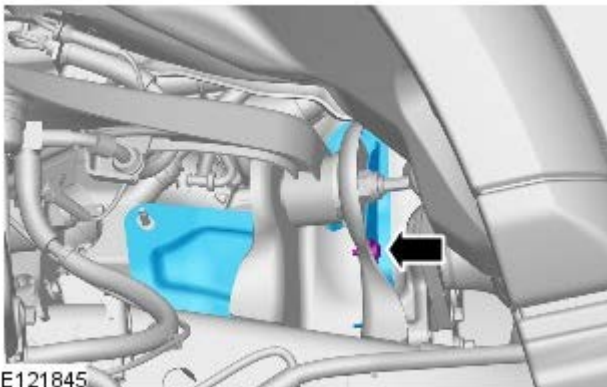
3. Refer to: Engine Oil Vacuum Draining and Filling (303-01B, General Procedures).


4. Refer to: Suspension Height Sensor (204-05, Removal and Installation).

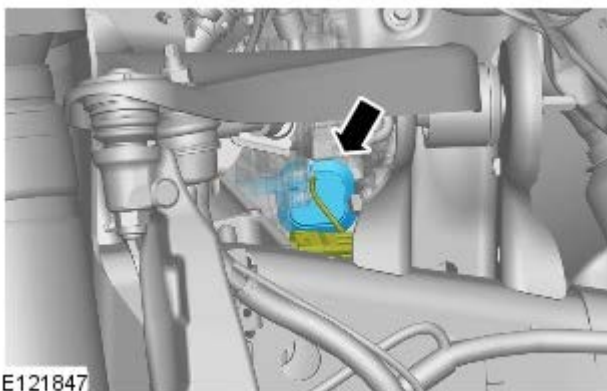
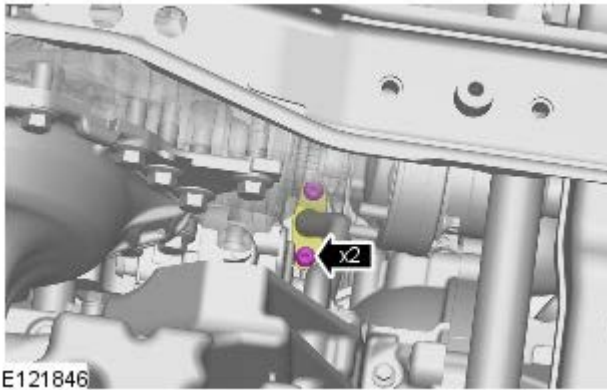
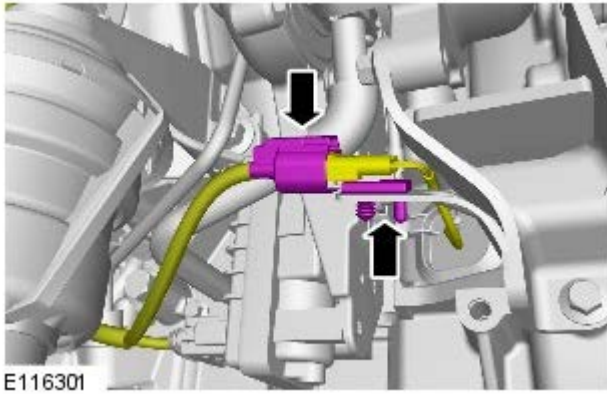
5. *Torque:* 9 Nm



6. *Torque:* 9 Nm




7.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.



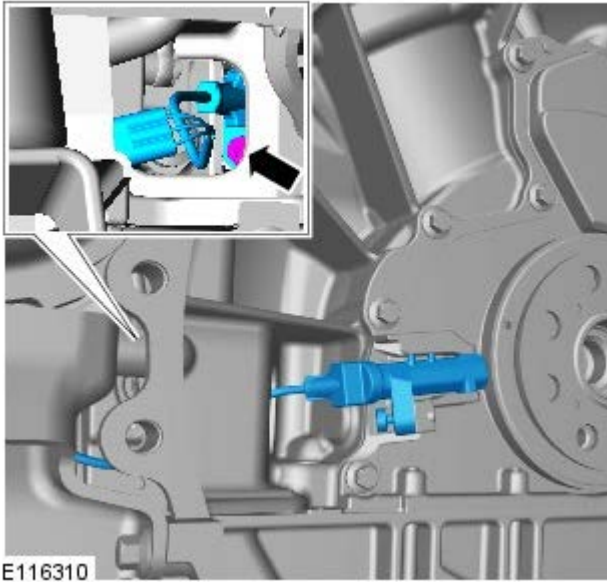
8.  NOTE: Remove and discard the gasket.
Torque: 10 Nm

9.  NOTE: Remove and discard the gasket.
Torque: 10 Nm

10.

11.  CAUTION: Before the disconnection or removal of any components, make sure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

NOTES:




 Engine shown removed for clarity.

 The CKP sensor retaining bolt should not be removed from the CKP sensor.

Torque: 5 Nm

Installation

1.  **CAUTION:** Install the CKP sensor correctly into the housing. Failure to follow this instruction may result in damage to the CKP sensor.

To install, reverse the removal procedure.

Electronic Engine Controls - TDV6 3.0L Diesel - Crankshaft Position (CKP) Sensor Ring

Removal and Installation

Special Tool(s)

 <p>303-1130 Installer - Crankshaft Position (CKP) Sensor Ring</p> <p>E49378</p>	
---	--

Removal

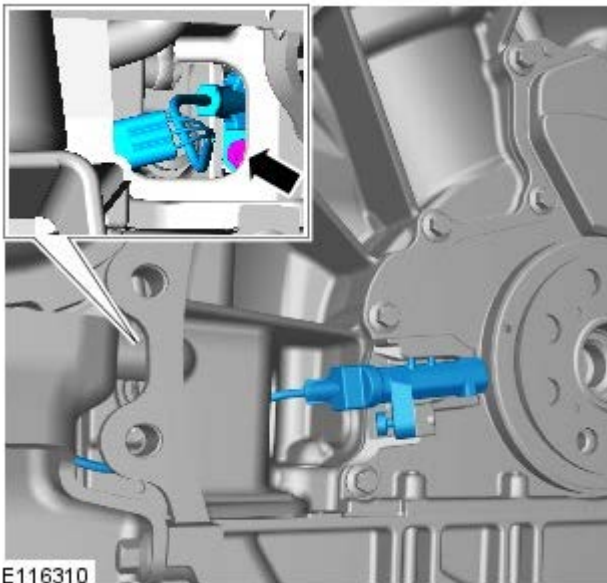
1. Disconnect the battery ground cable.


Refer to: Specifications (414-00, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Refer to: Flexplate (303-01, Removal and Installation).




4.  **CAUTION:** Before the disconnection or removal of any components, make sure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

 **NOTE:** The CKP sensor retaining bolt should not be removed from the CKP sensor.

- 5.



Installation

1.  CAUTION: Make sure that the CKP sensor ring is aligned correctly with the special tool pip and that both mating surfaces are fully seated.

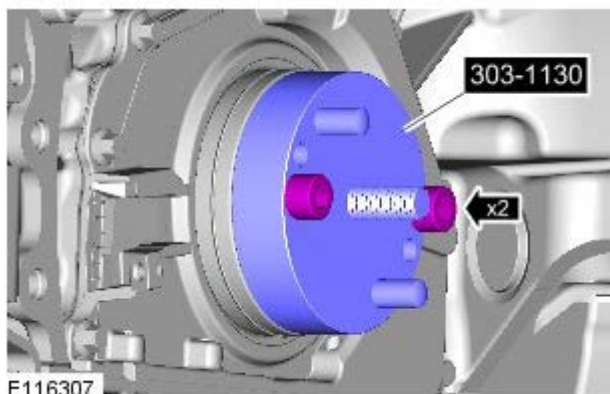
- *Special Tool(s):* [303-1130](#)



E116306

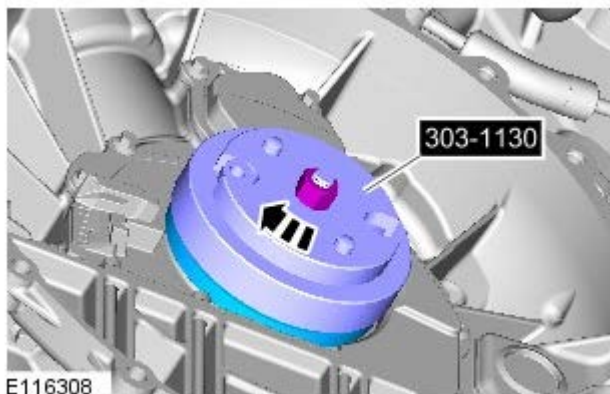
2. Install the special tool.

- *Special Tool(s):* [303-1130](#)



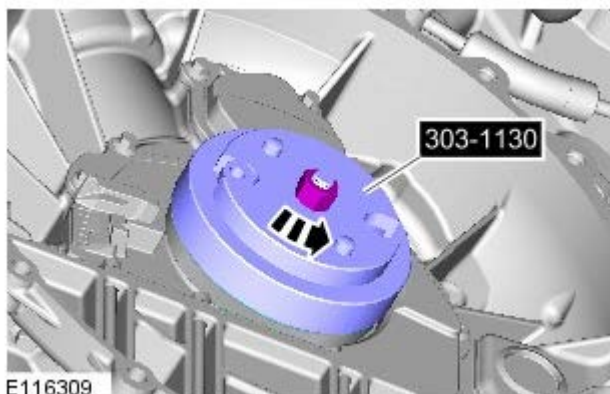
E116307

- 3.



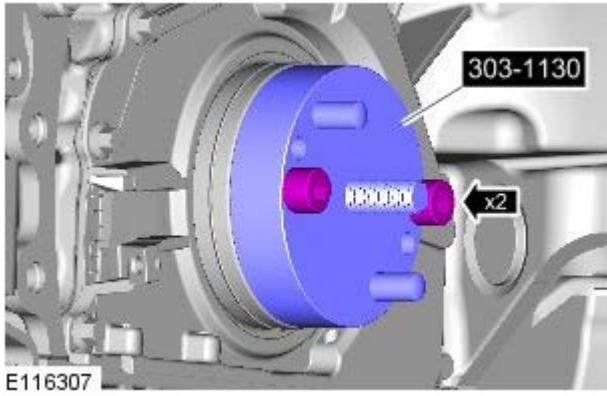
E116308

- 4.

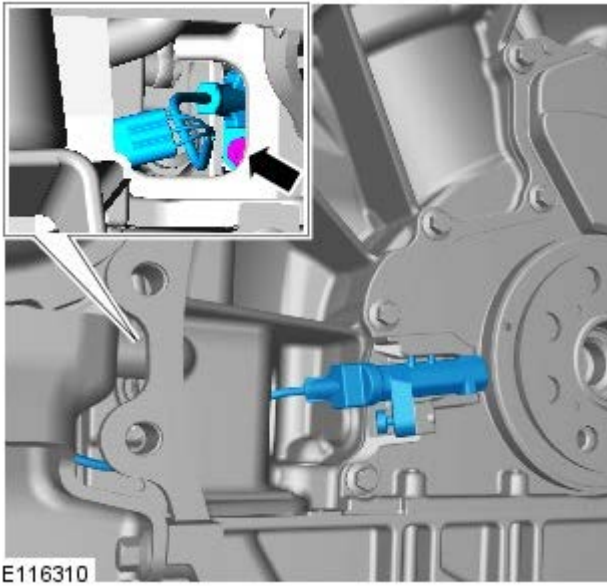


E116309


5. Remove the special tool.





Special Tool(s): [303-1130](#)



6. CAUTIONS:

 Install the CKP sensor correctly into the housing. Failure to follow this instruction may result in damage to the CKP sensor.

 Make sure that the mating faces are clean and free of foreign material.

 Make sure that the component is clean, free of foreign material and lubricant.

- Torque: 5 Nm

7. Refer to: Flexplate (303-01, Removal and Installation).

8. Connect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

Electronic Engine Controls - TDV6 3.0L Diesel - Diesel Particulate Filter (DPF) Differential Pressure Sensor

Removal and Installation

Removal

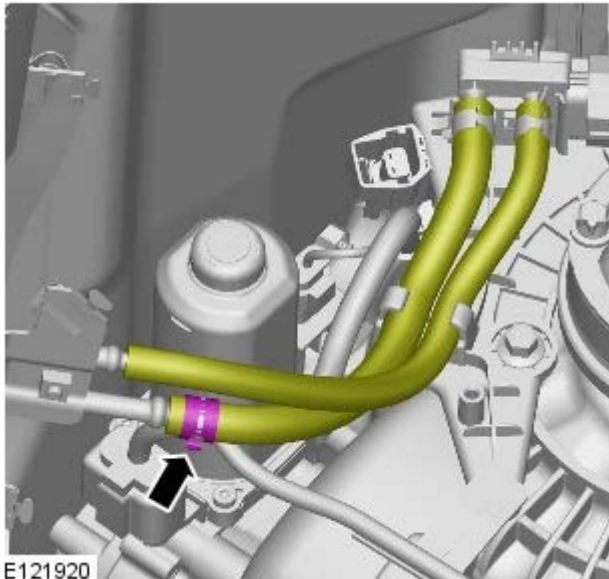


NOTE: Removal steps in this procedure may contain installation details.

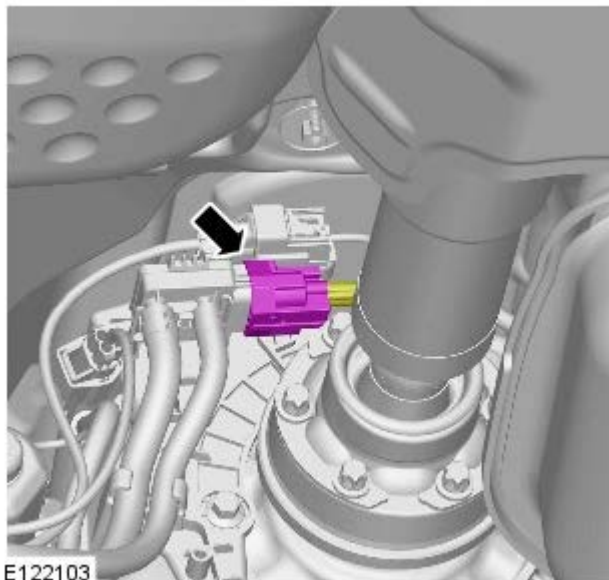
1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

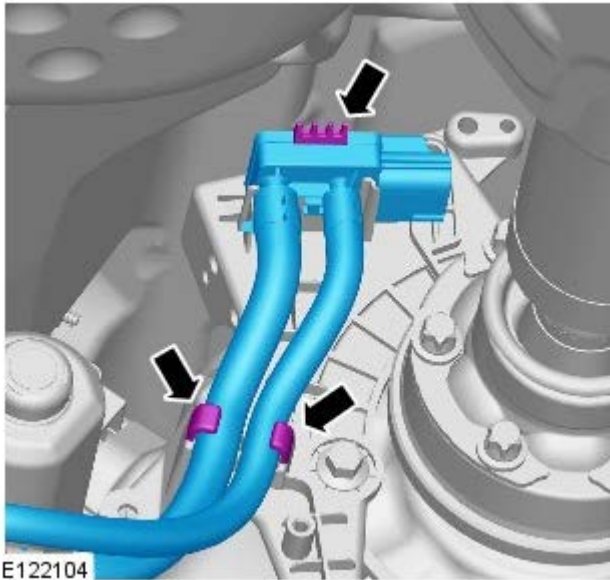
2.



3.



4.



E122104

5.



E114350

Installation

1. To install, reverse the removal procedure.

2.  **NOTE:** This step is only necessary when installing a new component.

1. Using the diagnostic tool, clear diagnostic trouble codes (DTCs) from the engine control module (ECM).
2. Using the data logger, check the engine oil temperature.
3. Make sure the selector lever is in the 'P' position.
4. Start and run the engine.
5. Make sure that the engine oil is at a minimum temperature of 50 degrees C.
6. Allow the engine to idle for 2 minutes and 30 seconds.
7. Make sure that the engine cooling fan is not running.
8. Turn off the ignition.
9. Wait for 30 seconds.
10. Repeat steps 4 to 9, a further 5 times.
11. Disconnect the Jaguar approved diagnostic system.

Electronic Engine Controls - TDV6 3.0L Diesel - Engine Coolant Temperature (ECT) Sensor

Removal and Installation

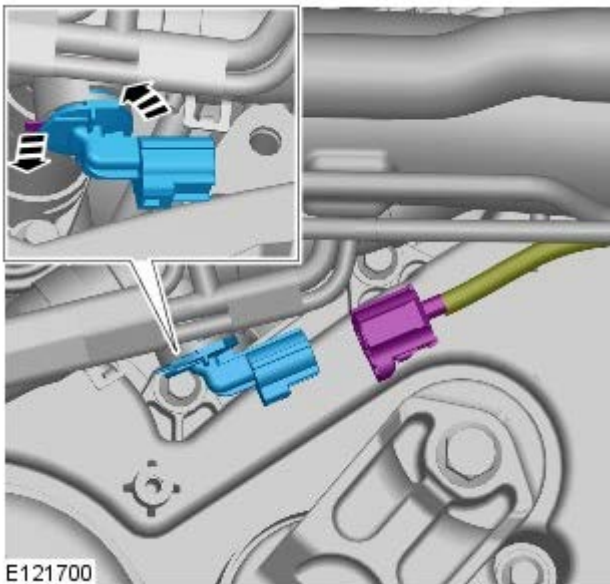
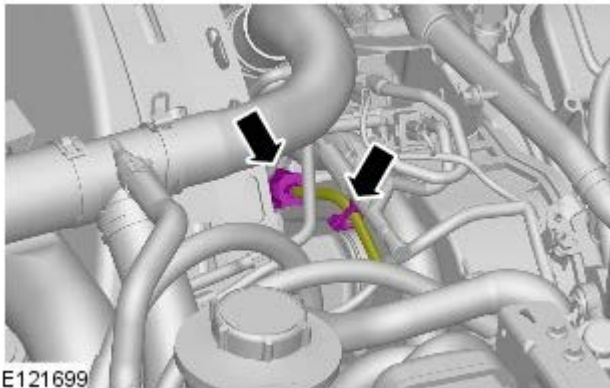
Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).

2.



3. CAUTIONS:



Be prepared to collect escaping fluids.



The seal is to be reused unless damaged.



Make sure that the mating faces are clean and free of foreign material.



NOTE: Release the locking tang to remove the ECT sensor.

Installation



1. NOTE: Make sure that all the component mating faces are clean.

To install, reverse the removal procedure.

2. Fill the cooling system, keeping coolant to the upper level mark of the expansion tank.

Electronic Engine Controls - TDV6 3.0L Diesel - Engine Control Module (ECM)

Removal and Installation

Removal



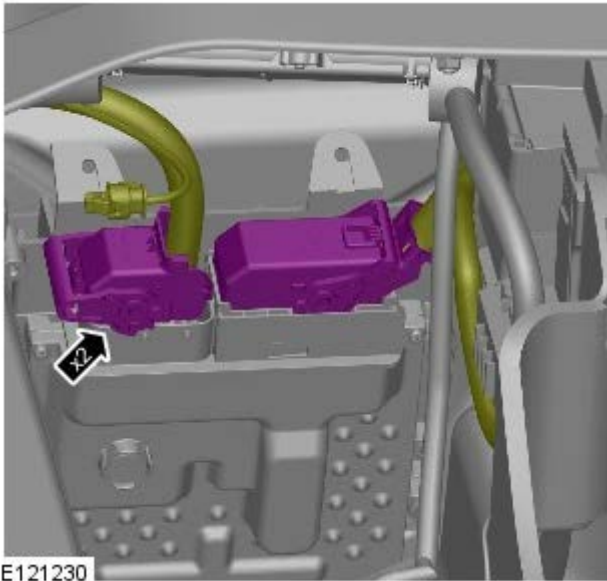
NOTE: Removal steps in this procedure may contain installation details.

All vehicles


1. Remove the battery.

Refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

Left-hand drive vehicles

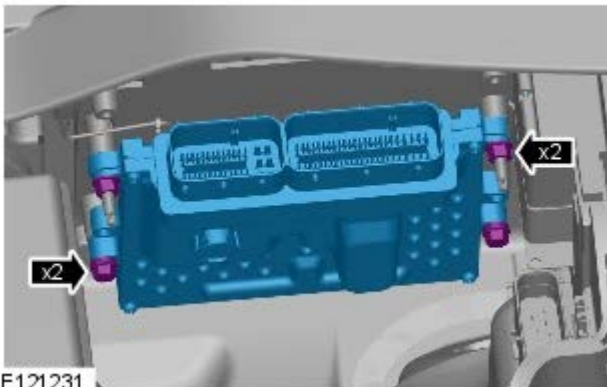


E121230


2.  CAUTION: Before the disconnection or removal of any components, make sure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.




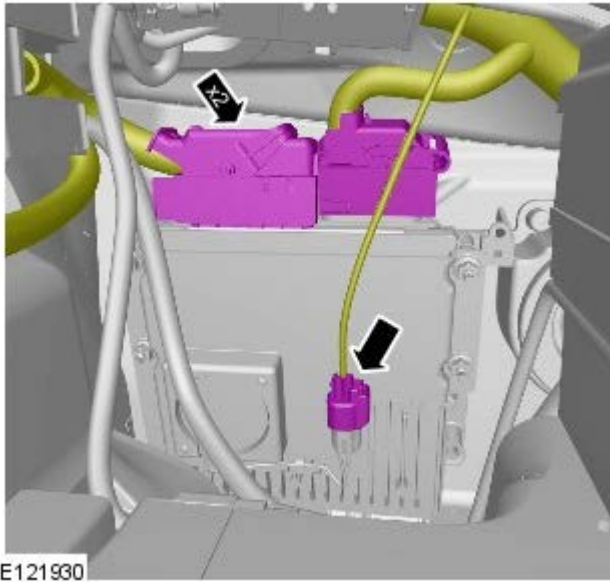
E121231

3.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

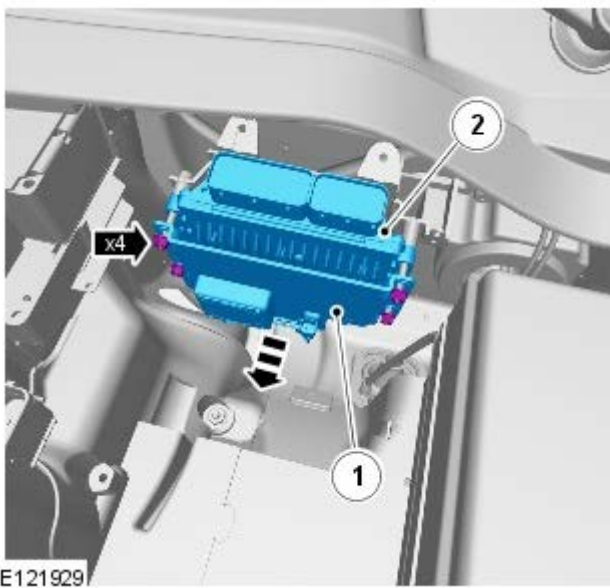
Torque: 7 Nm

Right-hand drive vehicles

4.  CAUTION: Before the disconnection or removal of any components, make sure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.



5. Torque: 7 Nm



Installation

1. To install, reverse the removal procedure.
2. New units must be configured using the Programmable Module Routine in the diagnostic tool.

Electronic Engine Controls - TDV6 3.0L Diesel - Engine Oil Level Sensor

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

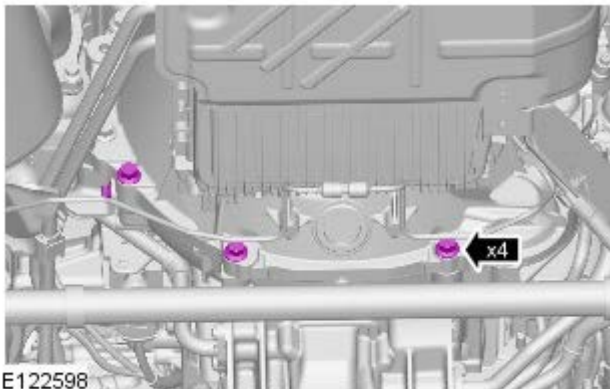
Refer to: Specifications (414-00, Specifications).


2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

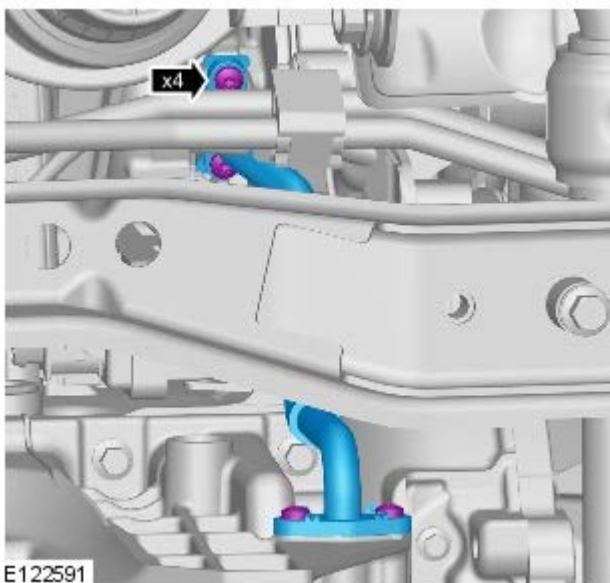
3. Refer to: Engine Oil Draining and Filling (303-01B, General Procedures).
4. Refer to: Front Drive Axle and Differential (205-03, Description and Operation).
5. Refer to: Starter Motor (303-06, Removal and Installation).

6. *Torque:*
M10 40 Nm
M8 24 Nm

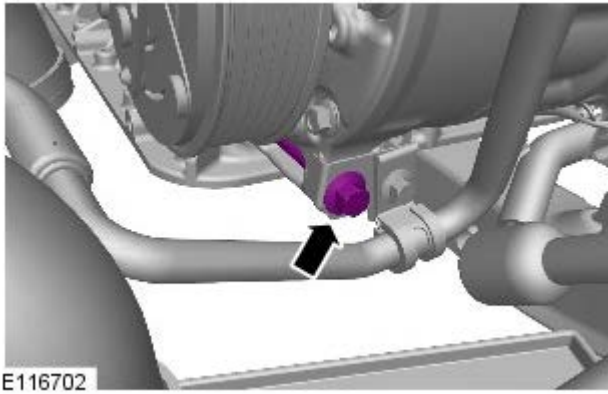


7.  **CAUTION:** Make sure that the gaskets are correctly located.

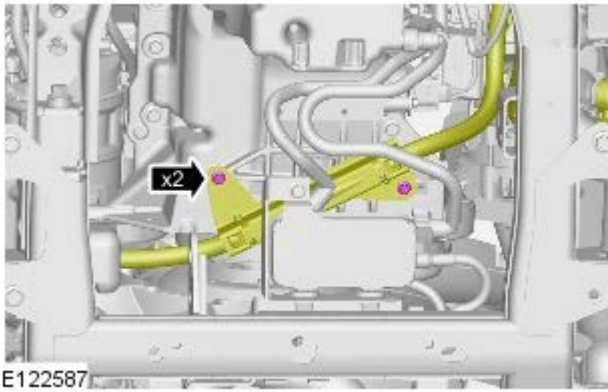
Torque: 10 Nm



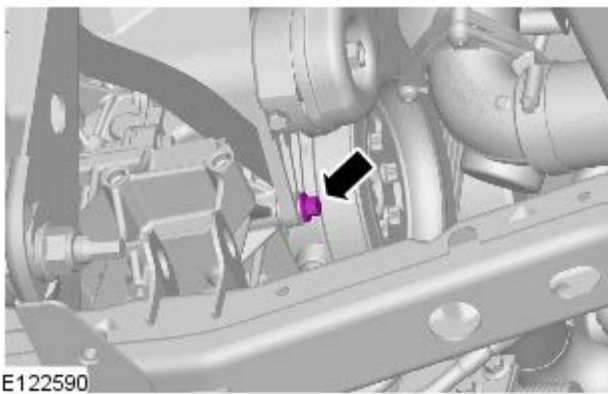
8. *Torque:* 25 Nm



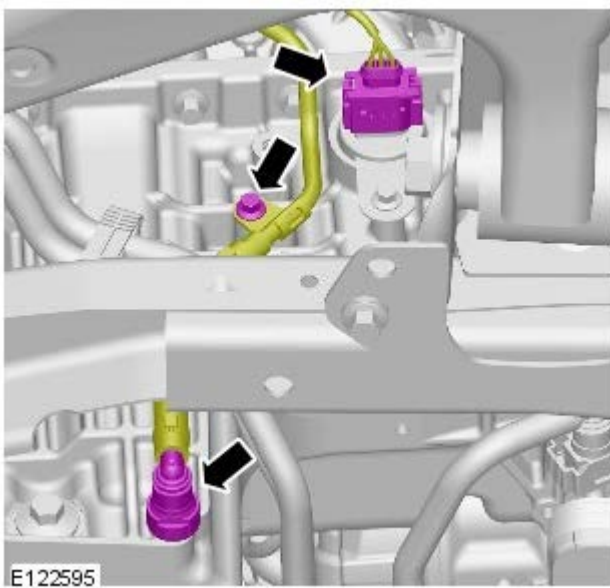
9. Torque: 10 Nm



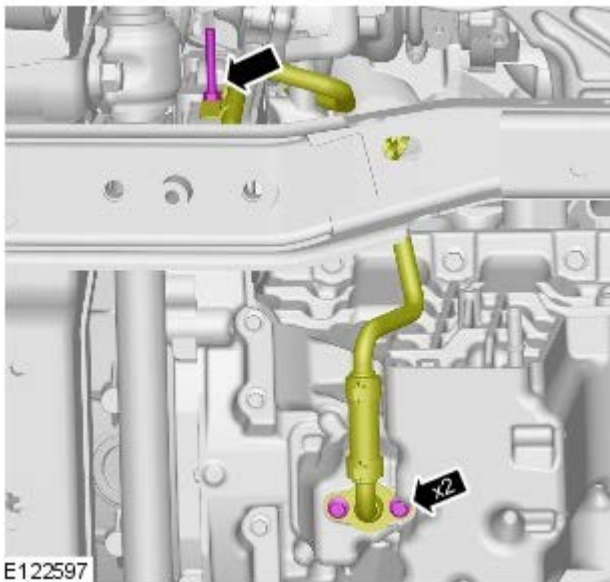
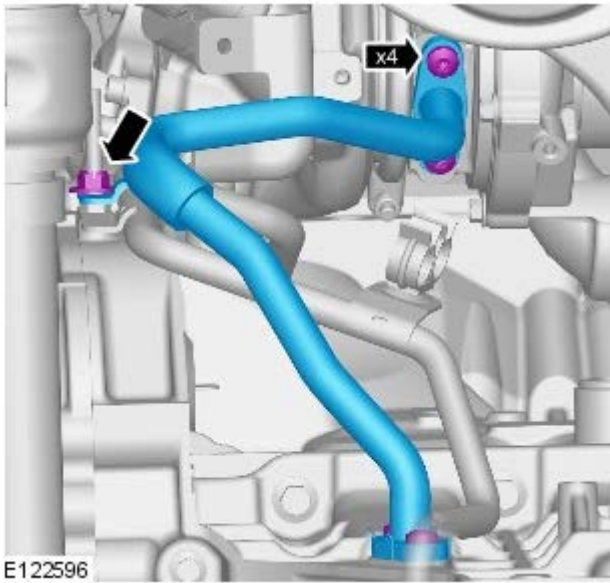
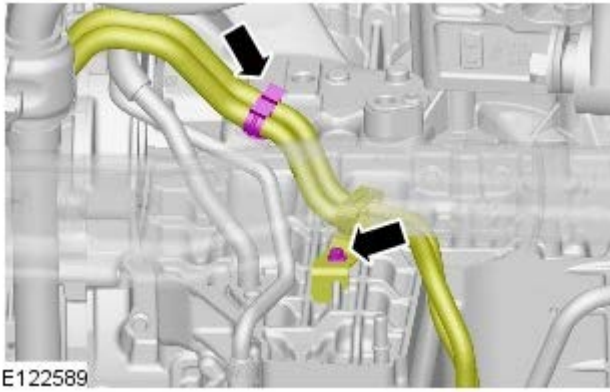
10. Torque: 24 Nm




11. Torque: 10 Nm




12. Torque: 10 Nm




13.  CAUTION: Make sure that the gaskets are correctly located.

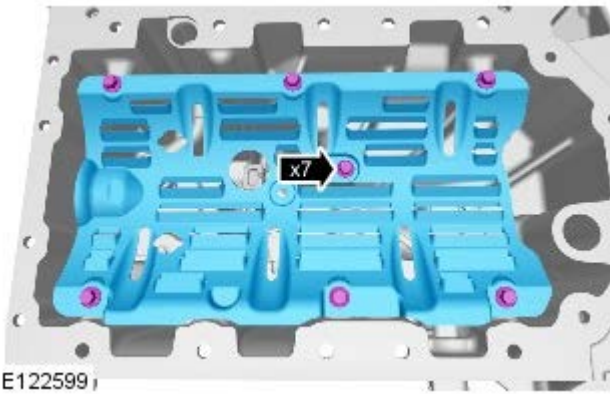
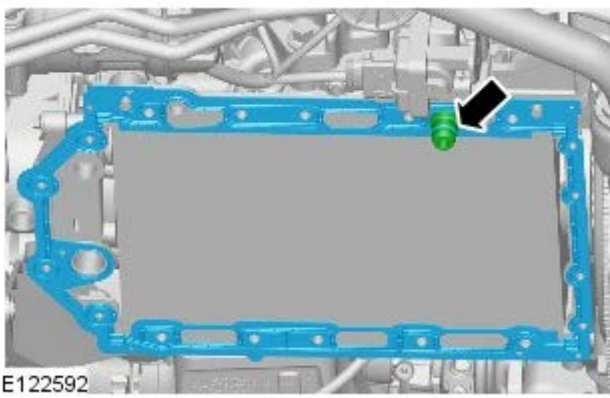
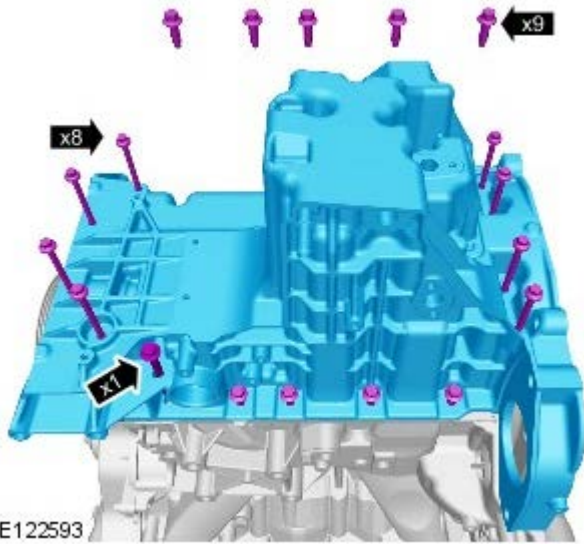
Torque: 10 Nm


14.  NOTE: Remove and discard the gasket.

Torque: 10 Nm

15.  CAUTION: Note the position of the bolts, prior to removal.

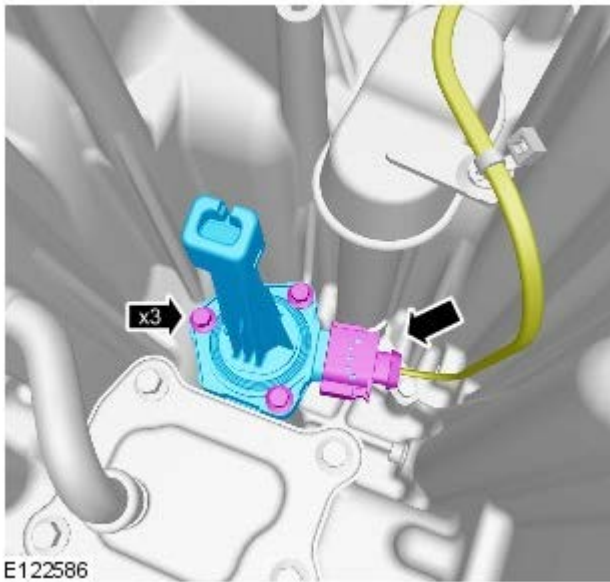
Torque:
M8 23 Nm
M6 10 Nm



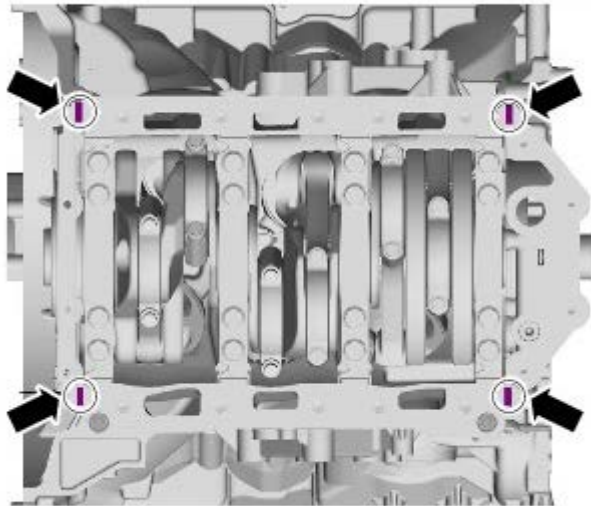
16.  CAUTION: Remove and discard the O-ring seal.

17. Torque: 10 Nm


18. Torque: 10 Nm




Installation



1. CAUTIONS:

 Make sure that the mating faces are clean and free of corrosion and foreign material.

 Installation of the oil pan and tightening must be carried out within 7 minutes of applying the sealant.

Apply an 8 mm bead of sealant to the cylinder block in the areas shown.

2. To install, reverse the removal procedure.

Electronic Engine Controls - TDV6 3.0L Diesel - Engine Oil Pressure (EOP) Sensor

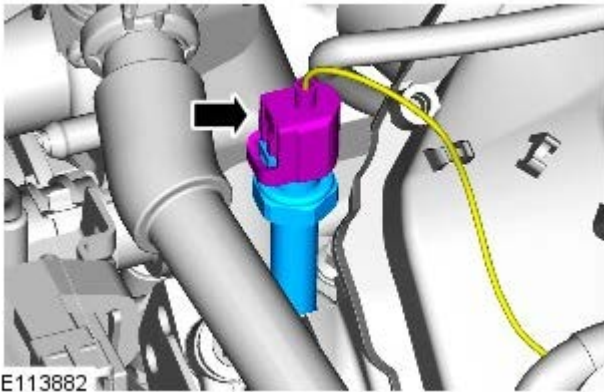
Removal and Installation

Removal




NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).



E113882

2.  CAUTION: Before the disconnection or removal of any components, make sure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

- Torque: 14 Nm

Installation

1. To install, reverse the removal procedure.


Electronic Engine Controls - TDV6 3.0L Diesel - Exhaust Gas Temperature Sensor RH


Removal and Installation

Removal

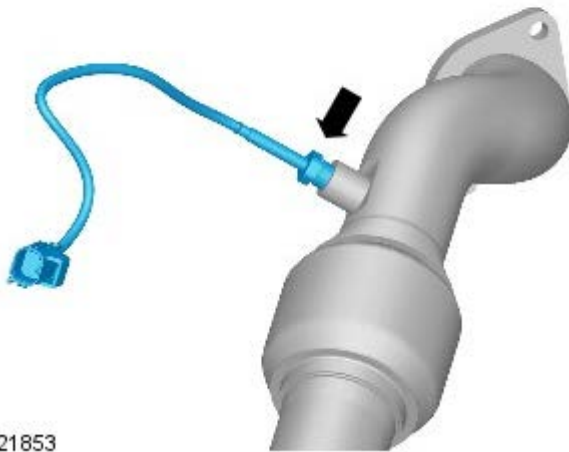


NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: Exhaust System (309-00, Removal and Installation).

3.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Torque: 35 Nm



E121853

Installation

1.  **CAUTION:** If accidentally dropped or knocked install a new sensor.



NOTE: If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

To install, reverse the removal procedure.


Electronic Engine Controls - TDV6 3.0L Diesel - Heated Oxygen Sensor (HO2S)


Removal and Installation

Removal

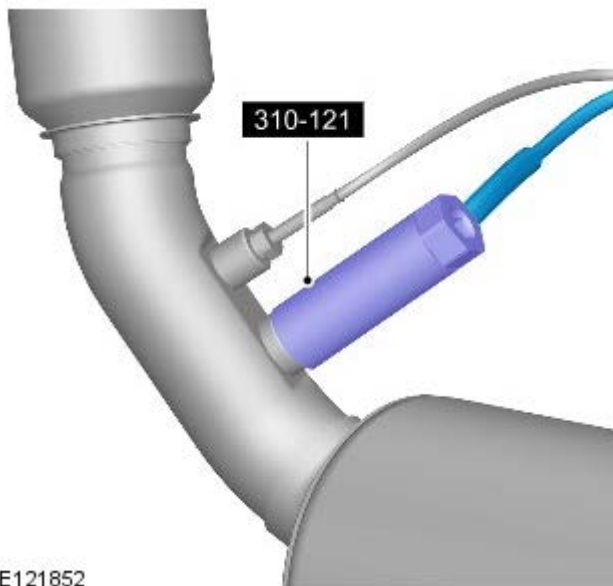


NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: Catalytic Converter (309-00 Exhaust System - 3.0L V6 - TdV6, Removal and Installation).

3.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Torque: 48 Nm



E121852

Installation

1. **CAUTIONS:**



If accidentally dropped or knocked install a new sensor.



Make sure the HO2S wiring harness is not twisted more than 180 degrees and is not in contact with either the exhaust or driveshaft.

NOTES:



If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.



Make sure the anti-seize compound does not contact the HO2S tip.

To install, reverse the removal procedure.

2. If a new unit is installed, configure using the approved diagnostic tool.

Electronic Engine Controls - TDV6 3.0L Diesel - Intake Air Temperature (IAT) Sensor

Removal and Installation

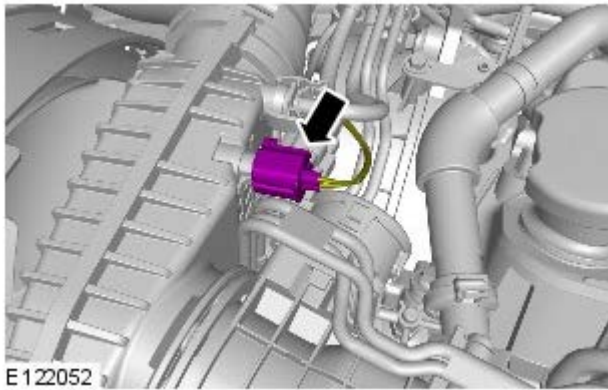
Removal



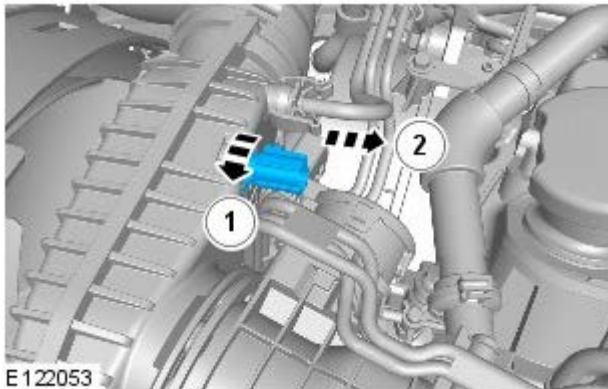
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).

2.



3.



Installation

1. To install, reverse the removal procedure.

Electronic Engine Controls - TDV6 3.0L Diesel - Manifold Absolute Pressure (MAP) Sensor

Removal and Installation

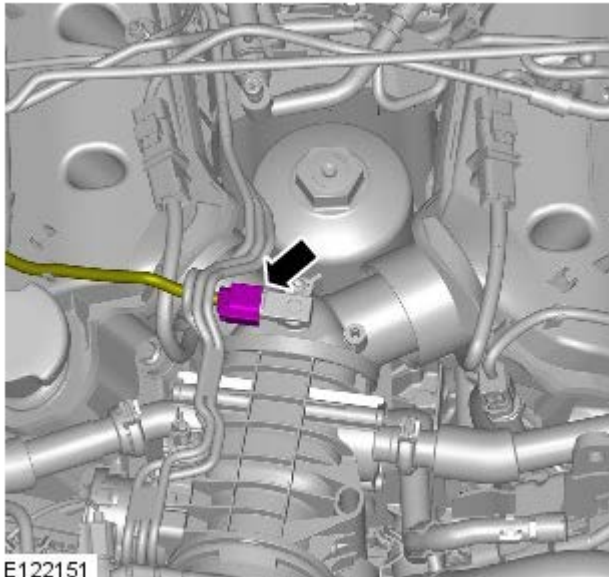
Removal



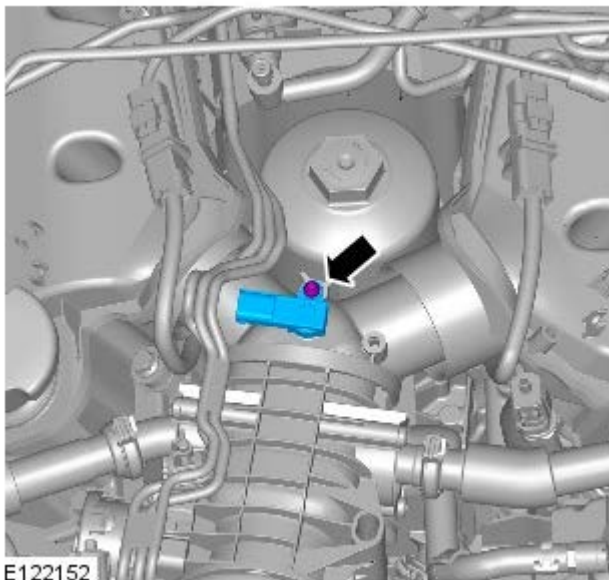
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).

2.



3. Torque: 3 Nm



Installation

1. To install, reverse the removal procedure.

Electronic Engine Controls - TDV6 3.0L Diesel - Mass Air Flow (MAF) Sensor

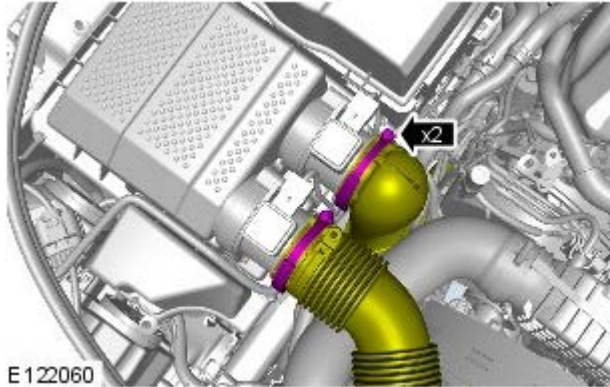
Removal and Installation

Removal

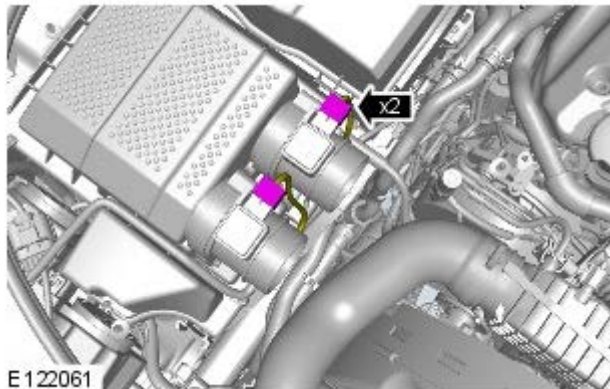


NOTE: Removal steps in this procedure may contain installation details.

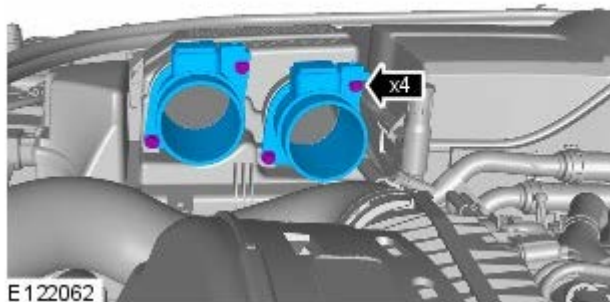
1. Torque: 3.5 Nm



- 2.



3. Torque: 2 Nm



Installation

1. To install, reverse the removal procedure.

Electronic Engine Controls - TDV6 3.0L Diesel - Oil Temperature Sensor

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. The oil temperature sensor is an integrated part of the engine oil level sensor.

Refer to: Engine Oil Level Sensor (303-14, Removal and Installation).

Installation

1. To install, reverse the removal procedure.


Electronic Engine Controls - TDV6 3.0L Diesel - Post Catalytic Converter Temperature Sensor

Removal and Installation

Removal

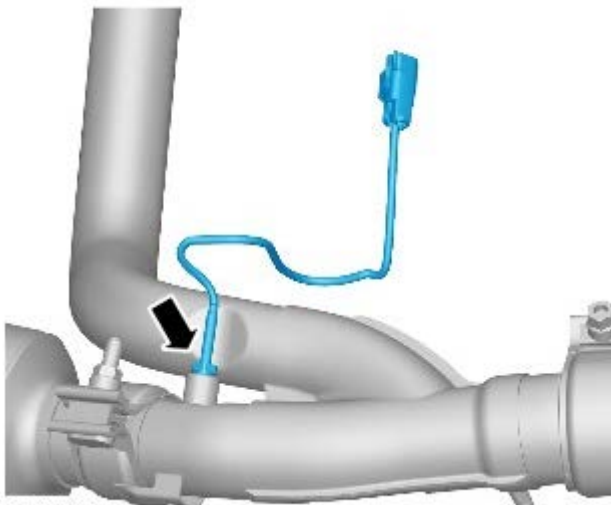


NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: Exhaust System (309-00, Removal and Installation).

3.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Torque: 35 Nm



E121854

Installation

1.  **CAUTION:** If accidentally dropped or knocked install a new sensor.



NOTE: If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

To install, reverse the removal procedure.


Electronic Engine Controls - TDV6 3.0L Diesel - Post DPF Exhaust Gas Temperature Sensor


Removal and Installation

Removal

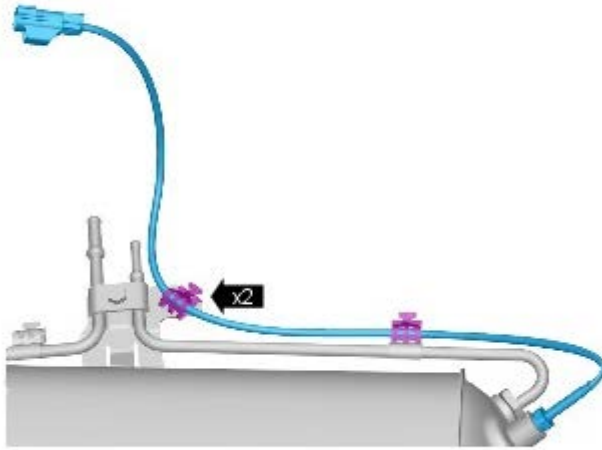


NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: Diesel Particulate Filter (DPF) (309-00, Removal and Installation).

3.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Torque: 35 Nm



E121856

Installation

1.  **CAUTION:** If accidentally dropped or knocked install a new sensor.



NOTE: If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

To install, reverse the removal procedure.


Electronic Engine Controls - TDV6 3.0L Diesel - Pre Catalytic Converter Temperature Sensor

Removal and Installation

Removal

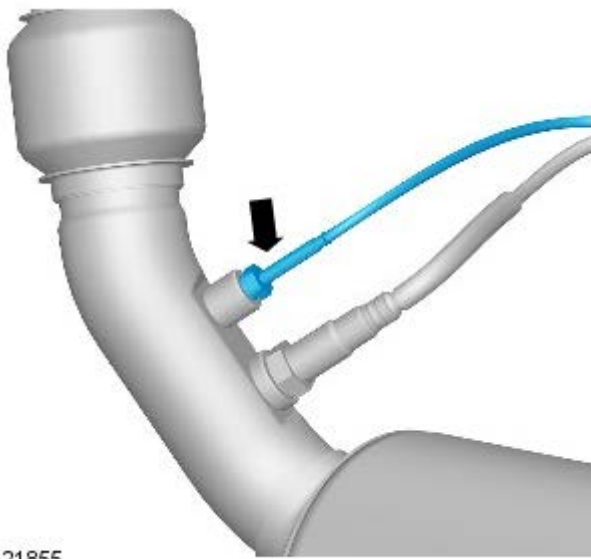


NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: Exhaust System (309-00, Removal and Installation).


3.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Torque: 35 Nm



E121855

Installation

1.  **CAUTION:** If accidentally dropped or knocked install a new sensor.



NOTE: If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

To install, reverse the removal procedure.


Electronic Engine Controls - TDV6 3.0L Diesel - Pre DPF Exhaust Gas Temperature Sensor

Removal and Installation

Removal

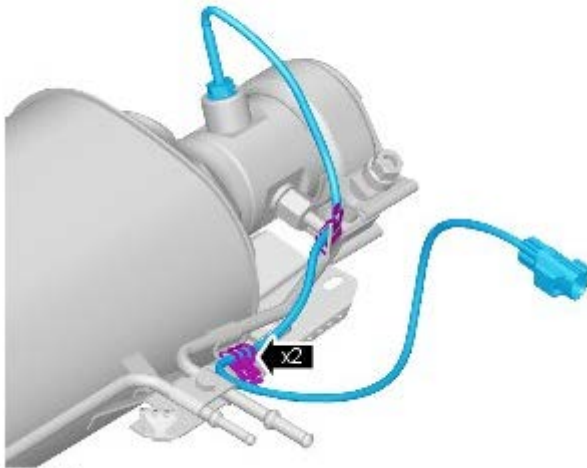


NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: Diesel Particulate Filter (DPF) (309-00, Removal and Installation).

3.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Torque: 35 Nm



E121857

Installation

1.  **CAUTION:** If accidentally dropped or knocked install a new sensor.



NOTE: If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol -**Torque Specifications**

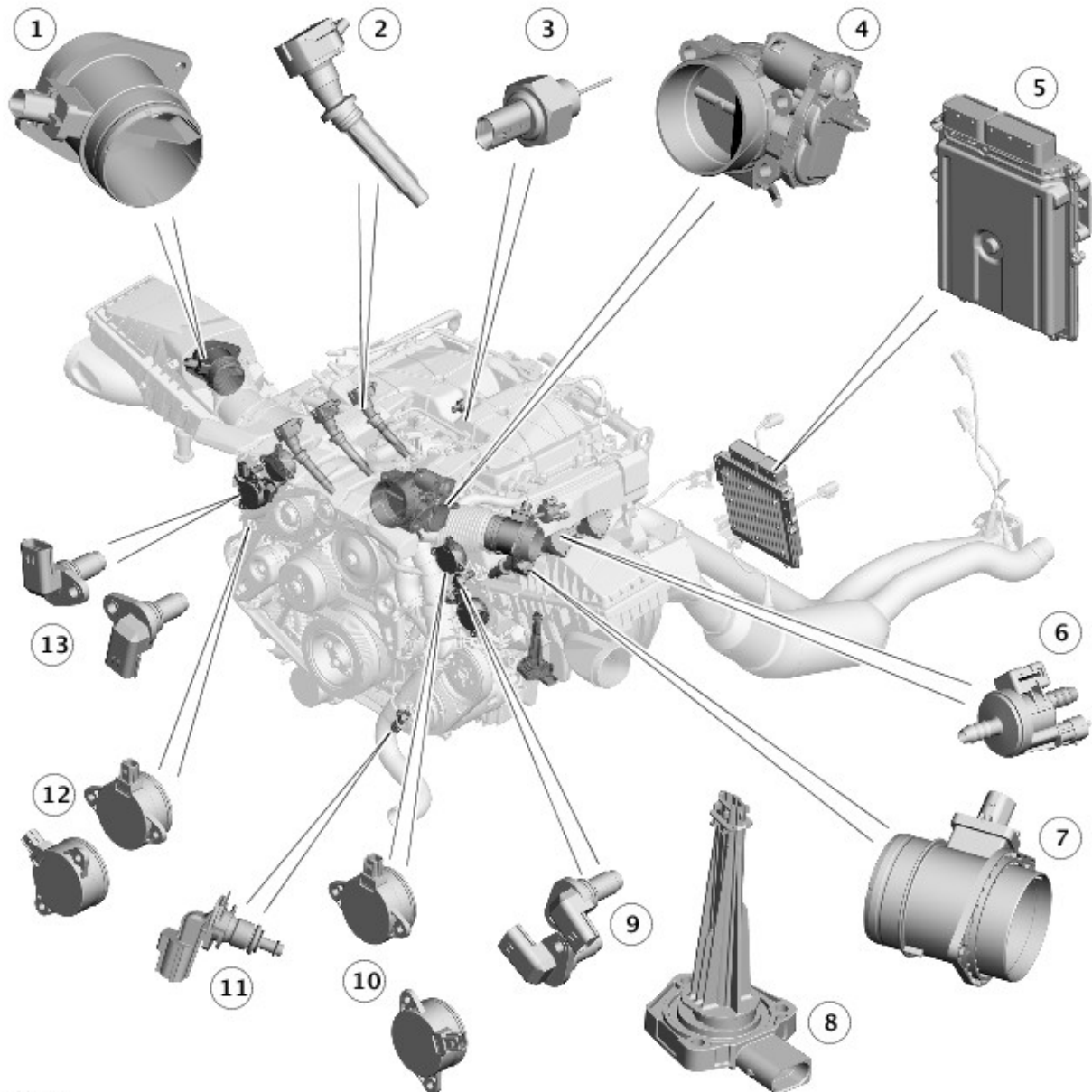
Description	Nm	lb-ft	lb-in
Camshaft position (CMP) sensor(s) retaining bolt	10	7	-
Crankshaft position (CKP) sensor retaining bolt	10	7	-
Heated oxygen sensor(s) (HO2S)	48	35	-
Catalyst monitor sensor(s)	48	35	-
Knock sensor(s) (KS) retaining bolt	20	15	-
Fuel rail pressure (FRP) sensor	32	24	-
Manifold absolute pressure and temperature (MAPT) sensor	5	-	44
Mass air flow (MAF) sensor	1.6	-	14
Engine oil level sensor retaining bolts	12	9	-
Variable valve timing (VVT) oil control solenoid(s) retaining bolt	10	7	-
Engine control module (ECM) retaining bolt	7	-	62
Engine control module (ECM) retaining nut	7	-	62
ECM retaining bracket bolt	7	-	62

Electronic Engine Controls - V6 S/C 3.0L Petrol - Electronic Engine Controls

Description and Operation

COMPONENT LOCATION

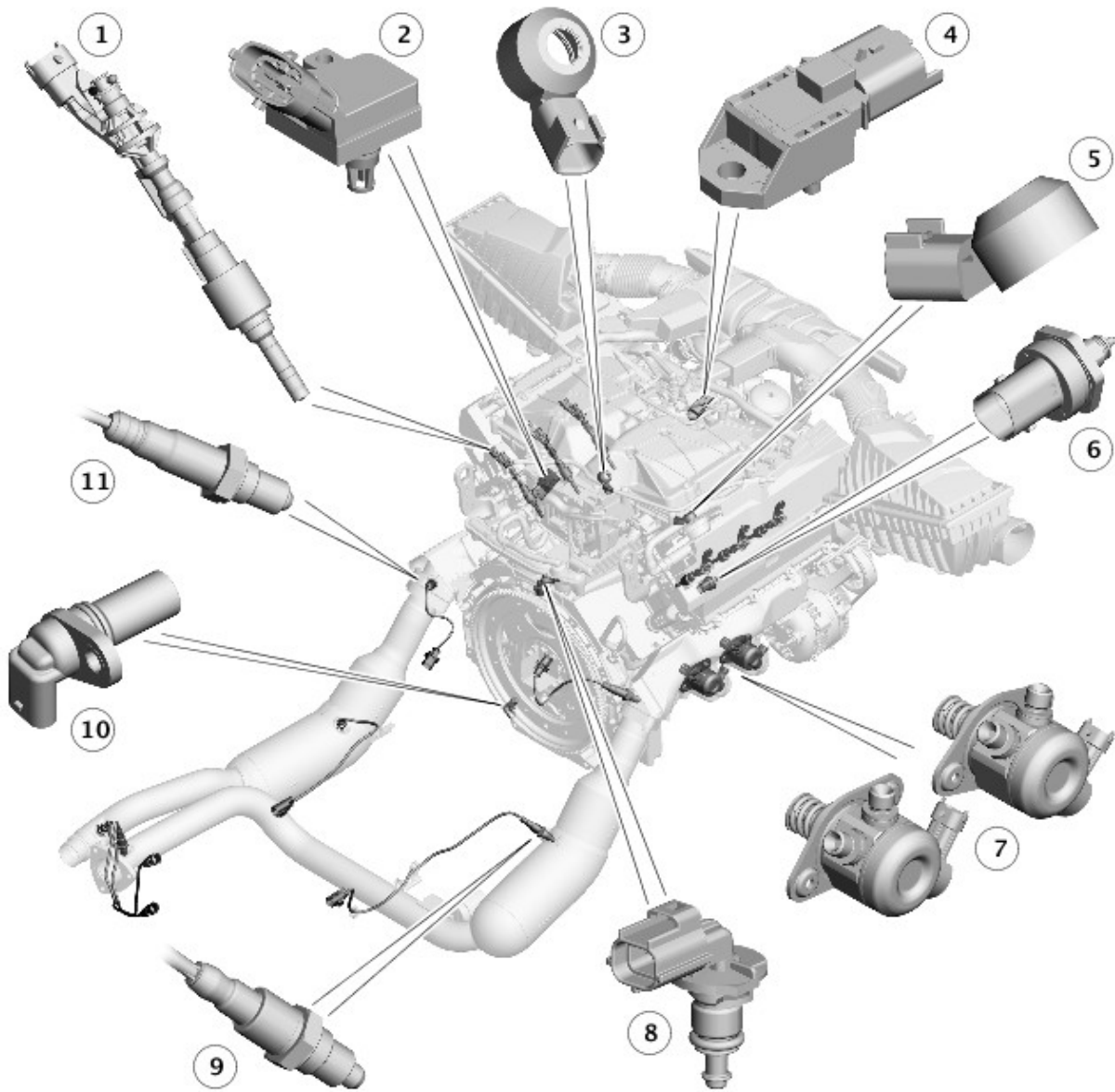
Location 1 of 3



E160715

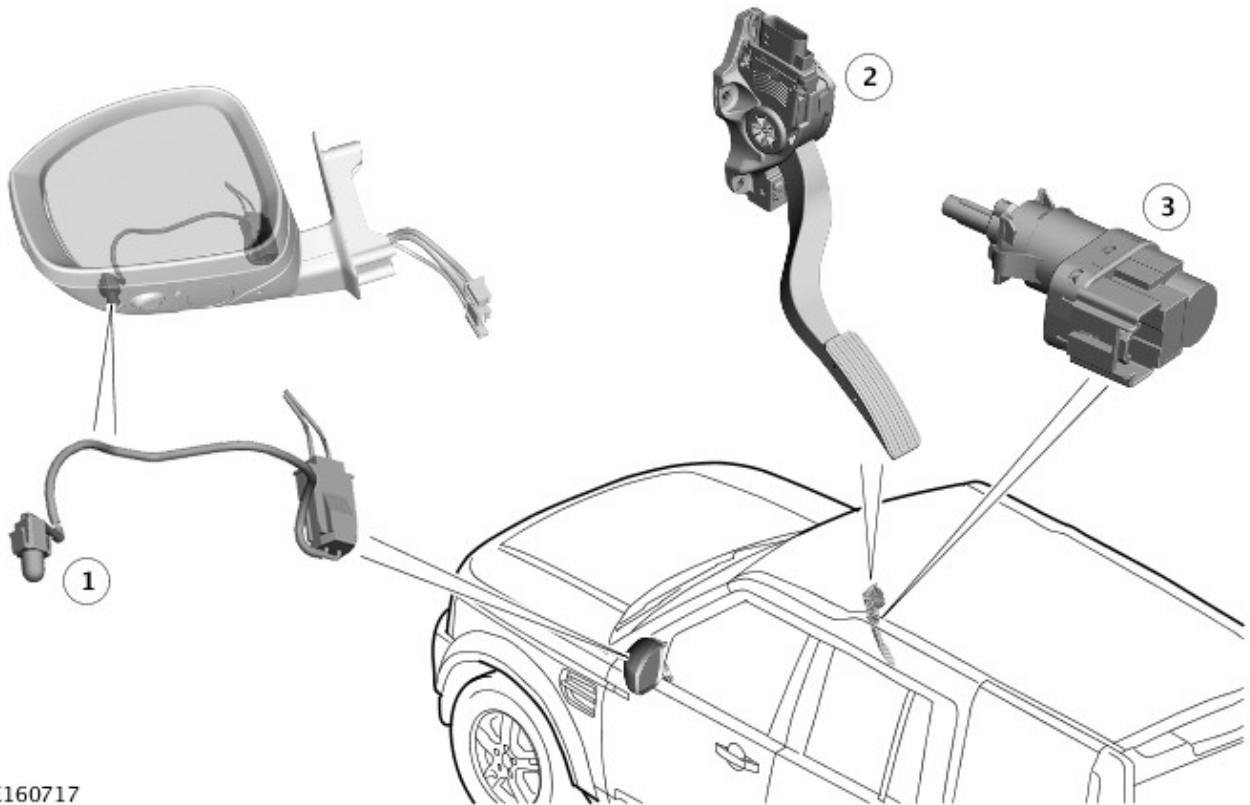
Item	Part Number	Description
1	-	Right Mass Air Flow and Temperature (MAFT) sensor
2	-	Ignition coil (6 off)
3	-	Charge air temperature sensor
4	-	Electric throttle
5	-	Engine Control Module (ECM)
6	-	Purge Valve
7	-	Left Mass Air Flow and Temperature (MAFT) sensor
8	-	Engine oil level sensor
9	-	Camshaft Position (CMP) sensor - Bank 2 (2 off)
10	-	Variable Camshaft Timing (VCT) actuator - Bank 2 (2 off)
11	-	Engine Coolant Temperature (ECT) sensor 2
12	-	Variable Camshaft Timing (VCT) actuator - Bank 1 (2 off)
13	-	Camshaft Position (CMP) sensor - Bank 1 (2 off)

Location 2 of 3



E160716

Item	Part Number	Description
1	-	Fuel injector (6 off)
2	-	Manifold Absolute Pressure and Temperature (MAPT) sensor
3	-	Knock sensor - Bank 1
4	-	Manifold Absolute Pressure (MAP) sensor
5	-	Knock sensor - Bank 2
6	-	Fuel Rail Pressure and Temperature (FRPT) sensor
7	-	High Pressure (HP) fuel pump (2 off)
8	-	Engine Coolant Temperature (ECT) sensor 2
9	-	Heated Oxygen Sensor (HO2S) - Mid catalyst (2 off)
10	-	Crankshaft Position (CKP) sensor
11	-	Heated Oxygen Sensor (HO2S) - Pre catalyst (2 off)



E160717

Item	Part Number	Description
1	-	Ambient Air Temperature (AAT) sensor
2	-	Accelerator Pedal Position (APP) sensor
3	-	Brake pedal switch

OVERVIEW

The electronic engine control system operates the engine to generate the output demanded by the accelerator pedal and loads imposed by other systems. The electronic engine control system has an [ECM \(engine control module\)](#) that uses a torque-based strategy to evaluate inputs from sensors and other systems, then produces outputs to engine actuators to produce the required torque.

The electronic engine control system controls the following:

- Charge air
- Fueling
- Ignition timing
- Valve timing
- Cylinder knock
- Idle speed
- Engine cooling fan
- Evaporative emissions
- On-board diagnostics
- Immobilization system interface
- Speed control.

DESCRIPTION

Engine Control Module



E148512

The ECM is installed in the rear left corner of the engine compartment, behind the secondary bulkhead panel. The ECM is attached to brackets on the wheel housing and the fender outer support panel.

The ECM has the capability of adapting its fuel and ignition control outputs in response to several sensor inputs.

The ECM receives inputs from the following:

- [CKP \(crankshaft position\)](#) sensor.
- [CMP \(camshaft position\)](#) sensors (4 off).
- [ECT \(engine coolant temperature\)](#) sensors (2 off).
- Knock sensors (2 off).
- [MAP \(manifold absolute pressure\)](#) sensor.
- [MAPT \(manifold absolute pressure and temperature\)](#) sensor.
- [MAFT \(mass air flow and temperature\)](#) sensors (2 off).
- Charge air temperature sensor.
- TPS (throttle position sensor).
- [HO2S \(heated oxygen sensor\)](#) sensors (6 off).
- [APP \(accelerator pedal position\)](#) sensor.
- AAT (ambient air temperature) sensor.
- Supercharger bypass valve actuator.
For additional information, refer to: [Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Description and Operation).
- FRPT (fuel rail pressure and temperature) sensor.
For additional information, refer to: [Fuel Charging and Controls](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Description and Operation).
- Engine cooling fan.
For additional information, refer to: [Engine Cooling](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Description and Operation).
- Brake pedal switch.
For additional information, refer to: [Anti-Lock Control - Traction Control](#) (206-09A Anti-Lock Control - Traction Control, Description and Operation).
- Oil level and temperature sensor.
For additional information, refer to: [Engine](#) (303-01B Engine - V6 S/C 3.0L Petrol, Description and Operation).
- Fuel LP (low pressure) sensor.
For additional information, refer to: [Fuel Tank and Lines](#) (310-01B Fuel Tank and Lines - V6 S/C 3.0L Petrol, Description and Operation).
- [FPDM \(fuel pump driver module\)](#).
For additional information, refer to: [Fuel Tank and Lines](#) (310-01B Fuel Tank and Lines - V6 S/C 3.0L Petrol, Description and Operation).
- [TCS \(transmission control switch\)](#).
For additional information, refer to: [External Controls](#) (307-05 Automatic Transmission/Transaxle External Controls - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, Description and Operation).
- [RCM \(restraints control module\)](#).
For additional information, refer to: [Air Bag and Safety Belt Pretensioner Supplemental Restraint System \(SRS\)](#) (501-20B Supplemental Restraint System, Description and Operation).

The ECM provides outputs to the following:

- Electric throttle.
- ECM relay.
- Fuel injectors (6 off).
For additional information, refer to: [Fuel Charging and Controls](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Description and Operation).
- Ignition coils (6 off).
For additional information, refer to: [Engine Ignition](#) (303-07B Engine Ignition - V6 S/C 3.0L Petrol, Description and Operation).
- [VCT \(variable camshaft timing\)](#) solenoids (4 off).
For additional information, refer to: [Engine](#) (303-01B Engine - V6 S/C 3.0L Petrol, Description and Operation).
- [EVAP \(evaporative emission\)](#) purge valve.
For additional information, refer to: [Evaporative Emissions](#) (303-13 Evaporative Emissions - V6 S/C 3.0L Petrol, Description and Operation).
- Engine starter relay.
For additional information, refer to: [Starting System](#) (303-06B Starting System - V6 S/C 3.0L Petrol, Description and Operation).
- Engine cooling fan.
For additional information, refer to: [Engine Cooling](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Description and Operation).
- Supercharger bypass valve actuator.
For additional information, refer to: [Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Description and Operation).
- Charge air coolant pump relay.
For additional information, refer to: [Supercharger Cooling](#) (303-03C Supercharger Cooling - V6 S/C 3.0L Petrol, Description and Operation).
- HP (high pressure) fuel pumps.
For additional information, refer to: [Fuel Charging and Controls](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Description and Operation).
- [FPDM](#).
For additional information, refer to: [Fuel Tank and Lines](#) (310-01B Fuel Tank and Lines - V6 S/C 3.0L Petrol, Description and Operation).
- [DMTL \(diagnostic module tank leakage\)](#) pump (where fitted).
For additional information, refer to: [Evaporative Emissions](#) (303-13 Evaporative Emissions - V6 S/C 3.0L Petrol, Description and Operation).

Crankshaft Position Sensor



E148504

The **CKP** sensor is an inductive sensor that allows the **ECM** to determine the angular position of the crankshaft and the engine speed.

The CKP sensor is installed in the rear left side of the oil pan, in line with the engine drive plate. The sensor is secured with a single screw and sealed with an O-ring. A two pin electrical connector provides the interface with the engine harness.

The head of the CKP sensor faces a reluctor ring pressed into the outer circumference of the engine drive plate. The reluctor ring has a 60 minus 2 tooth pattern. There are 58 teeth at 6° intervals, with two teeth removed to provide a reference point with a centerline that is 21° **BTDC** (before top dead center) on cylinder 1.

If the CKP sensor fails, the ECM:

- Uses signals from the **CMP** sensors to determine the angular position of the crankshaft and the engine speed
- Adopts a limp home mode where engine speed is limited to a maximum of 3000 rev/min.

With a failed CKP sensor, engine starts will require a long crank time while the ECM determines the angular position of the crankshaft.

Camshaft Position Sensors



E116087

The **CMP** sensors are MRE (magneto resistive element) sensors that allow the **ECM** to determine the angular position of the camshafts. MRE sensors produce a digital output which allows the ECM to detect speeds down to zero.

The four CMP sensors are installed in the front upper timing covers, one for each camshaft.

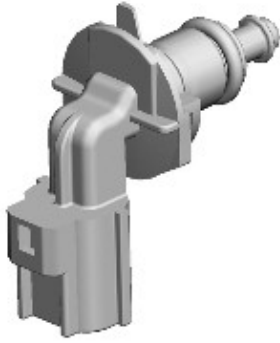
Each CMP sensor is secured with a single screw and sealed with an O-ring. On each CMP sensor, a three pin electrical connector provides the interface with the engine harness.

The head of each CMP sensor faces a reluctor ring attached to the front of the related **VCT** actuator.

If an exhaust CMP sensor fails, the ECM disables the VCT of both exhaust camshafts.

If an intake CMP sensor fails, the ECM disables the VCT of both intake camshafts. This can result in the engine being slow, or failing, to start.

Engine Coolant Temperature Sensors



E108397

The ECT sensors are NTC (negative temperature coefficient) thermistors that allow the ECM to monitor the engine coolant temperature.

There are two identical ECT sensors installed, which are identified as ECT 1 and ECT 2. Each sensor is secured with a twist-lock and latch mechanism, and is sealed with an O-ring. A two pin electrical connector provides the interface between the sensor and the engine harness.

ECT 1

ECT 1 is installed in the heater manifold, at the rear of the Bank1 cylinder head. The input from this sensor is used in calibration tables and by other systems.

If there is an ECT 1 fault, the ECM adopts an estimated coolant temperature. On the second consecutive trip with an ECT 1 fault, the ECM illuminates the MIL (malfunction indicator lamp).

ECT 2

ECT 2 is installed in the lower hose connector which attaches to the bottom of the thermostat. The input from this sensor is used for OBD (on-board diagnostic) 2 diagnostics and, in conjunction with the input from ECT 1, to confirm that the thermostat is functional.

If there is an ECT 2 fault, the ECM illuminates the MIL on the second consecutive trip.

Knock Sensors



E108400

The knock sensors are piezo-ceramic sensors that allow the ECM to employ active knock control and prevent engine damage from pre-ignition or detonation.

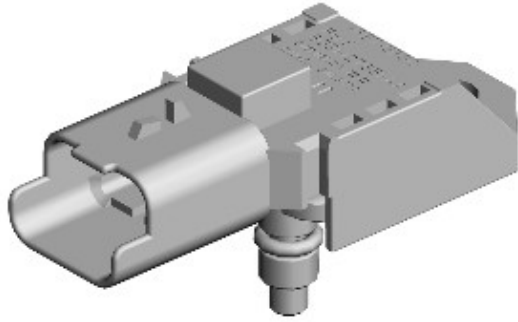
Two knock sensors are installed on the inboard side of each cylinder head, one the midway of Bank 1, and one midway of Bank 2 cylinders. Each knock sensor is secured with a single screw. On each knock sensor, a two pin electrical connector provides the interface with the engine harness.

The ECM compares the signals from the knock sensors with mapped values stored in memory to determine when detonation occurs on individual cylinders. When detonation is detected, the ECM retards the ignition timing on that cylinder for a number of engine cycles, then gradually returns it to the original setting.

The ECM cancels closed loop control of the ignition system if the signal received from a knock sensor becomes implausible. In these circumstances the ECM defaults to base mapping for the ignition timing. This ensures the engine will not become damaged if low quality fuel is used. The MIL will not illuminate, although the driver may notice that the engine 'pinks' in some driving conditions and displays a drop in performance and smoothness.

The ECM calculates the default value if one sensor fails on each bank of cylinders.

Manifold Absolute Pressure Sensor



E148520

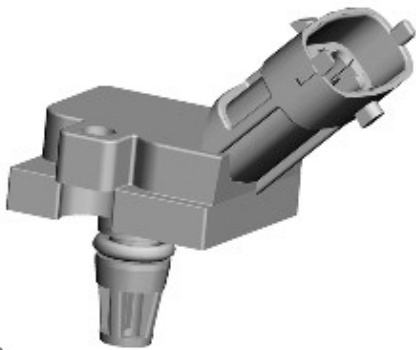
The **MAP** sensor allows the **ECM** to calculate the load on the engine, which is used in the calculation of fuel injection time.

The MAP sensor is installed in the air inlet of the supercharger. The sensor is secured with a single screw and sealed with an O-ring. A three pin electrical connector provides the interface with the engine harness.

If the MAP sensor fails, the ECM adopts a default value of 1 bar (14.5 lbf/in.²).

With a failed MAP sensor, the engine will suffer from poor starting, rough running and poor driveability.

Manifold Absolute Pressure and Temperature Sensor

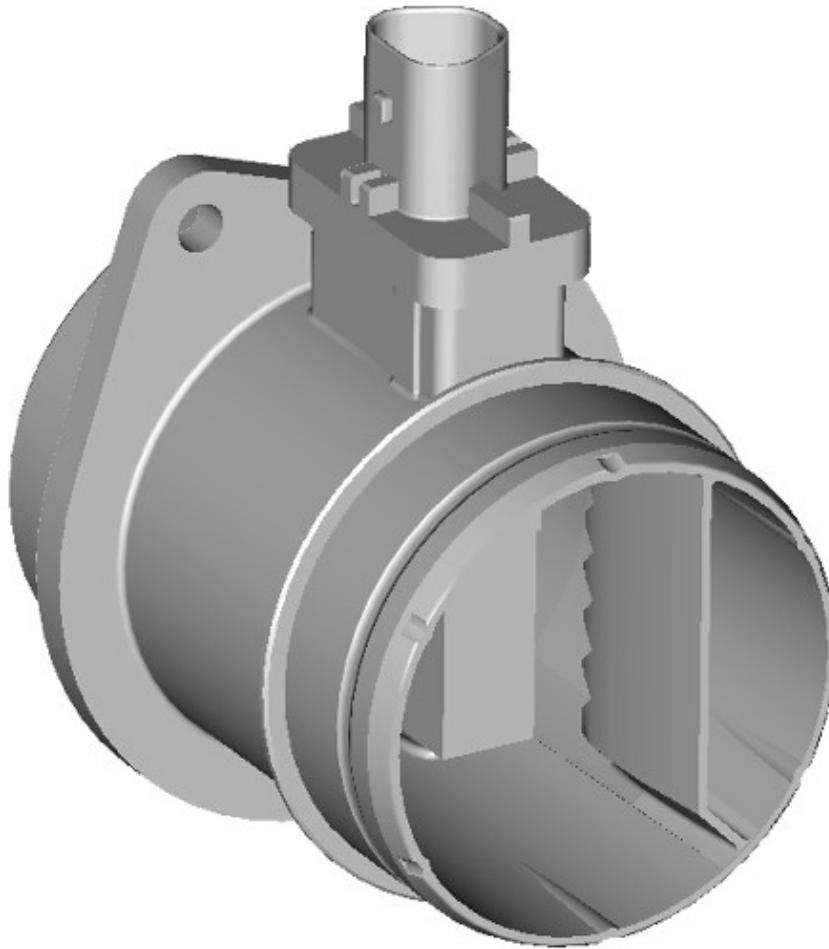


E116088

The **MAPT** sensor allows the **ECM** to calculate the charge air density immediately before it enters the cylinders. This is used to adjust the ignition timing relative to the boost pressure, and to monitor the performance of the charge air coolers.

The MAPT sensor is installed in the rear of the left intake manifold. The sensor is secured with a single screw and sealed with an O-ring. A four pin electrical connector provides the interface with the engine harness.

Mass Air Flow and Temperature Sensors



E153646

The **MAFT** sensors allow the **ECM** to measure the mass flow and the temperature of the air flow into the engine. The mass air flow is measured with a hot film element in the sensor. The temperature of the air flow is measured with a **NTC** thermistor in the sensor. The mass air flow is used to determine the fuel quantity to be injected in order to maintain the stoichiometric air:fuel mixture required for correct operation of the engine and the catalytic converters.

Identical MAFT sensors are attached to each of the air cleaner outlets. On each MAFT sensor, a five pin electrical connector provides the interface with the engine harness.

If the hot film element signal fails the ECM invokes a software backup strategy to calculate the mass air flow from other inputs. Closed loop fuel control, closed loop idle speed control and evaporative emissions control are discontinued. The engine will suffer from poor starting, poor throttle response and, if the failure occurs while driving, the engine speed may dip before recovering.

If the NTC thermistor signal fails the ECM adopts a default value of 25 °C (77 °F) for the intake air temperature.

Charge Air Temperature Sensor



E149162

The charge air temperature sensor is installed in the supercharger intercooler top cover. A two pin electrical connector provides the interface between the sensor and the engine harness. The sensor contains an **NTC** thermistor with supply and return connections to the **ECM**.

The ECM supplies the charge air temperature sensor with a 5 V reference voltage and translates the return voltage into a temperature. The ECM uses the input:

- To monitor operation of the charge air coolant pump
- For air mass calculations used in control of the supercharger bypass valve, as part of the charge air strategy that co-ordinates operation of the electric throttle and the bypass valve, and predicts the air mass delivered to the cylinders.



NOTE: The charge air temperature sensor is introduced together with the electric actuator for the **SC** (supercharger) bypass valve (in place of the vacuum actuator), which enables more accurate control of the bypass air flow.

If the charge air temperature sensor fails, the ECM substitutes the input with a modeled temperature. Failure of the sensor is unlikely to be noticeable to the driver.

Throttle Position Sensors

The TPS (throttle position sensor)'s allows the **ECM** to determine the position and angular rate of change of the throttle blade.

There are two TPS sensors located in the electric throttle. See below for details of the electric throttle.

If a TPS sensor fails, the **ECM**:

- Adopts a limp home mode where engine speed is limited to a maximum of approximately 2000 rev/min.
- Discontinues **EVAP** control.
- Discontinues closed loop control of engine idle speed.

With a failed TPS sensor, the engine will suffer from poor running and throttle response.

Heated Oxygen Sensors



E148505

A pre catalyst **HO2S** is installed in the outlet of each exhaust manifold, which enables independent closed loop control of the air:fuel mixture for each cylinder bank.



NOTE: A mid catalyst and a post catalyst **HO2S** is installed in each branch of the exhaust system. Together with the pre catalyst sensors, these are used by the **ECM** to monitor the performance of the catalytic converters.

The heater elements of the pre catalyst **HO2S** are controlled by a **PWM** (pulse width modulation) signal from the **ECM**. The heater elements are operated after each engine start, once it has been calculated that there is no moisture in the exhaust (between 0 and 2 minutes delay), and also during low load conditions when the temperature of the exhaust gases is insufficient to maintain the required sensor temperature. The **PWM** duty cycle is carefully controlled to prevent thermal shock to cold sensors. A non-functioning heater delays the sensor's readiness for closed loop control and increases emissions.

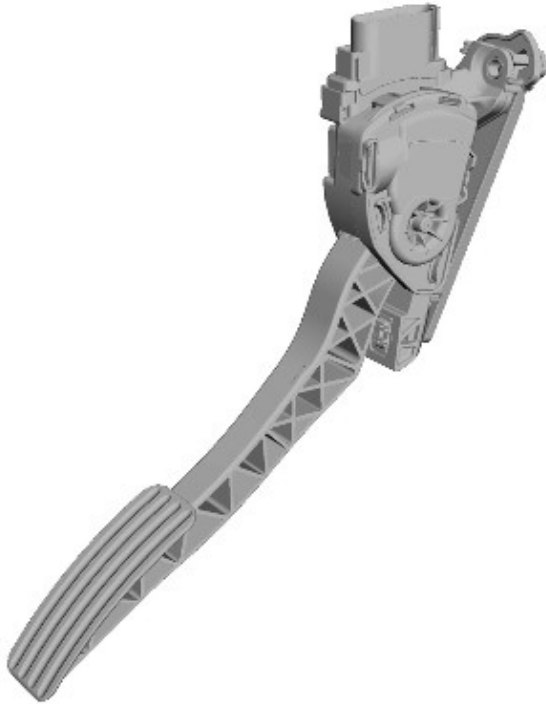
The heated oxygen sensors age with mileage, increasing their response time to switch from rich to lean and lean to rich. This increase in response time influences the ECM closed loop control and leads to progressively increased emissions. Measuring the period of rich to lean and lean to rich switching monitors the response rate of the pre catalyst sensors.

The pre catalyst HO2S sensor produces a constant voltage, with a variable current that is proportional to the lambda ratio. The ECM monitors the pre catalyst HO2S by checking the signal against maximum and minimum threshold, for open and short circuit conditions. If a HO2S fails:

- The ECM defaults to open loop fueling for the related cylinder bank.
- The **CO (carbon monoxide)** and emissions content of the exhaust gases increases.
- The exhaust smells of rotten eggs (hydrogen sulphide).

With a failed pre catalyst HO2S the engine will suffer from unstable operation and reduced performance.

Accelerator Pedal Position Sensor



E141165

The **APP** sensor allows the **ECM** to determine the driver requests for vehicle speed, acceleration and deceleration. The ECM uses this information, together with information from the **ABS (anti-lock brake system)** and the **TCM (transmission control module)**, to determine the setting of the electric throttle.

The APP sensor is integrated into the accelerator pedal, which is attached to the lower dash panel. A six pin electrical connector provides the interface with the vehicle harness.

The APP sensor is a twin track potentiometer. Each track receives an independent power supply from the ECM and returns an independent analog signal to the ECM. Both signals contain the same positional information, but the signal from track 2 is half the voltage of the signal from track 1 at all positions.

If both signals have a fault, the ECM adopts a limp home mode, which limits the engine speed to 2000 rev/min maximum.

The ECM constantly checks the range and plausibility of the two signals and stores a fault code if it detects a fault.

Ambient Air Temperature Sensor



E116093

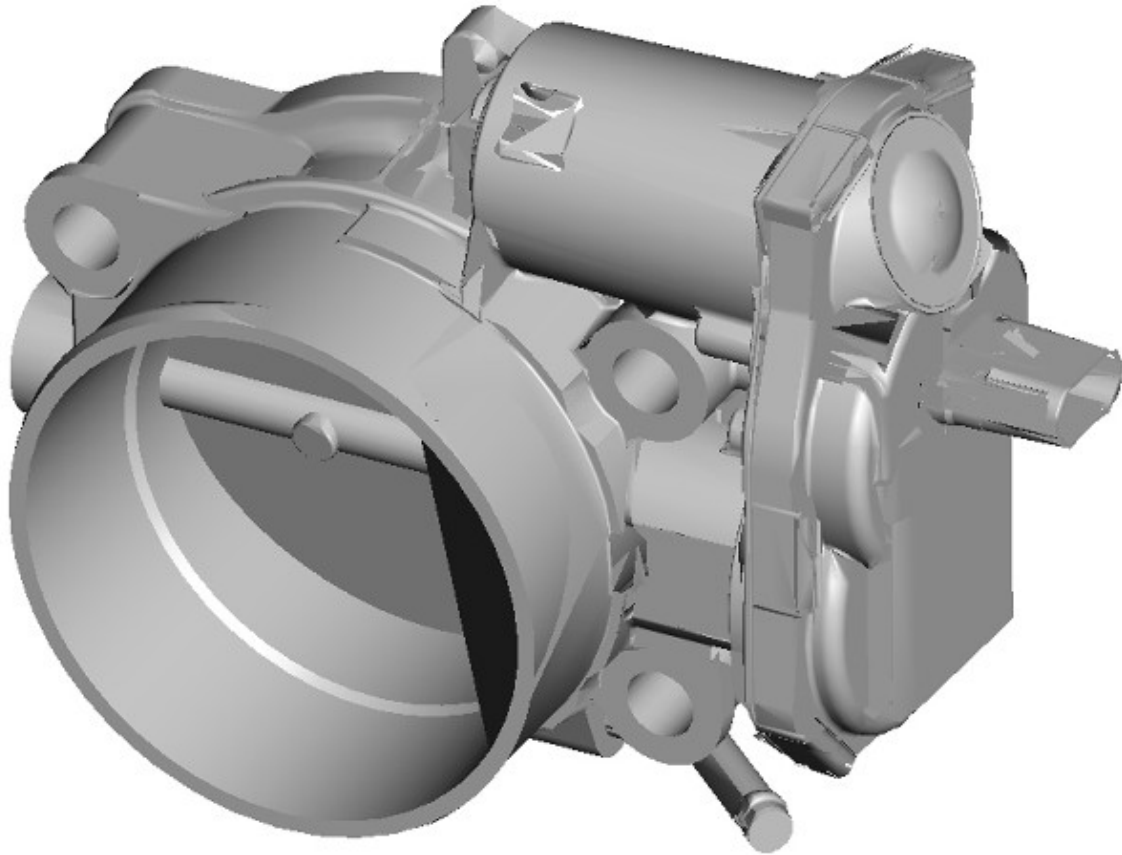
The AAT (ambient air temperature) sensor is a [NTC](#) thermistor that allows the [ECM](#) to monitor the temperature of the air around the vehicle. The ECM uses the AAT input for a number of functions, including engine cooling fan control. The ECM also transmits the ambient temperature on the HS (high speed) [CAN \(controller area network\)](#) bus for use by other control modules.

The AAT sensor is installed in the left exterior mirror, with the bulb of the sensor positioned over a hole in the bottom of the mirror casing.

The ECM supplies the sensor with a 5 V reference voltage and a ground, and translates the return signal voltage into a temperature.

If there is a fault with the AAT sensor, the ECM calculates the AAT from the temperature inputs of the [MAFT](#) sensors. If the AAT sensor and the temperature inputs of the MAFT sensors are all faulty, the ECM adopts a default ambient temperature of 25 °C (77 °F).

Electric throttle



E153645

The [ECM](#) uses the electric throttle to regulate engine torque.

The electric throttle is installed between the clean air duct and the supercharger.

For additional information, refer to: [Intake Air Distribution and Filtering](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Description and Operation).

The throttle plate is operated by an electric [DC \(direct current\)](#) motor integrated into the throttle body. The ECM uses a [PWM](#) signal to control the DC motor. The ECM compares the [APP](#) sensor inputs against an electronic map to determine the required position of the throttle plate. The ECM and electric throttle are also required to:

- Monitor requests for cruise control operation.
- Automatically operate the electric throttle for accurate cruise control.
- Perform all dynamic stability control engine interventions.
- Monitor and carry out maximum engine speed and road speed cut outs.
- Provide different engine maps for the ride and handling optimization system.

A software strategy within the ECM calibrates the position of the throttle plate at the beginning of each ignition cycle. When the ignition is turned on, the ECM performs a self test and calibration routine by fully closing the throttle plate and then opening it again. This tests the default position springs and allows the ECM to learn the fully closed position.

OPERATION

Engine Control Module Relay

The [ECM](#) relay is used to initiate the power up and power down routines within the ECM. The ECM relay is installed in the [EJB \(engine junction box\)](#).

When the ignition is turned on, battery voltage is applied to the ignition sense input from the [CJB \(central junction box\)](#). The ECM then starts its power up routines and energizes the ECM relay.

When the ignition is turned off, the ECM maintains its powered up state while it conducts the power down routines. This can be for:

- Up to 20 minutes in extreme cases, when the DMTL system is running (NAS markets).
- Up to 5 minutes when cooling fans are required.

On completion of the power down routines the ECM de-energizes the ECM relay.

Engine Control Module Adaptions

The ECM has the ability to adapt the input values it uses to control certain outputs. This capability maintains engine refinement and ensures the engine emissions remain within the legislated limits. The components which have adaptions associated with them are:

- The APP sensor.
- The HO2S sensors.
- The MAFT sensors.
- The CKP sensor.
- Electric throttle
- Knock sensors.

Oxygen and Mass Air Flow and Temperature Sensors

There are several adaptive maps associated with the fueling strategy. Within the fueling strategy the ECM calculates short-term adaptions and long term adaptions. The ECM will monitor the deterioration of the HO2S's over a period of time. It will also monitor the current correction associated with the sensors.

The ECM will store a fault code in circumstances where an adaption is forced to exceed its operating parameters. At the same time, the ECM will record the engine speed, engine load and intake air temperature.

Crankshaft Position Sensor

The characteristics of the signal supplied by the CKP sensor are learned by the ECM. This enables the ECM to set an adaption and support the engine misfire detection function. Due to the small variation between different drive plates and different CKP sensors, the adaption must be reset if either component is renewed, or removed and refitted. It is also necessary to reset the drive plate adaption if the ECM is renewed or replaced. The ECM supports four drive plate adaptions for the CKP sensor. Each adaption relates to a specific engine speed range. The engine speed ranges are detailed in the table below:

Adaption	Engine Speed, rev/min
1	1800 - 3000
2	3001 - 3800
3	3801 - 4600
4	4601 - 5400

Misfire Detection

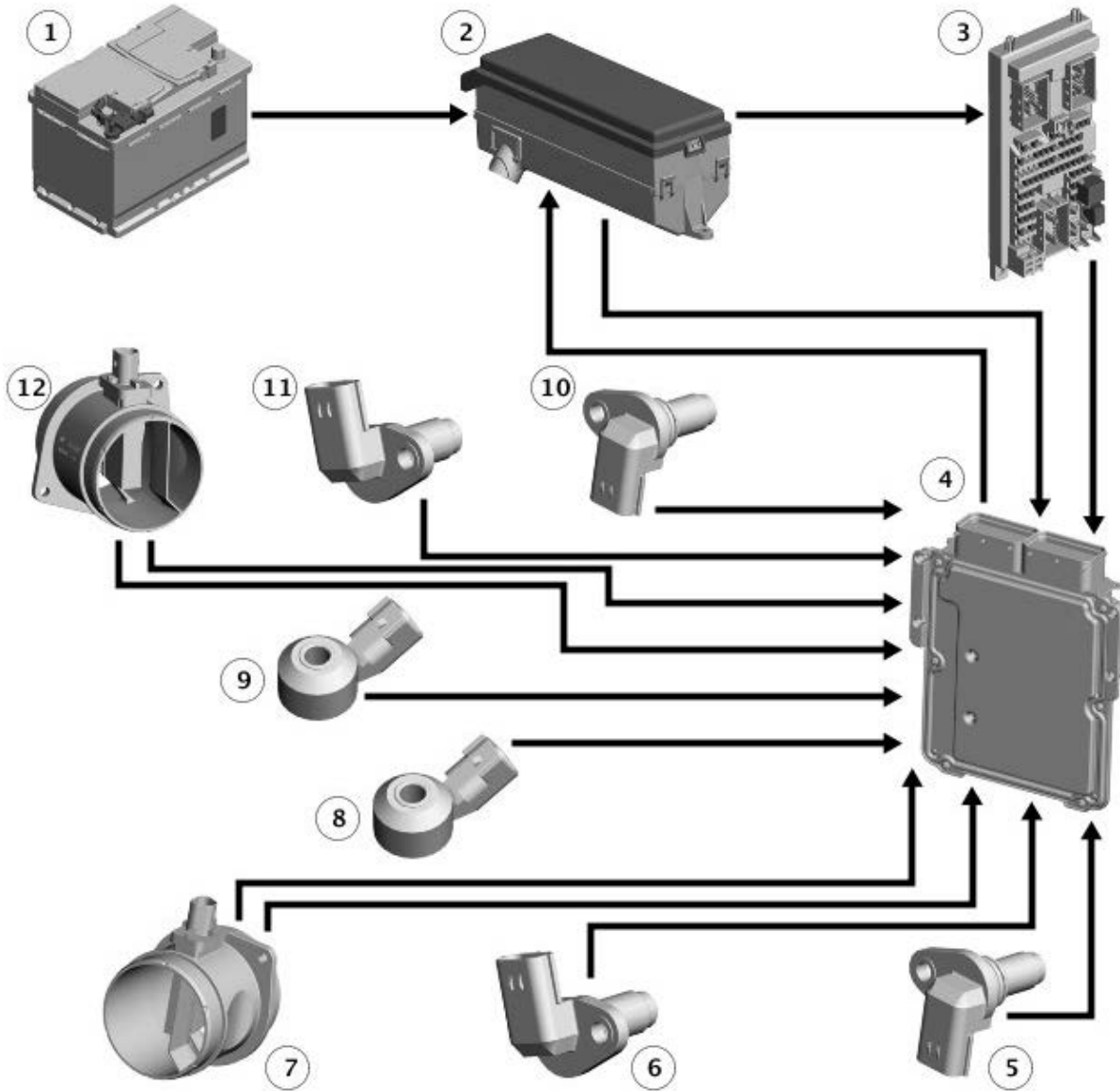
Legislation requires that the ECM must be able to detect the presence of an engine misfire. It must be able to detect misfires at two separate levels. The first level is an amount of misfire that could lead to the legislated emissions limit being exceeded by a given amount. The second level is a misfire rate that causes degradation in catalytic converter efficiency.

The ECM monitors the number of misfire occurrences within two engine revolution ranges. If the ECM determines a misfire failure within either of these two ranges, over two consecutive journeys, it will record a fault code and details of the engine speed, engine load and engine coolant temperature. In addition, if the second level of misfire occurs, on any trip, the ECM flashes the MIL while the fault is occurring.

The signal from the CKP sensor indicates how fast the poles on the drive plate are passing the sensor tip. A sine wave is generated each time a pole passes the sensor tip. The ECM can detect variations in drive plate speed by monitoring the sine wave signal supplied by the CKP sensor. By assessing this signal, the ECM can detect the presence of an engine misfire. The ECM will evaluate the signal against a number of factors and will decide whether to record the occurrence or ignore it. The ECM can assign a misfire judgment to an individual cylinder, which can be viewed on Land Rover approved diagnostic equipment.

CONTROL DIAGRAM

Control Diagram 1 of 2

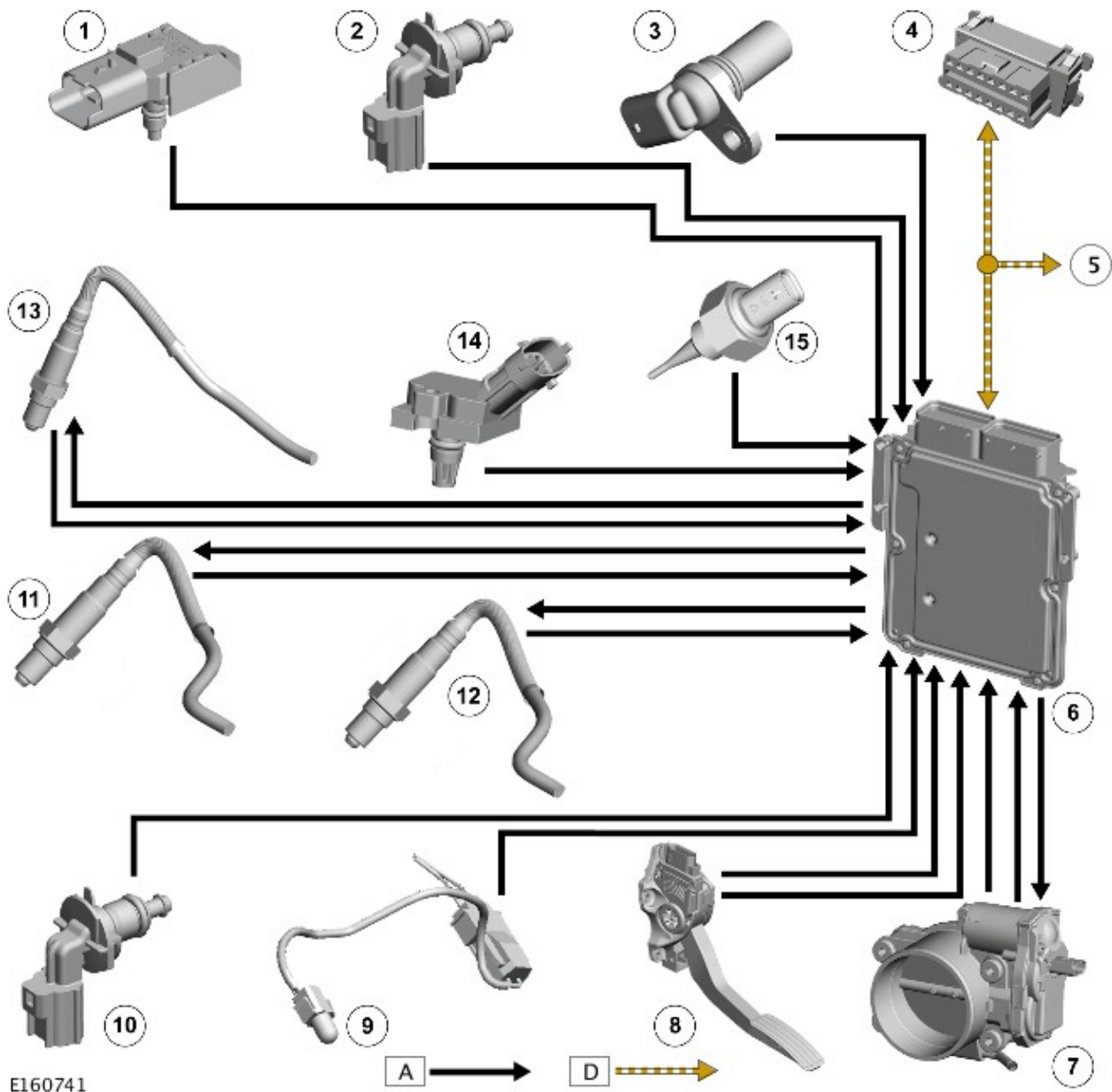


E160740

A →

A = Hardwired

Item	Part Number	Description
1	-	Battery
2	-	Engine Junction Box (EJB)
3	-	Central Junction Box (CJB)
4	-	Engine Control Module (ECM)
5	-	Left intake Camshaft Position (CMP) sensor
6	-	Left exhaust Camshaft Position (CMP) sensor
7	-	Left Mass Air Flow and Temperature (MAFT) sensor
8	-	Left knock sensor
9	-	Right knock sensor
10	-	Right intake Camshaft Position (CMP) sensor
11	-	Right exhaust Camshaft Position (CMP) sensor
12	-	Right Mass Air Flow and Temperature (MAFT) sensor



A = Hardwired; D = High Speed CAN Bus.

Item	Part Number	Description
1	-	Manifold Absolute Pressure (MAP) sensor
2	-	Engine Coolant Temperature (ECT) 2 sensor
3	-	Crankshaft Position (CKP) sensor
4	-	Diagnostic connector
5	-	High Speed CAN (controller area network) bus connection to other system control modules
6	-	Engine Control Module (ECM)
7	-	Electric throttle
8	-	Accelerator Pedal Position (APP) sensor
9	-	Ambient Air Temperature (AAT) sensor
10	-	Engine Coolant Temperature (ECT) 1 sensor
11	-	Right and left mid catalyst HO2S (heated oxygen sensor) (2 off)
12	-	Right and left post catalyst HO2S (2 off)
13	-	Right and left pre catalyst HO2S (2 off)
14	-	Manifold Absolute Pressure and Temperature (MAPT) sensor
15	-	Charge air temperature sensor

Electronic Engine Controls - V6 S/C 3.0L Petrol - Electronic Engine Controls

Diagnosis and Testing

Principle of Operation

For a detailed description of electronic engine controls, refer to the relevant description and operation section of the workshop manual. REFER to:

[Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 S/C 3.0L Petrol, Description and Operation),
[Electronic Engine Controls](#) (303-14D, Description and Operation),
[Electronic Engine Controls](#) (303-14D, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests

1. Verify the customer concern
2. Visually inspect for obvious signs of mechanical or electrical damage

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Engine oil level and condition • Cooling system coolant level • Fuel level/fuel leaks • Fuel contamination/grade/quality • Throttle body • Accessory drive belt • Sensor installation/condition • Cooling fan • Air cleaner condition 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Electrical connector(s) • 5 volt sensor supply • Sensor(s) • Engine control module • Transmission control module

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the symptom chart, alternatively check for diagnostic trouble codes (DTCs) and refer to the DTC index

Symptom Chart

Symptom	Possible Cause	Action
Engine non-start		
Engine does not crank	<ul style="list-style-type: none"> • Security system / immobilizer engaged • Engine in shut-down mode • Engine control module relay • Battery • Starting system • Engine seized 	<ul style="list-style-type: none"> • Check that the security system is disarmed • Read DTCs and refer to DTC index in section 100-00 for engine control module relay diagnostics • Ensure the battery is in fully charged and serviceable condition • For starting system tests refer to the relevant section of the workshop manual • For engine system tests refer to the relevant section of the workshop manual
Engine cranks, but does not fire	<ul style="list-style-type: none"> • Engine breather system disconnected/restricted • Ignition system • Fuel system • Electronic engine controls 	<ul style="list-style-type: none"> • Ensure the engine breather system is free from restriction and is correctly installed • For ignition system tests refer to the relevant section of the workshop manual • For fuel system tests refer to the relevant section of the workshop manual • Read DTCs and refer to DTC index in section 100-00 for electronic engine

		control diagnostics
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> • Evaporative emissions purge valve • Fuel pump • Spark plugs • HT short to ground (tracking) check rubber boots for cracks/damage • Ignition coil failure(s) 	<ul style="list-style-type: none"> • For purge valve tests refer to the relevant section of the workshop manual • For fuel system tests refer to the relevant section of the workshop manual • For ignition system tests refer to the relevant section of the workshop manual
Difficult to start		
Difficult cold start	<ul style="list-style-type: none"> • Check engine coolant level/anti-freeze content • Battery • Electronic engine controls • Fuel pump • Evaporative emissions purge valve 	<ul style="list-style-type: none"> • Check the engine coolant level and condition. Refer to the relevant sections of the workshop manual • Ensure the battery is in a fully charged and serviceable condition. Refer to the battery care manual and the relevant sections of the workshop manual. • Read DTCs and refer to DTC index in section 100-00 for electronic engine control diagnostics • For fuel system tests refer to the relevant section of the workshop manual • Refer to the relevant section of the workshop manual and check the purge valve and associated hoses and connections
Difficult hot start	<ul style="list-style-type: none"> • Injector leak • Electronic engine controls • Evaporative emissions purge valve • Fuel pump • Ignition system 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual, carry out injector leak tests, install new injectors as necessary • Read DTCs and refer to DTC index in section 100-00 for electronic engine control diagnostics • Refer to the relevant section of the workshop manual and check the purge valve and associated hoses and connections • For fuel system tests refer to the relevant section of the workshop manual • For ignition system tests refer to the relevant section of the workshop manual
Difficult to start after hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> • Injector leak • Electronic engine controls • Evaporative emissions purge valve • Fuel pump • Ignition system 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual, carry out injector leak tests, install new injectors as necessary • Read DTCs and refer to DTC index in section 100-00 for electronic engine control diagnostics • Refer to the relevant section of the workshop manual and check the purge valve and associated hoses and connections • For fuel system tests refer to the relevant section of the workshop manual • For ignition system tests refer to the relevant section of the workshop manual
Engine cranks too fast/slow	<ul style="list-style-type: none"> • Compressions high/low • Battery • Starting system 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual, carry out compression tests • Ensure the battery is in a fully charged and serviceable condition. Refer to the battery care manual and the relevant sections of the workshop manual • For starting system tests refer to the relevant section of the workshop manual
Engine stalls		

Engine stalls soon after start	<ul style="list-style-type: none"> • Breather system disconnected/restricted • Engine control module relay • Electronic engine controls • Ignition system • Air intake system restricted • Air leakage • Fuel lines 	<ul style="list-style-type: none"> • Ensure the engine breather system is free from restriction and is correctly installed • Read DTCs and refer to DTC index in section 100-00 for engine control module relay diagnostics • Read DTCs and refer to DTC index in section 100-00 for electronic engine control diagnostics • For ignition system tests refer to the relevant section of the workshop manual • Check for blockage in air cleaner element and air intake system • Check for leakage in air intake system • For fuel system tests refer to the relevant section of the workshop manual
Engine stalls on overrun	<ul style="list-style-type: none"> • Engine control module relay • Throttle position sensors 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC index in section 100-00 for engine control module relay and throttle position sensor diagnostics
Engine stalls at steady speed	<ul style="list-style-type: none"> • Engine control module relay • Crankshaft position sensor • Throttle position sensors 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC index in section 100-00 for engine control module relay, crankshaft position sensor and throttle position sensor diagnostics
Engine stalls with speed control enabled	<ul style="list-style-type: none"> • Engine control module relay 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC index in section 100-00 for engine control module relay diagnostics
Engine stalls when manoeuvring	<ul style="list-style-type: none"> • Engine control module relay • Throttle position sensors • Additional engine loads (power assisted steering, air conditioning, etc) • Transmission malfunction • CAN malfunction 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC index in section 100-00 for engine control module relay and throttle position sensor diagnostics • Check for excessive loads being placed on the engine from power assisted steering, air conditioning systems etc • Refer to the workshop manual or transmission troubleshooting guide for transmission system tests • Refer to the relevant section of the workshop manual and the electrical wiring diagrams to perform CAN network tests
Poor driveability		
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> • Fuel pressure, fuel pump, fuel lines • Injector leak • Air leakage • Electronic engine controls • Ignition system • Transmission malfunction • Throttle motor • Restricted pedal travel (carpet, etc) 	<ul style="list-style-type: none"> • For fuel system tests refer to the relevant section of the workshop manual • Carry out fuel injector leak tests, install new injectors as necessary • Check for leakage from air intake system • Read DTCs and refer to DTC index in section 100-00 for electronic engine control diagnostics • For ignition system tests refer to the relevant section of the workshop manual • Refer to the workshop manual or transmission troubleshooting guide for transmission system tests • Ensure accelerator pedal is free from restriction
Engine backfires	<ul style="list-style-type: none"> • Fuel pump, fuel lines • Air leakage • Electronic engine controls • Ignition system • Sticking variable camshaft timing hub 	<ul style="list-style-type: none"> • For fuel system tests refer to the relevant section of the workshop manual • Check for leakage from air intake system • Read DTCs and refer to DTC index in section 100-00 for electronic engine control diagnostics • For ignition system tests refer to the

		<p>relevant section of the workshop manual</p> <ul style="list-style-type: none"> • Read DTCs and refer to DTC index in section 100-00 for variable camshaft timing system diagnostics
Engine surges	<ul style="list-style-type: none"> • Fuel pump, fuel lines • Electronic engine controls • Ignition system 	<ul style="list-style-type: none"> • For fuel system tests refer to the relevant section of the workshop manual • Read DTCs and refer to DTC index in section 100-00 for electronic engine control diagnostics • For ignition system tests refer to the relevant section of the workshop manual
Engine detonates/knocks	<ul style="list-style-type: none"> • Electronic engine controls • Fuel pump, fuel lines, fuel quality • Air leakage • Sticking variable camshaft timing hub 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC index in section 100-00 for electronic engine control diagnostics • For fuel system tests refer to the relevant section of the workshop manual • Check for leakage from air intake system • Read DTCs and refer to DTC index in section 100-00 for variable camshaft timing system diagnostics
No throttle response	<ul style="list-style-type: none"> • Electronic engine controls • Throttle motor 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC index in section 100-00 for electronic engine control and throttle system diagnostics
Speed control inhibited or disabled	<ul style="list-style-type: none"> • Default mode enabled • Speed control, brake switch • Electronic engine controls • CAN fault 	<ul style="list-style-type: none"> • Check message center for default message, read DTCs and refer to DTC index • Refer to the relevant section of the workshop manual for speed control, and brake switch tests • Read DTCs and refer to DTC index in section 100-00 for electronic engine control diagnostics • Refer to the relevant section of the workshop manual and the electrical wiring diagrams to perform CAN network tests
Poor throttle response	<ul style="list-style-type: none"> • Breather system disconnected/restricted • Electronic engine controls • Transmission malfunction • Traction control event • Air leakage 	<ul style="list-style-type: none"> • Ensure engine breather system is free from restriction and is correctly installed • Read DTCs and refer to DTC index in section 100-00 for electronic engine control diagnostics • Refer to the workshop manual or transmission troubleshooting guide for transmission system tests • Check for leakage in air intake system
Engine defaults, warning light and messages. Refer to the owner handbook	<ul style="list-style-type: none"> • Electronic engine controls 	<ul style="list-style-type: none"> • Read DTCs and refer to DTC index in section 100-00 for electronic engine control diagnostics

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: V6 3.0L S/C Petrol, DTC: Engine Control Module \(ECM\)](#) (100-00 General Information, Description and Operation).

Electronic Engine Controls - V6 S/C 3.0L Petrol - Brake Pedal Position (BPP) Switch Adjustment


General Procedures

Check

1. Remove the brake pedal rubber.




E135356

2.  **NOTE:** Make sure that the dial test indicator (DTI) gauge is in line with the brake pedal movement.

Position the DTI gauge on a suitable mounting block, as illustrated.

3. With the aid of another technician, gently press the brake pedal until the stop lamps illuminate.

4.  **NOTE:** The specification is that the stop lamps should illuminate at between 5.5mm and 8.5mm brake pedal travel.

Note the measurement of the brake pedal travel from rest position until the stop lamps illuminated.

Adjust



NOTE: The Brake Pedal Position Switch is self adjusting when removed and installed.

1. Remove and install Brake Pedal Position Switch.
For additional information, refer to: [Stoplamp Switch](#) (417-01 Exterior Lighting, Removal and Installation).
2. Check the adjustment of the stop lamp switch by following the **Check** procedure in this procedure and carry out the **Adjust** procedure if required.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Camshaft Position (CMP) Sensor LH

Removal and Installation

Removal


NOTES:

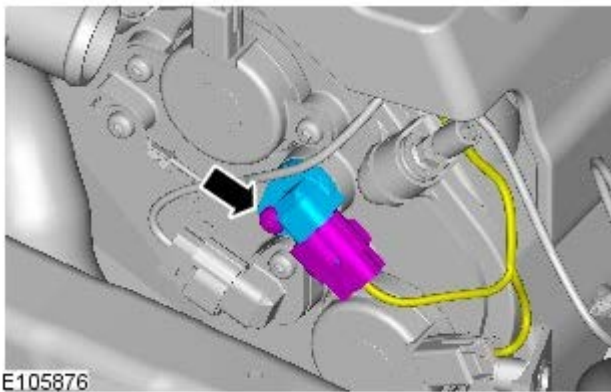


Some variation in the illustrations may occur, but the essential information is always correct.



Removal steps in this procedure may contain installation details.

-  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
- Refer to: [Thermostat Housing](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).
- Torque: 10 Nm*



Installation

- CAUTIONS:



Make sure that the mating faces are clean and free of foreign material.



Make sure that the sensor tip is clean and free of foreign material.



NOTE: Lubricate the O-ring seal with clean engine oil.

To install, reverse the removal procedure.


Electronic Engine Controls - V6 S/C 3.0L Petrol - Camshaft Position (CMP) Sensor RH

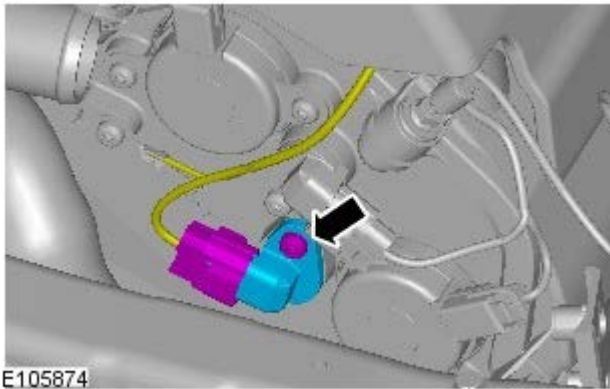
Removal and Installation


Removal



NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: [Thermostat Housing](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).



3.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.
 - Torque: 10 Nm

Installation

1. **CAUTIONS:**



Make sure that the mating faces are clean and free of foreign material.



Make sure that the sensor tip is clean and free of foreign material.



NOTE: Lubricate the O-ring seal with clean engine oil.

To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Crankshaft Position (CKP) Sensor

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

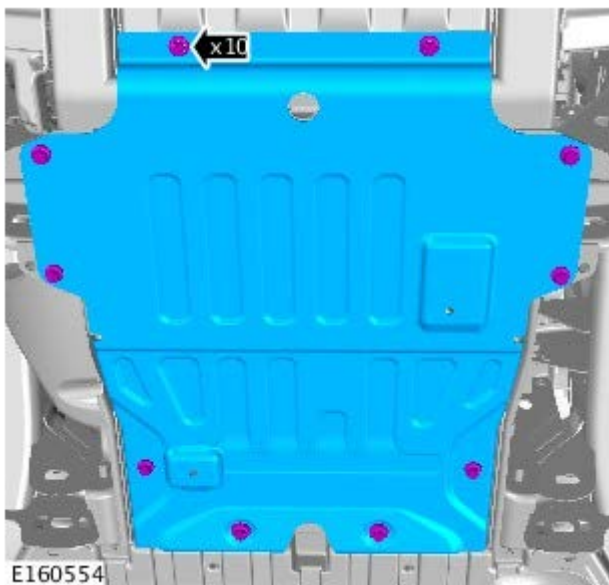
1. Disconnect the battery ground cable.


Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  WARNING: Make sure to support the vehicle with axle stands.

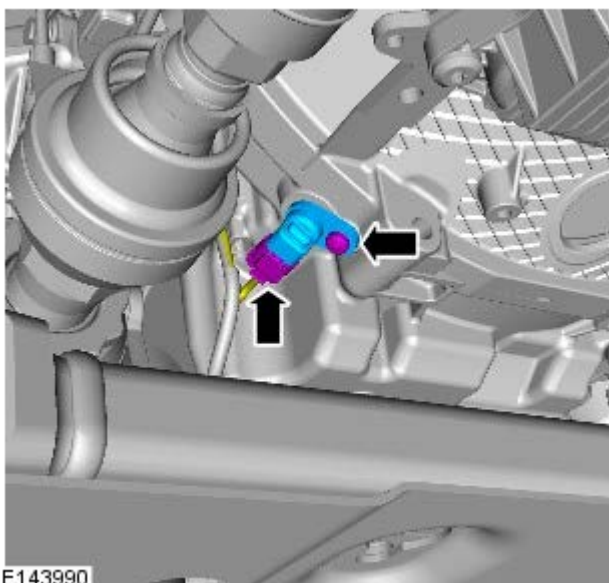
Raise and support the vehicle.

3. Torque: 62 Nm



4.  CAUTION: Before the disconnection or removal of any components, make sure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

Torque: 10 Nm



Installation

1. CAUTIONS:



Make sure that the mating faces are clean and free of foreign material.



Make sure that the component is clean, free of foreign material and lubricant.

To install, reverse the removal procedure.

2. Using the approved diagnostic equipment, clear the powertrain control module (PCM) adaptations.


Electronic Engine Controls - V6 S/C 3.0L Petrol - Engine Coolant Temperature (ECT) Sensor

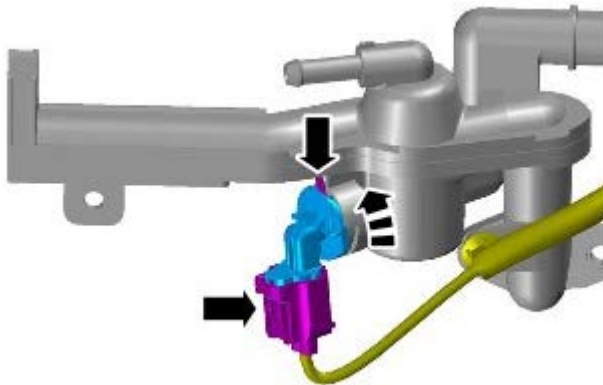
Removal and Installation


Removal



NOTE: Removal steps in this procedure may contain installation details.

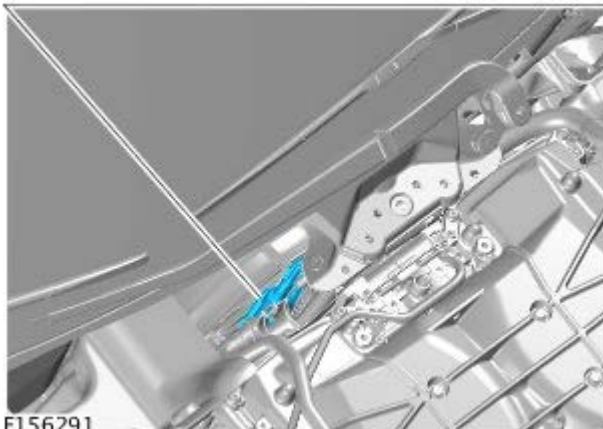
1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Refer to: [Cooling System Partial Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).



4.  **CAUTION:** Be prepared to collect escaping coolant.



NOTE: Position cloth to collect fluid spillage.



Installation

1. To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Engine Oil Level Sensor

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).
2. Refer to: [Engine Oil Vacuum Draining and Filling](#) (303-01B Engine - V6 S/C 3.0L Petrol, General Procedures).



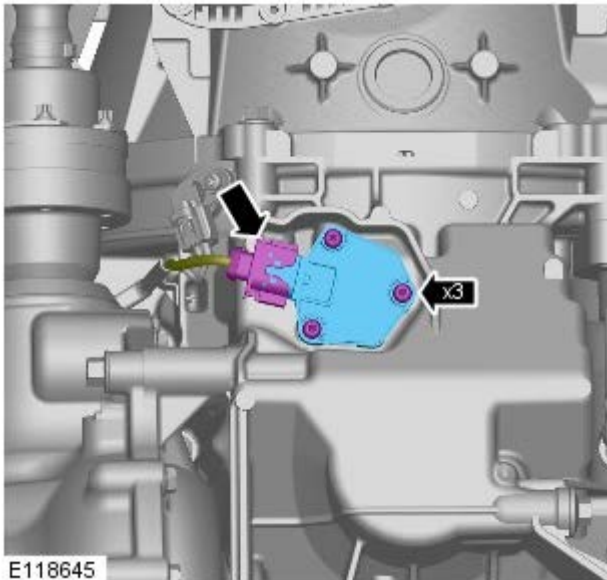
3. WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.



4. CAUTION: Before the disconnection or removal of any components, make sure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

Torque: 12 Nm



Installation



1. NOTE: Install a new O-ring seal.

To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Fuel Rail Pressure (FRP) Sensor

Removal and Installation

Removal

CAUTIONS:



Make sure that all openings are sealed. Use new blanking caps.



Make sure that the tools and equipment are clean, free of foreign material and lubricant.

NOTES:



Removal steps in this procedure may contain installation details.



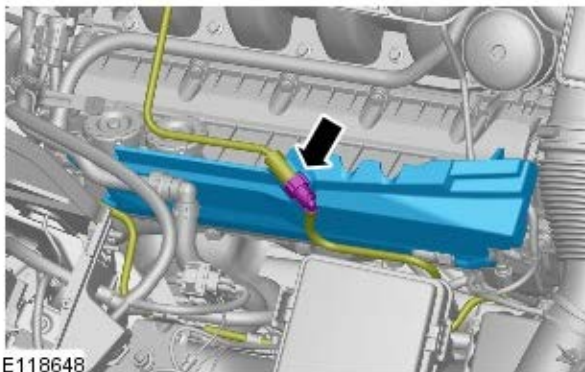
Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).
2. Refer to: [Fuel System Pressure Release - V6 S/C 3.0L Petrol](#) (310-00 Fuel System - General Information, General Procedures).
3. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Refer to: [Plenum Chamber](#) (412-01 Air Distribution and Filtering, Removal and Installation).
5. Disconnect the battery ground cable.

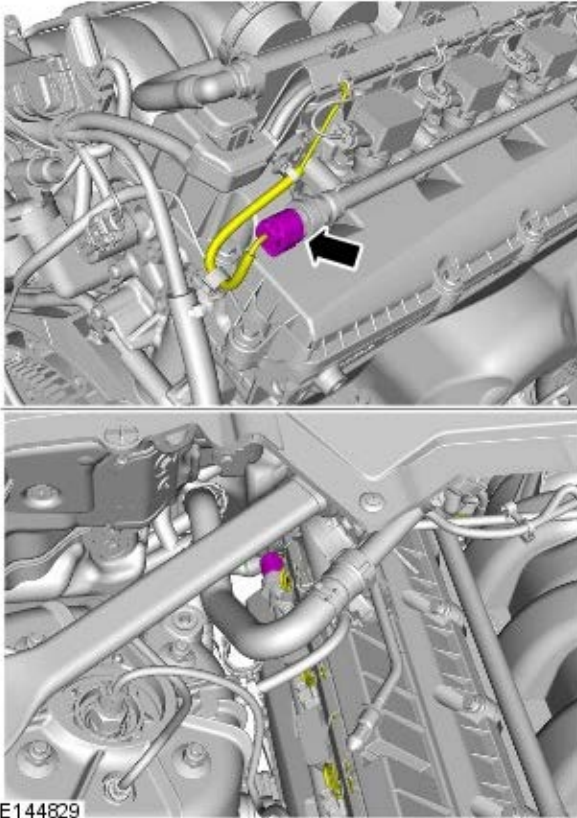
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

6. Refer to: [Fuel Injection Component Cleaning](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, General Procedures).

7.




8.



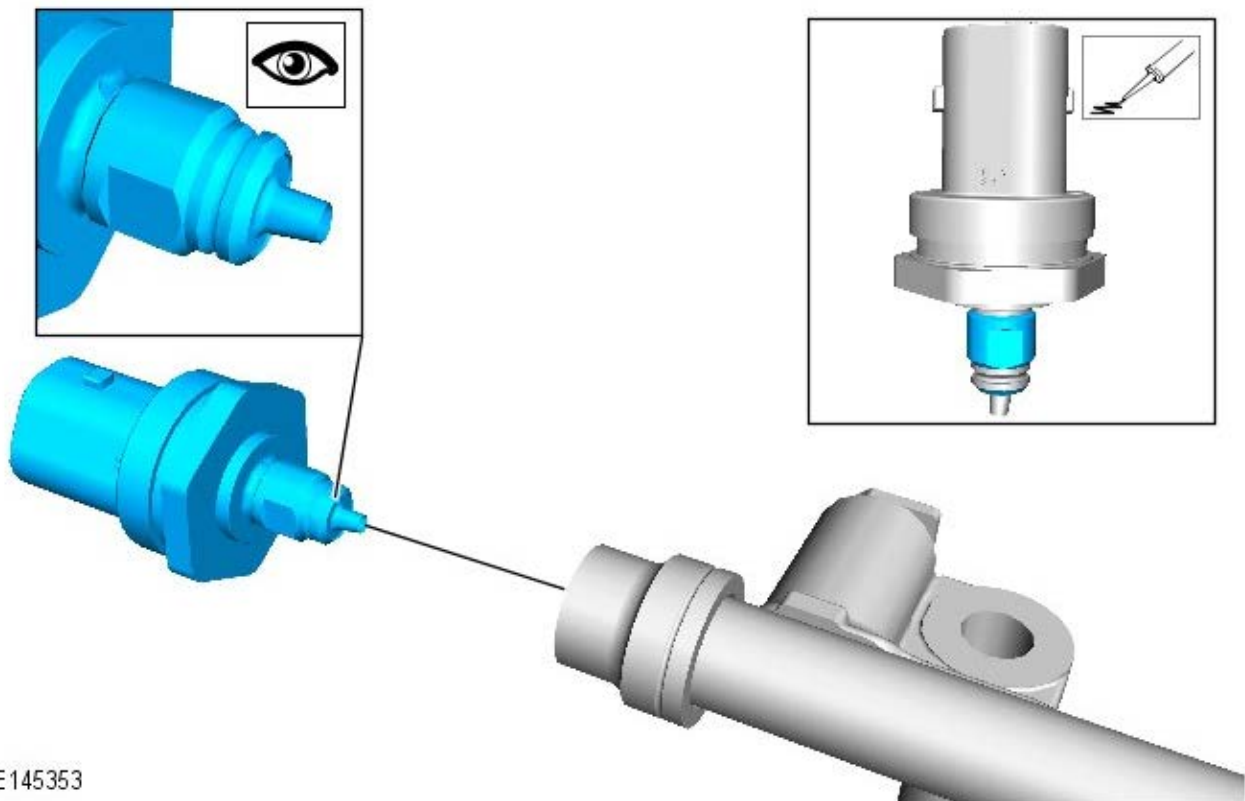
E144829

9.  CAUTION: Be prepared to collect escaping fluids.

 NOTE: During lubrication, keep the component vertically as shown.

Lubricate with Molykote W15 as shown.

Torque: 38 Nm



E145353

Installation

1. To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Knock Sensor (KS)

LH

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

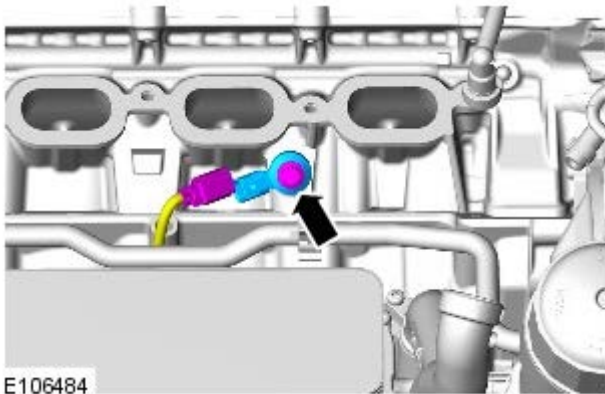
1. Disconnect the battery ground cable.


Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.


3. Refer to: [Supercharger](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).



4.  **NOTE:** Note the orientation of the component prior to removal.

Torque: 20 Nm

Installation

1.  **NOTE:** Make sure that the component is installed to the noted removal position.

To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Knock Sensor (KS)

RH

Removal and Installation


Removal



NOTE: Removal steps in this procedure may contain installation details.

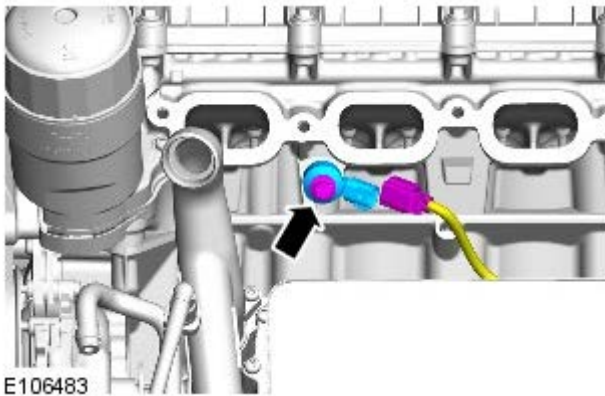
1. Disconnect the battery ground cable.


Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.


3. Refer to: [Supercharger](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).



4.  NOTE: Note the orientation of the component prior to removal.

Torque: 20 Nm

Installation

1.  NOTE: Make sure that the component is installed to the noted removal position.

To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Manifold Absolute Pressure (MAP) Sensor

Removal and Installation

Removal

NOTES:



Engine shown removed for clarity.



Some variation in the illustrations may occur, but the essential information is always correct.



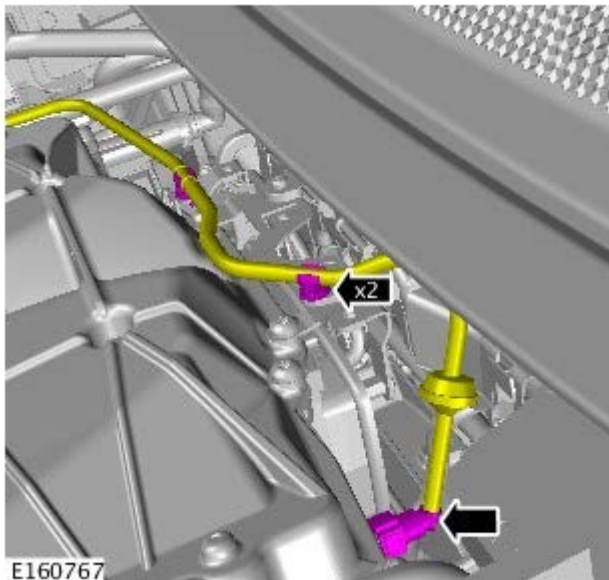
Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

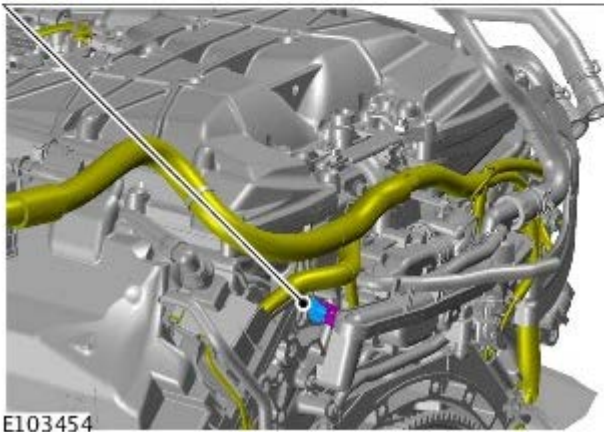
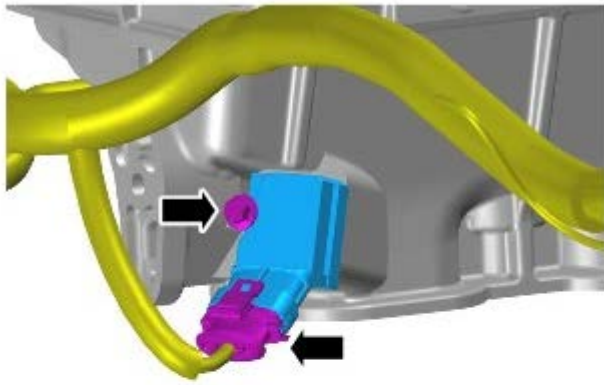
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.



4. Torque: 5 Nm



E103454

Installation

1. To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Variable Valve Timing (VVT) Oil Control Solenoid LH

Removal and Installation

Removal


NOTES:

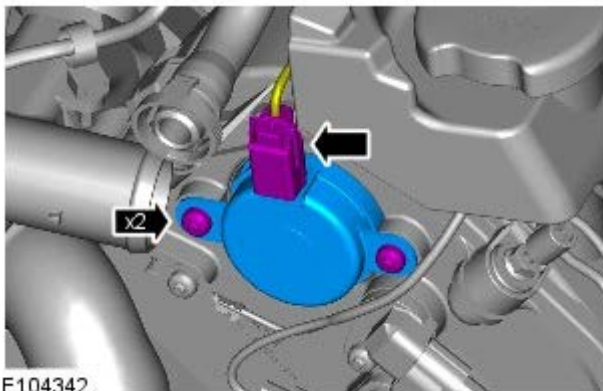


Removal steps in this procedure may contain installation details.



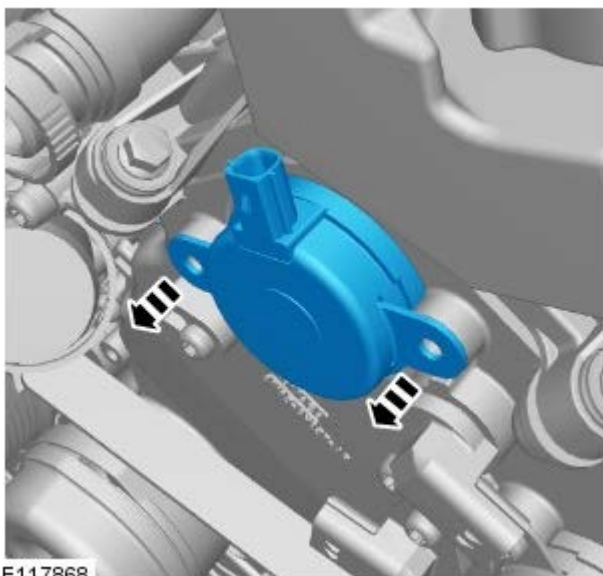
Some variation in the illustrations may occur, but the essential information is always correct.

-  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
- Refer to: [Thermostat Housing](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).
- Torque:* 10 Nm




E104342

-  **CAUTION:** Evenly and progressively, remove the VVT units from each side.



E117868

Installation

-  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.



NOTE: Lubricate the O-ring seal with clean engine oil.

To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Variable Valve Timing (VVT) Oil Control Solenoid RH

Removal and Installation

Removal


NOTES:



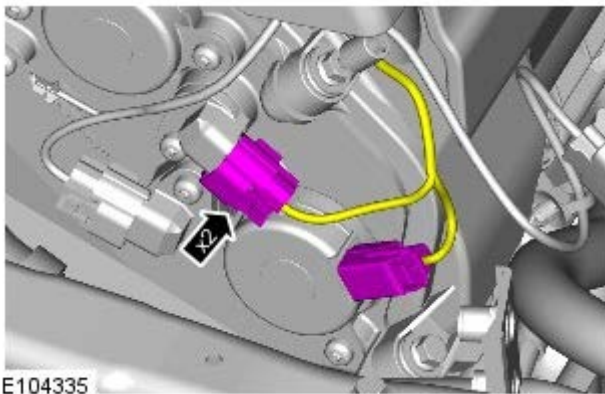
Removal steps in this procedure may contain installation details.



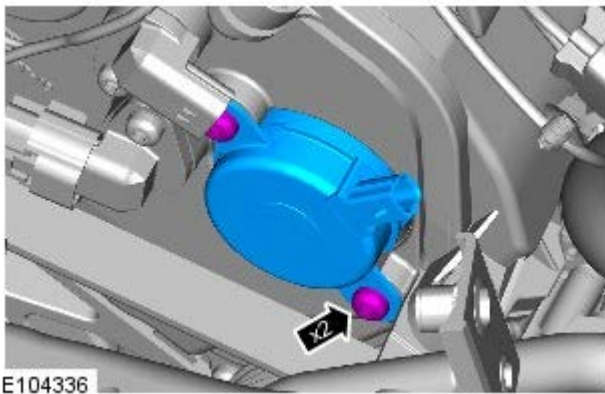
Some variation in the illustrations may occur, but the essential information is always correct.


1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: [Thermostat Housing](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).

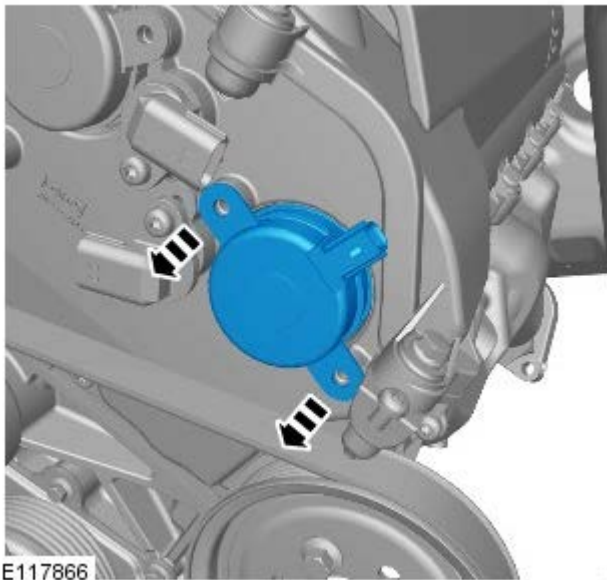
3.



4. *Torque:* 10 Nm




5.  **CAUTION:** Evenly and progressively, remove the VVT units from each side.



E117866

Installation

1.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

 **NOTE:** Lubricate the O-ring seal with clean engine oil.

To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Left Mid catalyst Heated Oxygen Sensor (HO2S)

Removal and Installation

Removal



WARNING: Observe due care when working near a hot exhaust system.



NOTE: Removal steps in this procedure may contain installation details.



1. **WARNING:** Make sure to support the vehicle with axle stands.

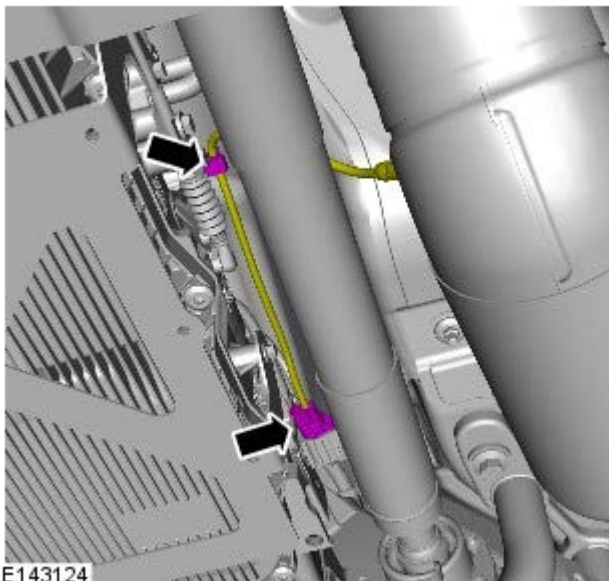
Raise and support the vehicle.

2. Torque: 10 Nm




E160774

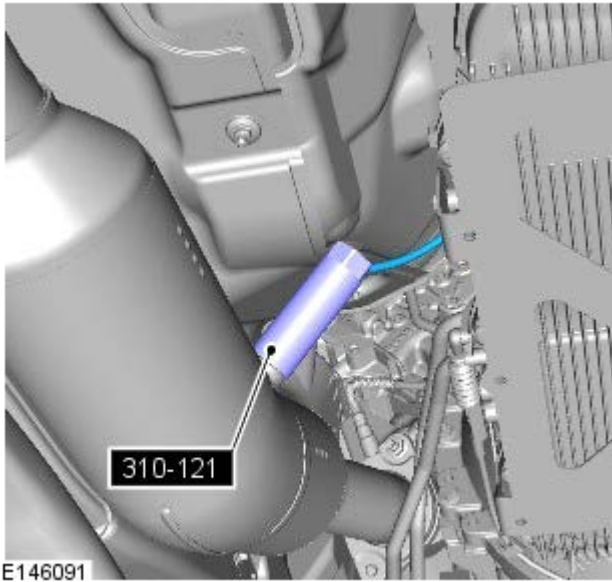
- 3.



E143124

4.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Torque: 48 Nm



Installation

1. CAUTIONS:



Make sure the anti-seize compound does not contact the HO2S tip.



If accidentally dropped or knocked install a new sensor.



Make sure the HO2S wiring harness is not twisted more than 180 degrees and is not in contact with either the exhaust or driveshaft.



NOTE: If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Right Mid catalyst Heated Oxygen Sensor (HO2S)

Removal and Installation


Removal



WARNING: Observe due care when working near a hot exhaust system.



NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

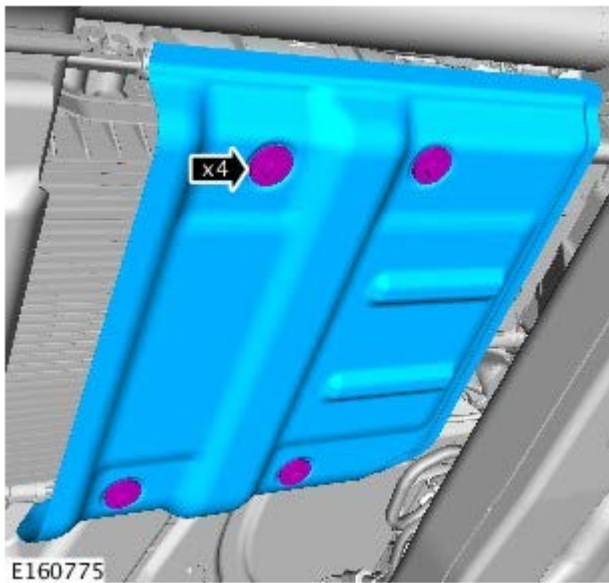
Raise and support the vehicle.

2.  **NOTE:** If equipped.

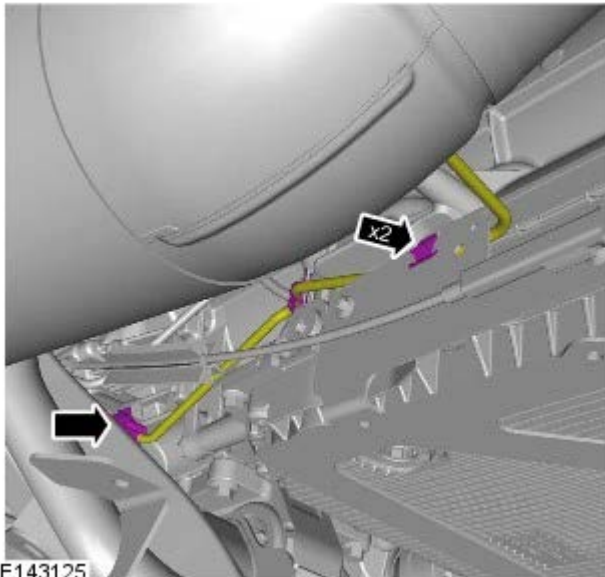
Torque: 10 Nm



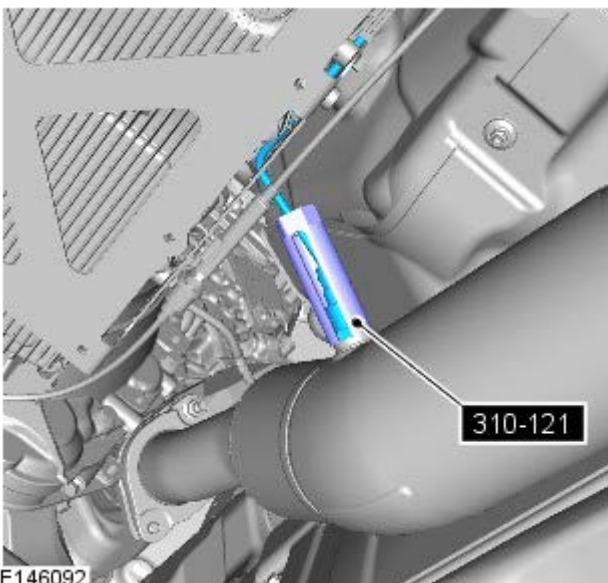
3. *Torque: 10 Nm*



- 4.



E143125



E146092

5.  CAUTION: Make sure that the mating faces are clean and free of foreign material.


Torque: 48 Nm

Installation

1. CAUTIONS:

 Make sure the anti-seize compound does not contact the HO2S tip.

 If accidentally dropped or knocked install a new sensor.

 Make sure the HO2S wiring harness is not twisted more than 180 degrees and is not in contact with either the exhaust or driveshaft.

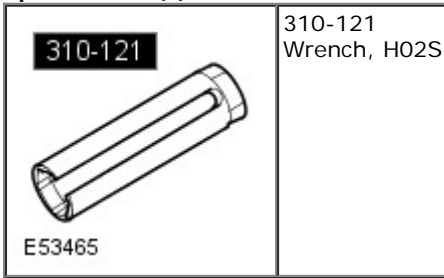
 NOTE: If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Pre catalyst Heated Oxygen Sensor (HO2S)

Removal and Installation

Special Tool(s)



Removal



WARNING: Observe due care when working near a hot exhaust system.

NOTES:



Removal steps in this procedure may contain installation details.



LH illustration shown, RH is similar.

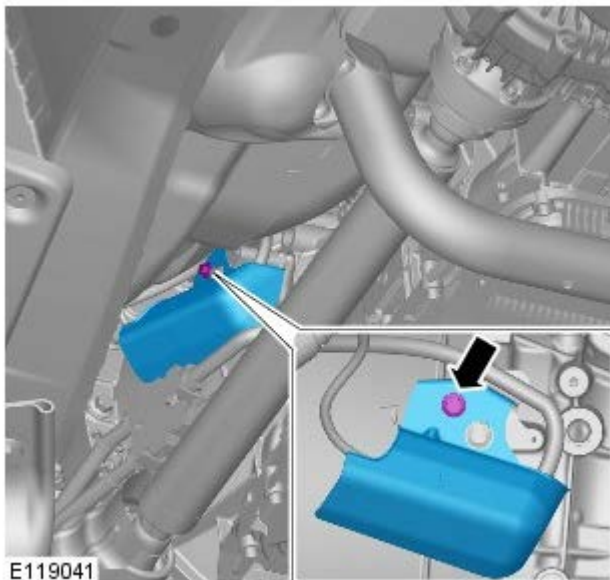


- WARNING:** Make sure to support the vehicle with axle stands.

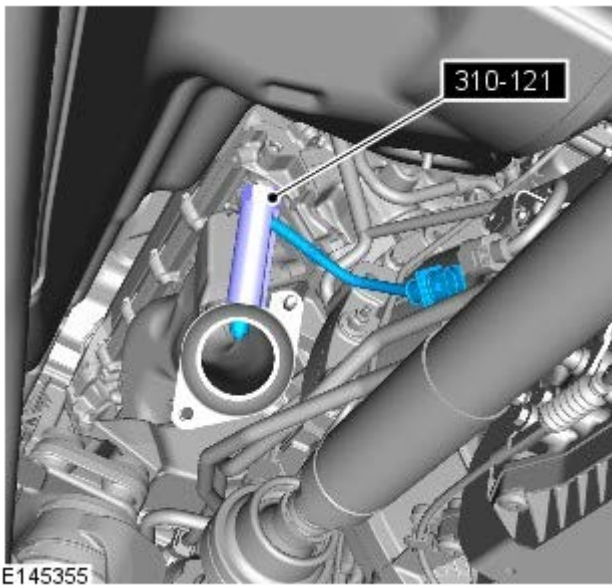
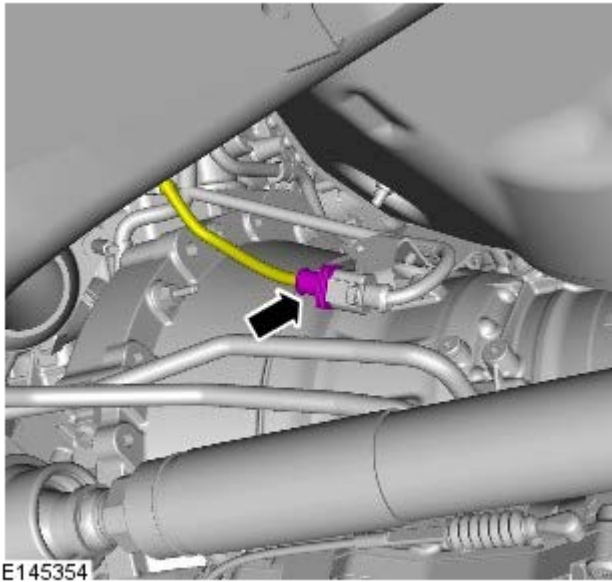
Raise and support the vehicle.

- Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).

- Torque: 11 Nm



-



5.  CAUTION: Make sure that the mating faces are clean and free of foreign material.


Special Tool(s): [310-121](#)
Torque: 48 Nm

Installation

1. CAUTIONS:

 Make sure the anti-seize compound does not contact the HO2S tip.

 If accidentally dropped or knocked install a new sensor.

 Make sure the HO2S wiring harness is not twisted more than 180 degrees and is not in contact with either the exhaust or driveshaft.

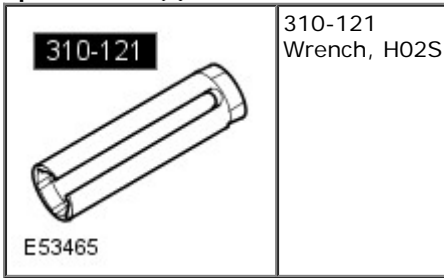
 NOTE: If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Post catalyst Heated Oxygen Sensor (HO2S)

Removal and Installation

Special Tool(s)



Removal



WARNING: Observe due care when working near a hot exhaust system.

NOTES:



Removal steps in this procedure may contain installation details.



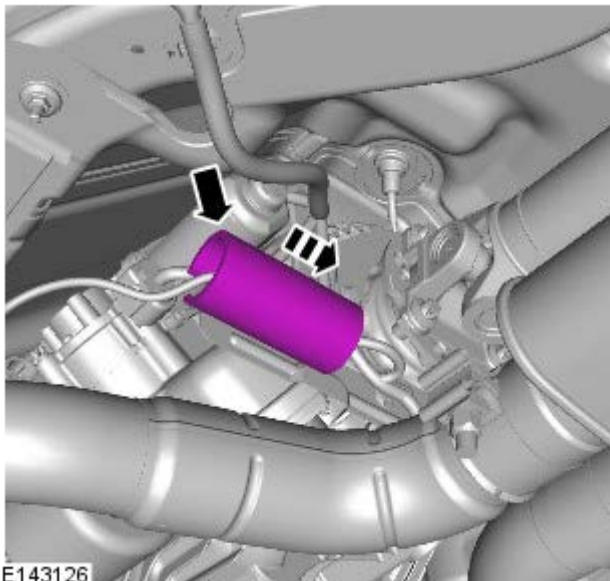
LH illustration shown, RH is similar.



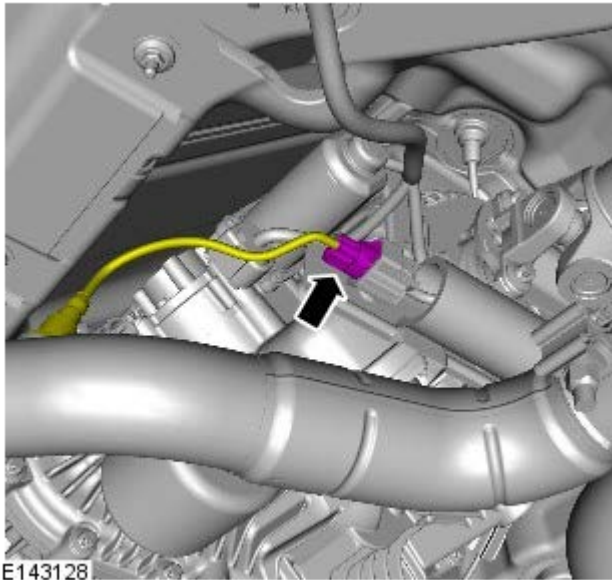
1. **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

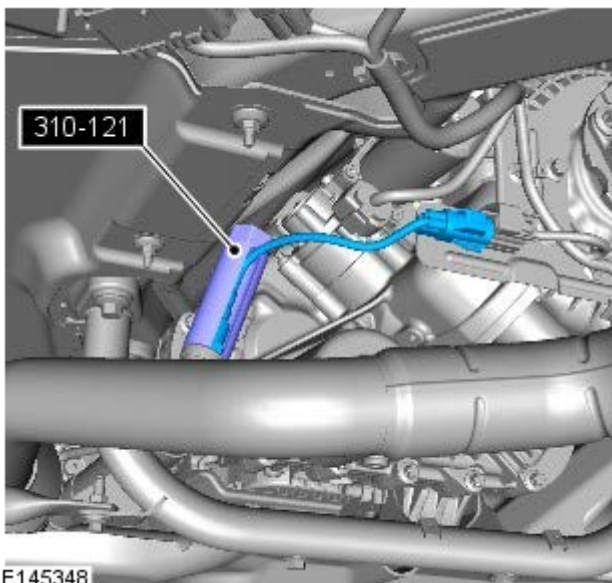
2.



3.



E143128



E145348

4.  CAUTION: Make sure that the mating faces are clean and free of foreign material.

Special Tool(s): [310-121](#)


Torque: 48 Nm

Installation

1. CAUTIONS:

 Make sure the anti-seize compound does not contact the HO2S tip.

 If accidentally dropped or knocked install a new sensor.

 Make sure the HO2S wiring harness is not twisted more than 180 degrees and is not in contact with either the exhaust or driveshaft.

 NOTE: If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Mass Air Flow (MAF) Sensor

Removal and Installation

Removal

NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.

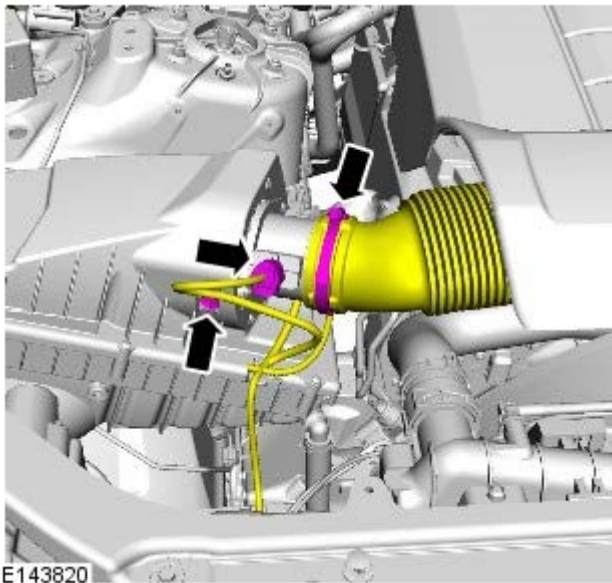


Removal steps in this procedure may contain installation details.

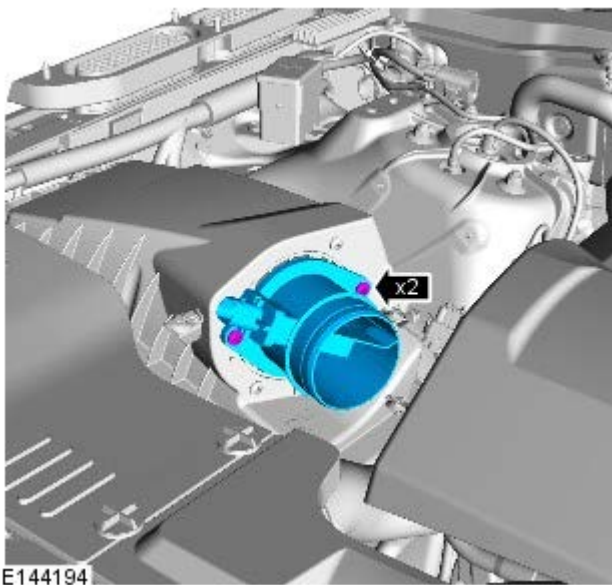


Right-hand shown, left-hand similar.

1. Torque: 3.5 Nm



2. Torque: 1.6 Nm



Installation

1. To install, reverse the removal procedure.

Electronic Engine Controls - V6 S/C 3.0L Petrol - Engine Control Module (ECM)

Removal and Installation

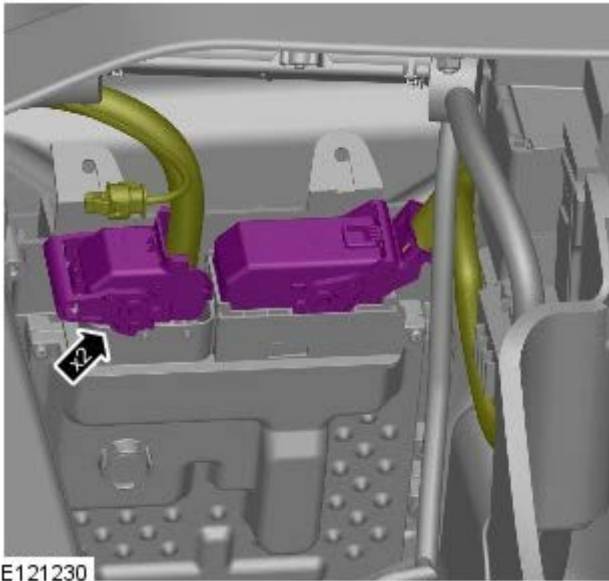
Removal




NOTE: Removal steps in this procedure may contain installation details.

1. Remove the battery.

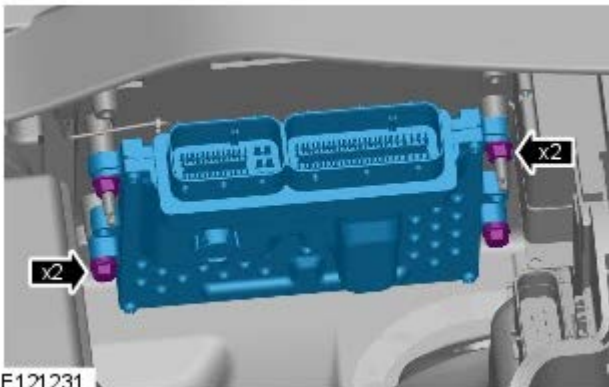
Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).



E121230

2.  CAUTION: Before the disconnection or removal of any components, make sure the area around joint faces and connections are clean. Plug any open connections to prevent contamination.

3. Torque: 7 Nm



E121231

Installation

1. To install, reverse the removal procedure.

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD -

Maintenance



CAUTION: Use only Shell L12108 (ZF Lifeguard 8) Automatic transmission fluid. Use of any other fluids may result in a transmission malfunction or failure.

Description	Intervals
Normal maintenance	Filled for life.
Severe duty maintenance	Change the fluid at 48,000 km (30,000 miles) intervals.

Capacities

	Liters
Transmission	8.5

Lubricants, Fluids, Sealers and Adhesives

Description	Specification
Transmission fluid	Shell L12108 (ZF Lifeguard 8)
Sealant	WSS-M4G323-A6
Metal surface cleaner	WSW-M5B392-A
High temperature grease	Molecote FB180

Torque Specifications



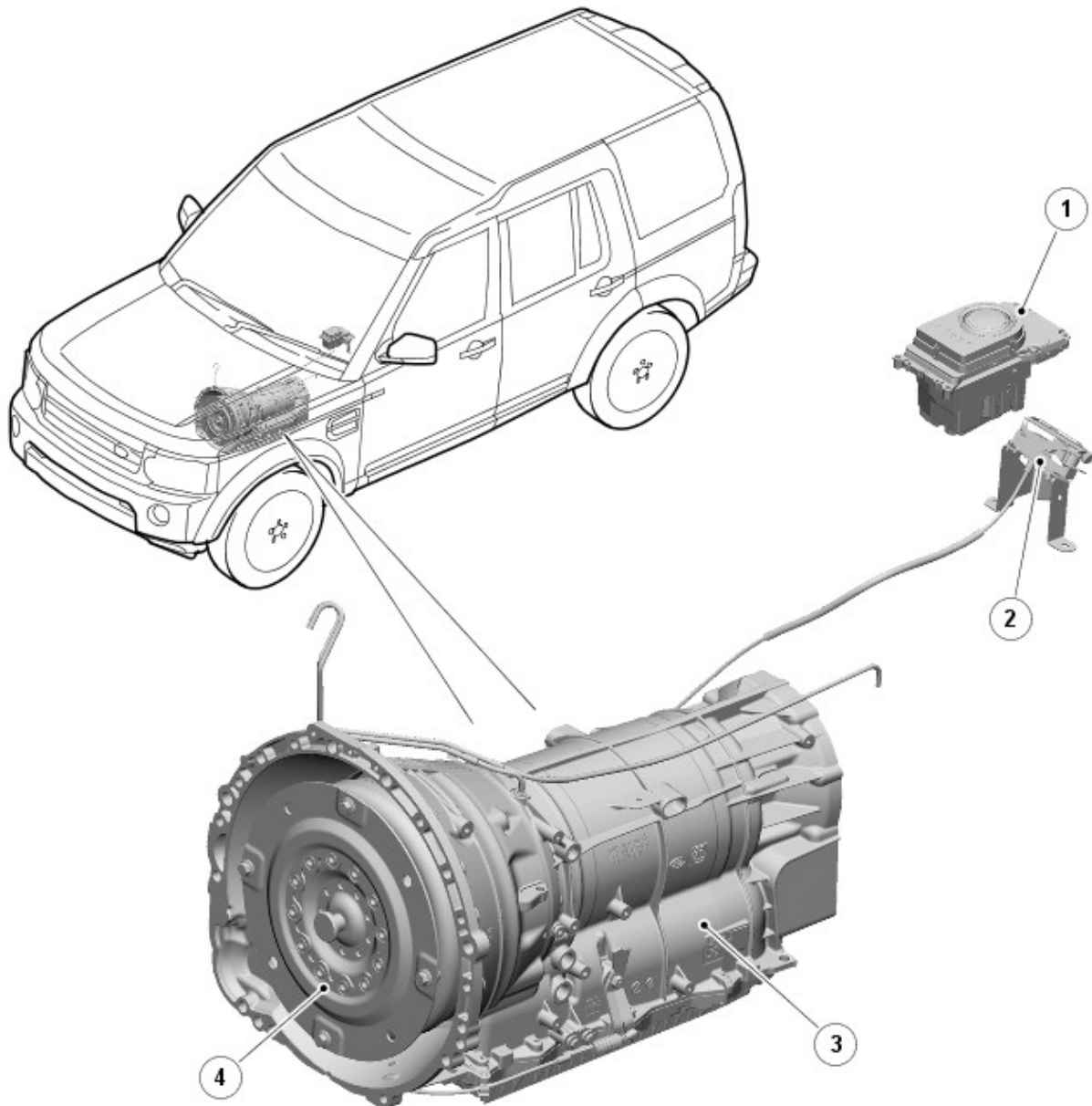
NOTE: * = refer to the procedure for correct torque sequence

Description	Nm	lb-ft	lb-in
Transmission retaining bolts	40	30	-
Transmission mount retaining bolts	60	44	-
* Transmission fluid fill plug	35	26	-
* Transmission control module (TCM) and main control valve body retaining bolts	8	6	-
Torque converter retaining bolts	63	46	-
Transmission fluid cooler tube retaining bolt	12	9	-
Transmission fluid drain plug	8	6	-
* Transmission fluid pan, gasket and filter retaining bolts	10	7	-

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission Description

Description and Operation

COMPONENT LOCATION



E137695

Item	Part Number	Description
1	-	Electronic Transmission Selector (ETS)
2	-	Emergency park release lever
3	-	Automatic transmission
4	-	Torque converter

INTRODUCTION

The ZF 8HP70 transmission is an electronically controlled, hydraulically operated, eight-speed automatic unit. The hydraulic and electronic control elements of the transmission, including the [TCM \(transmission control module\)](#), are incorporated in a single unit located inside the transmission and is known as 'Mechatronic'.

The ZF 8HP70 transmission has the following features:

- Designed to be maintenance free
- Transmission fluid is 'fill for life'
- The torque converter features a controlled slip feature with electronically regulated control of lock-up, creating a smooth transition to the fully locked condition
- Shift programs controlled by the [TCM](#)

ASIS (adaptive shift strategy), to provide continuous adaptation of shift changes to suit the driving style of the driver, which can vary from sporting to economical

- Connected to the **ECM (engine control module)** via the high-speed **CAN (controller area network)** bus for communications
- Default mode if major faults occur
- Diagnostics available from the **TCM** via the high speed **CAN** bus.

The higher fuel efficiency of the ZF 8HP70 automatic transmission is mainly due to the following modifications:

- a wider ratio spread and more gears for better adaptation to ideal engine operating points
- significantly reduced drag torque in the shift elements (only two open shift elements per gear)
- use of a more efficient **ATF (automatic transmission fluid)** pump (double-stroke vane pump)
- decoupling of the transmission when the vehicle is at standstill
- improved torsion damping in the converter.

The transmission selections are made using the Electronic Transmission Selector (ETS) in the floor console. For additional information, refer to: External Controls (307-05 Automatic Transmission/Transaxle External Controls - TDV6 3.0L Diesel, Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, Description and Operation).

TRANSMISSION

The transmission comprises the main casing which houses all of the transmission components. The main casing also incorporates an integral torque converter housing.

A fluid pan is attached to the lower face of the main casing and is secured with bolts. The fluid pan is sealed to the main casing with a gasket. Removal of the fluid pan allows access to the Mechatronic valve block. The fluid pan has magnets located at the rear which collects any ferrous metallic particles present in the transmission fluid.

A fluid filter is located inside the fluid pan. If the transmission fluid becomes contaminated or after any service work, the fluid pan with integral filter must be replaced.

The transmission does not have a Bowden cable for park lock operation. This is initiated electronically when the ETS is moved to the 'P' park position. An emergency park interlock release mechanism is provided to release the park interlock if a failure occurs.

A new feature of the 8 speed transmission is decoupling of the transmission when the vehicle is at a standstill. Normally the transmission remains in gear with the torque converter slipping and the vehicle is prevented from moving by applying the brake. The new system disengages one of the transmission clutches and only a minimum rotating load remains. This has the effect of further reducing fuel consumption.

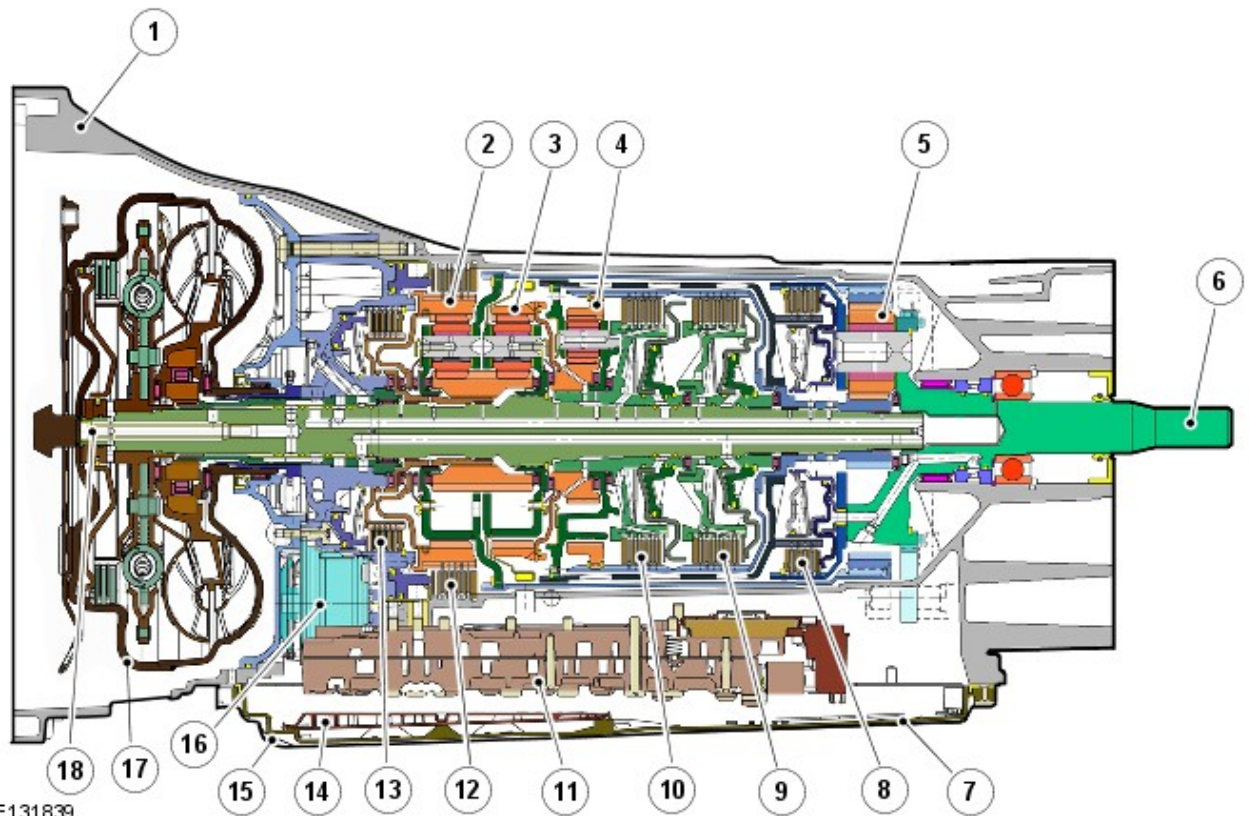
The internal oil pump is driven by a simplex chain and two drive gears from the input shaft. The oil pump is a double stroke vane cell pump which delivers 50 cm² of transmission fluid per revolution.

The integral torque converter housing provides protection for the torque converter assembly and also provides the attachment for the gearbox to the engine. The torque converter is a non-serviceable assembly which also contains the lock-up clutch mechanism.

The main casing contains the following major components:

- Input shaft
- Output shaft
- Mechatronic valve block which contains the solenoids, speed sensors and the **TCM**
- Three rotating multiplate drive clutches
- Two fixed multiplate brake clutches
- Four planetary gear trains.

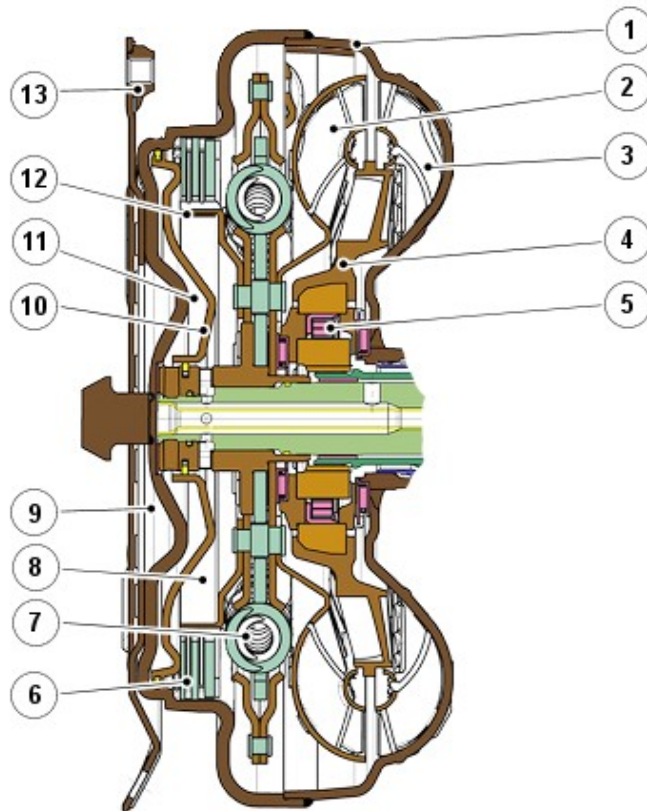
Transmission Sectional View



E131839

Item	Part Number	Description
1	-	Transmission casing
2	-	Gear set 1
3	-	Gear set 2
4	-	Gear set 3
5	-	Gear set 4
6	-	Output shaft
7	-	Drain plug
8	-	Clutch D
9	-	Clutch C
10	-	Clutch E
11	-	Mechatronic valve block
12	-	Brake B
13	-	Brake A
14	-	Fluid filter
15	-	Fluid pan
16	-	Fluid pump
17	-	Torque converter
18	-	Input shaft

TORQUE CONVERTER



E131838

Item	Part Number	Description
1	-	Converter cover
2	-	Turbine
3	-	Impeller
4	-	Stator
5	-	Stator freewheel
6	-	Lined plate of lock-up clutch
7	-	Torsional vibration damper
8	-	Pipe 1 and 2
9	-	Pipe 3
10	-	Lock-up clutch piston
11	-	Space behind lock-up clutch
12	-	Disc carrier
13	-	Drive plate/disc carrier

The torque converter is the coupling element between the engine and the transmission and is located in the torque converter housing, on the engine side of the transmission. The driven power from the engine crankshaft is transmitted hydraulically and mechanically through the torque converter to the transmission. The torque converter is connected to the engine by a flex plate attached to the rear of the crankshaft.

The torque converter comprises an impeller, a stator and a turbine. The torque converter is a sealed unit with all components located between the converter housing cover and the impeller. The two components are welded together to form a sealed, fluid filled housing. With the impeller brazed to the converter housing cover, the impeller is therefore driven at engine crankshaft speed.

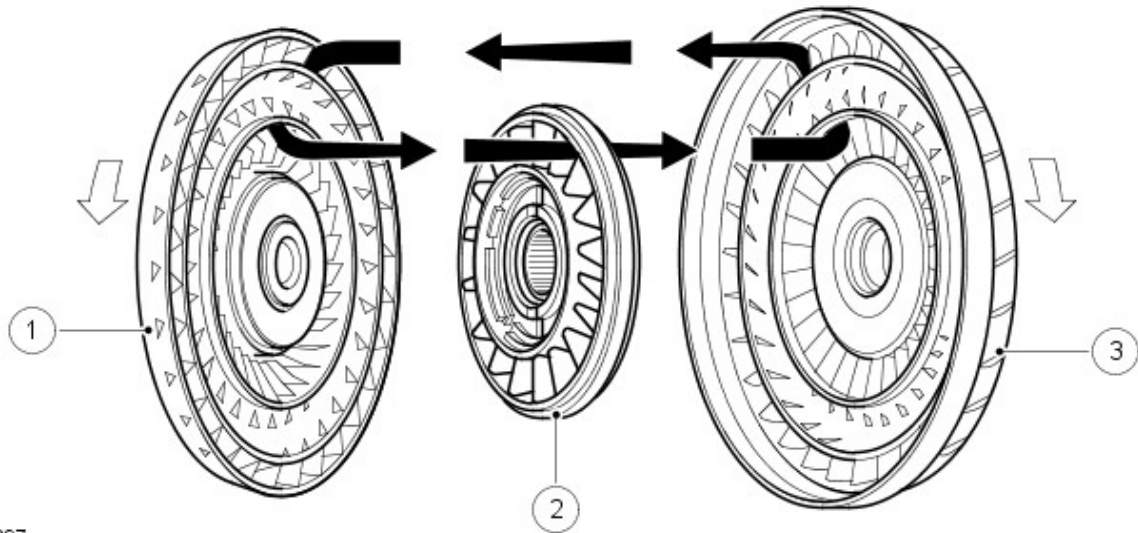
The converter housing drive plate has four threaded bosses, which provide for attachment of the engine flex plate. The threaded bosses also provide for location of special tools which are required to remove the torque converter from the torque converter housing.

Impeller

Fluid Flow



NOTE: The following illustration shows a typical turbine, stator and impeller.



E42397

Item	Part Number	Description
1	-	Turbine
2	-	Stator
3	-	Impeller

When the engine is running the rotating impeller acts as a centrifugal pump, picking up fluid at its center and discharging it at high velocity through the blades on its outer rim. The design and shape of the blades and the curve of the impeller body cause the fluid to rotate in a clockwise direction as it leaves the impeller. This rotation improves the efficiency of the fluid as it contacts the outer row of blades on the turbine.

The centrifugal force of the fluid leaving the blades of the impeller is passed to the curved inner surface of the turbine via the tip of the blades. The velocity and clockwise rotation of the fluid causes the turbine to rotate.

Turbine

The turbine is similar in design to the impeller with a continuous row of blades. Fluid from the impeller enters the turbine through the tip of the blades and is directed around the curved body of the turbine to the root of the blades. The curved surface redirects the fluid back in the opposite direction to which it entered the turbine, applying a turning force to the turbine from the impeller.

The fluid leaving the inner row of the turbine blades is rotated in a counter-clockwise direction due to the curve of the turbine and the shape of the blades. The fluid is now flowing in the opposite direction to the engine rotation and therefore the impeller. If the fluid was allowed to hit the impeller in this condition, it would have the effect of applying a brake to the impeller. To prevent this, the stator is located between the impeller and the turbine.

Stator

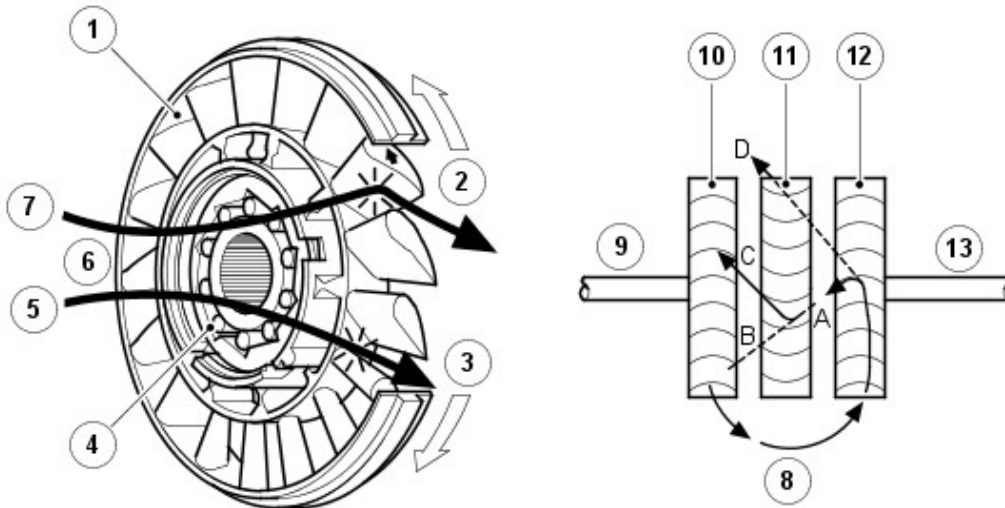
The stator is located on the splined transmission stator shaft via a freewheel clutch. The stator comprises a number of blades which are aligned in an opposite direction to those of the impeller and turbine. The main function of the stator is to redirect the returning fluid from the turbine, changing its direction to that of the impeller.

The redirected fluid from the stator is directed at the inner row of blades of the impeller, assisting the engine in turning the impeller. This sequence increases the force of the fluid emitted from the impeller and thereby produces the torque multiplication effect of the torque converter.

Stator Functions



NOTE: The following illustration shows a typical stator



E 42398

Item	Part Number	Description
1	-	Blades
2	-	Stator held – fluid flow redirected
3	-	Stator rotates freely
4	-	Roller freewheel
5	-	Converter at coupling speed
6	-	Fluid flow from turbine
7	-	Converter multiplying
8	-	Fluid flow from impeller
9	-	Drive from engine
10	-	Impeller
11	-	Stator
12	-	Turbine
13	-	Output to transmission

Fluid emitted from the impeller acts on the turbine. If the turbine is rotating at a slower speed than the fluid from the impeller, the fluid will be deflected by the turbine blades in the path 'A'. The fluid is directed at and deflected by the stator blades from path 'B' to path 'C'. This ensures that the fluid is directed back to the pump in the optimum direction. In this condition the roller clutch is engaged and the force of the fluid on the stator blades assists the engine in rotating the impeller.

As the rotational speed of the transmission and therefore the turbine increases, the direction of the fluid leaving the turbine changes to path 'D'. The fluid is now directed from the turbine to the opposite side of the stator blades, rotating the stator in the opposite direction. To prevent the stator from resisting the smooth flow of the fluid from the turbine, the freewheel clutch releases, allowing the stator to rotate freely on its shaft.

When the stator becomes inactive, the torque converter no longer multiplies the engine torque. When the torque converter reaches this operational condition it ceases to multiply the engine torque and acts solely as a fluid coupling, with the impeller and the turbine rotating at approximately the same speed.

One Way Free Wheel Clutch

The free wheel clutch can perform two functions; hold the stator stationary and free wheel allowing the stator to rotate without a drive output. The free wheel clutch used is of the roller type and comprises an inner and outer race and a roller and cage assembly. The inner and outer races are pressed into their related components with which they rotate. The roller and cage assembly is located between the inner and outer races.

The rollers are located in a cage which is a spring which holds the rollers in the 'wedge' direction and maintains them in contact with the inner and outer races. The outer race has a series of ramps which allow the rollers to lock the inner and outer races together.

When the outer race is rotated in a clockwise direction, the rollers are 'wedged' between the inner and outer races. The rollers then prevent the rotation of the outer race by holding it to the inner race, which is held stationary.

Lock-Up Clutch Mechanism

The **TCC (torque converter clutch)** is hydraulically controlled by an Electronic Pressure Regulating Solenoid (EPRS), which is controlled by the **TCM**. This allows the torque converter to have three states of operation as follows:

- Fully engaged
- Controlled slip variable engagement
- Fully disengaged.

The torque converter pressure valve reduces system pressure and guarantees the pressure needed for the torque converter. It also limits the maximum torque converter pressure, to prevent the torque converter from expanding.

The solenoid valve is operated by **PWM (pulse width modulation)** signals from the **TCM** to give full, partial or no lock-up

of the torque converter.

The lock-up clutch is a hydro-mechanical device which eliminates torque converter slip, improving fuel consumption. The engagement and disengagement is controlled by the TCM to allow a certain amount of controlled 'slip'. This allows a small difference in the rotational speeds of the impeller and the turbine which results in improved shift quality. The lock-up clutch comprises a piston and a clutch friction plate.

In the unlocked condition, the oil pressure supplied to the piston chamber is reduced and the pressure in the turbine chamber is allowed to push the piston back. In this condition the clutch plate are released and torque converter slip is permitted.

In the locked condition, the TCC spool valves are actuated by the EPRS. Pressurized fluid is directed into the lock-up clutch piston. The piston moves with the pressure and pushes the clutch plates together. As the pressure increases, the friction between the clutch plates increases, finally resulting in full lock-up of the clutch plates. In this condition there is direct mechanical drive from the engine crankshaft to the transmission planetary gear train.

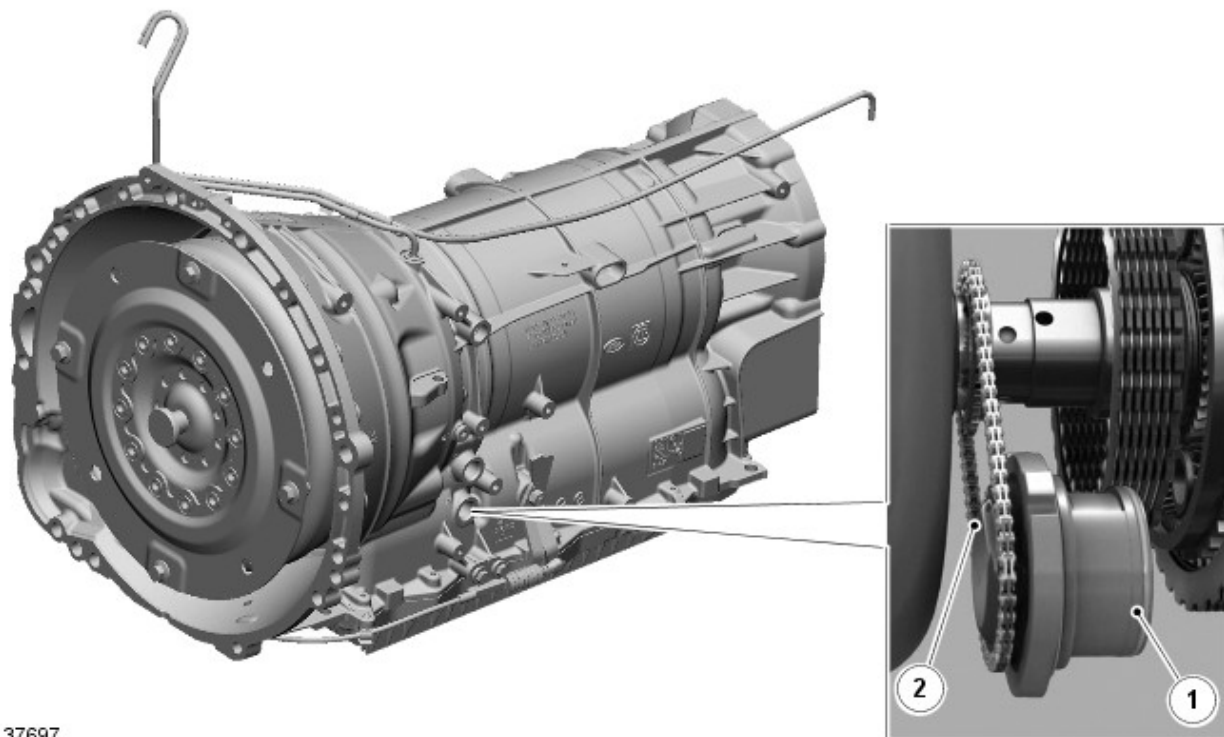
The standstill decoupling feature is new for the 8 speed transmission. When the vehicle comes to a standstill (with the brakes applied), the converter is disconnected from the driveline so that only a slight residual load remains. This further reduces fuel consumption. Decoupling is by actuating clutch B in the transmission, and is dependent on load and output speed.

FLUID PUMP

The fluid pump is an integral part of the transmission. The fluid pump is used to supply hydraulic pressure for the operation of the control valves and clutches, to pass the fluid through the transmission cooler and to lubricate the gears and shafts.

The ZF 8HP70 fluid pump is a double stroke, vane type pump and is located below the transmission input shaft. The pump is driven by a chain drive from a sprocket located on the input shaft. The pump has a delivery rate of 50 cm³ per revolution. The drive sprocket is driven at engine speed through a splined connection in the torque converter shell.

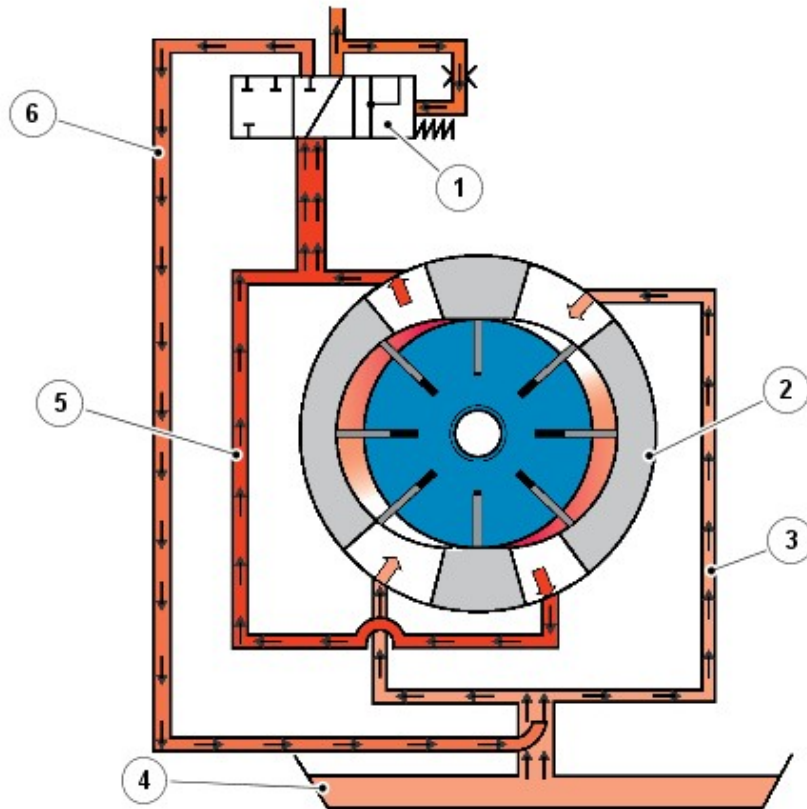
Double Vane Fluid Pump Location



E137697

Item	Part Number	Description
1	-	Vane pump
2	-	Chain drive from torque converter cover

Double Vane Fluid Pump Schematic Diagram



E131109

Item	Part Number	Description
1	-	System pressure valve
2	-	Vane pump
3	-	Intake pipe
4	-	Oil pan
5	-	Pressure pipe
6	-	Recycling of redundant fluid

The pump comprises a sprocket, a rear cover with bearing, a front cover with bearing, a cylinder, a rotor shaft and a rotor with vanes. A pressure relief valve is fitted in the pressure outlet gallery from the pump but is not an integral part of the pump itself.

A sprocket is located around the transmission input shaft. Splines on the torque converter nose and the sprocket ensure a positive drive. A simplex chain transmits the rotation of the torque converter cover into rotation of the pump rotor shaft via a second sprocket fitted to the rotor shaft. The gearing of the two sprockets rotates the pump rotor shaft at a speed slightly higher than the Revolutions Per minute (RPM) of the torque converter cover which is directly connected to the engine crank.

The pump contains 7 vanes which are attached to the rotor and rotate within the cam shaped cylinder. As the vanes rotate, the eccentricity of the central hole in the cylinder causes the space between the vanes to increase. This causes a depression between the vanes and fluid is drawn into the space between the vanes via a suction port connected to the fluid pan. The fluid passes through the fluid pan filter before it is drawn into the pump.

As the rotor shaft rotates further, the inlet port is closed by the vanes which have drawn in fluid, trapping the fluid in the space between the vanes. The eccentric hole in the cylinder causes the space between the vanes to decrease and consequentially compresses and pressurizes the fluid trapped between them.

Further rotation of the rotor shaft moves the vanes towards the outlet port. As the vanes pass the outlet port the pressurized fluid passes from the space between the vanes into the pressure gallery to the pressure relief valve.

As the pump is a double stroke vane pump, this sequence is repeated twice per revolution of the rotor shaft.

The pressure relief valve controls the pressure and flow of fluid delivered to the transmission valve block, torque converter and other components. Pressure is controlled by a relief valve which limits the maximum system pressure to 32 bar (464 lbf/in²). The pressure control maintains a constant pressure of fluid irrespective of torque converter input shaft rotational speed. A metering orifice is subject to the pump output pressure. If the pressure in the orifice reaches a predetermined level, a spring loaded ball in the flow control valve is lifted from its seat and pressurized fluid is allowed to recirculate through the pump.

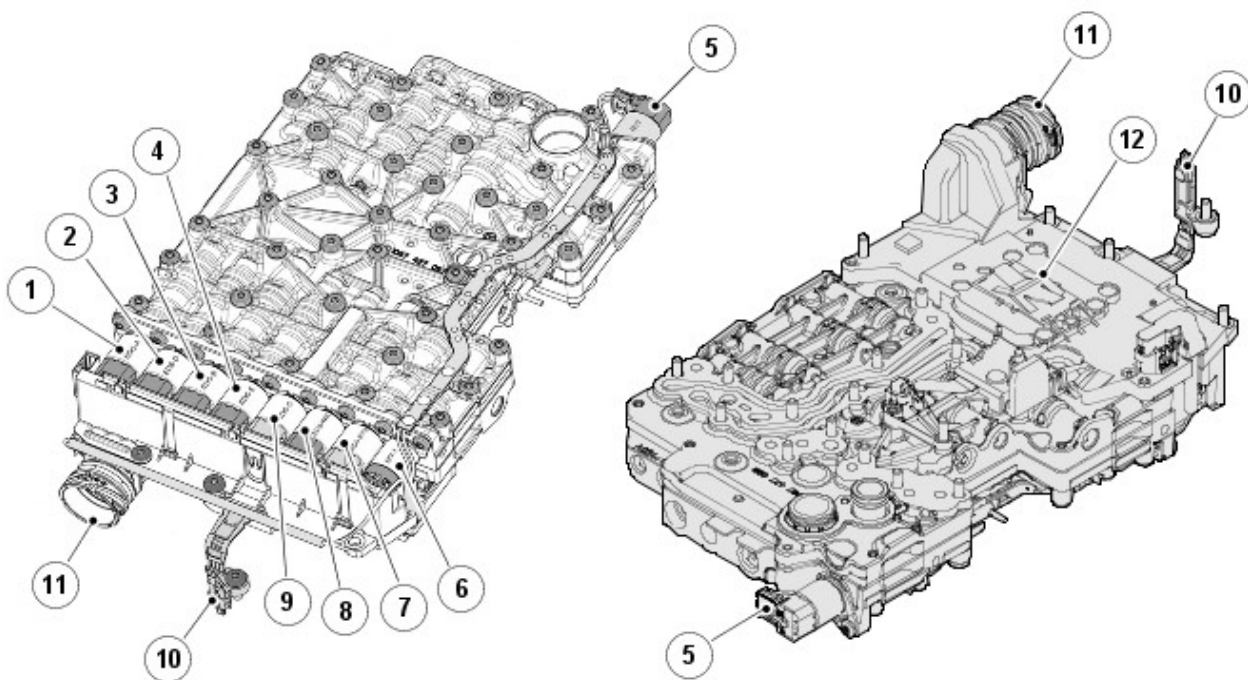
MECHATRONIC VALVE BLOCK

The Mechatronic valve block is located in the bottom of the transmission and is covered by the fluid pan. The valve block houses the TCM, electrical actuators, speed sensors and control valves which provide all electro-hydraulic control for all transmission functions. The Mechatronic valve block comprises the following components:

- TCM
- Seven pressure regulator solenoids
- Two park lock solenoids

- Twenty one hydraulic spool valves
- Temperature sensor
- Turbine speed sensor
- Output shaft speed sensor.

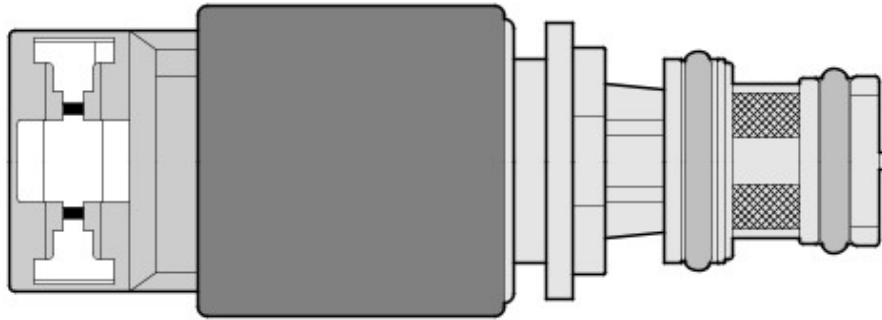
Mechatronic Valve Block



E131253

Item	Part Number	Description
1	-	EPRS A - A brake valve
2	-	EPRS D - D clutch valve
3	-	EPRS B - B brake valve
4	-	EPRS E - E clutch valve
5	-	MV 2 - magnet-valve 2 for electrical park interlock (hold out of park)
6	-	MV 1 - pressure reducing valve
7	-	EPRS SYS - system pressure valve
8	-	EPRS WK - Torque converter lock-up clutch valve
9	-	EPRS C - C clutch valve
10	-	Transmission input shaft speed sensor
11	-	Electrical connector
12	-	Transmission Control Module (TCM) - hidden

Electronic Pressure Regulator Solenoids (EPRS)



E42713

Seven EPRS are located in the valve block. The solenoids are controlled by **PWM** signals from the **TCM**. The solenoids convert the electrical signals into hydraulic control pressure proportional to the signal to actuate the spool valves for precise transmission operation.

Solenoids EPRS A, B, D, E and WK supply a higher control pressure as the signal amperage increases and can be identified by an orange connector cap. The **TCM** operates the solenoids using **PWM** signals. The **TCM** monitors engine load and clutch slip and varies the solenoid duty cycle accordingly. The solenoids have a 12 V operating voltage and a pressure range of 0 - 4.7 bar (0 - 68 lbf.in²).

Solenoids EPRS C and SYS supply a lower control pressure as the signal amperage increases and can be identified by a gray connector cap. The **TCM** monitors engine load and clutch slip and varies the solenoid duty cycle accordingly. The solenoids have a 12 V operating voltage and a pressure range of 4.7 - 0 bar (68 - 0 lbf.in²).

The resistance of the solenoid coil winding for EPRS solenoids is 5.05 Ohms at 20 °C (68 °F).

Control Solenoid (MV 1)



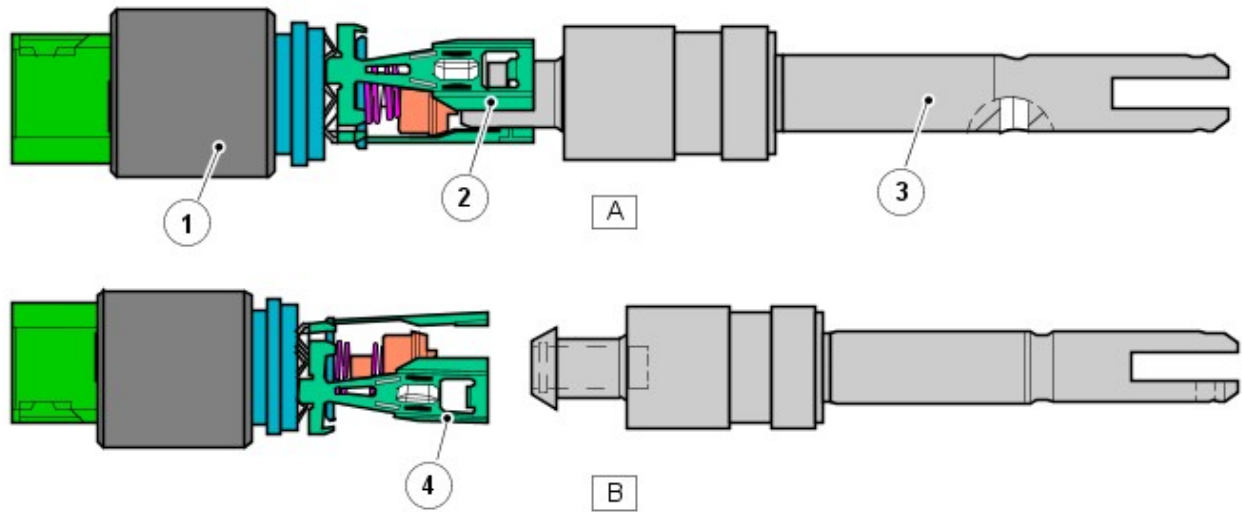
E42714

A shift control solenoid MV1 (Magnetic Valve 1) is located in the valve block. The solenoid is controlled by the **TCM** and converts electrical signals into hydraulic control signals to control clutch application.

The shift control solenoid is an open/closed, on/off solenoid which is controlled by the **TCM** switching the solenoid to earth. The **TCM** also supplies power to the solenoid. The **TCM** energizes the solenoid in a programmed sequence for clutch application for gear ratio changes and shift control.

The resistance of the solenoid coil winding for solenoid is between 10 to 11 Ohms at 20 °C (68 °F).

Control Solenoid (MV 2)



E 131254

Item	Part Number	Description
A	-	Solenoid in locked (energized) condition - park lock released
B	-	Solenoid in unlocked (deenergized) condition - park lock engaged
1	-	Solenoid
2	-	Claw - locked
3	-	Piston
4	-	Claw - unlocked

A control solenoid MV 2 (Magnetic Valve 2) is located in the valve block. The solenoid is controlled by the TCM and converts electrical signals into hydraulic control signals to control the electronic park lock function

The control solenoid is an on/off solenoid which is controlled by the TCM by switching the solenoid to earth.

When the park position is deselected, control solenoid MV2 resets the parking lock valve in the Mechatronic valve block. This is achieved by the TCM providing the ground for the solenoid which is energized, releasing the claws from retaining the park lock piston. Main fluid pressure acting on the parking lock piston, pushes the piston back to release the lock.

When the park position is selected, control solenoid MV2 is deenergized. The fluid pressure at the parking lock cylinder piston is vented and the mechanical interlock of the piston is opened. A pre-tensioned torsion spring at the park lock disc pulls the piston into the "park" position where the piston engages with the control solenoid claws and is locked in the park position. An emergency release wire cable can be used to release the parking lock manually if an electrical failure occurs.

The resistance of the solenoid coil winding for solenoid is 25 Ohms at 20 °C (68 °F).

When the neutral "N" position is selected and the engine is turned off, the fluid pressure at the park lock cylinder piston is released. The current supply to the control solenoid MV2 remains. The park lock cylinder piston is still held in the unlocked position by the spring force acting on the park lock disc, preventing the park lock plate from engaging the parking lock. This allows the vehicle to be moved when the engine is not running for a short time. Should the battery voltage fall below the level required to maintain the solenoid in the energized condition, the park lock will be engaged.

Sensors

Speed Sensors

The turbine speed sensor and the output shaft speed sensor are Hall effect type sensors located in the Mechatronic valve block and are not serviceable items. The TCM monitors the signals from each sensor to determine the input (turbine) speed and the output shaft speed.

The turbine speed is monitored by the TCM to calculate the slip of the torque converter clutch and internal clutch slip. This signal allows the TCM to accurately control the slip timing during shifts and adjust clutch application or release pressure for overlap shift control.

The output shaft speed is monitored by the TCM and compared to engine speed signals received on the CAN bus from the ECM. Using a comparison of the two signals the TCM calculates the transmission slip ratio for plausibility and maintains adaptive pressure control.

Temperature Sensor

The temperature sensor is also located in the Mechatronic valve block. The TCM uses the temperature sensor signals to determine the temperature of the transmission fluid. These signals are used by the TCM to control the transmission operation to promote faster warm-up in cold conditions or to assist with fluid cooling by controlling the transmission operation when high fluid temperatures are experienced. If the sensor fails, the TCM will use a default value and a fault code will be stored in the TCM.

Spool Valves

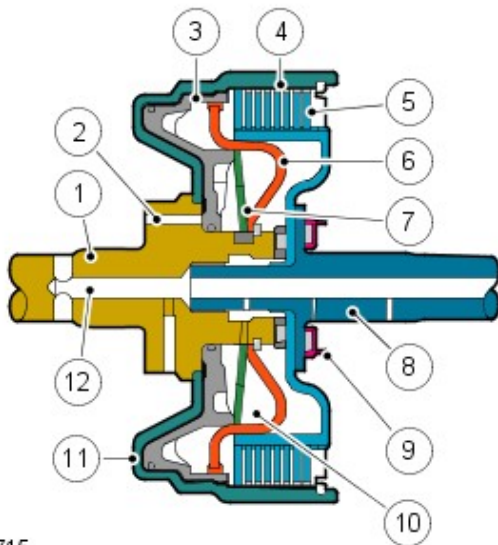
The valve block contains spool valves which control various functions of the transmission. The spool valves are of conventional design and are operated by fluid pressure.

Each spool valve is located in its spool bore and held in a default (unpressurized) position by a spring. The spool bore has a number of ports which allow fluid to flow to other valves and clutches to enable transmission operation. Each spool has a piston which is waisted to allow fluid to be diverted into the applicable ports when the valve is operated.

When fluid pressure moves a spool, 1 or more ports in the spool bore are covered or uncovered. Fluid is prevented from flowing or is allowed to flow around the applicable waisted area of the spool and into another uncovered port. The fluid is either passed through galleries to actuate another spool, operate a clutch or is returned to the fluid pan.

DRIVE CLUTCHES

Multiplate Clutch or Brake – Typical



E42715

Item	Part Number	Description
1	-	Input shaft
2	-	Main pressure supply port
3	-	Piston
4	-	Cylinder – external plate carrier
5	-	Clutch plate assembly
6	-	Baffle plate (for clutch, not brake)
7	-	Diaphragm spring
8	-	Output shaft
9	-	Bearing
10	-	Dynamic pressure equalization chamber
11	-	Piston chamber
12	-	Lubrication channel

There are three drive clutches and two brakes used in the transmission. Each clutch comprises a number of friction plates dependent on the output controlled. A typical clutch consists of a number of alternating steel plates and plates with friction material bonded to each face.

The clutch plates are held apart mechanically by a diaphragm spring and hydraulically by dynamic pressure. The pressure is derived from a lubrication channel which supplies fluid to the bearings and clutch cooling. The fluid is passed via a drilling in the input shaft into the chamber between the baffle plate and the piston. To prevent inadvertent clutch application due to pressure build up produced by centrifugal force, the fluid in the dynamic pressure equalization chamber overcomes any centrifugal pressure in the piston chamber and holds the piston off the clutch plate assembly.

When clutch application is required, main pressure from the fluid pump is applied to the piston chamber from the supply port. This main pressure overcomes the low pressure fluid present in the dynamic pressure equalization chamber. The piston moves, against the pressure applied by the diaphragm spring, and compresses the clutch plate assembly. When the main pressure falls, the diaphragm spring pushes the piston away from the clutch plate assembly, disengaging the clutch.

PLANETARY GEAR TRAINS

The 8 forward gears and the reverse gear are produced by a combination of four simple planetary gear sets, 3 clutches

and 2 brakes. The front two gear sets share a common sun gear. Power is output always through the planetary carrier of the fourth gearset.

Five shift elements comprising 3 clutches and 2 brakes, are responsible for all 8 forward and reverse gears. High efficiency is achieved by the use of only 2 shift elements disengaged in each gear which reduces drag and so increases the efficiency.

Planetary Gear Sets 1, 2 and 3

The planetary gear sets 1 and 2 comprise:

- Sunwheel - shared by both gear sets
- 4 planetary gears per gear set
- Planetary gear carrier (spider) per gear set
- Ring gear per gear set.

The planetary gear set 3 comprises:

- Sunwheel
- 3 planetary gears
- Planetary gear carrier (spider)
- Ring gear.



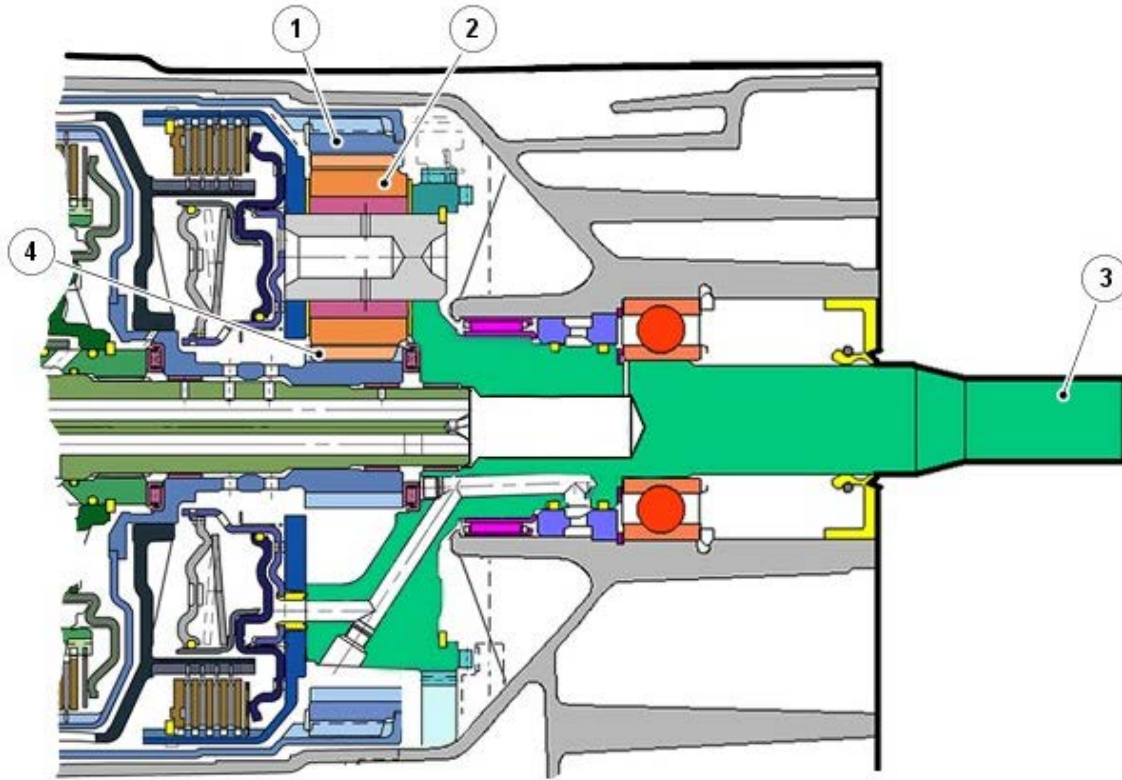
E131255

Item	Part Number	Description
1	-	Planetary gears - gear set 1
2	-	Ring gear - gear set 1
3	-	Planetary gear carrier (spider)
4	-	Planetary gears - gear set 2
5	-	Ring gear - gear set 2
6	-	Planetary gears - gear set 3
7	-	Ring gear - gear set 3
8	-	Sun wheel - gear set 3
9	-	Sun wheel - joint gear sets 1 and 2

Planetary Gear Set 4

The planetary gear set 4 comprises:

- Sunwheel
- 4 planetary gears
- Planetary gear carrier (spider) - output shaft
- Ring gear.



E131256

Item	Part Number	Description
1	-	Ring gear
2	-	Planetary gears
3	-	Output shaft / gear carrier
4	-	Sun wheel

TRANSMISSION CONTROL MODULE

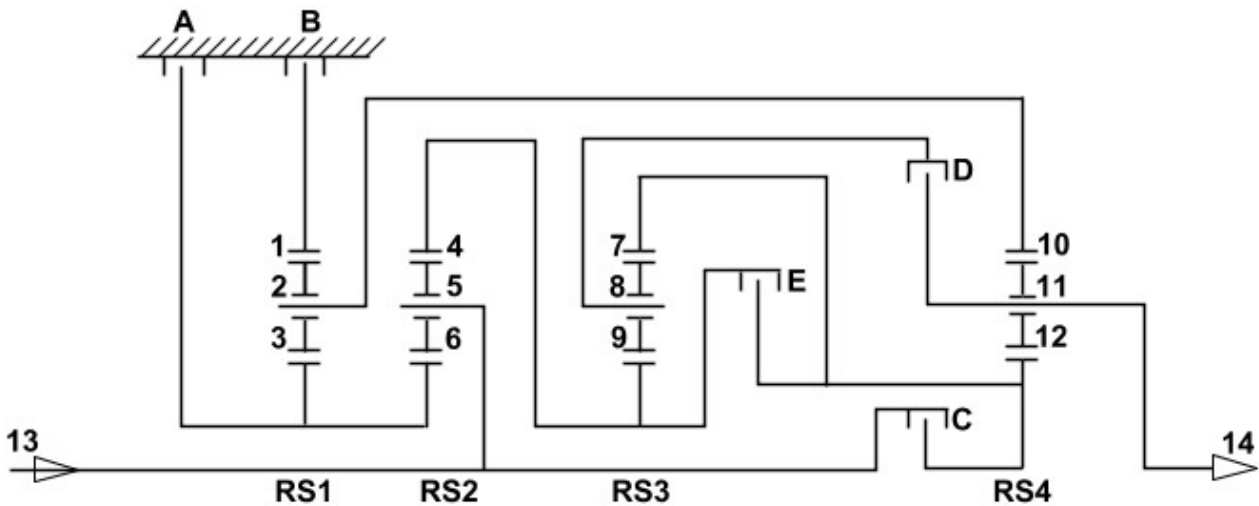
The **TCM** is an integral part of the Mechatronic valve block which is located at the bottom of the transmission, within the fluid pan. The **TCM** is the main controlling component of the transmission.

The **TCM** processes signals from the transmission speed and temperature sensors, **ECM** and other vehicle systems. From the received signal inputs and pre-programmed data, the module calculates the correct gear, torque converter clutch setting and optimum pressure settings for gear shift and lock-up clutch control.

CONTROL DIAGRAM



NOTE: **A** = Hardwired; **D** = High speed CAN bus.



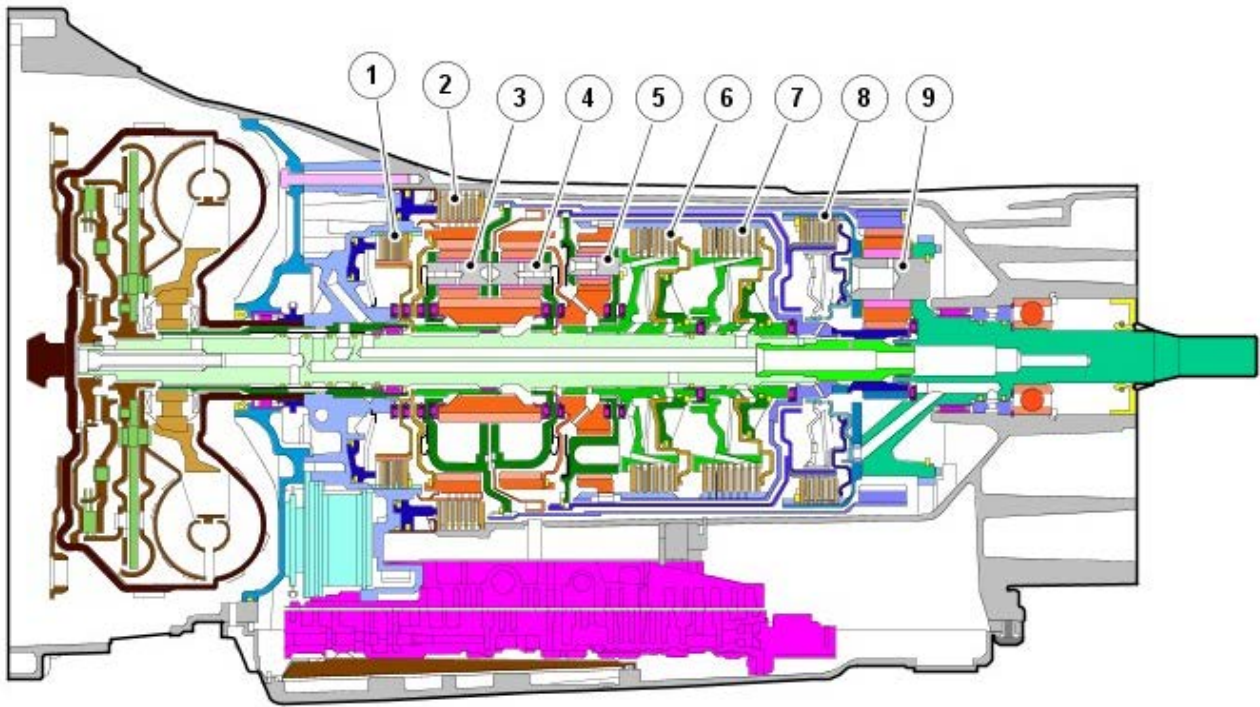
E131258

Item	Part Number	Description
A	-	Multiplate brake
B	-	Multiplate brake
C	-	Multiplate clutch
D	-	Multiplate clutch
E	-	Multiplate clutch
1	-	Ring gear of planetary gear set 1
2	-	Planetary gears of planetary gear set 1
3	-	Sun gear of planetary gear set 1
4	-	Ring gear of planetary gear set 2
5	-	Planetary gears of planetary gear set 2
6	-	Sun gear of planetary gear set 2
7	-	Ring gear of planetary gear set 3
8	-	Planetary gears of planetary gear set 3
9	-	Sun gear of planetary gear set 3
10	-	Ring gear of planetary gear set 4
11	-	Planetary gears of planetary gear set 4
12	-	Sun gear of planetary gear set 4
13	-	Power input from torque converter
14	-	Power output to output shaft

Engine torque is transferred, via operation of single or combinations of clutches to the 4 planetary gear trains. All gear trains are controlled by reactionary inputs from brake clutches to produce the 8 forward gears and 1 reverse gear. The ratios are as follows:

Gear	1st	2nd	3rd	4th	5th	6th	7th	8th	Reverse
Ratio	4.714	3.143	2.106	1.667	1.285	1.000	0.839	0.667	3.317

Shift Elements



E131259

Item	Part Number	Description
1	-	Brake A
2	-	Brake B
3	-	Gear set 1
4	-	Gear set 2
5	-	Gear set 3
6	-	Clutch E
7	-	Clutch C
8	-	Clutch D
9	-	Gear set 4

The shift elements, clutches and brakes are actuated hydraulically. Fluid pressure is applied to the required clutch and/or brake, pressing the plates together and allowing drive to be transmitted through the plates. The purpose of the shift elements is to perform power-on shifts with no interruption to traction and smooth transition between gear ratios.

Instrument Cluster



E137706

Item	Part Number	Description
1	-	MIL (malfunction indicator lamp)
2	-	Message center
3	-	Transmission status display

The instrument cluster is connected to the TCM via the high speed CAN bus. Transmission status is transmitted by the TCM and displayed to the driver in one of two displays in the instrument cluster. For additional information, refer to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

Malfunction Indicator Lamp

Transmission related faults which may affect the vehicle emissions will illuminate the MIL (malfunction indicator lamp).

The MIL is illuminated by the ECM on receipt of a relevant fault message from the TCM on the high speed CAN. The nature of the fault can be diagnosed using Land Rover approved diagnostic equipment which reads the fault codes stored in the TCM memory.

Transmission Status Display

The transmission status display is located in the tachometer of the instrument cluster. The display shows the selector lever position or the selected gear when in manual and sport modes.

The following table shows the displays and their descriptions.

Symbol	Description
P	Park selected
R	Reverse selected
N	Neutral selected
D*	Drive and temporary manual mode selected (* = current gear)
S*	Sport mode selected (* = current gear)
1	1st gear selected (manual CommandShift mode)
2	2nd gear selected (manual CommandShift mode)
3	3rd gear selected (manual CommandShift mode)
4	4th gear selected (manual CommandShift mode)
5	5th gear selected (manual CommandShift mode)
6	6th gear selected (manual CommandShift mode)
7	7th gear selected (manual CommandShift mode)
8	8th gear selected (manual CommandShift mode)

Message Center

The message center relays vehicle status and operating information to the driver and display's messages relating to a number of vehicle systems. If a transmission fault occurs, the message GEARBOX FAULT is displayed in the message center.

For additional information, refer to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

Transmission Control Module

The **TCM** outputs signals to control the shift control solenoid valves and the EPRS's to control the hydraulic operation of the transmission.

The **TCM** processes signals from the transmission speed and temperature sensors, the Electronic Transmission Selector (ETS), the **ECM** and other vehicle systems. From the received signal inputs and pre-programmed data, the **TCM** calculates the correct gear, torque converter clutch setting and optimum pressure settings for gear shift and lock-up clutch control.

The **ECM** supplies the engine management data over the high speed **CAN** bus. The **TCM** requires engine data to efficiently control the transmission operation, for example; flywheel torque, engine speed, accelerator pedal angle, engine temperature. The steering angle sensor and the **ABS (anti-lock brake system)** module also supply data to the **TCM** on the high speed **CAN** bus. The **TCM** uses data from these systems to suspend gear changes when the vehicle is cornering and/or the **ABS** module is controlling braking or traction control.

The **CJB (central junction box)** supplies steering wheel paddle data over the high speed **CAN** bus. The **TCM** uses this to schedule driver requested upshifts and downshifts.

Using the signal inputs and the memorized data, the **TCM** control program computes the correct gear and torque converter lock-up clutch setting and the optimum pressure settings for gear shift and lock-up clutch control. Special output-side modules (power output stages, current regulator circuits), allow the **TCM** to control the solenoid valves and pressure regulators and consequently precisely control the hydraulics of the automatic transmission. In addition, the amount and duration of engine interventions are supplied to the engine management by way of the **CAN** bus.

The **TCM** determines the position of the selector lever using signals from the electronic transmission selector on the high speed **CAN** bus and Local **LIN (local interconnect network)** bus

The **TCM** transmits the position of the electronic transmission selector and any manual gear selected on the high speed **CAN** bus. This information is shown in the gear selector display in the instrument cluster.

Engine Stall

If the vehicle stalls it will coast down in gear, with the transmission providing drive to the engine. A restart can be attempted at this point and the engine may start and the driver can continue.

If the coast down speed reduces such that the speed of the engine is less than 400 rev/min, the transmission will go to neutral, 'D' illumination will flash in the instrument cluster. The driver needs to select neutral or park and then press the brake pedal to restart the engine.

If the start/stop button is pressed when driving, the message ENGINE STOP BUTTON PRESSED is displayed in the message center but there will be no change to the ignition state. If the driver requires to switch off the engine, the start/stop button must be pressed for a second time. The engine will be stopped and will be back driven by the transmission as the vehicle coasts down.

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Diagnostics TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD

Diagnosis and Testing

Principle of Operation

For a detailed description of the automatic transmission/transaxle system and operation, refer to the relevant Description and Operation sections in the workshop manual. REFER to: Transmission Description (307-01B, Description and Operation).

Fluid Level and Condition Check



CAUTION: The vehicle should not be driven if the fluid level is low as internal failure can result



NOTE: The transmission fluid temperature must not be allowed to exceed 50°C (122°F) whilst checking level. Should the temperature rise above this figure, abort the check and allow the transmission fluid to cool to below 30°C (86°F)

This vehicle is not equipped with a fluid level indicator. An incorrect level may affect the transmission operation and could result in transmission damage. To correctly check and add fluid to the transmission REFER to: Transmission Fluid Level Check (307-01B, General Procedures).

High Fluid Level

A fluid level that is too high may cause the fluid to become aerated due to the churning action of the rotating internal parts. This will cause erratic control pressure, foaming, loss of fluid from the vent tube and possible transmission damage. If an overfill condition is identified, with the engine at idle ensure the fluid temperature is within the specified range and allow the excess fluid to drain until a small thread of fluid runs from the filler/level plug hole

Low Fluid Level

A low fluid level could result in poor transmission engagement, slipping, or damage. This could also indicate a leak in one of the transmission seals or gaskets
REFER to: Transmission Fluid Level Check (307-01B, General Procedures).

Adding Fluid



CAUTION: The use of any other type of transmission fluid other than that specified can result in transmission damage

If fluid needs to be added, add fluid in 0.50 liter increments through the fill hole opening. Do not overfill the fluid. For fluid type, refer to the general specification chart in this section
REFER to: Specifications (307-01B, Specifications).

Fluid Condition Check

1. Check the fluid level
2. Observe the color and the odor of the fluid. The color under normal circumstances should be like honey, not dark brown or black
3. Allow the fluid to drip onto a facial tissue and examine the stain
4. If evidence of solid material is found, the transmission fluid pan should be removed for further inspection

NOTE: In the event of a transmission unit replacement for internal failure, the oil cooler and pipes must also be replaced

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

Mechanical	Electrical	Hydraulic

Damaged/stuck shift mechanism <ul style="list-style-type: none"> • Damaged automatic transmission casing 	Blown fuse(s) <ul style="list-style-type: none"> • Damaged, loose or corroded connectors • Wiring harness 	Fluid level too high/low <ul style="list-style-type: none"> • Poor condition of fluid • Fluid leak
---	---	--

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident check for diagnostic trouble codes (DTCs) and refer to the DTC Index

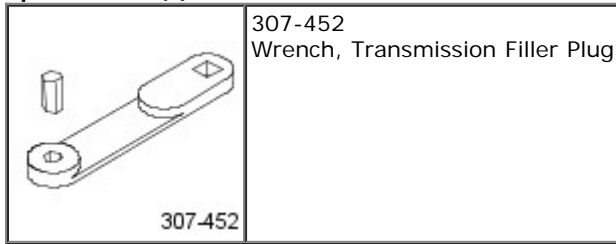
DTC Index

For a list of DTCs that could be logged on this vehicle, please refer to Section 100-00.
 REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Transmission Control Module (TCM) - Bosch (100-00, Description and Operation).

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission Fluid Level Check

General Procedures

Special Tool(s)



Check

WARNINGS:




Observe due care when draining, as the fluid can be very hot.



Observe due care when working near a hot exhaust system.

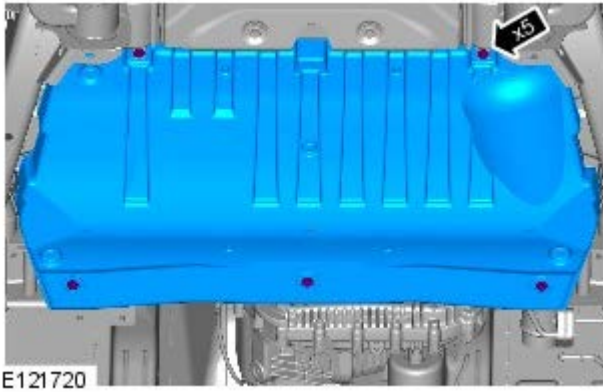



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1.
 - The following steps must be observed before starting the transmission fluid level check.
 - The vehicle must be on a horizontal ramp.
 - The parking brake must be applied.
 - Place the transmission control switch (TCS) knob in the N position.
2.
 - Start the engine.
 - Apply, and hold, the footbrake.
 - Move the TCS to the 'R' position and wait for 5 seconds.
 - Move the TCS to the 'D' position and wait for 5 seconds.
 - Engage second gear and wait for 5 seconds.
 - Move the TCS back to the 'N' position.
3. Make sure that the torque converter is full of oil by holding the engine speed at 2,000 rpm for a minimum of 30 seconds. Move the TCS to the park position and allow the engine to idle between 600rpm and 750 rpm.
4. Connect the diagnostic tool to the vehicle.
5. Make sure that the transmission oil has exceeded a temperature of 69 degrees celsius so that the thermostat has fully opened allowing full circulation of the transmission fluid. Allow the temperature to drop below 30 degrees celsius before checking the transmission oil level.
6.  **WARNING:** Make sure to support the vehicle with axle stands.

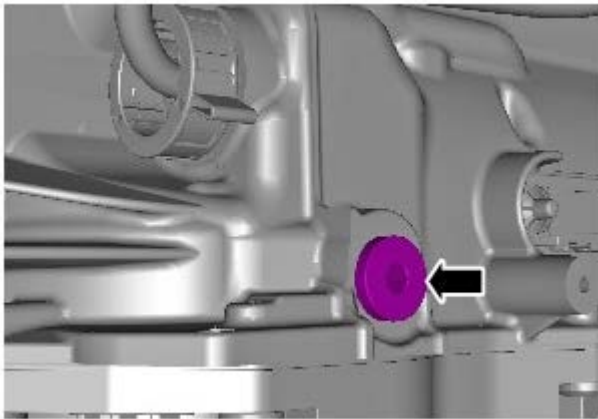
Raise and support the vehicle.

7.




8.  CAUTION: Make sure that the transmission fluid temperature is below 30 degrees before starting the fluid level check.

Place a suitable container under the transmission fluid fill plug.

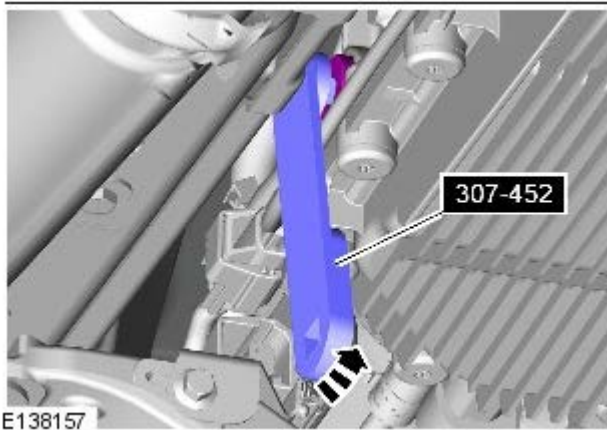


9. CAUTIONS:


 The transmission fluid level must only be checked when the temperature of the fluid is between 30 degrees and 50 degrees. The fluid level obtained will be incorrect if the reading is outside this temperature range.

 Discard the component.

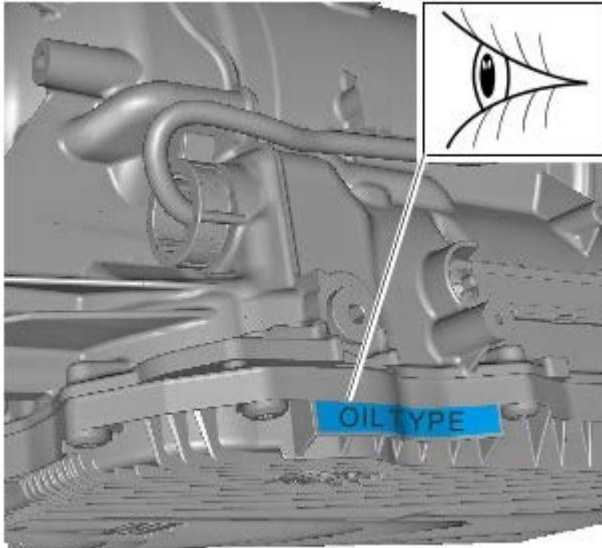
- *Special Tool(s)*: [307-452](#)
- Clean the area around the transmission fluid level plug.



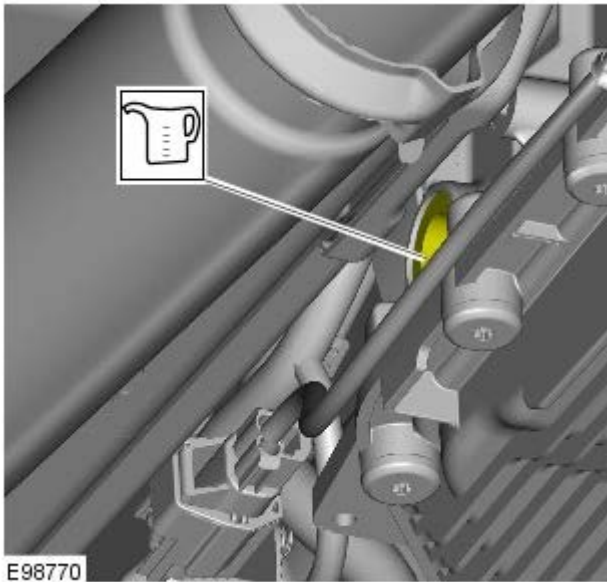
Adjustment

1.  CAUTION: Make sure the correct specification of oil is used.

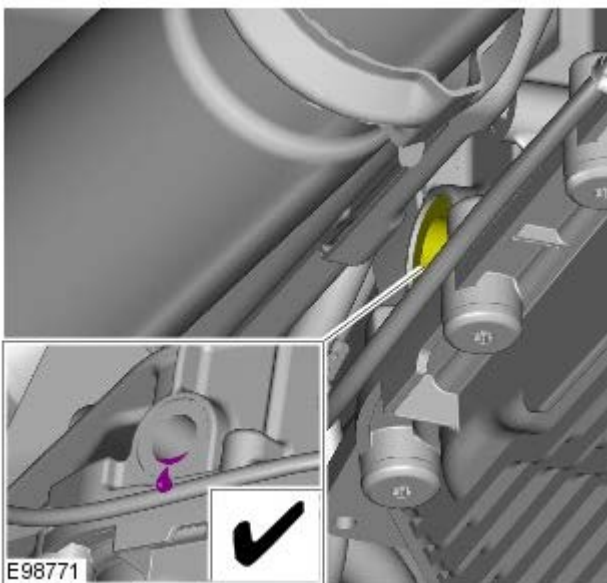
Refer to: Specifications (307-01B, Specifications).



E138154




E98770

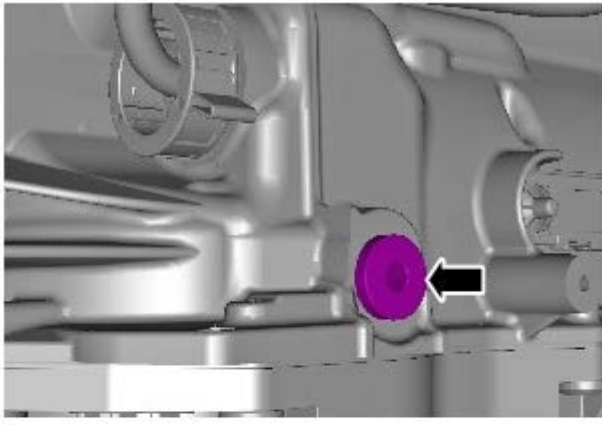


E98771

2. If the transmission fluid does not come out of the transmission fluid fill plug hole the transmission fluid level is insufficient. If this is the case add the transmission fluid in 0.5 liter units into the transmission fluid fill plug hole until fluid comes out.

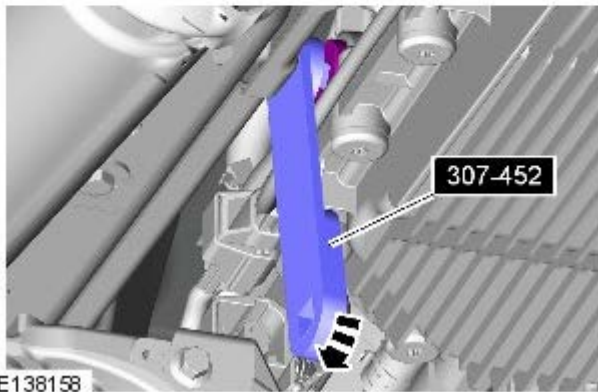
3. Allow the transmission fluid to drain from the transmission fluid filler plug hole until the flow almost stops.


4.  **WARNING:** Make sure to support the vehicle with axle stands.

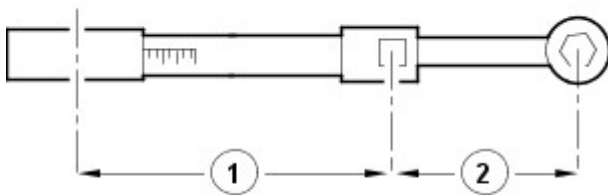


 **NOTE:** Install a new fluid level filler plug.

- Using the special tool, install the new transmission fluid fill plug.
- Lower the vehicle on the lift.
- Switch off the engine.
- Raise and support the vehicle.



5.  **CAUTION:** Make sure the transmission fluid fill plug is tightened to the correct specification. Failure to follow this instruction may result in damage to the vehicle.



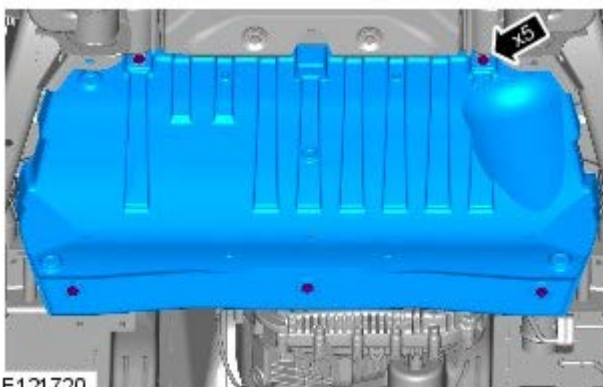
E37107

- To make sure the transmission fill plug is torqued to the correct specification. Using the special tool and torque wrench the following calculation steps must be followed.
- Step 1. Multiply 35 Nm by the effective length of the torque wrench (1).
- Step 2. Add the effective length of the special tool (2) to the effective length of the torque wrench (1).
- Step 3. Divide the total of step 1 by the total of step 2.
- Step 4. Set the torque wrench to the figure arrived at in step 3.
- Tighten the transmission fluid fill plug to the torque given by the calculation.

6. Remove the special tool.

7. Remove the container.

8. **Torque:** 10 Nm



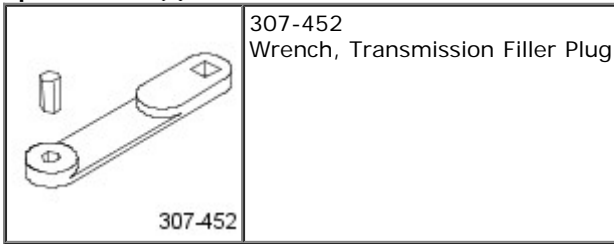
9. Lower the vehicle.

10. Disconnect the diagnostic tool.

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission Fluid Drain and Refill

General Procedures

Special Tool(s)



WARNINGS:




Observe due care when draining, as the fluid can be very hot.



Observe due care when working near a hot exhaust system.

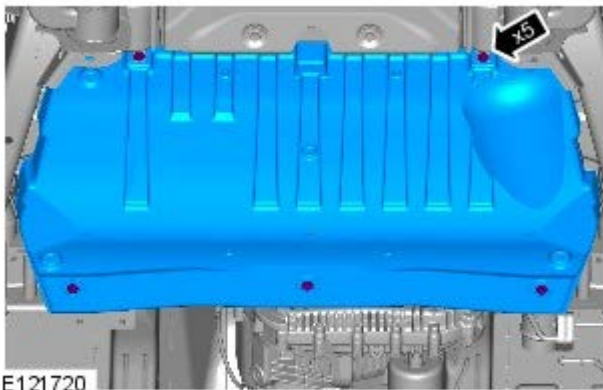


NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1.  WARNING: Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

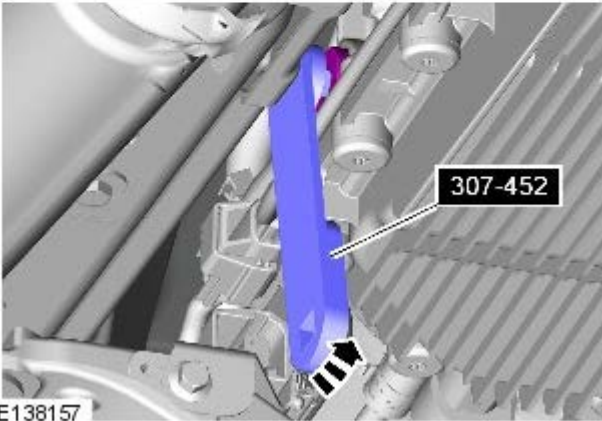
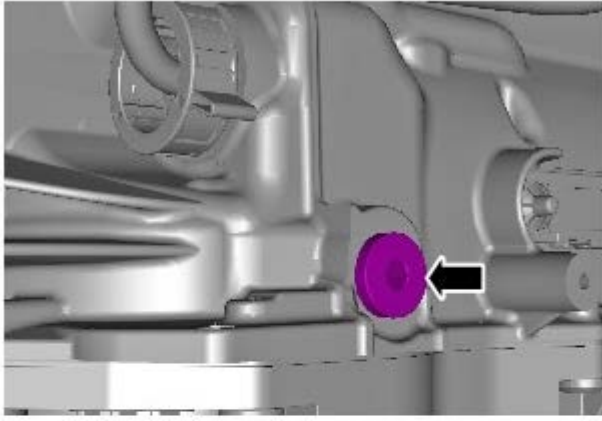
2.



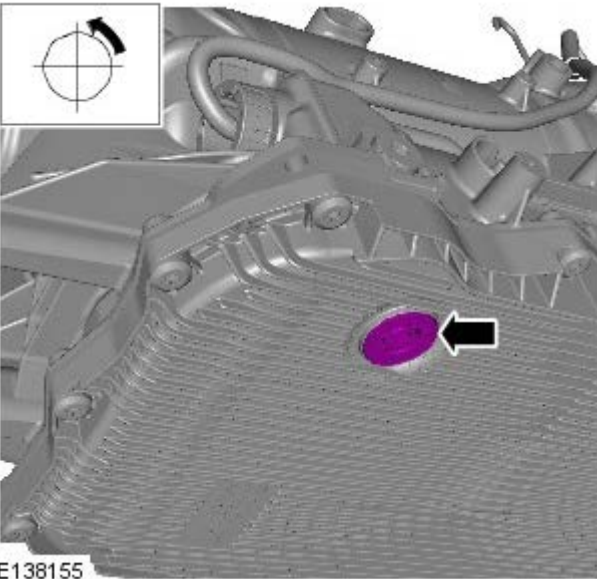
3. Place a container under the transmission.

4.

- *Special Tool(s):* [307-452](#)
- Discard the component.



E138157



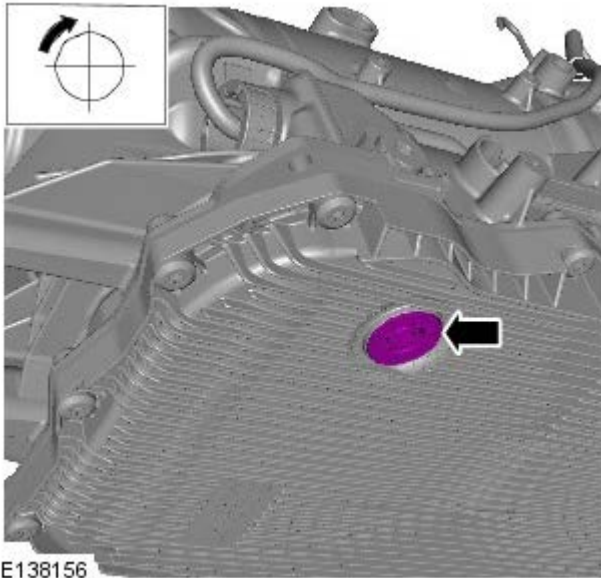
E138155

5.

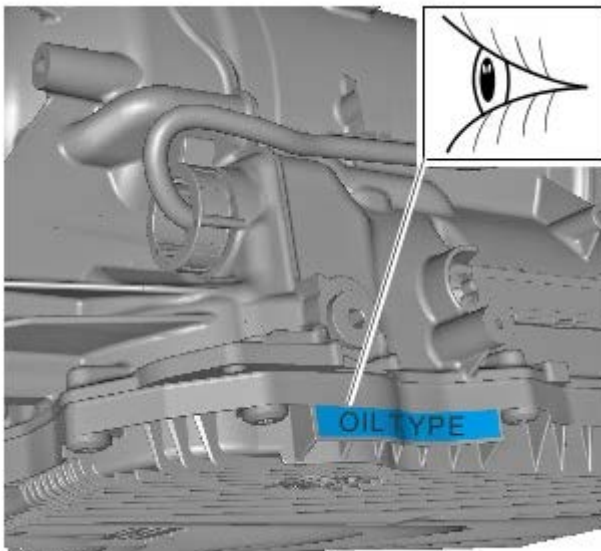
- Allow the fluid to drain.
- Discard the component.

6.

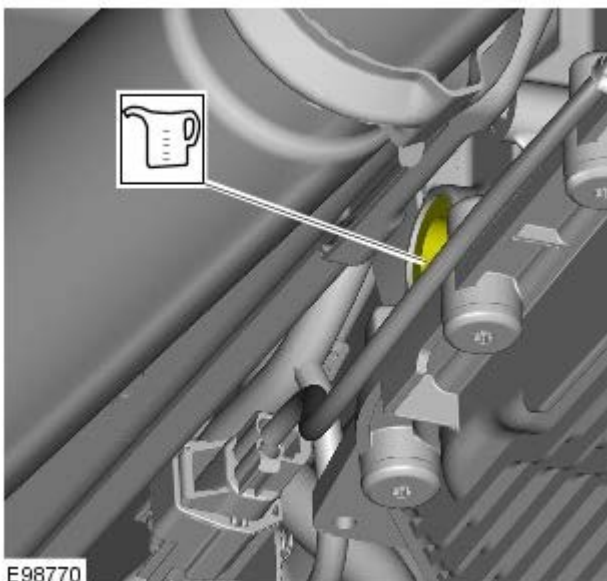
- Install a new component.
- *Torque: 8 Nm*




E138156



E138154



E98770

7.  CAUTION: Make sure the correct specification of oil is used.

Refer to: Specifications (307-01B, Specifications).


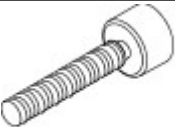
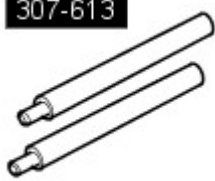


- 8.
- Refill the transmission with fluid.
 - For fluid quantity, refer to the specification's section.

9. Refer to: Transmission Fluid Level Check (307-01, General Procedures).

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Input Shaft Seal

Removal and Installation

Special Tool(s)

 <p>100-012 E54135</p>	100-012 Slide Hammer
 <p>100-012-01</p>	100-012-01 Slide Hammer Adapter
 <p>307-613 E84067</p>	307-613 Holding Pins, Torque Converter
 <p>308-375</p>	308-375 Remover, Input and Output Seal
 <p>E131592</p>	JLR-308-845 Installer, Input Shaft Seal

Removal

NOTES:




Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

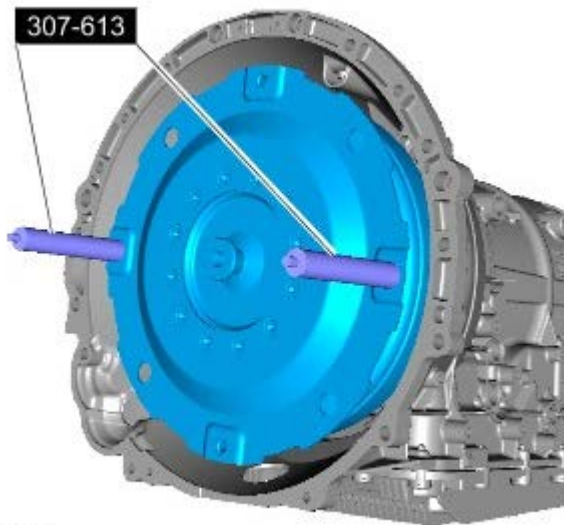
1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).


2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

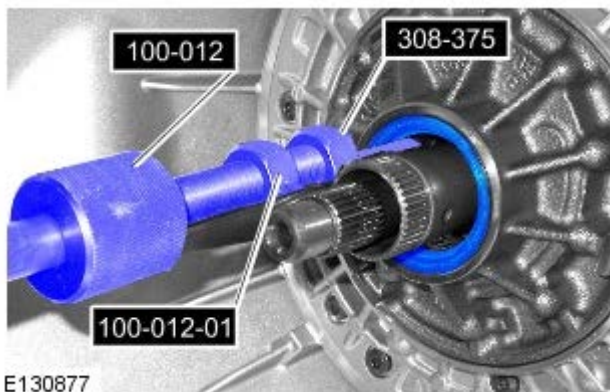
3. Refer to: [Transmission - V6 S/C 3.0L Petrol](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, Removal).



E112115

4.  CAUTION: Be prepared to collect escaping fluids.

Special Tool(s): [307-613](#)



E130877

5. CAUTIONS:

 Discard the seal.

 Care must be taken to avoid damage to the seal register and running surface.

Special Tool(s): [100-012](#), [100-012-01](#), [308-375](#)


Installation




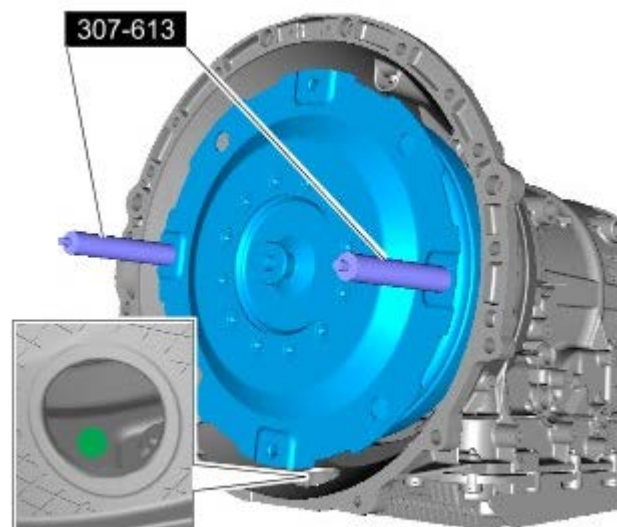
E130980

1.  CAUTION: Install a new seal.


Special Tool(s): [JLR-308-845](#)

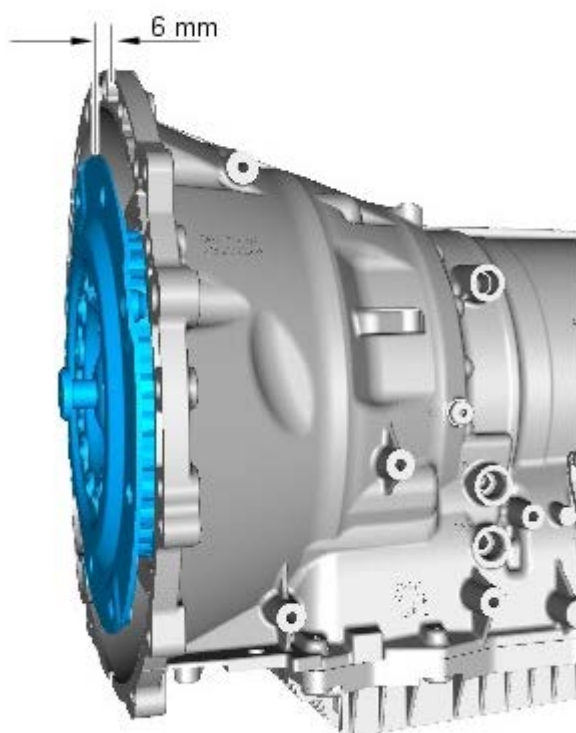
2.  CAUTION: Be prepared to collect escaping fluids.

 NOTE: Make sure that the painted mark is at the lowest possible point when the first retaining bolt is installed, as illustrated.



E112118

3.  NOTE: Make sure that the torque converter is fully engaged to the transmission.



E138283

4. Refer to: [Transmission - V6 S/C 3.0L Petrol](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, Installation).

5. Connect the battery ground cable.


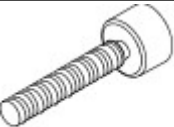
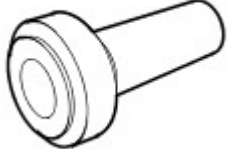


Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

6. Refer to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, General Procedures).

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Extension Housing Seal

Removal and Installation

Special Tool(s)

 <p>100-012</p> <p>E54135</p>	100-012 Slide Hammer
 <p>100-012-01</p>	100-012-01 Slide Hammer Adapter
 <p>307-520</p> <p>E52536</p>	307-520 Installer, Output Shaft Seal
 <p>308-375</p>	308-375 Remover, Input and Output Seal
 <p>E130934</p>	JLR-307-520-01 Adapter, Output Shaft Seal

Removal

WARNING: Be prepared to collect escaping fluids.



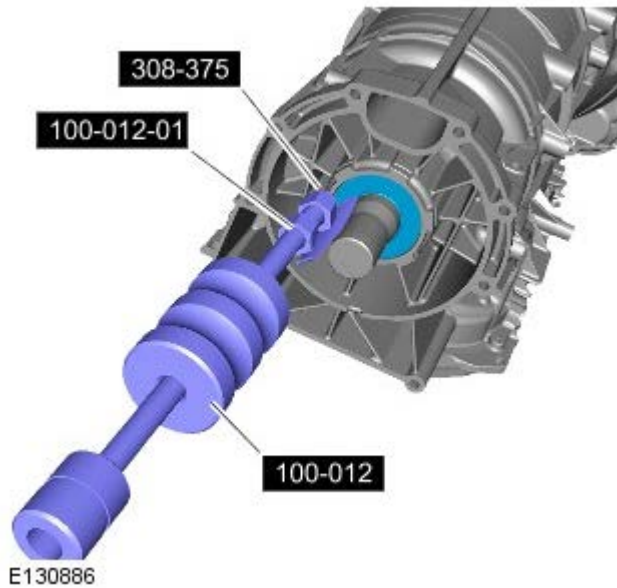
NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, Removal).
Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Removal).



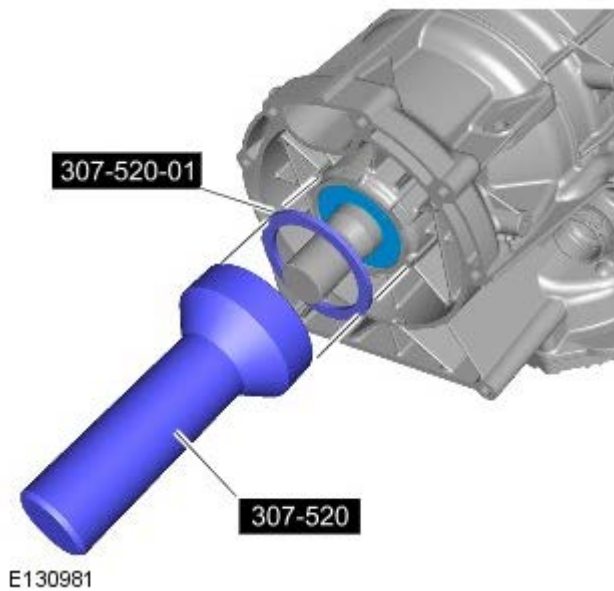
2. **CAUTION:** Care must be taken to avoid damage to the seal register and running surface.

Special Tool(s): [100-012](#), [100-012-01](#), [308-](#)




[375](#)

Installation



1. CAUTIONS:

 Oil seals must be installed dry.

 Make sure that the mating faces are clean and free of foreign material.

Special Tool(s): [307-520](#), [JLR-307-520-01](#)

2. Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, Installation).
Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Installation).


3. Carry out a transmission fluid level check.

Refer to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, General Procedures).

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission Control Module (TCM) and Main Control Valve Body

Removal and Installation

Special Tool(s)

 <p>E130935</p>	<p>JLR-308-844 Remover/Installer, Transmission Control Module Electrical Connector</p>
--	--

Removal



WARNING: Be prepared to collect escaping fluids.



CAUTION: Make sure all suitable safety precautions are taken to protect the TCM and main control valve body electrical connector pins against electrostatic discharge.




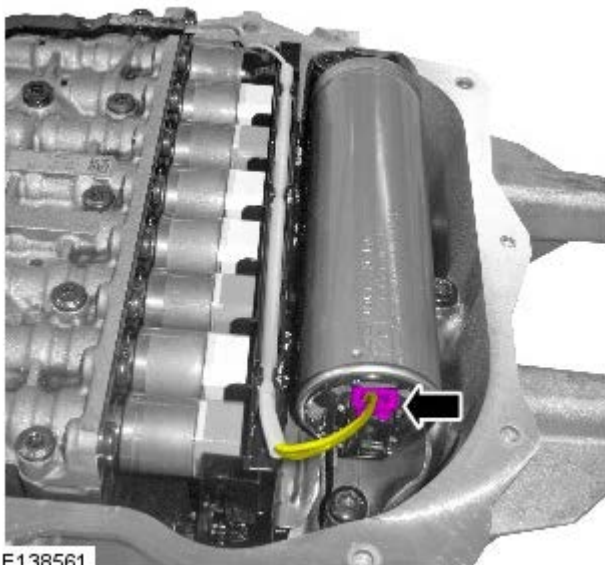
NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

All vehicles

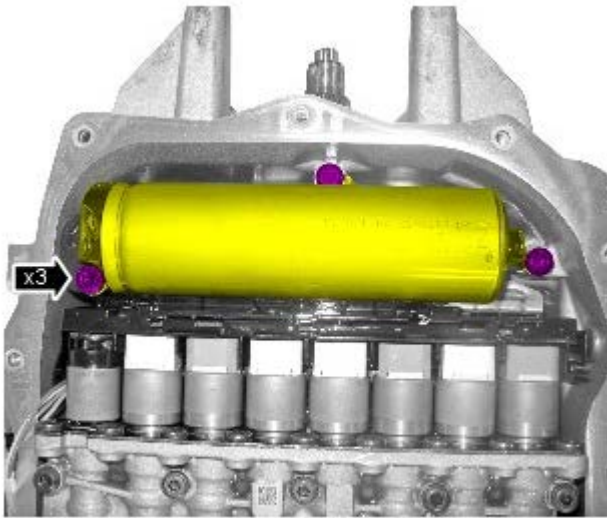
1. Refer to: [Transmission Support Crossmember - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).
2. Refer to: [Transmission Fluid Pan, Gasket and Filter](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, Removal and Installation).

Vehicles with Stop/Start

3.  **CAUTION:** Take precautions to avoid any electrostatic charging, which could damage this component.



4.



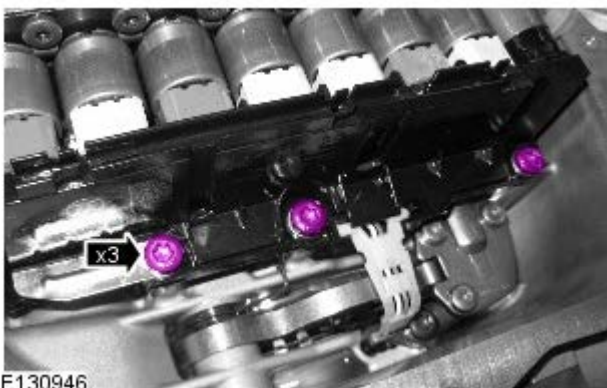
E138562







E138563

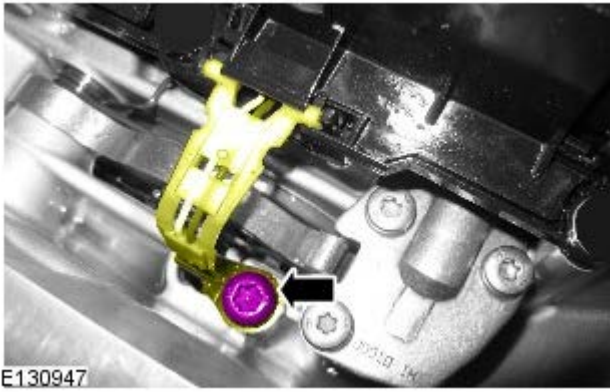
5.  CAUTION: Remove and discard the O-ring seals.

All vehicles

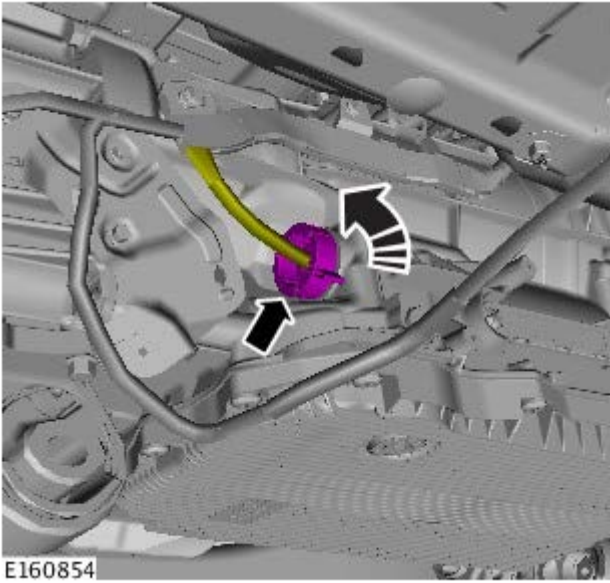



E130946

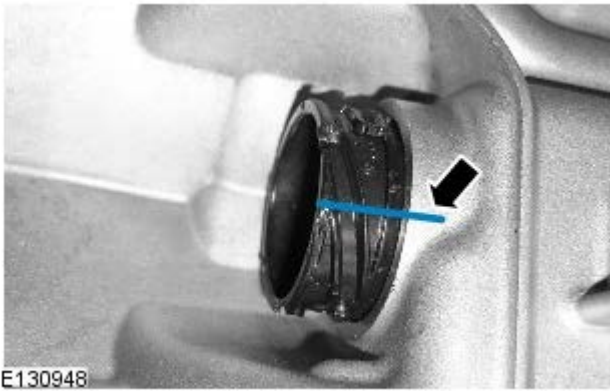
6. CAUTIONS:
 -  Make sure all suitable safety precautions are taken to protect the TCM and main control valve body electrical connector pins against electrostatic discharge.
 -  Discard the bolts.
 -  Take precautions to avoid any electrostatic charging, which could damage this component.
7.  CAUTION: Discard the bolt.



8.



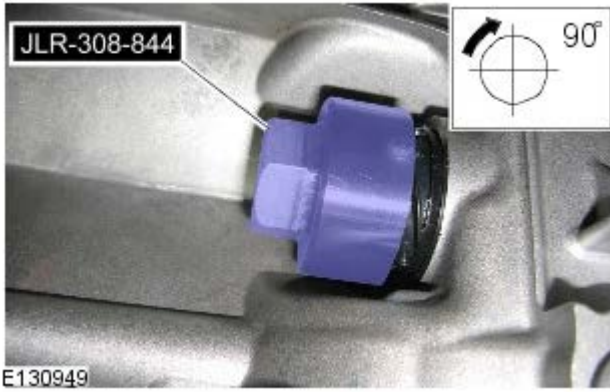
9.  NOTE: Note the orientation of the component prior to removal.



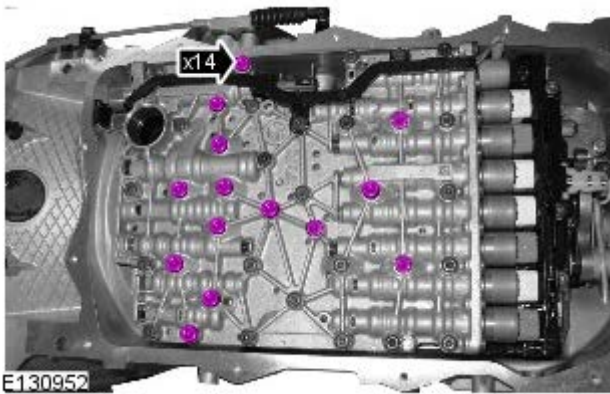
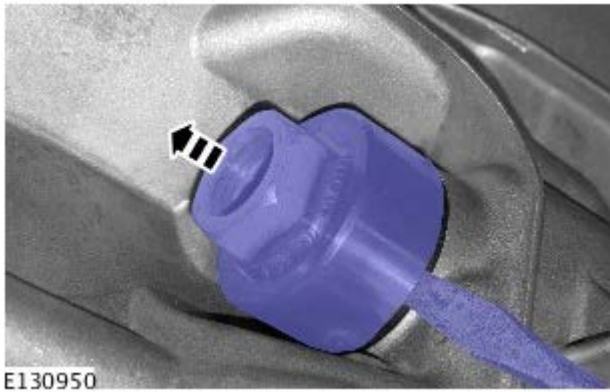
10.





11. *Special Tool(s):* [JLR-308-844](#)



12.



13.  CAUTION: Discard the bolts.
Torque: 8 Nm

14.  NOTE: Note the position of the manual park brake release.



E130953


Installation

All vehicles

1.



E150701

2.  **NOTE:** Make sure that the component is installed to the noted removal position.



E130953

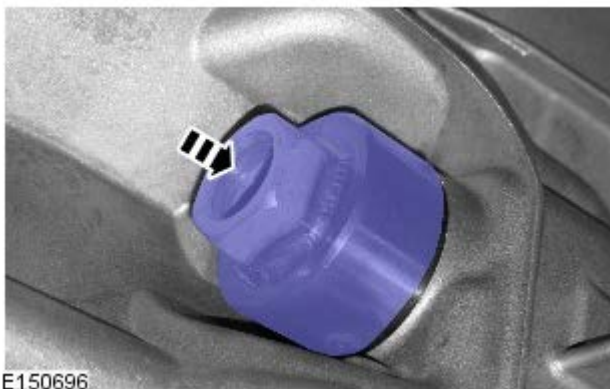
3.

- *Special Tool(s):* [JLR-308-844](#)



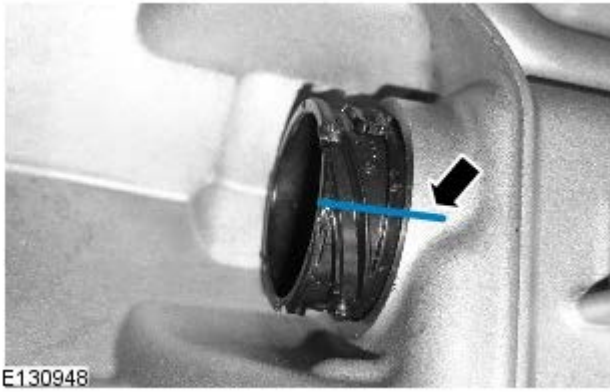
E150812

4.



E150696

5.  CAUTION: Make sure that the electrical

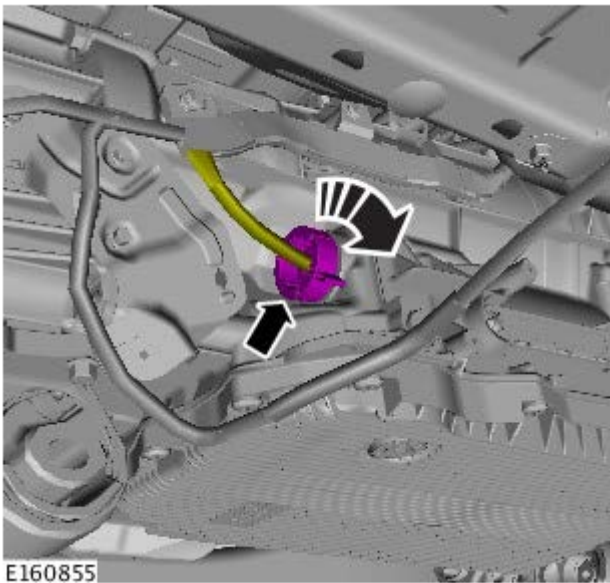


connector is installed in the correct orientation as noted in the removal step.


6.



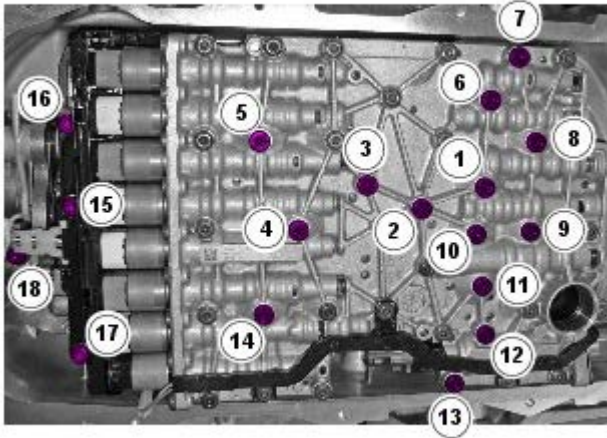
7. Torque: 10 Nm



8.  CAUTION: Make sure that new bolts are installed.

 NOTE: Tighten the retaining bolts evenly and progressively.

Torque: 8 Nm



E130933


Vehicles with Stop/Start

9.  CAUTION: A new O-ring seal is to be installed.

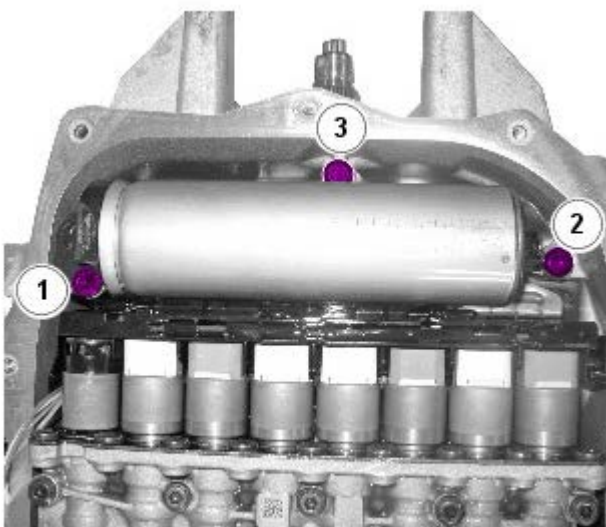


E138563

10.  CAUTION: Make sure that new bolts are installed.

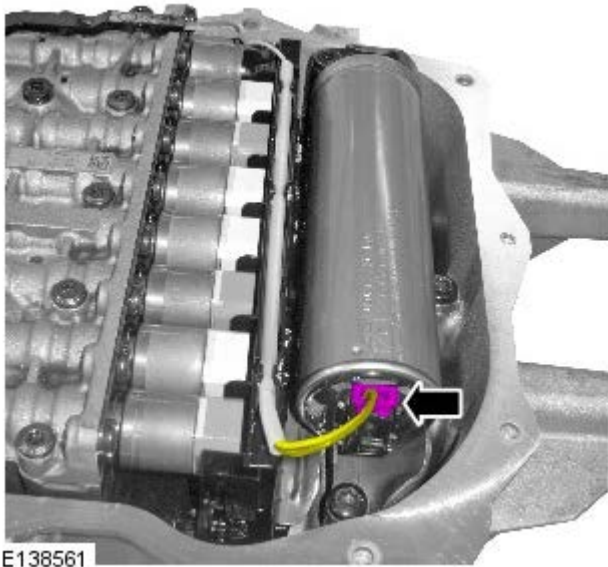
 NOTE: Tighten the retaining bolts evenly and progressively.

Torque: 8 Nm



E138566

11.



E138561

All vehicles

12. Refer to: [Transmission Fluid Pan, Gasket and Filter](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, Removal and Installation).
13. Refer to: [Transmission Support Crossmember - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).
14. Using the diagnostic tool, calibrate the main control valve body and the transmission control module (TCM).

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission Fluid Pan, Gasket and Filter

Removal and Installation

General Equipment

Transmission jack

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

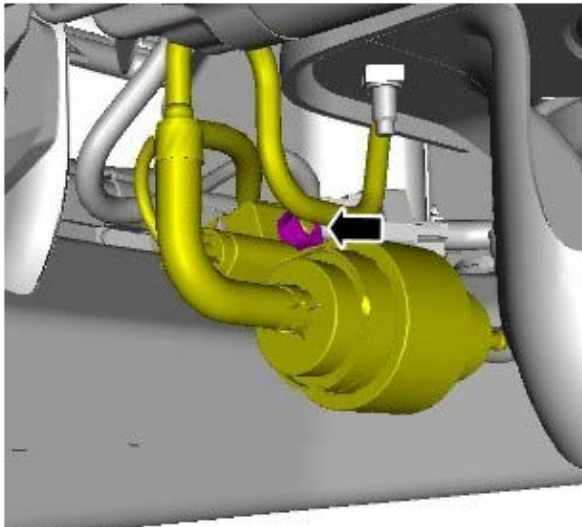
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Refer to: [Transmission Fluid Drain and Refill](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, General Procedures).

4. Torque: 10 Nm

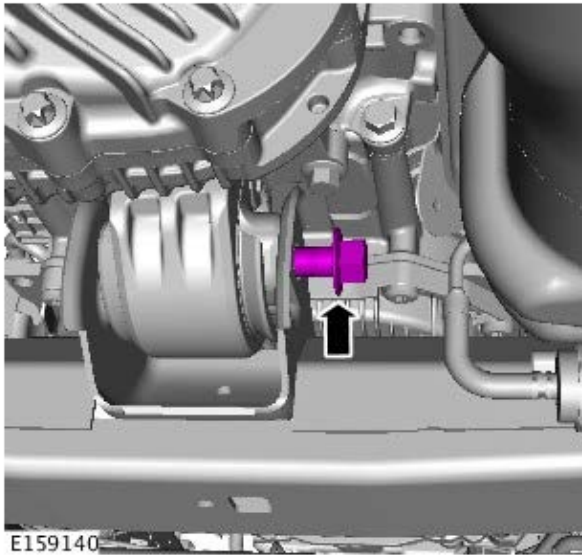


E159139

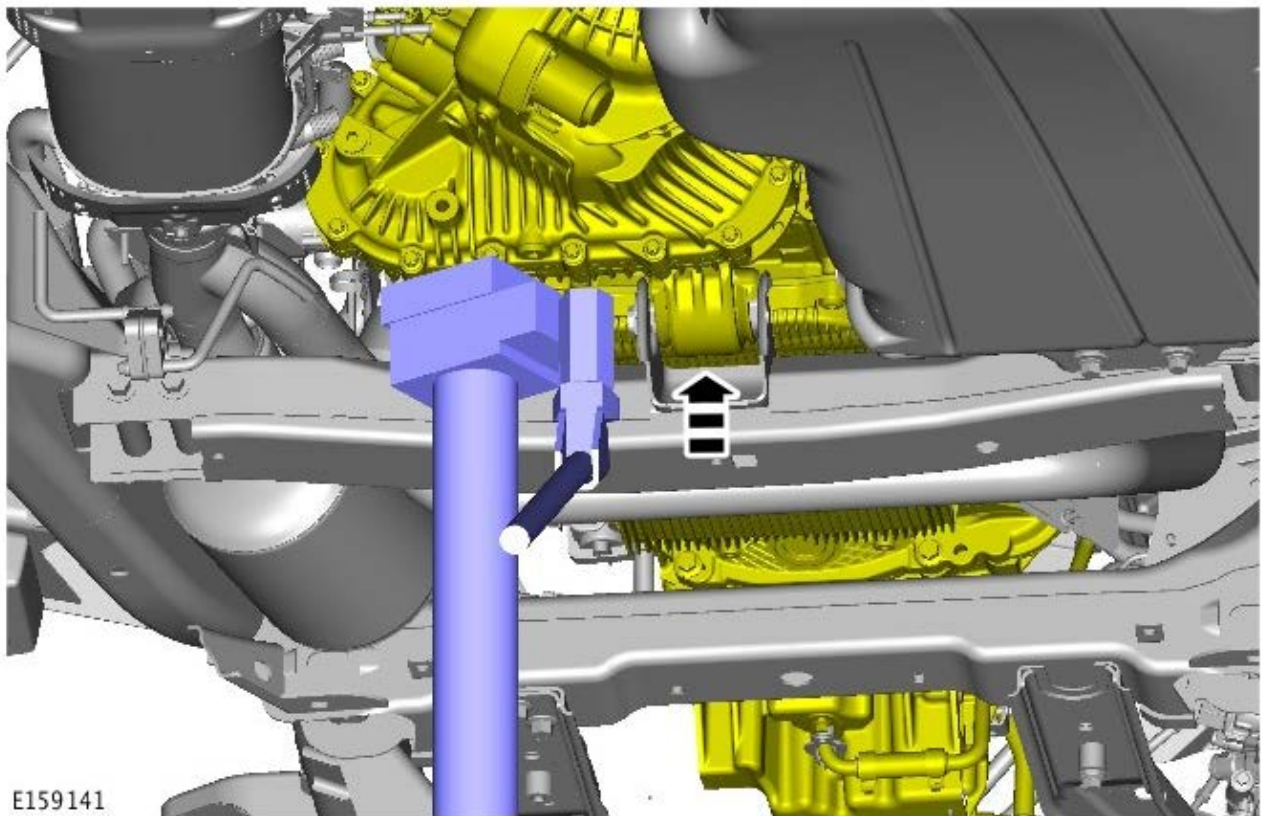
5. Using the transmission jack, support the transmission.

General Equipment: [Transmission jack](#)






6. Torque: 175 Nm



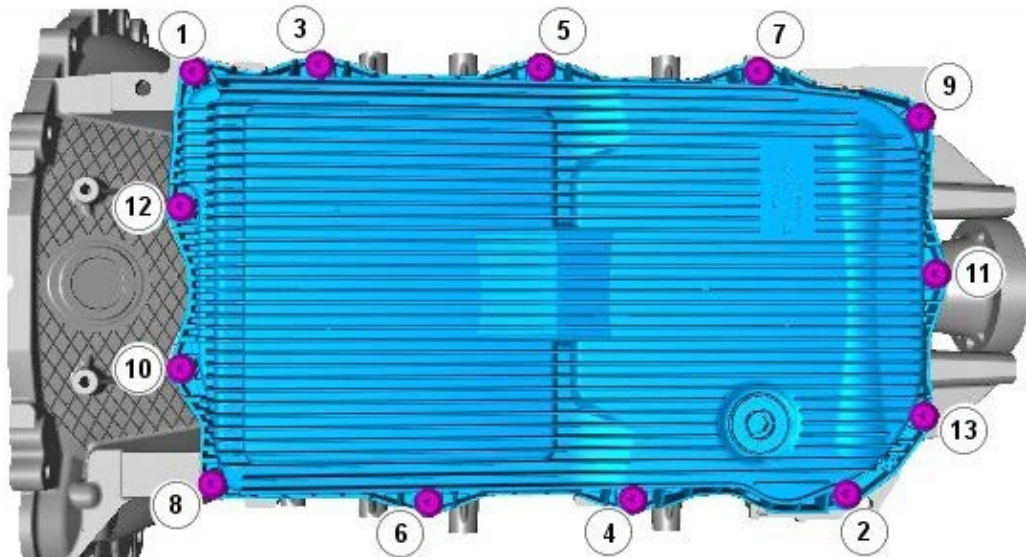
7.



8. CAUTIONS:

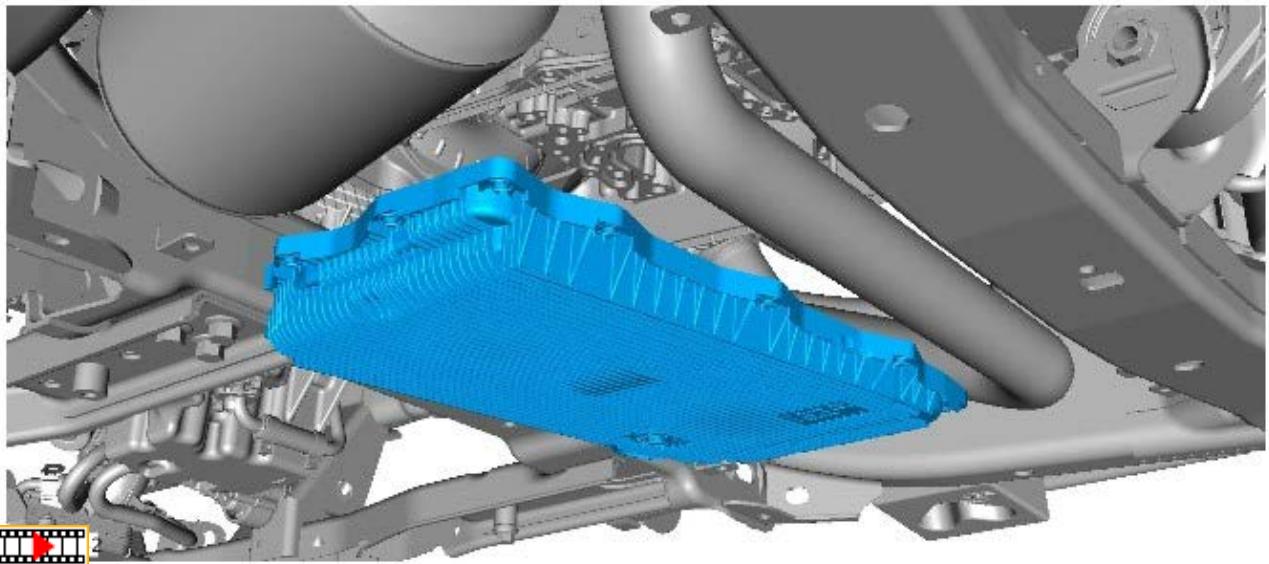
-  Take extra care when removing the component, prevent damage to the mating faces.
-  Make sure that the area around the component is clean and free of foreign material.
-  Be prepared to collect escaping fluids.
-  Discard all components including pan and bolts.
-  Remove and install pan bolts in order sequence 1 to 13.

Torque: 10 Nm

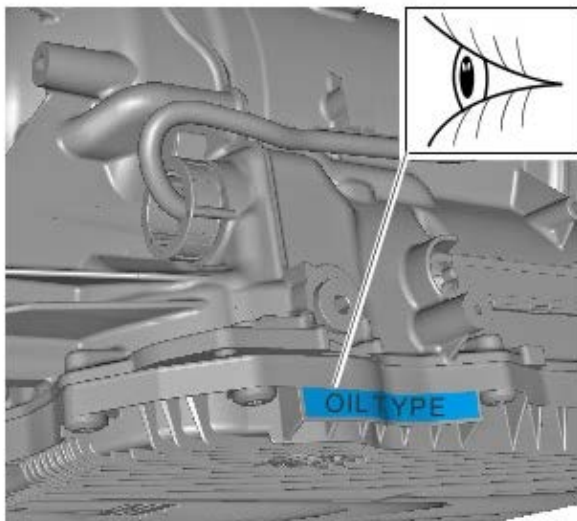


E138159

9.  NOTE: Turn pan through 90 degrees to allow removal.






Installation



E138154

1. CAUTIONS:

-  Make sure the correct specification of oil is used.
-  Make sure that new components are installed.
-  Make sure that the mating faces are clean and free of foreign material.

To install, reverse the removal procedure.

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission Support Insulator

Removal and Installation

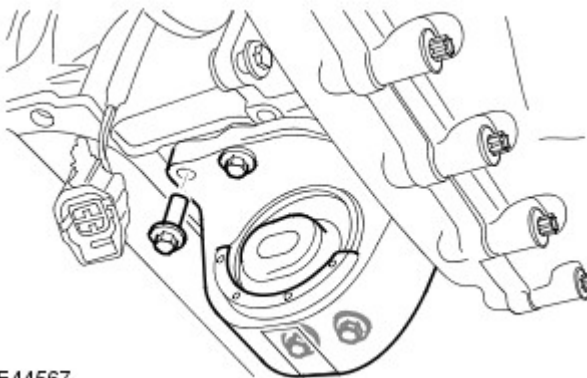
Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the transmission crossmember.
For additional information, refer to: Transmission Support Crossmember - 5.0L (502-02, Removal and Installation) / Transmission Support Crossmember - 3.0L Diesel (502-02, Removal and Installation).

3. Remove the transmission support insulator.
 - Remove the 4 bolts.



E44567




Installation

1. To install, reverse the removal procedure.
 - Clean the component mating faces.
 - Tighten the bolts to 60 Nm (44 lb.ft).

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Selector Shaft Seal

Removal and Installation

Special Tool(s)

 <p>307-509-1</p> <p>E50766</p>	<p>Seal extractor 307-509-1(LRT-44-033/1)</p>
 <p>307-509-2</p> <p>E50767</p>	<p>Seal extractor 307-509-2(LRT-44-033/2)</p>
 <p>307-509-3</p> <p>E50768</p>	<p>Seal installer 307-509-3(LRT-44-033/3)</p>

Removal

NOTES:



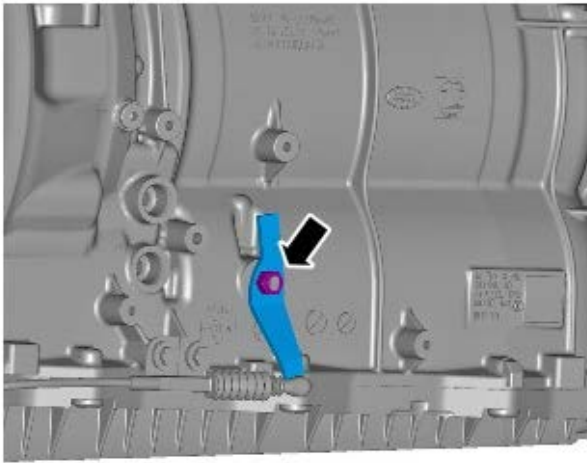
Some variation in the illustrations may occur, but the essential information is always correct.




Some illustrations may show the transmission removed for clarity.

1. For additional information, refer to: [Catalytic Converter LH](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).
2. For additional information, refer to: [Front Driveshaft - V6 S/C 3.0L Petrol](#) (205-01 Driveshaft, Removal and Installation).

3.

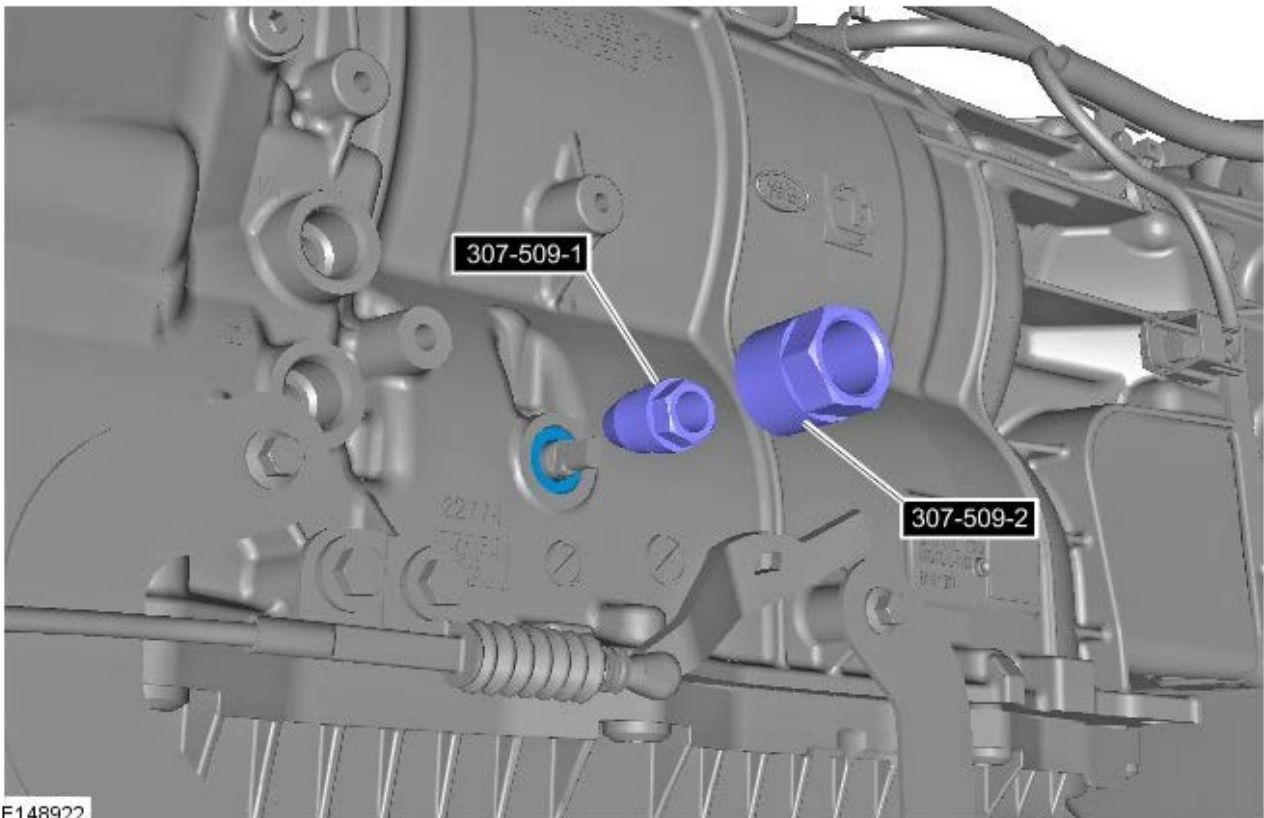


E149590

4.  **WARNING:** Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.


 **CAUTION:** Discard the seal.

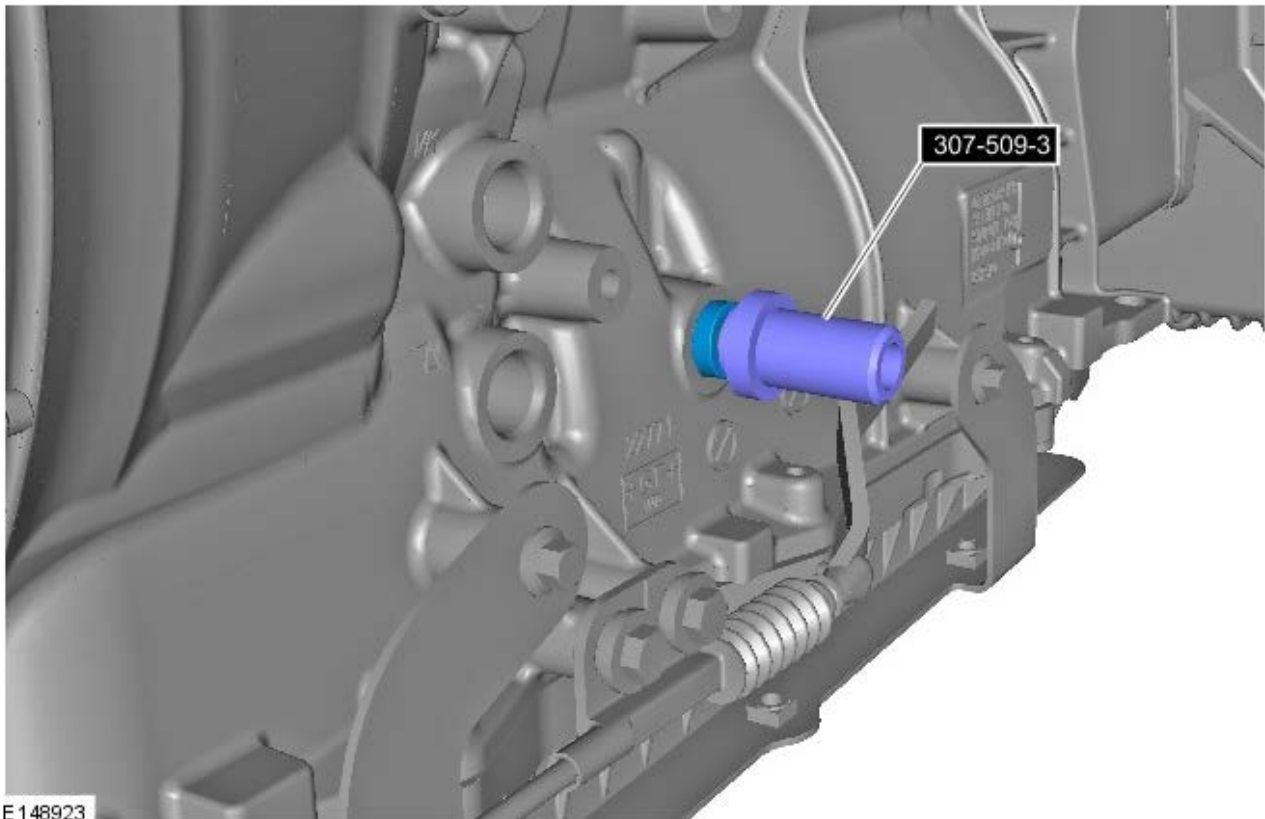
Install 307-509-2 to 307-509-1 and extract the seal.



E148922

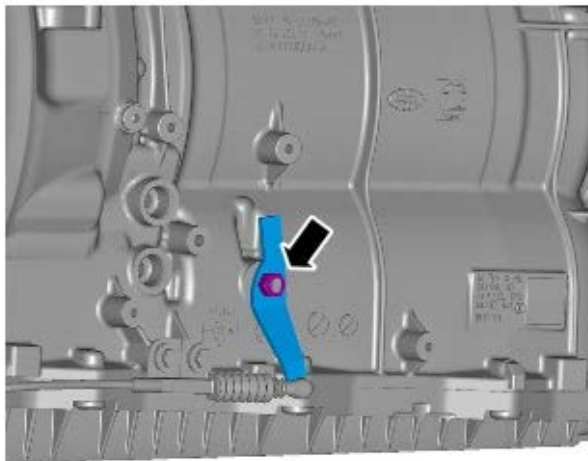
Installation

1.  **CAUTION:** Make sure that the seal is correctly located.
Using 307-509-3, install the selector shaft seal.



E148923

2. TORQUE: 12 Nm



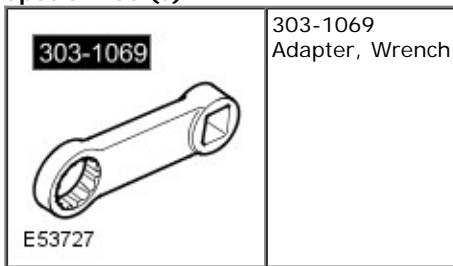
E149590

3. For additional information, refer to: [Front Driveshaft - V6 S/C 3.0L Petrol](#) (205-01 Driveshaft, Removal and Installation).
4. For additional information, refer to: [Catalytic Converter LH](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).
5. For additional information, refer to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, General Procedures).

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission TDV6 3.0L Diesel

Removal

Special Tool(s)



General Equipment

Transmission jack

NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.

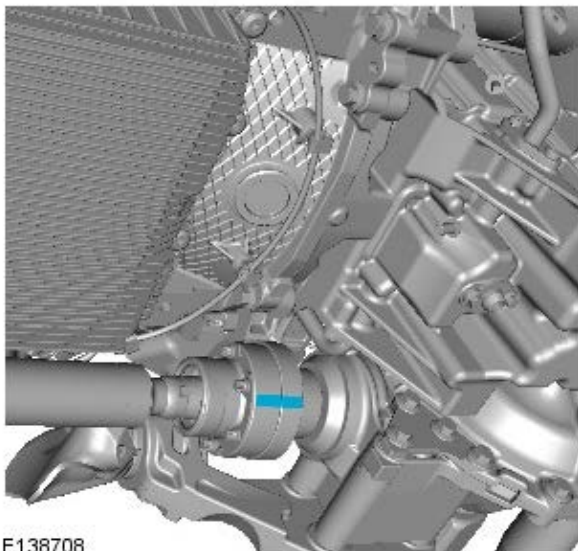


Some illustrations may show the transmission removed for clarity.




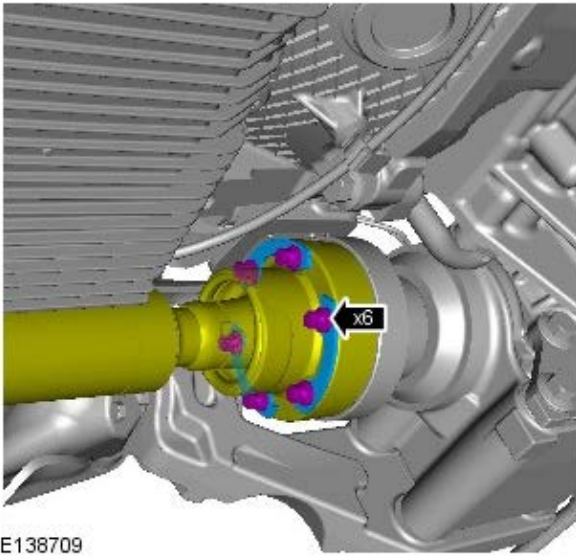
Some illustrations may show the engine removed for clarity.

1. Disconnect the battery ground cable.
2.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
3. Refer to: Exhaust System (309-00A, Removal and Installation).
4. Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).
- 5.



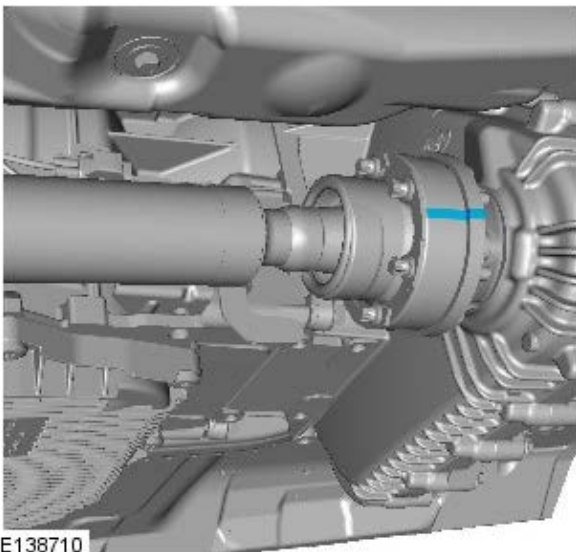
E138708

6.  **CAUTION:** Discard the bolts.
Using a suitable tie strap, secure the driveshaft.



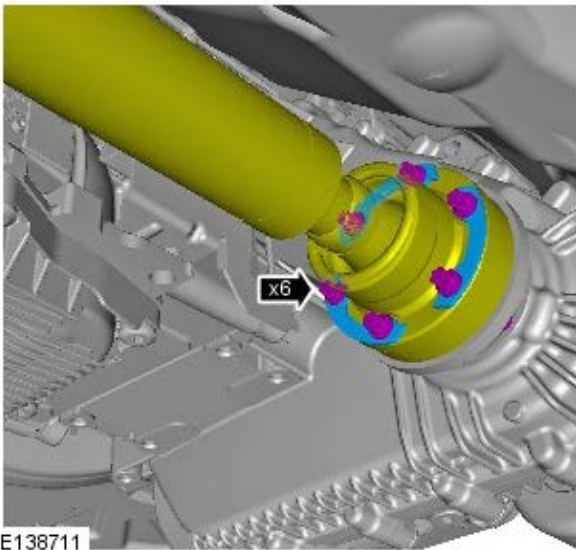
E138709

7.



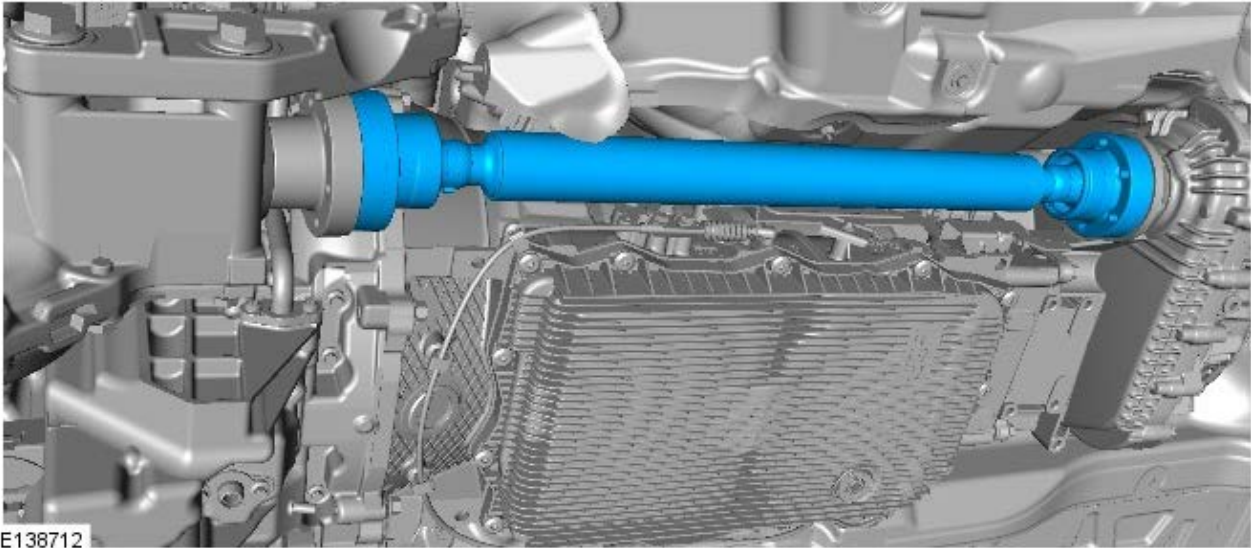
E138710

8.  CAUTION: Discard the bolts.



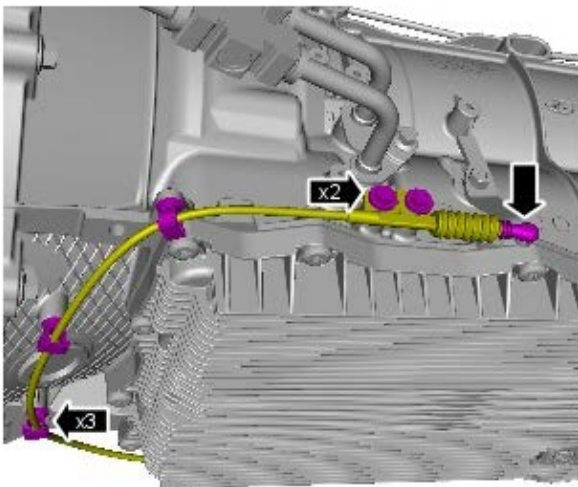
E138711

9.



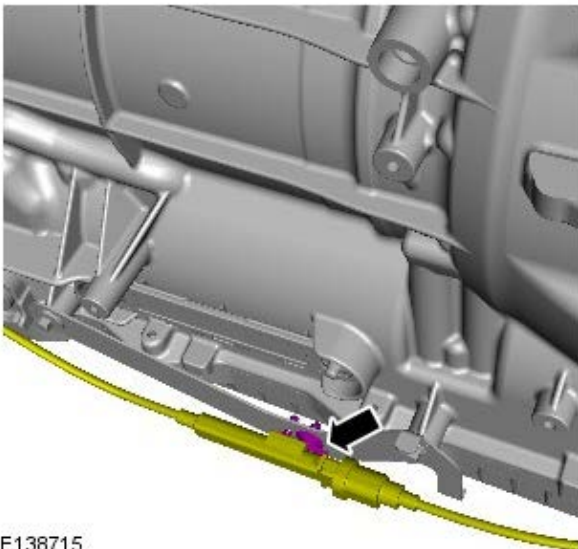
E138712

10.





E138714

11.  NOTE: Discard the retaining clip.

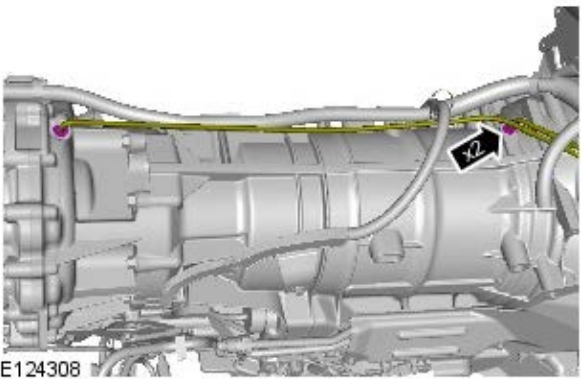
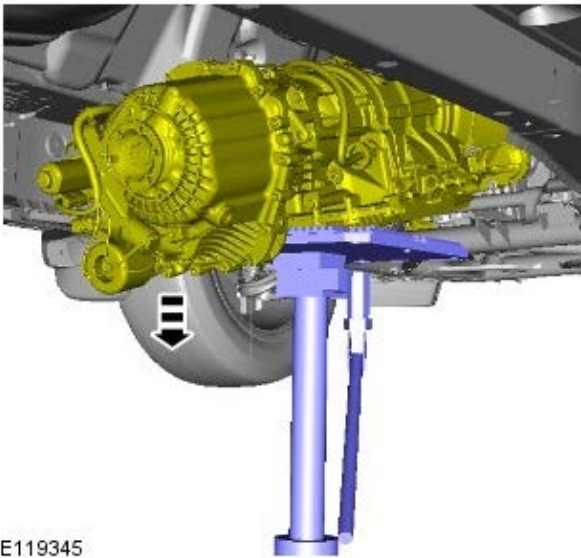
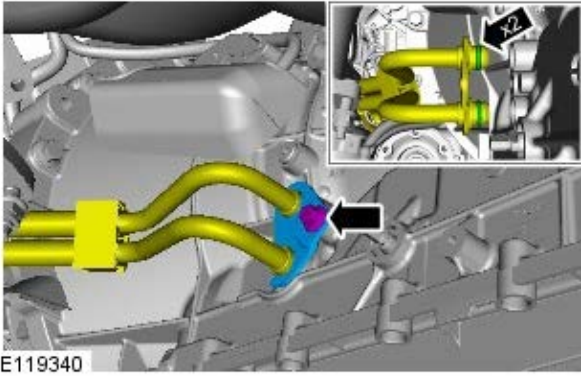



E138715

12.  WARNING: Be prepared to collect escaping fluids.

 NOTE: Make sure that all openings are sealed. Use new blanking caps.

Remove and discard the 2 O-ring seals.

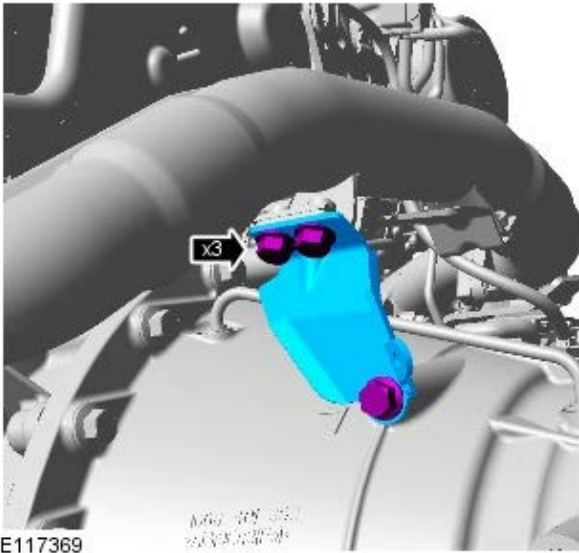


13.  **WARNING:** Make sure that the transmission is secured with suitable retaining straps.

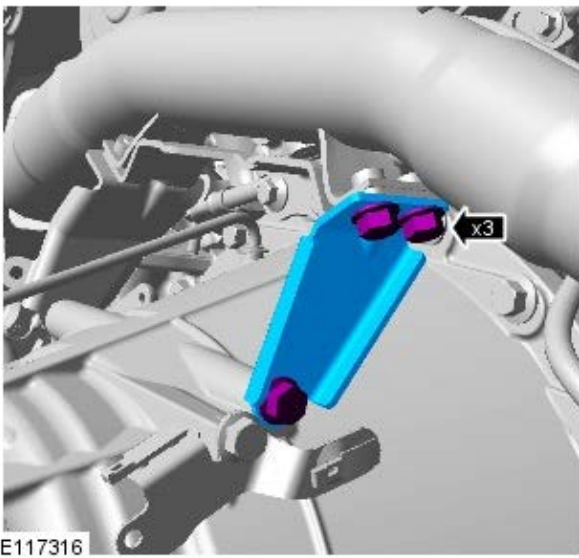
- *General Equipment:* [Transmission jack](#)
- Lower the rear of the transmission for access.

14.

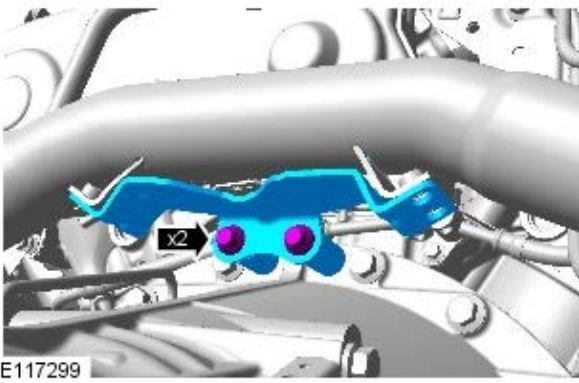
15.



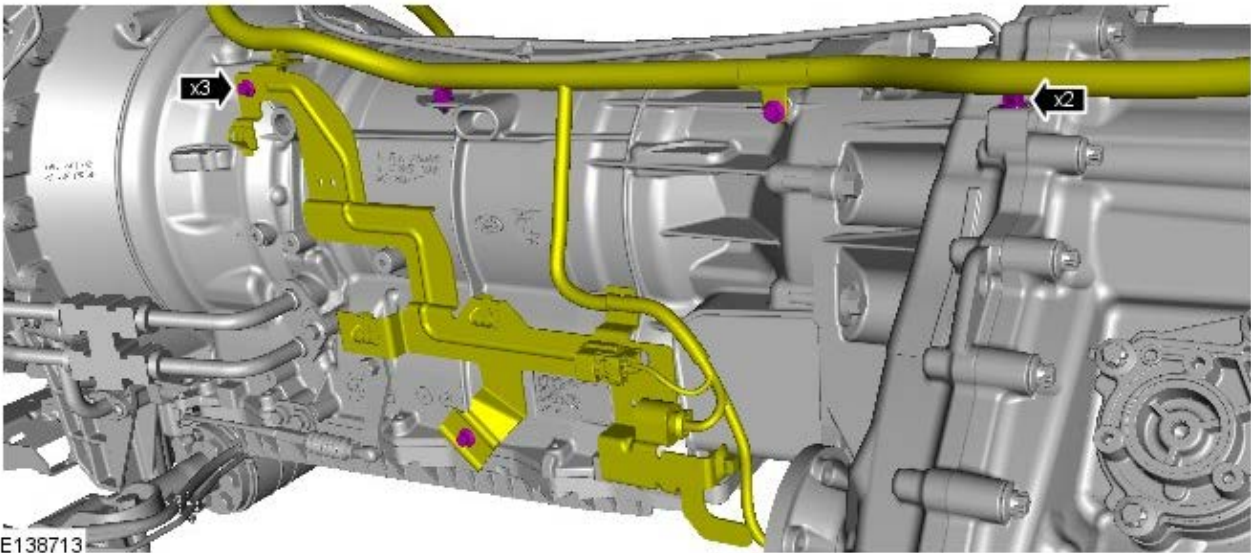
16.



17.

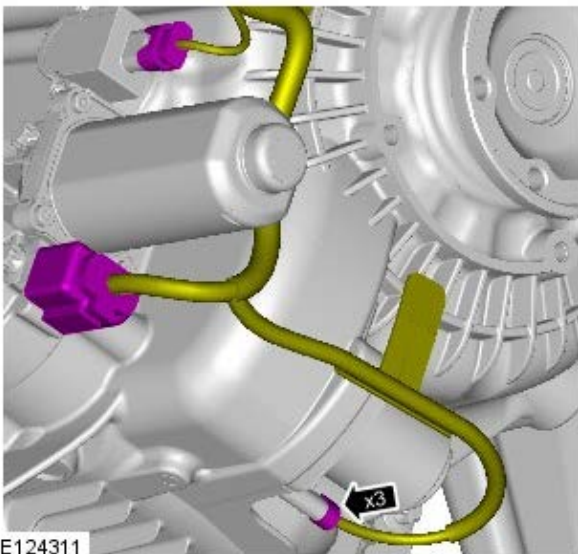


18.



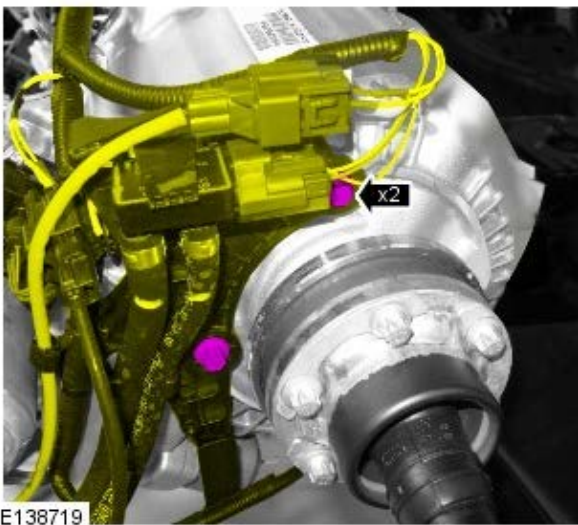
E138713

19.



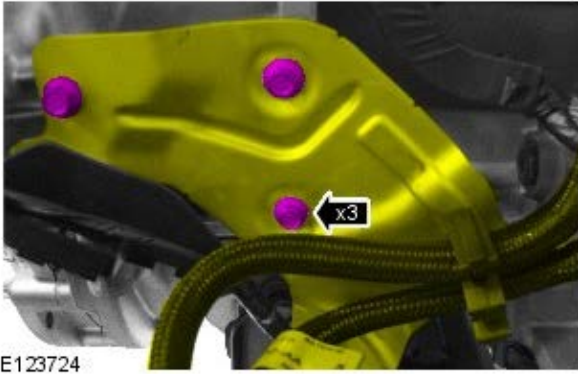
E124311

20.



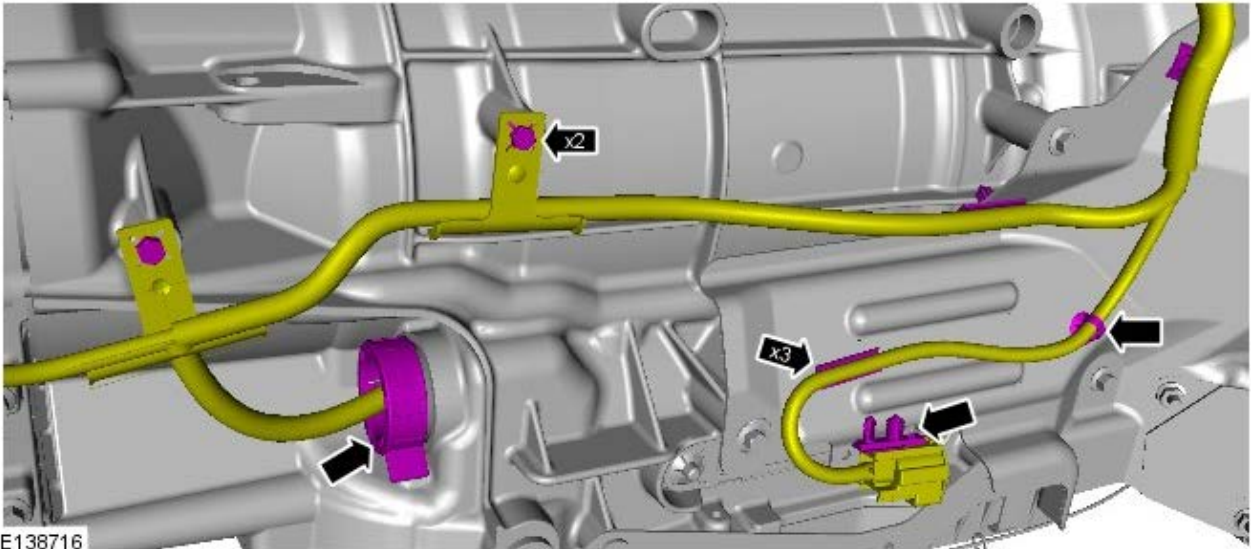
E138719

21.



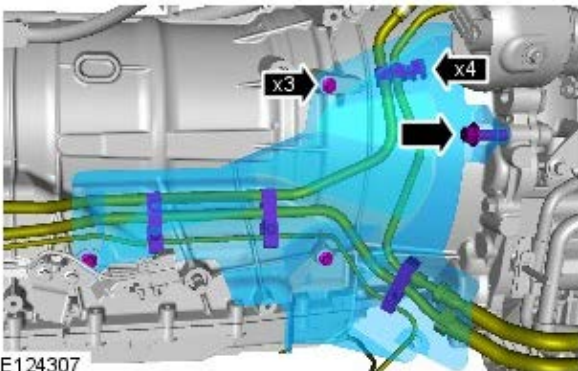
E123724

22.




E138716


23.

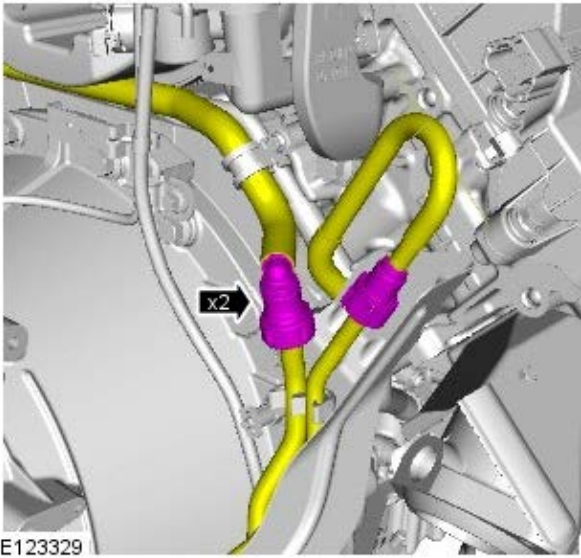


E124307

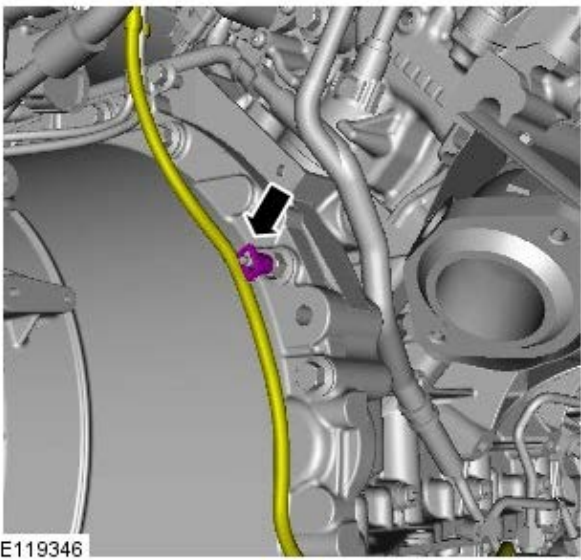
24.  **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 **CAUTION:** Be prepared to collect escaping fluids.

 **NOTE:** Make sure that all openings are sealed. Use new blanking caps.

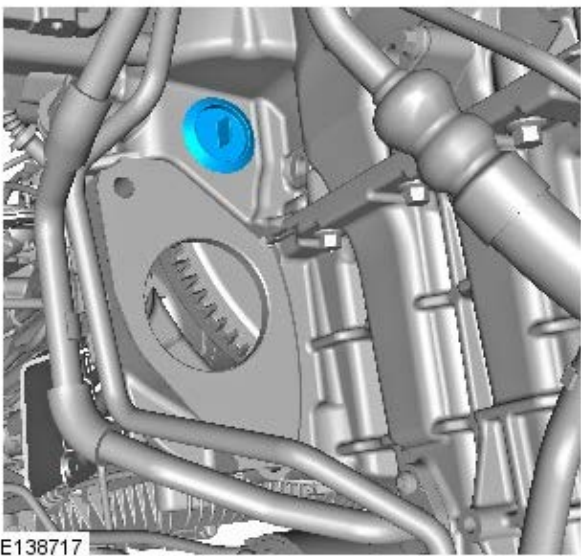


25.

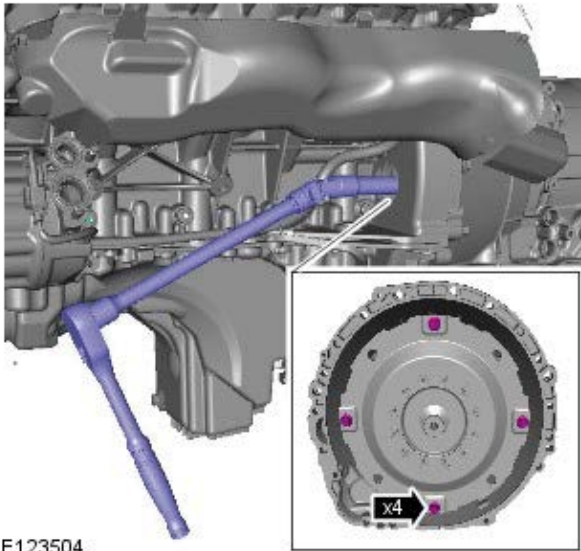


26. Refer to: Starter Motor (303-06 Starting System - TDV6 3.0L Diesel, Removal and Installation).

27.

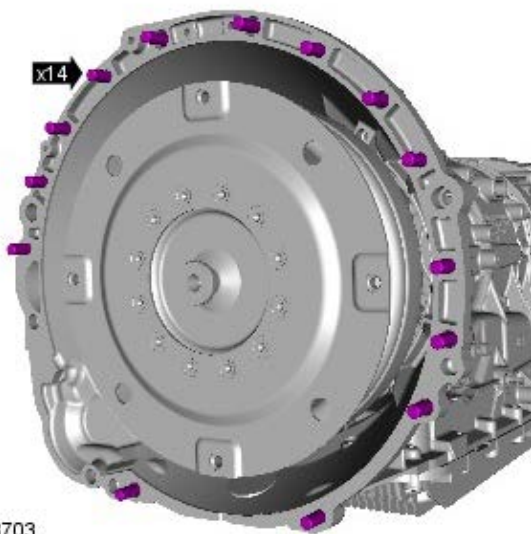


28.




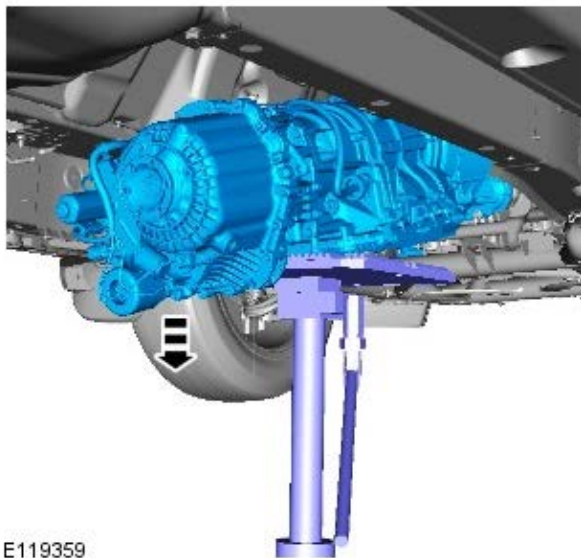
E123504

29.



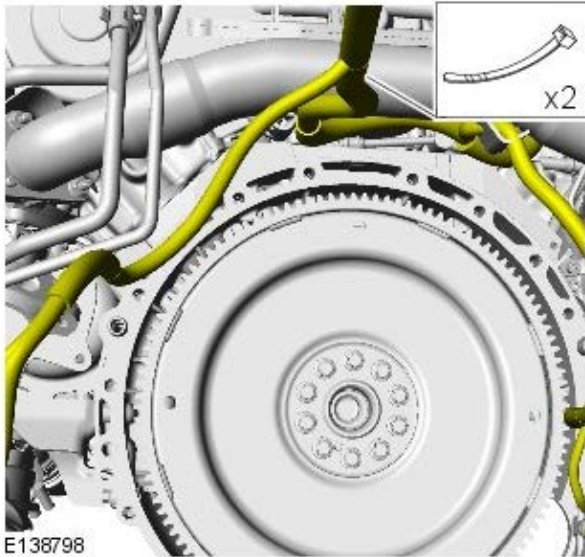
E138703


30.  **WARNING:** Make sure that the transmission is secured with suitable retaining straps.

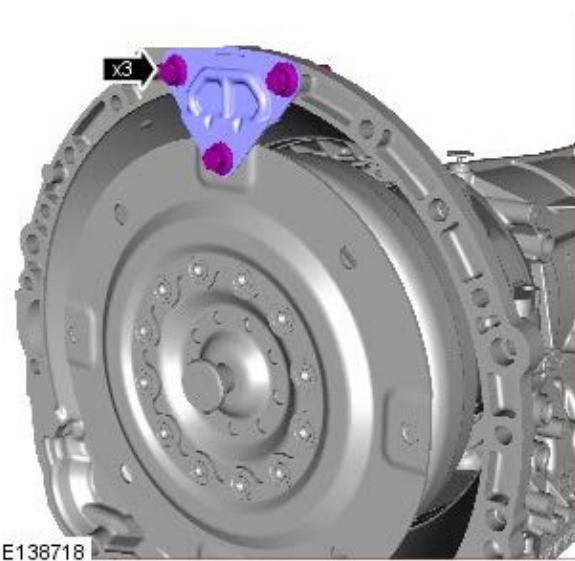



E119359

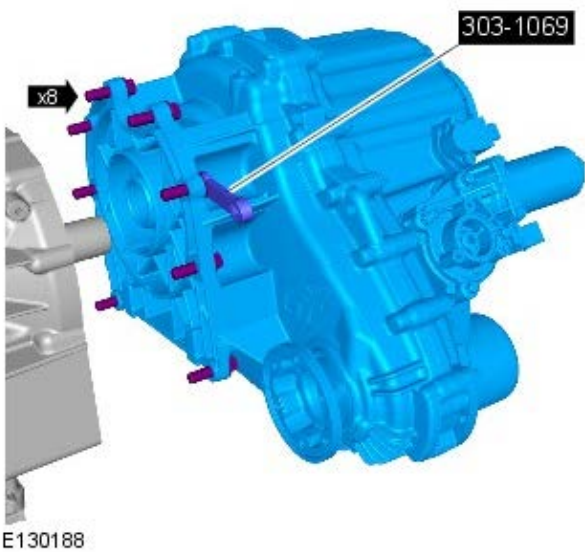
31. Carefully tie the harness aside.





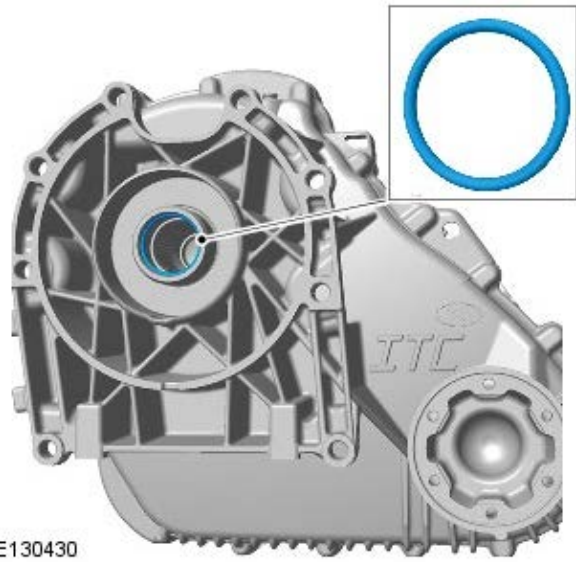
32.  CAUTION: Make sure that the torque converter remains in the transmission.



33.  NOTE: Do not disassemble further if the component is removed for access only.
Special Tool(s): [303-1069](#)



34.  CAUTION: Inspect the seal, replace if damaged
 NOTE: Remove and discard the O-ring seal.




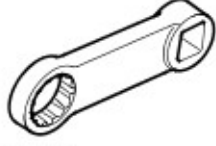

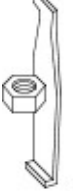


E130430

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission V6 S/C 3.0L Petrol

Removal

Special Tool(s)

 <p>100-012</p> <p>E54135</p>	<p>100-012 Slide Hammer</p>
 <p>100-012-01</p>	<p>100-012-01 Slide Hammer Adapter</p>
 <p>303-021</p>	<p>303-021 Engine support bracket</p>
 <p>303-1069</p> <p>E53727</p>	<p>303-1069 Adapter, Wrench</p>
 <p>E115255</p>	<p>303-1435 Engine Lifting Brackets Rear</p>
 <p>308-375</p>	<p>308-375 Remover, Input and Output Seal</p>

NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.

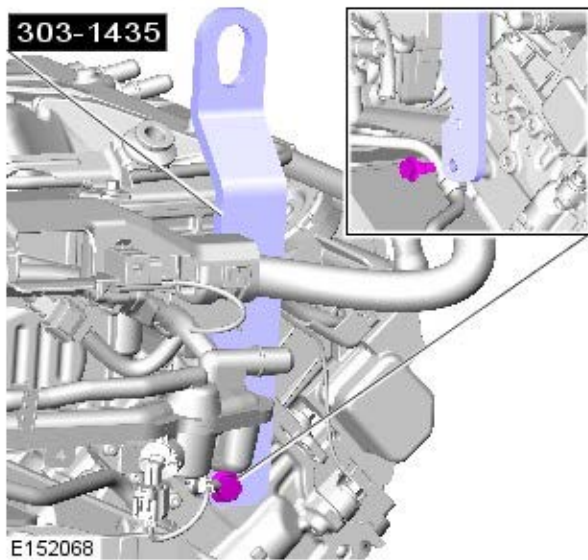


Some illustrations may show the transmission removed for clarity.

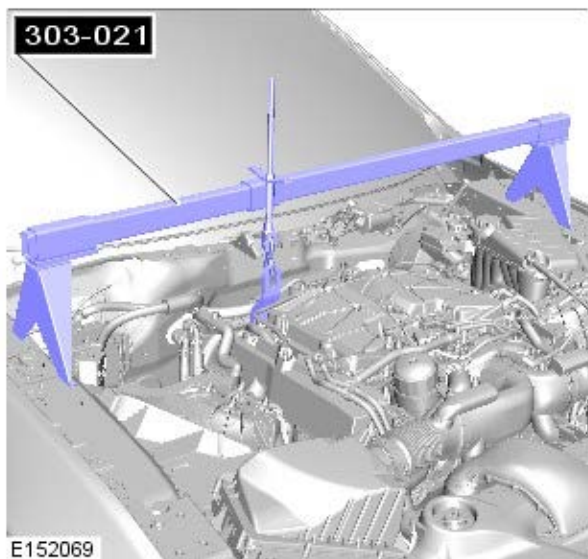
1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-01 Battery, Mounting and Cables, Specifications).

2. Refer to: [Plenum Chamber](#) (412-01 Air Distribution and Filtering, Removal and Installation).



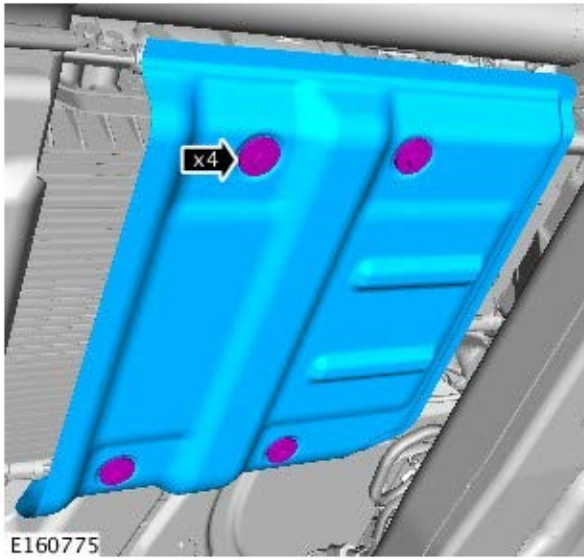
3. *Special Tool(s):* [303-1435](#)
Torque: 40 Nm



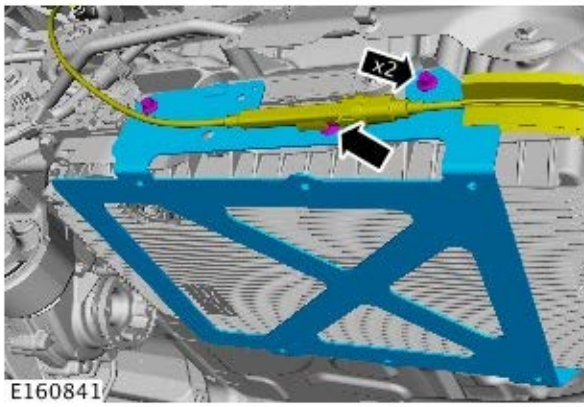
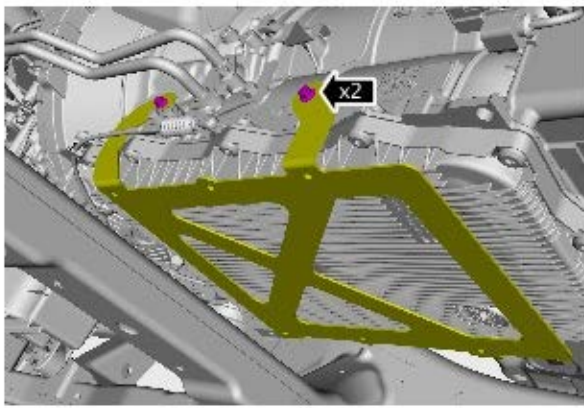
4. *Special Tool(s):* [303-021](#)

5. Refer to: [Cooling System Partial Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).
6. Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).
7. Refer to: Front Driveshaft - V6 S/C 3.0L Petrol (205-01, Removal and Installation).
8. Refer to: [Rear Driveshaft](#) (205-01 Driveshaft, Removal and Installation).

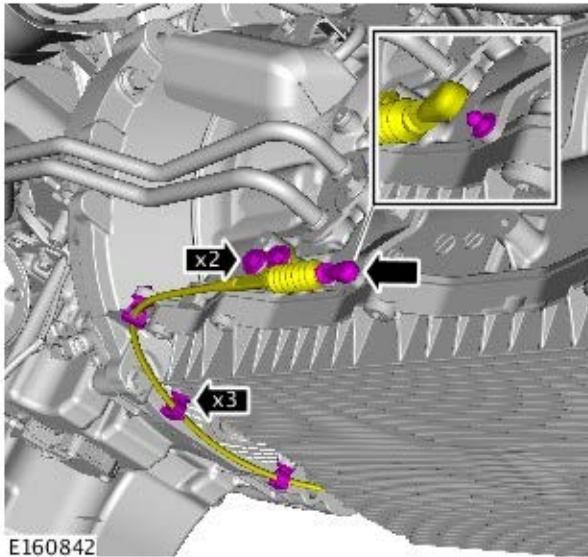
9.





10.

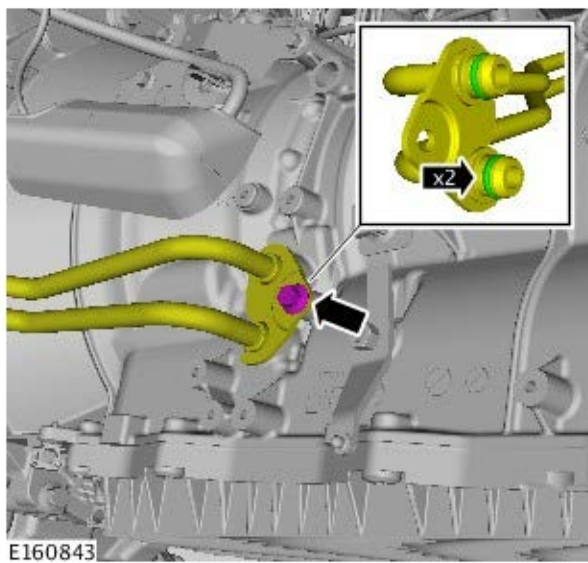


11.

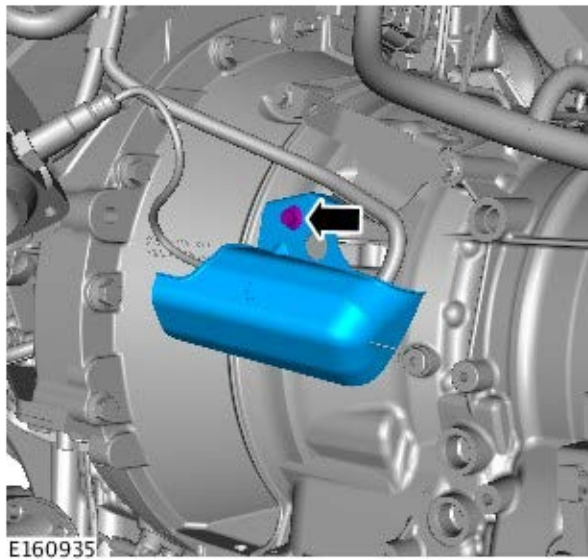


12. CAUTIONS:

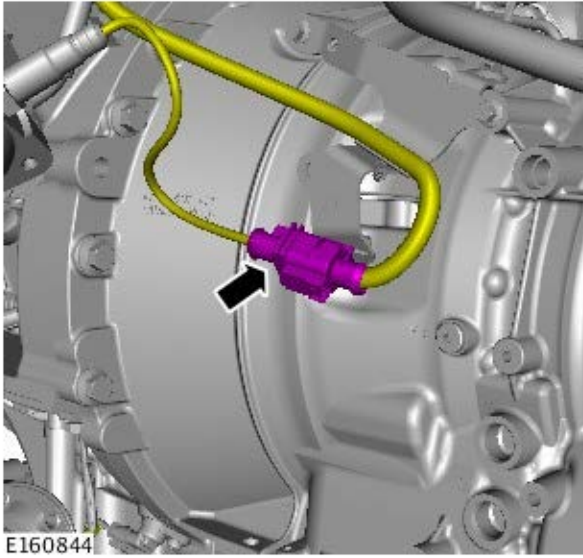
-  Be prepared to collect escaping fluid.
-  Remove and discard the seals.



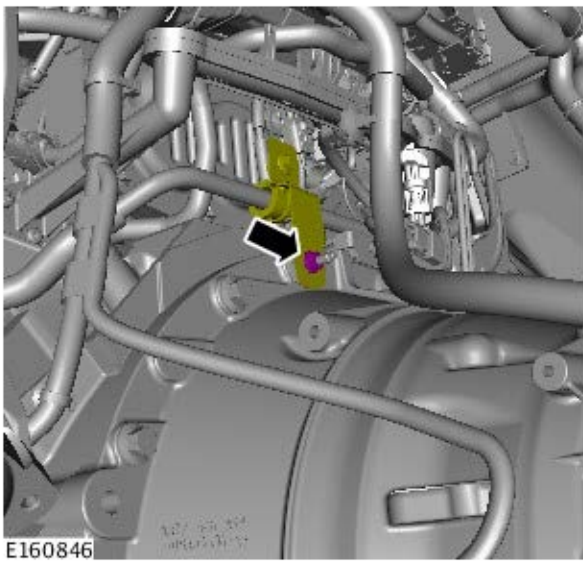
13.



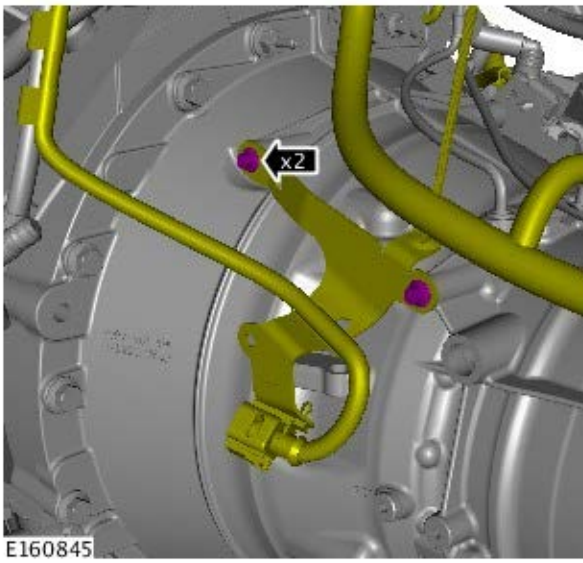
14.



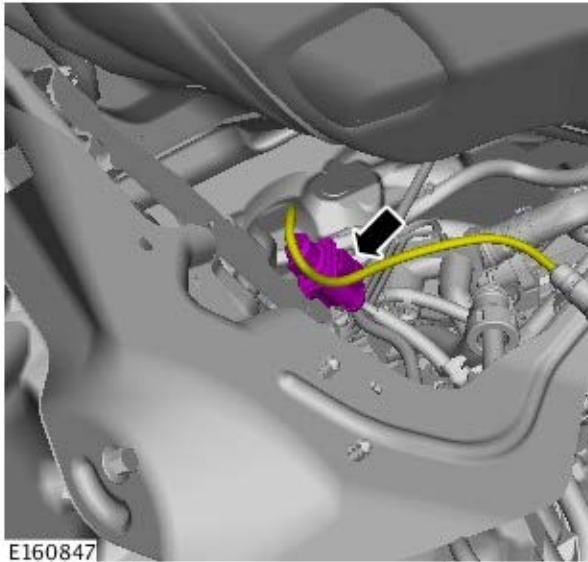
15.



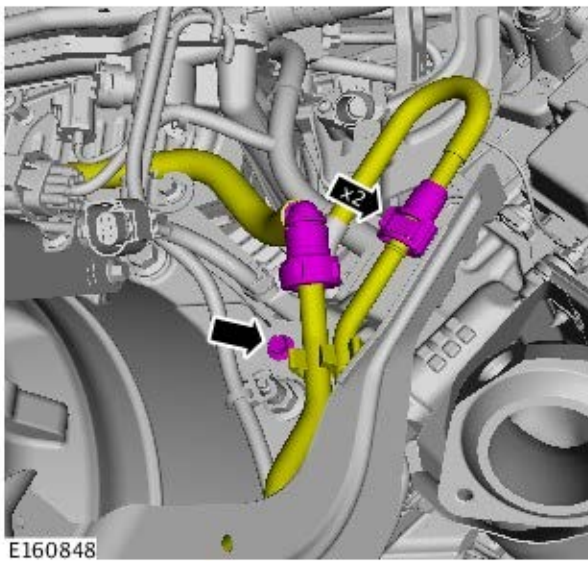
16.




17.




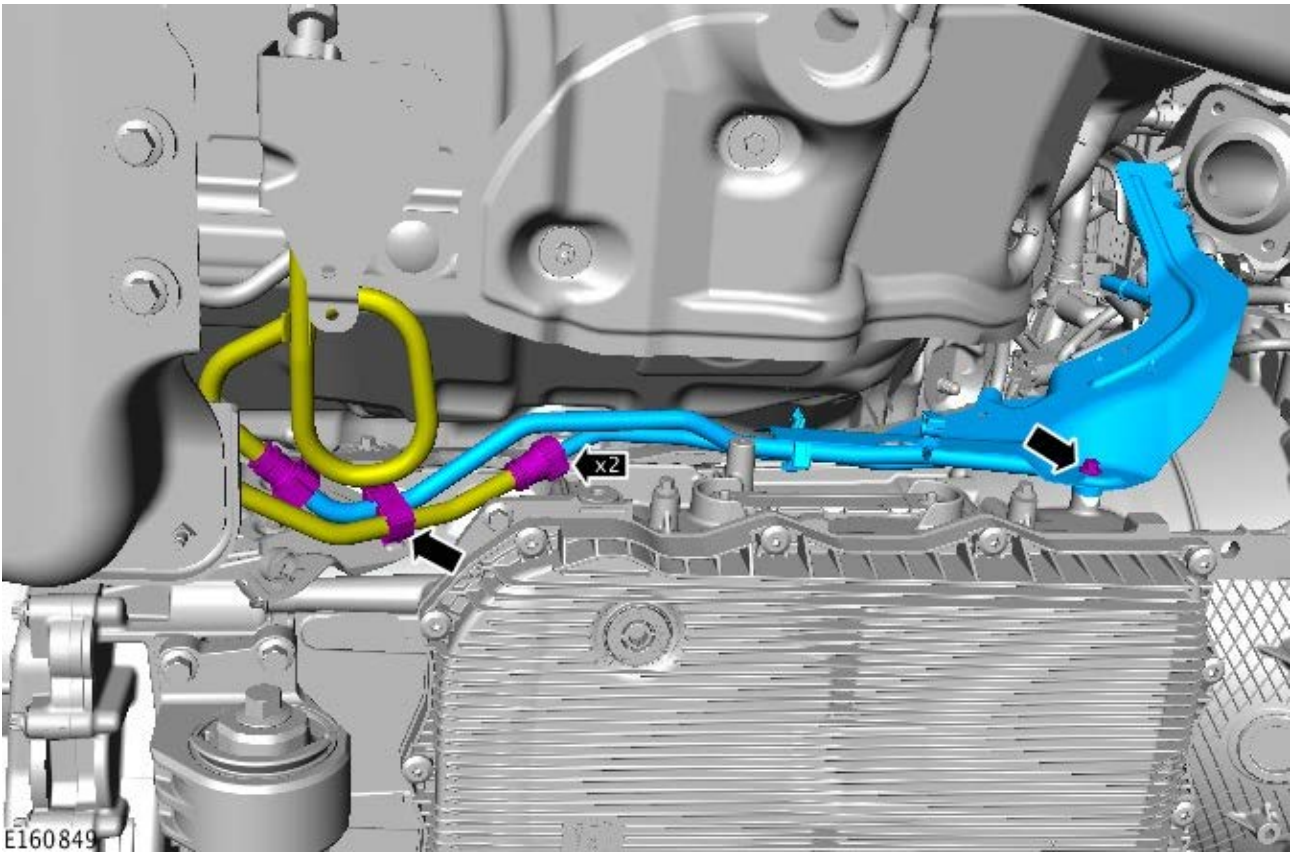
E160847



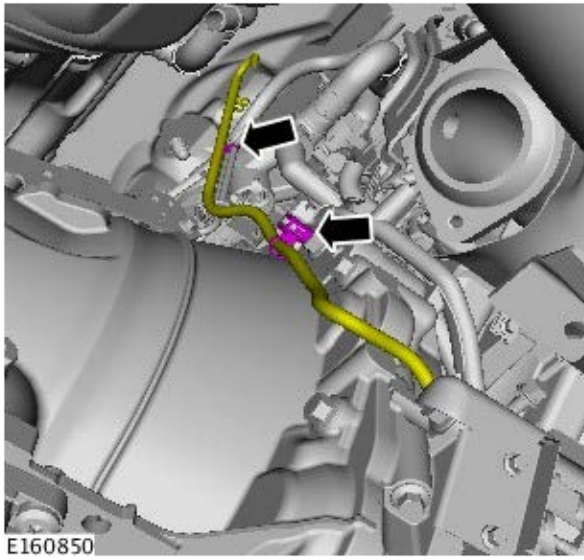
E160848

18.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

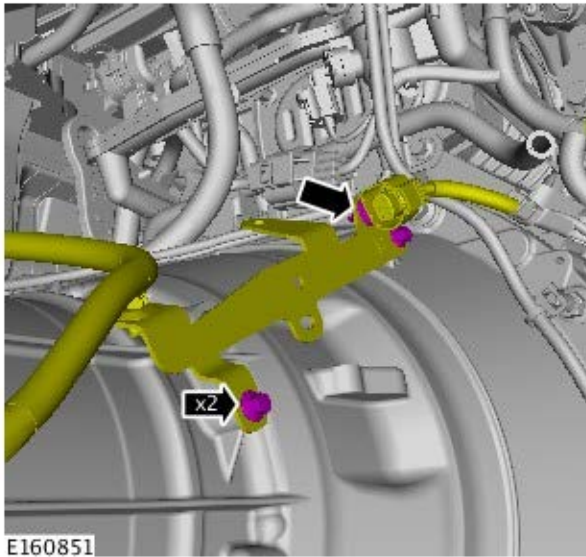
19.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.



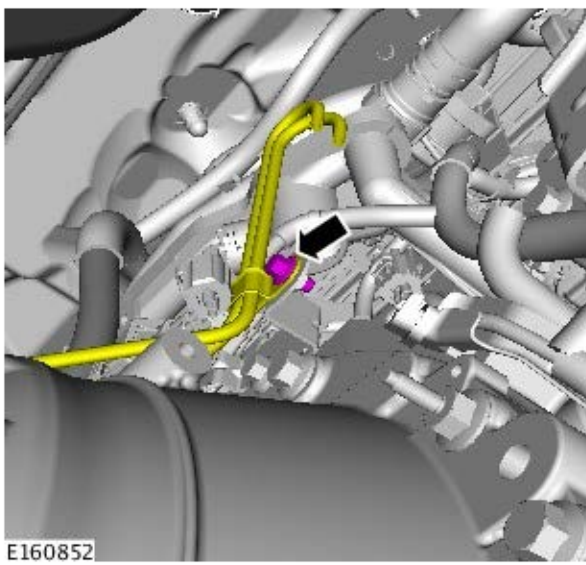
20.



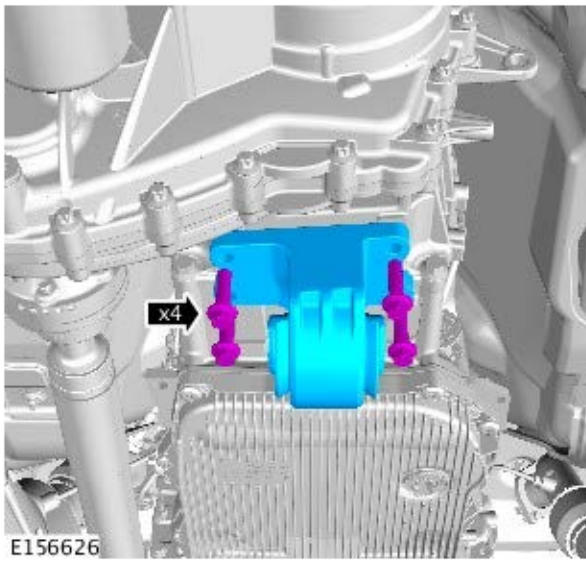
21.



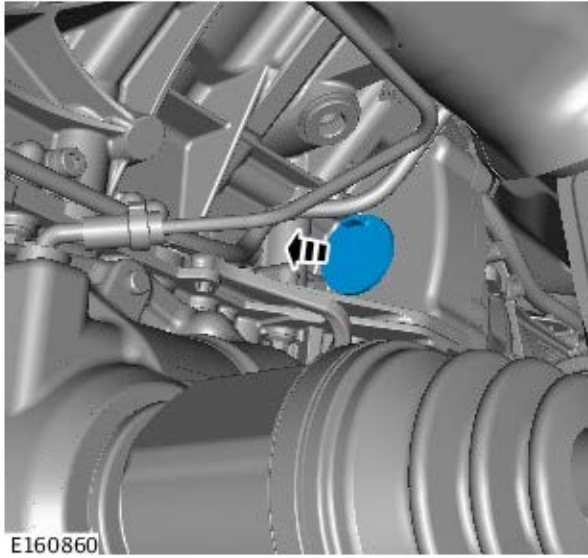
22.



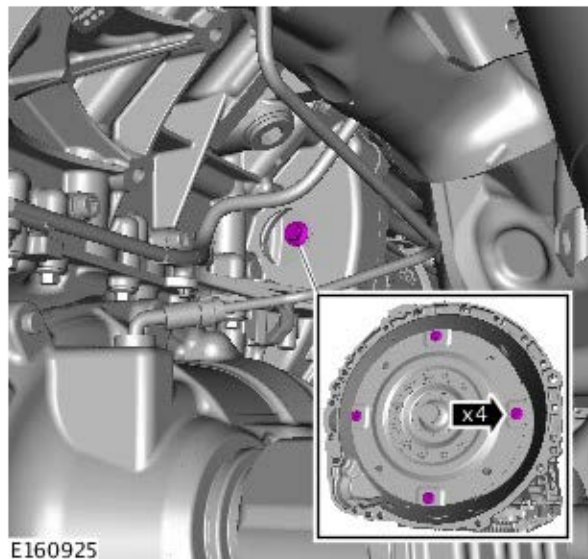
23.



24.




E160860

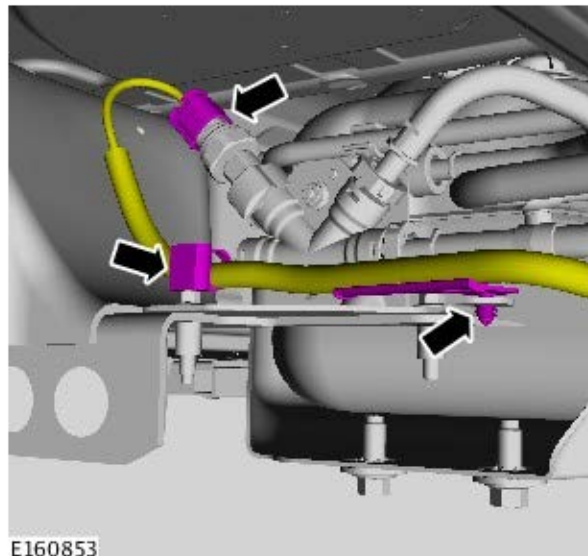


E160925

25. CAUTIONS:

 Only rotate the crankshaft clockwise.

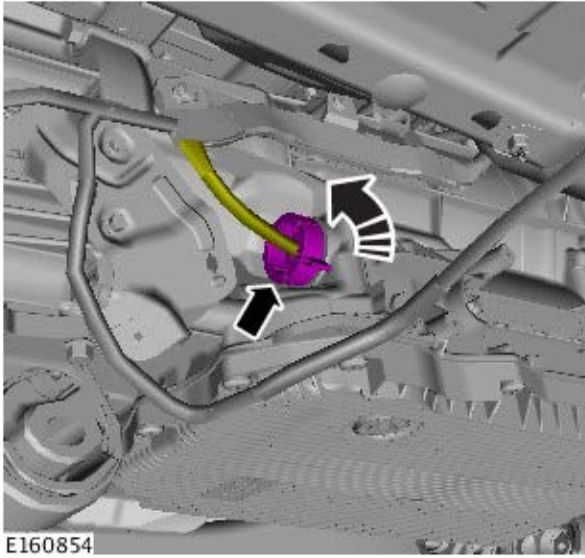
 Discard the bolts.



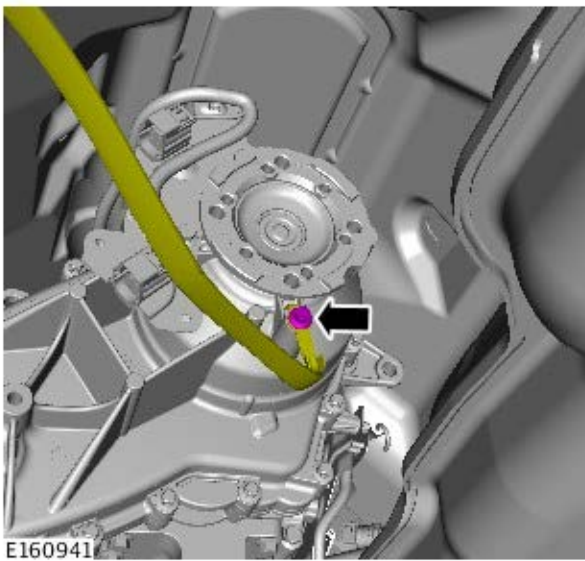
E160853

26.

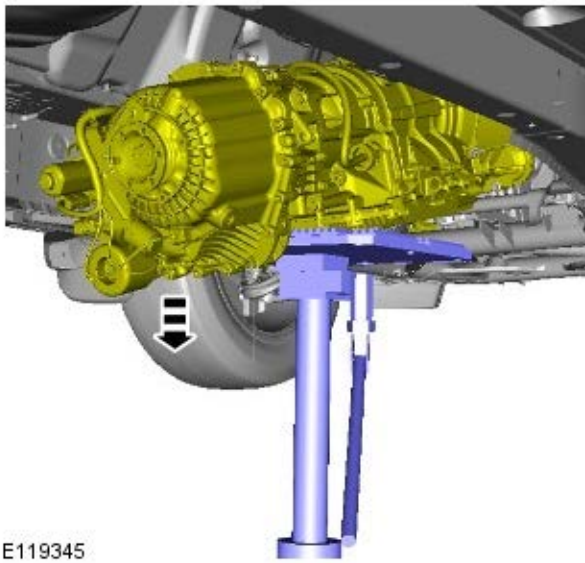
27.



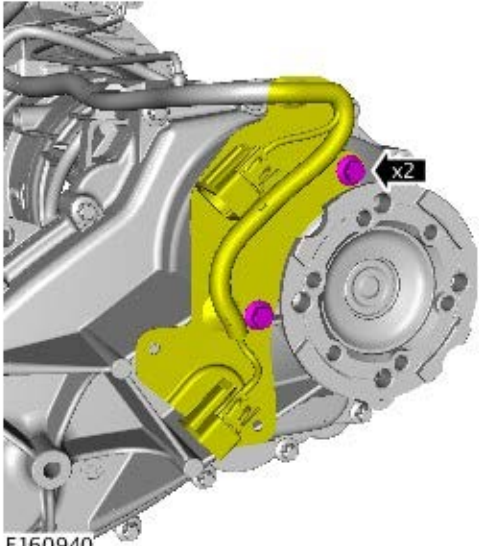
28.



29. Lower the rear of the transmission for access.

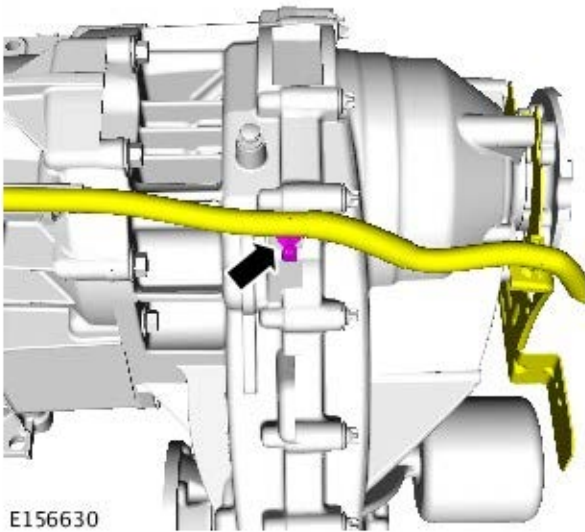


30.



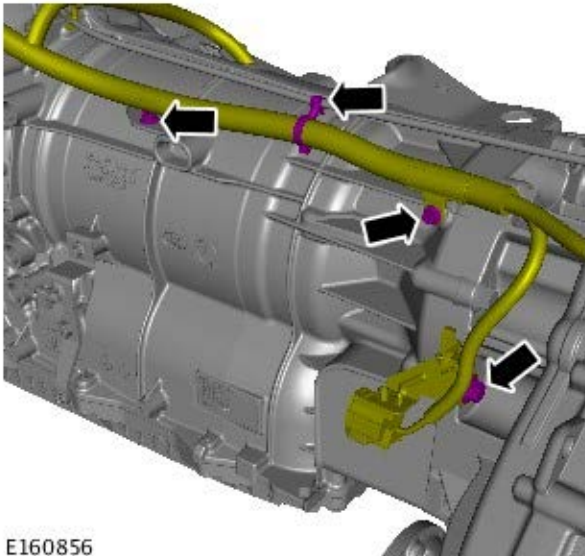
E160940

31.



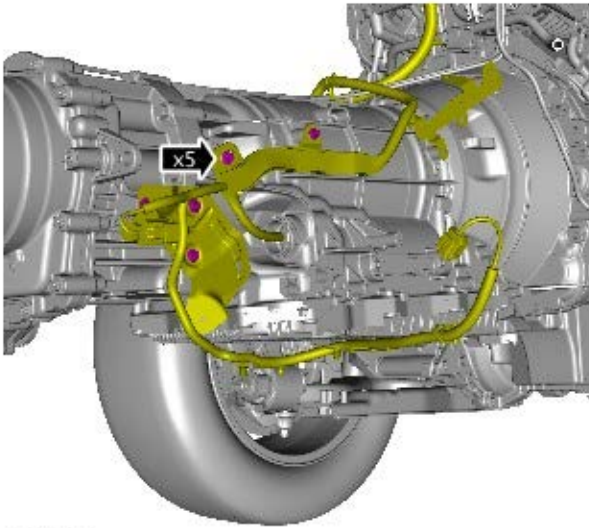
E156630

32.

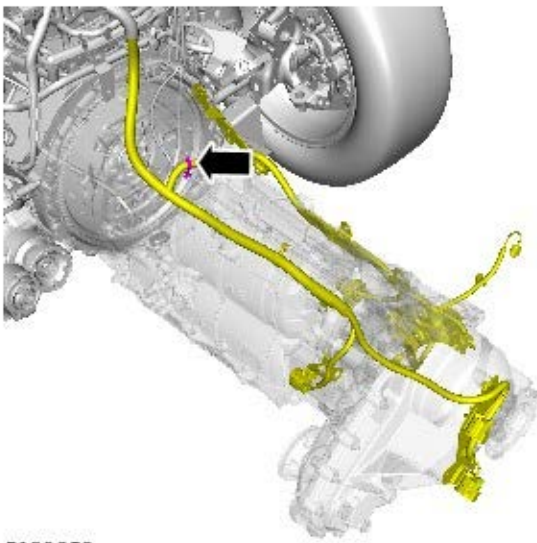


E160856

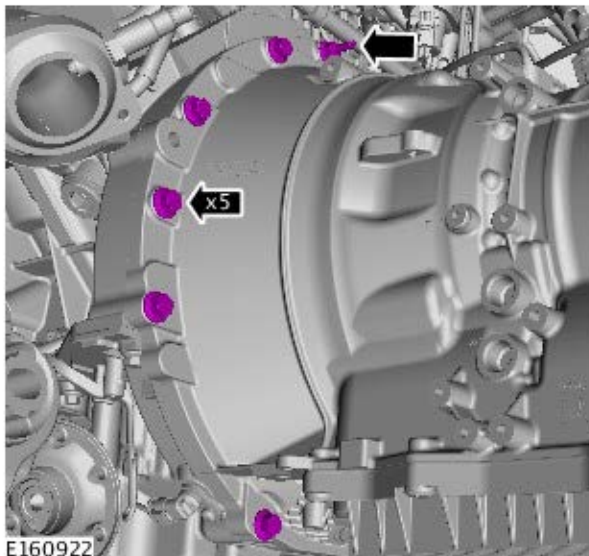
33.




E160857





E160858

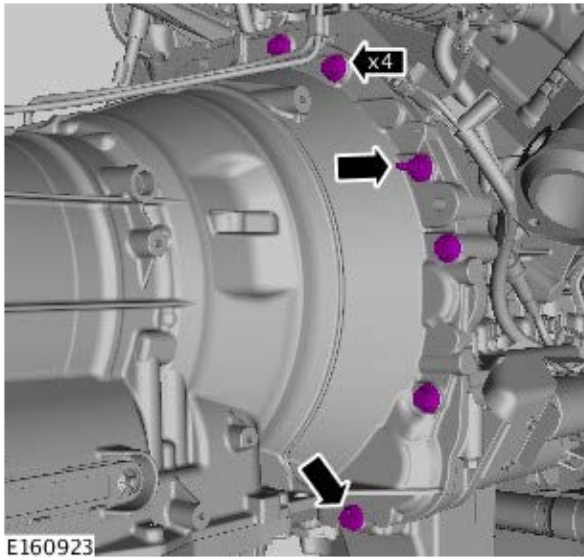


E160922

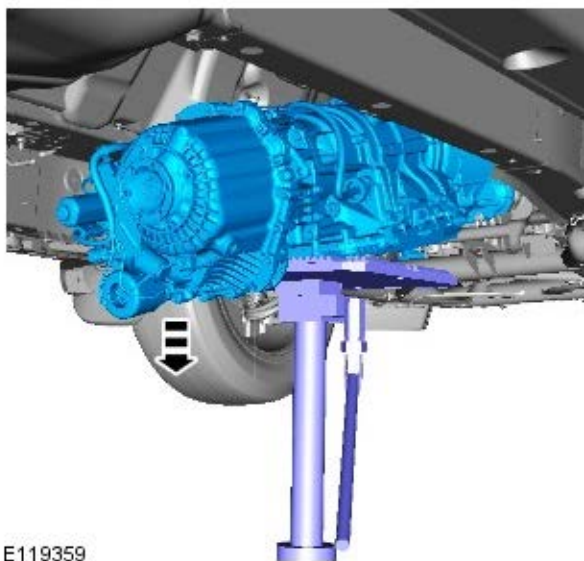
34.  NOTE: Secure the wiring loom with suitable cable ties.

35.  CAUTION: Note the fitted position of the retaining bolts prior to removal.

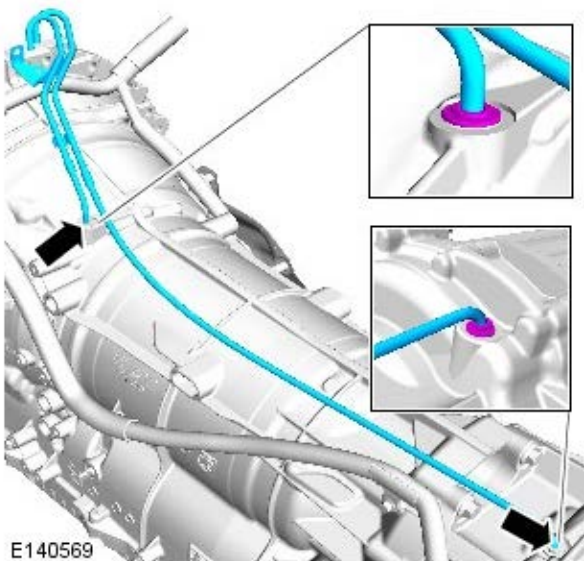
36.  CAUTION: Note the fitted position of the retaining bolts prior to removal.



E160923





E119359



E140569

37. WARNINGS:


 This step requires the aid of another technician.

 Make sure that the transmission is secured with suitable retaining straps.

CAUTIONS:

 Make sure that the torque converter remains in the transmission.

 Secure the torque converter to the transmission using suitable cable ties.

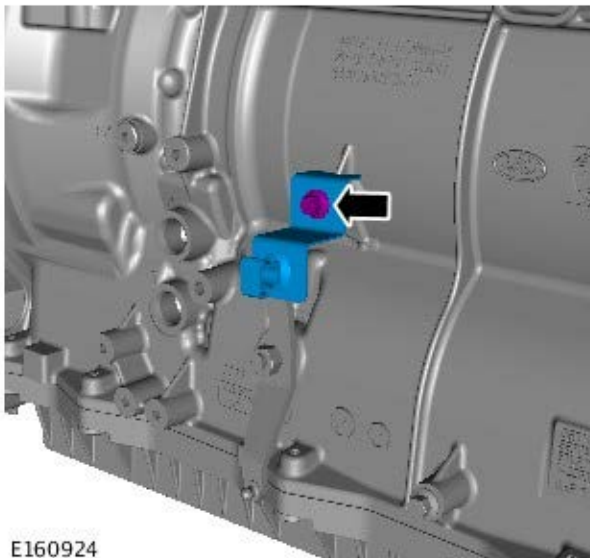
38.  CAUTION: Always plug any open connections to prevent contamination.

39.



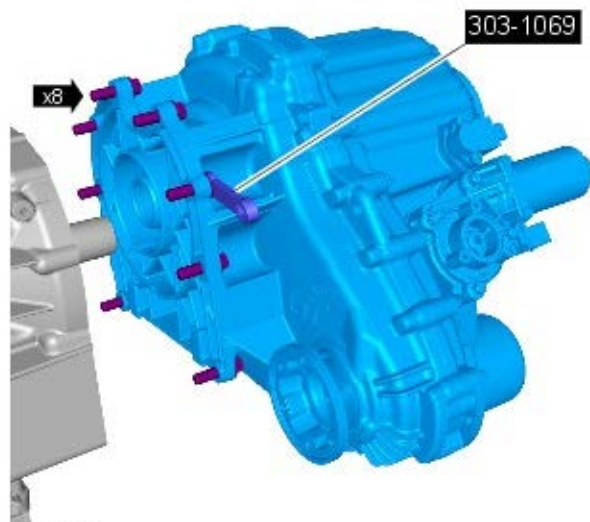
E107972

40.




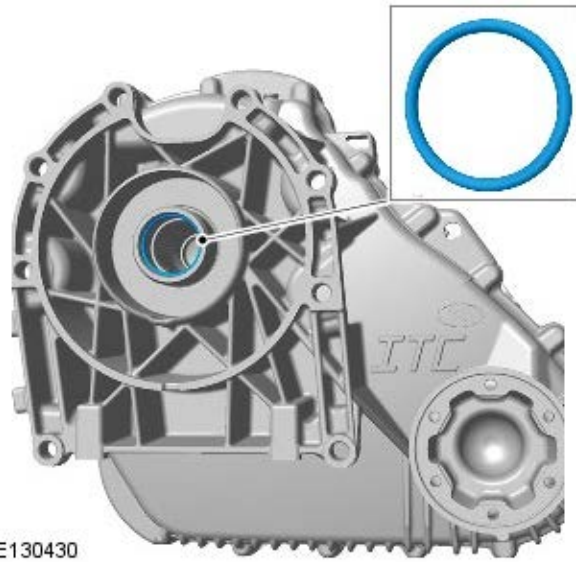
E160924

41. *Special Tool(s):* [303-1069](#)

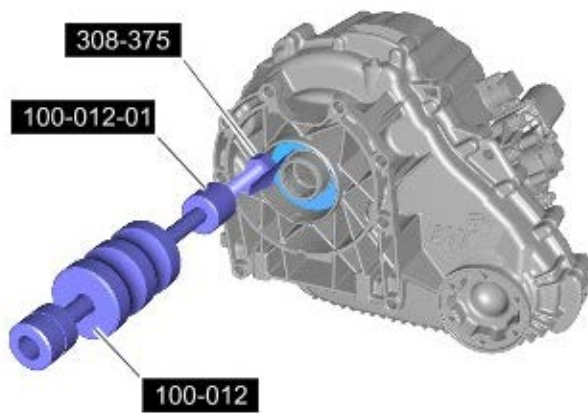


E130188

42.  **CAUTION:** Do not carry of this step if a new transfer box is to be installed.




E130430



E131138

43. CAUTIONS:

 Care must be taken to avoid damage to the seal register and running surface.


 Note the installed position of the component(s) prior to removal.

Special Tool(s): [100-012](#), [100-012-01](#), [308-375](#)

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission TDV6 3.0L Diesel

Installation

Special Tool(s)

 <p>303-1069 Adapter, Wrench</p> <p>E53727</p>	<p>303-1069 Adapter, Wrench</p>
---	-------------------------------------

NOTES:



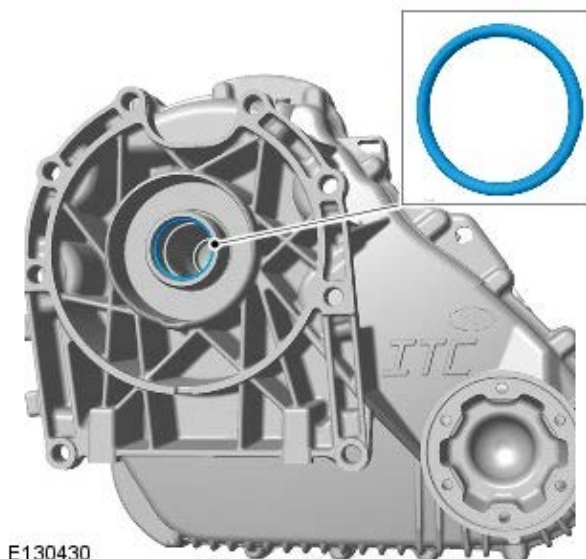
Some variation in the illustrations may occur, but the essential information is always correct.



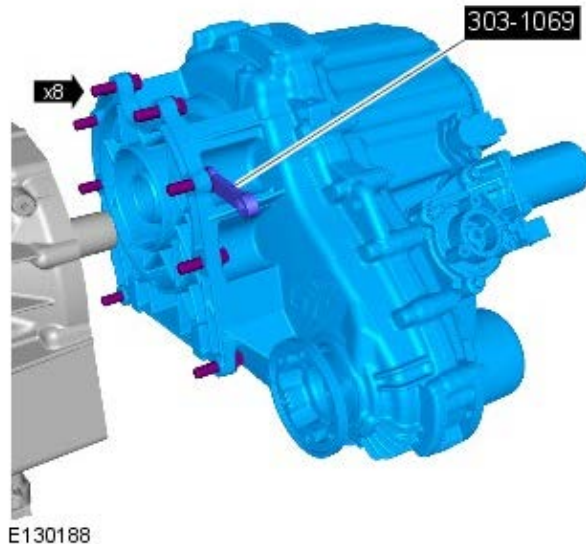
Some illustrations may show the transmission removed for clarity.



Some illustrations may show the engine removed for clarity.

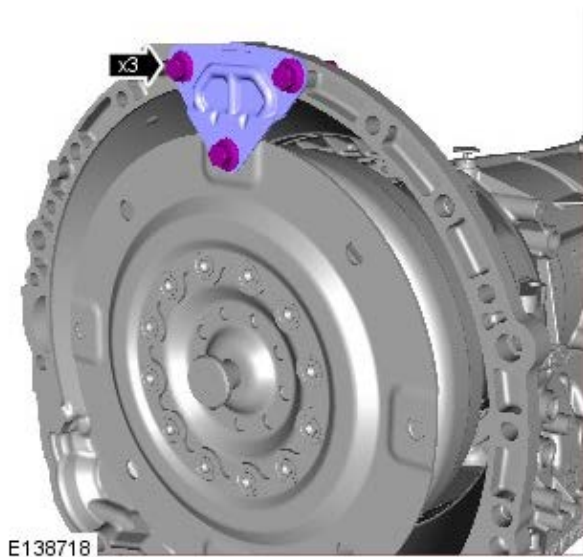



1.  NOTE: Install a new O-ring seal.

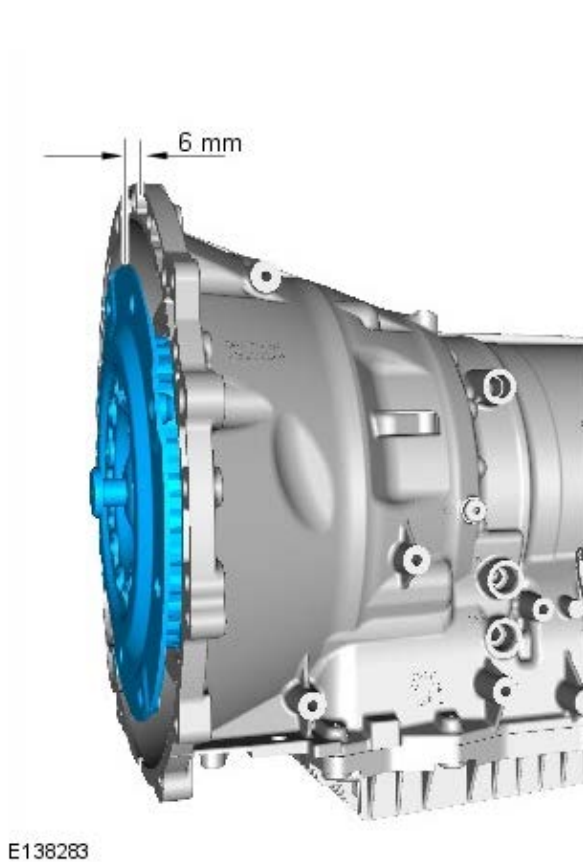



2.  NOTE: This step is only required if previously removed.


- Clean the component mating faces.
- Lubricate input shaft splines with 'Weicon TL7391' grease.
- *Special Tool(s)*: [303-1069](#)
- *Torque*: 45 Nm

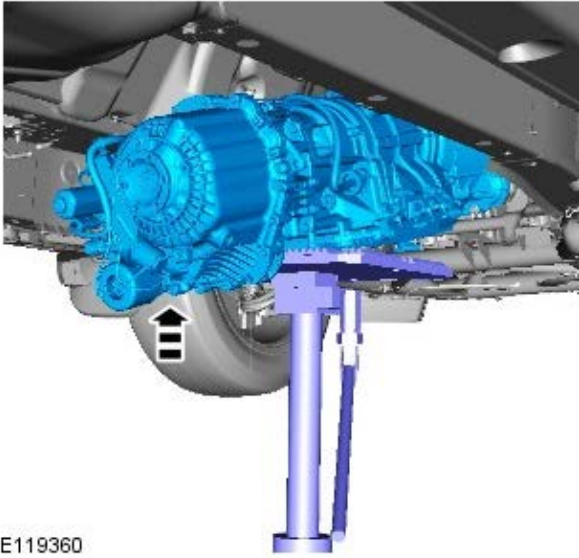


3.  CAUTION: Make sure that the torque converter remains in the transmission.

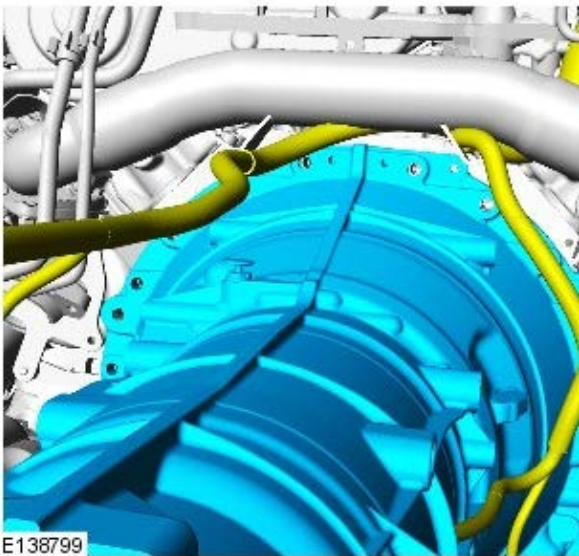


4.  NOTE: Make sure that the torque converter is fully engaged to the transmission.


5.  CAUTION: Apply grease of the correct specification to the torque converter spigot.
Clean the component mating faces.

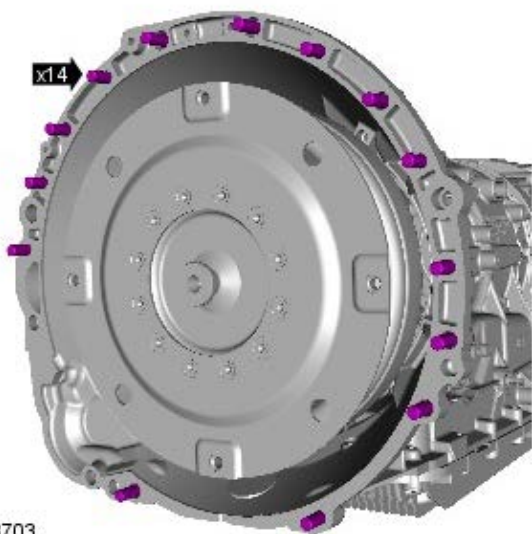


E119360



E138799

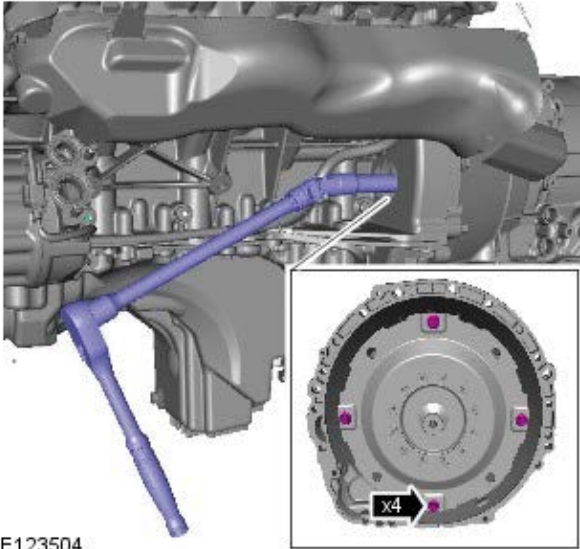
6.  CAUTION: Care must be taken to avoid damaging the engine bay wiring harnesses.
Cut the cable ties that are holding the harnesses aside.



E138703

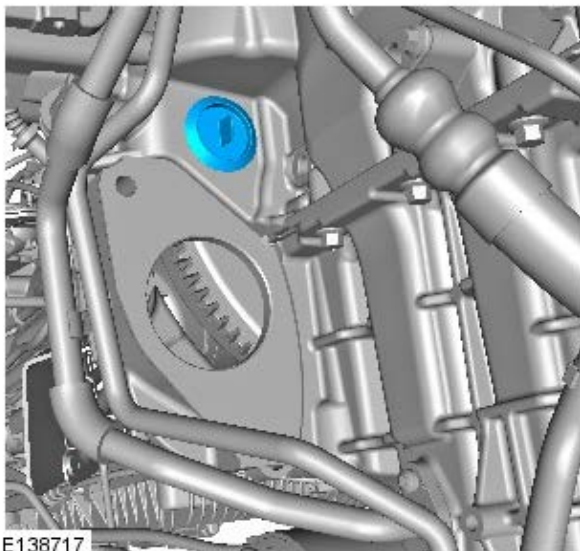
7. Torque: 40 Nm

8. Torque: 63 Nm



E123504

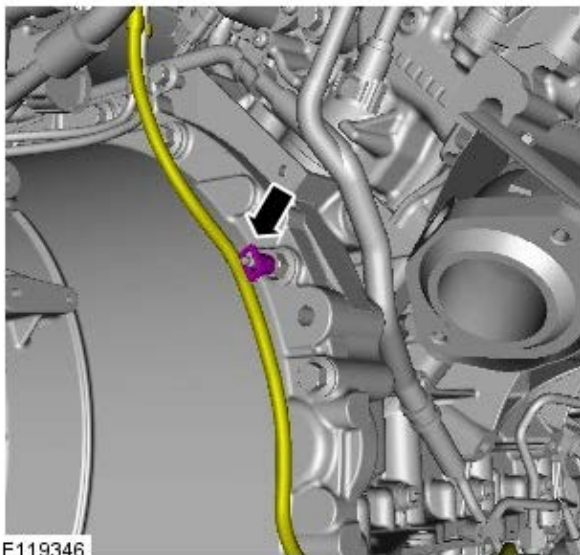
9.



E138717

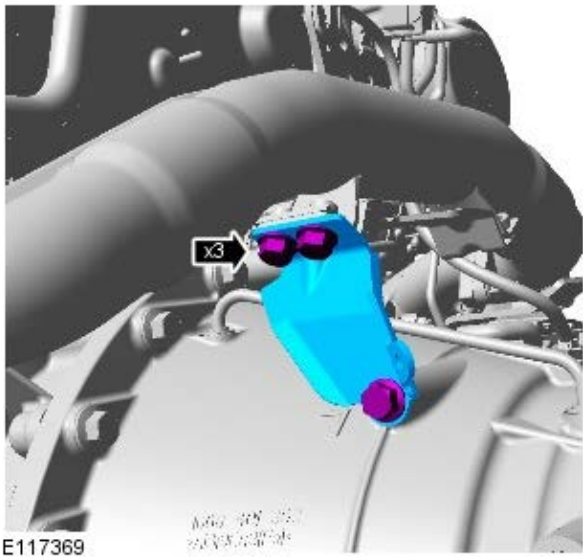
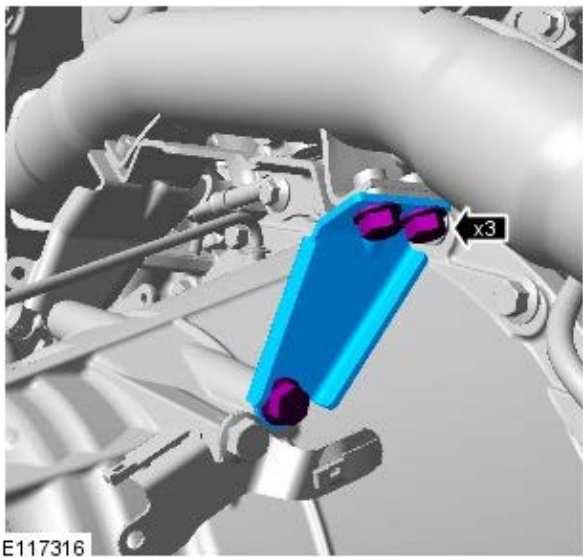
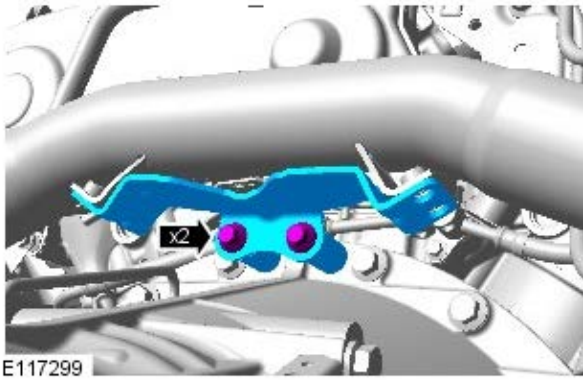
10. Refer to: Starter Motor (303-06 Starting System - TDV6 3.0L Diesel, Removal and Installation).

11.



E119346

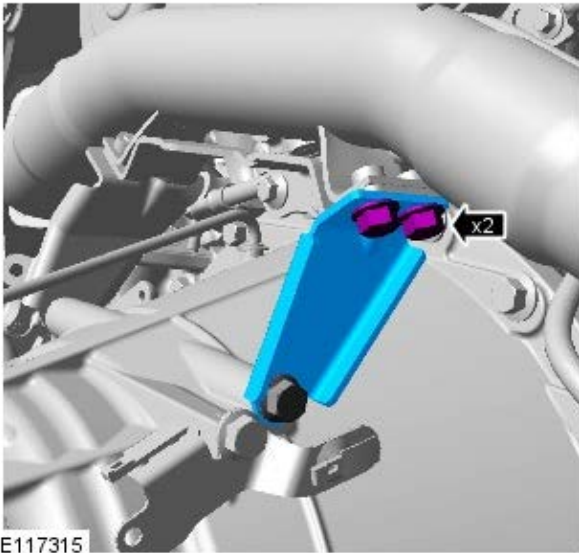
12. Torque: 23 Nm



13.  CAUTION: Only tighten the bolts finger-tight at this stage.

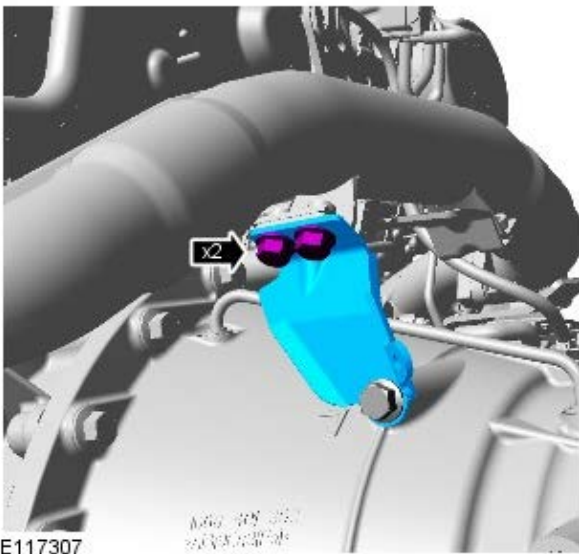
14.  CAUTION: Only tighten the bolts finger-tight at this stage.

15. Torque: 23 Nm



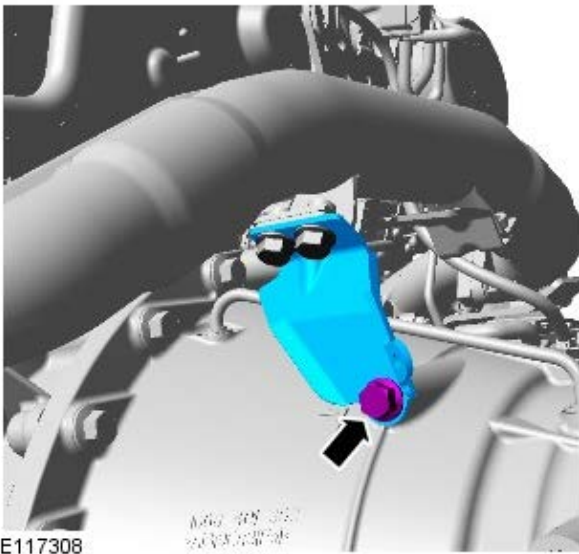
E117315

16. Torque: 23 Nm



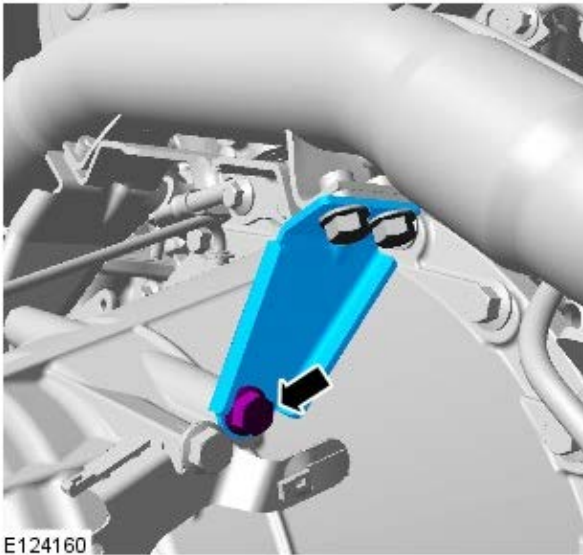
E117307

17. Torque: 23 Nm

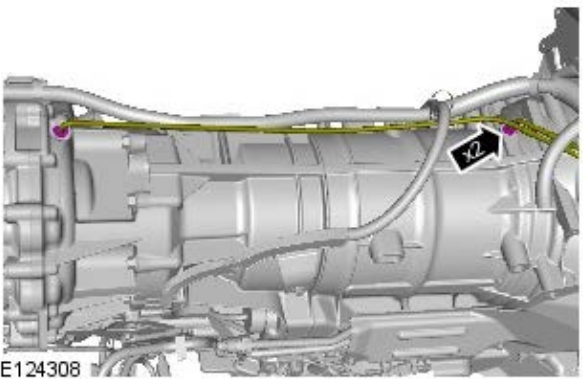



E117308

18. Torque: 23 Nm

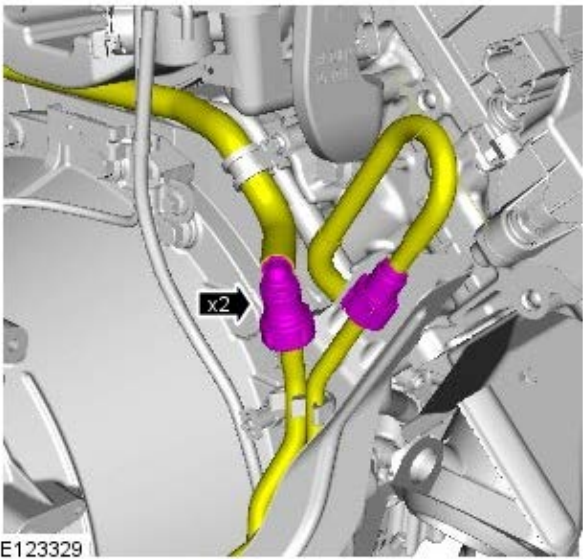


19.

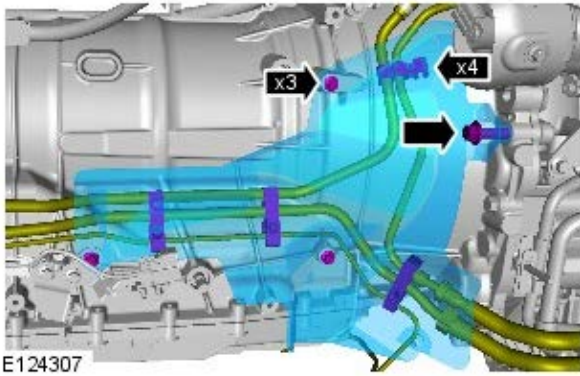


20.  **WARNING:** Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

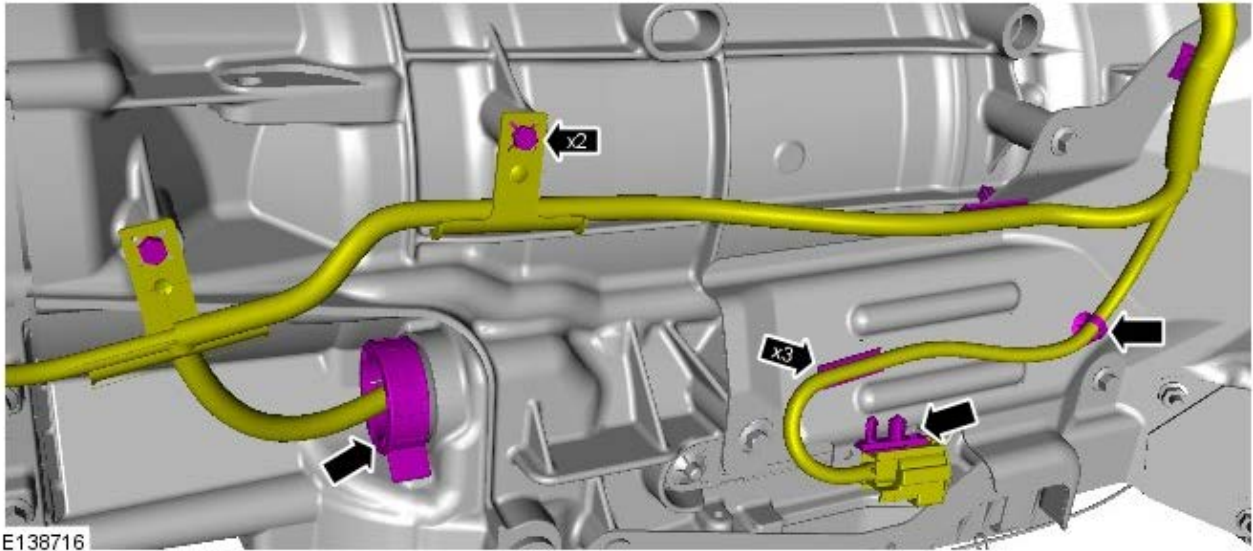
 **CAUTION:** Be prepared to collect escaping fluids.



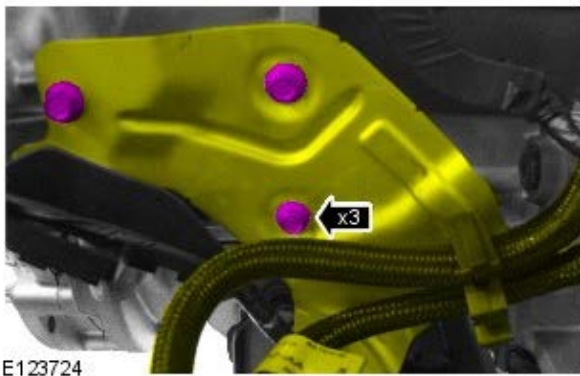
21. *Torque:*
M6 9 Nm
M10 40 Nm



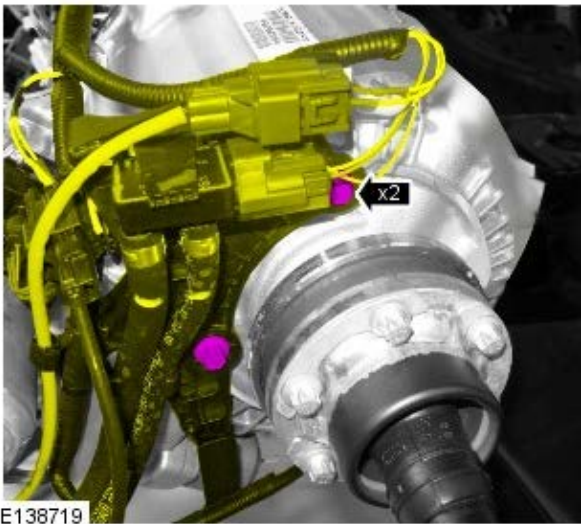
22. Torque: 9 Nm



23. Torque: 9 Nm

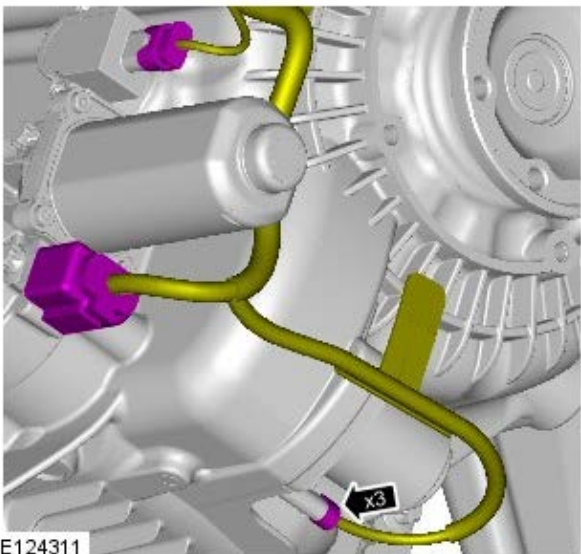


24. Torque: 9 Nm



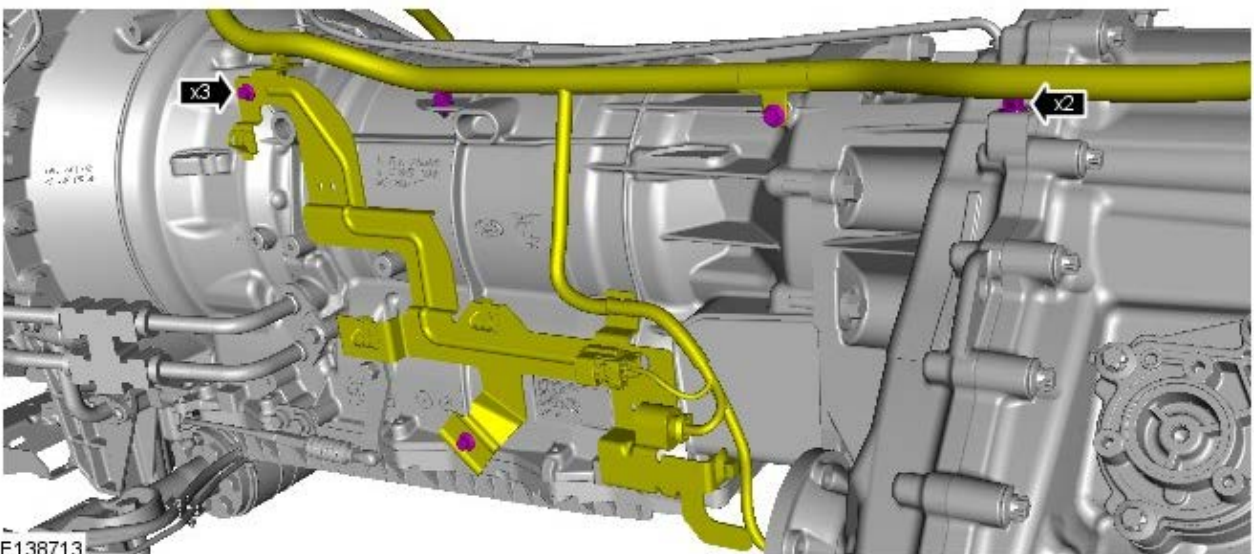
E138719

25.



E124311

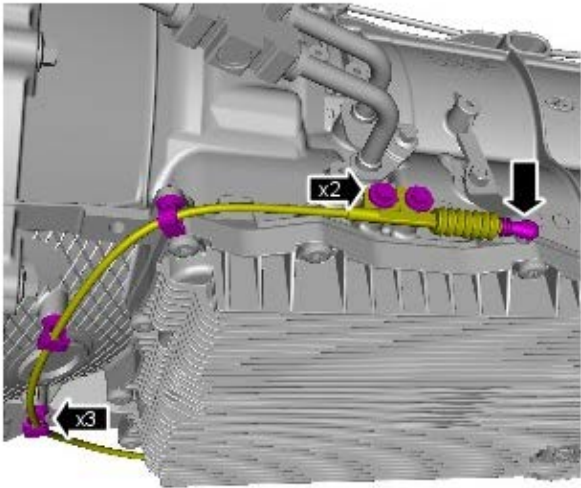
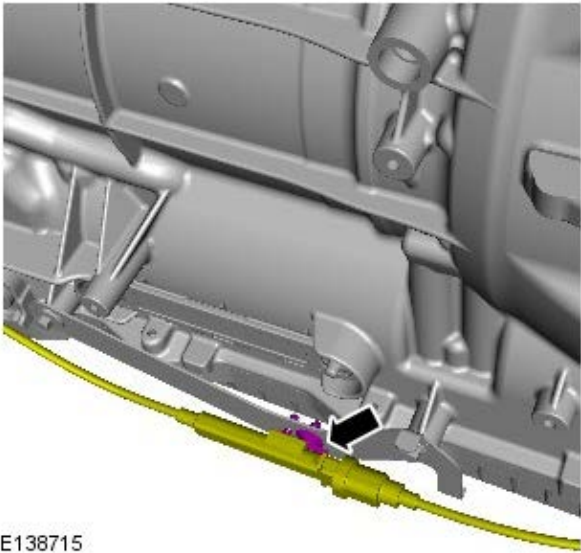
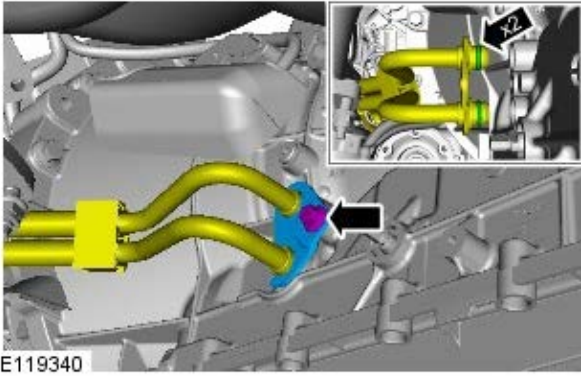
26. Torque: 9 Nm



E138713

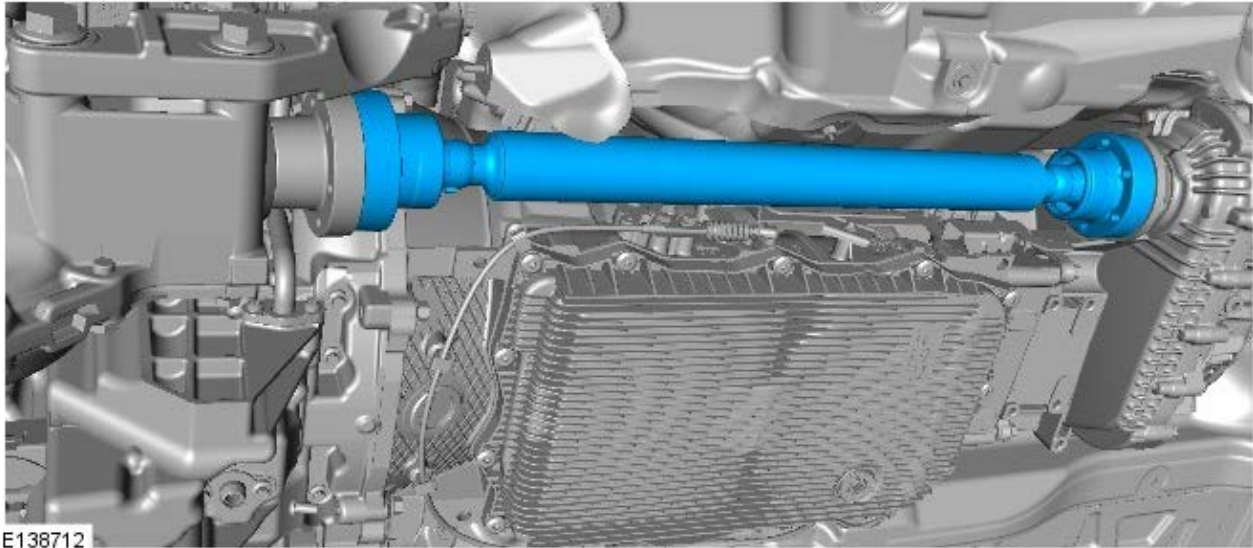
27.  NOTE: Install new O-ring seals.

Torque: 12 Nm




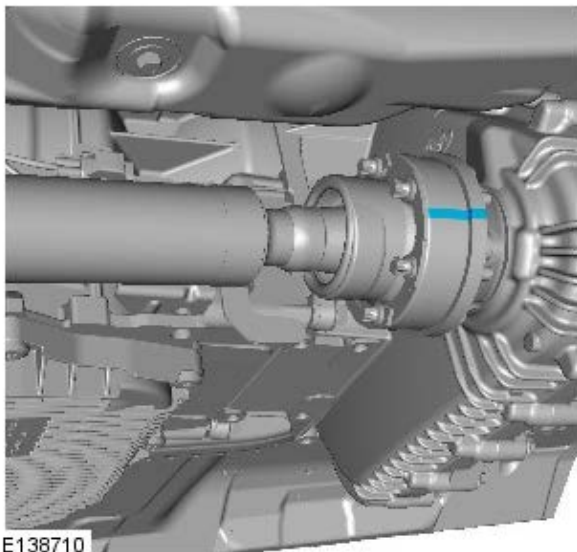
28.  NOTE: Install a new retaining clip.

29. Torque: 10 Nm



E138712

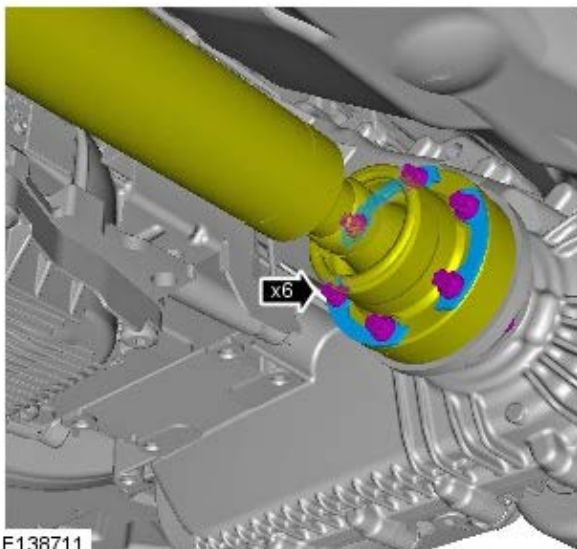
31.  NOTE: Make sure that the component aligns with the installation mark noted in the removal step.




E138710

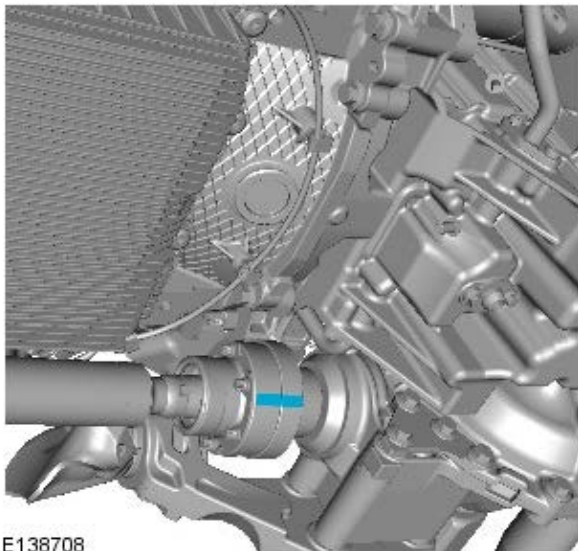
32.  CAUTION: Make sure that new bolts are installed.

Torque:
Stage 1: 45 Nm
Stage 2: 90°

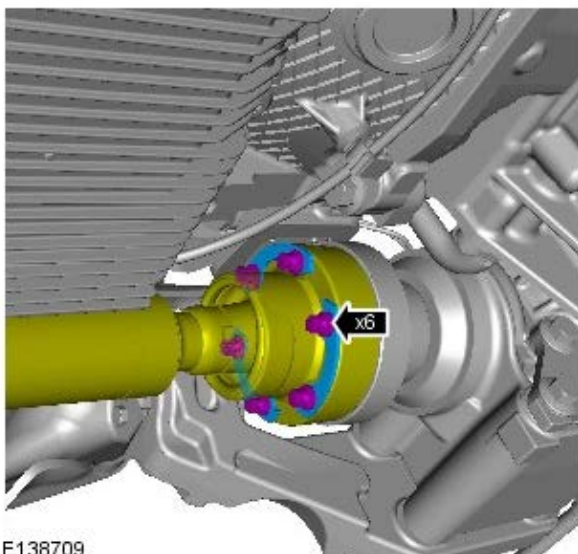


E138711

33.  NOTE: Make sure that the component aligns with the installation mark noted in the removal step.



E138708



E138709

34.  CAUTION: Make sure that new bolts are installed.

Torque:

Stage 1: 45 Nm

Stage 2: 90°

35. Refer to: Rear Driveshaft (205-01 Driveshaft, Removal and Installation).
36. Refer to: Exhaust System (309-00A, Removal and Installation).
- 37.
- Remove the securing straps.
 - Remove the jack supporting the transmission.
 - Lower the vehicle.

38. Connect the battery ground cable.

Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

39. Refer to: Transmission Fluid Level Check (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel, Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, General Procedures).

Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission V6 S/C 3.0L Petrol

Installation

Special Tool(s)

 303-021	303-021 Engine support bracket
 E53727	303-1069 Adapter, Wrench
 E115255	303-1435 Engine Lifting Brackets Rear
 E52536	307-520 Installer, Output Shaft Seal
 E158796	JLR-308-930 Installer, Oil Seal

General Equipment

Transmission jack


NOTES:

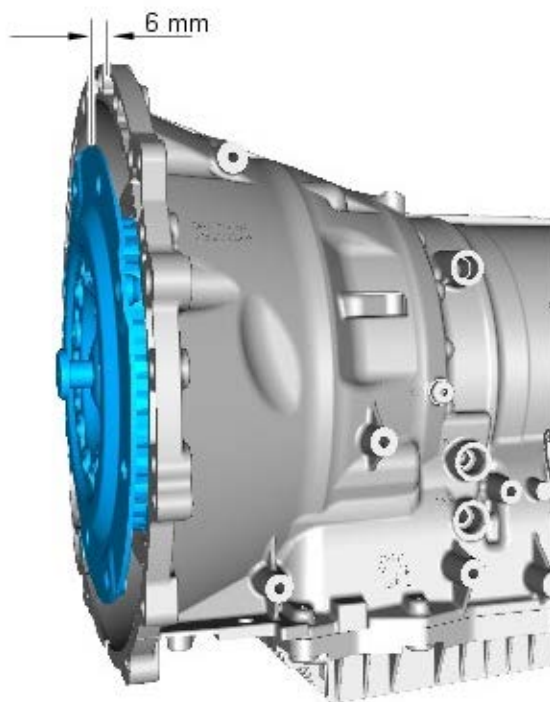
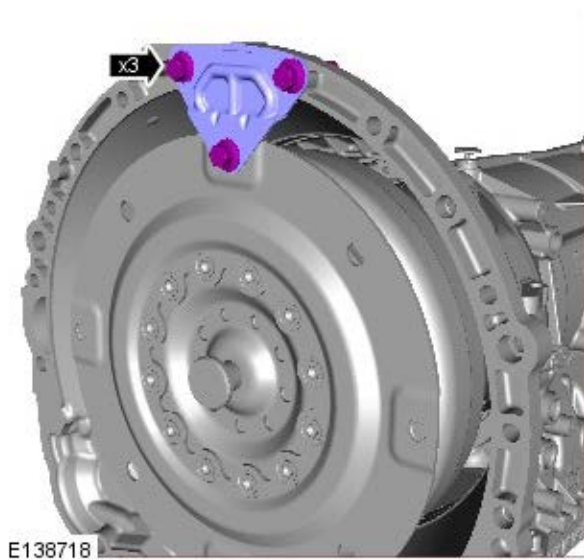



Some variation in the illustrations may occur, but the essential information is always correct.



Some illustrations may show the transmission removed for clarity.

- 
CAUTION: This step is only required if a new component is installed.




2.  CAUTION: Make sure that the torque converter is fully engaged to the transmission.

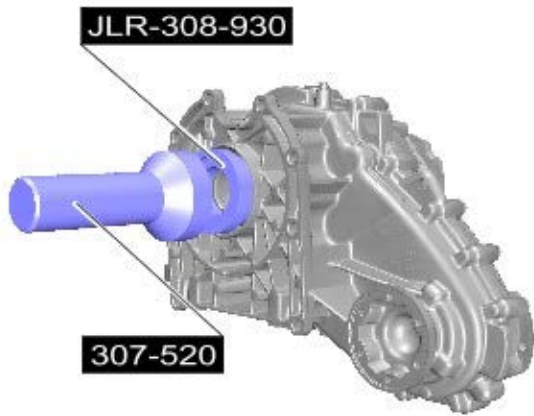
3. CAUTIONS:

 Oil seals must be installed dry.

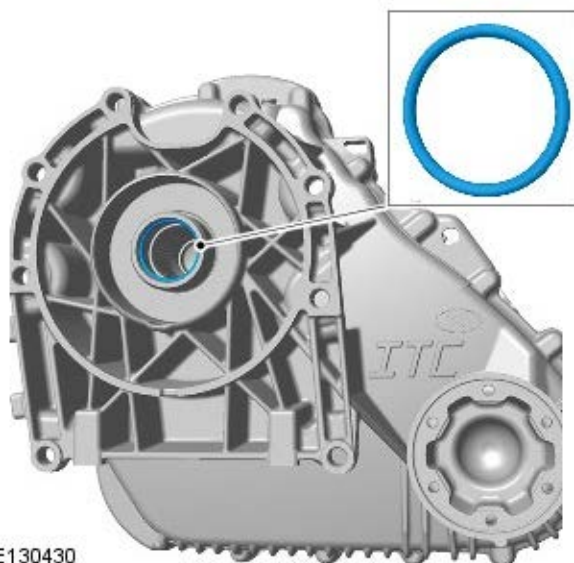
 This step is only required if previously removed.

 Make sure that the component is installed to the noted removal position.

Special Tool(s): [JLR-308-930](#), [307-520](#)




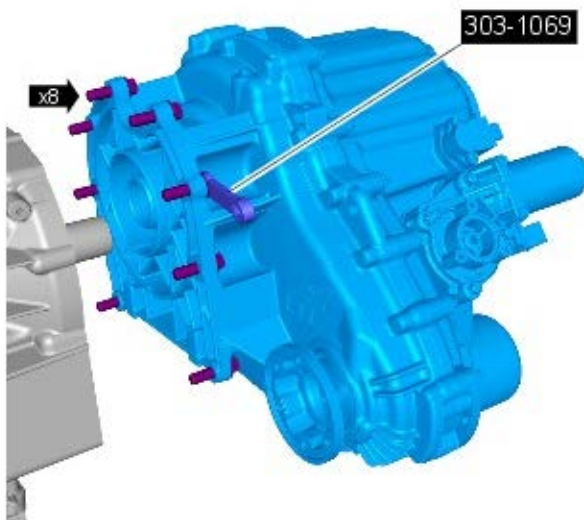
E158632




E130430

4.  CAUTION: This step is only required if a new component is installed.

 NOTE: Install a new O-ring seal.

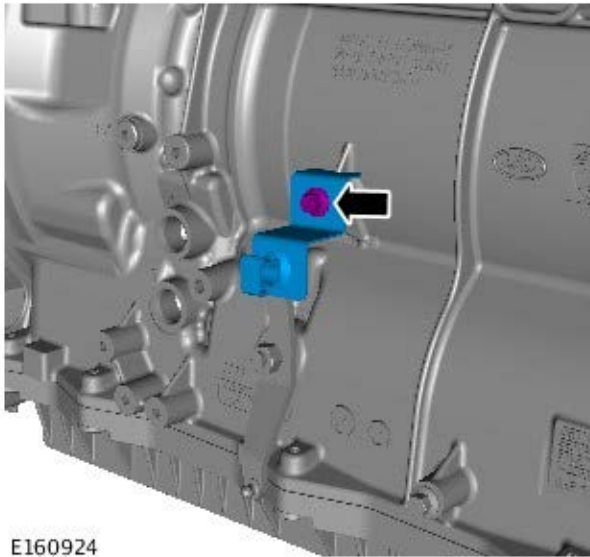


E130188

5.  NOTE: This step is only required if previously removed.

- Clean the component mating faces.
- Lubricate input shaft splines with 'Weicon TL7391' grease.
- *Special Tool(s)*: [303-1069](#)
- *Torque*: 45 Nm

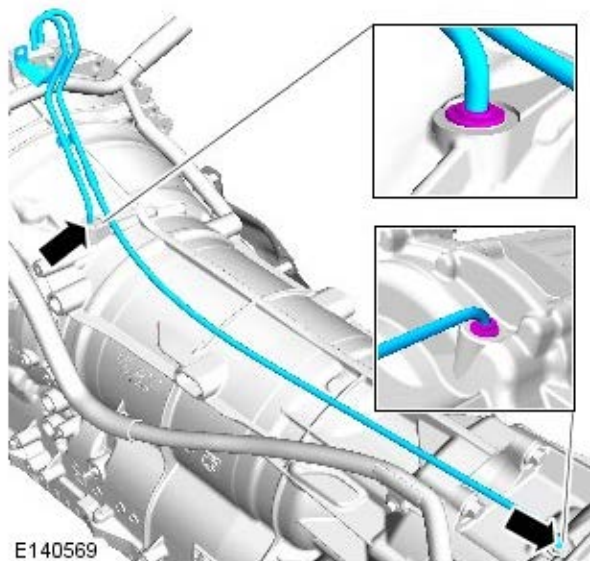
6. *Torque*: 12 Nm



E160924




E107972





E140569

7.


8. CAUTIONS:

 To prevent water ingress and subsequent transmission damage, make sure that the breather is fully pushed home into the transmission casing. The white line around the circumference of the pipe should not be visible when correctly installed.

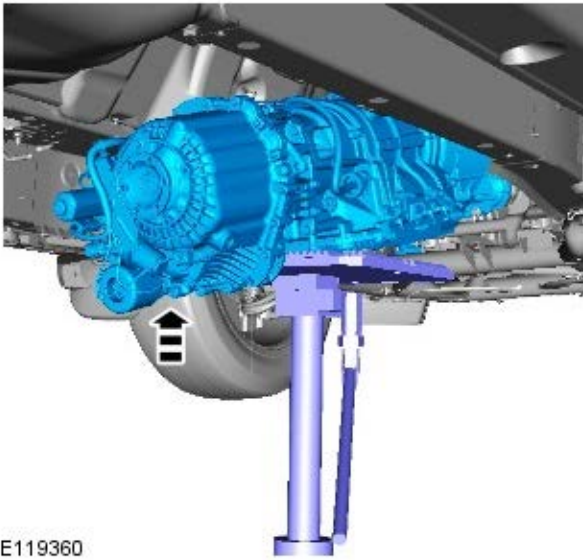
 Remove the blanking plugs.

 NOTE: This step is only required if previously removed.

9. WARNINGS:

 This step requires the aid of another technician.







E119360

Make sure that the transmission is secured with suitable retaining straps.

CAUTIONS:

 Apply grease of the correct specification to the torque converter spigot.

 Make sure that the torque converter remains in the transmission.

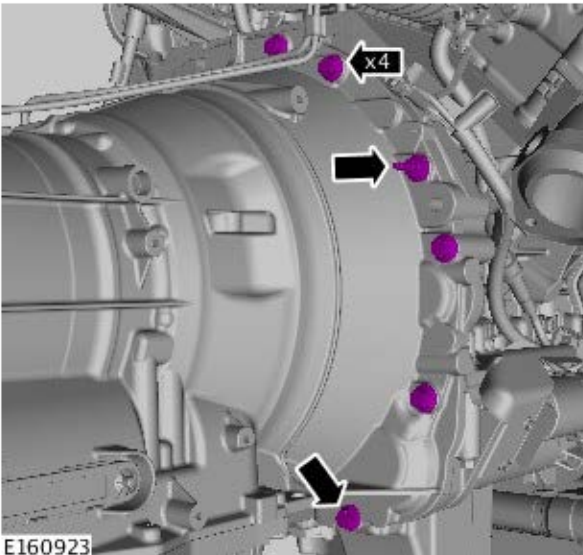
 Secure the torque converter to the transmission using suitable cable ties.

Using a suitable hydraulic jack, support the transmission.

10. *General Equipment:* [Transmission jack](#)

11.  CAUTION: Install the bolts in the noted position.

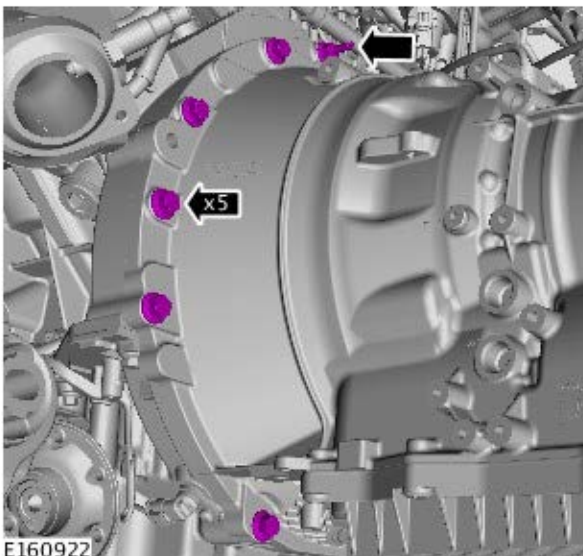
Torque: 40 Nm



E160923

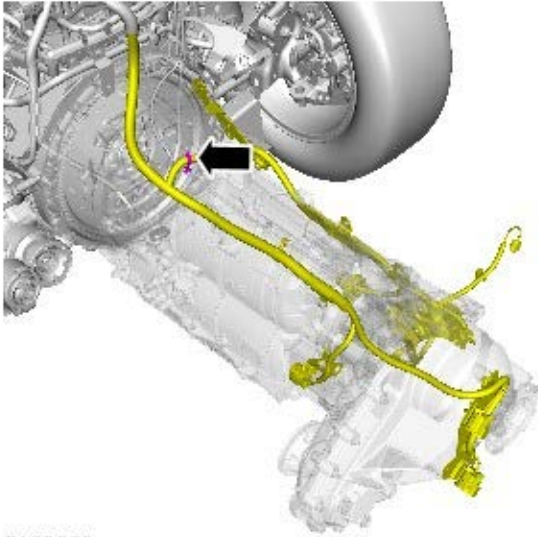
12.  CAUTION: Install the bolts in the noted position.

Torque: 40 Nm



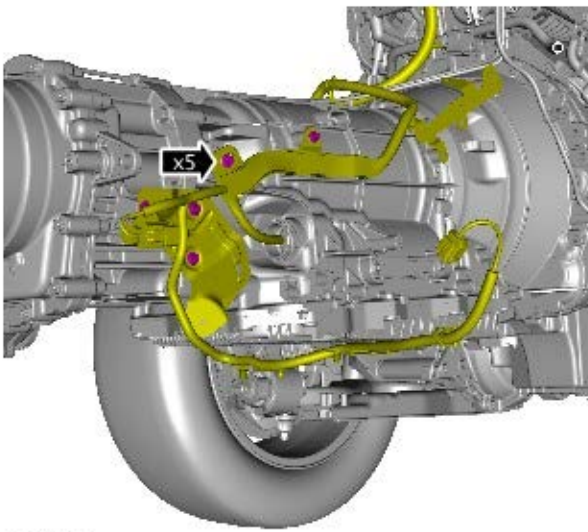
E160922

13.  NOTE: Remove the cable ties.



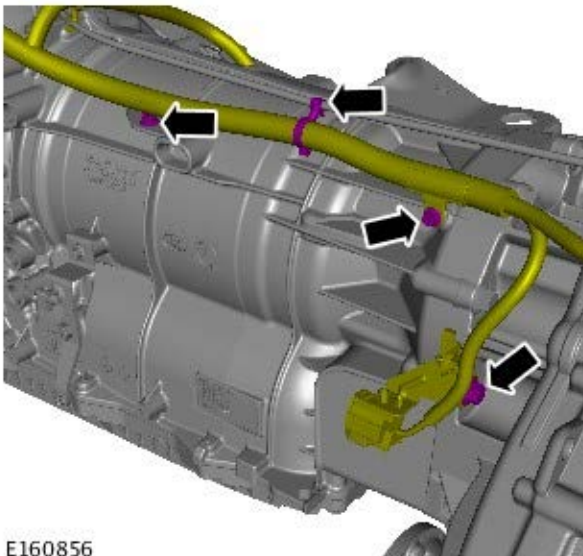
E160858

14. Torque: 10 Nm



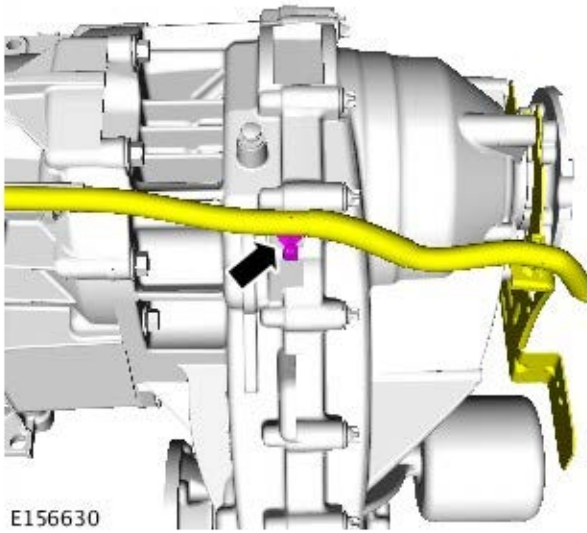
E160857

15. Torque:
M10 48 Nm
M6 10 Nm



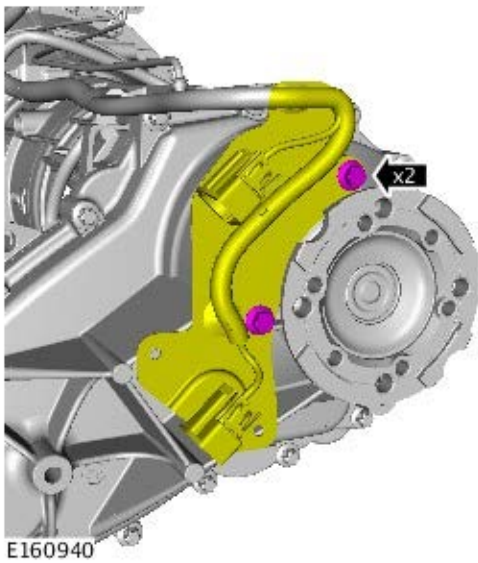
E160856

16.



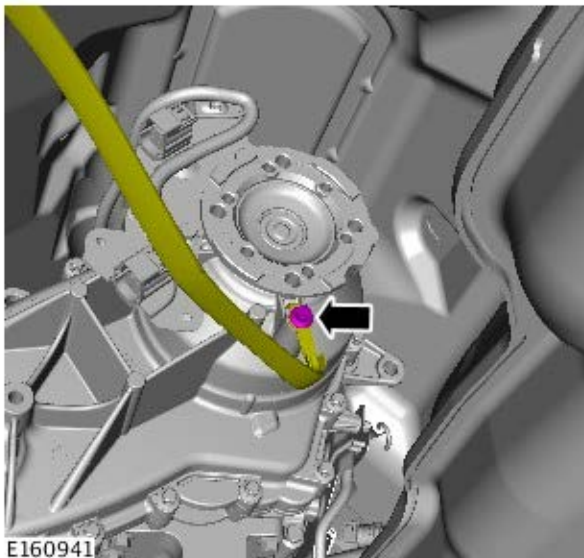
E156630

17. Torque: 25 Nm



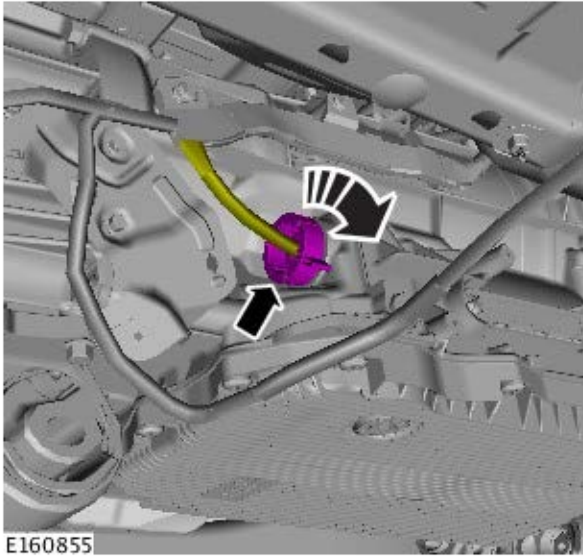
E160940

18. Torque: 25 Nm

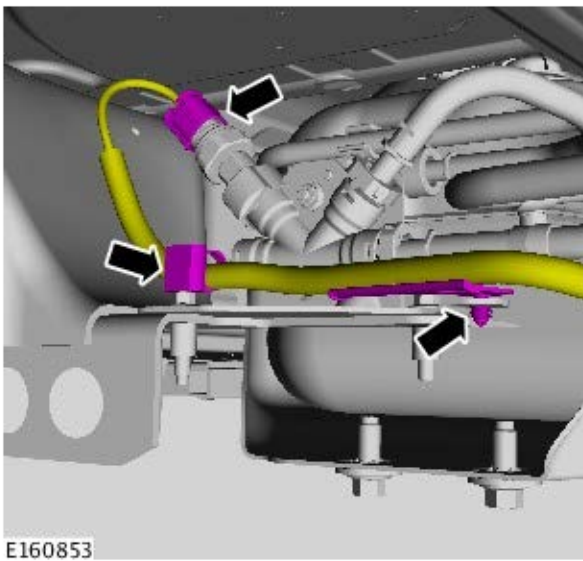


E160941


19.



20.

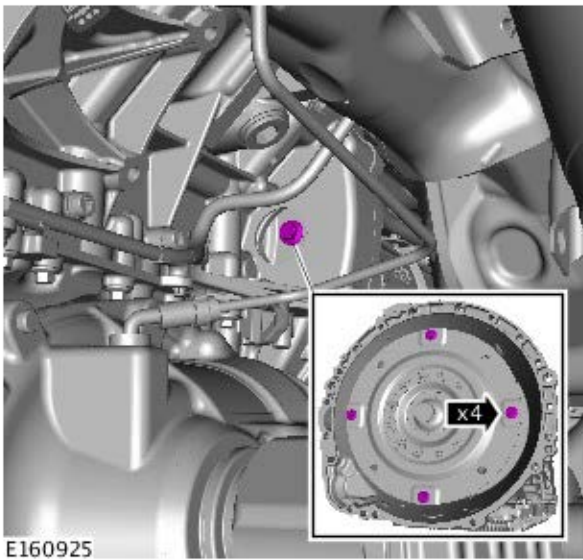


21. CAUTIONS:

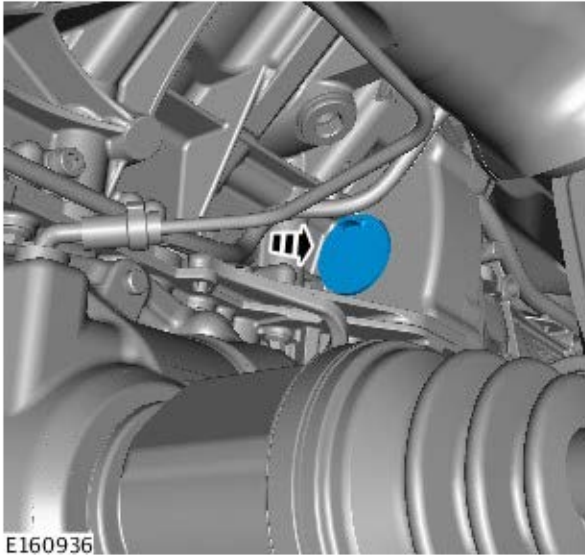
 Only rotate the crankshaft clockwise.

 Install new bolts.

Torque: 63 Nm

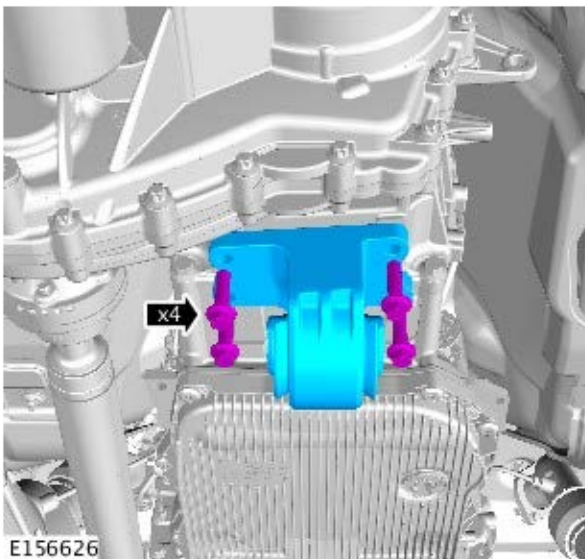


22.



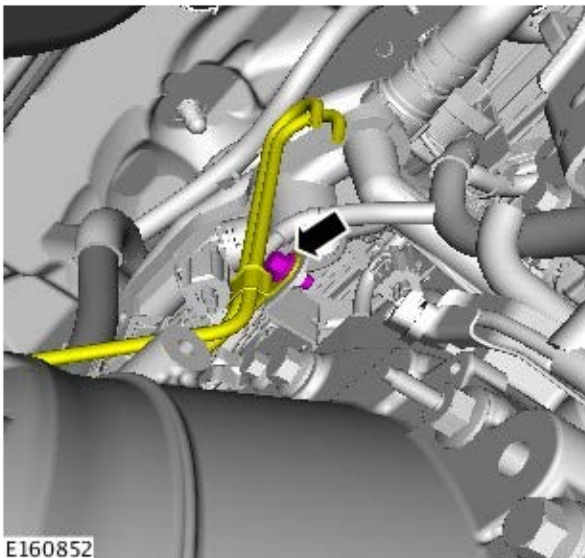
E160936

23. Torque: 60 Nm



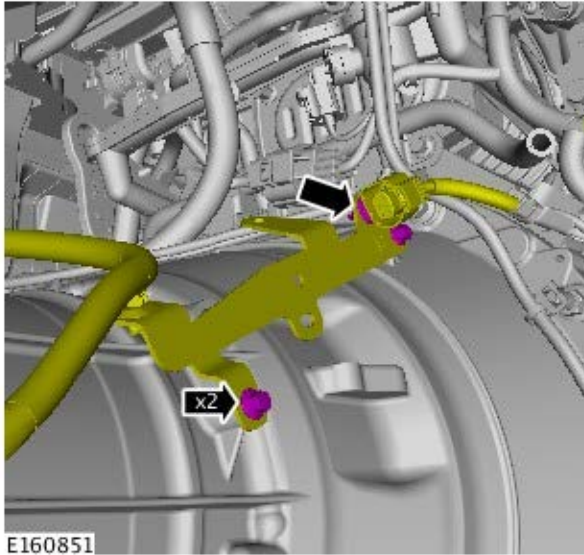
E156626

24. Torque: 10 Nm

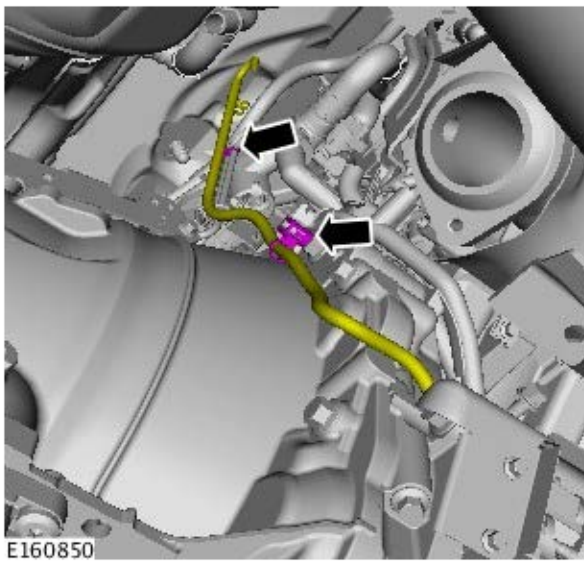


E160852

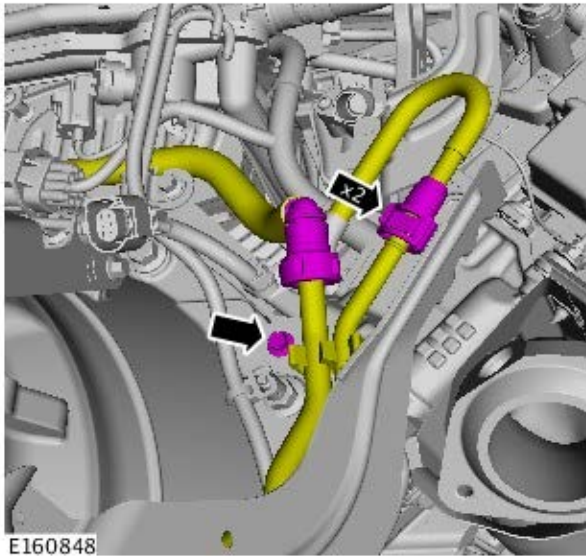
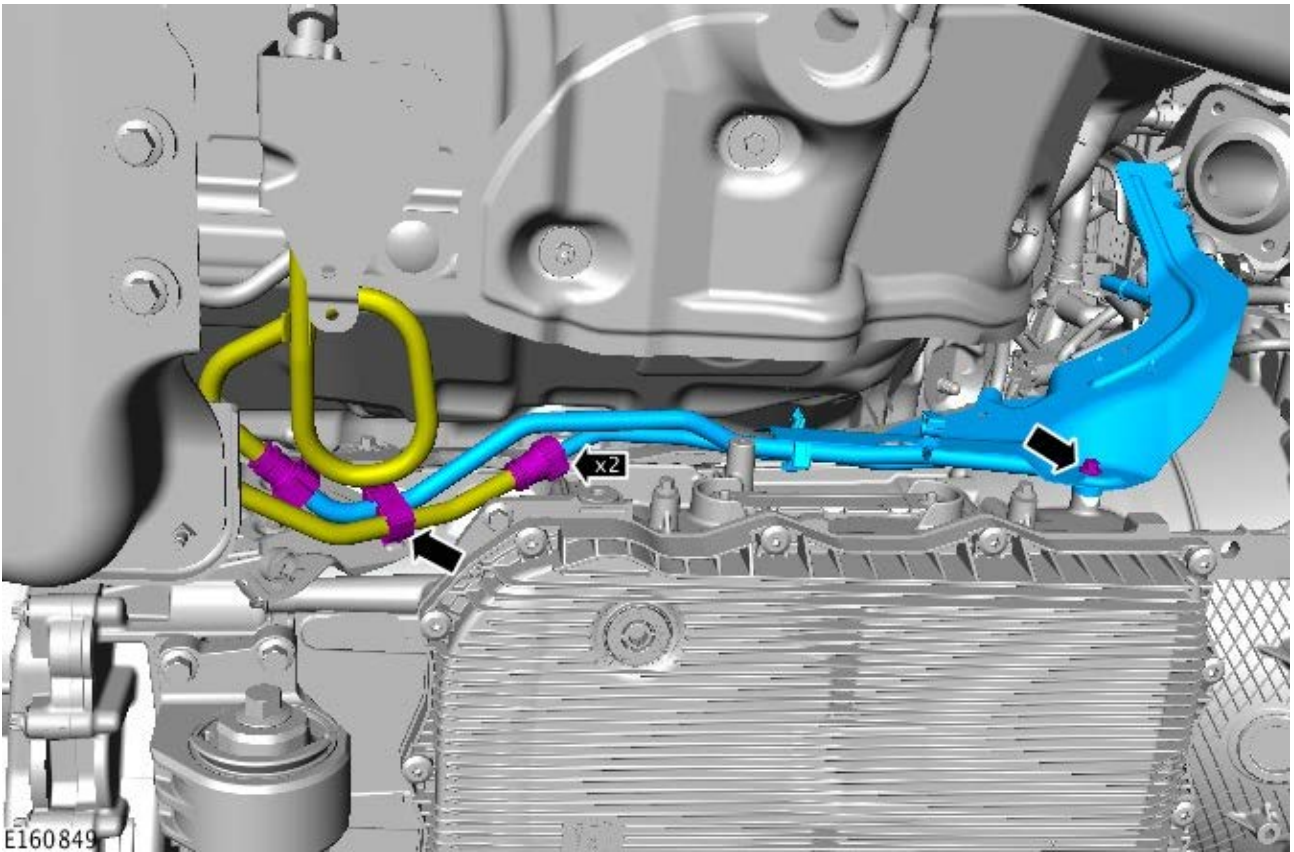
25. Torque: 10 Nm



26.



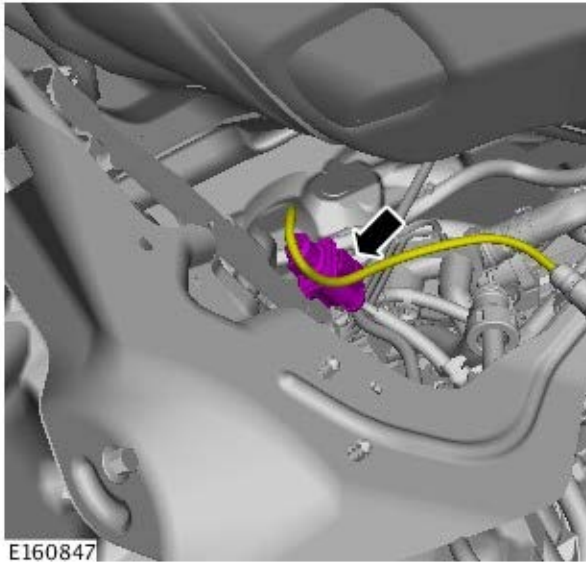
27.  CAUTION: Remove and discard the blanking plugs.
Torque: 9 Nm



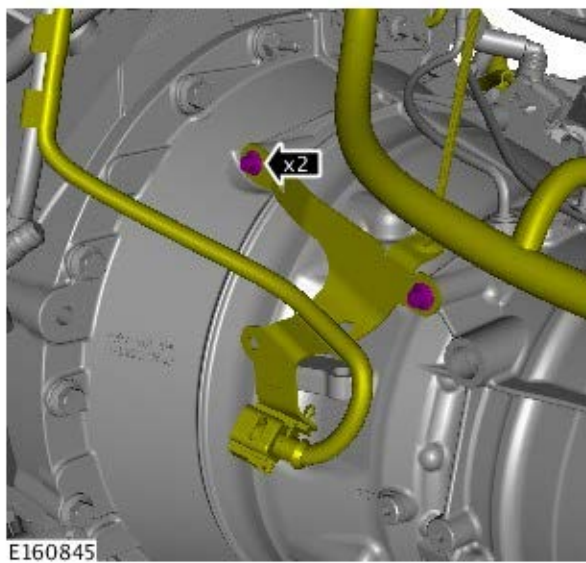
28.  CAUTION: Remove and discard the blanking plugs.

Torque: 9 Nm

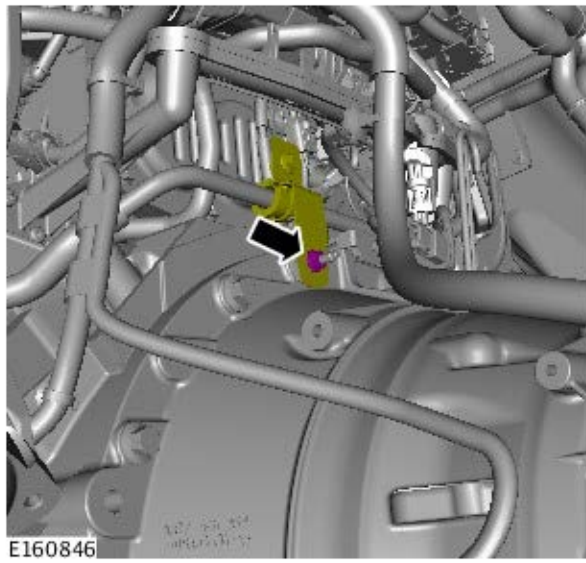
29.



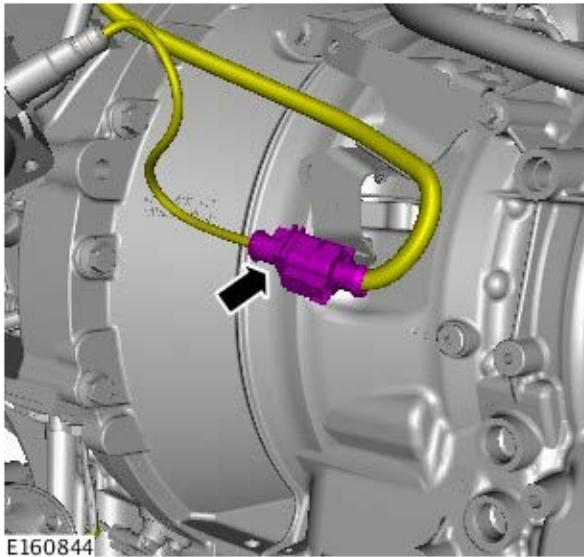
30. Torque: 9 Nm



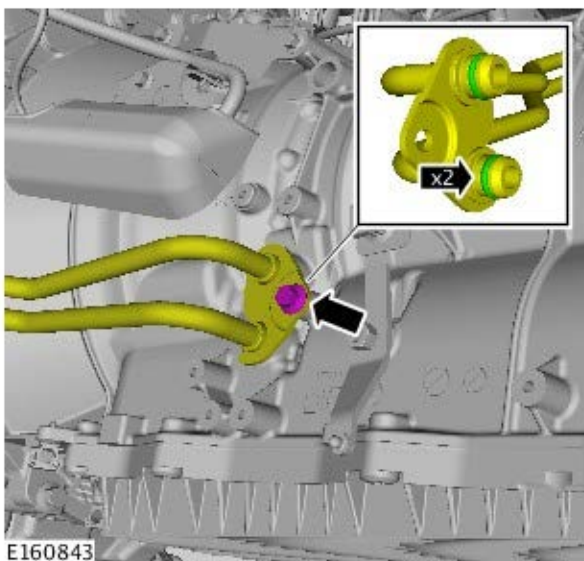
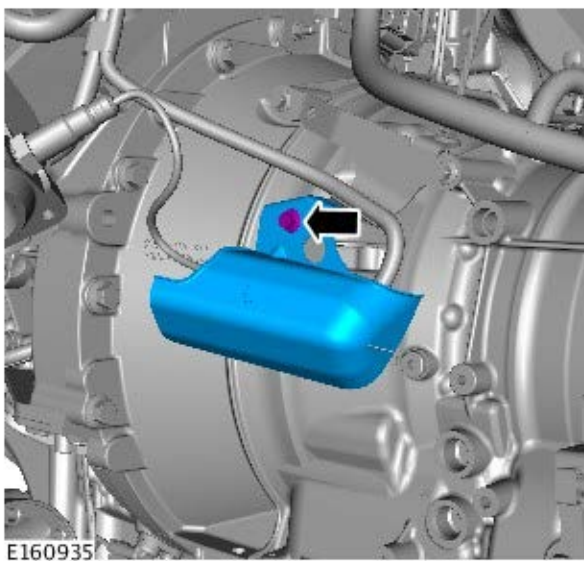
31. Torque: 12 Nm



32.



33. Torque: 15 Nm




34. CAUTIONS:

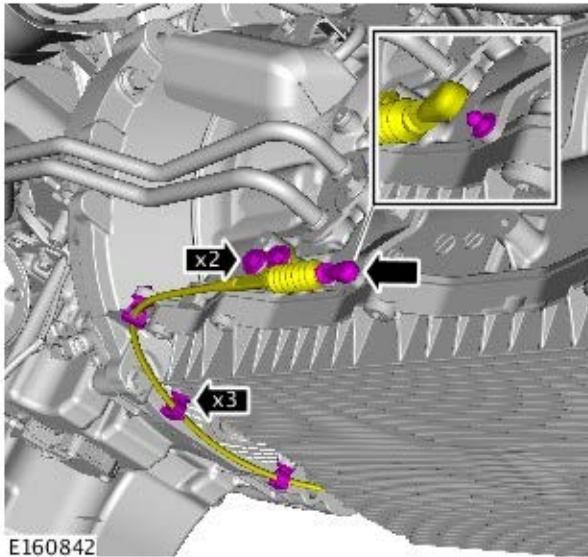
 Be prepared to collect escaping fluid.

 Install new O-ring seals.

Torque: 22 Nm

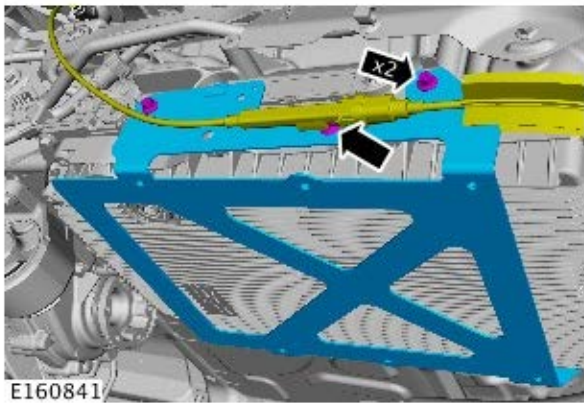
35.  CAUTION: If necessary, install new clips.

Torque: 11 Nm



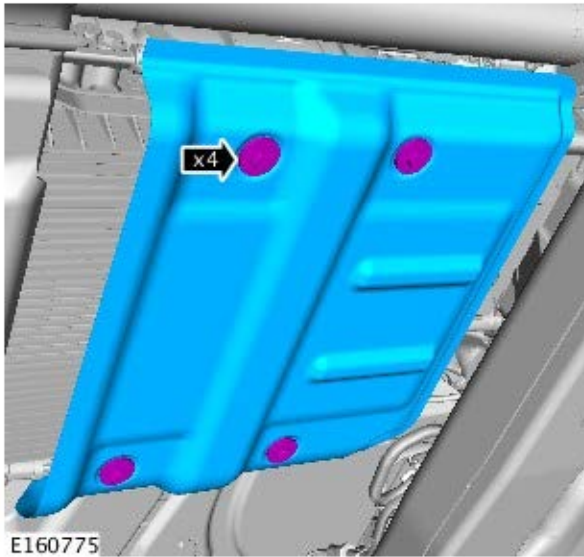
E160842

36. Torque: 9 Nm



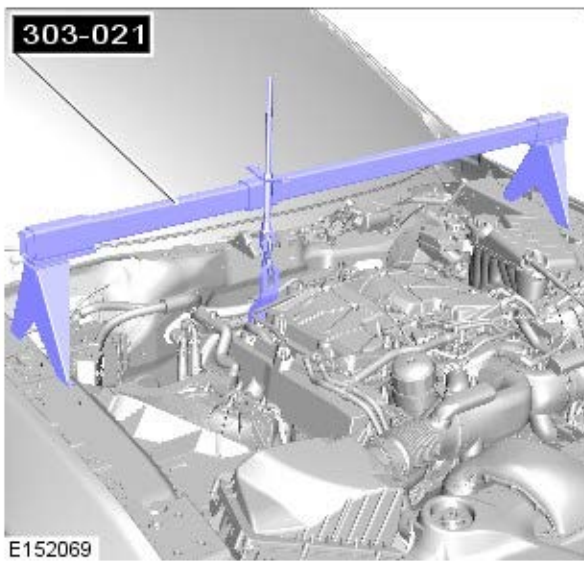
E160841

37. Torque: 9 Nm

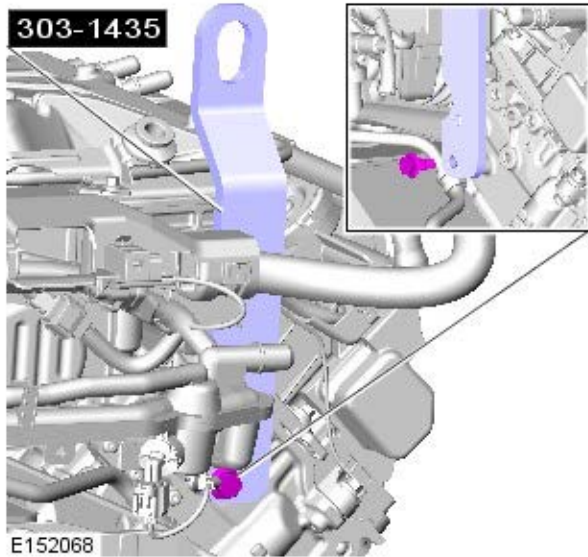


38. Refer to: [Rear Driveshaft](#) (205-01 Driveshaft, Removal and Installation).
39. Refer to: [Front Driveshaft - V6 S/C 3.0L Petrol](#) (205-01, Removal and Installation).
40. Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).
41. Refer to: [Cooling System Partial Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).

42. *Special Tool(s):* [303-021](#)



43. *Special Tool(s):* [303-1435](#)
Torque: 40 Nm



44. Refer to: [Plenum Chamber](#) (412-01 Air Distribution and Filtering, Removal and Installation).

45. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-01 Battery, Mounting and Cables, Specifications).

46. Refer to: [Transmission Fluid Level Check](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, General Procedures).

Transmission/Transaxle Cooling - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD -

Lubricants

CAUTIONS:



Do not use any lubricant other than that specified.



Do not over lubricate.

Item	Specification
Transmission fluid	ATF Shell M 1375.4 Land Rover Part No. TYK500050

Capacity

Item	Capacity
Initial dry fill	9.5 Litres (16.7 pints) (10.0 US quarts)

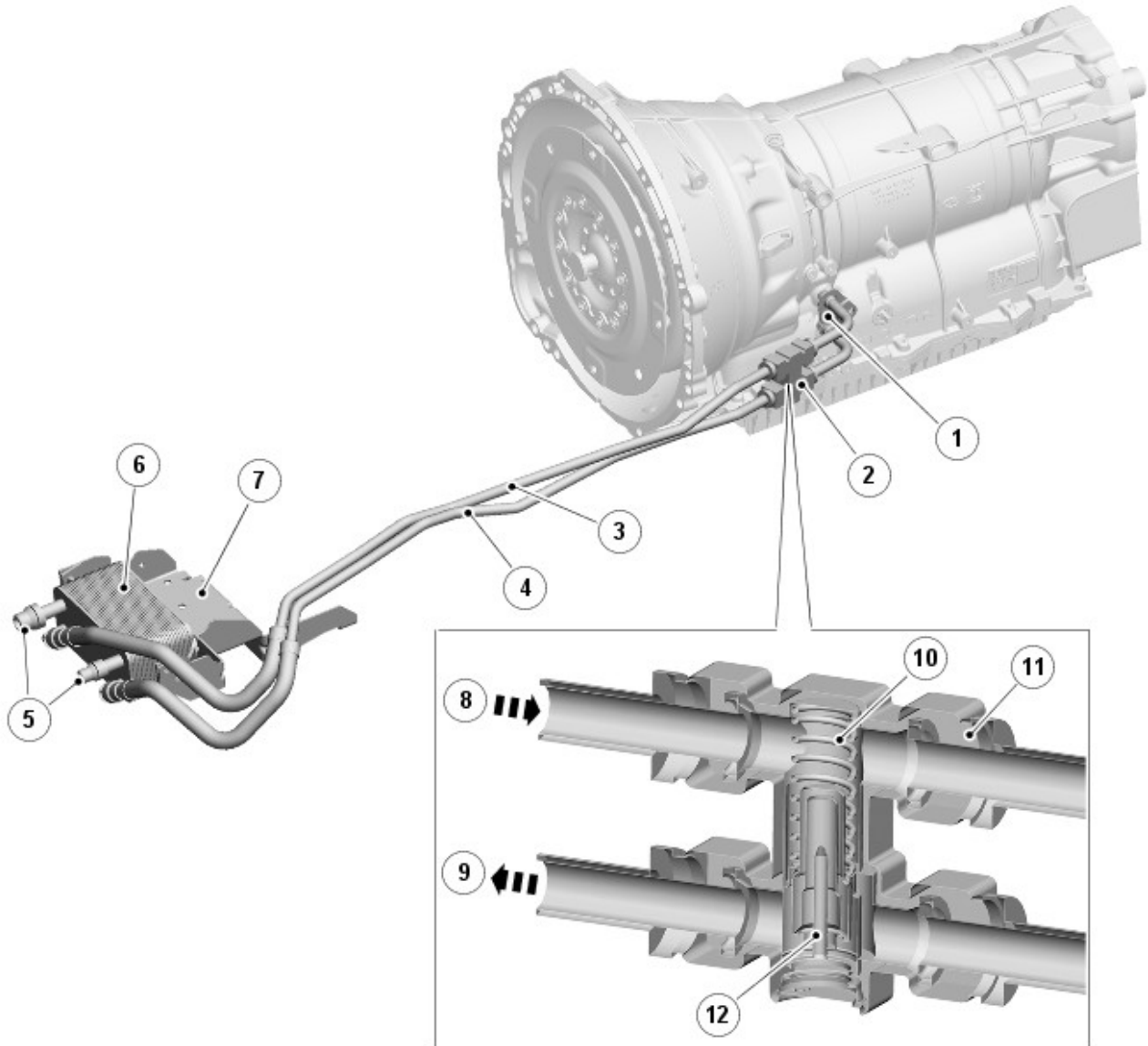
Torque Specification

Description	Nm	lb-ft	lb-in
Transmission fluid cooler tube to transmission housing bolt	23	17	-
Transmission fluid cooler tube bracket retaining bolt - vehicles with Engine 5.0L	10	7	-
Transmission fluid cooler tube bracket retaining nut - vehicles with Engine 3.0D	11	8	-
Transmission fluid cooler retaining bolts	25	18	-
Transmission fluid cooler tube line union to cooler	16	12	-

Transmission/Transaxle Cooling - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission Cooling

Description and Operation

TRANSMISSION COOLING COMPONENTS



E138647

Item	Part Number	Description
1	-	Latch-plate, transmission cooling pipe connection
2	-	Thermostatic valve
3	-	Fluid return pipe (to transmission)
4	-	Fluid supply pipe (from transmission)
5	-	Engine coolant hose connections
6	-	Transmission fluid cooler
7	-	Support bracket
8	-	Fluid return flow
9	-	Fluid supply flow
10	-	Spring
11	-	Thermostatic valve body
12	-	Valve

DESCRIPTION

The transmission fluid cooler is a separate cooling unit located behind the engine cooling radiator. The unit is attached, via a bracket, to the cooling pack protection subframe. The transmission is connected to the fluid cooler via flexible hoses and metal pipes.

The transmission fluid cooler is a dedicated cooler which is connected into the engine cooling system circuit. The transmission fluid is cooled by the temperature differential between the transmission fluid and the engine coolant flowing through the cooler.

Fluid is supplied from the transmission fluid pump, through the thermostatic valve (if open) into the cooler. After passing through the cooler, the fluid passes out of the cooler and is returned to the transmission fluid pan.

The thermostatic valve is located in the transmission cooler fluid supply and return lines. The valve contains a bi-metallic spring and valve which is closed when the transmission fluid temperature is below 69 °C (156.2 °F). At a temperature of 69 °C (156.2 °F) and above, the valve begins to open allowing the fluid to flow around the cooler. The valve is fully open at 79 °C (174.2 °F) .

Transmission/Transaxle Cooling - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission Cooling

Diagnosis and Testing

Principle of Operation

For a detailed description of the automatic transmission cooling system and operation, refer to the relevant Description and Operation sections in the workshop manual. REFER to: (307-02 Transmission/Transaxle Cooling)

Transmission Cooling (Description and Operation),
Transmission Cooling (Description and Operation),
Transmission Cooling (Description and Operation).

Inspection and Verification

1. Verify the customer concern by operating the system.
2. Visually inspect for obvious signs of damage and system integrity.

Visual Inspection

Mechanical
<ul style="list-style-type: none"> • Feed and return tubes • Connections to the automatic transmission and the automatic transmission fluid cooler • Automatic transmission fluid level

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Condition	Possible Causes	Action
Over heating of the automatic transmission	Obstruction in the automatic transmission fluid cooler	Flush out the automatic transmission fluid cooler with new automatic transmission fluid. If the flushing is unsuccessful, install a new transmission fluid cooler.
Over heating of the automatic transmission	Obstruction in the automatic transmission fluid tubes	Flush out the automatic transmission fluid cooler tubes with new automatic transmission fluid. If the flushing is unsuccessful install new automatic transmission fluid cooler tubes.
Loss of automatic transmission fluid	Connections to the automatic transmission and the automatic transmission fluid cooler	Check the integrity of the tubes, connections and seals. Check the torque of the tube fixings.
Loss of automatic transmission fluid	Leak at oil cooler	Check the integrity of tubes, connections and seals. Check the torque of the tube fixings.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Transmission Control Module (TCM) (100-00, Description and Operation).

Automatic Transmission/Transaxle External Controls - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD -

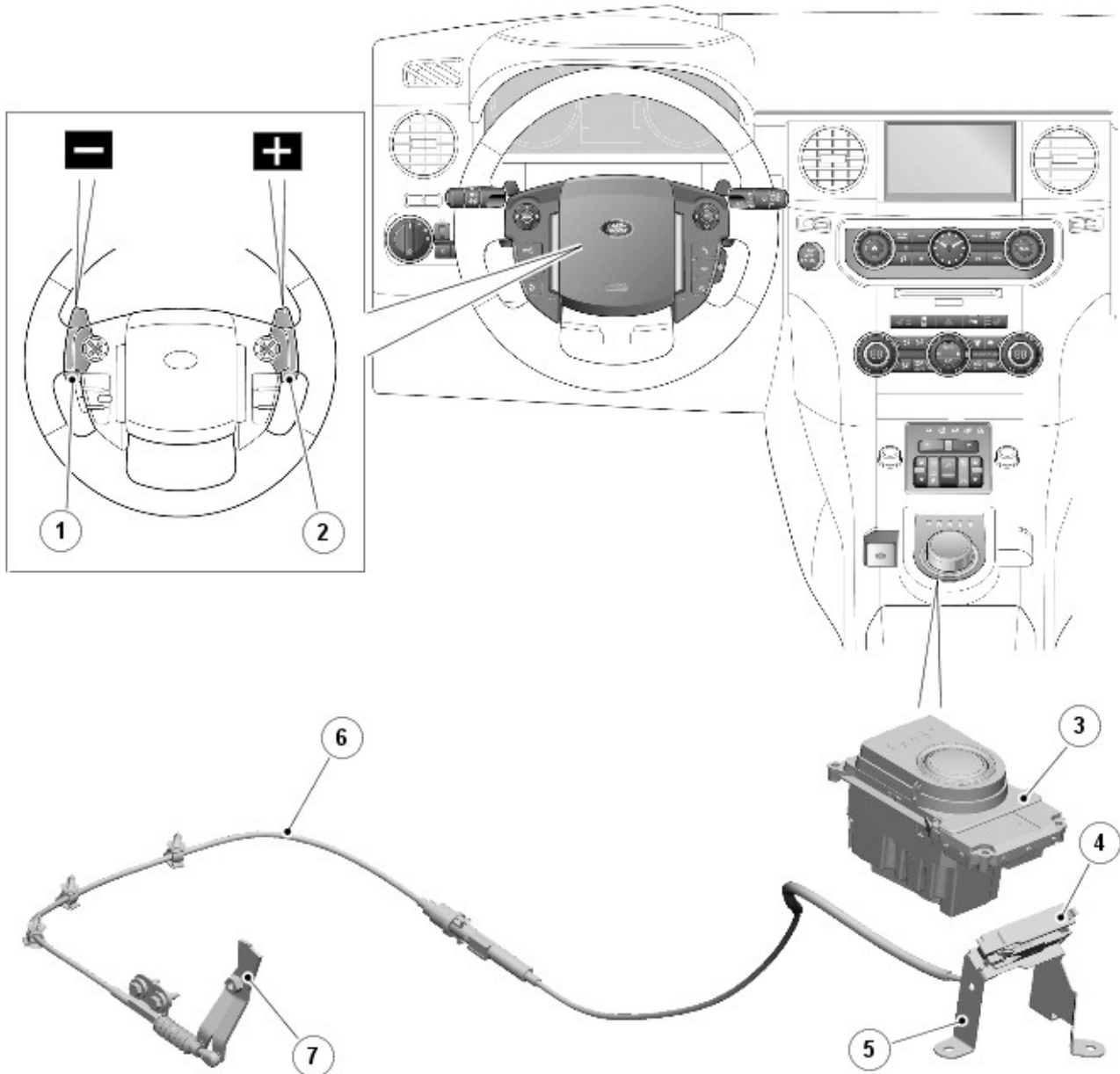
Torque Specifications

Description	Nm	lb-ft
Transmission undershield bolts	10	7
Emergency park position release cable bracket to transmission bolts	10	7
Emergency park position release lever cable bracket to floor console bolt	3	2

Automatic Transmission/Transaxle External Controls - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - External Controls

Description and Operation

TRANSMISSION EXTERNAL CONTROLS COMPONENT LOCATION



E138170

Item	Part Number	Description
1	-	Downshift paddle switch
2	-	Upshift paddle switch
3	-	Electronic Transmission Selector (ETS)
4	-	Emergency park lock lever
5	-	Mounting bracket
6	-	Cable
7	-	Emergency park lock transmission lever

OVERVIEW

The external controls for the transmission consist of an ETS (Electronic Transmission Selector), two steering wheel mounted paddle switches and an emergency park lock release-lever and cable. The ETS transmits driver transmission selections to the [TCM \(transmission control module\)](#). The paddle switches allow the driver to initiate gear shifts in all transmission modes; 'D' (Drive), 'S' (Sport) and 'S' (Sport) manual CommandShift.

The emergency park release allows the transmission park-lock to be disengaged during vehicle recovery operations.

DESCRIPTION

The ETS (Electronic Transmission Selector) is a rotary selector installed in the floor console and controls the driver transmission selections.

The TCM allows the transmission to be operated as a conventional automatic unit by selecting: 'P' (Park), 'R' (Reverse), 'N' (Neutral), 'D' (Drive) on the ETS. Rotation of the ETS allows the selection of P, R, N and D. By depressing the ETS and rotating clockwise from the D position, S mode can be selected. The ETS is a fully electronic rotary transmission-selector with no mechanical connection to the transmission.

The ETS rises once the engine is running. When the engine is stopped with the ETS in any position other than 'N', it retracts into the console again. If the ETS is in position 'N' when the engine is stopped, it remains in the raised position for up to 10 minutes; for use in a drive-through car wash for example. After 10 minutes the ETS automatically retracts. The ETS also retracts if 'P' is selected within the 10 minute period of 'N' selection. If the ETS does not rise from the console when the engine is started, but electrical power is supplied to the ETS, the retracted ETS can still be rotated to make selections.

If electrical power to the ETS is lost, the ETS will not rise from the console when the engine is started and the retracted selector will not rotate. The ETS contains an internal interlock solenoid to prevent the selector from being rotated when the engine is not running.

The engine can be stopped with the ETS in any position. Once the engine is stopped the selector will automatically reset to the 'P' position and the transmission park-lock will be engaged, except if the selector is in the 'N' position when the engine is stopped.

PADDLE SWITCHES

Two gear change paddle-switches are fitted at the rear of the steering wheel and allow the driver to operate the transmission as a semi-automatic manual gearbox using the 'Commandshift' feature. Each paddle switch has three connections; ground, illumination PWM (pulse width modulation) supply and ground switch signal.

EMERGENCY PARK RELEASE



WARNING: The vehicle must be suitably restrained either by use of the EPB (electronic parking brake) or wheel chocks before operation of the emergency park-release mechanism in order to prevent vehicle roll-away.

If the vehicle requires recovery/transportation, the emergency park-release mechanism is used to manually disengage the park-lock and position the transmission in neutral. The emergency park release mechanism consists of an operating lever that is connected to a park interlock lever on the transmission by a cable assembly. The operating lever is installed in the floor console, under the drinks holder. To access lever remove the drinks holder. The park interlock lever is attached to the transmission selector shaft via a Bowden cable.

OPERATION

Rotation of the ETS (Electronic Transmission Selector) selector to any of the five positions is sensed by the TCM via the high-speed CAN (controller area network). The TCM then reacts according to the selected position.

PARK INTERLOCK AND NEUTRAL LOCK

Neutral lock is a requirement for the ETS. The selector is always locked at ignition 'on' when the engine is not running, except after an engine stall when the selector is not in 'P' or 'N'. If, when driving with the ETS in 'S', 'D' or 'R' at a speed of more than 5 km/h (3 mph), and the driver selects 'P' or 'N'; without the brake pedal pressed, the ETS will be immediately locked once the vehicle speed falls to below 5 km/h (3 mph).

With the brake pedal pressed, the ETS will remain unlocked for as long as the brake pedal remains pressed, regardless of vehicle speed. The transmission will only engage park once the vehicle speed is less than 2 km/h (1 mph). If the driver selects 'N' and releases the brake pedal with a vehicle speed of less than 5 km/h (3 mph), the ETS will be locked 2 seconds after 'N' is selected. The selector will remain locked until the driver presses the brake pedal again.

To ensure that a driver request to change from a non-driving range ('N' for example) to a driving range ('D' for example), the park interlock and neutral lock features are used in conjunction with the intermediate position. If the transmission receives a range change request without the brake pedal pressed, the TCM initiates a soft lock function. The transmission will remain in park or neutral, depending on the starting position.

The ETS is a magnetic system using Hall effect sensors to determine the position of the selector. The 'S' (sport) position selection allows the TCM to operate the transmission using the semi-automatic 'Commandshift' system. Gear selections are sensed by the TCM when the driver operates the steering wheel paddle-switches. Once the ETS position is confirmed, the TCM outputs appropriate information on the high-speed CAN bus which is received by the instrument cluster to display the gear selection information in the message center. The paddles can also be used on a temporary basis when the ETS is in the 'D' position to override the automatic gear selection if required.

If a transmission position letter is flashing in the message center and the vehicle has no drive, the driver must:

- Press the brake pedal
- Reselect 'N' or 'P' on the ETS
- Select the required driving range, ensuring that the brake pedal is pressed.

Rocking Function

The rocking function compliments the neutral lock function. For all changes from a non-driving range to a driving range, it is necessary to press the brake pedal (to release either the park interlock or neutral lock). In situations where the driver will require to change the gear selection from 'R' to 'D', or from 'D' to 'R', without brake pedal input

(car park maneuvering, 3 point turns or 'rocking' the vehicle from a slippery surface for example), the rocking function gives a 2 second lock delay when 'N' is selected on the ETS and the brake pedal is not pressed.

Intermediate Position

If the ETS is rotated slowly from 'P' to 'S' and back to position 'P' with the brake pedal pressed, the 'R' or 'D' position display letter in the message center will flash and the transmission will remain in park or neutral depending on the previous starting position of the selector. If the brake pedal is released when 'R' or 'D' is flashing in the message center and the ETS is rotated to the 'R' or 'D' position, the required range will not be selected and the transmission will remain in park or neutral, depending on the previous starting position. This feature is known as soft lock. If the driving range letter in the message center is flashing and the vehicle has no drive, the driver should depress the brake pedal to reselect 'N' or 'P', and then select the required driving range while the brake pedal remains pressed.

PADDLE SWITCHES

The paddle switches are hardwired to the steering wheel audio and via the clockspring to the instrument cluster. The instrument cluster converts the signal into a high-speed CAN bus signal to the TCM.

Pulling the LH (left-hand) downshift (-) paddle provides down changes and pulling the RH (right-hand) upshift (+) paddle provides up changes. The first operation of either paddle, after sport mode is selected, puts the transmission into permanent manual Commandshift. Rotation of the ETS back to the 'D' position, returns the transmission to conventional automatic operation. Temporary operation of Commandshift mode can also be operated with the ETS in the 'D' position. Operation of either the upshift or downshift paddles activates the manual mode operation. If the ETS is in 'D', Commandshift will cancel after a time period or can be cancelled by pressing and holding the (+) paddle for approximately 2 seconds.

EMERGENCY PARK RELEASE

One end of the operating lever is attached to a base by a hinge pin. A locking cylinder is installed in the other end of the operating lever, to secure the operating lever to the base. The operating lever is raised by pulling on a strap. When operated, the emergency park release mechanism turns the transmission selector shaft.



WARNING: Before disengaging the park lock, apply the EPB if electrical power is available or apply restraints to the vehicle, for example wheel chocks, to prevent vehicle roll-away. Ensure that the ignition is turned off.

To disengage the park lock: Remove the drinks holders. Rotate the locking mechanism of the emergency park release lever 90 degrees counterclockwise. Apply the footbrake, pull the operating lever upwards and ensure it locks in the vertical position. Raising the operating lever causes the emergency park release cable to rotate the park interlock lever on the transmission, which disengages the parking pawl and engages neutral. This allows the vehicle to freewheel.

To re-engage the park lock: Hold the strap on the operating lever, release the latch and lower the operating lever to the horizontal position. Lock the operating lever by turning the locking mechanism 90 degrees clockwise. Install the drink holders.

Automatic Transmission/Transaxle External Controls - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - External Controls

Diagnosis and Testing

Principles of Operation

For a detailed description of the transmission external controls, refer to the relevant description and operation sections in the workshop manual.

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Check for stuck/jammed switches and buttons • Visibly damaged or worn components • Loose or missing fasteners 	<ul style="list-style-type: none"> • Fuse(s) • Loose or corroded electrical connector(s)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, check for diagnostic trouble codes (DTCs) and refer to the DTC index

DTC Index

For a list of diagnostic trouble codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Engine Control Module - 3.0L NA V6 - AJ63 (PCM) (100-00, Description and Operation).

Automatic Transmission/Transaxle External Controls - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission Control Switch (TCS)

Removal and Installation

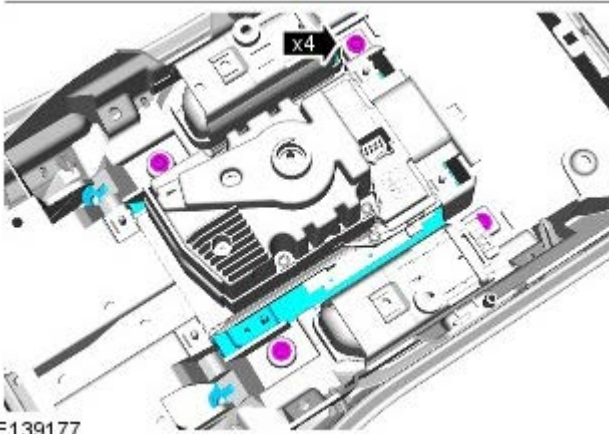
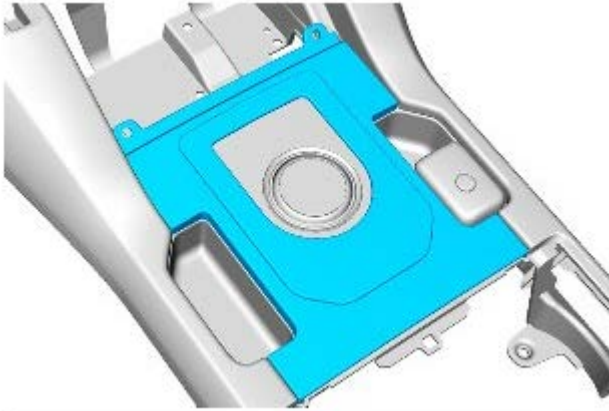
Removal



NOTE: Removal steps in this procedure may contain installation details.

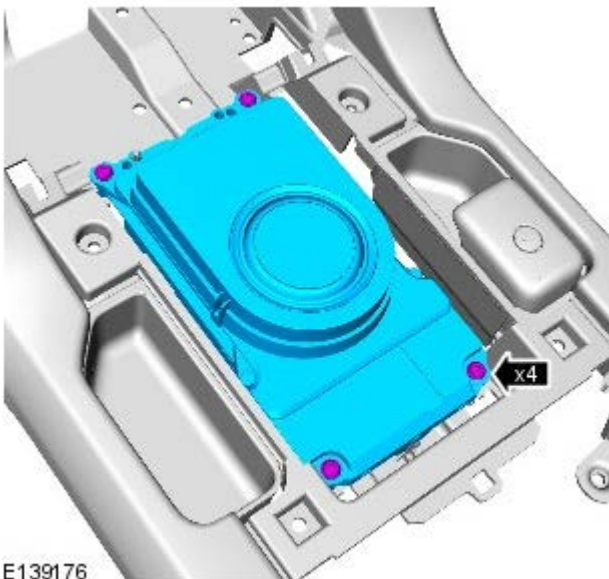
1. Refer to: Floor Console Upper Section (501-12, Removal and Installation).

2.



E139177

3.



E139176

Installation

1. To install, reverse the removal procedure.

Automatic Transmission/Transaxle External Controls - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Transmission Control Switch (TCS) Knob

Removal and Installation

Removal

NOTES:




Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.



E138747

1.  **WARNING:** The cap will be released suddenly. Keep hands clear during removal. Failure to follow this instruction may result in personal injury.

CAUTIONS:

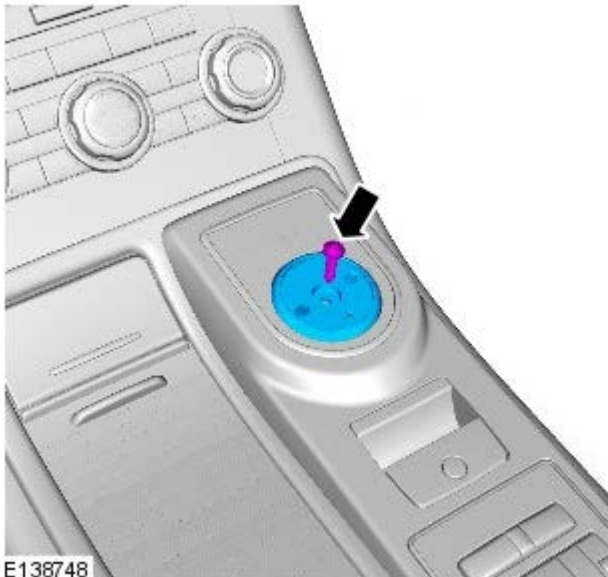


Do not start the engine.




Care must be taken to avoid damaging the surrounding components.

2. *Torque: 2 Nm*



E138748

Installation

1.  **CAUTION:** Make sure that a new component is installed.



NOTE: Make sure to install the TCS plastic carrier to the TCS knob.

To install, reverse the removal procedure.

Automatic Transmission/Transaxle External Controls - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Emergency Park Position Release Lever

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

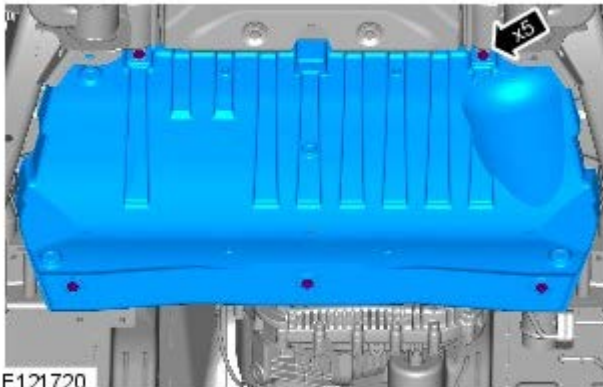
1. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

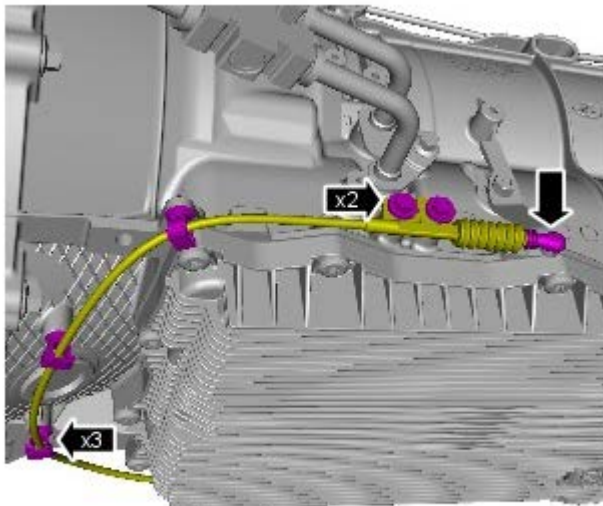
2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

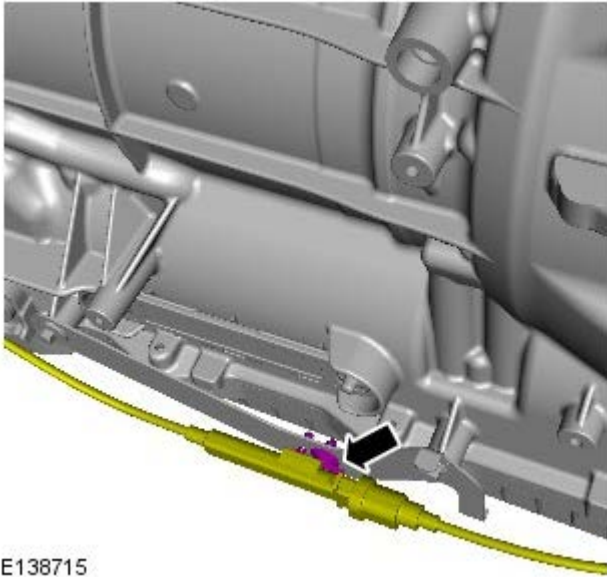
3. Torque: 10 Nm



4. Torque: 10 Nm

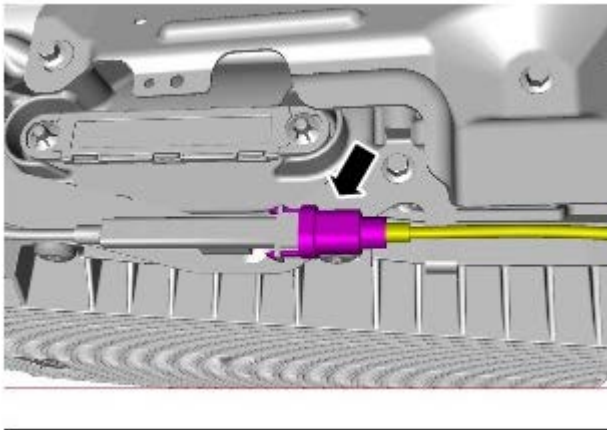


- 5.



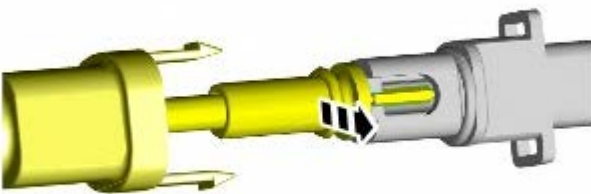
E138715

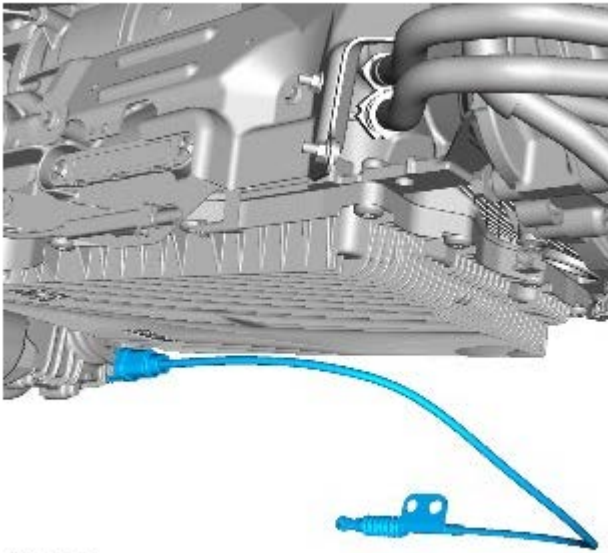
6.



E139023

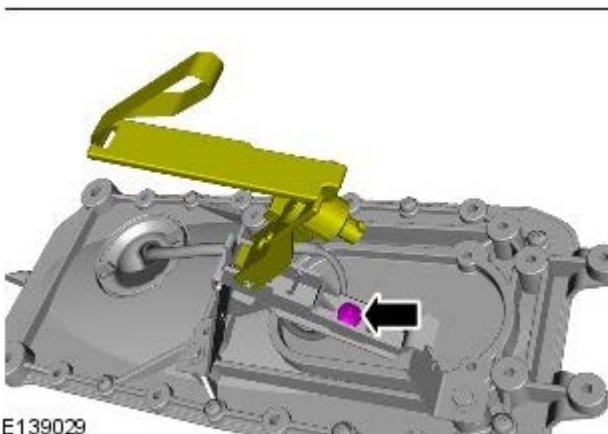
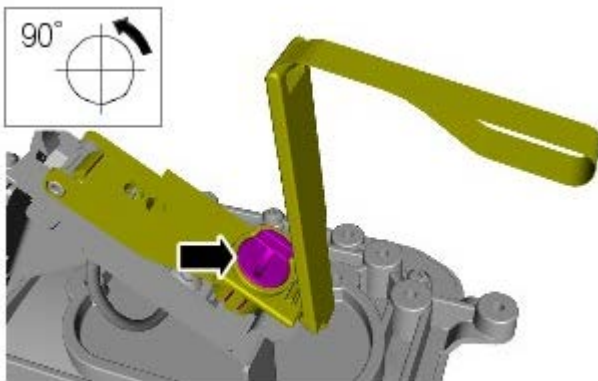
7.





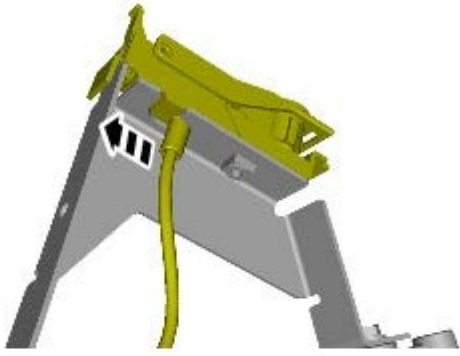
E139024

8. Lower the vehicle.
9. Refer to: Floor Console Upper Section (501-12, Removal and Installation).
10. *Torque: 3 Nm*



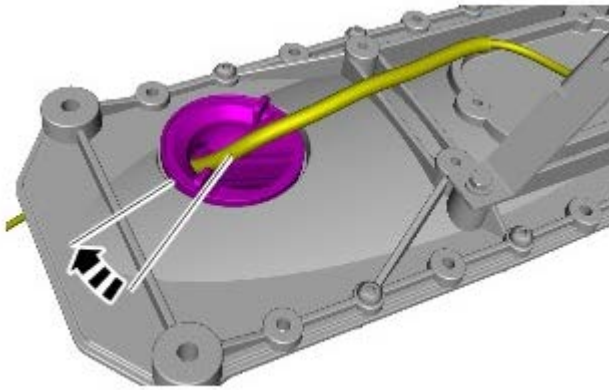
E139029

- 11.



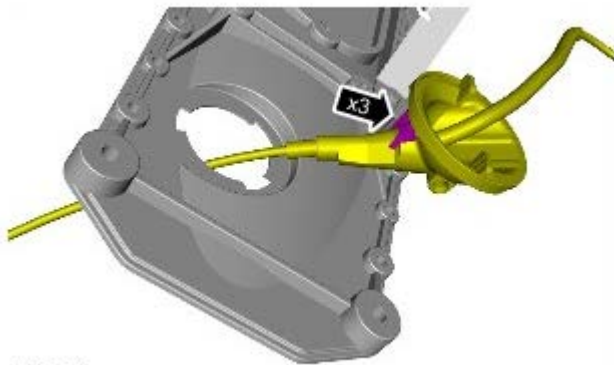
E139030

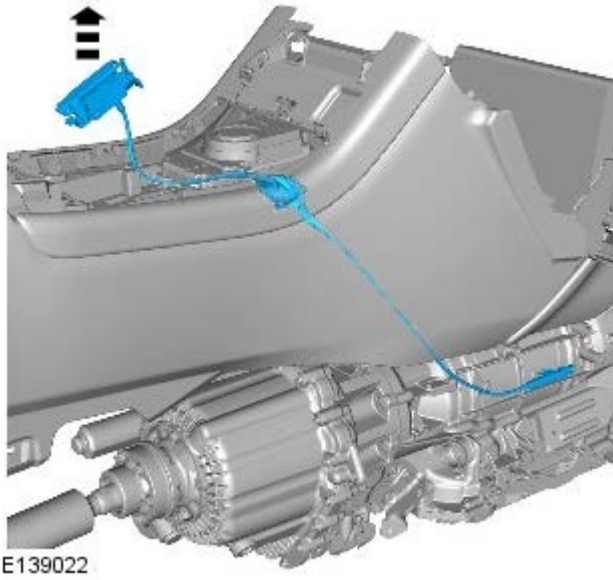
12.



E139031

13.





E139022

Installation

1. To install, reverse the removal procedure.

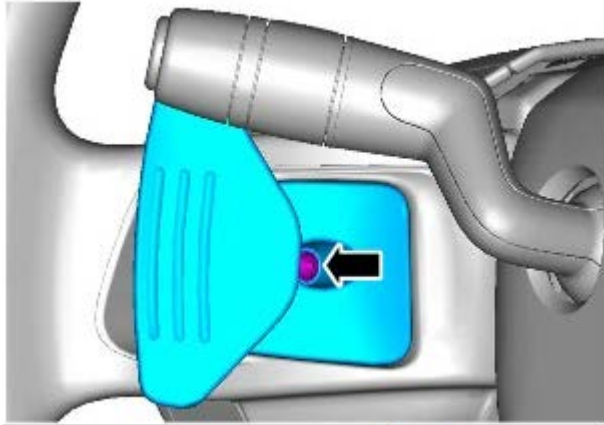
Automatic Transmission/Transaxle External Controls - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Upshift Paddle Switch

Removal and Installation

Removal

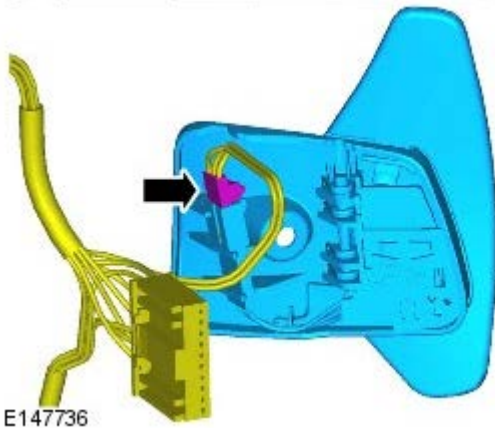


NOTE: Removal steps in this procedure may contain installation details.



1. NOTE: Make sure that the harness is routed to the position noted on removal.

Torque: 3 Nm



Installation

1. To install, reverse the removal procedure.

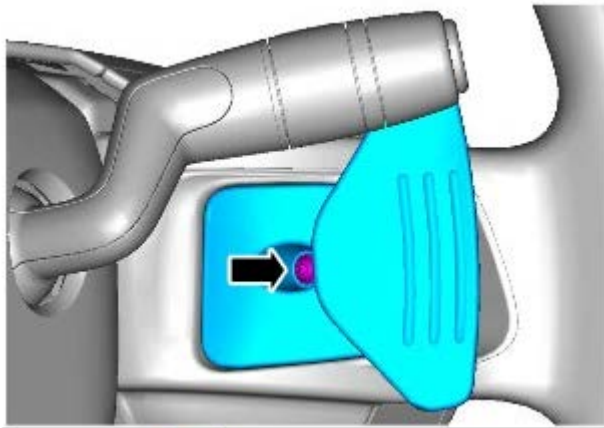
Automatic Transmission/Transaxle External Controls - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD - Downshift Paddle Switch

Removal and Installation

Removal

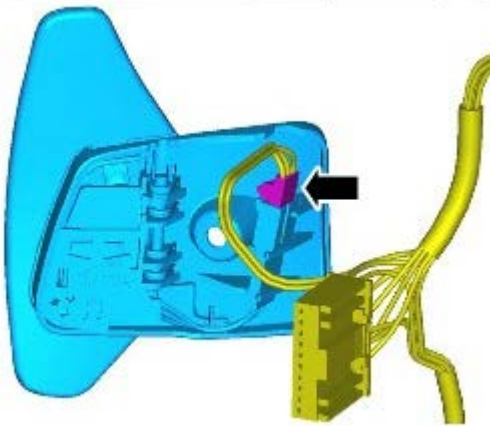


NOTE: Removal steps in this procedure may contain installation details.



1. NOTE: Make sure that the harness is routed to the position noted on removal.

Torque: 3 Nm



E147737

Installation

1. To install, reverse the removal procedure.

Four-Wheel Drive Systems -

Torque Specifications



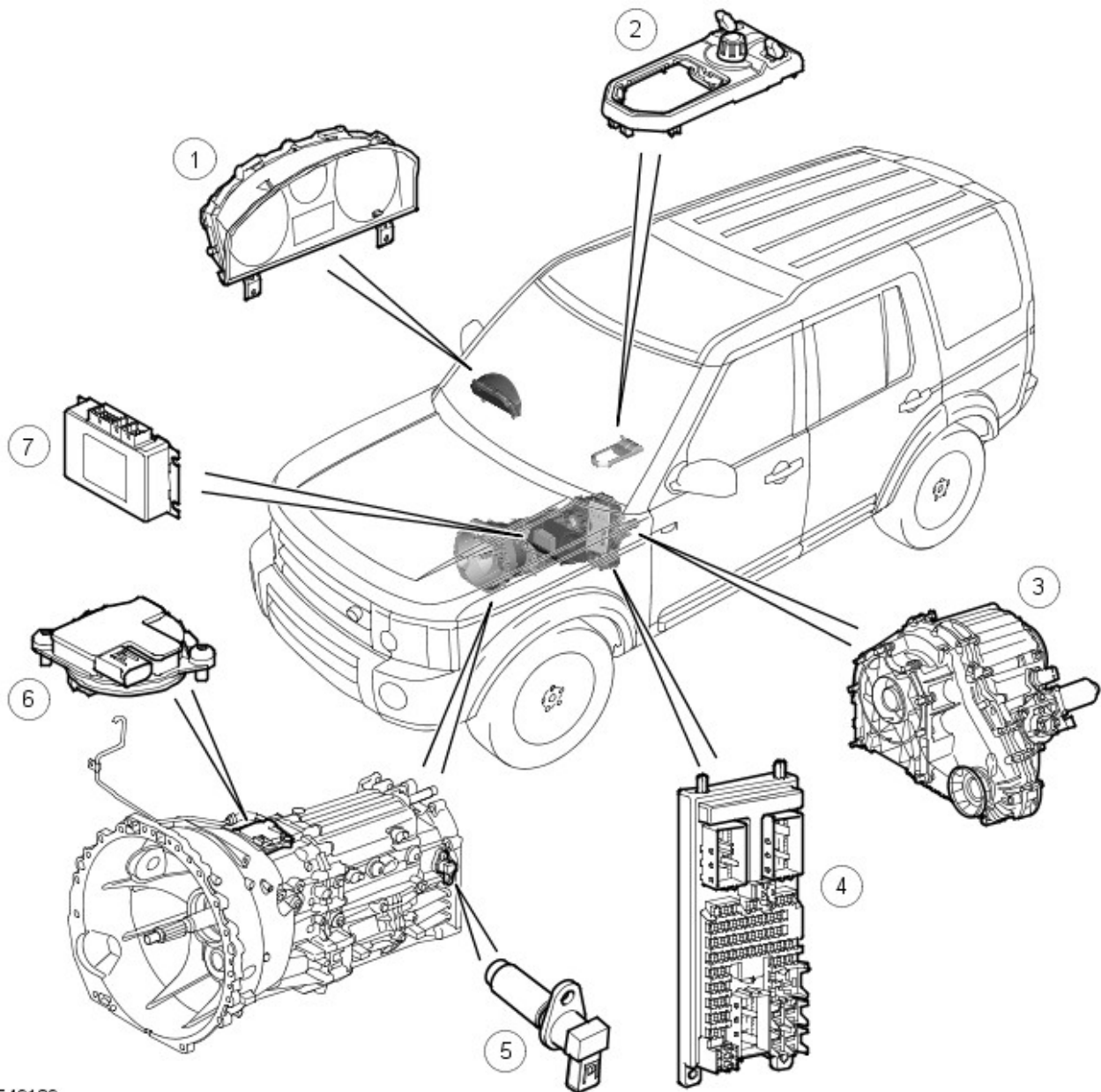
NOTE: * **New bolts must be used when a new component is installed.**

Description	Nm	lb-ft
* Transfer case shift motor Torx bolts	35	26
* Transfer case clutch control solenoid Torx bolts	5	4
* High/Low range sensor Torx bolts	5	4

Four-Wheel Drive Systems - Four-Wheel Drive Systems

Description and Operation

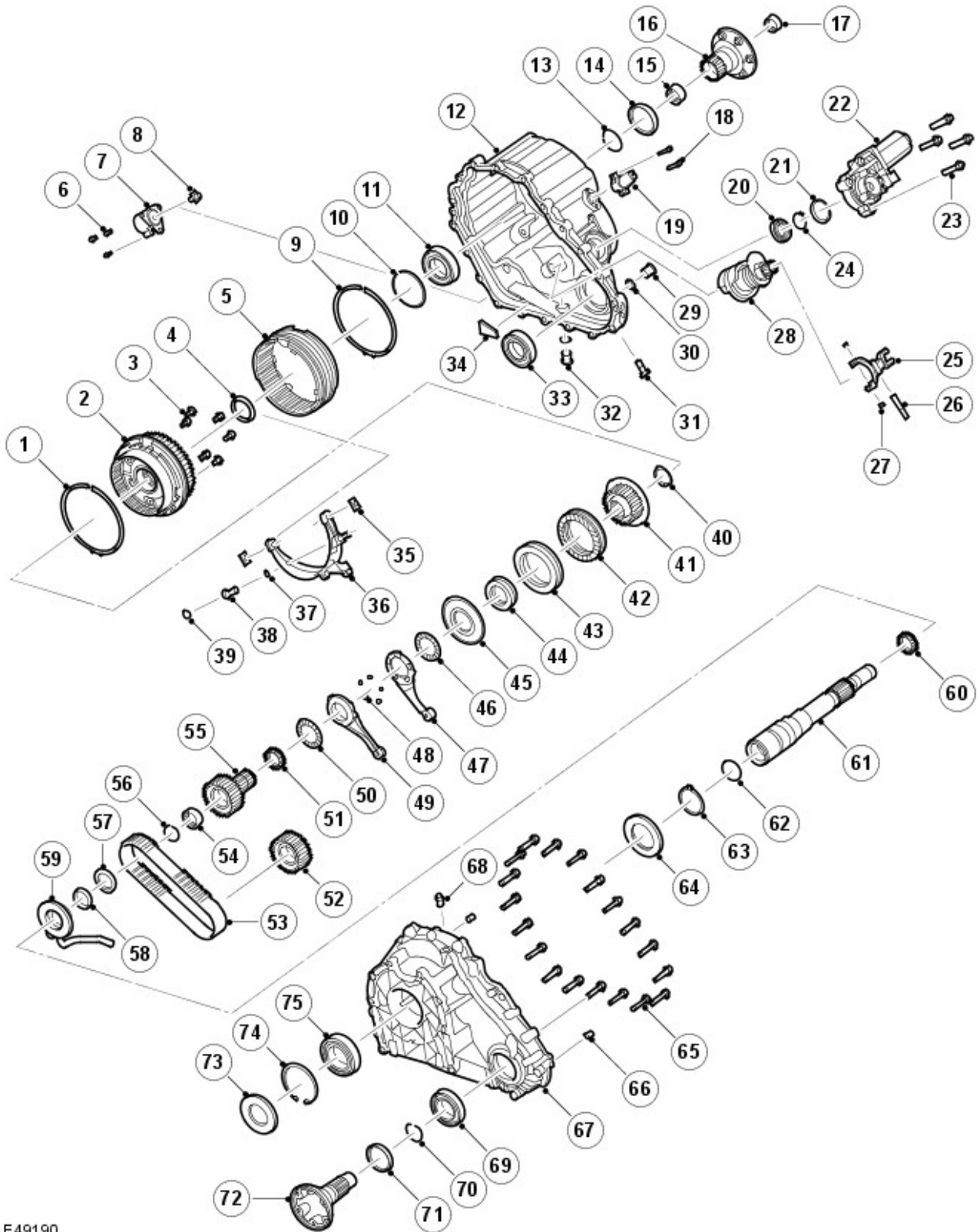
Transfer Box Component Location



E49189

Item	Part Number	Description
1	-	Instrument cluster
2	-	Range change selection switch
3	-	Transfer box
4	-	Central junction box (CJB)
5	-	Manual transmission output shaft speed sensor
6	-	Gear position sensor (manual transmission only)
7	-	Transfer box control module

Transfer Box Exploded View



E49190

Item	Part Number	Description
1	-	Synchronisation spring
2	-	Differential assembly
3	-	Bolt, 6 off
4	-	Spacer ring
5	-	Shifting sleeve
6	-	Bolt, 3 off
7	-	Solenoid
8	-	Shifting element
9	-	Synchronisation spring
10	-	Circlip
11	-	Ball bearing

12	-	Rear housing
13	-	Circlip
14	-	Seal ring
15	-	Needle roller bearing
16	-	Rear output flange
17	-	Needle roller bearing
18	-	Bolt, 2 off
19	-	Selector fork position sensor
20	-	Bearing
21	-	Circlip
22	-	Transfer box motor assembly
23	-	Bolt, 4 off
24	-	Circlip
25	-	Shifting fork
26	-	Fork pin
27	-	Sliding block
28	-	Actuator assembly
29	-	Fill plug
30	-	Seal ring
31	-	Ball retention
32	-	Drain plug
33	-	Seal ring
34	-	Particle collector magnet
35	-	Sliding block
36	-	High/low shifting fork
37	-	O-ring
38	-	High/low fork pin
39	-	Circlip
40	-	Circlip
41	-	Clutch hub
42	-	Clutch friction plate, 10 off
43	-	Clutch steel plate, 10 off
44	-	Disc spring, 6 off
45	-	Clutch piston
46	-	Axial needle roller bearing
47	-	Transfer box motor lever assembly
48	-	Ball, 5 off
49	-	Transfer box motor lever assembly
50	-	Axial needle roller bearing
51	-	Needle roller bearing
52	-	Front output sprocket
53	-	Chain
54	-	Needle roller bearing
55	-	Sprocket
56	-	Circlip
57	-	Thrust washer
58	-	Spacer ring
59	-	Oil pump assembly
60	-	Needle roller bearing
61	-	Input shaft
62	-	O-ring
63	-	Circlip
64	-	Disc spring, 2 off
65	-	Bolt, 19 off
66	-	Dowel pin (2 off)
67	-	Front housing
68	-	Breather cartridge
69	-	Bearing
70	-	Circlip
71	-	Seal ring
72	-	Front output flange
73	-	Seal ring
74	-	Circlip

GENERAL

The DD295 transfer box is a full time, permanent four-wheel-drive unit, with 50/50 torque distribution to the front and rear driveshafts. The unit is manufactured by Magna Steyr Powertrain in Graz, Austria and supports the following features:

- Permanent four-wheel-drive with a bevel gear centre differential, providing a 50:50 torque split
- Selectable high and low range for optimum on-road and off-road performance
- Two-speed, fully synchronized 'shift-on-the-move' system allows the driver to change the range without having to stop the vehicle
- Electronically controlled multi-plate clutch providing a centre differential lock and torque biasing function to give improved traction performance and vehicle dynamic stability.

A strategy, to electronically control the centre differential multi plate clutch assembly, has been developed to provide:

- a pre-loading function, increasing locking torque with increased driving torque
- a slip controller to increase locking torque under off-road conditions and decrease locking torque for optimum comfort, e.g. parking.

The unit is located under the vehicle and is mounted on the cross-member, behind the transmission. The unit is identical for all engine derivatives.

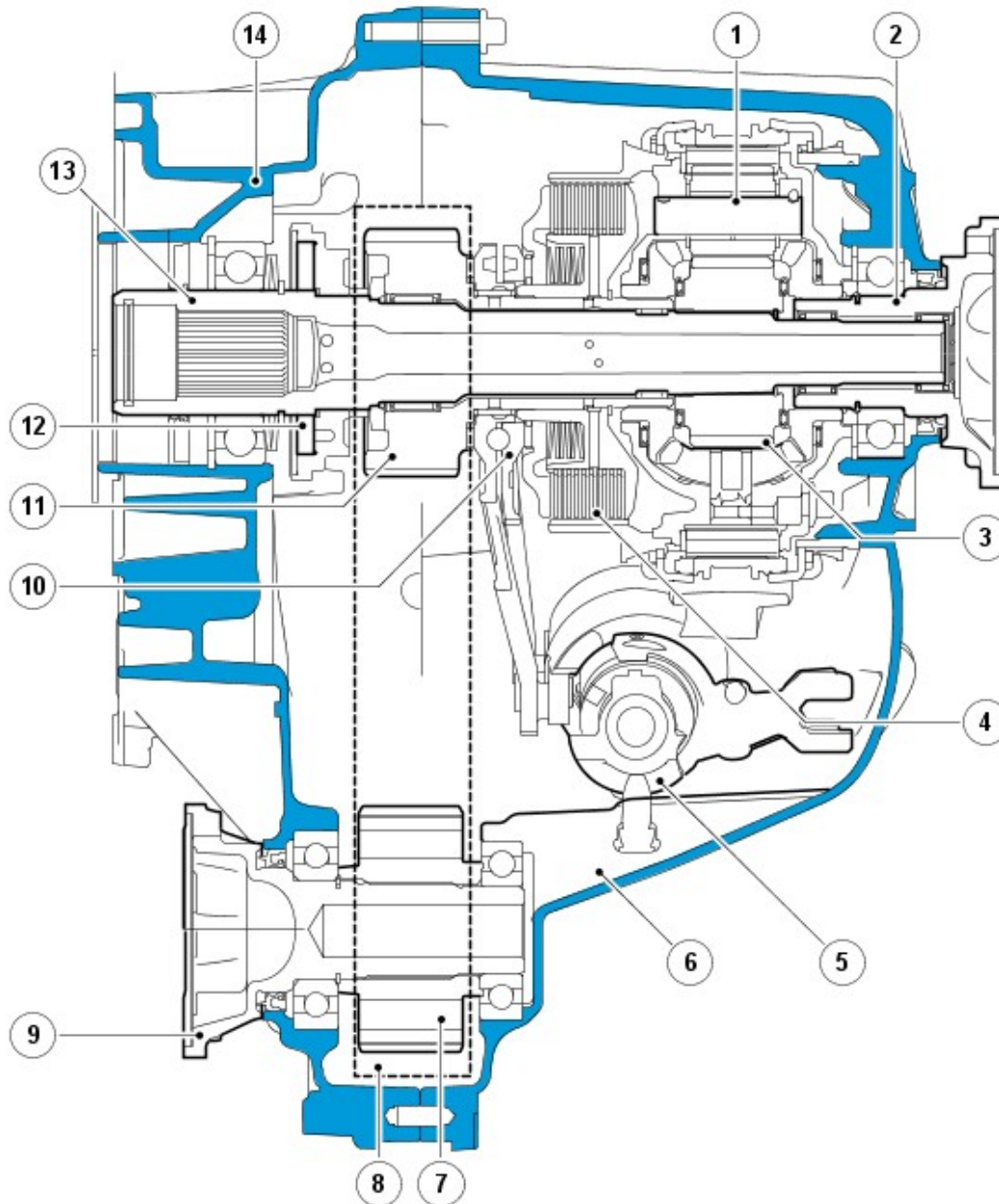
The transfer box receives a torque input from the transmission output shaft, which is passed through the unit to two outputs for the front and rear drive shafts.

The input torque is equally distributed via a bevel gear type differential. In order to provide an optimal torque distribution to each wheel in all driving conditions, the unit is equipped with an electronically controlled locking and torque-biasing device. This device detects wheel slip via various vehicle system inputs to the transfer box control module and locks the differential accordingly. The locking torque is applied through a multi-plate clutch assembly.

A planetary gear set, located in the differential assembly, allows the driver to select high or low range whilst driving, this is known as 'shift on the move'. When in low range, the planetary gear set provides a ratio of 2.93:1, which gives the vehicle an extremely low crawl speed for off road driving and trailer towing. High range is a direct drive from the transmission output shaft and provides a 1:1 ratio.

Both the centre differential locking and biasing and the 'shift on the move' features are actuated via a DC transfer box motor, which is controlled by the transfer box control module, via a Pulse Width Modulation (PWM) signal.

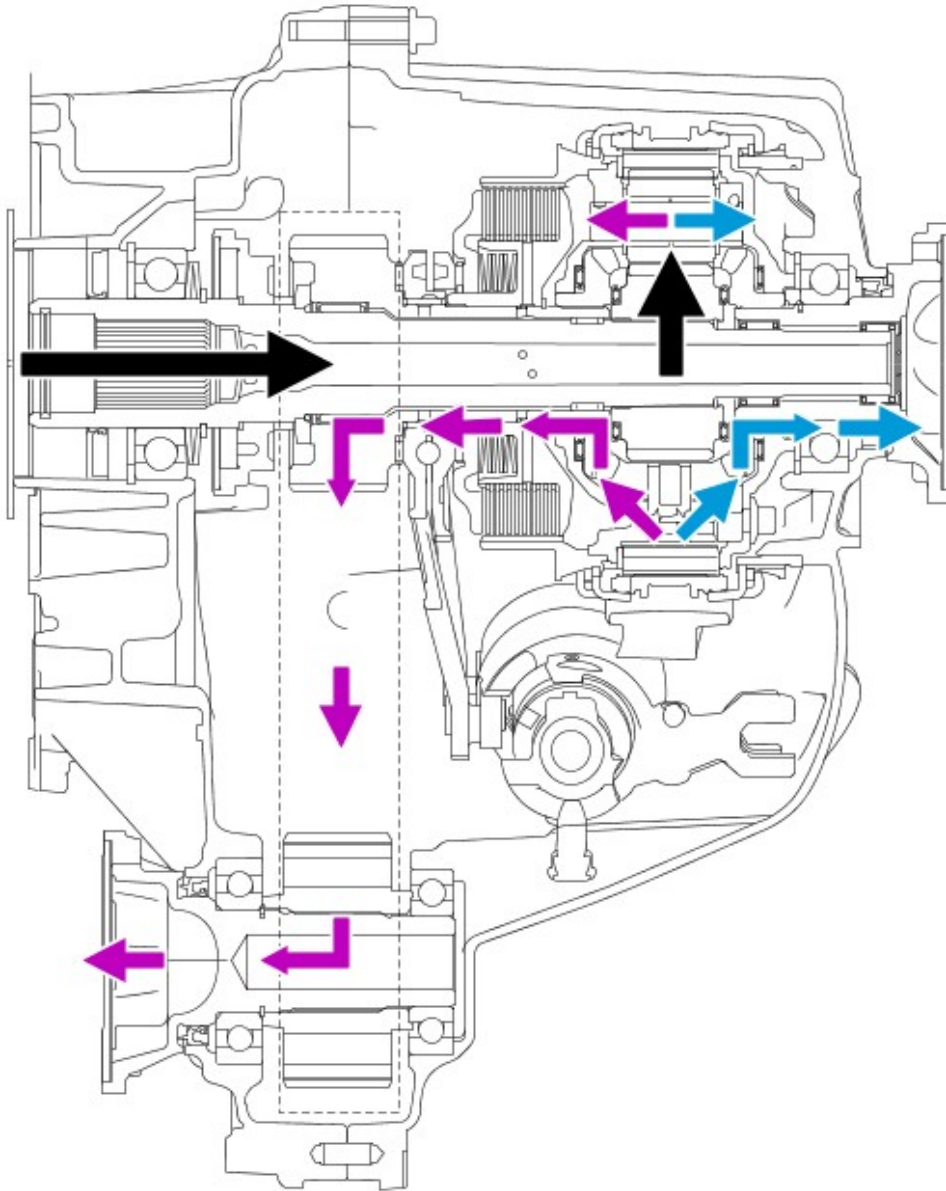
Transfer Box - Sectional View



E49191

Item	Part Number	Description
1	-	Planetary gear set
2	-	Rear output flange
3	-	Centre differential assembly
4	-	Multi-plate clutch
5	-	Transfer box motor module
6	-	Rear housing assembly
7	-	Front output sprocket
8	-	Chain drive
9	-	Front output flange
10	-	Transfer box motor levers
11	-	Sprocket
12	-	Oil pump assembly
13	-	Input shaft
14	-	Front housing assembly

Transfer Box Power Flow



E49192

The input torque, from the transmission, is transferred to the input shaft of the transfer box and then onto the planetary sun gear and planetary pinion gears. The planetary pinion gears are held in place by the planet pinion shafts, which are connected to the differential carrier, and drive the differential pinion gears. The torque is then distributed to both the front and rear carriers, which are connected to the outputs of the transfer box. The rear carrier is connected directly to the rear output flange; the front carrier is connected to the sprocket and therefore to the chain drive, which provides the front output flange rotation.

TRANSFER BOX CASINGS

The front and rear casing assemblies are manufactured from cast aluminium.

Front Casing Assembly

The front casing assembly provides the location for the input shaft bearing and the front output flange bearing. It is also equipped with threaded holes to mount the chassis mounting bush, two lifting eyes and a breather cartridge for the transfer box breather pipe. The breather pipe allows an equalisation between atmospheric and internal transfer box pressure.

Rear Casing Assembly

The rear casing assembly provides the location for the rear output flange bearing, the transfer box motor and the oil fill and drain plug. Fins are cast into the rear casing assembly to improve the heat dissipation. The unit number is also stamped into the rear housing.

OIL PUMP

An oil pump assembly is located in the front casing to provide lubrication for the bearings and rotary components through cross-drillings in the input shaft. A flat-sectioned coupling on the input shaft drives the rotor of the pump; the stator is fixed to the front housing assembly. A tube is attached to the pump, which leads into a calm suction area at the bottom of the two casing assemblies. The collector magnet in the suction area of the pump collects any

metallic debris.

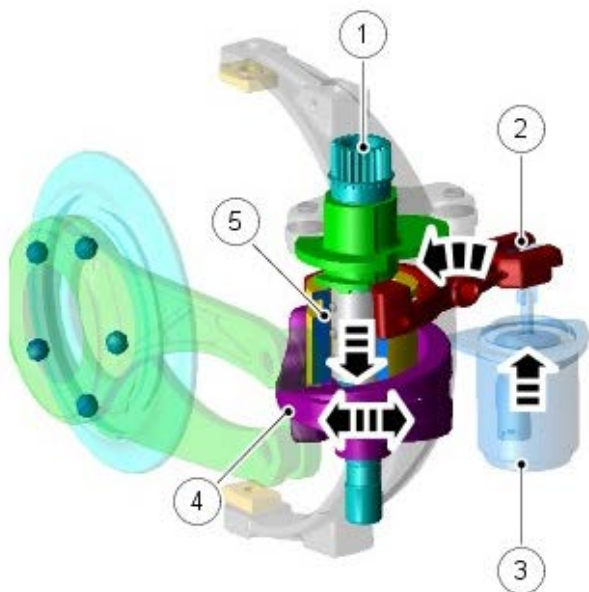
CHAIN DRIVE

The chain-drive transfers drive from the centre differential to the front output flange. A 3/8" pitch chain connects the sprocket on the transfer box input shaft with the sprocket on the front output flange. As both sprockets have the same number of teeth, the rotational speed of both sprockets is identical.

TRANSFER BOX MOTOR

One motor operates both the high/low range change and the differential locking and torque-biasing device (multi-plate clutch). The motor solenoid switches between the two functions, while the motor provides the rotational movement for both operations.

Transfer Box Motor Position For Clutch Control Mode



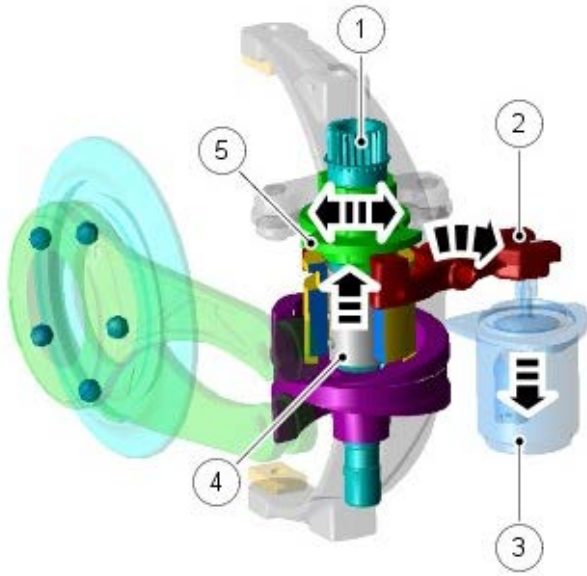
E49193

Item	Part Number	Description
1	-	Motor shaft
2	-	Solenoid shift fork
3	-	Solenoid
4	-	Clutch control disc
5	-	Shifting sleeve

To actuate the multi-plate clutch, the transfer box control module energizes the solenoid (3). The solenoid pin pivots the solenoid shift fork (2), which engages the shifting sleeve (5) into the dogteeth on the clutch control disc (4). The rotational movement of the motor shaft (1) is then linked to the clutch control disc via the shifting sleeve.

This is the normal operating mode of the transfer box. In this position, the range change function is disengaged and mechanically locked.

Transfer Box Motor Position For High/Low Range Mode



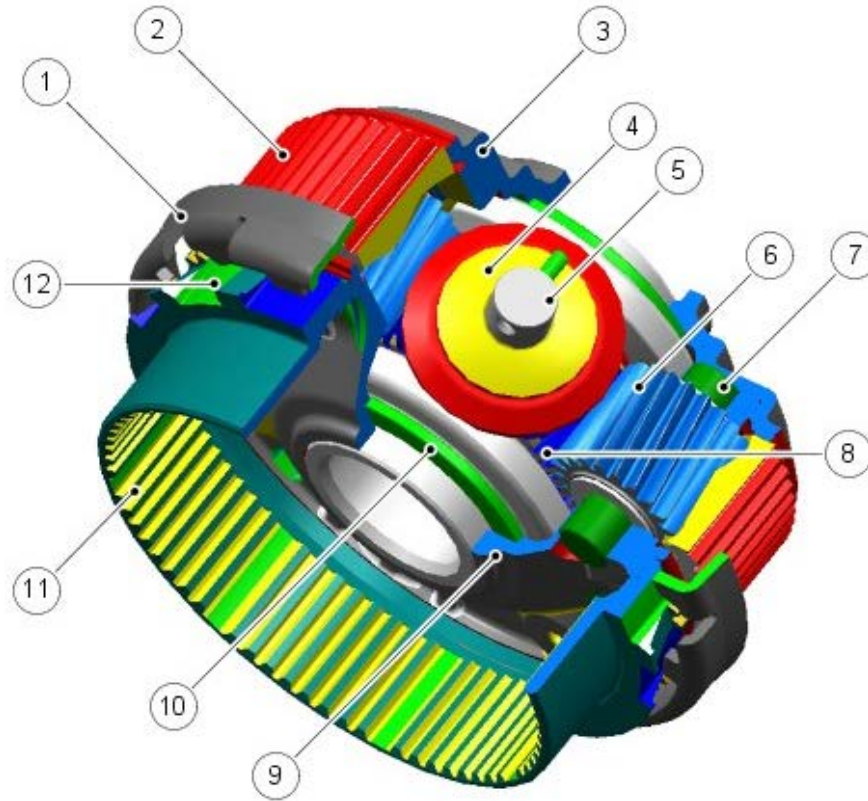
E49194

Item	Part Number	Description
1	-	Motor shaft
2	-	Solenoid shift fork
3	-	Solenoid
4	-	Shifting sleeve
5	-	Actuation cam

To actuate the high/low range change, the transfer box control module de-energizes the solenoid (3). A spring in the solenoid retracts the solenoid pin and rotates the solenoid shift fork (2). This engages the shifting sleeve (4) to the dogteeth on the high/low actuation cam (5). The rotational movement of the motor shaft (1) is then linked to the cam.

In this position, the multi-plate clutch is open, the differential cannot be locked and torque cannot be biased. Once the range change is complete the system returns to clutch control mode. In the event of an electrical failure, the motor will default to this position.

CENTRE DIFFERENTIAL ASSEMBLY



E49195

Item	Part Number	Description
1	-	Synchronisation cup and spring
2	-	Planetary ring gear
3	-	Differential carrier
4	-	Pinion gears
5	-	Pinion gear shafts
6	-	Planetary pinion gears
7	-	Planetary pinion gear shafts
8	-	Planetary sun gear
9	-	Differential cover
10	-	Differential side gears
11	-	Multi-plate clutch basket
12	-	Dogteeth

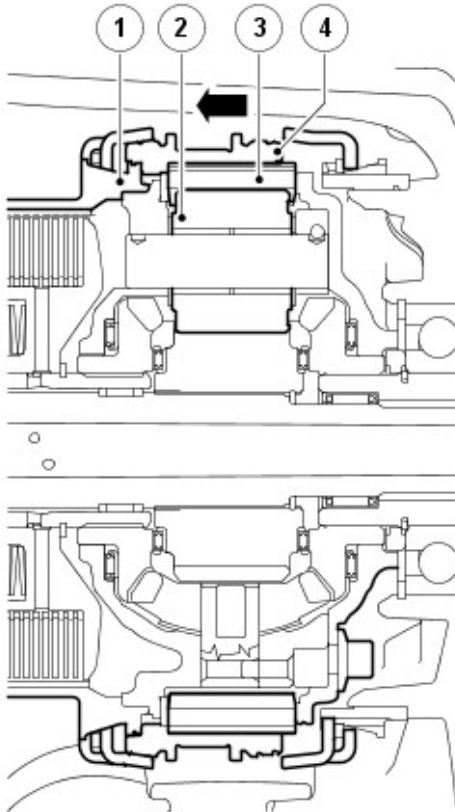
The centre differential assembly is the primary feature of the transfer box. Torque is transmitted through the centre differential carrier and distributed to the differential gears and the front and rear output flanges. The planetary gear set, for the high/low range change function, is also an integral part of the centre differential assembly.

The assembly comprises 3 differential pinion gears (4) and shafts (5), which are equally spaced within the centre differential carrier (3). The differential shafts have a rigid connection to the differential carrier. Located between the pinion gears are 3 planetary pinion gears (6) and shafts (7). The planetary sun gear (8) and two differential side gears (10) are located in the centre line of the carrier.

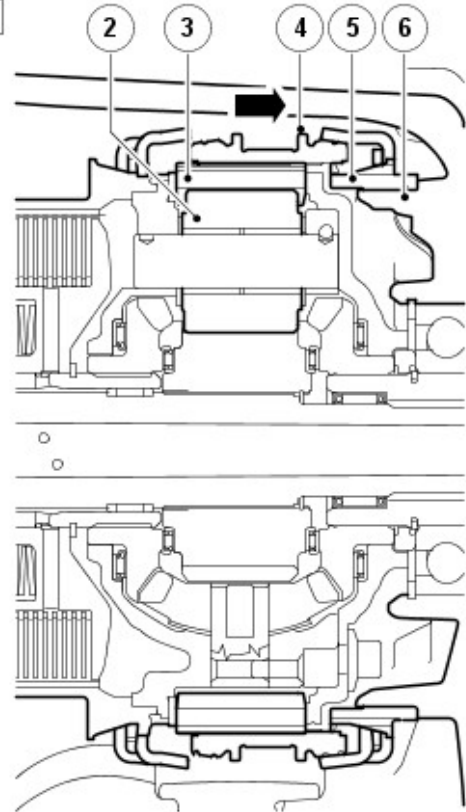
The planetary ring gear (2) is supported in both directions by the differential casing and the differential cover (9). The planetary ring gear is connected to a shifting sleeve, which is engaged in either high or low range.

The multi-plate clutch basket (11), which is welded to the differential casing, supports the friction plates, the dogteeth (12) for high range engagement and the synchronisation cup and spring (1) for the 'shift-on-the-move' function.

A



B



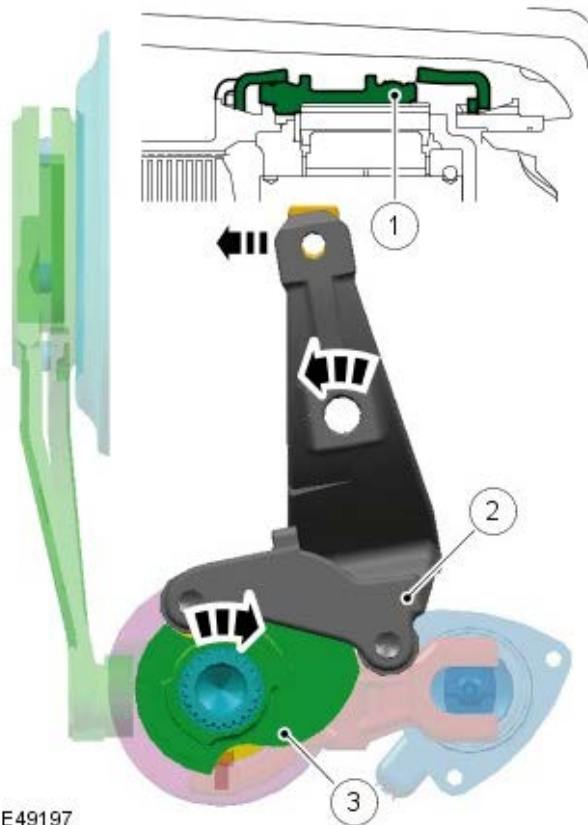
E49196

Item	Part Number	Description
A	-	High range position
B	-	Low range position
1	-	Dogteeth
2	-	Planetary pinion gears
3	-	Planetary ring gear
4	-	Shifting sleeve
5	-	Low range dogteeth
6	-	Rear carrier assembly

When high range is engaged, the shifting sleeve (4) connects to the differential carrier via dogteeth (1). The planetary ring gear (3), via the shifting sleeve, and the planetary pinion gears (5), via the planetary shafts, are also attached to the differential carrier. The planetary gear set rotates as one unit and therefore turns the differential side gear with a 1:1 ratio.

In low range the motor moves the shifting sleeve (4) in the direction of the low range dogteeth (5). The low range dogteeth, with the synchronisation cup and spring, are fixed to the rear carrier assembly (6). When the shifting sleeve is engaged with the low range dogteeth, the planetary ring gear (3), via the shifting sleeve, is stationary and the planetary pinion gears (2), via the planetary bolts, turn the differential side gears with 2.93: 1 ratio.

High range actuation sequence

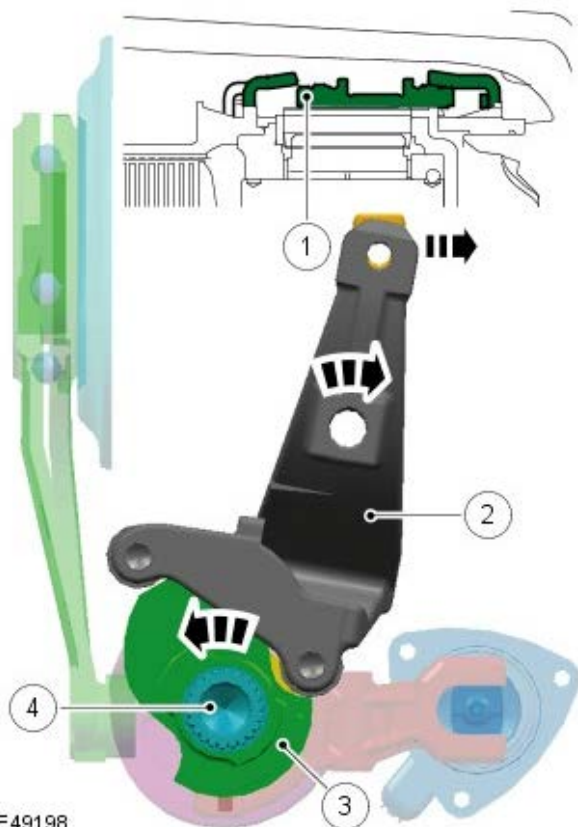


E49197

Item	Part Number	Description
1	-	Shifting sleeve
2	-	High/low shifting fork
3	-	Shifting cam

The rotational movement of the motor shaft turns the shifting cam (3) to high range position. The shifting cam then moves the shifting sleeve (1), via the high/low shifting fork (2), into the high range position. After the synchronisation sequence, the planetary ring gear is connected to the high range dogteeth, via the shifting sleeve, on the differential carrier. In this position, the input speed equals the output speed, which equates to a high range ratio of 1:1.

Low range actuation sequence

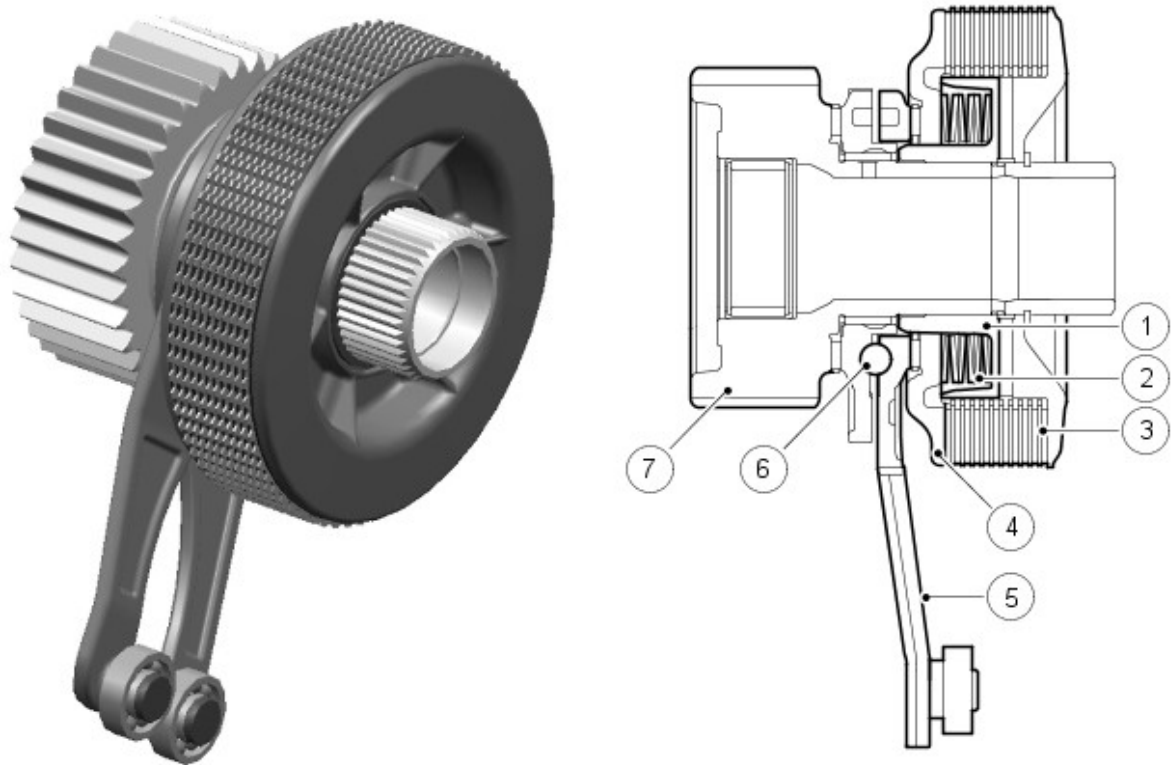


E49198

Item	Part Number	Description
1	-	Shifting sleeve
2	-	High/low shifting fork
3	-	Shifting cam
4	-	Motor shaft

The rotational movement of the motor shaft (4) turns the shifting cam (3) into low range position. The shifting cam then moves the shifting sleeve (1) of the centre differential assembly via the high/low shifting fork (2) into low range position. After the synchronisation sequence, the planetary ring gear is connected to the low range dogteeth, via the shifting sleeve, on the rear carrier assembly. The output speed is then reduced to a ratio of 2.93:1.

MULTI - PLATE CLUTCH ASSEMBLY



E49199

Item	Part Number	Description
1	-	Clutch hub
2	-	Cup springs
3	-	Clutch plates
4	-	Clutch piston
5	-	Motor levers
6	-	Ball ramp mechanism
7	-	Sprocket

The multi-plate clutch assembly for both centre and rear differentials act in a similar way. The aim of the multi-plate clutch assembly is to prevent excessive differential slip and therefore maximise the traction performance of the vehicle. This is fundamentally different from the 'braked' traction control, which can only counter act differential slip when it occurs.

A certain amount of differential slip is required to allow the vehicle to turn corners and to remain stable under control of the Anti-lock Braking System (ABS). The transfer box control module monitors the driver's demands through primary vehicle controls and automatically sets the slip torque at the differentials. The system is completely automatic and does not require any special driver input.

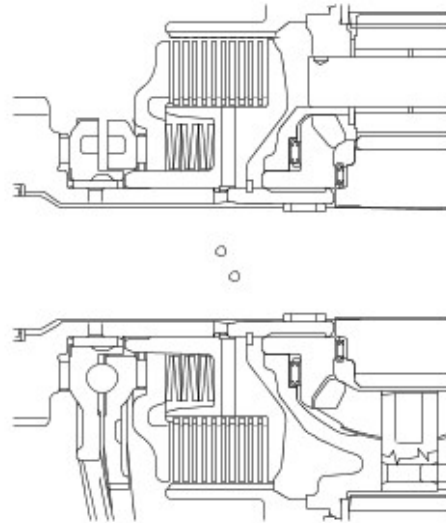
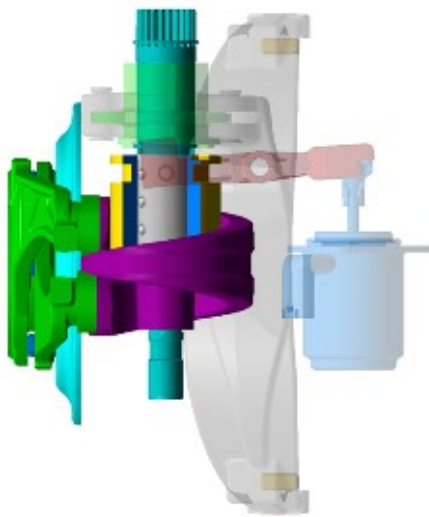
The multi-plate clutch assembly actively controls the torque flow through the centre differential and optimises the torque distribution in the driveline. The clutch assembly biases the torque from the transmission to the axle and wheels with the higher grip and prevents the wheels with the lower grip from spinning.

The multi-plate clutch assembly comprises the sprocket (7), which is connected to the front differential side gear, the motor levers (5) with the ball ramp mechanism (6), the clutch hub (1) as support for the clutch plates (3), the clutch piston (4) to generate friction between the clutch plates, and a pack of cup springs (2) to return the clutch piston into its original position.

One set of friction plates are connected to the clutch hub; the other set of friction plates are connected to the multi-plate clutch basket, which is welded to the centre differential housing.

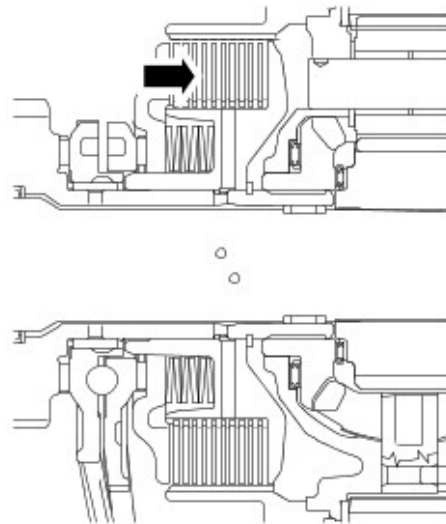
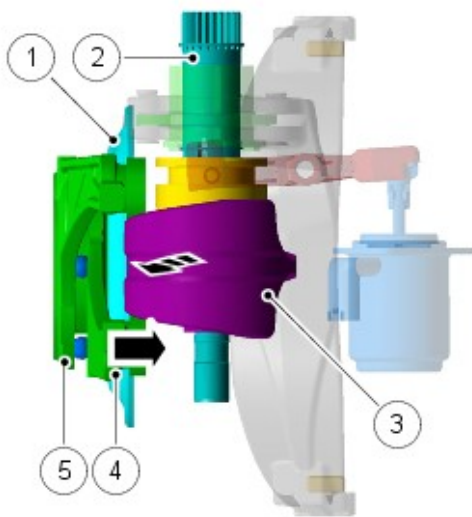
Multi-plate Clutch Actuation

Transfer box motor levers in initial position, multi-plate clutch open condition



E49200

Transfer box motor in end position, multi-plate clutch closed condition



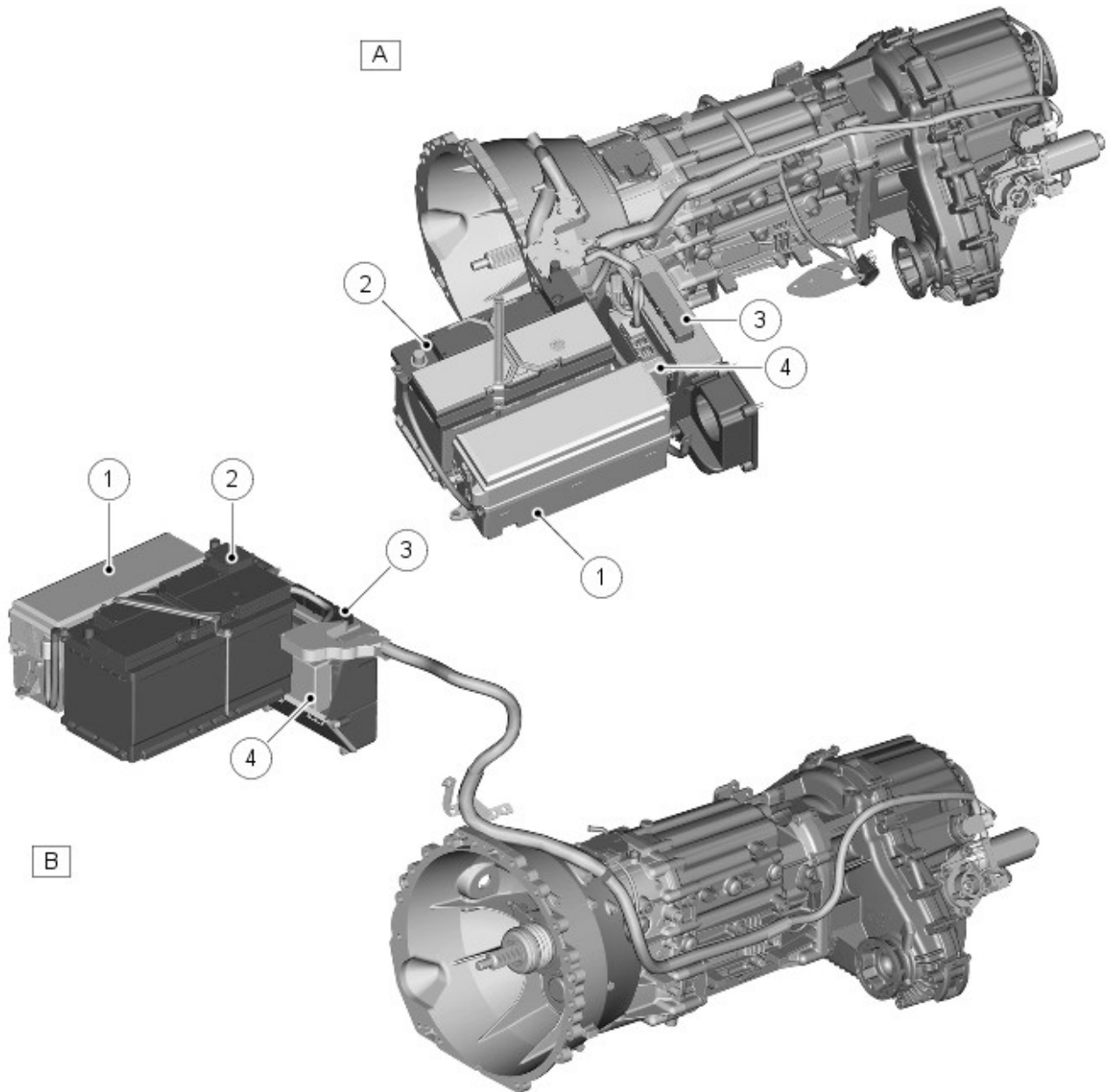
E49201

Item	Part Number	Description
1	-	Clutch piston
2	-	Motor shaft
3	-	Clutch control disc
4	-	Motor levers
5	-	Ramp mechanism balls

By turning the clutch control disc (3), via the motor shaft (2), the motor levers (4) are rotated relative to each other. This relative movement acts on 5 balls (5) in a ramp mechanism between the two levers and give a defined axial movement. The movement forces the clutch piston (1) to induce friction between the plates supported by the clutch hub and the plates supported by the clutch basket on the differential carrier. This frictional force inhibits the differential rotation; the differential carrier and front differential side gear are locked together.

TRANSFER BOX CONTROL MODULE

The transfer box control module controls the high/low 'shift-on-the-move' actuation and the multi-plate clutch actuation. The control module is located in the E-box, next to the Engine Control Module (ECM), behind the battery in the engine compartment. The position of the control module changes with LH and RH drive vehicles.



E49202

Item	Part Number	Description
A	-	RH drive
B	-	LH drive
1	-	Battery Junction Box (BJB)
2	-	Battery
3	-	Engine Control Module (ECM)
4	-	Transfer box control module

The control module is connected to the Controller Area Network (CAN) bus and controls the transfer box operation using CAN messages from other control modules on the network.

The control module memorises the position of the transfer box motor when the ignition is switched off.

The transfer box control module uses the same actuator to control both range change function and application of centre differential locking torque. The module uses position feed back from the actuator to provide smooth range changing capability and graduated application of locking torque appropriate for the current driving conditions. Range change can be carried out while moving providing the transmission is in neutral and the vehicle is below the speed necessary for the requested range change.

The control module uses three connectors for all inputs and outputs. It receives a permanent power supply via a 30A fusible link located in the Battery Junction Box (BJB), and an ignition supply via fuse 24 in the Central Junction Box (CJB).

The control module uses a series of programmed shift maps to control the synchronisation speed and ensure that a maximum shift time of approximately one second is achieved.

If the control module is replaced, T4 must be connected to the vehicle and the transfer box control module self-calibration procedure must be performed. This procedure must also be performed if the transfer box motor assembly is replaced.

Default/Limp-home Strategy

If a fault occurs with the transfer box, the transfer box control module or one of the required input signals i.e. road speed signal, the control module records an error code and will respond appropriately to provide the highest level of system capability under the specific fault conditions. The following fault states are possible:

Fault state	System response	Driver warning
No reduction in capability	Diagnostic Trouble Code (DTC) will be recorded but no effect on performance	Non
Clutch control not possible. Temporary over temperature condition	The tractive capability of the vehicle, off road, is reduced.	Driveline over temperature warning lamp or "CENTRE DIFF OVER TEMP REDUCE SPEED" on message centre
Clutch control not possible. Permanent fault	The tractive capability of the vehicle, off road, is reduced.	Driveline fault warning lamp or "CENTRE DIFF FAULT TRACTION REDUCED" on message centre
Range change not possible	The system inhibits the driver from making a range change	Driveline fault warning lamp or "TRANSMISSION RANGE CHANGE NOT AVAILABLE" on message centre
Stuck in Transfer box neutral	The transfer box is stuck between high and low range resulting in no drive to wheels	Flash low range indicator plus "APPLY HANDBRAKE (PARK BRAKE in USA and Canada)". The message will only display at times when it is deemed safe or necessary. It will not display during normal driving for example.

If a driveline over temperature condition has occurred, after the driveline has been allowed to cool, clutch control will be re-enabled and the warnings will disappear. There is no need to seek service assistance following an over temperature event.

If clutch control or Range change is not possible due to a permanent fault the driver must seek service assistance at the earliest opportunity.

If the system suffers a fault, which causes the transfer box to fail in neutral, the control module is designed to continue attempting to engage the requested range or return to its original range for a fixed number of attempts. If this has not been successful and the low range lamp is still flashing the driver should bring the vehicle to a halt and attempt the range change again while stationary. If this does not work after a number of attempts, key off for 30 seconds, restart engine and request range change again while stationary. The driver must seek service assistance at the earliest opportunity.

Transfer Box Control Module Pin Out Details

Connector 1-C1319

Pin No.	Description	Input/output
1	Not used	-
2	Not used	-
3	CAN bus low	Data (input and output)
4	Range change selection switch - High	Input
5	Range change selection switch - Low	Input
6	CAN bus high	Data (input and output)
7	Key interlock solenoid	Output
8	LED-high	Output
9	LED-low	Output

Connector 2-C1854

Pin No.	Description	Input/output
1	CAN bus low	Data (input and output)
2	Not used	-
3	Ignition power supply	Input
4	CAN bus high	Data (input and output)
5	Ground	-
6	Permanent battery power supply	Input

Connector 3-C1855

Pin No.	Description	Input/output
1	Hall sensor signal-A (directional)	Input
2	Hall sensor ground	-
3	Hall sensors supply	Output
4	Not used	-
5	Temperature sensor	Input
6	Hall sensor signal-B (speed)	Input
7	Selector position ground	-
8	5V position sensor supply	Output
9	Selector mode solenoid ground	-
10	Selector position sensor signal	Input
11	Transmission position sensor X axis signal	Input
12	Selector mode solenoid power supply	Output
13	Transmission position sensor Y axis signal	Input
14	Manual transmission output shaft speed sensor supply	Output

15	Motor supply/ground	Input/output
16	Manual transmission output shaft speed signal	Input
17	Manual transmission output shaft speed sensor ground	-
18	Motor supply/ground	Input/output

TRANSFER BOX CONTROL MODULE INPUTS

The transfer box control module receives the following inputs:

- Range change selection switch
- High/low position sensor
- Transfer box actuator motor temperature
- Transfer box actuator motor position sensor
- CAN bus messages
- Gear position sensor (manual transmission only)
- Transmission output shaft speed sensor (manual transmission only).

CAN Bus Messages

The CAN bus is a high speed broadcast network connected between various vehicle control modules. The CAN network carries an extensive list of messages between the different control modules enabling more sophisticated control with reduced complexity. Data on the network is packaged for efficient communication and prioritised according to the urgency and importance of the Messages. The bus comprises two wires, which are twisted together to minimise electromagnetic interference (noise) produced by the CAN messages.

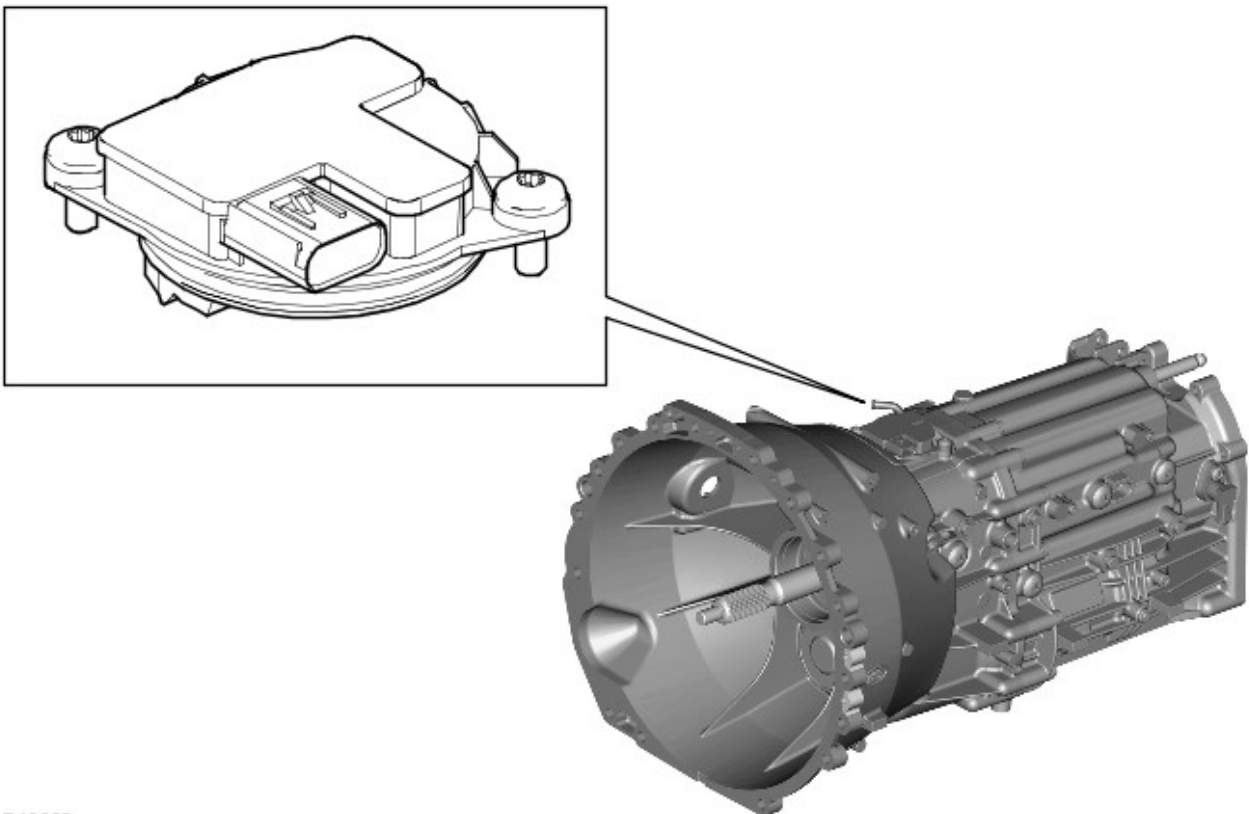
For additional information, refer to: Communications Network (418-00, Description and Operation).

The transfer box control module is connected on the CAN bus and controls transfer box operation using CAN messages from other control units on the network. Wheel speed, vehicle acceleration, engine torque and speed, gear information, from the automatic transmission, temperature information, car configuration, axle ratios and Terrain Response™ mode inputs, are some of the main signals received by the control module.

In the event of a CAN bus failure the following symptoms may be observed:

- Shift from high to low or low to high inoperative
- Instrument cluster low range warning lamp inoperative
- warning messages or lamps displayed in instrument cluster.

Gear Position Sensor (Manual Transmission Only)

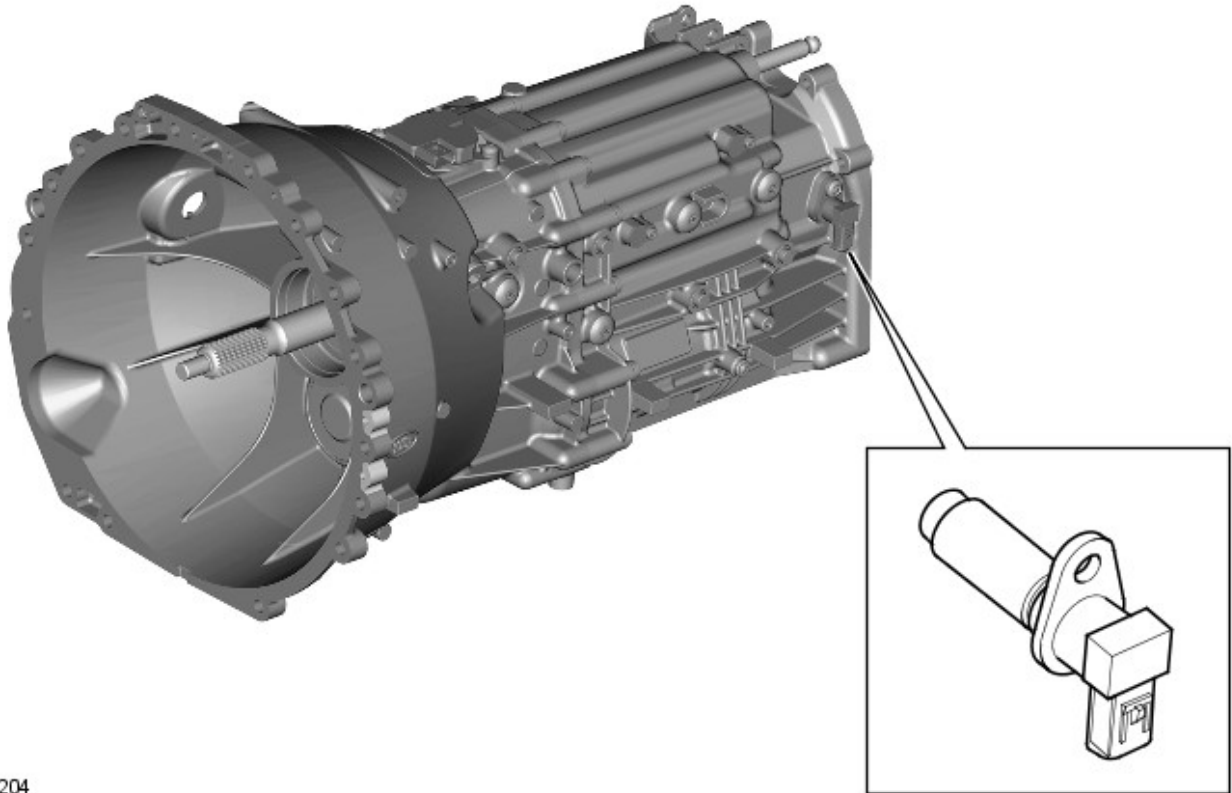


E49203

The transfer box control module uses positional information from the manual gear position sensor to determine which gear the transmission is in. This information is broadcast on the CAN bus for display on the instrument cluster and for use by other vehicle systems. Vehicles fitted with automatic transmission use a similar message broadcast by the Transmission Control Module (TCM). Vehicles fitted with manual transmission have a learning function, which compares the positional information from the sensor with the gear ratio calculated from the ratio of engine speed to transmission output shaft speed. The transmission learning is carried out at end of manufacture. If a new transmission is fitted during the life of the vehicle the learning algorithm needs to learn the characteristics of the new transmission.

The instrument cluster displays the selected gear as determined by the transfer box. The transfer box also uses this to check the vehicle is in neutral before attempting a range change.
For additional information, refer to: Manual Transmission (308-03, Description and Operation).

Manual Transmission Output Shaft Speed Sensor

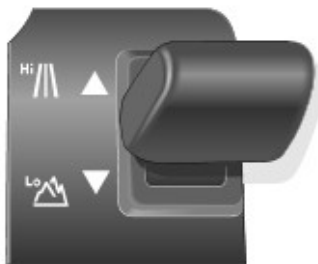


E49204

The output shaft speed sensor is located at the rear of the transmission and measures the speed of the transmission output shaft.

The transfer box is designed to allow range changes when the vehicle is moving, providing the transmission speed complies with the preset thresholds determined by the control module. The control module calculates the optimised synchronization timing through the speed of the transmission output shaft and the wheel speed of the vehicle.
For additional information, refer to: Manual Transmission (308-03, Description and Operation).

Range Change Selection Switch



E49205

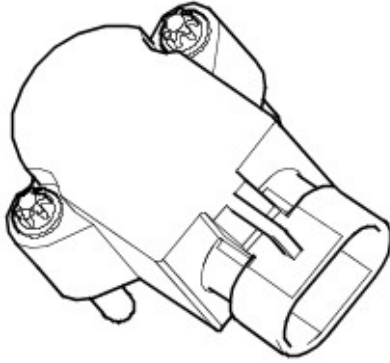
The range change selection switch is located behind the main transmission selection lever, in the centre console. The switch is a 3-position momentary action centre sprung device. The driver pushes the lever forward to select high range and back to select low range.

The switch comprises a housing, which provides the location for a sliding contact. When the switch is moved to the high or low position, it completes a momentary connection to 12V with one of two micro-switches located at each end of the range change selection switch. These micro-switches correspond to the high or low range positions.

The transfer box control module receives this momentary signal and selects the requested range.

In this position, a spring will move the selector lever to the centre position when released.

High/Low Position Sensor



E49209

The high/low position sensor converts the pivotal movement of the high/low fork into a PWM signal on the input. The PWM signal of the position sensor differs between high range and low range. The control module checks this signal and informs the driver, via the instrument cluster and the range change selection switch LED's, if a range change is in progress or has been completed.

The high/low position sensor is connected to the transfer box control module via a three-pin connector.

TRANSFER BOX CONTROL MODULE OUTPUTS

The transfer box control module sends the following outputs:

- CAN bus messages
- Key interlock solenoid
- High/low range change LED
- Transfer box motor
- Solenoid.

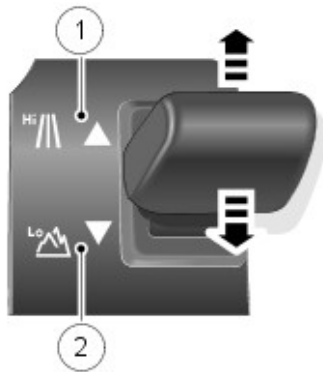
CAN Bus Messages

The control module also sends messages via the CAN bus to tell other control modules on the network, the status of the transfer box. The high/low status, clutch torque and default mode status are some of the main signals sent out by the transfer box control module.

Key Interlock Solenoid

The transfer box control module is able to send a signal to the key interlock solenoid. This signal locks the key in the ignition barrel to prevent it from being removed if the automatic transmission is not in the 'Park' position.

High/Low Range Change LED



E49206

Item	Part Number	Description
1	-	High range LED
2	-	Low range LED

The control module is responsible for illuminating the 2 'high/low' range change LED's adjacent to the range change lever. One LED indicates high range and the other indicates low range.

One LED will be on continuously when in the corresponding range.

When changing range, the current range LED will remain on until the new range status has been achieved.

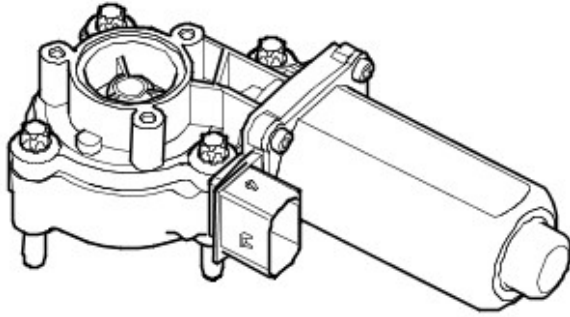
The new range LED will start flashing only when the range change has commenced (i.e. speed and neutral conditions have been met). The new range LED will be illuminated continuously at the same instant that the current range (now the old range) LED turns off.

The flash rate is 2 Hz with a 50% duty cycle.

The LED's have 2 levels of intensity, high when the vehicle lights are switch off and low when they are switched on.

If both lights are flashing at 0.5 Hz, this would indicate a transfer box fault or that the transfer box is in undefined range and may require calibration.

Transfer Box Motor



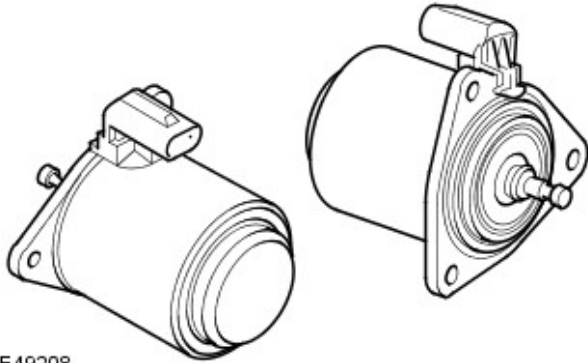
E49207

The transfer box motor provides the necessary movement to perform the high/low range change and the multi-plate clutch actuation. The motor is located on the rear casing assembly and secured with four bolts.

The motor is a PWM controlled, DC motor with an integrated worm gear reduction drive. It is connected to the transfer box control module with an eight-pin connector; the power supply of the motor is maintained through two large diameter cables on the motor connector. An internal position sensor checks the rotational movement of the motor.

There is an temperature sensor located within the motor housing.

Solenoid



E49208

The solenoid switches the power flow on the actuation system between high/low range change mode and clutch control mode. When the solenoid is energized, the solenoid pin deploys and activates the clutch control mode. When the solenoid is de-energized, the internal spring rejects the solenoid pin and activates the high/low range change mode.

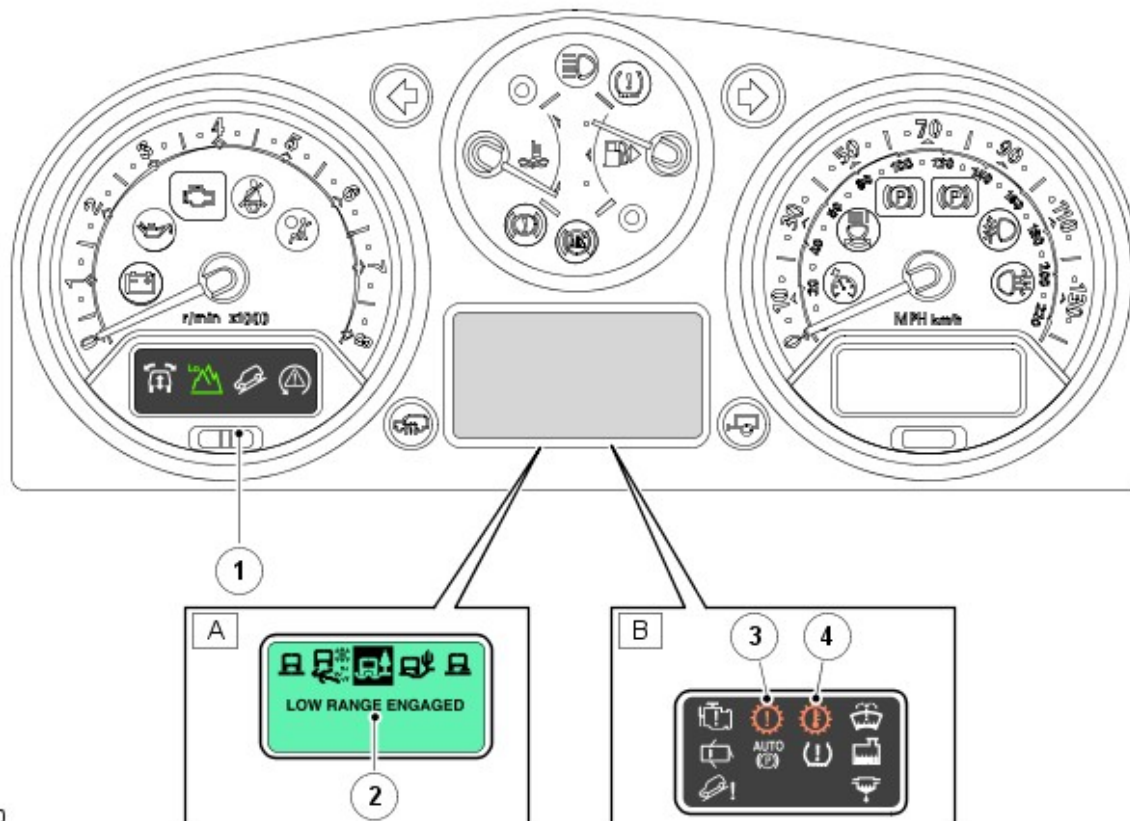


NOTE: In order to replace the solenoid in service, the solenoid must be energized using the diagnostic tool.

The solenoid is connected to the transfer box control module with a two-pin connector.

Status Indication

Instrument Cluster



E49210

Item	Part Number	Description
A	-	High-line instrument cluster
B	-	Low-line instrument cluster
1	-	Low-range status indicator
2	-	Message centre text (high-line only)
3	-	Driveline fault lamp
4	-	Driveline over temperature

On vehicles fitted with the high line instrument cluster there will be one low range status indicator. This indicator will take the form of a mountain symbol and has the following logic:

- Lamp on = low range
- Lamp off = high range
- Lamp flashing = range change in progress/range undefined/range fault.

There will also be a message displayed in the message centre, on vehicles with high-line instrument cluster, which will inform the driver of any faults with the transfer box.

The following table shows the messages that can be displayed in the message centre of a high-line instrument cluster relating to the transfer box:

Message	Description	Chime
'LOW RANGE ENGAGED'	Transfer case has engaged low range after a range change request	Single
'HIGH RANGE ENGAGED'	Transfer case has engaged high range after a range change request	Single
'SPEED TOO HIGH FOR RANGE CHANGE'	Range change request when vehicle speed too high	Single
'SELECT NEUTRAL FOR RANGE CHANGE'	Range change request when lever not in neutral	Single
'APPLY HANDBRAKE' (PARK BRAKE in USA and Canada)	This alerts the driver that the automatic transmission park lock function is inoperative due to transfer box out of high or low range. Transfer box control module has stopped transmitting on the CAN bus during a range change or while in neutral mode and as a result the automatic transmission park lock function is inoperative	One per second for three seconds
'TRANSMISSION RANGE CHANGE NOT AVAILABLE'	Transfer box has detected a fault inhibiting a new range change. Control unit has shut down due to thermal overload	Single
'CENTRE DIFF OVER TEMP REDUCE SPEED'	Centre differential temperature is approaching the over heated threshold	Single
'CENTRE DIFF FAULT - TRACTION REDUCED'	Centre differential has failed - operating as an open differential	Single
'CENTRE DIFF FAULT - TRACTION REDUCED'	Transfer box control module has stopped transmitting on the CAN bus and defaults to open centre differential	Single

The transfer box control module receives a gear position signal from the manual transmission gear position sensor and publishes the status on the CAN bus. This is displayed in the odometer display, similar to how the automatic transmission displays gear information.

Odometer Display	Description
N	Transmission is in neutral
1	Transmission is in first gear
2	Transmission is in second gear
3	Transmission is in third gear
4	Transmission is in fourth gear
5	Transmission is in fifth gear
6	Transmission is in sixth gear
R	Transmission is in reverse gear (Japan only)
Blank display	Transmission is between neutral and a gear
E	Transmission gear position sensor has a fault

On vehicles fitted with the low line instrument cluster, in place of the message centre there will be a status lamp, which has the following logic:

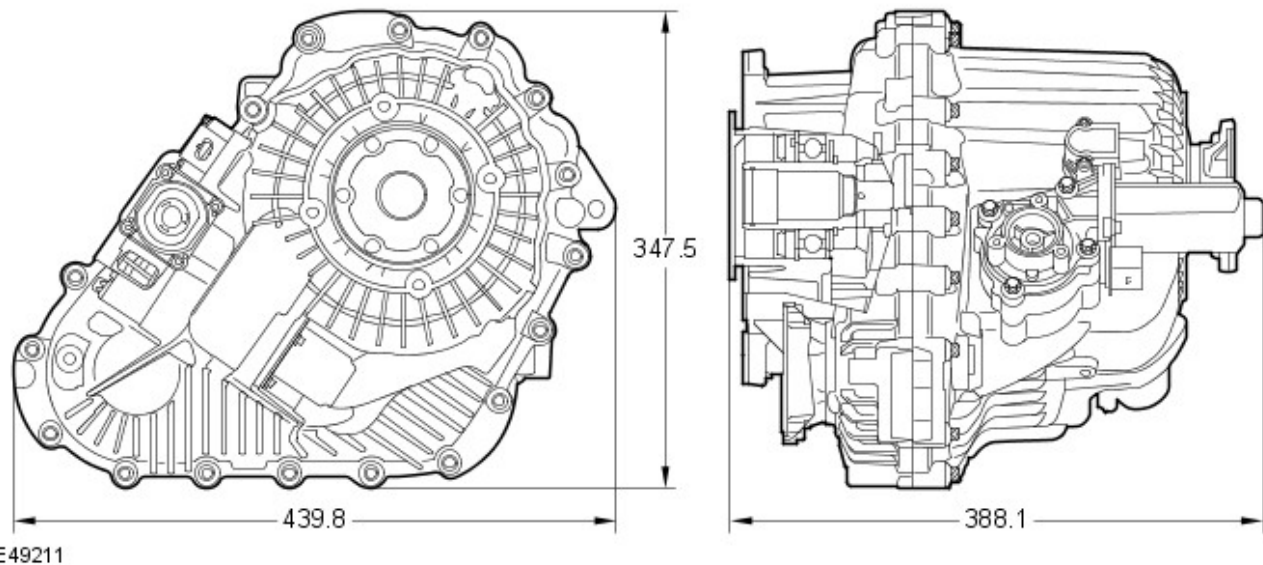
- Amber - Over temperature
- Red - Failure, stop vehicle

The following table shows the faults that could possibly illuminate the transfer box status lamp on vehicles fitted with the low-line instrument cluster:

Indication	Description
OFF	Transfer box is operating at normal working temperature
YELLOW WARNING LAMP ON	Transfer box temperature is approaching the over heated threshold
YELLOW WARNING LAMP ON	Transfer box has detected a fault, which affects the range change function (current range is still maintained) or the centre differential has failed to open.
RED WARNING LAMP ON	Transfer box has detected a fault which renders the transmission park lock function inoperative due to out of range condition, OR centre differential has failed with a non-zero locking torque
YELLOW WARNING LAMP ON	Transfer box control module has stopped transmitting on the CAN bus and defaults to open centre differential
RED WARNING LAMP ON	Transfer box control module has stopped transmitting on the CAN bus during a range change or while in neutral mode and as a result the automatic transmission park lock function is inoperative

SERVICE

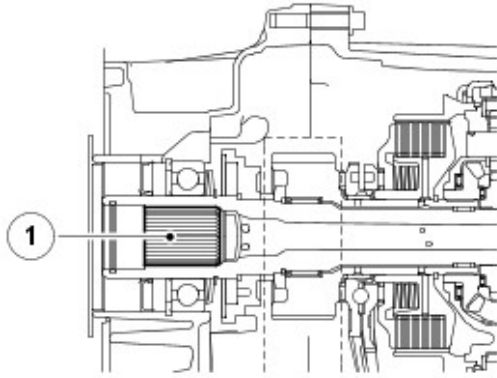
Basic Dimensions (Millimetres)



The transfer box weighs 40.30 kg without oil and 41.55 kg with oil. The unit requires 1500 ml \pm 2% of oil from empty.

The oil used in the transfer box is Shell TF 0753, which has been specially developed by Magna Steyr and Shell. The oil contains unique additives, which enhance the transfer box operation. No other oil must be used in the transfer box.

There is a unique type of grease, Weicon anti-seize montagepaste grau TL 7391, that needs to be applied the units input shaft spline when installing or reinstalling the transfer box.



E49212

Item	Part Number	Description
1	-	Input shaft spline

DIAGNOSTICS

The transfer box control module can store fault codes, which can be retrieved using T4 or a diagnostic tool using KW2000* protocol.

The information is communicated via a diagnostic socket.

The diagnostic socket allows the exchange of information between the various control modules on the bus systems and T4 or another suitable diagnostic tool. The information is communicated to the socket via the CAN bus. This allows the retrieval of diagnostic information and programming of certain functions using T4 or another suitable diagnostic tool.

The transfer box control module uses Diagnostic Trouble Codes (DTC), which relate to transfer box electrical faults.

Clutch and Range Change Mechanism Calibration

In order for the range change mechanism to function correctly, the transfer box control module must be calibrated to the mechanical dimensions of the transfer box that it is connected to.

This procedure will need to be followed if one of the following occurs:

- The switch is changed
- The transfer box control module is changed
- The transfer box or range position sensor is changed
- Vehicle or transfer box control module fault has caused the transfer box to revert to an undefined range.

Calibration can be carried out using T4.

Manual Transmission Gear Learning Procedure

The transfer box control module contains an adaption that enables it to recognize which gear the driver has selected. The adaption has to be reset, by performing the gear learning procedure, if one of the following occurs:

- The transfer box control module is reprogrammed or replaced
- The manual transmission is replaced
- The gear position sensor is replaced

During the gear learning procedure the vehicle must be driven smoothly in all gears, with the clutch fully released in each gear, in a single drive cycle. The procedure can be performed with the transfer box in either high or low range.

Gear Learning Procedure

1. If the gear learning procedure is to be performed because the manual transmission or the gear position sensor has been replaced, use T4 to set the gear adaption status to 0 in the transfer box control module.
2. Start the vehicle.
3. Drive in reverse gear and fully remove your foot from the clutch, drive in reverse with your foot off the clutch for 3 seconds and ensure that R is displayed in the instrument cluster.
4. Drive in 1st gear and, when gear position 1 is displayed in the instrument cluster, change to the next gear. Continue driving, and changing up to the next gear once the current gear is displayed in the instrument cluster, until gear 6 is displayed in the instrument cluster, then stop the vehicle.
5. Stop the engine, remove the ignition key and wait for a minimum of 60 seconds (for the transfer box control module to power down).
6. Insert the ignition key and turn the ignition switch to position II (ignition).
7. Select each gear in turn. If the appropriate gear position is displayed in the instrument cluster as soon as each gear is selected, the gear learning procedure has been successful. If the gear position is not displayed in the instrument cluster, the gear learning procedure has failed and must be repeated.
 - NOTE: T4 can also be used to check if the gear learning procedure has been successful.

SYSTEM OPERATION

The selection of high/low range is achieved by using a switch located behind the main transmission selection lever in the centre console. A range change can only be performed when the transmission selector lever is in neutral (position 'N' for vehicles with automatic transmission). The accelerator pedal must not be depressed when a range change is in progress.

If high or low range is requested and the transmission selector lever is in a position other than neutral, or 'N' or 'P' on a vehicle with an automatic transmission, the instrument cluster message centre, if fitted, will display 'SELECT NEUTRAL FOR RANGE CHANGE'.



NOTE: On vehicles with an automatic transmission, if the transmission selector lever is in the 'P' position, the range change will not take place and the 'SELECT NEUTRAL FOR RANGE CHANGE' message will not be displayed in the message centre.

When low range is selected, the low range 'mountain' symbol will flash when the range change is taking place and then remain illuminated when the range change is complete. The instrument cluster message centre, if fitted, will display 'LOW RANGE' for approximately 3 seconds followed by a chime from the instrument cluster to confirm that the range change has been completed. On vehicles with automatic transmission, only 'D' and 'Manual mode' are available, the 'Sport mode' selection is not available.

When high range is selected, the low range 'mountain' symbol will flash when the range change is taking place and then extinguish when the range change is complete. The instrument cluster message centre, if fitted, will display 'HIGH RANGE' for approximately 3 seconds followed by a chime from the instrument cluster to confirm that the range change has been completed.

The design of the transfer box allows range changes when the vehicle is moving, within set limitations as follows:

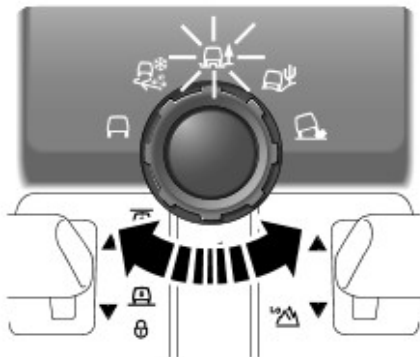
- High to Low – at speeds not exceeding 25 mph (40 km/h) for vehicles with automatic transmission, and 12 mph (20 km/h) for vehicles with manual transmission
- Low to High – at speeds not exceeding 37 mph (60 km/h).

If the vehicle speed is higher than the parameters given, the instrument cluster message centre, if fitted, will display 'SLOW DOWN'. When the correct speed range is reached, the message will be deleted and the range change will commence.

The transfer box control module interprets a road speed of less than 2 mph (3 km/h) as a static shift (vehicle not moving). In this instance, on vehicles with automatic transmission, the driver must use the shift lock procedure of operating the brake pedal to allow the selector lever to be moved from 'N' to 'D' after the range change has been performed.

High range should be used for all normal road driving and also for off-road driving across dry, level terrain. Low range should only be required where low speed manoeuvring is necessary, such as reversing a trailer, negotiating steep slippery surfaces or boulder-strewn terrain. Low range should also be used for extreme off-road conditions where progress in high range cannot be maintained. Low range should never be used for normal road driving.

Terrain Response™



The Terrain Response™ system allows the driver to select a program, which will provide the optimum settings for traction and performance for the prevailing terrain conditions.

The system is controlled by a rotary control located on the centre console. The rotary control allows the selection of one of the following five programs:

- Special programs off (general driving conditions)
- Grass/Gravel/Snow
- Mud/Ruts
- Sand
- Rock crawl.

The Terrain Response™ system uses a combination of vehicle subsystems to achieve the required vehicle characteristics for the terrain selected. The following subsystems form the Terrain Response™ system:

- Engine management system
- Automatic transmission (if fitted)
- Transfer box
- Rear locking differential (if fitted)
- Brake system
- Air suspension.

Each subsystem control module provides a feedback for the selected program so that the Terrain Response™ control module can check that all systems are controlling the system correctly.

For additional information, refer to: Ride and Handling Optimization (204-06, Description and Operation).

HIGH RANGE OPERATION

In high range, the torque input from the transmission is passed to the transfer box input shaft. The position of the synchroniser sleeve couples the shaft directly to the differential housing. The differential splits the torque between the two side gears. One side gear is connected by splines and passes the torque to the rear output flange. The second side gear is connected to the chain drive sprocket and passes the torque, via the chain, to the front output flange.

LOW RANGE OPERATION

In low range, the torque input from the transmission is passed to the transfer box input shaft. The synchroniser sleeve is moved and connects the planetary carrier to the differential housing. The torque from the transmission is now directed through the sun gear of the epicyclic gearset and, via the pinion gears and pinion gear shafts, into the planetary carrier. The annulus gear of the epicyclic gearset is secured inside the casing and generates the low range ratio of 2.93:1. The torque is then passed, via the synchroniser sleeve, to the differential housing where it is split between the two side gears. One side gear is connected by splines and passes the torque to the rear output flange. The second side gear is connected to the chain drive sprocket and passes the torque, via the chain, to the front output flange.

HIGH/LOW RANGE GEARS WITH SHIFT-ON-THE-MOVE

The driver is able to change between high and low range gears while the vehicle is moving, or if the vehicle is stationary.

Pushing the range change lever makes a range change requests. This lever is located on the centre console behind and to one side of the main transmission lever.

The driver requests a high to low range change by pushing the range change lever towards the rear of the vehicle and, conversely, a low to high request by pushing the lever towards the front of the vehicle. The range change lever is centre sprung and therefore does not latch in the forward or rear positions.

The driver is informed of the range status via a green lamp (mountain symbol) in the instrument cluster and LED's next to the range change lever. The lamp will not be illuminated in high range, illuminated in low range and flashing during a range change. There are two LED's on the range change lever one for high and one for low. During a range change the new range LED will flash.

The vehicle will remain in the selected range unless the driver requests a change, i.e. it will not automatically revert to high range following a key off/key on sequence.

RANGE CHANGE PROCEDURE (AUTOMATIC VEHICLES ONLY)

Neutral must be selected on the main transmission before requesting a range change and then select the appropriate gear following completion of the range change. During the range change the main transmission will be locked in neutral.

If neutral is not selected when a range change is requested then the request is denied and the driver will be advised to select neutral via the instrument cluster message centre (if fitted).

The range change process can take up to one second to complete following a request being accepted.

There is a limit set on the maximum speed at which a range change can be achieved. The maximum speed for a high to low range change is 25 mph (40 km/h) for vehicles with automatic transmission, and 12 mph (20 km/h) for vehicles with manual transmission. The maximum speed for a low to high range change is 37 mph (60 km/h). If the vehicle speed is over the limit when a range change is selected then the request is denied and the instrument cluster message centre (if fitted) will display a 'SLOW DOWN' message.

RANGE CHANGE PROCEDURE (MANUAL VEHICLES ONLY)

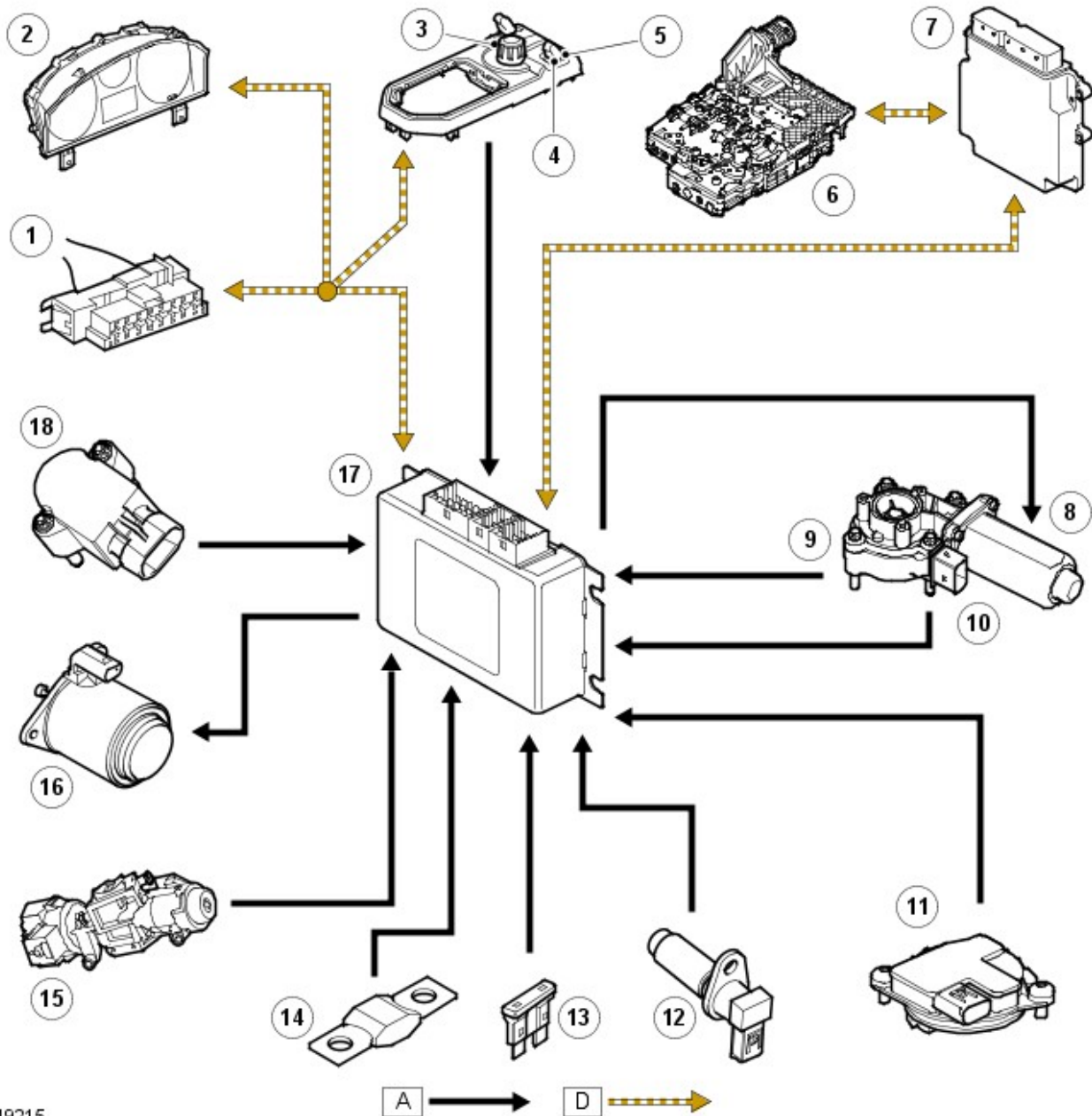
Neutral must be selected on the main transmission before requesting a range change and then select the appropriate gear following completion of the range change. During the range change the driver must not attempt to move the main transmission out of neutral. If the lever is moved out of neutral then the range change will stop and will be completed only when the driver re-selects neutral on the main transmission. This must be done to prevent damage to the transfer box mechanism.

The speed limit for shift-on-the-move for the manual vehicle is set lower than for the auto, at around 12 mph (20 km/h) for high to low and 37 mph (60 km/h) for low to high. The lower limits are set so that, if the driver tries to select too lower gear following a range change, no damage is caused to the vehicle.

TRANSFER BOX CONTROL DIAGRAM



NOTE: A = Hardwired; D = CAN bus



E49215

Item	Part Number	Description
1	-	Diagnostic socket
2	-	Instrument cluster
3	-	Terrain response™
4	-	High/Low range selection switch
5	-	High/Low range LED
6	-	Transmission Control Module (TCM)
7	-	Engine Control Module (ECM)
8	-	Transfer box motor
9	-	Temperature sensor
10	-	Hall sensors (speed and direction)
11	-	Manual transmission gear position sensor
12	-	Output shaft speed sensor
13	-	Fuse 24 ignition feed
14	-	Fusible link permanent battery feed
15	-	Ignition switch
16	-	Solenoid
17	-	Transfer box control module
18	-	High/low position sensor

Four-Wheel Drive Systems - Transfer Case Clutch Solenoid

Removal and Installation

Removal


1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.


2. Drain the transfer case.


Refer to: [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).



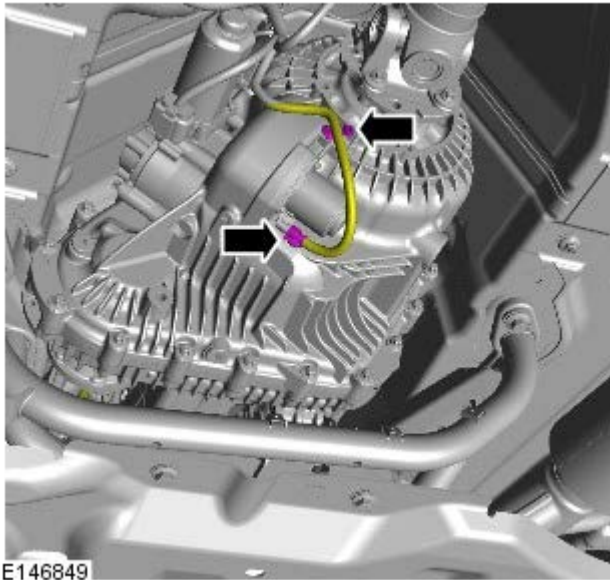
3.  **CAUTION:** Connect the diagnostic tool, prior to removal of the solenoid. Carry out the diagnostic service function **transfer case – solenoid replacement**.

NOTES:

 Some fluid spillage is inevitable during this operation.

 Note the orientation of the electrical connector prior to removal.


4.




Installation





1. CAUTIONS:

 Failure to energise the solenoid to aid installation of the arm, may result in damage to the shift fork once the component is installed and the system is operated.

 Make sure the seal is installed correctly.

 Make sure that new bolts are installed.

 Make sure that the electrical connector is installed in the correct orientation as noted in the removal step.

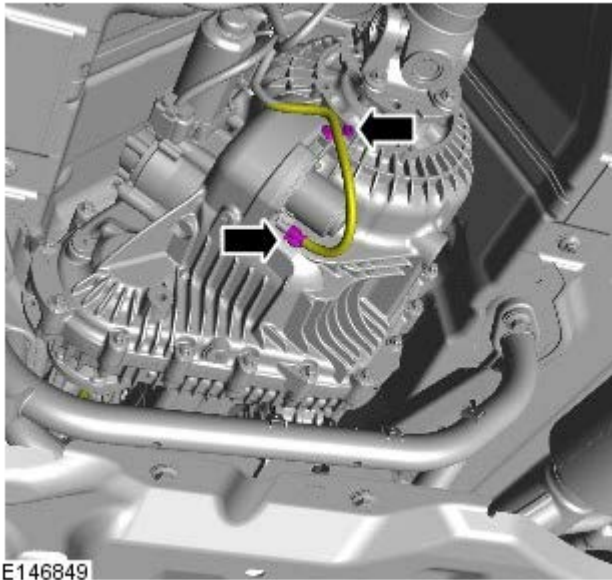
 Make sure that the component sits flush to the transfer case.

 **NOTE: Tighten the retaining bolts evenly and progressively.**

Connect the electrical connector and energise the solenoid (use the service function **transfer case – solenoid replacement** to assist with energising the solenoid) to allow the arm to extend and correctly locate into the shift fork.

Torque: 5 Nm

2.



3. Fill the transfer case.

Refer to: [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).

4. Using the approved diagnostic equipment, clear all diagnostic trouble code(s) (DTCs) and check for correct operation.

Four-Wheel Drive Systems - High/Low Range Sensor

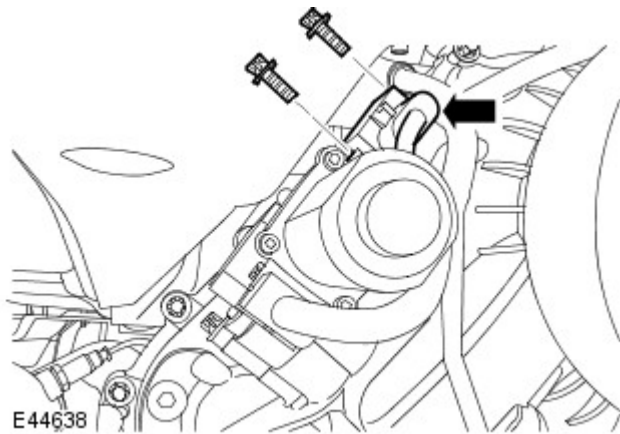
Removal and Installation

Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the crossmember.
For additional information, refer to: [Transmission Support Crossmember - TDV6 3.0L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation) / [Transmission Support Crossmember - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).



3. **CAUTIONS:**

 To avoid damage to the joints or gaiters, do not allow the transmission to hang on the driveshafts.

 Discard the bolts.

Remove the high/low range sensor.

- Lower the rear of the transmission for access.
- Disconnect the electrical connector.
- Remove the 2 Torx bolts.

Installation

1.  **CAUTION:** Make sure that new bolts are installed.

To install, reverse the removal procedure.

- Clean the components.
- Install the high/low range sensor.
- Tighten the Torx bolts to 5 Nm (4 lb.ft).

2. Install the crossmember.
For additional information, refer to: [Transmission Support Crossmember - TDV6 3.0L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation) / [Transmission Support Crossmember - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).
3. Connect the Land Rover approved diagnostic equipment.
 1. Start the service function "transfer case-absolute position sensor replacement"
 2. Clear any Diagnostic Trouble Codes (DTCs) after calibration and check for correct operation.

Four-Wheel Drive Systems - Four-Wheel Drive (4WD) Control Module

Removal and Installation

Removal

NOTES:



LHD shown, RHD is similar.



Some variation in the illustrations may occur, but the essential information is always correct.

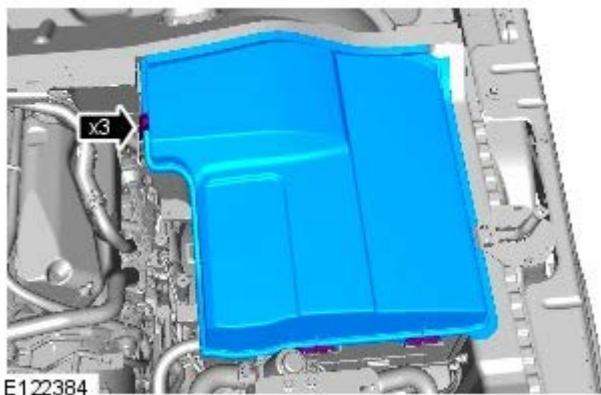


Removal steps in this procedure may contain installation details.

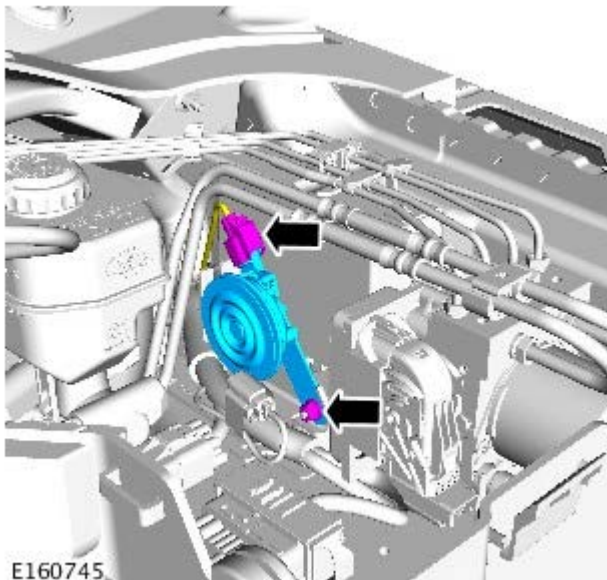
1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2. Remove drivers side plenum box lid.

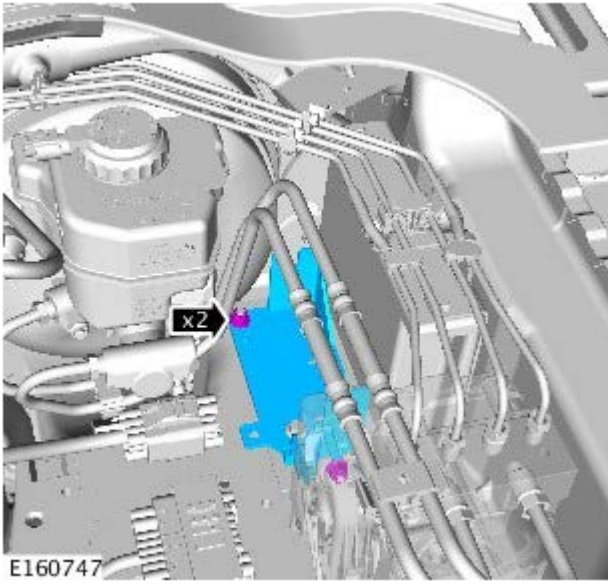


3. Torque: 9 Nm

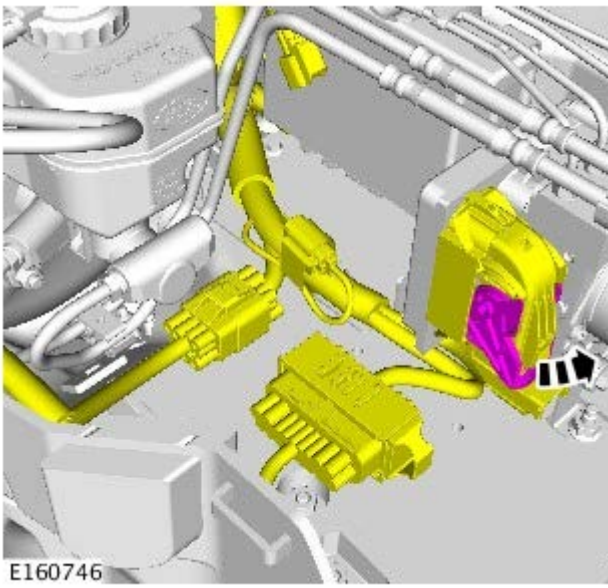


4.  NOTE: Some components shown removed for clarity.

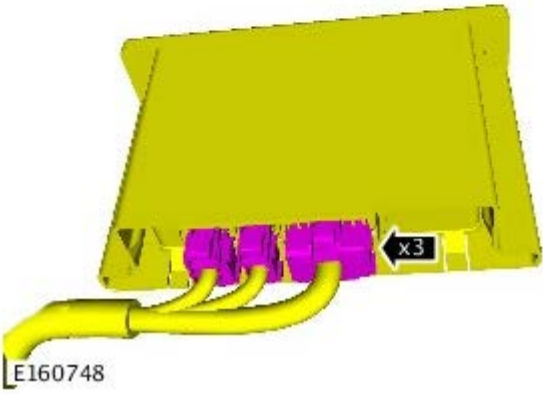
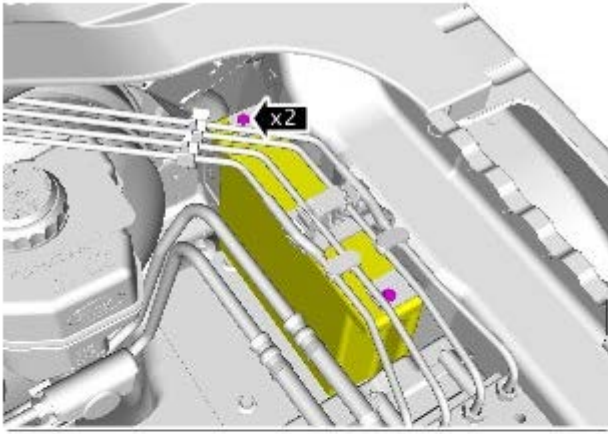
Torque: 9 Nm



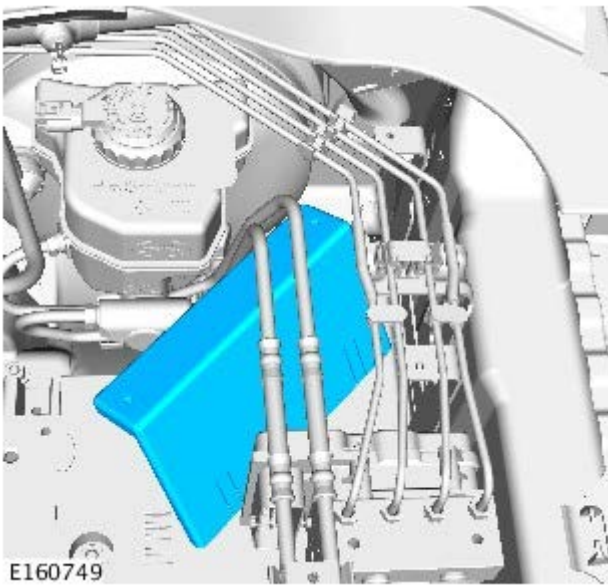
5.



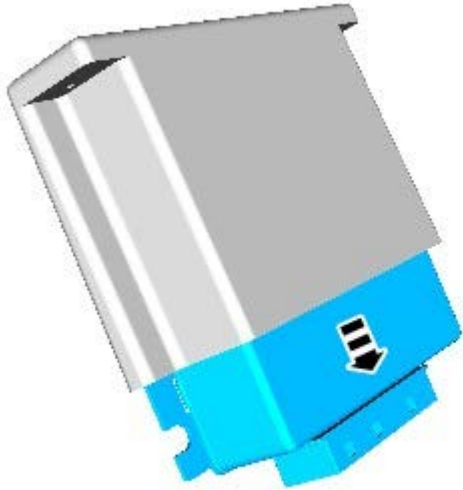
6. Torque: 1.6 Nm



7.



8.



E160750

Installation

1. To install, reverse the removal procedure.
2.
 1. Connect the Land Rover approved diagnostic equipment.
 2. Clear any Diagnostic Trouble Codes (DTCs).
 3. Start the service function "transfer case-transfer case replacement"
 4. Carry out the transfer case calibration procedure.
 5. Clear any DTCs after calibration and check for correct function.

Four-Wheel Drive Systems - Transfer Case Shift Motor

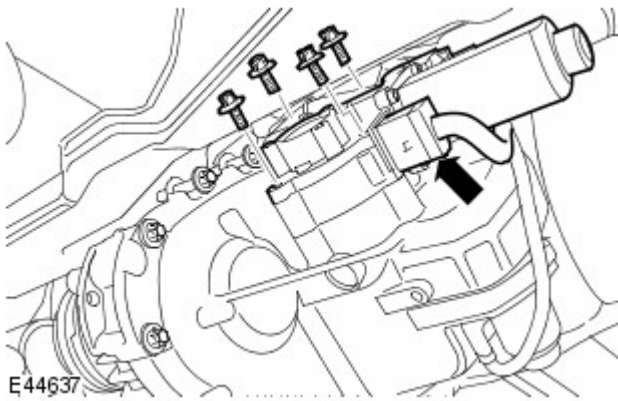
Removal and Installation

Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Remove the transmission crossmember.
For additional information, refer to: [Transmission Support Crossmember - TDV6 3.0L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation) / [Transmission Support Crossmember - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).



3. **CAUTIONS:**

 To avoid damage to the joints or gaiters, do not allow the transmission to hang on the driveshafts.

 Discard the bolts.

Remove the shift motor.

- Lower the rear of the transmission for access.
- Disconnect the electrical connector.
- Remove the 4 Torx bolts.

Installation

1.  **CAUTION:** Make sure that new bolts are installed.

Install the shift motor.

- Clean the components.
- Tighten the Torx bolts to 35 Nm (26 lb.ft).
- Connect the electrical connector.

2. Install the transmission crossmember.
For additional information, refer to: [Transmission Support Crossmember - TDV6 3.0L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation) / [Transmission Support Crossmember - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).
3. Connect the Land Rover approved diagnostic equipment.
 1. Start the diagnostic service function "transfer case-transfer case replacement".
 2. Clear any Diagnostic Trouble Codes (DTCs) after calibration and check for correct operation.

Transfer Case - Vehicles With: Single Speed Transfer Case -

Sealants and Lubricants

Item	Specification
* Recommended oil	Castrol BOT850
Capacity - Wet and dry fill	0.75 litres, (1.3 pints) (0.8 US quarts)
Input shaft splines grease	Weicon TL7391



CAUTION: * Do not use any lubricant other than that specified

Item	Specification
Model	ITC Torsen
Type	Single speed, permanent four wheel drive transfer box with 42 front / 58 rear (± 20% to either axle, dependant on traction) torque split across the centre differential
Ratio	1:1

Torque Specifications

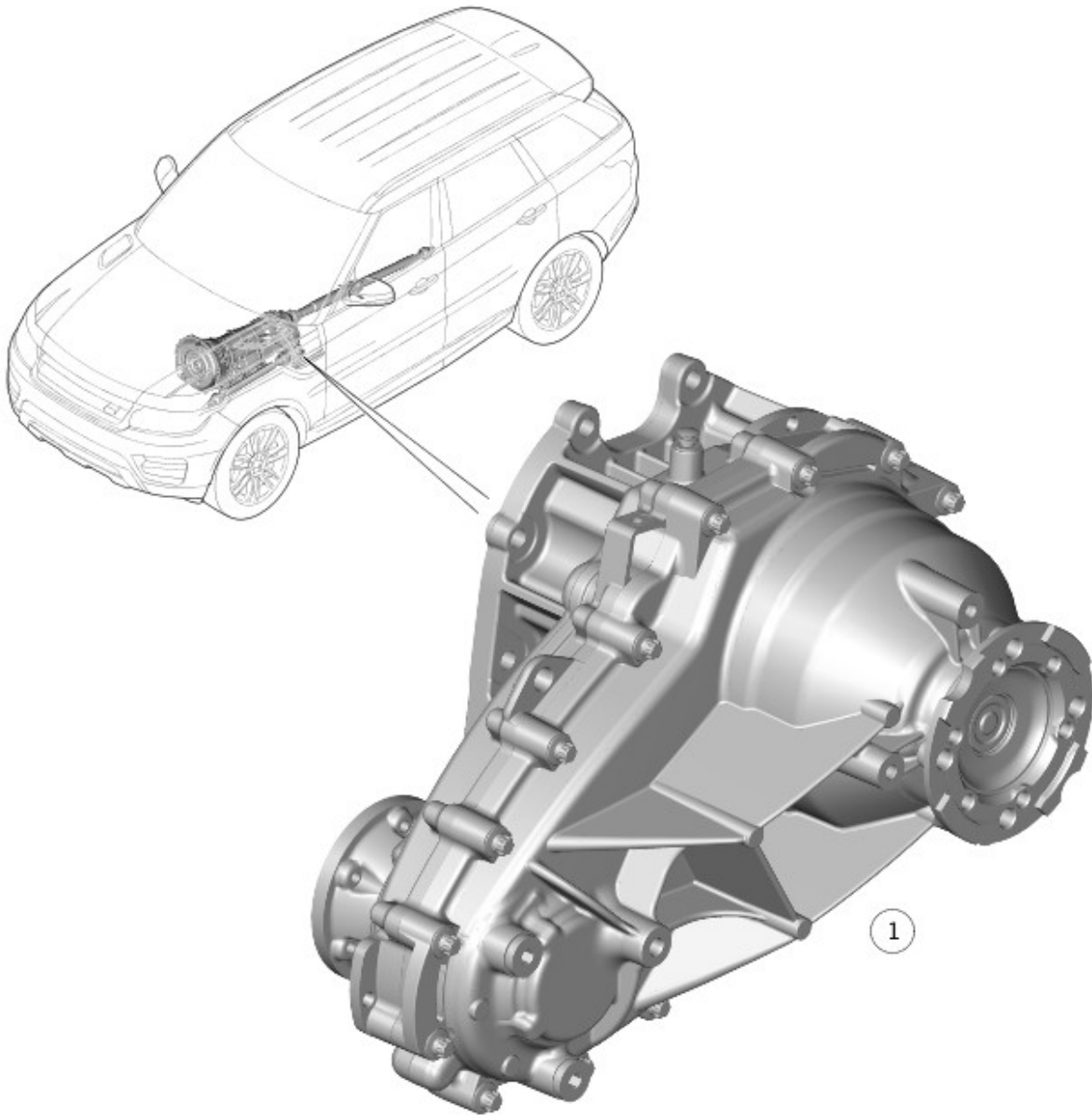
Description	Nm	lb-ft
Transfer casing fluid drain plug	28	21
Transfer casing fluid filler/level plug	28	21
Fuel tank heat shield nuts / bolts	10	7
Transfer casing retaining bolts	45	33
* Rear driveshaft to transfer casing output flange Torx screws	73	54
Rear driveshaft centre bearing bolts	30	22
* Front driveshaft to transfer case output flange:		
Stage 1	45	33
Stage 2	Further 90°	Further 90°
Transfer casing bolts	35	26
Transmission support insulator	60	44
Transfer casing damper	75	55
Transfer casing earth strap fixing	25	18
Transfer casing wiring bracket	15	11

* New 'patched' Torx bolts must be installed

Transfer Case - Vehicles With: Single Speed Transfer Case - Transfer Case

Description and Operation

COMPONENT LOCATION



E164178

Item	Part Number	Description
1	-	Single speed transfer case

OVERVIEW

The new Single speed Transfer Case is standard fitted for V6 Petrol and V6 Diesel engines. (Twin speed Transfer Case is optional.)

The Single speed transfer case is full time, permanent four-wheel-drive unit, with 40/60 torque distribution to the front and rear driveshafts.

Common components with Twin-speed Transfer Case:

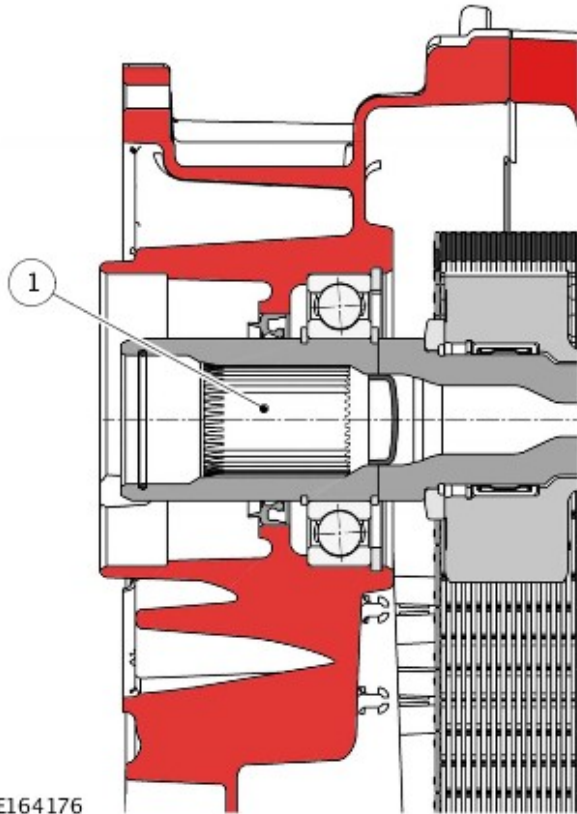
- Front and Rear Flanges
- Main Seals
- Main Bearings
- Fill/Drain Plugs
- Fixings and Torques
- Breather
- Tachograph encoder (optional)

The improvements of the new Single speed Transfer Case are the following:

- Different oil specification - Castrol BOT850 with friction modifier
- Reduced Complexity
- No electronic controls
- Optimized dynamic vehicle behavior

The Single speed TC consists of 25 components, the weight and inertia were reduced for improved economy.

A unique type of grease, Weicon anti-seize montagepaste grau TL 7391, must be applied to the transfer case input shaft spline when installing the transfer case.



Item	Part Number	Description
1	-	Input shaft spline

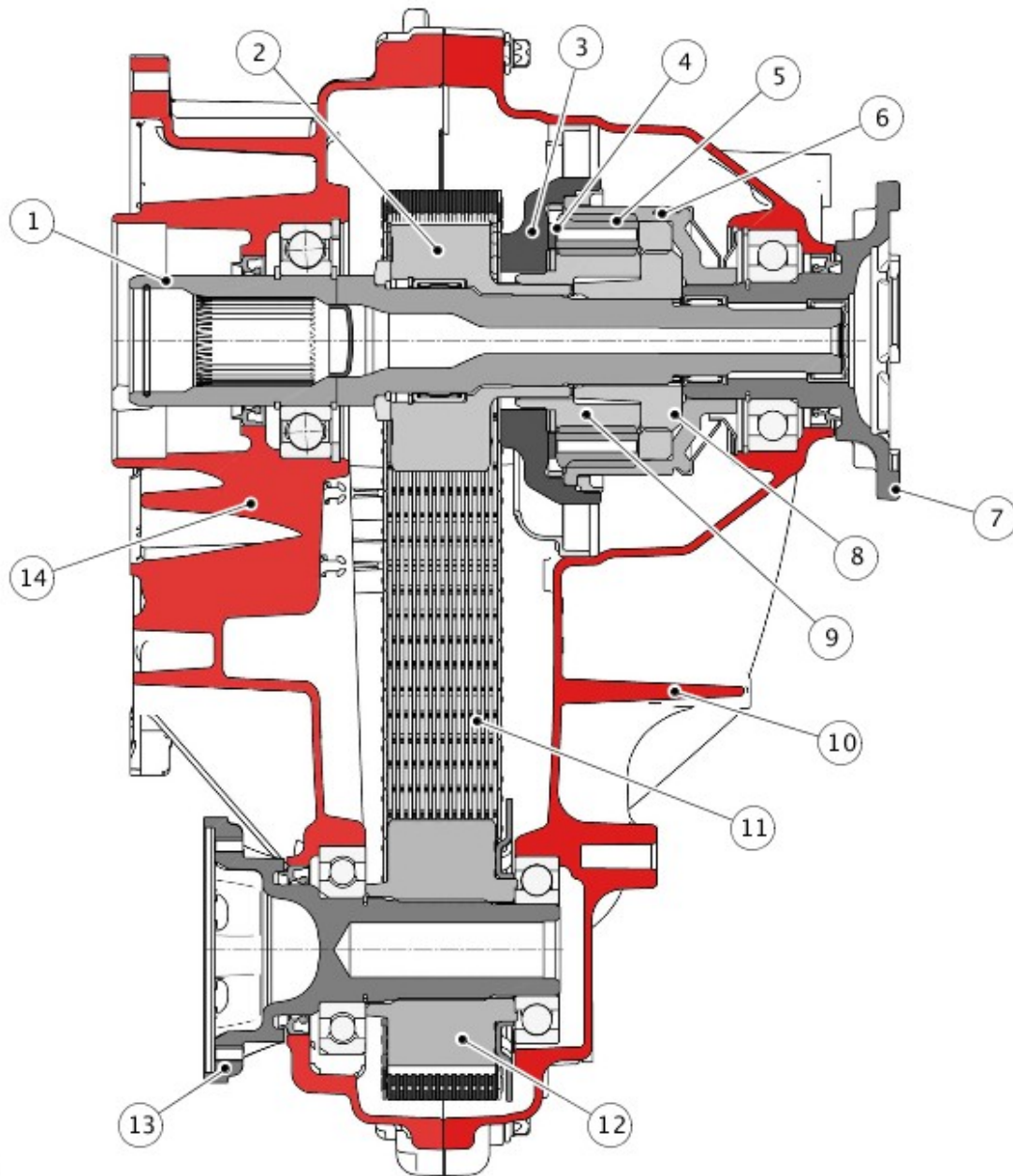
SYSTEM OPERATION

The torque input from the transmission is passed to the transfer case input shaft. The input shaft connected directly to the differential coupling. The differential coupling connects to the housing which splits the torque between the internal gear and the sun gear by the six planetary gears. The internal gear is connected and passes the torque to the rear output flange. The sun gear is connected to the chain drive sprocket and passes the torque to the front output flange via the chain.

The center differential responds to the torque changes at the axles. The basic torque distribution between the front and rear axles is 40/60% at normal drive conditions. If an axle loses traction, the driving torque is redirected instantaneously to the other axle between 65/35% Front/Rear and 20/80% Front/Rear.

DESCRIPTION

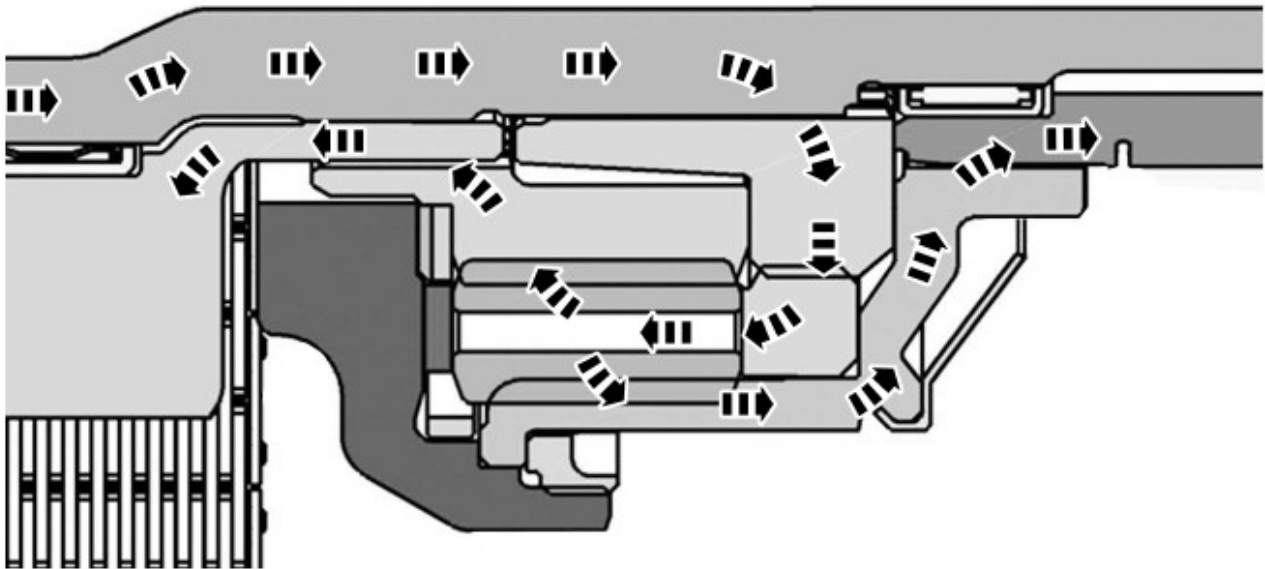
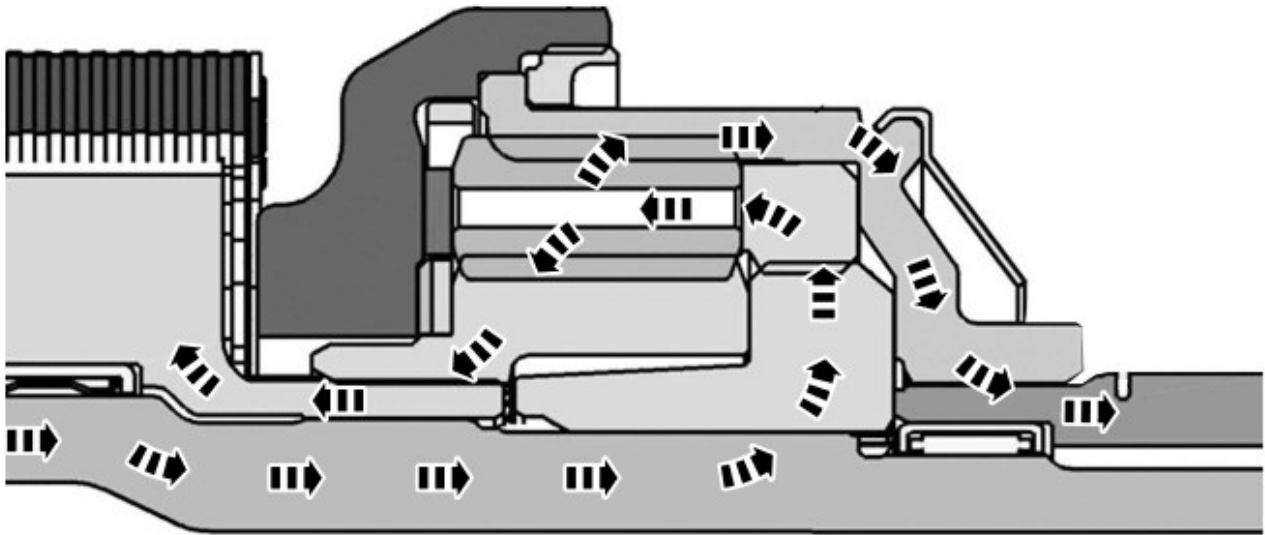
Transfer Case - Sectional View



E164179

Item	Part Number	Description
1	-	Input shaft
2	-	Drive chain sprocket
3	-	Center differential cap
4	-	Friction washer
5	-	Planetary gear (6 off)
6	-	Center differential internal gear
7	-	Rear output flange
8	-	Center differential coupling
9	-	Center differential sun gear
10	-	Rear housing assembly
11	-	Drive chain
12	-	Drive chain sprocket - Front output
13	-	Front output flange
14	-	Front housing assembly

Transfer Case Power Flow



E164180

Input torque from the transmission is transferred to the input shaft of the transfer case and then onto the differential coupling. The coupling is connected to the differential housing. The planetary gears are held in place by the differential housing, which are connected to the differential internal gear, and the sun gear. The torque is then distributed to both the differential internal gear, and the sun gear, which are connected to the outputs of the transfer case. The internal gear is connected directly to the rear output flange, the sun gear is connected directly to the drive chain sprocket and therefore to the chain drive, which provides front output flange rotation.

Front Casing Assembly

The front casing assembly provides the location for the input shaft bearing and the front output flange bearing. It is also equipped with threaded holes to mount the chassis mounting bush, 2 lifting eyes and a breather cartridge for the transfer case breather pipe. The breather pipe allows equalization between atmospheric and internal transfer case pressure.

The front casing has an additional boss cast on the inside. The boss is used to mount two snubbers - one on drive side of the chain and one on the coast side - which are secured with 2 screws. The snubbers are suppressing chain vibrations which can occur under medium acceleration conditions, therefore improving NVH (Noise, Vibration and Harshness) issues. During normal operation the chain does not contact the snubbers.

Rear Casing Assembly

The rear casing assembly provides the location for the rear output flange bearing, the oil fill and drain plug. Fins are cast into the rear casing assembly to improve heat dissipation. The part number & serial number are printed on a bar code label.

Chain Drive

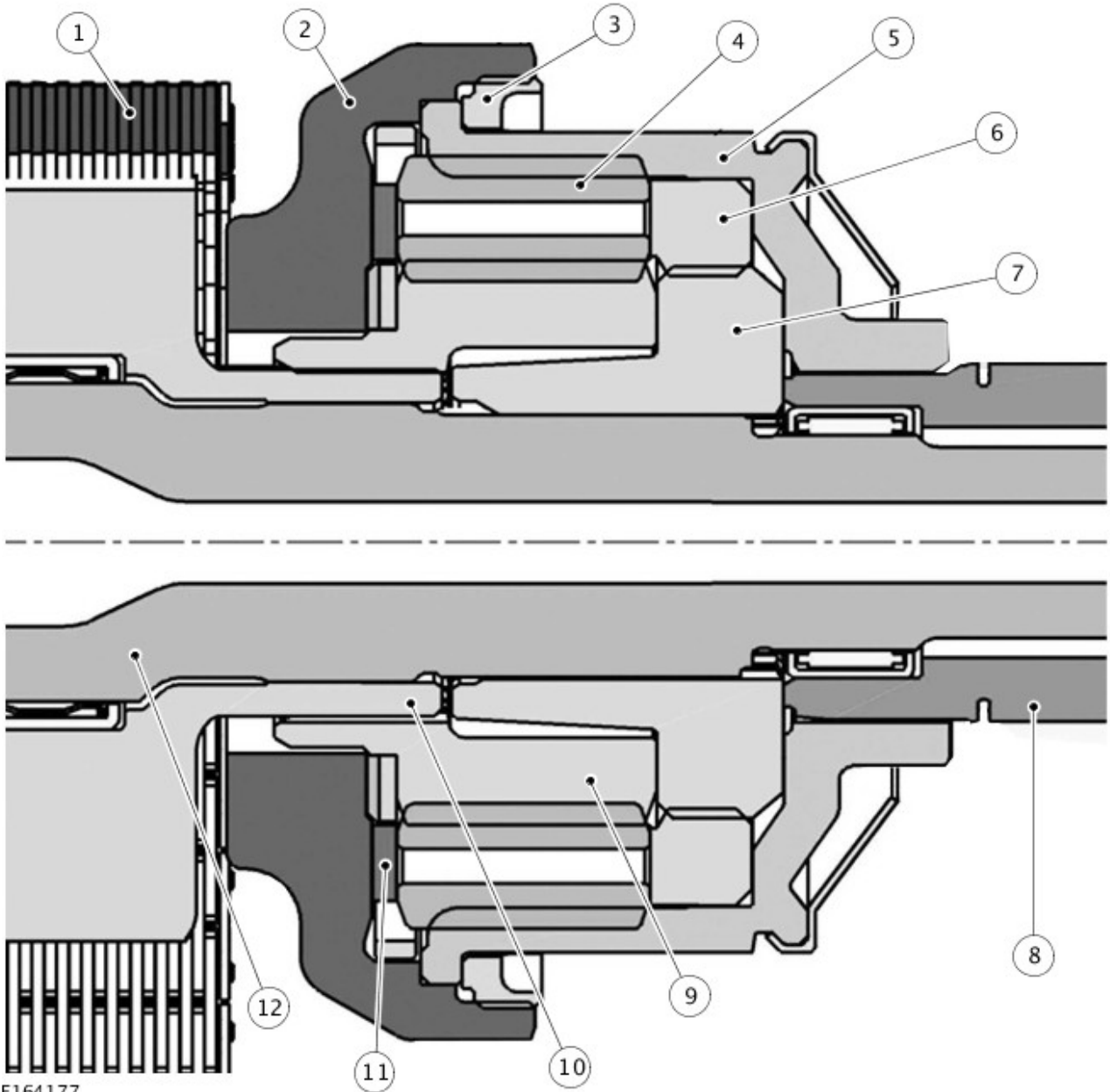
The chain-drive transfers drive from the center differential to the front output flange. A 3/8" pitch chain connects the sprocket on the transfer case input shaft with the sprocket on the front output flange. As both sprockets have the same number of teeth, the rotational speed of both sprockets is identical. During the vehicle operation the chain delivers the oil upwards and provides the lubrication for the input shaft, the output flange bearings, and the center

differential assembly.



NOTE: When installing or replacing the chain, the BLUE guide links must be facing the center differential, towards the rear output flange.

Center differential



E164177

Item	Part Number	Description
1	-	Drive chain
2	-	Center differential cover
3	-	Fixing nut
4	-	Planetary gear (6 off)
5	-	Center differential internal gear
6	-	Center differential housing
7	-	Coupling
8	-	Rear output shaft
9	-	Center differential sun gear
10	-	Drive chain sprocket
11	-	Friction washer
12	-	Input shaft

The center differential assembly is the primary feature of the transfer case. Torque is transmitted through the center differential coupling and housing, and distributed by the planetary gear set to the differential gears and the front and rear output flanges.

The assembly comprises 6 planetary gears, which are equally spaced within the center differential housing. The

planetary gears are supported in both directions by the differential casing and the differential cap.

The different basic torque distribution results from the different circle diameters of the internal gear and the sun gear. If an axle loses traction, the bias between the casing, the planetary gears and the cap generates internal friction inside the differential, and the torque directed to the other axle.

Transfer Case - Vehicles With: Single Speed Transfer Case - Transfer Case

Diagnosis and Testing

Principles of Operation

For a detailed description of the Transfer Case - Single speed, refer to the relevant Description and Operation section in the workshop manual.

REFER to: [Transfer Case](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

Mechanical
<ul style="list-style-type: none"> • Transfer case • Driveshafts • Differentials • Halfshafts • Fluid leaks

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index
5. Check DDW for open campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint and carry out the recommendations as required

Transfer Case - Vehicles With: Single Speed Transfer Case - Transfer Case Draining and Filling

General Procedures

Draining

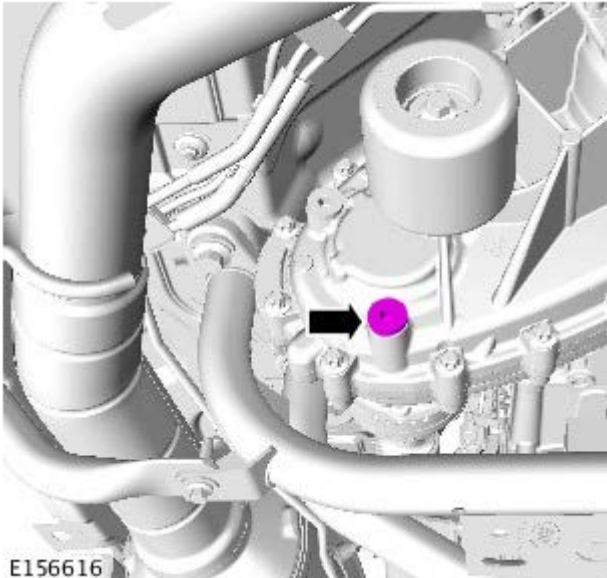


NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Position a container to collect the fluid.

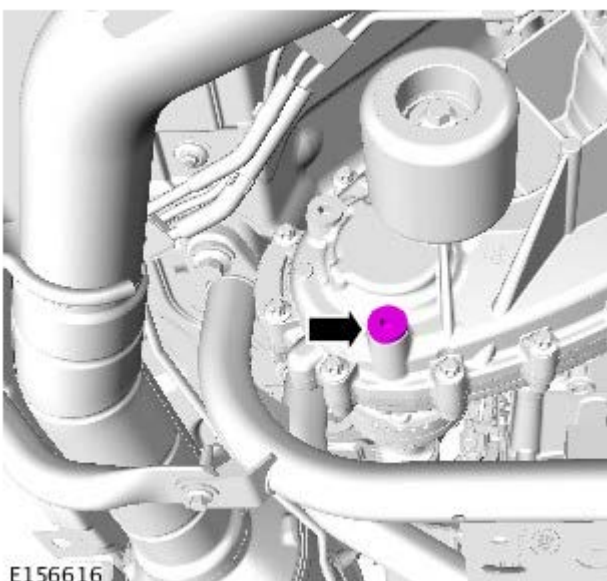


3. **CAUTION:** Make sure that the area around the component is clean and free of foreign material.



NOTE: Remove and discard the sealing washer.

4. Allow the fluid to drain.



5. **NOTES:**



Make sure that all the component mating faces are clean.

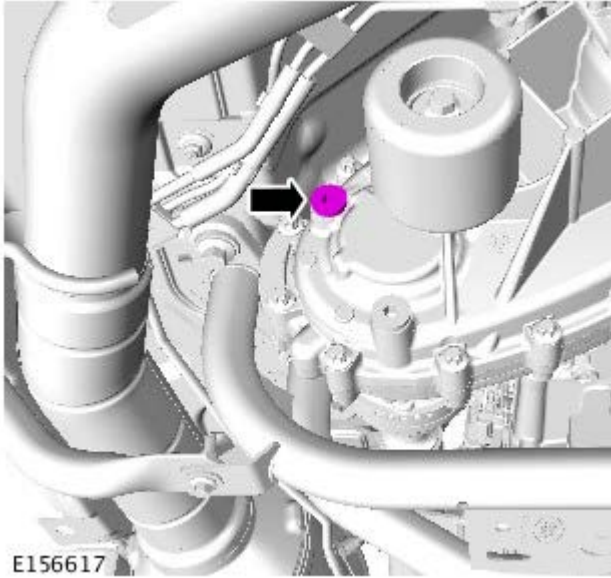



Install a new sealing washer.

Torque: 28 Nm

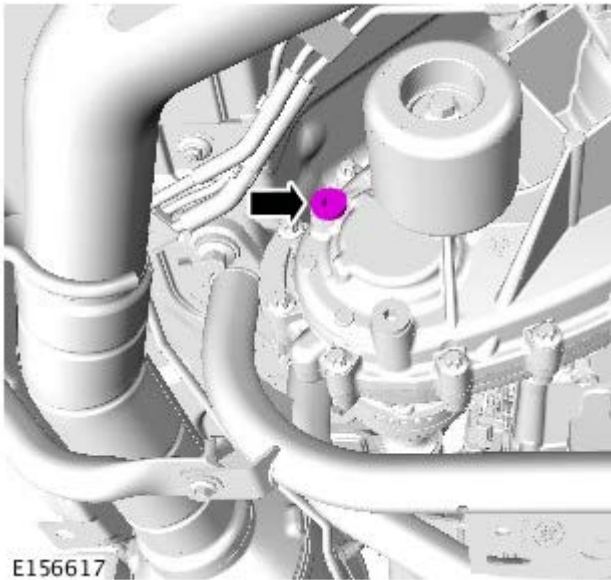
Filling

1. **CAUTION:** Make sure that the area around the component is clean and free of foreign material.




 NOTE: Remove and discard the sealing washer.

2. Refill transfer case with the recommended fluid, until the fluid is level with bottom of filler/level plug hole.



3. NOTES:

 Make sure that all the component mating faces are clean.





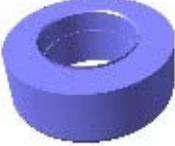
 Install a new sealing washer.

Torque: 28 Nm

Transfer Case - Vehicles With: Single Speed Transfer Case - Transfer Case Front Output Seal

Removal and Installation

Special Tool(s)

 <p>205-818 E55429</p>	205-818 Installer, Seal
 <p>E159151</p>	308-620 Installer, Seal
 <p>308-636 E55702</p>	308-636 Installer
 <p>E158794</p>	JLR-308-926 Support Tool, Transfer Case
 <p>E158799</p>	JLR-308-933 Remover, Transfer Case Flange


Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).


2.  **WARNING:** Make sure to support the vehicle with axle stands.

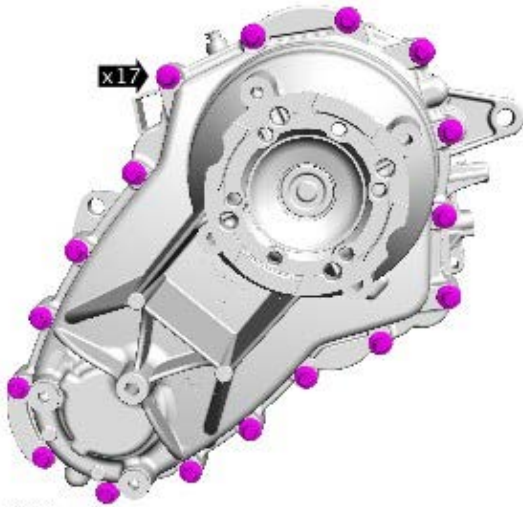
Raise and support the vehicle.

3. Refer to: [Transfer Case Draining and Filling](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, General Procedures).
4. Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07B Transfer


Case - Vehicles With: Single Speed Transfer Case, Removal).
Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, Removal).

5.  **WARNING:** Eye protection must be worn.

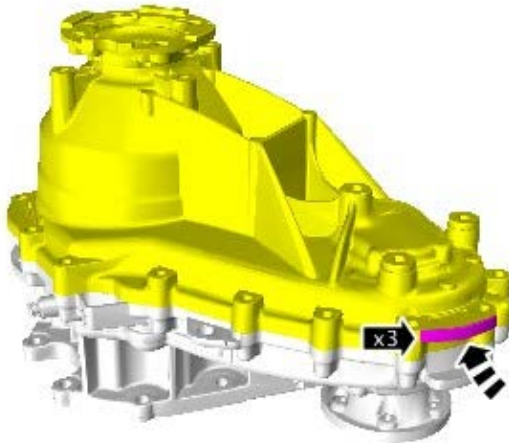
 **CAUTION:** Make sure the bolt holes are clean and free from swarf.



E156694

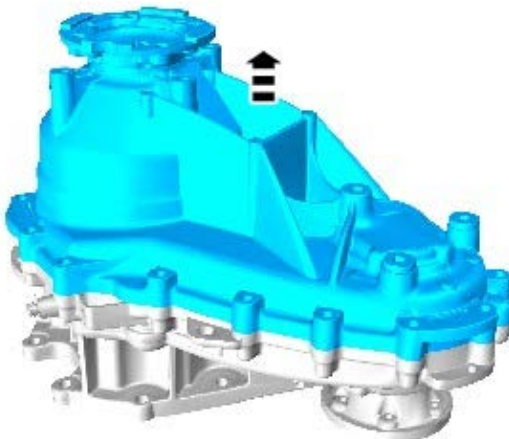
6.  **CAUTION:** Care must be taken to avoid damage to the mating surfaces.

Using a soft faced mallet, release the rear casing.




E156613

- 7.

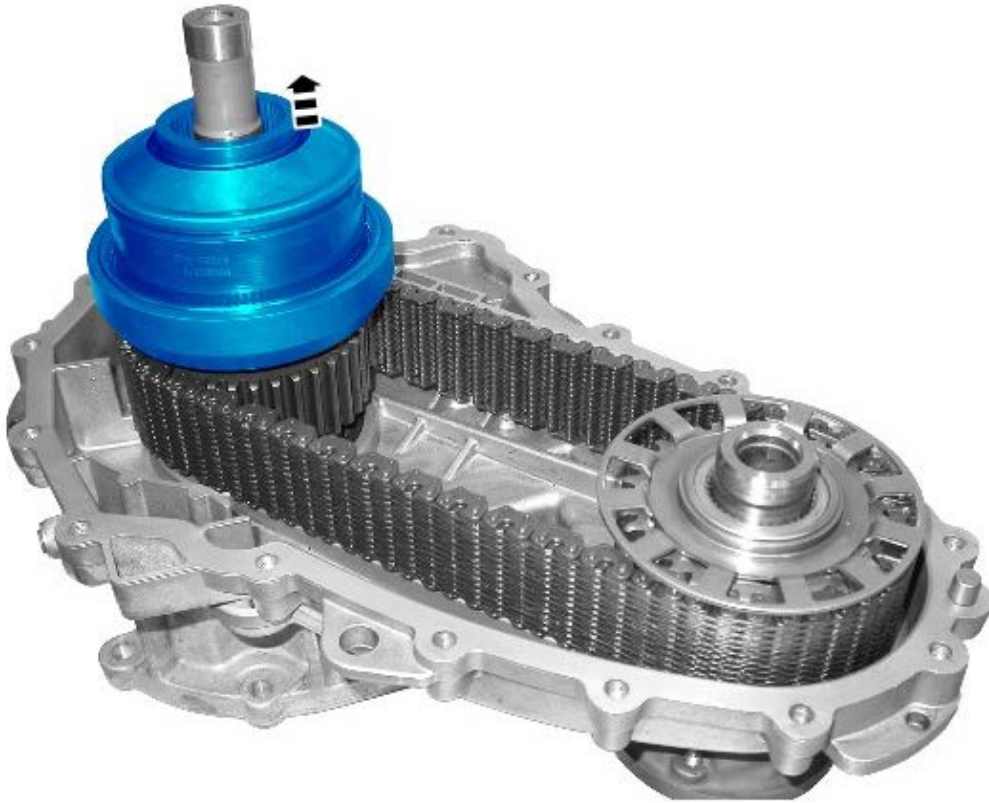


E156614

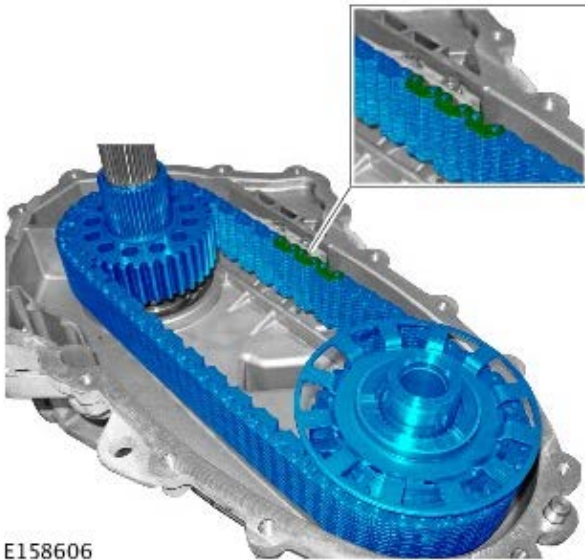
8.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Remove the sealant from the transfer case mating faces.


9.  CAUTION: Note the installed position of the component prior to removal.




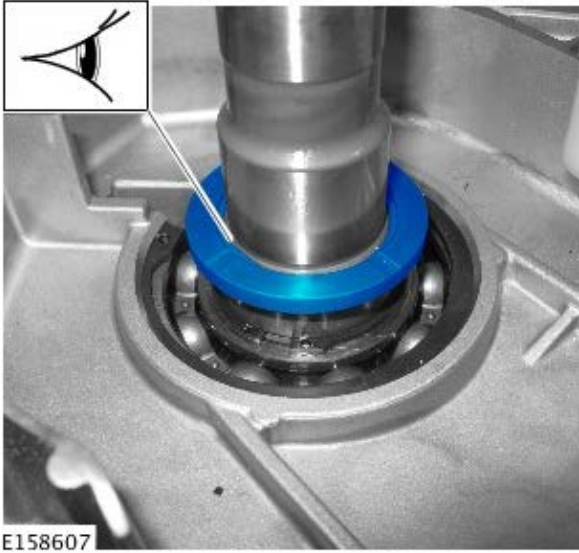
E156773



E158606

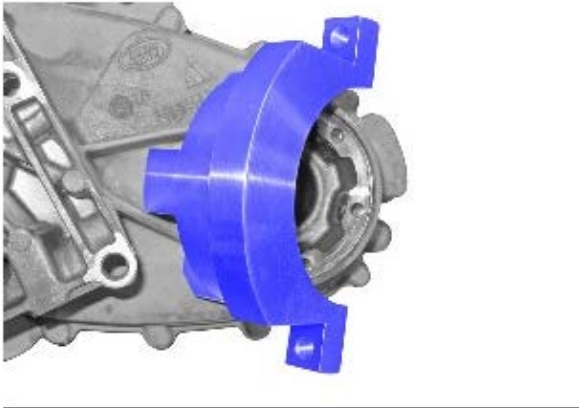
10.  CAUTION: Note the installed position of the components prior to removal.

11.  CAUTION: Note the installed position of the component prior to removal.



E158607


12. *Special Tool(s):* [JLR-308-926](#)



E158608



JLR-308-926

13.  CAUTION: Make sure that the special tool is correctly located. This will make sure that the snap ring is fully compressed during the next step.

Special Tool(s): [JLR-308-933](#)



14. CAUTIONS:

 Do not use excessive force whilst removing the flange assembly.

 Discard the snap ring.

Special Tool(s): [JLR-308-933](#)


15.

16.



E158612

Installation

 CAUTION: During the installation, make sure that all components are clean and free from foreign material.

1. Position the special tool as shown, to support the transfer casing during the next step.

Special Tool(s): [JLR-308-926](#)



E158613

JLR-308-926

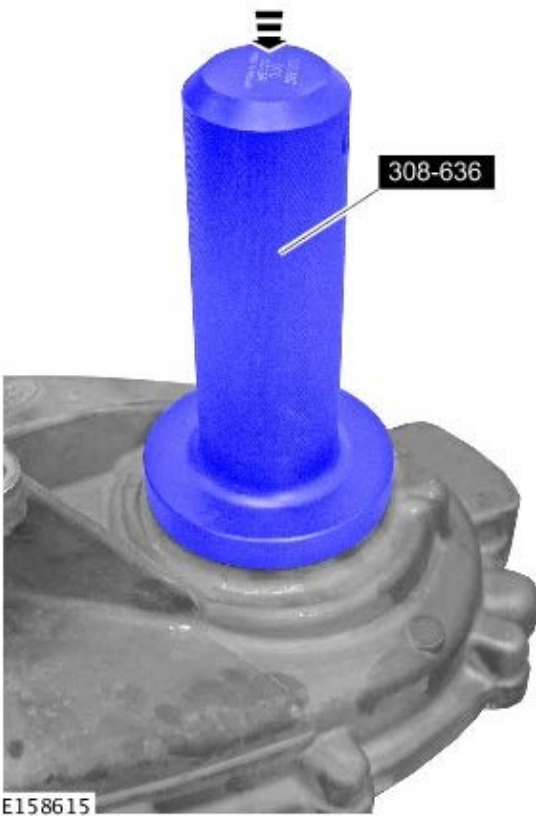
2. CAUTIONS:

 The chamfer on the bearing inner track must face the seal.

 The transfer casing must be supported by the special tool on a flat surface during the next step.

Install the bearing.

Special Tool(s): [308-620](#), [JLR-308-926](#)



3. Install the seal.

Special Tool(s): [308-636](#)

4. CAUTIONS:

 Centralise the snap ring in the snap ring groove before installing the output flange.

 Extreme care is necessary to make sure the snap ring enters the bearing squarely.

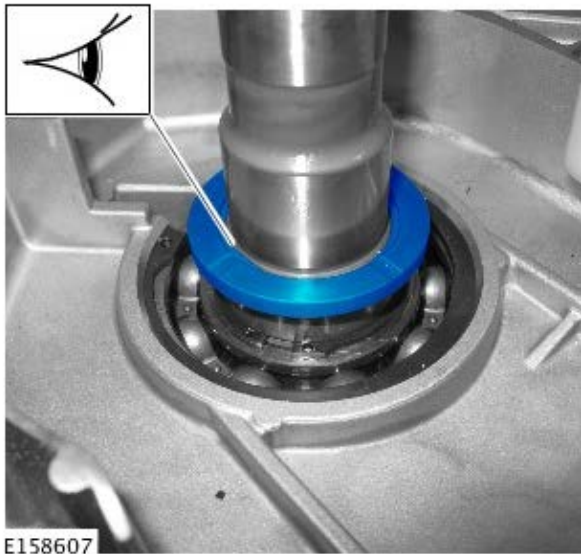
 Install a new snap ring.



E158616

Using the special tool and with assistance, install the drive flange.


Special Tool(s): [205-818](#)




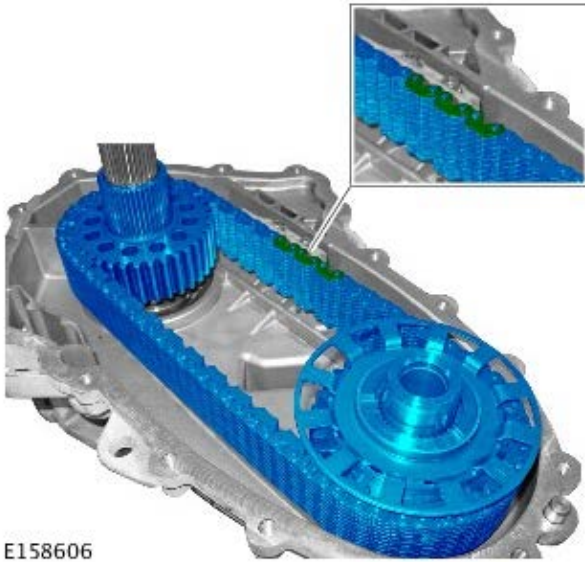
E158607

5.  CAUTION: Make sure that the component is installed to the noted removal position.


6. CAUTIONS:

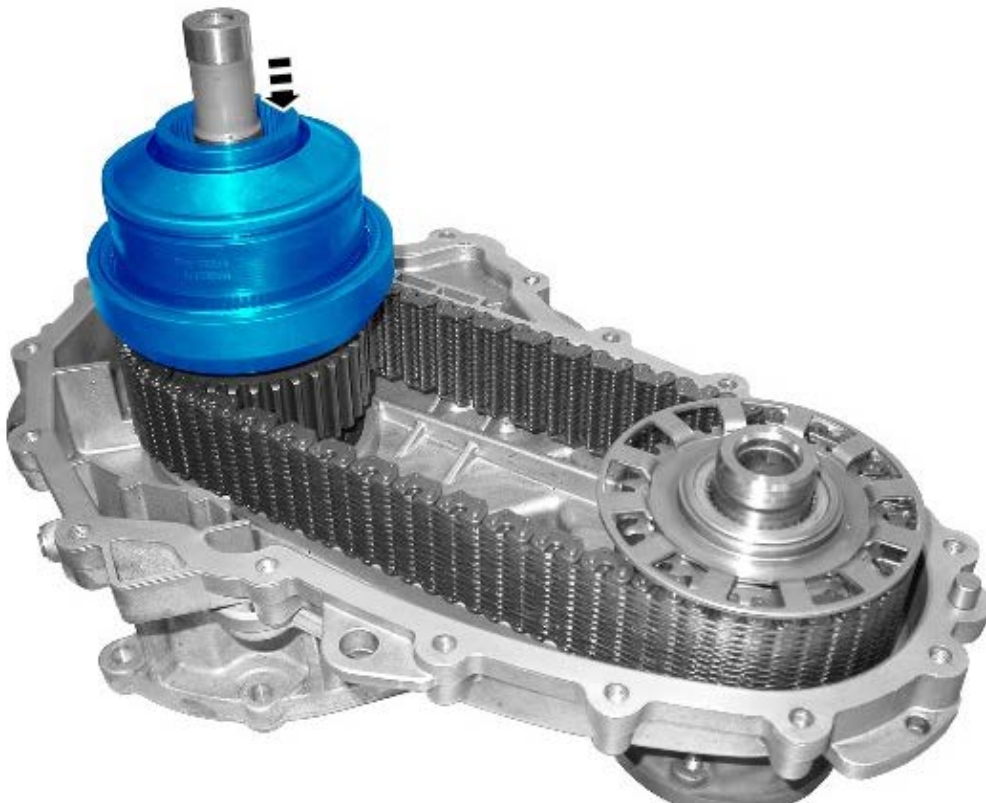
 Make sure that the components are installed to the noted removal position.

 The dark links in the chain face up as shown.



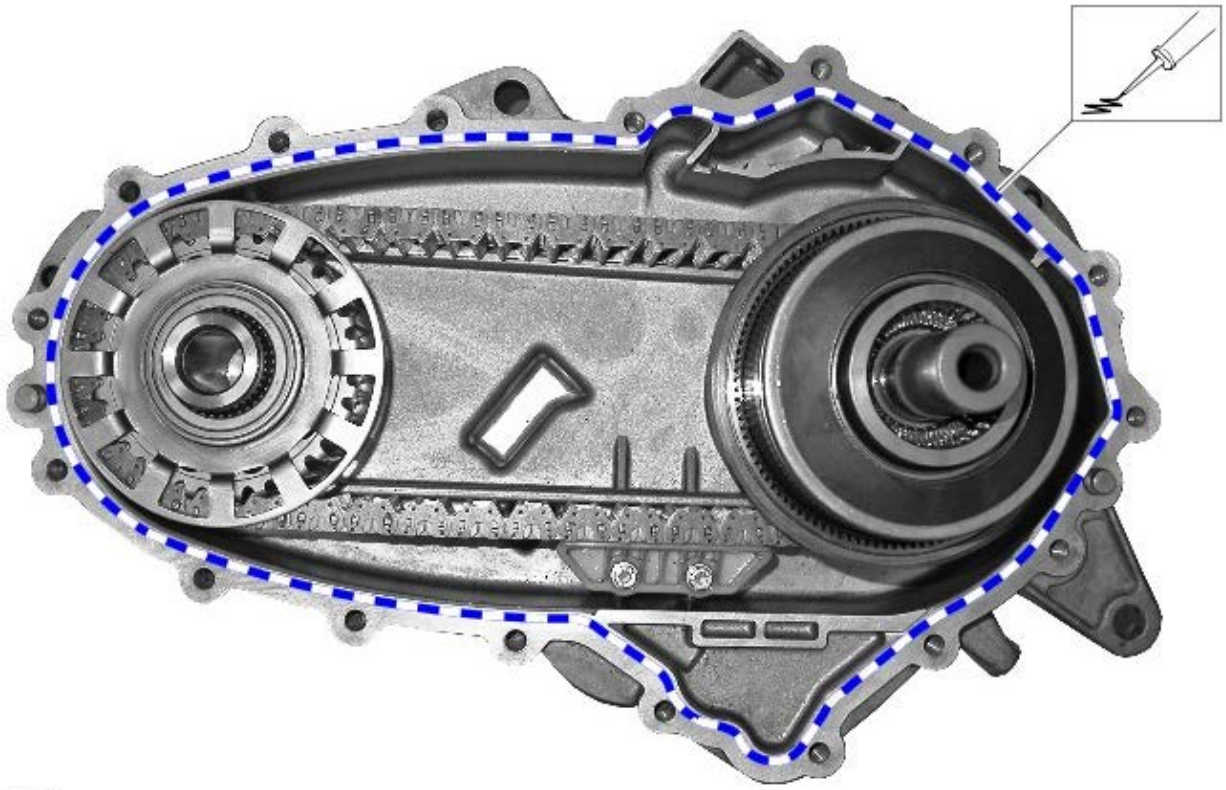
E158606

7.  CAUTION: Make sure that the component is installed to the noted removal position.



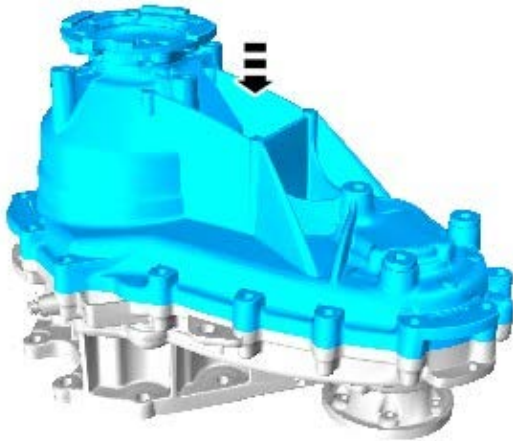
E158607

8. Apply a 2 mm bead of sealant to one surface of the transfer case mating face, as shown.



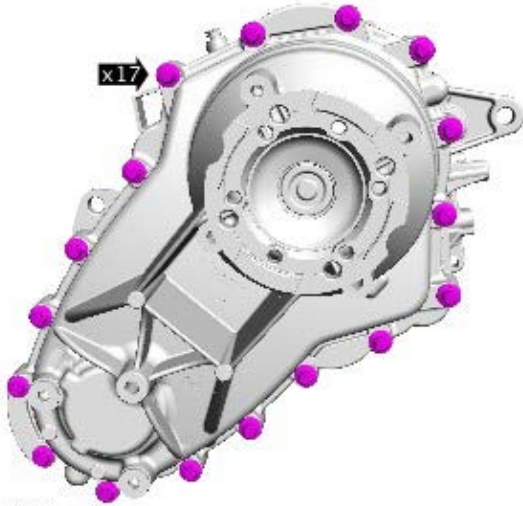
E156774

9.



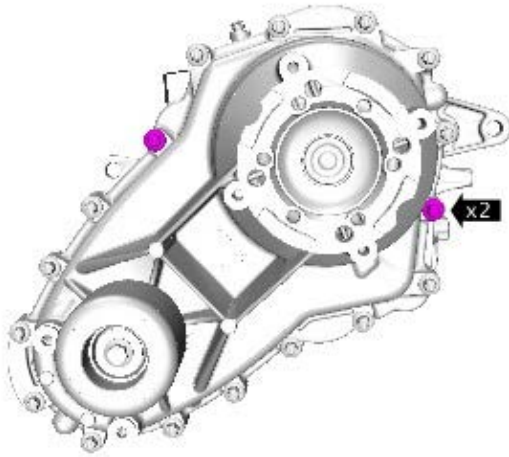
E156785

10.  CAUTION: Only tighten the bolts finger-tight at this stage.



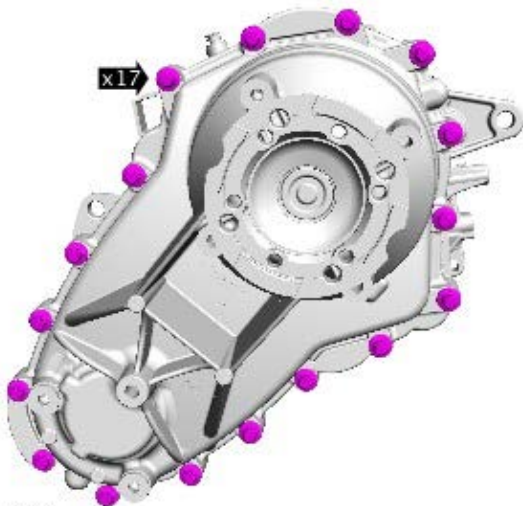
E156694

11. Torque: 10 Nm



E157851

12. Torque: 35 Nm



E156694

13. Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, Installation). Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, Installation).
14. Refer to: [Transfer Case Draining and Filling](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, General Procedures).

15. Connect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Transfer Case - Vehicles With: Single Speed Transfer Case - Transfer Case Front Output Shaft Bearing

Removal and Installation

Removal

1. Refer to: Transfer Case Front Output Seal (308-07, Removal and Installation).

Installation

1. Refer to: Transfer Case Front Output Seal (308-07, Removal and Installation).

Transfer Case - Vehicles With: Single Speed Transfer Case - Transfer Case Rear Output Seal

Removal and Installation

Special Tool(s)

 <p>E159758</p>	<p>204-525-1 Replacer, Drive Flange</p>
<p>205-726</p>  <p>E87692</p>	<p>205-726 Remover/Installer, Wheel Hub Bearing</p>
<p>308-637</p>  <p>E55697</p>	<p>308-637 Installer</p>
 <p>E158795</p>	<p>JLR-308-927 Support Tool, Transfer Case</p>
 <p>E158797</p>	<p>JLR-308-931 Remover, Transfer Case Flange</p>


Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

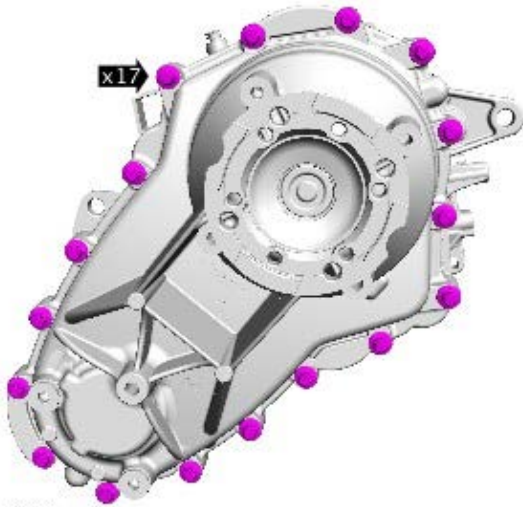
Raise and support the vehicle.

3. Refer to: [Transfer Case Draining and Filling](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, General Procedures).
4. Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07B Transfer


Case - Vehicles With: Single Speed Transfer Case, Removal).
Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, Removal).

5.  **WARNING:** Eye protection must be worn.

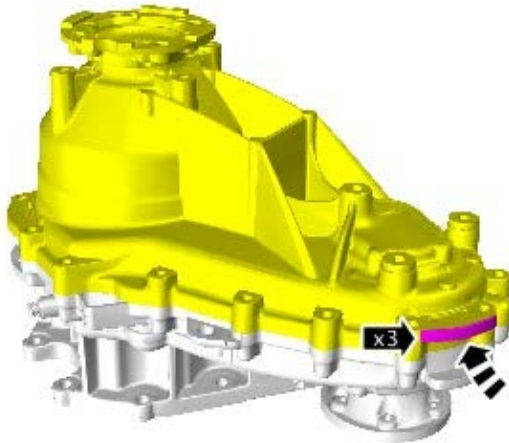
 **CAUTION:** Make sure the bolt holes are clean and free of swarf.



E156694

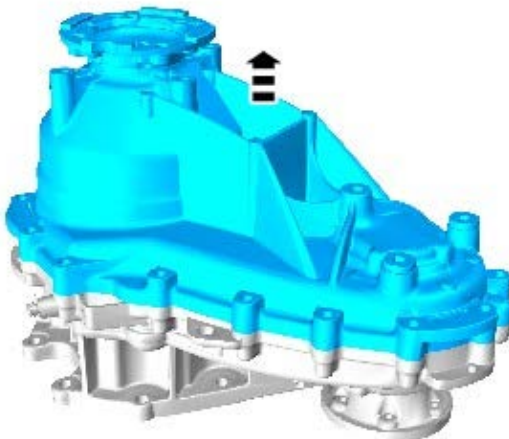
6.  **CAUTION:** Care must be taken to avoid damage to the mating surfaces.

Using a soft faced mallet, release the rear casing.




E156613

- 7.

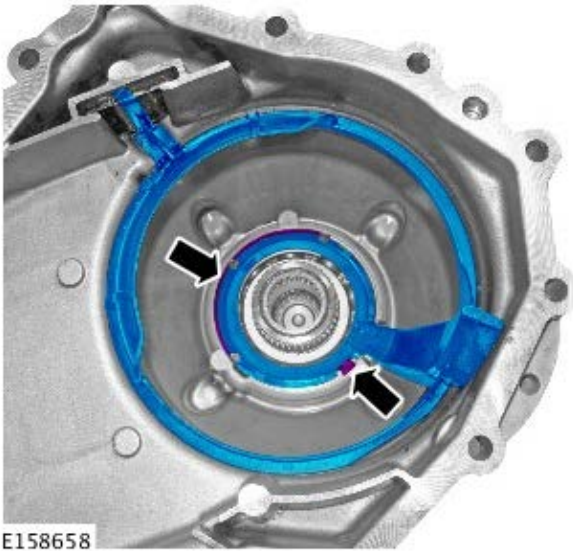


E156614

8.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

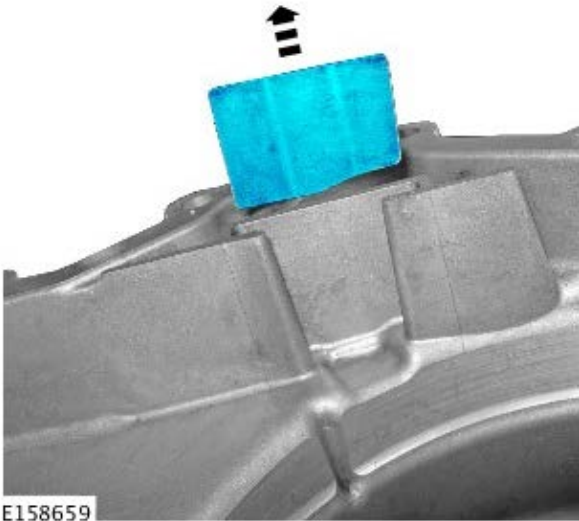
Remove the sealant from the transfer case mating faces.

9.



E158658

10.  NOTE: Note the orientation of the component prior to removal.



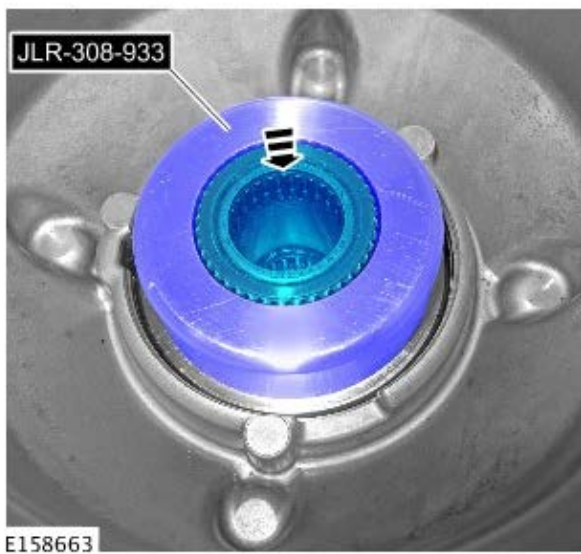
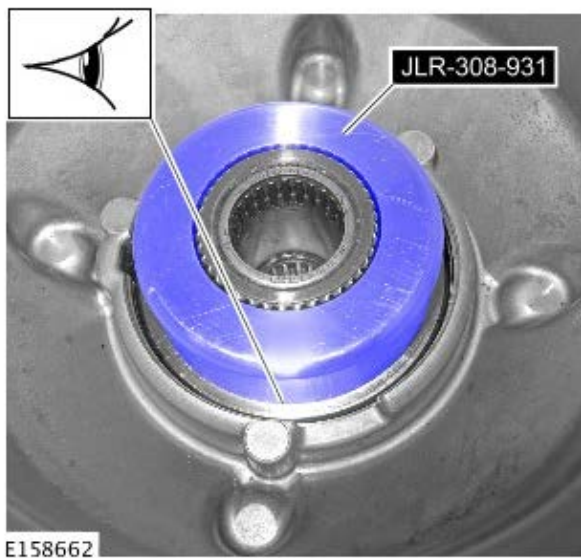
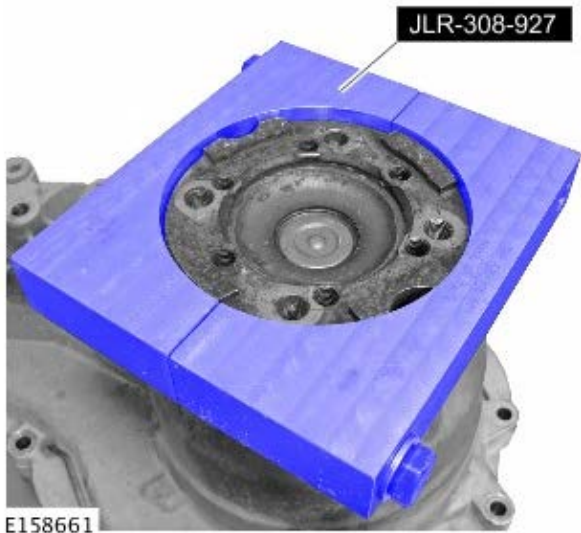
E158659


11.



E158660

12. Special Tool(s): [JLR-308-927](#)



13.  CAUTION: Make sure that the special tool is correctly located. This will make sure that the snap ring is fully compressed during the next step.

Special Tool(s): [JLR-308-931](#)

14. CAUTIONS:

 Do not use excessive force whilst removing the flange assembly.

 Discard the snap ring.

Special Tool(s): [JLR-308-931](#)

- 15.



E158664

16.



E158665

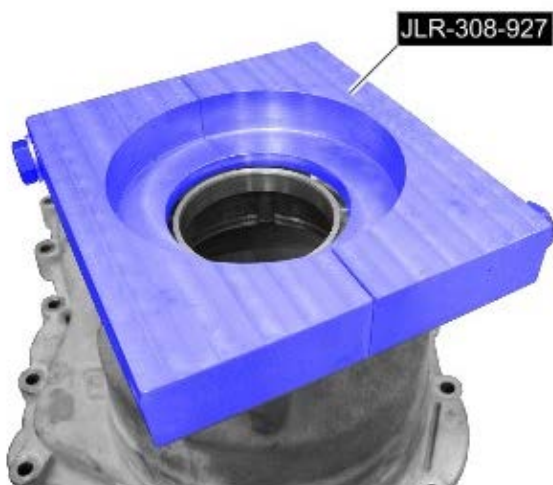
Installation




CAUTION: During the installation, make sure that all components are clean and free from foreign material.

1. Position the special tool as shown, to support the transfer casing during the next step.

Special Tool(s): [JLR-308-927](#)



E158666

2.  CAUTION: The chamfer on the bearing inner track must face the seal.



E158667

Install the bearing.

Special Tool(s): [205-726](#)



E158668

3. Install the seal.

Special Tool(s): [308-637](#)

4. CAUTIONS:



Centralise the snap ring in the snap ring groove before installing the output flange.



Extreme care is necessary to make sure the snap ring enters the bearing squarely.



Install a new snap ring.

Using the special tool and with assistance, install the drive flange.

Special Tool(s): [204-525-1](#)

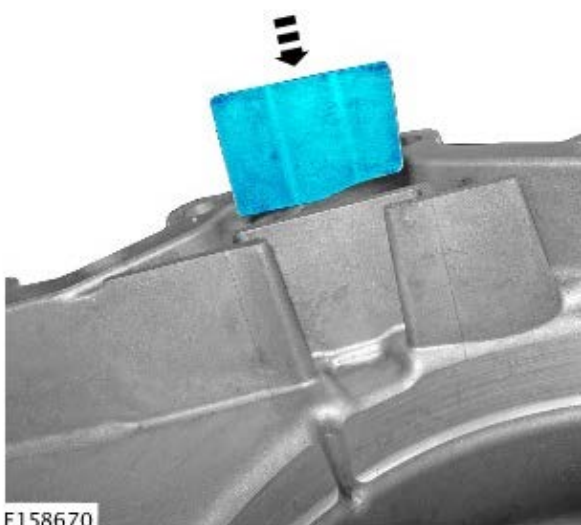


E158669

5.





E158660





E158670

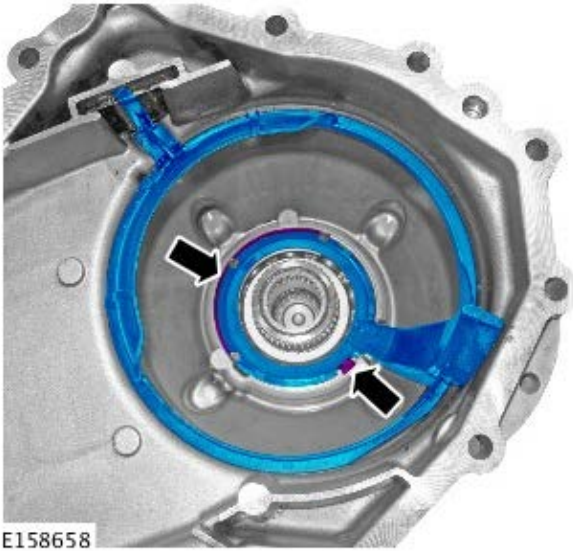
6. CAUTIONS:

 Make sure that the component is installed to the noted removal position.

 Make sure that the component is clean and free of foreign material.

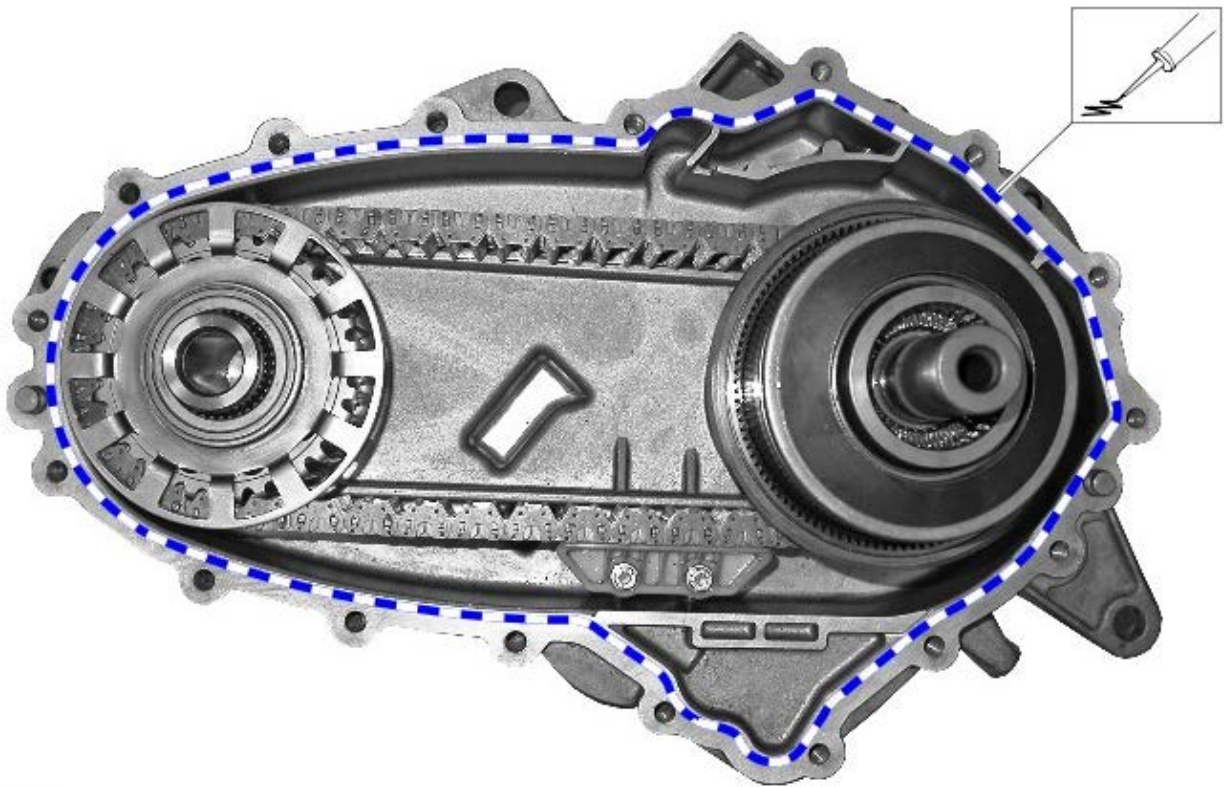
7.  CAUTION: Make sure that the retaining tangs are installed correctly.

 NOTE: Make sure that the component is correctly installed.



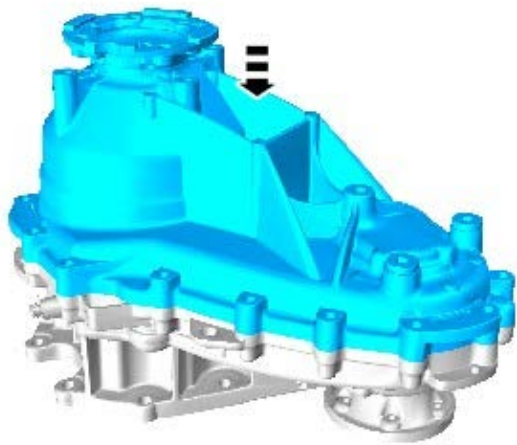
E158658

8. Apply a 2 mm bead of sealant to one surface of the transfer case mating face, as shown.



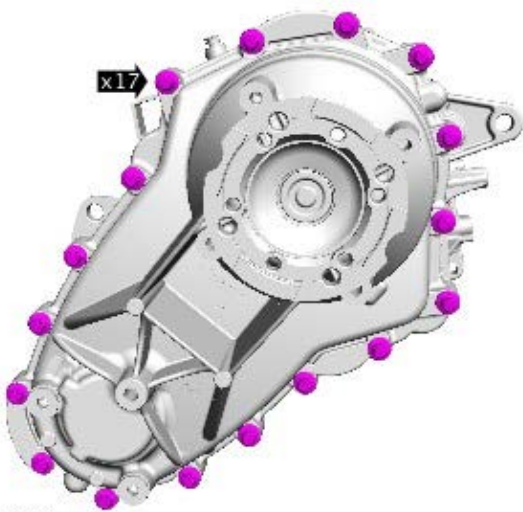
E156774

- 9.



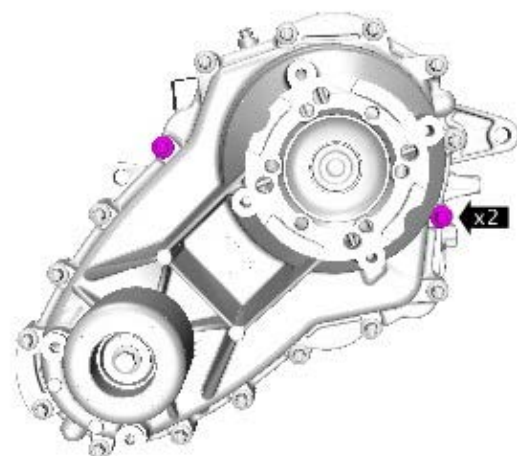
E156785

10.  CAUTION: Only tighten the bolts finger-tight at this stage.



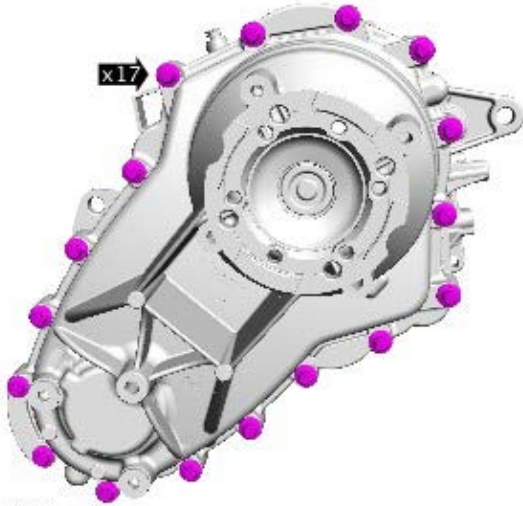
E156694

11. Torque: 10 Nm



E157851

12. Torque: 35 Nm



E156694

13. Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, Installation). Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, Installation).
14. Refer to: [Transfer Case Draining and Filling](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, General Procedures).
15. Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Transfer Case - Vehicles With: Single Speed Transfer Case - Transfer Case Rear Output Shaft Bearing

Removal and Installation

Removal

1. Refer to: Transfer Case Rear Output Seal (308-07, Removal and Installation).



Installation

1. Refer to: Transfer Case Rear Output Seal (308-07, Removal and Installation).

Transfer Case - Vehicles With: Single Speed Transfer Case - Transfer Case Connecting Sleeve Seals

Removal and Installation

Special Tool(s)

 <p>100-012</p> <p>E54135</p>	<p>100-012 Slide Hammer</p>
 <p>307-520</p> <p>E52536</p>	<p>307-520 Installer, Output Shaft Seal</p>
 <p>E15 8796</p>	<p>JLR-308-930 Installer, Oil Seal</p>
 <p>E15 8798</p>	<p>JLR-308-932 Remover, Oil Seal</p>

Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

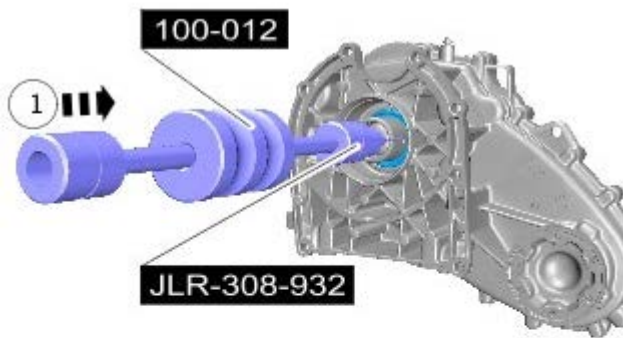
Raise and support the vehicle.

3. Remove the transfer case.

Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, Installation).

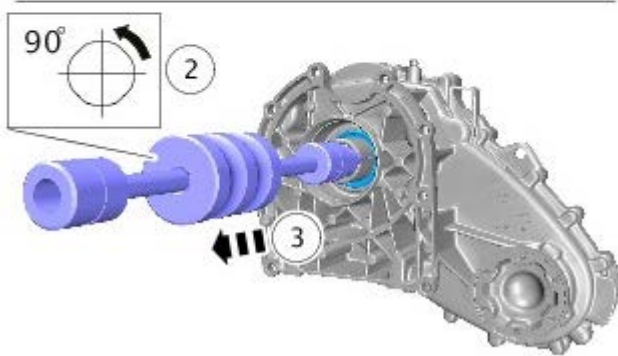
Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, Removal).

4.  **CAUTION:** Care must be taken to avoid



damage to the seal register and running surface.

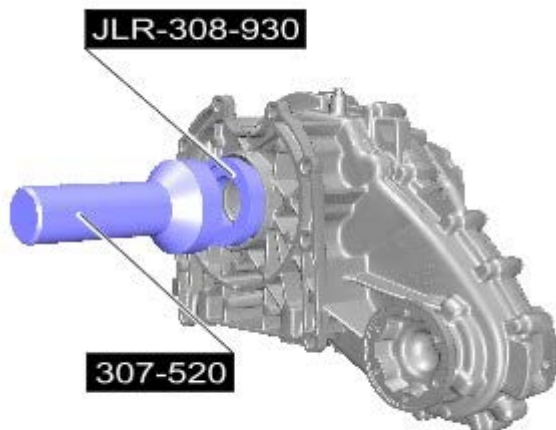
Special Tool(s): [100-012](#), [JLR-308-932](#)



E156808

Installation

1. Special Tool(s): [307-520](#), [JLR-308-930](#)



E158632

2. Install the transfer case.

Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, Installation).

Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, Installation).

3. Connect the battery ground cable.

Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Transfer Case - Vehicles With: Single Speed Transfer Case - Transfer Case Differential

Removal and Installation

Removal

1. Disconnect the battery ground cable.

Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).


2.  **WARNING:** Make sure to support the vehicle with axle stands.

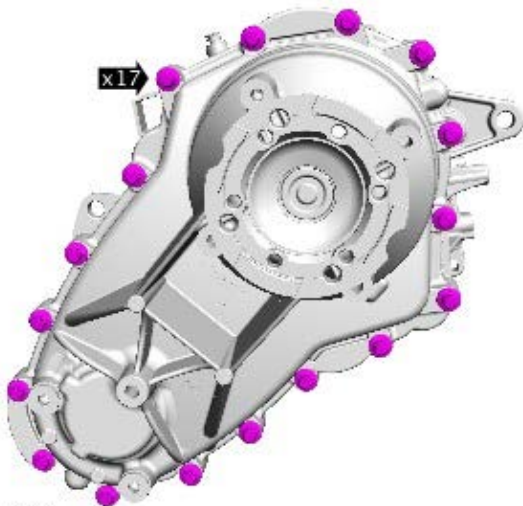
Raise and support the vehicle.

3. Refer to: Transfer Case Draining and Filling (308-07 Transfer Case - Vehicles With: Single Speed Transfer Case, General Procedures).


4. Refer to: Transfer Case - TDV6 3.0L Diesel (308-07 Transfer Case - Vehicles With: Single Speed Transfer Case, Removal).
Refer to: Transfer Case - V6 S/C 3.0L Petrol (308-07 Transfer Case - Vehicles With: Single Speed Transfer Case, Removal).

5.  **WARNING:** Eye protection must be worn.

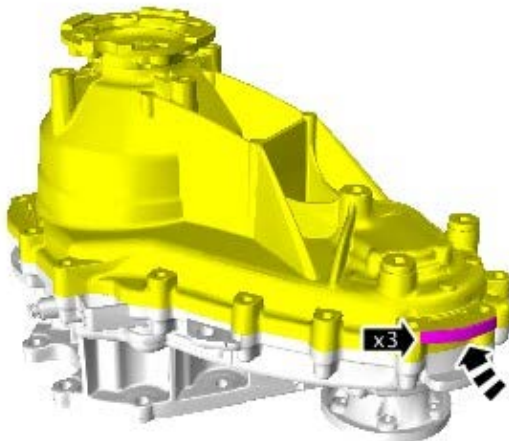
 **CAUTION:** Make sure the bolt holes are clean and free of swarf.



E156694

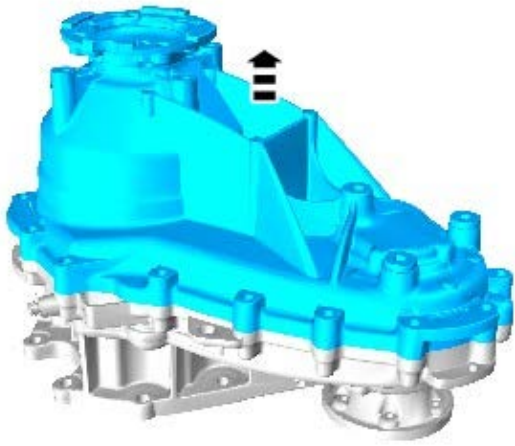
6.  **CAUTION:** Care must be taken to avoid damage to the mating surfaces.

Using a soft faced mallet, release the rear casing.




E156613

- 7.

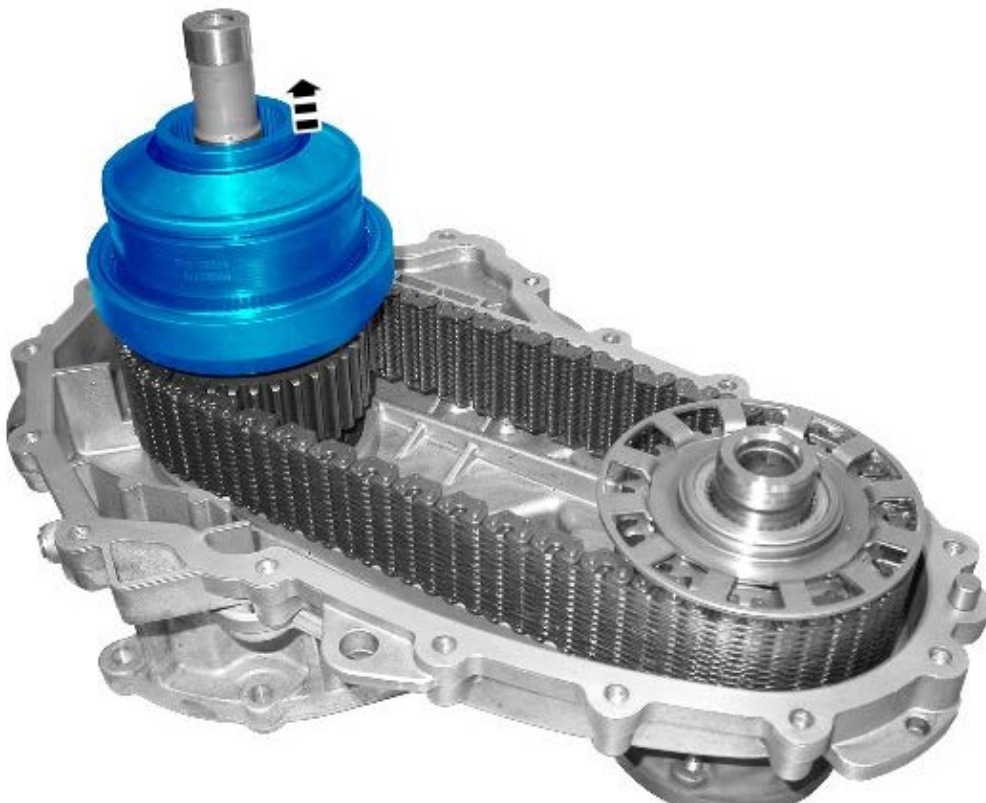


E156614

8.  CAUTION: Make sure that the mating faces are clean and free of foreign material.

Remove the sealant from the transfer case mating faces.

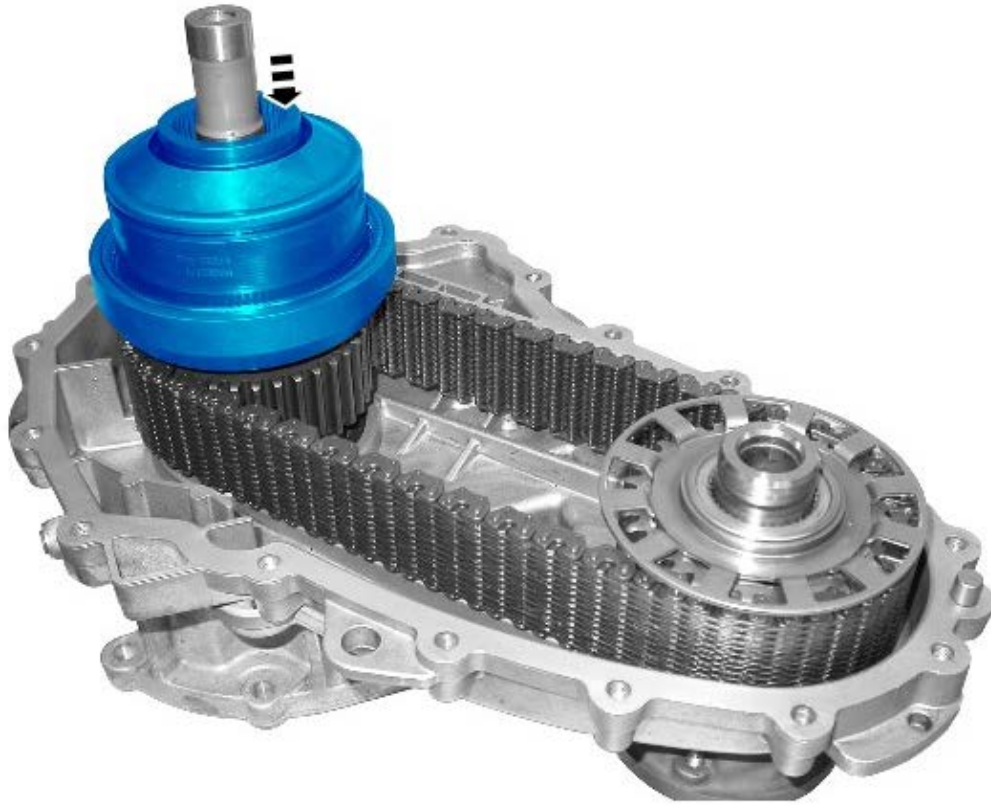
9.  CAUTION: Note the fitted position of the component prior to removal.



E156773

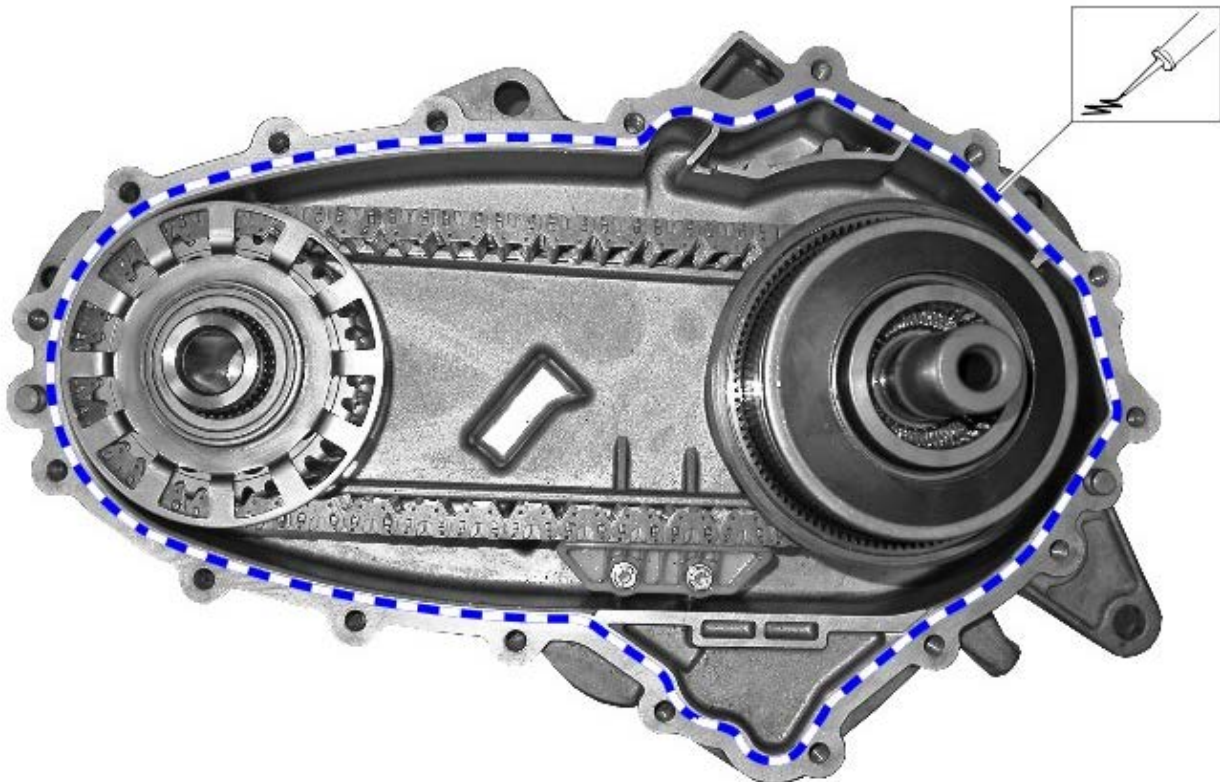
Installation

1.



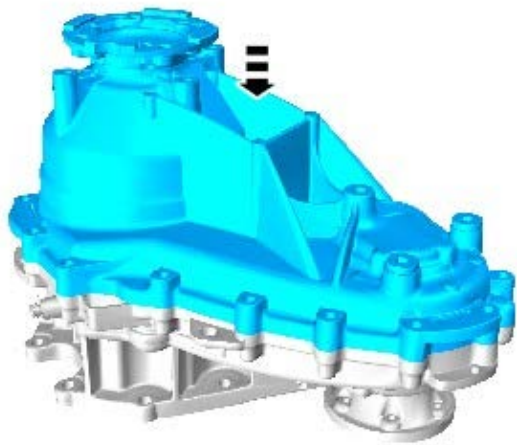
E156807

2. Apply a 2 mm bead of sealant to one surface of the transfer case mating face, as shown.



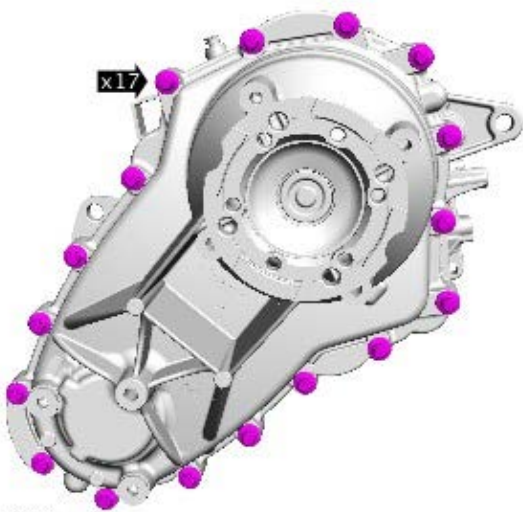
E156774

- 3.



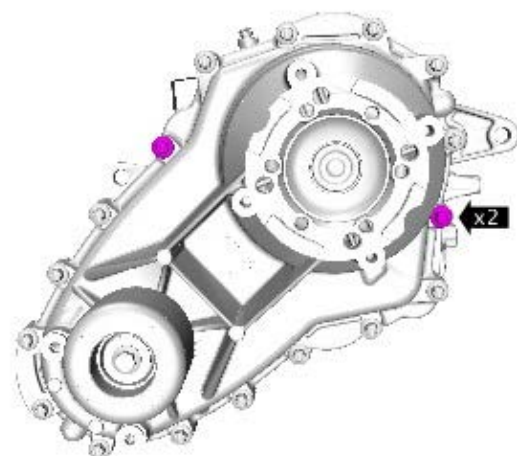
E156785

4.  CAUTION: Only tighten the bolts finger-tight at this stage.



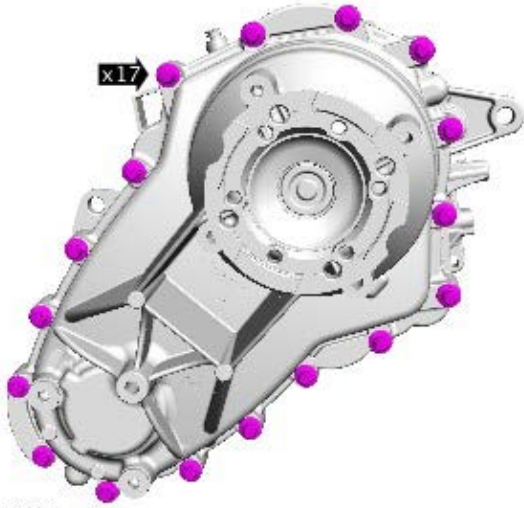
E156694

5. Torque: 10 Nm



E157851

6. Torque: 35 Nm



E156694

7. Refer to: Transfer Case - TDV6 3.0L Diesel (308-07 Transfer Case - Vehicles With: Single Speed Transfer Case, Installation).
Refer to: Transfer Case - V6 S/C 3.0L Petrol (308-07 Transfer Case - Vehicles With: Single Speed Transfer Case, Installation).
8. Refer to: Transfer Case Draining and Filling (308-07 Transfer Case - Vehicles With: Single Speed Transfer Case, General Procedures).
9. Connect the battery ground cable.

Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Transfer Case - Vehicles With: Single Speed Transfer Case - Transfer Case TDV6 3.0L Diesel

Removal

General Equipment

Transmission jack
Vehicle/axle stands
Wooden Block

NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.




Some component shown removed for clarity.

1. Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

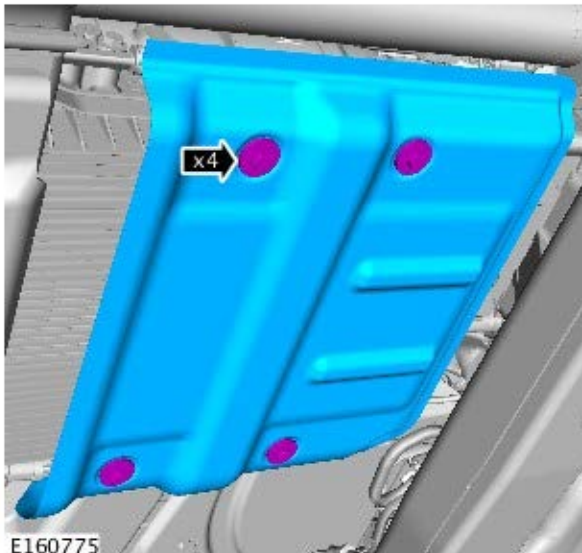
3.  **NOTE:** Do not carry out this step, if the component removed for access only.

Refer to: [Transfer Case Draining and Filling](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, General Procedures).

4.  **NOTE:** Vehicles with Diesel particulate filters only.

Refer to: [Diesel Particulate Filter \(DPF\)](#) (309-00A Exhaust System - TDV6 3.0L Diesel, Removal and Installation).

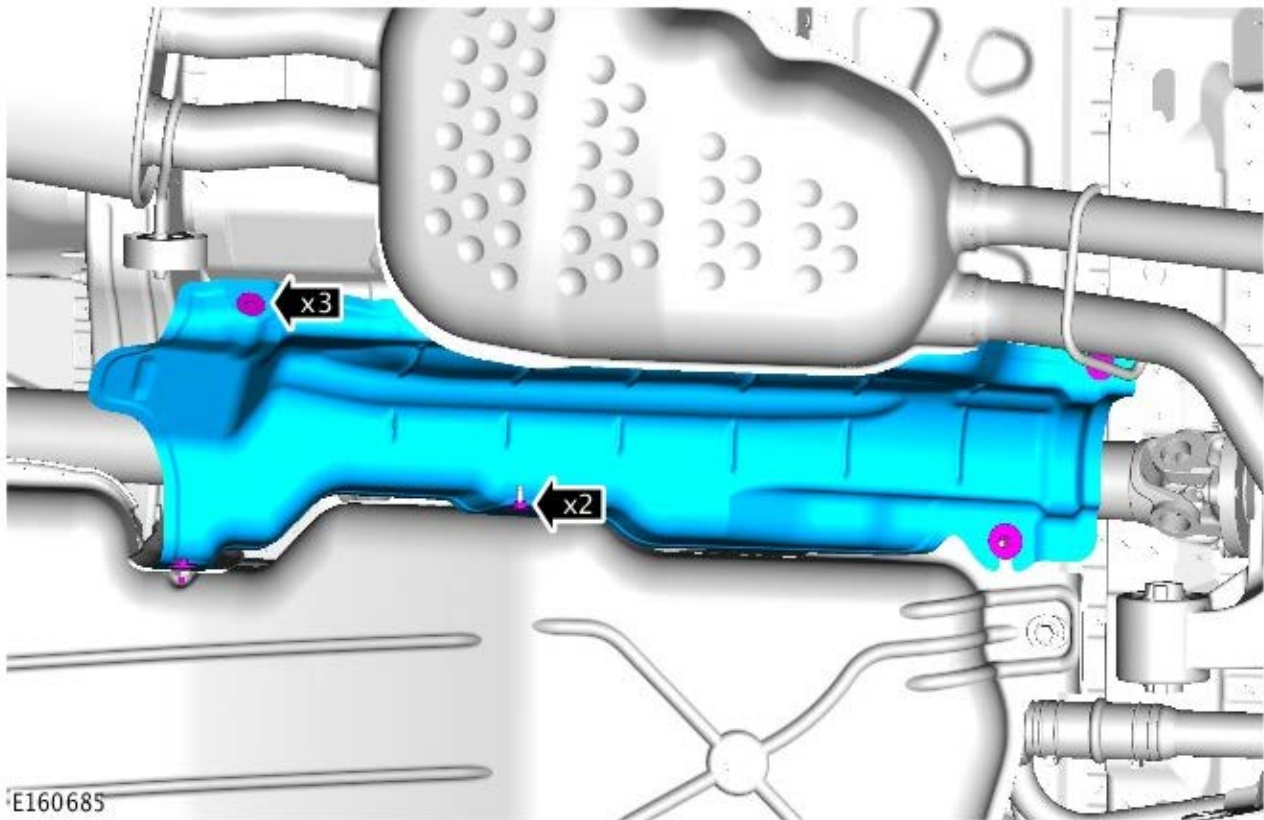
5.



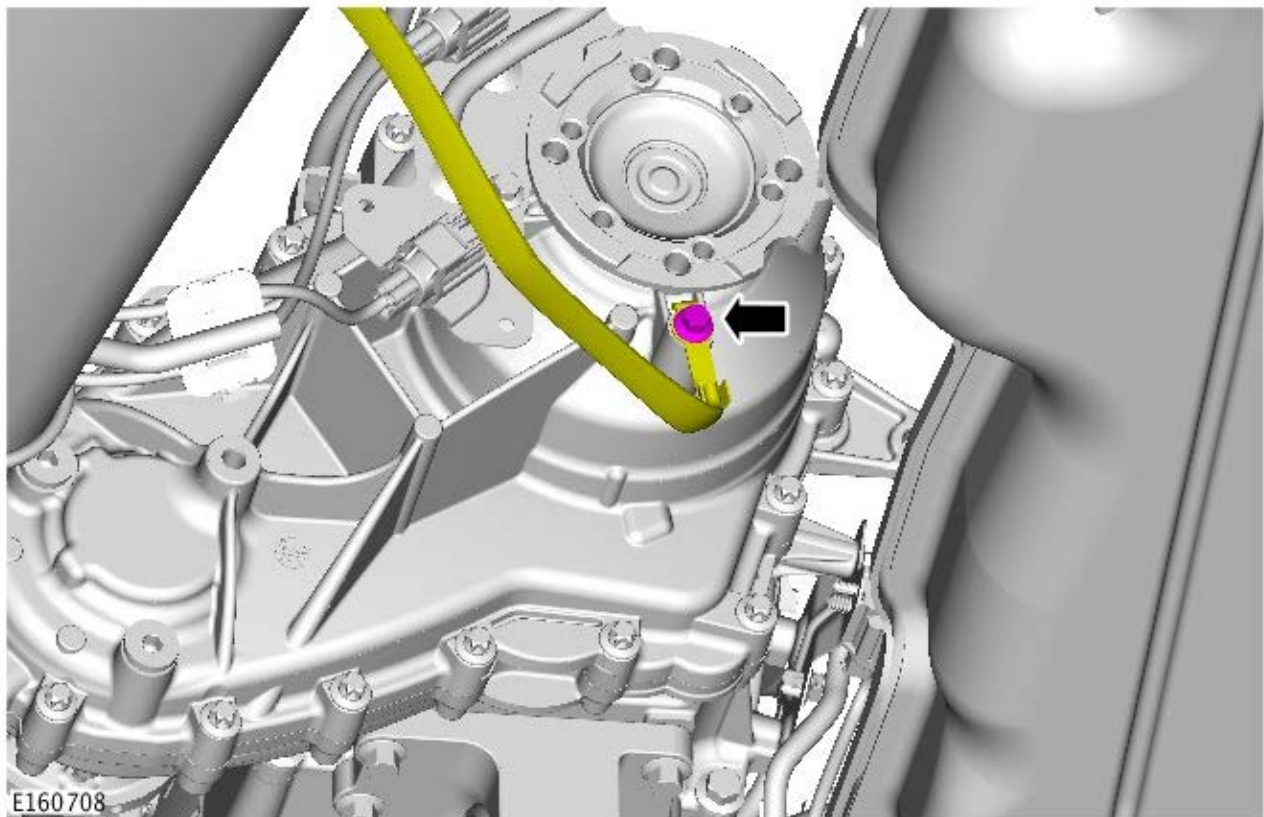
6.  **CAUTION:** Support the transmission with suitable stand before removing the Transmission support crossmember.

Refer to: [Transmission Support Crossmember - TDV6 3.0L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation).

7.



8.

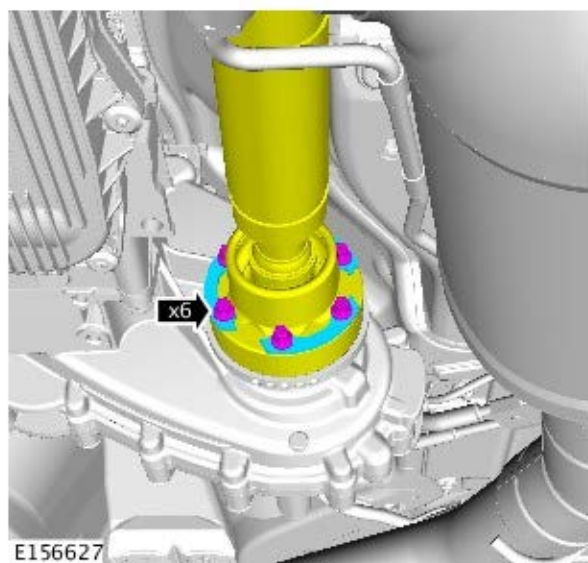
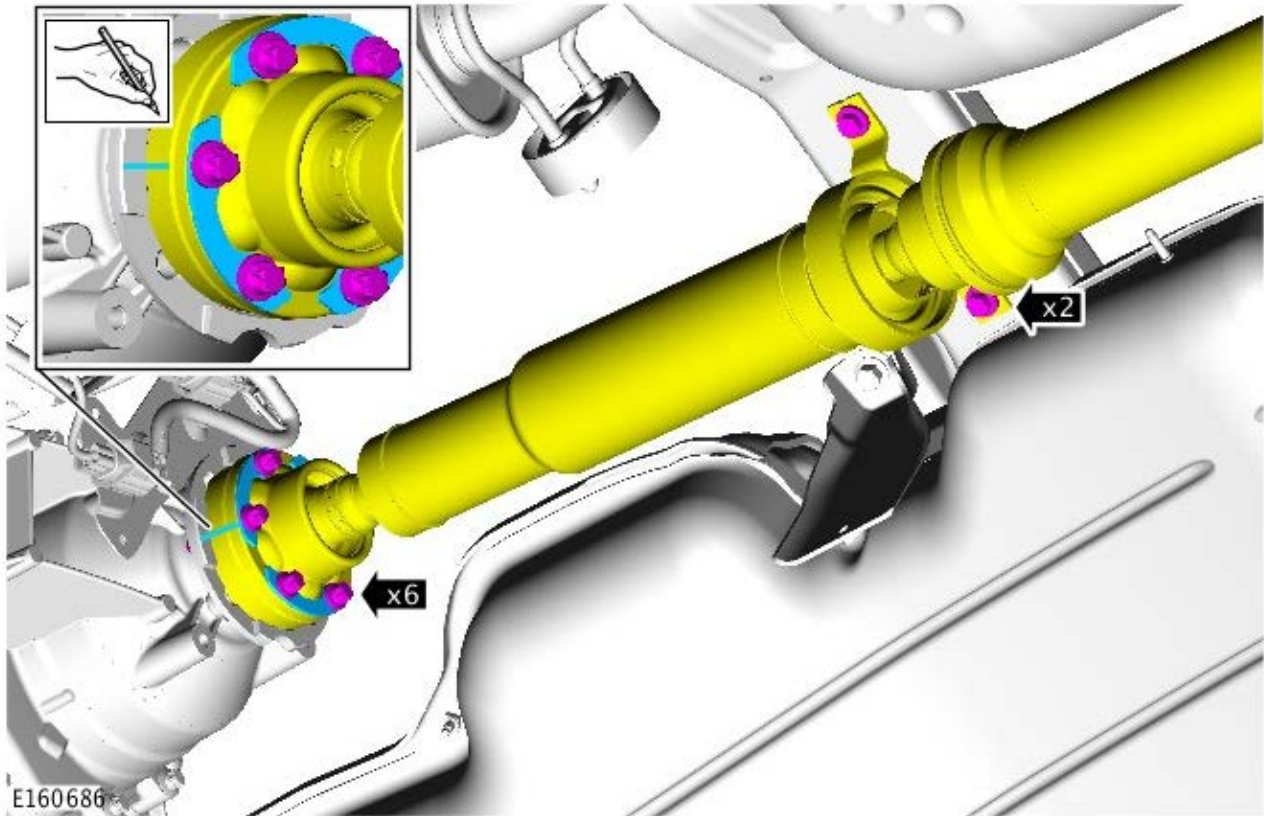


9. CAUTIONS:




 Mark the position of the driveshaft flange in relation to the drive pinion flange.

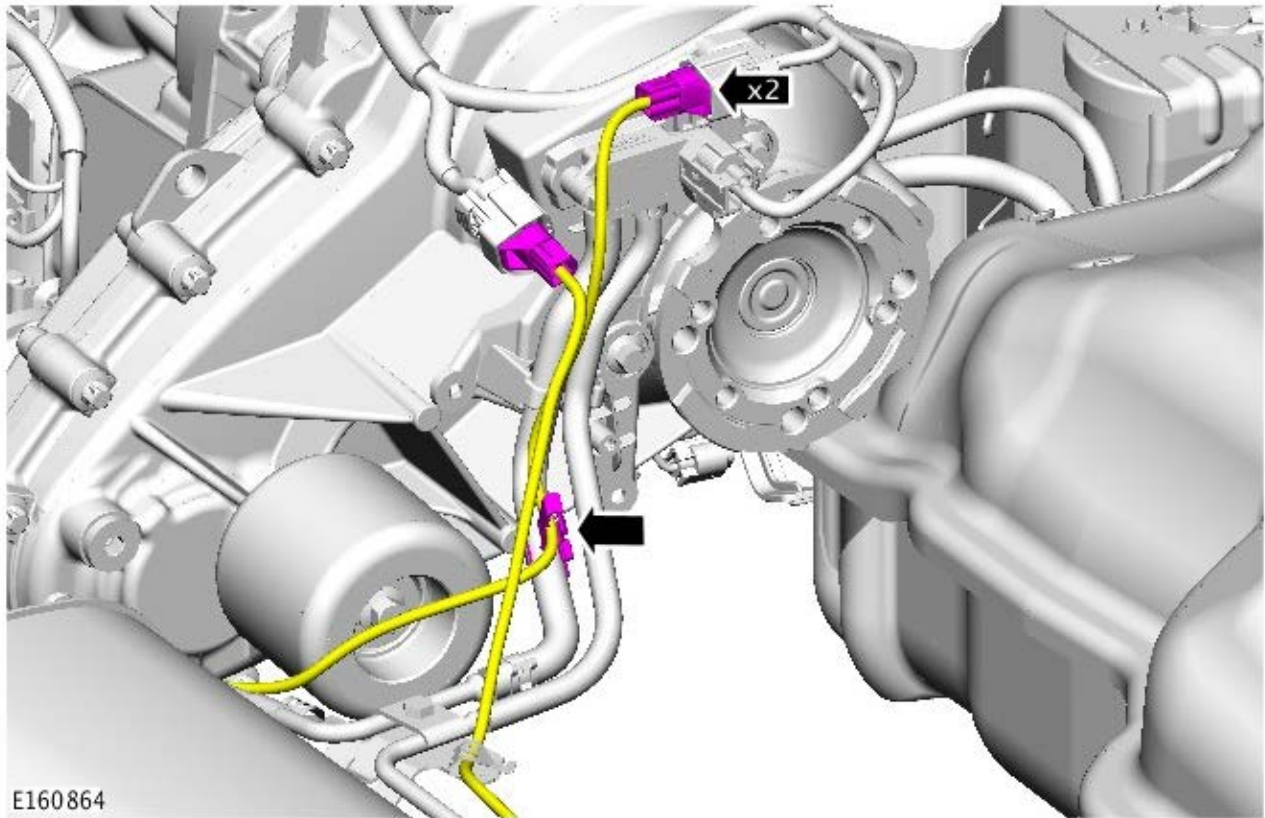
 To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

 Discard the driveshaft flange bolts.

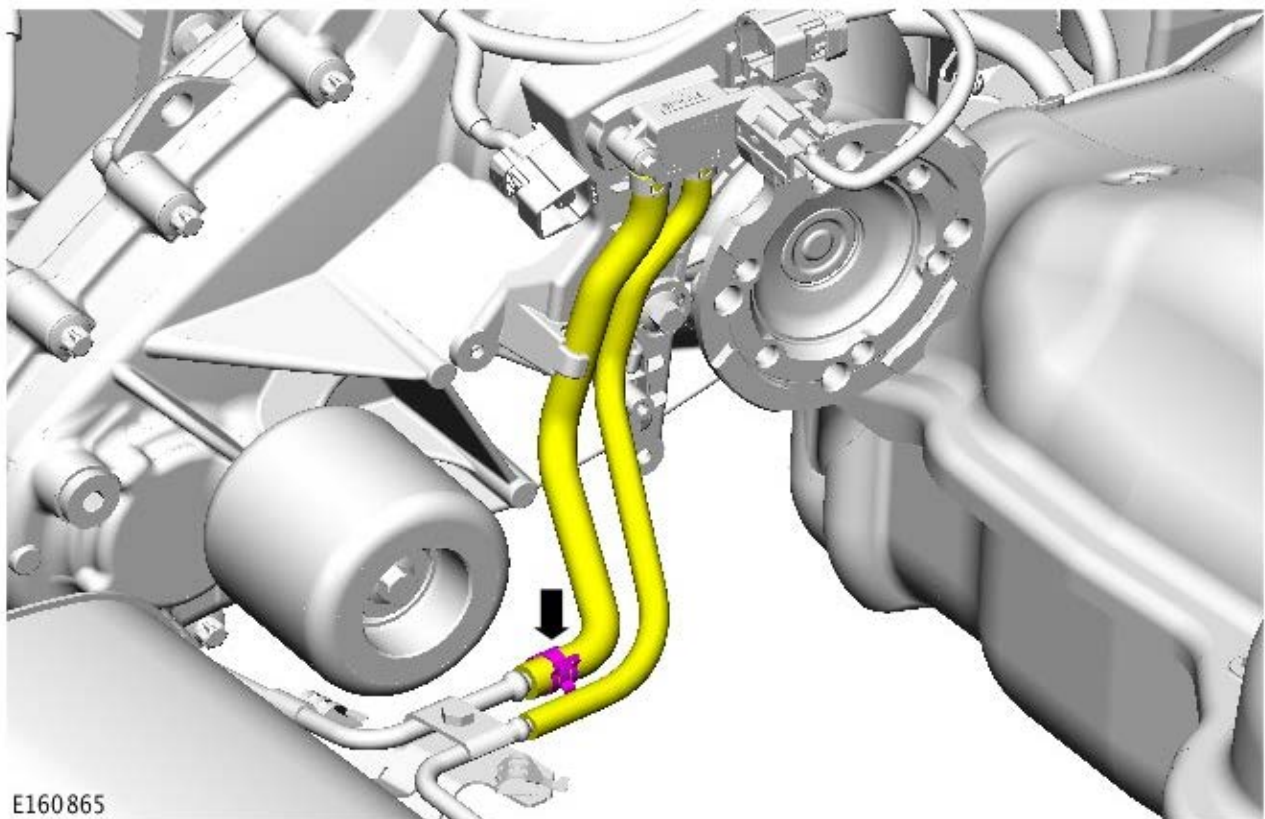


10. CAUTIONS:

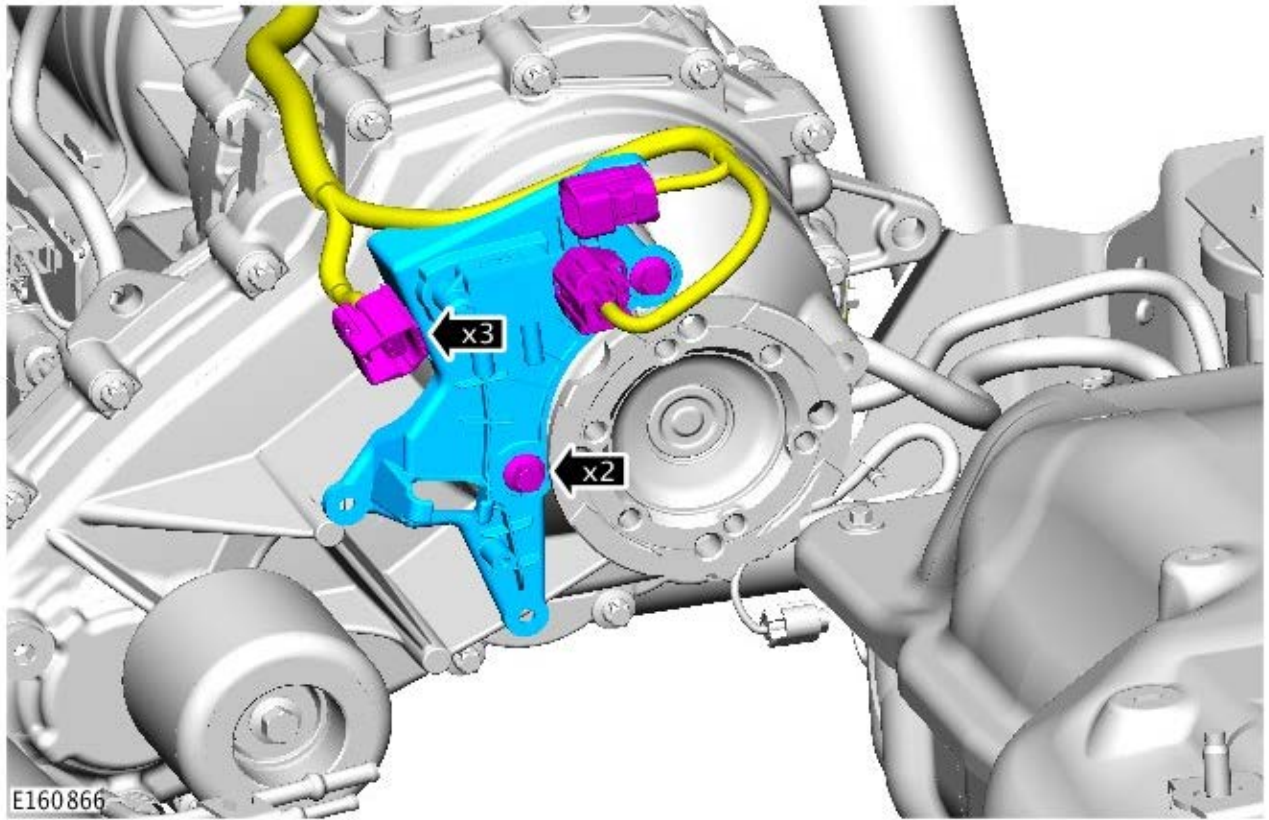
-  Mark the position of the driveshaft flange in relation to the drive pinion flange.
-  To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.
-  Discard the driveshaft flange bolts.



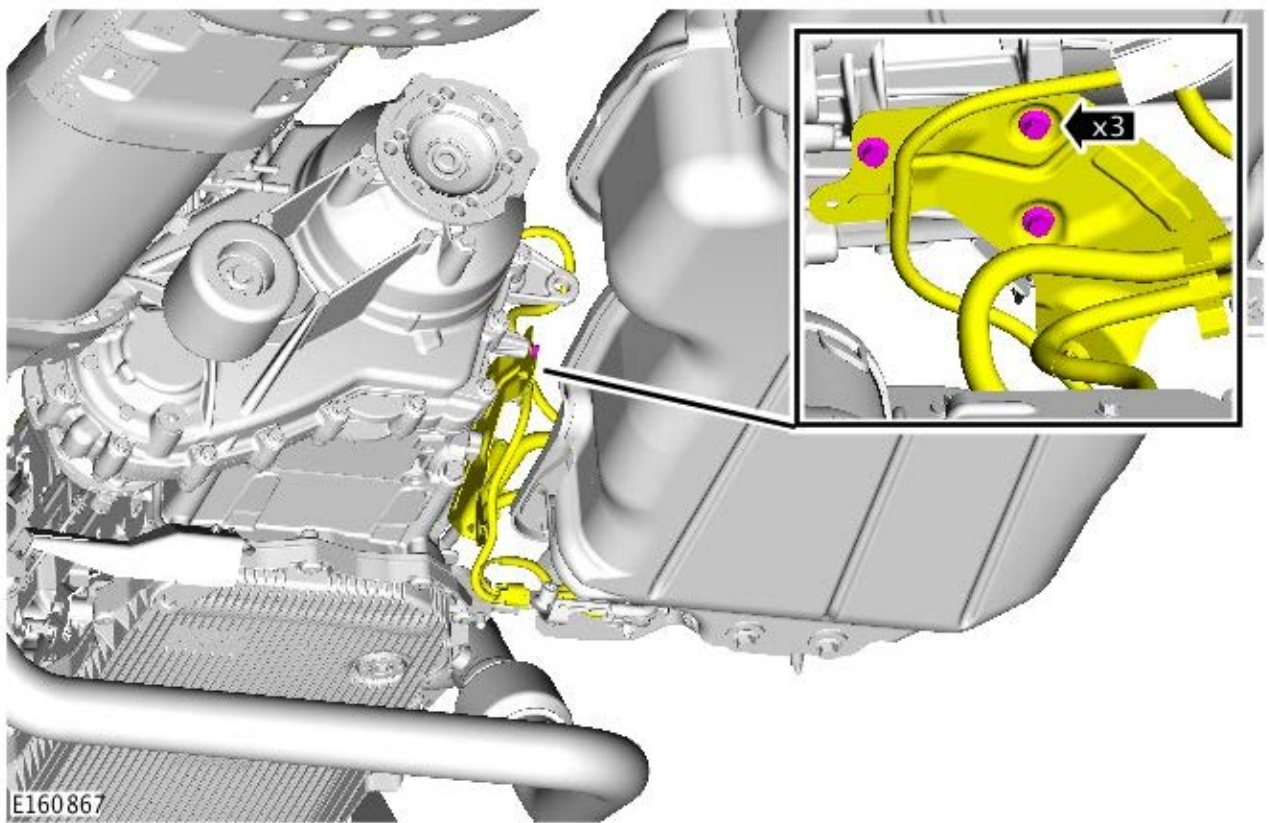
12.



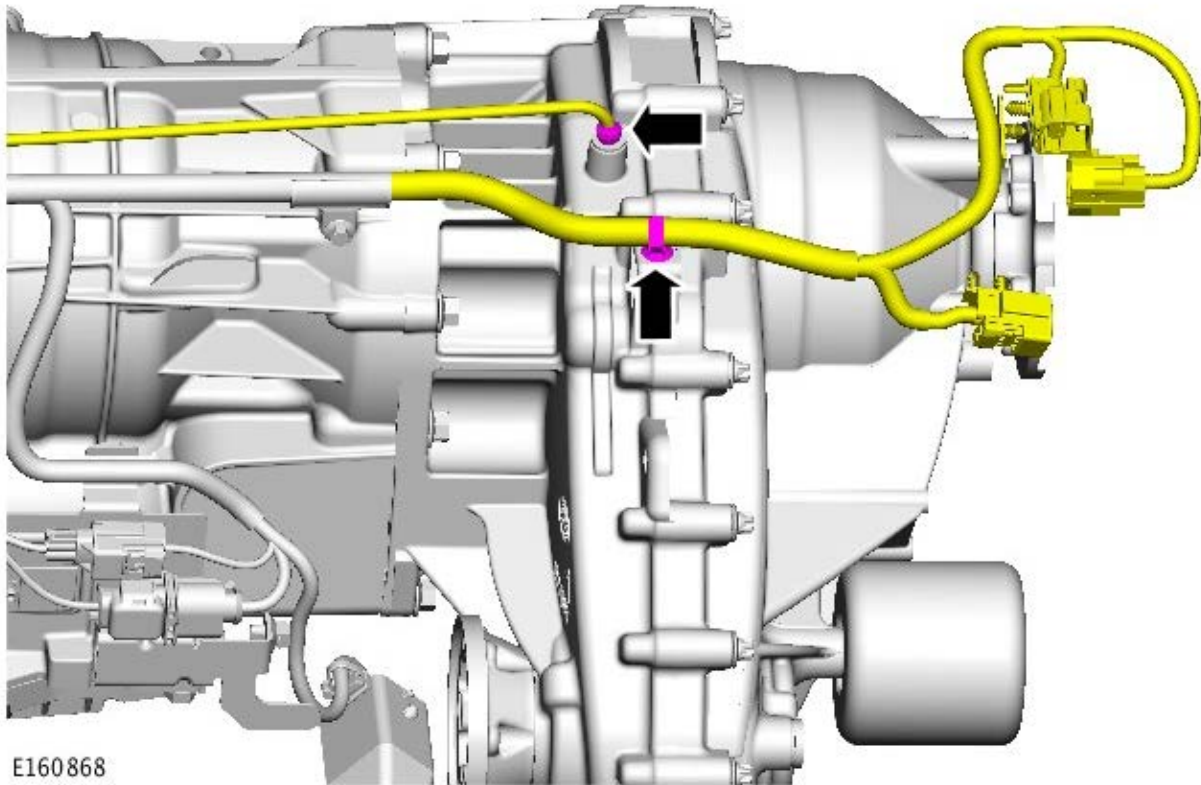
13.



14.



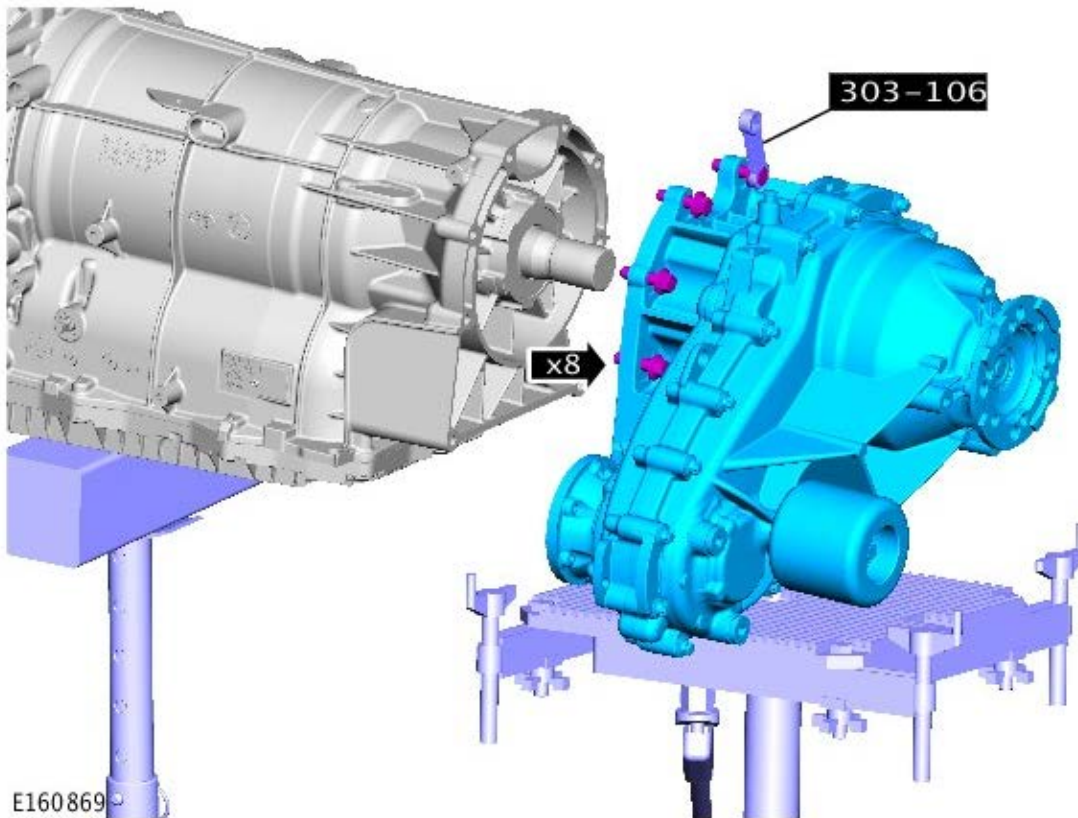
15.




E160868

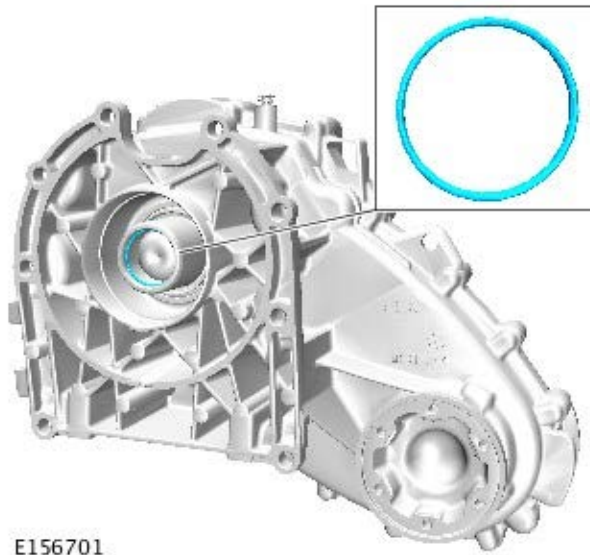
16.  **WARNING:** This step requires the aid of another technician.

- General Equipment: [Wooden Block](#)
- General Equipment: [Transmission jack](#)
- General Equipment: [Vehicle/axle stands](#)

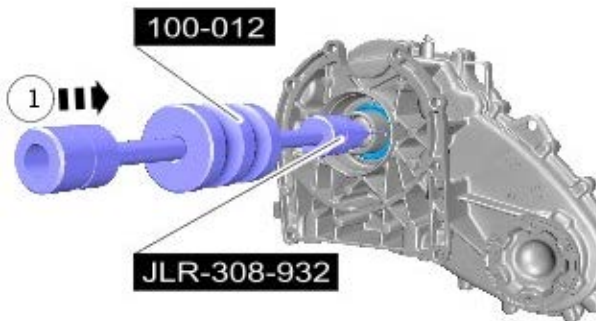


E160869

17.  **CAUTION:** Do not carry out this step if a new transfer box is to be installed.




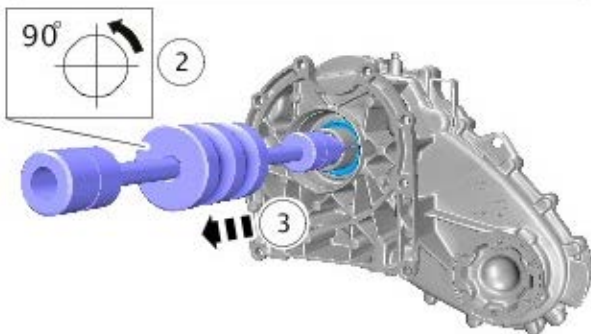
E156701




18. CAUTIONS:

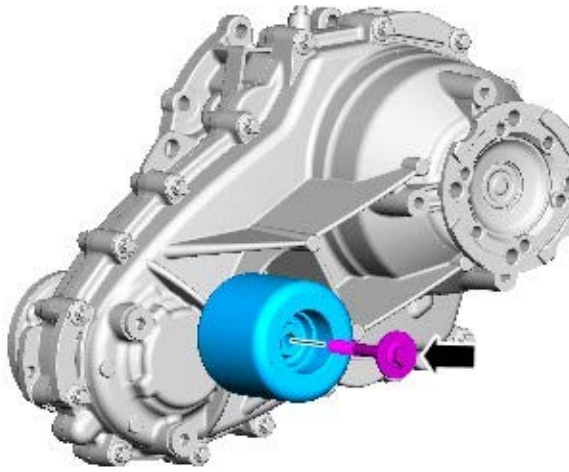
 Do not carry out this step if a new transfer box is to be installed.

 Care must be taken to avoid damage to the seal register and running surface.



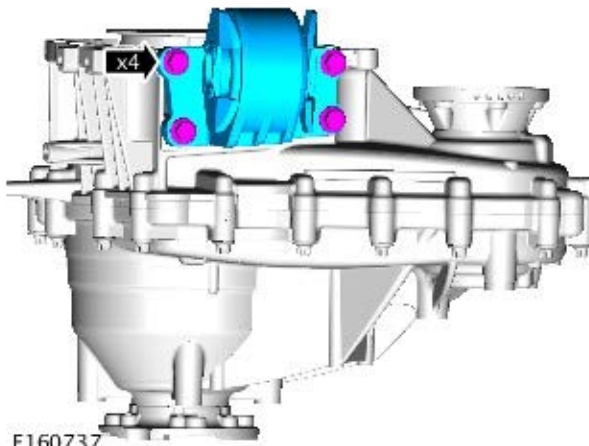
E156808

 NOTE: Do not disassemble further if the component is removed for access only.



E160870

20.



E160737

Transfer Case - Vehicles With: Single Speed Transfer Case - Transfer Case V6 S/C 3.0L Petrol

Removal

General Equipment

Transmission jack
Vehicle/axle stands
Wooden Block

NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.




Some component shown removed for clarity.

1. Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

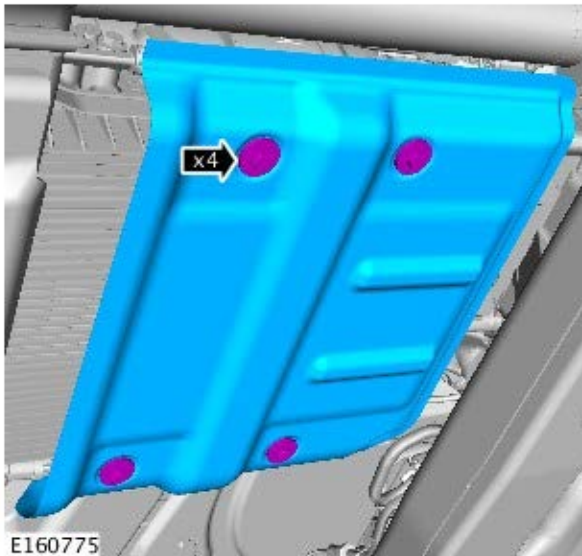
2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3.  **NOTE:** Do not carry out this step, if the component removed for access only.

Refer to: [Transfer Case Draining and Filling](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, General Procedures).

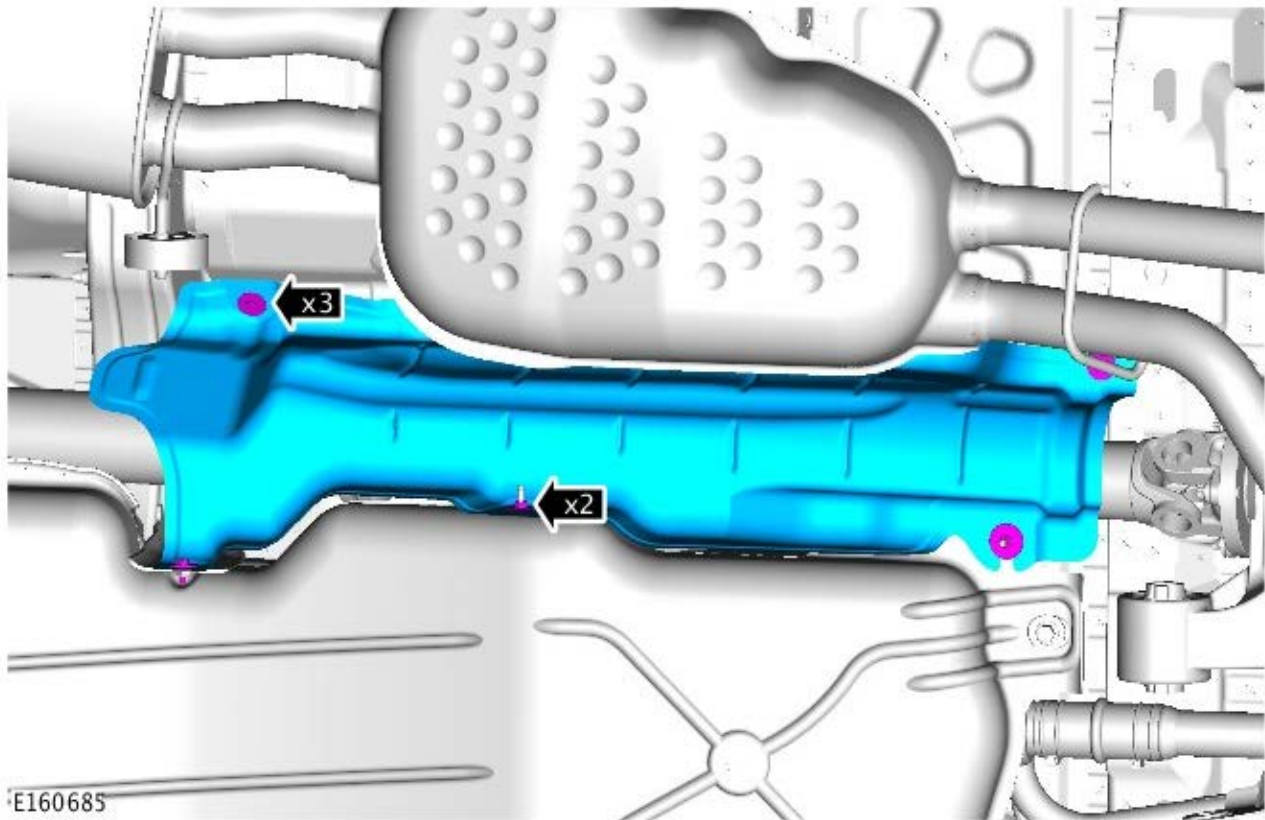
4.



5.  **CAUTION:** Support the transmission with suitable stand before removing the Transmission support crossmember.




Refer to: [Transmission Support Crossmember - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).

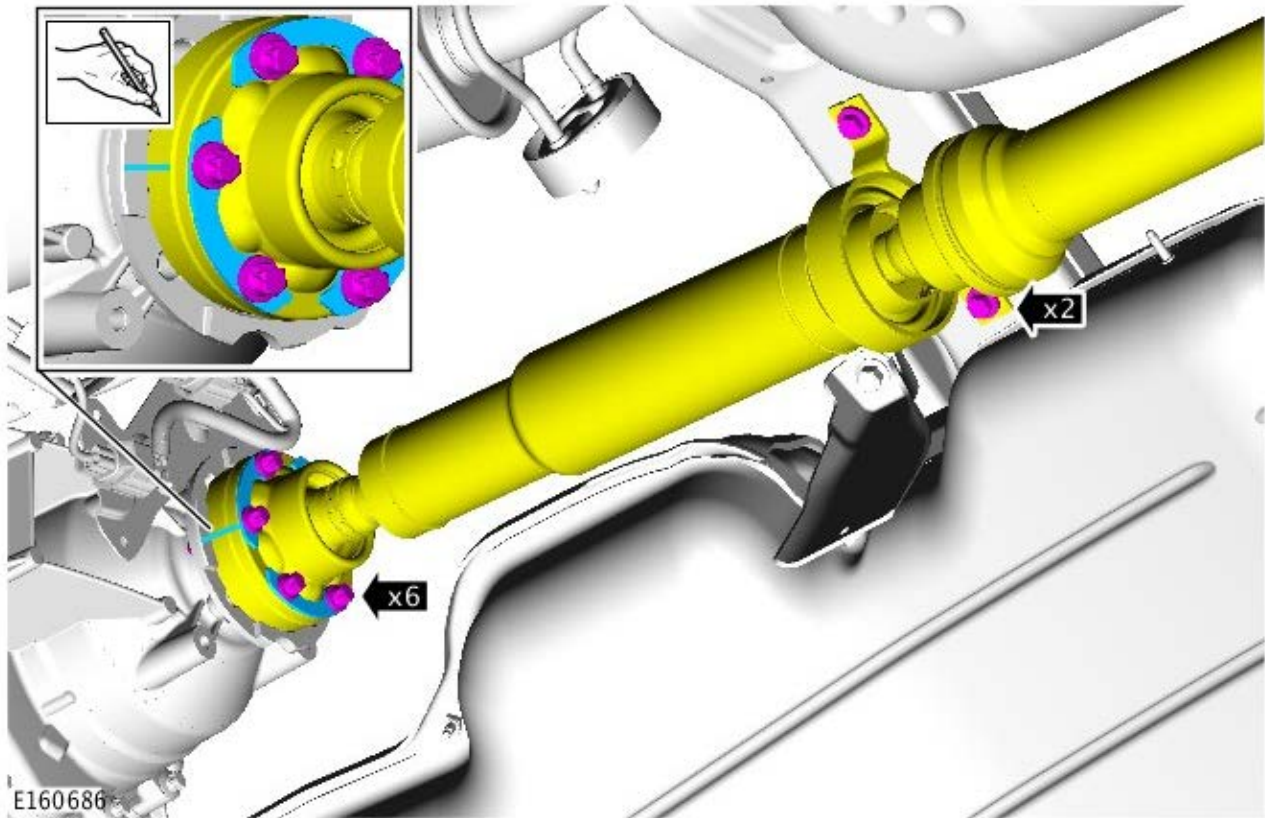
6.



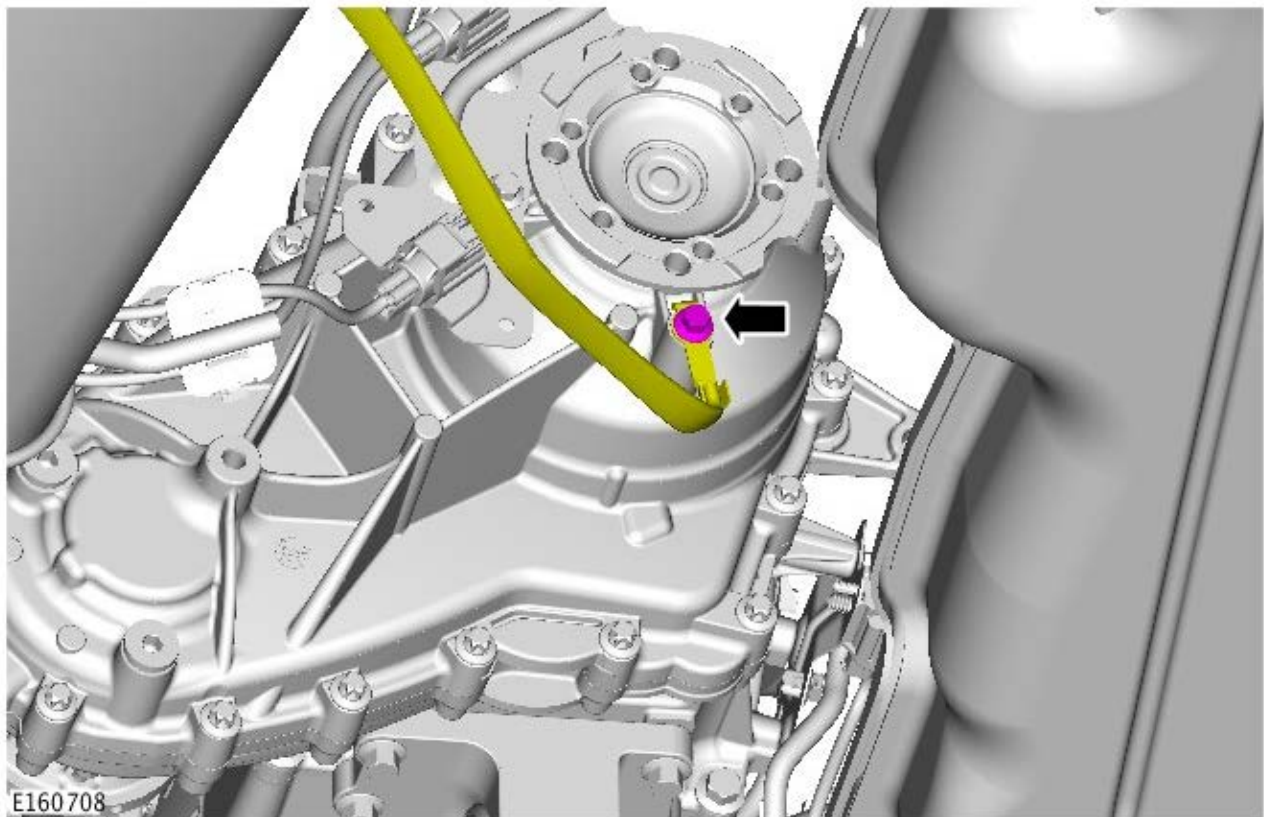
E160685

7. CAUTIONS:


-  Mark the position of the driveshaft flange in relation to the drive pinion flange.
-  To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.
-  Discard the driveshaft flange bolts.




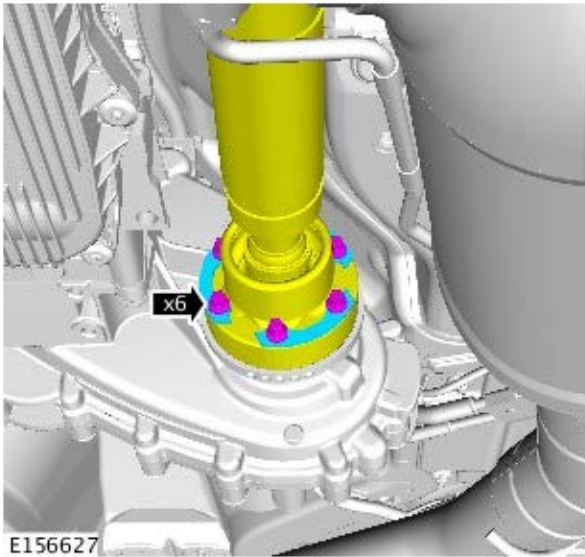
8.



9. CAUTIONS:

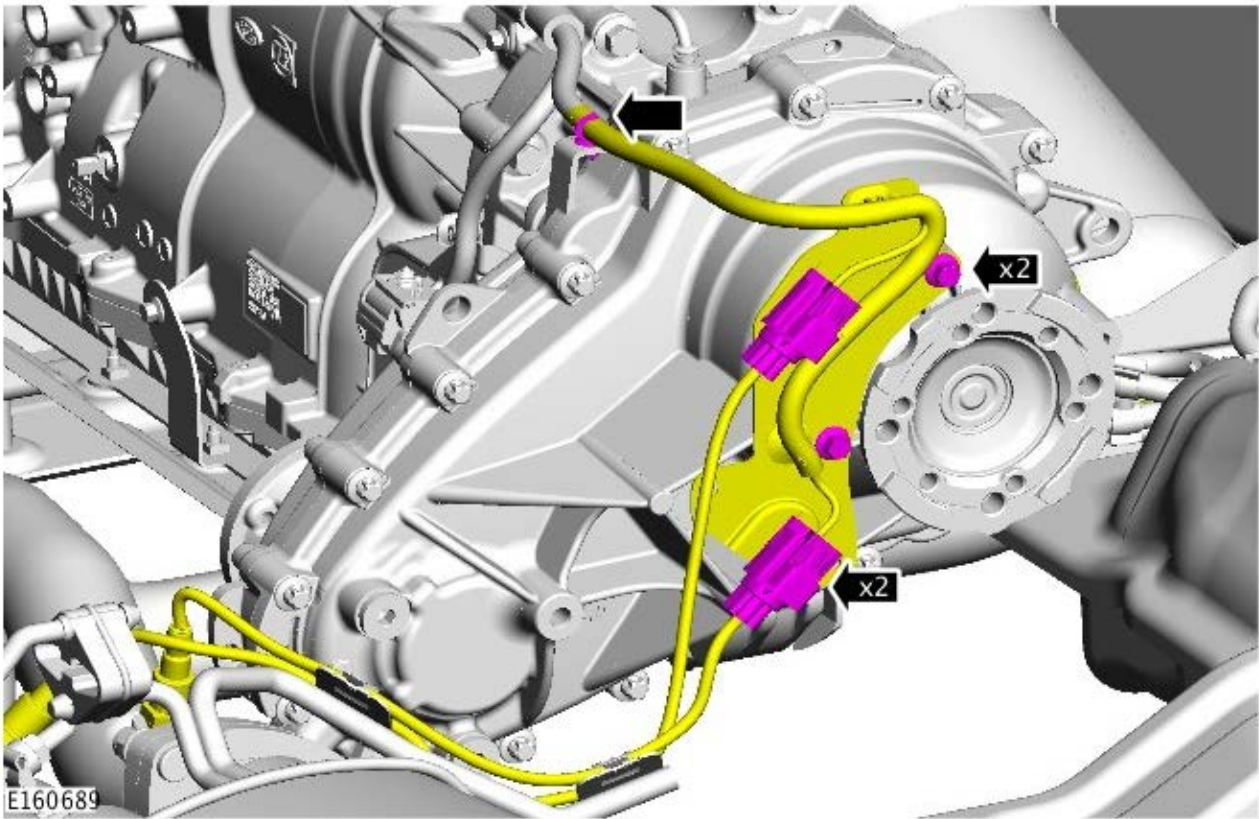
 Mark the position of the driveshaft flange in relation to the drive pinion flange.

 To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

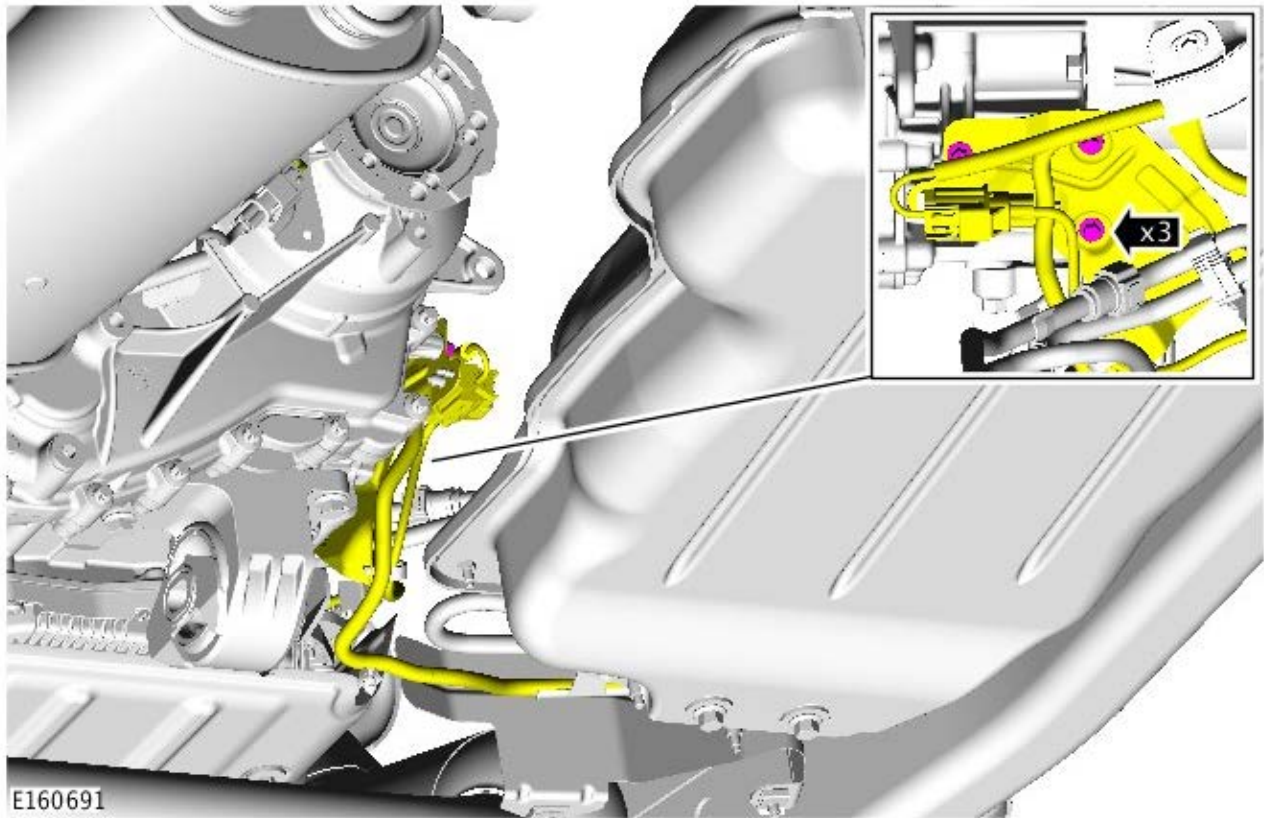


 Discard the driveshaft flange bolts.

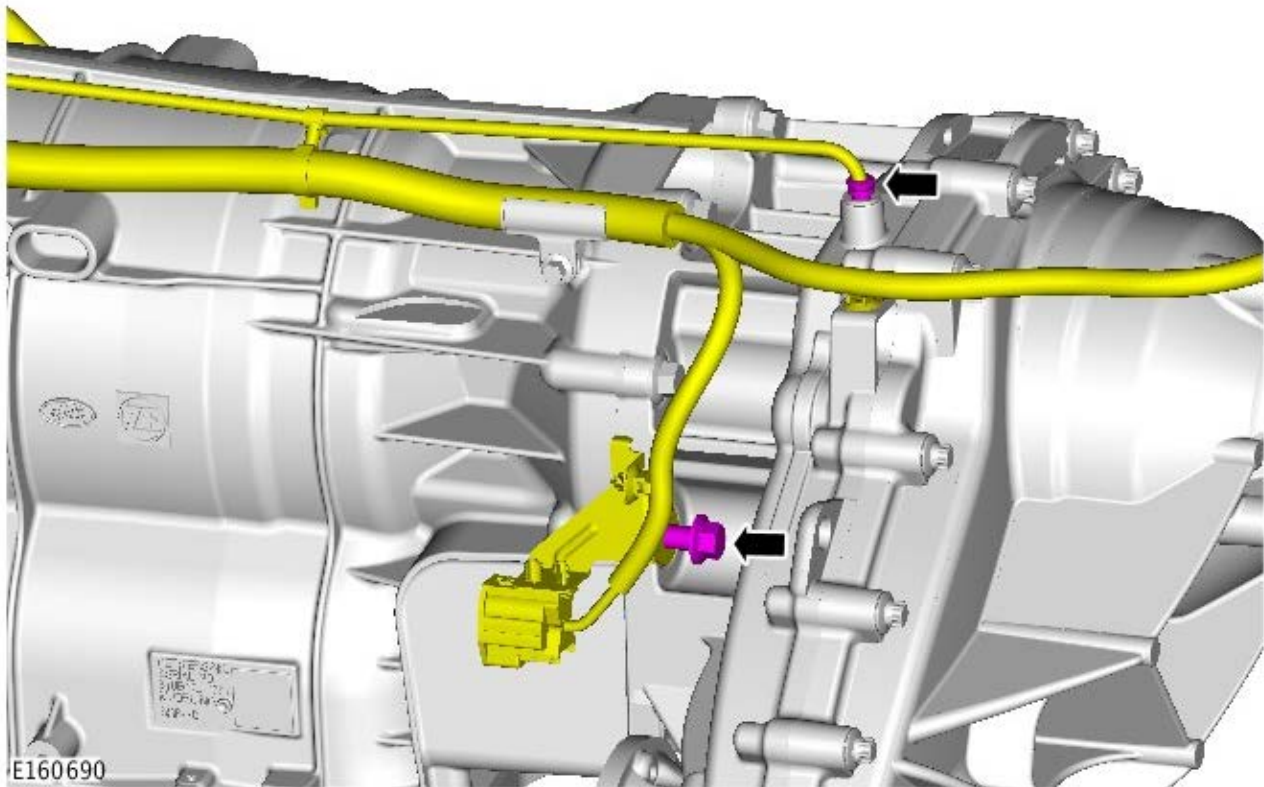
10.



11.

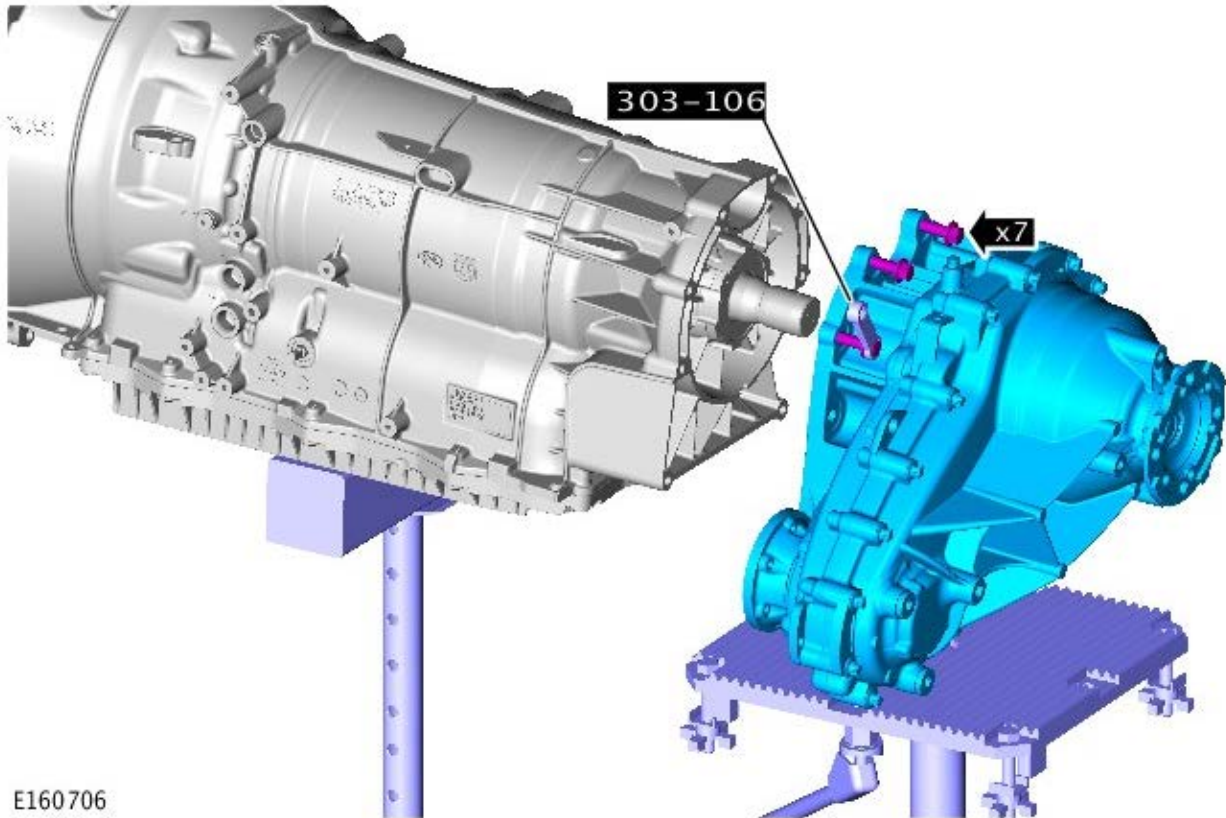


12.




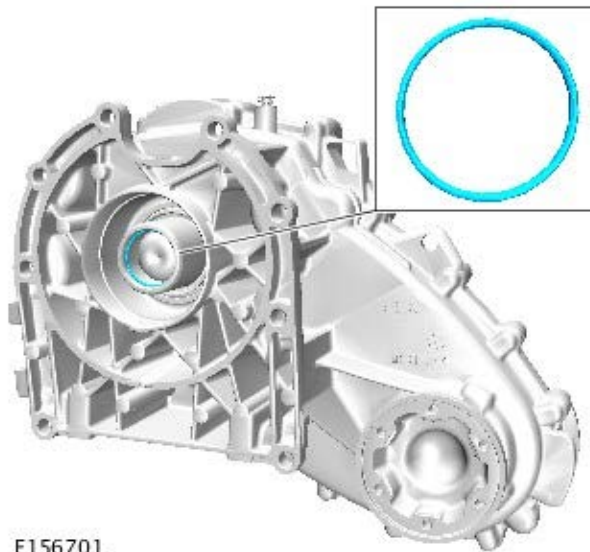
13.  **WARNING:** This step requires the aid of another technician.

- General Equipment: [Wooden Block](#)
- General Equipment: [Transmission jack](#)
- General Equipment: [Vehicle/axle stands](#)



E160706


14.  CAUTION: Do not carry out this step if a new transfer box is to be installed.

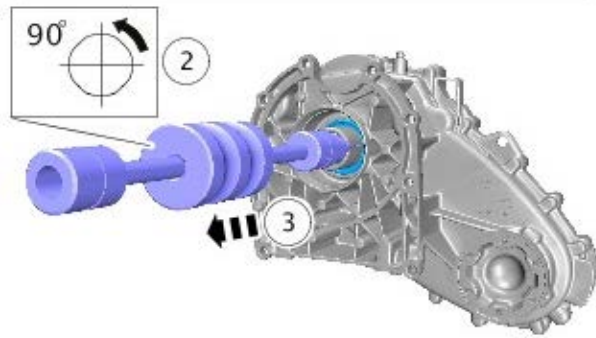
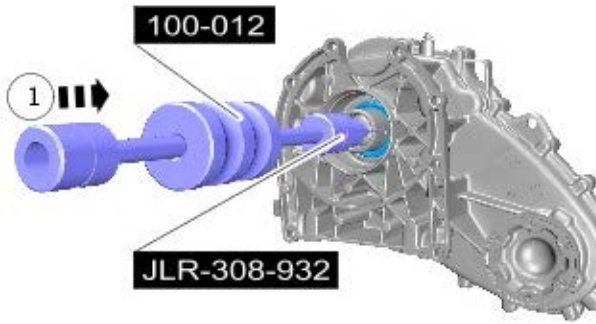


E156701


15. CAUTIONS:

 Do not carry out this step if a new transfer box is to be installed.

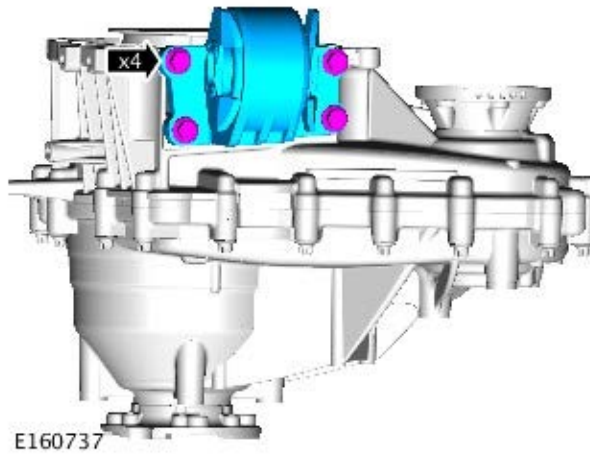
 Care must be taken to avoid damage to the seal register and running surface.



E156808

 NOTE: Do not disassemble further if the component is removed for access only.

16.



Transfer Case - Vehicles With: Single Speed Transfer Case - Transfer Case TDV6 3.0L Diesel

Installation

General Equipment

- Transmission jack
- Vehicle/axle stands
- Wooden Block

NOTES:



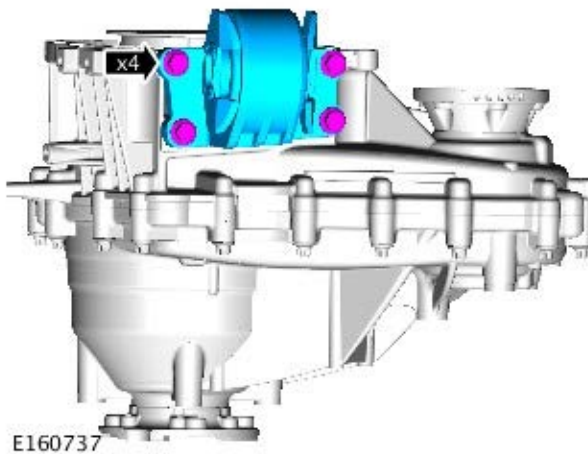
Some variation in the illustrations may occur, but the essential information is always correct.




Component shown removed for clarity.

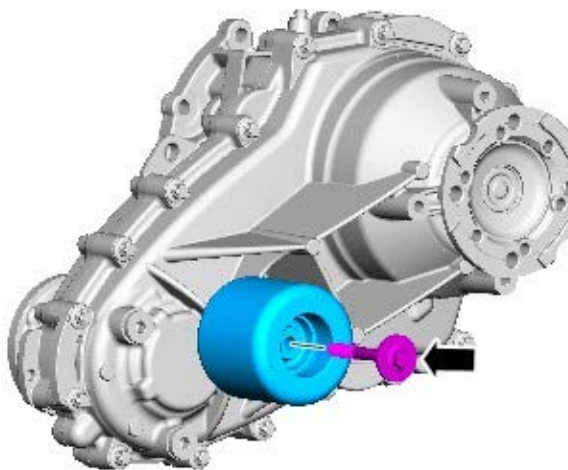
-  NOTE: This step is only required if previously removed.

Torque: 60 Nm

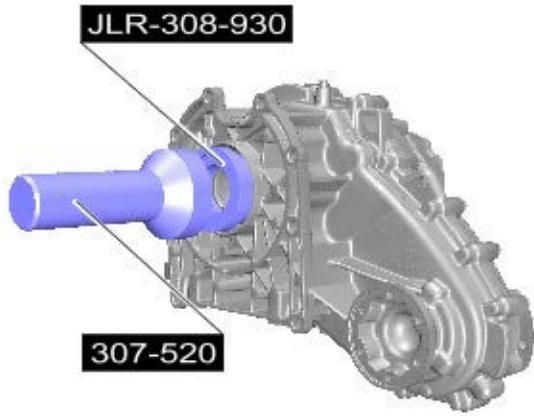


-  NOTE: This step is only required if previously removed.

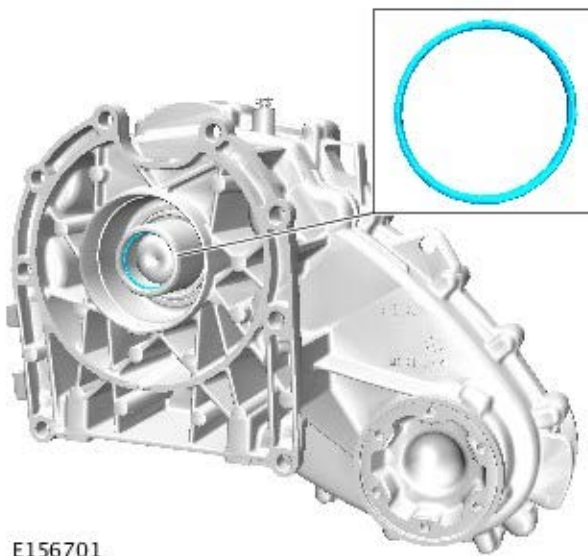
Torque: 75 Nm



-  NOTE: This step is only required if previously removed.




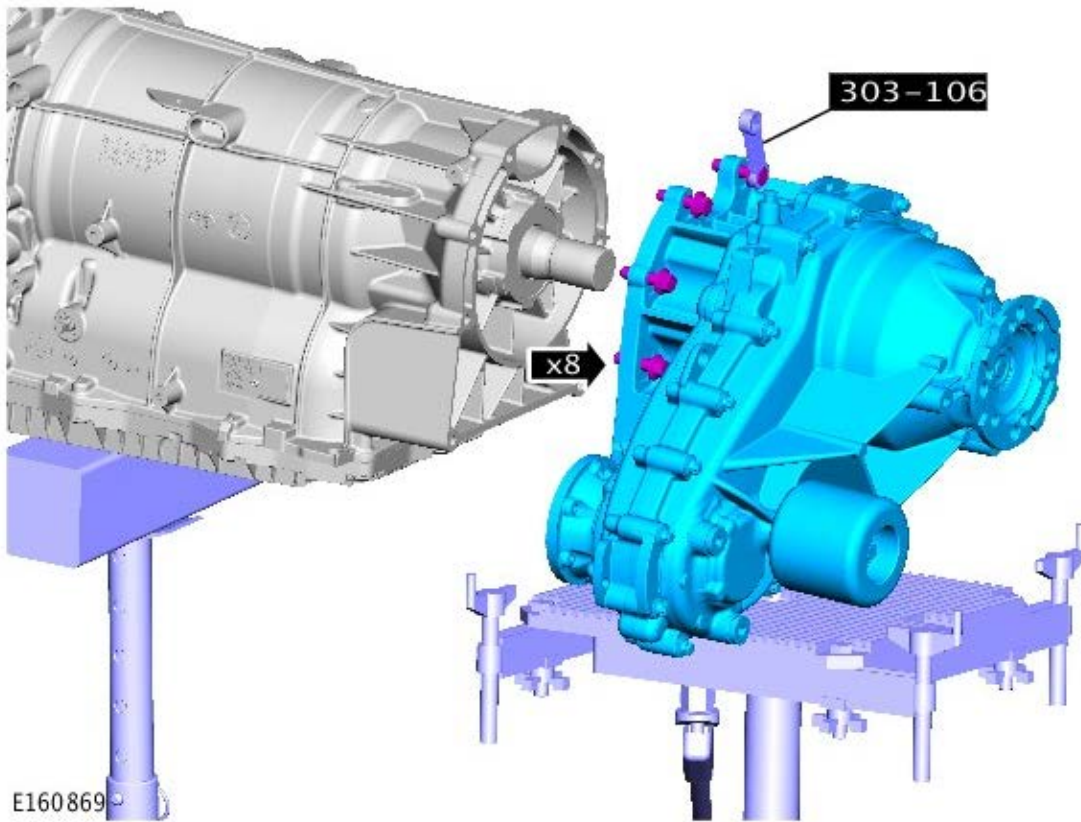
E158632



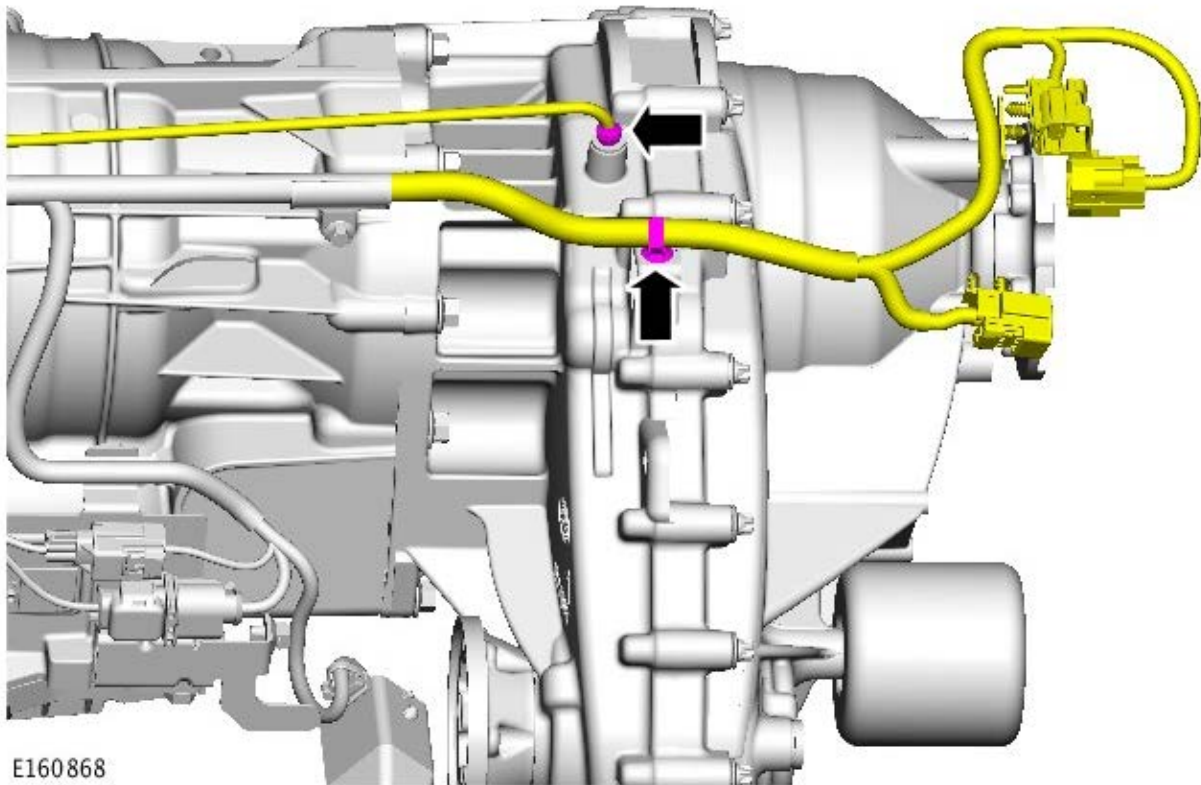
E156701

4.  NOTE: This step is only required if previously removed.

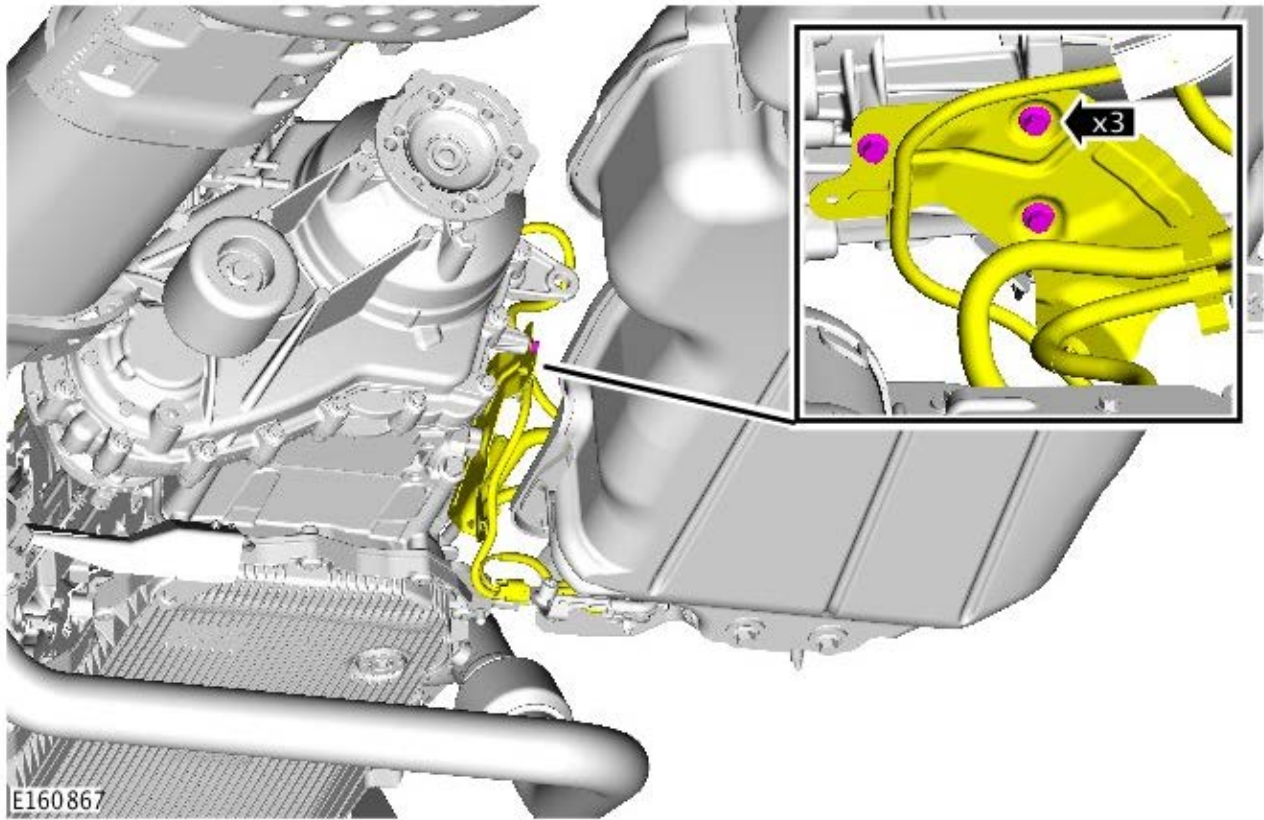
5.  WARNING: This step requires the aid of another technician.
- Clean the component mating faces.
 - Lubricate input shaft splines with 'Weicon TL7391' grease.
 - General Equipment: [Wooden Block](#)
 - General Equipment: [Transmission jack](#)
 - General Equipment: [Vehicle/axle stands](#)



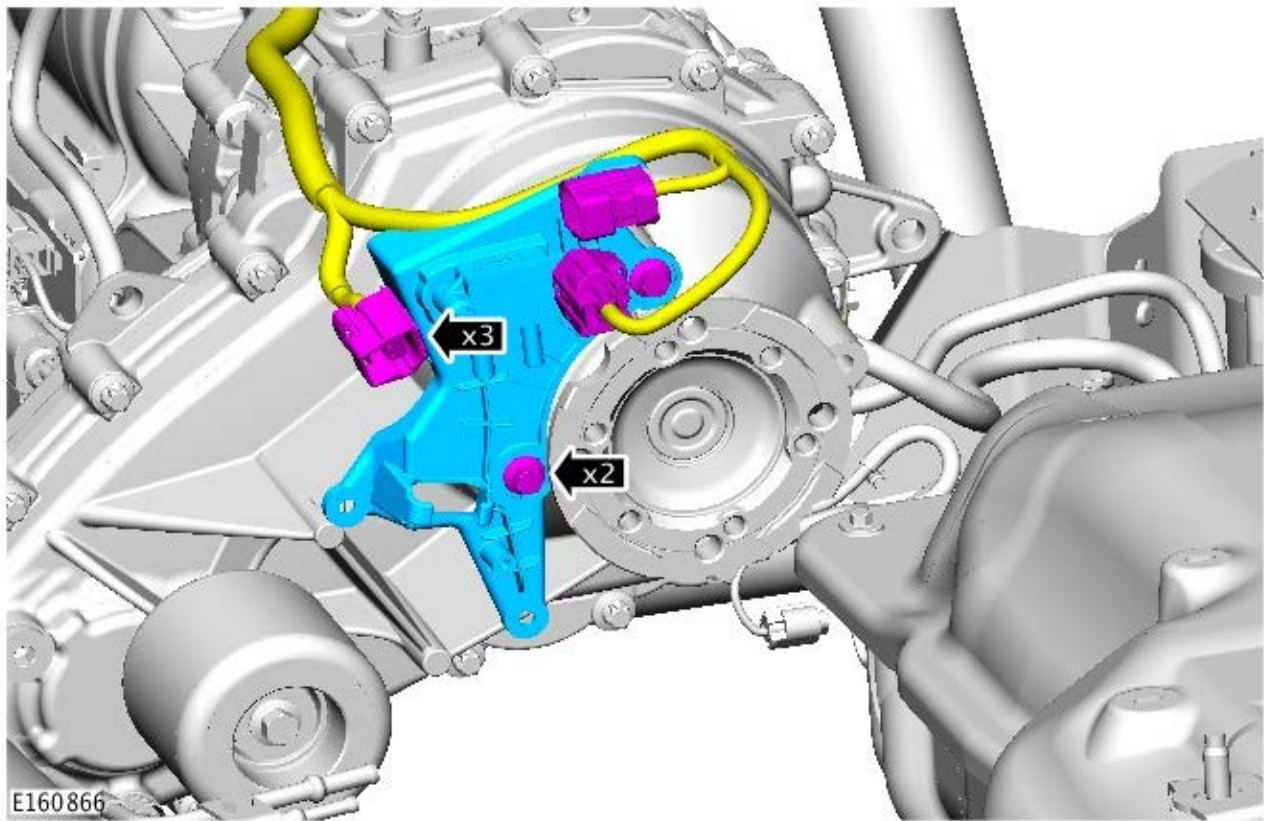
6.



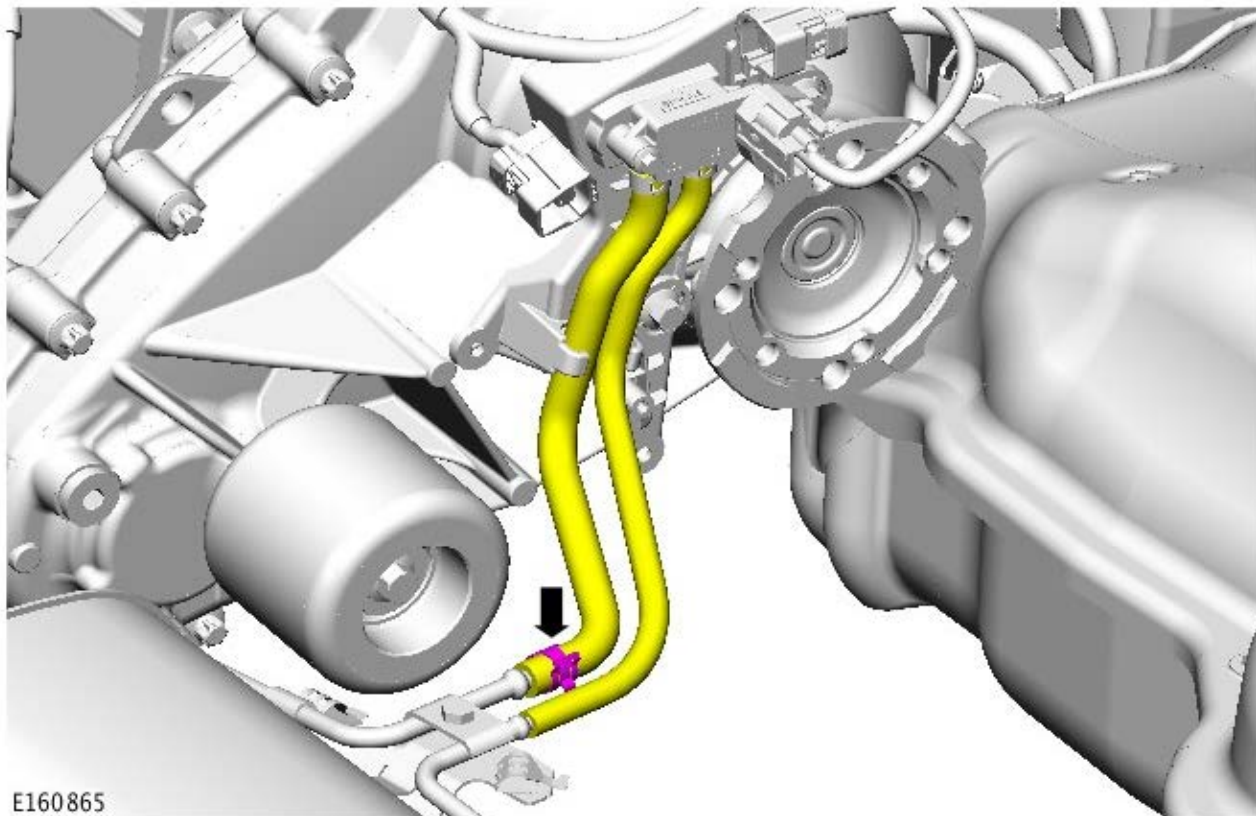
7. Torque: 15 Nm



8. Torque: 15 Nm

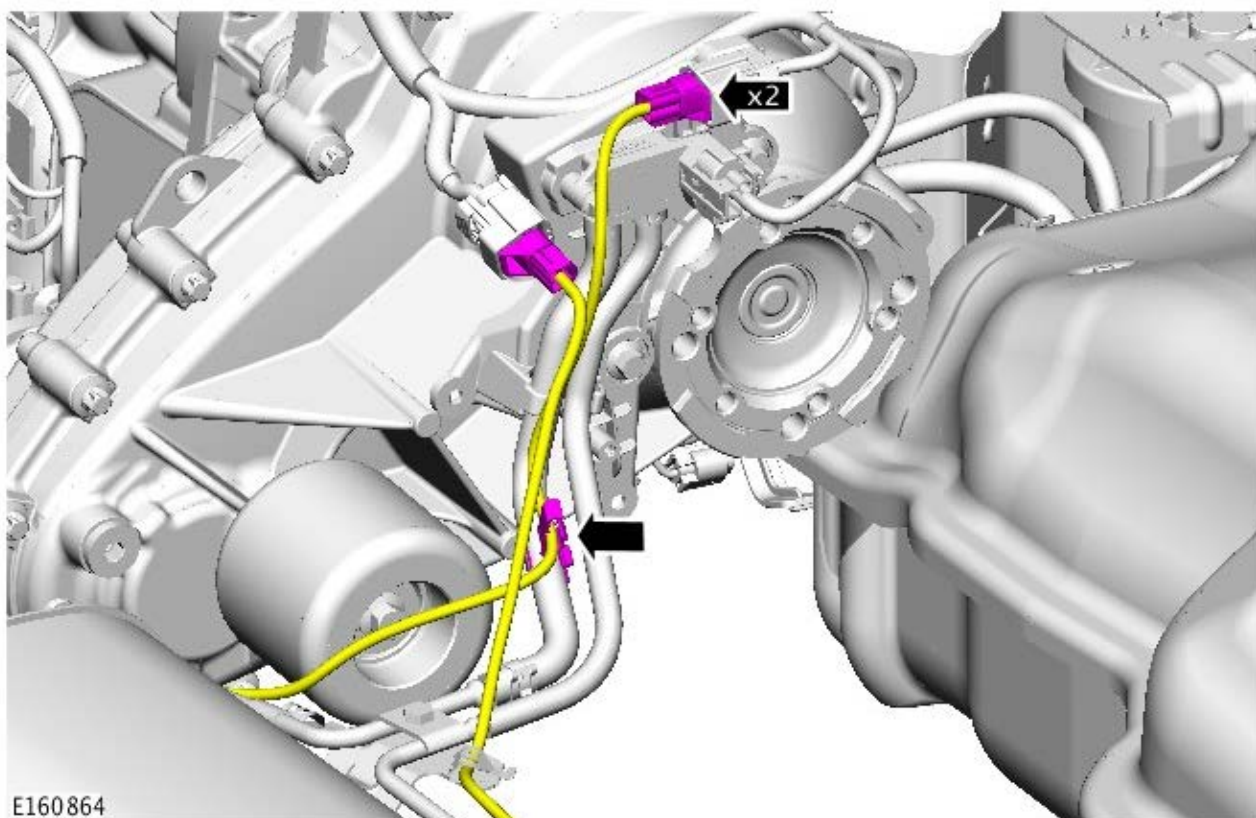


9.




E160865

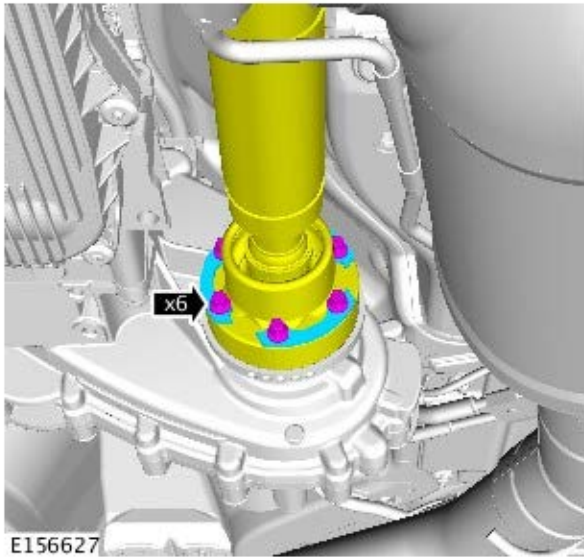
10.



E160864

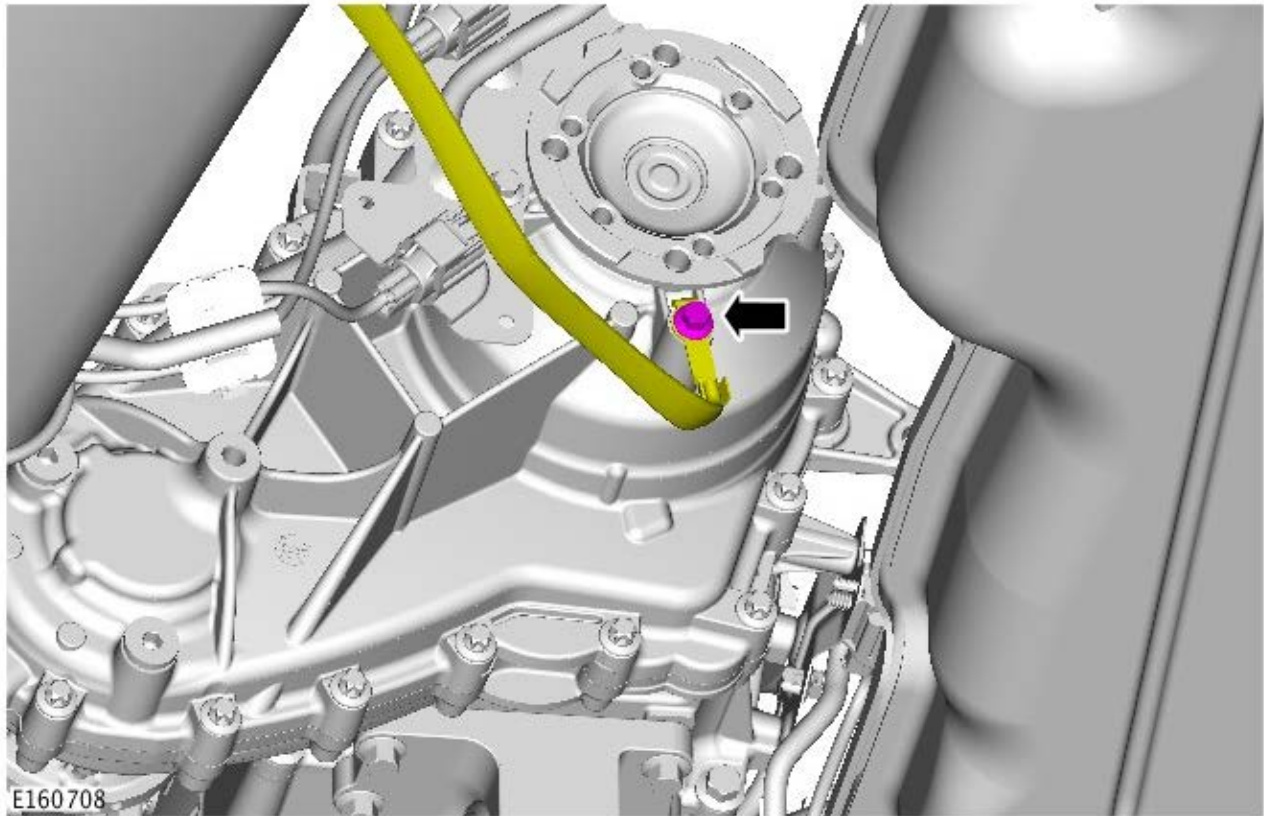
11.  CAUTION: Make sure that new driveshaft flange bolts are installed.


Torque:
Stage 1: 45 Nm
Stage 2: 90°



12. Refer to: [Transmission Support Crossmember - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).

13. Torque: 25 Nm

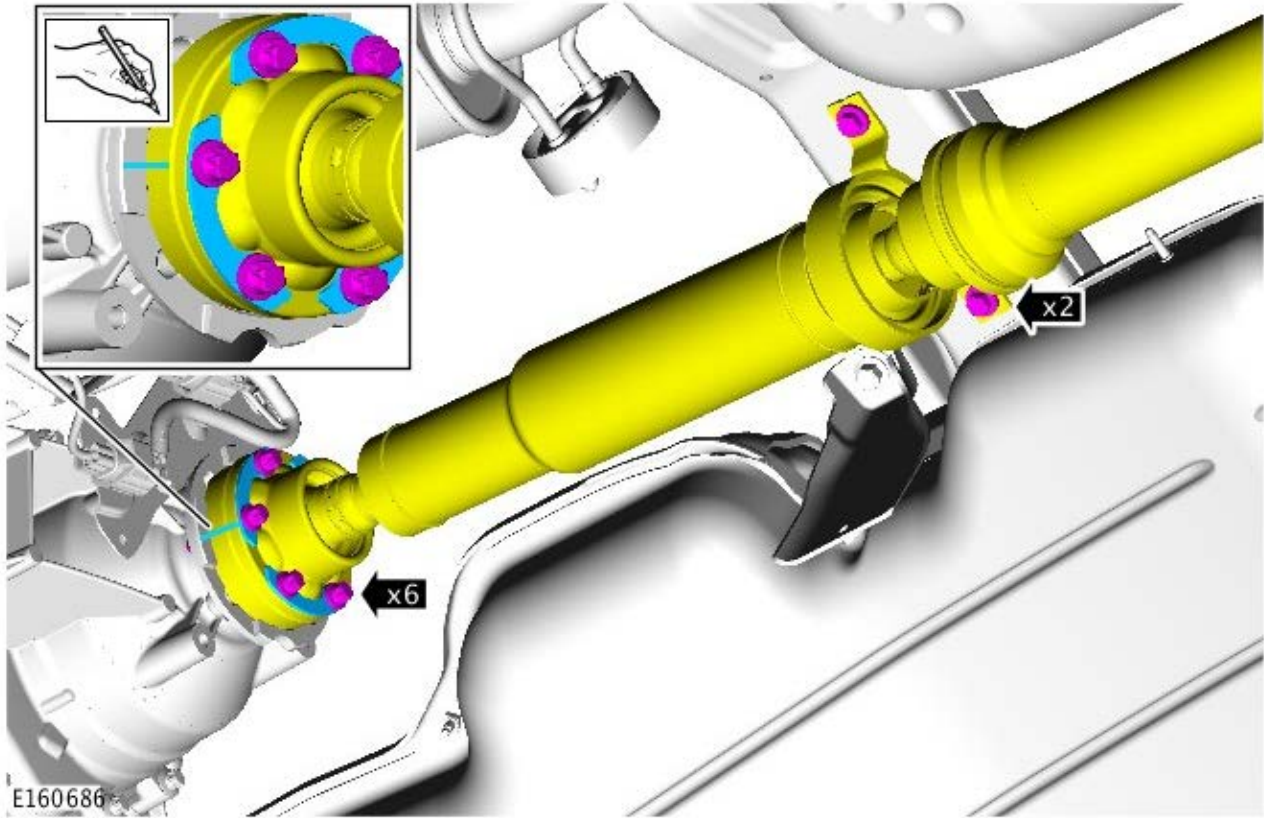


14.  **CAUTION:** Make sure that new driveshaft flange bolts are installed.

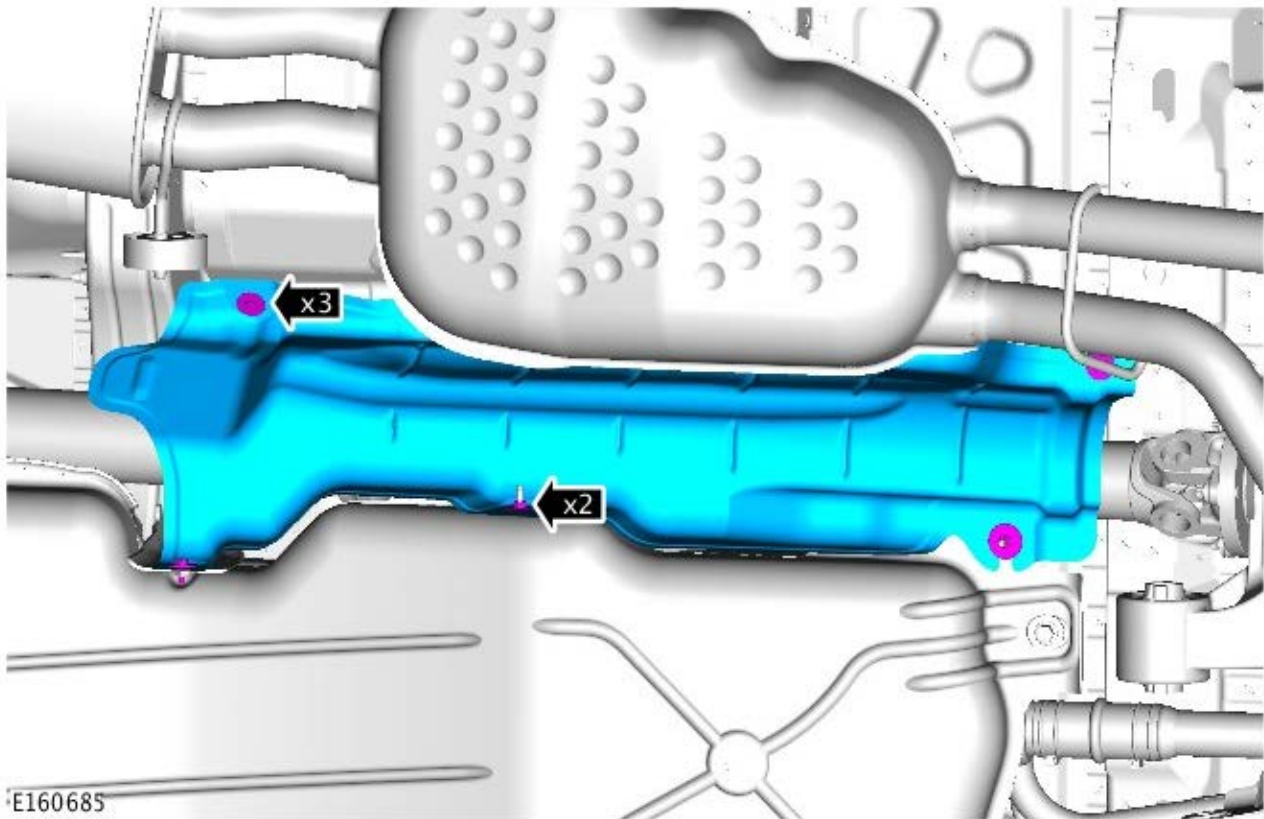
Torque:

Driveshaft flange bolts 73 Nm

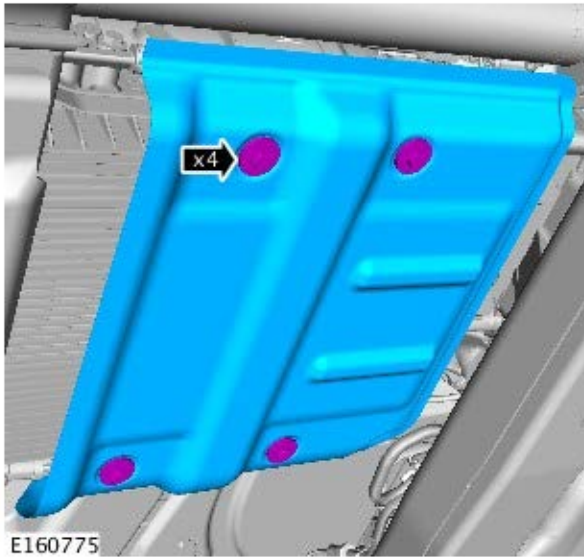
Driveshaft bearing mounting bolts 30 Nm





15. Torque:
Bolts 15 Nm
Nuts 10 Nm



16. Torque: 15 Nm



17.  NOTE: Vehicles with Diesel particulate filters only.
Refer to: [Diesel Particulate Filter \(DPF\)](#) (309-00A Exhaust System - TDV6 3.0L Diesel, Removal and Installation).
18.  NOTE: Do not carry out this step, if the component removed for access only.
Refer to: [Transfer Case Draining and Filling](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, General Procedures).
19. Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Transfer Case - Vehicles With: Single Speed Transfer Case - Transfer Case V6 S/C 3.0L Petrol

Installation

General Equipment

- Transmission jack
- Vehicle/axle stands
- Wooden Block

NOTES:



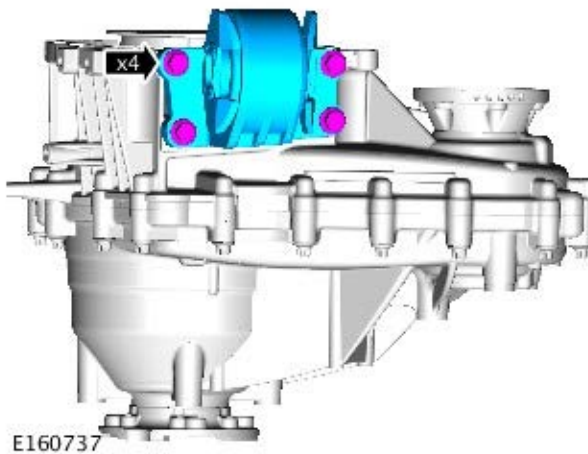
Some variation in the illustrations may occur, but the essential information is always correct.



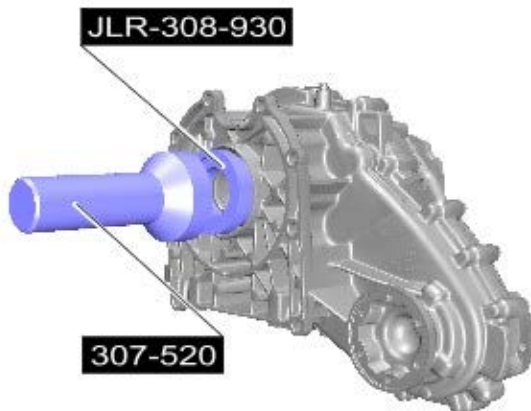
Some components shown removed for clarity.

-  NOTE: This step is only required if previously removed.

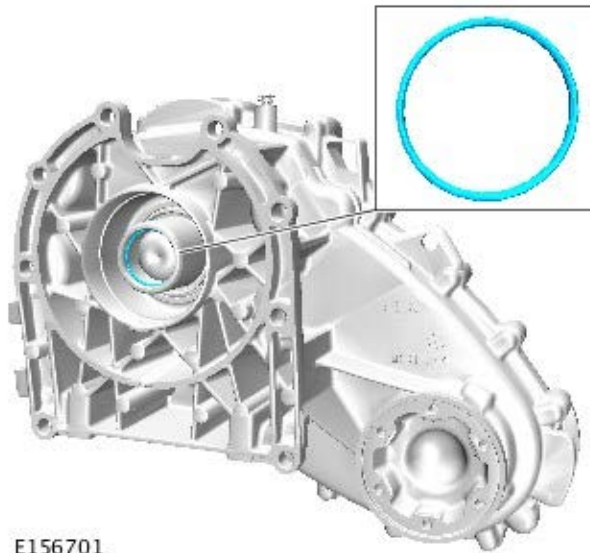
Torque: 60 Nm



-  NOTE: This step is only required if previously removed.



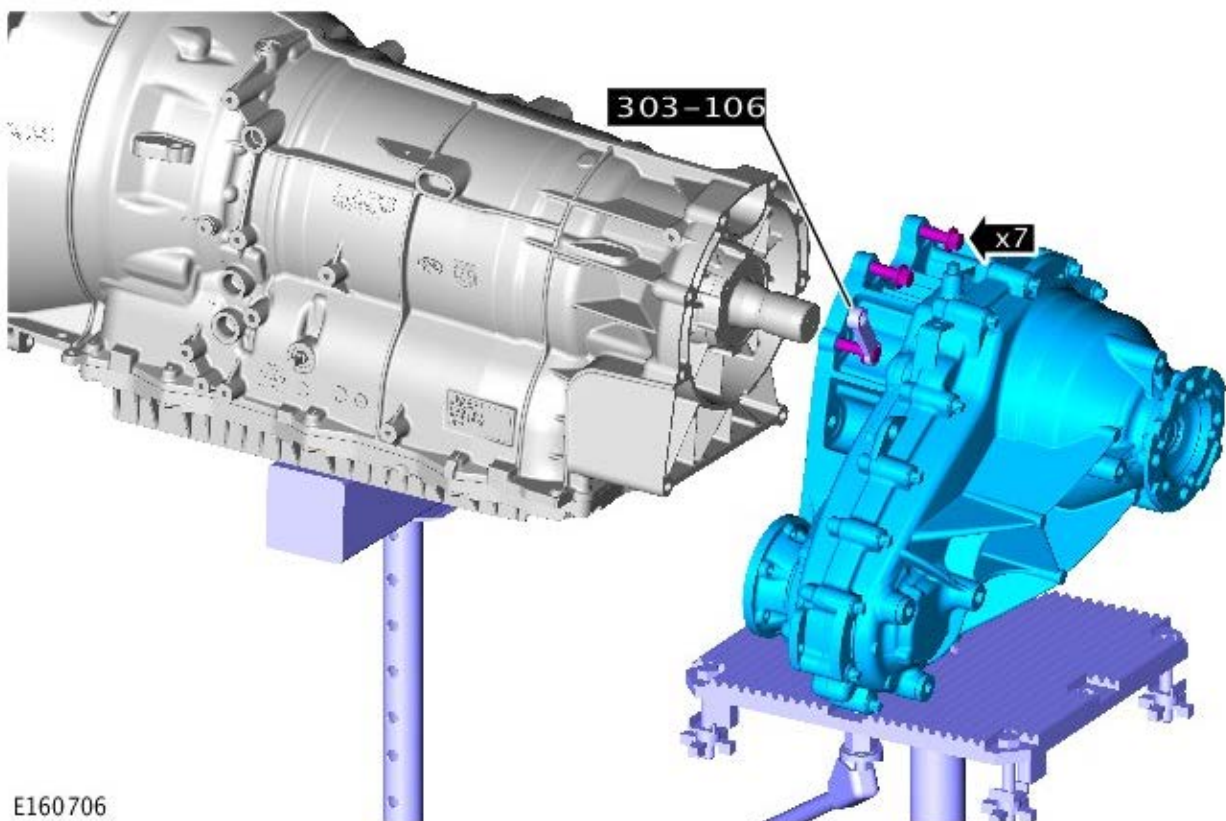
-  NOTE: This step is only required if previously removed.



E156701

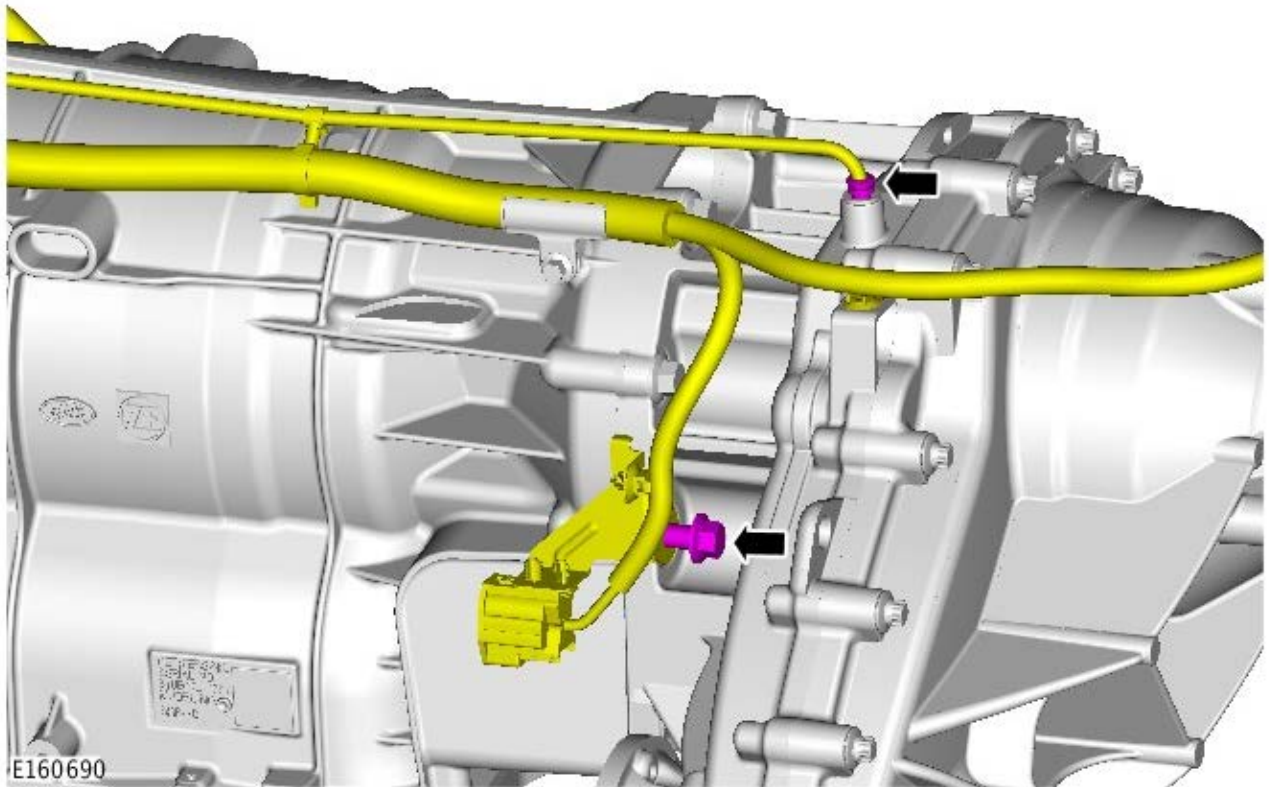
4.  **WARNING:** This step requires the aid of another technician.

- Clean the component mating faces.
- Lubricate input shaft splines with 'Weicon TL7391' grease.
- General Equipment: [Wooden Block](#)
- General Equipment: [Transmission jack](#)
- General Equipment: [Vehicle/axle stands](#)

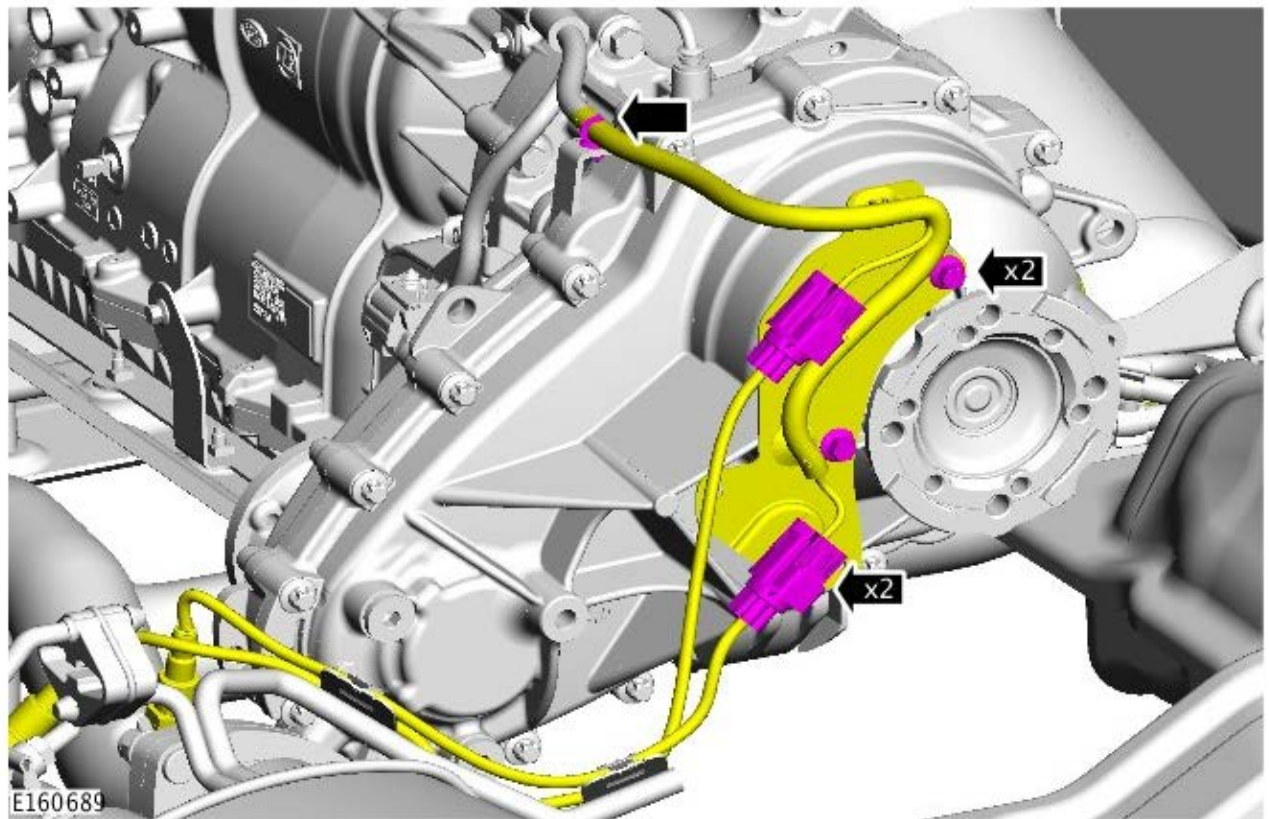


E160706

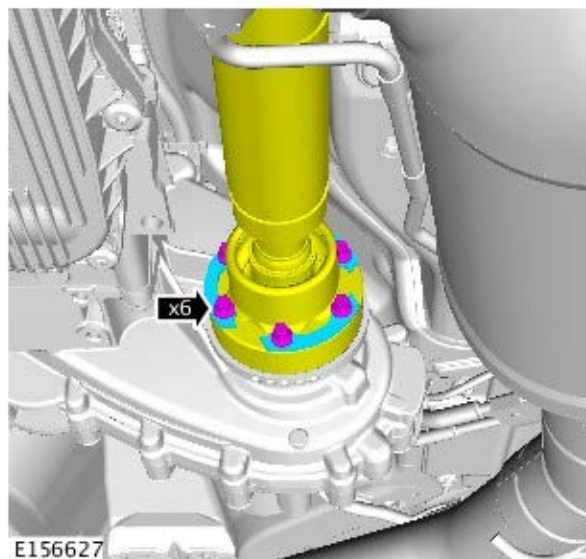
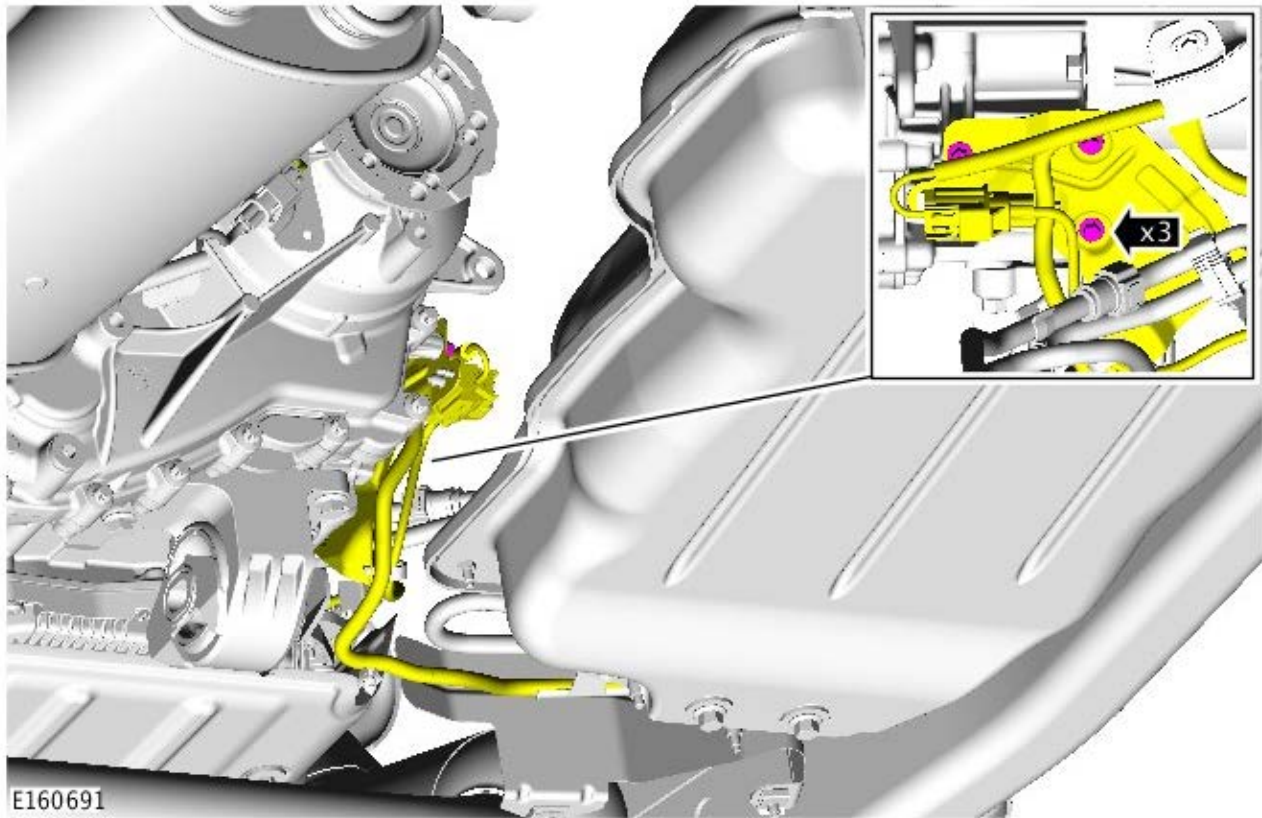
5. Torque: 45 Nm




6. Torque: 15 Nm



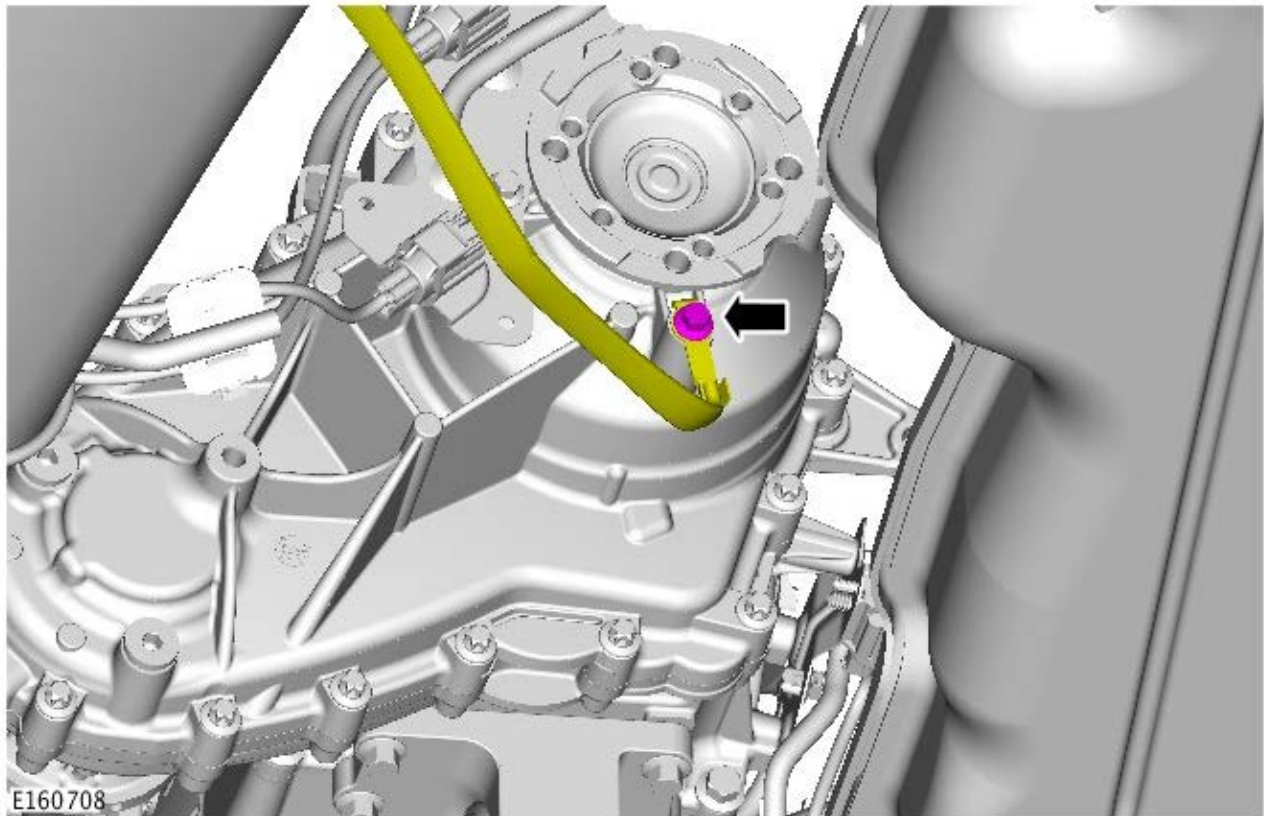
7. Torque: 15 Nm




8.  CAUTION: Make sure that new driveshaft flange bolts are installed.

Torque:
Stage 1: 45 Nm
Stage 2: 90°

9. Refer to: [Transmission Support Crossmember - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).
10. *Torque:* 25 Nm

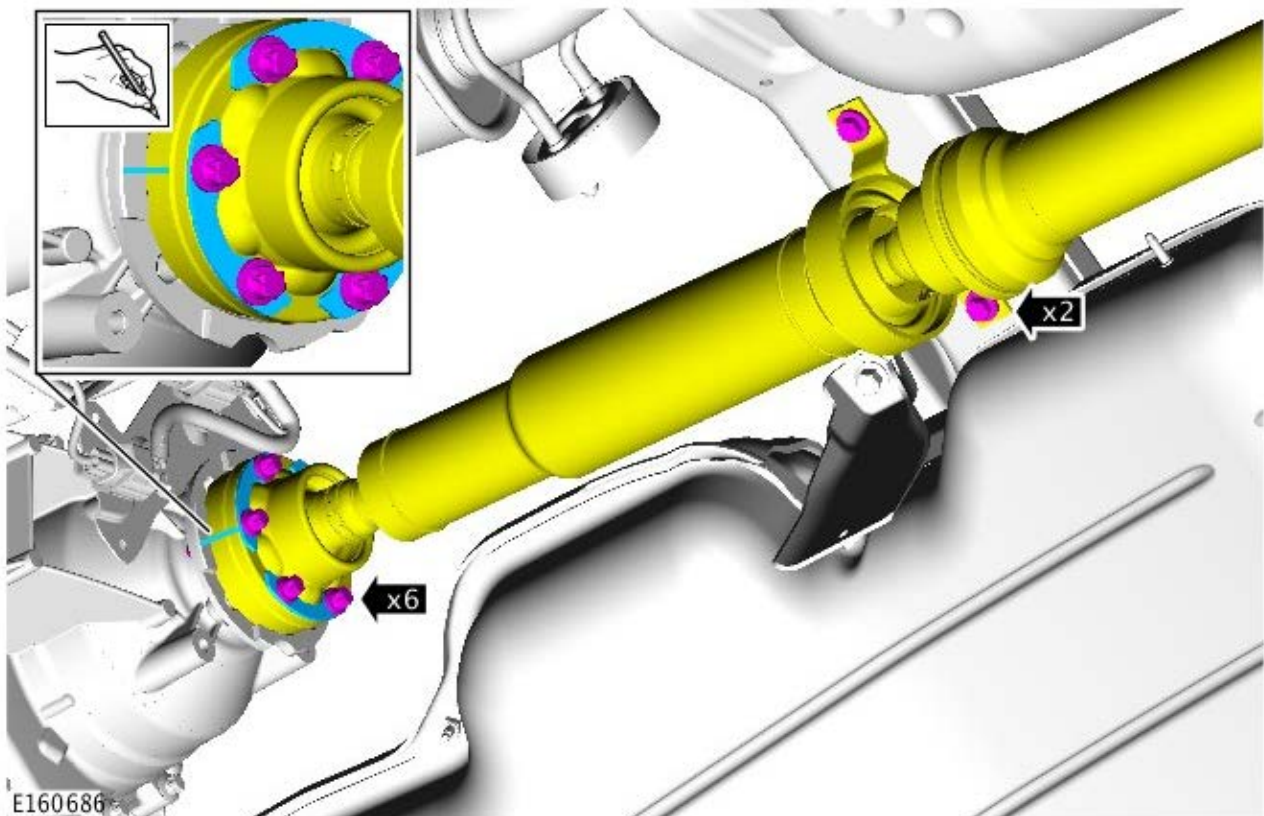


11.  CAUTION: Make sure that new driveshaft flange bolts are installed.

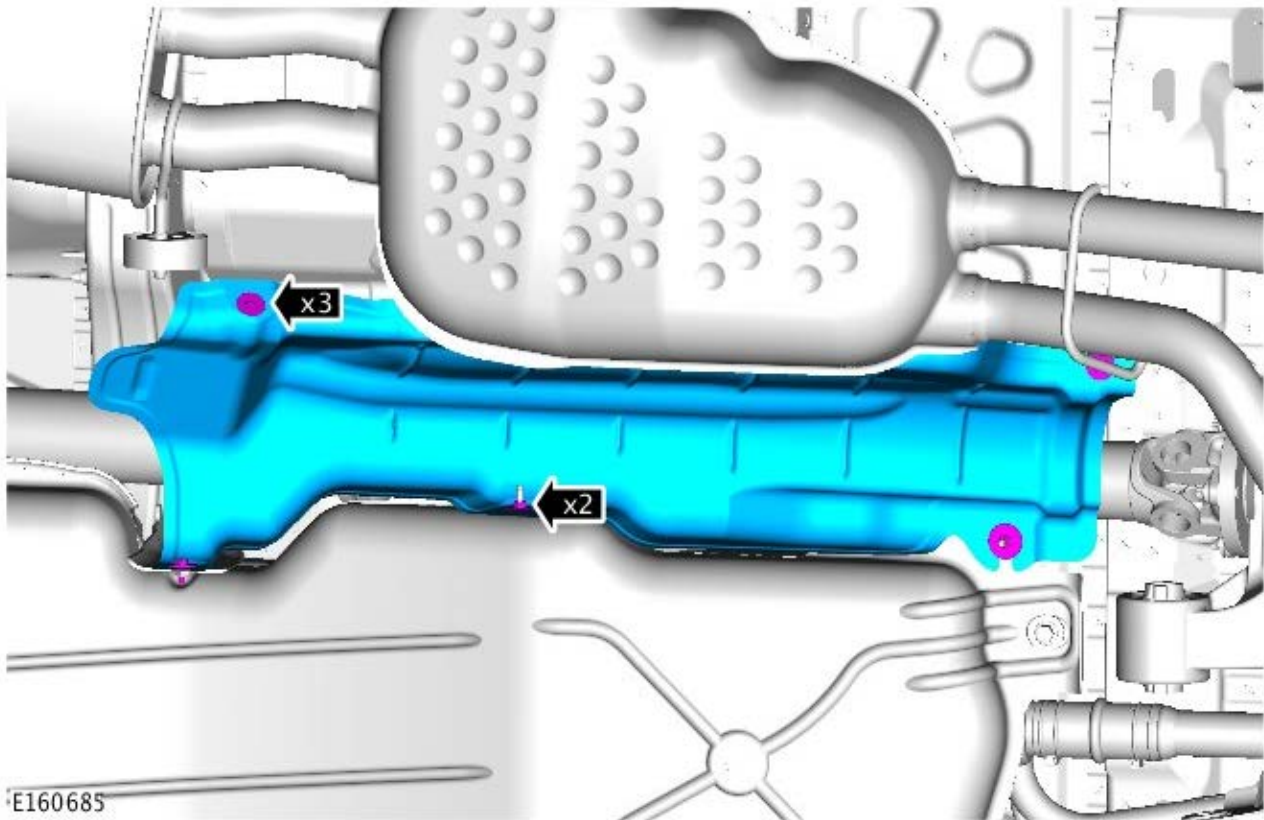
Torque:

Driveshaft flange bolts 73 Nm

Driveshaft bearing mounting bolts 30 Nm

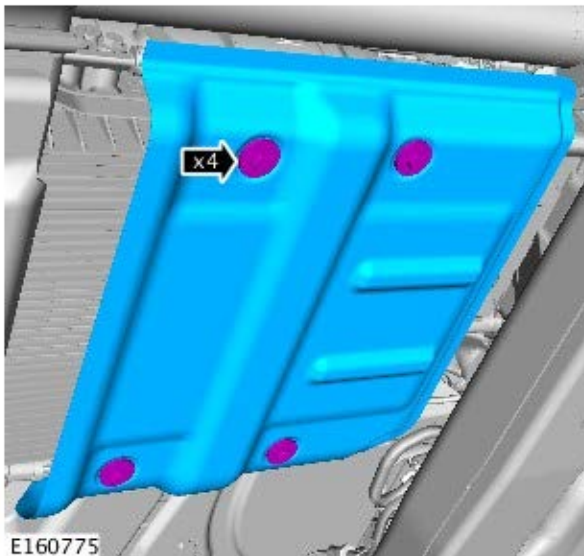


12. *Torque:*
Bolts 15 Nm
Nuts 10 Nm




E160685

13. Torque: 15 Nm



E160775

14.  NOTE: Do not carry out this step, if the component removed for access only.

Refer to: [Transfer Case Draining and Filling](#) (308-07B Transfer Case - Vehicles With: Single Speed Transfer Case, General Procedures).

15. Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

Transfer Case - Vehicles With: Twin Speed Transfer Case -

Sealers and Lubricants

Item	Specification
* Recommended oil	Shell TF 0753
Capacity - Wet and dry fill	1.5 litres, (2.6 pints) (1.5 US quarts)
Input shaft splines grease	Weicon TL7391
Sealant	STC 50550 or Loctite 5900

* **CAUTION:** Do not use any lubricant other than that specified

General Specification

Item	Specification
Model	DD295
Type	Two speed, permanent four wheel drive transfer box having synchronised low to high ratio shift on the move facility with an actively controlled wet clutch and 50/50 torque split across the centre differential
Clutch type	Wet, multi-plate
Maximum torque capacity	2500 Nm (1842.5 lb.ft)
Ratios:	
<ul style="list-style-type: none"> • High • Low 	<ul style="list-style-type: none"> • 1:1 • 2.93:1
Maximum shift speeds, Manual Gearbox:	
<ul style="list-style-type: none"> • High to low ratio • Low to high ratio 	<ul style="list-style-type: none"> • 0 kph (0 mph) • 60 kph (37.2 mph)
Maximum shift speeds, Automatic Transmission:	
<ul style="list-style-type: none"> • High to low ratio • Low to high ratio 	<ul style="list-style-type: none"> • 0 kph (0 mph) • 60 kph (37.2 mph)

Torque Specifications

NOTES:



** New 'Patchlock' Torx bolts must be installed.



+ New bolts must be used when a new component is installed.

Description	Nm	lb-ft
Transfer case fluid drain plug	28	21
Transfer case fluid level/filler plug	28	21
Fuel tank heat shield nuts/bolts	10	7
** Rear drive shaft M12 Torx screws	150	111
Rear drive shaft M10 Torx screws	73	54
** Front driveshaft Torx screws		
Stage 1	45	33
Stage 2	Further 90°	Further 90°
Drive shaft centre bearing bolts	30	22
Transmission support insulator	60	44
Wiring harness securing bolts	10	7
Fuel line support bracket bolts	10	7
Transfer case retaining bolts	45	33
Earth cable bolt (2010 Model Year onwards)	15	11
+ Transfer case shift motor bolts	35	26
+ Transfer case clutch control solenoid bolts	5	4
+ Transfer case high / low range position sensor bolts	5	4

Transfer Case - Vehicles With: Twin Speed Transfer Case - Transfer Case

Description and Operation

For additional information, refer to: Four-Wheel Drive Systems (308-07A Four-Wheel Drive Systems, Description and Operation).

Transfer Case - Vehicles With: Twin Speed Transfer Case - Transfer Case

Diagnosis and Testing

Principle of Operation

For a detailed description of the transfer case system and operation, refer to the relevant Description and Operation section of the workshop manual.

REFER to: [Transfer Case](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity.

Visual Inspection


Mechanical	Electrical
<ul style="list-style-type: none"> • Transfer case • Driveshafts • Differentials • Halfshafts • Fluid leaks 	<ul style="list-style-type: none"> • Fuse(s) • Wiring harnesses and connectors • Controller Area Network (CAN) circuits • Instrument Cluster (IC) • High/low range switch • Transfer Case Control Module (TCCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index
5. Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required

Symptom Chart

Symptom	Message	Possible Causes	Action
Loss of drive due to transfer case being stuck in neutral	PARK LOCK FAILURE APPLY HANDBRAKE	<ul style="list-style-type: none"> • High speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance • Transfer case range change mechanism obstruction 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and test the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
Automatic transmission park lock function inoperative due to transfer case stuck in neutral			
Loss of drive	-	<ul style="list-style-type: none"> • Front/rear driveshaft failure • Front/center/rear 	<ul style="list-style-type: none"> • Check the integrity of the front and rear driveshafts • Check the integrity of the front, center and rear

		<ul style="list-style-type: none"> differential failure • Front/rear left/right halfshaft failure • Transfer case system failure 	<ul style="list-style-type: none"> differentials • Check the integrity of the halfshafts • Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
Range change inhibited	TRANSMISSION RANGE CHANGE INOPERATIVE	<ul style="list-style-type: none"> • Transfer case control module has shut down due to thermal overload • Transfer case range change mechanism obstruction • Transfer case control module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
Off road traction reduced	TRANSMISSION OVERHEAT SLOW DOWN	<ul style="list-style-type: none"> • Center differential temperature is approaching the overheat threshold 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index
	TRANSMISSION FAULT – TRACTION REDUCED	<ul style="list-style-type: none"> • Center differential clutch has failed - Operating as an open differential • Transfer case control module has stopped transmitting on the CAN bus and defaults to open center differential 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the transfer case control module for related DTCs and refer to the relevant DTC index • Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and check the high speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
Judder during low speed manoeuvring with high steering inputs (front and rear driveshafts rotating at different speeds)	-	<ul style="list-style-type: none"> • Transfer case clutch not disengaged fully due to water contamination of the transfer case fluid 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual and check the transfer case fluid level/condition. If water is present in the fluid (white coloration/emulsification), check the integrity of the transfer case breather and drain and refill the transfer case fluid. Using the manufacturer approved diagnostic system, perform routine - Transfer Case Replacement. Clear the DTCs and re-test. If the fault persists, install a new transfer case and perform routine - Transfer Case Replacement
Clunk during transfer case range change Clunk when ignition is set to off (transfer case cycles to rest position)	-	<ul style="list-style-type: none"> • Transfer case clutch not calibrated correctly • Transfer case fluid contaminated due to water ingress 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform routine - Transfer Case Replacement. Check the transfer case control module for related DTCs and refer to the relevant DTC index • Refer to the relevant section of the workshop manual and check the transfer case fluid level/condition. If water is present in the fluid (white coloration/emulsification), check the integrity of the transfer case breather and drain and refill the transfer case fluid. Using the manufacturer approved diagnostic system, perform routine - Transfer Case Replacement. If the fault persists, install a new transfer case and perform routine - Transfer Case Replacement
Whine from the transfer case	-	<ul style="list-style-type: none"> • Transfer case chain wear 	 NOTE: VIN LA572494 to LA650630 <ul style="list-style-type: none"> • For vehicles within the VIN range listed above, refer to the relevant section of the workshop manual and install a new transfer case chain • For vehicles outside of the VIN range listed above, install a new transfer case and perform routine - Transfer Case Replacement
	-	<ul style="list-style-type: none"> • Transfer case bearing wear 	 NOTE: VIN pre-LA572494

			<p>For vehicles within the VIN range listed above, install a new transfer case front/rear output shaft bearing and seal</p> <ul style="list-style-type: none"> For vehicles outside of the VIN range listed above, install a new transfer case and perform routine - Transfer Case Replacement
Transfer case fluid burnt (darker color than normal)	-	<ul style="list-style-type: none"> Excessive off-road driving Transfer case clutch worn/burnt 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and drain and refill the transfer case fluid. Using the manufacturer approved diagnostic system, perform routine - Transfer Case Replacement. Check the transfer case control module for related DTCs and refer to the relevant DTC index Check the integrity of the driveshafts, differentials and halfshafts. Rectify as necessary. Check the vehicle history for driveline failures. If no driveline failures have occurred, refer to the relevant section of the workshop manual and drain and refill the transfer case fluid, and using the manufacturer approved diagnostic system, perform routine - Transfer Case Replacement. Clear the DTCs and re-test. If a driveline failure has occurred, drain and refill the transfer case fluid, and perform routine - Transfer Case Replacement. Clear the DTCs and re-test. If the fault persists, install a new transfer case and perform routine - Transfer Case Replacement
Vibration through the steering wheel, front seat or floor at 2400rpm to 2800rpm during medium to heavy acceleration	-	<ul style="list-style-type: none"> Transfer case is torsioning/twisting on the rear of the transmission 	 <p>NOTE: This Action applies to 5.0L petrol vehicles only.</p> <ul style="list-style-type: none"> Install a mass damper (part number IAI500100) to the vacant threaded hole in the transfer case. Torque the fixing (part number IYP500080) to 75Nm

Repairs

Transfer Case Adaptions

When new transfer case components are installed, the relevant routine must be performed using the manufacturer approved diagnostic system:

- Transfer case control module - Transfer Case Replacement routine
- Transfer case motor - Transfer Case Replacement routine
- Transfer case - Transfer Case Replacement routine
- Transfer case mode selector solenoid - Solenoid Replacement routine
- Transfer case mode selector position sensor - Absolute Position Sensor Replacement routine

Drive Cycle

To validate a transfer case repair, the following drive cycle must be completed:

- Drive the vehicle a short distance and halt and drive away at least twice
- Select low range and then select high range (vehicle not moving)
- Select low range and then select high range (vehicle moving at appropriate speed)
- Halt the vehicle and select Neutral (manual transmission) or Park (automatic transmission)
- Set the ignition to off
- Wait until the transmission control switch Park LED has extinguished (automatic transmission)
- Drive the vehicle until the engine, transmission and transfer case are at normal operating temperature
- Repeat steps 1 to 6


DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: Transfer Case Control Module \(TCCM\)](#) (100-00 General Information, Description and Operation).

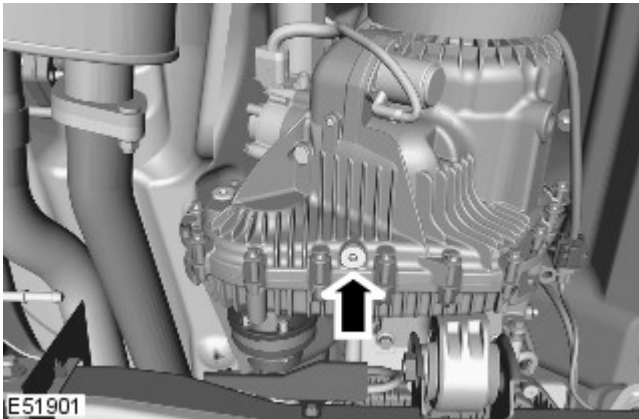
Transfer Case - Vehicles With: Twin Speed Transfer Case - Transfer Case Draining and Filling

General Procedures

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

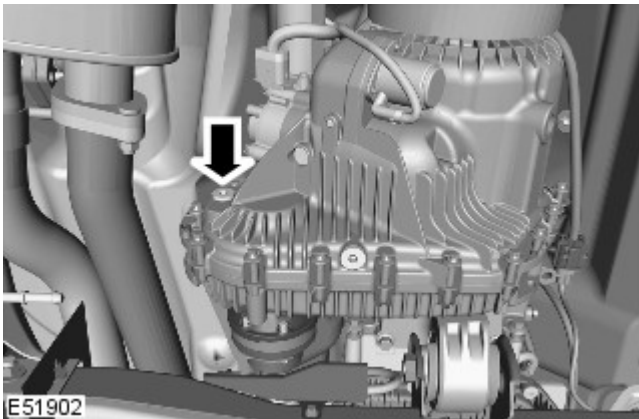
2. Position a container to collect the fluid.



3. Remove the fluid drain plug.
 - Clean the immediate area.
 - Remove and discard the sealing washer.

4. Allow the fluid to drain.

5. Install the drain plug and tighten it to 28 Nm (21 lb ft).
 - Clean the component mating faces.
 - Install a new sealing washer.



6. Remove the fluid filler/level plug.
 - Clean the immediate area.
 - Remove and discard the sealing washer.



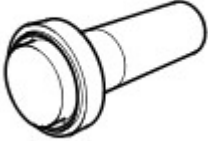

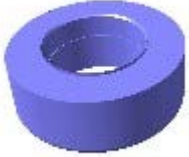
7. Refill transfer case with the recommended fluid, until the fluid is level with bottom of filler/level plug hole. For additional information, refer to: [Specifications](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Specifications).

8. Install the fluid filler/level plug and tighten to 28 Nm (21 lb ft).
 - Clean the component mating faces.
 - Install a new sealing washer.

Transfer Case - Vehicles With: Twin Speed Transfer Case - Transfer Case Front Output Seal

Removal and Installation


Special Tool(s)

 <p>205-818 E55429</p>	205-818 Installer, Seal
 <p>E159151</p>	308-620 Installer, Seal
 <p>308-636 E55702</p>	308-636 Installer
 <p>E15 8794</p>	JLR-308-926 Support Tool, Transfer Case
 <p>E15 8799</p>	JLR-308-933 Remover, Transfer Case Flange

Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

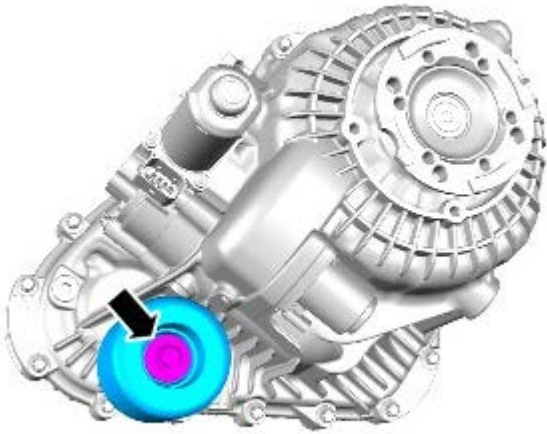
- 
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.
- Refer to: [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).
- Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case,

Removal).
Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Removal).

4. With assistance, secure the transfer case with it's transmission mating face down on a flat surface.

5.




E159189




E159190

6.  WARNING: Eye protection must be worn.


 CAUTION: Make sure the bolt holes are clean and free of swarf.

7.  WARNING: Eye protection must be worn.

 CAUTION: Make sure the bolt holes are clean and free of swarf.




E159191

8.  CAUTION: Care must be taken when turning the transfer case over. The transfer case halves must not be allowed to separate.

With assistance, release the transfer case and secure with the rear face of the transfer case facing down on a flat surface.



9.  CAUTION: Care must be taken to avoid damage to the mating surfaces.

Using a soft faced mallet, release the front casing.



E159214


10. Remove the sealant from the transfer case mating faces.

11.



12. *Special Tool(s)*: [JLR-308-926](#)



13.  CAUTION: Make sure that the special tool is correctly located. This will make sure that the snap ring is fully compressed during the next step.


Special Tool(s): [JLR-308-933](#)




14. CAUTIONS:



E159219

 Do not use excessive force whilst removing the flange assembly.

 Discard the snap ring.

Special Tool(s): [JLR-308-933](#)

15.




E159220

16.



E159221

Installation

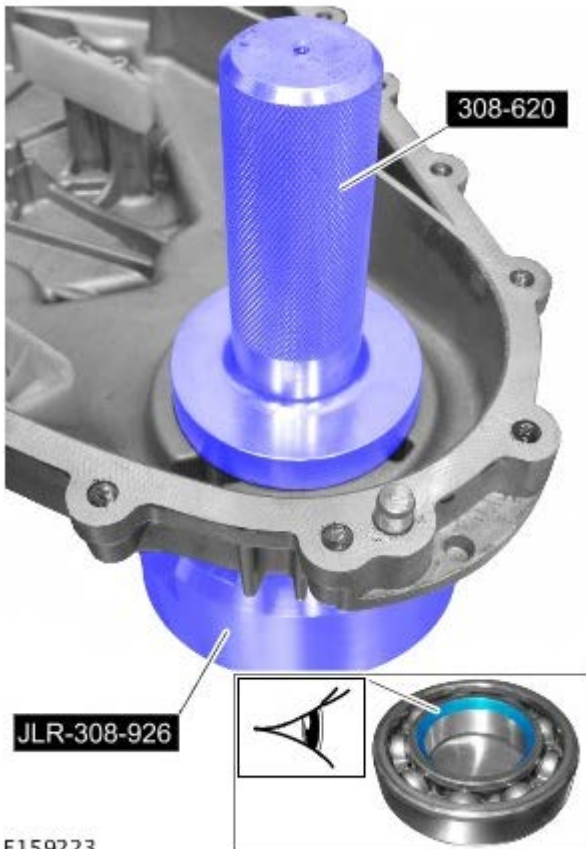
 **CAUTION:** During the installation, make sure that all components are clean and free from foreign material.



E159222


1. Position the special tool as shown, to support the transfer case during the next step.


Special Tool(s): [JLR-308-926](#)



E159223

2. CAUTIONS:

 The chamfer on the bearing inner track must face the seal.

 The transfer case must be supported by the special tool on a flat surface during this step.

Install the bearing.

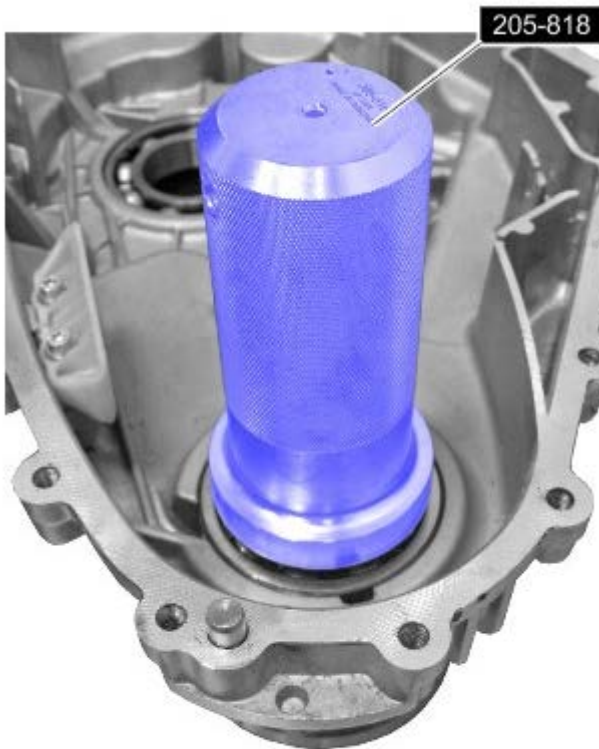
Special Tool(s): [308-620](#), [JLR-308-926](#)

3. Install the seal.

Special Tool(s): [308-636](#)





E159224



E159225

4. CAUTIONS:


 Centralise the snap ring in the snap ring groove before installing the output flange.

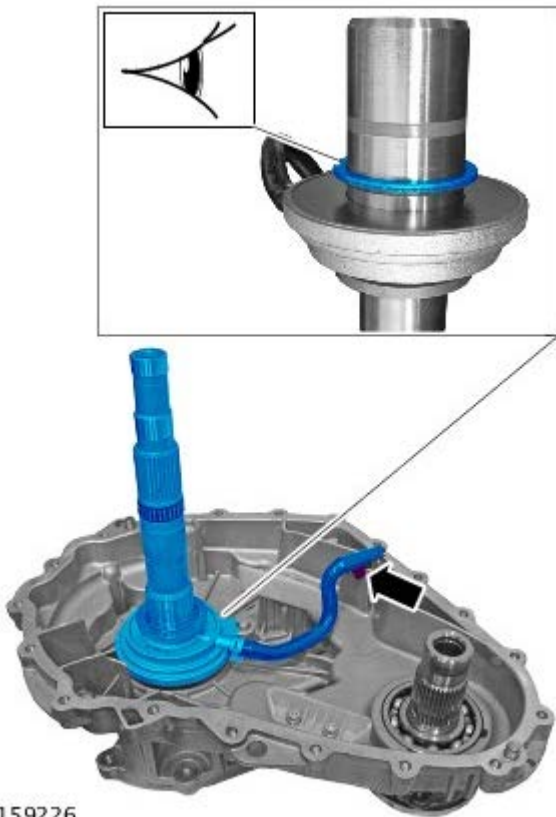
 Extreme care is necessary to make sure the snap ring enters the bearing squarely.

 Install a new snap ring.

Using the special tool and with assistance, install the drive flange.


Special Tool(s): [205-818](#)

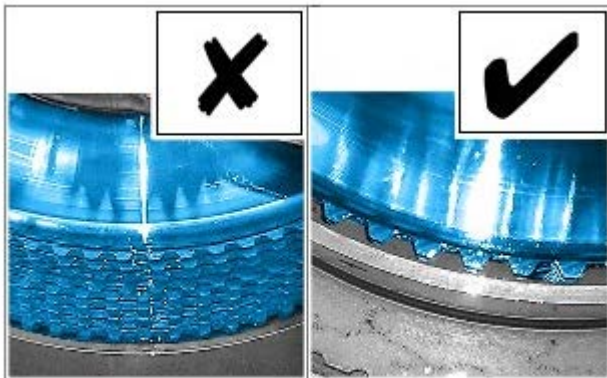
5.  CAUTION: Make sure that the oil pump is installed over its location peg.




E159226

6. Clean the magnetic filter.

7.  CAUTION: Make sure that the clutch assembly is correctly located as illustrated.

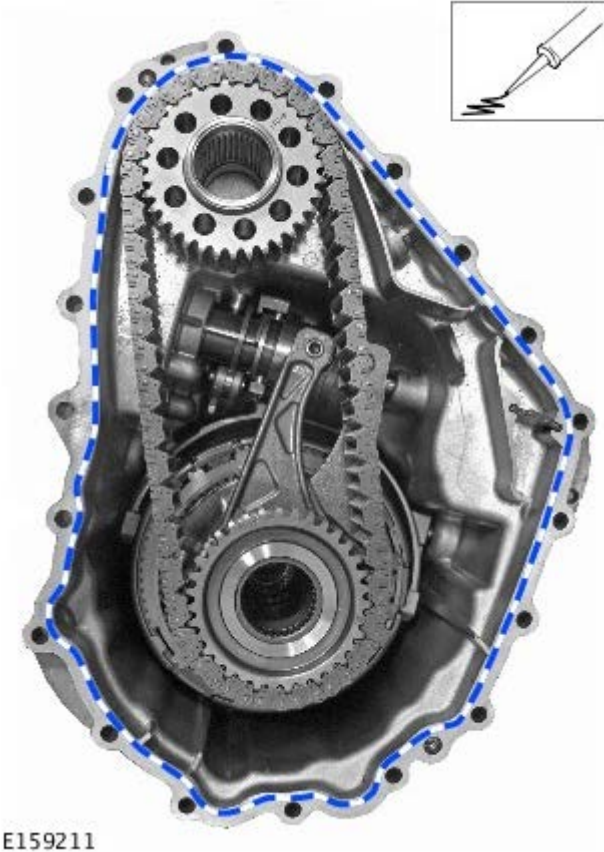


E 149289


8.  CAUTION: Make sure that the clutch assembly is correctly located as illustrated.




9. Apply a 2 mm bead of sealant to one surface of the transfer case mating face, as shown.

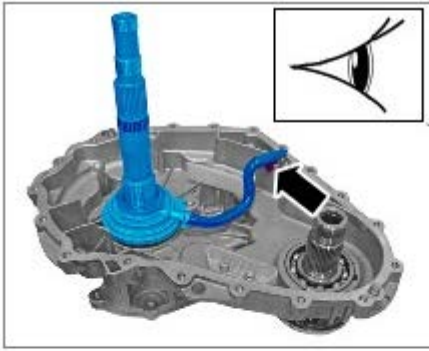


10. CAUTIONS:


 Make sure that the input shaft spacer is correctly located.

 The input shaft and fluid pump assembly must be supported and held in place by hand, until it is located securely into the clutch assembly.


Install the front half of the transfer case.



E159212

11.  CAUTION: Care must be taken when turning the transfer case over. The transfer case halves must not be allowed to separate.

With assistance, release the transfer case and secure with its transmission mating face down on a flat surface.

12.  CAUTION: Only tighten the bolts finger-tight at this stage.



E159191

13. Torque: 10 Nm



E159409

14. Torque: 35 Nm

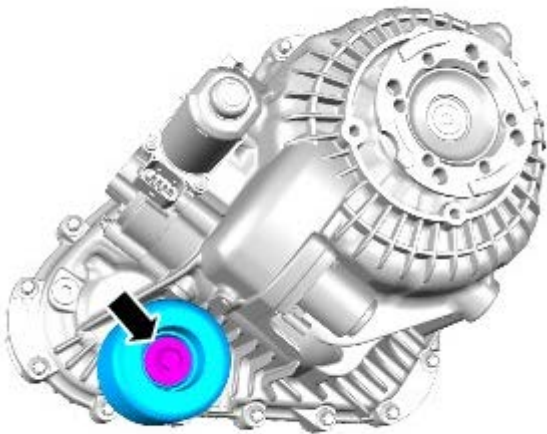


E159191

15. Torque: 35 Nm



16. Torque: 75 Nm



E159189

17. With assistance, release the transfer case from the flat surface.
18. Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Installation).
Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Installation).
19. Refer to: [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).

Transfer Case - Vehicles With: Twin Speed Transfer Case - Transfer Case Front Output Shaft Bearing

Removal and Installation

Removal

1. The transfer case front output shaft bearing must be serviced with the seal as a pair.

Refer to: [Transfer Case Front Output Seal](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Removal and Installation).




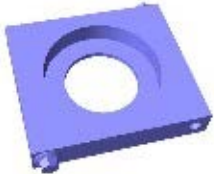

Installation

1. To install, reverse the removal procedure.

Transfer Case - Vehicles With: Twin Speed Transfer Case - Transfer Case Rear Output Seal

Removal and Installation


Special Tool(s)

 <p>E159758</p>	<p>204-525-1 Replacer, Drive Flange</p>
<p>205-726</p>  <p>E87692</p>	<p>205-726 Remover/Installer, Wheel Hub Bearing</p>
<p>308-637</p>  <p>E55697</p>	<p>308-637 Installer</p>
 <p>E158795</p>	<p>JLR-308-927 Support Tool, Transfer Case</p>
 <p>E158797</p>	<p>JLR-308-931 Remover, Transfer Case Flange</p>

Removal

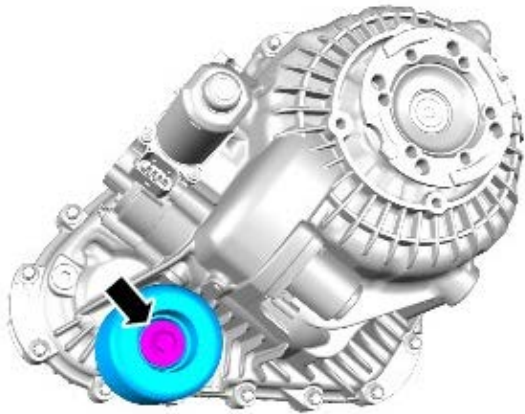


NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

- 
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
 Raise and support the vehicle.
- Refer to: [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).
- Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Removal).
 Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Removal).
- With assistance, secure the transfer case with it's transmission

mating face down a flat surface.

5.




E159189




E159190

6.  WARNING: Eye protection must be worn.

 CAUTION: Make sure the bolt holes are clean and free of swarf.

7.  WARNING: Eye protection must be worn.


 CAUTION: Make sure the bolt holes are clean and free of swarf.



E159191



E159192

8.  CAUTION: Care must be taken to avoid damage to the mating surfaces.
Using a soft faced mallet, release the rear casing.

9.




E159215



10. Locate the magnetic filter. The filter may have dropped into the front housing in the previous step.



E159213

11.  **CAUTION:** Make sure that the mating faces are clean and free of foreign material.

Remove the sealant from the transfer case mating faces.

12. Remove the spacer.



E159193

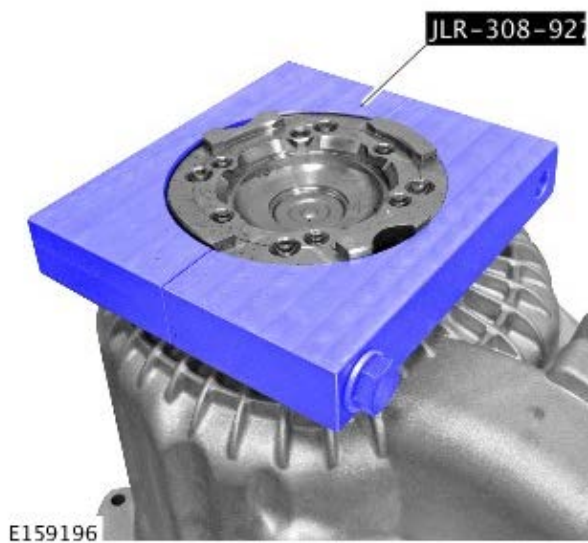
- 13.




14.  NOTE: Remove as an assembly.

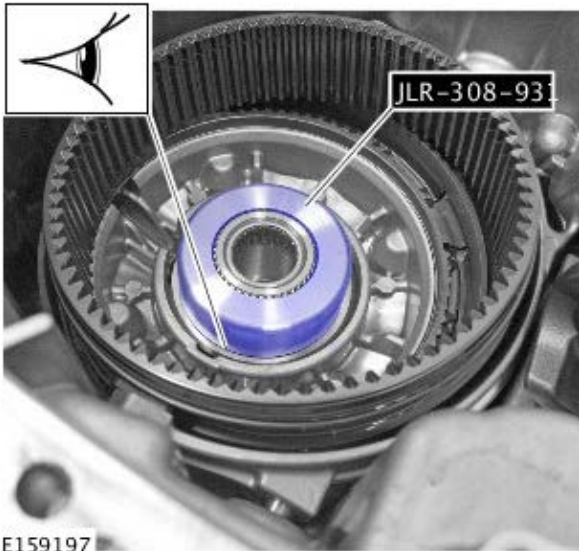


15. *Special Tool(s):* [JLR-308-927](#)



16.  CAUTION: Make sure that the special tool is correctly located. This will make sure that the snap ring is fully compressed during the next step.

Special Tool(s): [JLR-308-931](#)



E159197



E159198

17. CAUTIONS:

 Do not use excessive force whilst removing the flange assembly.

 Discard the snap ring.

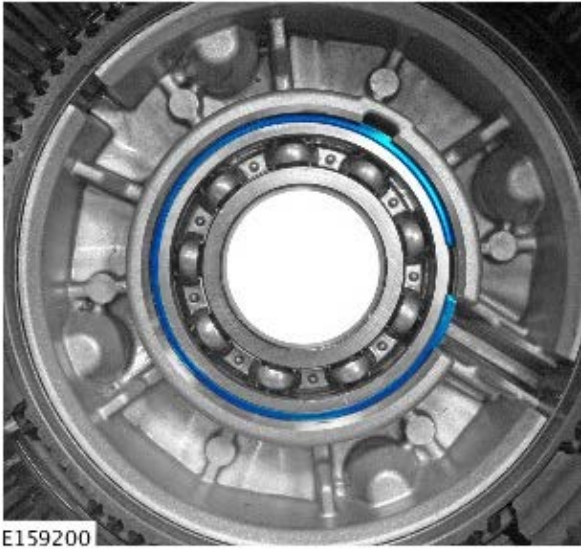
Special Tool(s): [JLR-308-931](#)



E159199

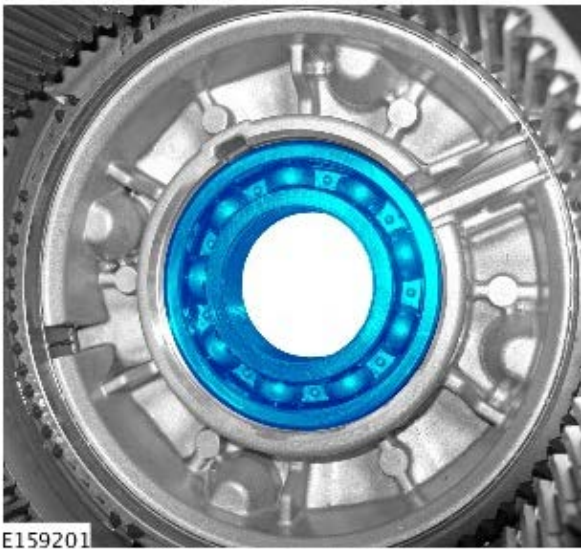
18.

19.



E159200

20.



E159201

21. With assistance, release the transfer case from the flat surface.

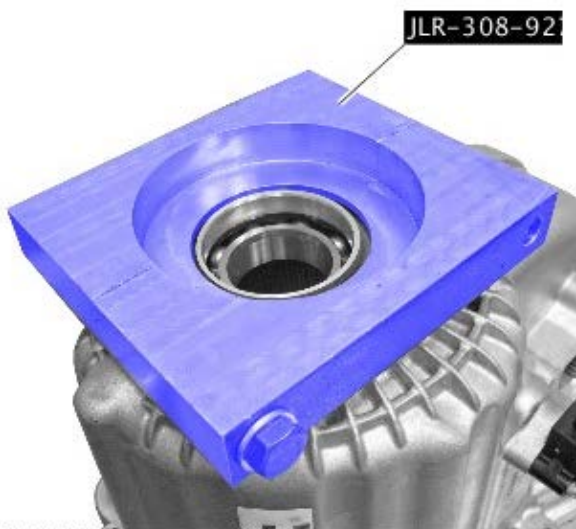
Installation



CAUTION: During the installation, make sure that all components are clean and free from foreign material.


1. Position the special tool as shown, to support the transfer case during the next step.

Special Tool(s): [JLR-308-927](#)



E159202



2.  CAUTION: The chamfer on the bearing inner track must face the seal.

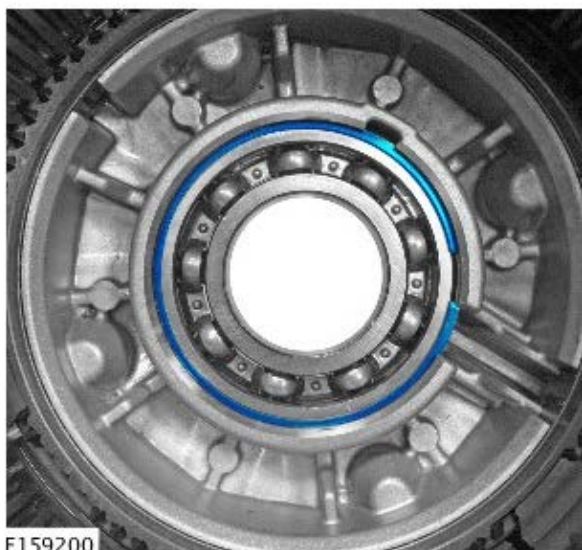
Install the bearing.

Special Tool(s): [205-726](#)



E159203

- 3.



E159200

4. Install the seal.

Special Tool(s): [308-637](#)



5. CAUTIONS:

⚠ Centralise the snap ring in the snap ring groove before installing the output flange.

⚠ Extreme care is necessary to make sure the snap ring enters the bearing squarely.

⚠ Install a new snap ring.

Using the special tool and with assistance, install the drive flange.

Special Tool(s): [204-525-1](#)

6. With assistance, secure the rear half of the transfer case with its rear face down on a flat surface.

7. Install the spacer.

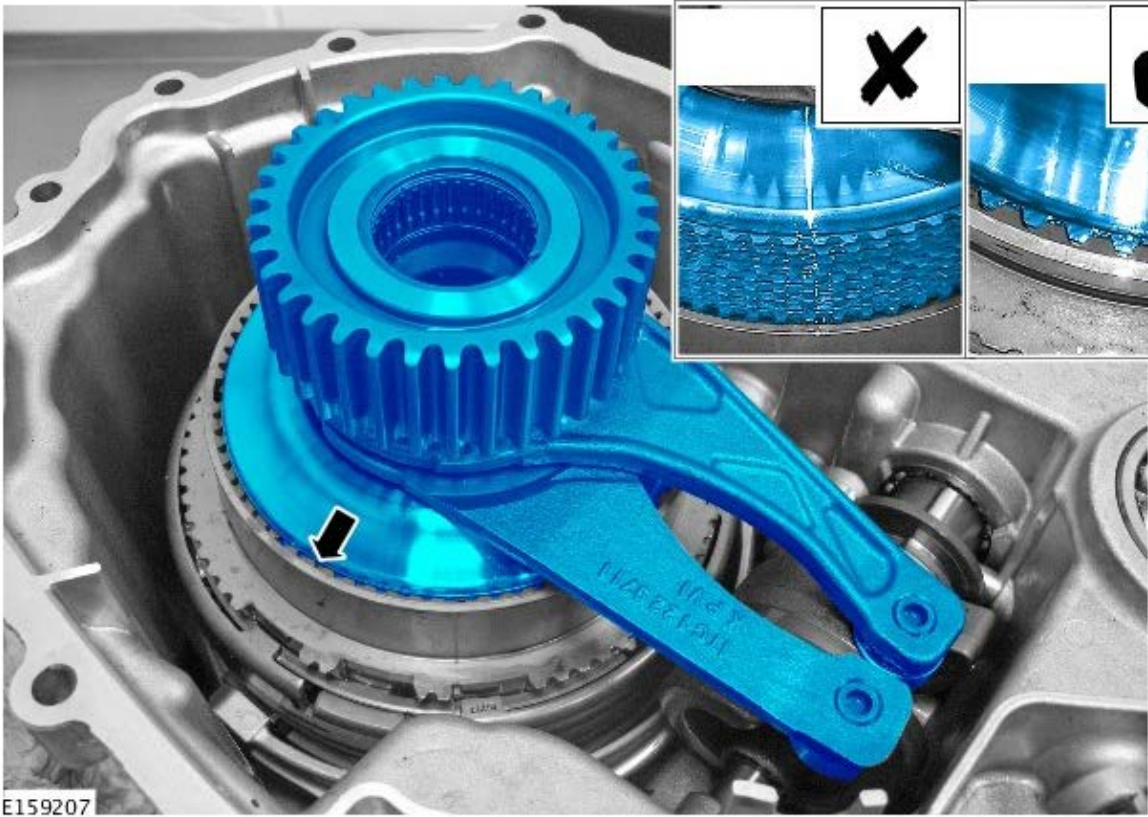


8. ⚠ NOTE: Rotate the differential to engage the splines.



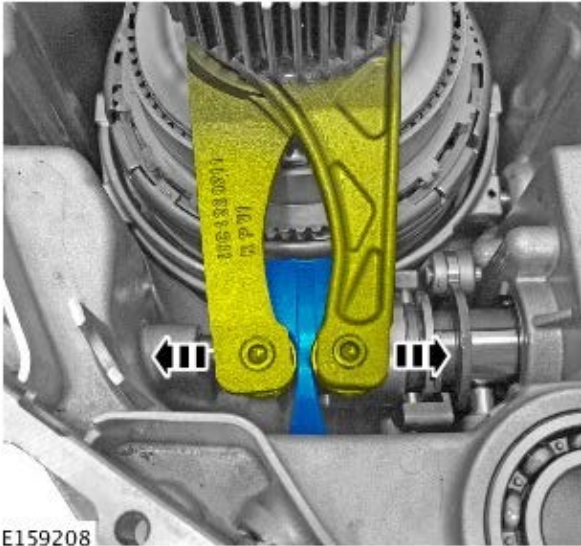
E159206

9.  NOTE: Rotate the assembly to engage the clutch plates.




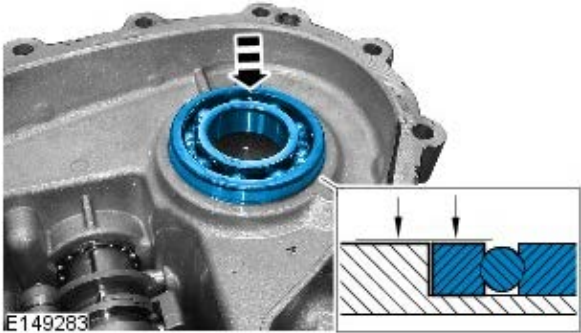
E159207

10.




E159208

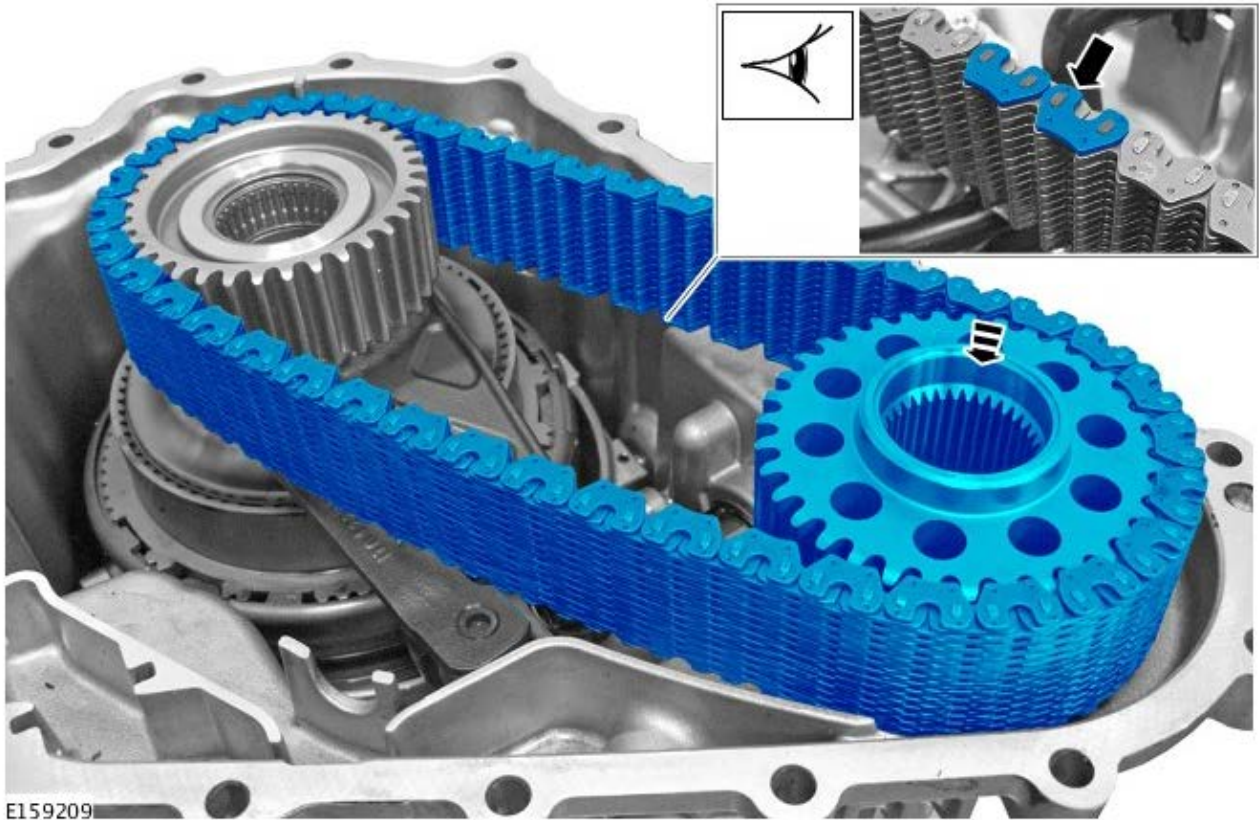
- 11.  CAUTION: Make sure that the front driveshaft gear bearing is fully seated before installing the chain and gear.




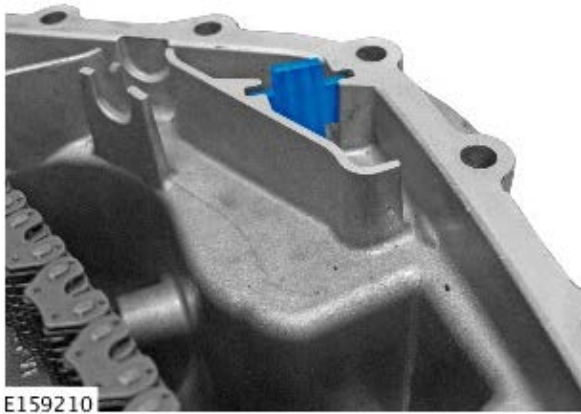
E149283

- 12.  CAUTION: Make sure that the chain is installed with the dark links facing down.

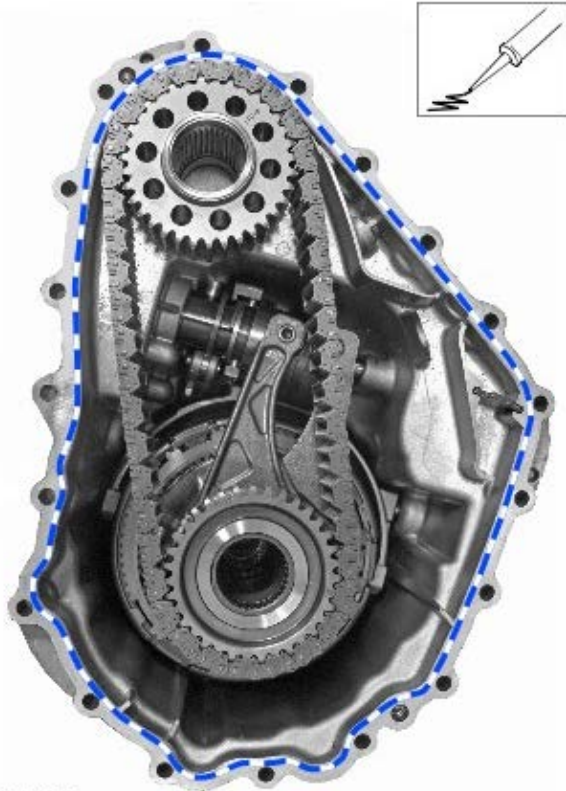
 NOTE: The relieved splined inner diameter of the sprocket must face up as shown.



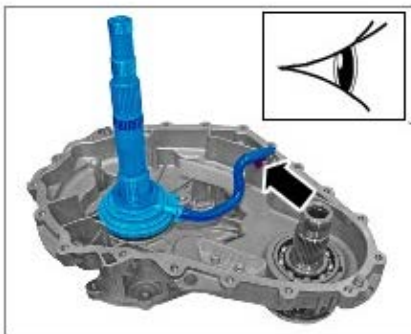
13.  CAUTION: Make sure that the component is clean and free of foreign material .



14. Apply a 2 mm bead of sealant to one surface of the transfer case mating face, as shown.




E159211



15. CAUTIONS:


 Make sure that the input shaft spacer is located correctly.

 The input shaft and fluid pump assembly must be supported and held in place by hand, until it is located securely into the clutch assembly.

Install the front half of the transfer case.



E159212

16.  CAUTION: Care must be taken when turning the transfer case over. The transfer case halves must not be allowed to separate.

With assistance, release the transfer case and secure with it's transmission mating face down on a flat surface.

17.  CAUTION: Only tighten the bolts finger-tight at this stage.



E159191

18. Torque: 10 Nm



E159409

19. Torque: 35 Nm



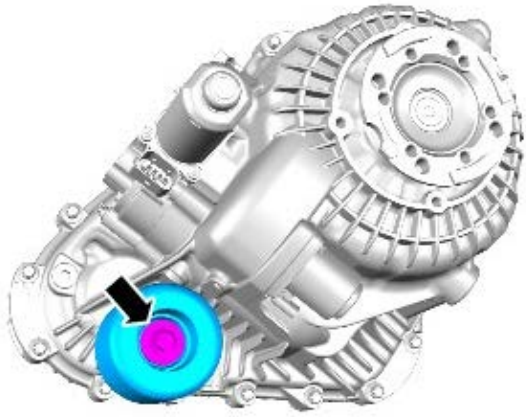
E159191

20. Torque: 35 Nm



E159190

21. Torque: 75 Nm



E159189

22. With assistance, release the transfer case from the flat surface.
23. Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Installation). Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Installation).
24. Refer to: [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).

Transfer Case - Vehicles With: Twin Speed Transfer Case - Transfer Case Rear Output Shaft Bearing

Removal and Installation

Removal

1. The transfer case rear output shaft bearing must be serviced with the seal as a pair.

Refer to: [Transfer Case Rear Output Seal](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Removal and Installation).


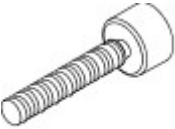


Installation

1. To install, reverse the removal procedure.

Transfer Case - Vehicles With: Twin Speed Transfer Case - Transfer Case Connecting Sleeve Seals

Removal and Installation

Special Tool(s)

 <p>100-012</p> <p>E54135</p>	100-012 Slide Hammer
 <p>100-012-01</p>	100-012-01 Slide Hammer Adapter
 <p>308-375</p>	308-375 Remover, Input and Output Seal
 <p>308-598</p> <p>E50941</p>	308-598 Installer, Oil Seal


Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-01 Battery, Mounting and Cables, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

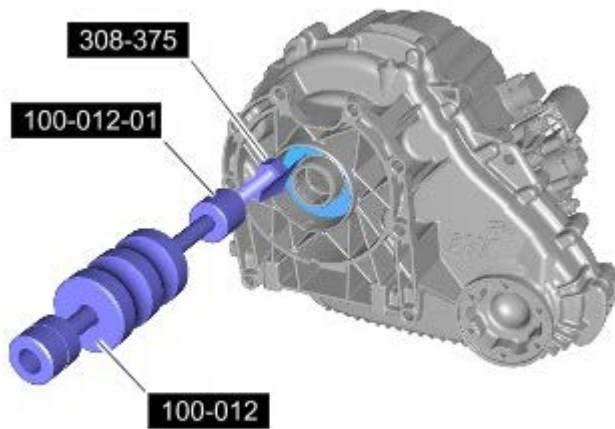
3. Remove the transfer case.

Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Removal).

Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Removal).

4.  **CAUTION:** Care must be taken to avoid damage to the seal register and running surface.

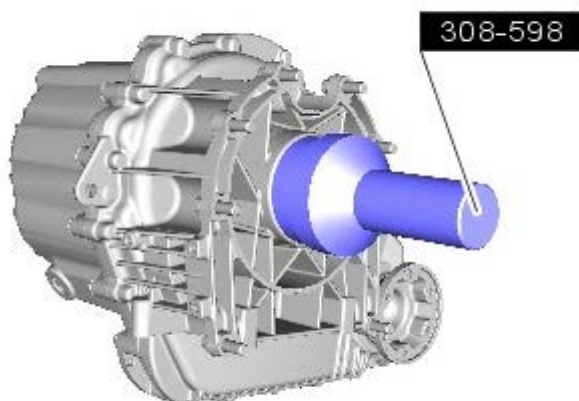
Carefully remove and discard the oil seal.




Special Tool(s): [308-375](#), [100-012](#), [100-012-01](#)

E131138

Installation



1. CAUTIONS:

 Make sure that the area around the component is clean and free of foreign material.

 Oil seals must be installed dry.

Install a new seal.

Special Tool(s): [308-598](#)

E50943

2. Install the transfer case.

Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Removal).

Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Removal).

3. Connect the battery ground cable.

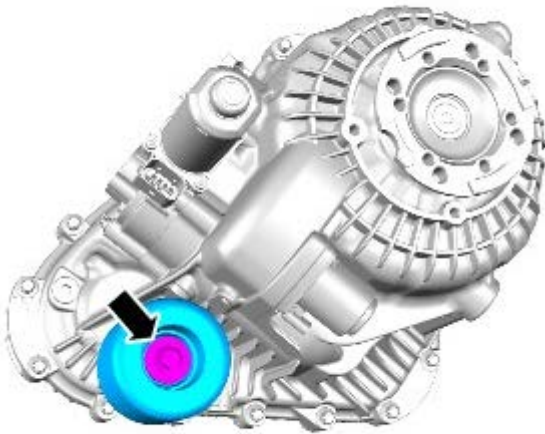
Refer to: [Specifications](#) (414-01 Battery, Mounting and Cables, Specifications).

Transfer Case - Vehicles With: Twin Speed Transfer Case - Transfer Case Chain

Removal and Installation

Removal

1. Refer to: [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).
2. Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Removal).
Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Removal).
3. With assistance, secure the transfer case with it's transmission mating face down on a flat surface.
- 4.




E159189




E159190

5.  **WARNING:** Eye protection must be worn.


 **CAUTION:** Make sure the bolt holes are clean and free from swarf.

6.  **WARNING:** Eye protection must be worn.

 **CAUTION:** Make sure the bolt holes are clean and free from swarf.




E159191

7.  CAUTION: Care must be taken when turning the transfer case over. The transfer case halves must not be allowed to separate.

With assistance, release the transfer case and secure with the rear face of the transfer case facing down on a flat surface.



8.  CAUTION: Care must be taken to avoid damaging the mating surfaces.

Using a soft faced mallet, release the front casing.




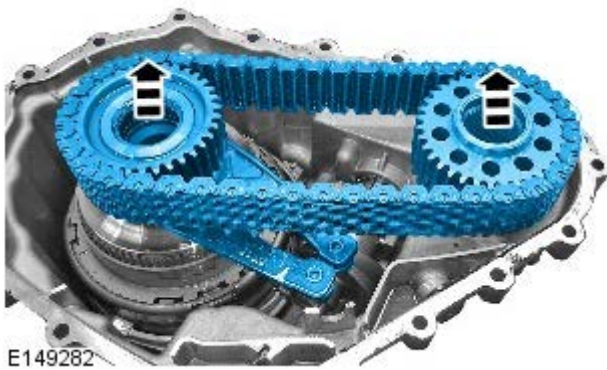
E159214

9.



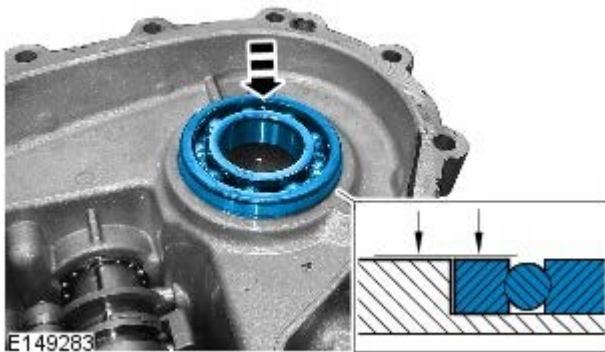
E159216

10.  CAUTION: The shaft may be tight on the bearing. Care must be taken when removing the component.





E149282

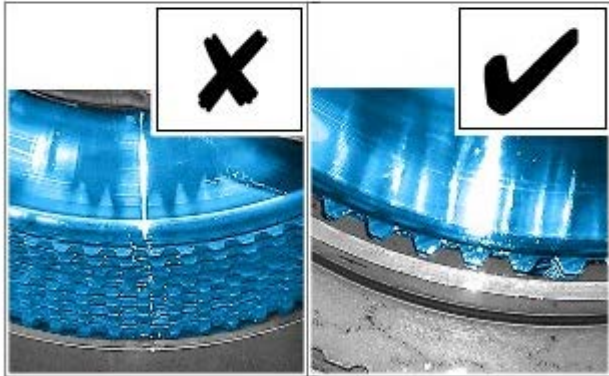
Installation



E149283

1.  CAUTION: Make sure that the front driveshaft gear bearing is fully seated before installing the new chain and gear.


2.  CAUTION: Make sure that the clutch assembly is correctly located as illustrated.

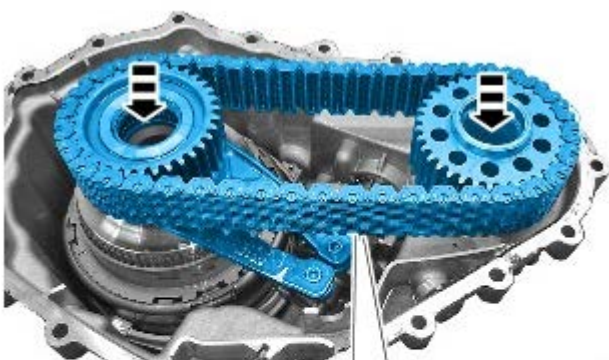


E149289



E149286

3.  CAUTION: Make sure that the clutch assembly is correctly located as illustrated.

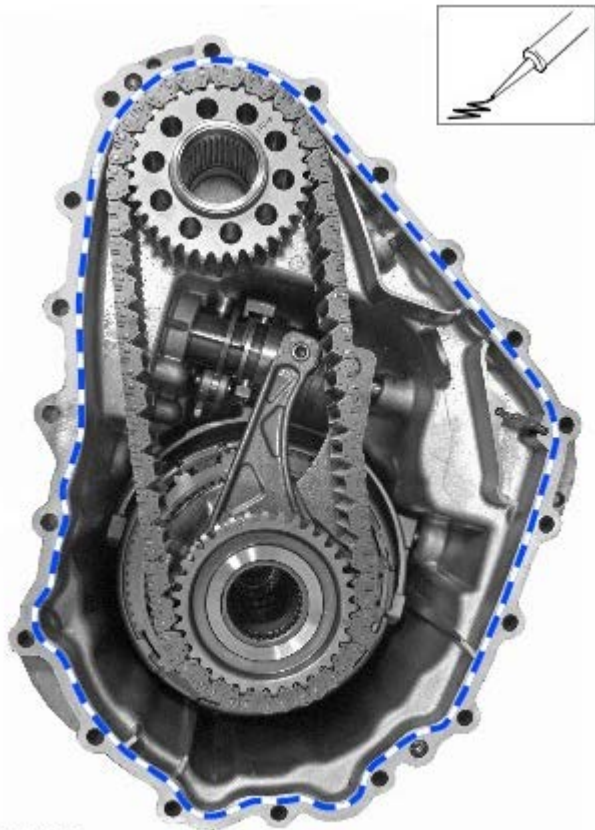


E149284

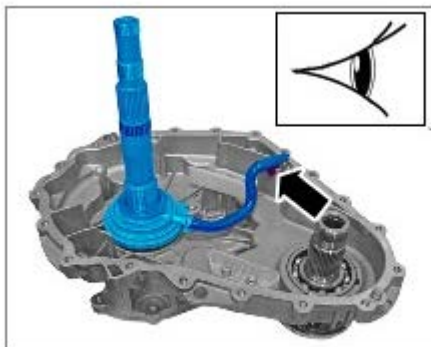


4.  CAUTION: Make sure that the chain is installed with the chain link facing down.


5. Apply a 2mm bead of sealant to one surface of the transfer case mating faces, as shown.




E159211



6. CAUTIONS:


 Make sure that the input shaft spacer is correctly located.

 The input shaft and fluid pump assembly must be supported and held in place by hand, until it is located securely into the clutch assembly.


Install the front half of the case.



E159212

7.  CAUTION: Care must be taken when turning the transfer case over. The transfer case halves must not be allowed to separate.

With assistance, release the transfer case and secure with it's transmission mating face down on a flat surface.

8.  CAUTION: Only tighten the bolts finger-tight at this stage.



E159191

9. Torque: 10 Nm



E159409

10. Torque: 35 Nm



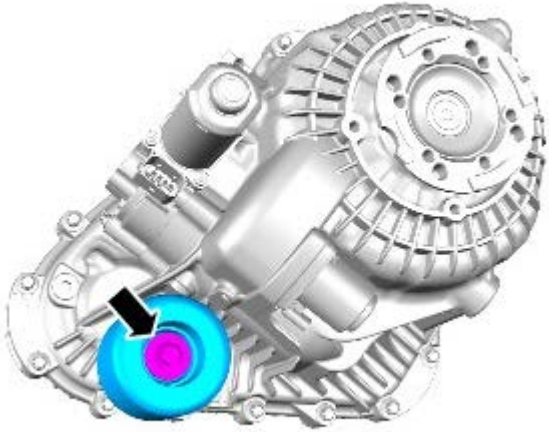
E159191

11. Torque: 35 Nm



E159190

12. Torque: 75 Nm



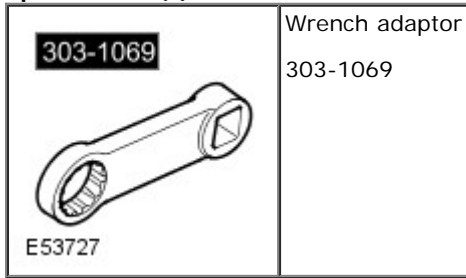
E159189

13. Refer to: [Transfer Case - TDV6 3.0L Diesel](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Installation).
Refer to: [Transfer Case - V6 S/C 3.0L Petrol](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, Installation).
14. Refer to: [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).

Transfer Case - Vehicles With: Twin Speed Transfer Case - Transfer Case TDV6 3.0L Diesel

Removal

Special Tool(s)




Removal

All vehicles



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).


2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

Vehicles with diesel particulate filter (DPF)

3. Remove the diesel particulate filter (DPF).
For additional information, refer to: [Diesel Particulate Filter \(DPF\)](#) (309-00A Exhaust System - TDV6 3.0L Diesel, Removal and Installation).

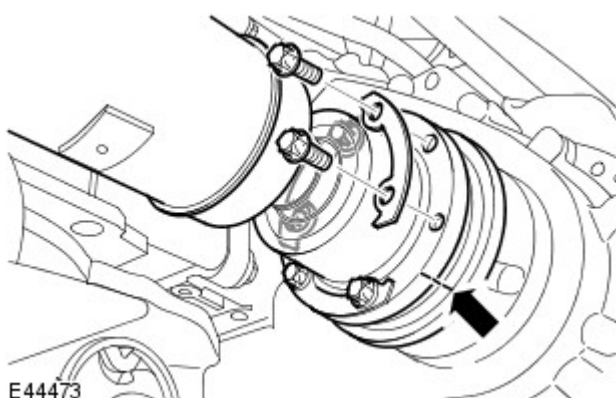
All vehicles


4.  **NOTE:** Do not carry out this step if the component removed for access only.

Drain the transfer case fluid.

For additional information, refer to: [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).

5. Remove the transmission crossmember.
For additional information, refer to: [Transmission Support Crossmember - TDV6 3.0L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation).



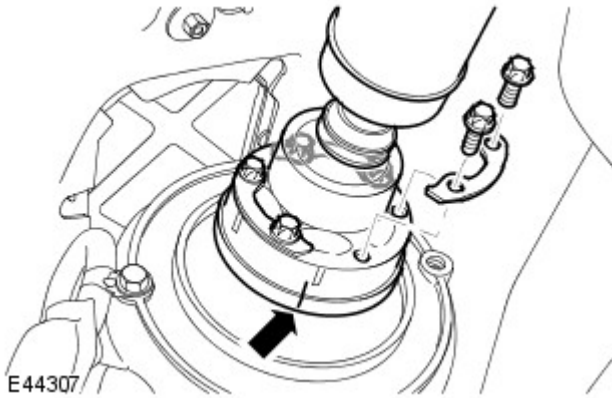
6.  **CAUTION:** To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.





NOTE: Mark the position of the driveshaft on the transmission flange.

Release the front driveshaft from the transfer case drive flange.

- Remove the 6 Torx bolts and washers, discard the bolts.
- Using a suitable tie strap, secure the driveshaft.

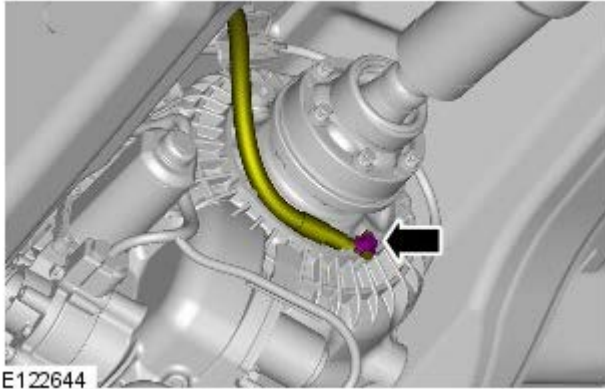


7.  **CAUTION:** To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

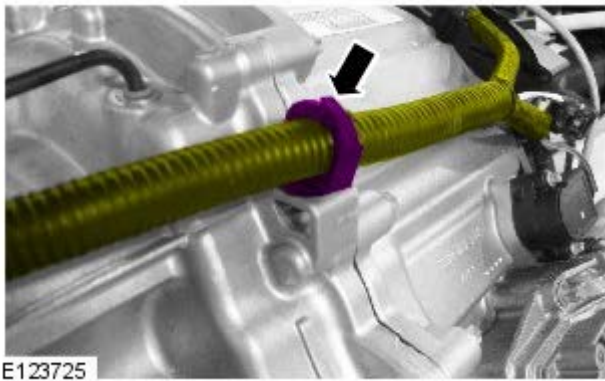
 **NOTE:** Mark the position of the driveshaft on the transmission flange.

Release the rear driveshaft from the transfer case drive flange.

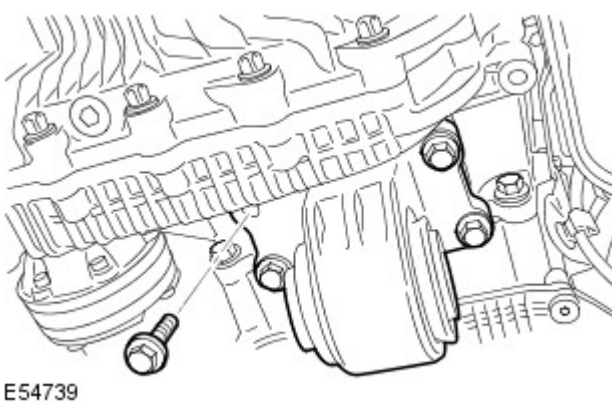
- Remove the 6 Torx bolts and washers.
- Using a suitable tie strap, secure the driveshaft.



8. Remove the ground cable from the transfer box.
- Remove the bolt.

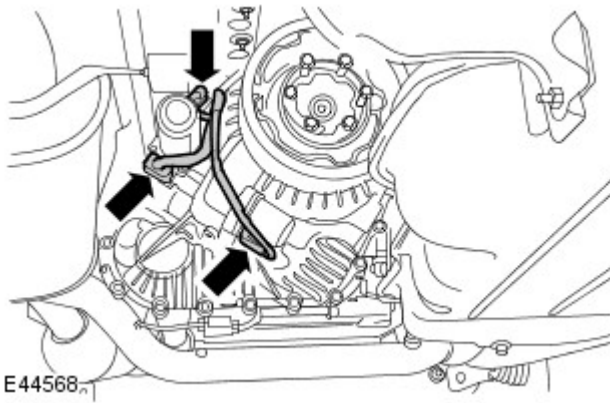


9. Release the transmission wiring harness retaining clip.

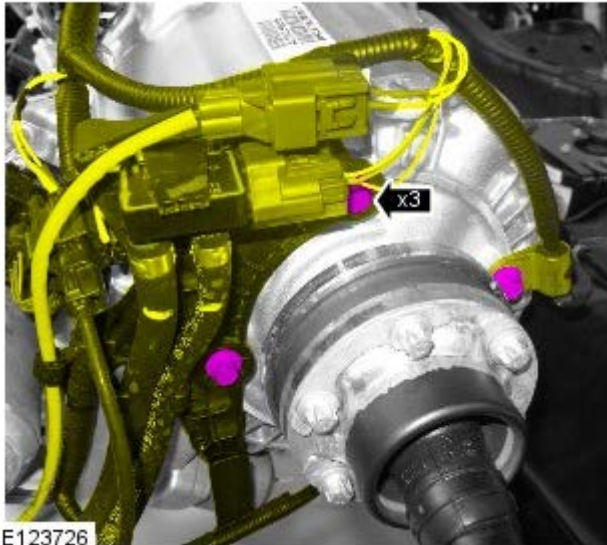



10. Remove the transmission support insulator.
- Remove the 4 bolts.

11. Disconnect the transfer case 3 electrical connectors.



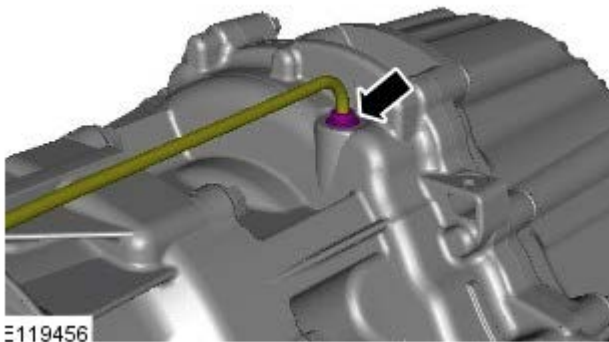
12. Release the wiring harness from the transfer case.
 - Remove the 3 bolts.



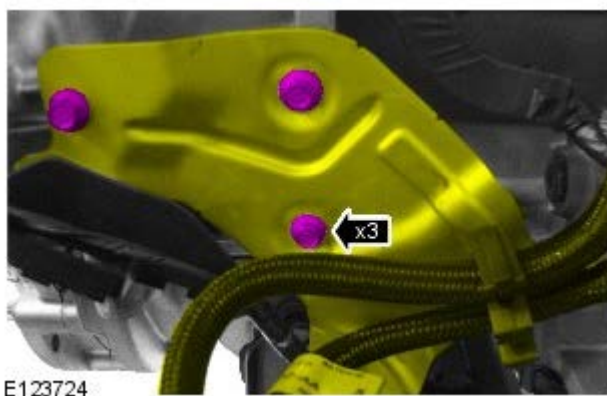
13.  CAUTION: Always plug any open connections to prevent contamination.

Disconnect the breather line.

- Depress the locking ring.



14. Release the fuel line support bracket.
 - Remove the 3 bolts.

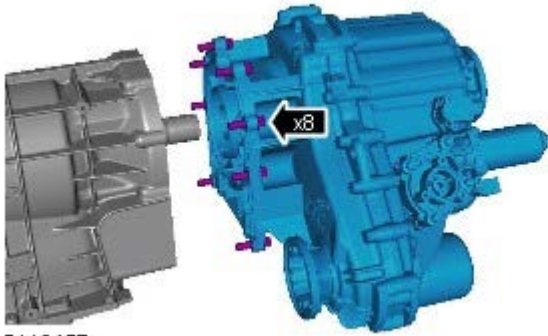


15. Support the transmission on a jack.

16.  **WARNING:** Secure the component to the transmission jack.

Using a transmission jack, support the transfer case.

17. With assistance, remove the transfer case.
- Remove the 8 bolts.
 - Move the fuel hose support bracket aside.
 - Remove the O-ring seal.

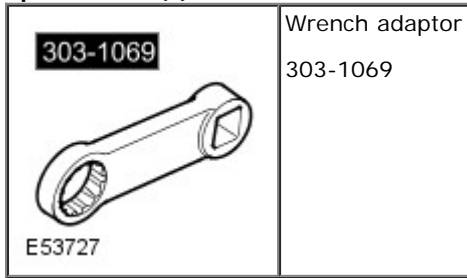


E119457

Transfer Case - Vehicles With: Twin Speed Transfer Case - Transfer Case V6 S/C 3.0L Petrol


Removal

Special Tool(s)



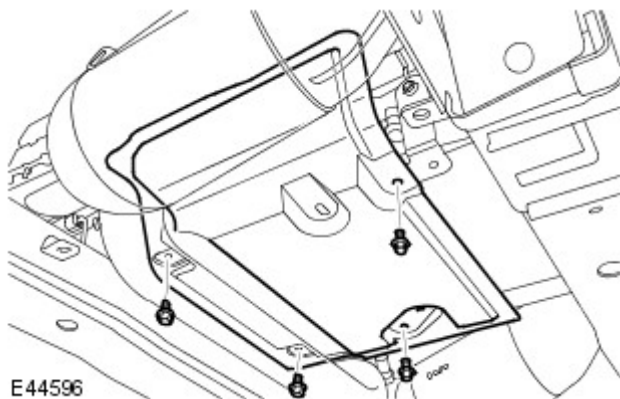
Removal

1. Disconnect the battery ground cable.
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

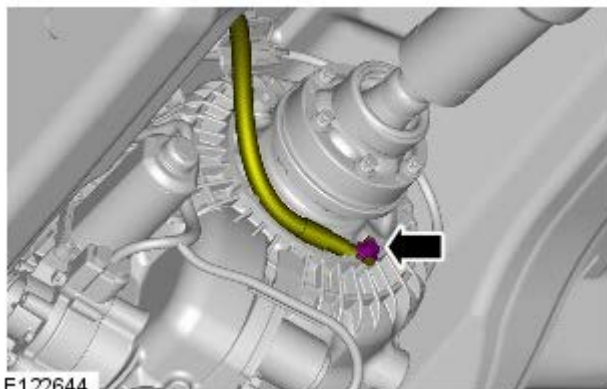
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.


Raise and support the vehicle.

3. Remove the transmission heat shield.
 - Remove the 4 bolts.



4. Remove the ground cable from the transfer box.
 - Remove the bolt.

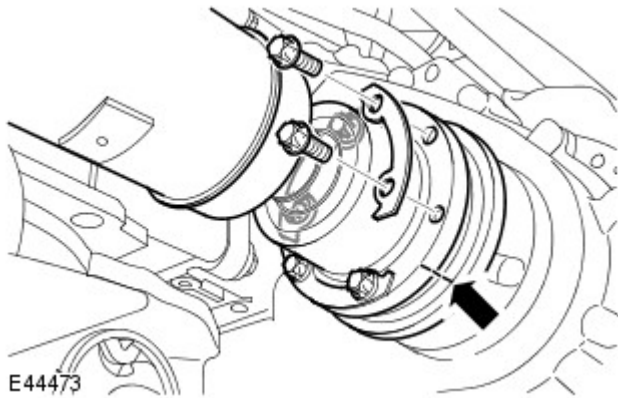


5.  **NOTE:** Do not carry out this step if the component removed for access only.


Drain the transfer case fluid.


For additional information, refer to: [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).

6. Remove the transmission crossmember.
For additional information, refer to: [Transmission Support](#)



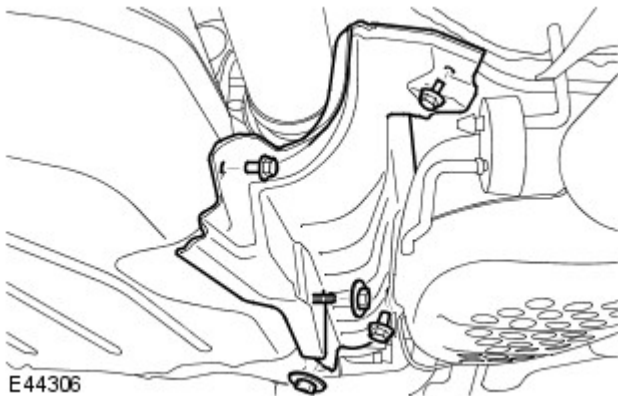
7. CAUTIONS:

 Mark the position of the driveshaft flange in relation to the drive pinion flange.

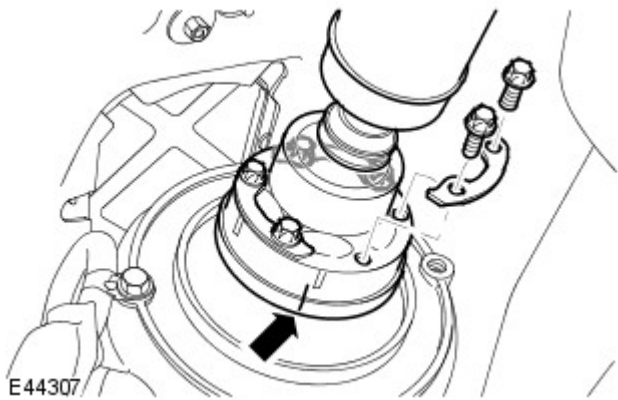
 To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

Release the front driveshaft from the transfer case drive flange.


- Remove the 6 Torx bolts and washers, discard the bolts.
- Using a suitable tie strap, reposition and secure the driveshaft to the exhaust system.




8. Remove the fuel tank heat shield.
- Remove the 3 bolts and 2 nuts.



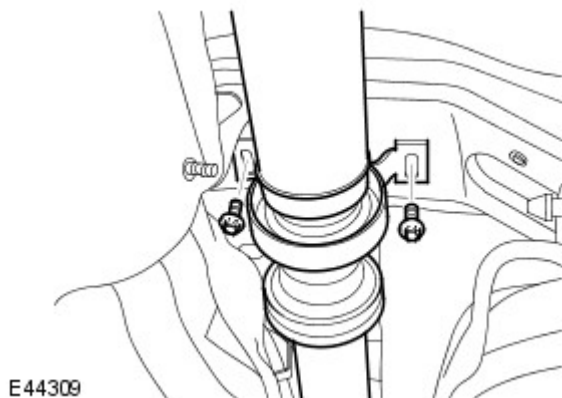
9. CAUTIONS:


 Mark the position of the driveshaft flange in relation to the drive pinion flange.

 To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

Release the rear driveshaft from the transfer case drive flange.

- Remove the 6 Torx bolts and washers.

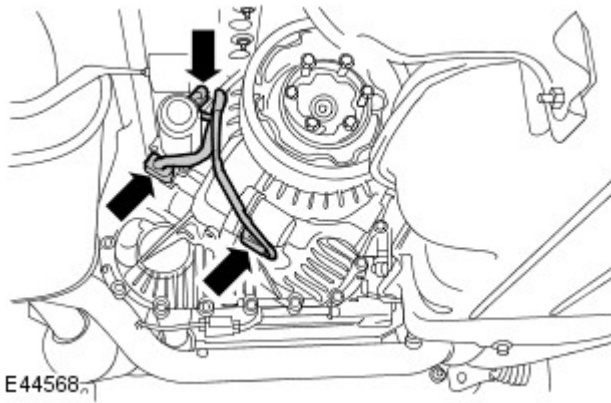


10.  CAUTION: To avoid damage to the joint or gaiter, do not allow the driveshaft to hang.

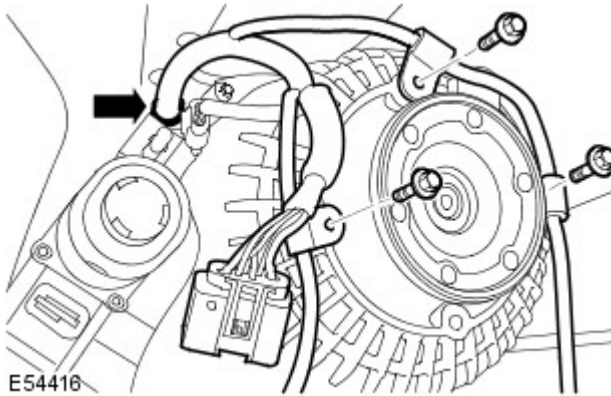
Release the driveshaft center bearing mount.


- Remove the 2 driveshaft center bearing mount bolts.
- Using suitable securing strap, reposition and support the driveshaft.

11. Disconnect the transfer case 3 electrical connectors.



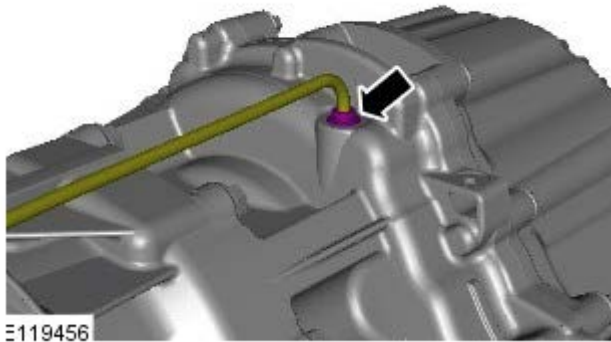
12. Release the wiring harness from the transfer case.
 - Remove the 3 bolts.
 - Release the clip.



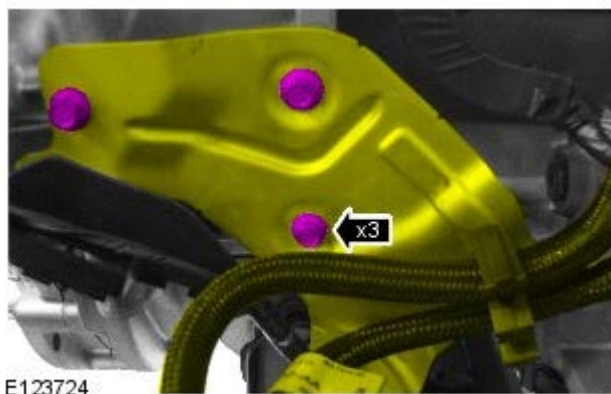
13.  **CAUTION:** Always plug any open connections to prevent contamination.

Disconnect the breather line.


- Depress the locking ring.



14. Release the fuel line support bracket.
 - Remove the 3 bolts.

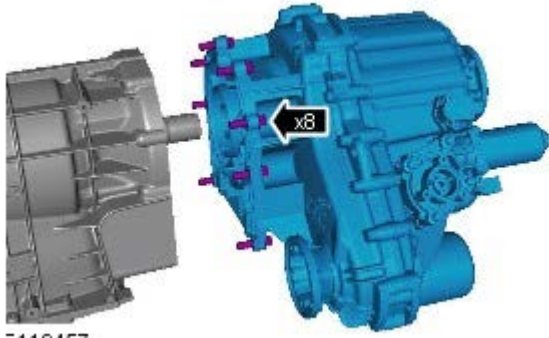


15. Support the transmission on a jack.

16.  **WARNING:** Secure the component to the transmission jack.

Using a transmission jack, support the transfer case.

17. With assistance, remove the transfer case.
 - Remove the 8 bolts.



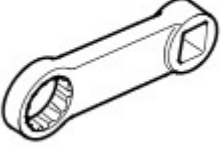
E119457

- Move the fuel hose support bracket aside.
- Remove the O-ring seal.

Transfer Case - Vehicles With: Twin Speed Transfer Case - Transfer Case TDV6 3.0L Diesel

Installation

Special Tool(s)

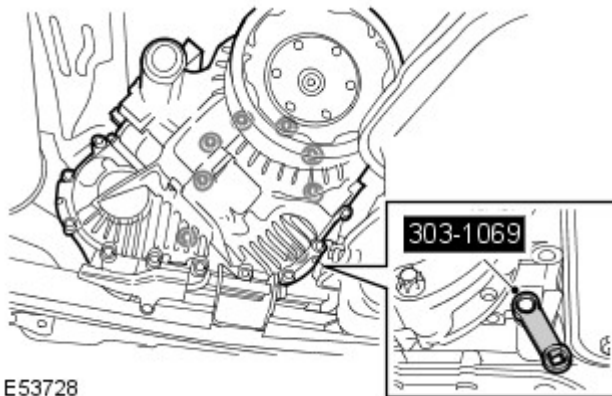
 <p>303-1069</p> <p>E53727</p>	<p>Wrench adaptor</p> <p>303-1069</p>
---	---------------------------------------

Installation

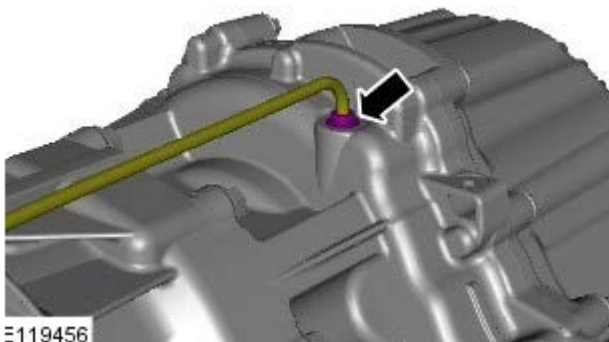


NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

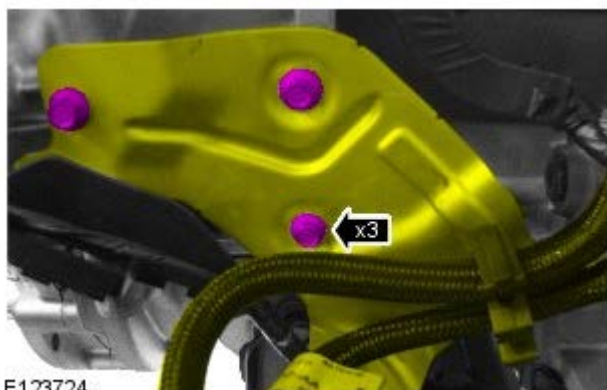
All vehicles



1. With assistance, install the transfer case.
 - Clean the component mating faces.
 - Lubricate input shaft splines with 'Weicon TL7391' grease.
 - Install the O-ring seal.
 - Align the fuel hose support bracket.
 - Using the special tool, tighten the bolts to 45 Nm (33 lb.ft).

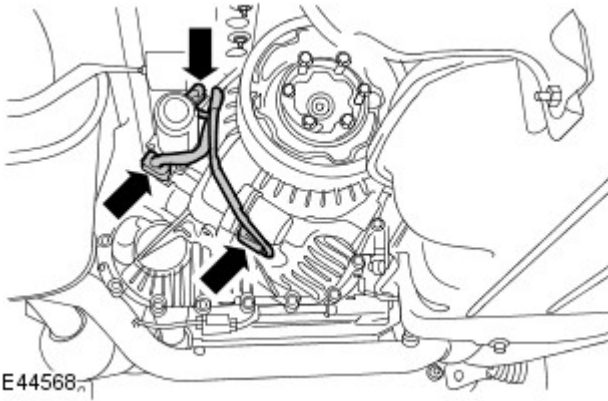


2. Connect the breather line.



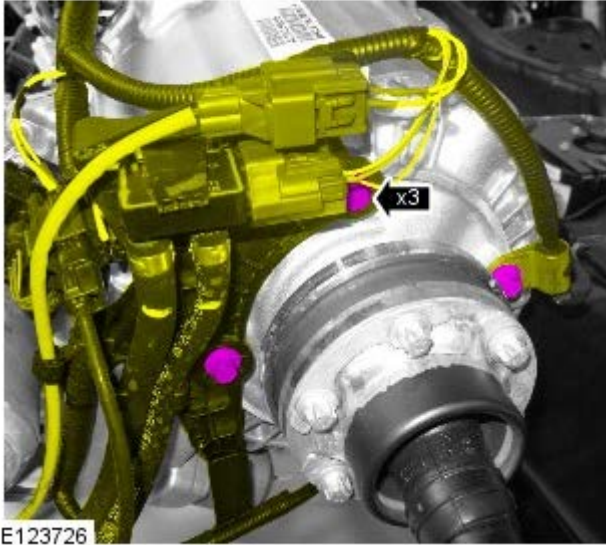
3. Secure the fuel line support bracket.
 - Tighten the bolts to 10 Nm (7 lb.ft).

4. Connect the electrical connectors.



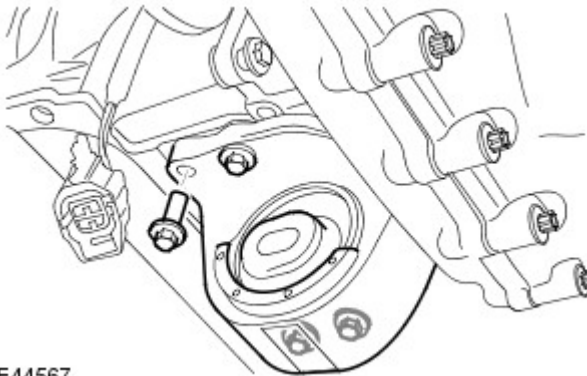
E44568

5. Secure the wiring harness to the transfer case.
 - Tighten the bolts to 25 Nm (18 lb.ft).



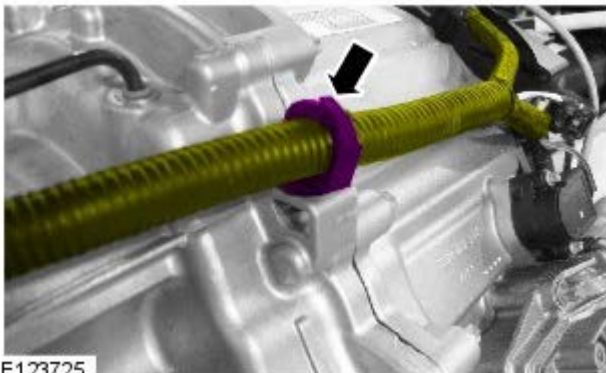
E123726

6. Install the transmission support insulator.
 - Clean the component mating faces.
 - Tighten the bolts to 60 Nm (44 lb.ft).



E44567

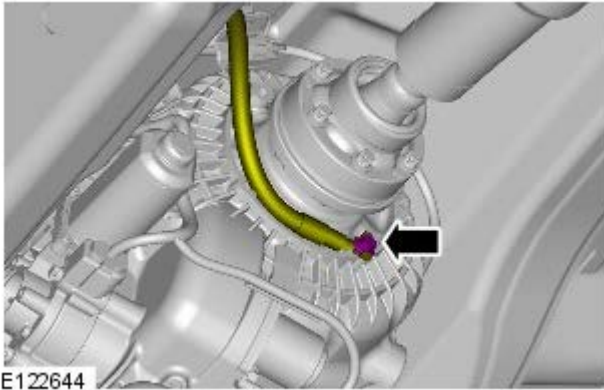
7. Secure the transmission wiring harness.



E123725

8. Secure the rear driveshaft to the transfer case drive flange.
 - Install the washers.
 - Tighten the Torx bolts to 55 Nm (40 lb.ft).

9. Secure the front driveshaft to the transfer case drive flange.
 - Install the washers.
 - Stage 1: Tighten the bolts to 45 Nm (33 lb.ft).
 - Stage 2: Tighten the bolts a further 90 degrees.
10. Install the ground cable to the transfer box.
 - Tighten the bolt to 15Nm (11 lb.ft).




11. Install the transmission crossmember.
For additional information, refer to: [Transmission Support Crossmember - TDV6 3.0L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation).

Vehicles with diesel particulate filter (DPF)

12. Install the DPF.
For additional information, refer to: [Diesel Particulate Filter \(DPF\)](#) (309-00A Exhaust System - TDV6 3.0L Diesel, Removal and Installation).


All vehicles

13.  **NOTE:** Do not carry out this step if the component removed for access only.

Fill the transfer case with the recommended fluid.
For additional information, refer to: [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).

14. Connect the battery ground cable.
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

15.


 **NOTE:** Do not carry out this step if the component removed for access only.

1. Connect the Land Rover approved diagnostic equipment.
2. Start the diagnostic service function **transfer case-transfer case replacement**.
3. Clear any Diagnostic Trouble Codes (DTCs) after calibration and check for correct operation.

Transfer Case - Vehicles With: Twin Speed Transfer Case - Transfer Case V6 S/C 3.0L Petrol

Installation

Special Tool(s)

	<p>Wrench adaptor 303-1069</p>
---	------------------------------------

Installation

1. With assistance, install the transfer case.
 - Clean the component mating faces.
 - Lubricate input shaft splines with 'Weicon TL7391' grease.
 - Install the O-ring seal.
 - Using the special tool, tighten the bolts to 45 Nm (33 lb.ft).
2. Connect the breather line.
3. Position the fuel line support bracket.
 - Tighten the bolts to 10 Nm (7 lb.ft).
 - Secure the fuel lines.
4. Connect the electrical connectors.
5. Secure the wiring harness to the transfer case.
 - Secure with the clip.
 - Tighten the bolts to 25 Nm (18 lb.ft).
6. Secure the front driveshaft to the transfer case drive flange.
 - Stage 1: Tighten the bolts to 45 Nm (33 lb.ft).
 - Stage 2: Tighten the bolts a further 90 degrees.
7. Secure the rear driveshaft to the transfer case drive flange.
 - Clean the component mating faces.
 - Tighten the Torx bolts to 55 Nm (40 lb.ft).
8. **CAUTIONS:**



Align the driveshaft center bearing mount by moving the floating front section of the shaft backward or forwards until the bolt holes in the mount align with the holes in the chassis.




Make sure the center bearing mount is not under tension.

Install the driveshaft center bearing mount bolts.

- Align the center bearing mount.
 - Tighten the driveshaft center bearing retaining bolts to 30 Nm (22 lb.ft).
9. Install the fuel tank heat shield.
 - Tighten the bolts to 6 Nm (4 lb.ft).
 - Tighten the nuts to 3 Nm (2 lb.ft).
 10. Install the ground cable to the transfer box.
 - Tighten the bolt to 15Nm (11 lb.ft).
 11. Install the transmission heat shield.
 - Tighten the bolts to 10 Nm (7 lb.ft).

12. Install the transmission crossmember.
For additional information, refer to: [Transmission Support Crossmember - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).

13.  NOTE: Do not carry out this step if the component removed for access only.

Fill the transfer case with the recommended fluid.
For additional information, refer to: [Transfer Case Draining and Filling](#) (308-07C Transfer Case - Vehicles With: Twin Speed Transfer Case, General Procedures).

14. Connect the battery ground cable.
For additional information, refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

- 15.



NOTE: Do not carry out this step if the component removed for access only.

1. Connect the Land Rover approved diagnostic equipment.
2. Start the diagnostic service function **transfer case-transfer case replacement**.
3. Clear any Diagnostic Trouble Codes (DTCs) after calibration and check for correct operation.

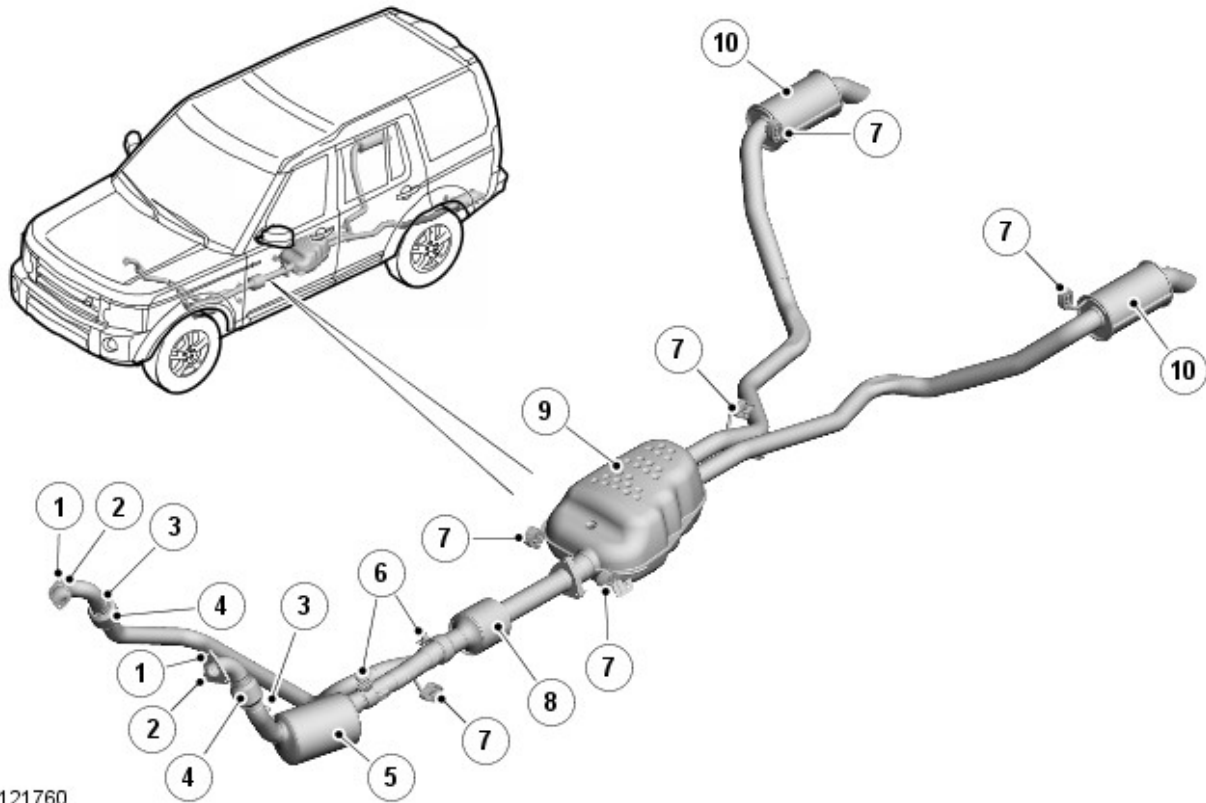
Exhaust System - TDV6 3.0L Diesel -

Description	Nm	lb-ft	lb -in
Turbocharger to catalytic converter retaining bolts	28	21	-
Catalytic converter clamp without diesel particulate filter (DPF)	48	35	-
Catalytic converter clamp with DPF	48	35	-
DPF to front muffler securing strap nuts	23	17	-
Catalytic converter temperature sensors	35	26	-
DPF temperature sensor	35	26	-
Heated oxygen sensor (HO2S)	48	35	-
DPF heat shield retaining bolts	10	7	-
Service clamp	48	35	-

Exhaust System - TDV6 3.0L Diesel - Exhaust System

Description and Operation

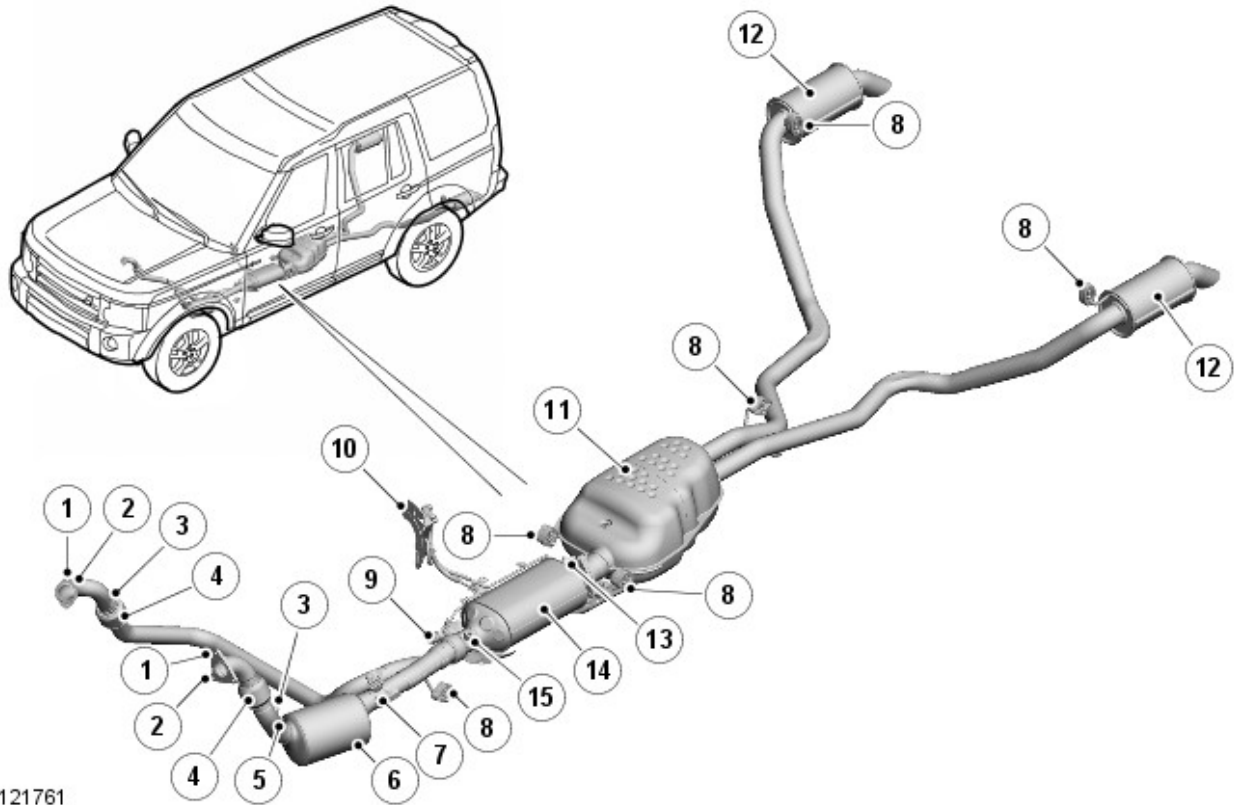
3.0L TdV6 EXHAUST SYSTEM COMPONENT LOCATION - WITHOUT DIESEL PARTICULATE FILTER



E121760

Item	Part Number	Description
1	-	Bolt (5 off)
2	-	Gasket
3	-	Flexible coupling
4	-	Heated Oxygen Sensor (HO2S) mounting boss
5	-	Catalytic converter
6	-	Clamp
7	-	Mounting rubber (6 off)
8	-	Catalytic converter
9	-	Silencer - Center
10	-	Silencer - Rear

3.0L TdV6 EXHAUST SYSTEM COMPONENT LOCATION - WITH DIESEL PARTICULATE FILTER (IF FITTED)



E121761

Item	Part Number	Description
1	-	Bolt (5 off)
2	-	Gasket
3	-	Temperature sensor mounting boss
4	-	Flexible coupling
5	-	HO2S mounting boss
6	-	Catalytic converter
7	-	Clamp
8	-	Mounting rubber (6 off)
9	-	Clamp
10	-	Differential pressure sensor
11	-	Silencer - Center
12	-	Silencer - Rear
13	-	Temperature sensor mounting boss
14	-	Diesel Particulate Filter (DPF)
15	-	Temperature sensor mounting boss

OVERVIEW

The 3.0L V6 TdV6 exhaust system is fabricated from stainless steel and is supplied as four separate assemblies; 2 front sections, one incorporating a catalytic converter, a connecting section or Diesel Particulate Filter (DPF) and a rear section incorporating a centre silencer and two rear silencers.

The system is attached to the underside of the body with 6 mounting rubbers which are located on mild steel hanger bars that are welded to the system. The mounting rubbers locate on corresponding hangers which are welded to the underside of the vehicle body.

The system has service repair items available. Indentations in the rear section between the center and the rear silencers show the cut points for the service replacement rear silencers or front section. When a service repair section is used, the joint is connected using a sleeve and two clamps to connect the pipes at the cut points.

Two variants of the exhaust system are available; a non DPF system and a system incorporating a DPF. The DPF is required to comply with EU5 emission regulations



CAUTION: The use of bio-fuels can seriously contaminate and destroy the coatings used on the catalytic converter. The DPF and the catalytic converter can become irreversibly contaminated if non-specified oils or fuels are used. This will result in the vehicle being unable to regenerate the DPF, becoming non-compliant with tailpipe emission regulations and replacement of the catalytic converter and DPF will be required.

If the vehicle is waded in deep water and the engine is stopped with the tailpipes submerged, the water, which can enter the system, can also contaminate both the DPF and the catalytic converter. This again can result in catalytic converter damage and damaging the ability for the DPF to regenerate therefore requiring both components to be

replaced.

DESCRIPTION

FRONT SECTION

The front section comprises 1 catalytic converter for the LH (left-hand) bank of cylinders. The catalytic converter has a welded inlet pipe which is curved through 90 degrees. The RH (right-hand) bank also has a curved inlet pipe which connects to a pipe to the DPF (if fitted) or catalytic converter assembly (vehicles without DPF).

The outer end of each inlet pipe is fitted with a flange which mates with the turbocharger for each bank of cylinders. Three bolts in the LH flange and two bolts in the RH flange locate in threaded holes in the mating flange on the turbocharger. Each flange is sealed with a gasket. The inlet pipes are 55 mm (2.16 in) diameter and are fitted with a flexible coupling.

The base of the catalytic converter has a connection with the LH bank outlet pipe and is secured with a clamp. The outlet connection from the LH bank catalytic converter and the outlet connection from the RH bank, merge into one single pipe which then connects to the DPF (if fitted) or catalytic converter assembly (vehicles without DPF).

The DPF (if fitted) or catalytic converter assembly (vehicles without DPF) is connected at its rearward end to the center silencer with a flange connection with the rear exhaust section. Three studs in the DPF (if fitted) or catalytic converter assembly (vehicles without DPF) mate with the center silencer rear section flange and are secured with 3 nuts and sealed with a gasket.

REAR SECTION

The centre silencer comprises two pressed stainless steel shells which are welded together to give a capacity of 25.2 liters (1537 in³). The silencer contains baffles and perforated tubes which reduce noise as the exhaust gases pass through the silencer.

Hanger bars are welded to the front right hand side and left hand side of the silencer and provide for the location of mounting rubbers. The silencer has two 60 mm (2.3 in) diameter outlet pipes, with a 1.5 mm (0.06 in) wall thickness, which are curved to pass around the rear suspension components. Each outlet pipe terminates in a welded joint with the rear silencers. The outlet pipes have a hanger bar which provides for the location of a mounting rubber. A hanger bar is welded to the front face of each rear silencer and provides for the location of a mounting rubber.

The silencer is a circular fabrication with a baffle tube which is surrounded with glass fiber to provide further noise suppression. Each silencer has a capacity of 2.7 liters (165 in³). The silencers each have an outlet pipe which is 65 mm (2.55 in) diameter, with a wall thickness of 1.2 mm (0.05 in). Each outlet pipe is curved downwards to direct exhaust gasses away from the rear of the vehicle.

CATALYTIC CONVERTER

The oxidizing catalytic converter is fitted in the front section of the LH bank outlet pipe from the turbocharger, after the pre-catalyst exhaust gas temperature sensor (vehicles with DPF only) and the Heated Oxygen Sensor (HO2S).



NOTE: On vehicles fitted with a DPF: The pre and post catalyst exhaust gas temperature sensors are used by the engine management system to monitor the DPF for regeneration purposes.

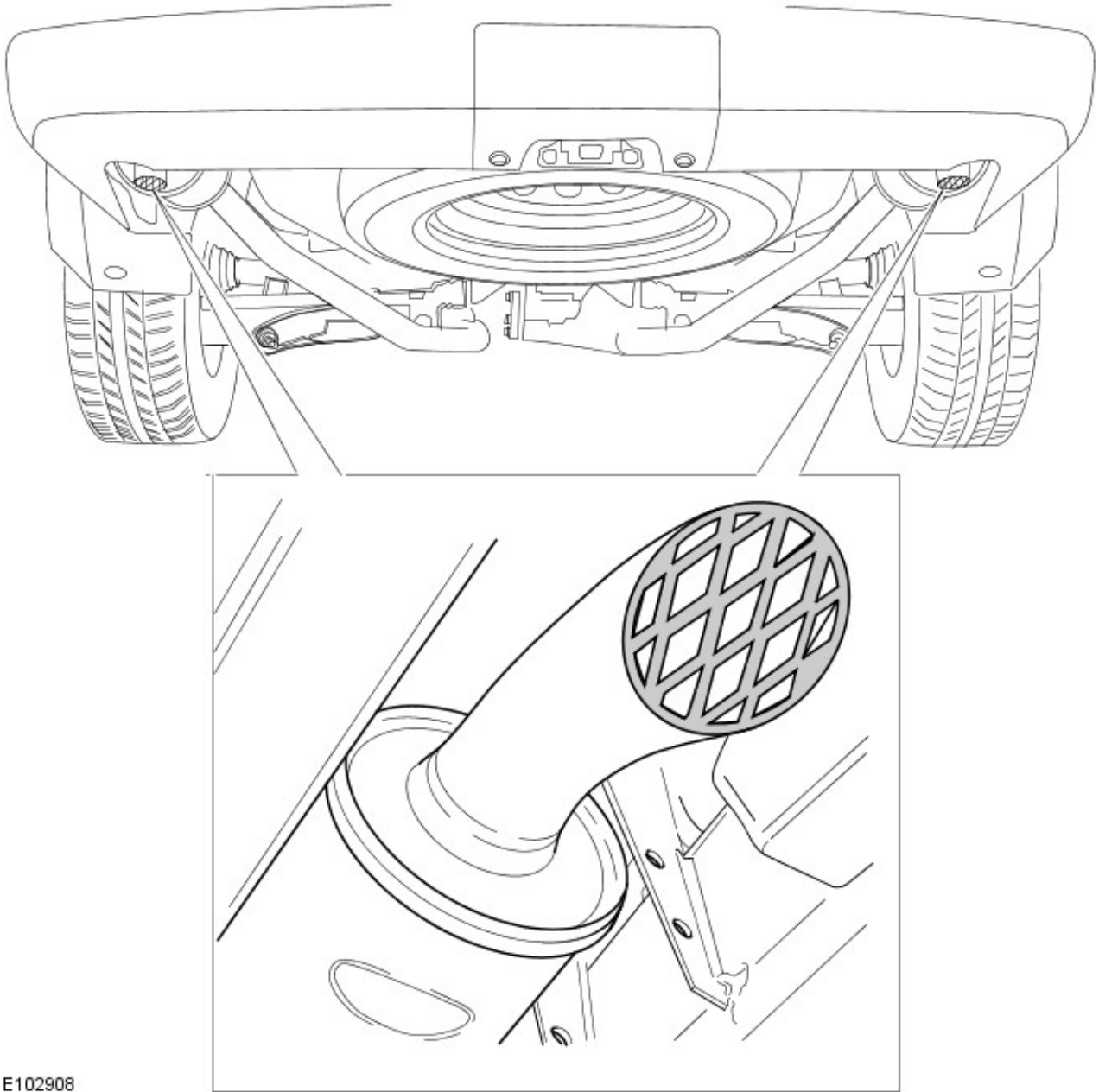
On vehicles without a DPF, a second smaller catalytic converter is fitted in place of the DPF to further improve emissions.

The engine management system provides accurately metered quantities of fuel to the combustion chambers to ensure the most efficient use of fuel and to minimise the exhaust emissions. To further reduce the carbon monoxide and hydrocarbons content of the exhaust gases, a catalytic converter is integrated into the LH bank front pipe of the exhaust system. In the catalytic converter the exhaust gases are passed through honeycombed ceramic elements coated with a special surface treatment called 'washcoat'. The washcoat increases the surface area of the ceramic elements by a factor of approximately 7000. On top of the washcoat is a coating containing platinum and palladium, which are the active constituents for converting harmful emissions into inert by-products. The platinum and palladium add oxygen to the carbon monoxide and the hydrocarbons in the exhaust gases, to convert them into carbon dioxide and water respectively.

Exhaust System - TDV6 3.0L Diesel - Exhaust System

Description and Operation

Exhaust pipe anti-tamper grill

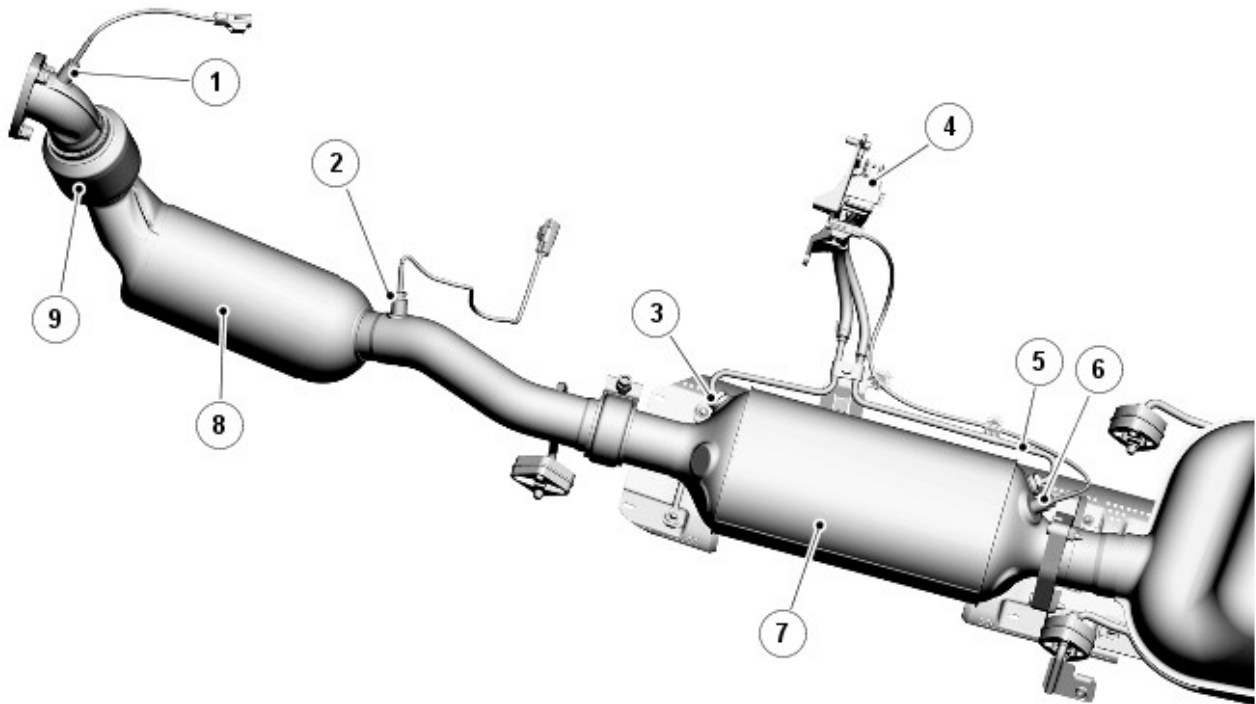


E102908

To prevent the engine being stalled by forcefully restricting the flow of exhaust gases, an anti-tamper grill is fitted to the end of each exhaust tail-pipe to prevent an obstruction being inserted.

Exhaust System - TDV6 3.0L Diesel - Diesel Particulate Filter - Component Location

Description and Operation

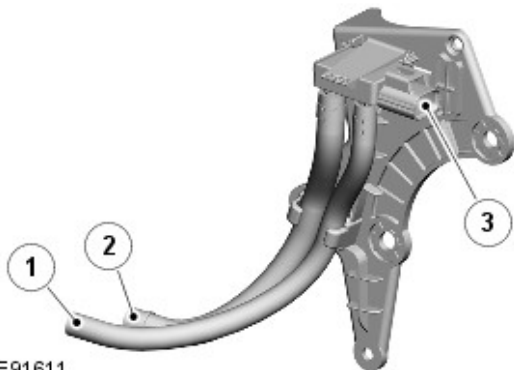


E91610

Item Description

- 1 Exhaust gas temperature sensor (pre catalyst)
- 2 Exhaust gas temperature sensor (post catalyst)
- 3 High pressure sensor pipe
- 4 Differential pressure sensor
- 5 Low pressure sensor pipe
- 6 Exhaust gas temperature sensor (Post DPF)
- 7 Diesel particulate filter
- 8 Catalytic converter
- 9 Flexible coupling

COMPONENT LOCATION - DIFFERENTIAL PRESSURE SENSOR



E91611

Item Description

- 1 Low pressure connection
- 2 High pressure connection
- 3 Electrical connector

Exhaust System - TDV6 3.0L Diesel - Diesel Particulate Filter - System Operation and Component Description

Description and Operation

System Operation

DIESEL PARTICULATE FILTER (DPF)

Two processes are used to regenerate the DPF; passive and active.

Passive Regeneration

Passive regeneration requires no special engine management intervention and occurs during normal engine operation. The passive regeneration involves a slow conversion of the particulate matter deposited in the DPF into carbon dioxide. This process occurs when the DPF temperature exceeds 250°C (482°F) and is a continuous process when the vehicle is being driven at higher engine loads and speeds.

During passive regeneration, only a portion of the particulate matter is converted into carbon dioxide. This is because the chemical reaction, which utilises nitrogen dioxide, is slower than the rate of engine production of particulate matter and is effective from 250°C (482°F).

Above 580°C the conversion efficiency of the particulates into carbon dioxide rapidly increases. These temperatures are generally only be achieved using the active regeneration process.

Active Regeneration

Active regeneration starts when the particulate loading of the DPF reaches a threshold as monitored or determined by the DPF control software. The threshold calculation is based on driving style, distance travelled and back pressure signals from the differential pressure sensor.

Active regeneration generally occurs every 250 miles (400 km) although this is dependant on how the vehicle is driven. For example, if the vehicle is driven at low loads in urban traffic regularly, active regeneration will occur more often. This is due to the rapid build-up of particulates in the DPF than if the vehicle is driven at high speeds when passive regeneration will have occurred.

The DPF software incorporates a mileage trigger which is used as back-up for active regeneration. If active regeneration has not been initiated by a back pressure signal from the differential pressure sensor, regeneration is requested based on distance travelled.

Active regeneration of the DPF is commenced when the temperature of the DPF is increased to the combustion temperature of the particles. The DPF temperature is raised by increasing the exhaust gas temperature. This is achieved by introducing post-injection of fuel after the pilot and main fuel injections have occurred.

It is determined by the DPF software monitoring the signals from the two DPF temperature sensors to establish the temperature of the DPF. Depending on the DPF temperature, the DPF software requests the [ECM \(engine control module\)](#) to perform either one or two post-injections of fuel:

- The first post-injection of fuel retards combustion inside the cylinder which increases the temperature of the exhaust gas.
- The second post-injection of fuel is injected late in the power stroke cycle. The fuel partly combusts in the cylinder, but some unburnt fuel also passes into the exhaust where it creates an exothermic event within the catalytic converter, further increasing the temperature of the DPF.

The active regeneration process takes up to 20 minutes to complete. The first phase increases the DPF temperature to 500°C (932°F). The second phase further increases the DPF temperature to 600°C (1112°F) which is the optimum temperature for particle combustion. This temperature is then maintained for 15-20 minutes to ensure complete oxidation of the particles within the DPF. The oxidation process converts the carbon particles to carbon dioxide.

The active regeneration temperature of the DPF is closely monitored by the DPF software to maintain a target temperature of 600°C (1112°F) at the DPF inlet. The temperature control ensures that the temperatures do not exceed the operational limits of the turbocharger and the catalytic converter. The turbocharger inlet temperature must not exceed 830°C (1526°F) and the catalytic converter brick temperature must not exceed 800°C (1472°F) and the exit temperature must remain below 875°C (1382°F).

During the active regeneration process the following [ECM](#) controlled events occur:

- The turbocharger is maintained in the fully open position. This minimizes heat transmission from the exhaust gas to the turbocharger and reduces the rate of exhaust gas flow allowing optimum heating of the DPF. If the driver demands an increase in engine torque, the turbocharger will respond by closing the vanes as necessary.
- The throttle is closed as this assists in increasing the exhaust gas temperature and reduces the rate of exhaust gas flow which has the effect of reducing the time for the DPF to reach the optimum temperature.
- The [EGR \(exhaust gas recirculation\)](#) valve is closed. The use of [EGR](#) decreases the exhaust gas temperature and therefore prevents the optimum DPF temperature being achieved.

If, due to vehicle usage and/or driving style, the active regeneration process cannot take place or is unable to regenerate the DPF, the dealer can force regenerate the DPF. This is achieved by either driving the vehicle until the engine is at its normal operating temperature and then driving for a further 20 minutes at speeds of not less

than 30 mph (48 km/h).

DPF Control

The DPF requires constant monitoring to ensure that it is operating at its optimum efficiency and does not become blocked. The **ECM** contains DPF software which controls the monitoring and operation of the DPF system and also monitors other vehicle data to determine regeneration periods and service intervals.

The DPF software can be divided into three separate control software modules; a DPF supervisor module, a DPF fuel management module and a DPF air management module.

These three modules are controlled by a fourth software module known as the DPF co-ordinator module. The co-ordinator module manages the operation of the other modules when an active regeneration is requested.

DPF Fuel Management Module

The DPF fuel management module controls the following functions:

- Timing and quantity of the four split injections per stroke (pilot, main and two post injections).
- Injection pressure and the transition between the three different calibration levels of injection.

The above functions are dependant on the condition of the catalytic converter and the DPF.

The controlled injection determines the required injection level in addition to measuring the activity of the catalytic converter and the DPF. The fuel management calculates the quantity and timing for the four split injections, for each of the three calibration levels for injection pressure, and also manages the transition between the levels.

The two post injections are required to separate the functionality of increasing in-cylinder gas temperatures and the production of hydrocarbons. The first post injection is used to generate the higher in-cylinder gas temperature while simultaneously retaining the same engine torque output produced during normal (non-regeneration) engine operation. The second post injection is used to generate hydrocarbons by allowing unburnt fuel into the catalytic converter without producing increased engine torque.

DPF Air Management Module

The DPF air management module controls the following functions:

- **EGR** control
- Turbocharger boost pressure control
- Intake air temperature and pressure control.

During active regeneration, the **EGR** operation is disabled -except for overrun conditions - and the closed-loop activation of the turbocharger boost controller is calculated. The air management module controls the air in the intake manifold to a predetermined level of pressure and temperature. This control is required to achieve the correct in-cylinder conditions for stable and robust combustion of the post injected fuel.

The module controls the intake air temperature by actuating the **EGR** throttle and by adjustment of the turbocharger boost pressure control.

DPF Co-ordinator Module

The DPF co-ordinator module reacts to a regeneration request from the supervisor module by initiating and co-ordinating the following DPF regeneration requests:

- **EGR** cut-off - except for overrun condition
- Turbocharger boost pressure control
- Engine load increase
- Control of air pressure and temperature in the intake manifold
- Fuel injection control.

When the supervisor module issues a regeneration request, the co-ordinator module requests **EGR** cut-off and a regeneration specific turbocharger boost pressure control. It then waits for a feedback signal from the **EGR** system confirming that the **EGR** valve is closed.

When the **EGR** valve is closed, the co-ordinator module initiates requests to increase engine load by controlling the intake air temperature and pressure.

Once confirmation is received that intake conditions are controlled or a calibration time has expired, the co-ordinator module then changes to a state awaiting an accelerator pedal release manoeuvre from the driver. If this occurs or a calibration time has expired, the co-ordinator module generates a request to control fuel injections to increase exhaust gas temperature.

DIFFERENTIAL PRESSURE SENSOR

As the amount of particulates trapped by the DPF increases, the pressure at the inlet side of the DPF increases in comparison to the DPF outlet. The DPF software uses this comparison, in conjunction with other data, to calculate the accumulated amount of trapped particulates.

By measuring the pressure difference between the DPF inlet and outlet and the DPF temperature, the DPF software can determine if the DPF is becoming blocked and requires regeneration.

Component Description

DIESEL PARTICULATE FILTER (DPF)

The DPF system reduces diesel particulate emissions to negligible levels to meet current European stage 5 emission standards.

The particulate emissions are the black fumes emitted from the diesel engine under certain load conditions. The emissions are a complex mixture of solid and liquid components with the majority of the particulates being carbon microspheres on which hydrocarbons from the engine's fuel and lubricant condense.

The DPF system comprises the following components:

- Diesel Particulate Filter (DPF)
- DPF control software incorporated in the [ECM](#)
- Differential pressure sensor.

The DPF is located in the exhaust system, downstream of the catalytic converter. Its function is to trap particulate matter in the exhaust gases leaving the engine. A major feature of the DPF is its ability for regeneration. Regeneration is the burning of particulates trapped by the filter to prevent obstruction to the free flow of exhaust gasses. The regeneration process takes place at calculated intervals and is not noticeable by the driver of the vehicle.

Regeneration is most important, since an overfilled filter can damage the engine through excessive exhaust back pressure and can itself be damaged or destroyed. The material trapped in the filter is in the most part carbon particles with some absorbed hydrocarbons.

The DPF uses a filter technology based on a filter with a catalytic coating. The DPF is made from silicon carbide housed in a steel container and has excellent thermal shock resistance and thermal conductivity properties. The DPF is designed for the engine's operating requirements to maintain the optimum back pressure requirements.

The porous surface of the filter consists of thousands of small parallel channels positioned in the longitudinal direction of the exhaust system. Adjacent channels in the filter are alternately plugged at the end. This design forces the exhaust gasses to flow through the porous filter walls, which act as the filter medium. Particulate matter which are too big to pass through the porous surface are collected and stored in the channels.

The collected particulate matter, if not removed, can create an obstruction to exhaust gas flow. The stored particles are removed by a regeneration process which incinerates the particles.

Diesel Particulate Filter Temperature Sensors

The sensors measure the temperature of exhaust gas exiting the turbocharger and before it passes through the DPF and provides the information needed to calculate the DPF temperature.

The information is used, in conjunction with other data, to estimate the amount of accumulated particulates and to control the DPF temperature.

Instrument Cluster (IC) Indications

For drivers who make regular short journeys at low speeds, it may not be possible to efficiently regenerate the DPF. In this case, the DPF software will detect a blockage of the DPF from signals from the differential pressure sensor and will alert the driver as follows:

The driver will be alerted to this condition by a message 'EXHAUST FILTER NEARLY FULL'. See 'HANDBOOK'. As detailed in the Owners Handbook, the driver should drive the vehicle until the engine is at its normal operating temperature and then drive for a further 20 minutes at speeds of not less than 30 mph (48 km/h). Successful regeneration of the DPF is indicated to the driver by the 'EXHAUST FILTER NEARLY FULL' message no longer being displayed. If the DPF software detects that the DPF is still blocked, the message will continue to be displayed or an additional message 'EXHAUST FILTER FULL VISIT DEALER' will be displayed. The driver should take the vehicle to an authorized dealer to have the DPF force regenerated using an approved diagnostic system.

Diesel Particulate Filter Side Effects

The following section details some side effects caused by the active regeneration process.

Engine Oil Dilution

Engine oil dilution can occur due to small amounts of fuel entering the engine crankcase during the post-injection phases. This has made it necessary to introduce a calculation based on driving style to reduce oil service intervals if necessary. The driver is alerted to the oil service by a message in the instrument cluster.

The DPF software monitors the driving style and the frequency of the active regeneration and duration. Using this information a calculation can be made on the engine oil dilution. When the DPF software calculates the engine oil dilution has reached a predetermined threshold (fuel being 7% of engine oil volume) a service message is displayed in the IC.

Depending on driving style, some vehicles may require an oil service before the designated interval. If a service message is displayed, the vehicle will be required have a full service and the service interval counter will be reset.

Fuel consumption

During the active regeneration process of the DPF, there will be an increase in fuel consumption.

However, because active regeneration occurs infrequently, the overall effect on fuel consumption is

approximately 2%. The additional fuel used during the active regeneration process is accounted for in the instantaneous and average fuel consumption displays in the instrument cluster.

DIFFERENTIAL PRESSURE SENSOR

The differential pressure sensor is used by the DPF software to monitor the condition of the DPF. Two pipe connections on the sensor are connected by pipes to the inlet and outlet ends of the DPF. The pipes allow the sensor to measure the inlet and outlet pressures of the DPF.

Aftermarket DPF cleaning fluids

Recent years have seen the introduction of 'DPF cleaning fluids' to (non JLR approved) aftermarket sales. These products claim to reduce the temperature that the soot reaction takes place. It should be stressed that, during the vehicle development activity, every effort is made to generate DPF regeneration temperatures whilst maintaining safe levels for all other vehicle components. Unauthorized use of the aftermarket fluids produces a significant risk to soot burn rates and DPF peak temperatures real world driving conditions. These fluids are not authorised for JLR use.

Exhaust System - TDV6 3.0L Diesel - Diesel Particulate Filter

Diagnosis and Testing

Principle of Operation

For a detailed description of the exhaust system, refer to the relevant Description and Operation section of the workshop manual.

REFER to: Exhaust System (309-00B, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests

1. Verify the customer concern
2. Visually inspect for obvious signs of mechanical or electrical damage

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Diesel particulate filter • Differential pressure sensor hoses • Differential pressure sensor metal pipes and unions • Differential pressure sensor mounting position integrity • Metal fatigue • Joints • Mountings • Clearance around components • Damaged diesel particulate filter 	<ul style="list-style-type: none"> • Differential pressure sensor • Differential pressure sensor connector • Differential pressure sensor wiring harness • Electrical connector(s) • Sensor(s) • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for DTCs and refer to the DTC Index

Symptom Chart

Symptom	Possible Causes	Action
Amber warning message on instrument cluster - DPF FULL REFER TO HANDBOOK -	<ul style="list-style-type: none"> • Blocked regeneration • Customer driving routine does not allow the system to clean the particulate filter 	If DTC is P2459-65 or AMBER DPF FULL REFER TO HANDBOOK message is displayed with no other reported messages. No repair is required, if the vehicle is driven on a highway AS DIRECTED IN THE HANDBOOK then the light will be extinguished and the system self healed, nothing more than this is required
Lack of power	<ul style="list-style-type: none"> • Air intake system fault • Restricted exhaust system • Low fuel pressure • Exhaust Gas Recirculation (EGR) valve(s) fault • Turbocharger fault • Diesel Particulate filter fault 	Check the air intake system. Check for a blocked catalytic converter or muffler, install new components as necessary. Check the fuel pressure. For EGR and turbocharger tests, refer to the relevant section of the workshop manual

DTC Index

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component



Generic scan tools may not read the codes listed, or may read only 5-digit codes. Match the 5 digits from the scan tool to the first 5 digits of the 7-digit code listed to identify the fault (the last 2 digits give extra information read by the manufacturer approved diagnostic system)



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests



Inspect connectors for signs of water ingress, and pins for damage and/or corrosion



If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals

DTC	Description	Possible Cause	Action
P0030-11	HO2S Heater Control Circuit (Bank 1, Sensor 1) - circuit short to ground	<ul style="list-style-type: none"> • Harness fault - Universal Heated Exhaust Gas Oxygen sensor heater control circuit short to ground • Universal Heated Exhaust Gas Oxygen sensor internal fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Oxygen Sensor (O2S) Heater Duty Cycle Bank 1 Sensor 1 (0x03A1). Refer to the electrical circuit diagrams and check the Universal Heated Exhaust Gas Oxygen sensor heater control (heater ground) circuit for short to ground. This circuit runs from the Engine Control Module (ECM) through the transmission harness to the exhaust system. Check for external harness damage due to chafing or heat. Repair harness as required, clear DTC and retest system • Suspect sensor internal fault if DTC resets. Heater circuit resistance measured at the component connector at approximately 20°C ambient temperature should be 2.4 - 4.0 Ohms. Refer to the new module/component installation note at the top of the DTC Index
P0030-12	HO2S Heater Control Circuit (Bank 1, Sensor 1) - circuit short to battery	<ul style="list-style-type: none"> • Harness fault - Universal Heated Exhaust Gas Oxygen sensor heater control circuit short to power • Universal Heated Exhaust Gas Oxygen sensor internal fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Oxygen Sensor (O2S) Heater Duty Cycle Bank 1 Sensor 1 (0x03A1). Refer to the electrical circuit diagrams and check the Universal Heated Exhaust Gas Oxygen sensor heater control (heater ground) circuit for short to power. This circuit runs from the Engine Control Module (ECM) through the transmission harness to the exhaust system. Check for external harness damage due to chafing or heat. Repair harness as required, clear DTC and retest system • Suspect sensor internal fault if DTC resets. Heater circuit resistance measured at the component connector at approximately 20°C ambient temperature should be 2.4 - 4.0 Ohms. Refer to the new module/component installation note at the top of the DTC Index
P0030-13	HO2S Heater Control Circuit (Bank 1, Sensor 1) - circuit open	<ul style="list-style-type: none"> • Harness fault - Universal Heated Exhaust Gas Oxygen sensor heater control circuit open • Universal Heated Exhaust Gas Oxygen sensor internal fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Oxygen Sensor (O2S) Heater Duty Cycle Bank 1 Sensor 1 (0x03A1). Refer to the electrical circuit diagrams and check the Universal Heated Exhaust Gas Oxygen sensor heater control (heater ground) circuit for open circuit. This circuit runs from the Engine Control Module (ECM) through the transmission harness to the exhaust system. Check for external harness damage due to chafing or heat. Repair harness as required, clear DTC and retest system • Suspect sensor internal fault if DTC resets. Heater circuit resistance measured at the component connector at approximately 20°C ambient temperature should be 2.4 - 4.0 Ohms. Refer to the new module/component installation note at the top of the DTC Index
P0030-4B	HO2S Heater Control Circuit (Bank 1, Sensor 1) - over temperature	<ul style="list-style-type: none"> • Harness fault - Heated Oxygen Sensor heater control circuit short to power • Heated Oxygen 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Oxygen Sensor (O2S) Heater Duty Cycle Bank 1 Sensor 1 (0x03A1). Refer to the electrical circuit diagrams and check the Universal Heated Exhaust Gas Oxygen sensor heater control (heater ground) circuit for short to power. This circuit runs from the Engine Control Module (ECM) through the transmission harness to the exhaust system. Check for external harness damage due to chafing or heat. Repair

		Sensor internal fault	<p>harness as required, clear DTC and retest system</p> <ul style="list-style-type: none"> • Suspect sensor internal fault if DTC resets. Heater circuit resistance measured at the component connector at approximately 20°C ambient temperature should be 2.4 - 4.0 Ohms. Refer to the new module/component installation note at the top of the DTC Index
P0130-00	O2 Circuit (Bank 1, Sensor 1) - no sub type information	<ul style="list-style-type: none"> • Harness fault - Universal Heated Exhaust Gas Oxygen sensor circuits open circuit • Universal Heated Exhaust Gas Oxygen sensor internal component fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the Universal Heated Exhaust Gas Oxygen circuits for open circuits on the Nernst Voltage and Pumping Current signal lines. Check harness for signs of damage due to chaffing or heat. Check the other Universal Heated Exhaust Gas Oxygen sensor circuits for short circuits and open circuits • If no fault found in wiring harness suspect Universal Heated Exhaust Gas Oxygen sensor. Refer to the new module/component installation note at the top of the DTC Index
P0130-11	O2 Circuit (Bank 1, Sensor 1) - circuit short to ground	<ul style="list-style-type: none"> • The Engine Control Module (ECM) has detected a ground measurement for a period longer than expected or has detected a ground measurement when another value was expected • Harness fault - Universal Heated Exhaust Gas Oxygen sensor circuit short to ground • Universal Heated Exhaust Gas Oxygen sensor internal component fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the Universal Heated Exhaust Gas Oxygen sensor circuits for short to ground. Repair wiring harness as required, clear DTC and retest system • If no fault found in wiring harness suspect Universal Heated Exhaust Gas Oxygen sensor. Refer to the new module/component installation note at the top of the DTC Index
P0130-12	O2 Circuit (Bank 1, Sensor 1) - circuit short to battery	<ul style="list-style-type: none"> • Harness fault - Universal Heated Exhaust Gas Oxygen sensor circuit short to power • Universal Heated Exhaust Gas Oxygen sensor internal component fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the Universal Heated Exhaust Gas Oxygen sensor circuits for short to power. Repair wiring harness as required, clear DTC and retest system • If no fault found in wiring harness suspect Universal Heated Exhaust Gas Oxygen sensor. Refer to the new module/component installation note at the top of the DTC Index
P0130-13	O2 Circuit (Bank 1, Sensor 1) - circuit open	<ul style="list-style-type: none"> • Harness fault - Universal Heated Exhaust Gas Oxygen sensor circuit 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check the Universal Heated Exhaust Gas Oxygen sensor circuits for open circuit. Repair wiring harness as required, clear DTC and retest system • If no fault found in wiring harness suspect Universal Heated Exhaust Gas Oxygen sensor. Refer to the new

		<ul style="list-style-type: none"> open circuit Universal Heated Exhaust Gas Oxygen sensor internal component fault 	<p>module/component installation note at the top of the DTC Index</p>
P0130-1A	O2 Circuit (Bank 1, Sensor 1) - Circuit Resistance Below Threshold	<ul style="list-style-type: none"> Harness fault - Universal Heated Exhaust Gas Oxygen sensor circuit fault Universal Heated Exhaust Gas Oxygen sensor internal component fault 	<ul style="list-style-type: none"> This DTC is set when the Universal Heated Exhaust Gas Oxygen sensor internal trim resistance value is less than that expected by the Engine Control Module. Refer to the electrical circuit diagrams and check the Universal Heated Exhaust Gas Oxygen sensor circuits for short circuits. Repair wiring harness as required, clear DTC and retest system If no fault found in wiring harness suspect Universal Heated Exhaust Gas Oxygen sensor internal fault. Refer to the new module/component installation note at the top of the DTC Index
P0130-1B	O2 Circuit (Bank 1, Sensor 1) - Circuit Resistance Above Threshold	<ul style="list-style-type: none"> Harness fault - Universal Heated Exhaust Gas Oxygen sensor circuit fault Universal Heated Exhaust Gas Oxygen sensor internal component fault 	<ul style="list-style-type: none"> This DTC is set when the oxygen sensor internal trim resistance value is greater than that expected by the Engine Control Module. Refer to the electrical circuit diagrams and check the Universal Heated Exhaust Gas Oxygen sensor circuits for short circuits, open circuits. Repair wiring harness as required, clear DTC and retest system If no fault found in wiring harness suspect Universal Heated Exhaust Gas Oxygen sensor internal fault. refer to the new module/component installation note at the top of the DTC Index
P0130-26	O2 Circuit (Bank 1, Sensor 1) - Signal Rate Of Change Below Threshold	<ul style="list-style-type: none"> Exhaust system leak Fuel control system fault Universal Heated Exhaust Gas Oxygen sensor to Engine Control Module (ECM) circuit short to ground, short to power, high resistance Universal Heated Exhaust Gas Oxygen sensor failure 	<ul style="list-style-type: none"> Check for and rectify any exhaust leak between cylinder head and catalytic converter. Check Universal Heated Exhaust Gas Oxygen sensor is correctly installed in exhaust manifold Check fuel control system for related DTCs and refer to the relevant DTC Index Refer to the electrical circuit diagrams and check Universal Heated Exhaust Gas Oxygen sensor to Engine Control Module (ECM) circuit for short to ground, short to power, high resistance, open circuit Check and install a new Universal Heated Exhaust Gas Oxygen sensor as required
P0133-00	O2 Circuit Slow Response (Bank 1, Sensor 1) - no sub type information	<ul style="list-style-type: none"> Exhaust system leak Fuel control system fault Universal Heated Exhaust Gas Oxygen sensor to Engine Control Module (ECM) wiring shield high 	<ul style="list-style-type: none"> Check for and rectify any exhaust leak between cylinder head and catalytic converter. Check Universal Heated Exhaust Gas Oxygen sensor is correctly installed in exhaust manifold Check fuel control system for related DTCs and refer to the relevant DTC Index Refer to the electrical circuit diagrams and check Universal Heated Exhaust Gas Oxygen sensor to Engine Control Module (ECM) wiring shield for high resistance Check and install a new Universal Heated Exhaust Gas Oxygen sensor as required

		<ul style="list-style-type: none"> resistance Universal Heated Exhaust Gas Oxygen sensor failure 	
P0135-16	O2 Heater Circuit (Bank 1, Sensor 1) - Circuit Voltage Below threshold	<ul style="list-style-type: none"> Harness fault - Universal Heated Exhaust Gas Oxygen sensor circuit fault Universal Heated Exhaust Gas Oxygen sensor internal component fault 	<ul style="list-style-type: none"> This DTC is set when the voltage on the Universal Heated Exhaust Gas Oxygen sensor heater circuit is less than that expected by the Engine Control Module. Refer to the electrical circuit diagrams and check the Universal Heated Exhaust Gas Oxygen sensor heater supply and heater ground circuits for short circuits, open circuits. Repair wiring harness as required, clear DTC and retest system If no fault found in wiring harness suspect Universal Heated Exhaust Gas Oxygen sensor internal fault. refer to the new module/component installation note at the top of the DTC Index
P0435-00	Catalyst Temperature Sensor Circuit (Bank 2, Sensor Circuit 1) - no sub type information	<ul style="list-style-type: none"> Catalyst temperature sensor bank 2, sensor 1 circuit short to ground Catalyst temperature sensor bank 2, sensor 1 circuit short to power Catalyst temperature sensor bank 2, sensor 1 circuit high resistance Catalyst temperature sensor bank 2, sensor 1 circuit open circuit Catalyst temperature sensor bank 2, sensor 1 circuit disconnected Catalyst temperature sensor bank 2, sensor 1 failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 1 Voltage (0x03BF), Exhaust Gas Temperature Bank 2 Sensor 1 (0x03F7) Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for short to ground. Repair wiring harness as required, clear DTC and retest system Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for short to power. Repair wiring harness as required, clear DTC and retest system Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for high resistance. Repair wiring harness as required, clear DTC and retest system Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for open circuit. Repair wiring harness as required, clear DTC and retest system Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for disconnected. Repair wiring harness as required, clear DTC and retest system Check and install a new catalyst temperature sensor - bank 2, sensor 1 as required. Refer to the new module/component installation note at the top of the DTC Index
P0436-00	Catalyst Temperature Sensor Circuit Range/Performance (Bank 2, Sensor Circuit 1) - no sub type information	<ul style="list-style-type: none"> Catalyst temperature sensor bank 2, sensor 1 circuit short to ground Catalyst temperature sensor bank 2, sensor 1 circuit short to power Catalyst temperature sensor bank 2, sensor 1 circuit high resistance Catalyst temperature 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 1 Voltage (0x03BF), Exhaust Gas Temperature Bank 2 Sensor 1 (0x03F7) Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for short to ground. Repair wiring harness as required, clear DTC and retest system Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for short to power. Repair wiring harness as required, clear DTC and retest system Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for high resistance. Repair wiring harness as required, clear DTC and retest system Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for open circuit. Repair wiring harness as required, clear DTC and retest system

		<p>sensor bank 2, sensor 1 circuit open circuit</p> <ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 1 circuit disconnected • Catalyst temperature sensor bank 2, sensor 1 failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for disconnected. Repair wiring harness as required, clear DTC and retest system • Check and install a new catalyst temperature sensor - bank 2, sensor 1 as required. Refer to the new module/component installation note at the top of the DTC Index
P0437-00	Catalyst Temperature Sensor Circuit Low (Bank 2, Sensor Circuit 1) - no sub type information	<ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 1 circuit short to ground • Catalyst temperature sensor bank 2, sensor 1 circuit high resistance • Catalyst temperature sensor bank 2, sensor 1 circuit open circuit • Catalyst temperature sensor bank 2, sensor 1 circuit disconnected • Catalyst temperature sensor bank 2, sensor 1 failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 1 Voltage (0x03BF), Exhaust Gas Temperature Bank 2 Sensor 1 (0x03F7) • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for short to ground. Repair wiring harness as required, clear DTC and retest system • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for high resistance. Repair wiring harness as required, clear DTC and retest system • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for open circuit. Repair wiring harness as required, clear DTC and retest system • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for disconnected. Repair wiring harness as required, clear DTC and retest system • Check and install a new catalyst temperature sensor - bank 2, sensor 1 as required. Refer to the new module/component installation note at the top of the DTC Index
P0438-00	Catalyst Temperature Sensor Circuit High (Bank 2, Sensor Circuit 1) - no sub type information	<ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 1 circuit short to power • Catalyst temperature sensor bank 2, sensor 1 failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 1 Voltage (0x03BF), Exhaust Gas Temperature Bank 2 Sensor 1 (0x03F7). Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 1 circuit for short to power. Repair wiring harness as required, clear DTC and retest system • Check and install a new catalyst temperature sensor - bank 2, sensor 1 as required. Refer to the new module/component installation note at the top of the DTC Index.
P043A-00	Catalyst Temperature Sensor Circuit (Bank 2, Sensor Circuit 2) - no sub type information	<ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 2 circuit short to ground • Catalyst temperature sensor bank 2, sensor 2 circuit short to power • Catalyst temperature sensor bank 2, sensor 2 circuit high resistance • Catalyst temperature 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 2 Sensor 2 (0x03F8), Exhaust Gas Temperature Sensor Bank 2 Sensor 2 Voltage (0x03E9) • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for short to ground. Repair wiring harness as required, clear DTC and retest system • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for short to power. Repair wiring harness as required, clear DTC and retest system • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for high resistance. Repair wiring harness as required, clear DTC and retest system • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for open circuit. Repair wiring harness as required, clear DTC and retest system




		<p>sensor bank 2, sensor 2 circuit open circuit</p> <ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 2 circuit disconnected • Catalyst temperature sensor bank 2, sensor 2 failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for disconnected. Repair wiring harness as required, clear DTC and retest system • Check and install a new catalyst temperature sensor - bank 2, sensor 2 as required. Refer to the new module/component installation note at the top of the DTC Index
P043B-00	Catalyst Temperature Sensor Circuit Range/Performance (Bank 2, Sensor Circuit 2) - no sub type information	<ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 2 circuit short to ground • Catalyst temperature sensor bank 2, sensor 2 circuit short to power • Catalyst temperature sensor bank 2, sensor 2 circuit high resistance • Catalyst temperature sensor bank 2, sensor 2 circuit open circuit • Catalyst temperature sensor bank 2, sensor 2 circuit disconnected • Catalyst temperature sensor bank 2, sensor 2 failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 2 Sensor 2 (0x03F8), Exhaust Gas Temperature Sensor Bank 2 Sensor 2 Voltage (0x03E9) • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for short to ground. Repair wiring harness as required, clear DTC and retest system • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for short to power. Repair wiring harness as required, clear DTC and retest system • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for high resistance. Repair wiring harness as required, clear DTC and retest system • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for open circuit. Repair wiring harness as required, clear DTC and retest system • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for disconnected. Repair wiring harness as required, clear DTC and retest system • Check and install a new catalyst temperature sensor - bank 2, sensor 2 as required. Refer to the new module/component installation note at the top of the DTC Index
P043C-00	Catalyst Temperature Sensor Circuit Low (Bank 2, Sensor Circuit 2) - no sub type information	<ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 2 circuit short to ground • Catalyst temperature sensor bank 2, sensor 2 circuit high resistance • Catalyst temperature sensor bank 2, sensor 2 circuit open circuit • Catalyst temperature sensor bank 2, sensor 2 circuit disconnected • Catalyst temperature sensor bank 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 2 Sensor 2 (0x03F8), Exhaust Gas Temperature Sensor Bank 2 Sensor 2 Voltage (0x03E9) • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for short to ground. Repair wiring harness as required, clear DTC and retest system • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for high resistance. Repair wiring harness as required, clear DTC and retest system • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for open circuit. Repair wiring harness as required, clear DTC and retest system • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for disconnected. Repair wiring harness as required, clear DTC and retest system • Check and install a new catalyst temperature sensor - bank 2, sensor 2 as required. Refer to the new module/component installation note at the top of the DTC Index



		2, sensor 2 failure	
P043D-00	Catalyst Temperature Sensor Circuit High (Bank 2, Sensor Circuit 2) - no sub type information	<ul style="list-style-type: none"> • Catalyst temperature sensor bank 2, sensor 2 circuit short to power • Catalyst temperature sensor bank 2, sensor 2 failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 2 Sensor 2 (0x03F8), Exhaust Gas Temperature Sensor Bank 2 Sensor 2 Voltage (0x03E9) • Refer to the electrical circuit diagrams and check catalyst temperature sensor bank 2, sensor 2 circuit for short to power. Repair wiring harness as required, clear DTC and retest system • Check and install a new catalyst temperature sensor - bank 2, sensor 2 as required. Refer to the new module/component installation note at the top of the DTC Index
P0544-00	Exhaust Gas Temperature Sensor Circuit - Bank 1 Sensor 1 - no sub type information	<ul style="list-style-type: none"> • Exhaust gas temperature sensor, bank 1 sensor 1 circuit short to ground • Exhaust gas temperature sensor, bank 1 sensor 1 circuit short to power • Exhaust gas temperature sensor, bank 1 sensor 1 circuit high resistance • Exhaust gas temperature sensor, bank 1 sensor 1 circuit open circuit • Exhaust gas temperature sensor, bank 1 sensor 1 circuit disconnected • Exhaust gas temperature sensor, bank 1 sensor 1 failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for short to ground • Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for short to power • Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for high resistance • Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for open circuit • Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for disconnected. Repair wiring harness as required, clear DTC and retest system • Check and install a new exhaust gas temperature sensor, bank1 sensor 1 as required. Refer to the new module/component installation note at top of DTC Index
P0545-00	Exhaust Gas Temperature Sensor Circuit Low - Bank 1 Sensor 1 - no sub type information	<ul style="list-style-type: none"> • Exhaust gas temperature sensor, bank 1 sensor 1 circuit short to ground • Exhaust gas temperature sensor, bank 1 sensor 1 circuit high resistance • Exhaust gas temperature sensor, bank 1 sensor 1 circuit open circuit • Exhaust gas temperature sensor, bank 1 sensor 1 circuit disconnected • Exhaust gas temperature sensor, bank 1 sensor 1 failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for short to ground • Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for high resistance • Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for open circuit • Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for disconnected. Repair wiring harness as required, clear DTC and retest system • Check and install a new exhaust gas temperature sensor, bank1 sensor 1 as required. Refer to the new module/component installation note at top of DTC Index




		1 sensor 1 failure	
P0546-00	Exhaust Gas Temperature Sensor Circuit High - Bank 1 Sensor 1 - no sub type information	<ul style="list-style-type: none"> Exhaust gas temperature sensor, bank 1 sensor 1 circuit short to power Exhaust gas temperature sensor, bank 1 sensor 1 failure 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check exhaust gas temperature sensor, bank 1 sensor 1 circuit for short to power. Repair wiring harness as required, clear DTC and retest system Check and install a new exhaust gas temperature sensor, bank1 sensor 1 as required. Refer to the new module/component installation note at top of DTC Index
P2002-68	Diesel Particulate Filter Efficiency Below Threshold (Bank 1) - event information	<ul style="list-style-type: none"> Diesel particulate filter regeneration disabled by other DTCs logged 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC Index. Carry out a diesel particulate filter regeneration
P2031-00	Exhaust Gas Temperature Sensor Circuit Bank 1 Sensor 2 - no sub type information	<ul style="list-style-type: none"> Harness fault - Particulate filter inlet exhaust gas temperature sensor Particulate filter inlet exhaust gas temperature sensor internal fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 2 Voltage (0x03C4), Exhaust Gas Temperature Bank 1 Sensor 2 (0x03F5). This DTC is set if the particulate filter inlet exhaust gas temperature sensor fails a plausibility check at cold start. Refer to the workshop manual and check the particulate filter inlet exhaust gas temperature sensor and wiring harness for obvious signs of mechanical damage due to chaffing or heat. The particulate filter inlet exhaust gas temperature sensor is a thermistor located in the inlet to the particulate filter housing with a signal and ground connection. Refer to the electrical circuit diagrams and check the signal circuit for open circuit, short circuit to power, short circuit to ground, high resistance. Check the ground circuit for open circuit, high resistance, short circuit to power. Repair the wiring harness as required If there are no wiring faults, refer to the workshop manual and check the sensor resistance value. Replace the sensor if required, refer to the new module/component installation note at top of DTC Index
P2032-00	Exhaust Gas Temperature Sensor Circuit Low Bank 1 Sensor 2 - no sub type information	<ul style="list-style-type: none"> Harness fault - Particulate filter inlet exhaust gas temperature sensor Particulate filter inlet exhaust gas temperature sensor internal fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 2 Voltage (0x03C4), Exhaust Gas Temperature Bank 1 Sensor 2 (0x03F5). This DTC is set if the particulate filter inlet exhaust gas temperature sensor fails a diagnostic check due to the circuit voltage being less than the expected value. Refer to the workshop manual and check the particulate filter inlet exhaust gas temperature sensor and wiring harness for obvious signs of mechanical damage due to chaffing or heat. The particulate filter inlet exhaust gas temperature sensor is a thermistor located in the inlet to the particulate filter housing with a signal and ground connection. Refer to the electrical circuit diagrams and check the signal circuit for open circuit, short circuit to power, short circuit to ground, high resistance. Check the ground circuit for open circuit, high resistance, short circuit to power. Repair the wiring harness as required If there are no wiring faults, refer to the workshop manual and check the sensor resistance value. Replace the sensor if required, refer to the new module/component installation note at top of DTC Index
P2033-00	Exhaust Gas Temperature Sensor Circuit High Bank 1 Sensor 2 - no sub type information	<ul style="list-style-type: none"> Harness fault - Particulate filter inlet exhaust gas temperature sensor Particulate filter inlet exhaust gas temperature sensor 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 2 Voltage (0x03C4), Exhaust Gas Temperature Bank 1 Sensor 2 (0x03F5). This DTC is set if the particulate filter inlet exhaust gas temperature sensor fails a diagnostic check due to the circuit voltage being greater than the expected value. Refer to the workshop manual and check the particulate filter inlet exhaust gas temperature sensor and wiring harness for obvious signs of mechanical damage due to chaffing or heat. The particulate filter inlet exhaust gas



		internal fault	<p>temperature sensor is a thermistor located in the inlet to the particulate filter housing with a signal and ground connection. Refer to the electrical circuit diagrams and check the signal circuit for open circuit, short circuit to power, short circuit to ground, high resistance. Check the ground circuit for open circuit, high resistance, short circuit to power. Repair the wiring harness as required</p> <ul style="list-style-type: none"> If there are no wiring faults, refer to the workshop manual and check the sensor resistance value. Replace the sensor if required, refer to the new module/component installation note at top of DTC Index
P2080-00	Exhaust Gas Temperature Sensor Circuit Range/Performance Bank 1 Sensor 1 - no sub type information	<ul style="list-style-type: none"> Harness fault - Secondary turbo outlet temperature sensor Secondary turbo outlet temperature sensor internal fault 	<ul style="list-style-type: none"> This DTC is set when there is a plausibility error on the signal from the secondary turbo outlet temperature sensor. Refer to the workshop manual and check the secondary turbo outlet temperature sensor and wiring harness for obvious signs of mechanical damage due to chaffing or heat. The secondary turbo outlet temperature sensor is a thermistor with a signal and ground connection. Refer to the electrical circuit diagrams and check the signal circuit for open circuit, short circuit to power, short circuit to ground, high resistance. Check the ground circuit for open circuit, high resistance, short circuit to power. Repair the wiring harness as required If there are no wiring faults, refer to the workshop manual and check the sensor resistance value. Replace the sensor if required, refer to the new module/component installation note at top of DTC Index
P2084-00	Exhaust Gas Temperature Sensor Circuit Range/Performance Bank 1 Sensor 2 - no sub type information	<ul style="list-style-type: none"> Harness fault - close coupled catalyst outlet temperature sensor Close coupled catalyst outlet temperature sensor internal fault 	<ul style="list-style-type: none"> This DTC is set when there is a plausibility error on the signal from the close coupled catalyst outlet temperature sensor. Refer to the workshop manual and check the close coupled catalyst outlet temperature sensor and wiring harness for obvious signs of mechanical damage due to chaffing or heat. The close coupled catalyst outlet temperature sensor is a thermistor with a signal and ground connection. Refer to the electrical circuit diagrams and check the signal circuit for open circuit, short circuit to power, short circuit to ground, high resistance. Check the ground circuit for open circuit, high resistance, short circuit to power. Repair the wiring harness as required If there are no wiring faults, refer to the workshop manual and check the sensor resistance value. Replace the sensor if required, refer to the new module/component installation note at top of DTC Index
P2226-62	Barometric Pressure Sensor A Circuit - signal compare failure	<ul style="list-style-type: none"> The Engine Control Module (ECM) has been submersed in water or mud The Engine Control Module (ECM) has been sealed in a non approved covering 	<ul style="list-style-type: none"> Check the Engine Control Module (ECM) is clean and dry. Check the Engine Control Module (ECM) is not sealed by any non approved covering. If the DTC does not clear install a new Engine Control Module (ECM) as required. Refer to the new module/component installation note at top of DTC Index.
P2245-00	O2 Sensor Reference Voltage Circuit Low - Bank 1, Sensor 1 - no sub type information	<ul style="list-style-type: none"> Harness fault - oxygen sensor circuit Oxygen sensor internal fault 	<ul style="list-style-type: none"> This DTC is set if the Engine Control Module (ECM) detects the bank 1, oxygen sensor 1 reference voltage (LPV_A) is lower than expected. Refer to the electrical circuit diagrams and check the oxygen sensor harness for signs of damage caused by chaffing or heat. Check the oxygen sensor circuits for open circuits, high resistance, short to ground. Repair wiring as required, clear the DTC and retest the system If there are no wiring faults suspect the oxygen sensor. Refer to the new module/component installation note at the top of the DTC Index
P2246-00	O2 Sensor Reference Voltage Circuit High - Bank 1, Sensor 1 - no sub type	<ul style="list-style-type: none"> Harness fault - oxygen sensor circuit Oxygen sensor 	<ul style="list-style-type: none"> This DTC is set if the Engine Control Module (ECM) detects the bank 1, oxygen sensor 1 reference voltage (LPV_A) is greater than expected. Refer to the electrical circuit diagrams and check the oxygen sensor harness for signs of damage caused by chaffing or heat. Check

	information	internal fault	<p>the oxygen sensor circuits for open circuits, high resistance, short to power. Repair wiring as required, clear the DTC and retest the system</p> <ul style="list-style-type: none"> If there are no wiring faults suspect the oxygen sensor. Refer to the new module/component installation note at the top of the DTC Index
P242A-00	Exhaust Gas Temperature Sensor Circuit Bank 1 Sensor 3 - no sub type information	<ul style="list-style-type: none"> Harness fault - particulate filter outlet temperature sensor Particulate filter outlet temperature sensor internal fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 3 (0x03F6), Exhaust Gas Temperature Bank 1 Sensor 3 Voltage (0x03F8). This DTC is set if the Particulate filter outlet temperature sensor fails a cold start diagnostic check by the Engine Control Module. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter outlet temperature sensor signal circuit for open circuit, short to ground, short to other circuits. Check the sensor ground circuit for open circuit, short to power, high resistance. Repair wiring as required If there are no wiring faults suspect the particulate filter outlet temperature sensor. Refer to the new module/component installation note at the top of the DTC Index
P242B-00	Exhaust Gas Temperature Sensor Circuit Range/Performance Bank 1 Sensor 3 - no sub type information	<ul style="list-style-type: none"> Harness fault - particulate filter outlet temperature sensor Particulate filter outlet temperature sensor internal fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 3 (0x03F6), Exhaust Gas Temperature Bank 1 Sensor 3 Voltage (0x03F8). This DTC is set if the Particulate filter outlet temperature sensor fails a plausibility check by the Engine Control Module. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter outlet temperature sensor signal circuit for open circuit, short to ground, short to other circuits. Check the sensor ground circuit for open circuit, short to power, high resistance. Repair wiring as required If there are no wiring faults suspect the particulate filter outlet temperature sensor. Refer to the new module/component installation note at the top of the DTC Index
P242C-00	Exhaust Gas Temperature Sensor Circuit Low Bank 1 Sensor 3 - no sub type information	<ul style="list-style-type: none"> Harness fault - particulate filter outlet temperature sensor Particulate filter outlet temperature sensor internal fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 3 (0x03F6), Exhaust Gas Temperature Bank 1 Sensor 3 Voltage (0x03F8). This DTC is set if the Particulate filter outlet temperature sensor signal voltage is less than the Engine Control Module (ECM) was expecting. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter outlet temperature sensor signal circuit for open circuit, short to ground, short to other circuits. Check the sensor ground circuit for open circuit, short to power, high resistance. Repair wiring as required If there are no wiring faults suspect the particulate filter outlet temperature sensor. Refer to the new module/component installation note at the top of the DTC Index
P242D-00	Exhaust Gas Temperature Sensor Circuit High Bank 1 Sensor 3 - no sub type information	<ul style="list-style-type: none"> Harness fault - particulate filter outlet temperature sensor Particulate filter outlet temperature sensor internal fault 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Exhaust Gas Temperature Bank 1 Sensor 3 (0x03F6), Exhaust Gas Temperature Bank 1 Sensor 3 Voltage (0x03F8). This DTC is set if the Particulate filter outlet temperature sensor signal voltage is greater than the Engine Control Module (ECM) was expecting. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter outlet temperature sensor signal circuit for open circuit, short to ground, short to other circuits. Check the sensor ground circuit for open circuit, short to power, high resistance. Repair

			<ul style="list-style-type: none"> wiring as required If there are no wiring faults suspect the particulate filter outlet temperature sensor. Refer to the new module/component installation note at the top of the DTC Index.
P242F-00	Diesel Particulate Filter Restriction - Ash Accumulation (Bank 1) - no sub type information	<ul style="list-style-type: none"> Maximum ash load 	 <p>NOTE: The setting value of this DTC is inhibited</p> <ul style="list-style-type: none"> Contact dealer technical support
P244A-00	Diesel Particulate Filter Differential Pressure Too Low(Bank1) - no sub type information	<ul style="list-style-type: none"> Diagnostic fault check for minimum pressure differential characteristics 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC index Clear DTC and re-test
P244A-96	Diesel Particulate Filter Differential Pressure Too Low(Bank1) - component internal failure	<ul style="list-style-type: none"> Destroyed particulate filter 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
P244B-68	Diesel Particulate Filter Differential Pressure Too High (Bank 1) - event information	<ul style="list-style-type: none"> Engine protection back pressure high Sudden increases in differential pressure across the diesel particulate filter 	 <p>NOTE: This DTC when logged on its own is advisory only and no further action should be taken</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check for related DTCs. If this DTC exists with any other diesel particulate filter differential pressure sensor DTCs, follow the advise given for that DTC
P2452-23	Diesel Particulate Filter Pressure Sensor A Circuit - signal stuck low	<ul style="list-style-type: none"> Differential pressure sensor circuit, short circuit to ground Diesel particulate filter pressure sensor A circuit, hose line error 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and check the differential pressure sensor circuit, for short circuit to ground Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC Index
P2452-29	Diesel Particulate Filter Pressure Sensor A Circuit - signal invalid	<ul style="list-style-type: none"> Diagnostic fault check for frozen sensor 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC Index
P2452-95	Diesel Particulate Filter Pressure Sensor A Circuit - incorrect assembly	<ul style="list-style-type: none"> Diesel particulate filter pressure sensor hoses connected incorrectly Diesel particulate filter pressure sensor hoses crushed, blocked, split 	 <p>NOTE: If a new Diesel Particulate Filter pressure sensor or hose lines have been installed or incorrectly routed, or any pressure sensor circuit repairs carried out, the Engine Control Module must learn and store the new Diesel Particulate Filter pressure sensor offset value. The following conditions must be met to allow the Diesel Particulate Filter pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system, clear DTCs from Engine Control Module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500RPM for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park and set ignition status to off. Wait 30 seconds for the Engine Control Module to power down, learn and store Diesel Particulate Filter pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Particulate Filter Differential Pressure Sensor Voltage - Bank 1 (0x03DB). Refer to the workshop manual and check diesel particulate filter pressure sensor hoses are installed correctly Check diesel particulate filter pressure sensor hoses for



			crushed, blockage, split
P2453-00	Diesel Particulate Filter Pressure Sensor A Circuit Range/Performance - no sub type information	<ul style="list-style-type: none"> • Harness fault - Particulate filter pressure sensor • Particulate filter pressure sensor internal fault 	 <p>NOTE: If a new Diesel Particulate Filter pressure sensor or hose lines have been installed or incorrectly routed, or any pressure sensor circuit repairs carried out, the Engine Control Module must learn and store the new Diesel Particulate Filter pressure sensor offset value. The following conditions must be met to allow the Diesel Particulate Filter pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system, clear DTCs from Engine Control Module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500RPM for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park and set ignition status to off. Wait 30 seconds for the Engine Control Module to power down, learn and store Diesel Particulate Filter pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Particulate Filter Differential Pressure Sensor Voltage - Bank 1 (0x03DB). This DTC is set when the particulate pressure sensor fails a plausibility check. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter pressure sensor signal circuit for open circuit, short to ground, short to other circuits. Check the sensor ground circuit for open circuit, short to power, high resistance. Check the sensor power supply circuit for open circuit, short to ground, high resistance. Repair wiring as required • If there are no wiring faults suspect the particulate filter pressure sensor. Refer to the new module/component installation note at the top of the DTC Index
P2453-16	Diesel Particulate Filter Pressure Sensor A Circuit Range/performance - circuit voltage below threshold	<ul style="list-style-type: none"> • Diagnostic fault check for Signal Range Check low in flow resistance 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC Index
P2453-17	Diesel Particulate Filter Pressure Sensor A Circuit Range/Performance - circuit voltage above threshold	<ul style="list-style-type: none"> • Diagnostic fault check for Signal Range Check high in flow resistance 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC Index
P2454-00	Diesel Particulate Filter Pressure Sensor A Circuit Low - no sub type information	<ul style="list-style-type: none"> • Harness fault - Particulate filter pressure sensor • Particulate filter pressure sensor internal fault 	 <p>NOTE: If a new Diesel Particulate Filter pressure sensor or hose lines have been installed or incorrectly routed, or any pressure sensor circuit repairs carried out, the Engine Control Module must learn and store the new Diesel Particulate Filter pressure sensor offset value. The following conditions must be met to allow the Diesel Particulate Filter pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system, clear DTCs from Engine Control Module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500RPM for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park and set ignition status to off. Wait 30 seconds for the Engine Control Module to power down, learn and store Diesel Particulate Filter pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa</p> <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system check datalogger signals, Particulate Filter Differential Pressure Sensor Voltage - Bank 1 (0x03DB). This DTC is set when the particulate pressure sensor voltage is less than the threshold set in the Engine Control Module (ECM) diagnostic check. Refer to the workshop manual and check the particulate filter and sensor for obvious

			<p>signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter pressure sensor signal circuit for open circuit, short to ground, short to other circuits. Check the sensor ground circuit for open circuit, short to power, high resistance. Check the sensor power supply circuit for open circuit, short to ground, high resistance. Repair wiring as required</p> <ul style="list-style-type: none"> If there are no wiring faults suspect the particulate filter pressure sensor. Refer to the new module/component installation note at the top of the DTC Index
P2455-00	Diesel Particulate Filter Pressure Sensor A Circuit High - no sub type information	<ul style="list-style-type: none"> Harness fault - Particulate filter pressure sensor Particulate filter pressure sensor internal fault 	<p> NOTE: If a new Diesel Particulate Filter pressure sensor or hose lines have been installed or incorrectly routed, or any pressure sensor circuit repairs carried out, the Engine Control Module must learn and store the new Diesel Particulate Filter pressure sensor offset value. The following conditions must be met to allow the Diesel Particulate Filter pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system, clear DTCs from Engine Control Module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500RPM for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park and set ignition status to off. Wait 30 seconds for the Engine Control Module to power down, learn and store Diesel Particulate Filter pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system check datalogger signals, Particulate Filter Differential Pressure Sensor Voltage - Bank 1 (0x03DB). This DTC is set when the particulate pressure sensor voltage is greater than the threshold set in the Engine Control Module (ECM) diagnostic check. Refer to the workshop manual and check the particulate filter and sensor for obvious signs of damage. Check the sensor harness for chaffing or heat damage. Refer to the electrical circuit diagrams and check the particulate filter pressure sensor signal circuit for open circuit, short to ground, short to other circuits. Check the sensor ground circuit for open circuit, short to power, high resistance. Check the sensor power supply circuit for open circuit, short to ground, high resistance. Repair wiring as required If there are no wiring faults suspect the particulate filter pressure sensor. Refer to the new module/component installation note at the top of the DTC Index
P2456-00	Diesel Particulate Filter Pressure Sensor A Circuit Intermittent/Erratic - no sub type information	<ul style="list-style-type: none"> Diesel particulate filter pressure sensor hoses crushed, blocked, split Diesel particulate filter differential pressure sensor failure 	<p> NOTE: If a new Diesel Particulate Filter pressure sensor or hose lines have been installed or incorrectly routed, or any pressure sensor circuit repairs carried out, the Engine Control Module must learn and store the new Diesel Particulate Filter pressure sensor offset value. The following conditions must be met to allow the Diesel Particulate Filter pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system, clear DTCs from Engine Control Module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500RPM for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park and set ignition status to off. Wait 30 seconds for the Engine Control Module to power down, learn and store Diesel Particulate Filter pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa</p> <ul style="list-style-type: none"> Check diesel particulate filter pressure sensor hoses for crushed, blocked, split Check and replace diesel particulate filter differential pressure sensor as required. Refer to the new module/component installation note at the top of the DTC Index
P2458-66	Diesel Particulate Filter Regeneration Duration (Bank 1) -	<ul style="list-style-type: none"> Permanent regeneration 	<p> NOTE: This code is enabled for JLR engineering detailed diagnostics only. No further action should be taken</p>

	signal has too many transitions / events		<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC Index
P2459-65	Diesel Particulate Filter Regeneration Frequency (Bank 1) - signal has too few transitions / events	<ul style="list-style-type: none"> Blocked regeneration Customer driving routine does not allow the system to clean the particulate filter 	 <p>NOTE: If DTC is P2459-65 or AMBER DPF FULL REFER TO HANDBOOK message is displayed with no other reported messages. No repair is required, if the vehicle is driven on a highway AS DIRECTED IN THE HANDBOOK then the light will be extinguished and the system self healed, nothing more than this is required</p> <ul style="list-style-type: none"> Refer to the diesel particulate filter regeneration procedure at the bottom of the DTC Index Advise customer of driving routine required to regenerate diesel particulate filter as stated in the vehicle handbook
P2459-66	Diesel Particulate Filter Regeneration Frequency (Bank 1) - signal has too many transitions / events	<ul style="list-style-type: none"> Regeneration frequency 	 <p>NOTE: This code is enabled for JLR engineering detailed diagnostics only. No further action should be taken</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC Index
P2463-00	Diesel Particulate Filter Restriction - Soot Accumulation (Bank 1) - no sub type information	<ul style="list-style-type: none"> Maximum soot mass 	<ul style="list-style-type: none"> GO to Pinpoint Test B.
P246C-00	Diesel Particulate Filter Restriction - Forced Limited Power - no sub type information	<ul style="list-style-type: none"> Diagnostic fault check for maximum pressure differential characteristics 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check for related DTCs and refer to the relevant DTC Index


Pinpoint Tests

PINPOINT TEST A : DTC P244A-96 IS STORED	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK FOR OTHER DTCs	
	<p>1 Using the manufacturer approved diagnostic system, check if any of the following DTCs are stored</p> <ul style="list-style-type: none"> P2456-00 P2226-62 P2452-95 P2453-00
	<p>Are any of the additional DTCs stored?</p> <p>Yes Refer to the relevant DTC Index and carry out the relevant repair procedure. Only after the repair, using the manufacturer approved diagnostic system clear the DTC and re-test</p> <p>No Proceed to next step</p>
A2: EXHAUST PIPE AND JOINTS	
	1 Check all exhaust pipes and joints for leaks
	2 Check for external damage to the diesel particulate filter metalwork
	<p>Are any of the exhaust pipes leaking, or is there external damage to the diesel particulate filter metalwork?</p> <p>Yes Repair leaking exhaust joints as required Check and install a new diesel particulate filter as required Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p> <p>No Proceed to next step</p>
A3: DIESEL PARTICULATE FILTER PRESSURE SENSOR PIPES	
	1 Check differential pressure sensor pipes for cracks, mis-routing or hoses crossed
	Are any of the differential pressure sensor pipes cracked, mis-routed or hoses crossed?


	<p>Yes Repair as required, clear DTC and retest</p> <p>No Proceed to next step</p>
A4: HARNESS DIFFERENTIAL PRESSURE SENSOR	
	<p>1 Check wiring harness to the differential pressure sensor, include any inline connectors</p>
	<p>Was the wiring harness to the differential pressure sensor damaged?</p> <p>Yes Repair wiring harness as required, clear DTC and retest</p> <p>No Proceed to next step</p>
A5: CONNECTOR INTEGRITY DIFFERENTIAL PRESSURE SENSOR	
	<p>1 Check differential pressure sensor connector for damage and terminal corrosion</p>
	<p>Was the differential pressure sensor connector damaged or terminal corrosion present?</p> <p>Yes Refer to the electrical circuit diagrams and check connections are secure and wiring integrity. Repair as required, clear DTC and retest</p> <p>No Proceed to next step</p>
A6: FUNCTIONAL CHECK DIFFERENTIAL PRESSURE SENSOR	
	<p>NOTES:</p> <p> The Particulate Filter Differential Pressure Sensor measured voltage with the ignition on checks the sensor output with no variation/pressure in the exhaust system, checking the Particulate Filter Differential Pressure Sensor adaption is working. The measured voltages at engine idle and 4000 RPM will be considerably different depending on the diesel particulate filter soot loading. The idle value tells us that the Particulate Filter Differential Pressure Sensor is working if it goes up from the ignition on value. The 4000 RPM value tells us how much soot is in the diesel particulate filter. A diesel particulate filter which is recoverable measures less than 1.5volts / 300mbar at 4000 RPM</p> <p> If a new differential pressure sensor or hose lines have been installed, incorrectly routed, or any differential pressure sensor circuit repairs carried out, the Engine Control Module must learn and store the new differential pressure sensor offset value. The following conditions must be met to allow the differential pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system, clear DTCs from Engine Control Module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500RPM for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park and set ignition status to off. Wait 30 seconds for the Engine Control Module to power down, learn and store differential pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa</p> <p>1 Using the manufacturer approved diagnostic system check datalogger signal - Particulate Filter Differential Pressure Sensor Voltage - Bank 1 - (0x03DB) under the conditions described below. Allow the voltage to stabilize before recording the value for approximately 7 seconds</p> <ul style="list-style-type: none"> • Ignition is ON and engine speed is 0 RPM • Engine idle speed • Engine speed is 4000 RPM
	<p>Was datalogger signal - Particulate Filter Differential Pressure Sensor Voltage - Bank 1 - (0x03DB) - value approximately than 0.75 Volts when ignition ON and engine speed is 0 RPM? Was datalogger signal - Particulate Filter Differential Pressure Sensor Voltage - Bank 1 - (0x03DB) - value less than 1 Volt when engine speed at idle? Was datalogger signal - Particulate Filter Differential Pressure Sensor Voltage - Bank 1 - (0x03DB) - value less than 1.5 Volts when engine speed at 4000 RPM? (1volt = 100mbar, 1.5volts = 300mbar at 4000RPM)</p> <p>Yes Proceed to next step</p> <p>No Check and install a new differential pressure sensor as required Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component Using the manufacturer approved diagnostic system clear the DTC and re-test</p> <p>NOTE: If a new differential pressure sensor or hose lines have been installed, incorrectly routed, or any differential pressure sensor circuit repairs carried out, the Engine Control Module must learn and store the new differential pressure sensor offset value. The following conditions must be met to allow the differential pressure sensor offset value to be learnt and stored: Using the manufacturer approved diagnostic system, clear DTCs from Engine Control Module, then monitor the datalogger signal 'sump oil temperature - measured' ensuring a minimum of 50 degrees C is achieved. Start engine, run above 500RPM for 2 minutes, then a further 30 seconds at idle. Ensure the engine cooling fan is not running. Set vehicle in park</p>

and set ignition status to off. Wait 30 seconds for the Engine Control Module to power down, learn and store differential pressure sensor offset value. This process must be carried out six times, to allow a large negative offset value to adapt back to 0 Hpa

A7: ACCELERATION SMOKE TEST

	 <p>NOTE: Ensure the engine is at normal operating temperature</p>
	<p>1 Increase the engine speed momentarily to 4000RPM and allow the engine to settle back to idle</p>
	<p>2 Carry out above step 3 times</p>
	<p>3 Carry out visual check for excessive black smoke leaving the tailpipe during each of the 3 tests</p>
	<p>Is excessive black smoke visible leaving the tailpipe during each of the 3 tests?</p> <p>Yes Note: Only install a new diesel particulate filter if black smoke is visible leaving the tailpipe. Check and install a new diesel particulate filter as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. Using the manufacturer approved diagnostic system clear the DTC and re-test. Return vehicle to the customer.</p> <p>No Check and install a new differential pressure sensor as required. Carry out differential pressure sensor adaption process.</p>

PINPOINT TEST B : RED WARNING MESSAGE DPF FULL VISIT DEALER IS DISPLAYED AND DTC P2463-00 IS LOGGED

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: VIN INFORMATION	
	<p>1 Record the full vehicle identification number for the vehicle under test, as this information may later be required by dealer technical support</p>
	<p>Has the vehicle identification number been recorded?</p> <p>Yes Proceed to the next step</p> <p>No Record the vehicle identification number and proceed to the next step</p>
B2: VEHICLE MILEAGE	
	<p>1 Record the full mileage for the vehicle under test, as this information may later be required by dealer technical support</p>
	<p>Has the mileage been recorded?</p> <p>Yes Proceed to the next step</p> <p>No Record the mileage and proceed to the next step</p>
B3: VEHICLE SOFTWARE PART NUMBER	
	 <p>NOTE: Known software issue on PD software level where Lambda sensor adaption is not complete and the assumed value of O2 in air is 0%, PE software level corrected to 21%. This can lead to non recognition of good regenerations of the diesel particulate filter</p> <p>1 Using the manufacturer approved diagnostic system, record the software part number for the Engine Control Module (ECM)</p>
	<p>Has the software part number been recorded? Is the software installed to the vehicle to the latest relevant level?</p> <p>Yes Proceed to the next step</p> <p>No Record the software part number and proceed to the next step</p>
B4: RECORD ALL ENGINE CONTROL MODULE (ECM) DTCs	
	<p>1 Using the manufacturer approved diagnostic system, check Engine Control Module (ECM), for related DTCs</p>
	<p>Are other DTCs logged?</p> <p>Yes Proceed to the next step</p> <p>No Proceed to step 7</p>
B5: DTC P2459-65 IS LOGGED	
	<p>1 Using the manufacturer approved diagnostic system, the logged mileage for DTCs can be seen by viewing the snapshot data</p>
	<p>Was DTC P2459-65 logged at a mileage up to 625 miles (1000KM) before the diagnostic trouble P2463-00 was logged?</p> <p>Yes Suspect the customer has ignored the AMBER DPF FULL REFER TO HANDBOOK message. The customer should be advised of this and the repair may become chargeable. Proceed to step 7</p> <p>No</p>

Proceed to the next step

B6: OTHER RELATED ENGINE CONTROL MODULE (ECM) DTCs

1 Related Engine Control Module (ECM) DTCs other than P2459-65 and P2463-00 are logged

Are related Engine Control Module (ECM) DTCs other than P2459-65 and P2463-00 logged?

Yes

Refer to the relevant DTC Index. Repair as required. Using the manufacturer approved diagnostic system clear the DTCs and re-test

No

Proceed to step 7

B7: DIESEL PARTICULATE FILTER REGENERATION CYCLE



NOTE: Using the manufacturer approved diagnostic system begin to perform a service regeneration cycle, **DO NOT** drive the cleaning cycle. **Record the grams of soot only**

1 With the engine at running temperature check the pre catalyst oxygen sensor operation as follows: -

2 Using the manufacturer approved diagnostic system check datalogger signals - Oxygen Sensor Voltage - (0xF424)

- Idle vehicle and record, should be (0.9 ~ 1 volt)
- Idle to 100% pedal, during acceleration record, should be 0 volts
- Accelerate to 4500RPM (stationary) and close throttle, should read 1.2 ~ 1.3 volts

Does the pre catalyst oxygen sensor meets this criteria?

Yes

Pre catalyst oxygen sensor is operating correctly
Note: DO NOT carry out the adaption process on the pre catalyst oxygen sensor, as this resets the adaption to 0
Proceed to step 8

No

Pre catalyst oxygen sensor adaption cycle is required

Pre catalyst oxygen sensor adaption cycle is **NOT** possible while DTCs are logged
Using the manufacturer approved diagnostic system, carry out FIT NEW PARTICULATE FILTER PROCESS only and clear the DTCs
After completing FIT NEW PARTICULATE FILTER PROCESS continue with pre catalyst oxygen sensor adaption cycle as follows: -
1. Idle vehicle for 10 minutes
2. Set car in command shift 3rd gear
3. Accelerate to 3800RPM (where achievable) and overrun / coastdown without braking until revs drop below 1500 RPM
4. Repeat step 3 a further 3 times
5. Check for any DTCs, if adaption failed a DTC will be evident and the sensor will require replacement
6. Check oxygen sensor adaption is now complete by returning to B7 item 27. Using the manufacturer approved diagnostic system clear the DTC and re-test.
Return vehicle to the customer

B8: SOOT ESTIMATOR IS ACCURATE AND THE DIFFERENTIAL PRESSURE SENSOR READING IS WORKING CORRECTLY

1 Using the manufacturer approved diagnostic system check datalogger signal - Particulate Filter Differential Pressure Sensor Voltage - Bank 1 - (0x03DB)

- Record value with ignition ON
- Idle engine record value
- Hold engine speed at 4000RPM and record value
- Note: 1volt = 100mbar, 1.5volts = 300mbar at 4000RPM

Have the values been recorded for each of the conditions?

Yes

Proceed to step 9

No

Record values for each of the conditions and proceed to step 9

B9: EXHAUST GAS TEMPERATURES

1 Using the manufacturer approved diagnostic system check datalogger signals

- Exhaust Gas Temperature Bank 1 Sensor 2 - (0x03F5)
- Exhaust Gas Temperature Bank 1 Sensor 3 - (0x03F6)
- Exhaust Gas Temperature Bank 2 Sensor 1 - (0x03F7)
- Exhaust Gas Temperature Bank 2 Sensor 2 - (0x03F8)

2 Hold engine speed at 2000RPM for 5 minutes and record values

(By doing this we are trying to establish if the system can recognize heat in the exhaust during regeneration)

Are all of the exhaust gas temperature sensors showing reasonable values between 120°C and 400°C?

Yes

Proceed to step 10



No

Check and install new exhaust gas temperature sensors as required. Refer to the new module/component installation note at the top of the DTC Index
Using the manufacturer approved diagnostic system clear the DTCs and re-test

B10: COMPARISON OF SOOT MASS IN DIESEL PARTICULATE FILTER AND PARTICULATE FILTER DIFFERENTIAL PRESSURE SENSOR VOLTAGE



NOTE: Using the results from steps 7 and 8 establish if the Soot Mass estimator and the differential pressure sensor are aligned, in terms of their assessment of soot in the filter. If the soot mass is less than 54 grams the diesel particulate filter is recoverable.

	1 Using the results from step 7 check soot mass is less than 54 grams
	2 Using the results from step 8 check particulate filter differential pressure sensor voltage at 4000RPM is less than 1.5Volts (300mbar)
	Is diesel particulate filter soot mass value less than 54 grams and particulate filter differential pressure sensor voltage at 4000RPM less than 1.5Volts (300mbar)? Yes If the diesel particulate filter soot mass value is greater than 50 grams and the differential pressure sensor voltage is between 0.5Volts and 1.1Volts then the diesel particulate filter is low on soot but has not been driven to allow pressure correction of the diesel particulate filter, if other issue from the tests performed are evident. Proceed to next step No If the diesel particulate filter soot mass value is greater than 50 grams and the differential pressure sensor voltage greater than 1.5Volts then the diesel particulate filter has a high soot content. If no other issue from the tests performed are evident then the vehicle has a soot generated fault not detected by DTCs. Refer to the relevant section of the workshop manual and check for boost pressure leakage using the manufacturer approved leak check tool. Contact dealer technical support for further advice
B11: SOOT MASS REDUCTION	
	1 With the vehicle fully up to temperature and in Park maintain 2500RPM for 10 minutes
	2 Return to step 7, check diesel particulate filter soot mass value
	Has the diesel particulate filter soot mass reduced from the original recorded value? Yes Proceed to next step No Proceed to step 13
B12: DRIVE VEHICLE	
	 CAUTION: At all times during this procedure you should observe all relevant speed limits, laws, and regulations 1 Drive the vehicle until the engine reaches normal operating temperature. The engine should NOT be left idling to achieve working temperature. Drive the vehicle for a further twenty minutes, keeping the vehicle at a constant speed between 75 km/h (45 mph) and 120 km/h (75 mph). Keeping a constant speed enables the diesel particulate filter to regenerate more efficiently. It is therefore recommended that cruise control is used to achieve this, if possible (Do NOT carry out diesel particulate filter service regeneration)
	Is the diesel particulate filter soot mass less than 20 grams? Yes Using the manufacturer approved diagnostic system clear the DTC and re-test. Return vehicle to the customer No Contact dealer technical support with all of the recorded values from the above tests
B13: CARRY OUT FIT NEW PARTICULATE FILTER PROCESS	
	 WARNING: DO NOT carry out this process on any other occasion without first installing a new diesel particulate filter 1 Using the manufacturer approved diagnostic system, select SPECIAL APPLICATIONS ~ POWERTRAIN ~ carry out FIT NEW PARTICULATE FILTER PROCESS
	2 Carry out diesel particulate filter service regeneration. Record grams of soot following diesel particulate filter service regeneration
	Is the diesel particulate filter soot mass less than 20 grams? Yes Using the manufacturer approved diagnostic system clear the DTC and re-test. Return vehicle to the customer No Contact dealer technical support with all of the recorded values from the above tests

Diesel particulate filter regeneration procedure

If DPF FULL SEE HANDBOOK appears in the message center, carry out the following procedure

CAUTIONS:



The regeneration procedure produces high temperatures in the diesel particulate filter. Heat can be felt radiating from beneath the vehicle, which is normal and not a cause for concern. However, the vehicle should not be parked over combustible material, particularly during dry weather. The heat generated could be sufficient to start a fire when in close proximity to combustible material such as long dry grass, paper etc



At all times during this procedure you should observe all relevant speed limits, laws, and regulations

NOTES:



The ideal speed and conditions for regeneration are 100 km/h (62 mph) ~ 120 km/h (75 mph), in Drive. Keeping a constant speed enables the diesel particulate filter to regenerate more efficiently. It is therefore

recommended that cruise control is used to achieve this, if possible



When driving off-road during the regeneration process, greater accelerator pedal use may be required

1. Drive the vehicle until the engine reaches normal operating temperature. The engine should **NOT** be left idling to achieve working temperature
2. Drive the vehicle for a further twenty minutes, keeping the vehicle at a constant speed between 75 km/h (45 mph) and 120 km/h (75 mph)
3. If regeneration is successful the warning message will be extinguished, once the message is extinguished please keep driving for 10 minutes to ensure that the diesel particulate filter is completely clean
4. If the message remains repeat the process

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (PCM) (100-00, Description and Operation).

Exhaust System - TDV6 3.0L Diesel - Exhaust System

Diagnosis and Testing

Principle of Operation

For a detailed description of the exhaust system, refer to the relevant Description and Operation section of the workshop manual.

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests

1. Verify the customer concern
2. Visually inspect for obvious signs of mechanical or electrical damage

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Leaks • Metal fatigue • Pipes • Catalytic converter • Muffler(s) • Joints • Mountings • Clearance around components 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Electrical connector(s) • Sensor(s) • Engine control module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for DTCs and refer to the DTC Index

Symptom Chart

Symptom	Possible Causes	Action
Noisy or leaking exhaust	<ul style="list-style-type: none"> • Exhaust system/components 	Install new components as necessary. Refer to the relevant section of the workshop manual
Lack of power	<ul style="list-style-type: none"> • Air intake system fault • Restricted exhaust system • Low fuel pressure • Exhaust gas recirculation (EGR) valve(s) fault • Turbocharger fault 	Check the air intake system. Check for a blocked catalytic converter or muffler, install new components as necessary. Check the fuel pressure. For EGR and turbocharger tests, refer to the relevant section of the workshop manual

DTC Index

For a complete list of all diagnostic trouble codes that could be logged on this vehicle, please refer to Section 100-00.

Exhaust System - TDV6 3.0L Diesel - Exhaust System Repair

General Procedures

Check

NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.



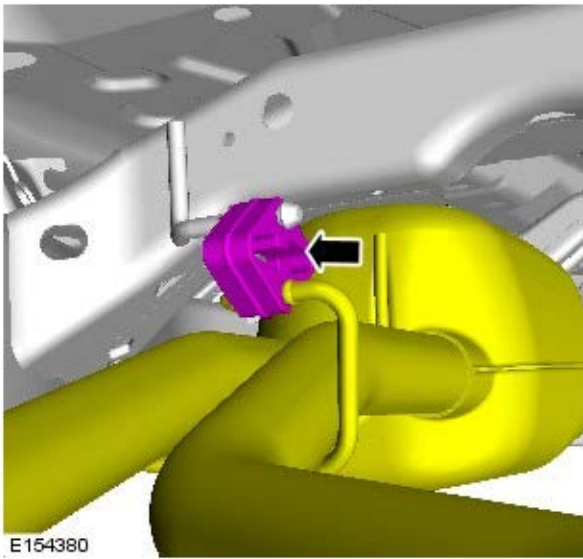
Some components shown removed for clarity.

All vehicles

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

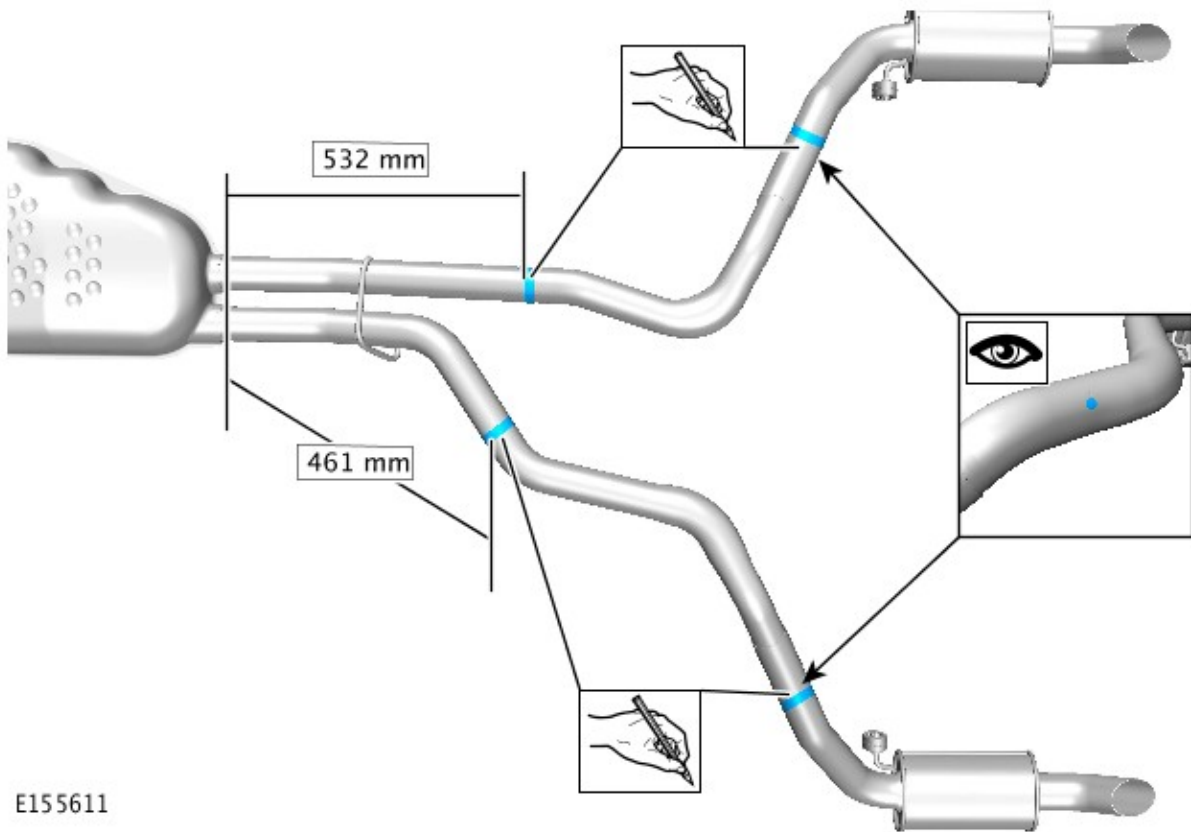
Raise and support the vehicle.

2.



Vehicles with diesel engine

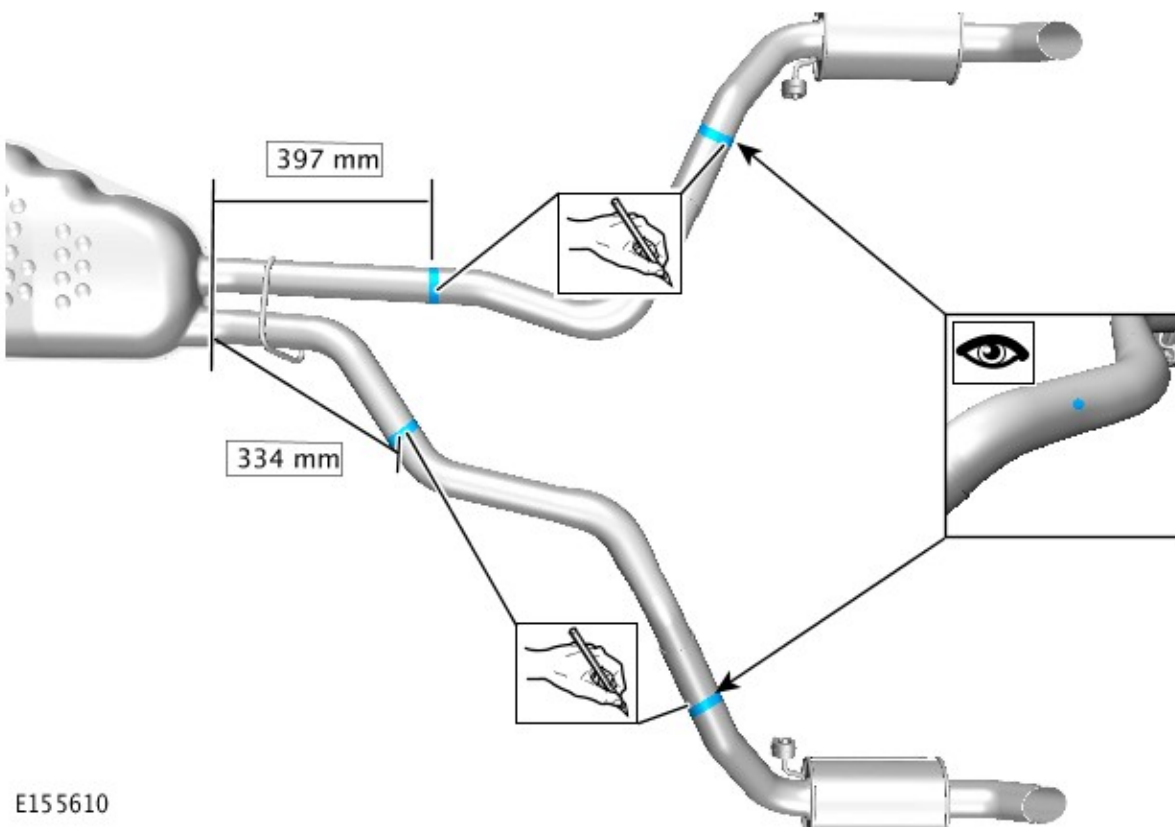
3.



E155611

Vehicles with petrol engine

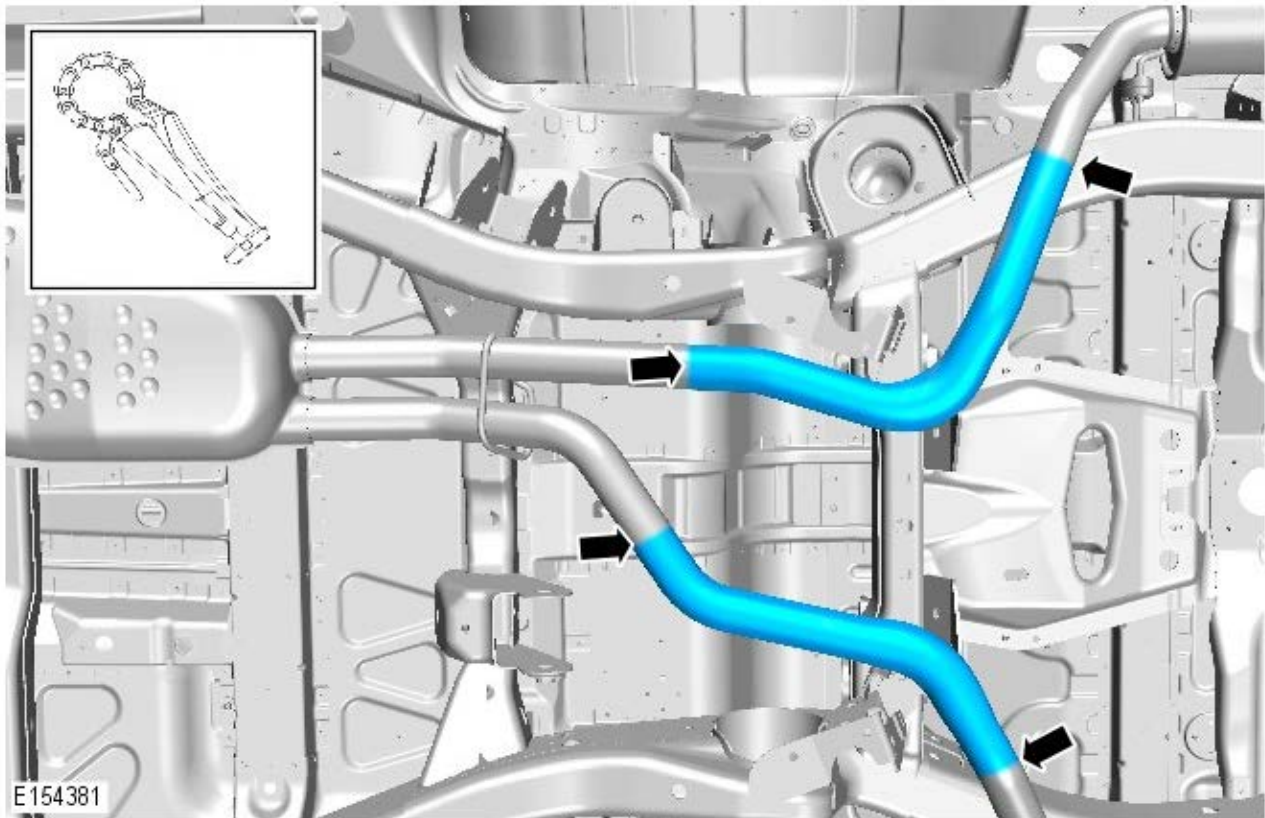
4.



E155610



All vehicles

5.

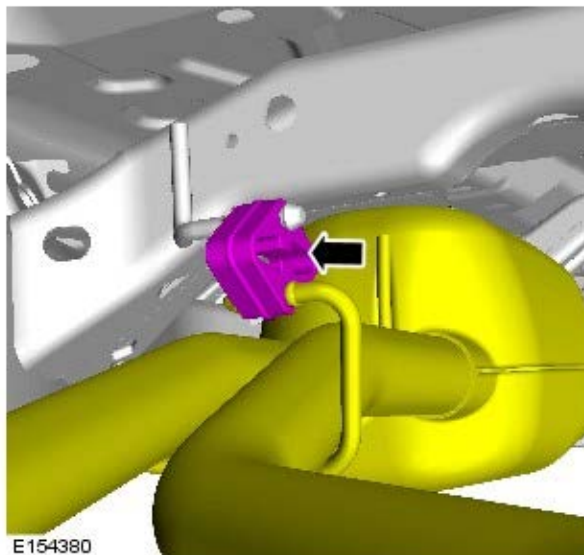


Adjustment

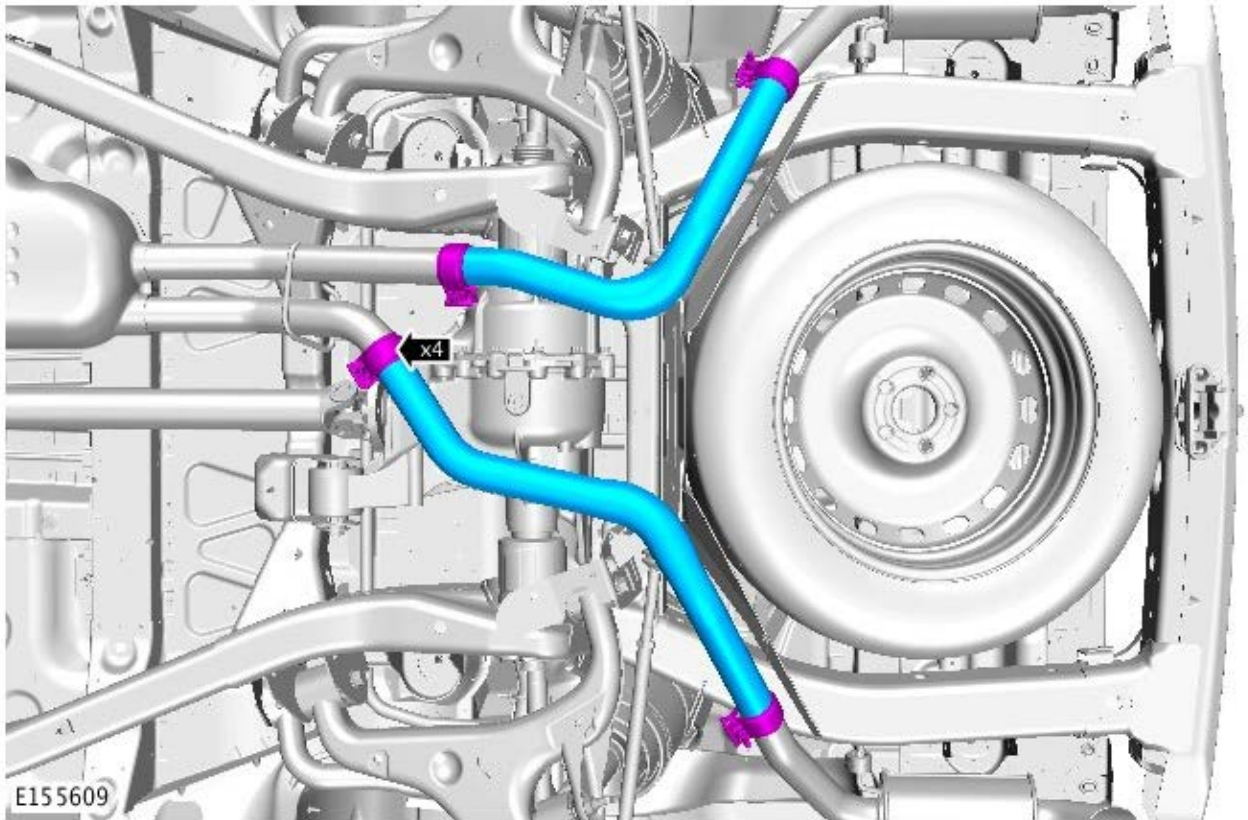
NOTES:

-  Some variation in the illustrations may occur, but the essential information is always correct.
-  Some components shown removed for clarity.

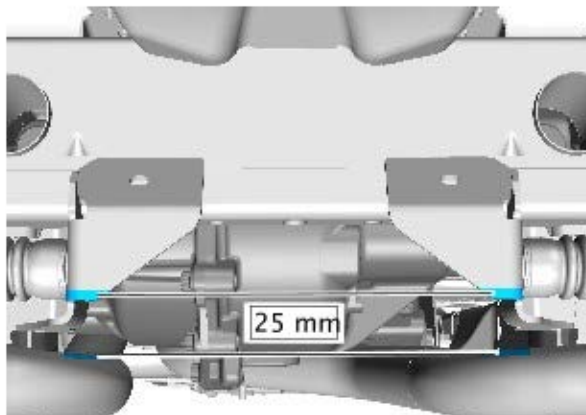
1.



2. Torque: 55 Nm



3. After the exhaust has been tightened, measure the clearance between exhaust and the chassis. If the measurement is not correct, loosen the exhaust retaining clamp and position the exhaust until the clearance is achieved.

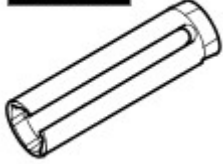


E155612

Exhaust System - TDV6 3.0L Diesel - Catalytic Converter

Removal and Installation


Special Tool(s)

 <p>310-121 E53465</p>	<p>310-121 Wrench, H02S</p>
---	---------------------------------

Removal

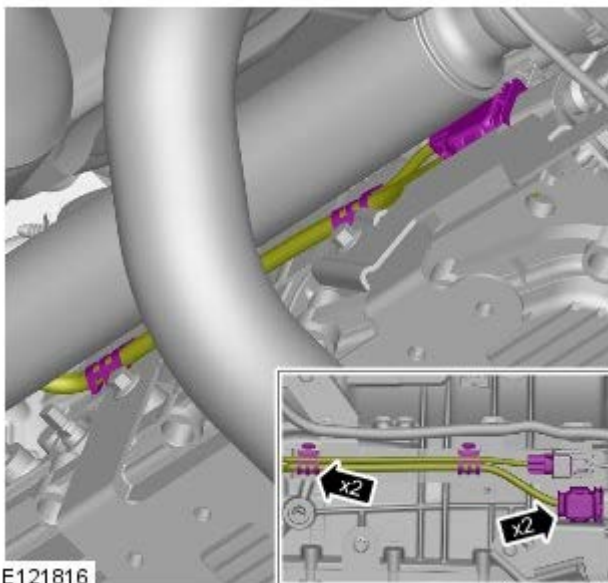



NOTE: Removal steps in this procedure may contain installation details.

- 
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

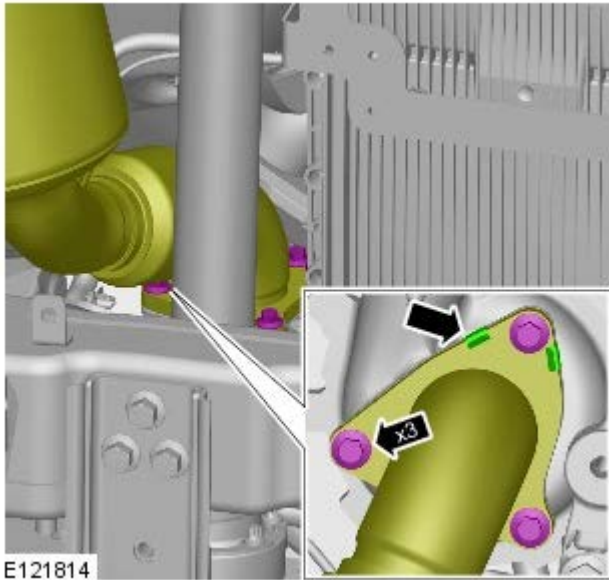
Raise and support the vehicle.
- Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).
- Refer to: [Transmission Support Crossmember - TDV6 3.0L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation).

4.




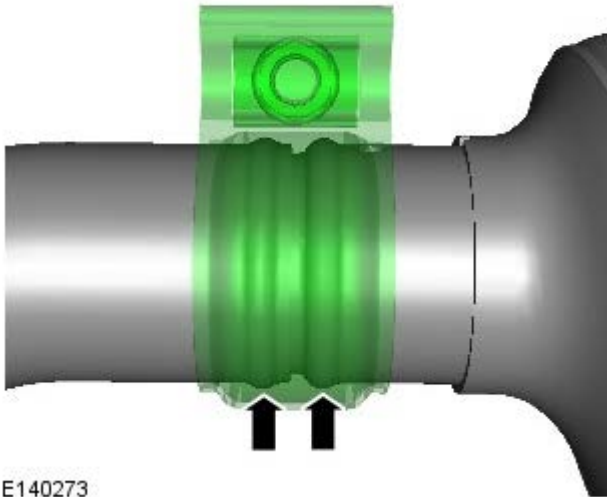
- 
CAUTION: Make sure that the exhaust system is supported with suitable retaining straps.

Torque: 28 Nm



E121814

6.  NOTE: Note the orientation of the component prior to removal.



E140273

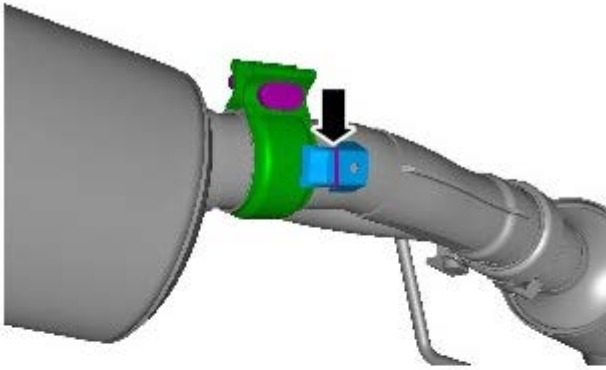
7.  WARNING: Always wear hand, eye and ear safety standard protection when grinding.

 CAUTION: Discard the clamp.

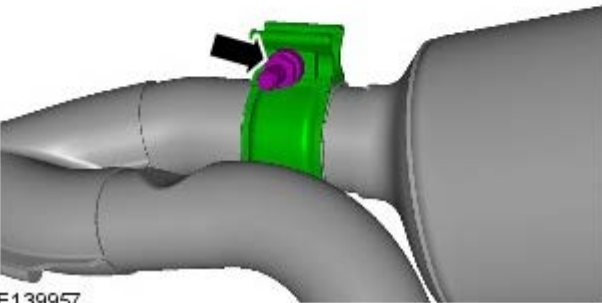
 NOTE: For vehicles with a welded exhaust clamp only.

Using suitable cutting/grinding equipment remove the clamp weld at the point illustrated.

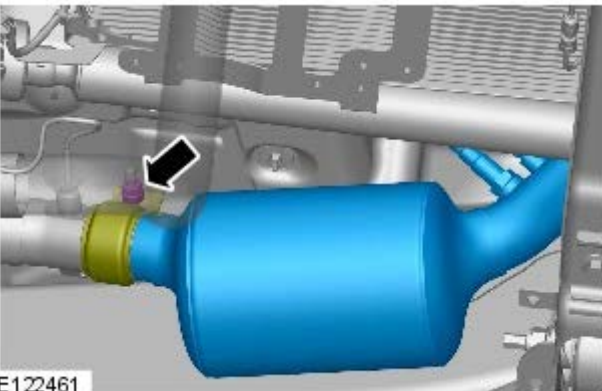
Torque: 55 Nm



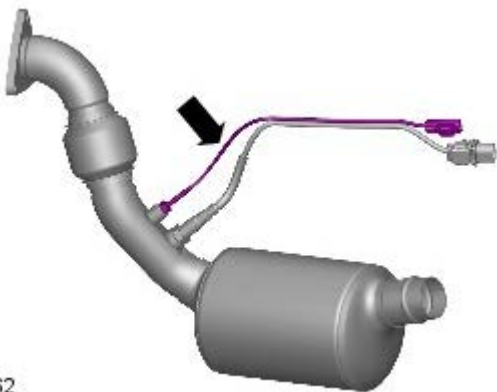
E139957




E122461





E122462




8. CAUTIONS:

 If weld is present on the clamp, grind off and install a new clamp.

 Discard the clamp.

 NOTE: Note the orientation of the component prior to removal.

Torque: 55 Nm

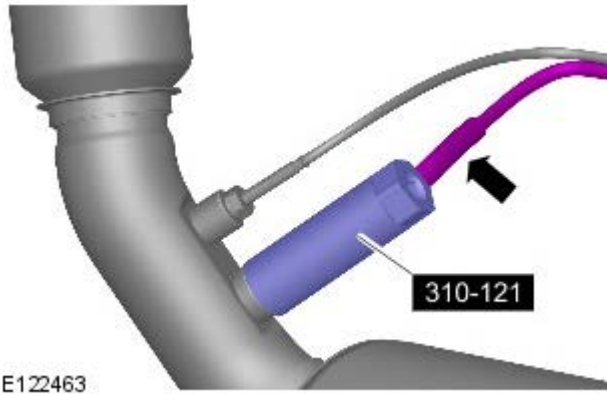
9.  NOTE: Do not disassemble further if the component is removed for access only.

Torque: 35 Nm

10.  NOTE: Do not disassemble further if the component is removed for access only.

Special Tool(s): 310-121

Torque: 48 Nm



E122463

Installation

1. CAUTIONS:



If accidentally dropped or knocked install a new sensor.



Make sure the HO2S wiring harness is not twisted more than 180 degrees and is not in contact with either the exhaust or driveshaft.

NOTES:



Install the retaining clamp.



Make sure the anti-seize compound does not contact the heated oxygen sensor (HO2S) tip.



If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

To install, reverse the removal procedure.

Exhaust System - TDV6 3.0L Diesel - Diesel Particulate Filter (DPF)

Removal and Installation


General Equipment

Transmission jack

Removal

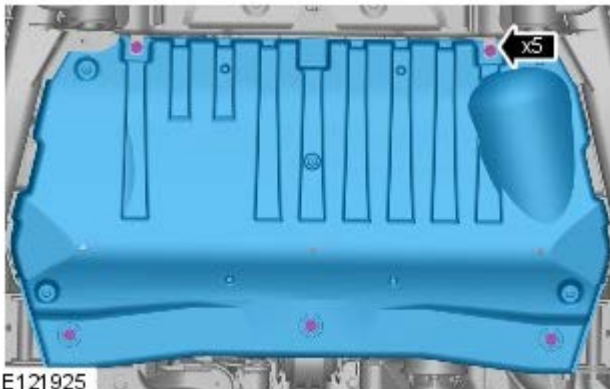


NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

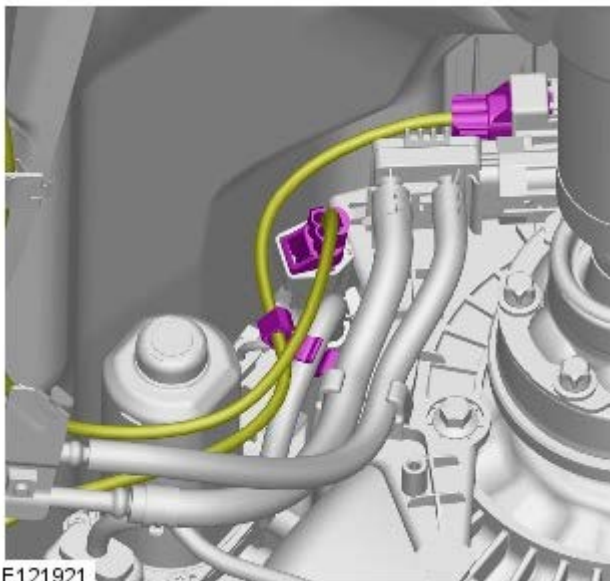
Raise and support the vehicle.

2. Torque: 10 Nm



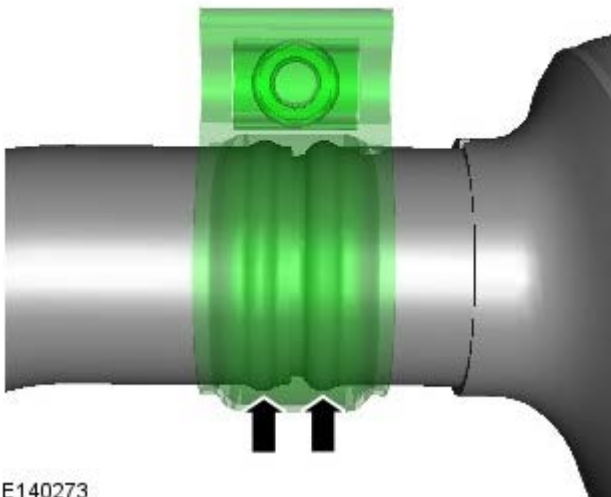
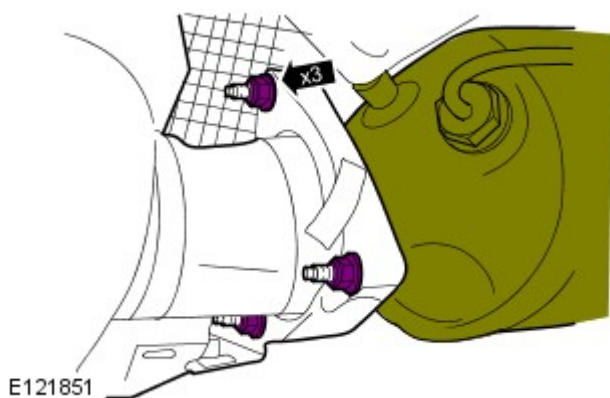
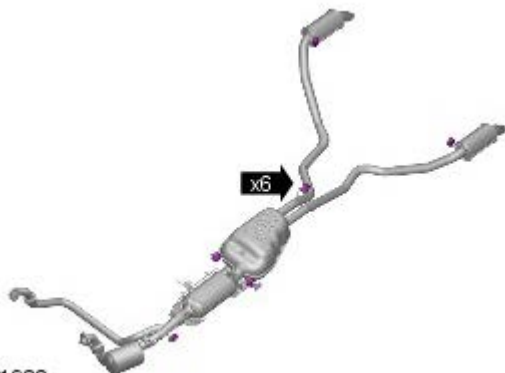
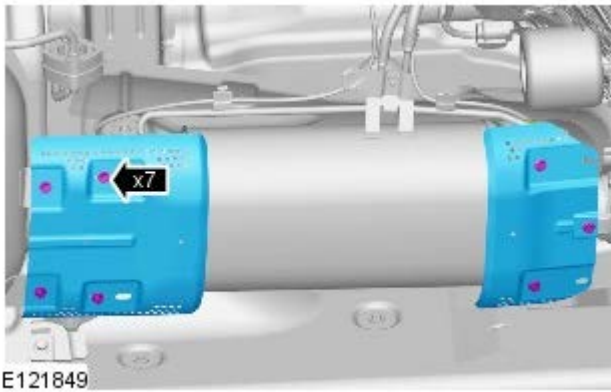
E121925


- 3.



E121921

4. Torque: 10 Nm




5.  CAUTION: Make sure that the exhaust system is supported with a suitable transmission stand.

Release the 6 exhaust hangers.

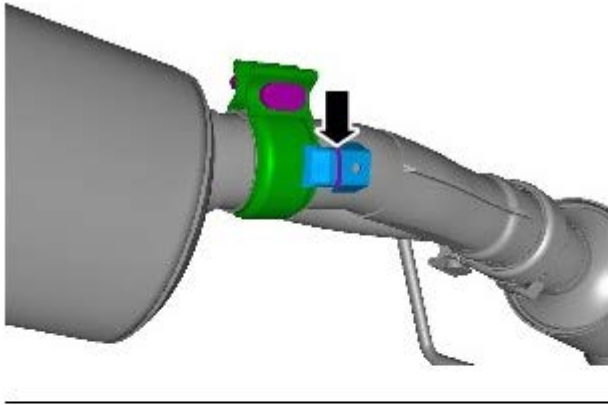
General Equipment: [Transmission jack](#)

6.  NOTE: Discard the gasket.

Torque: 23 Nm

7.  NOTE: Note the orientation of the component prior to removal.

8.  WARNING: Always wear hand, eye and ear safety standard protection when grinding.

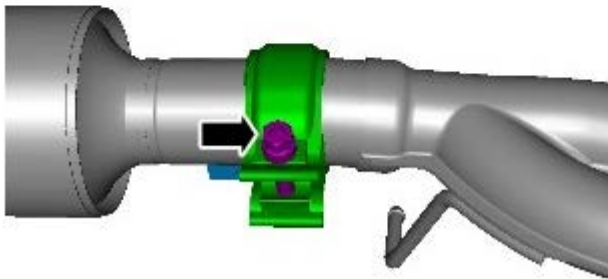


 CAUTION: Discard the clamp.

 NOTE: For vehicles with a welded exhaust clamp only.

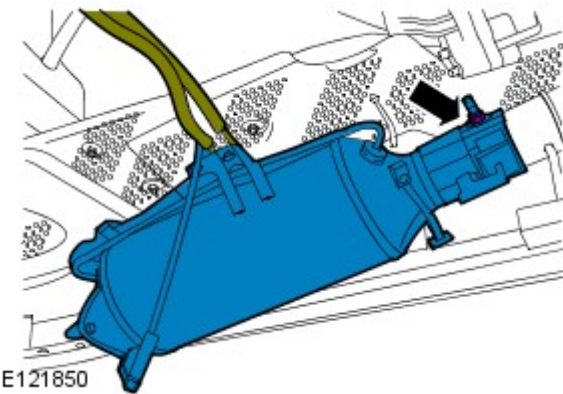
Using suitable cutting/grinding equipment remove the clamp weld at the point illustrated.

Torque: 50 Nm



E140009

9. Torque: 50 Nm



E121850

Installation

1. To install, reverse the removal procedure.
2. If a new unit is installed, configure using the approved diagnostic tool.

Exhaust System - TDV6 3.0L Diesel - Exhaust System


Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

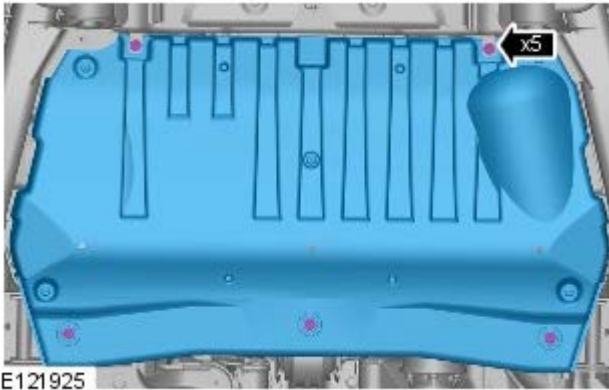
All vehicles

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

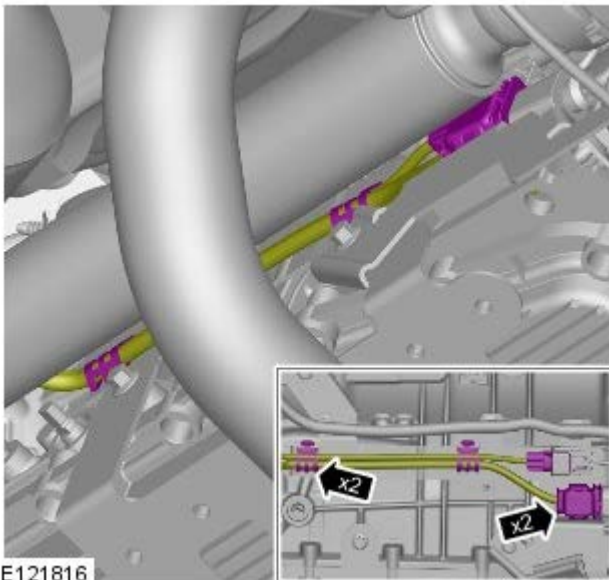
2. Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).
3. Refer to: [Transmission Support Crossmember - TDV6 3.0L Diesel](#) (502-02 Full Frame and Body Mounting, Removal and Installation).

4. Torque: 10 Nm



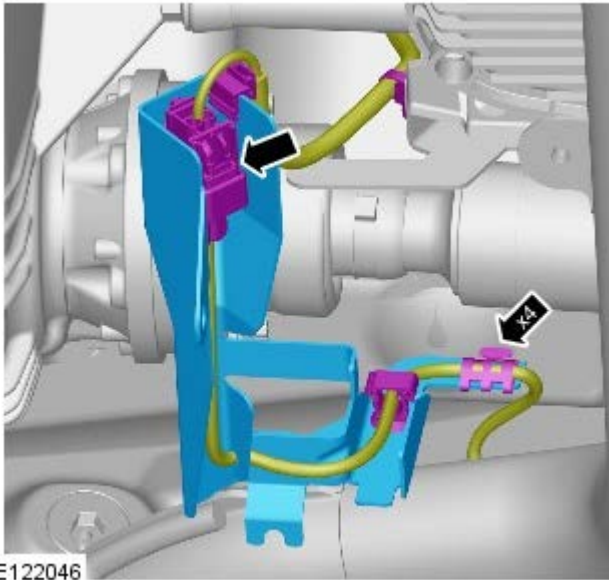
E121925

5.



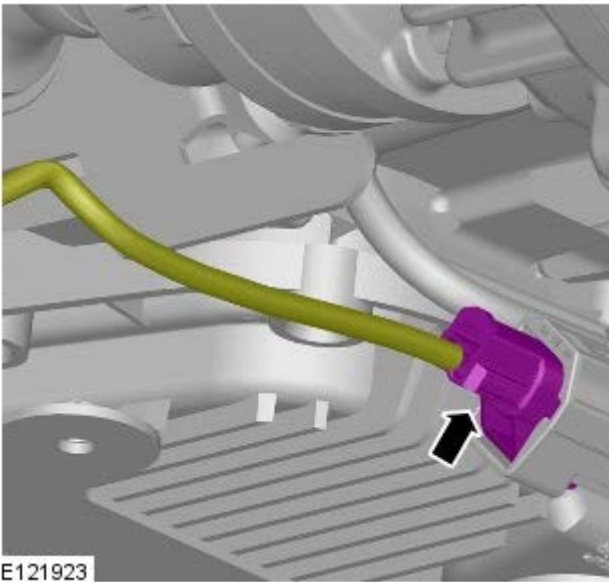
E121816

6.



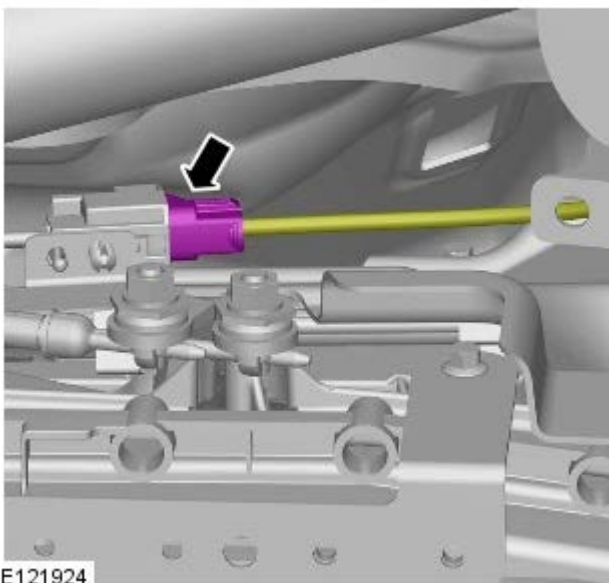
E122046

7.



E121923

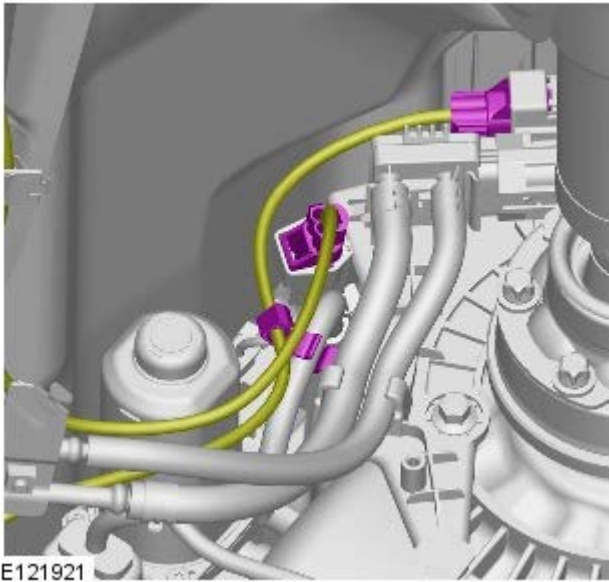
8.



E121924

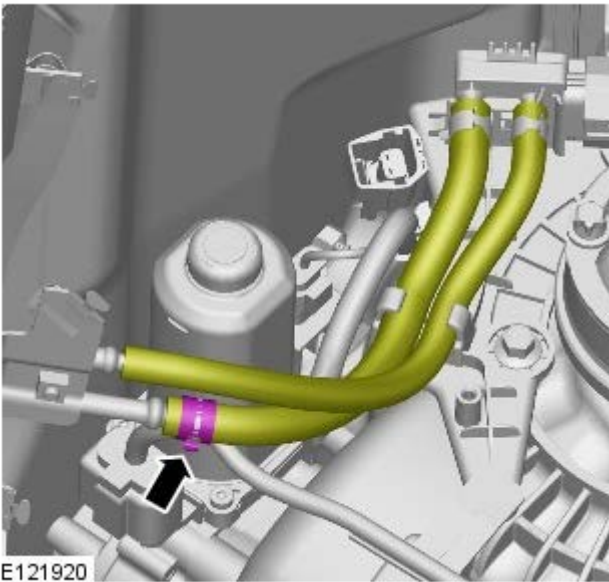
Vehicles with diesel particulate filter (DPF)

9.



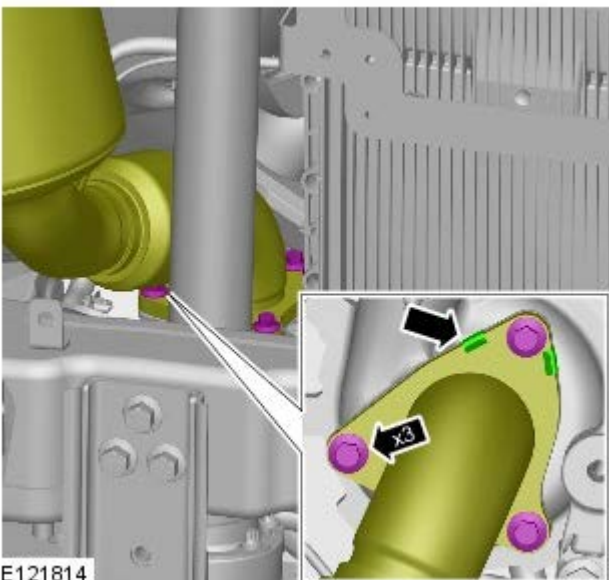
E121921

10.




E121920


All vehicles

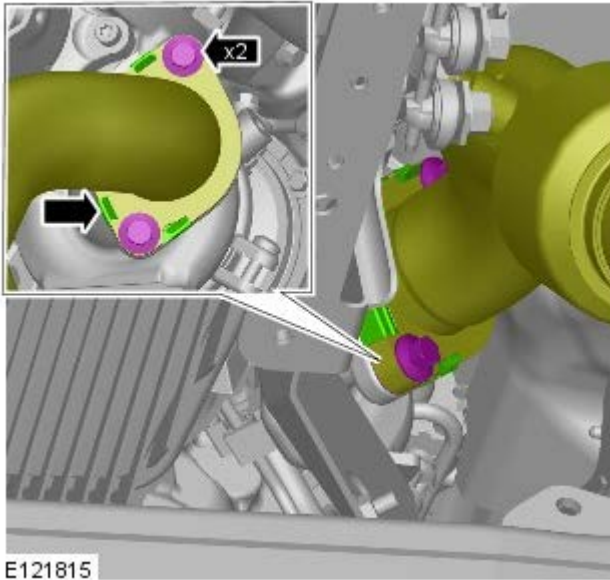


E121814

11.  CAUTION: Make sure that the exhaust system is supported with suitable retaining straps.

Torque: 28 Nm

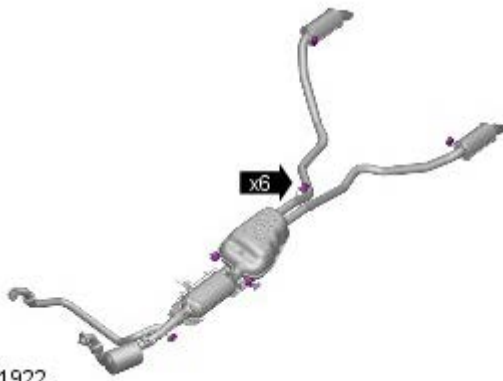
12.  CAUTION: Make sure that the exhaust system is supported with suitable retaining



straps.


Torque: 28 Nm

E121815



E121922

Installation

13.  **NOTE:** Do not disassemble further if the component is removed for access only.

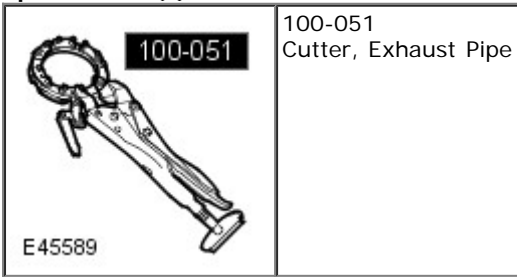
With assistance, remove the exhaust system.

1. To install, reverse the removal procedure.

Exhaust System - TDV6 3.0L Diesel - Front Muffler

Removal and Installation

Special Tool(s)




General Equipment

Transmission jack

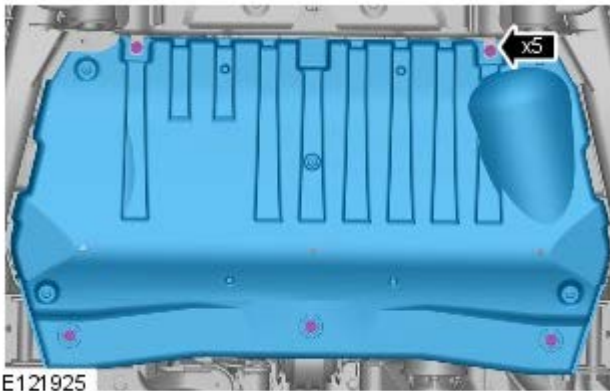
Removal

All vehicles

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

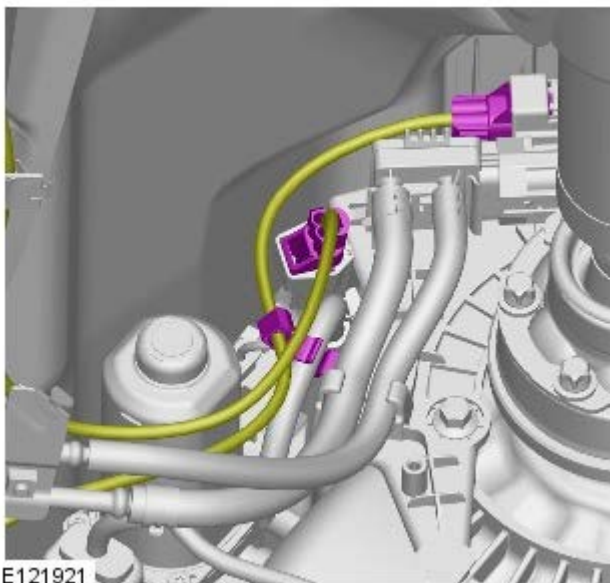
Raise and support the vehicle.

2. Remove the 6 bolts.

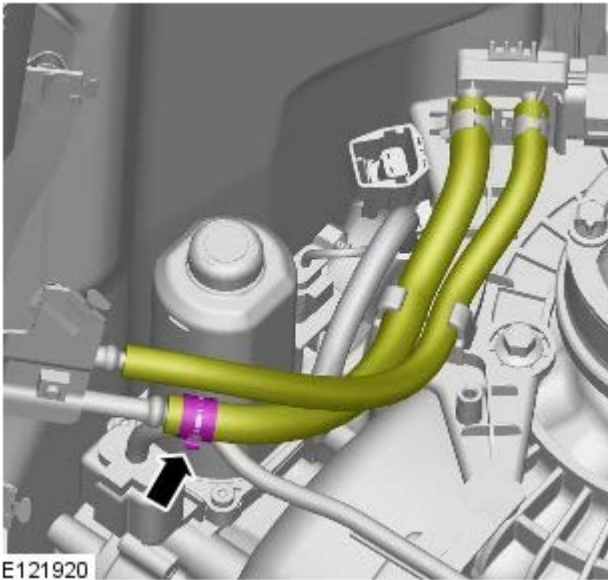


Vehicles with diesel particulate filter (DPF)

- 3.

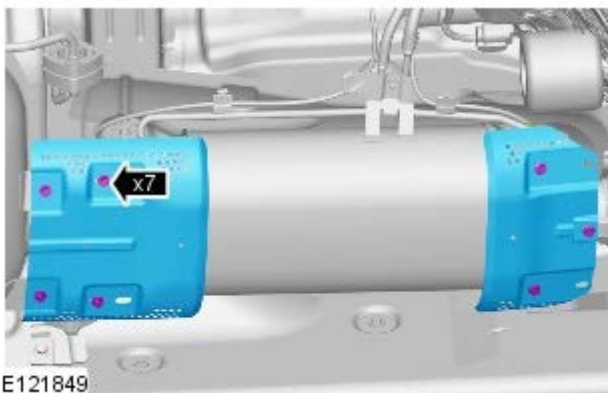


- 4.



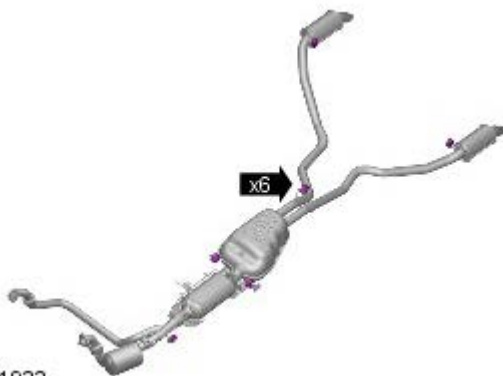
E121920

5.




E121849

All vehicles

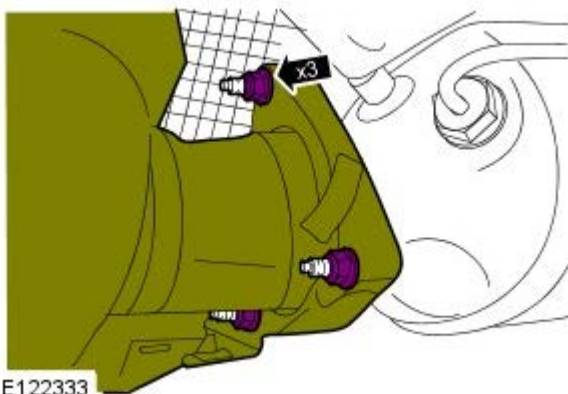


E121922

6.  **CAUTION:** Make sure that the exhaust system is supported with a suitable transmission stand.

Release the 6 exhaust hangers.

General Equipment: [Transmission jack](#)

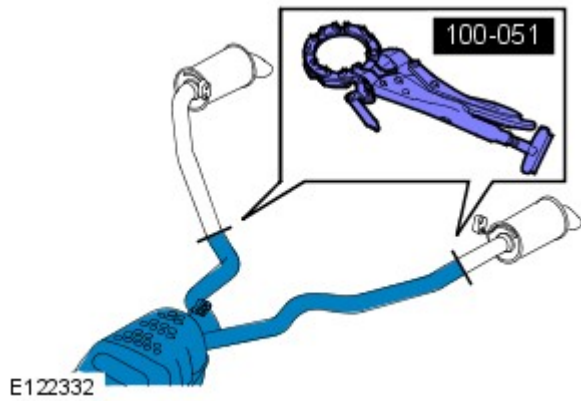


E122333

7.  **NOTE:** Discard the gasket.

With assistance, remove the muffler and tailpipe assembly.

8. Using the special tool, cut the exhaust pipe at






the marked position.

Special Tool(s): [100-051](#)

Installation

All vehicles

1.  **NOTE: Do not tighten the retaining clamp at this stage.**
Position the RH tail pipe to the muffler assembly.
2.  **NOTE: Do not tighten the retaining clamp at this stage.**
Position the LH tail pipe to the muffler assembly.
3.  **NOTE: Install a new gasket.**
With assistance, install the muffler assembly.
4. Tighten the nuts to 23 Nm (17 lb.ft).
5. Align both tail pipes and tighten the retaining clamps to 55 Nm (40 lb.ft).

Vehicles with diesel particulate filter (DPF)

6. Install the heat shields.

Torque: 10 Nm
7. Install the DPF differential pressure sensor, high and low pressure pipes.
8. Connect the DPF differential pressure sensor electrical connectors.

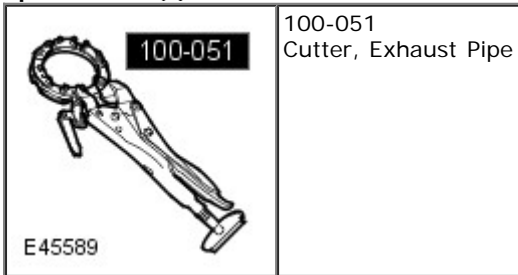
All vehicles

9. Install the transmission undershield.
10. Install the bolts and tighten to 10 Nm (7 lb.ft).

Exhaust System - TDV6 3.0L Diesel - Rear Muffler

Removal and Installation


Special Tool(s)



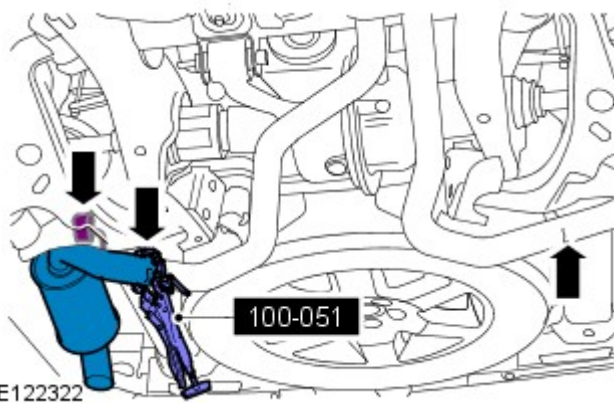
Removal



NOTE: Removal steps in this procedure may contain installation details.

- 
WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.



- NOTES:



Right-hand shown, left-hand similar.



Using the special tool, cut the exhaust pipe at the marked position.

Remove the tail pipe.

Special Tool(s): [100-051](#)

Installation

- NOTES:



Do not tighten the retaining clamp at this stage.



Clean the components.



Install the retaining clamp.

Install the tail pipe.

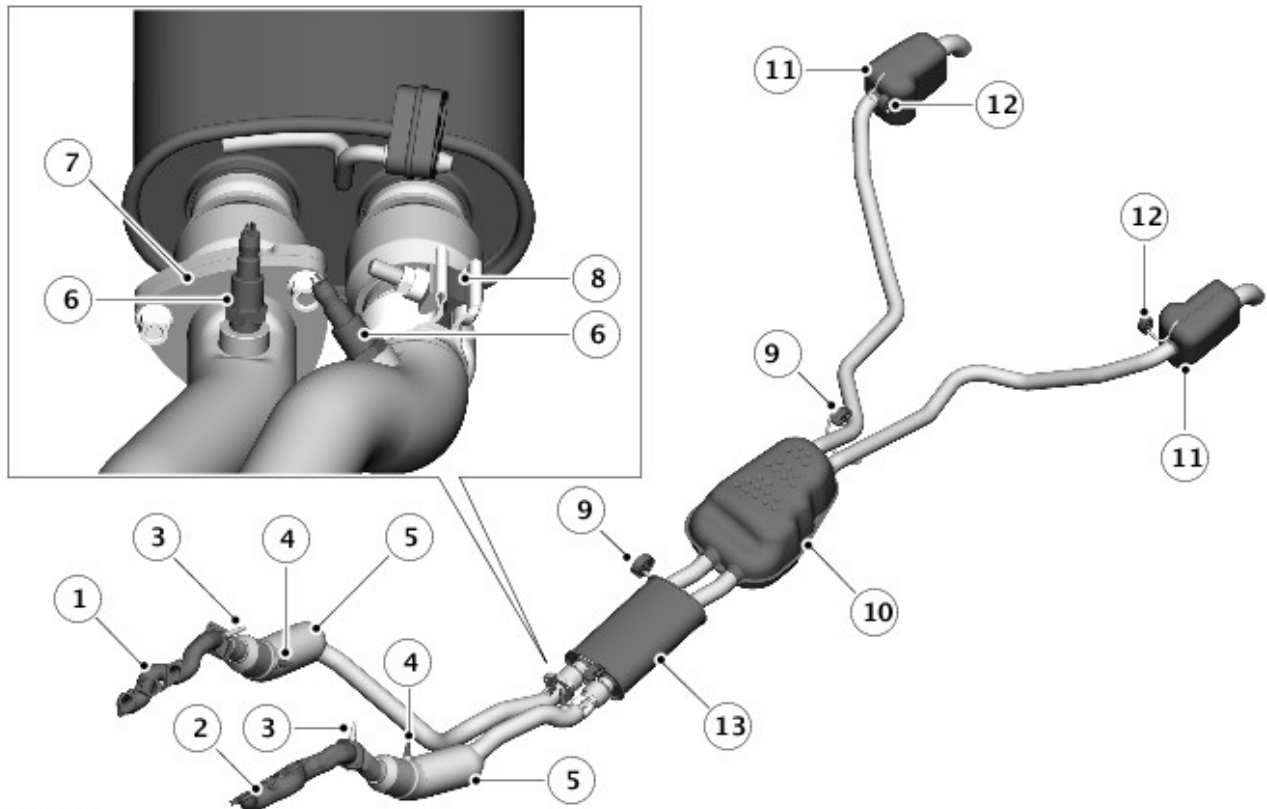
- Align the tail pipe and tighten the retaining clamp to 55 Nm (40 lb.ft).

Exhaust System - V6 S/C 3.0L Petrol -**Torque Specifications**

Description	Nm	lb-ft	lb-in
Heated oxygen sensor (HO2S)	48	35	-
Catalyst monitor sensor	48	35	-
Catalytic converter retaining clamp	55	40	-
Catalytic converter retaining bolts to exhaust manifold	25	16	-
Exhaust manifold retaining bolts	18	13	-

Exhaust System - V6 S/C 3.0L Petrol - Exhaust System

Description and Operation



E160671

Item	Part Number	Description
1	-	Exhaust manifold - Bank 1
2	-	Exhaust manifold - Bank 2
3	-	Pre-catalyst Heated Oxygen Sensor (HO2S) sensors (2 off)
4	-	Mid-catlayst HO2S (2 off)
5	-	Catalytic converter
6	-	Post-catalyst HO2S (2 off) Rear Silencer
7	-	Flange joint - Front section to center section
8	-	Clamp Exhaust Valve
9	-	Mounting rubber
10	-	Silencer - center
11	-	Silencer - rear
12	-	Mounting rubber
13	-	Silencer - front.

OVERVIEW

The V6 3.0L SC (supercharged) petrol engine exhaust system is supplied as three separate assemblies; a left front section incorporating a catalytic converter, a right front section incorporating a catalytic converter and a rear section incorporating a front silencer, a centre silencer and two rear silencers.

The system is attached to the underside of the body with 5 mounting rubbers which are located on mild steel hanger bars that are welded to the system. The mounting rubbers locate on corresponding hangers which are welded to the underside of the vehicle body. The system is routed mainly on the inside of the left chassis longitudinal before splitting near the rear differential to exit at each side of the rear of the vehicle.

The system has service repair items available. Indentations in the rear section, between the center and the rear silencers, show the cut points for the service replacement rear silencers or front section. When a service repair section is used, the joint is connected using a sleeve and two clamps to connect the pipes at the cut points.

DESCRIPTION

Front Section

Both front sections have a loose flange with two holes which provide for the attachment with two bolts onto the left and right exhaust manifolds. The flange is sealed by a tapered seat in the flange and a machined cone on the manifold.

Each flange is located on a short, straight pipe, which in turn is welded to the body of the catalytic converter. The

pipe has a threaded boss which is welded over a hole to provide location for the mid - catalyst **HO2S (heated oxygen sensor)** in a position between the pre-catalyst and the main catalyst.

Both outlet pipes from the catalytic converters, have a threaded boss which provide location for the post-catalyst HO2S.

The mid and post catalyst HO2S monitor the exhaust gasses leaving the engine. The **ECM (engine control module)** uses this information to provide accurately metered quantities of fuel to the combustion chambers to ensure the most efficient use of fuel and to minimize the exhaust emissions.

The front section also has a mass damper which will absorb resonance from the system.

Rear Section

The rear section comprises of a front silencer, center silencer and two rear silencers.

The front silencer comprises a double skin and two end plates which are rolled together to give a capacity of 7.0 litres (427 in³). The silencer contains baffles and perforated tubes which reduce noise as the exhaust gasses pass through the silencer. A hanger bar is welded to the front of the silencer and provides for the location of a mounting rubber.

The centre silencer comprises two pressed stainless steel shells which are welded together to give a capacity of 25.2 litres (1538 in³). The silencer contains baffles and perforated tubes which reduce noise as the exhaust gasses pass through the silencer. A hanger bar is welded to the front right side of the silencer and provides location for a mounting rubber.

Each outlet pipe terminates in a welded joint with the tail silencers. The outlet pipes have a hanger bar which provides for the location of a mounting rubber.

A hanger bar is welded to the front face of each rear silencer and provides for the location of a mounting rubber. The silencer is a rectangular fabrication with a baffle tube which is surrounded with glass fibre to provide further noise suppression. Each silencer has a capacity of 4 litres (244 in³).

Each outlet pipe is curved downwards to direct exhaust gasses away from the rear of the vehicle.

Exhaust Manifolds

The cast exhaust manifolds are unique for each cylinder bank. Spacers on the securing bolts allow the manifolds to expand and retract with changes of temperature while maintaining the clamping loads. Heat shields are integrated into the exhaust manifold gaskets. Each manifold has a threaded port near to its outlet which allows for the fitment of the pre-catalyst **HO2S**.

OPERATION

Catalytic Converters

In the catalytic converters, the exhaust gases are passed through honeycombed ceramic elements coated with a special surface treatment called 'washcoat'. The washcoat increases the surface area of the ceramic elements by a factor of approximately 7000°. On top of the washcoat is a coating containing palladium and rhodium, which are the active constituents for converting harmful emissions into inert by-products. The palladium and rhodium take oxygen from nitrogen oxides, to leave nitrogen, and combine the oxygen with carbon monoxide and hydrocarbons to leave carbon dioxide and water.

Exhaust System - V6 S/C 3.0L Petrol - Exhaust System Repair

General Procedures

Check

NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.



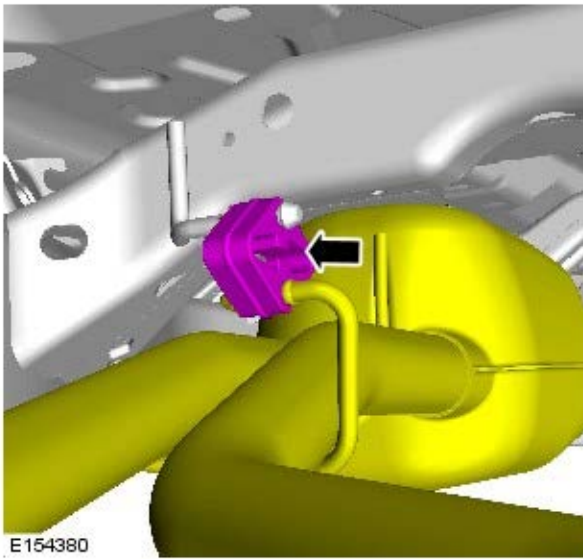
Some components shown removed for clarity.

All vehicles

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

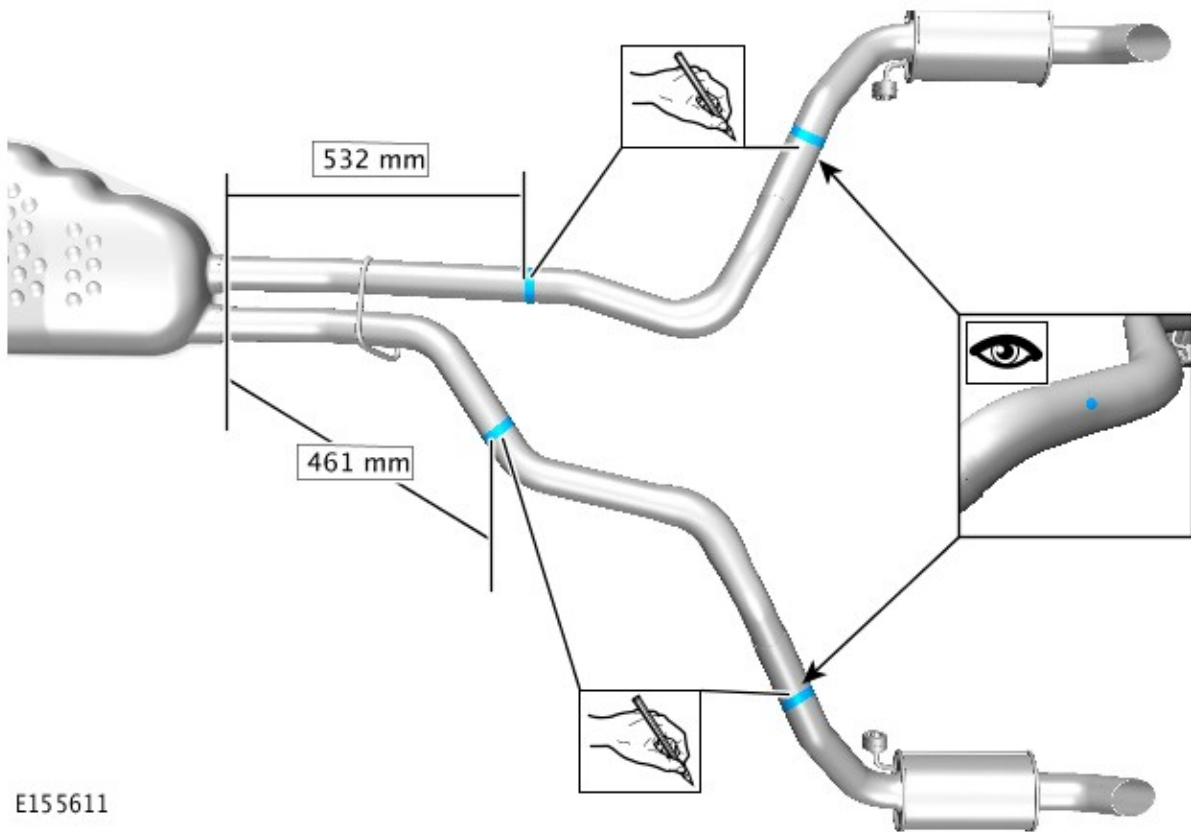
Raise and support the vehicle.

2.



Vehicles with diesel engine

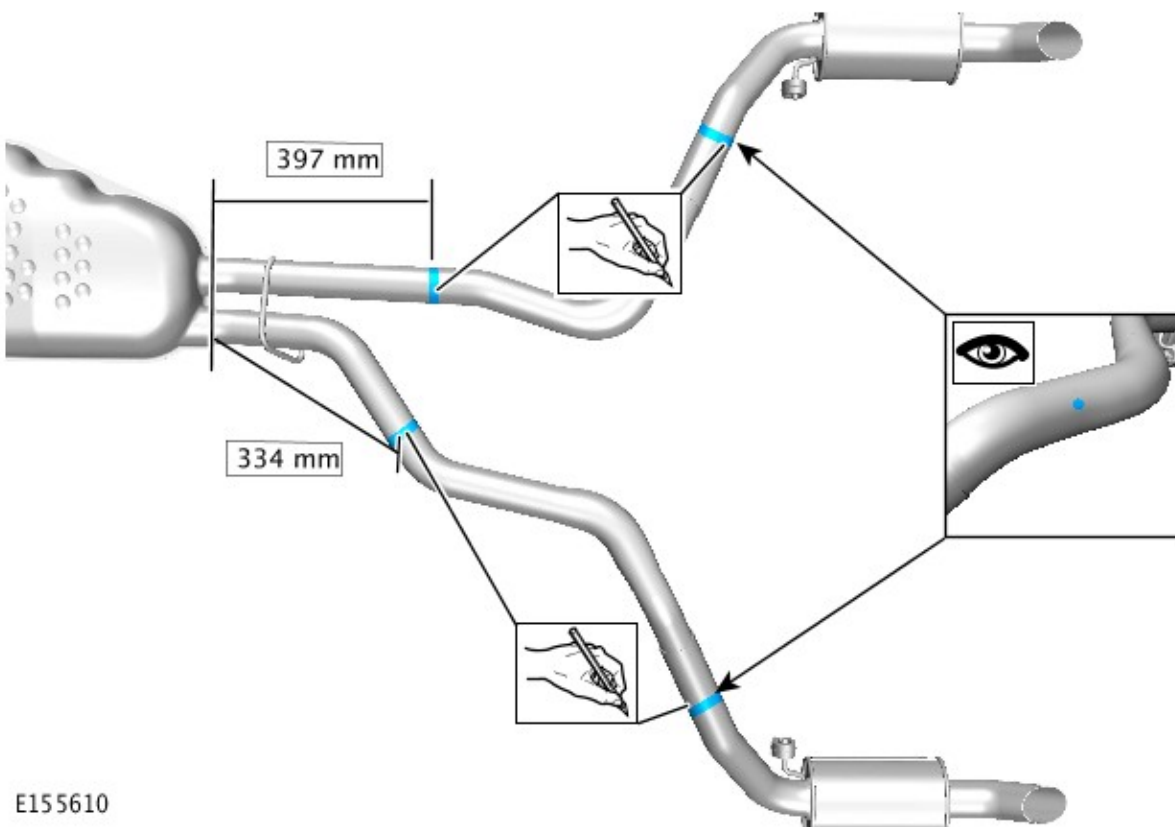
3.



E155611

Vehicles with petrol engine

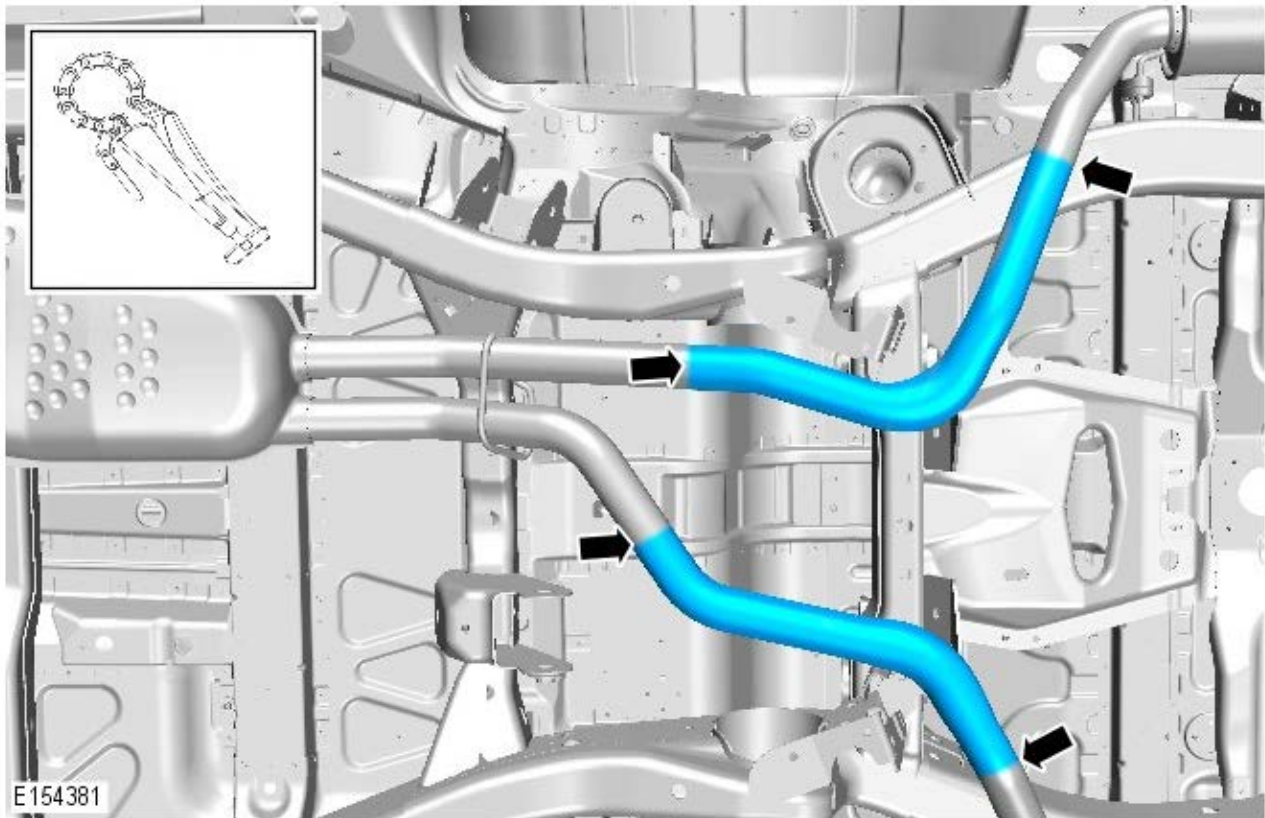
4.



E155610



All vehicles

5.

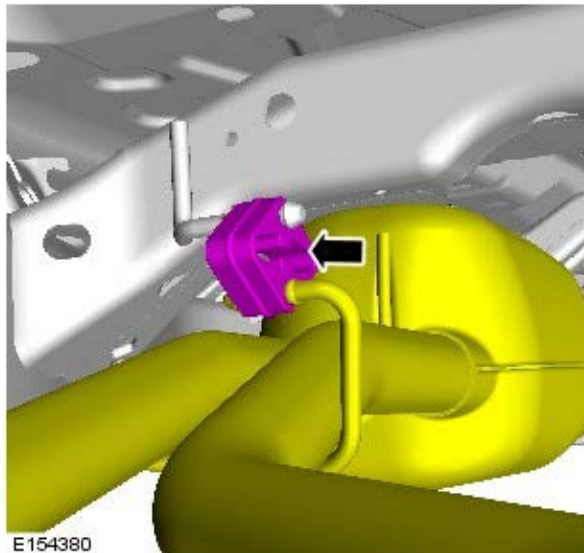


Adjustment

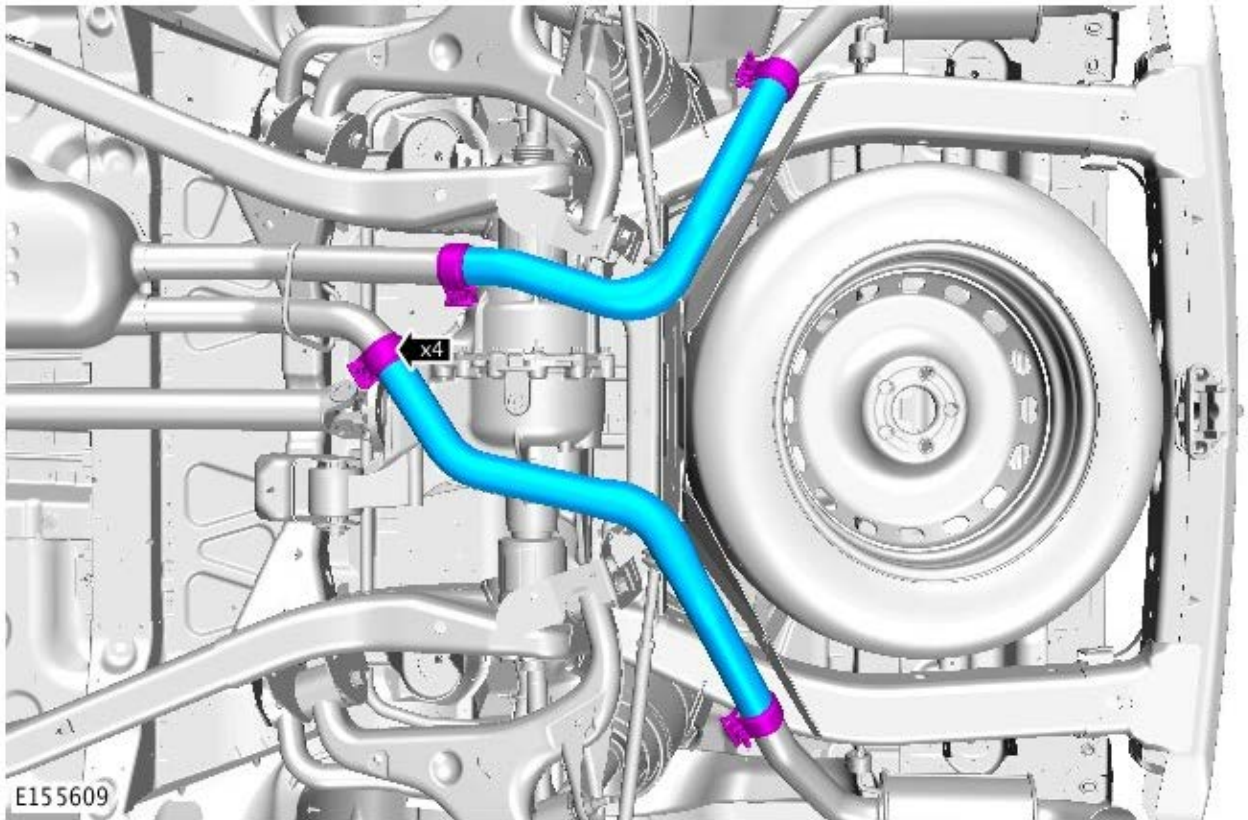
NOTES:

-  Some variation in the illustrations may occur, but the essential information is always correct.
-  Some components shown removed for clarity.

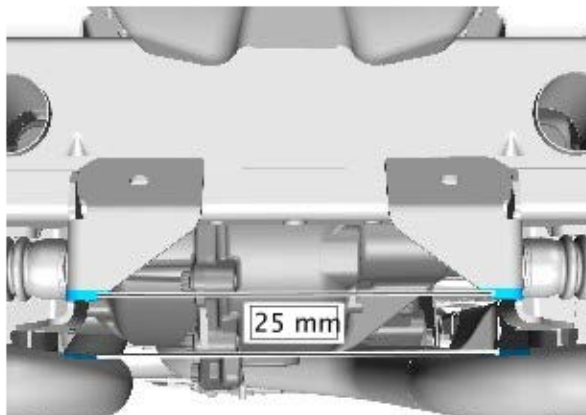
1.



2. Torque: 55 Nm



3. After the exhaust has been tightened, measure the clearance between exhaust and the chassis. If the measurement is not correct, loosen the exhaust retaining clamp and position the exhaust until the clearance is achieved.




E155612

Exhaust System - V6 S/C 3.0L Petrol - Catalytic Converter LH

Removal and Installation

Special Tool(s)

 <p>310-121</p> <p>E53465</p>	<p>310-121 Wrench, H02S</p>
---	---------------------------------


Removal

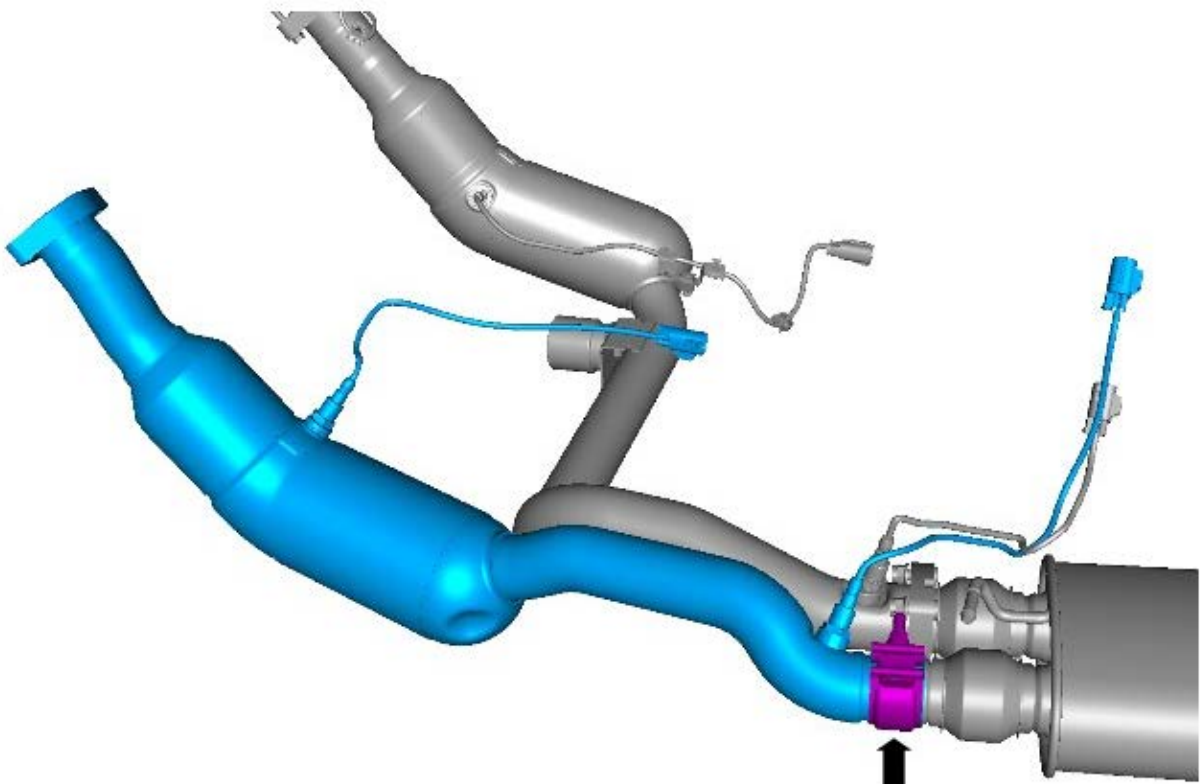


WARNING: Observe due care when working near a hot exhaust system.




NOTE: Removal steps in this procedure may contain installation details.

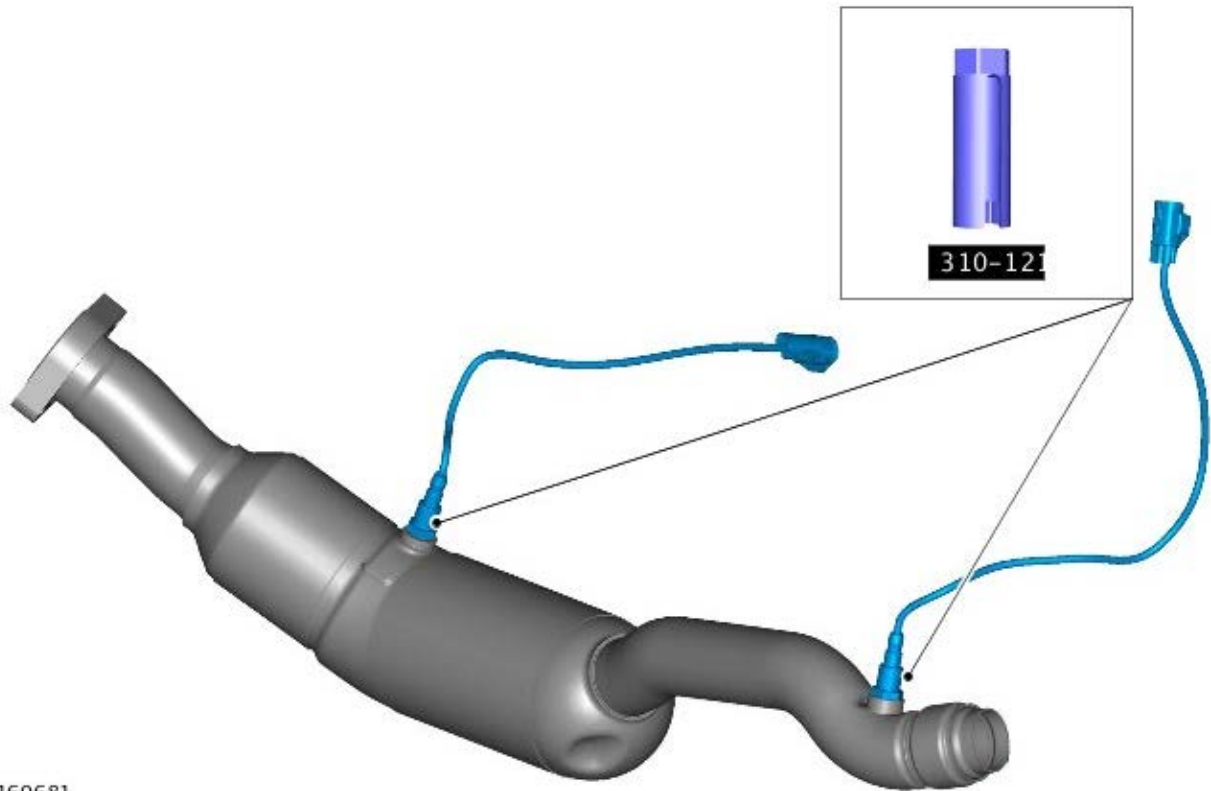
- 
WARNING: Make sure to support the vehicle with axle stands.
 Raise and support the vehicle.
- Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).
- Torque:** 55 Nm



E160680

- 
NOTE: Do not disassemble further if the component is removed for access only.

Special Tool(s): [310-121](#)
Torque: 48 Nm



E160681

Installation

1. CAUTIONS:



Make sure the anti-seize compound does not contact the heated oxygen sensor (HO2S) tip.



If accidentally dropped or knocked install a new sensor.



Make sure the HO2S wiring harness is not twisted more than 180 degrees and is not in contact with either the exhaust or driveshaft.



NOTE: If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

To install, reverse the removal procedure.

Exhaust System - V6 S/C 3.0L Petrol - Catalytic Converter RH

Removal and Installation

Removal



WARNING: Observe due care when working near a hot exhaust system.



NOTE: Removal steps in this procedure may contain installation details.

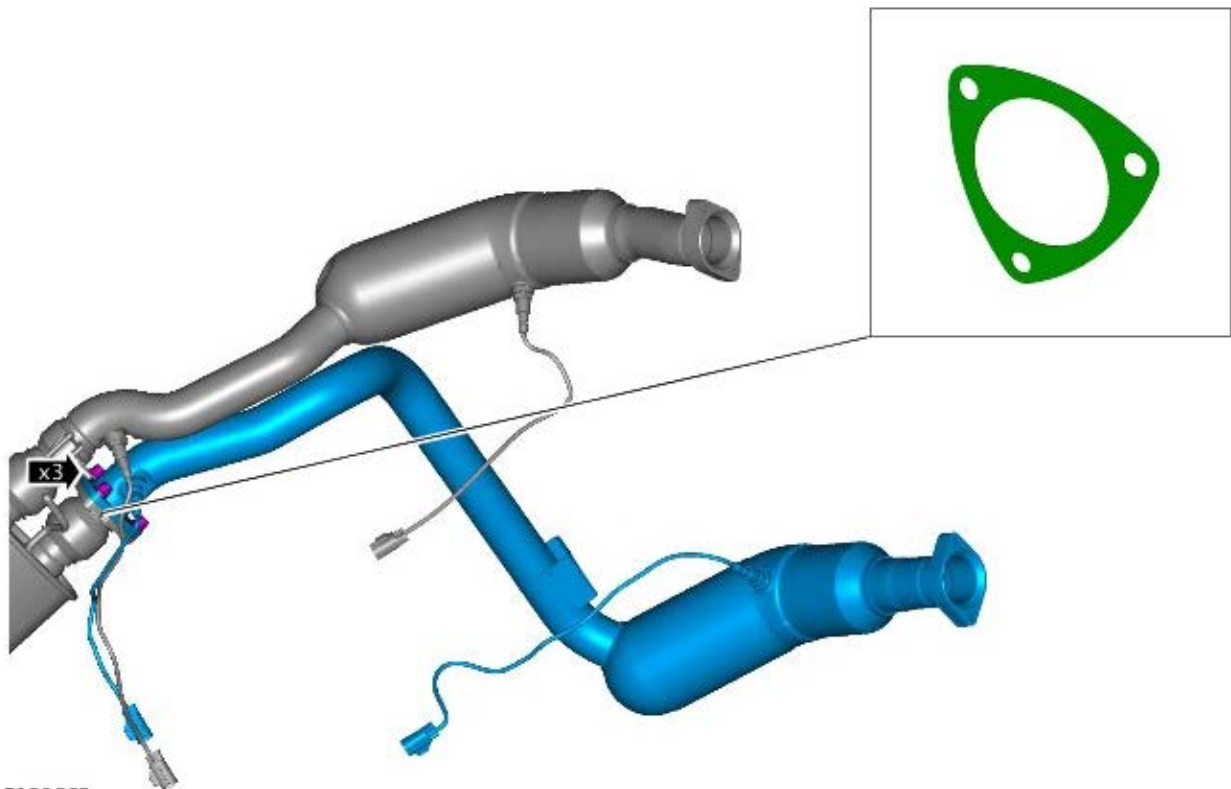
1. Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).



2. **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. *Torque:* 55 Nm

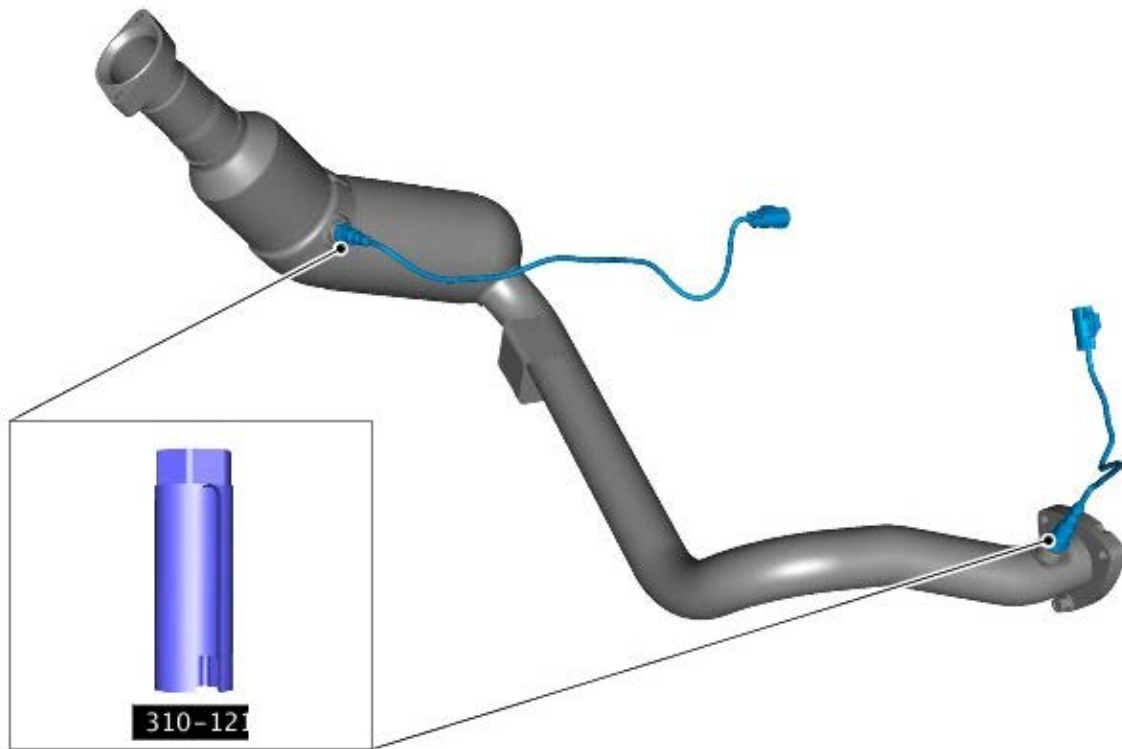


E160682



4. **NOTE:** Do not disassemble further if the component is removed for access only.

Torque: 48 Nm



E160684

Installation

1. CAUTIONS:



Make sure the anti-seize compound does not contact the heated oxygen sensor (HO2S) tip.



If accidentally dropped or knocked install a new sensor.



Make sure the HO2S wiring harness is not twisted more than 180 degrees and is not in contact with either the exhaust or driveshaft.



NOTE: If the original sensor is to be installed, apply lubricant meeting specification ESE-M12A4-A to the thread of the sensor.

To install, reverse the removal procedure.

Exhaust System - V6 S/C 3.0L Petrol - Exhaust System

Removal and Installation


Removal



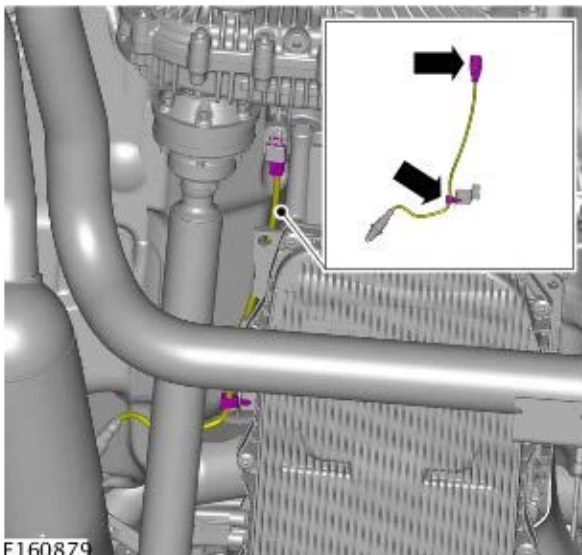
WARNING: Observe due care when working near a hot exhaust system.



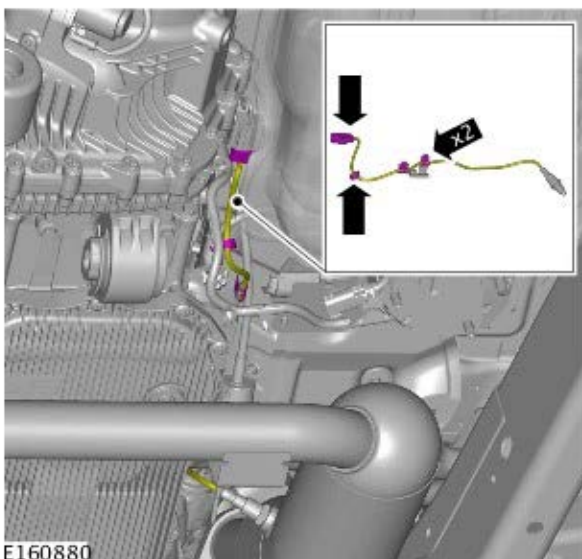
NOTE: Removal steps in this procedure may contain installation details.


1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).
3. Refer to: [Transmission Support Crossmember - V6 S/C 3.0L Petrol](#) (502-02 Full Frame and Body Mounting, Removal and Installation).

4.



5.

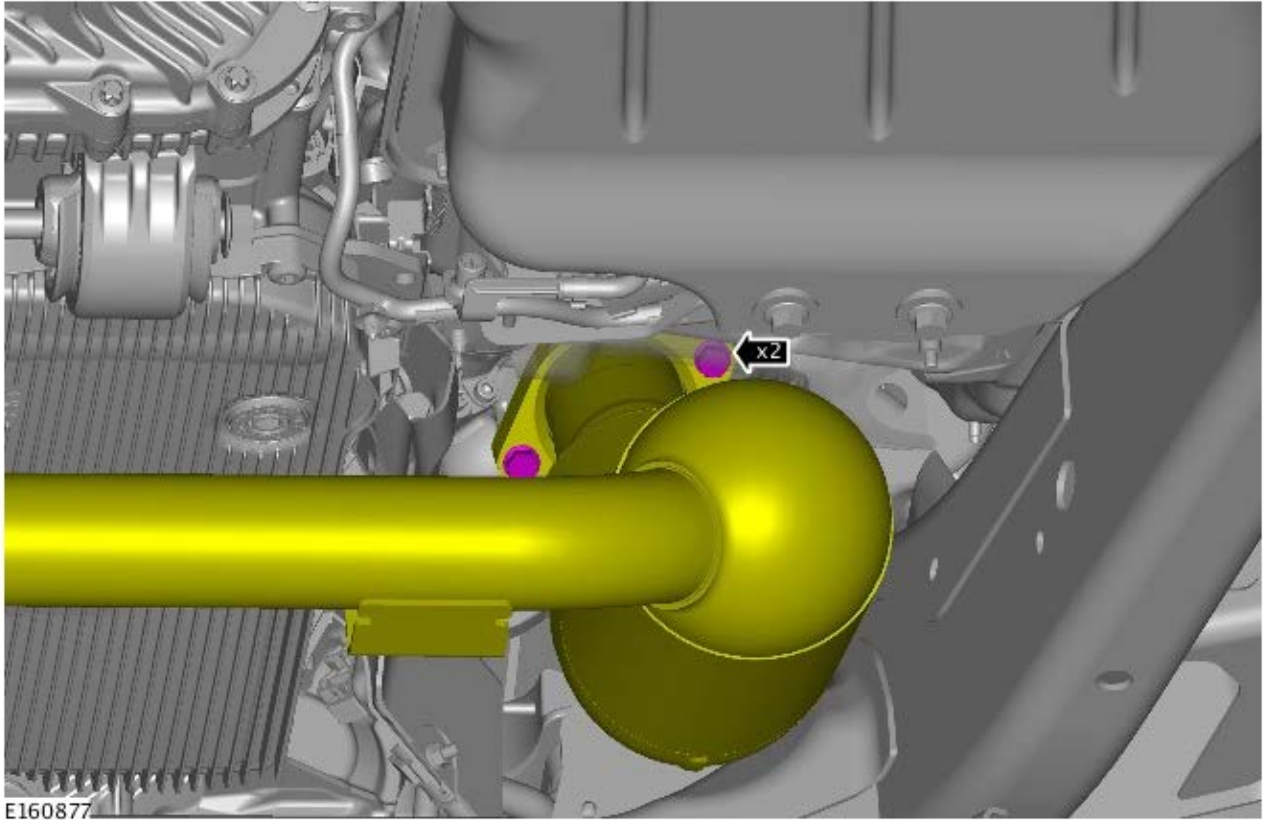



6.  **CAUTION:** Make sure that the exhaust system is supported with suitable retaining straps.

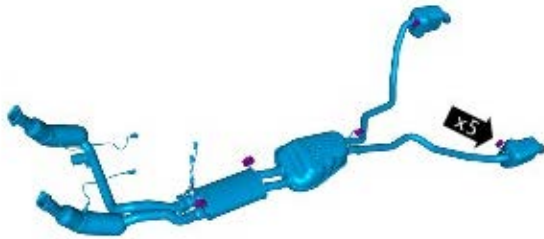
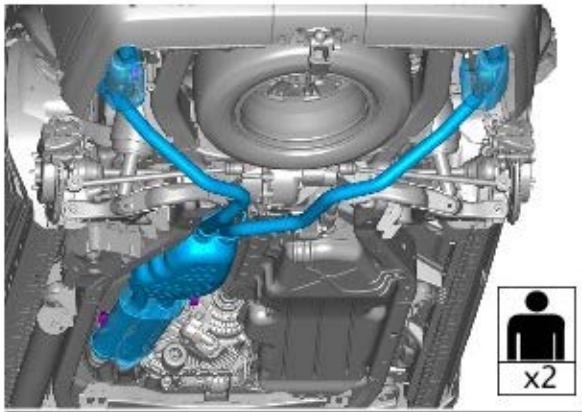


NOTE: The step must be carried out on both sides.


Torque: 40 Nm



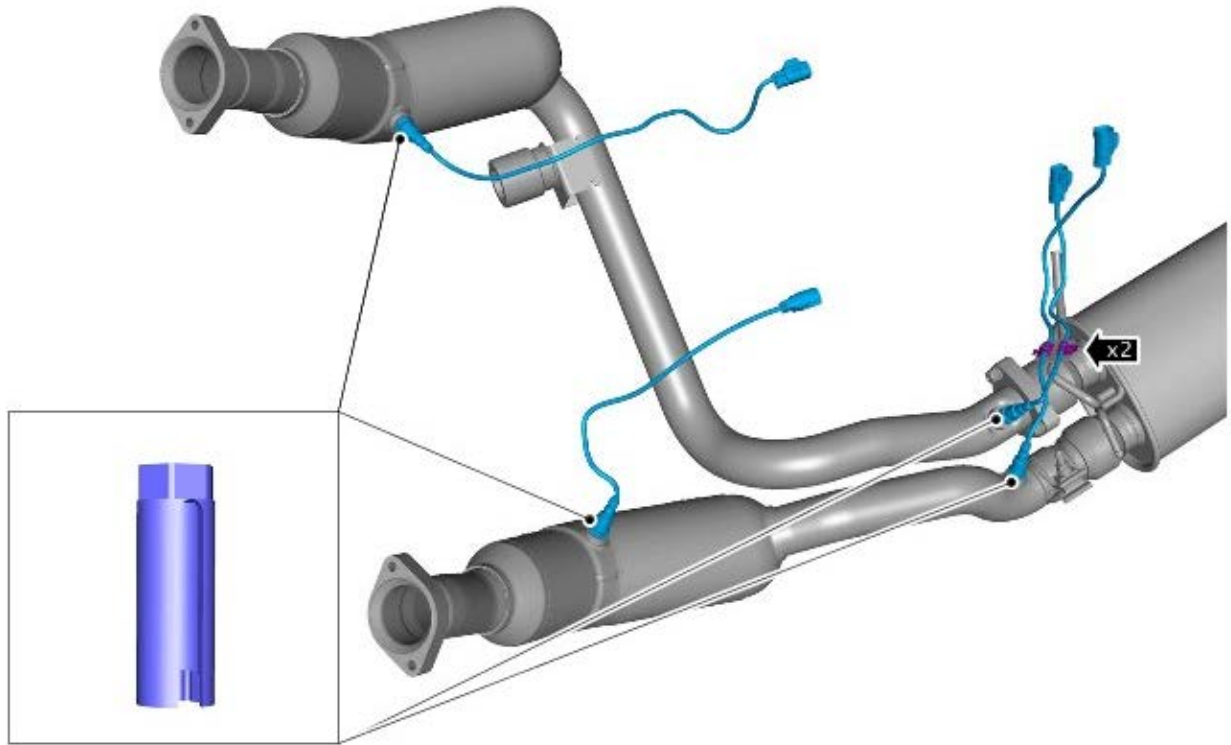
7.  CAUTION: Make sure that the exhaust system is supported with suitable retaining straps.



E160882

8.  NOTE: Do not disassemble further if the component is removed for access only.

Torque: 48 Nm



E160881


Installation

1. To install, reverse the removal procedure.

Exhaust System - V6 S/C 3.0L Petrol - Front Muffler

Removal and Installation

Special Tool(s)

 <p>E130266</p>	<p>100-051 Cutter, Exhaust Pipe</p>
--	---

Removal



WARNING: Observe due care when working near a hot exhaust system.



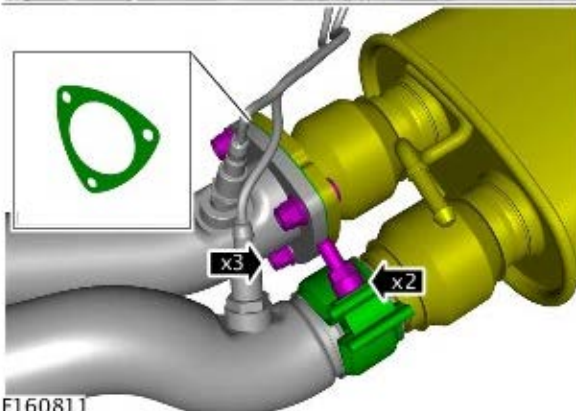
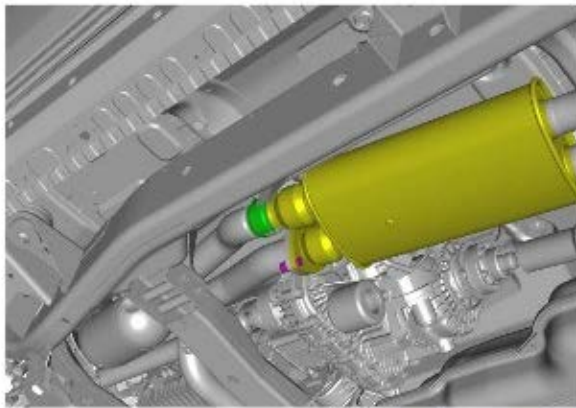
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Engine Undershield](#) (501-02 Front End Body Panels, Removal and Installation).


2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. *Torque:* 55 Nm

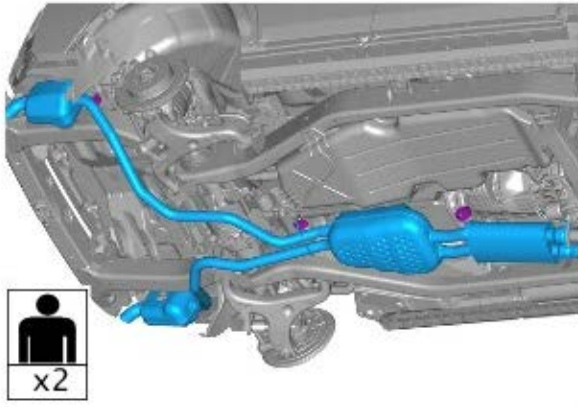


E160811


4.  **CAUTION:** Make sure that the exhaust system is supported with suitable retaining straps.

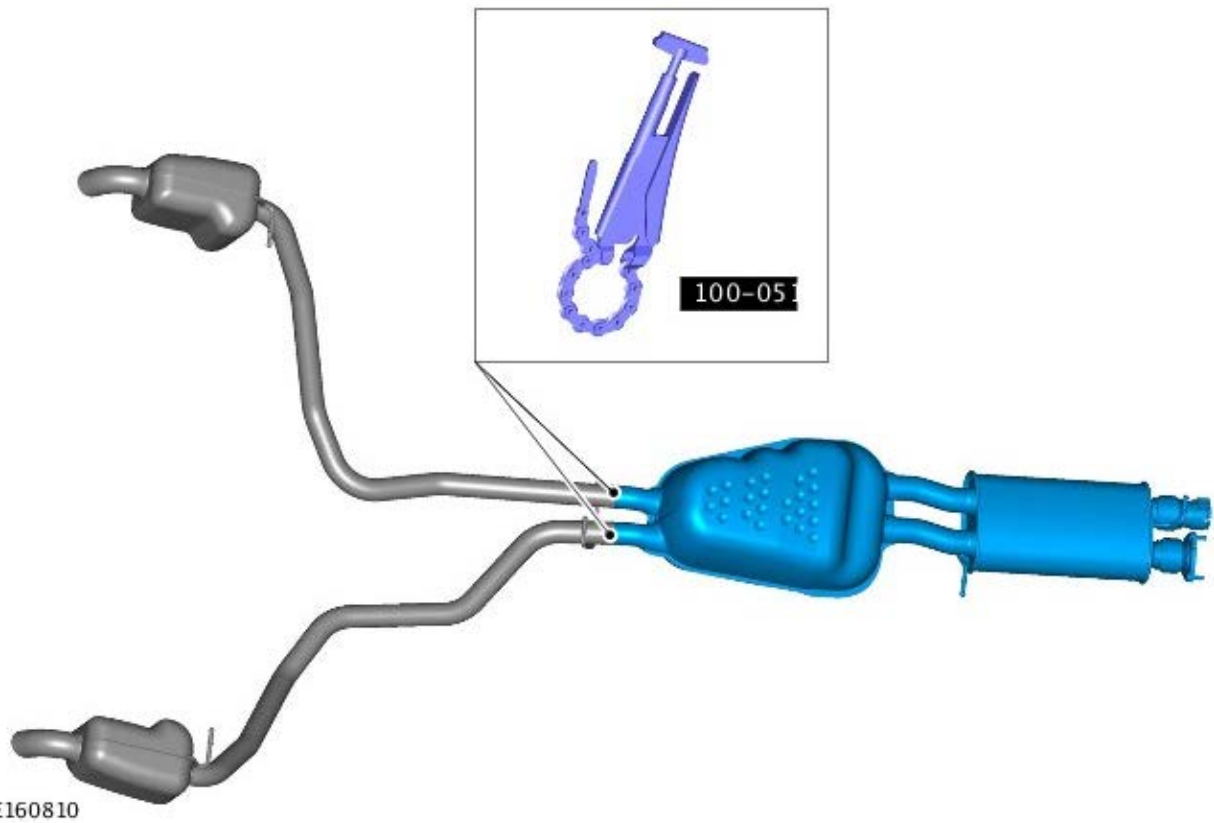


NOTE: The step must be carried out on both sides.




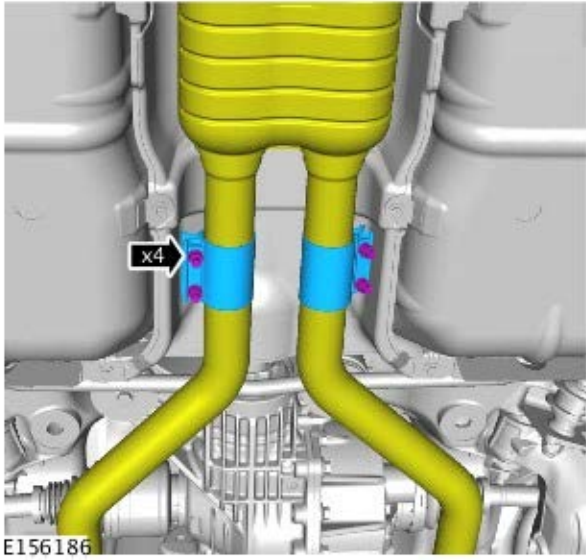
E160809

5.  NOTE: Do not disassemble further if the component is removed for access only.
- Special Tool(s): [100-051](#)



Installation

1.  WARNING: Make sure that any corrosion or dirt is removed from the mating surfaces.



To install, reverse the removal procedure.

Exhaust System - V6 S/C 3.0L Petrol - Rear Muffler

Removal and Installation

Removal



WARNING: Observe due care when working near a hot exhaust system.

NOTES:



Removal steps in this procedure may contain installation details.



LH illustration shown, RH is similar.



- WARNING:** Make sure to support the vehicle with axle stands.

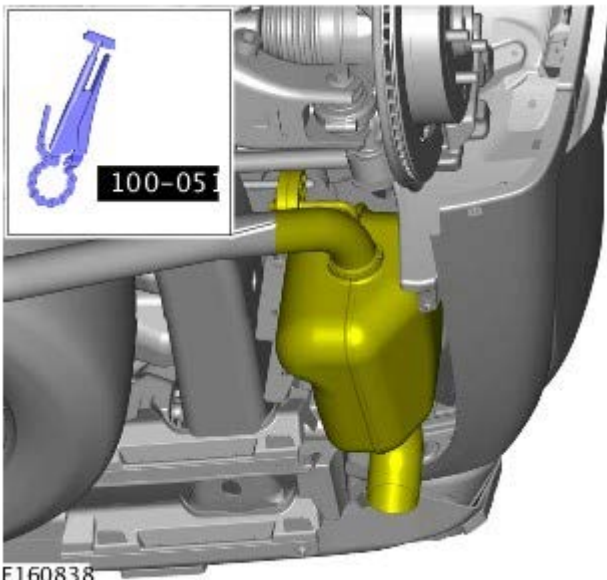
Raise and support the vehicle.



- CAUTION:** Make sure that the exhaust system is supported with suitable retaining straps.

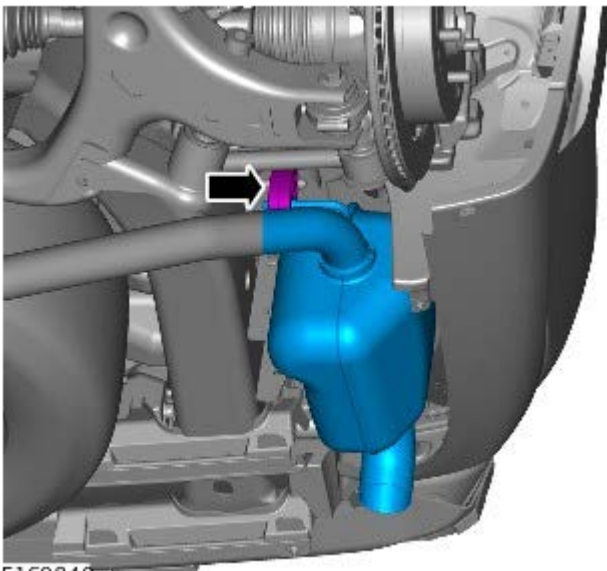


NOTE: Using the special tool, cut the exhaust pipe at the marked position.



E160838

-
-
-

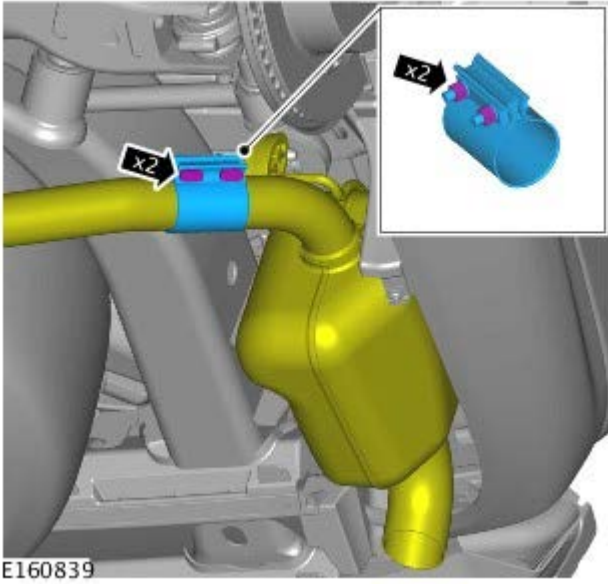


E160840

Installation



- WARNING:** Make sure that any corrosion



E160839

or dirt is removed from the mating surfaces.
To install, reverse the removal procedure.

Fuel System - General Information - Diesel Filter Water Drain-Off

General Procedures

WARNINGS:



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.



If taken internally, do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.



Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.



The spilling of fuel is unavoidable during this operation. Make sure that all necessary precautions are taken to prevent fire and explosion.


CAUTIONS:



Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

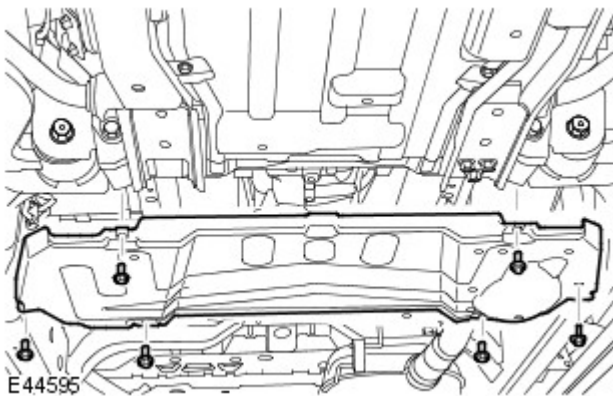



Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

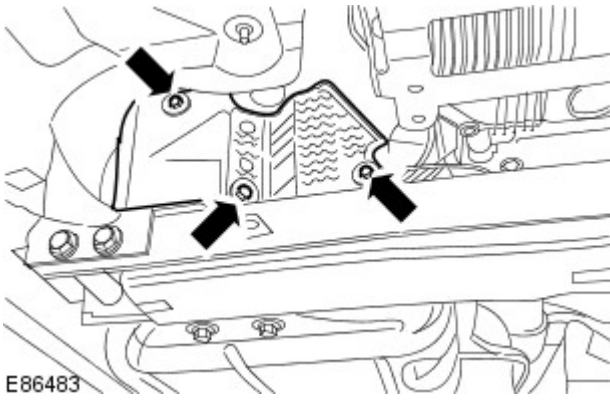
Raise and support the vehicle.

- Remove the transmission undershield.
 - Remove the 6 bolts.



-  **WARNING:** Observe due care when working near a hot exhaust system.

Remove the fuel filter heat shield.



- Remove the 3 bolts.



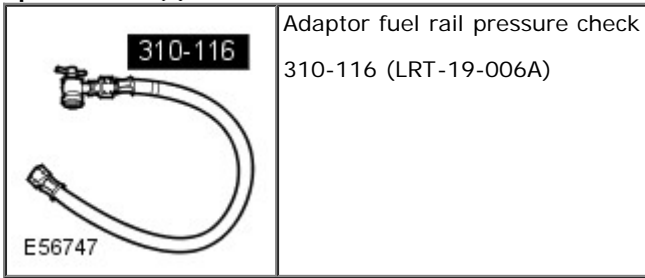
4. Drain the fuel filter element.
 - Attach a suitable drain tube to the water-in-fuel drain port.
 - Loosen the water-in-fuel drain port 2 complete turns and allow the fluid to drain into a container.
 - Turn the ignition to position 2 until 100ml of fluid is drained, then turn to position O.
 - Remove the drain tube.

5. Tighten the water-in-fuel drain port.
6. Install the fuel filter heat shield.
 - Tighten the bolts to 6 Nm (4 lb.ft).
7. Install the transmission undershield.
 - Tighten the bolts to 10 Nm (7 lb.ft).

Fuel System - General Information - Low-Pressure Fuel System Bleeding

General Procedures

Special Tool(s)



WARNINGS:



Wait at least 30 seconds after the engine stops before commencing any repair to the high-pressure fuel injection system. Failure to follow this instruction may result in personal injury.



Before any work is carried out on the fuel system, ground the vehicle to earth and maintain the ground connection until the work is complete.



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.



If taken internally, do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.



If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.



Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTIONS:



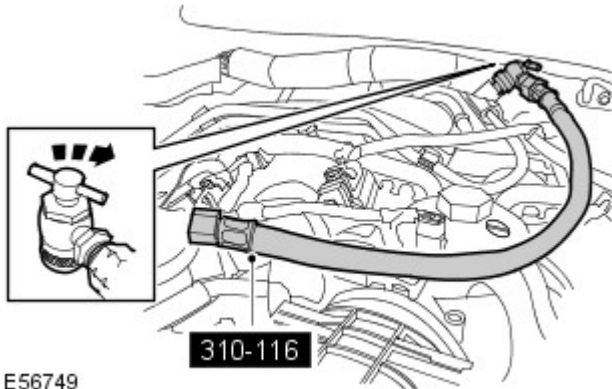
Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.



This procedure must be carried out before the engine is attempted to be started, following removal or replacement of any fuel system component involving fuel line intrusion. Failure to follow this instruction will result in damage to the fuel injection pump.

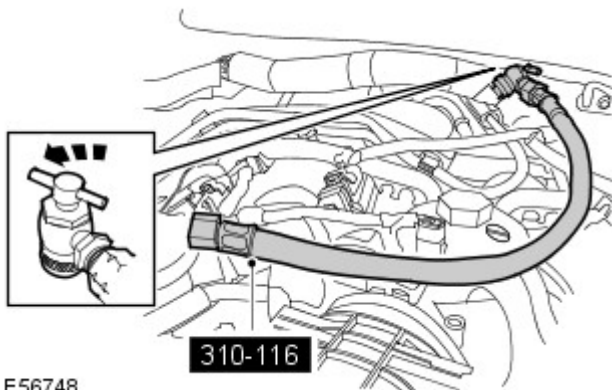
1. This procedure is necessary if any of the following fuel system components are removed, disconnected or replaced: Fuel tank, fuel lines, fuel filter element, fuel coolers, fuel injection pump or fuel rail pressure sensor.
2. Remove the engine cover. For additional information, refer to: Engine Cover - 3.0L V6 - TdV6 (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Install the special tool to the fuel rail Schraeder valve.
 - Remove the fuel rail Schraeder valve cap.

4. Position a container to collect spillage.
 - Open the valve on the special tool.




5. Turn the ignition switch to the ON position for 25 seconds. The fuel pump in the fuel tank will be audible.
6. Repeat the above procedure until clean, air free fuel is seen escaping from the special tool.
 - While the pump is still running, close the valve on the special tool to prevent air entering the fuel system.


7. Remove the special tool from the Schraeder valve.
 - Install the Schraeder valve protective cap.



8. Remove the container.

9.  **CAUTION:** If a new fuel injection pump is fitted, the following step must be carried out to make sure the fuel injection pump is fully primed. Failure to follow this instruction may result in damage to the vehicle.

Repeat Step 5 four times.

10.  **NOTE:** The engine must be allowed to idle for two minutes to allow air in the fuel injection supply manifolds and fuel injectors to purge.

Start the engine and allow to idle.

11. Install the engine cover. For additional information, refer to: Engine Cover - 3.0L V6 - TdV6 (501-05 Interior Trim and Ornamentation, Removal and Installation).

Fuel System - General Information - Fuel Tank Draining

General Procedures

WARNINGS:



Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.



Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.



The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.



CAUTION: Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

1. Open the fuel filler door and remove the cap.
2. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
3. Connect the fuel tank drain equipment ground cable to the vehicle.
4. Remove the fuel from the fuel tank, via the filler neck, using the fuel tank draining equipment. Follow the manufacturer's operating instructions.
5. To install, reverse the removal procedure.

Fuel System - General Information - Fuel System Pressure Release V6 S/C 3.0L Petrol

General Procedures

Draining

1.  **WARNING:**

Refer to: [Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions](#) (100-00 General Information, Description and Operation).

2. Remove the fuel pump fuse.
3. Remove the fuel filler cap.
4. Start the engine and allow it to idle until the engine stalls.
5. Crank the engine for approximately five seconds to make sure that the fuel rail pressure is released.

Filling

1.  **NOTE:** Make sure all repairs have been carried out before proceeding to the following steps.

Install the fuel pump fuse.

2. Install the fuel filler cap..
3. Read and clear stored DTC fault codes.

Fuel Tank and Lines - TDV6 3.0L Diesel -

General Specifications

Item	Specification
Fuel system	Mechanical - returnless
Fuel tank	Multi layer plastic
High pressure fuel pump	Located at rear of engine between the cylinder heads, belt driven from the camshafts
Low pressure fuel pump	Located in the fuel tank
Fuel filter	Remotely mounted on the inside of the longitudinal member - fitted with a renewable element
Fuel tank sender units	Two - Front and Rear - front sender is attached to the frame of the fuel pick up tube and the rear sender is attached to the fuel pump swirl pot
High pressure fuel pump maximum operating pressure	1650 bar - 23931.2 lbf/in ²
Low pressure fuel pump operating pressure	0.5 bar - 7.25 lbf/in ²

Capacities

	Liters
Fuel tank capacity	86.3 (total)

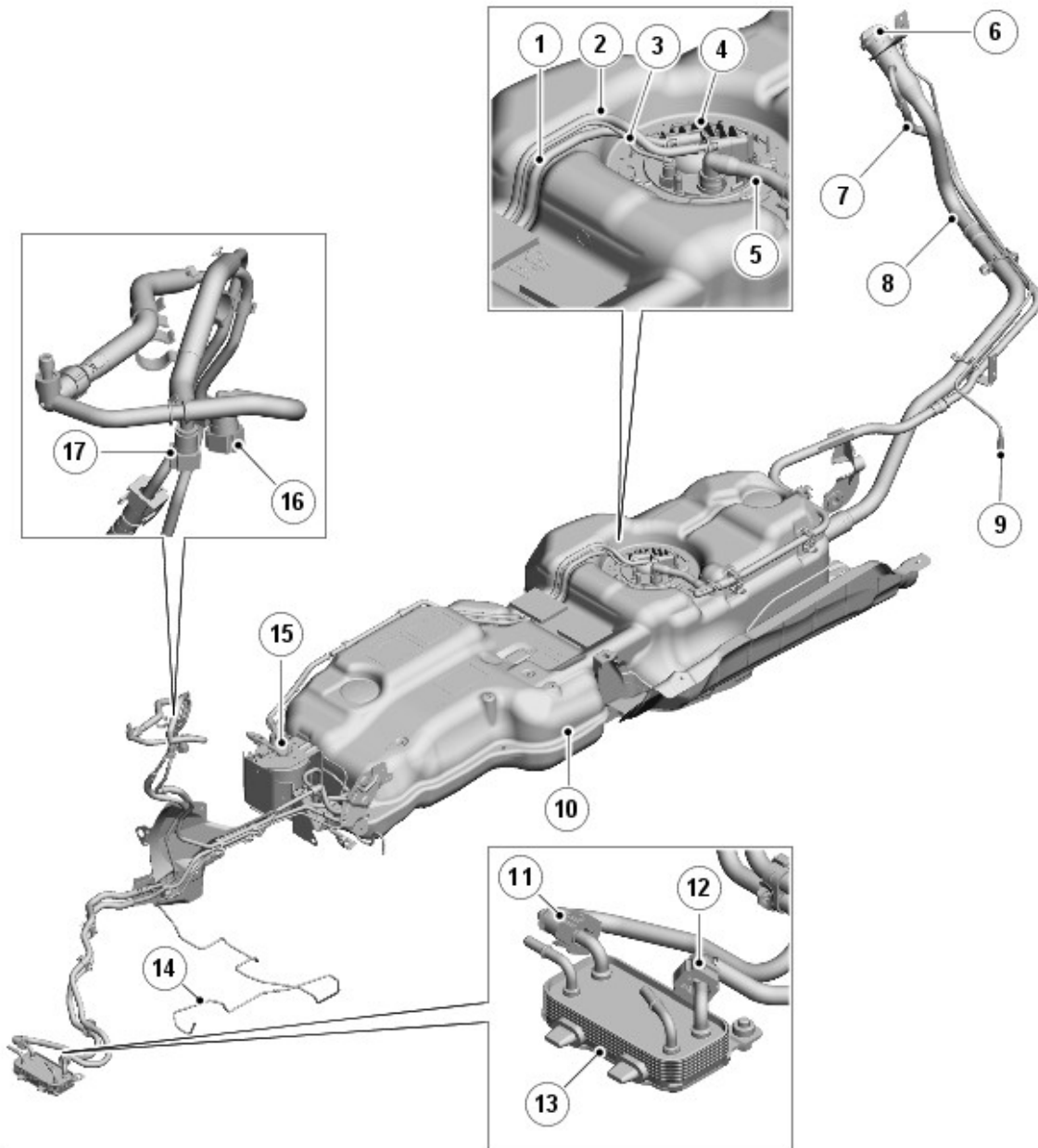
Torque Specifications

Description	Nm	lb-ft	lb-in
Fuel tank filler pipe retaining bolt	4	-	35
Fuel tank retaining bolts	45	33	-
Fuel tank heat shield retaining bolts	6	-	53
Fuel tank heat shield retaining nuts	3	-	27
Fuel filter heat shield retaining bolts	6	-	53
Transmission undershield retaining bolts	10	7	-
Fuel cooler retaining bolt	23	17	-

Fuel Tank and Lines - TDV6 3.0L Diesel - Fuel Tank and Lines

Description and Operation

3.0L V6 DIESEL FUEL TANK AND LINES COMPONENT LOCATION



E 122445

Item	Part Number	Description
1	-	Pipe - Fuel pump to filter (fuel feed)
2	-	Pipe - Filter to pump module (fuel return)
3	-	Pipe - Fuel burning heater supply
4	-	Fuel pump module assembly
5	-	Fuel tank vent pipe
6	-	Filler cap and lanyard
7	-	Fuel tank vent pipe
8	-	Fuel filler pipe
9	-	Rear differential breather pipe (Ref only)
10	-	Cover
11	-	Pipe - Fuel cooler to filter (fuel return)
12	-	Pipe - HP pump to fuel cooler (fuel return)
13	-	Fuel cooler
14	-	Pipe - Fuel burning heater supply
15	-	Fuel filter
16	-	Pipe - HP pump to fuel cooler (fuel return)

GENERAL

The major components of the 3.0L TdV6 fuel system comprises a fuel tank, a fuel pump module, a fuel filter, a fuel cooler, a fuel filler pipe and cap assembly and two fuel level sensors. The fuel system is a high pressure common rail system which uses an engine mounted and driven high pressure pump to deliver a uniform level of pressure to the common fuel rails which supply all 6 fuel injectors.

The fuel tank houses an internal fuel lift pump, located in the fuel pump module. The lift pump is employed to provide a low-pressure supply to the common rail high pressure fuel system.

Two fuel level sensors are installed in the front and rear of the fuel tank. The sensors are a MAGnetic Passive Position Sensor (MAPPS) which provide a variable resistance to ground for the output from the fuel gauge.

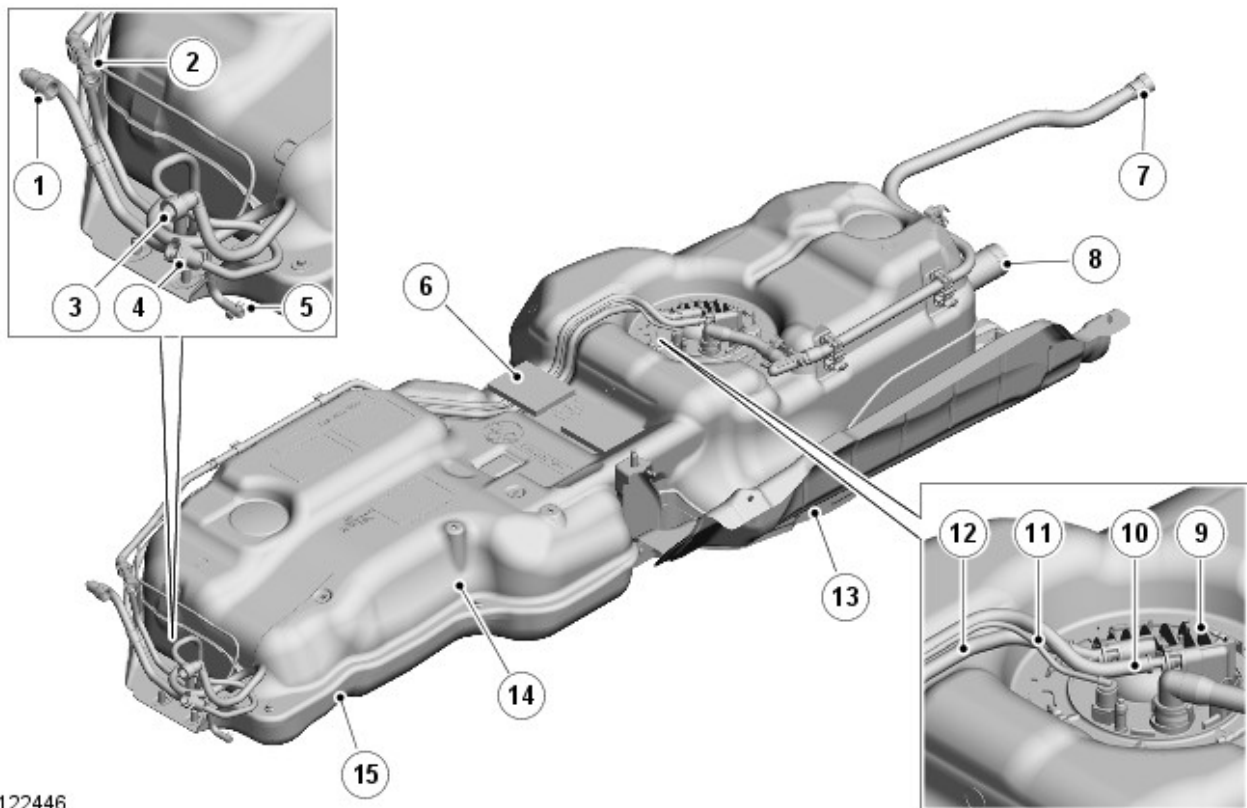
A fuel cooler is located in the low pressure side of the system in the fuel return line and is a fuel to water type cooler.

The fuel tank breather system consists of a fuel cut-off elbow. No Roll Over Valves (ROV's) are fitted.

The fuel filter is a disposable canister type and is located on a bracket at the front of the fuel tank.

DESCRIPTION

FUEL TANK ASSEMBLY



E122446

Item	Part Number	Description
1	-	Fuel return from filter to tank
2	-	Fuel supply from fuel pump to filter
3	-	Pipe - return from fuel cooler
4	-	Pipe - Fuel supply to HP pump
5	-	Pipe - Fuel burning heater supply
6	-	Pad (2 off)
7	-	Pipe - Fuel tank breather
8	-	Fuel tank filler inlet hose
9	-	Fuel pump module assembly
10	-	Pipe - Fuel return
11	-	Pipe - Fuel burning heater supply
12	-	Pipe - Fuel supply from pump
13	-	Heat shield
14	-	Cover
15	-	Cradle

The fuel tank is located on the right hand side of the vehicle, between the transmission and the right hand chassis

longitudinal. The tank is located on a mounting cradle which secures the whole fuel tank assembly to the vehicle. The tank is blow moulded from HDPE (high density polyethylene) and has a useable capacity of 82.0 liters (18 gallons).

The cradle is attached to the chassis with six screws. When the cradle is attached to the chassis, the tank is positively secured via foam pads which bear against the central chassis cross beam. A protective cover is fitted to the front right hand corner of the tank and provides additional protection.

The fuel tank is manufactured from moulded plastic which is a minimum of 3 mm thick. The tank is a sealed unit with the only internal access being via the pump module flange aperture on the top of the tank.

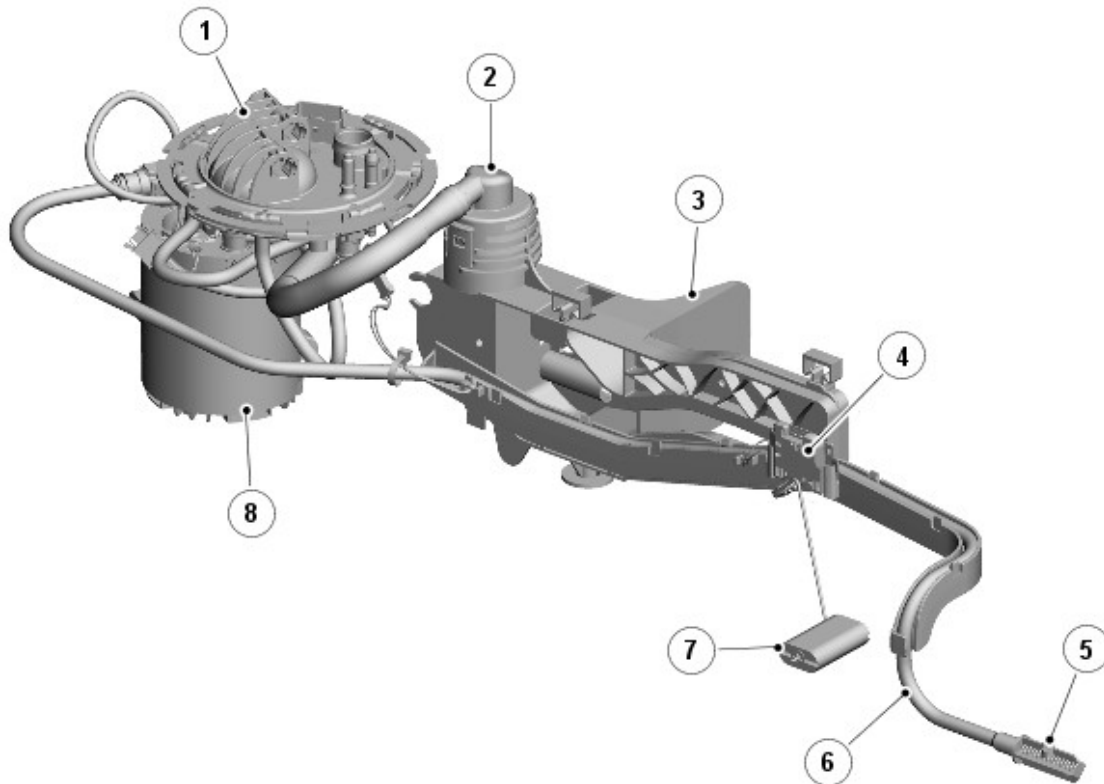
The flange is fitted with a locking ring and seal. The seal locates in a groove on the tank. The locking ring locates and clamps on the encapsulated ring that is moulded into the fuel tank. The flange has a tag which locates in the top of the tank to ensure correct orientation.

The flange has six pin internal and external connectors which provide for electrical connections for the level sensors and the fuel pump. Two quick release connectors provide for the connection of the fuel feed and return pipes and the vent pipes. The fuel return connection contains a non return valve which prevents fuel escaping from the connection in the event of a vehicle roll over and the pipe becoming detached. On vehicles with a fuel burning heater, a third connection provides the connection for the fuel feed supply to the fuel burning heater.

The fuel pump module is mounted on a bayonet lock ring which is welded inside the fuel tank. A carrier within the tank provides for the mounting of the fuel suction jet, front fuel sensor and the fuel cut-off elbow.

The fuel pump module contains a number of components. The module comprises the fuel pump, the rear fuel level sensor, the rear jet pump, the pump inlet filter and the fuel pressure regulator. Only the pump module assembly, the fuel level sensors and the flange are available as serviceable components, the individual assembly components are not available separately.

Fuel Tank Internal Components



E122447

Item	Part Number	Description
1	-	Fuel pump module assembly
2	-	Fuel cut-off elbow
3	-	Carrier
4	-	Forward fuel level sensor
5	-	Suction port filter
6	-	Suction port pipe
7	-	Level sensor float
8	-	Swirl pot

Fuel Pump Module

The low pressure fuel lift pump is located in the fuel pump module. The lift pump is employed to provide a low pressure supply at approximately 0.5 bar, to the common-rail high pressure fuel system and to allow the jet pump assemblies to maintain a full swirl pot.

The lift pump operation is controlled by the Engine Control Module (ECM), via the fuel pump relay located in the

Engine Junction Box (EJB). When the ignition is switched on, the fuel pump operates for 25 seconds to build up fuel pressure. As engine cranking commences the fuel pump stops running until the engine starts. This function is employed to decrease load on the battery.

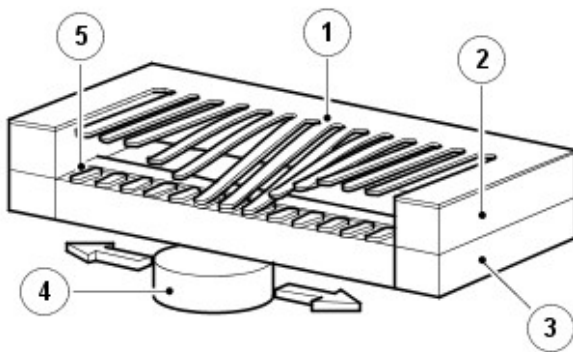
In cold conditions, 'waxing' of the fuel can occur. For this reason a coarse mesh filter is attached to the swirl pot inlet port at the bottom of the pump module.

A three way connection is located on the top of the module. Two outlets supply the jet pumps, the other outlet is the pressure feed through the pressure regulating valve to the fuel delivery line. The module incorporates a jet pump which draws fuel from the front of the tank and delivers it directly into the swirl pot.

Fuel Level Sensors

Two fuel level sensors are installed at either end of the tank. One is mounted on the fuel pump module, the other is mounted in a central position on the internal carrier within the tank. The sensors are a MAPPS (magnetic passive position sensor) which provide a variable resistance to ground for the output from the fuel gauge. The sensor is sealed from the fuel preventing contamination of the contacts, increasing reliability. The fuel level sensors are connected to an electrical connector on the underside of the fuel pump module flange.

The sensor comprises a series of 51 film resistors mounted in an arc on a ceramic surface. The resistors are wired in series with individual contacts. A soft magnetic foil with 51 flexible contacts is mounted a small distance above the film resistors. A magnet, located below the ceramic surface, is attached to the sender unit float arm. As the float arm moves, the magnet follows the same arc as the film resistors. The magnet pulls the flexible contacts onto the opposite film resistor contacts forming an electrical circuit.



E44504

Item	Part Number	Description
1	-	Magnetic foil
2	-	Spacer
3	-	Ceramic surface
4	-	Magnet
5	-	Resistance film

The film resistors are arranged in a linear arc with resistance ranging from 51.2 to 992.11 Ohms. The electrical output signal is proportional to the amount of fuel in the tank and the position of the float arm. The measured resistance is processed by the instrument cluster to implement an anti-slosh function. This monitors the signal and updates the fuel gauge pointer position at regular intervals, preventing constant pointer movement caused by fuel movement in the tank due to cornering or braking.

A warning lamp is incorporated in the instrument cluster and illuminates when the fuel level is low.

The fuel level sender signal is converted into a CAN (controller area network) message by the instrument cluster as a direct interpretation of the fuel tank contents in liters.

In the event that fuel is allowed to run too low, signals transmitted from the fuel level sensors initiate the fuel run-dry strategy. The driver will be notified before the tank is run critically low on fuel. Although this is a simulated run-dry procedure, it provides the symptoms of the vehicle running out of fuel and the driver will perceive it as such. The engine will stop when there is approximately 4 liters (0.87 gallons) of fuel remaining in the fuel tank.

Jet Pumps

The fuel system incorporates twin jet pumps which are integral with the fuel pump module. One jet pump collects fuel from the rear of the tank, and the other draws additional fuel from the front of the tank through a suction line that is mounted on the carrier. The jet pump operates on a venturi effect created by the fuel at pump output pressure passing through the jet pump.

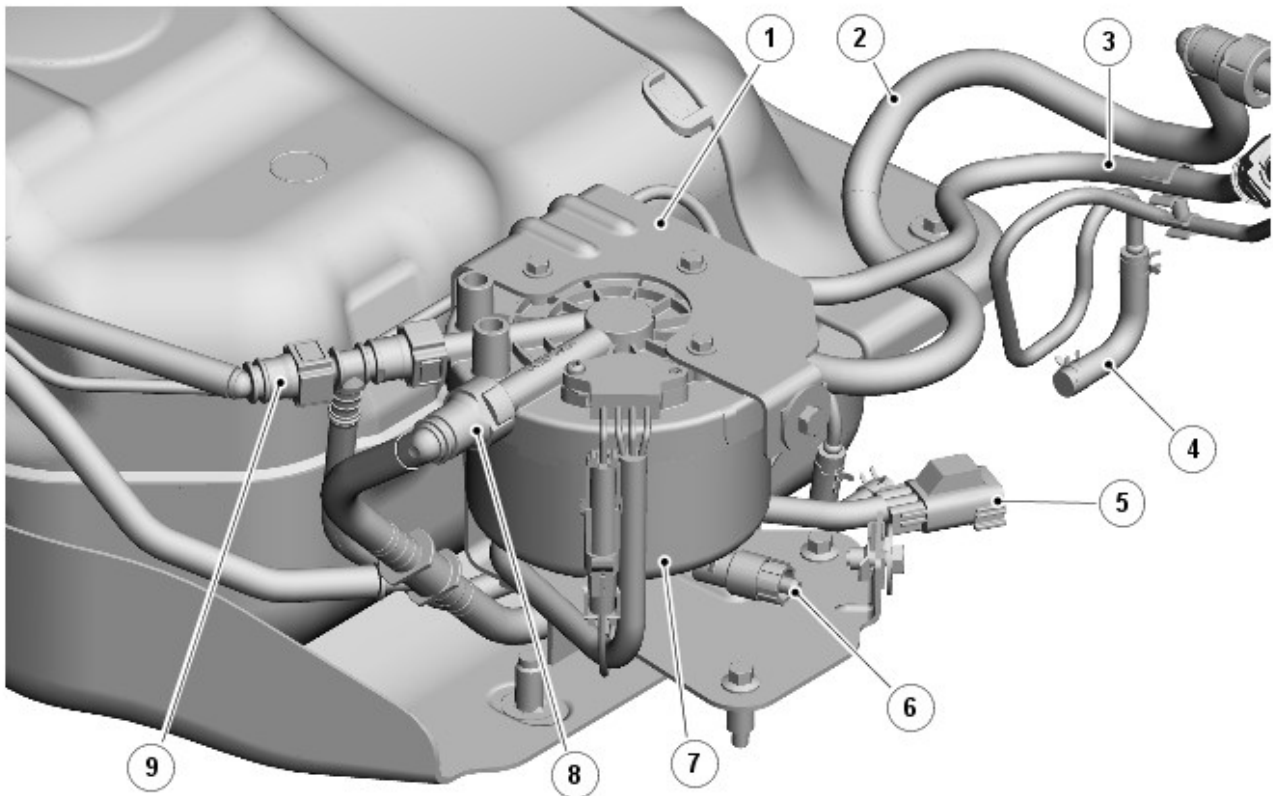
The prime function of the jet pump is to collect fuel from the front of the tank and transfer it into the fuel pump module swirl pot at the rear of the tank. The jet pump feature ensures that fuel is drained from the front of the tank before fuel run-out at the rear of the tank.

Fuel Cut-Off Elbow

The fuel cut-off elbow is located in the upper half of the tank on the carrier and is connected to the tank breather. The main purpose of the fuel cut-off elbow is to control the fill volume of the tank. During filling air, trapped inside the tank and a small amount of vapor is passed via the fuel cut-off elbow to the tank breather. The air and vapor mix then vents to atmosphere through the breather. During filling, when the tank reaches its full level, the fuel cut-off elbow closes and prevents air/vapor passing through to the tank breather. The resulting back pressure causes refueling to stop automatically.

The fuel cut-off elbow is always open when the fuel tank is below full, providing an unrestricted air/vapor outlet to the tank breather.

FUEL FILTER



E122448

Item	Part Number	Description
1	-	Mounting bracket
2	-	Pipe - Fuel return from fuel cooler
3	-	Pipe - Fuel supply to high pressure fuel pump
4	-	Pipe - Fuel supply to Fuel Burning Heater (FBH)
5	-	Electrical connector
6	-	Water drain
7	-	Fuel filter
8	-	Fuel return to tank connection
9	-	Fuel supply from tank connection

The fuel filter assembly is located in front of the fuel tank and is mounted on a bracket which is attached to the top face of the transfer box chassis cross member. The fuel filter assembly comprises a bracket, filter housing and the filtration element. The filter housing is secured to the bracket with 3 bolts. The bracket is secured to the cross member with 2 bolts which are screwed into threaded holes in the cross member.

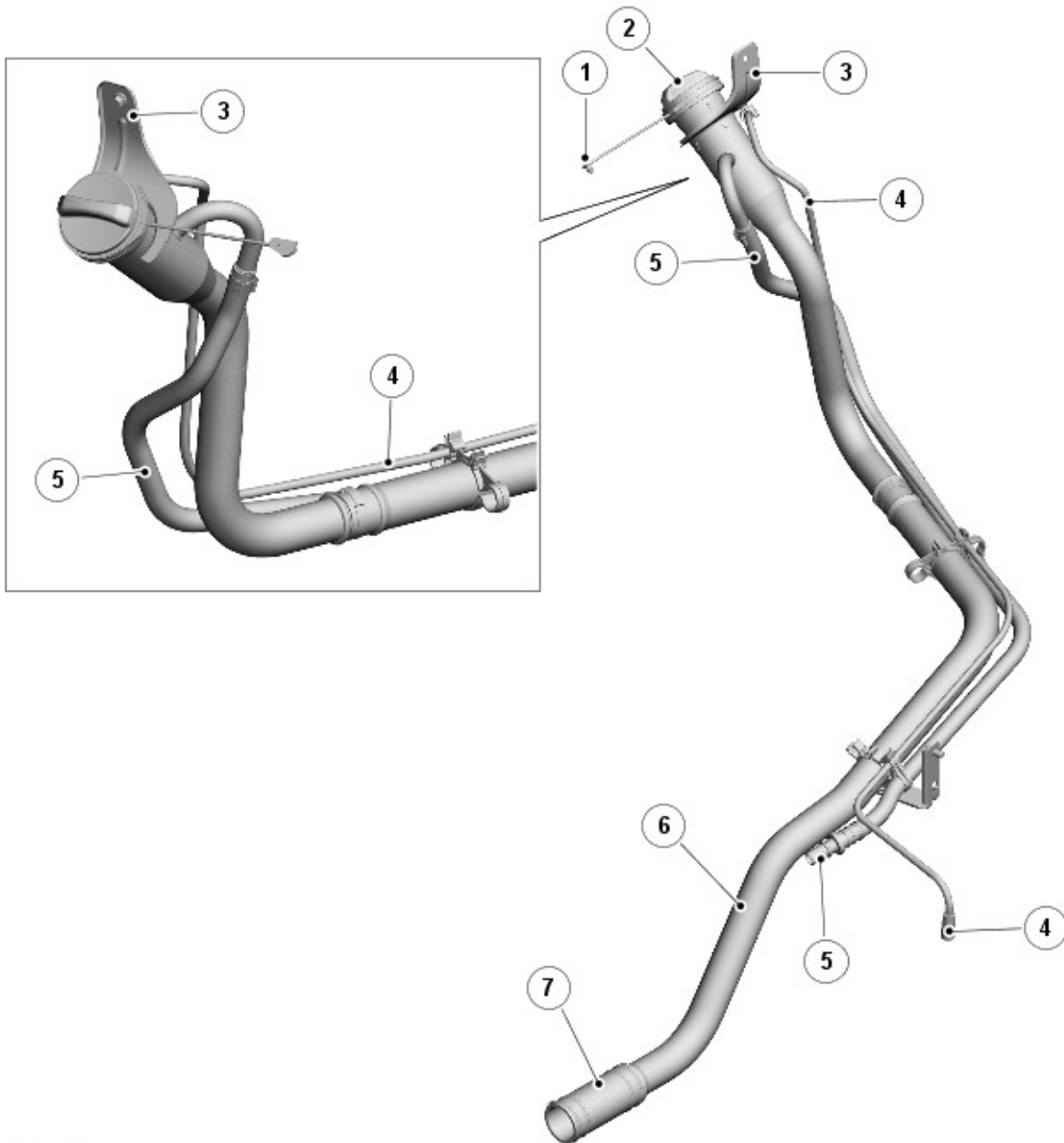
The filter housing has an inlet and outlet which allow for the attachment of hoses using quick release connectors. The filter element is located on the underside of the housing and can be removed by rotating one quarter turn to release from the housing.

The filter element has a capacity of 200 cm³ (12.2 in³). The filtration element can filter particulate matter larger than 15 microns. A water drain valve is located on the base of the filter. The filter can be purged of water by partially unscrewing the drain valve and allowing at least 84 cm³ (5.12 in³) of fuel to drain into a suitable container. The drain plug has a centre outlet which allows for the attachment of a drain hose.

The filter element also has a water sensor located in its base. The sensor is screwed into a threaded hole in the base of the element. When the filter is replaced at service, the sensor can be unscrewed from the element and installed in the new element. The sensor has an electrical connector located at the side of the element which can be disconnected to assist element removal.

The water sensor is connected to the Engine Control Module (ECM). When the water in the element reaches 64 cm³ (3.9 in³) the ECM issues a high speed Controller Area Network (CAN) bus message to the instrument cluster to display a 'WATER IN FUEL' message in the message center.

FUEL FILLER PIPE



E122449

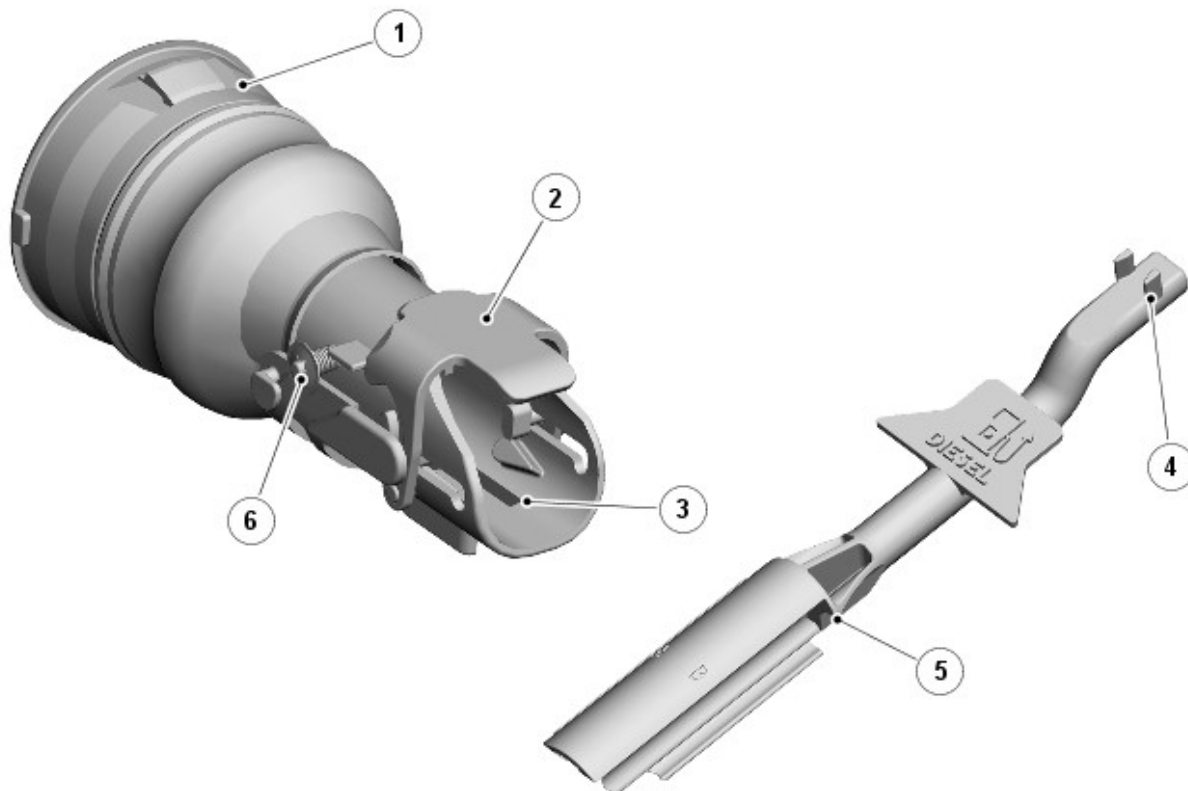
Item	Part Number	Description
1	-	Lanyard
2	-	Filler cap
3	-	Bracket
4	-	Pipe - Rear differential breather (Reference only)
5	-	Pipe - Fuel vapor vent
6	-	Fuel filler pipe
7	-	Hose - connection to fuel tank

The stainless steel filler neck has a wide bore neck specially designed to reduce diesel frothing while the fuel tank is being replenished. The filler pipe is connected at its lower end to the fuel tank by a hose which is secured to the pipe with a worm drive clamp. The opposite end of the hose is connected to the fuel tank inlet check valve and secured with another worm drive clamp.

A fuel vapor vent pipe is attached to the filler pipe and connects between the fuel level vent valve in the fuel tank and fuel filler pipe neck.

The filler head incorporates the Fuel Guard system to prevent accidental filling of the tank with petrol (gasoline).

Fuel Guard System



E117721

Item	Part Number	Description
1	-	Filler neck
2	-	Flap
3	-	Reset slots
4	-	Spigots
5	-	Reset tool
6	-	Spring

The fuel guard system comprises a mechanically operated flap which is triggered when the smaller diameter filler nozzle tube, used on petrol (gasoline) pumps, is inserted in the filler neck. The flap is actuated and blocks the sensor port on the fuel pump nozzle, causing it to automatically switch off. The flap is locked in this position by a latch mechanism.

A reset tool is provided and stored in the luggage compartment. The tool is used to reset the fuel guard device if triggered and release the latch. Two spigots on the tool locate in slots in the filler neck which release a latch and the flap is opened by its own spring. The tool is located in the filler neck and once the two spigots on the tool are located in the slots it can be pulled outwards, releasing a latch and allowing the flap to be opened by its own spring pressure. The tool is stored on the battery mounting clamp.

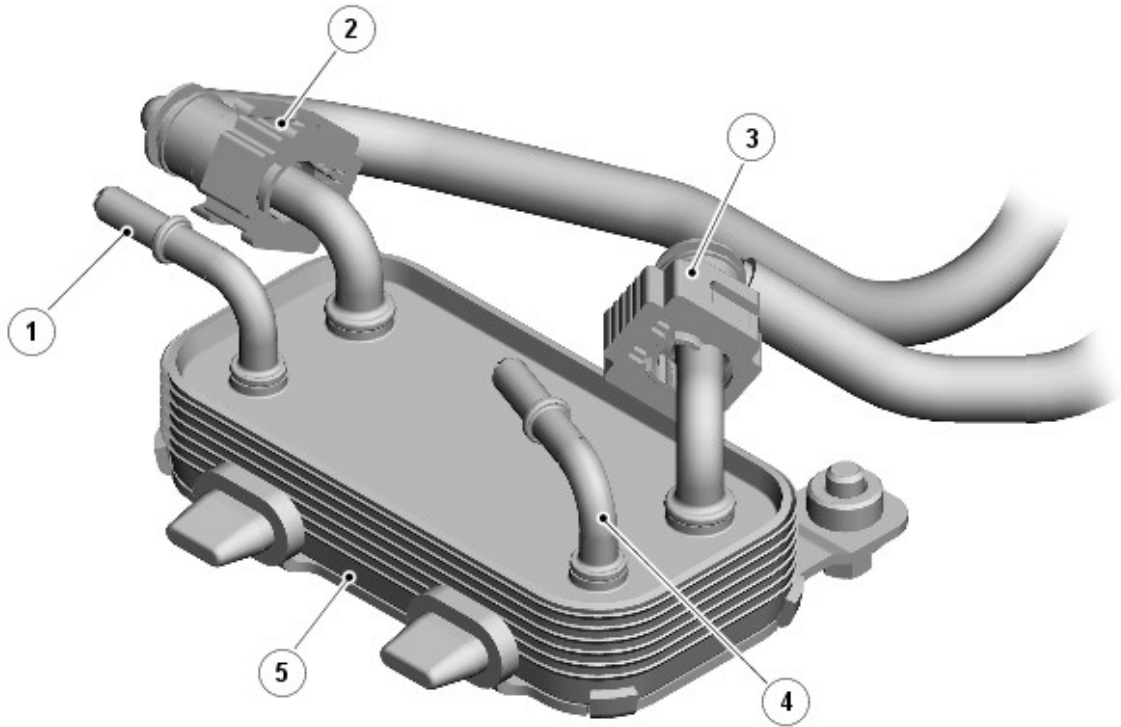
The flap is colored yellow so that it is clearly visible when activated and has a 'Handbook' symbol on it.

A diesel fuel pump nozzle will not activate the fuel guard because the nozzle stops against two molded lugs. However, if an unleaded gasoline pump nozzle is inserted into the housing, its smaller diameter allows it to pass the two molded lugs. The nozzle strikes two pins on the inside of the filler housing which move forward. This movement rotates the shut-off flap which is then held in place when the nozzle is removed by the latch mechanism.



NOTE: Russian markets do not use the fuel guard system and are fitted with a conventional filler neck.

FUEL COOLER



E122450

Item	Part Number	Description
1	-	Coolant outlet
2	-	Pipe - cooler to fuel filter
3	-	Pipe - HP pump to cooler
4	-	Coolant inlet
5	-	Fuel cooler

The fuel cooler uses engine coolant, direct from the lower part of the radiator, to cool fuel returning to the tank from the HP injection pump.

The fuel cooler is located on the right hand side of the chassis, at the rear of the engine, near to transmission cooler. A bracket, which is attached to the right hand chassis rail, provides for the attachment of the cooler. The bracket has two slots which accept two plastic pegs which are attached to the cooler. A bolt is inserted through a hole in the bracket and screws into a captive nut on the cooler to positively secure the cooler to the bracket.

The cooler has four quick fit connector pipes which provide for the attachment of the fuel inlet hose from the HP injection pump, the fuel outlet hose to the fuel filter, the coolant inlet hose from the radiator and the coolant outlet hose to the coolant thermostat housing. The coolant pipes can be identified by their smaller diameter.

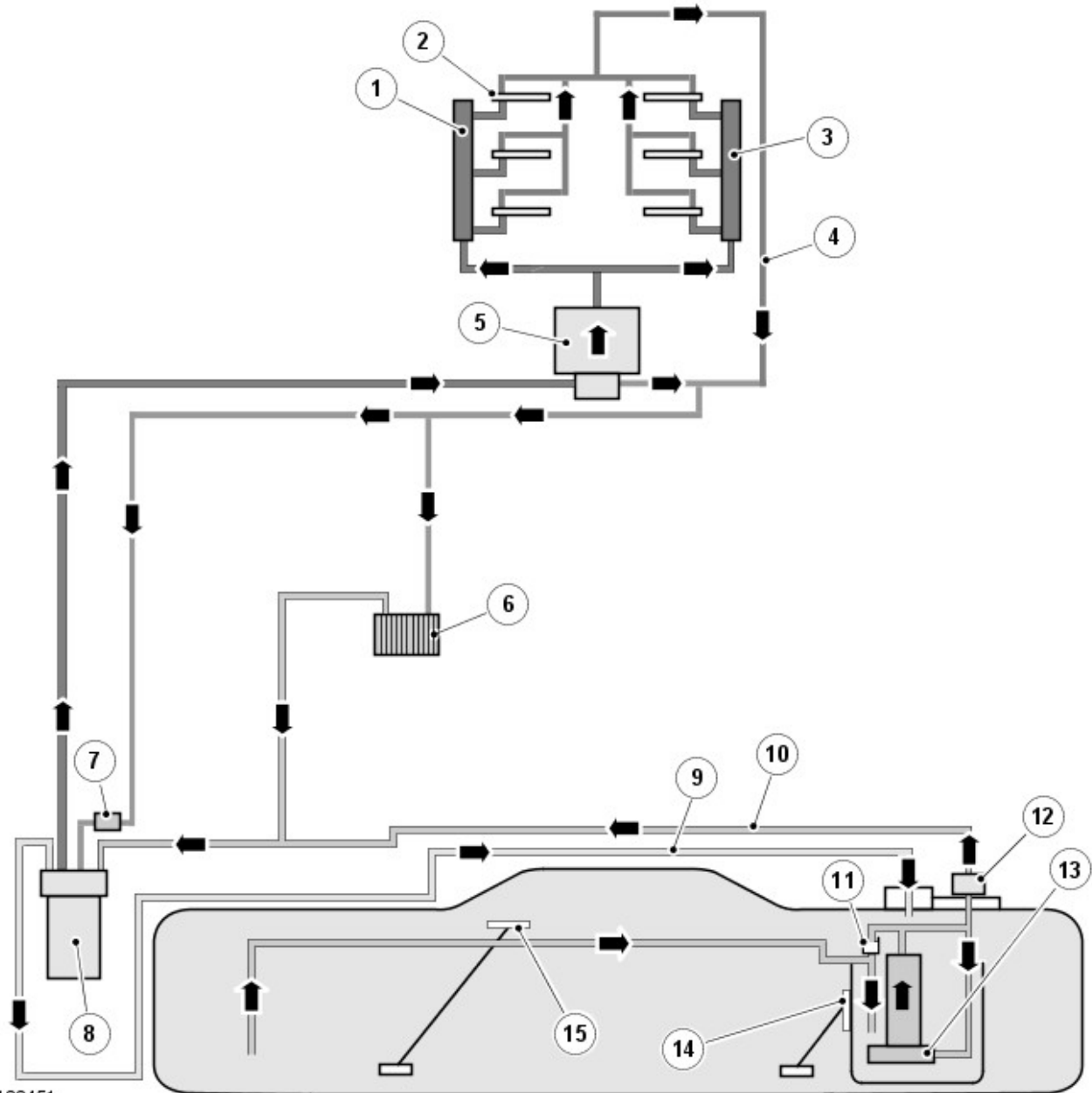
OPERATION

Diesel fuel is drawn from the tank by the internal electric lift pump. The fuel pressure regulator located in the fuel pump module assembly regulates the delivery pressure at approximately 0.5 bar to the transfer pump housed in the High Pressure (HP) pump. A VCV (volume control valve) governs the amount of fuel supplied to the HP pump.

The transfer and high pressure pump are driven directly by the engine. Due to the storage volume of the common rail, the injection pressure will remain practically constant over the complete duration of the injection process.

The HP pump has a return pipe circuit which is separate from the injector return pipes. For additional information, refer to: Fuel Charging and Controls (303-04C, Description and Operation).

Fuel Delivery Schematic Diagram



E122451

Item	Part Number	Description
1	-	Left Hand (LH) common rail
2	-	Fuel injector (6 off)
3	-	Right Hand (RH) common rail
4	-	Fuel rail and injector leak-off return line
5	-	High Pressure (HP) fuel pump
6	-	Fuel cooler
7	-	Thermostatic diverter valve
8	-	Fuel filter assembly
9	-	Fuel return/air bleed pipe
10	-	Low Pressure (LP) delivery pipe
11	-	Jet pump
12	-	Pressure regulator
13	-	Fuel pump module
14	-	Fuel level sensor - Rear
15	-	Fuel level sensor - Front

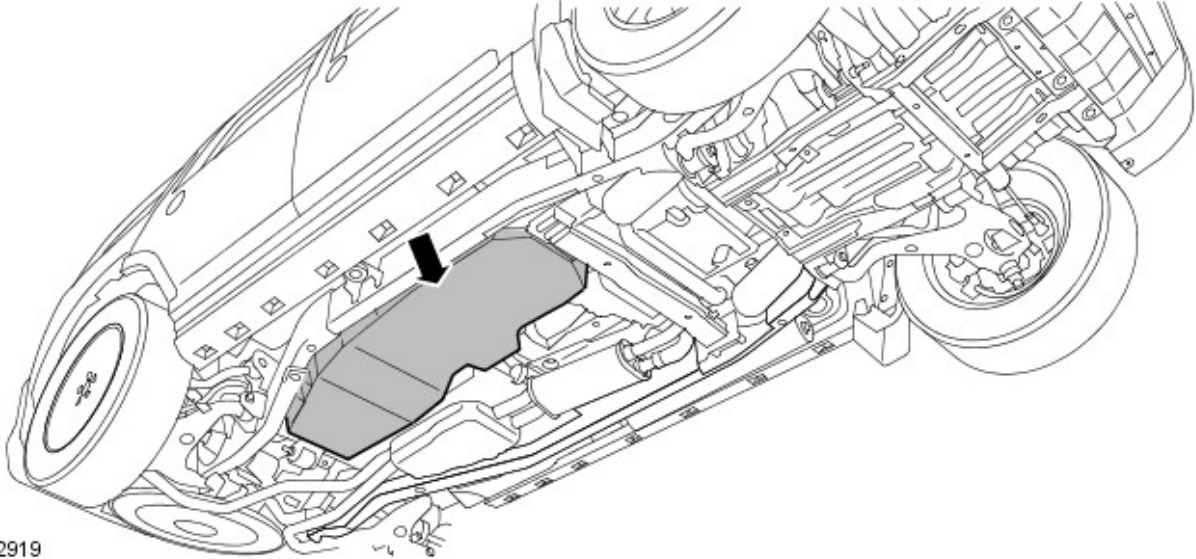
Fuel Tank and Lines - TDV6 3.0L Diesel - Fuel Tank and Lines

Description and Operation



WARNING: The weight of the armoured components fitted to the vehicle are far in excess of those fitted to the standard vehicle. Therefore, always be aware of the weight of components and have suitable lifting equipment available before attempting to remove any component from the vehicle.

Fuel tank armoured casing



E102919

To protect the vehicle's fuel supply the fuel tank is enclosed in an armoured casing. The casing can be removed to gain access to the fuel tank.

Fuel Tank and Lines - TDV6 3.0L Diesel - Fuel Tank and Lines

Diagnosis and Testing

Principle of Operation

For a detailed description of the fuel tank and lines system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Fuel Tank and Lines (310-01 Fuel Tank and Lines - TDV6 3.0L Diesel, Description and Operation).

Inspection and Verification

WARNINGS:



Do **NOT** carry out any work on the fuel system with the engine running. The fuel pressure within the system can be as high as 2000 bar (29,008 lb/in²). Failure to follow this instruction may result in personal injury.



Eye protection must be worn at all times when working on or near any fuel related components. Failure to follow this instruction may result in personal injury.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow this instruction may result in personal injury.



After carrying out repairs, the fuel system must be checked visually for leaks. This should be done after the engine has been run, but with the engine switched **OFF**. Failure to follow this instruction may result in personal injury.



If taken internally, **DO NOT** induce vomiting. Seek immediate medical attention. Failure to follow this instruction may result in personal injury.



If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek medical attention. Failure to follow this instruction may result in personal injury.



Wash hands thoroughly after handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention. Failure to follow this instruction may result in personal injury.

CAUTIONS:



Before disconnecting any part of the system, it is imperative that all dust, dirt and debris is removed from around components to prevent ingress of foreign matter into the fuel system. Failure to follow this instruction may result in damage to the vehicle.



The fuel pipes between the injectors and the rail must be discarded after each use, and new pipes installed. Failure to follow this instruction may result in damage to the vehicle.



It is essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in damage to the vehicle.



Make sure that the workshop area in which the vehicle is being worked on is as clean and dust-free as possible. Areas in which work on clutches, brakes or where welding or machining are carried out are not suitable in view of the risk of contamination to the fuel system. Failure to follow this instruction may result in damage to the vehicle.



Make sure that any protective clothing worn is clean and made from lint-free non-flocking material. Failure to follow this instruction may result in damage to the vehicle.



Make sure that any protective gloves worn are new and are of the non-powdered latex type. Failure to follow this instruction may result in damage to the vehicle.



Make sure that clean, non-plated tools are used. Clean tools using a new brush that will not lose its bristles and fresh cleaning fluid prior to starting work on the vehicle. Failure to follow this instruction may result in damage to the vehicle.



Use a steel-topped work bench and cover it with clean, lint-free, non-flocking material. Failure to follow this instruction may result in damage to the vehicle.



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Low/contaminated fuel • Fuel supply/return line(s) • Fuel tank and filler pipe • Fuel leak(s) • Fuel filler cap • Fuel filter • Push connect fittings • Fuel pump 	<ul style="list-style-type: none"> • Fuses • Links • Relays • Fuel pump module • Sensor(s) • Engine control module (ECM) • Central Junction Box (CJB) • Restraints Control Module (RCM) • Electric Park Brake Control Module (EPBCM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index

Symptom Chart

Symptom	Possible Causes	Action
Engine cranks, but does not start	<ul style="list-style-type: none"> • Crash mode detected • Low/contaminated fuel • Air leakage • Low-pressure fuel system fault • Fuel pump module (lift pump) fault • Blocked fuel filter • Crankshaft position (CKP) sensor 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the Restraints Control Module (RCM) for related DTCs and refer to the relevant DTC index • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Check the intake air system for leaks • Check the lift pump operation • Check the low-pressure fuel system for leaks/damage • Check the fuel filter • Refer to the electrical circuit diagrams and test the CKP sensor circuit for short circuit to ground, short circuit to power, open circuit, high resistance
Difficult to start	<ul style="list-style-type: none"> • Glow plug system fault (very cold conditions) • Low/contaminated fuel • Air leakage • Fuel pump module (lift pump) fault • Low-pressure fuel system fault • Blocked fuel filter • Exhaust Gas Recirculation (EGR) valve(s) fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the glow plug circuits for short circuit to ground, short circuit to power, open circuit, high resistance • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Check the intake air system for leaks • Check the lift pump operation • Check the low-pressure fuel system for leaks/damage • Check the fuel filter • Check the EGR system
Rough idle	<ul style="list-style-type: none"> • Intake air system fault • Low/contaminated fuel • Low-pressure fuel system fault • Blocked fuel filter • Exhaust Gas Recirculation 	<ul style="list-style-type: none"> • Check the intake air system for leaks • Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel • Check the low-pressure fuel system for leaks/damage • Check the fuel filter • Check the EGR system

	(EGR) valve(s) fault	
Lack of power when accelerating	<ul style="list-style-type: none"> Intake air system fault Restricted exhaust system Low fuel pressure Exhaust Gas Recirculation (EGR) valve(s) fault Turbocharger actuator fault 	<ul style="list-style-type: none"> Check the intake air system for leakage or restriction Check for a blockage/restriction in the exhaust system, install new components as necessary Check the EGR system Check turbocharger actuator
Engine stops/stalls	<ul style="list-style-type: none"> Air leakage Low/contaminated fuel Low-pressure fuel system fault Exhaust Gas Recirculation (EGR) valve fault 	<ul style="list-style-type: none"> Check the intake air system for leaks Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel Check the fuel system for leaks/damage Check the EGR system
Engine judders	<ul style="list-style-type: none"> Low/contaminated fuel Air ingress Low-pressure fuel system fault 	<ul style="list-style-type: none"> Check the fuel level and condition. Draw off approximately 1L (2.11 pints) of fuel and allow to stand for 1 minute. Check to make sure there is no separation of the fuel indicating water or other liquid in the fuel Check the intake air system for leaks Check the low-pressure fuel system for leaks/damage
Excessive fuel consumption	<ul style="list-style-type: none"> Low-pressure fuel system fault Fuel temperature sensor leak Exhaust Gas Recirculation (EGR) valve(s) fault 	<ul style="list-style-type: none"> Check the low-pressure fuel system for leaks/damage Check the fuel temperature sensor, fuel pump, etc for leaks Check the EGR system
Fuel gauge reading empty with fuel in the fuel tank	<ul style="list-style-type: none"> Active fuel level sensor circuit open circuit Passive fuel level sensor circuit open circuit Instrument cluster internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, perform the guided diagnostic routine - Fuel Level Sensor Test

Fuel Gauge, Resistance, Voltage And Fuel Tank Level Comparison Chart

Use the chart to determine fuel tank fuel volume versus fuel gauge reading to determine the fuel level symptom and fault.



NOTE: The vehicle must be parked on a level surface to obtain an accurate fuel level gauge reading.

Volume, Resistance and Voltage Values

Gauge Reading	Fill Volume (L)	Fuel Level Sensor "pump/active/A" (0xD908) - Rear		Fuel Level Sensor "eject/passive/B" (0xD907) - Front	
		Resistance (Ω)	Voltage (V)	Resistance (Ω)	Voltage (V)
	0	51.30	0.37	51.60	0.38
	1	51.30	0.37	51.60	0.38
	2	51.30	0.37	51.60	0.38
	3	51.30	0.37	51.60	0.38
(4.9L unuseable fuel)	4	51.30	0.37	51.60	0.38
Empty	5	51.30	0.37	51.60	0.38
	6	67.30	0.47	51.60	0.38
	8	92.90	0.63	51.60	0.38
	10	111.10	0.74	51.60	0.38
	12	130.20	0.84	67.80	0.47
	14	139.70	0.89	76.40	0.53
	16	160.20	0.99	93.70	0.64
	18	171.00	1.04	111.40	0.74

	20	182.00	1.10	120.90	0.78
	22	193.40	1.15	131.20	0.85
	24	204.90	1.21	150.90	0.95
¼	25	216.50	1.25	151.20	0.96
	26	228.50	1.30	161.40	0.99
	28	241.20	1.36	172.20	1.05
	30	254.20	1.41	193.90	1.15
	32	267.50	1.46	205.90	1.21
	34	281.30	1.51	217.90	1.26
	35	281.50	1.52	229.70	1.31
	36	295.50	1.56	230.00	1.32
	38	310.30	1.62	242.50	1.37
	40	325.20	1.68	269.00	1.47
	42	341.30	1.73	282.70	1.52
	44	357.10	1.78	297.20	1.58
½	45	373.10	1.83	312.00	1.64
	46	373.50	1.84	312.30	1.64
	48	390.50	1.89	327.70	1.68
	50	407.50	1.94	358.50	1.78
	52	427.10	1.99	374.80	1.84
	54	463.90	2.09	391.80	1.89
	55	463.90	2.09	409.60	1.95
	56	484.30	2.14	409.80	1.95
	58	505.90	2.00	427.90	1.96
	60	528.40	2.25	447.30	2.05
	62	550.90	2.29	486.40	2.11
	64	573.40	2.35	507.60	2.20
¾	65	573.60	2.36	507.70	2.20
	66	597.70	2.40	529.40	2.26
	68	623.40	2.45	553.60	2.31
	70	650.50	2.50	577.40	2.38
	72	677.50	2.55	628.20	2.46
	74	706.80	2.62	654.50	2.52
	75	736.70	2.66	655.00	2.53
	76	737.00	2.67	682.30	2.58
	78	801.10	2.76	710.00	2.63
	80	835.80	2.81	772.50	2.72
	82	872.30	2.87	805.00	2.79
	84	950.60	2.98	875.40	2.88
	86	992.10	3.02	951.60	2.98
Full	87	992.20	3.02	995.70	3.03

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.


REFER to: Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (PCM) (100-00, Description and Operation).

Fuel Tank and Lines - TDV6 3.0L Diesel - Fuel Cooler


Removal and Installation

Removal


WARNINGS:

 Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install new blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.

 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

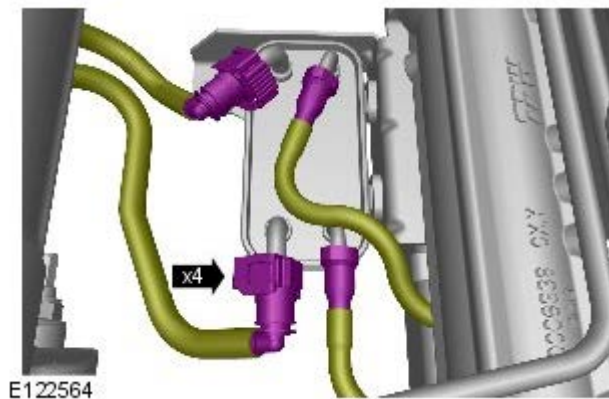
 CAUTION: Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.


 NOTE: Removal steps in this procedure may contain installation details.

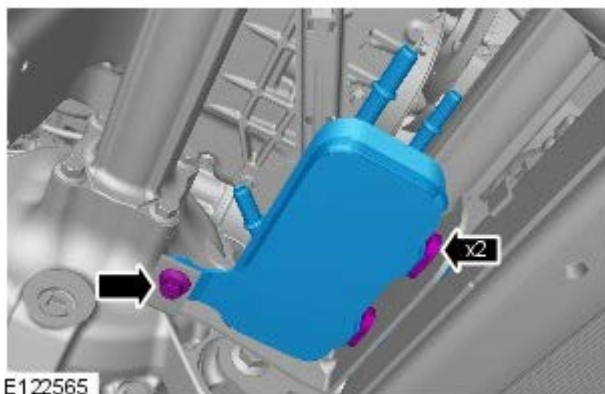
-  WARNING: Make sure to support the vehicle with axle stands.


Raise and support the vehicle.

- Refer to: Engine Undershield (501-02, Removal and Installation).



-  WARNING: Fluid loss is unavoidable, use absorbent cloth or a container to collect the fluid.



-  CAUTION: Always plug any open connections to prevent contamination.

Torque: 23 Nm

Installation

-  CAUTION: Remove and discard all blanking caps.

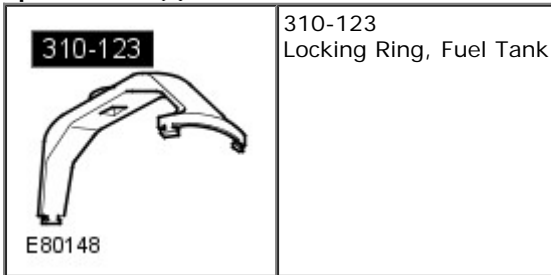
To install, reverse the removal procedure.

2. Fill the cooling system, keeping coolant to the upper level mark of the expansion tank.

Fuel Tank and Lines - TDV6 3.0L Diesel - Fuel Pump and Sender Unit

Removal and Installation

Special Tool(s)



General Equipment

Transmission jack

Removal

WARNINGS:



After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.



After the fuel tank drain is complete always fit the sealing covers over the drain ports. Failure to do so will mean that fuel vapor can escape.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.




CAUTION: Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.



NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

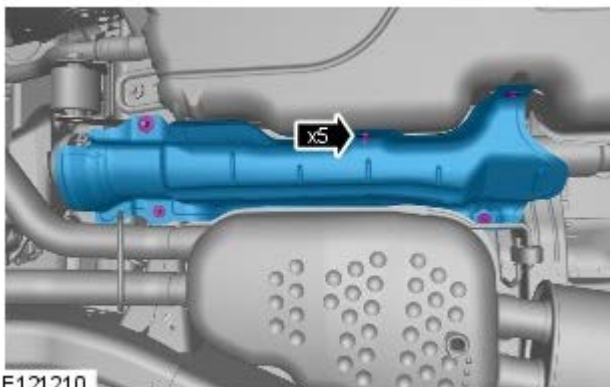
Raise and support the vehicle.

3. Refer to: Fuel Tank Draining (310-00, General Procedures).

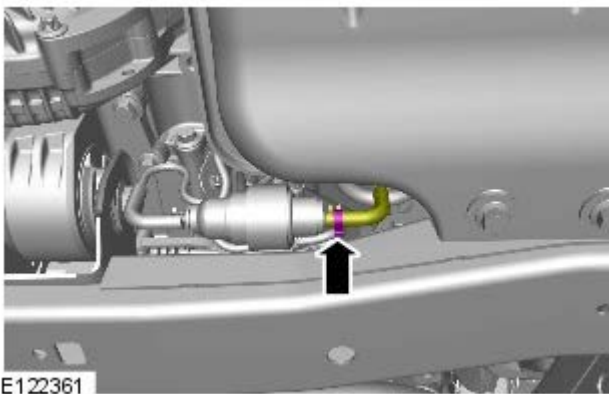
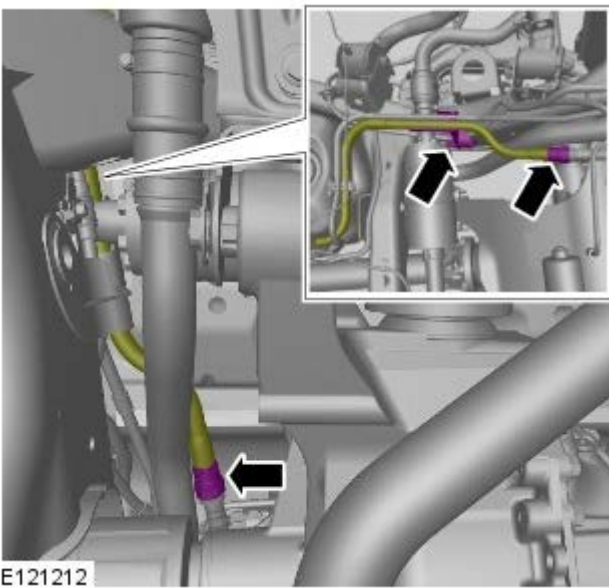
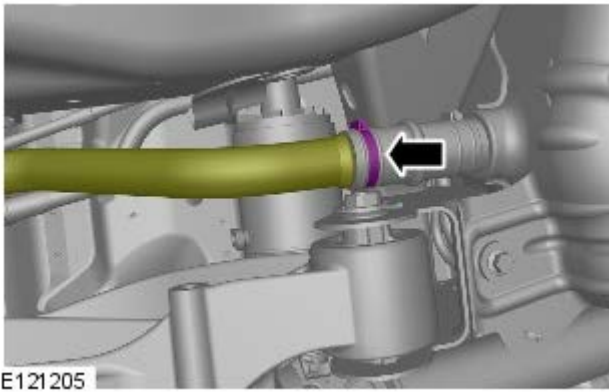
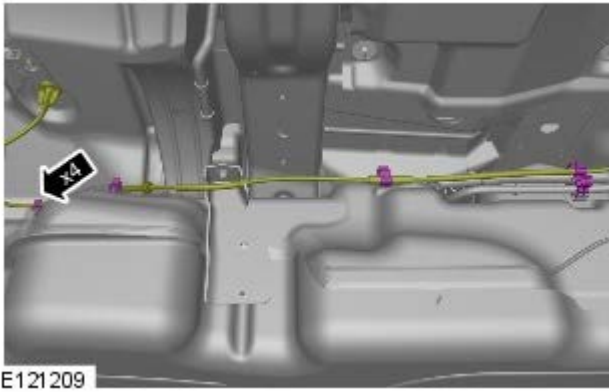
4. *Torque:*

Bolts 6 Nm


Nuts 3 Nm





- 5.




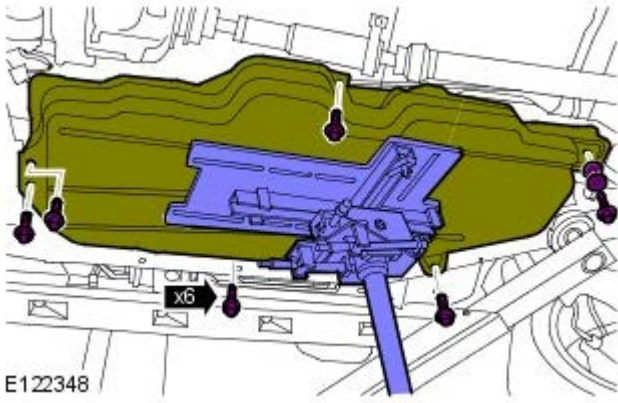
6.  CAUTION: Discard the retaining clip.
Remove the tamper proof cover.


7.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.


8.  WARNING: Be prepared to collect escaping fuel.

-  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

9.  WARNING: Secure the component to the transmission jack.

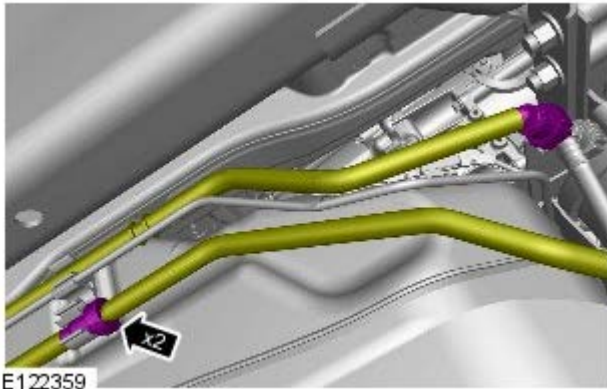



 **CAUTION:** Do not lower the fuel tank more than 250 mm.


 **NOTE:** Note the orientation of the two rear retaining bolts and washers.

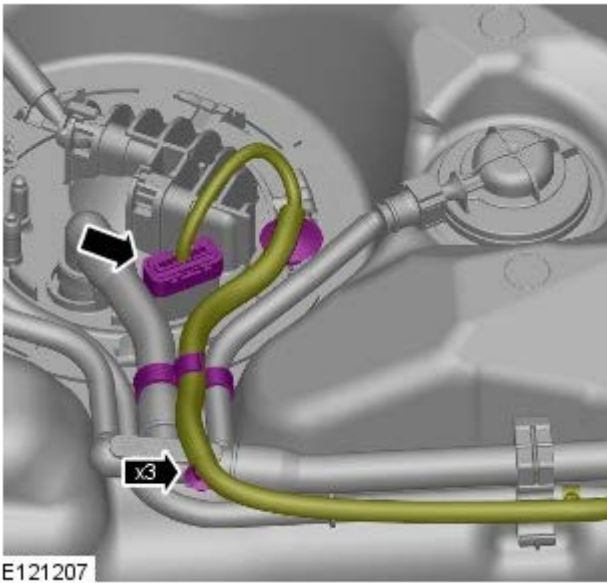
Using a suitable transmission jack, lower the fuel tank sufficiently only to access the top of the fuel tank.


General Equipment: [Transmission jack](#)
Torque: [45 Nm](#)

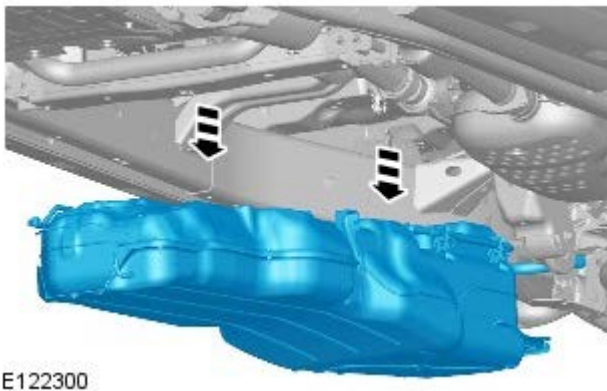


10.  **WARNING:** Be prepared to collect escaping fuel.

 **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.

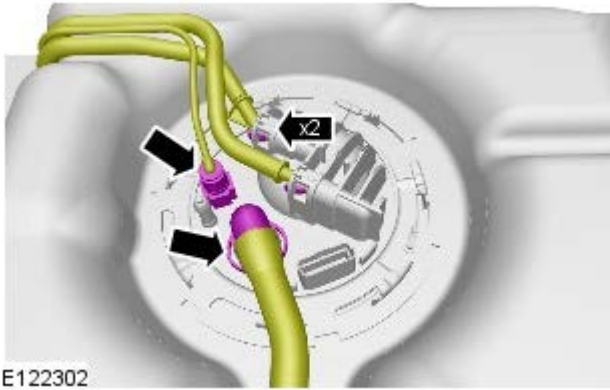


11.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.




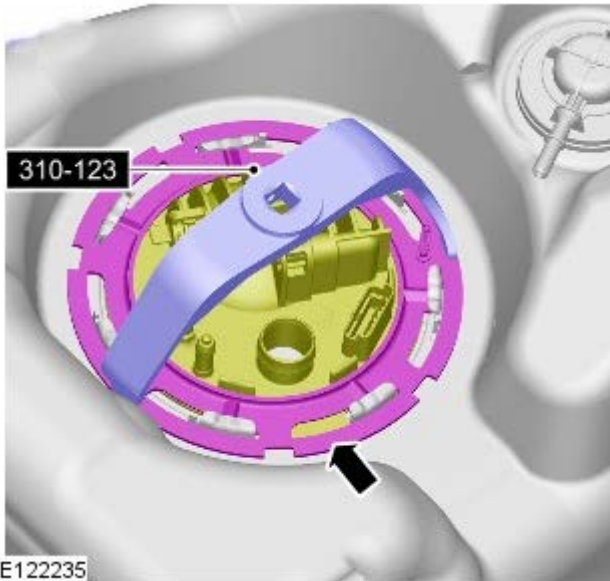
12.  **NOTE:** Do not disassemble further if the component is removed for access only.

With assistance, remove the fuel tank.



E122302


13.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.



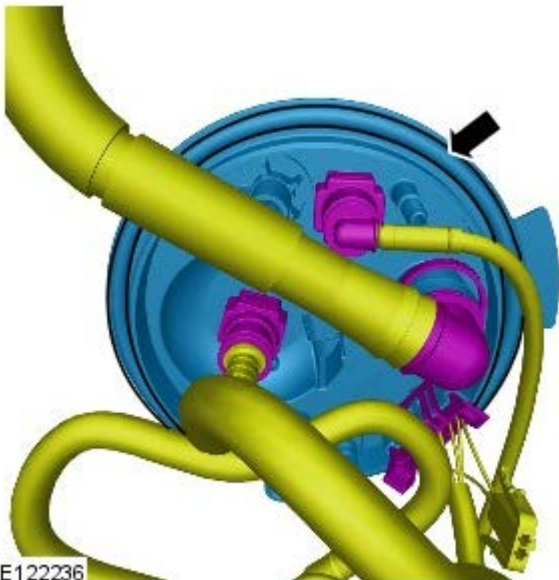
E12235

14. NOTES:


 Note the position of the locating tang.

 Some variation in the illustrations may occur, but the essential information is always correct.

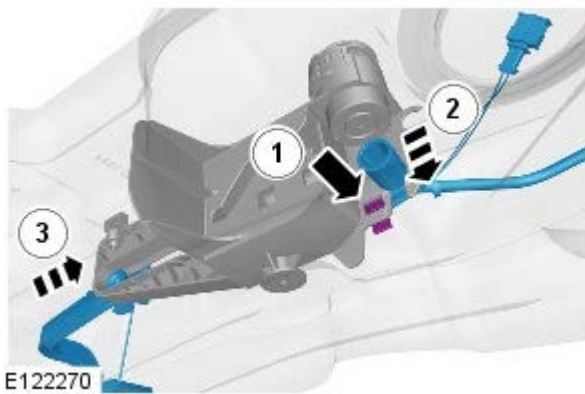
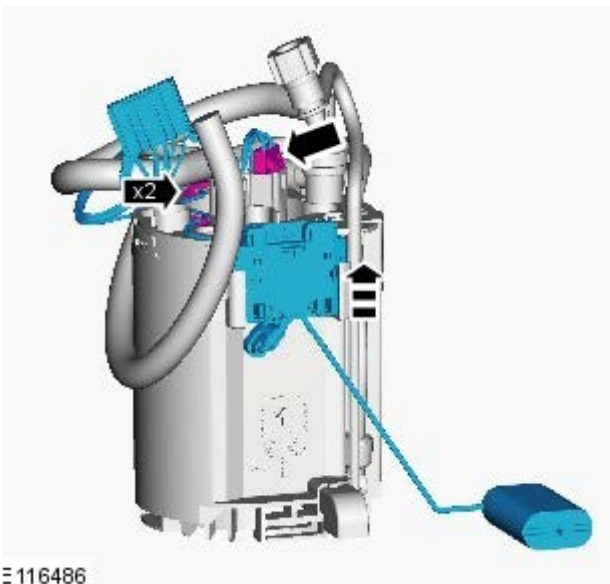
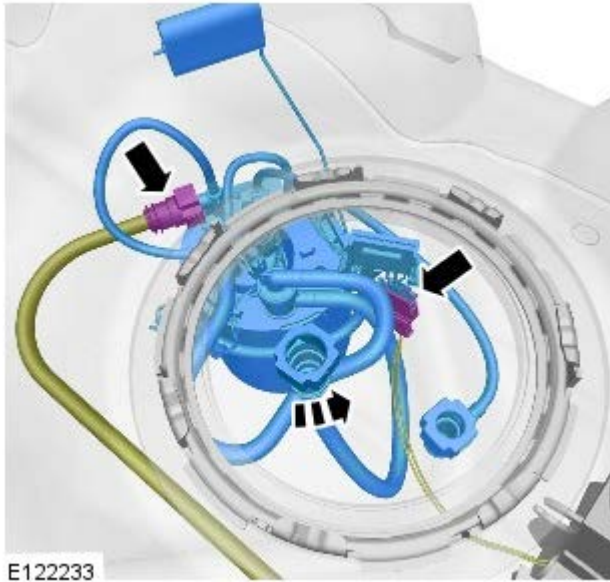
Special Tool(s): [310-123](#)



E12236

15.  NOTE: Remove and discard the O-ring seal.

16.  CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

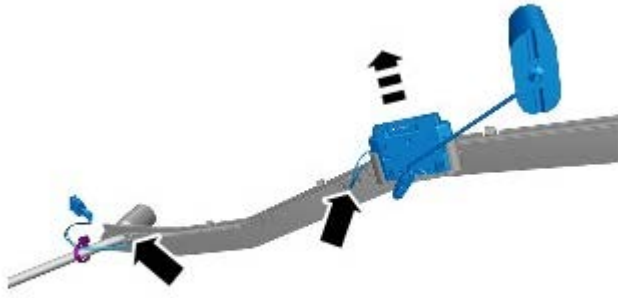


17.  CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

 NOTE: Do not disassemble further if the component is removed for access only.

18.  CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

19.



E122269

Installation

1. NOTES:



Remove and discard all blanking caps.




Make sure the locating tang is installed in the position noted in the removal step.

To install, reverse the removal procedure.

Fuel Tank and Lines - TDV6 3.0L Diesel - Fuel Tank

Removal and Installation

Special Tool(s)

 <p>310-123 E80148</p>	<p>310-123 Locking Ring, Fuel Tank</p>
---	--

Removal

WARNINGS:



After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.



After the fuel tank drain is complete always fit the sealing covers over the drain ports. Failure to do so will mean that fuel vapor can escape.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



CAUTION: Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.



NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Specifications (414-00, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

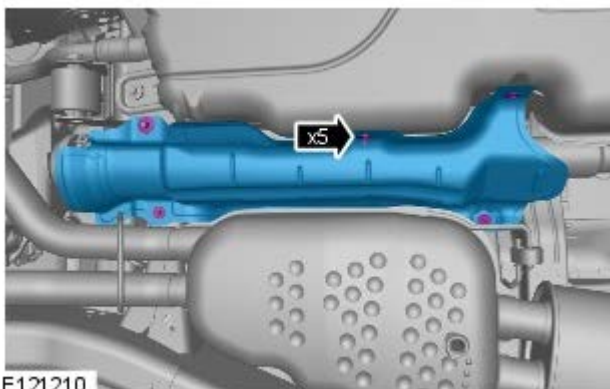
Raise and support the vehicle.

3. Refer to: Fuel Tank Draining (310-00, General Procedures).

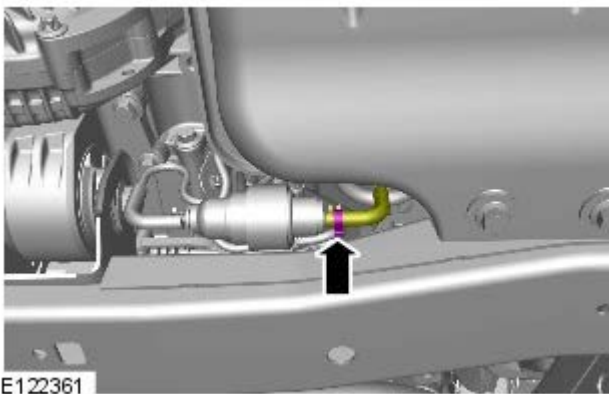
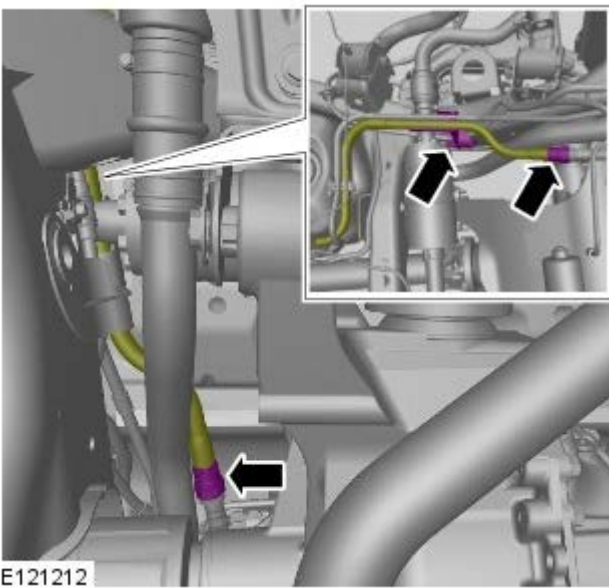
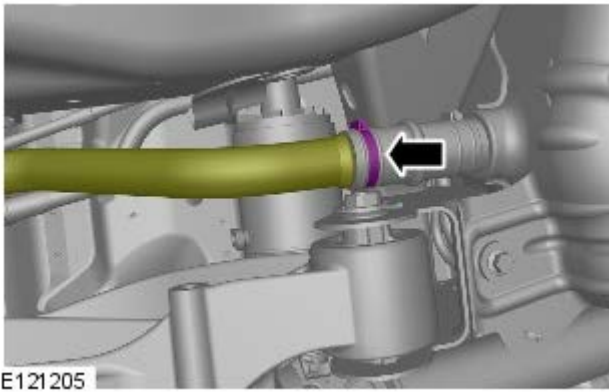
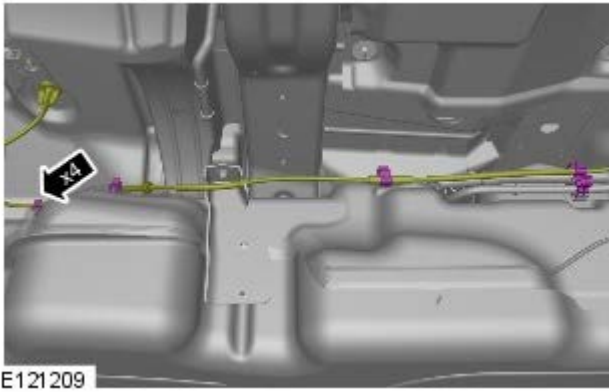
4. *Torque:*

Bolts 6 Nm


Nuts 3 Nm





5.



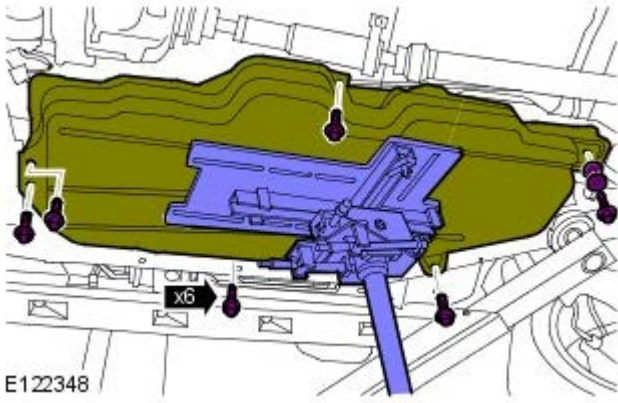
6.  NOTE: Discard the retaining clip.
Remove the tamper proof cover.

7.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.


8.  WARNING: Be prepared to collect escaping fuel.


-  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

9.  WARNING: Secure the component to the transmission jack.



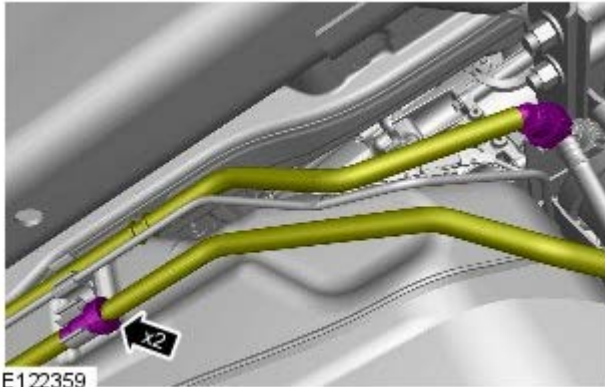
E122348

 **CAUTION:** Do not lower the fuel tank more than 250 mm (9.75 in)


 **NOTE:** Note the orientation of the two rear retaining bolts and washers.


Using a transmission jack, lower the fuel tank sufficiently only to access the top of the fuel tank.

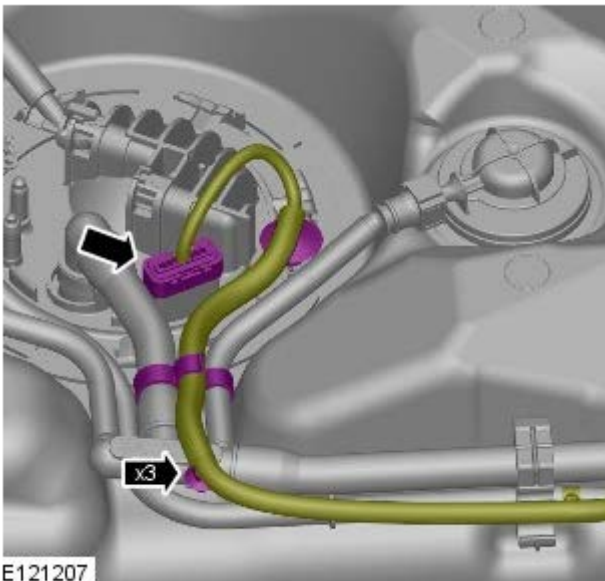
Torque: 45 Nm




E122359

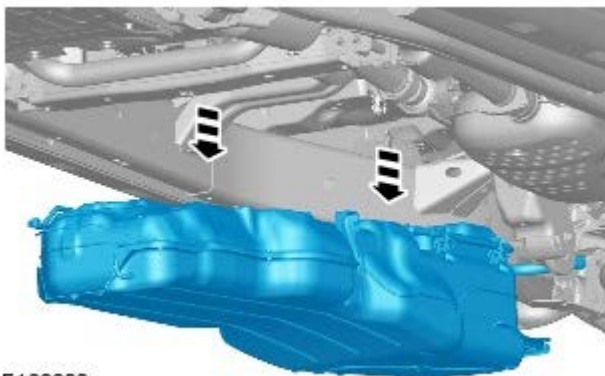
10.  **WARNING:** Be prepared to collect escaping fuel.

 **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.




E121207

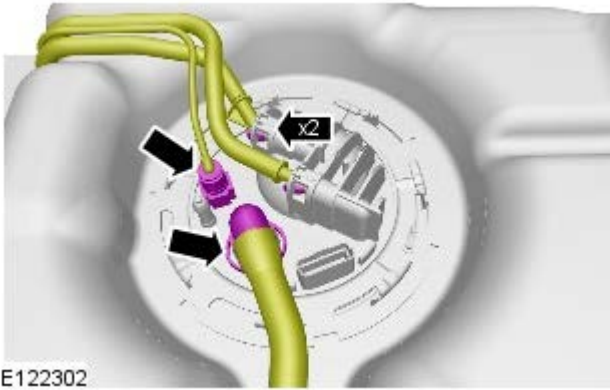
11.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.




E122300

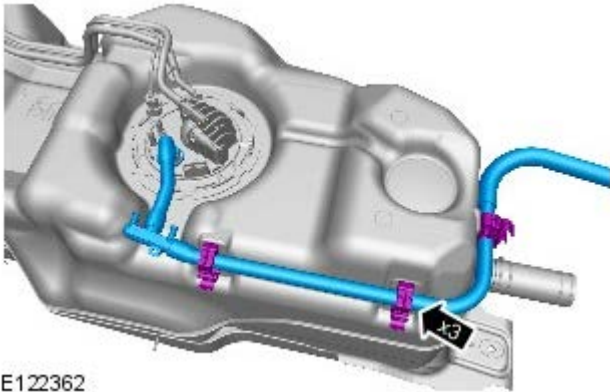
12.  **NOTE:** Do not disassemble further if the component is removed for access only.

With assistance, remove the fuel tank.



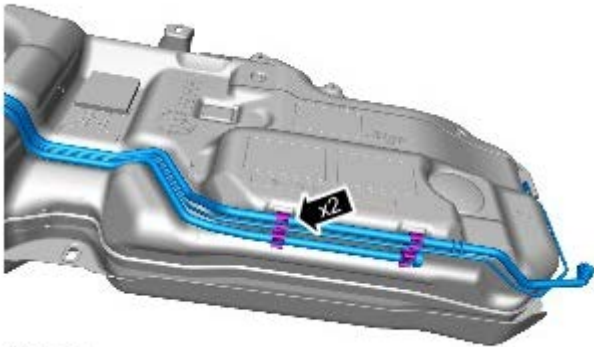
E122302

13.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.



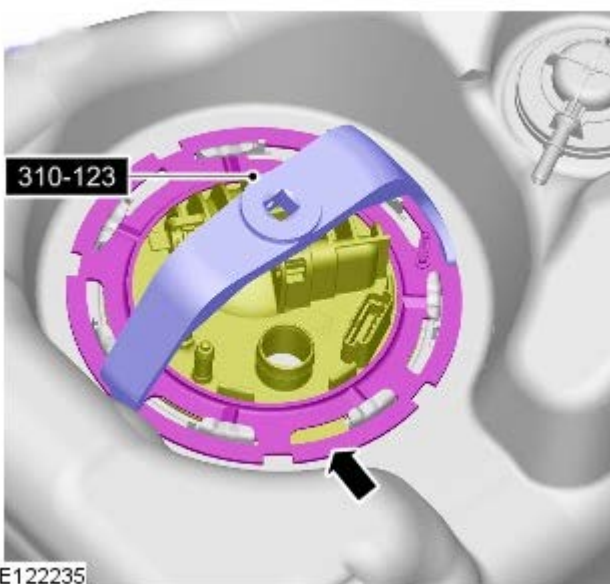
E122362

- 14.



E122360


- 15.

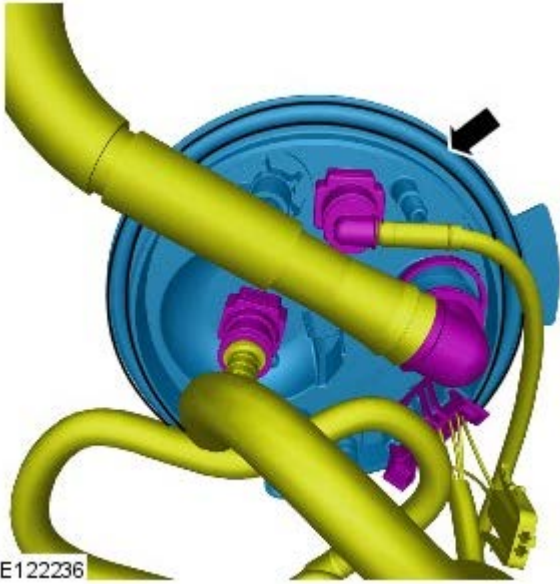


E122235

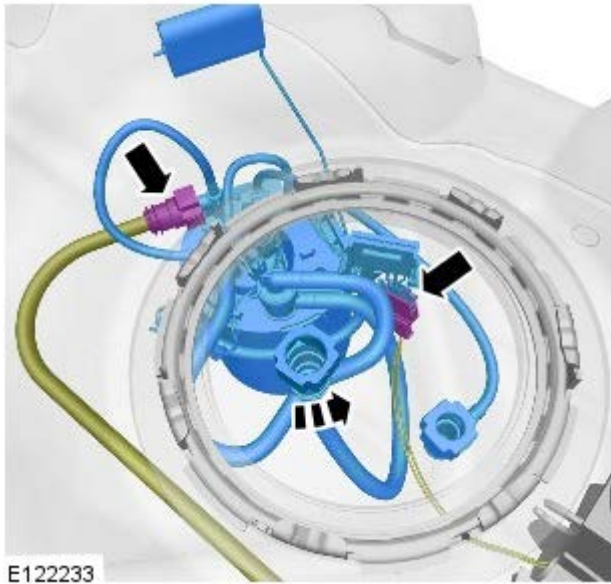
16.  NOTE: Note the position of the locating tang.

Special Tool(s): [310-123](#)

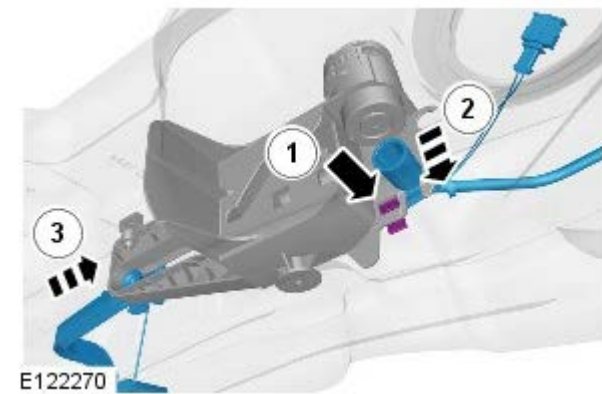
17.  NOTE: Remove and discard the O-ring



seal.

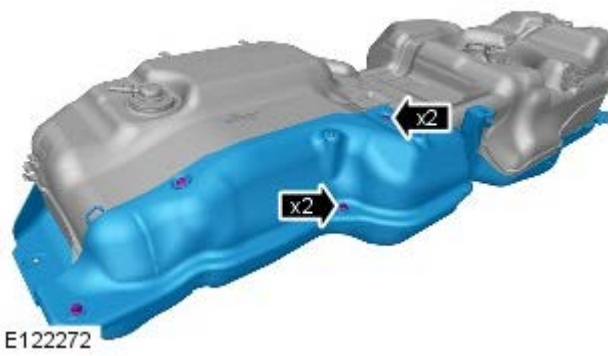


- 18.  CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.



- 19.  CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

20.



Installation

1. NOTES:



Remove and discard all blanking caps.



Make sure the locating tang is installed in the position noted in the removal step.

To install, reverse the removal procedure.

Fuel Tank and Lines - TDV6 3.0L Diesel - Fuel Tank Filler Pipe

Removal and Installation

Removal

WARNINGS:



The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.



After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.




NOTE: Removal steps in this procedure may contain installation details.

1. Remove the battery ground cable.

Refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

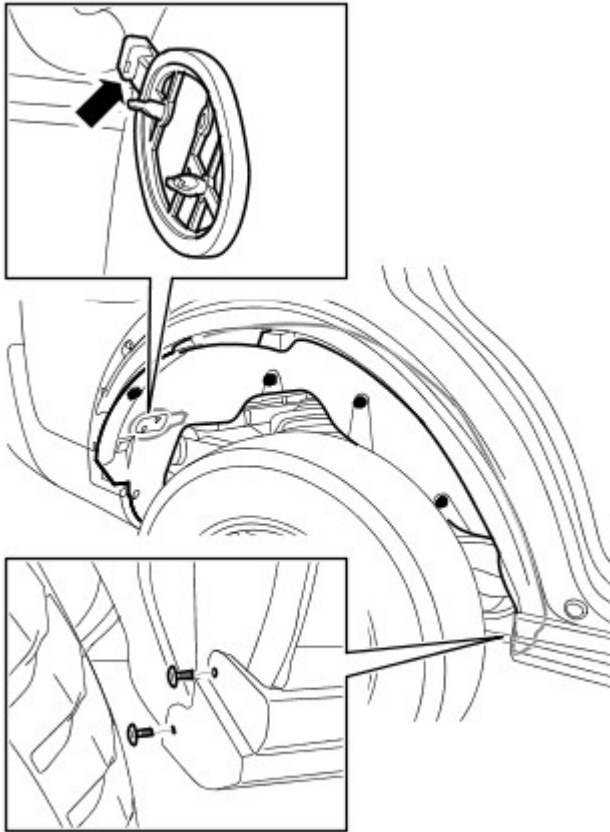
2. Remove the spare wheel and tire.

3.  **WARNING:** Make sure to support the vehicle with axle stands.

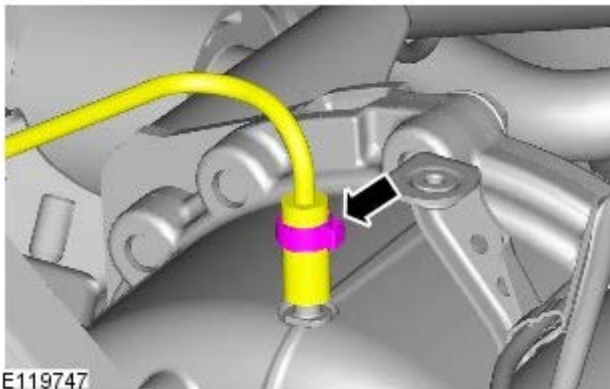
Raise and support the vehicle.

4. Refer to: Fuel Tank Draining (310-00 Fuel System - General Information, General Procedures).
5. Refer to: Fuel Filler Door Assembly (501-03 Body Closures, Removal and Installation).
6. Remove the RH rear wheel and tire.
7. Refer to: Rear Quarter Panel Moulding (501-08, Removal and Installation).

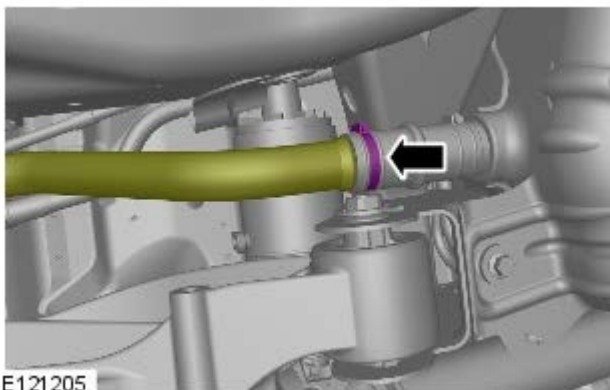
8. Remove the fender splash shield.



E48478



E119747




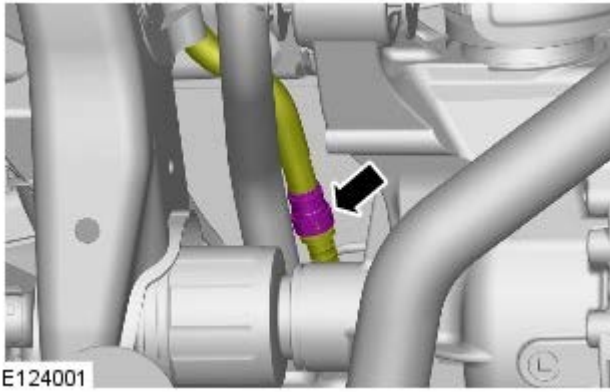
E121205

9.

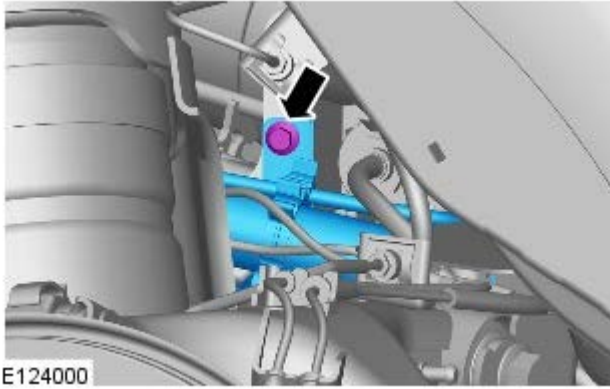
10.  **NOTE:** Discard the retaining clip.

Remove the tamper proof cover from the fuel tank filler pipe hose clip.

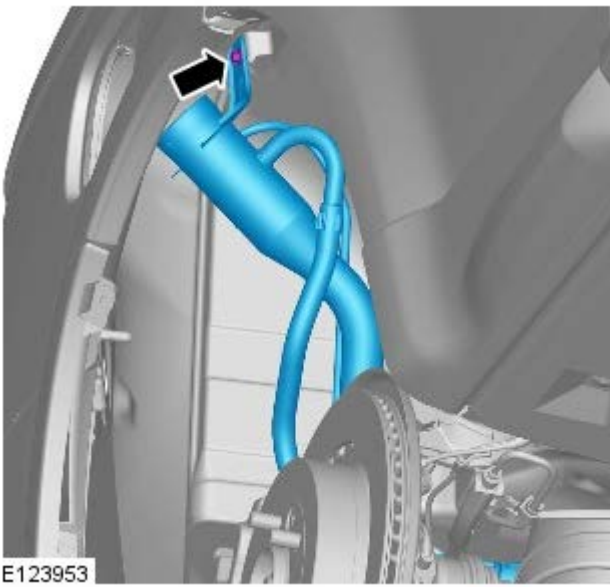
11.  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.



12. Torque: 4 Nm




13. Torque: 4 Nm



Installation

1. To install, reverse the removal procedure.

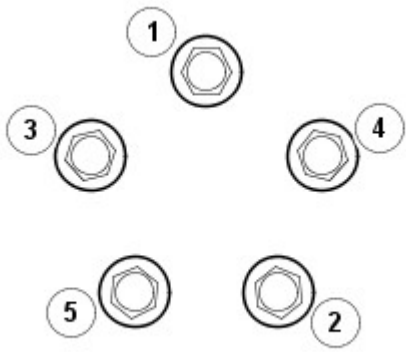
2.  **NOTE:** Tighten the wheel nuts in the sequence shown:

Torque:

Stage 1: 4 Nm

Stage 2: 70 Nm

Stage 3: 140 Nm




E74593

Fuel Tank and Lines - TDV6 3.0L Diesel - Fuel Filter Element


Removal and Installation


Removal

WARNINGS:

 Do not smoke or carry lighted tobacco or open flame of any type when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

 This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

 Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.


 If fuel contacts the eyes, flush the eyes with cold water or eyewash solution and seek immediate medical attention.


 If taken internally, do not induce vomiting, seek immediate medical attention. Failure to follow these instructions may result in personal injury.


 Wash hands thoroughly after fuel handling, as prolonged contact may cause irritation. Should irritation develop, seek medical attention.

 The spilling of fuel is unavoidable during this operation. Make sure that all necessary precautions are taken to prevent fire and explosion.

CAUTIONS:

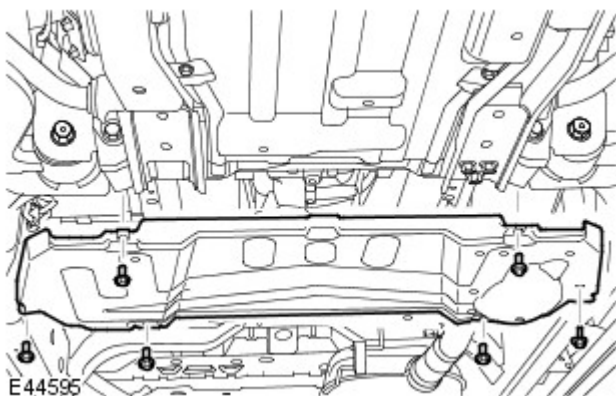
 Diesel fuel injection equipment is manufactured to very precise tolerances and fine clearances. It is therefore essential that absolute cleanliness is observed when working with these components. Always install blanking plugs to any open orifices or lines. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.


 Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.

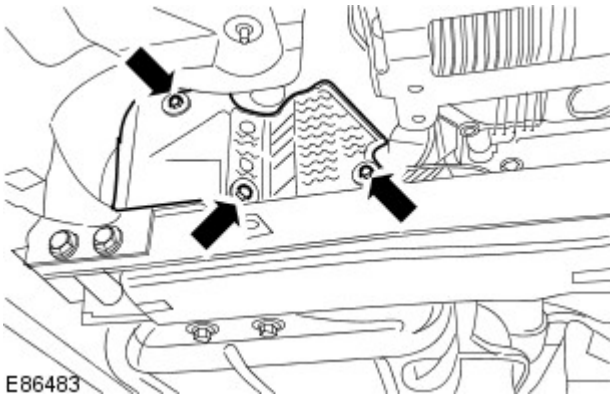
-  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

- Remove the transmission undershield.
 - Remove the 6 bolts.




-  **WARNING:** Observe due care when working near a hot exhaust system.



Remove the fuel filter heat shield.

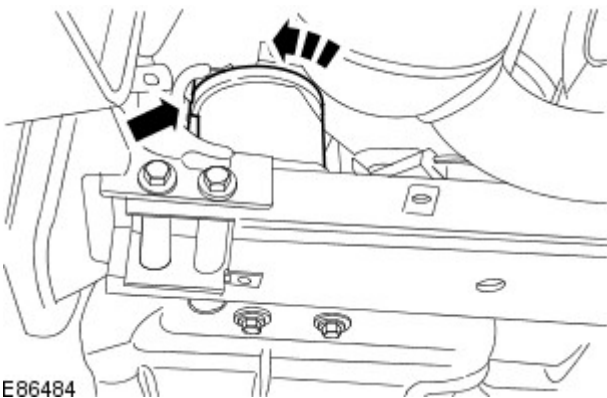
- Remove the 3 bolts.




4.  **CAUTION:** Make sure the water-in-fuel sensor remains in the aligned position.

Drain the fuel filter element.

- Position a container to collect the fluid spillage.
- Loosen the nut.
- Attach a suitable drain tube to the water-in-fuel sensor drain port.
- Remove the drain tube.
- Tighten the nut.



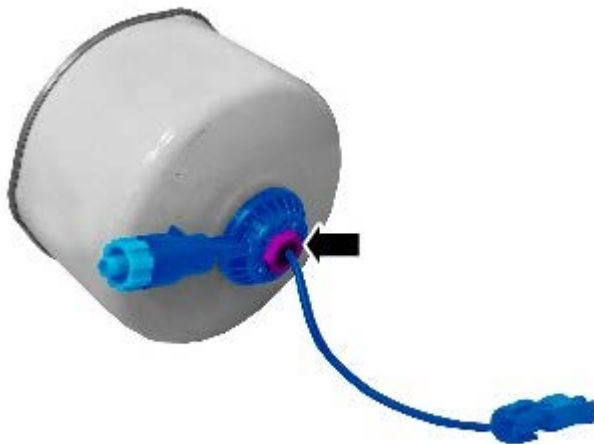
5.  **CAUTION:** Make sure that the area around the component is clean and free of foreign material.

Remove the fuel filter element.

- Disconnect the water-in-fuel sensor electrical connector.

6. Remove the water-in-fuel sensor.

- Discard the fuel filter element.



7. Remove and discard the O ring seals.



E138941

Installation

1. Install new O ring seals.



E138940

2.  CAUTION: Make sure that the mating faces are clean and free of foreign material.

 NOTE: Make sure that the water-in-fuel

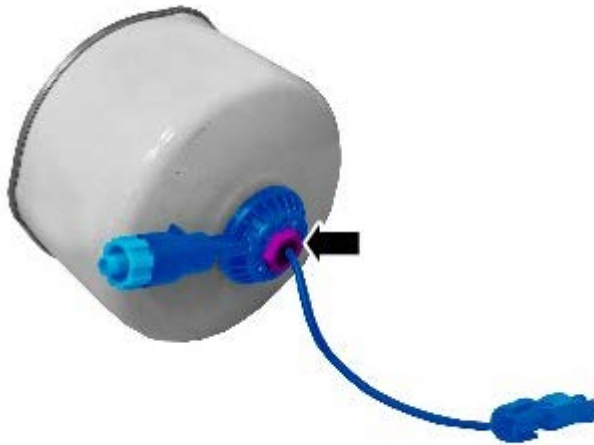


E138603


sensor is aligned with the drain arrow.

Install the water-in-fuel sensor.


- Remove and discard the water-in-fuel drain plug from the new fuel filter element.



E138939

3.  CAUTION: Make sure the water-in-fuel sensor remains in the aligned position.

Tighten the plastic nut to 1.6 Nm.

4.  NOTE: Make sure that the fuel filter element is correctly aligned. Failure to follow this instruction may result in damage to the vehicle.

Install the fuel filter element.


1. Insert the fuel filter with the the lock symbol arrow aligned with the inlet pipe on the fuel filter housing.



E138604



E138605

5.  **NOTE:** Make sure that the fuel filter element is correctly aligned. Failure to follow this instruction may result in damage to the vehicle.

Rotate to tighten and seal the fuel filter element.

1. When tightened correctly, the lock symbol arrow should be aligned with the arrow symbol on the fuel filter housing.
- Connect the water-in-fuel sensor electrical connector.
- Remove the container.

6. Install the fuel filter heat shield.
 - Tighten the bolts to 6 Nm.
7. Install the transmission undershield.
 - Tighten the bolts to 10 Nm.
8. Carry out the low-pressure fuel system bleeding.

Fuel Tank and Lines - V6 S/C 3.0L Petrol -**Capacity**

Item	Liters
Fuel tank capacity	86.3 (total)

General Specifications

Item	Specifications
Fuel system	Electronic - returnless
Fuel tank	Multi layer plastic
Fuel tank sender units	Two - Front and Rear - front sender unit is attached to the frame of the fuel pick up tube and the rear sender unit is attached to the fuel pump swirl pot
Fuel filter	Located in the fuel tank - if the fuel filter becomes blocked a new pump and sender unit must be installed
Fuel pump	Dual stage electric - submersible - located in fuel tank
System pressure	4.5 bar - 65.3 lbf/in ²
Starting pressure	6.3 bar - 91.4 lbf/in ²

Torque Specifications

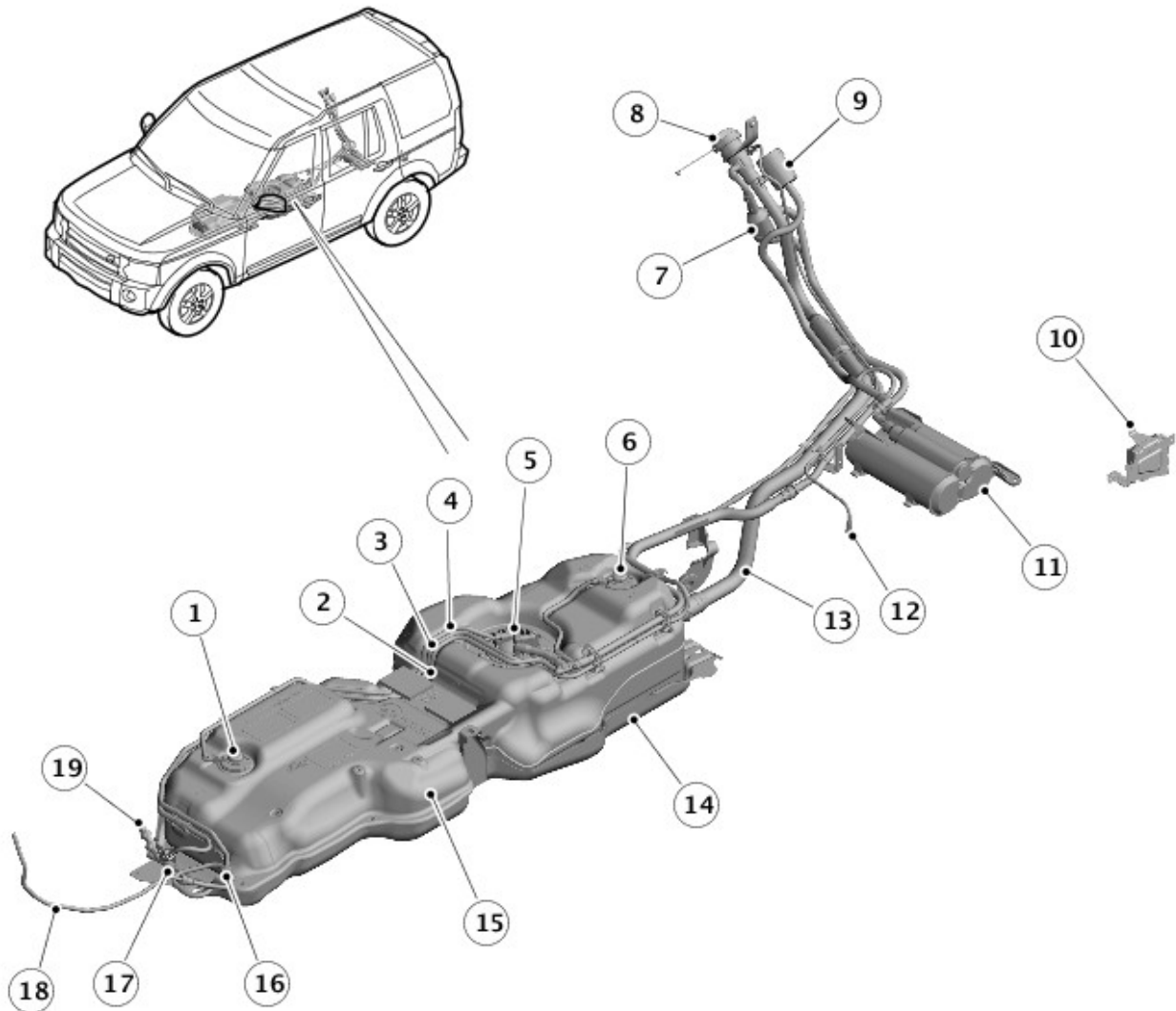
Item	Nm	lb-ft	lb-in
Fuel tank filler pipe retaining bolt	4	-	35
Fuel tank heat shield retaining bolts	6	-	53
Fuel tank heat shield retaining nuts	3	-	27
Fuel tank retaining bolts	45	33	-

Fuel Tank and Lines - V6 S/C 3.0L Petrol - Fuel Tank and Lines

Description and Operation

COMPONENT LOCATION

Fuel Tank and Lines - All Vehicles Except NAS Vehicles

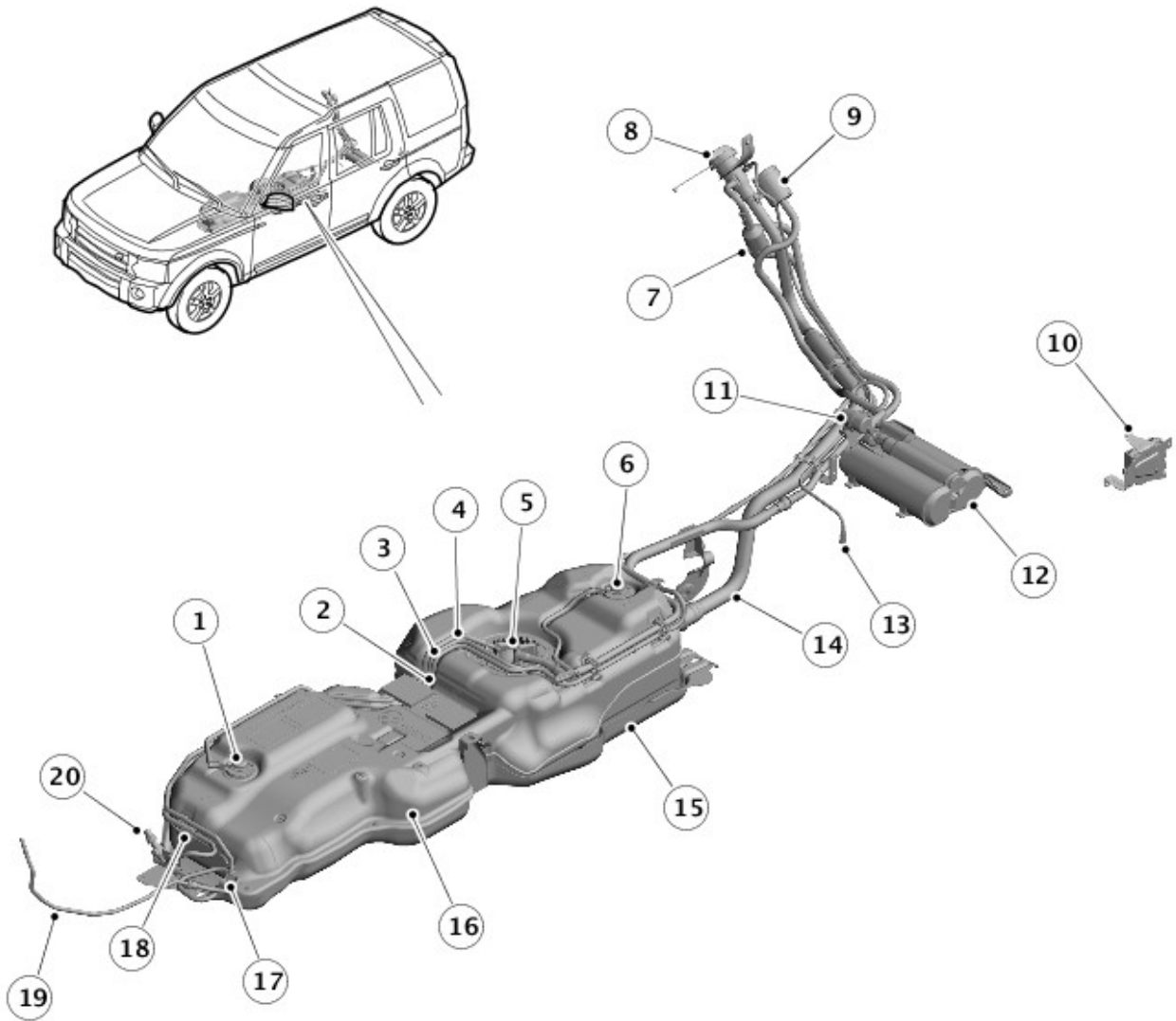


E161087

Item	Part Number	Description
1	-	Front Roll Over Valve (ROV)
2	-	Pipe - fuel vapor from charcoal canister to purge valve
3	-	Pipe - vent from front ROV
4	-	Pipe - fuel delivery line to engine mounted fuel pumps
5	-	Fuel delivery module
6	-	Rear ROV
7	-	Liquid Vapor Separator (LVS)
8	-	Fuel filler cap
9	-	Charcoal canister breather pipe
10	-	Fuel Pump Driver Module (FPDM)
11	-	Charcoal canister
12	-	Pipe - rear differential breather (Reference only)
13	-	Filler pipe
14	-	Heat shield

- 15 - Cover
- 16 - Pipe - charcoal canister breather connection to purge valve
- 17 - Pipe - fuel delivery line connection
- 18 - Pipe - fuel delivery line to engine mounted high pressure fuel pumps
- 19 - Low pressure fuel sensor

Fuel Tank and Lines - NAS Vehicles Only



E161088

Item	Part Number	Description
1	-	Front Roll Over Valve (ROV)
2	-	Pipe - fuel vapor from charcoal canister to purge valve
3	-	Pipe - vent from front ROV
4	-	Pipe - fuel delivery line to engine mounted fuel pumps
5	-	Fuel delivery module
6	-	Rear ROV
7	-	Liquid Vapor Separator (LVS)
8	-	Fuel filler cap
9	-	Charcoal canister breather pipe
10	-	Fuel Pump Driver Module (FPDM)
11	-	Diagnostic Monitoring Tank Leakage (DMTL) pump
12	-	Charcoal canister
13	-	Pipe - rear differential breather (Reference only)
14	-	Filler pipe
15	-	Heat shield

16	-	Cover
17	-	Pipe - connection to purge valve
18	-	Pipe - fuel delivery line connection
19	-	Pipe - fuel delivery line to engine mounted high pressure fuel pumps
20	-	Low pressure fuel sensor

OVERVIEW

The major components of the V6 3.0L SC (supercharged) fuel system comprises of a fuel tank, a fuel pump module, a fuel filler assembly and two fuel level sensors.

The V6 3.0L SC fuel system uses a returnless fuel system which comprises a fuel pump mounted in the fuel tank to deliver fuel at a variable flow and pressure to the engine mounted HP (high pressure) fuel pumps which supply fuel to the fuel rails and to all the fuel injectors.

The fuel pump operation is regulated by a [FPDM \(fuel pump driver module\)](#) which is controlled by the [ECM \(engine control module\)](#). The FPDM regulates the flow and pressure supplied by controlling the operation of the fuel pump using a [PWM \(pulse width modulation\)](#) output.

The fuel rails and the injectors are described in Fuel Charging and Controls – V6 3.0L SC

For additional information, refer to: [Fuel Charging and Controls](#) (303-04C Fuel Charging and Controls - V6 S/C 3.0L Petrol, Description and Operation).

Fuel system evaporative emission control is described in Evaporative emissions - V6 3.0L SC

For additional information, refer to: [Evaporative Emissions](#) (303-13 Evaporative Emissions - V6 S/C 3.0L Petrol, Description and Operation).

COMPONENT DESCRIPTION

Fuel Tank

The fuel tank is located on the right side of the vehicle, between the transmission and the right chassis longitudinal. The tank is located on a mounting cradle which secures the whole fuel tank assembly to the vehicle. The tank has a useable capacity of 86.0 liters (19 gallons).

The tank is a sealed unit with the only internal access being via the fuel pump module flange aperture on the top of the tank.

The flange is fitted with a locking ring and seal. The seal locates in a groove on the tank. The locking ring locates and clamps on the encapsulated ring that is moulded into the fuel tank. The flange has a tag which locates in the top of the tank to ensure correct orientation.

The flange has six pin internal and external connectors which provide for electrical connections for the level sensors and the fuel pump. A quick release connector provides for the connection of the fuel delivery line.

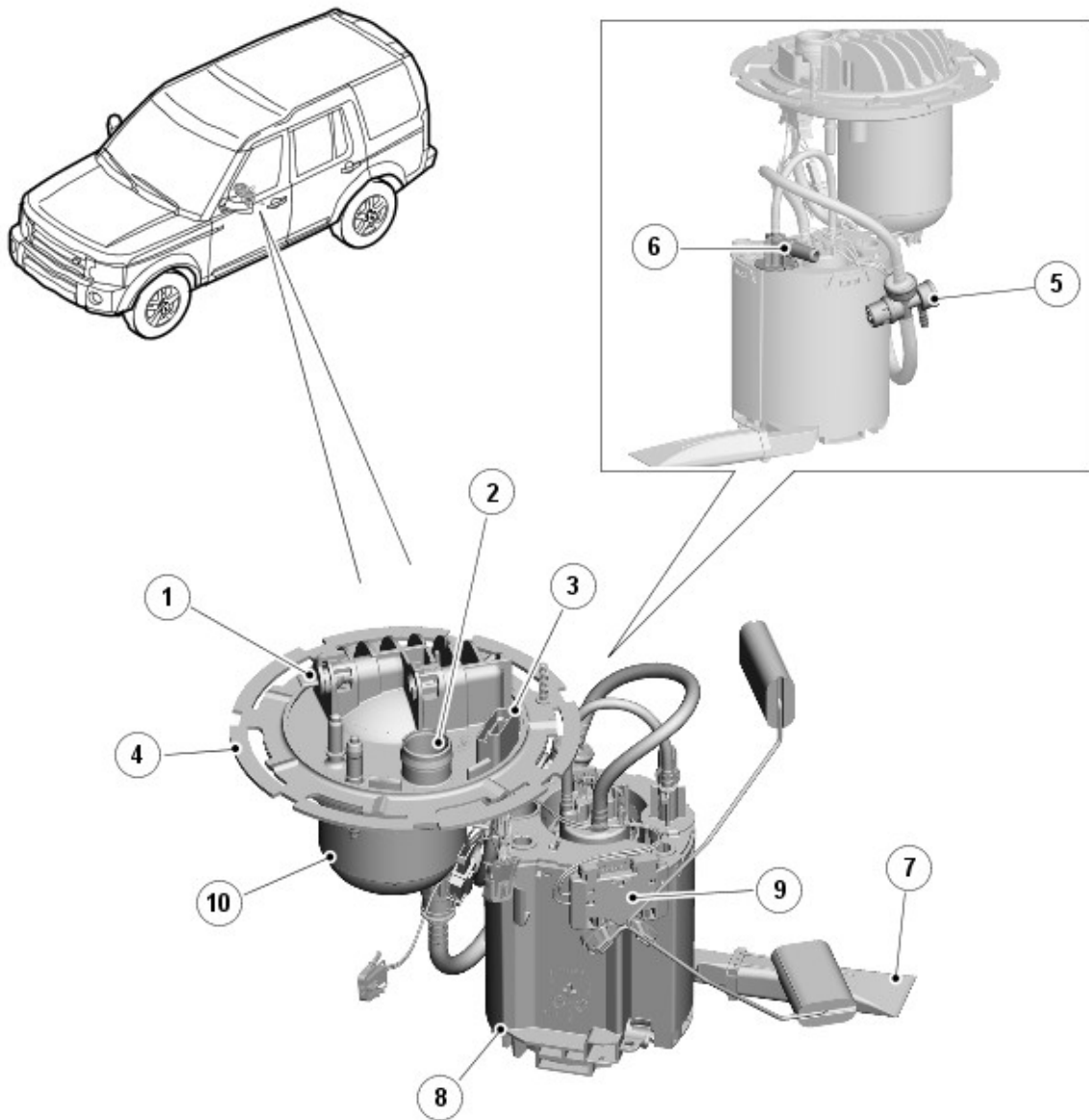
A carrier within the tank provides for the mounting of the fuel suction tube, vent valve, and the front fuel level sensor.

The fuel pump module is mounted on a bayonet lock ring which is welded inside the fuel tank. The fuel pump module comprises the fuel pump, jet pumps, the pump inlet filter and the fuel PRV (pressure relief valve). The rear fuel level sensor is also mounted on the side of the pump module body.

The PRV (pressure relief valve) assists engine starting by retaining a pre-set fuel pressure in the fuel supply pipe and the fuel rails. The valve also limits fuel rail pressure due to temporary vapor increase in hot conditions and pressure caused by sudden load changes; a fully open to closed throttle transition, for example.

Only the fuel pump module assembly, the fuel level sensors and the flange are available as serviceable components, the individual assembly components are not available separately.

Fuel Pump Module



E 122738

Item	Part Number	Description
1	-	Fuel delivery outlet connection
2	-	Vent pipe connection
3	-	Electrical connector
4	-	Locking ring
5	-	Pressure relief valve
6	-	Suction pipe connection
7	-	Fuel pick-up filter
8	-	Fuel pump
9	-	Rear fuel level sensor
10	-	Fuel filter

The fuel pump module is located inside the fuel tank and comprises three main components; a fuel pump, a remote fuel pick-up and a top flange assembly.

Fuel Pump

The fuel pump is a variable-speed rotary-vane type, which operates in a fuel pump module located at the rear of the fuel tank. A venturi transfer pump is also located in the rear of the tank. The fuel pump module is secured in the fuel tank with a bayonet style locking ring that is welded into the tank structure. The fuel pump module has an integral top plate for the external pipe work and electrical connectors.

The fuel pump delivers fuel at a maximum pressure of 630 kPa (6.3 bar; 91.4 lbf/in.²) to the filter bowl in the top flange.

The electric pump is located in a plastic swirl pot which collects fuel from the base of the fuel tank via a filter. The swirl pot acts as a fuel reserve, providing a constant supply of fuel to the fuel pump irrespective of fuel quantity or

vehicle attitude. When the vehicle is level the swirl pot contains approximately 275 cm³ (16.8 in³) of fuel when the engine is running. The jet pump ensures that fuel is constantly supplied to the swirl pot to provide a sufficient fuel delivery for the pump. A one way valve is located in the base of the swirl pot. The valve allows fuel from the tank to enter the swirl pot, but prevents it from escaping.

The fuel level sensor for the rear of the tank is attached to the outside of the swirl pot.

The fuel pump module is a serviceable component and access to the pump is by removal of the top flange.

Remote Fuel Suction Jet and Level Sensor Assembly

The remote fuel suction jet is located in the front of the fuel tank. The fuel suction jet is attached to the internal carrier which is secured inside the fuel tank.

The fuel system incorporates 2 jet pumps. The jet pumps are integrated into the fuel pump module and draw fuel from the front and rear of the fuel tank. A suction pipe is connected to the fuel suction jet that is located in the front of the tank that allows fuel to be drawn from the front of the tank, delivering fuel into the swirl pot via the suction pipe connection on the pump body. The jet pump operates on a venturi effect created by the fuel at pump output pressure passing through the jet pump.

The fuel level sensor for the front of the fuel tank is attached to the carrier frame. The fuel suction jet and the level sensor are serviceable components and access is by removal of the flange cover on the top rear of the fuel tank.

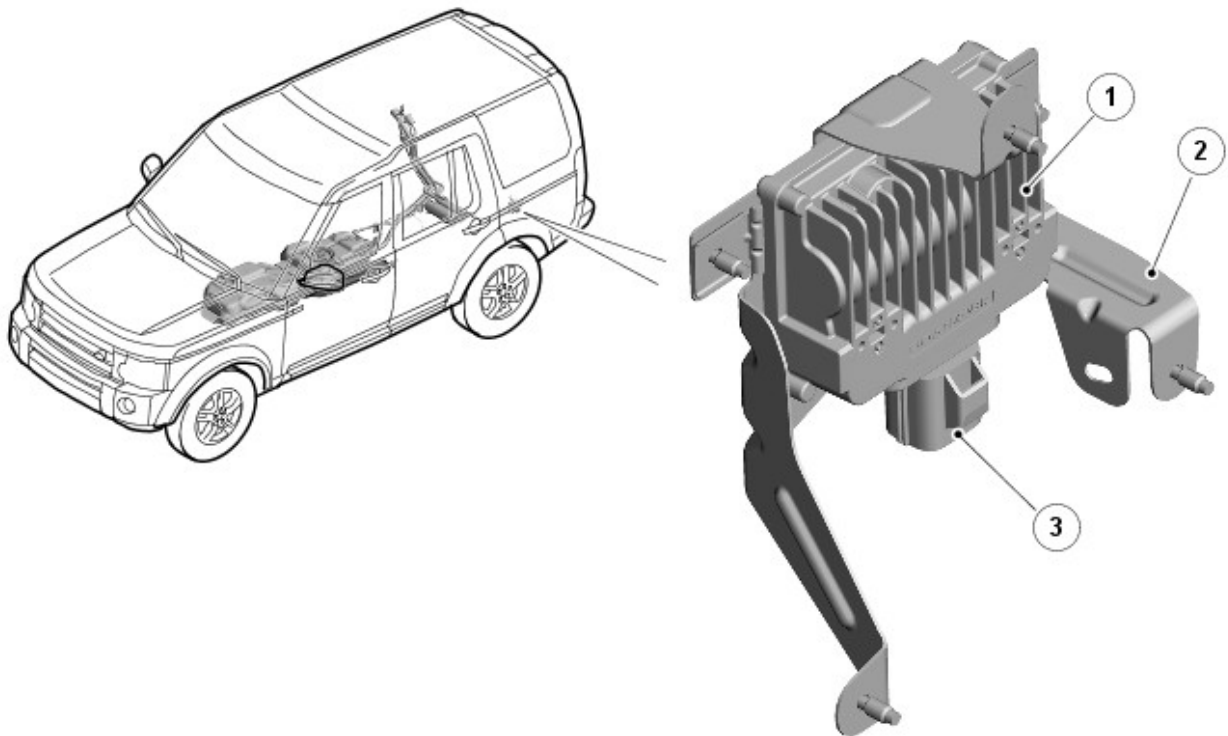
Top Flange Assembly

The top flange is located on the top of the fuel tank. The flange assembly is sealed in the tank with a with a sealing ring. A locking ring secures the flange assembly in the tank and requires a special tool for removal.

The outer surface of the flange has 1 fuel feed outlet with a quick-fit connection. The connection is for the fuel delivery line outlet to the engine mounted fuel pumps. An electrical connector is located adjacent to the pipe connections and provides the electrical interface to the fuel pump and the level sensors. A breather connection allows the fuel tank to breathe and connects the fuel tank to the fuel filler and charcoal canister systems.

On the underside of the flange, inside the tank, is a moulded housing which contains the non-serviceable fuel filter. Fuel from the fuel pump enters the base of the housing and passes through the filter before exiting the tank to the engine mounted fuel pumps. An electrical connection on the base of the filter housing provides a ground for the filter.

Fuel Pump Driver Module (FPDM)



E122739

Item	Part Number	Description
1	-	Fuel Pump Driver Module (FPDM)
2	-	Mounting bracket
3	-	Electric connector

The **FPDM** is located in the left side of the luggage compartment, above the left wheel arch, behind the trim panel. The FPDM is located on a bracket and secured with 2 bolts and nuts.

The fuel pump operation is regulated by the FPDM which is controlled by the **ECM**. The FPDM regulates the flow and pressure supplied by controlling the operation of the fuel pump using a **PWM** output.

The FPDM is powered by a supply from the fuel pump relay in the [EJB \(engine junction box\)](#). The fuel pump relay is energized on opening the driver's door or when power mode 9 engine crank is initiated using the stop/start button. The FPDM supplies power to the fuel pump, and adjusts the power to control the speed of the fuel pump and thus the pressure and flow in the fuel delivery line.

A [PWM](#) signal from the ECM tells the FPDM the required speed for the fuel pump. The on time of the PWM signal represents half the fuel pump speed, e.g. if the PWM signal has an on time of 50%, the FPDM drives the pump at 100%.

The FPDM will only energize the fuel pump if it receives a valid PWM signal, with an on time of between 4% and 50%. To switch the fuel pump off, the ECM transmits a PWM signal with an on time of 75%.

The output pressure from the fuel pump will change with changes of engine demand and fuel temperature. The ECM monitors the input from the LP (low pressure) fuel sensor and the FRPT (fuel rail pressure and temperature) sensor and adjusts the speed of the fuel pump as necessary to maintain a nominal output pressure of 450 kPa (4.5 bar; 65.3 lbf/in.²), except during engine start-up. At engine start-up the target pressure for the fuel delivery line is 630 kPa (6.3 bar; 91.4 lbf/in.²).

If the [SRS \(supplemental restraint system\)](#) outputs a crash signal on the HS (high speed) [CAN \(controller area network\)](#) bus, the ECM de-energizes the fuel pump relay to prevent any further fuel being pumped to the engine.

If the ECM does not detect pressure in the fuel delivery line, it stops, or refuses to start the engine and stores the appropriate [DTC \(diagnostic trouble code\)](#).

The ECM receives a monitoring signal from the FPDM. Any DTC's produced by the FPDM are stored by the ECM.

DTC's can be retrieved from the ECM using an approved Land Rover diagnostic system. The FPDM itself cannot be interrogated by the approved Land Rover diagnostic system.

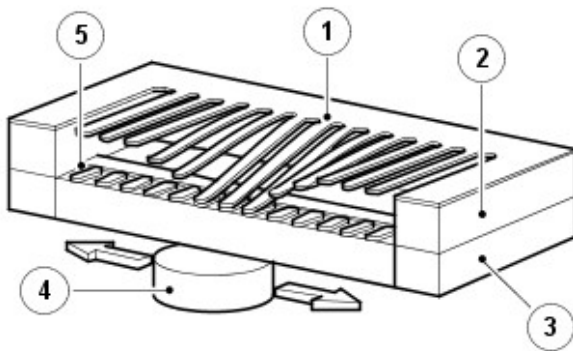
Fuel Level Sensors

Two fuel level sensors are used in the fuel tank to measure the amount of remaining fuel in the front and rear of the fuel tank. The front level sensor is attached to the internal carrier and the rear level sensor is attached to the fuel pump swirl pot. The sensors are connected to the vehicle wiring harness via a connector on the outer face of the top flange assembly.

The sensors are a MAPPS (MAGnetic Passive Position Sensor) which provides a variable resistance to ground for the output from the fuel gauge. The sensor is sealed from the fuel preventing contamination of the contacts and increasing reliability. The front and rear fuel level sensors are connected to the external electrical connector on the flange via the connectors on the underside of the fuel pump module flange.

The sensor comprises a series of 51 film resistors mounted in an arc on a ceramic surface. The resistors are wired in series with individual contacts. A soft magnetic foil with 51 flexible contacts is mounted a small distance above the film resistors. A magnet, located below the ceramic surface, is attached to the sender unit float arm. As the float arm moves, the magnet follows the same arc as the film resistors. The magnet pulls the flexible contacts onto the opposite film resistor contacts forming an electrical circuit.

Sensor Operating Principle



E44504

Item	Part Number	Description
1	-	Magnetic foil
2	-	Spacer
3	-	Ceramic surface
4	-	Magnet
5	-	Resistance film

The film resistors are arranged in a linear arc with resistance ranging from 51.2 to 992.11 Ohms. The electrical output signal output is proportional to the amount of fuel in each side of the tank and the position of the float arms. The measured resistance is processed by the instrument cluster to implement an anti-slosh function. This monitors the signal and updates the fuel gauge pointer position at regular intervals, preventing constant pointer movement caused by fuel movement in the tank due to cornering or braking.

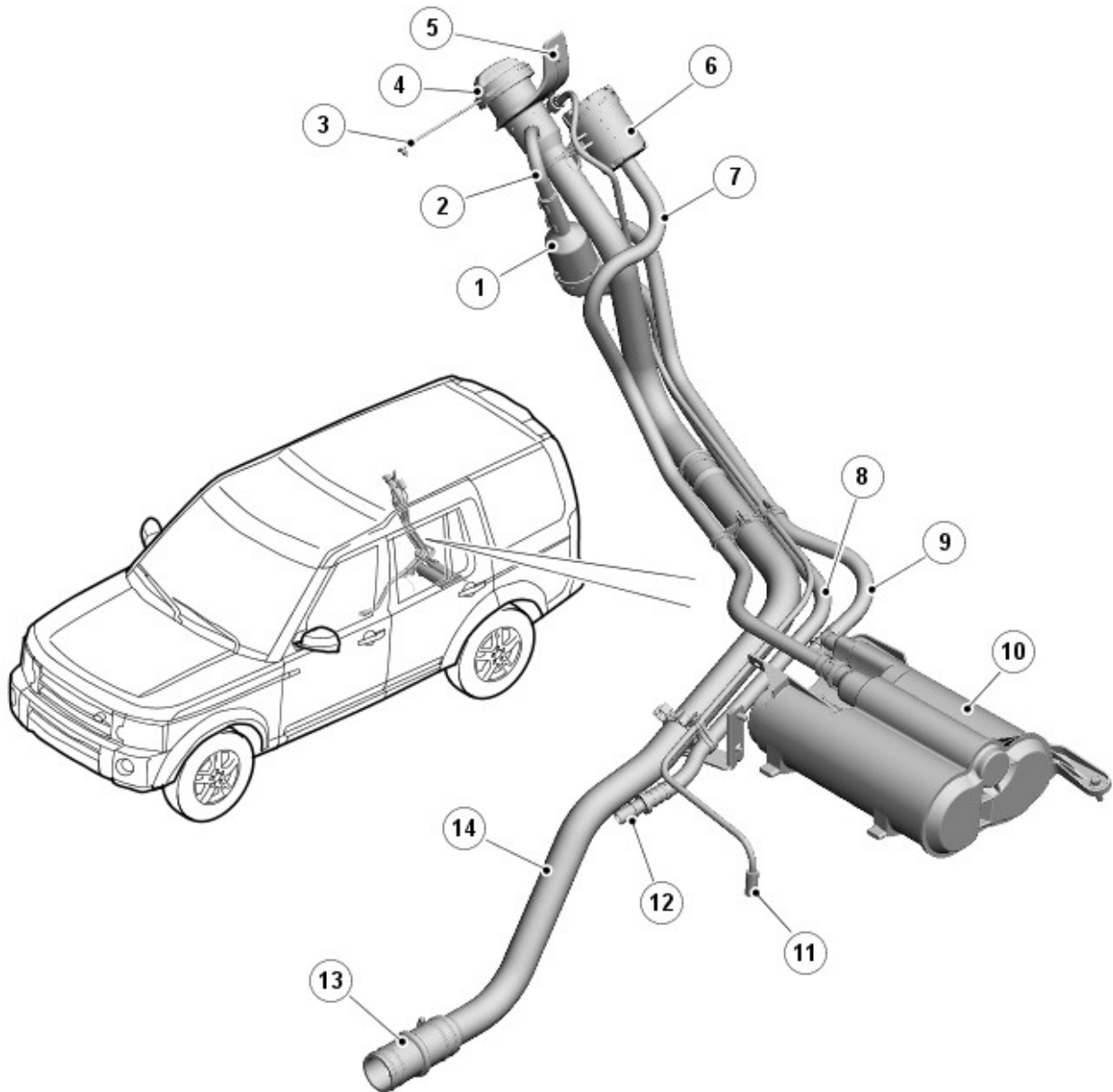
A warning indicator is incorporated in the instrument cluster and illuminates when the fuel level is at or below 10 liters (2.64 US gallons).

The fuel level sender signals are converted into a CAN bus message by the IC (nstrument cluster) as a direct

interpretation of the fuel tank contents in liters. The ECM uses the CAN bus message to store additional OBD (on-board diagnostic) P Codes for misfire detection when the fuel level is below a predetermined capacity.

Fuel Filler Pipe and Tank Breather Assembly

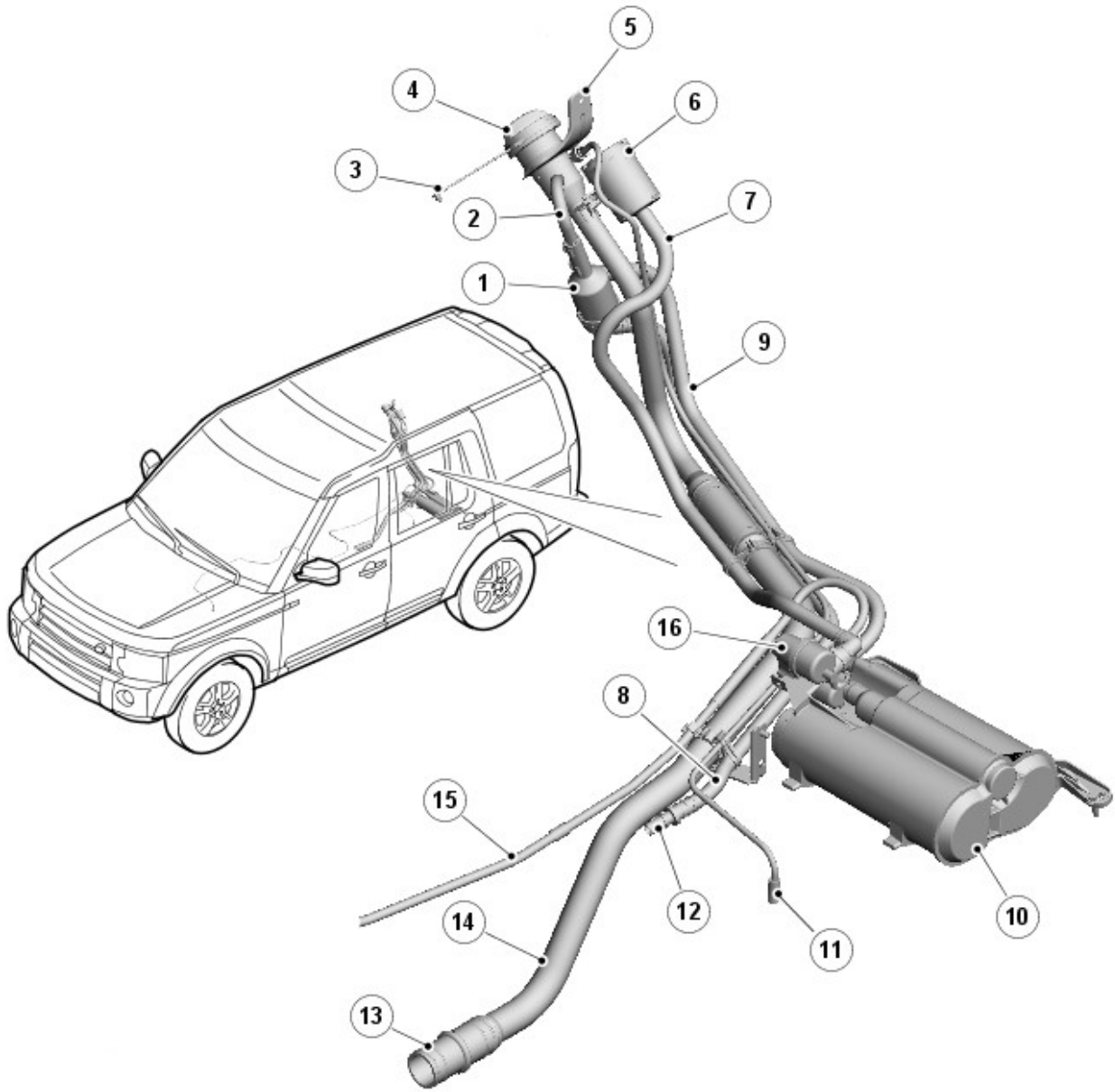
Fuel Filler Pipe Assembly - All Vehicles Except NAS



E 122740

Item	Part Number	Description
1	-	Liquid Vapor Separator (LVS)
2	-	Pipe - fuel vapor vent
3	-	Filler cap lanyard
4	-	Filler cap
5	-	Bracket
6	-	Charcoal canister breather/dust filter
7	-	Pipe - breather
8	-	Pipe - fuel vapor vent
9	-	Pipe - fuel vapor to charcoal canister
10	-	Charcoal canister
11	-	Pipe - rear differential breather (Reference only)
12	-	Pipe - fuel vapor connection
13	-	Hose - fuel filler pipe to fuel tank spit back flap
14	-	Pipe - fuel filler

Fuel Filler Pipe Assembly - NAS Vehicles Only



E 122741

Item	Part Number	Description
1	-	Liquid Vapor Separator (LVS)
2	-	Pipe - fuel vapor vent
3	-	Filler cap lanyard
4	-	Filler cap
5	-	Bracket
6	-	Charcoal canister breather/dust filter
7	-	Pipe - breather
8	-	Pipe - fuel vapor vent
9	-	Pipe - fuel vapor to charcoal canister
10	-	Charcoal canister
11	-	Pipe - rear differential breather (Reference only)
12	-	Pipe - fuel vapor connection
13	-	Hose - fuel filler pipe to fuel tank spit back flap
14	-	Pipe - fuel filler
15	-	Pipe - fuel vapor to purge valve (part of fuel tank assembly)
16	-	Diagnostic Tank Monitoring Leakage (DMTL) pump

The fuel filler head is positioned at the rear of the vehicle, above the right rear wheel. The filler head and cap is covered by a moulded plastic cover which is electrically locked when the vehicle is locked.

The filler cap is a conventional screw in type which is secured to the vehicle with a lanyard. The filler cap must be securely fitted to ensure that the tank venting system is sealed. The cap has a locking mechanism which gives an audible click when the cap is correctly tightened.

Failure to correctly secure the filler cap will result in vapor being lost from the system. On NAS Vehicles, if the cap is incorrectly secured when the ECM operates the DMTL (diagnostic monitoring tank leakage) system, the loss of vapor will be detected as a leak and the MIL (malfunction indicator lamp) lamp will be illuminated.

A connection on the rear of the filler head allows for the connection of the fuel tank breather pipe from the vapor separator on ROW vehicles and from the roll over valves on NAS vehicles.

The fuel filler pipe locates in the tank and incorporates a spitback flap in the tank end of the pipe. The flap is a spring loaded cover which acts as a 1-way valve, allowing the tank to be filled but preventing fuel leaving the tank into the filler pipe.

All vehicles have a charcoal canister breather pipe which is connected from the charcoal canister and is routed alongside the fuel filler pipe to the filler head. The filler head end of this pipe is connected differently depending on market as follows:

- On ROW vehicles the breather pipe is fitted with a mesh and allows fresh air to be drawn into the charcoal canister when fuel vapor is being purged from the system.
- On NAS vehicles the breather pipe is connected to the DMTL pump. Fresh air is drawn into the pipe via a DMTL filter integral with the pump when fuel vapor is being purged from the system. When the DMTL system is active, the breather pipe is closed by the pump, sealing the system and allowing the system to be pressure checked for leakage.

For information on the charcoal canister and purging system refer to the evaporative emissions section.

For additional information, refer to: [Evaporative Emissions](#) (303-13 Evaporative Emissions - V6 S/C 3.0L Petrol, Description and Operation).

A second pipe is routed alongside the charcoal canister breather pipe. On ROW vehicles, this pipe is the fuel tank breather pipe from the vapor separator and is connected into the fuel filler pipe near to the filler head. On NAS vehicles, this pipe is smaller in diameter and also serves as the fuel tank breather pipe. The pipe is not connected to the vapor separator but allows fuel vapor from the right hand roll over valve to vent into the connection with the fuel filler pipe near to the filler head.

A pipe is routed across the top of the tank in front of the vapor separator. This pipe connects the charcoal canister to the purge valve located in the engine compartment.

Low Pressure (LP) Fuel Sensor



E112870

The LP (low pressure) fuel sensor supplies a pressure signal to the ECM to enable closed loop control of the fuel pump. The LP fuel sensor is installed in a manifold in the fuel delivery line. The manifold is mounted to the rear chassis rail, in front of the fuel tank.

OPERATION

The fuel pump is a variable-speed rotary-vane type, which operates in a fuel pump module located in the fuel tank. The fuel pump module has an integral top plate for the external pipe work and electrical connectors.

Fuel level is biased towards the rear of the fuel tank by drawing fuel from the front of the tank via the jet pump, which serves to deliver a constant supply of fuel to the swirl pot. High pressure fuel from the fuel pump is directed through the jet pump's orifice, creating a low pressure area to be formed in the cross over pipe. The fuel is drawn into this low pressure area in the cross over pipe and directed into the swirl pot delivery pipe.

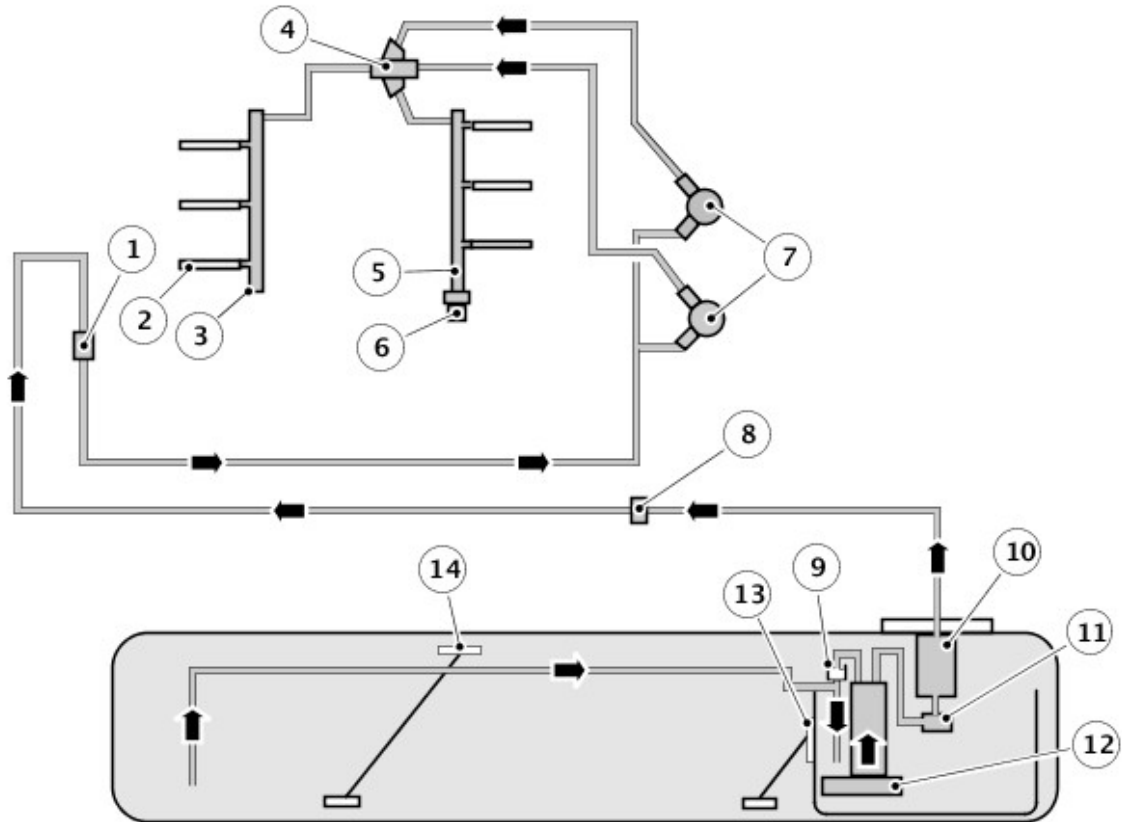
Fuel is pumped from the fuel pump to the two engine mounted HP fuel pumps via the integral filter and pressure relief valve.

The pressure relief valve assists engine starting by retaining a pre-set fuel pressure in the supply pipe and fuel rail. The pressure relief valve also limits fuel rail pressure due to temporary vapor increase in hot conditions and pressure caused by sudden load changes, for example, a fully open to closed throttle transition.

To meet emission requirements, the fuel tank and associated components are designed to minimize fuel vapor loss during refueling. This is achieved by preventing fuel vapor from the fuel tank venting directly to the atmosphere. Instead fuel vapor is directed into the charcoal canister where it is stored before being purged at intervals to the engine's intake manifold.

North American Specification (NAS) vehicles feature additional connections and pipes at the rear of the filler head and also incorporates a Diagnostic Monitoring Tank Leakage (DMTL) pump for leak detection requirements.

Fuel System Schematic Diagram



E160910

Item	Part Number	Description
1	-	Fuel line connection
2	-	Fuel injector (6 off)
3	-	Left side fuel rail
4	-	High pressure (HP) fuel line connection
5	-	Right side fuel rail
6	-	Fuel Rail Pressure and Temperature (FRPT) sensor
7	-	HP fuel pumps
8	-	Low Pressure (LP) fuel sensor
9	-	Jet pump
10	-	Fuel filter
11	-	Pressure Relief Valve (PRV)
12	-	Fuel pump module assembly
13	-	Fuel level sensor - Rear
14	-	Fuel level sensor - Front

Fuel Tank and Lines - V6 S/C 3.0L Petrol - Fuel Tank and Lines

Diagnosis and Testing

Principle of Operation

For a detailed description of the fuel tank and lines system and operation, refer to the relevant description and operation section of the workshop manual. REFER to: Fuel Tank and Lines (310-01A, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests

1. Verify the customer concern
2. Visually inspect for obvious signs of mechanical or electrical damage

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Fuel level • Fuel leaks • Damaged fuel lines • Damaged push connect fittings • Fuel contamination/grade/quality • Throttle body • Damaged fuel tank filler pipe cap • Damaged fuel tank filler pipe 	<ul style="list-style-type: none"> • Fuses • Loose or corroded electrical connectors • Harnesses • Sensor(s) • Engine control module

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, check for diagnostic trouble codes (DTCs) and refer to the DTC index

Symptom Chart

Symptom	Possible Causes	Action
Engine cranks, but does not fire	<ul style="list-style-type: none"> • Engine breather system disconnected/restricted • Ignition system • Fuel system • Electronic engine control 	Ensure the engine breather system is free from restriction and is correctly installed. Check for ignition system, fuel system and electronic engine control DTCs and refer to the relevant DTC index
Engine cranks and fires, but will not start	<ul style="list-style-type: none"> • Evaporative emissions purge valve • Fuel pump • Spark plugs • HT short to ground (tracking) check rubber boots for cracks/damage • Ignition system 	Check for evaporative emissions, fuel system and ignition system related DTCs and refer to the relevant DTC index
Difficult cold start	<ul style="list-style-type: none"> • Engine coolant level/anti-freeze content • Battery • Electronic engine controls • Fuel pump • Purge valve 	Check the engine coolant level and condition. Ensure the battery is in a fully charged and serviceable condition. Check for electronic engine controls, engine emissions, fuel system and evaporative emissions system related DTCs and refer to the relevant DTC index
Difficult hot start	<ul style="list-style-type: none"> • Injector leak • Electronic engine control • Purge valve • Fuel pump • Ignition system 	Check for injector leak, install new injector as required. Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC index
Difficult to start after	<ul style="list-style-type: none"> • Injector leak 	Check for injector leak, install new injector as required.

hot soak (vehicle standing, engine off, after engine has reached operating temperature)	<ul style="list-style-type: none"> • Electronic engine control • Purge valve • Fuel pump • Ignition system 	Check for electronic engine controls, evaporative emissions, fuel system, ignition system and engine emission system related DTCs and refer to the relevant DTC index
Engine stalls soon after start	<ul style="list-style-type: none"> • Breather system disconnected/restricted • Engine control module relay • Electronic engine control • Ignition system • Air intake system restricted • Air leakage • Fuel lines 	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine control, ignition system and fuel system related DTCs and refer to the relevant DTC index. Check for blockage in air filter element and air intake system. Check for air leakage in air intake system
Engine hesitates/poor acceleration	<ul style="list-style-type: none"> • Fuel pressure, fuel pump, fuel lines • Injector leak • Air leakage • Electronic engine control • Throttle motor • Restricted accelerator pedal travel (carpet, etc) • Ignition system • Transmission malfunction 	Check for fuel system related DTCs and refer to the relevant DTC index. Check for injector leak, install new injector as required. Check for air leakage in air intake system. Ensure accelerator pedal is free from restriction. Check for electronic engine controls, ignition, engine emission system and transmission related DTCs and refer to the relevant DTC index
Engine backfires	<ul style="list-style-type: none"> • Fuel pump/lines • Air leakage • Electronic engine controls • Ignition system • Sticking variable camshaft timing hub 	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls, ignition system and variable camshaft timing system related DTCs and refer to the relevant DTC index
Engine surges	<ul style="list-style-type: none"> • Fuel pump/lines • Electronic engine controls • Throttle motor • Ignition system 	Check for fuel system failures. Check for electronic engine controls, throttle system and ignition system related DTCs and refer to the relevant DTC index
Engine detonates/knocks	<ul style="list-style-type: none"> • Fuel pump/lines • Air leakage • Electronic engine controls • Sticking variable camshaft timing hub 	Check for fuel system failures. Check for air leakage in intake air system. Check for electronic engine controls and variable camshaft timing system related DTCs and refer to the relevant DTC index
No throttle response	<ul style="list-style-type: none"> • Electronic engine controls • Throttle motor 	Check for electronic engine controls and throttle system related DTCs and refer to the relevant DTC index
Poor throttle response	<ul style="list-style-type: none"> • Breather system disconnected/restricted • Electronic engine controls • Transmission malfunction • Traction control event • Air leakage 	Ensure the engine breather system is free from restriction and is correctly installed. Check for electronic engine controls, transmission and traction control related DTCs and refer to the related DTC index. Check for air leakage in intake air system

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: V6 S/C 3.0L Petrol Engine Control Module (ECM) (100-00, Description and Operation).

Fuel Tank and Lines - V6 S/C 3.0L Petrol - Fuel Tank Filler Pipe

Removal and Installation

Removal

WARNINGS:



The spilling of fuel is unavoidable during this operation. Ensure that all necessary precautions are taken to prevent fire and explosion.



After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow these instructions may result in personal injury.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



NOTE: Removal steps in this procedure may contain installation details.

1. Remove the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

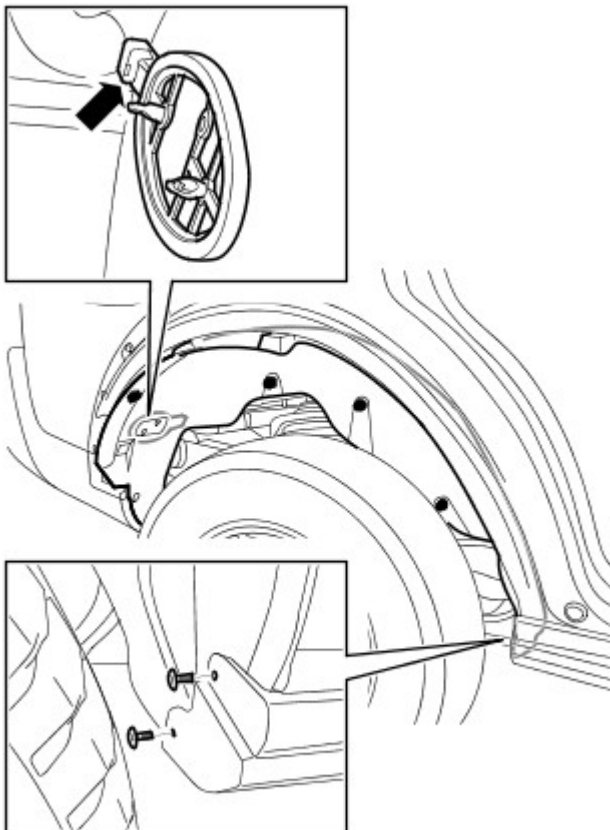


2. **WARNING:** Make sure to support the vehicle with axle stands.

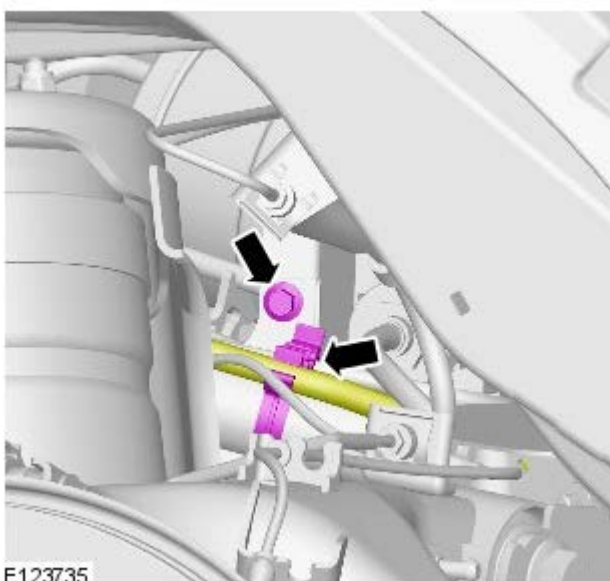
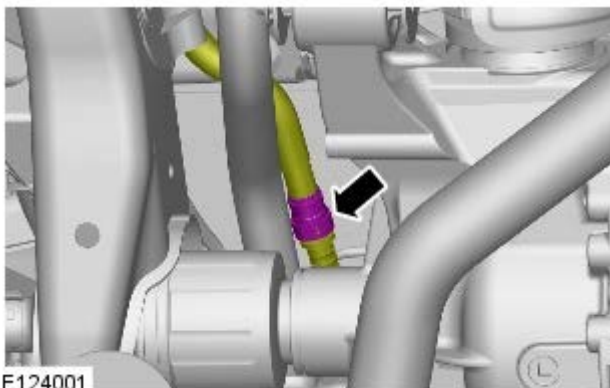
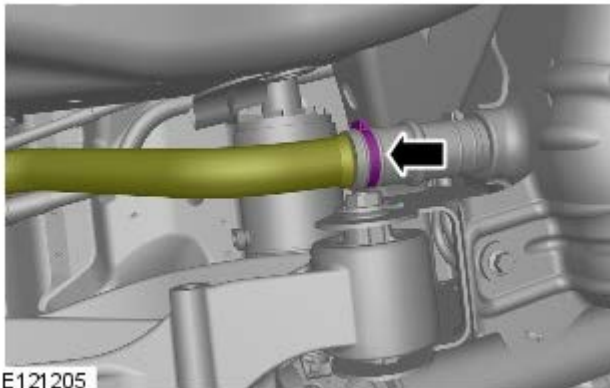
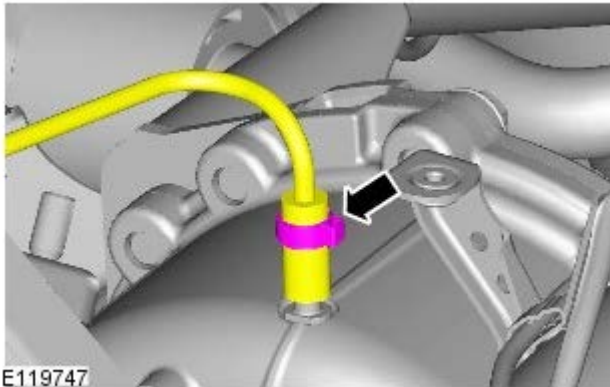
Raise and support the vehicle.

3. For additional information, refer to: Fuel Tank Draining (310-00, General Procedures).
4. For additional information, refer to: Fuel Filler Door Assembly (501-03, Removal and Installation).
5. Remove the RH rear wheel and tire.
 - TORQUE: 140 Nm


6. Remove the fender splash shield.




E48478



7.

8.  **NOTE:** Discard the retaining clip.

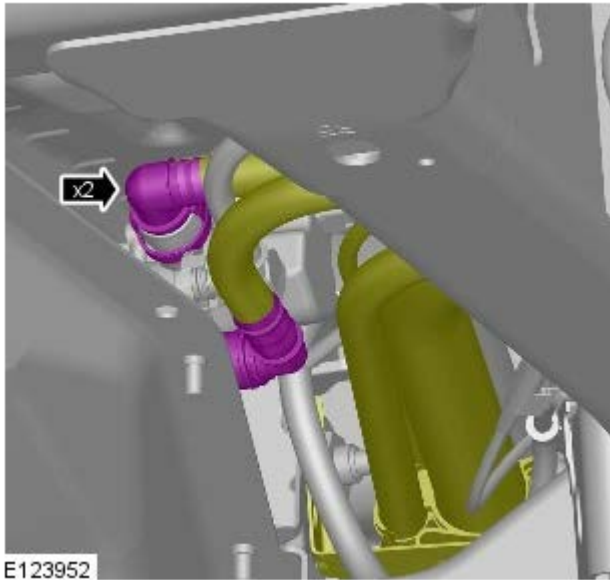
Remove the tamper proof cover from the fuel tank filler pipe hose clip.

9.  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.

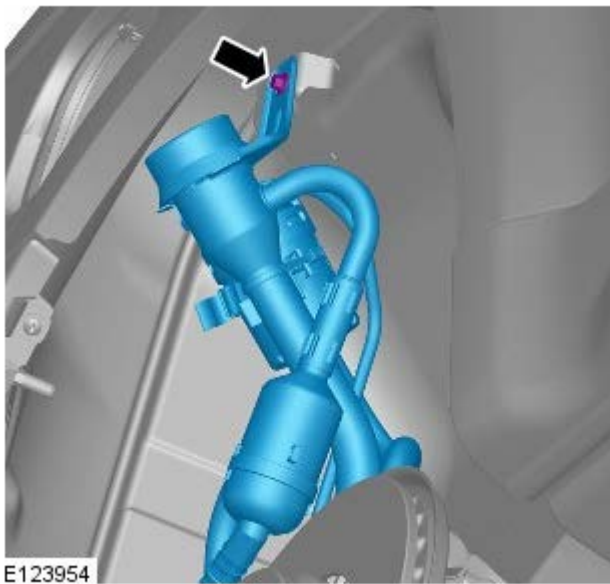
10.

- TORQUE: 4 Nm

11.  **CAUTION:** Make sure that all openings are



sealed. Use new blanking caps.



12.

- TORQUE: 4 Nm

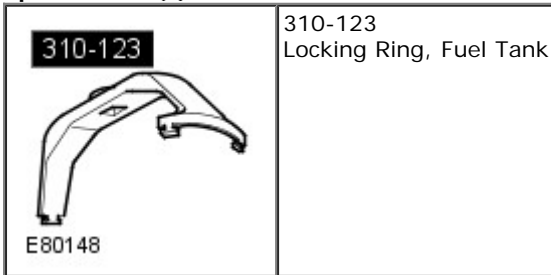
Installation

1. To install, reverse the removal procedure.

Fuel Tank and Lines - V6 S/C 3.0L Petrol - Fuel Pump and Sender Unit

Removal and Installation

Special Tool(s)



General Equipment

Transmission jack

Removal

WARNINGS:



After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.



After the fuel tank drain is complete always fit the sealing covers over the drain ports. Failure to do so will mean that fuel vapor can escape.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



CAUTION: Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.




NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00, Description and Operation).

2. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

3.  **WARNING:** Make sure to support the vehicle with axle stands.

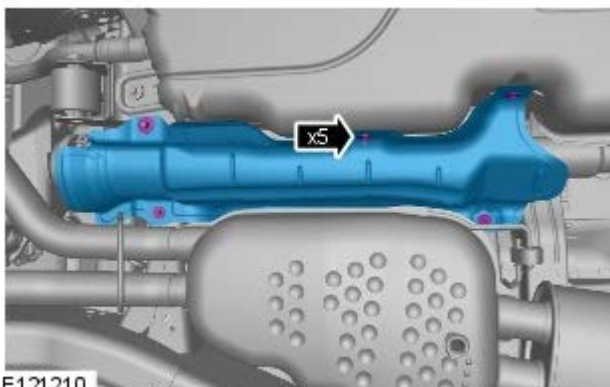
Raise and support the vehicle.

4. Refer to: Fuel Tank Draining (310-00, General Procedures).

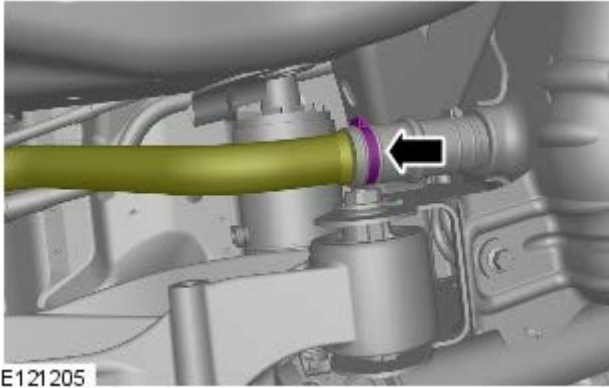
5. *Torque:*


Bolts 6 Nm

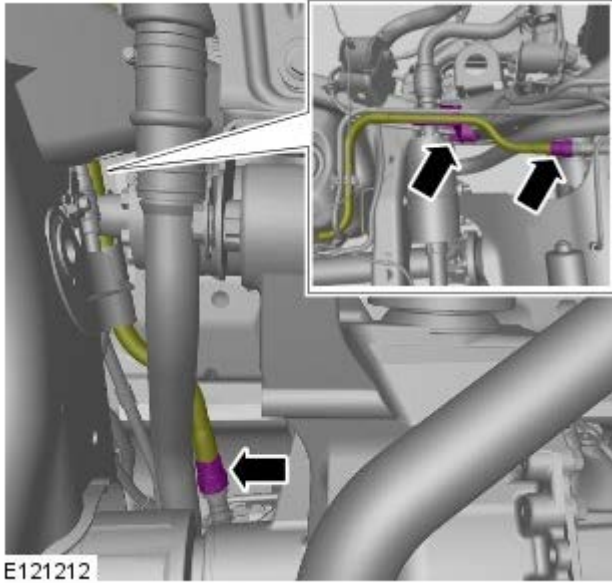
Nuts 3 Nm




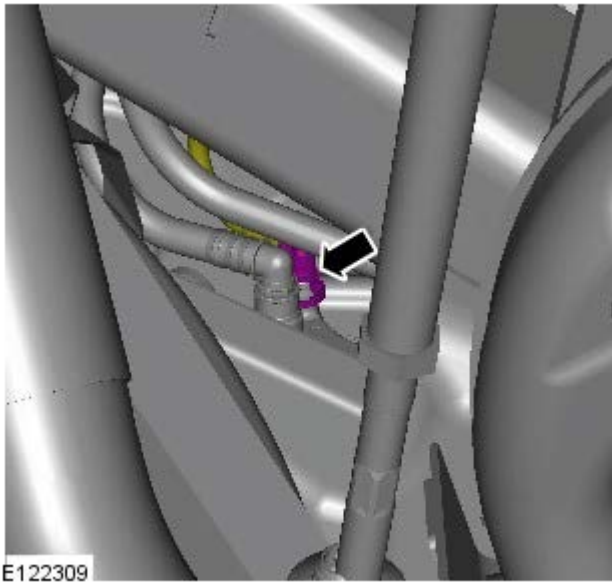
E121210




6.  NOTE: Discard the retaining clip.
Remove the tamper proof cover.




7.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.



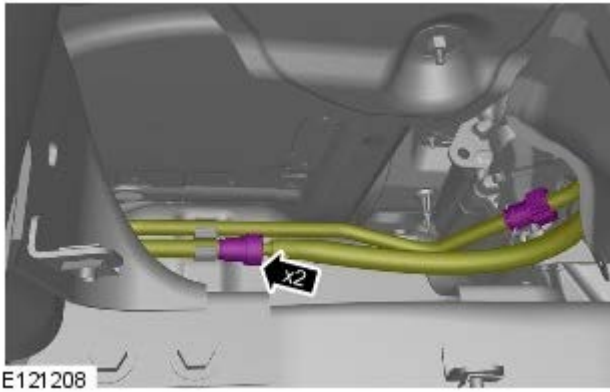
8.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

9. CAUTIONS:

 Be prepared to collect escaping fluids.

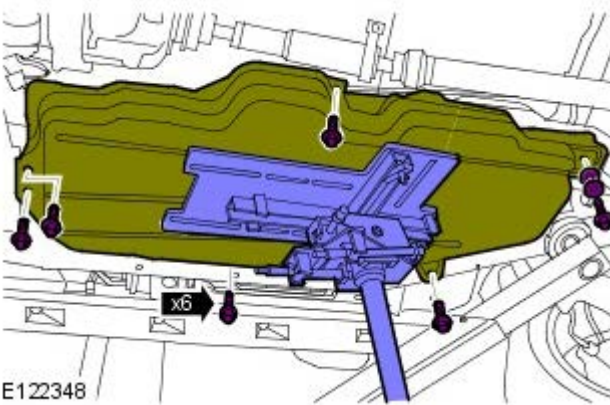
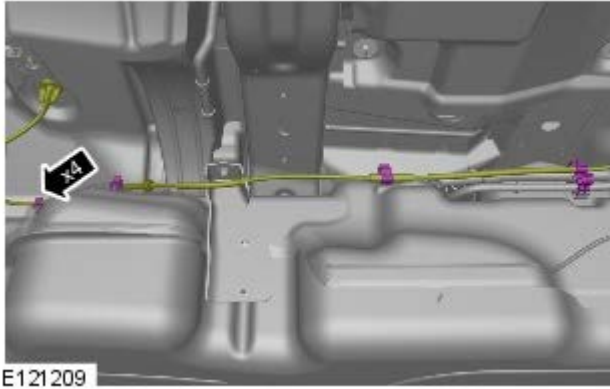
 Make sure that all openings are sealed. Use new blanking caps.


 NOTE: Transmission support heat shield





shown removed for clarity.

10.



11.  **WARNING:** Secure the component to the transmission jack.

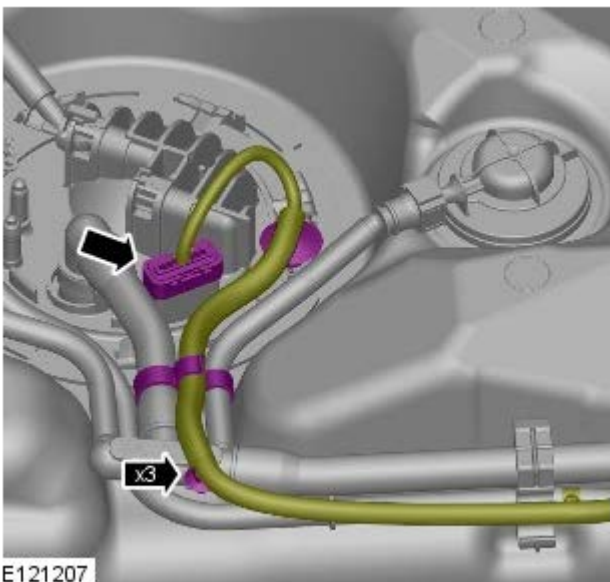
 **CAUTION:** Do not lower the fuel tank more than 250 mm.

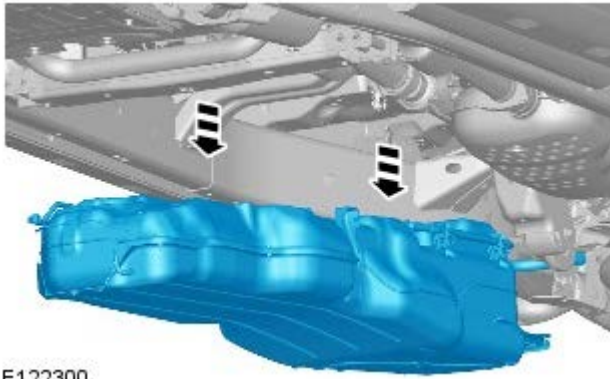
 **NOTE:** Note the orientation of the two rear retaining bolts and washers.

Using a suitable transmission jack, lower the fuel tank sufficiently only to access the top of the fuel tank.


General Equipment: [Transmission jack](#)
Torque: 45 Nm

12.



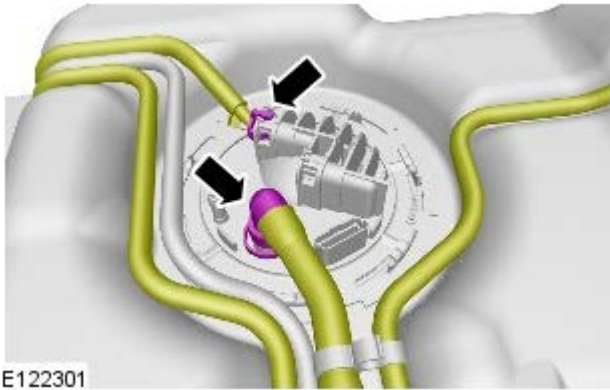


E122300


13.  CAUTION: Position the breather hose and vent hose through the vehicle body during the fuel tank removal operation.

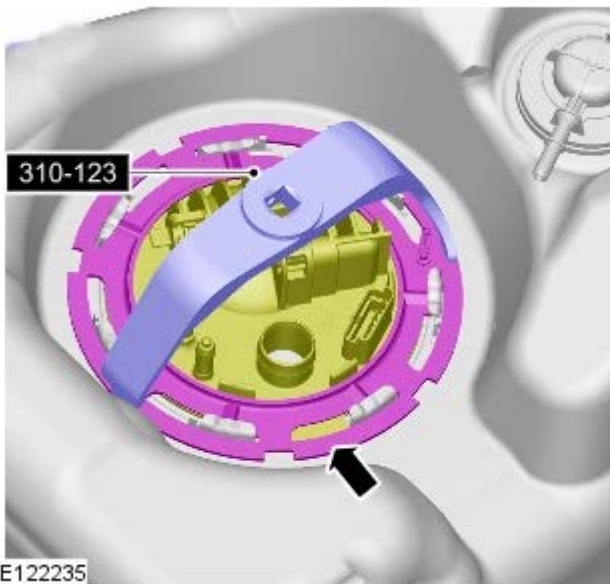
 NOTE: Do not disassemble further if the component is removed for access only.

With assistance, remove the fuel tank.




E122301


14.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.




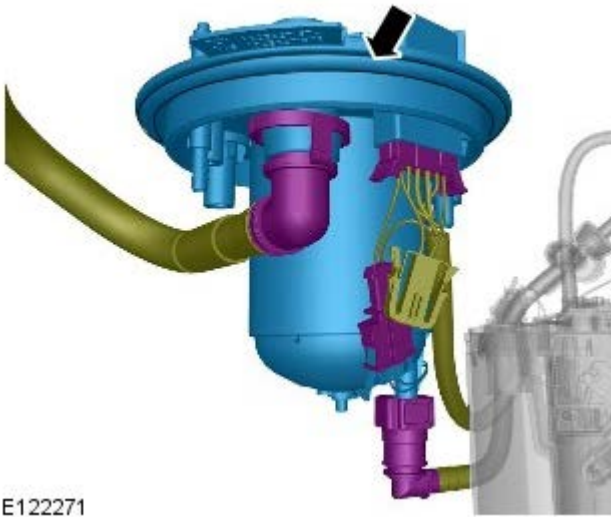
E12235

15.  NOTE: Note the position of the locating tang.

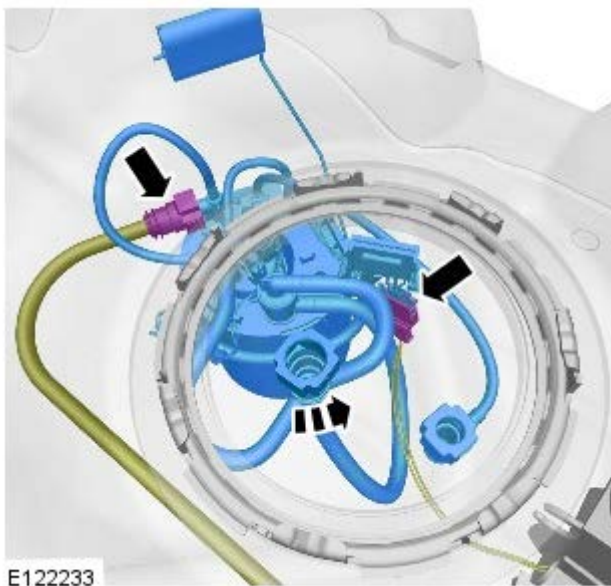
- *Special Tool(s):* [310-123](#)

16.  CAUTION: Be prepared to collect escaping fuel.

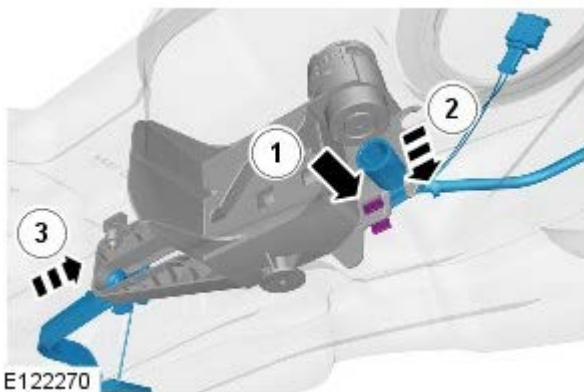
 NOTE: Remove and discard the O-ring seal.



E122271




E122233



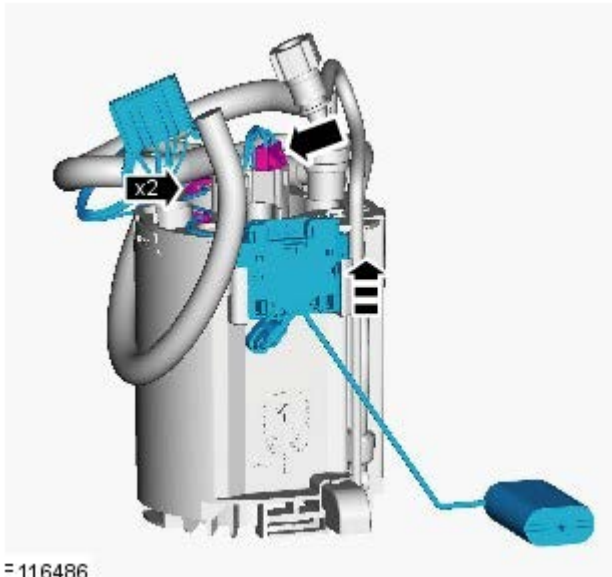
E122270

17.  CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

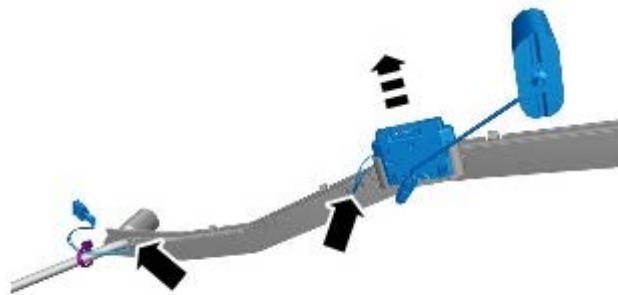
 NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

18.  CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

19.  CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.



20.



Installation

1. NOTES:



Remove and discard all blanking caps.



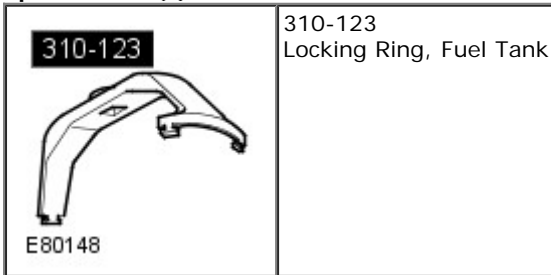
Make sure the locating tang is installed in the position noted in the removal step.

To install, reverse the removal procedure.

Fuel Tank and Lines - V6 S/C 3.0L Petrol - Fuel Tank

Removal and Installation

Special Tool(s)



General Equipment

Transmission jack

Removal

WARNINGS:



After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.



After the fuel tank drain is complete always fit the sealing covers over the drain ports. Failure to do so will mean that fuel vapor can escape.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.



CAUTION: Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.




NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00, Description and Operation).

2. Disconnect the battery ground cable.

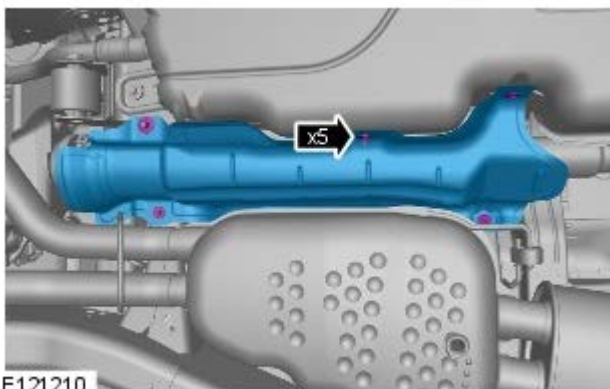
Refer to: Specifications (414-01, Specifications).

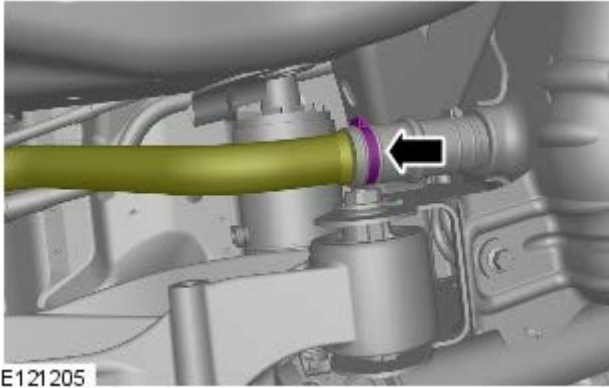
3.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

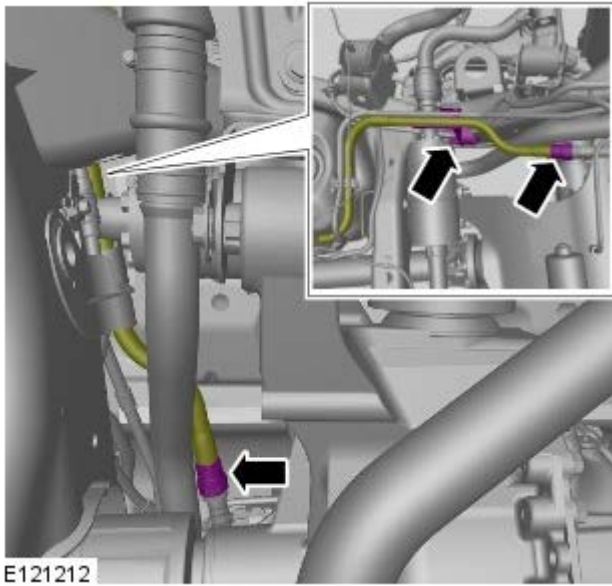
4. Refer to: Fuel Tank Draining (310-00, General Procedures).


5. *Torque:*
Bolts 6 Nm
Nuts 3 Nm

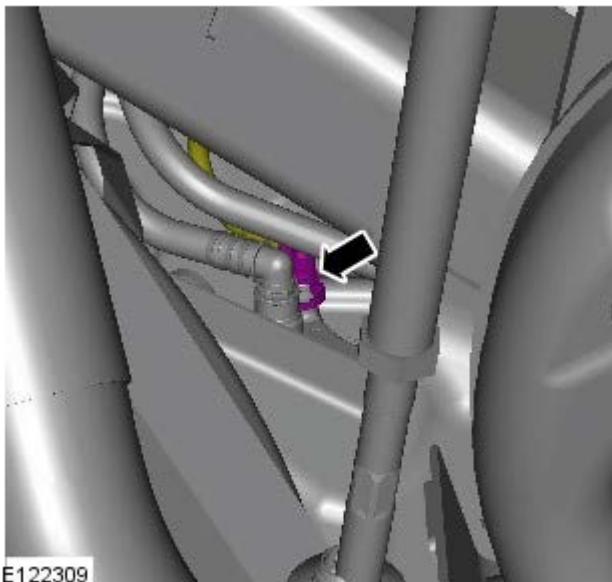





6.  CAUTION: Discard the retaining clip.
Remove the tamper proof cover.




7.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.



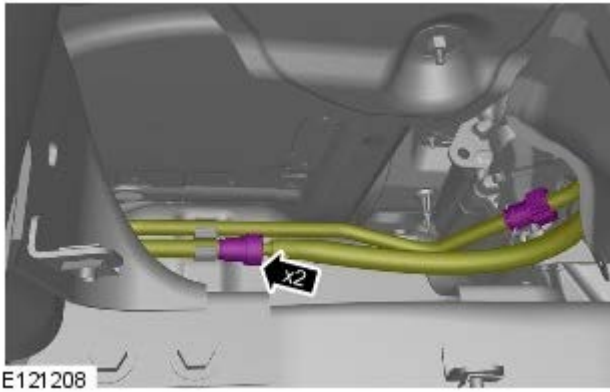
8.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

9. CAUTIONS:

 Be prepared to collect escaping fluids.

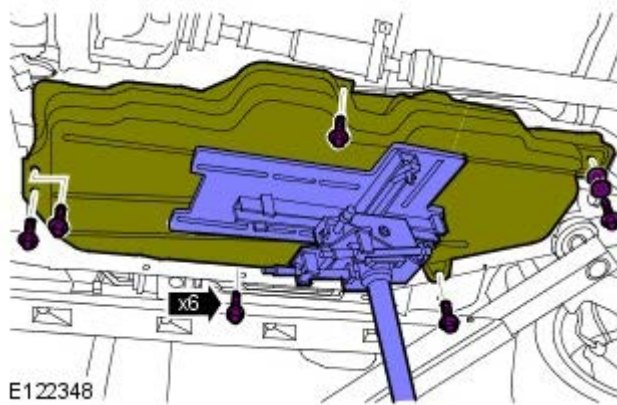
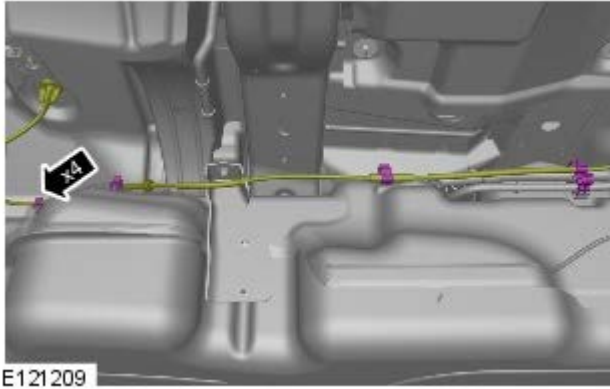
 Make sure that all openings are sealed. Use new blanking caps.


 NOTE: Transmission support heat shield





shown removed for clarity.

10.



11.  **WARNING:** Secure the component to the transmission jack.

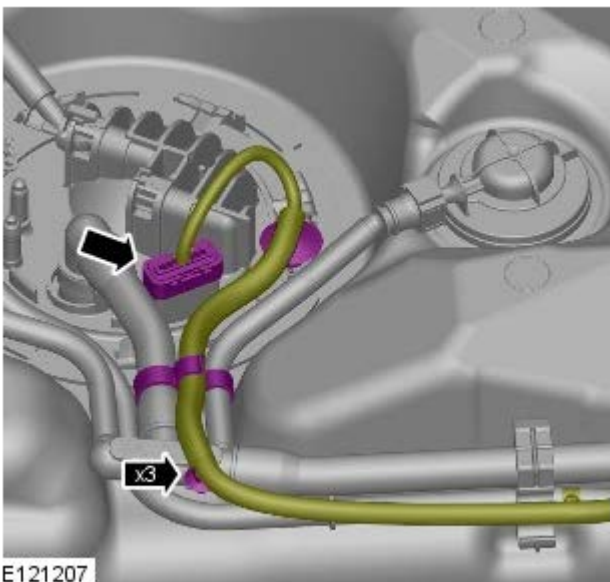
 **CAUTION:** Do not lower the fuel tank more than 250 mm.


 **NOTE:** Note the orientation of the two rear retaining bolts and washers.

Using a suitable transmission jack, lower the fuel tank sufficiently only to access the top of the fuel tank.

General Equipment: [Transmission Jack](#)
Torque: 45 Nm

12.

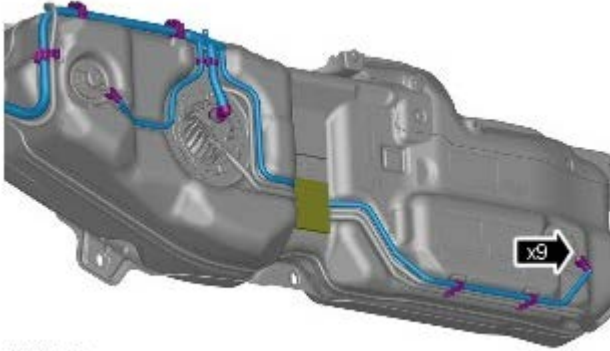


13.  CAUTION: Position the breather and vent hoses through the vehicle body during the fuel tank removal.

 NOTE: Do not disassemble further if the component is removed for access only.

With assistance, remove the fuel tank.

14.



E121213

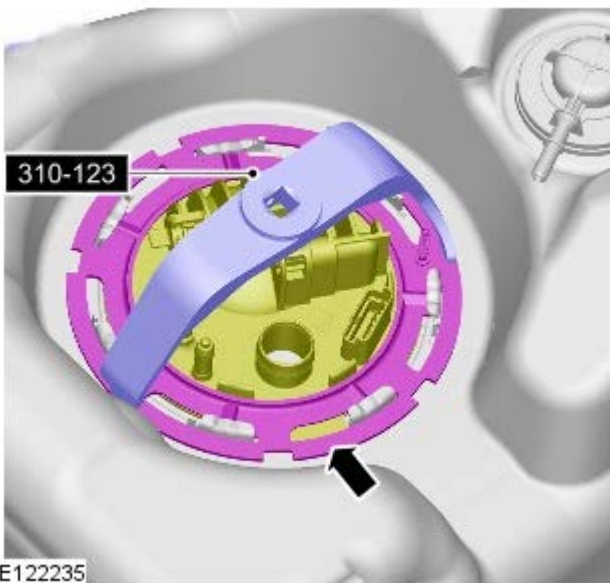
15.



E121211


16.  NOTE: Note the position of the locating tang.

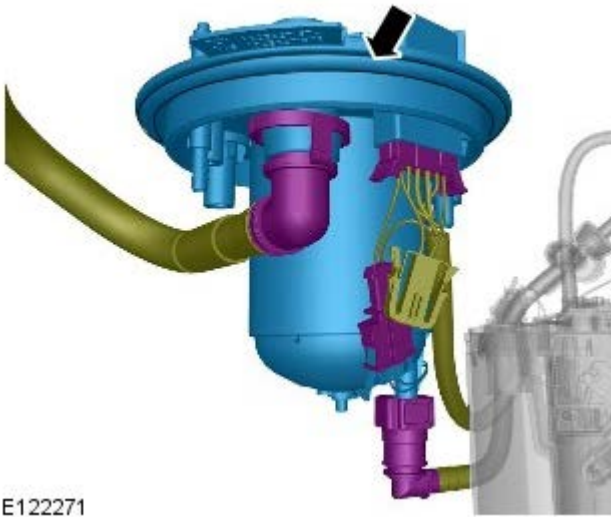
Special Tool(s): [310-123](#)



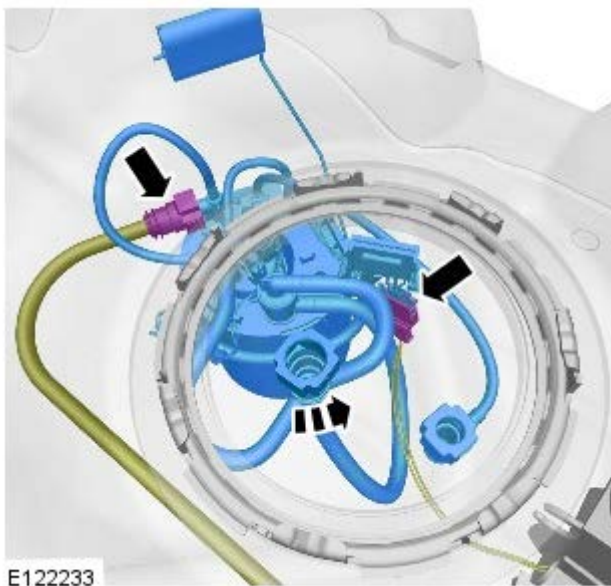
E122235

17.  CAUTION: Be prepared to collect escaping fluids.

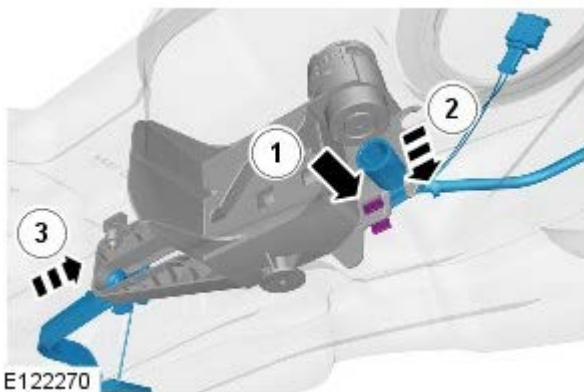
 NOTE: Remove and discard the O-ring seal.



E122271




E122233



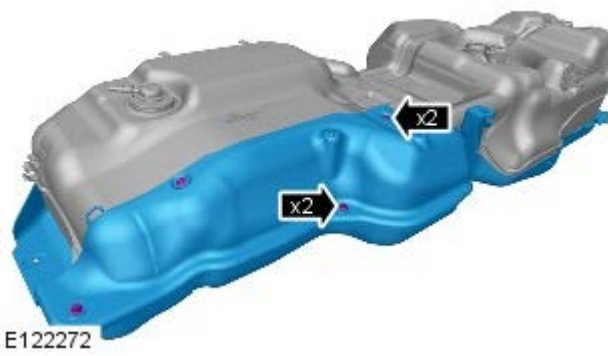
E122270

18.  CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

 NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

19.  CAUTION: Take extra care not to damage the fuel tank level sensor float and arm.

20.



Installation

1. NOTES:



Remove and discard all blanking caps.



Make sure the locating tang is installed in the position noted in the removal step.

To install, reverse the removal procedure.

Fuel Tank and Lines - V6 S/C 3.0L Petrol - Fuel Filter

Removal and Installation

Removal

WARNINGS:



After carrying out repairs, the fuel system must be checked visually for leaks. Failure to follow this instruction may result in personal injury.



This procedure involves fuel handling. Be prepared for fuel spillage at all times and always observe fuel handling precautions. Failure to follow these instructions may result in personal injury.

CAUTIONS:



Always carry out the cleaning process before carrying out any repairs to the fuel injection system components. Failure to follow this instruction may result in foreign matter ingress to the fuel injection system.



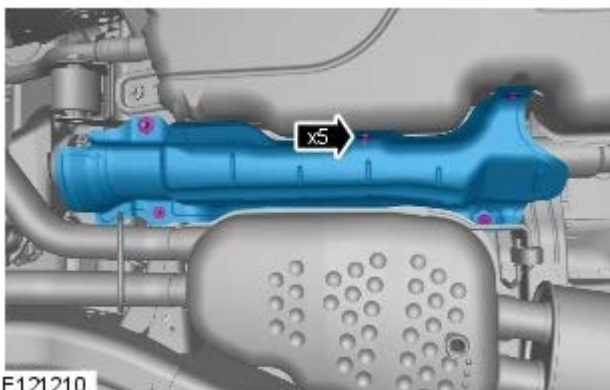
Make sure the workshop area in which the vehicle is being worked on is as clean and as dust free as possible. Foreign matter from work on clutches, brakes or from machining or welding operations can contaminate the fuel system and may result in later malfunction.



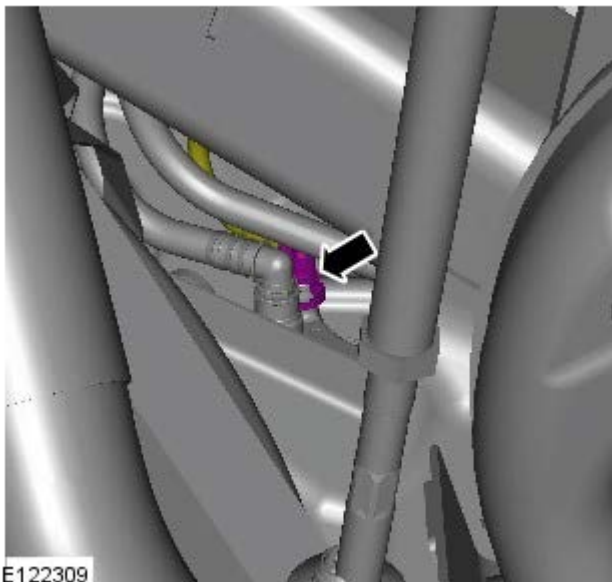
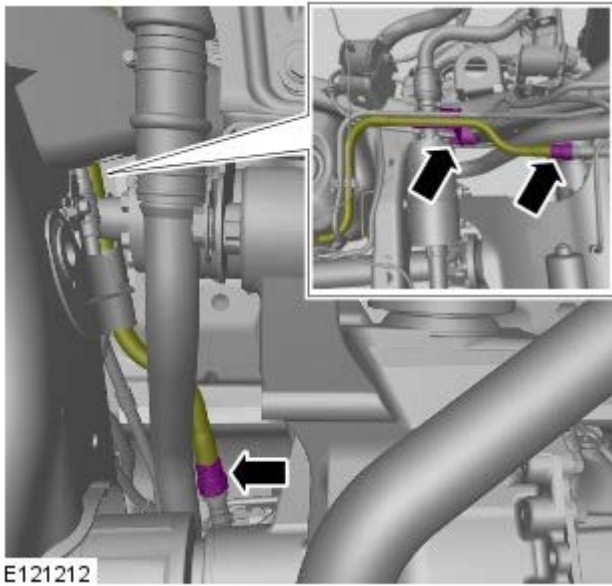
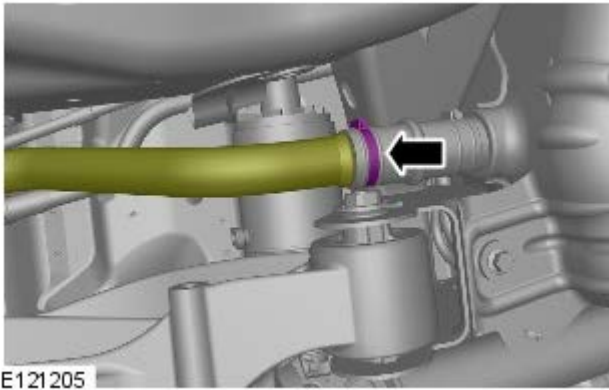
NOTE: Removal steps in this procedure may contain installation details.


1. For additional information, refer to: Petrol and Petrol-Ethanol Fuel Systems Health and Safety Precautions (100-00, Description and Operation).
2. For additional information, refer to: Fuel System Pressure Release - 5.0L (310-00, General Procedures).
3. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
4. For additional information, refer to: Fuel Tank Draining (310-00, General Procedures).


5.



6.  NOTE: Discard the retaining clip.
Remove the tamper proof cover.




7.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

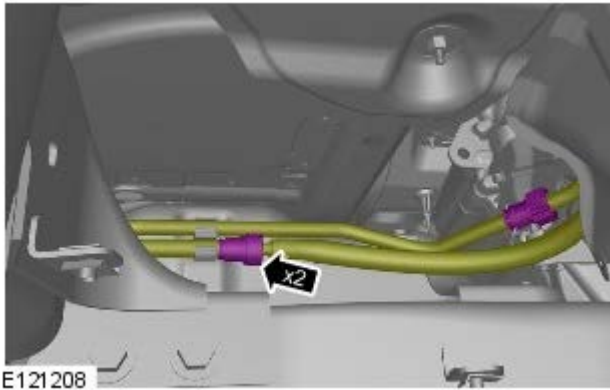
8.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

9. CAUTIONS:

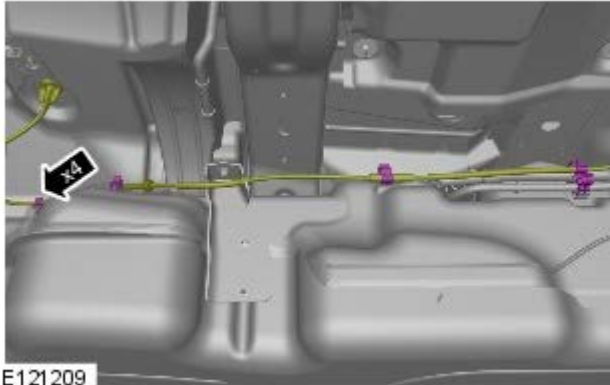
 Be prepared to collect escaping fuel.

 Make sure that all openings are sealed. Use new blanking caps.

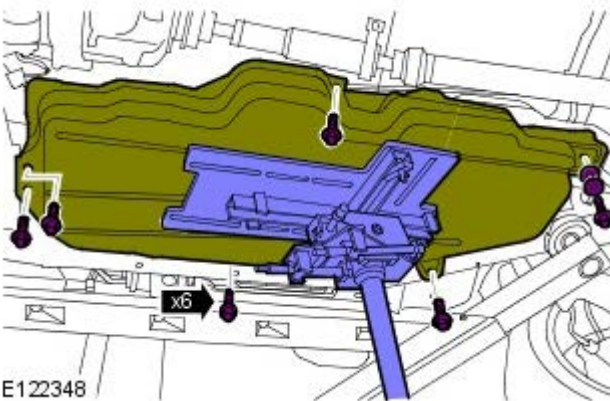
 NOTE: Transmission support heat shield shown removed for clarity.



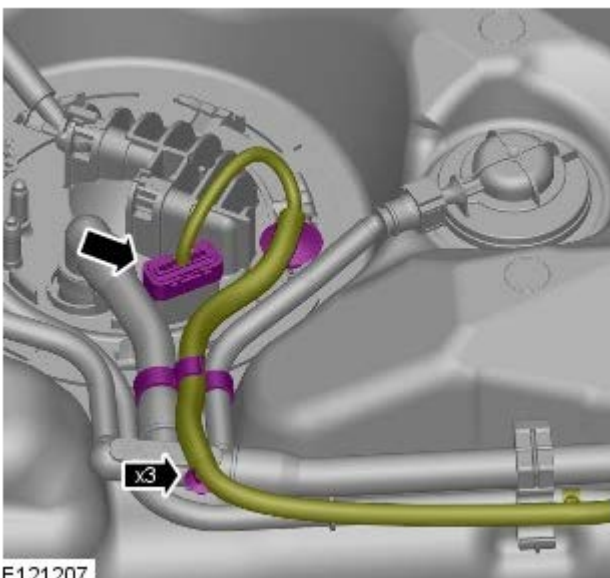
E121208



E121209




E122348




E121207

10.

11.  **WARNING:** Secure the component to the transmission jack.


 **CAUTION:** Do not lower the fuel tank more than 250 mm.

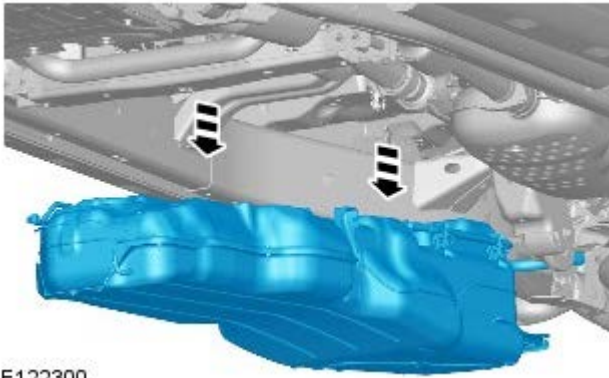
 **NOTE:** Note the orientation of the two rear retaining bolts and washers.

Using a suitable transmission jack, lower the fuel tank sufficiently only to access the top of the fuel tank.

- TORQUE: 45 Nm


12.

13.  **CAUTION:** Position the breather hose and vent hose through the vehicle body during the

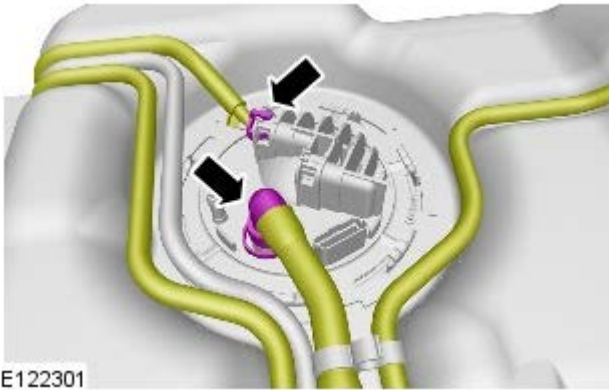


E122300


fuel tank removal operation.

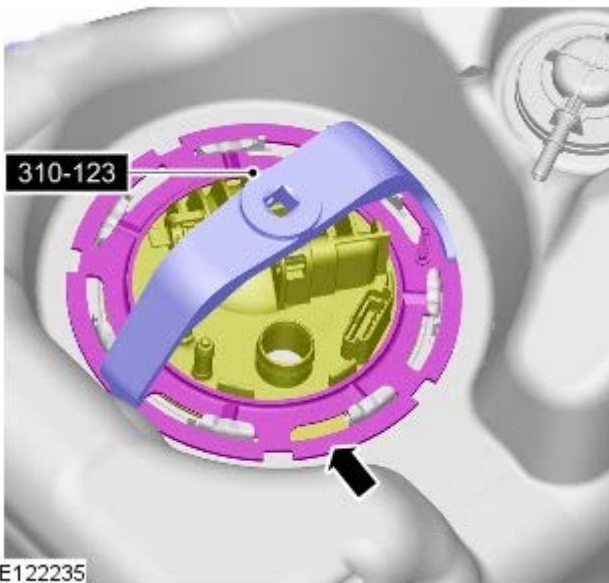
 NOTE: Do not disassemble further if the component is removed for access only.

With assistance, remove the fuel tank.




E122301


14.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

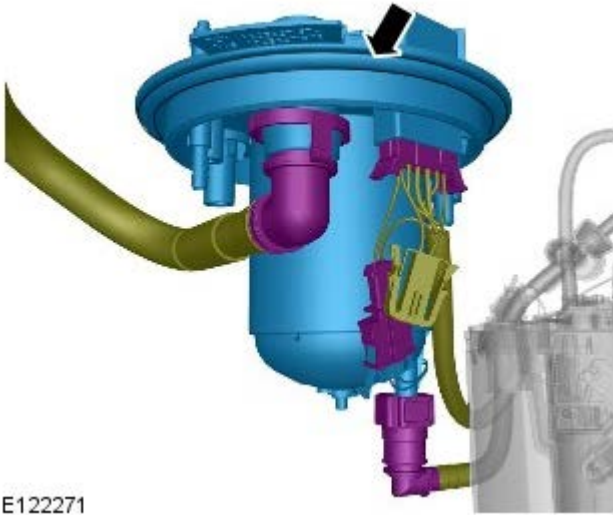


E122335

15.  NOTE: Note the position of the locating tang.

16.  CAUTION: Be prepared to collect escaping fuel.

 NOTE: Remove and discard the O-ring seal.



E122271

Installation

1. To install, reverse the removal procedure.

Acceleration Control -

Torque Specifications

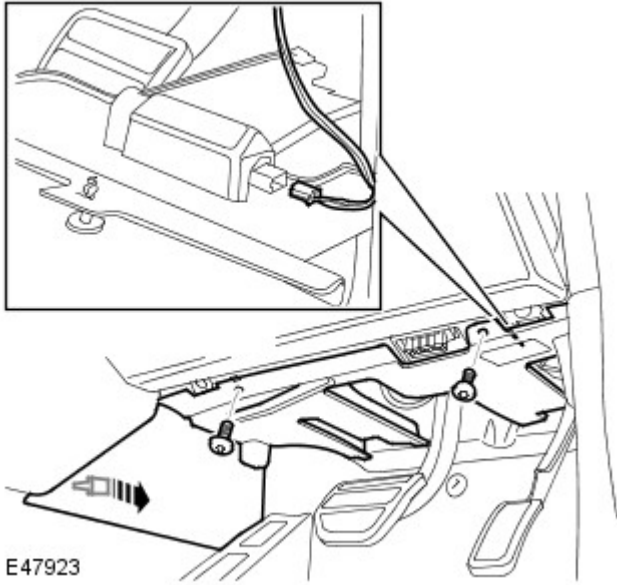
Description	Nm	lb-ft
Accelerator pedal bracket nuts and bolts	10	7
Accelerator pedal assembly nuts	25	18

Acceleration Control - Accelerator Pedal

Removal and Installation

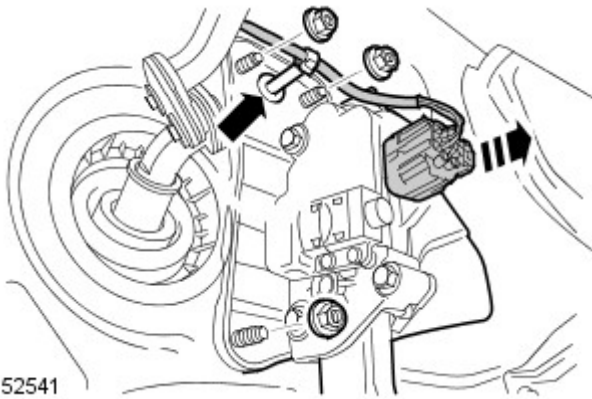
Removal

1. Remove the driver side closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.




E47923

2. Remove the accelerator pedal assembly.
 - Release the wiring harness.
 - Remove the 3 nuts.
 - Disconnect the electrical connector.

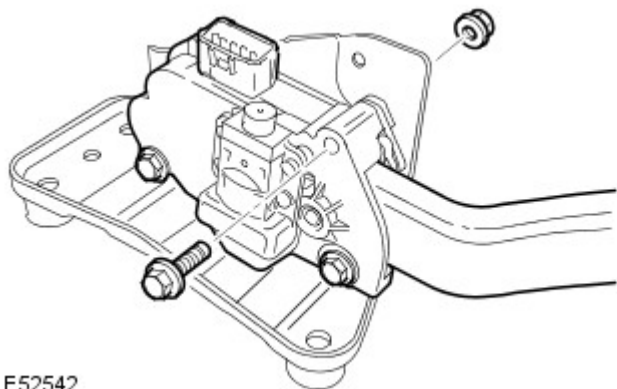


E52541

3.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the accelerator pedal bracket.

- Remove the 3 nuts and bolts.




E52542

Installation

All vehicles

1. Attach the accelerator pedal bracket.
 - Tighten the nuts and bolts to 10 Nm (7 lb.ft).

2.  **NOTE:** Make sure the electrical connector is securely connected.

Install the accelerator pedal assembly.

- Connect the electrical connector.
 - Tighten the nuts to 25 Nm (18 lb.ft).
 - Secure the wiring harness.
3. Install the closing trim panel.
 - Connect the electrical connector.
 - Secure the clip.
 - Tighten the screws.

Vehicles with petrol engine

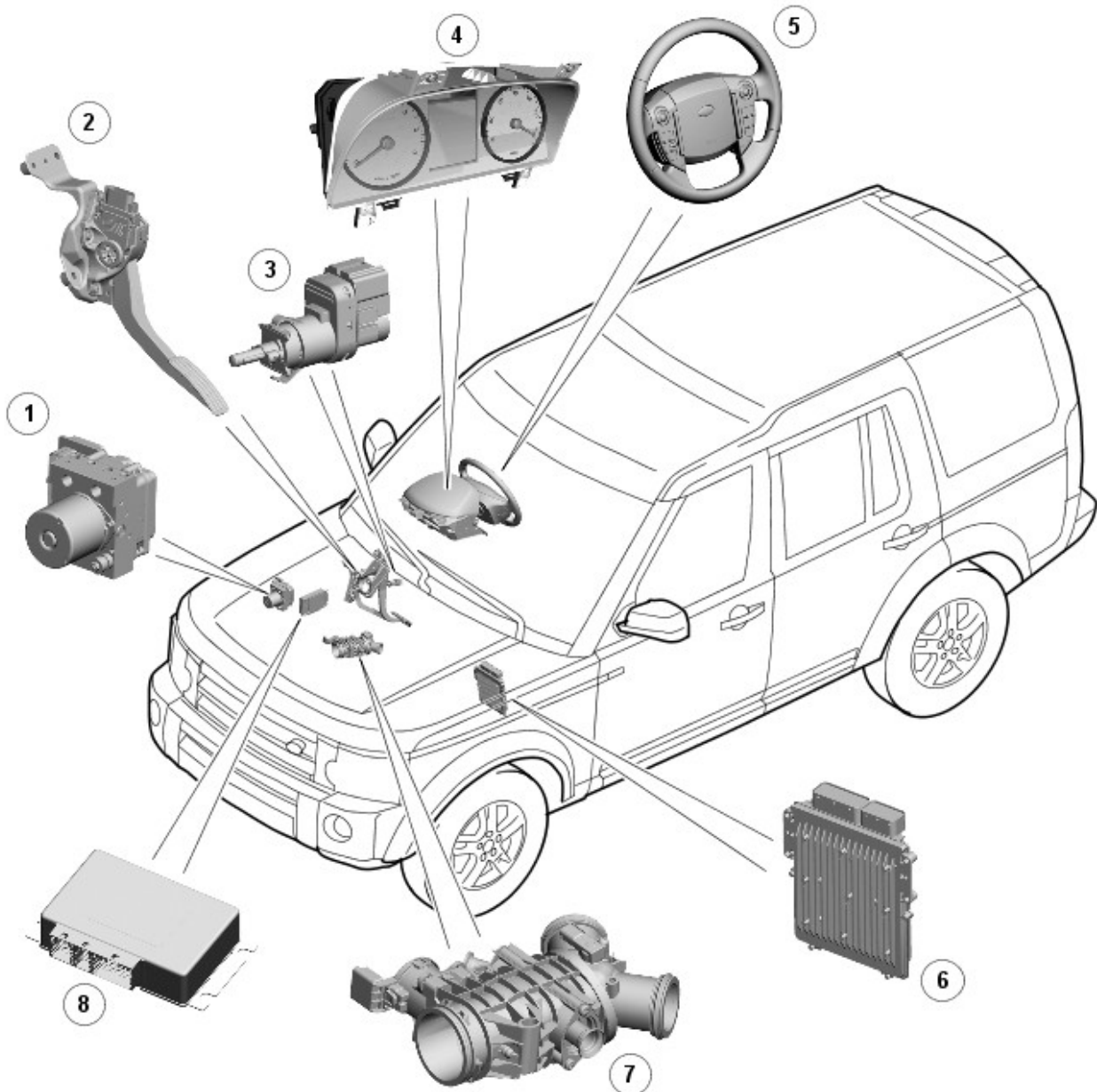
4. Using the approved diagnostic equipment, clear the powertrain control module (PCM) adaptations.

This section contains no data

Speed Control - TDV6 3.0L Diesel - Speed Control

Description and Operation

3.0L V6 DIESEL SPEED CONTROL COMPONENT LOCATION



E124127

Item	Part Number	Description
1	-	Anti-lock Brake System (ABS) module
2	-	Accelerator Pedal Position (APP) sensor
3	-	Brake switch
4	-	Instrument cluster
5	-	Speed control switches
6	-	Engine Control Module (ECM)
7	-	Electric throttle
8	-	Transfer box control module

GENERAL

The speed control system maintains a set speed selected by the driver until operation is suspended or cancelled by a further input from the driver and is controlled by the Engine Control Module (ECM).

The system has the following components:

- A set + switch
- A - switch
- A RESUME switch

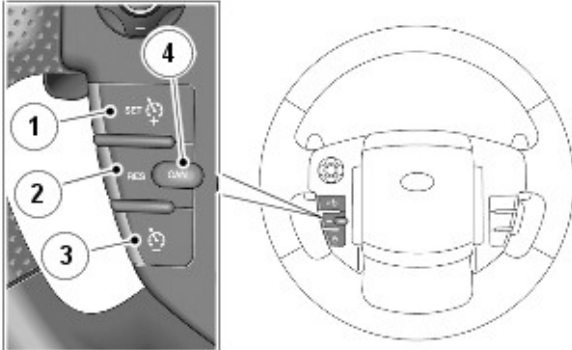
- A CANCEL switch.

The system uses the following vehicle systems:

- The ECM
- The brake switch
- The Accelerator Pedal Position (APP) sensor.

DESCRIPTION

Speed Control Switches



E 124128

Item	Part Number	Description
1	-	Set '+' increase the speed
2	-	Decrease '-' the speed
3	-	Resume set speed
4	-	Cancels without erasing memorized speed

Instrument Cluster Warning Indicator



E124129

Item	Part Number	Description
1	-	Speed control warning indicator

The speed control switches are located on the Left Hand (LH) side of the steering wheel. The switches are connected via fly leads to the clock spring. The speed control switches are resistive ladder type switches which vary the resistance of a 5 volt signal sent to them. The signal is returned along a Local Interconnect Network (LIN) bus to the instrument cluster. The instrument cluster routes the control signals to the Engine Control Module (ECM) on the high speed Controller Area Network (CAN) bus.

Speed control is engaged by pressing the set/increase switch. Once engaged the speed can be varied by the speed adjustment switches. Each press of the speed adjustment switches (+/-) will increase or decrease the set speed in

steps of 1 mph (2 kph).

Accelerate/Decelerate (+/-) Switches

The Set + switch is used to activate the speed control system and set the speed control at the current vehicle speed. A speed control warning indicator will illuminate on the instrument cluster to advise the driver that the system is active. The switch can be pressed to adjust the set speed. Each single press of the switch increases the vehicle speed by 1 mph (2 km/h). If the switch is pressed and held the vehicle speed will increase and once the switch is released the attained vehicle speed will be maintained.

The vehicle speed can be increased by using the accelerator pedal. When the accelerator pedal is released the vehicle speed will reduce to the previously set speed. When the vehicle speed is increased by use of the accelerator pedal, the message 'Cruise Override' will be displayed in the instrument cluster message center. This method can also be used to increase the vehicle set speed; once the required increase in speed is achieved, a single press of the Set + switch will maintain that speed as the new set speed.



NOTE: If the accelerator pedal is pressed for more than 5 minutes, the speed control is cancelled.

The '-' switch can be used to decrease the vehicle set speed. The speed can be reduced by pressing and holding the switch until the required set speed is reached. When the switch is released the current speed will become the new set speed. A single press of the '-' switch will decrease the vehicle speed by 1 mph (2 km/h).

Cancel Switch

Speed control can be suspended temporarily or switched off by a single press of the Cancel switch. When the switch is pressed the speed control warning indicator in the instrument cluster is extinguished and the message 'Cruise Cancelled' is displayed in the message center.

Speed control can also be suspended if the brake pedal is pressed, if the transmission selector lever is moved to the neutral position or if Hill Descent Control (HDC) or Dynamic Stability Control (DSC) become active.

Once suspended, the cruise control can be resumed at the previously set speed by pressing the resume switch.



NOTE: The set speed is not removed from the memory when the cancel switch is pressed. The set speed is only erased when the ignition is off.

Resume Switch

The resume speed is used to re-activate the speed control system at the previously set speed after the speed control has been cancelled or suspended.

OPERATION

Speed Control

The speed control system is integrated with the engine management system and uses fueling intervention to automatically maintain a set vehicle speed. Once engaged, the system can also be used to accelerate the vehicle without using the accelerator pedal. The speed control system comprises the following components:

- '+' and '-' (set/accelerate and decelerate) steering wheel switches
- Resume switch
- Cancel switch
- Clock spring
- Speed control warning lamp.

The speed control system also uses inputs from the brake pedal switch, the APP sensor, the ECM and the ABS module.

The speed control is operated by the driver using only the steering wheel switches. When speed control is active, the ECM regulates the Pulse Width Modulation (PWM) signals to the fuel injectors to adjust the fuel supply as required to maintain the set speed.

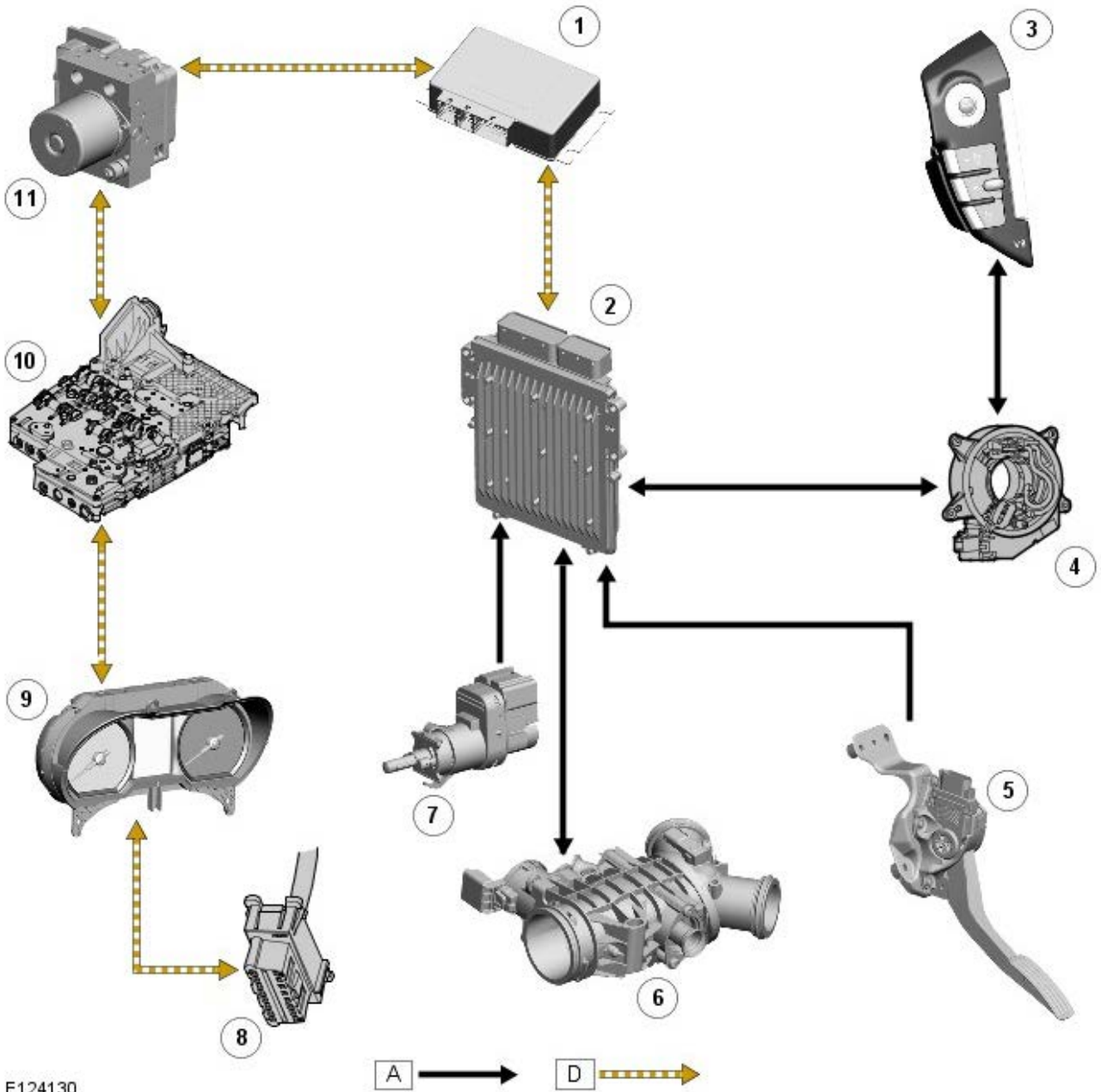
During speed control operation, the ECM controls vehicle speed by adjusting fuel injection duration and timing. When the accelerator pedal is pressed with speed control active, the ECM outputs a calculated throttle angle signal in place of the actual throttle angle signals produced by the APP sensor. The calculated throttle angle is derived from fuel demand.

The minimum set speed for speed control is 20 mph (32 km/h). Speed control is automatically suspended if the following conditions apply:

- Vehicle speed falls below 20 mph (32 km/h).
- The brake pedal is pressed
- The cancel button is pressed
- Neutral, park or reverse gear is selected
- Certain Terrain Modes are selected (i.e. Rock crawl)
- Low range gear selected
- The difference between actual speed and the set speed is too great
- When the vehicle speed reaches a maximum speed of 150 mph (240 kph)
- If the accelerator pedal is used to accelerate beyond the set speed for too long
- Stability control system intervention
- System error causes shut-off.

CONTROL DIAGRAM

 NOTE: **A** = Hardwired; **D** = High speed CAN Bus



E124130

Item	Part Number	Description
1	-	Transfer box control module
2	-	Engine control Module (ECM)
3	-	Left Hand (LH) steering wheel speed control switches
4	-	Clock spring
5	-	Accelerator Pedal Position (APP) sensor
6	-	Electric throttle
7	-	Brake switch
8	-	Diagnostic socket
9	-	Instrument cluster
10	-	Transmission Control Module (TCM)
11	-	Anti-lock Brake System (ABS) module

Speed Control - TDV6 3.0L Diesel - Speed Control Switch

Removal and Installation

Removal

WARNINGS:



To avoid accidental deployment, the restraints control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.



Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.



To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.



To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.



To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.



Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.



Painting over the driver air bag module trim cover or instrument panel could lead to deterioration of the trim cover and air bags. Do not for any reason attempt to paint discolored or damaged air bag module trim covers or instrument panel. Install a new component. Failure to follow this instruction may result in personal injury.



NOTE: Removal steps in this procedure may contain installation details.

1. Make the air bag supplemental restraint system (SRS) safe.

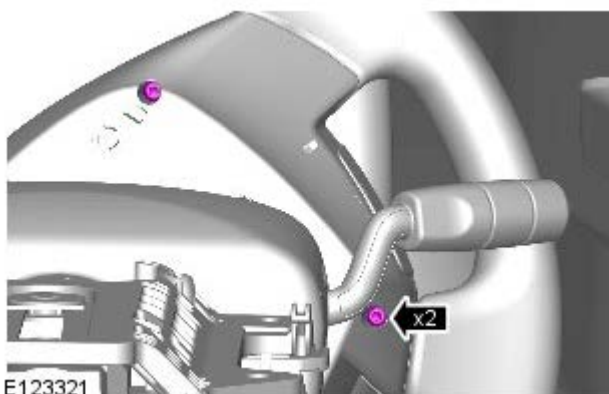
Refer to: Standard Workshop Practices (100-00, Description and Operation).

2. Disconnect the battery ground cable.

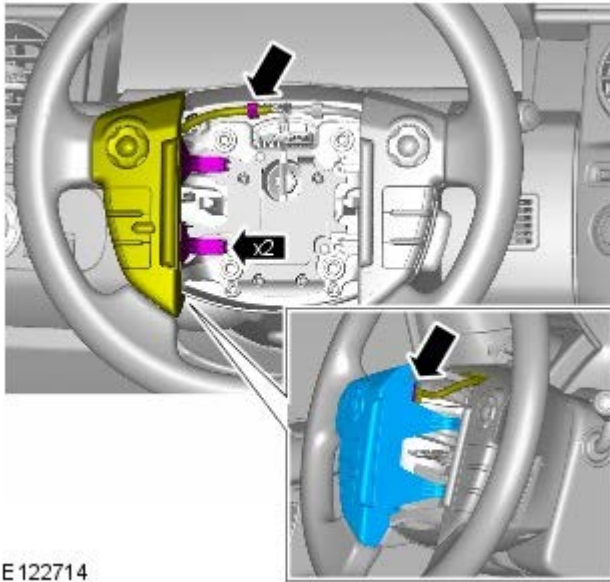
Refer to: Specifications (414-00, Specifications).

3. Refer to: Driver Air Bag Module (501-20, Removal and Installation).

4. Torque: 1.5 Nm



- 5.



E122714

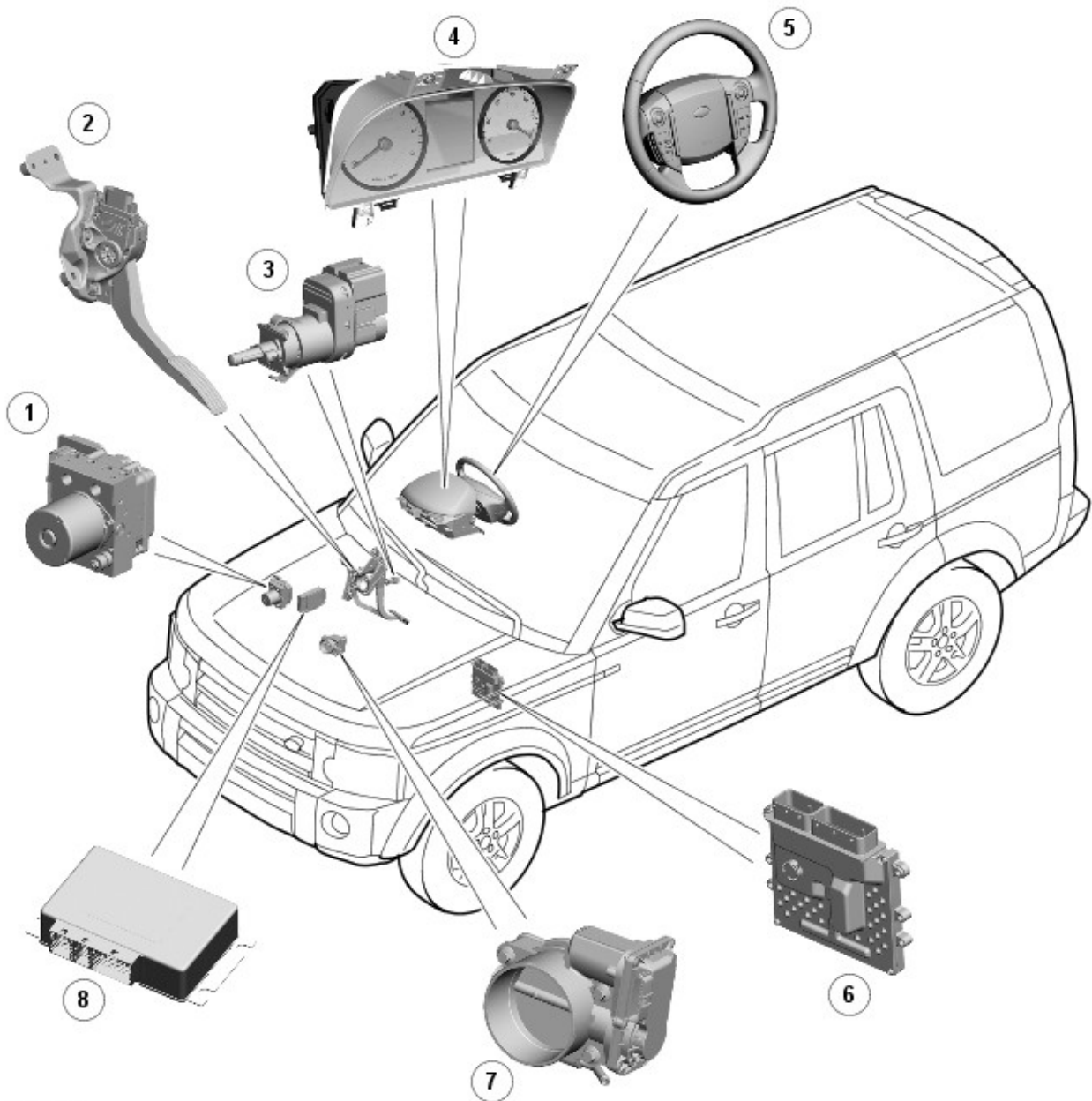
Installation

1. To install, reverse the removal procedure.

Speed Control - V6 S/C 3.0L Petrol - Speed Control

Description and Operation

COMPONENT LOCATION



E124153

Item	Part Number	Description
1	-	Anti-lock Braking System (ABS) control module
2	-	Accelerator Pedal Position (APP) sensor
3	-	Brake pedal switch
4	-	Instrument Cluster (IC)
5	-	Steering wheel switchpack
6	-	Engine Control Module (ECM)
7	-	Electric throttle
8	-	Transfer Case Control Module (TCCM)

OVERVIEW

The speed control system is controlled by the [ECM \(engine control module\)](#) and switches on the left steering wheel switchpack. The speed control system also uses the:

- Brake pedal switch.
For additional information, refer to: [Anti-Lock Control - Traction Control](#) (206-09A Anti-Lock Control - Traction Control, Description and Operation).
- [APP \(accelerator pedal position\)](#).

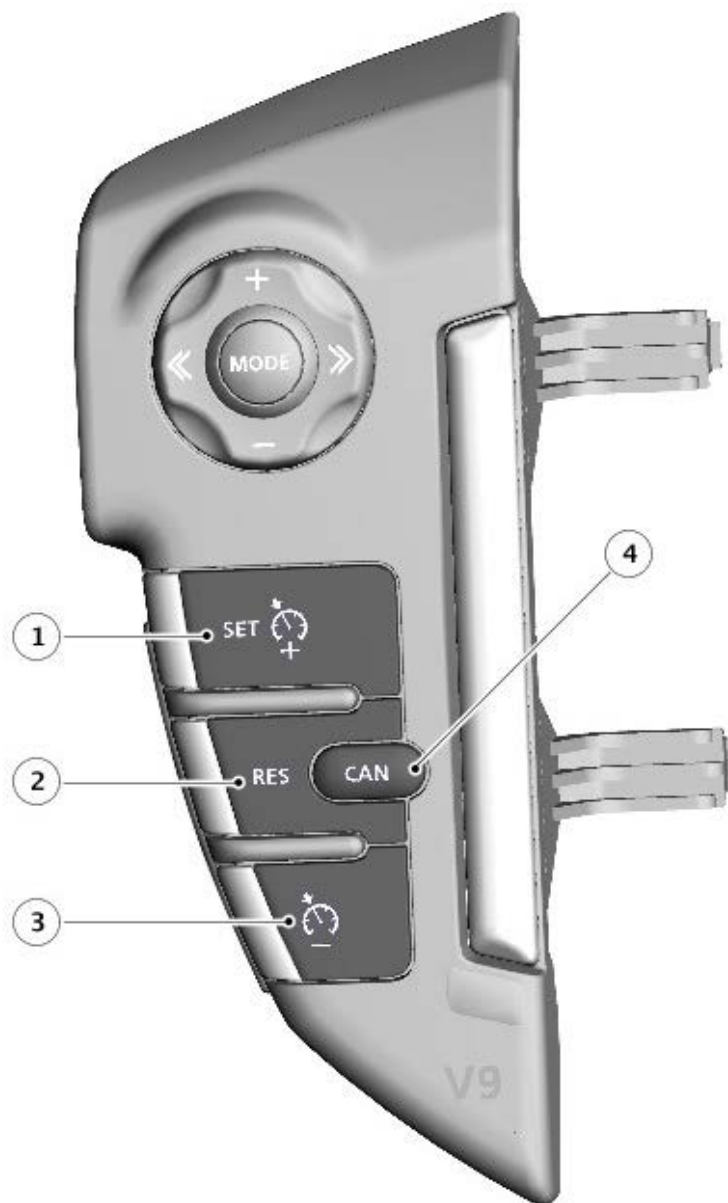
- For additional information, refer to: [Electronic Engine Controls](#) (303-14B Electronic Engine Controls - V6 S/C 3.0L Petrol, Description and Operation).
- [ABS \(anti-lock brake system\)](#) control module.
For additional information, refer to: [Anti-Lock Control - Traction Control](#) (206-09A Anti-Lock Control - Traction Control, Description and Operation).
 - [TCS \(transmission control switch\)](#).
For additional information, refer to: [External Controls](#) (307-05 Automatic Transmission/Transaxle External Controls - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, Description and Operation).
 - [TCM \(transmission control module\)](#).
For additional information, refer to: [Transmission Description](#) (307-01 Automatic Transmission/Transaxle - TDV6 3.0L Diesel /V6 S/C 3.0L Petrol , Vehicles With: 8HP70 8-Speed Automatic Transmission AWD, Description and Operation).
 - IC (instrument cluster).
For additional information, refer to: [Instrument Cluster](#) (413-01 Instrument Cluster, Description and Operation).

During speed control operation, the ECM controls vehicle speed by adjusting the engine throttle and fuel injection.

DESCRIPTION

Standard Speed Control

Speed Control Switch



E160606

Item	Part Number	Description
1	-	Set + (engage/accelerate) switch
2	-	RES (resume) switch
3	-	- (decelerate) switch

The speed control switches are located on the left steering wheel switchpack. The switches are resistive ladder type switches which vary the resistance of a 5 volt signal sent to them. The resistive ladder is wired to a LIN (local interconnect network) node which transmits the data to the IC (instrument cluster) via the clockspring. The IC then transmits the data to the ECM on the HS (high speed) CAN (controller area network) bus.

Instrument Cluster Warning Indicators

Speed Control Warning Indicator



E147363

The speed control warning indicator illuminates when standard speed control is engaged.

OPERATION

For speed control to engage, the vehicle must be in the following configuration:

- Transmission in D (drive).
- Transfer case in high range.
- Terrain Response® in the general (special programs off) or grass/gravel/snow program.
- HDC (hill descent control) off.
- Traveling at 20 mph (32 km/h) or more.

Speed Control

Engage Speed Control

Speed control is engaged by pressing the SET + switch. On receipt of the switch input, the ECM adopts the current vehicle speed as the speed control set speed. When speed control is engaged the IC (instrument cluster) illuminates the speed control warning indicator and the set speed is displayed in the message center.

The set speed is cleared when the ignition is switched off or if the speed control system develops a fault.

Set Speed Adjustment

Once engaged the set speed can be increased by one of 3 methods:

- Press and hold the SET + switch which will cause the vehicle to accelerate. When the switch is released the attained speed will be the new set speed.
- Repeatedly pressing the SET + switch. Each press increases the vehicle speed by 1 mph (2 km/h).
- Use the accelerator pedal to increase the vehicle speed. Once the required speed is reached, a single press of the SET + switch will set the cruise speed.

The set speed can be reduced by pressing and holding the decelerate - switch until the required speed is reached. When the switch is released the speed is reset at that value. The set speed can be reduced incrementally by pressing and releasing the decelerate - switch. Each press will reduce the speed by 1 mph (2 km/h).

Speed control adjustment is limited around the current vehicle speed. This means speed adjustment won't occur when resuming or if the vehicle speed is noticeably different to set speed. This is noticeable when resuming speed control and a large difference exists between the set speed and the current speed. The driver can set a new speed, but can't adjust the old speed.

Suspending Speed Control

Suspending speed control means speed control has been deactivated without loss of the set speed. Speed control is suspended when one of the following occurs:

- Vehicle speed falls below 20 mph (32 km/h).
- The brake pedal is pressed.
- The CANCEL switch is pressed.
- N (neutral), R (reverse) or P (park) is selected on the TCS.

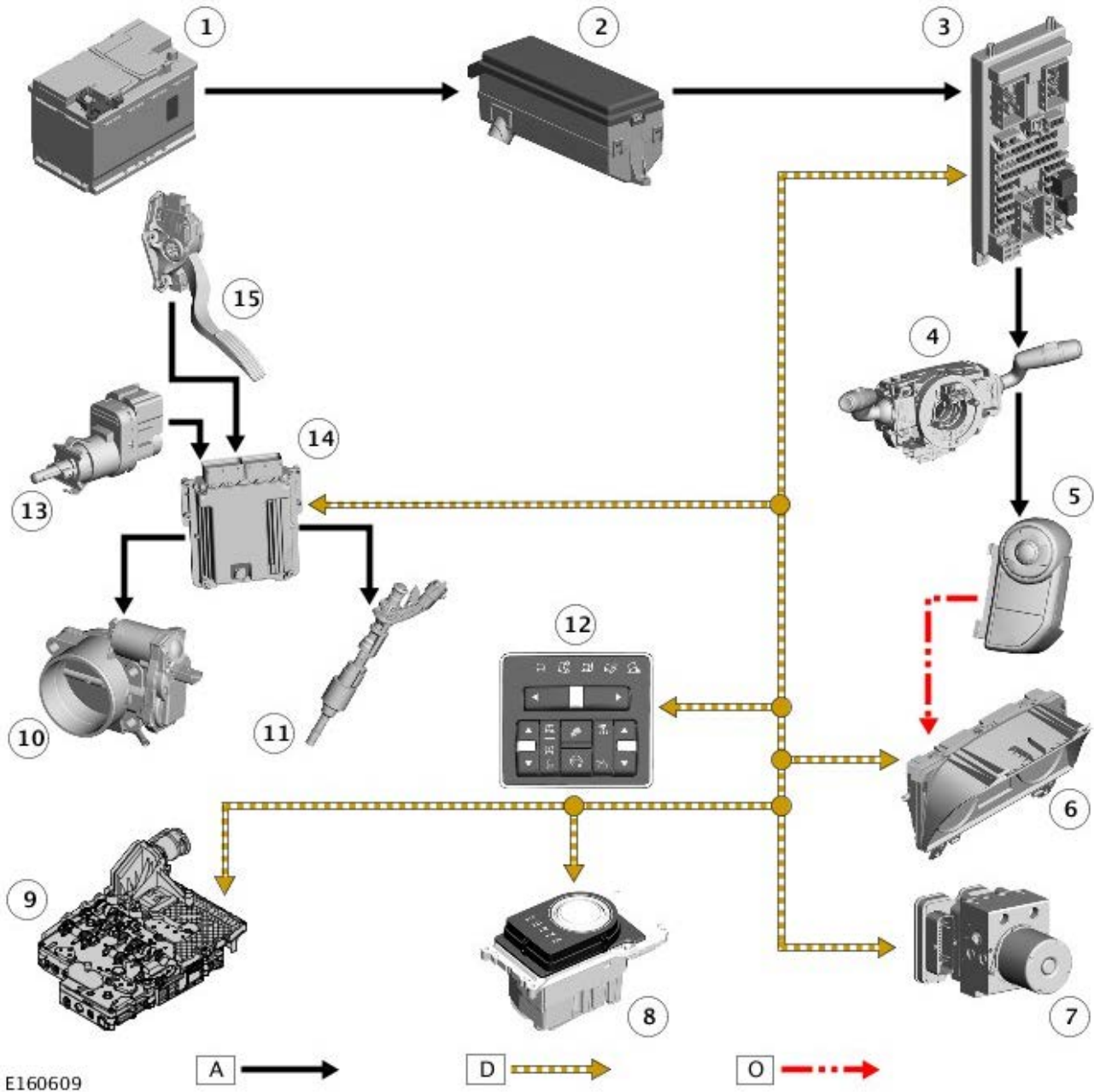
- The EPB (electronic parking brake) is applied.
- If the accelerator pedal is used to accelerate beyond the set speed for too long (more than 5 minutes).
- Engine speed too high (cancel limit set just below red line).
- The ABS control module activates ETC (electronic traction control) or DSC (dynamic stability control).
- HDC (hill decent control) is selected.
- Terrain Response® adopts a special program other than grass/gravel/snow.
- The transfer case is selected to low range.

Resuming Speed Control

A single press of the RES switch will resume speed control at the memorized set speed.

CONTROL DIAGRAM

Speed Control



A = Hardwired; D = High Speed CAN Bus.

Item	Part Number	Description
1	-	Battery
2	-	Engine Junction Box (EJB)
3	-	Central Junction Box (CJB)
4	-	Clockspring
5	-	Left steering wheel switchpack
6	-	Instrument Cluster (IC)
7	-	Anti-lock Brake System (ABS) module
8	-	Transmission Control Switch (TCS)

- 9 - Transmission Control Module (TCM)
- 10 - Electric throttle
- 11 - Fuel injector (6 off)
- 12 - Terrain Response® switchpack
- 13 - Brake pedal switch
- 14 - Engine Control Module (ECM)
- 15 - Accelerator Pedal Position (APP) sensor

Climate Control System - General Information -

General Specification

Type	Description
Heating, ventilation and air conditioning unit: <ul style="list-style-type: none">• Front unit - Manual version• Front unit Automatic Temperature Control (ATC) version• Rear unit•	<ul style="list-style-type: none">• Centrally mounted with offset (handed) blower unit• Dual zone with side to side temperature control• Located behind right hand rear quarter panel. Includes heater, evaporator, in-line TVX, blower motor and drain tube. Air intake is 100% recirculation.
Compressor	Clutchless, belt driven from engine with electronically controlled outputs.

Climate Control System - General Information - Climate Control System

Diagnosis and Testing

Principle of Operation

For a detailed description of the Climate Control System, refer to the relevant Description and Operation section in the workshop manual. REFER to:

[Air Distribution and Filtering](#) (412-01 Air Distribution and Filtering, Description and Operation),
[Heating and Ventilation](#) (412-02A Heating and Ventilation, Description and Operation),
[Auxiliary Heater](#) (412-02B Auxiliary Heating, Description and Operation),
[Auxiliary Climate Control](#) (412-03C Auxiliary Climate Control, Description and Operation),
[Control Components](#) (412-04 Control Components, Description and Operation).

Inspection and Verification



WARNING: Servicing must be carried out by personnel familiar with both vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Coolant level • Hose(s) • Coolant pump • Control flap(s) • Duct(s) • Vent(s) • Cabin air filter • Drive belt • Air conditioning compressor • Thermostatic expansion valve • Evaporator • Receiver drier • Air conditioning condenser • Refrigerant pipes • Auxiliary drive belt • Fuel fired booster heater • Fuel fired booster heater fuel pump • Fuel fired booster heater fuel pipes 	<ul style="list-style-type: none"> • Fuse(s) • Wiring harness • Electrical connectors • Blower • Air conditioning compressor • Electric cooling fan • Automatic Temperature Control Module (ATCM) • Refrigerant pressure sensor

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index
5. Check DDW for open campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint and carry out the recommendations as required

Distribution motor self-test

The motor and flap operation can be checked using the on-board distribution motor self-test function.

The self-test can be initiated by pressing and holding the **ECON** and **RECIRC** buttons while turning the ignition switch to the **ON** position.

The control module will then compare the current motor position with the values stored in the module and will indicate an error by flashing the **ECON** LED (light emitting diode).

If there are no errors, the LED will go out and the system will function normally.

To confirm that there are no errors, turn the ignition switch to the **OFF** position, then back to the **ON** position.



Observe the operation of the **programmed defrost** LED.



If there are errors present, the **programmed defrost** LED will flash and the system will attempt to calibrate itself.

Symptom Chart

Symptom	Possible Causes	Action
No climate control function, flashing LED at start-up	<ul style="list-style-type: none"> The system is in calibration mode 	<ul style="list-style-type: none"> Check the motors and levers at the heating and ventilation assembly for damage/foreign objects jamming the movement of the flaps. For additional information on the self-calibration process, see the distribution motor self-test above
Air conditioning performance poor or inoperative	<ul style="list-style-type: none"> Refrigerant undercharged Refrigerant overcharged Thermostatic expansion valve faulty Receiver drier restricted Water in refrigerant 	<ul style="list-style-type: none"> GO to Pinpoint Test A.
Air conditioning operates briefly and then switches off	<ul style="list-style-type: none"> Electric cooling fan inoperative Air conditioning condenser airflow obstructed 	<ul style="list-style-type: none"> Test the operation of the electric cooling fan Check the air conditioning condenser for external obstructions







Pinpoint Tests

PINPOINT TEST A : PRELIMINARY TESTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: PRELIMINARY TEST 1	
NOTES:	
	This test is performed with the engine not running.
	Normal pressure for a correctly charged and switched off system is approximately 4.5 bar on both gauges (system equalised).
	1 Close the valves on the air conditioning station
	2 Connect the air conditioning station to the vehicle charging ports
	3 Check the pressure values
	Is a pressure registered on both gauges?
	Yes GO to Pinpoint Test B .
	No GO to Pinpoint Test D .

PINPOINT TEST B : FUNCTIONALITY TESTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: FUNCTIONALITY TEST 1	
NOTES:	
	Normal pressures for a correctly charged and working system are 1.0 bar to 2.0 bar (low) and 11.0 bar to 15.0 bar (high).
	Normal temperature (measured at the center air vent) for a correctly charged and working system is -7°C to -2°C when ambient temperature is 20°C.
	1 Close the valves on the air conditioning station
	2 Connect the air conditioning station to the vehicle charging ports
	3 Open all doors and the tailgate
	4 Start the engine
	5 Set the temperature to the lowest setting (all zones)
	6 Set the fan speed to maximum

	7 Set the recirculate switch to off
	8 Insert a temperature probe into the centre air vent
	9 Raise engine speed to 1500rpm and maintain this speed for 5 minutes
	10 Check the temperature value
	11 Check the pressure values
	Are the pressure readings stable and in the green 'normal' region of the gauge? Yes Air conditioning system operating normally No Air conditioning system fault present. GO to Pinpoint Test C.

PINPOINT TEST C : GAUGE TESTS

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: GAUGE TEST 1	
	NOTE: This test is performed with the engine running and the air conditioning set to on.
	1 Check the pressure values
	Did the gauges register a change in pressure when the air conditioning was switched on? Yes GO to C2. No Using the manufacturer approved diagnostic system, check the Automatic Temperature Control Module (ATCM) for related DTCs and refer to the relevant DTC index
C2: GAUGE TEST 2	
	NOTE: This test is performed with the engine running and the air conditioning set to on.
	1 Check the pressure values
	Are the pressure gauge readings fluctuating? Yes Moisture present in the air conditioning system. Recover the refrigerant. Install a new receiver drier. Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B. No GO to C3.
C3: GAUGE TEST 3	
NOTES:	
	This test is performed with the engine running and the air conditioning set to on.
	Normal pressures for a correctly charged and working system are 1.0 bar to 2.0 bar (low) and 11.0 bar to 15.0 bar (high).
	1 Check the pressure values
	Are the pressure gauge readings too low? Yes GO to C4. No GO to C6.
C4: GAUGE TEST 4	
	NOTE: This test is performed with the engine not running.
	1 Stop the engine
	2 Using the manufacturer approved refrigerant leak detector, check for a refrigerant leak
	Was a refrigerant leak detected? Yes Refer to the relevant section of the workshop manual and recover the refrigerant. Repair as necessary. Evacuate and recharge the air conditioning system. GO to Pinpoint Test B. No GO to C5.
C5: GAUGE TEST 5	
	NOTE: This test is performed with the engine not running.
	1 Refer to the relevant section of the workshop manual and recover the refrigerant
	Was the weight of the recovered refrigerant less than specified for the air conditioning system? Yes Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B. No Install a new receiver drier. Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B.
C6: GAUGE TEST 6	

NOTES:



This test is performed with the engine running and the air conditioning set to on.



Normal pressures for a correctly charged and working system are 1.0 bar to 2.0 bar (low) and 11.0 bar to 15.0 bar (high).

	1 Check the pressure values Are the pressure gauge readings too high? Yes GO to C7. No Test inconclusive. GO to Pinpoint Test B.
--	--

C7: GAUGE TEST 7



NOTE: This test is performed with the engine **not** running.

	1 Stop the engine 2 Refer to the relevant section of the workshop manual and recover the refrigerant
	Was the weight of the recovered refrigerant more than specified for the air conditioning system? Yes Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B. No Install a new thermal expansion valve. Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B.

PINPOINT TEST D : NITROGEN LEAK TESTS

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

D1: NITROGEN LEAK TEST



CAUTION: When charging the system with nitrogen, the pressure should be regulated to 7.0 bar.



NOTE: This test is performed with the engine **not** running.

	1 Charge the air conditioning system with nitrogen 2 Isolate the nitrogen supply 3 Monitor the pressure gauge and check for leaks
	Has the source of the leak been identified? Yes Rectify the leak as necessary. Install a new receiver drier. Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B. No Refer to the relevant section of the workshop manual and evacuate and recharge the air conditioning system. GO to Pinpoint Test B.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: Automatic Temperature Control Module \(ATC\)](#) (100-00 General Information, Description and Operation).

Climate Control System - General Information - Air Conditioning (A/C) System Recovery, Evacuation and Charging

General Procedures



WARNING: Servicing must be carried out by personnel familiar with both vehicle system and the charging and testing equipment. All operations must be carried out in a well ventilated area away from open flame and heat sources.



NOTE: The receiver drier need only be changed under the following circumstances: There is dirt in the refrigerant circuit (eg. compressor seizure); the system is leaking and refrigerant has been lost to atmosphere; refrigerant circuit has been open more than 24 hours due to repair.



1. **Refrigerant recovery:** Remove the dust covers from the high and low pressure connections.

2. Connect the high and low pressure lines to the appropriate connections.
3. Open the valves on the connections.
4. Turn the valves on the station to the correct positions.
5. Turn the process switch to the correct position.
6. Turn the main switch to 'ON'.



7. **WARNING:** Refrigerant must always be recycled before re-use to ensure that the purity of the refrigerants high enough for safe use in the air conditioning system. Recycling should always be carried out with equipment which is design certified by Underwriter Laboratory Inc. for compliance with SEA J1991. Other equipment may not recycle refrigerant to the required level of purity. R143a Refrigerant Recover Recycling Recharging station must not be used with any other type of refrigerant. Refrigerant R134a from domestic and commercial sources must not be used in motor vehicles air conditioning systems.

Allow the system to recover the refrigerant from the system.

8. Close the valves on the refrigerant station.
9. Turn the main switch 'OFF'.
10. Close the valves on the connections.
11. Disconnect the high and low pressure connections.
12. Install the dust covers to the connectors.
13. Open the tap at the rear of the station to drain the refrigerant oil.
14. Measure and record the quantity of refrigerant oil recovered from the system.

15. Close the tap at the rear of the station.
16. **Evacuation:** Remove the dust covers from the high and low pressure connections.
17. Connect the high and low pressure lines to the appropriate connections.
18. Open the valves on the connections.
19. Turn the valves on the station to the correct positions.
20. Turn the process switch to the correct position.
21. Turn the main switch to 'ON'.
22. Allow the station to evacuate the A/C system.



23. **CAUTION:** The system must be evacuated immediately before recharging commences. Delay between evacuation and recharging is not permitted

Recharging: Close the valves on the refrigerant station.

24. Close the valve on the oil charger.
25. Disconnect the yellow line from the refrigerant station.
26. Remove the cover from the oil charger.
27. Pour the correct quantity of refrigerant oil into the oil charger.
28. Install the cover to the oil charger.
29. Connect the yellow line to the refrigerant station.
30. Open the valve on the oil charger.
31. Move the pointer on the refrigerant gauge to mark the position of the refrigerant drop.
32. Slowly open the correct valve on the refrigerant to allow the vacuum to pull the refrigerant into the system.
33. Close the valve on the refrigerant station when the correct amount of refrigerant has been drawn into the air conditioning system.
34. Turn the main switch 'OFF'.
35. Close the valves on the connections.
36. Disconnect the high and low pressure connections.

Climate Control System - General Information - Air Conditioning (A/C) Compressor Commissioning

General Procedures

Activation



CAUTION: Failure to follow this instruction may result in damage to the component.

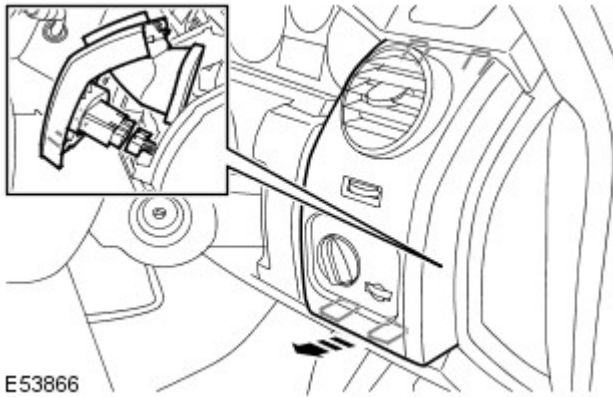
1. Set the ignition to the on position, make sure the air conditioning (A/C) is in the off position.
2. Start the engine and allow to run for a minimum of 5 minutes.
3. Set the heater controls to 22°C, with the fan speed set to 75%.
4. Switch on the A/C system.
5. Open all air vents in the dashboard.
6. Run the A/C system for a minimum of 5 minutes, while the engine is still at idle speed.
7. Once this is achieved the compressor is stabilized, with the oil being distributed evenly throughout the system.

This section contains no data

Air Distribution and Filtering - Driver Side Register Trim Panel

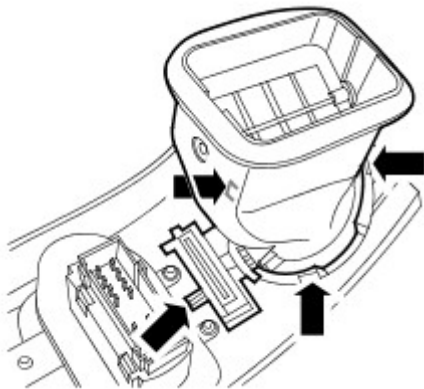
Removal and Installation

Removal




E53866

1. Remove the driver side register trim panel.
 - Release the 2 clips.
 - Disconnect the electrical connector.

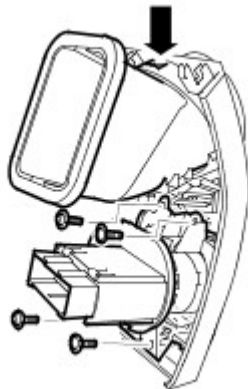


E53867

2.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the register.

- Release the 4 clips.



E49998

3. Remove the headlamp switch.
 - Remove the 4 Torx screws.

Installation

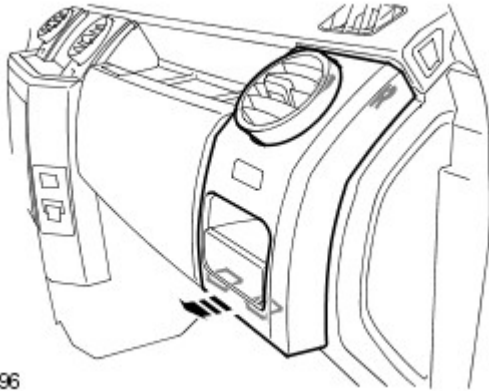
1. Install the headlamp switch.
 - Tighten the Torx screws.
2. Install the register.
 - Secure with the clips.
3. Install the driver side register trim panel.
 - Connect the electrical connector.
 - Secure with the clips.

Air Distribution and Filtering - Passenger Side Register Trim Panel


Removal and Installation

Removal

1. Remove the passenger side register trim panel.
 - Release the 2 clips.

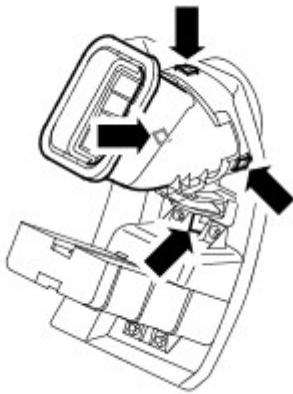


E49996

2.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the register.

- Release the 4 clips.



E53870

3. Remove the cup holder.
 - Remove the 4 Torx screws.



E49997

Installation

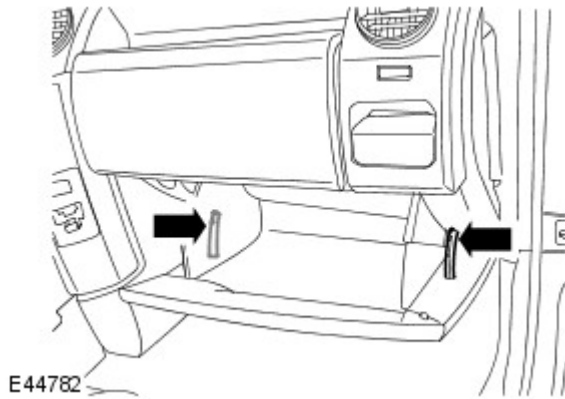
1. Install the cup holder.
 - Tighten the Torx screws.
2. Install the register.
 - Secure with the clips.
3. Install the passenger side register trim panel.
 - Secure with the clips.

Air Distribution and Filtering - Pollen Filter

Removal and Installation

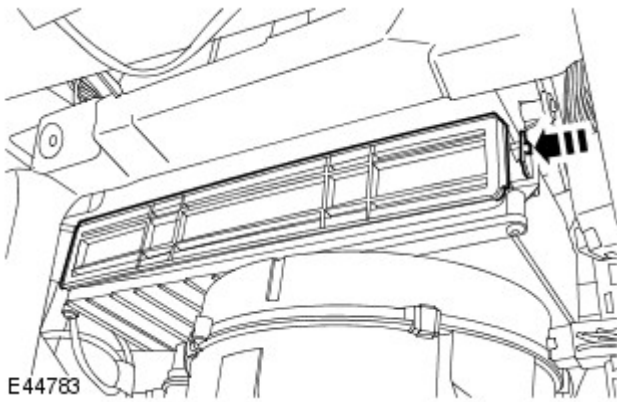
Removal

1. Open the glove compartment to the service condition.
 - Release the glove compartment latch stops.



E44782

2. Remove the pollen filter housing cover.



E44783

3. Remove the pollen filter.

Installation

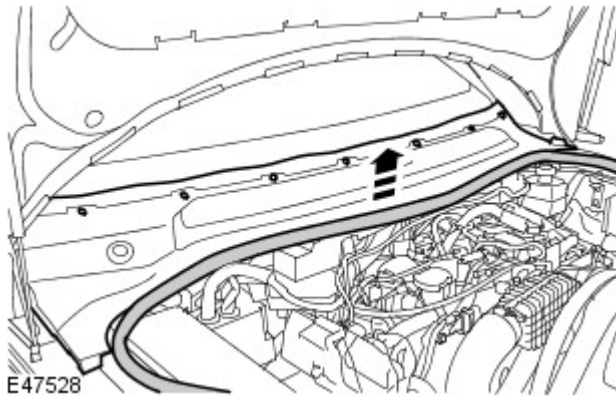
1. To install, reverse the removal procedure.
 - Clean the component mating faces.

Air Distribution and Filtering - Plenum Chamber

Removal and Installation

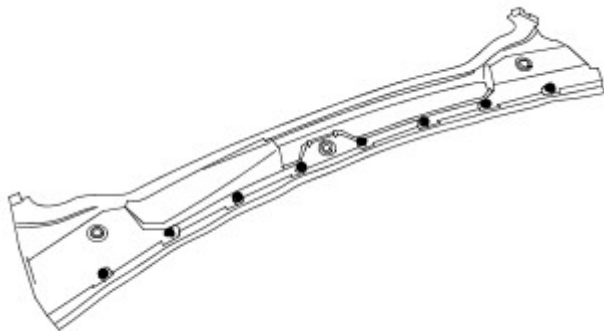
Removal

1. Remove the A-pillar mouldings.
For additional information, refer to: A-Pillar Moulding LH (501-08, Removal and Installation).
2. Remove the windshield wiper arms.
For additional information, refer to: Front Wiper Pivot Arm (501-16, Removal and Installation).
3. Release the hood seal from the plenum chamber.




E47528

4. Remove the plenum chamber panel.
 - Release the 8 clips.



E47529

5.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the clips from the plenum chamber panel.

Installation

1. To install, reverse the removal procedure.

- 4 - Air inlet duct
- 5 - Heater
- 6 - Ventilation outlets

GENERAL

The heating and ventilation system controls the temperature and flow of air supplied to the vehicle interior. The system consists of:

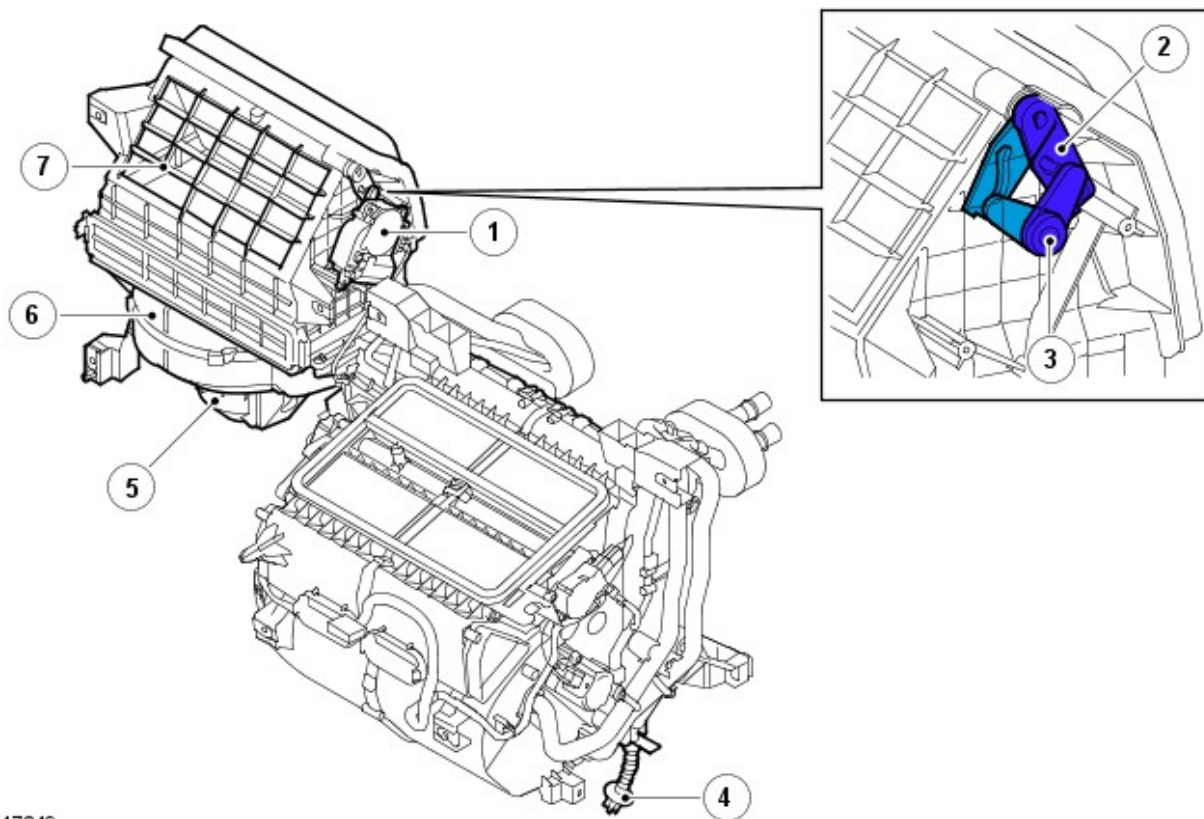
- An air inlet duct.
- A blower.
- A blower control module.
- A blower relay.
- A heater.
- Two ventilation outlets.

Fresh or recirculated air flows into the heater assembly from the inlet duct. The blower, and ram effect when the vehicle is moving, forces the air through the heater assembly. Air from the cabin exhausts through the ventilation outlets.

AIR INLET DUCT



NOTE: RHD version shown, LHD mirror image



E47349

Item	Part Number	Description
1	-	Recirculation door motor
2	-	Recirculation door arm
3	-	Recirculation motor arm
4	-	Evaporator drain tube
5	-	Blower
6	-	Air inlet duct
7	-	Recirculation air inlet

The air inlet duct is installed behind the instrument panel, on the front passenger side, and connected between the plenum chamber below the windshield and the heater.

The plenum chamber is formed by the upper and lower cowl and a plenum molding. Grilles in the plenum molding allow fresh air into the plenum chamber. From the plenum chamber, the air passes through a water separator and into the fresh air inlet of the air inlet duct.

The air inlet duct incorporates a grille to provide the inlet for recirculated air from the vehicle interior. The air inlet duct also accommodates:

- The cabin air filter.
For additional information, refer to: Air Distribution and Filtering (412-01 Air Distribution and Filtering,

- Description and Operation).
- The blower.
 - The blower control module.

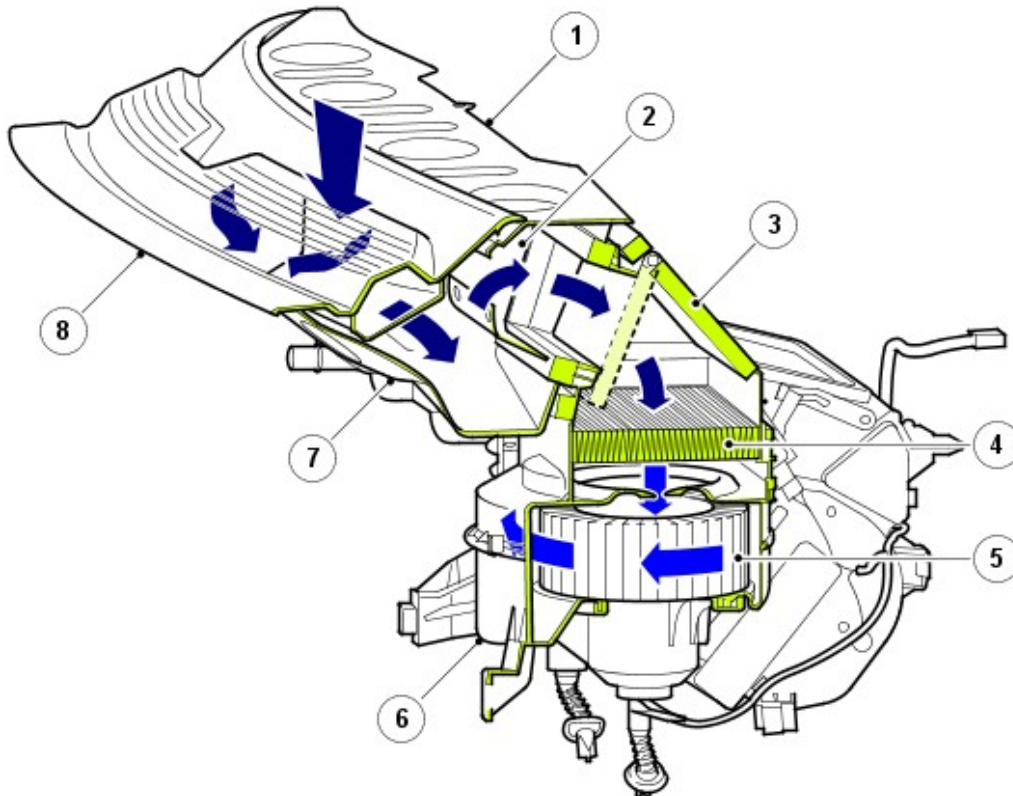
The outlet from the air inlet duct forms the rear wall of the heater, enclosing the evaporator and incorporating the two evaporator drain outlets. Drain tubes connect the evaporator drain outlets to the transmission tunnel, to direct the water that condenses on the evaporator overboard.

A recirculation door is installed between the fresh and recirculated air inlets, to control the source of incoming air. A lever on the recirculation door is driven by the recirculation door motor. Operation of the recirculation door motor is automatically controlled by the **ATC (automatic temperature control)** module and manually controlled by a switch on the **ATC** module control panel.

For additional information, refer to: Control Components (412-04 Control Components, Description and Operation).

Fresh or recirculated air enters the air inlet duct and passes through the cabin air filter to the hub of the blower. From the blower, the air flows to the outlet of the air inlet and into the heater. The blower, and ram effect from the forward motion of the vehicle, forces the air through the air inlet duct.

Air Flow Through Air Inlet Duct



E47350

Item	Part Number	Description
1	-	Upper cowl
2	-	Water separator
3	-	Recirculation door
4	-	Cabin air filter
5	-	Blower
6	-	Air inlet duct casing
7	-	Lower cowl
8	-	Plenum molding

BLOWER

The blower is installed in the air inlet duct, below the cabin air filter, and consists of an open hub, centrifugal fan powered by an electric motor. Operation of the blower is controlled by the **ATC** module, using the blower relay in the **BJB (battery junction box)** and the blower control module. The blower control module is installed in the air inlet duct downstream of the blower, where any heat generated during operation is dissipated by the air flow. A wiring harness on the air inlet duct connects the recirculation door motor, blower and blower control module to the vehicle wiring.

When the blower is required, the **ATC** module energizes the coil of the blower relay. The energized blower relay supplies battery power to the blower motor, which is connected to ground through the blower control module. The speed of the blower is controlled by the blower control module, the blower motor control module regulates the voltage in response to the voltage signal from the linear **ATC** module. To change the blower motor voltage, **ATC** module will change the working cycle linear voltage signal.

When the blower is in the automatic mode the **ATC** module determines the blower speed required from the comfort algorithms. When the blower is in the manual mode, the **ATC** module operates the blower at one of seven fixed

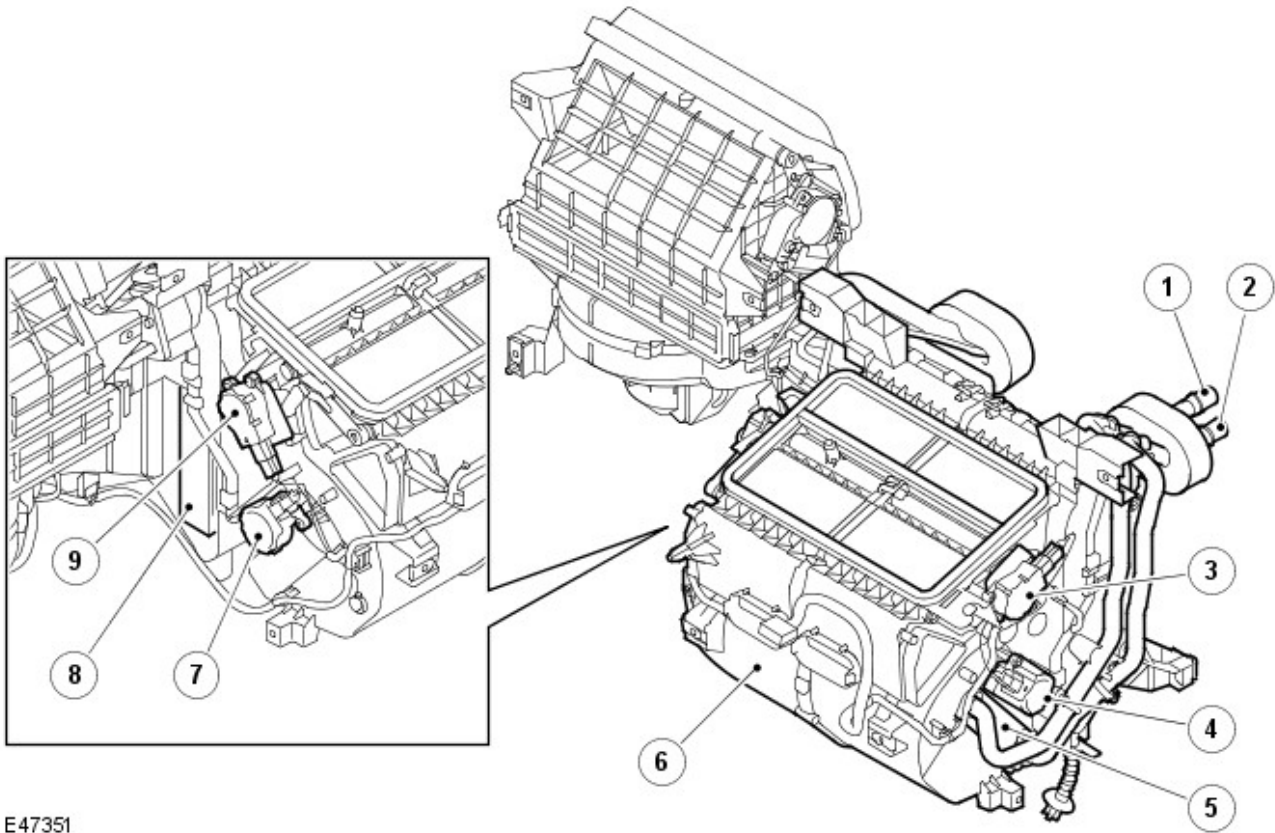
speeds as selected on the control panel.

For additional information, refer to: Control Components (412-04 Control Components, Description and Operation).

HEATER



NOTE: RHD unit shown, LHD units similar



E47351

Item	Part Number	Description
1	-	Coolant outlet pipe
2	-	Coolant inlet pipe
3	-	Windshield distribution door motor
4	-	RH (right-hand) temperature blend motor
5	-	Heater core
6	-	Heater casing
7	-	LH (left-hand) temperature blend motor (automatic system only)
8	-	Evaporator
9	-	Face and feet distribution door motor

The heater controls the temperature of the air supplied to the distribution ducts, as directed by the ATC module. The heater is installed on the vehicle center-line, between the instrument panel and the engine bulkhead. The heater consists of a casing, formed from a series of plastic molding, which contains an evaporator, heater core and control doors. Internal passages integrated into the casing guide the air through the casing and separate it into two flows, one for the LH outlets and one for the RH outlets.

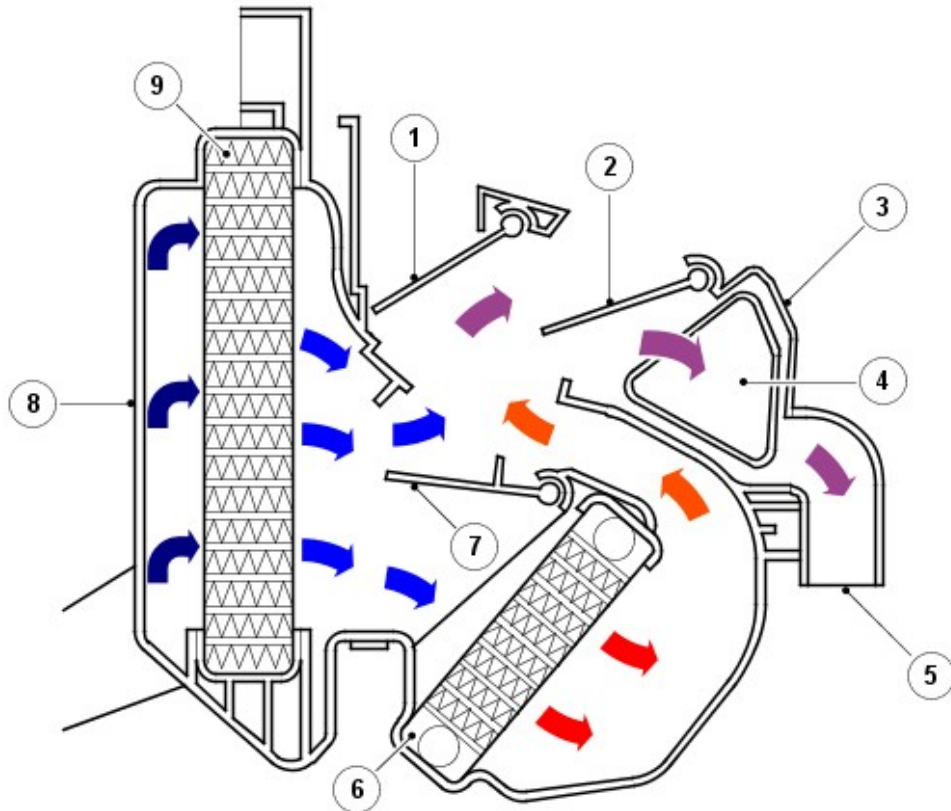
When the A/C (air conditioning) system is operating, the evaporator cools the air entering the heater.

The heater core provides the heat source to warm the air being supplied to the distribution ducts. The heater core is an aluminum two pass, fin and tube heat exchanger, installed across the width of the heater housing. Two aluminum tubes attached to the heater core extend through the engine bulkhead to connect with the engine cooling system. When the engine is running, coolant is constantly circulated through the heater matrix by the coolant pump. On vehicles with a FFBH (fuel fired booster heater), when the FFBH is active the coolant flow is assisted by an electric circulation pump.

For additional information, refer to: Auxiliary Heater (412-02B Auxiliary Heating, Description and Operation).

Two temperature blend doors, one LH and one RH, regulate the flow of air through the heater core to control the temperature of the air leaving the heater. On the automatic system, the two temperature blend doors operate independently to allow different temperatures to be set for the LH and RH outlets. On the manual system, the temperature blend doors are coupled together and produce a common temperature for the LH and RH outlets.

Air Flow Through Heater



E47352

Item	Part Number	Description
1	-	Windshield distribution door
2	-	Face and feet distribution door
3	-	Heater casing
4	-	Front footwell outlet
5	-	Rear footwell outlet
6	-	Heater core
7	-	Temperature blend door
8	-	Air inlet duct casing
9	-	Evaporator

Stepper Motors

On the automatic system, separate stepper motors operate the **RH** and the **LH** side temperature blend doors. On the manual system, a single stepper motor operates both the **RH** and the **LH** temperature blend doors.

The distribution doors in the heater are also operated by stepper motors. One for the windshield distribution door and one for the face and feet distribution door.

If a stepper motor is to be replaced, ensure it is replaced with the correct replacement part. Although similar in appearance, each of the stepper motors is different and faults will occur if an incorrect motor is fitted.

Operation of the distribution and temperature blend door stepper motors is controlled by the **ATC** module, which is connected to the stepper motors by a LIN (local interconnect network) bus.

All of the stepper motors contain microprocessors, which store positional information. To enable the **ATC** module to move the stepper motors correctly it requires the following information:

- The travel range, end to end, of each motor.
- Where each motor is on its range.

Approximately 2 minutes after the vehicle ignition is switched off, the climate control system powers down. At this point, the **ATC** module stores the position of each stepper motor in its memory. Each of the stepper motors also stores its own position in its memory. When the ignition is next switched on, all of the stepper motors send positional information to the **ATC** module via the LIN bus. This information is compared with the positional information stored within the **ATC** module memory.

In normal circumstances, the information sent by the stepper motors matches that held in the **ATC** module memory. In this instance, the **ATC** module recognizes there are no problems with the system and starts normally. If however, there are differences, the **ATC** module carries out a calibration routine.

The stepper motor calibration routine will normally take about 15 seconds to complete, but can take up to approximately 2 minutes in certain circumstances. During this period:

- The programmed de-frost **LED (light emitting diode)** on the **ATC** module panel will flash.
- All other climate control operations will be suspended.

The programmed de-frost LED will stop flashing after 2 minutes, regardless of whether the exercise was successful or not so it is important to check that calibration has been carried out successfully. To do this:

1. Switch the ignition off.
2. Switch the ignition back on.
3. Check for a flashing programmed de-frost LED.

If calibration has been successful, the programmed de-frost LED will not flash and the system will return to normal operation. If flashing does occur, more investigation will be required .

Automatic Calibration: The ATC module will automatically initiate a calibration routine every 175 hours of vehicle life. This occurs approximately 1 minute after the ignition has been switched off once 175 hours is reached. In this instance, the programmed de-frost LED will not blink.

Forced Calibration: The ATC module can be manually forced to carry out a calibration routine on the stepper motors. This can be carried out by holding down the ECON and recirculation buttons on the ATC module panel while simultaneously switching the ignition on. The ATC module will now carry out a calibration routine on the stepper motors, but will flash the ECON LED rather than the programmed de-frost LED.

Stepper Motor Diagnostics

Fault diagnosis on the heater stepper motors falls into two main groups:

- Electrical fault: A DTC (diagnostic trouble code) will be raised and logged in the ATC module memory.
- Mechanical fault: The programmed de-frost LED will blink to indicate the ATC module is attempting to carry out a calibration routine.

A calibration routine will be initiated by the ATC module if any of the following occur:

- One or more of the stepper motors is replaced.
- The ATC module is replaced.
- A foreign object enters the system and causes a stepper motor to stall.

Stepper motor related DTCs are stored in the ATC module memory and can be retrieved using T4. For additional information, refer to: Climate Control System (412-00, Diagnosis and Testing).

VENTILATION OUTLETS

The ventilation outlets promote the free flow of air through the passenger compartment. The outlets are installed in the LH and RH rear quarter body panels, behind the tail lamps.

Each ventilation outlet consists of a grille covered by soft rubber flaps and is effectively a non-return valve. The flaps open and close automatically depending on the differential between cabin and outside air pressures.

Heating and Ventilation - Heating and Ventilation

Diagnosis and Testing

Principles of Operation

For a detailed description of the heating and ventilation system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Heating and Ventilation (412-02 Heating and Ventilation, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Front End Accessory Drive (FEAD) belt • Refrigerant • Heater control flaps • Ducting • Cabin air filter • Coolant level • Compressor • Cooling fan 	<ul style="list-style-type: none"> • Fuses • Electrical harnesses • Harness connectors • Blower motor • Cooling fan • Actuators

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Climate Control Module (HVAC) (100-00, Description and Operation).

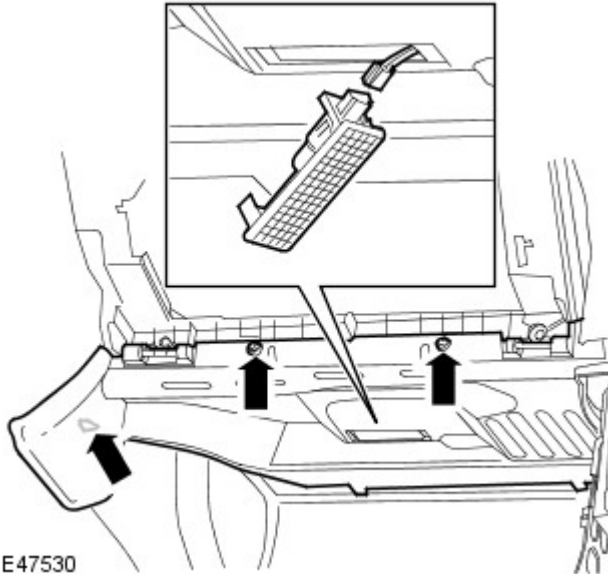
Heating and Ventilation - Blower Motor

Removal and Installation

Removal

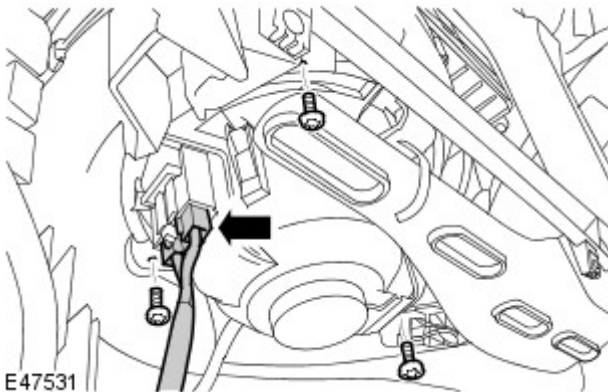
1. Remove the glove compartment.
For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

2. Remove the passenger side closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.



E47530


3. Position the footwell duct aside for access.
 - Release the clip.



E47531

4. Remove the blower motor.
 - Disconnect the electrical connector.
 - Remove the 3 screws.

Installation

1.  **CAUTION:** Fixings must be started by hand to avoid damaging threads.

Install the blower motor.

- Tighten the screws.
- Connect the electrical connector.

2. Secure the footwell duct.
 - Install the clip.

3. Install the closing trim panel.
 - Connect the electrical connector.
 - Secure the clip.
 - Tighten the screws.

4. Install the glove compartment.
For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

Heating and Ventilation - Heater Core LHD AWD

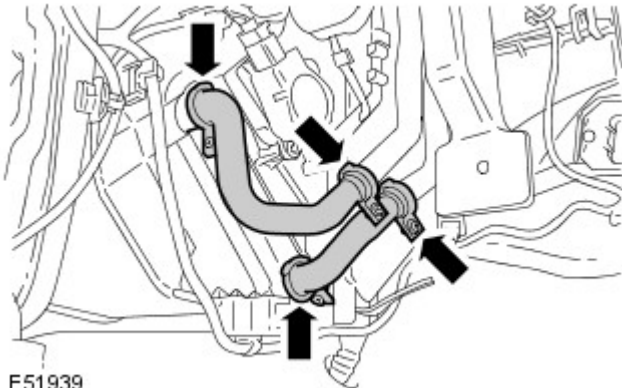
Removal and Installation

Removal

1. Drain the cooling system.
For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding (303-03B, General Procedures).
2. Remove the instrument panel passenger side reinforcement.

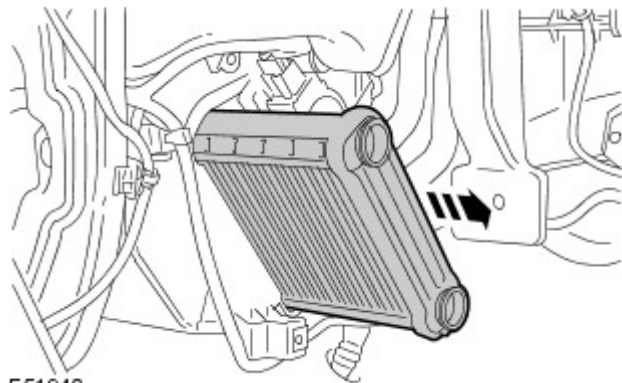
For additional information, refer to: [Instrument Panel Passenger Side Reinforcement](#) (501-12 Instrument Panel and Console, Removal and Installation).

3. Remove the heater core upper and lower pipes.
 - Position a container to collect the fluid.
 - Loosen the 4 screws and remove the clips.
 - Remove and discard the 4 O-ring seals.



E51939

4. Remove the heater core.



E51940

Installation

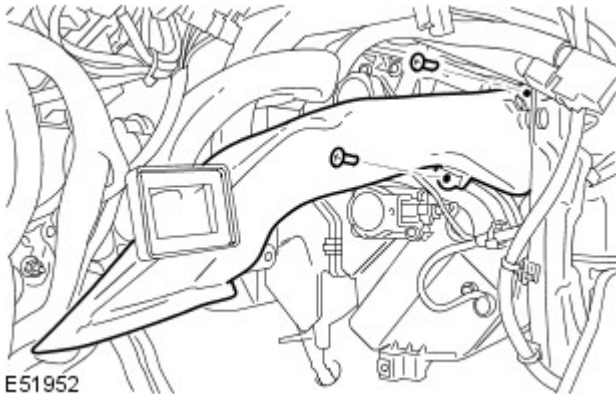
1. Install the heater core.
2. Install the heater core upper and lower pipes.
 - Clean the components.
 - Install the new O-ring seals.
 - Install the clips and tighten the screws.
 - Remove the container.
3. Install the instrument panel passenger side reinforcement.
For additional information, refer to: [Instrument Panel Passenger Side Reinforcement](#) (501-12 Instrument Panel and Console, Removal and Installation).
4. Refill the cooling system.
For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding (303-03B, General Procedures).

Heating and Ventilation - Heater Core RHD AWD

Removal and Installation

Removal

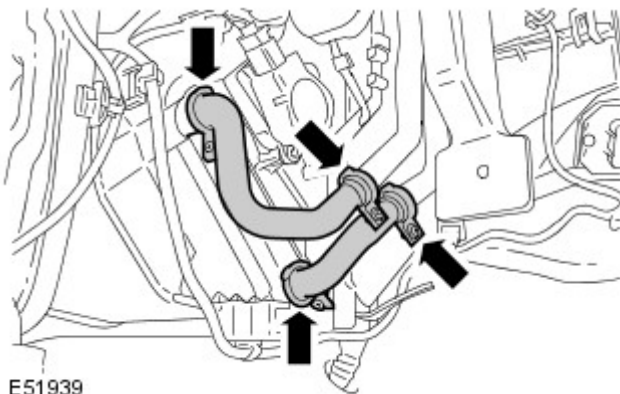
1. Drain the cooling system.
For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding (303-03B, General Procedures).
2. Remove the instrument panel driver side reinforcement.
For additional information, refer to: [Instrument Panel Driver Side Reinforcement](#) (501-12 Instrument Panel and Console, Removal and Installation).



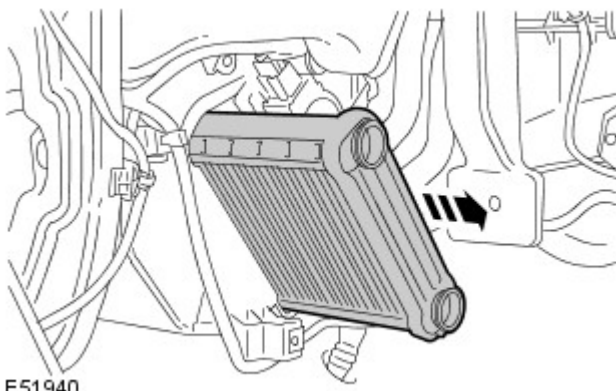
3.  **NOTE:** LHD illustration shown, RHD is similar.

Remove the driver side footwell duct.

- Remove the 2 Torx screws.



4. Remove the heater core upper and lower pipes.
 - Position a container to collect the fluid.
 - Loosen the 4 screws and remove the clips.
 - Remove and discard the 4 O-ring seals.



5. Remove the heater core.

Installation

1. Install the heater core.
2. Install the heater core upper and lower pipes.
 - Clean the components.
 - Install the new O-ring seals.
 - Install the clips and tighten the screws.
 - Remove the container.

3. Install the driver side footwell duct.
 - Tighten the screws.
4. Install the instrument panel driver side reinforcement.
For additional information, refer to: [Instrument Panel Driver Side Reinforcement](#) (501-12 Instrument Panel and Console, Removal and Installation).
5. Refill the cooling system.
For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding (303-03B, General Procedures).

Auxiliary Heating -

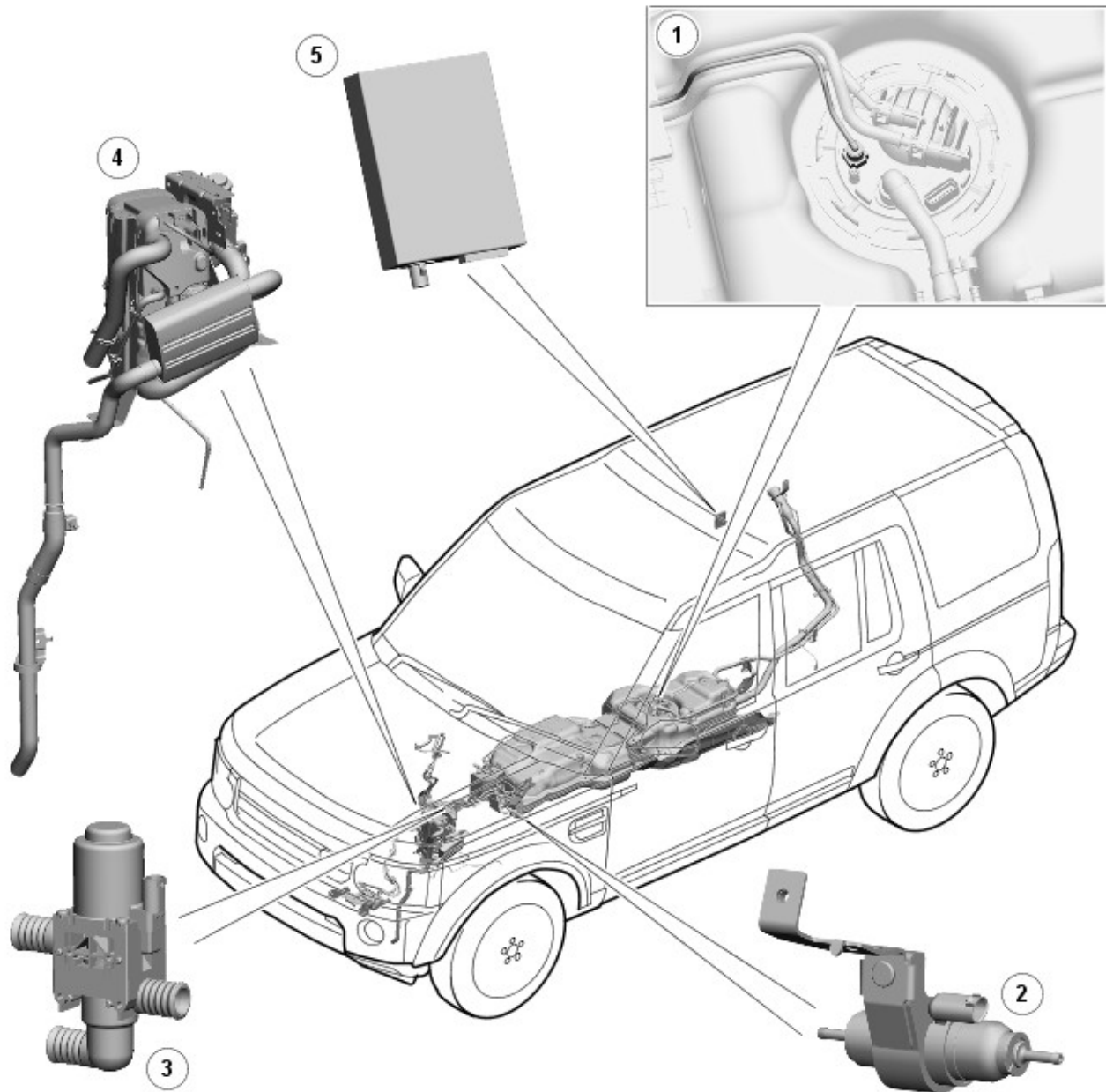
Torque Specifications

Description	Nm	lb-ft
Fuel fired booster heater exhaust bracket bolt	10	7
Fuel fired booster heater	10	7

Auxiliary Heating - Auxiliary Heater

Description and Operation

COMPONENT LOCATIONS



E137283

Item	Part Number	Description
1	-	FFBH (fuel fired booster heater) fuel line connection to fuel tank
2	-	FFBH auxiliary fuel pump
3	-	FFBH changeover valve
4	-	FFBH
5	-	FFBH receiver

INTRODUCTION

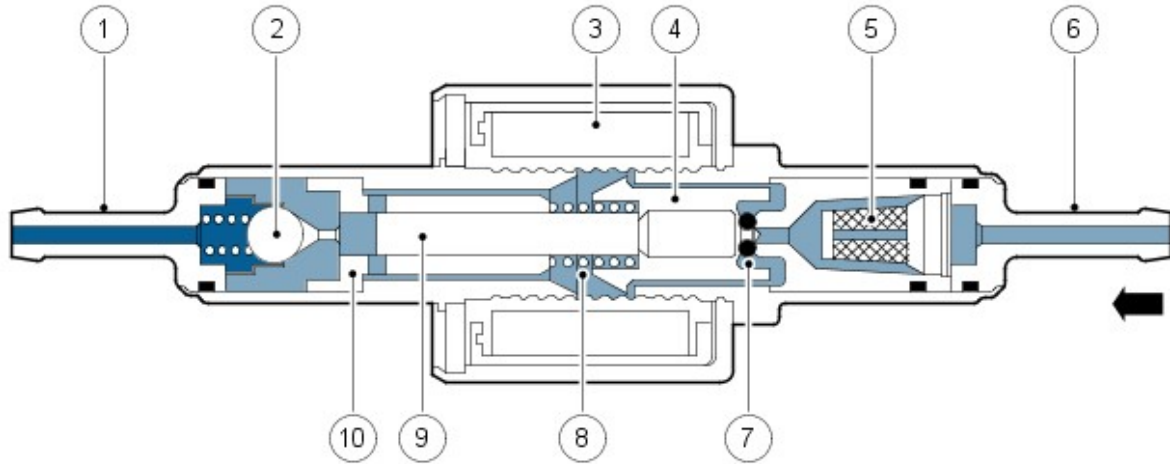
Auxiliary heating is provided by a FFBH (fuel fired booster heater), which boosts the temperature of the engine coolant. Fuel for the FFBH is taken from the vehicle fuel tank, through a fuel line attached to the fuel pump module. An auxiliary fuel pump supplies the fuel at low pressure to the FFBH. In the FFBH, the fuel is burned and the resultant heat output is used to heat the engine coolant.

For remote operation, the system includes a FFBH receiver and a remote handset.

AUXILIARY FUEL PUMP

The auxiliary fuel pump regulates the fuel supply to the FFBH. The pump is a self priming, solenoid operated plunger pump, controlled by a pulse width modulation (PWM) signal from the control module in the FFBH. When the pump is de-energized, it provides a positive shut-off of the fuel supply.

Sectioned View of Auxiliary Fuel Pump



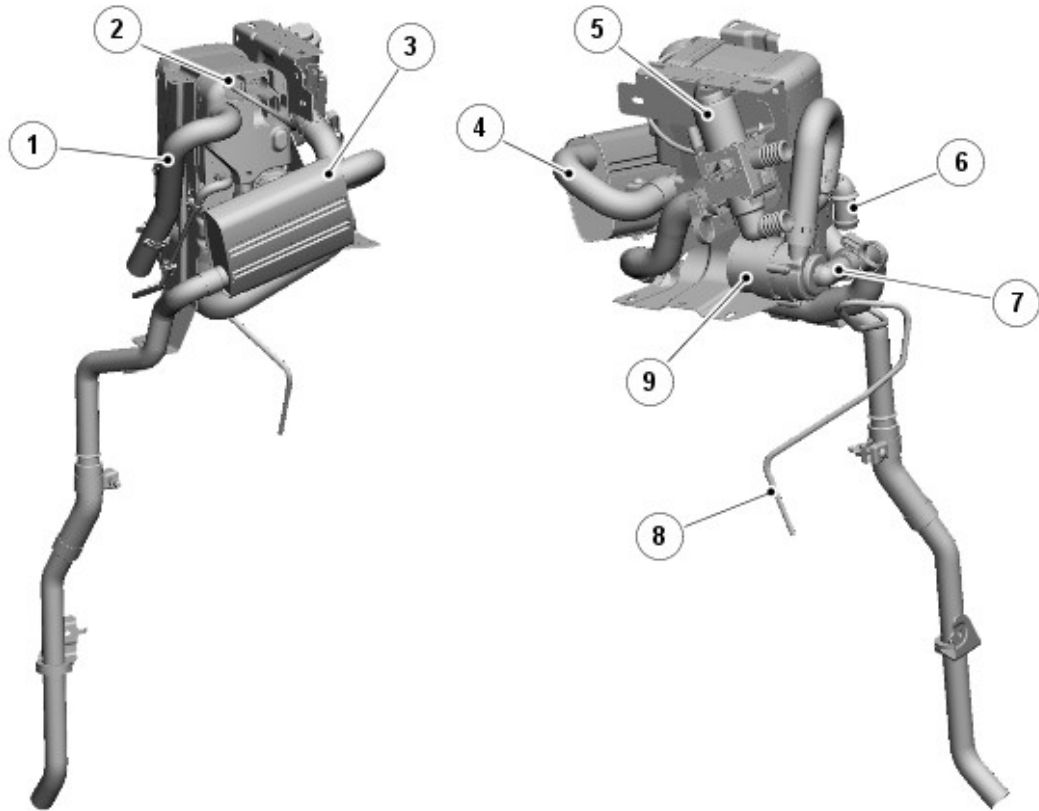
E43569

Item	Part Number	Description
1	-	Fuel line connector
2	-	Non return valve
3	-	Solenoid coil
4	-	Plunger
5	-	Filter insert
6	-	Fuel line connector
7	-	O-ring seal
8	-	Spring
9	-	Piston
10	-	Bush

The solenoid coil of the auxiliary fuel pump is installed around a housing which contains a plunger and piston. The piston locates in a bush, and a spring is installed on the piston between the bush and the plunger. A filter insert and a fuel line connector are installed in the inlet end of the housing. A non return valve and a fuel line connector are installed in the inlet end of the housing.

While the solenoid coil is de-energized, the spring holds the piston and plunger in the closed position at the inlet end of the housing. An O-ring seal on the plunger provides a fuel tight seal between the plunger and the filter insert, preventing any flow through the pump. When the solenoid coil is energized, the piston and plunger move towards the outlet end of the housing, until the plunger contacts the bush; fuel is then drawn in through the inlet connection and filter. The initial movement of the piston also closes transverse drillings in the bush and isolates the pumping chamber at the outlet end of the housing. Subsequent movement of the piston then forces fuel from the pumping chamber through the non return valve and into the line to the FFBH. When the solenoid de-energizes, the spring moves the piston and plunger back towards the closed position. As the piston and plunger move towards the closed position, fuel flows past the plunger and through the annular gaps and transverse holes in the bush to replenish the pumping chamber.

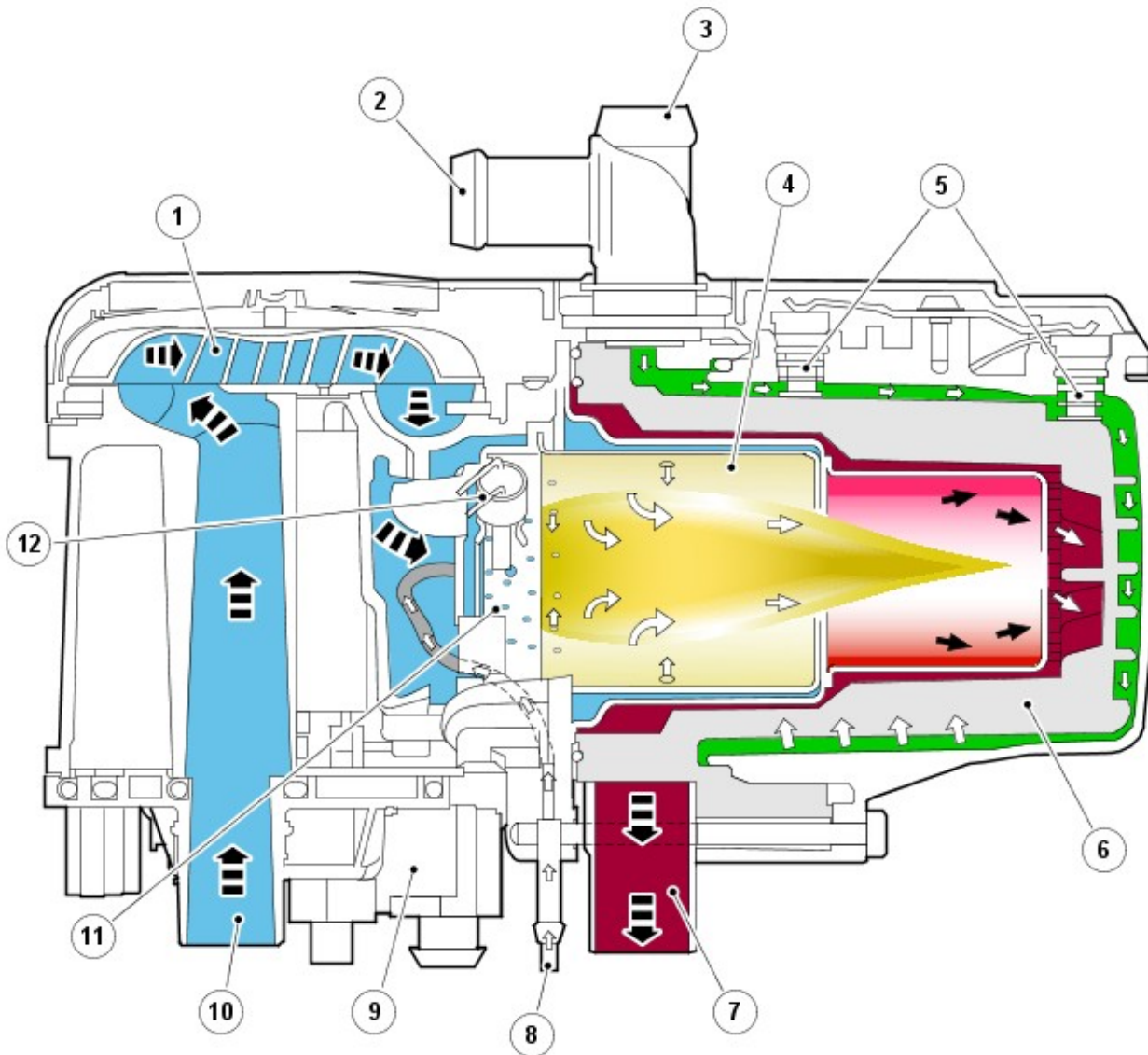
FFBH (Fuel Fired Booster Heater)



E137284

Item	Part Number	Description
1	-	Air inlet pipe
2	-	Electrical connectors
3	-	Exhaust muffler
4	-	Exhaust pipe
5	-	Changeover valve (if fitted)
6	-	Coolant outlet connection
7	-	Coolant inlet connection
8	-	Fuel supply line
9	-	Coolant circulation pump

Sectioned View of FFBH



E137285

Item	Part Number	Description
1	-	Combustion air fan
2	-	Coolant inlet
3	-	Coolant outlet
4	-	Burner insert
5	-	Coolant temperature sensors
6	-	Heat exchanger
7	-	Exhaust outlet
8	-	Fuel inlet
9	-	Control unit
10	-	Air inlet
11	-	Fuel evaporator
12	-	Glow plug / flame sensor

Coolant Circulation Pump

The coolant circulation pump is installed at the coolant inlet to the FFBH to assist the coolant flow through the FFBH and the vehicle heater core. The pump runs continuously while the FFBH is in standby or active operating modes. While the FFBH is inactive, coolant flow is reliant on the engine coolant pump. Operation of the FFBH coolant circulation pump is controlled by a power feed direct from the FFBH control module.

Combustion Air Fan

The combustion air fan regulates the flow of air into the FFBH to support combustion of the fuel supplied by the auxiliary fuel pump and to purge and cool the FFBH after operation.

Burner Housing

The burner housing contains the burner insert and also incorporates connections for the exhaust pipe, the coolant inlet from the coolant circulation pump and the coolant outlet to the vehicle heater core.

The burner insert incorporates the fuel combustion chamber, an evaporator and a glow pin and flame sensor. Fuel from the auxiliary fuel pump is supplied to an evaporator mat, where it evaporates and enters the combustion chamber to mix with air from the combustion air fan. The glow pin/flame sensor provides the ignition source of the fuel: air mixture and, once combustion is established, monitors the flame.

Heat Exchanger

The heat exchanger transfers heat generated by combustion to the coolant. Two sensors are installed in the heat exchanger casing to provide the control module with inputs of coolant temperature. The control module uses the temperature inputs to control system operation.

Air Inlet Pipe

The air inlet pipe delivers air to the combustion chamber for fuel ignition.

Exhaust Pipe and Muffler

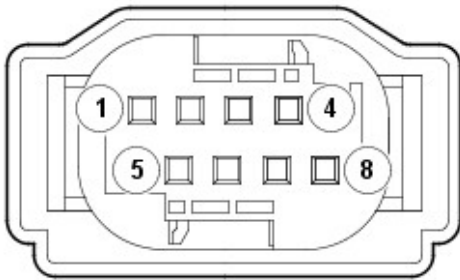
The exhaust pipe and muffler directs exhaust combustion gases to atmosphere. Exhaust vapor may be visible when the FFBH is running, depending on atmospheric conditions.

Control Module

The control module controls and monitors operation of the FFBH system. An internal flow of air from the combustion air fan ventilates the control module to prevent it overheating.

The control module communicates with other systems on the vehicle over the medium speed [CAN \(controller area network\)](#) bus.

FFBH Control Module Harness Connector C0925

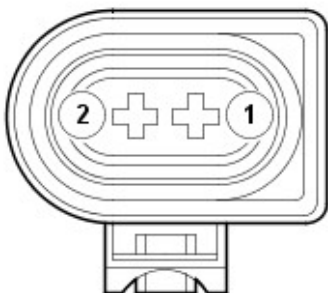


E50045

FFBH Control Module Harness Connector C0925 Pin Details

Pin No.	Description	Input/Output
1	Not used	-
2	WBUS diagnostic (Teleststart signal)	Input/Output
3	Not used	-
4	Medium speed controller area network (CAN) bus low	Input/Output
5	Auxiliary fuel pump power feed	Output
6	Not used	-
7	Medium speed CAN bus high	Input/Output
8	Not used	-

FFBH Control Module Harness Connector C0926



E50046

FFBH Control Module Harness Connector C0926 Pin Details

Pin No.	Description	Input/Output
1	Permanent battery power supply	Input

2	Ground	Output
---	--------	--------

Changeover Valve

The changeover valve is a normally open solenoid valve installed between the supply and return sides of the heater coolant circuit. When de-energized, the changeover valve connects the heater coolant circuit to the engine coolant circuit. When energized, the changeover valve isolates the heater coolant circuit from the engine coolant circuit.

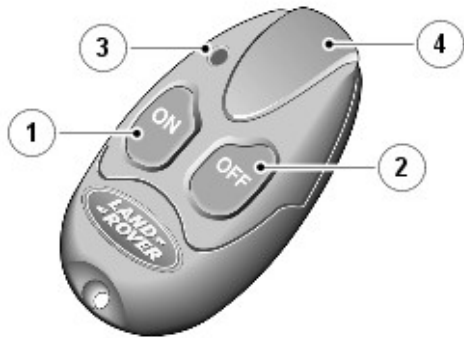
The changeover valve is controlled by a power feed from the [ATC \(automatic temperature control\)](#) module.

FFBH Receiver

The FFBH receiver translates the FFBH request radio signals, relayed from the [TV \(television\)](#) antenna amplifier, into a voltage output to the FFBH unit. When a request for parked heating is received, the FFBH receiver outputs a battery power feed to the FFBH unit. When a request to switch off parked heating is received, the FFBH receiver disconnects the power feed.

The FFBH receiver has a permanent power feed from the [BJB \(battery junction box\)](#) and is connected to the [TV](#) antenna amplifier by a coaxial cable.

FFBH Remote Handset



E103416

Item	Description
1	On button
2	Off button
3	LED (light emitting diode)
4	Antenna

The FFBH remote handset allows parked heating to be remotely controlled up to a minimum of 100 m (328 ft) from the vehicle. 'On' and 'off' buttons activate and de-activate parked heating.

An [LED](#):

- Flashes green when parked heating is active.
- Flashes red after a start selection, if communication has not been established with the vehicle.
- Flashes orange when the remote handset battery needs replacing.

The FFBH remote handset is powered by a 3.3 V CR1/3N battery located under a cover on the rear of the handset.

Remote Handset Pairing:

Each remote handset must be 'paired' to the receiver to enable communications. Each handset has a unique identification number which is stored by the receiver. The receiver can store up to 3 handset identification numbers. If a fourth handset is paired to the receiver, the receiver will replace the first paired handset number with that for the fourth handset in the receiver memory. Subsequently, the first paired handset will no longer be paired and will not be recognized by the receiver.

The following procedure details the pairing process:



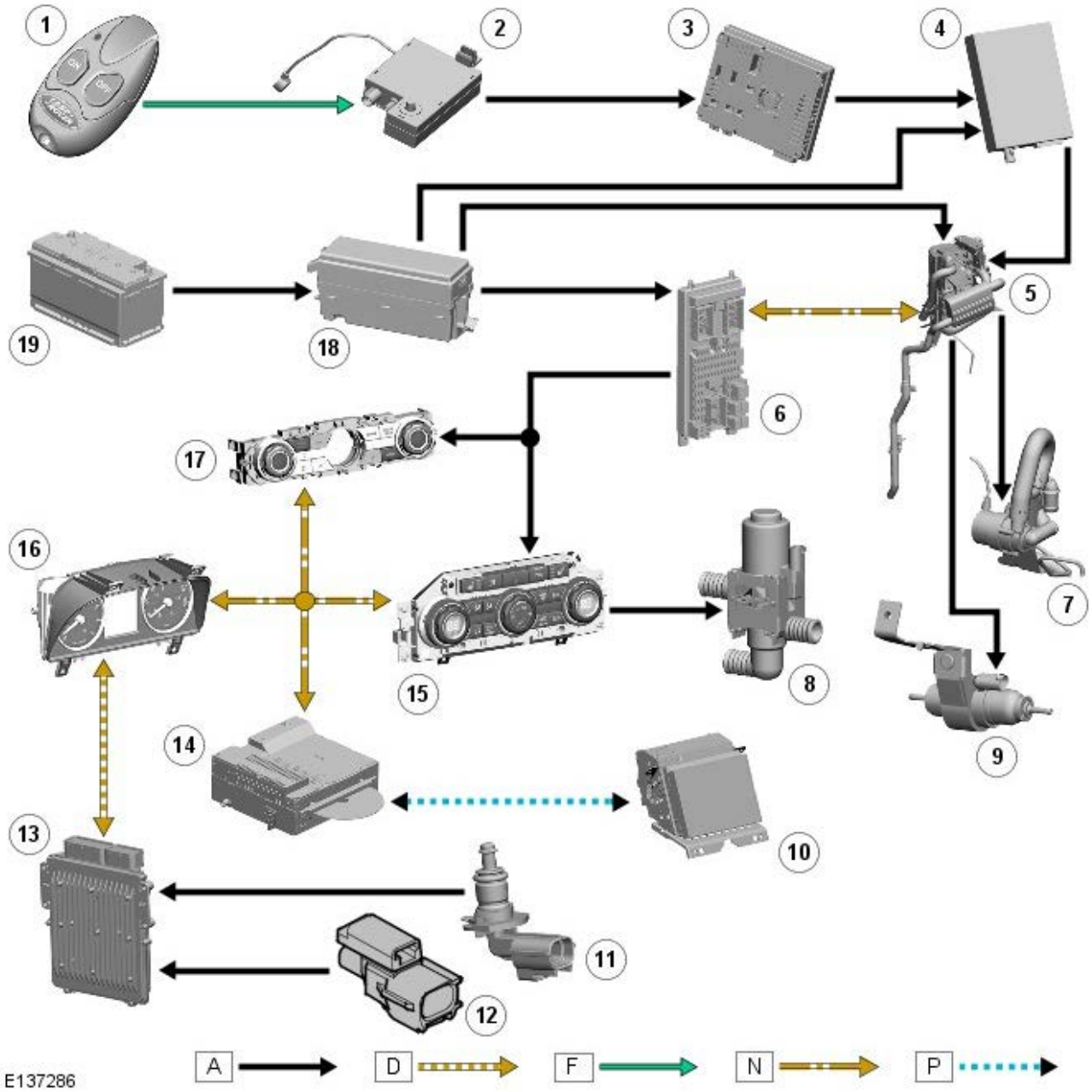
NOTE: The pairing process relies on the FFBH receiver having the power supply removed and then the power supply re-instated. The fuse method is the easiest method but it can also be achieved by battery disconnection or removal of the harness connector from the receiver unit.

- Remove mini-fuse F2 5A (telestart fuse) from the [BJB](#)
- Wait for a minimum of 5 seconds
- Replace fuse to position F2 5A in the [BJB](#)
- Within 5 seconds of replacing the fuse (and restoring the receiver power supply), press and hold the remote handset OFF button
- Confirmation of successful pairing is displayed by the remote handset [LED](#) illuminating in a red color for 2 seconds.

CONTROL DIAGRAM



NOTE: A = Hardwired connections; D = High speed CAN bus; F = RF transmission; N = Medium speed CAN bus; P = MOST bus



E137286

Item	Part Number	Description
1	-	FFBH remote handset
2	-	TV antenna
3	-	TV tuner module
4	-	FFBH receiver
5	-	FFBH
6	-	CJB (central junction box)
7	-	FFBH coolant circulation pump
8	-	Changeover valve (if fitted)
9	-	FFBH fuel pump
10	-	Touch screen display
11	-	ECT (engine coolant temperature) sensor
12	-	Ambient air temperature sensor
13	-	ECM (engine control module)
14	-	IAM (integrated audio module)
15	-	ATC module
16	-	Instrument cluster
17	-	Integrated control panel
18	-	BJB
19	-	Battery

OPERATION

The FFBH system operates in two modes:

- Provides additional heating by boosting heater performance while the engine is running.
- If fitted; parked heating heats the passenger compartment or engine while the vehicle is parked with the engine off.

The [ATC](#) module disables FFBH operation if battery voltage is too low, as determined from an ambient air temperature, dependent voltage-map. Where fitted, the battery monitoring system can also disable FFBH operation based on the battery charge state with the engine off.

Parked Heating/Ventilation

Parked heating works in conjunction with parked ventilation. When parked heating/ventilation is selected, the vehicle interior is either heated by parked heating or cooled by parked ventilation, depending on the ambient temperature. Parked heating occurs if the ambient temperature is less than 16 °C (61 °F); parked ventilation occurs if the ambient temperature is 16 °C (61 °F) or more.

Parked heating/ventilation is controlled by direct selection on the (TSD) Touch Screen Display. This is achieved by using the TSD to program one or two 'on/off' cycle start-times per day, and one 'on/off' cycle start-time further in the future.

The direct selection and programmed time modes of operation are selected when the engine is stopped and the smart key is in the vehicle. The key can then be removed and the vehicle locked. Any timed event will automatically run without the key inside the vehicle.

In all operating modes, to prevent excessive drain on the battery, parked heating/ventilation is automatically de-activated after:

- 20 minutes in moderate climate conditions, and
- after 30 minutes in climates where the ambient temperature regularly falls below minus 25 °C (minus 13 °F).

Parked ventilation is automatically de-activated when the ignition is switched on.

When programmed start times for parked heating/ventilation are entered on the TSD, the times are stored in the [CJB](#).

If the engine is started while parked heating is on and:

- the engine coolant temperature is equal to or more than the heater coolant temperature, parked heating is switched off.
- the engine coolant temperature is less than the heater coolant temperature, parked heating remains on until the engine coolant temperature reaches the heater coolant temperature. The changeover valve also remains closed until the engine coolant temperature reaches the heater coolant temperature.

Parked heating/ventilation can also be operated by using the FFBH remote handset.

Programmed Parked Heating/Ventilation

At a programmed parked heating/ventilation start time, the [EJB \(engine junction box\)](#) sends a start signal to the [ATC](#) module on the medium speed [CAN](#).

On receipt of the message:

- If the ambient temperature is less than 16 °C (61 °F) and more than -20 °C (-4 °F), the [ATC](#) module initiates parked heating and:
 - Energizes the changeover valve.
 - Sends a [CAN](#) bus message to activate the FFBH.
 - Operates the blower at 47% of the maximum speed.
 - Operates the distribution doors in the heater assembly to direct the air to the footwells for approximately 30 seconds, then to either only the windscreen, or to both the footwells and the windscreen, depending on the ambient air temperature.
 - Flashes the auto blower [LED](#) at 2 Hz.
 - If the ambient temperature is -20 °C (-4 °F) or below, the [ATC](#) module sends a [CAN](#) bus message to activate the FFBH, but leaves the changeover valve de-energized and does not operate the blower or distribution doors. Heated coolant is circulated around the engine and heater core(s) to heat the engine and improve engine starting.
 - Once the FFBH coolant temperature is above a suitable threshold the cabin blower is switched on and cabin heating commenced.
- If the ambient temperature is 16 °C (61 °F) or more, the [ATC](#) module initiates parked ventilation and:
 - Operates the blower at 47% of maximum speed.
 - Operates the distribution doors in the heater assembly to direct the air to the face level outlets.
 - Flashes the [A/C \(air conditioning\)](#) distribution LED at 2 Hz.

After 20 minutes in moderate climate conditions and after 30 minutes in climates where the ambient temperature regularly falls below minus 25 °C (minus 13 °F), the [ATC](#) module stops the parked heating/ventilation:

- If parked heating is active, the [ATC](#) module:
 - Sends a [CAN](#) bus message to de-activate the FFBH.
 - Switches off the blower.
 - Returns the distribution doors to the previous settings.
 - After 3 minutes, de-energizes the changeover valve.
- If parked ventilation is active, the [ATC](#) module:
 - Switches off the blower.
 - Returns the distribution doors to the previous settings.

Remotely Selected Parked Heating/Ventilation

When parked heating/ventilation is selected 'on' with the remote handset, the request is received by the FFBH receiver via the TV antenna and TV antenna amplifier. The FFBH receiver relays the request as a hardwired signal to the FFBH control module. On receipt of the request, the FFBH control module sends the request to the ATC module on the CAN bus. The ATC module then determines if parked heating or ventilation is required.

Operation of the FFBH is controlled by a status message from the automatic temperature control (ATC) module to the control module. A similar status message, from the control module to the ATC module, advises the ATC module of the current operating status of the FFBH.

While the engine is running, if the ambient air temperature is less than 9 °C (48 °F) and the engine coolant temperature (ECT) is less than 75 °C (167 °F) the ATC module changes the status message from 'heater off' to 'supplemental heat'. The control module then changes the status message it sends the ATC module to 'supplemental heat' and starts the FFBH. The control module will not start the FFBH, or will discontinue operation, if any of the following occur:

- The control module is in the error lockout mode (see Diagnostics, below).
- A crash message is received from the restraints control module (RCM).
For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B, Description and Operation).
- A low fuel level message is received from the instrument cluster.
For additional information, refer to: Information and Message Center (413-08, Description and Operation).
- The engine is not running, or stops running for approximately 4 seconds. The time delay is included for stall protection.

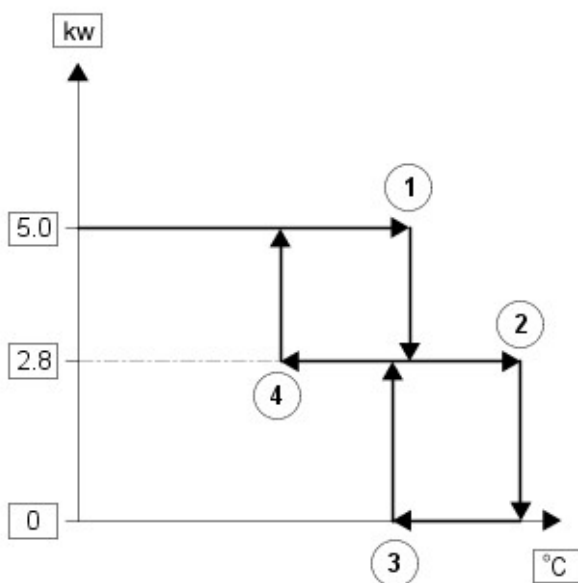
If the control module does not start the FFBH, or discontinues operation, the status message to the ATC module remains at, or changes to, 'heater off'. If the ambient air temperature increases to 9 °C (48 °F), or the ECT increases to 75 °C (167 °F), the ATC module cancels supplementary heating, by changing the status message to the control module back to 'heater off'. The control module then cancels FFBH operation and changes the status message to the ATC module to 'heater off'.

The FFBH is controlled at one of two heat output levels, 2.8 kW at part load combustion and 5 kW at full load combustion. The control module transmits the FFBH coolant temperature to the ATC module.

Start Sequence: At the beginning of a start sequence, the control module energizes the glow pin function of the glow pin and flame sensor, to pre heat the combustion chamber, starts the combustion air fan at slow speed and energizes the coolant circulation pump. After approximately 30 seconds, the control module energizes the auxiliary fuel pump at the starting sequence speed. The fuel delivered by the auxiliary fuel pump evaporates in the combustion chamber, mixes with air from the combustion air fan and is ignited by the glow pin and flame sensor. The control module then progressively increases the speed of the auxiliary fuel pump and the combustion air fan. Once combustion is established the control module switches the glow pin and flame sensor from the glow pin function to the flame sensing function to monitor combustion. From the beginning of the start sequence to stable combustion at full load takes approximately 240 seconds.

Coolant Temperature Control: While the FFBH is running, the control module cycles the FFBH between full load combustion, part load combustion and a control idle phase of operation, depending on the temperature of the coolant in the heat exchanger.

Switching Point Diagram



Switching Point		Temperature, °C (°F)
Figure Item No.	Description	
1	Full load to part load	84 (183)
2	Part load to control idle	88 (190)
3	Control idle to part load	78 (172)
4	Part load to full load	74 (165)

After the start sequence, the control module maintains full load combustion until the coolant temperature reaches switching point temperature 1. At this temperature, the control module decreases the speed of the auxiliary fuel pump and the combustion air fan to half speed, to produce part load combustion. The control module maintains part load combustion while the coolant temperature remains between switching point temperatures 2 and 4. At part load combustion the temperature of the coolant will increase or decrease depending on the amount of heat required to heat the vehicle interior. If the coolant temperature decreases to switching point temperature 4, the control module increases the speed of the auxiliary fuel pump and the combustion air fan to full speed, to return to full load combustion. If the coolant temperature increases to switching point temperature 2, the control module enters a control idle phase of operation.

On entering the control idle phase, the control module immediately switches the auxiliary fuel pump off, to stop combustion, and starts a timer for the combustion air fan. After a 2 minute cool down period, the control module switches the combustion air fan off and then remains in the control idle phase while the coolant temperature remains above switching point temperature 3. If the coolant temperature decreases to switching point temperature 3, the control module initiates a start to part load combustion. A start to part load combustion takes approximately 90 seconds.

In order to limit the build up of carbon deposits on the glow pin and flame sensor, the control module also enters the control idle phase if continuous combustion time exceeds 72 minutes (at part load, full load or a combination of both). After the cool down period, if the coolant is still in the temperature range that requires additional heat, the control module restarts the FFBH.

Shutdown: To stop the FFBH, the control module de-energizes the auxiliary fuel pump to stop combustion, but continues operation of the combustion air fan and the coolant circulation pump for a time, to cool down the FFBH. The cool down time is 100 seconds if the FFBH was operating at part load combustion and 175 seconds if the FFBH was operating at full load combustion.

DIAGNOSTICS

The control module monitors the FFBH system for faults. Any faults detected are stored in a volatile memory in the control module, which can be interrogated by approved diagnostic equipment via the medium speed CAN bus. A maximum of three faults and associated freeze frame data can be stored at any one time. If a further fault is detected, the oldest fault is overwritten by the new fault.

The control module also incorporates an error lockout mode of operation that inhibits operation to prevent serious faults from causing further damage to the system. In the error lockout mode, the control module immediately stops the auxiliary fuel pump, and stops the combustion air fan and coolant circulation pump after a cool down time of approximately 2 minutes. Error lockout occurs for start sequence failures, combustion flameouts, heat exchanger casing overheat and if battery voltage is out of limits. The error lockout mode can be cleared using approved diagnostic equipment.

Start Failure and Flameout: If a start sequence fails to establish combustion, or a flameout occurs after combustion is established, the control module immediately initiates another start sequence. The start failure or flameout is also recorded by an event timer in the control module. The event timer is increased by one after each start failure or flameout, and decreased by one if a subsequent start is successful. If the event timer increases to three (over any number of drive cycles), the control module enters the error lockout mode.

Heat Exchanger Casing Overheat: To protect the system from excessive temperatures, the control module enters the error lockout mode if the heat exchanger coolant temperature exceeds 125 °C (257 °F).

Battery Voltage Limits: 10.25 - 15.5 volts.

Auxiliary Heating - Fuel Fired Booster Heater

Diagnosis and Testing

Principles of Operation

For a detailed description of the fuel fired booster heater system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Auxiliary Heater (412-02 Auxiliary Heating, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Fuel fired booster heater assembly <ul style="list-style-type: none"> - Coolant inlet/outlet - Exhaust - Fuel inlet - Air inlet • Auxiliary fuel pump and lines • Auxiliary coolant pump 	<ul style="list-style-type: none"> • Fuses • Harnesses • Electrical connector(s) • Control module(s)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Fuel Fired Booster Heater Control Module (FFBH) (100-00, Description and Operation).

Auxiliary Heating - Fuel Fired Booster Heater TDV6 2.7L Diesel

Removal and Installation

Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

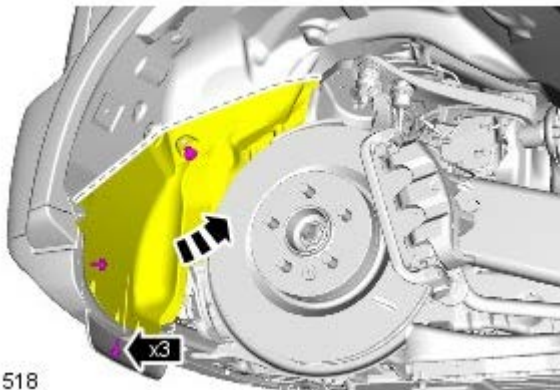
1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3.  **NOTE:** Wheel shown removed for clarity.

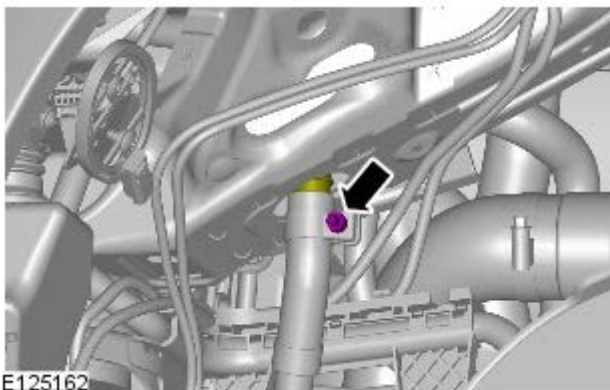
Carefully release the wheel arch liner, to allow access to the fuel fired burner heater (FFBH) exhaust clamp retaining bolt.




E131518

4.  **NOTE:** Components removed for clarity.

Release the exhaust clamp.

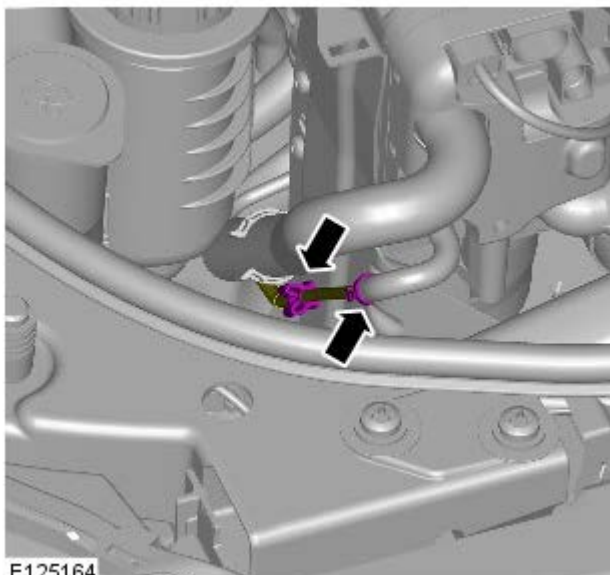


E125162

5.  **CAUTION:** Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Disconnect the fuel fired booster heater fuel line.

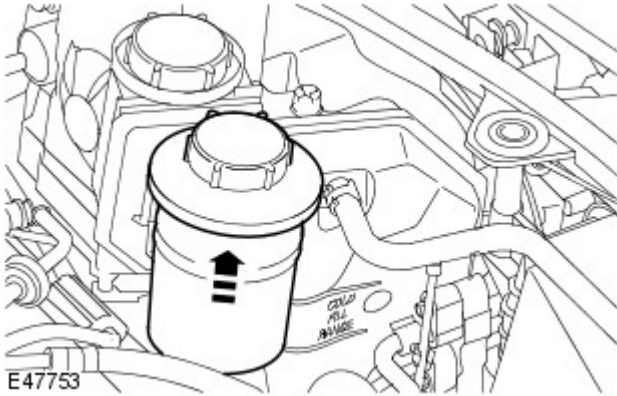
- Release the clip.



E125164

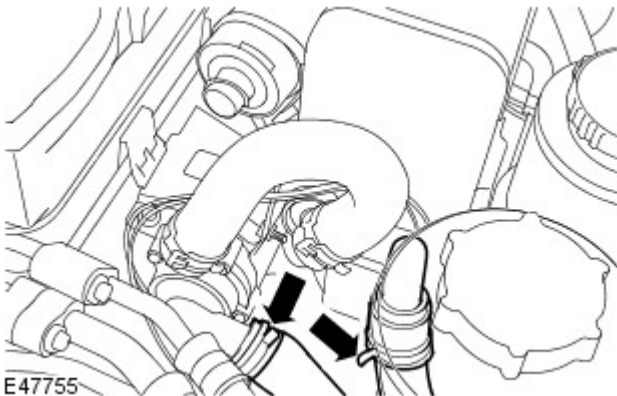
6. Lower the vehicle.

7. Release the power steering fluid reservoir.



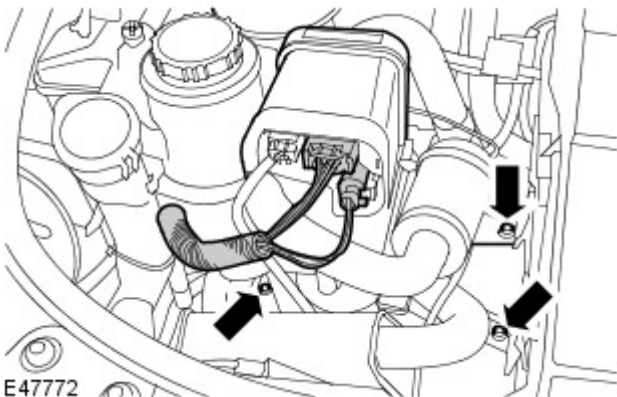
8. Disconnect the fuel fired booster heater inlet and outlet coolant hoses.

- Clamp the hoses to minimise coolant loss.
- Release the 2 clips.



9. Remove the fuel fired booster heater.

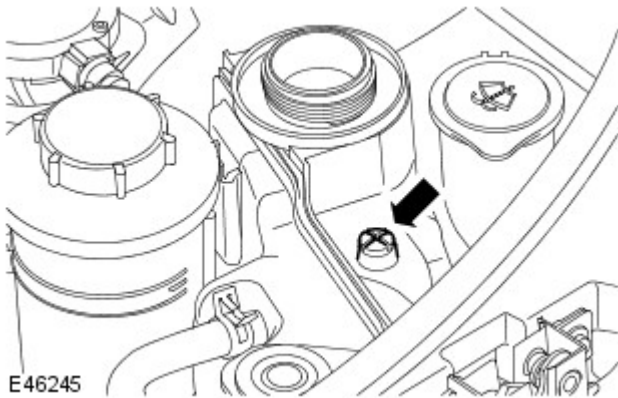
- Disconnect the 2 electrical connectors.
- Remove the 3 bolts.
- Release the fuel pipe from the clip.



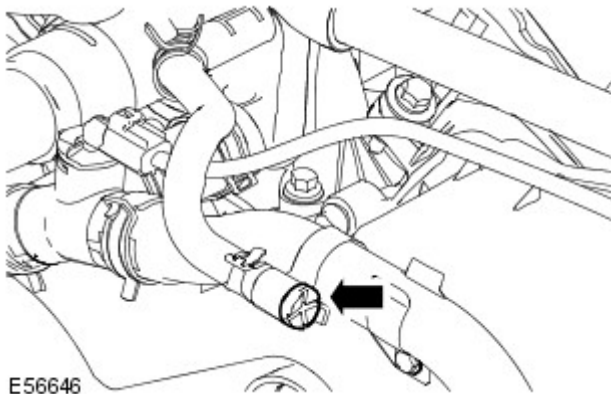
Installation


1. Install the fuel fired booster heater.
 - Tighten the bolts to 10 Nm (7 lb.ft).
 - Connect the electrical connectors.
 - Secure the fuel pipe in the clip.
2. Connect the fuel fired booster heater coolant hoses.
 - Secure with the clips.
 - Remove the clamps.
3. Connect the fuel fired booster heater fuel hose.
 - Secure with the clip.
4. Raise the vehicle.
5. Tighten the exhaust clamp.
 - Tighten to 10 Nm (7 lb.ft).
6. Secure the wheel arch liner.
 - Install the two retaining screws.
 - Install the clip.

7. Lower the vehicle.
8. Install the power steering fluid reservoir.
9. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
10. Connect exhaust extraction hoses to the tail pipes.
11. Remove the engine cover.
For additional information, refer to: Engine Cover - 2.7L V6 - TdV6 (501-05 Interior Trim and Ornamentation, Removal and Installation).
12. Loosen the coolant expansion tank bleed screw.




13. Loosen the cylinder head bleed hose bleed screw.



14. Refill the cooling system.
15. Tighten the bleed screws to 14 Nm (10 lb.ft).
16. Fill the cooling system, keeping coolant to the upper level mark of the expansion tank, until a steady stream of coolant is seen returning to the tank.
17.  **NOTE:** When the coolant bleed is complete and prior to installing the expansion tank cap, top up the expansion tank to 30mm above the maximum level.

Install the coolant expansion tank cap.

18.  **WARNING:** Release the cooling system pressure by slowly turning the expansion tank cap a quarter of a turn. Cover the expansion tank cap with a thick cloth to prevent the possibility of scalding. Failure to follow this instruction may result in personal injury.

Start and run the engine.

- Hold the engine speed at 3,000 RPM for one minute.
- Return the engine to idle for five minutes.
- Hold the engine speed at 3,000 RPM for one minute.
- Run the engine until the thermostat opens.

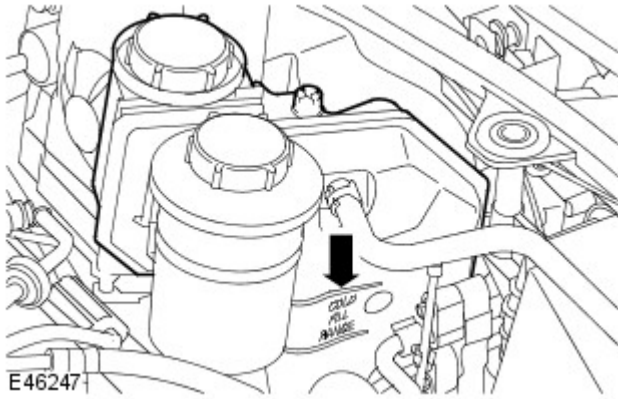
- Remove coolant expansion tank cap, allow float to settle and top-up coolant if required. Install cap.

19. Switch the engine off and allow to cool.

20. Install the engine cover.

For additional information, refer to: Engine Cover - 2.7L V6 - TdV6 (501-05 Interior Trim and Ornamentation, Removal and Installation).

21. Check and top-up the coolant if required.



Auxiliary Heating - Fuel Fired Booster Heater TDV6 3.0L Diesel

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Specifications (414-00, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.


3.  **NOTE:** Wheel shown removed for clarity.

- Carefully release the wheel arch liner, to allow access to the fuel fired burner heater (FFBH) exhaust clamp retaining bolt.

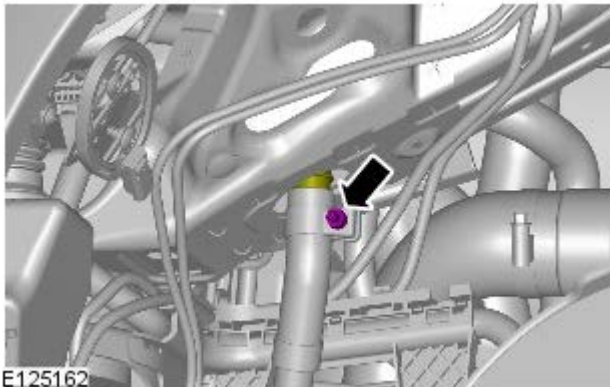


E131518

4.

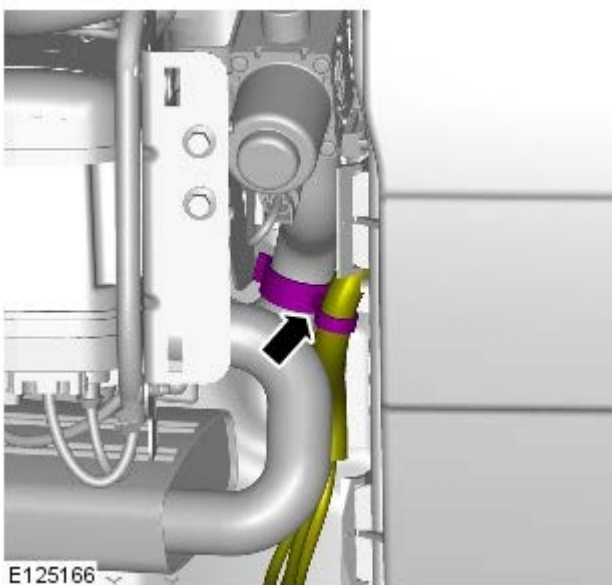
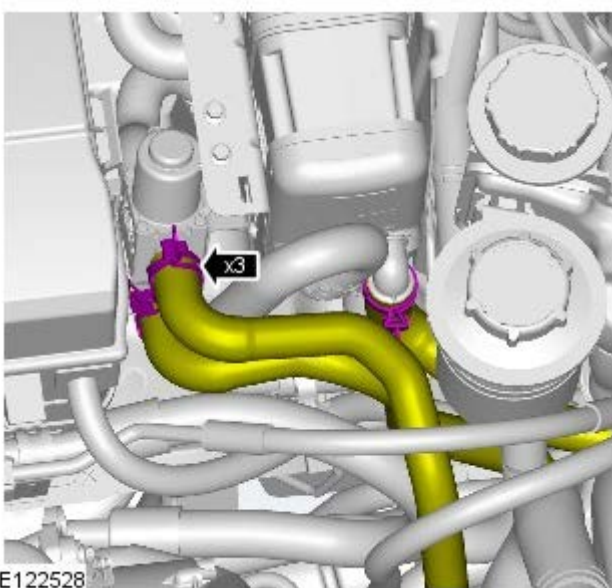
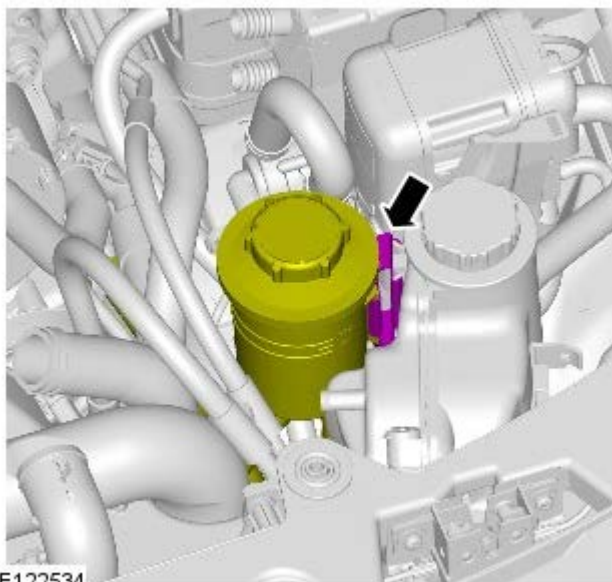
-  **NOTE:** Components removed for clarity.


Torque: 10 Nm



E125162

5.

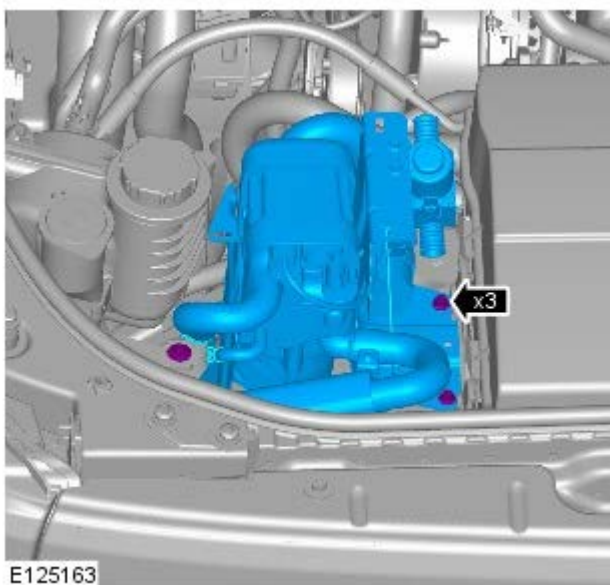
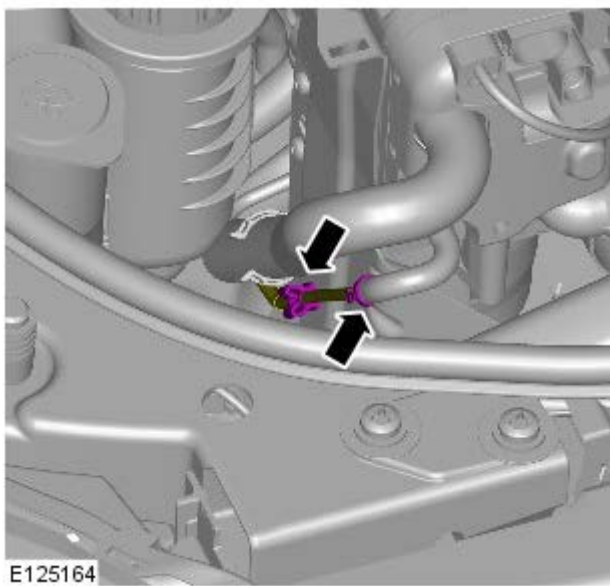
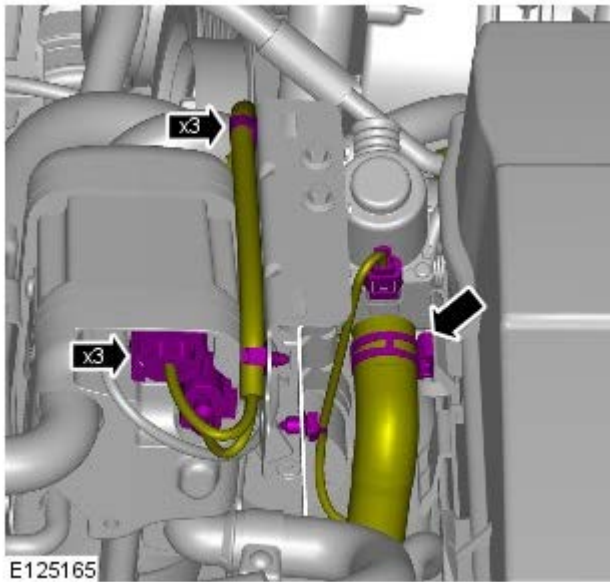



6.  CAUTION: Be prepared to collect escaping coolant.

- Clamp the hoses to minimize coolant loss.

7.

8.



9.  **CAUTION:** Before disconnecting or removing components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

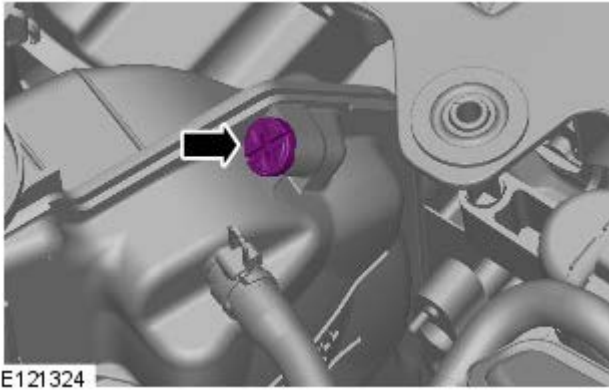
10. *Torque:* 10 Nm

Installation

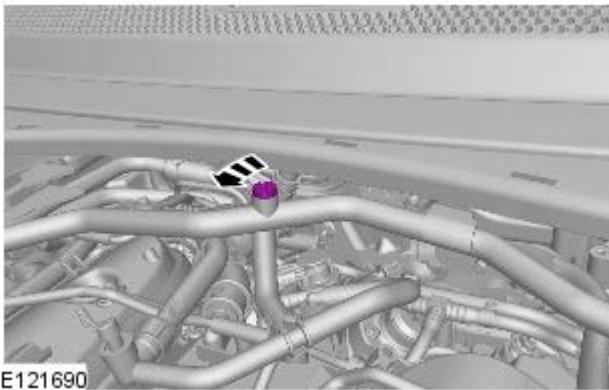
1. To install, reverse the removal procedure.

2. Refer to: Engine Cover - 3.0L V6 - TdV6 (501-05, Removal and Installation).

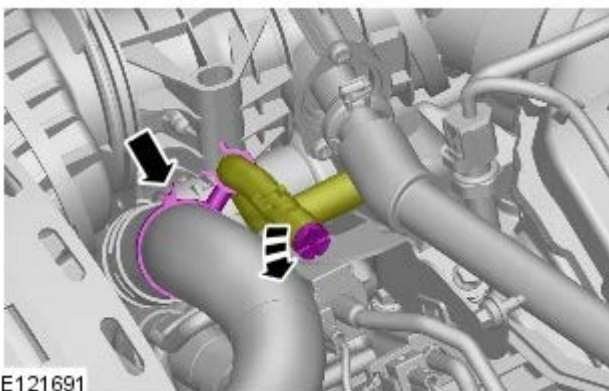
3.




4.



5.

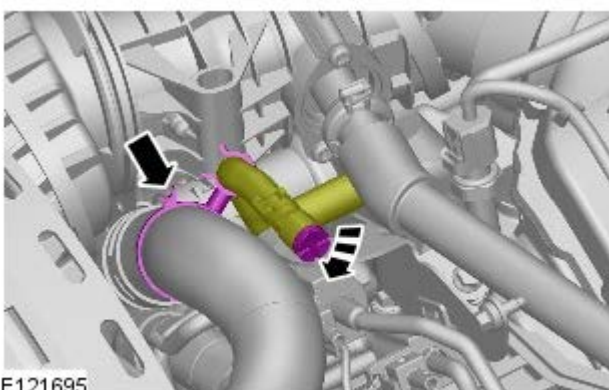



6. CAUTIONS:

 Anti-freeze concentration must be maintained at 50%.

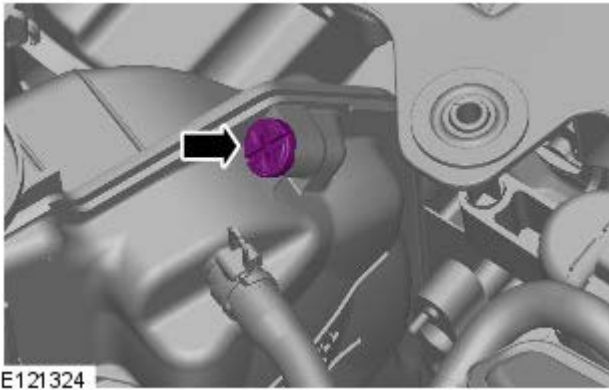
 Be prepared to collect escaping coolant.

Fill the coolant expansion tank until coolant appears through the bleed ports.



7.  CAUTION: Be prepared to collect escaping coolant.

Fill the coolant expansion tank until coolant appears through the bleed ports.



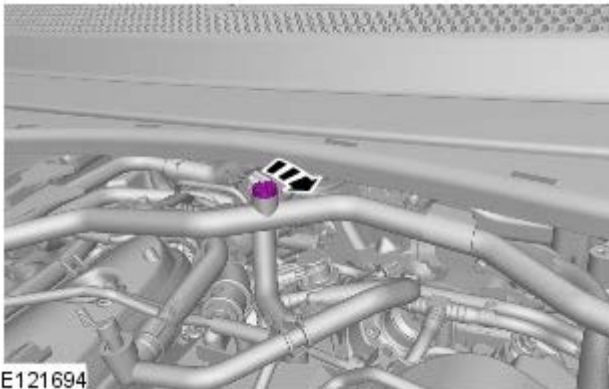
E121324

8.


- Set the heater controls to maximum.

9.

- Start the engine and continue to fill the coolant until the maximum level is reached.



E121694

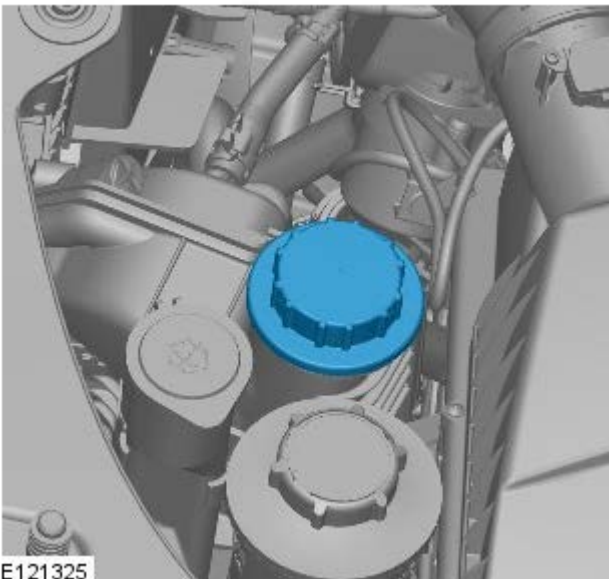
10.  **CAUTION:** Be prepared to collect escaping coolant.

Fill the coolant expansion tank until coolant appears through the bleed ports.


11. Increase engine speed to 2500rpm and cycle between this and idle.

12.

- Continue to top-up with coolant with the engine at idle.




E121325

13.  **CAUTION:** Correct installation of the Coolant expansion tank cap can be obtained by tightening the cap until an audible click is heard.

14. Allow the engine to idle, until hot air is emitted at the face registers.


15. Once the front heater is warm, check if the rear heater is warm (if equipped). If no heat is felt, increase the engine


speed to 3000 rpm for 30 seconds and return to idle.


16.  CAUTION: Switch off the engine and allow the coolant temperature to go cold.
17. Visually check the engine and cooling system for signs of coolant leakage.

18.  WARNING: When releasing the cooling system pressure, cover the coolant expansion tank cap with a thick cloth.

CAUTIONS:

 Since injury such as scalding could be caused by escaping steam or coolant, make sure the vehicle cooling system is cool prior to carrying out this procedure

 Make sure the coolant level remains above the "COLD FILL RANGE" lower level mark.

 NOTE: When the cooling system is warm, the coolant will be approximately 10mm above the upper level mark on the expansion tank with the cap removed.

Check and top-up the coolant if required.

19. Refer to: Engine Cover - 3.0L V6 - TdV6 (501-05, Removal and Installation).

Auxiliary Heating - Fuel Fired Booster Heater Glow Plug And Burner Assembly TDV6 2.7L Diesel

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

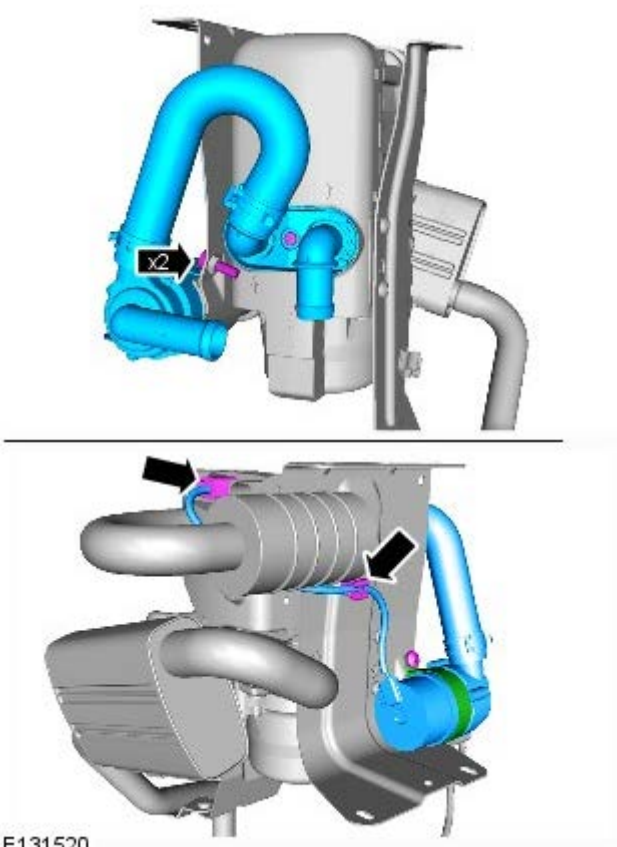
1. Refer to: Specifications (414-00, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

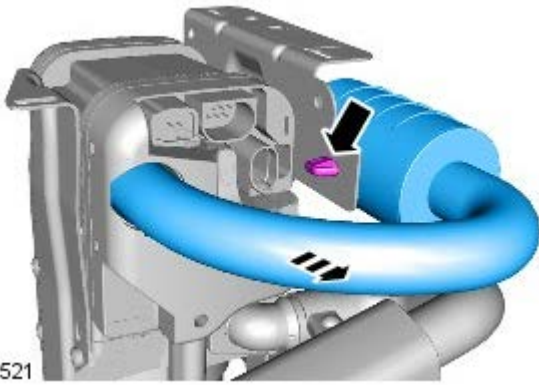
3. Refer to: Fuel Fired Booster Heater (412-02B, Removal and Installation).

4. 7.5 Nm



E131520

5.



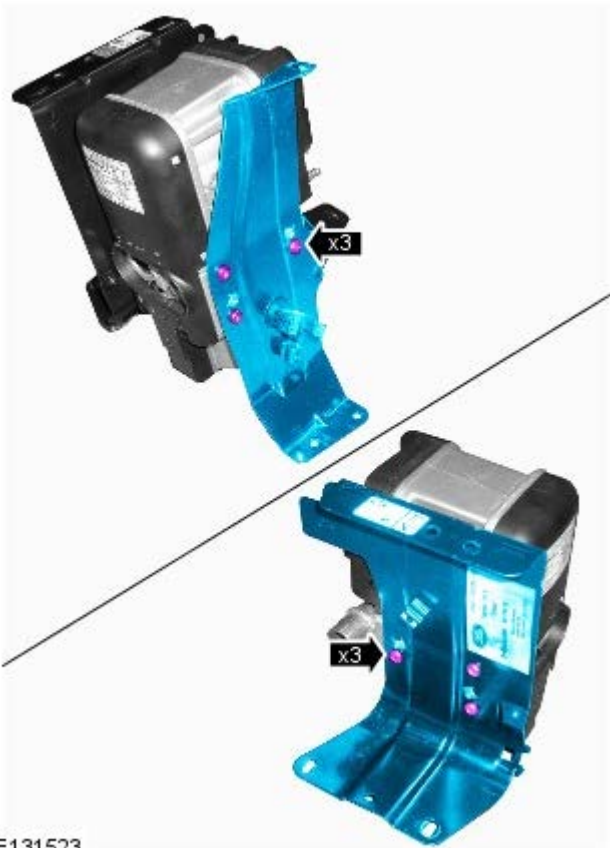
E131521

6. 10 Nm



E131522

7. 10 Nm



E131523

8.



E131524

9.



E131525

10.



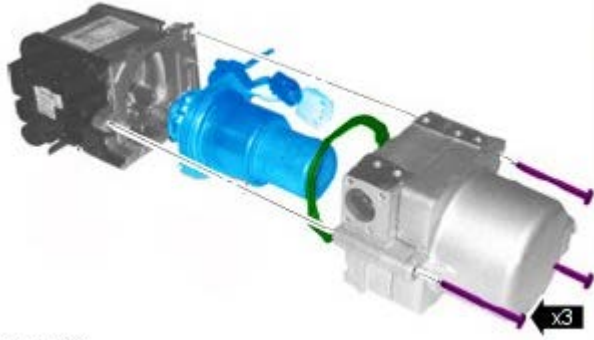
E131526

11.



E131527

12. 7 Nm



E131528

Installation


1. To install, reverse the removal procedure.
2. Refer to: Fuel Fired Booster Heater (412-02B, Removal and Installation).

Auxiliary Heating - Fuel Fired Booster Heater Glow Plug And Burner Assembly TDV6 3.0L Diesel

Removal and Installation

Removal

1. Refer to: Specifications (414-00, Specifications).

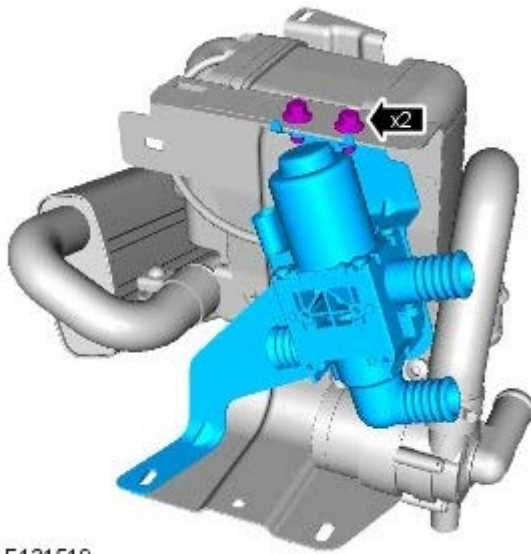
2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3. Refer to: Fuel Fired Booster Heater - 3.0L V6 - TdV6 (412-02B, Removal and Installation).

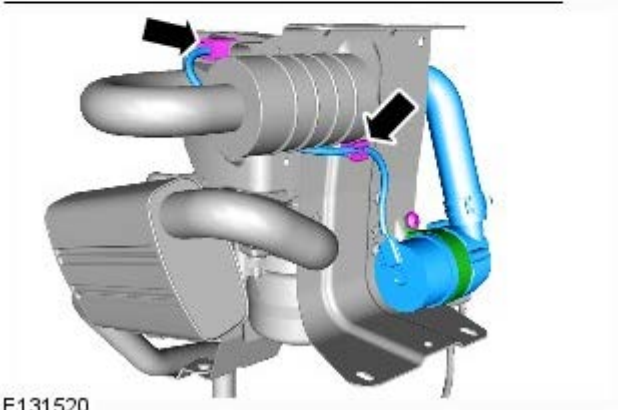
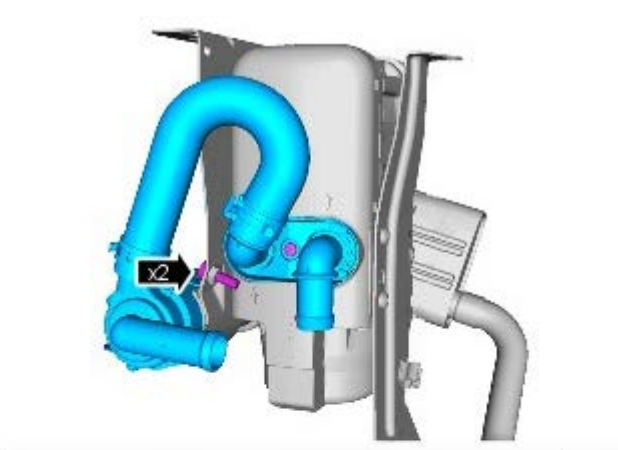
4.  **NOTE:** Where installed.

10 Nm



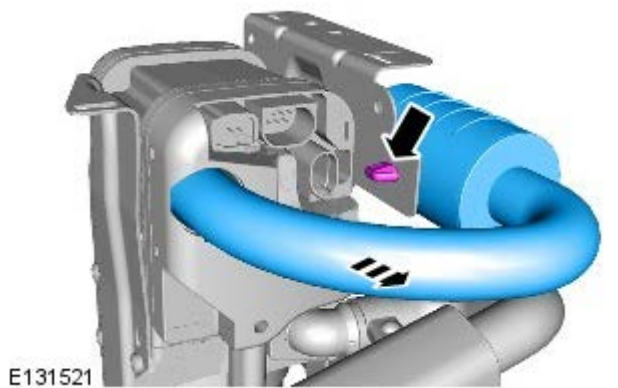
E131519

5. 7.5 Nm



E131520

6.



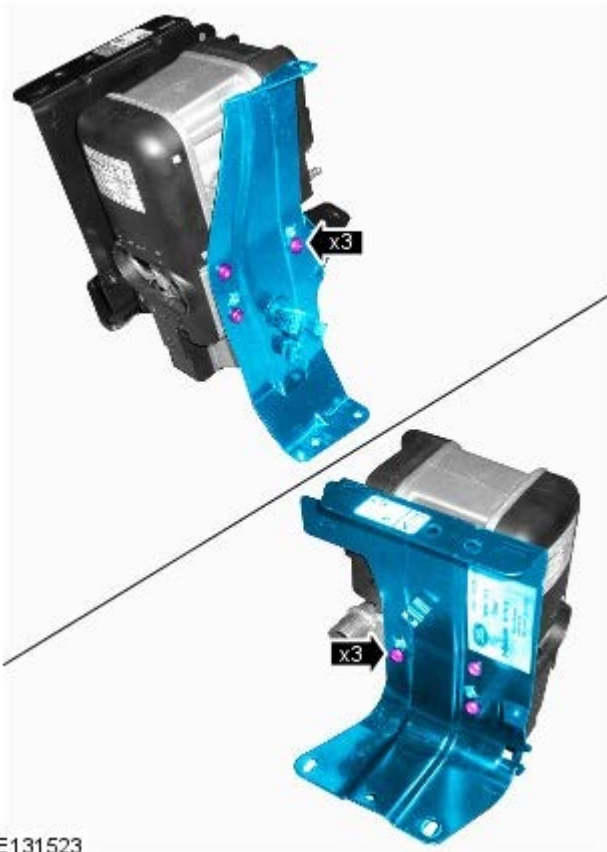
E131521

7. 10 Nm



E131522

8. 10 Nm



E131523

9.



E131524

10.



E131525

11.



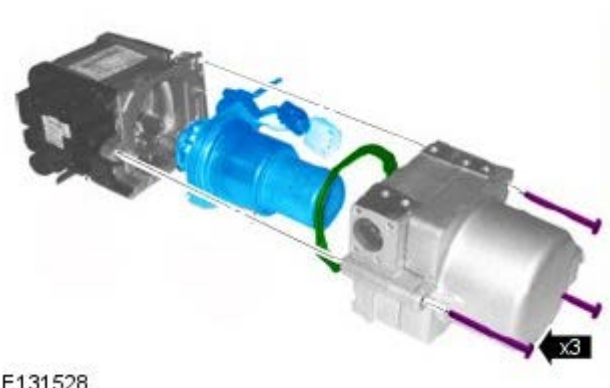
E131526

12.



E131527

13. 7 Nm



E131528

Installation

1. To install, reverse the removal procedure.
2. Refer to: Fuel Fired Booster Heater - 3.0L V6 - TdV6 (412-02B, Removal and Installation).

Auxiliary Heating - Fuel Fired Booster Heater Receiver Unit

Removal and Installation

Removal

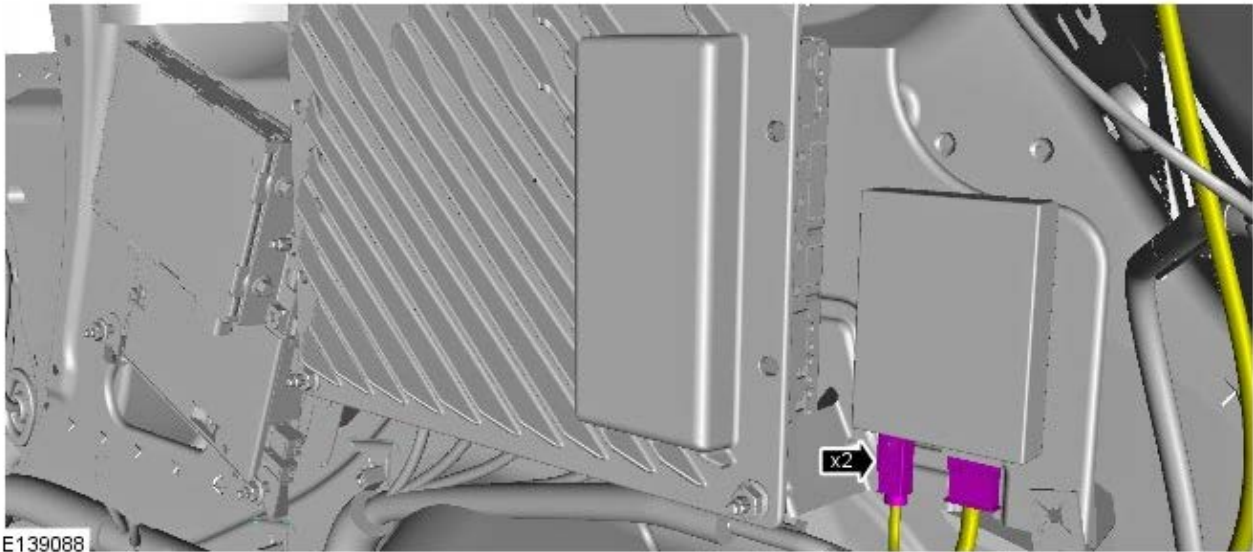


NOTE: Removal steps in this procedure may contain installation details.

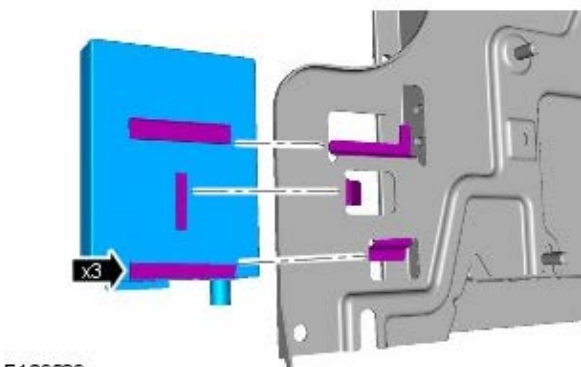
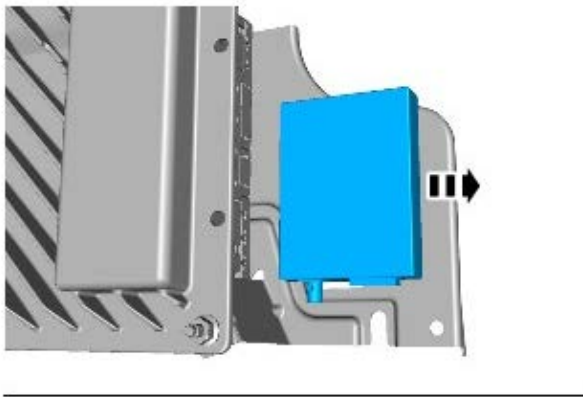
1. NOTE: RH side only.

Refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).

- 2.



- 3.



Installation

1. To install, reverse the removal procedure.

2. Using the diagnostic tool, calibrate the component.

Air Conditioning - TDV6 3.0L Diesel -

Lubricant

Item	Specification
Air conditioning (A/C) compressor oil type	Sanden SPA2 oil
A/C compressor oil - vehicles fitted with 2 zone	80ml
A/C compressor oil - vehicles fitted with 4 zone	130 ml

Refrigerant



NOTE: For NAS vehicles.

Item	Specification
Refrigerant type	R1234yf
Refrigerant - vehicles fitted with 2 zone - vehicles with 3.0 diesel	600 grammes
Refrigerant - vehicles fitted with 2 zone - vehicles with 3.0L/5.0L	650 grammes
Refrigerant - vehicles fitted with 4 zone	900 grammes

Refrigerant



NOTE: For ROW vehicles.

Item	Specification
Refrigerant type	R134A
Refrigerant - vehicles fitted with 2 zone - vehicles with 3.0 diesel	600 grammes
Refrigerant - vehicles fitted with 2 zone - vehicles with 3.0L/5.0L	650 grammes
Refrigerant - vehicles fitted with 4 zone	900 grammes

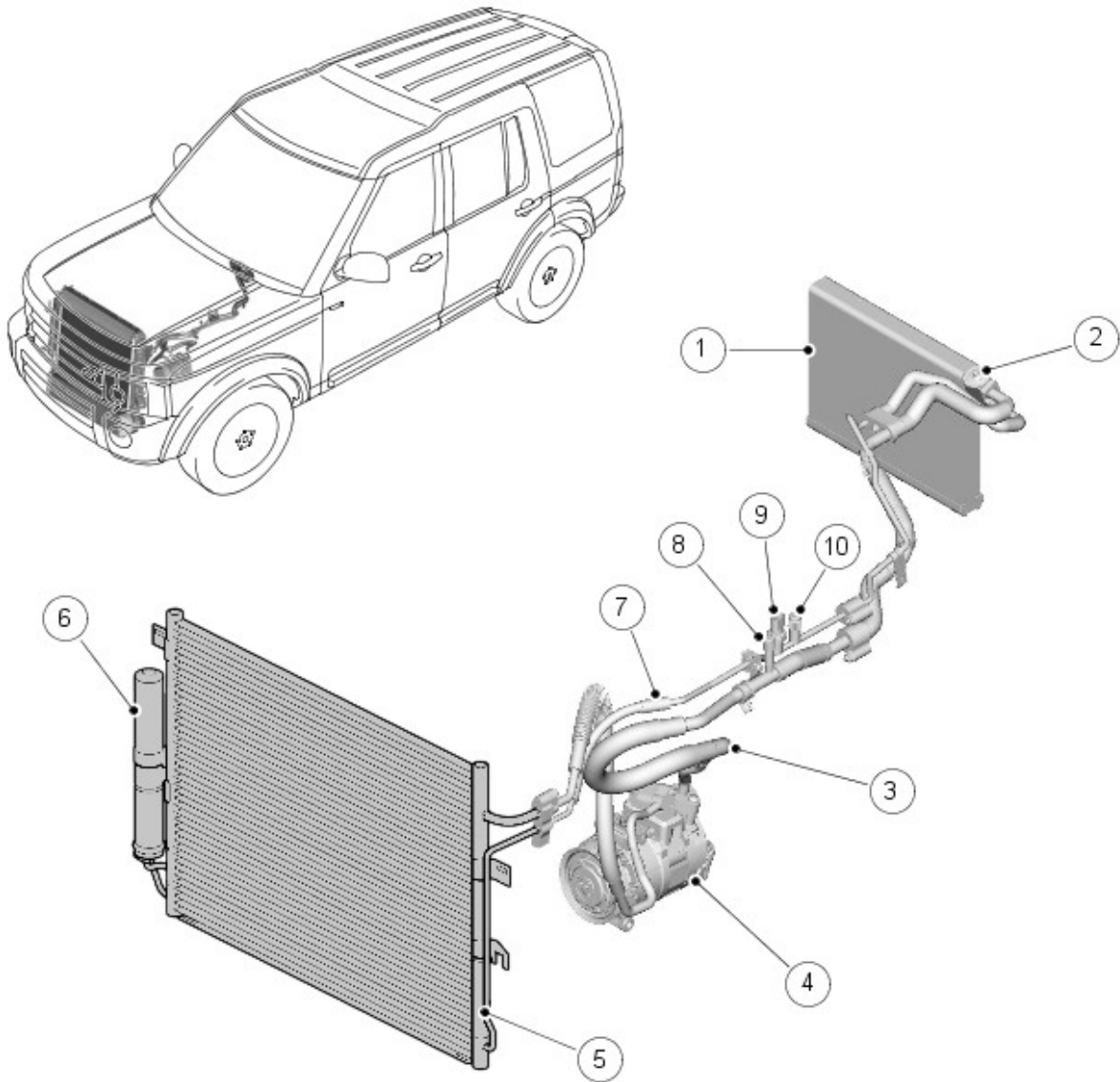
Torque Specifications

Description	Nm	lb-ft	lb-in
A/C compressor bolts	25	18	221
A/C discharge line to compressor bolt	18	13	159
A/C suction line to compressor bolt	18	13	159
A/C suction line bracket bolts	6	4	53
A/C discharge line to condenser bolt	6	4	53
A/C liquid line to condenser bolt	6	4	53
A/C condenser manifold to radiator bolt	10	7	88
Condenser to radiator bolt - vehicles with 5.0L	10	7	88
Condenser to radiator bolt - vehicles with 3.0 diesel	5	4	44
Evaporator line to evaporator core bolt	6	4	53
Evaporator line bracket nut	6	4	53
A/C liquid line to front evaporator line bolt - vehicles fitted with 4 zone	18	13	159
A/C suction line to front evaporator line bolt - vehicles fitted with 4 zone	18	13	159
A/C lines to rear evaporator bolts - vehicles fitted with 4 zone	9	7	80
A/C pressure transducer	10	7	88
Thermostatic expansion valve (TXV) to refrigerant line clamp bolts	5	4	44

Air Conditioning - TDV6 3.0L Diesel - Air Conditioning

Description and Operation

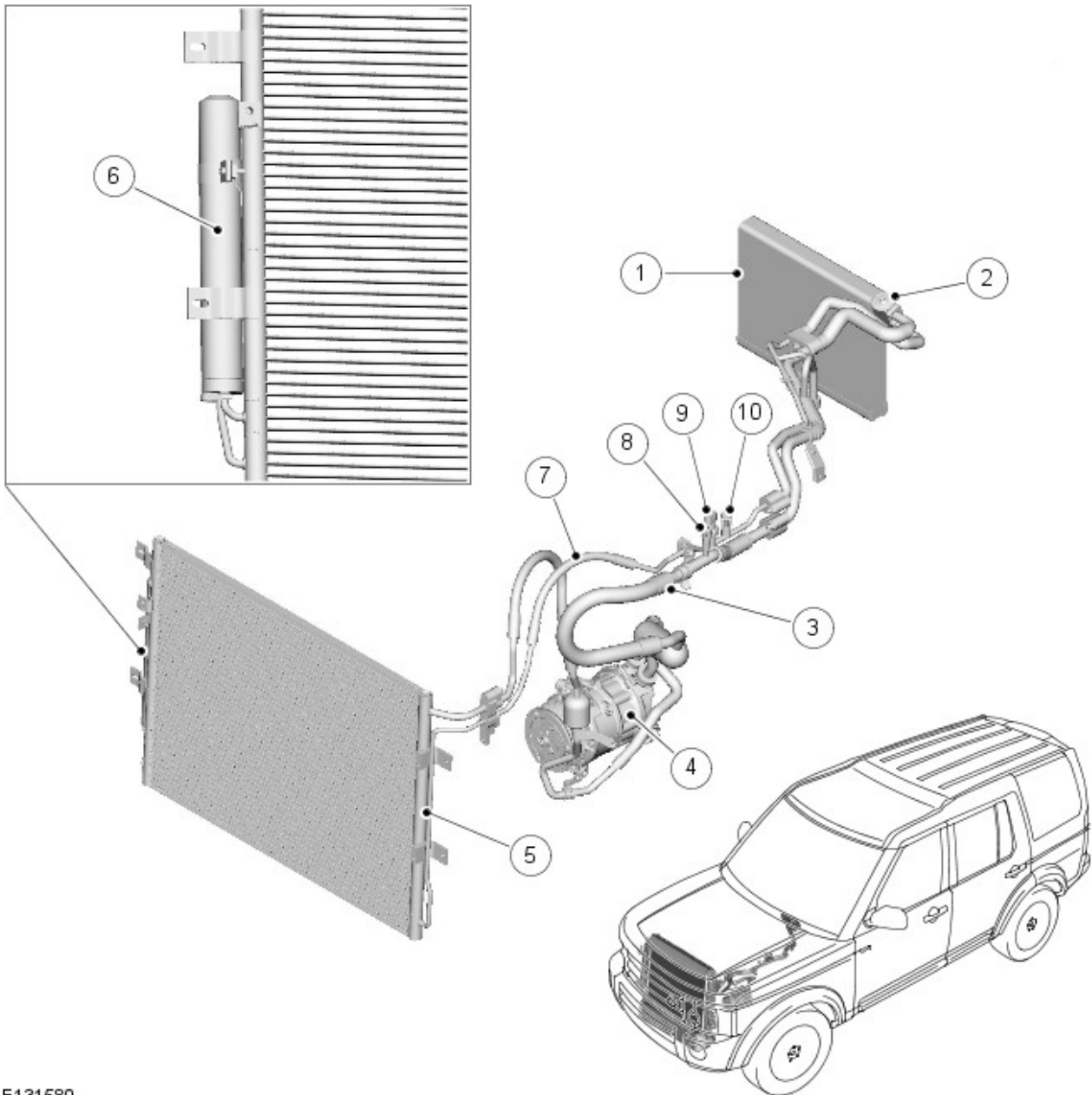
COMPONENT LOCATION 2.7L TdV6



E131578

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	Low pressure line
4	-	air conditioning (A/C) compressor
5	-	Condenser
6	-	Receiver drier
7	-	High pressure line
8	-	Low pressure servicing connection
9	-	Refrigerant pressure sensor (reference)
10	-	High pressure servicing connection

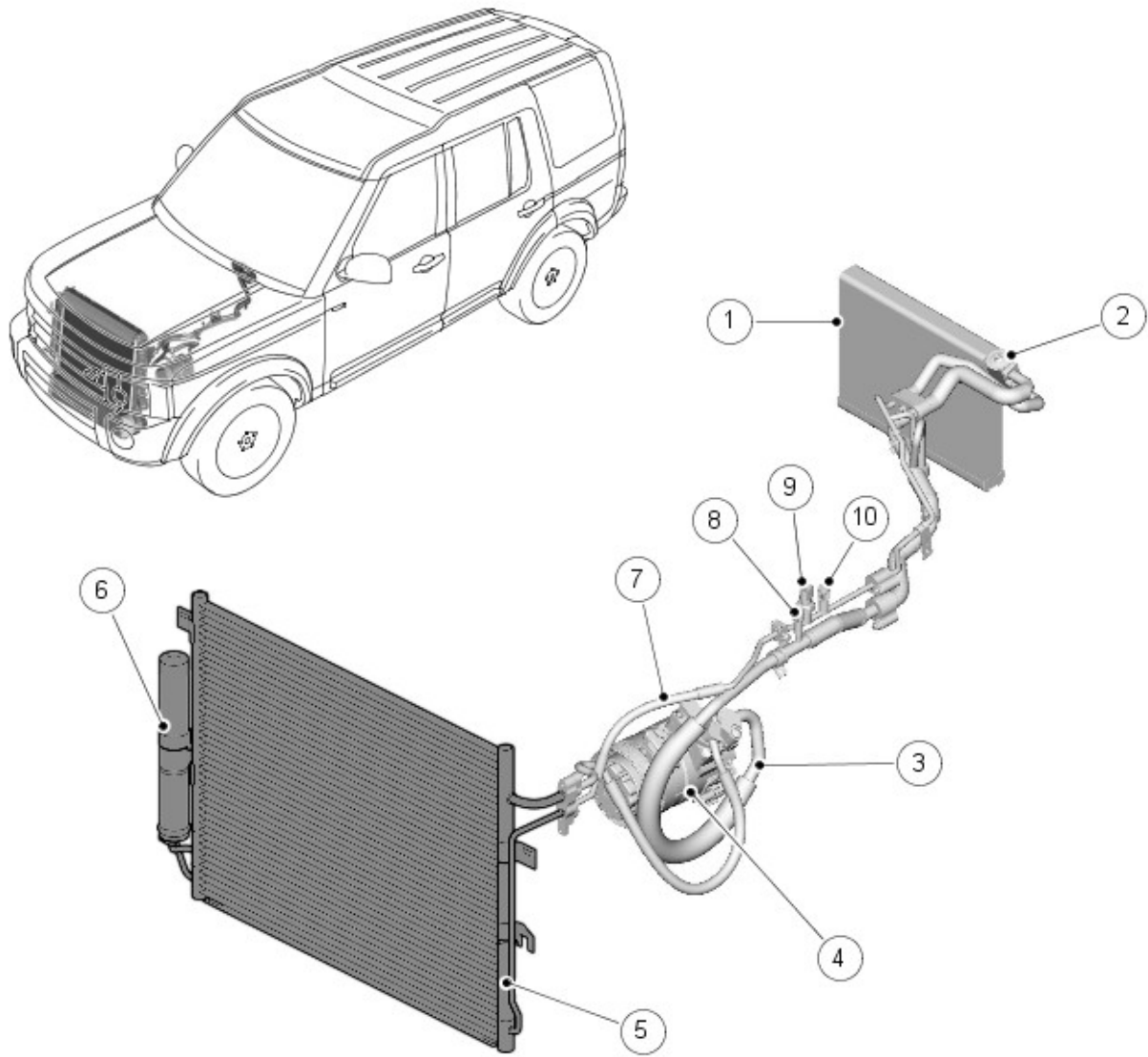
COMPONENT LOCATION 3.0L TdV6



E131580

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	Low pressure line
4	-	A/C compressor
5	-	Condenser
6	-	Receiver drier
7	-	High pressure line
8	-	Low pressure servicing connection
9	-	Refrigerant pressure sensor (reference)
10	-	High pressure servicing connection

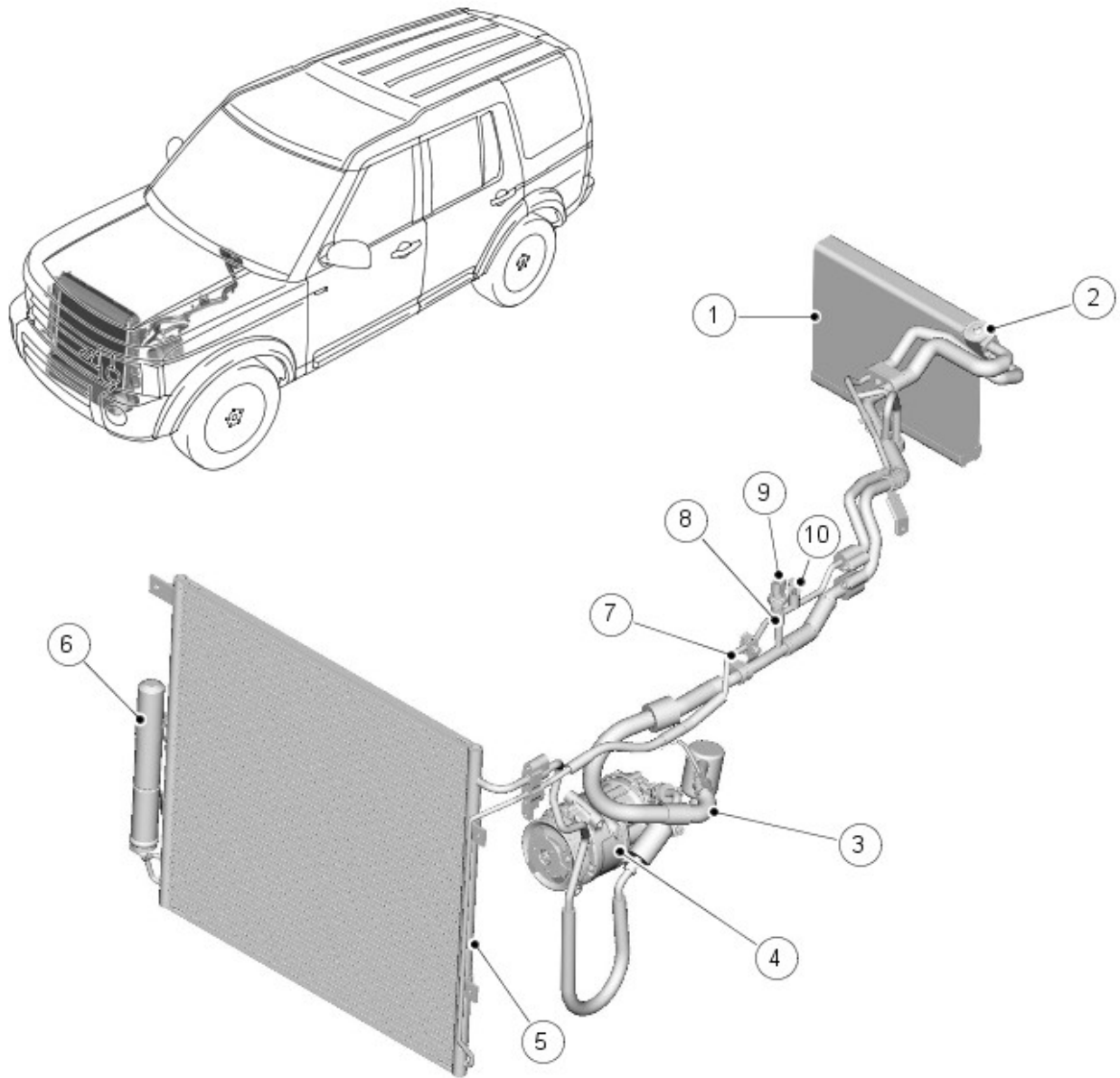
COMPONENT LOCATION 4.0L NA V6



E131582

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	Low pressure line
4	-	A/C compressor
5	-	Condenser
6	-	Receiver drier
7	-	High pressure line
8	-	Low pressure servicing connection
9	-	Refrigerant pressure sensor (reference)
10	-	High pressure servicing connection

COMPONENT LOCATION 5.0L NA V8



E131583

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	Low pressure line
4	-	A/C compressor
5	-	Condenser
6	-	Receiver drier
7	-	High pressure line
8	-	Low pressure servicing connection
9	-	Refrigerant pressure sensor (reference)
10	-	High pressure servicing connection

GENERAL

The A/C system transfers heat from the vehicle interior to the outside atmosphere to provide the heater assembly with dehumidified cool air. The system consists of:

- A compressor.
- A condenser.
- A receiver drier.
- A thermostatic expansion valve.
- An evaporator.
- Low and high pressure refrigerant lines.

The system is a sealed, closed loop, filled with a charge weight of R134a refrigerant as the heat transfer medium. Oil is added to the refrigerant to lubricate the internal components of the compressor.

Operation of the air conditioning system is controlled by the automatic temperature control (ATC) module. The A/C compressor circulates the refrigerant around the system by compressing low pressure, low temperature vapor from the evaporator and discharging the resultant high pressure, high temperature vapor to the condenser.

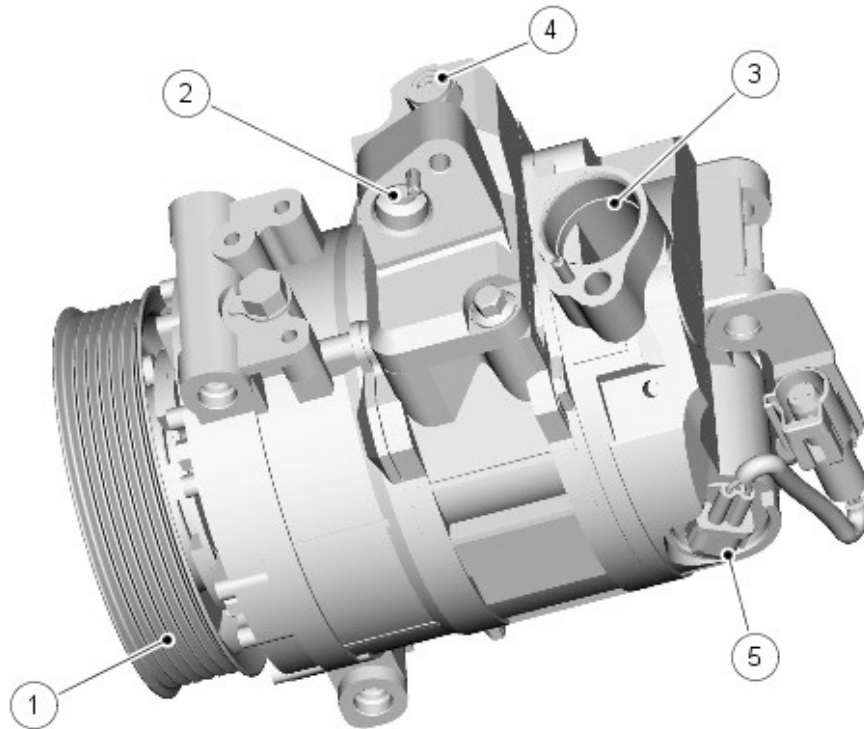
The A/C compressor is a variable displacement unit which is driven by the engine accessory drive belt. On 2.7L/4.0L and 5.0L vehicles, the A/C (air conditioning) compressor is permanently driven directly from the pulley. On 3.0L diesel vehicles the A/C compressor is driven via an electro-magnetic clutch.

To protect the refrigerant system from excessive pressure, a pressure relief valve is installed in the outlet side of the A/C compressor. The pressure relief valve vents excess pressure into the engine compartment.

For additional information, refer to: Control Components (412-04, Description and Operation).

A/C COMPRESSOR

2.7L TdV6



E131577

Item	Part Number	Description
1	-	Pulley
2	-	Outlet port
3	-	Inlet port
4	-	Pressure relief valve
5	-	Electronic control valve connector

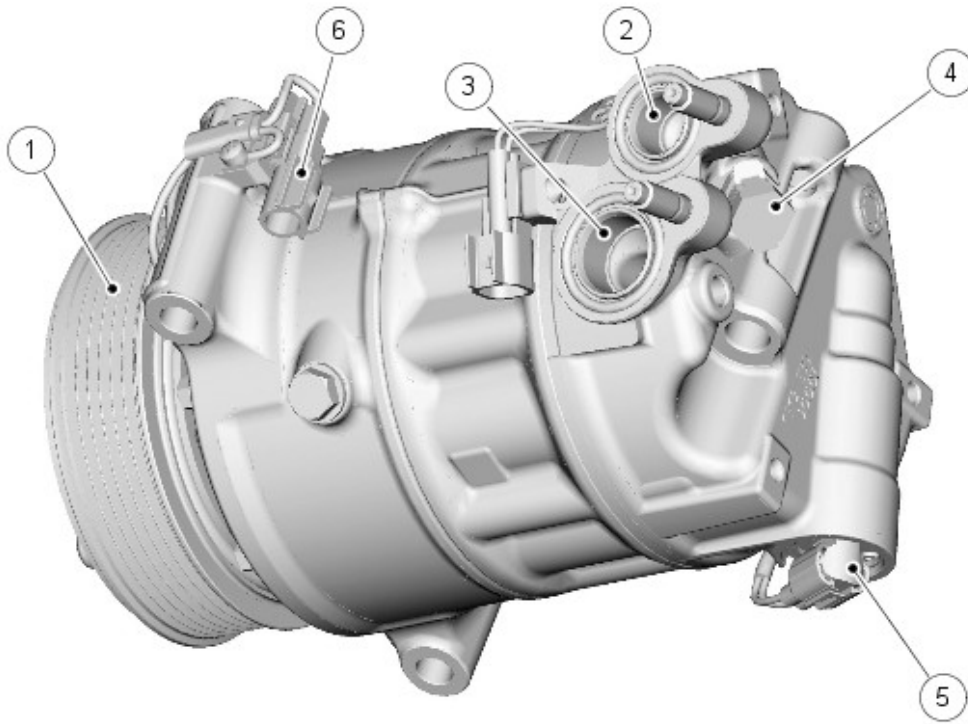
The A/C compressor fitted to 2.7L TdV6 petrol vehicles is a variable displacement unit. The secondary accessory drive belt, driven by the engine crankshaft, drives the A/C compressor via a pulley. Operation of the compressor is controlled by an electronic control valve working in conjunction with the ATC (automatic temperature control) module.

The A/C compressor is a 7 cylinder swash plate unit with a minimum displacement of 1.6 cm³/rev (0.10 in³/rev) and maximum displacement of 171 cm³/rev (10.43 in³/rev). The ATC module automatically adjusts the displacement of the A/C compressor between the minimum and maximum values, to match the thermal load of the evaporator. By matching refrigerant flow and the thermal load of the evaporator, the ATC module maintains cabin comfort whilst also considering fuel economy.

To protect the refrigerant system from unacceptably high pressure, a pressure relief valve is installed in the outlet side of the A/C compressor. The pressure relief valve is set to open at 3.5 to 4.3 MPa (508 to 623 lbf/in²) and vents excess pressure into the engine compartment. The pressure relief valve closes again when the pressure decreases to 3.01 MPa (436 lbf/in²).

The pulley of the A/C compressor incorporates a mechanical torque limiter, which disconnects the drive plate from the compressor shaft if torque increases to a level that indicates imminent compressor seizure.

3.0L TdV6



E131579

Item	Part Number	Description
1	-	Pulley
2	-	Outlet port
3	-	Inlet port
4	-	Pressure relief valve
5	-	Electronic control valve connector
6	-	electromagnetic clutch connector

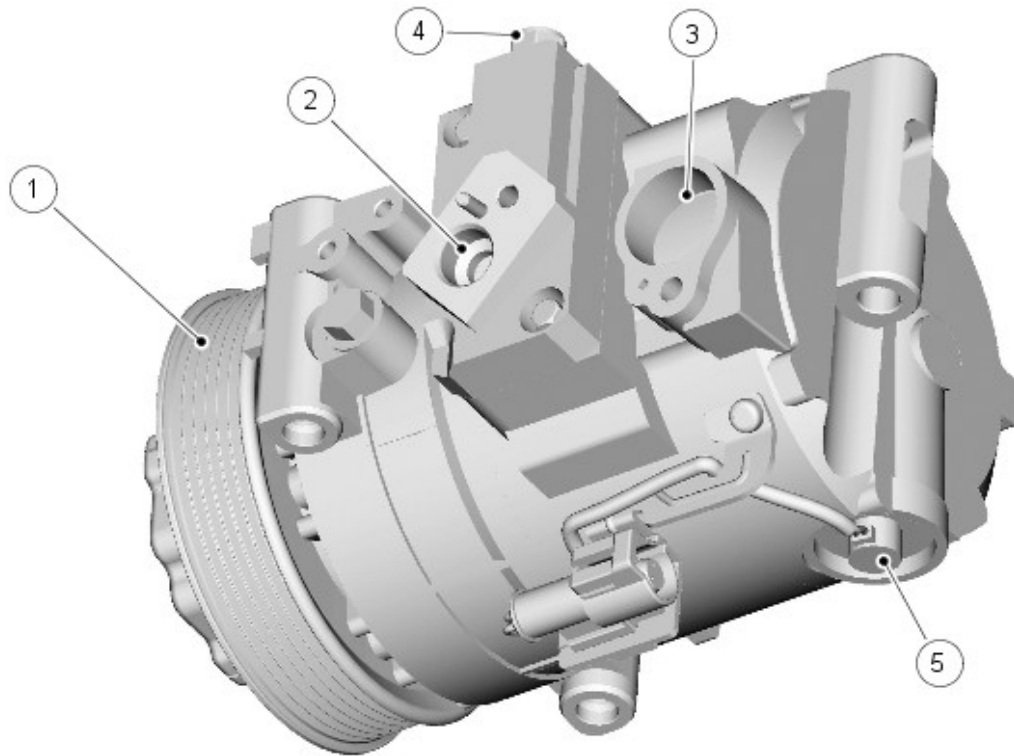
The **A/C** compressor fitted to 3.0L TdV6 diesel vehicles is a variable displacement unit. The secondary accessory drive belt, driven by the engine crankshaft, drives the **A/C** compressor via a pulley and an electromagnetic clutch. Operation of the clutch is controlled by a power feed from the **ATC** module.

The **A/C** compressor is a 7 cylinder swash plate unit with a minimum displacement of 1.6 cm³/rev (0.10 in³/rev) and maximum displacement of 163 cm³/rev (9.95 in³/rev). The **ATC** module automatically adjusts the displacement of the **A/C** compressor between the minimum and maximum values, to match the thermal load of the evaporator. By matching refrigerant flow and the thermal load of the evaporator, the **ATC** module maintains cabin comfort whilst also considering fuel economy.

To protect the refrigerant system from unacceptably high pressure, a pressure relief valve is installed in the outlet side of the **A/C** compressor. The pressure relief valve is set to open at 3.5 to 4.1 MPa (508 to 595 lbf/in²) and vents excess pressure into the engine compartment. The pressure relief valve closes again when the pressure decreases to 3.1 MPa (449 lbf/in²).

The clutch of the **A/C** compressor incorporates a thermal cut-off fuse, which disconnects the power feed from the **ATC** module if the temperature increases to 182 ± 5 °C (360 ± 9 °F).

4.0L NA V6



E131581

Item	Part Number	Description
1	-	Pulley
2	-	Outlet port
3	-	Inlet port
4	-	Pressure relief valve
5	-	Electronic control valve connector

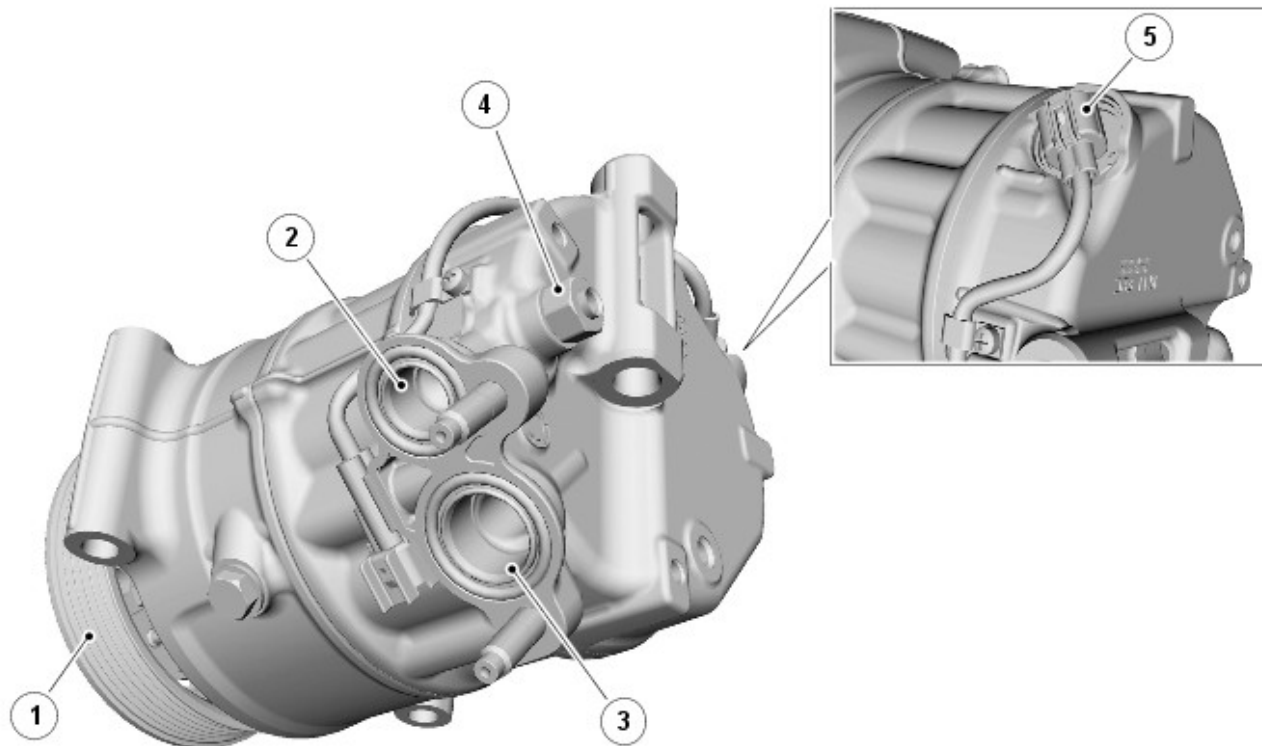
The **A/C** compressor fitted to 4.0L NA V6 petrol vehicles is a variable displacement unit. The secondary accessory drive belt, driven by the engine crankshaft, drives the **A/C** compressor via a pulley. Operation of the compressor is controlled by an electronic control valve working in conjunction with the **ATC** module.

The **A/C** compressor is a 7 cylinder swash plate unit with a minimum displacement of 1.6 cm³/rev (0.10 in³/rev) and maximum displacement of 171 cm³/rev (10.43 in³/rev). The **ATC** module automatically adjusts the displacement of the **A/C** compressor between the minimum and maximum values, to match the thermal load of the evaporator. By matching refrigerant flow and the thermal load of the evaporator, the **ATC** module maintains cabin comfort whilst also considering fuel economy.

To protect the refrigerant system from unacceptably high pressure, a pressure relief valve is installed in the outlet side of the **A/C** compressor. The pressure relief valve is set to open at 3.5 to 4.3 MPa (508 to 623 lbf/in²) and vents excess pressure into the engine compartment. The pressure relief valve closes again when the pressure decreases to 3.01 MPa (437 lbf/in²).

The pulley of the **A/C** compressor incorporates a mechanical torque limiter, which disconnects the drive plate from the compressor shaft if torque increases to a level that indicates imminent compressor seizure.

5.0L NA V8



E131337

Item	Part Number	Description
1	-	Pulley
2	-	Outlet port
3	-	Inlet port
4	-	Pressure relief valve
5	-	Electronic control valve connector

The **A/C** compressor fitted to 5.0L V8 petrol vehicles is a variable displacement unit. The secondary accessory drive belt, driven by the engine crankshaft, drives the **A/C** compressor via a pulley. Operation of the compressor is controlled by an electronic control valve working in conjunction with the **ATC** module.

The **A/C** compressor is a 7 cylinder swash plate unit with a minimum displacement of 1.6 cm³/rev (0.10 in³/rev) and maximum displacement of 163 cm³/rev (9.95 in³/rev). The **ATC** module automatically adjusts the displacement of the **A/C** compressor between the minimum and maximum values, to match the thermal load of the evaporator. By matching refrigerant flow and the thermal load of the evaporator, the **ATC** module maintains cabin comfort whilst also considering fuel economy.

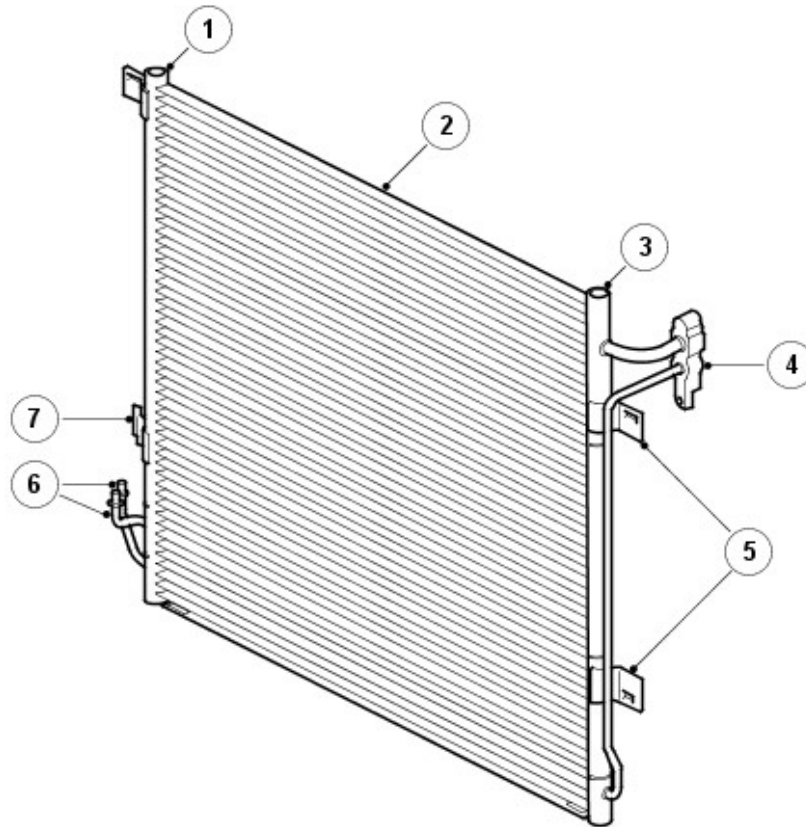
To protect the refrigerant system from unacceptably high pressure, a pressure relief valve is installed in the outlet side of the **A/C** compressor. The pressure relief valve is set to open at 3.5 to 4.1 MPa (508 to 595 lbf/in²) and vents excess pressure into the engine compartment. The pressure relief valve closes again when the pressure decreases to 3.1 MPa (449 lbf/in²).

The pulley of the **A/C** compressor incorporates a mechanical torque limiter, which disconnects the drive plate from the compressor shaft if torque increases to a level that indicates imminent compressor seizure.

CONDENSER



NOTE: 5.0L NA V8 version shown other installations similar



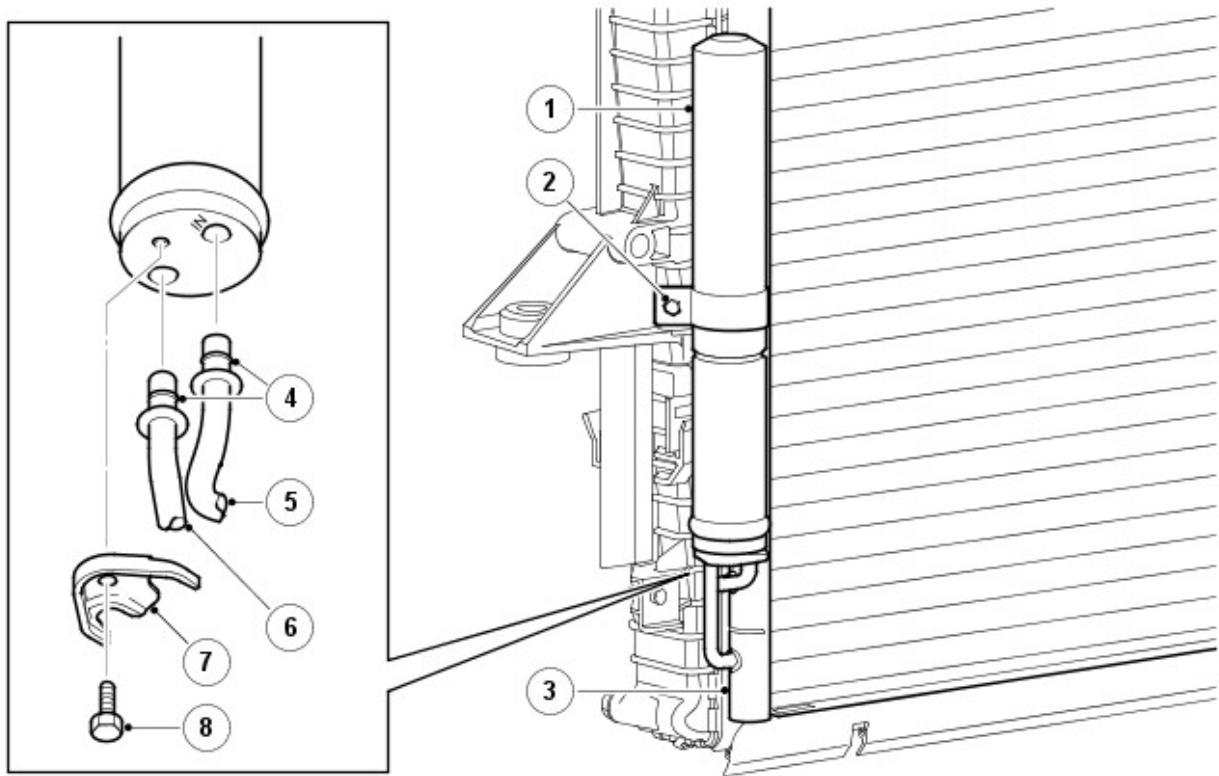
E46920

Item	Part Number	Description
1	-	right-hand (RH) end tank
2	-	Condenser core
3	-	left-hand (LH) end tank
4	-	High pressure line connector block
5	-	Condenser attachment brackets
6	-	Receiver drier pipes
7	-	Receiver drier attachment bracket

The condenser transfers heat from the refrigerant to the surrounding air to convert the high pressure vapor from the compressor into a liquid. The condenser is installed immediately in front of the radiator. Two brackets on each end tank of the condenser attach the condenser to clips on the end tanks of the radiator.

The condenser is classified as a sub-cooling condenser and consists of a fin and tube heat exchanger core installed between two end tanks. Divisions in the end tanks separate the heat exchanger into a four pass upper (condenser) section and a two pass lower (sub-cooler) section. A connector block on the left end tank of the condenser provides connections for the high pressure lines from the A/C compressor and the evaporator. Two pipes at the bottom of the right end tank of the condenser provide connections for the receiver drier.

RECEIVER DRIER



E46921

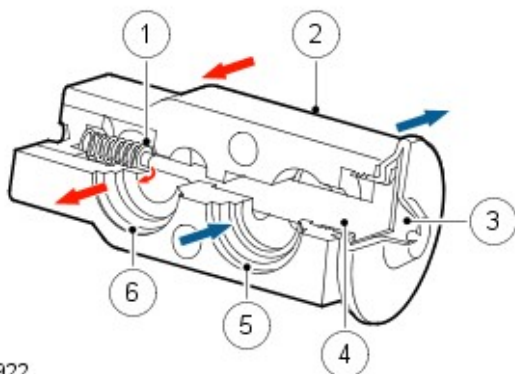
Item	Part Number	Description
1	-	Receiver drier
2	-	Clamp
3	-	Condenser RH end tank
4	-	O-ring seals
5	-	Inlet pipe
6	-	Outlet pipe
7	-	Collar
8	-	Bolt

The receiver drier removes solid impurities and moisture from the refrigerant, and provides a reservoir for liquid refrigerant to accommodate changes of heat load at the evaporator.

The receiver drier is attached to the two stub pipes on the right end tank of the condenser. A collar, located on lands on the stub pipes and secured with a bolt, attaches the stub pipes to the receiver drier. A clamp secures the body of the receiver drier to a bracket welded to the right end tank of the condenser. The inlet and outlet ports of the receiver drier are the same size, so care must be taken to install the receiver drier the correct way round on the stub pipes; to assist with installation, the inlet port is identified with the word IN etched into the receiver drier.

Refrigerant entering the receiver drier passes through a filter and a desiccant pack, then collects in the base of the unit before flowing through the outlet stub pipe back to the condenser. The desiccant and the filter are non-serviceable; the complete unit must be replaced when a change of desiccant is required.

THERMOSTATIC EXPANSION VALVE



E46922

Item	Part Number	Description
1	-	Metering valve
2	-	Housing

- 3 - Diaphragm
- 4 - Temperature sensitive tube
- 5 - Outlet passage from evaporator
- 6 - Inlet passage to evaporator

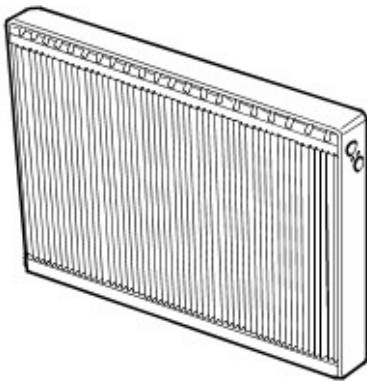
The thermostatic expansion valve meters the flow of refrigerant into the evaporator, to match the refrigerant flow with the heat load of the air passing through the evaporator.

The thermostatic expansion valve is a block type valve located behind the heater assembly, and attached to the inlet and outlet ports of the evaporator. The thermostatic expansion valve consists of an aluminum housing containing inlet and outlet passages. A ball and spring metering valve is installed in the inlet passage and a temperature sensor is installed in the outlet passage. The temperature sensor consists of a temperature sensitive tube connected to a diaphragm. The bottom end of the temperature sensitive tube acts on the ball of the metering valve. Pressure on top of the diaphragm is controlled by evaporator outlet temperature conducted through the temperature sensitive tube. The bottom of the diaphragm senses evaporator outlet pressure.

Liquid refrigerant flows through the metering valve into the evaporator. The restriction across the metering valve reduces the pressure and temperature of the refrigerant. The restriction also changes the liquid stream of refrigerant into a fine spray, to improve the evaporation process. As the refrigerant passes through the evaporator, it absorbs heat from the air flowing through the evaporator. The increase in temperature causes the refrigerant to vaporize and increase in pressure.

The temperature and pressure of the refrigerant leaving the evaporator act on the diaphragm and temperature sensitive tube, which regulate the metering valve opening and so control the volume of refrigerant flowing through the evaporator. The warmer the air flowing through the evaporator, the more heat available to evaporate refrigerant and thus the greater the volume of refrigerant allowed through the metering valve.

EVAPORATOR



E46923

The evaporator is installed in the heater assembly between the blower and the heater matrix, to absorb heat from the exterior or recirculated air. Low pressure, low temperature refrigerant changes from liquid to vapor in the evaporator, absorbing large quantities of heat as it changes state.

Most of the moisture in the air passing through the evaporator condenses into water, which drains out of the heater and through the floorpan, to the underside of the vehicle, through two drain tubes.

REFRIGERANT LINES

To maintain similar flow velocities around the system, the diameter of the refrigerant lines varies to suit the two pressure/temperature regimes. The larger diameters are installed in the low pressure/temperature regime and the smaller diameters are installed in the high pressure/temperature regime.

Low and high pressure charging connections are incorporated into the refrigerant lines for system servicing. Where auxiliary A/C is installed, connections for the auxiliary refrigerant lines are incorporated near the engine bulkhead.

Under normal operating conditions, the smaller diameter pipes (A/C compressor discharge, liquid refrigerant) are hot to the touch and the larger diameter pipes (A/C compressor suction, gaseous refrigerant) are cold to the touch.

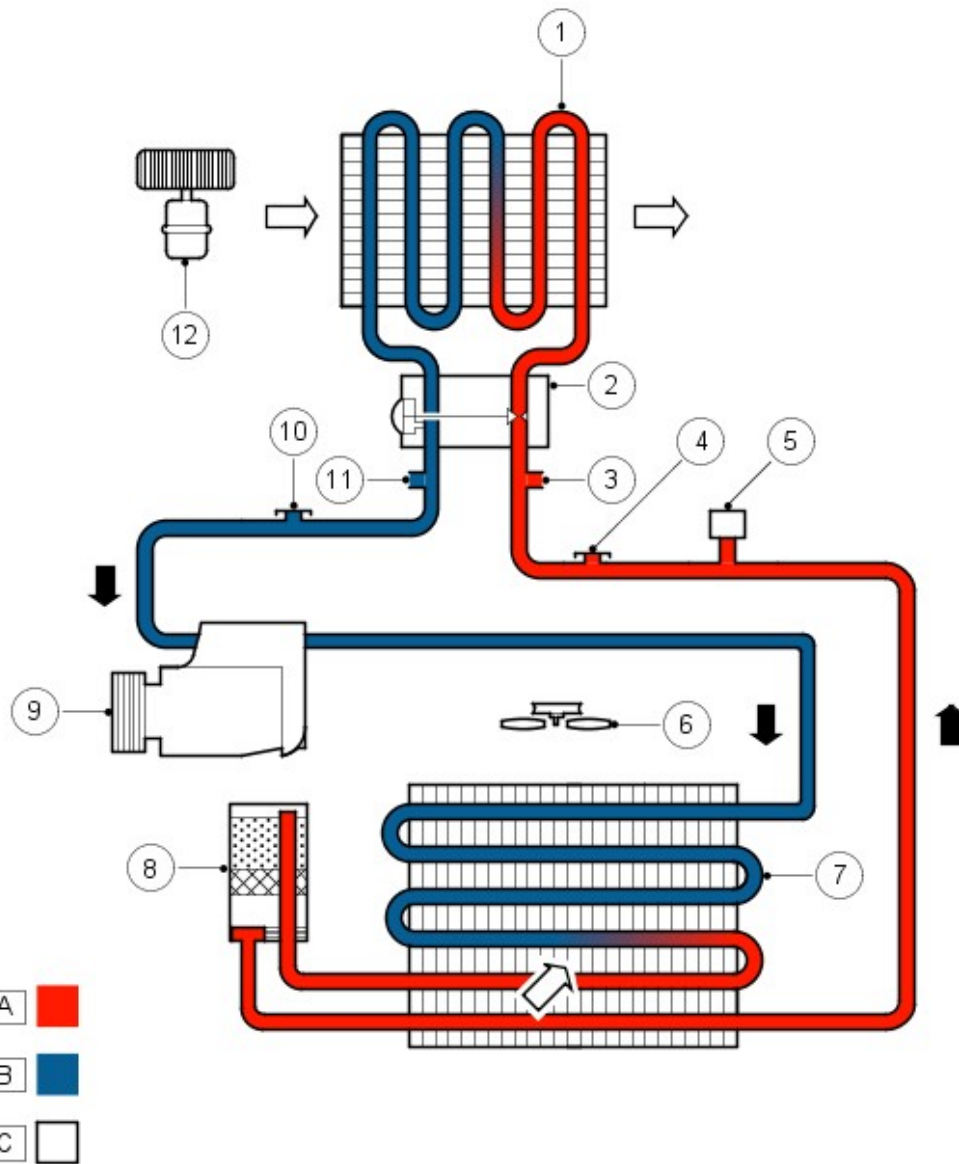
SYSTEM OPERATION

To accomplish the transfer of heat, the refrigerant is circulated around the system, where it passes through two pressure/temperature regimes. In each of the pressure/temperature regimes, the refrigerant changes state, during which process maximum heat absorption or release occurs. The low pressure/temperature regime is from the thermostatic expansion valve, through the evaporator to the compressor; the refrigerant decreases in pressure and temperature at the thermostatic expansion valve, then changes state from liquid to vapor in the evaporator, to absorb heat. The high pressure/temperature regime is from the compressor, through the condenser and receiver drier to the thermostatic expansion valve; the refrigerant increases in pressure and temperature as it passes through the compressor, then releases heat and changes state from vapor to liquid in the condenser.

A/C SYSTEM SCHEMATIC



NOTE: A = Refrigerant liquid; B = Refrigerant vapor; C = Air flow



E46924

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	High pressure connection with auxiliary climate control (where fitted)
4	-	High pressure servicing connection
5	-	Refrigerant pressure sensor
6	-	Cooling fan
7	-	Condenser
8	-	Receiver drier
9	-	A/C compressor
10	-	Low pressure servicing connection
11	-	Low pressure connection with auxiliary climate control (where fitted)
12	-	Blower

Air Conditioning - TDV6 3.0L Diesel - Air Conditioning

Diagnosis and Testing

For additional information.

REFER to: Climate Control System (412-00, Diagnosis and Testing).

Air Conditioning - TDV6 3.0L Diesel - Air Conditioning (A/C) Compressor

Removal and Installation

Removal



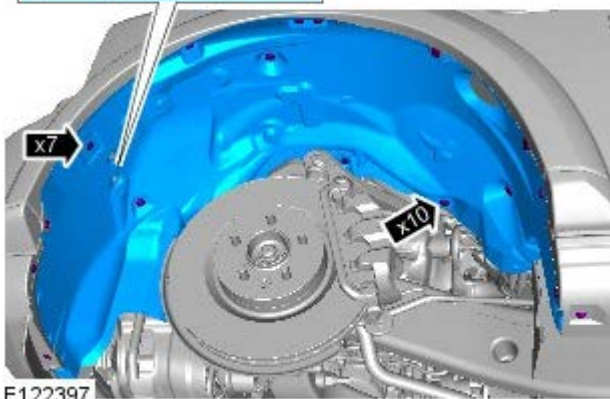
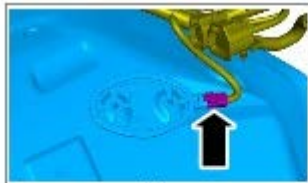
NOTE: Removal steps in this procedure may contain installation details.


1.  **WARNING:** Make sure to support the vehicle with axle stands.

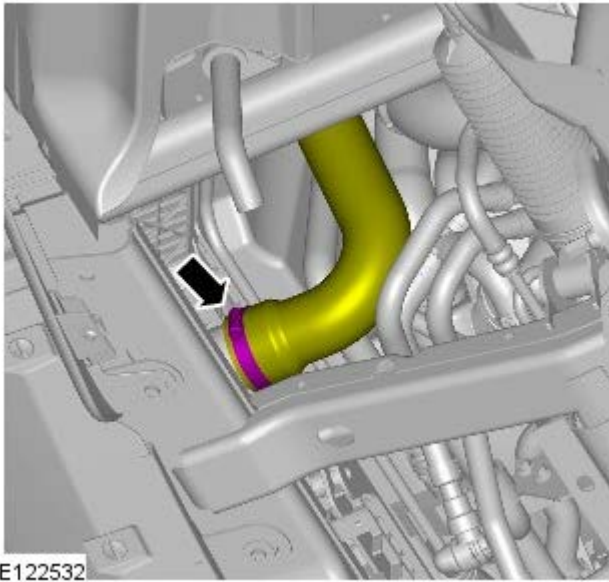
Raise and support the vehicle.

2. Refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
3. Refer to: Accessory Drive Belt (303-05, Removal and Installation).
4. Refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00, General Procedures).
5. Refer to: Transmission Fluid Cooler Tubes - 3.0L Diesel (307-02, Removal and Installation).

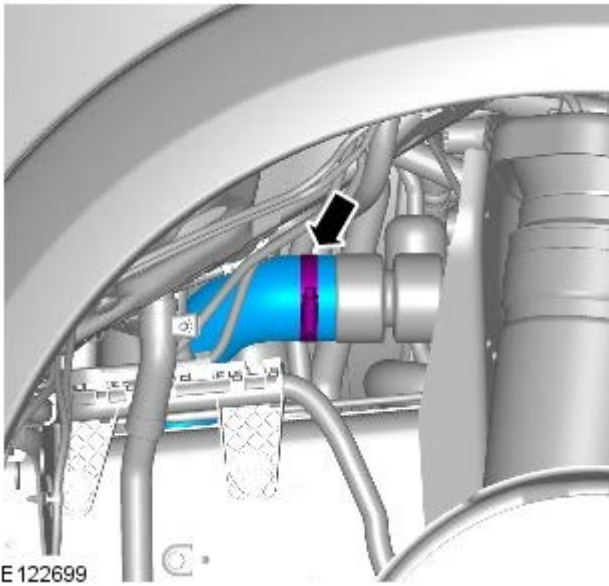
6.



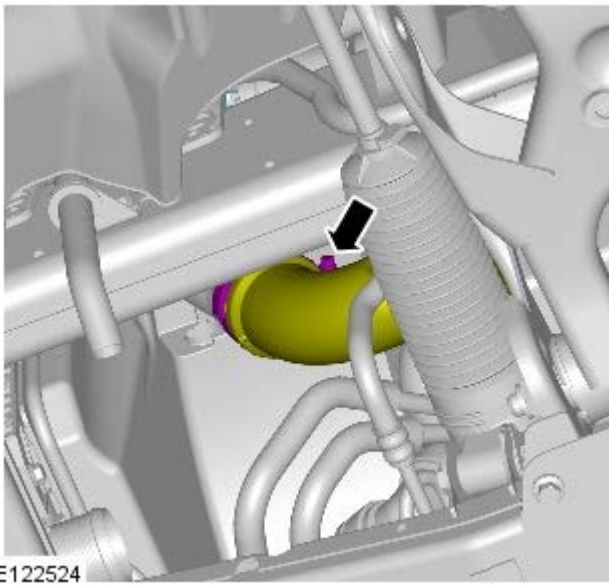
7.  **CAUTION:** Be prepared to collect escaping coolant.




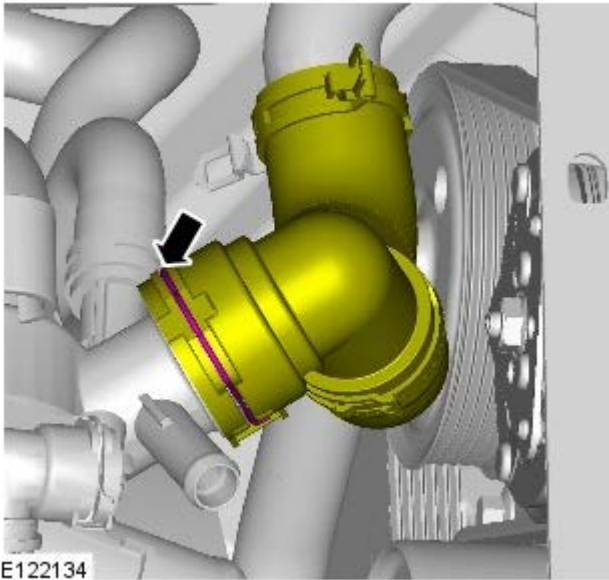
8.




9.

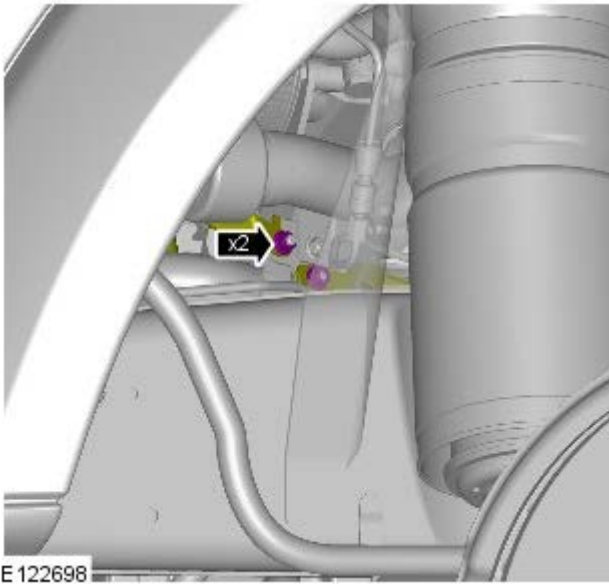


10.  CAUTION: Be prepared to collect escaping coolant.

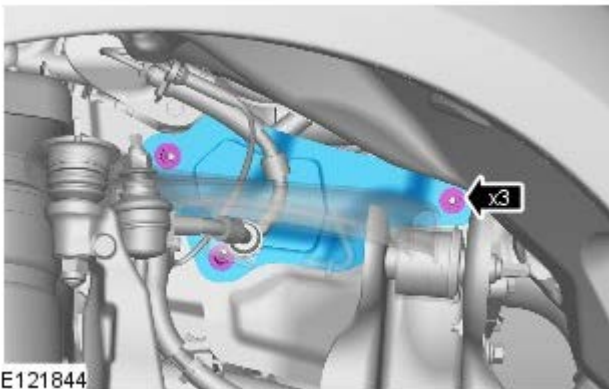


 NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

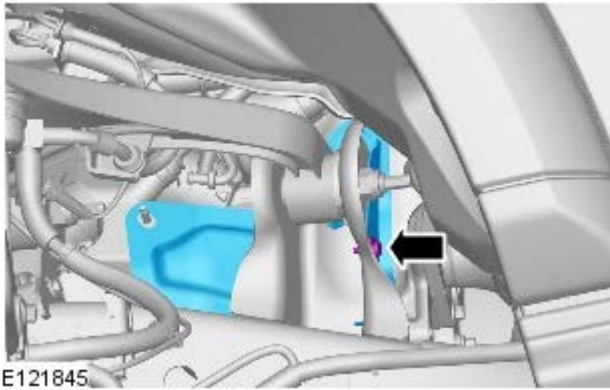
11. Torque: 6 Nm



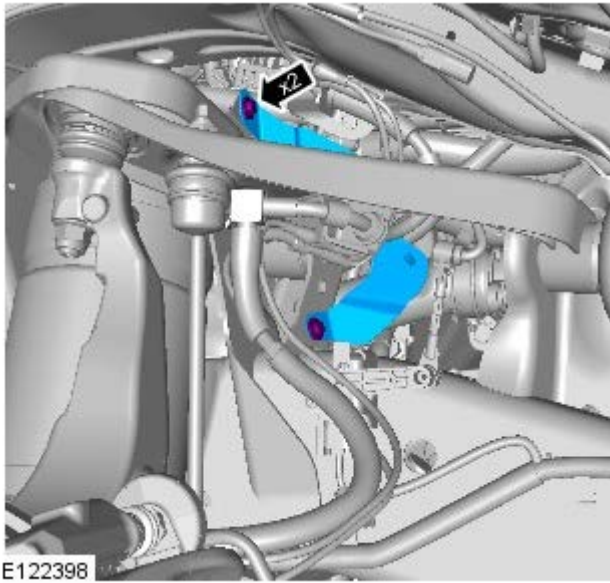
12. Torque: 9 Nm



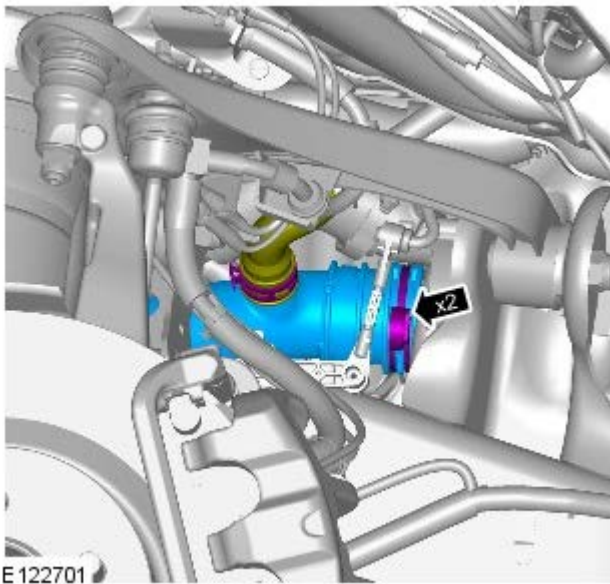
13. Torque: 9 Nm




14. Torque: 9 Nm



15.

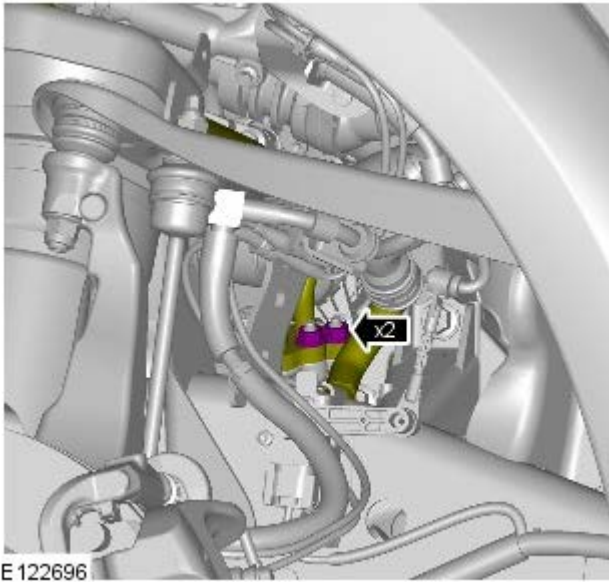


16. CAUTIONS:

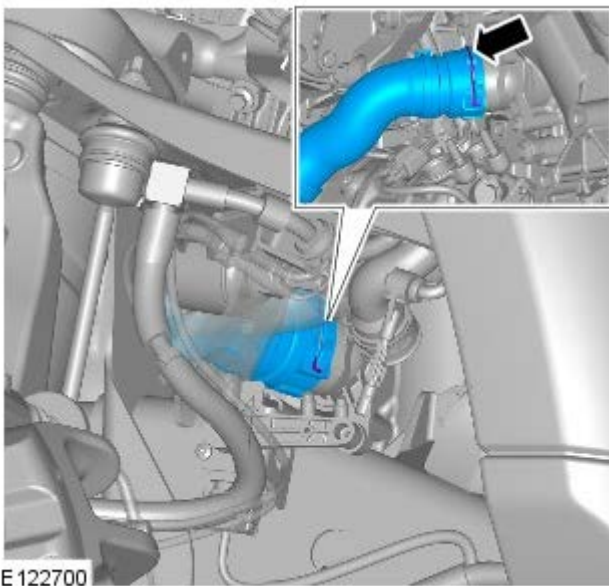
 Make sure that all openings are sealed. Use new blanking caps.

 A new O-ring seal is to be installed.


Torque: 18 Nm



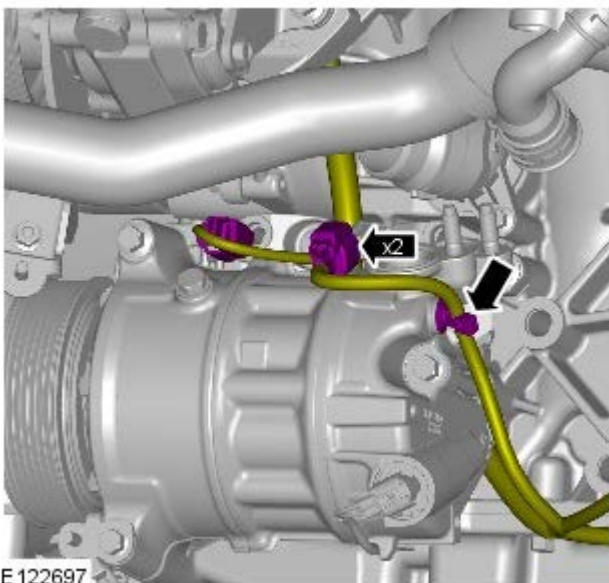
E 122696



E 122700

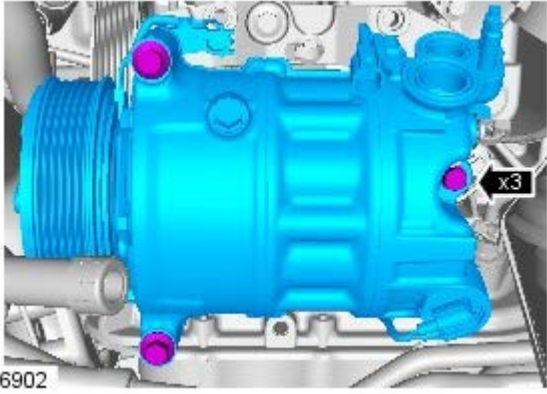
17.  CAUTION: Be prepared to collect escaping coolant.

18.



E 122697

19. Torque: 25 Nm



E116902

Installation

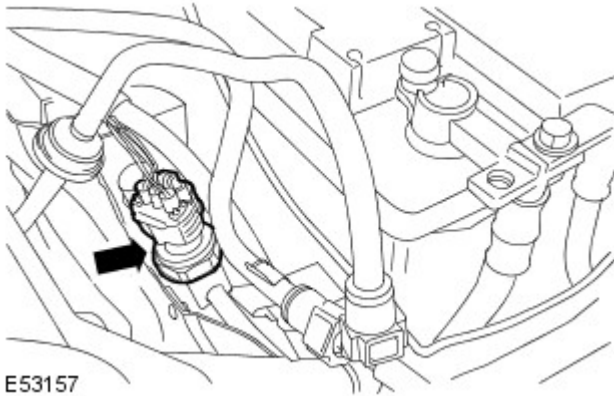
1. To install, reverse the removal procedure.

Air Conditioning - TDV6 3.0L Diesel - Air Conditioning (A/C) Pressure Transducer

Removal and Installation


Removal


1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Recover the A/C refrigerant.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).



E53157

3. CAUTIONS:

 Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

 To prevent damage to components, use an additional wrench when loosening or tightening unions.

Remove the A/C pressure transducer.

- Disconnect the electrical connector.
- Remove and discard the seal.

Installation

1. Install the A/C pressure transducer.
 - Clean the component mating faces.
 - Install a new seal.
 - Tighten the transducer to 10 Nm (7 lb.ft).
 - Connect the electrical connector.
2. Recharge the A/C system.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
3. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).

Air Conditioning - TDV6 3.0L Diesel - Condenser Core

Removal and Installation

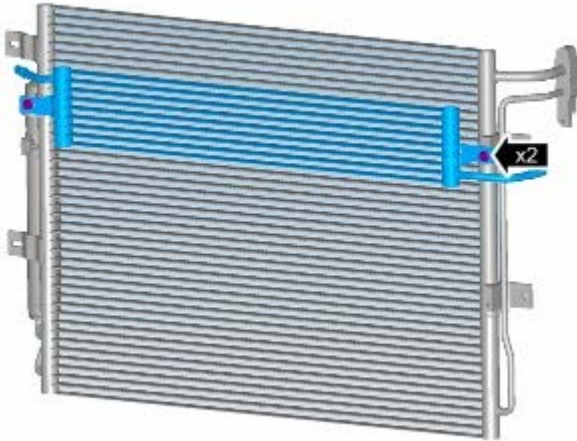
Removal



NOTE: Removal steps in this procedure may contain installation details.

1. For additional information, refer to: Radiator (303-03, Removal and Installation).

2. TORQUE: 5 Nm



E122605


Installation

1. To install, reverse the removal procedure.

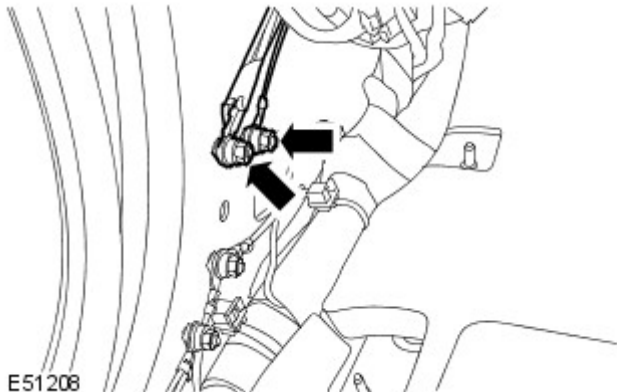
Air Conditioning - TDV6 3.0L Diesel - Evaporator Core

Removal and Installation

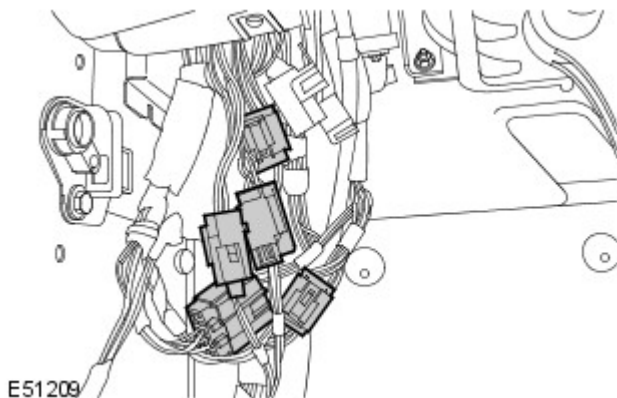
Removal

1. Evacuate the A/C system.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00, General Procedures).
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

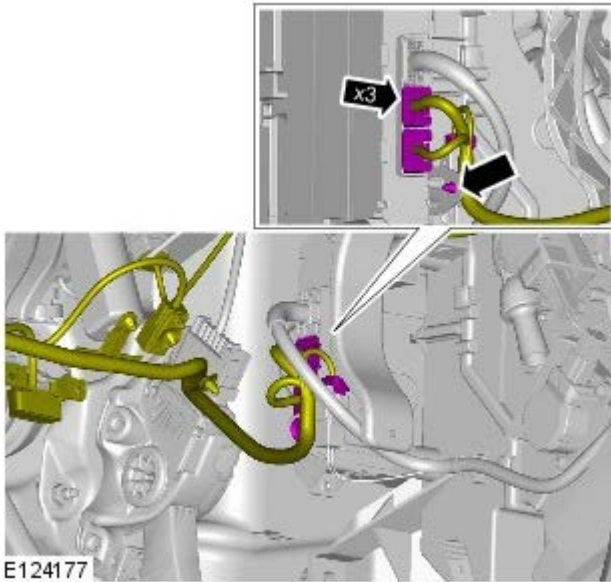
Raise and support the vehicle.
3. Drain the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).
4. Remove the driver side front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).
5. Remove the floor console.
For additional information, refer to: Floor Console (501-12, Removal and Installation).
6. Remove the instrument panel upper section.
For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).
7. Release the 3 ground cables from the driver side lower A-pillar.
 - Remove the 2 nuts.



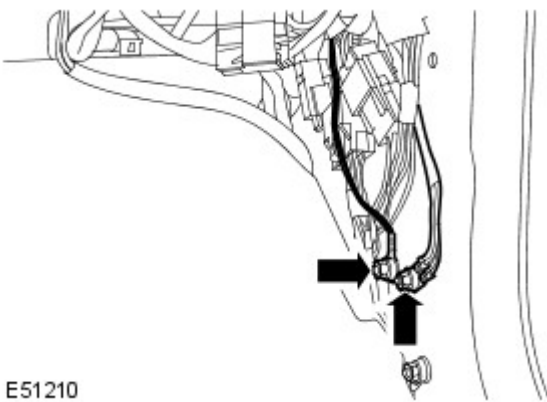
8. Disconnect the 5 electrical connectors from the driver side lower A-pillar.



9. Disconnect the 3 electrical connectors.



E124177

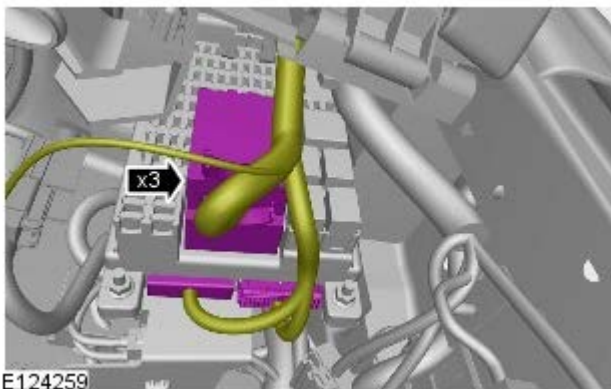


E51210

10. Release the 3 ground cables from the passenger side lower A-pillar.
 - Remove the 2 nuts.


11. Disconnect the 5 electrical connectors from the passenger side lower A-pillar.

12. Disconnect the central junction box (CJB) three electrical connectors.



E124259

13. Disconnect 2 electrical connectors from the instrument panel center reinforcement.

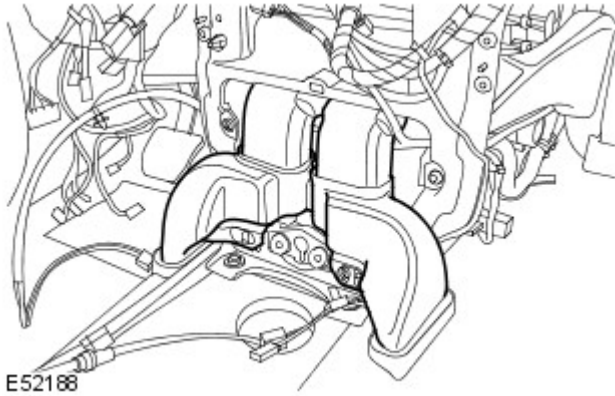
14.  **CAUTION:** Cover fiber optic cable connectors to minimize dust ingress and avoid bending the cables in a radius of less than 30 mm.

If installed, disconnect the instrument panel center reinforcement fibre optic cables.

- Disconnect the electrical connector.



15. Remove the heater housing center ducts.



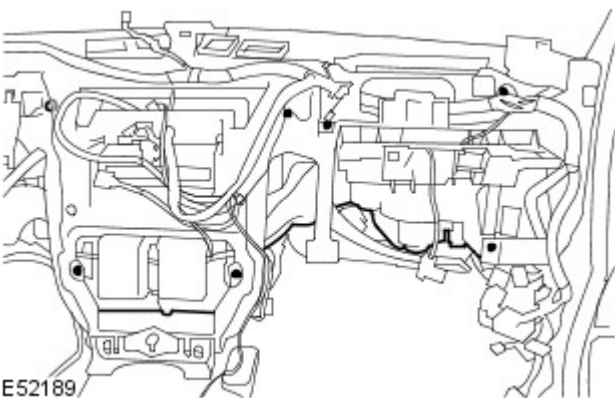
16. Disconnect the steering column intermediate shaft from the steering column.

- Note the fitted position.
- Remove the special bolt and discard the nut.



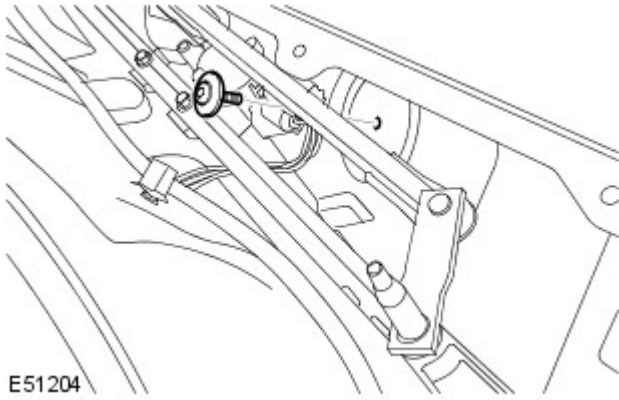
17. Release the heater housing from the instrument panel carrier.

- Remove the 7 Torx screws.



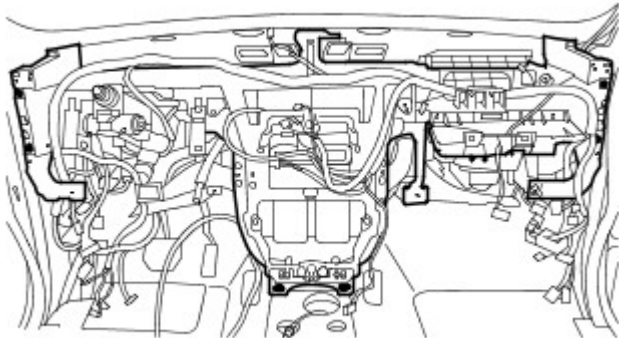
18. Remove the plenum chamber panel.
For additional information, refer to: Plenum Chamber (412-01, Removal and Installation).

19. Remove the instrument panel carrier to bulkhead Torx bolt.



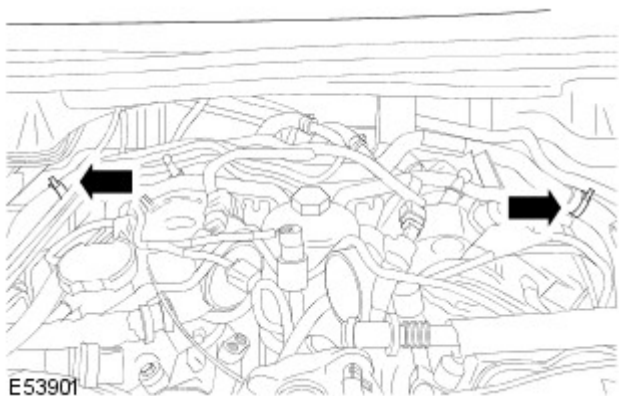
E51204

20. With assistance, remove the instrument panel.
 - Remove the 6 Torx bolts.



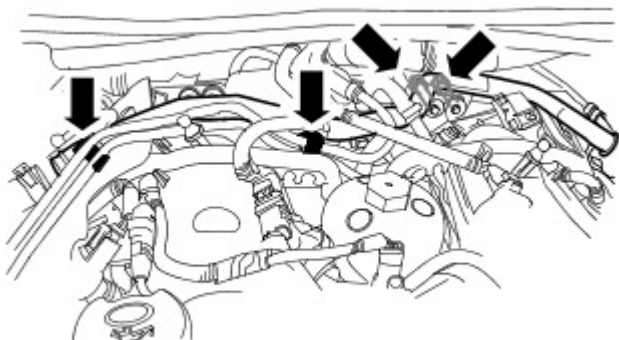
E52190

21. Disconnect both exhaust gas recirculation (EGR) coolant cross-over pipe hoses.
 - Release the 2 clips.




E53901

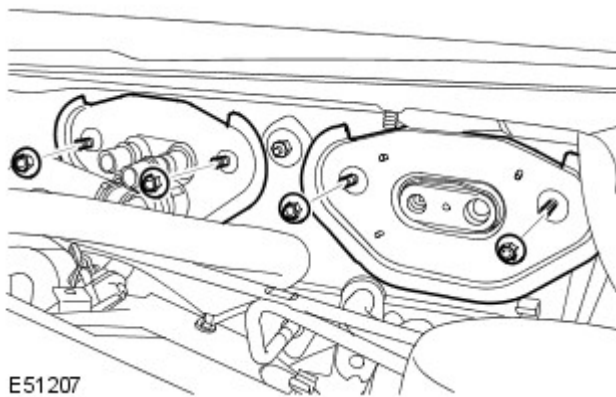
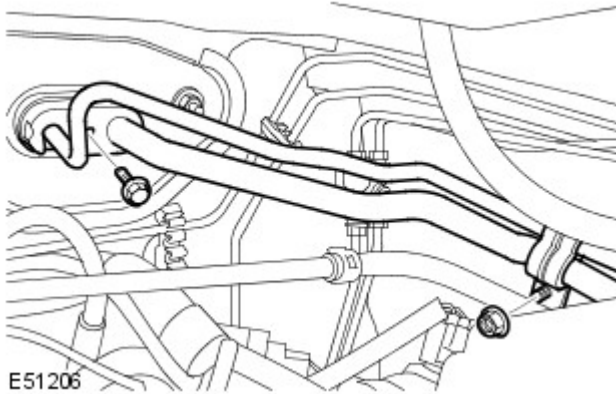
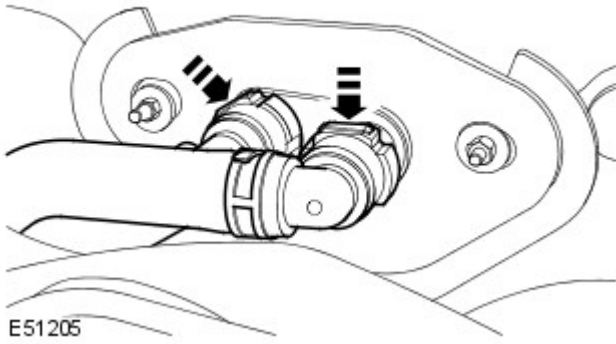
22. Remove the EGR coolant cross-over pipe.
 - Remove the 2 bolts.
 - Release the 2 clips.



E55561

23.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

- Disconnect 2 heater hoses from the bulkhead.
- Release the 2 clips.



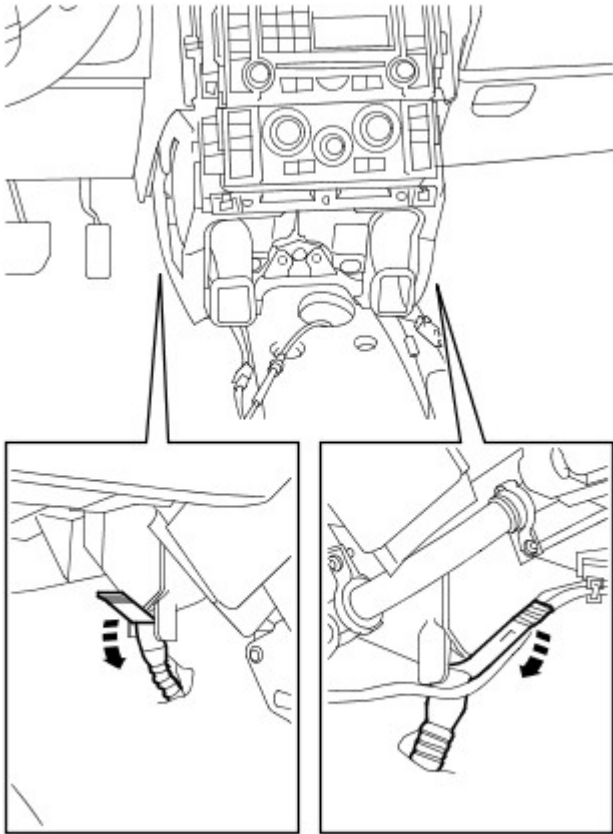
24.  **CAUTION:** Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Release the 2 A/C refrigerant lines.

- Remove the nut and bolt.
- Remove and discard the O-ring seals.

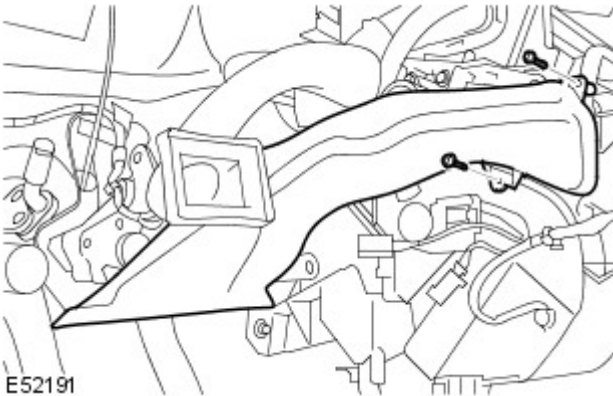
25. Remove the 2 adapter panels.
- Remove the 4 nuts.

26. Disconnect 2 drain tubes from the heater housing.



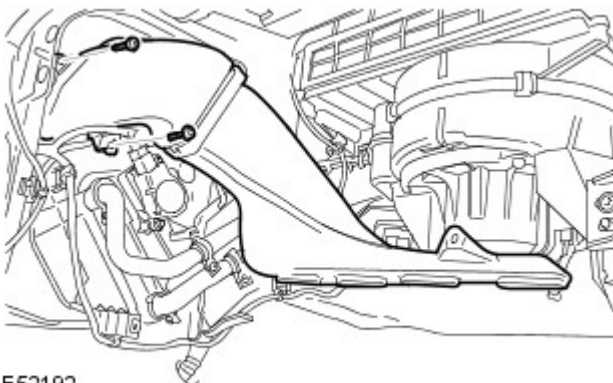
E51199

27. Remove the driver side footwell duct.
 - Remove the 2 Torx screws.



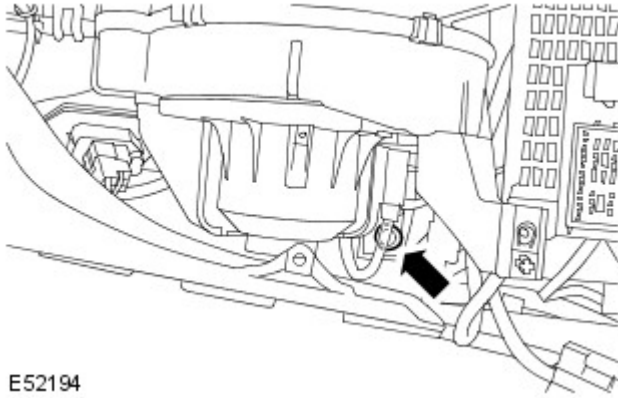
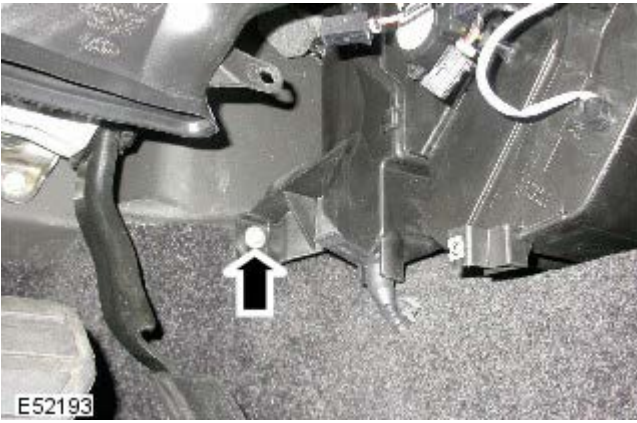
E52191

28. Remove the passenger side footwell duct.
 - Remove the 2 Torx screws.

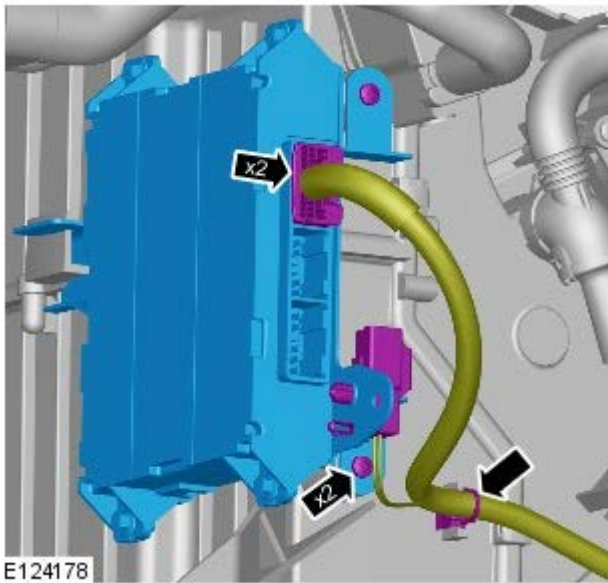


E52192

29. Driver side: Remove the heater housing to bulkhead Torx bolt.



30. Passenger side: Remove the heater housing to bulkhead Torx bolt.
 - With assistance, remove the heater and evaporator core housing.

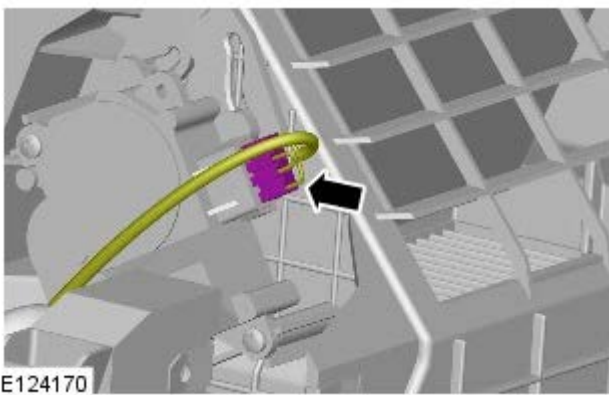


31. Remove the A/C control module.

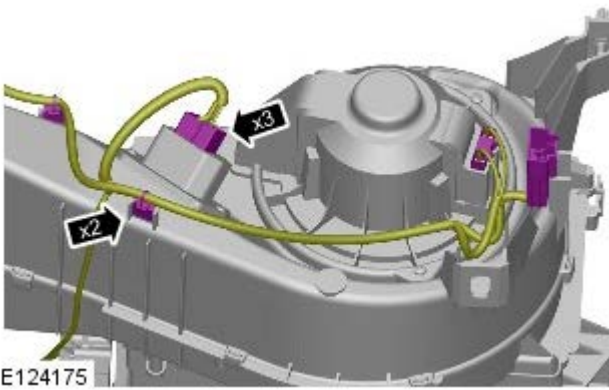
32. Disconnect the evaporator core temperature sensor electrical connector.



33. Disconnect the electrical connector.



34. Detach the wiring harness.

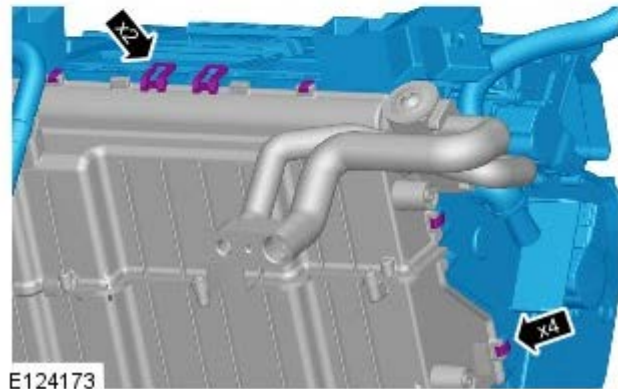
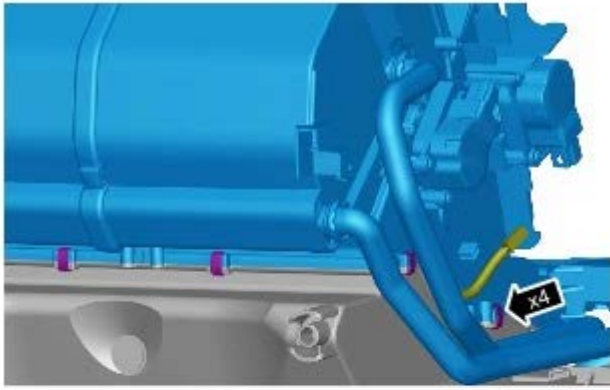


35. Remove the bolt from the support bracket.



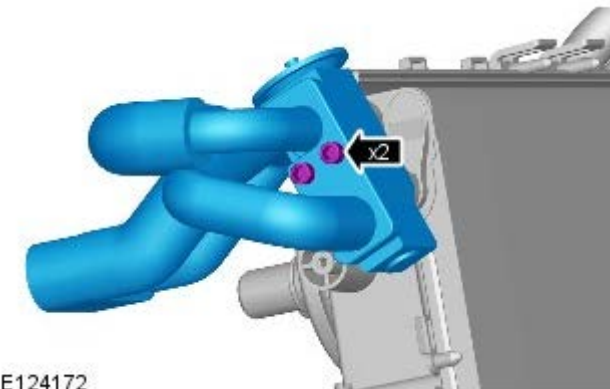
36. Remove the heater and evaporator core housing.

- Remove the 8 clips.



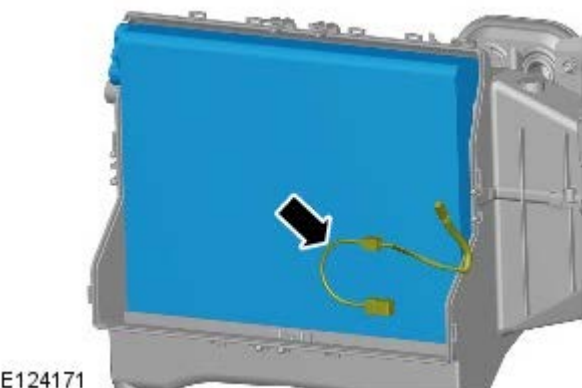
E124173

- Carefully release the 2 clips.



E124172

37. Remove the thermostatic expansion valve.



E124171

38. Remove the evaporator core.
- Release the temperature sensor.

Installation

- Install the evaporator core.
 - Secure the temperature sensor.
- Secure the heater core housing.
 - Install the clips.
- Install the thermostatic expansion valve.

- Tighten the bolts to 3.5 Nm (2.5 lb.ft).
4. Install the wiring harness.
 5. Install and tighten the bolt.
 6. Connect the temperature sensor electrical connector.
 7. Install the CC module.
 - Tighten the bolts.
 8. Passenger side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).
 - With assistance, install the heater and evaporator core housing.
 9. Driver side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).
 10. Install the footwell ducts.
 - Tighten the Torx screws.
 11. Connect the drain tubes to the heater housing.
 12. Install the adapter panels.
 - Tighten the nuts to 6 Nm (4 lb.ft).
 13. Secure the A/C refrigerant lines.
 - Clean the components.
 - Install new O-ring seals.
 - Tighten the bolt to 5 Nm (4 lb.ft).
 - Tighten the nut to 6 Nm.
 14. Connect the bulkhead heater hoses.
 15. Install the EGR coolant cross-over pipe.
 - Tighten the bolts to 10 Nm (7 lb.ft).
 - Secure the clips.
 - Connect the hoses and secure with the clips.
 16. With assistance, install the instrument panel.
 - Tighten the Torx bolts to 25 Nm (18 lb.ft).
 17. Install the instrument panel carrier to bulkhead Torx bolt and tighten to 25 Nm (18 lb.ft).
 18. Install the plenum chamber panel.
For additional information, refer to: Plenum Chamber (412-01, Removal and Installation).
 19. Secure the heater housing.
 - Tighten the screws.
 20. Connect the steering column intermediate shaft.
 - Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).
 21. Install the heater housing center ducts.
 22. Connect the instrument panel center reinforcement fibre optic cables.
 23. Connect the instrument panel center reinforcement electrical connectors.
 24. Connect the CJB electrical connectors.
 25. Connect the electrical connectors to the passenger side lower A-pillar.
 26. Connect the ground cables to the passenger side lower A-pillar.
 - Tighten the nuts to 10 Nm (7 lb.ft).

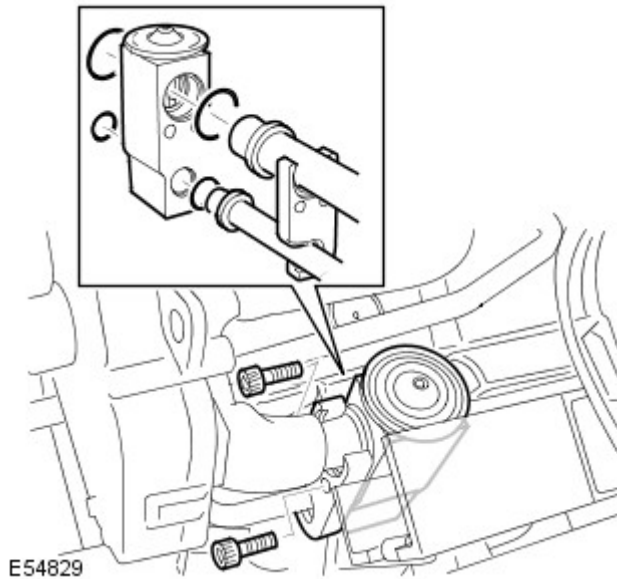
27. Connect the electrical connectors to the driver side lower A-pillar.
28. Connect the ground cables to the driver side lower A-pillar.
 - Tighten the nuts to 10 Nm (7 lb.ft).
29. Connect the 3 electrical connectors.
30. Install the instrument panel upper section.
For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).
31. Install the floor console.
For additional information, refer to: Floor Console (501-12, Removal and Installation).
32. Install the front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).
33. Recharge the A/C system.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00, General Procedures).
34. Refill the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03, General Procedures).

Air Conditioning - TDV6 3.0L Diesel - Thermostatic Expansion Valve

Removal and Installation

Removal

1. Evacuate the A/C system.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Remove the instrument panel upper section.
For additional information, refer to: Instrument Panel Upper Section (501-12 Instrument Panel and Console, Removal and Installation).



3.  **CAUTION:** Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Remove the thermostatic expansion valve.

- Remove the cover.
- Remove the 2 Allen bolts.
- Remove and discard the 4 O-ring seals.

Installation

1. Install the thermostatic expansion valve.
 - Clean the components.
 - Install the new O-ring seals.
 - Tighten the Allen bolts to 5 Nm (4 lb.ft).
 - Install the cover.
2. Install the instrument panel upper section.
For additional information, refer to: Instrument Panel Upper Section (501-12 Instrument Panel and Console, Removal and Installation).
3. Recharge the A/C system.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

Air Conditioning - V6 S/C 3.0L Petrol -

Lubricant

Item	Specification
Air conditioning (A/C) compressor oil type	Sanden SPA2 oil
A/C compressor oil - vehicles fitted with 2 zone	80ml
A/C compressor oil - vehicles fitted with 4 zone	130 ml

Refrigerant



NOTE: For NAS vehicles.

Item	Specification
Refrigerant type	R1234yf
Refrigerant - vehicles fitted with 2 zone - vehicles with 3.0 diesel	600 grammes
Refrigerant - vehicles fitted with 2 zone - vehicles with 3.0L/5.0L	650 grammes
Refrigerant - vehicles fitted with 4 zone	900 grammes

Refrigerant



NOTE: For ROW vehicles.

Item	Specification
Refrigerant type	R134A
Refrigerant - vehicles fitted with 2 zone - vehicles with 3.0 diesel	600 grammes
Refrigerant - vehicles fitted with 2 zone - vehicles with 3.0L/5.0L	650 grammes
Refrigerant - vehicles fitted with 4 zone	900 grammes

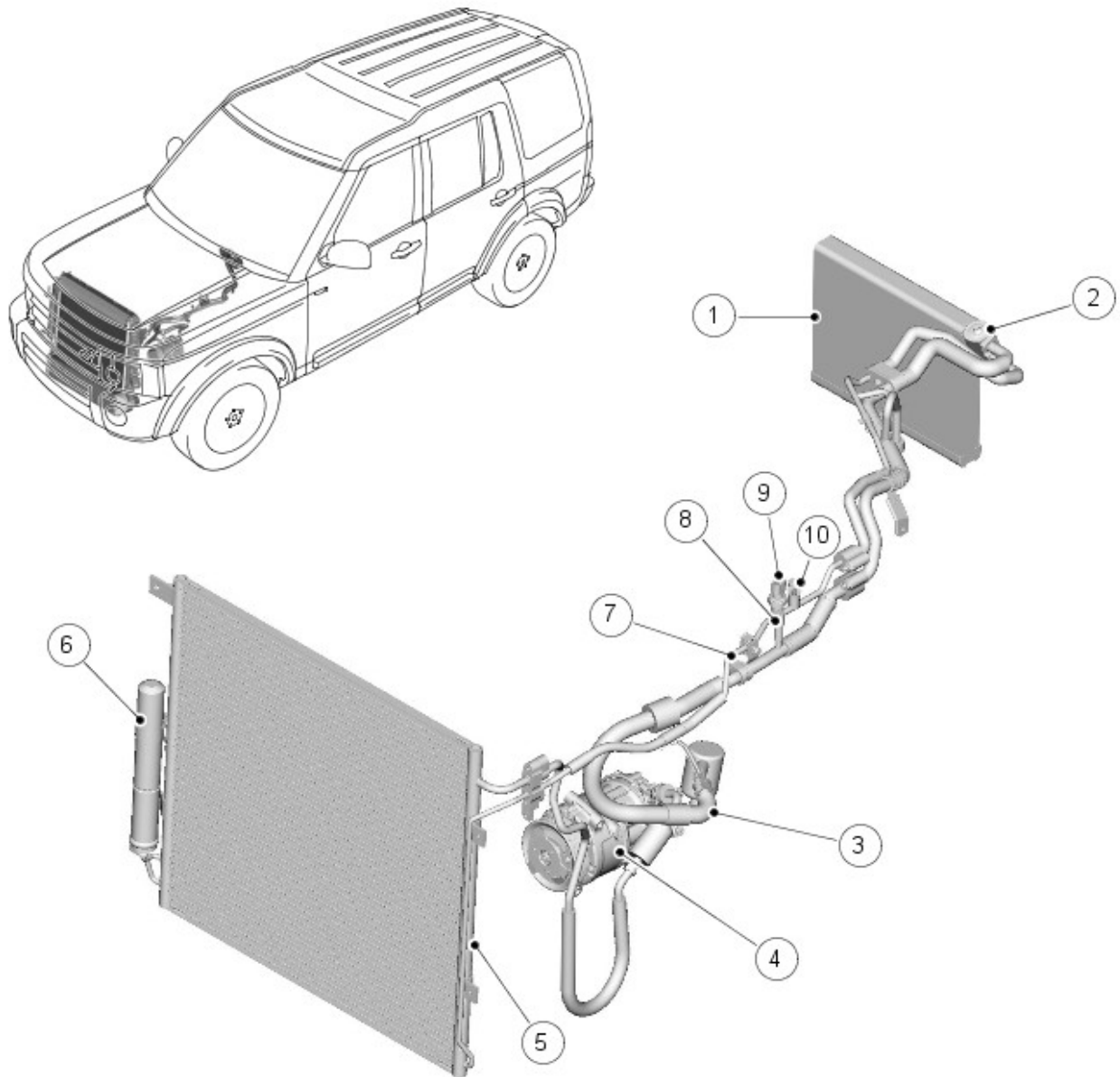
Torque Specifications

Description	Nm	lb-ft	lb-in
A/C compressor bolts	25	18	221
A/C discharge line to compressor bolt	18	13	159
A/C suction line to compressor bolt	18	13	159
A/C suction line bracket bolts	6	4	53
A/C discharge line to condenser bolt	6	4	53
A/C liquid line to condenser bolt	6	4	53
A/C condenser manifold to radiator bolt	10	7	88
Condenser to radiator bolt - vehicles with 5.0L	10	7	88
Condenser to radiator bolt - vehicles with 3.0 diesel	5	4	44
Evaporator line to evaporator core bolt	6	4	53
Evaporator line bracket nut	6	4	53
A/C liquid line to front evaporator line bolt - vehicles fitted with 4 zone	18	13	159
A/C suction line to front evaporator line bolt - vehicles fitted with 4 zone	18	13	159
A/C lines to rear evaporator bolts - vehicles fitted with 4 zone	9	7	80
A/C pressure transducer	10	7	88
Thermostatic expansion valve (TXV) to refrigerant line clamp bolts	5	4	44

Air Conditioning - V6 S/C 3.0L Petrol - Air Conditioning

Description and Operation

COMPONENT LOCATION



E131583

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	Low pressure line
4	-	A/C (air conditioning) compressor
5	-	Condenser
6	-	Receiver drier
7	-	High pressure line
8	-	Low pressure servicing connection
9	-	Refrigerant pressure sensor (reference)
10	-	High pressure servicing connection

OVERVIEW

The A/C system is a sealed, closed loop system filled with a charge weight of refrigerant as the heat transfer medium. Depending on market, the refrigerant is either R1234yf or R134a. Oil is added to the refrigerant to lubricate the internal components of the A/C compressor. The system consists of:

- A A/C compressor.

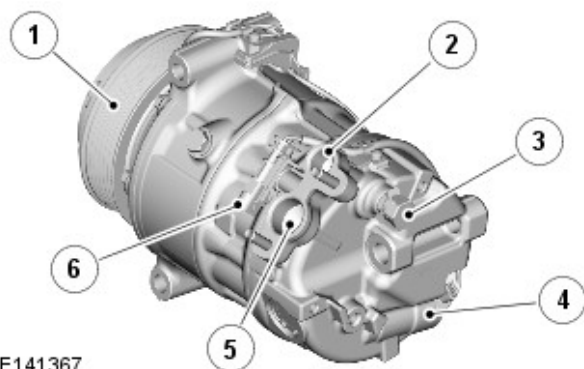
- A condenser.
- A receiver drier.
- A thermostatic expansion valve.
- An evaporator.
- Low and high pressure refrigerant lines.

A pressure sensor in the high pressure refrigerant line allows the ATCM (automatic temperature control module) to monitor the status of the A/C system.

For additional information, refer to: [Control Components](#) (412-04 Control Components, Description and Operation).

DESCRIPTION

Air Conditioning Compressor



Item	Part Number	Description
1	-	Pulley
2	-	Refrigerant outlet port
3	-	Pressure relief valve
4	-	Electronic control valve
5	-	Refrigerant inlet port
6	-	Electrical connector

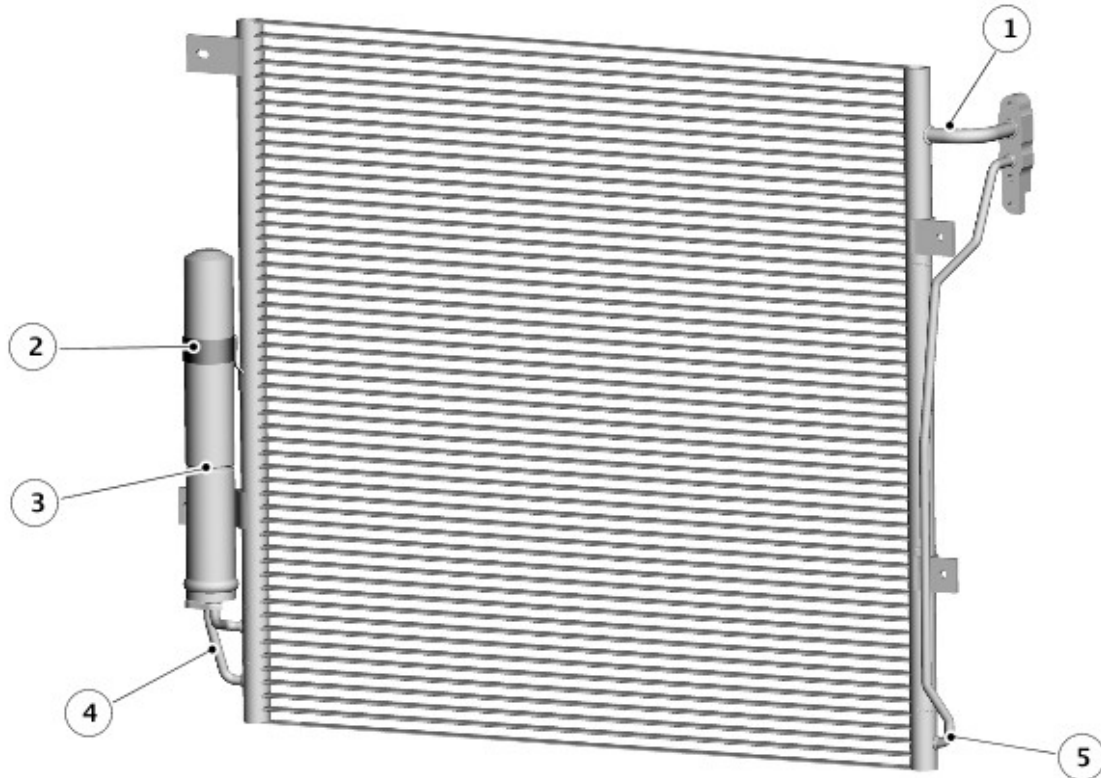
On all engine variants, the A/C compressor is a variable displacement unit attached to the front left side of the engine with three bolts.

The compressor is driven by the engine accessory drive belt via an electro-magnetic clutch in the compressor pulley. The ATCM (automatic temperature control module) controls the operation of the electro-magnetic clutch. The clutch incorporates a thermal cut-off fuse, which disconnects the power feed from the ATCM if the temperature increases to $182 \pm 5 \text{ }^\circ\text{C}$ ($360 \pm 9 \text{ }^\circ\text{F}$).

The displacement of the compressor is controlled by an integral electronic control valve, which is operated by the ATCM. The ATCM automatically adjusts the displacement of the A/C compressor, between the minimum and maximum values, to match the thermal load of the evaporator.

To protect the refrigerant system from excessive pressure, a pressure relief valve is installed in the outlet side of the A/C compressor. The pressure relief valve vents excess pressure into the engine compartment.

Condenser



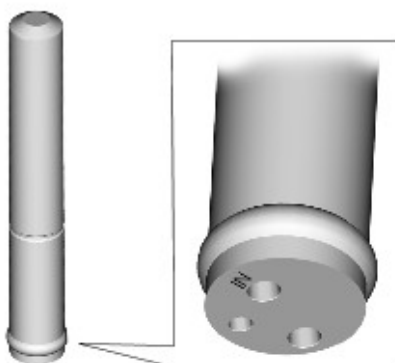
E161114

Item	Part Number	Description
1	-	Refrigerant inlet port
2	-	Receiver drier attachment bracket
3	-	Receiver drier
4	-	Receiver drier pipes
5	-	Refrigerant outlet port

The condenser transfers heat from the refrigerant to the surrounding air to convert the high pressure vapor from the compressor into a liquid. The condenser is installed immediately in front of the radiator. Two brackets on each end tank of the condenser attach the condenser to clips on the end tanks of the radiator.

The condenser is classified as a sub-cooling condenser and consists of a fin and tube heat exchanger core installed between two end tanks. Divisions in the end tanks separate the heat exchanger into a four pass upper (condenser) section and a two pass lower (sub-cooler) section. A connector block on the left end tank of the condenser provides connections for the high pressure lines from the *A/C* compressor and the evaporator. Two pipes at the bottom of the right end tank of the condenser provide connections for the receiver drier.

Receiver Drier



E141370

The receiver drier is attached to the two stub pipes on the right end tank of the condenser. A collar, located on lands on the stub pipes and secured with a bolt, attaches the stub pipes to the receiver drier. The body of the receiver drier is installed in a bracket welded to the right end tank of the condenser.

The inlet and outlet ports of the receiver drier are the same size, so care must be taken to install the receiver drier the correct way round on the stub pipes. To assist with installation, the inlet port is identified with the word 'IN' etched into the receiver drier.

Refrigerant entering the receiver drier passes through a filter and a desiccant pack, then collects in the base of the unit before flowing through the outlet stub pipe back to the condenser. The desiccant and the filter are both

serviceable.

Thermostatic Expansion Valve



E127740

The thermostatic expansion valve is a block type valve attached to the inlet and outlet ports of the evaporator, under a thermal insulation cover.

Two bolts secure the refrigerant pipes and the thermostatic expansion valve to the inlet and outlet ports of the evaporator.

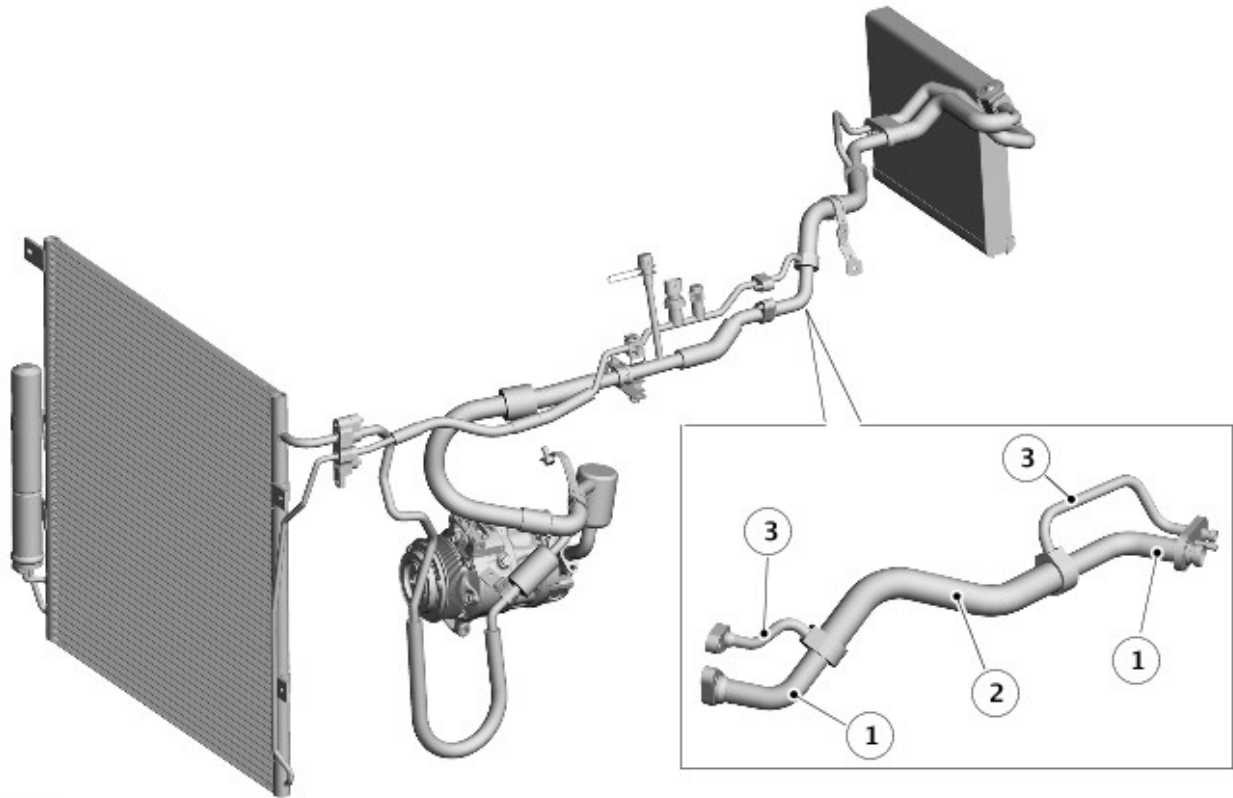
Evaporator



E161115

The evaporator is a fin and tube heat exchanger installed in the heater assembly, between the blower and the heater core.

Refrigerant Lines



E161116

Item	Part Number	Description
1	-	Low pressure pipe
2	-	Internal heat exchanger
3	-	High pressure pipe

The refrigerant lines consist of a combination of rigid pipes and flexible hoses that connect the thermostatic expansion valve on the evaporator to the A/C compressor and the condenser. An internal heat exchanger increases the efficiency of the evaporator and ensures any residual liquid in the low pressure line is evaporated before it reaches the compressor.

Low and high pressure servicing connections are incorporated into the refrigerant lines for system servicing. The high pressure line also incorporates a refrigerant pressure sensor for the climate control system.

For additional information, refer to: [Control Components](#) (412-04 Control Components, Description and Operation).

On vehicles with auxiliary climate control, connections for the auxiliary A/C system are incorporated into the refrigerant lines in the left rear corner of the engine compartment.

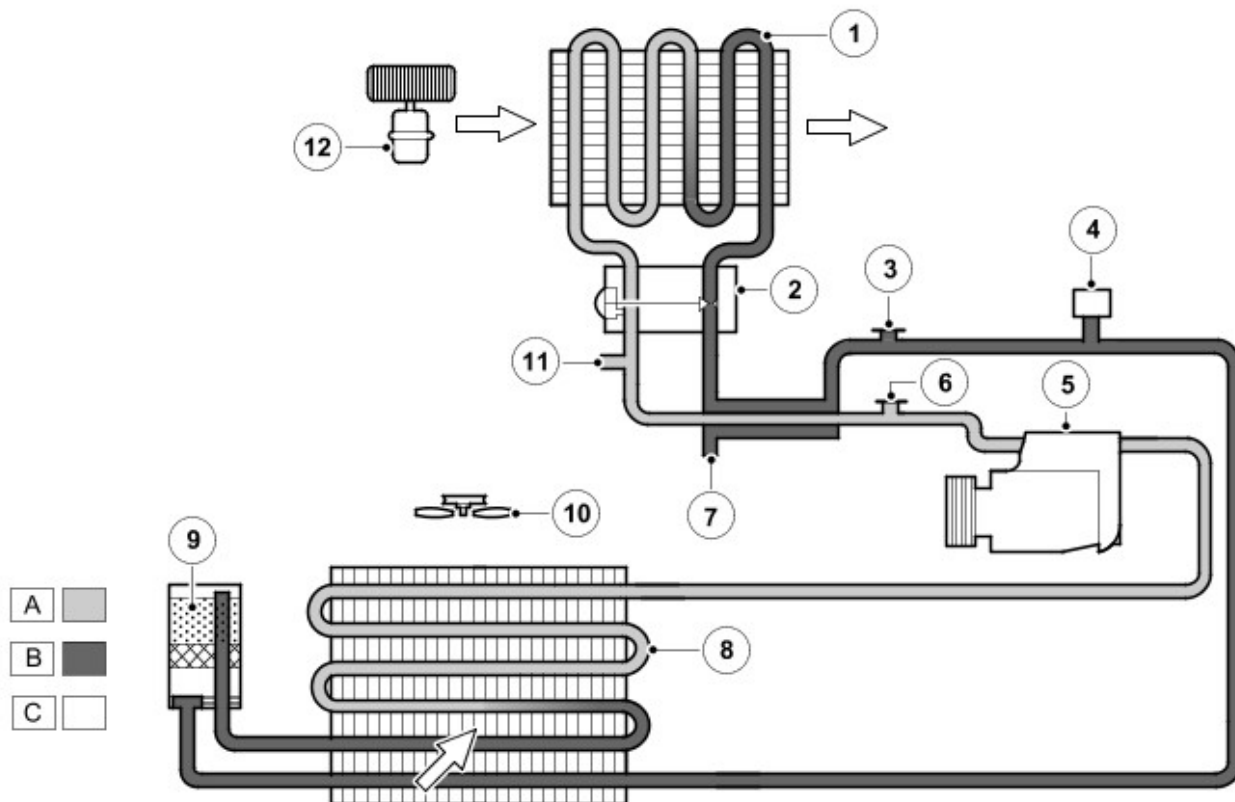
For additional information, refer to: [Auxiliary Climate Control](#) (412-03C Auxiliary Climate Control, Description and Operation).

OPERATION

The A/C compressor circulates the refrigerant around the system by compressing low pressure, low temperature vapor from the evaporator and discharging the resultant high pressure, high temperature vapor to the condenser. In the condenser the vapor converts to a liquid, which then passes through the receiver drier and out of the condenser to the thermostatic expansion valve. As it passes through the thermostatic expansion valve, the liquid refrigerant changes to a fine, low pressure, spray, which is directed into the evaporator. In the evaporator the refrigerant changes back to a low pressure, low temperature vapor, as it absorbs heat from the air in the passenger compartment, then returns to the A/C compressor to begin the cycle again.

Operation of the air conditioning system is controlled by the ATCM (automatic temperature control module), which adjust the electronic control valve in the A/C compressor to match the refrigerant flow around the system to the thermal load of the evaporator. By matching refrigerant flow to the thermal load of the evaporator, the ATCM maintains the required temperature in the passenger compartment while maximizing fuel economy.

Air Conditioning System Schematic



E141373

A = Refrigerant vapor; B = Refrigerant liquid; C = Air flow.

Item	Part Number	Description
1	-	Evaporator
2	-	Thermostatic expansion valve
3	-	High pressure servicing connection
4	-	Refrigerant pressure sensor
5	-	Air conditioning compressor
6	-	Low pressure servicing connection
7	-	High pressure connection for auxiliary climate control (where fitted)
8	-	Condenser
9	-	Receiver drier
10	-	Engine cooling fan
11	-	Low pressure connection for auxiliary climate control (where fitted)
12	-	Blower

Air Conditioning - V6 S/C 3.0L Petrol - Air Conditioning

Diagnosis and Testing

For additional information.

REFER to: Climate Control System (412-00, Diagnosis and Testing).


Air Conditioning - V6 S/C 3.0L Petrol - Air Conditioning (A/C) Compressor

Removal and Installation

Removal

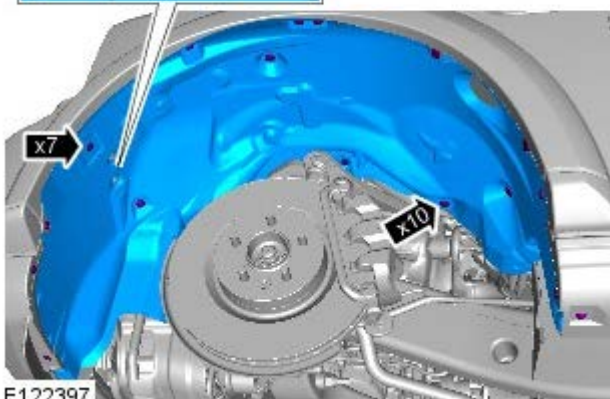
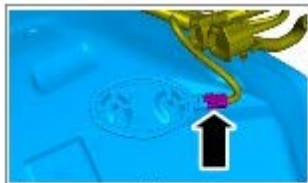


NOTE: Removal steps in this procedure may contain installation details.


1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Refer to: Cooling System Partial Draining, Filling and Bleeding - V8 5.0L Petrol (303-03B, General Procedures).
3. Refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
4. Refer to: Accessory Drive Belt (303-05 Accessory Drive - V8 5.0L Petrol, Removal and Installation).
5. Remove the LH front road wheel.

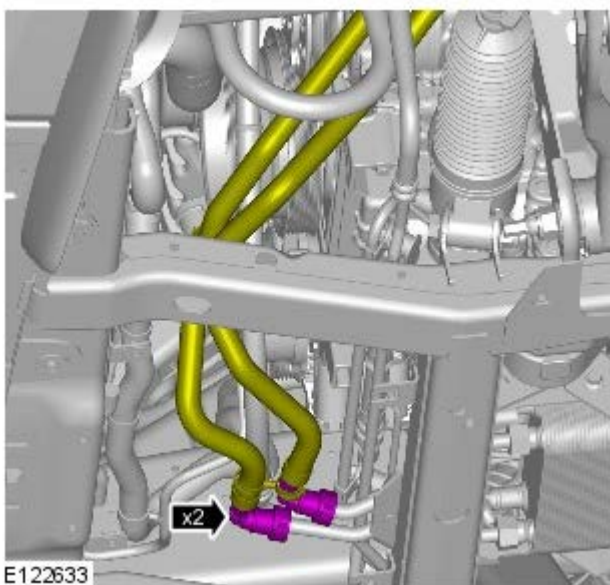
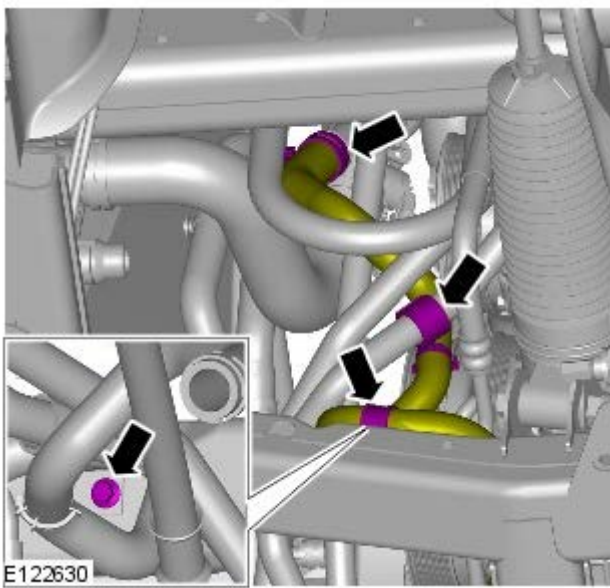
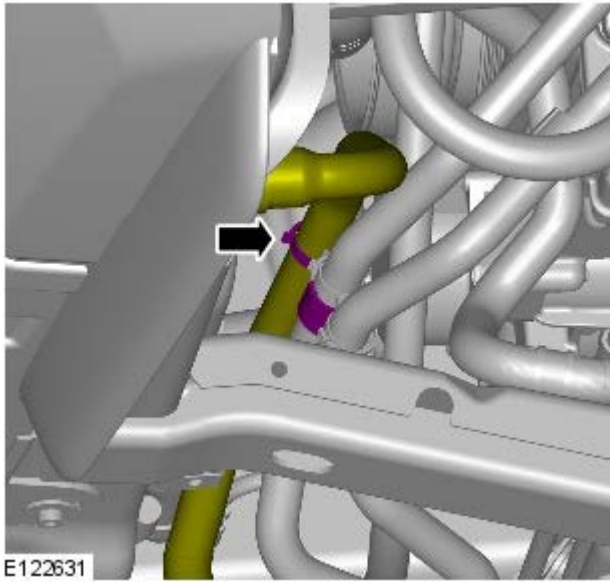
Torque: 140 Nm


6.




E122397

7.  **CAUTION:** Be prepared to collect escaping coolant.

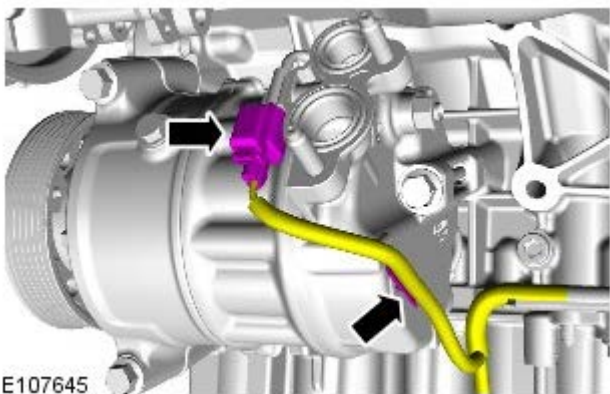
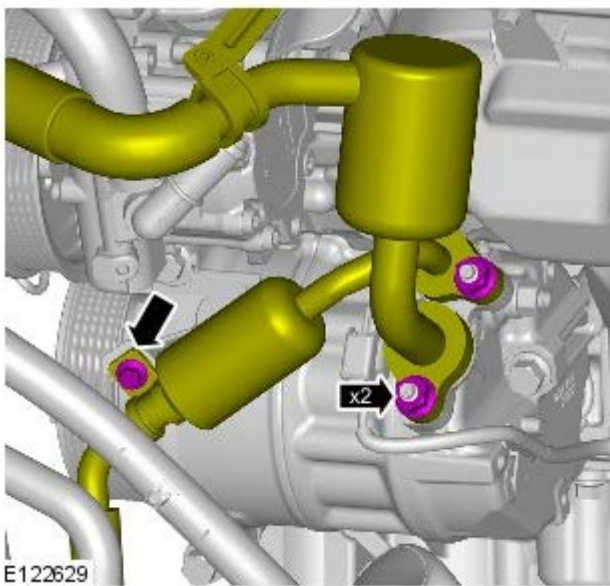
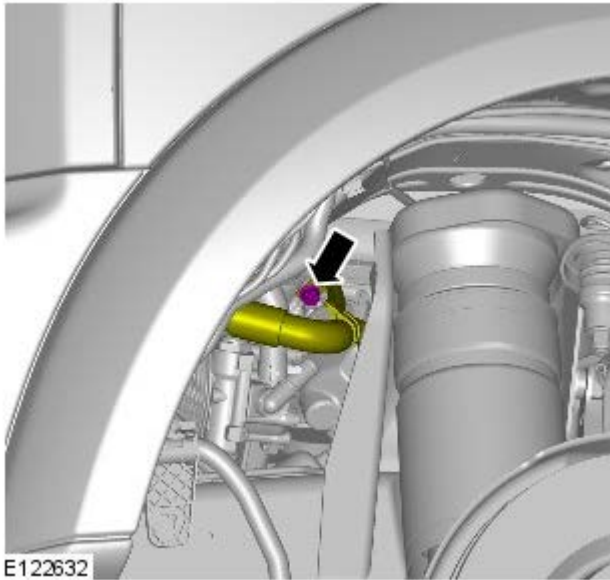


8.  CAUTION: Be prepared to collect escaping coolant.


Torque: 10 Nm

9.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

10. Torque: 18 Nm



11. CAUTIONS:

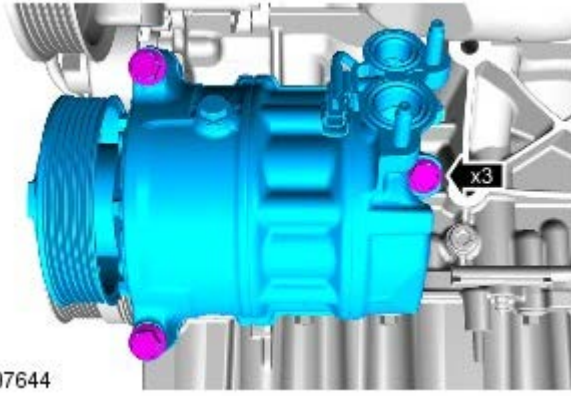
 Make sure that all openings are sealed.
Use new blanking caps.

 A new O-ring seal is to be installed.

Torque:
M8 18 Nm
M6 6 Nm

12.

13. Torque: 25 Nm



E107644

Installation

1. To install, reverse the removal procedure.

Air Conditioning - V6 S/C 3.0L Petrol - Condenser Core

Removal and Installation

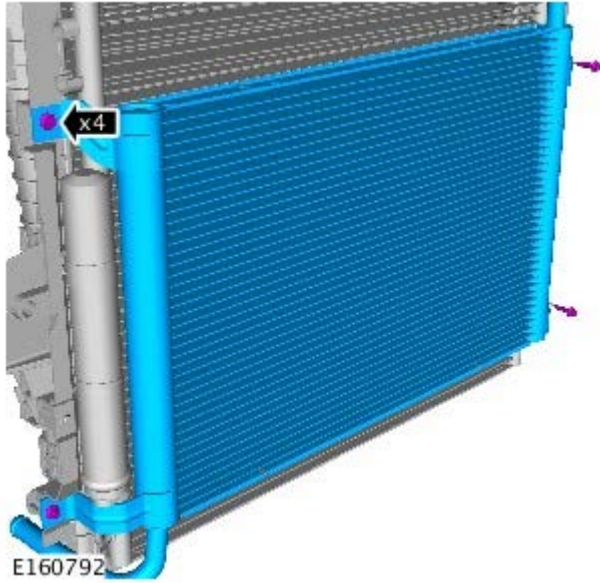
Removal



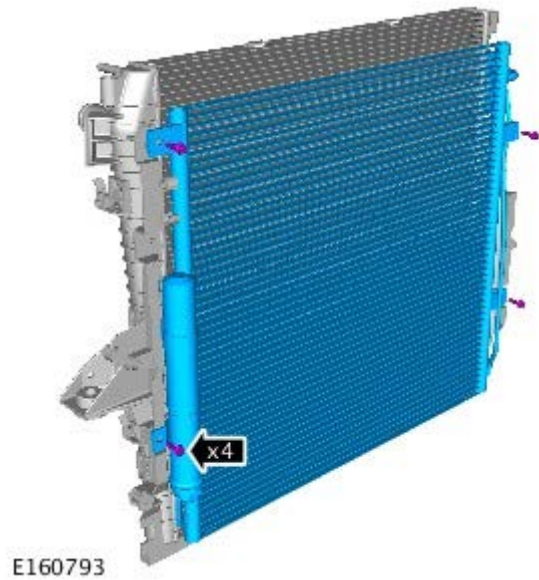
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: [Radiator](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, Removal and Installation).

2. Torque: 10 Nm



3. Torque: 10 Nm



Installation

1. To install, reverse the removal procedure.

Air Conditioning - V6 S/C 3.0L Petrol - Condenser Fan

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

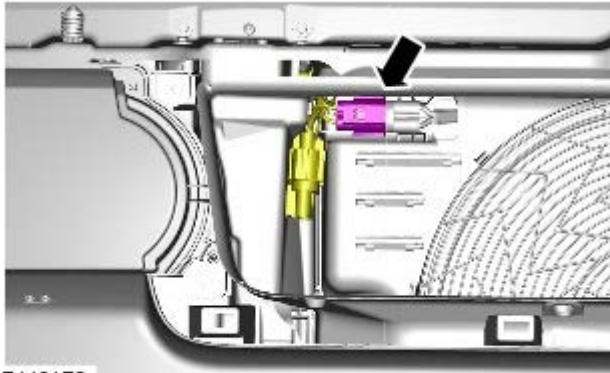
Refer to: Specifications (414-00, Specifications).

2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

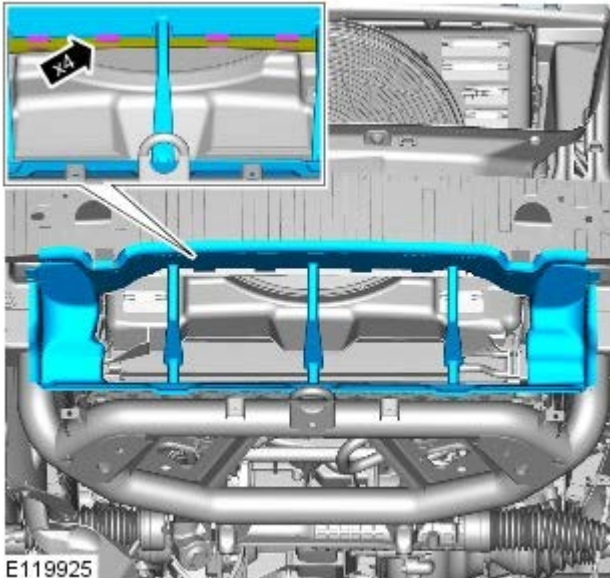
3. Refer to: Hood Latch Panel (501-02, Removal and Installation).

4.



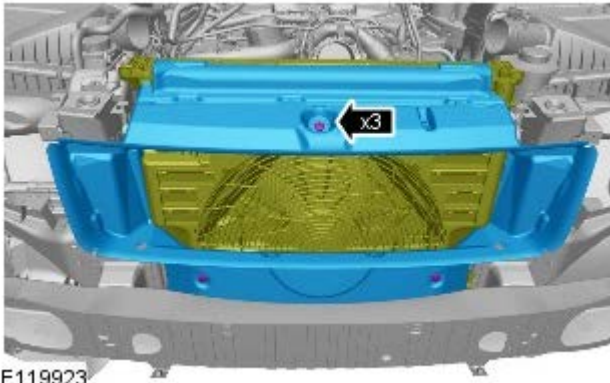
E119172

5.



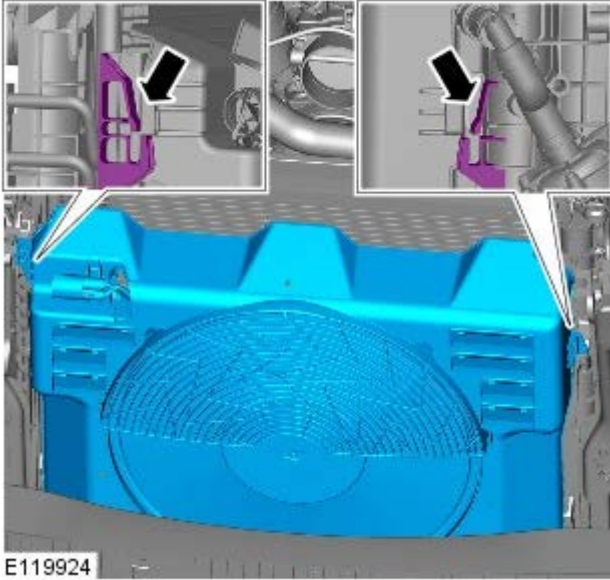
E119925

6.



E119923

7.



E119924


Installation

1. To install reverse the removal procedure.

Air Conditioning - V6 S/C 3.0L Petrol - Evaporator Core

Removal and Installation

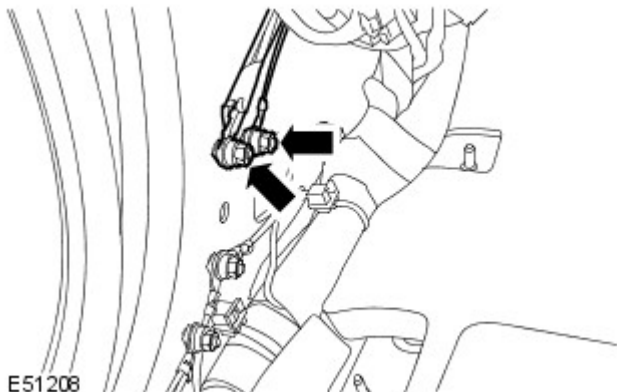
Removal

1. Remove the engine cover.
For additional information, refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Evacuate the A/C system.
For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

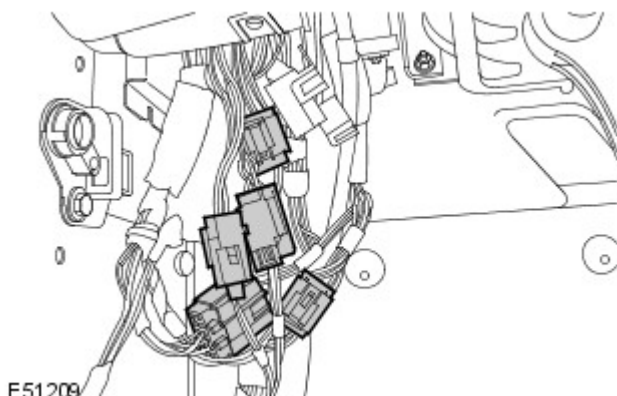
4. Drain the cooling system.
For additional information, refer to: Cooling System Partial Draining, Filling and Bleeding (303-03B, General Procedures).
5. Remove the driver side front seat.
For additional information, refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).
6. Remove the floor console.
For additional information, refer to: [Floor Console](#) (501-12 Instrument Panel and Console, Removal and Installation).
7. Remove the instrument panel upper section.
For additional information, refer to: [Instrument Panel Upper Section](#) (501-12 Instrument Panel and Console, Removal and Installation).

8. Release the 3 ground cables from the driver side lower A-pillar.
 - Remove the 2 nuts.



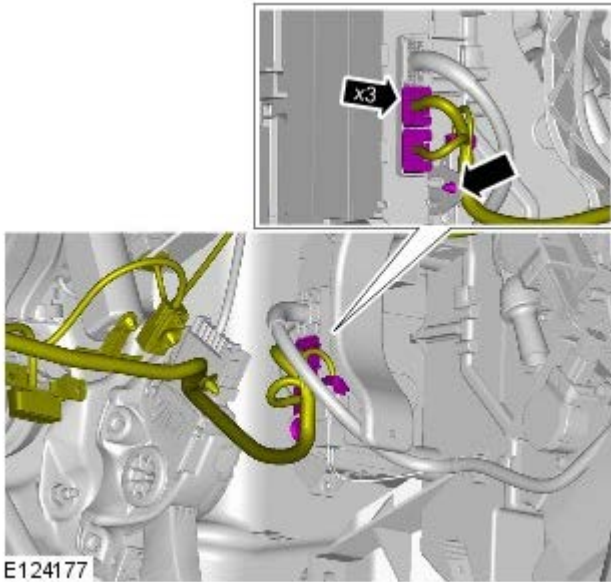
E51208

9. Disconnect the 5 electrical connectors from the driver side lower A-pillar.



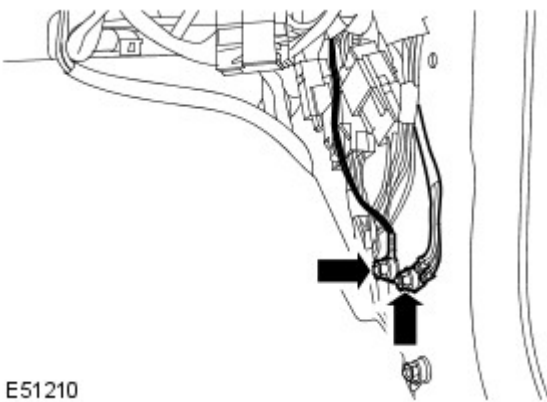
E51209

10. Disconnect the 3 electrical connectors.



E124177

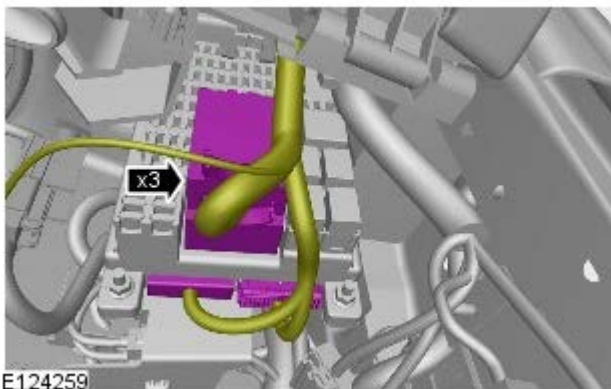
11. Release the 3 ground cables from the passenger side lower A-pillar.
 - Remove the 2 nuts.



E51210


12. Disconnect the 5 electrical connectors from the passenger side lower A-pillar.

13. Disconnect the central junction box (CJB) three electrical connectors.



E124259

14. Disconnect 2 electrical connectors from the instrument panel center reinforcement.

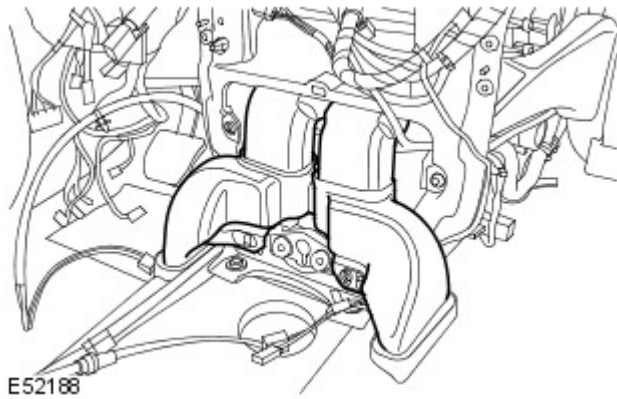
15.  **CAUTION:** Cover fiber optic cable connectors to minimize dust ingress and avoid bending the cables in a radius of less than 30 mm.

If installed, disconnect the instrument panel center reinforcement fibre optic cables.

- Disconnect the electrical connector.



16. Remove the heater housing center ducts.



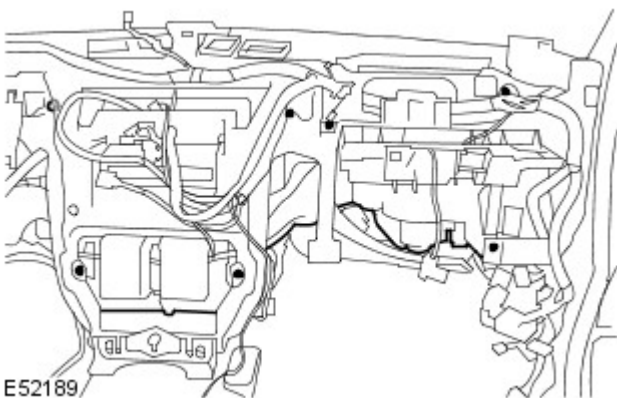
17. Disconnect the steering column intermediate shaft from the steering column.

- Note the fitted position.
- Remove the special bolt and discard the nut.



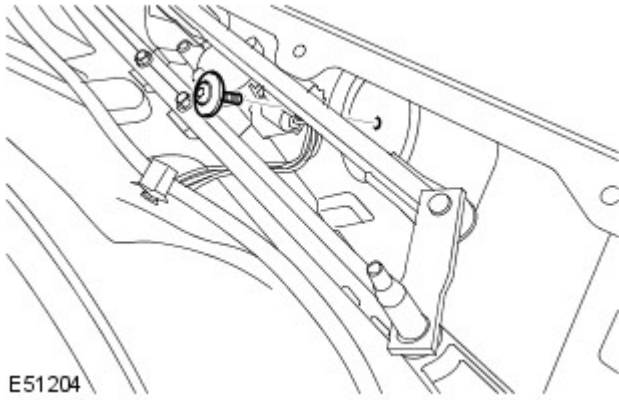
18. Release the heater housing from the instrument panel carrier.

- Remove the 7 Torx screws.

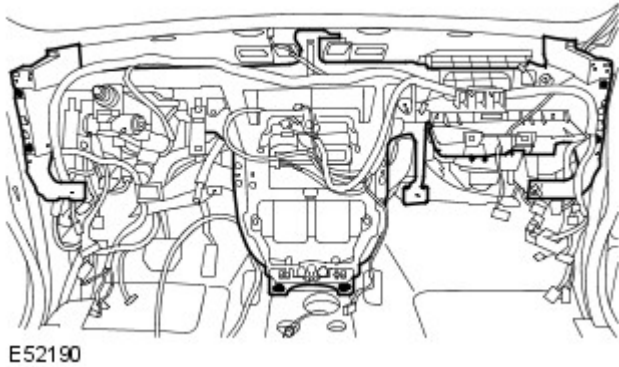



19. Remove the plenum chamber panel.
For additional information, refer to: [Plenum Chamber](#) (412-01 Air Distribution and Filtering, Removal and Installation).

20. Remove the instrument panel carrier to bulkhead Torx bolt.



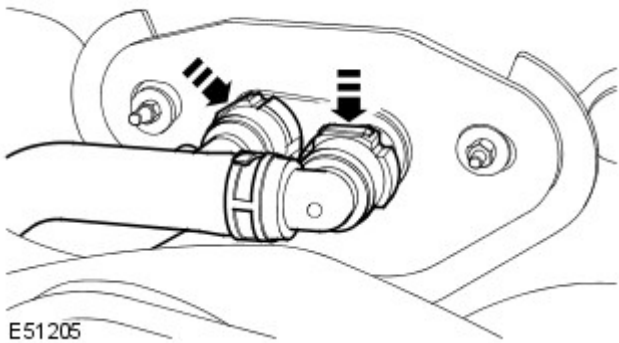
21. With assistance, remove the instrument panel.
- Remove the 6 Torx bolts.



22.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

Disconnect 2 heater hoses from the bulkhead.

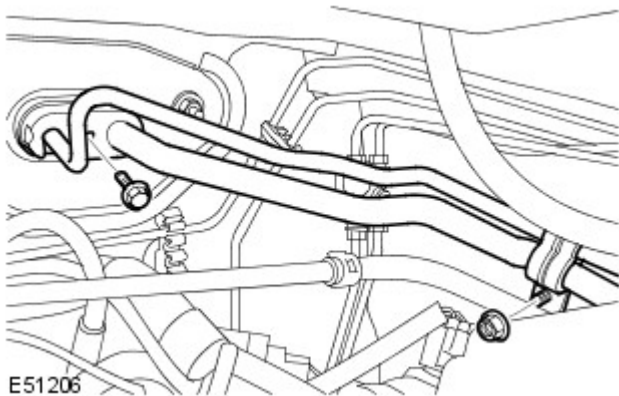
- Release the 2 clips.



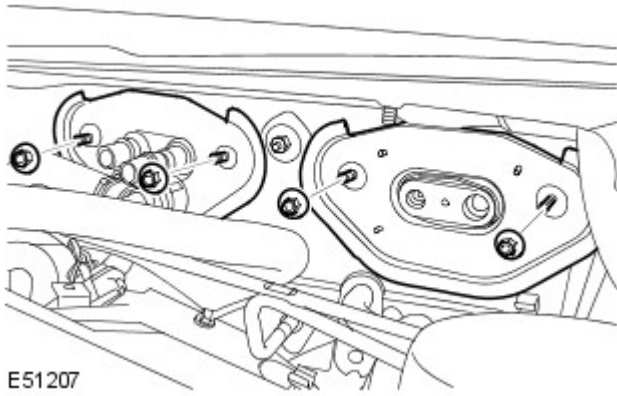
23.  **CAUTION:** Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Release the 2 A/C refrigerant lines.

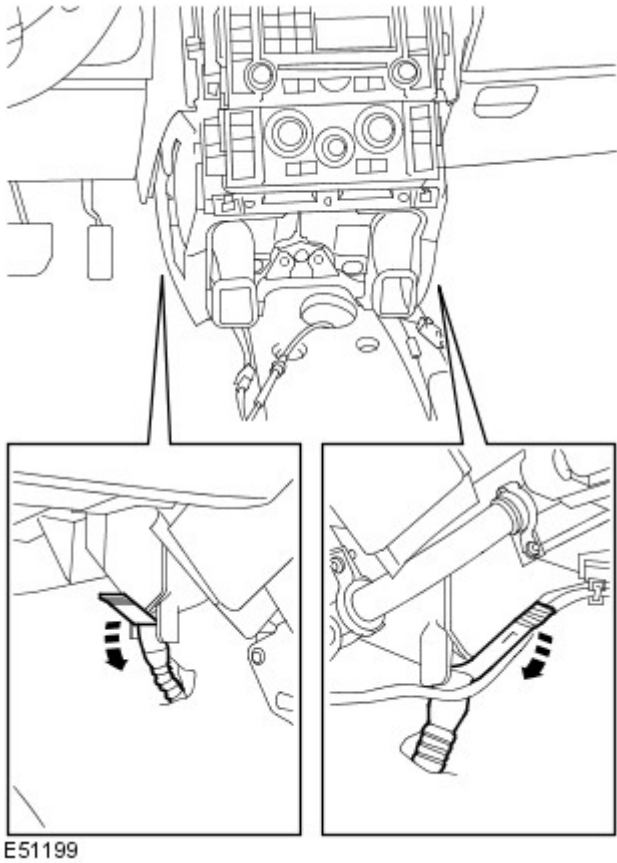
- Remove the nut and bolt.
- Remove and discard the O-ring seals.



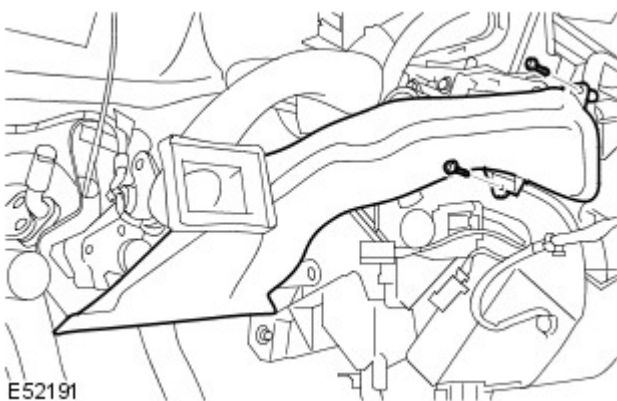
24. Remove the 2 adapter panels.
- Remove the 4 nuts.



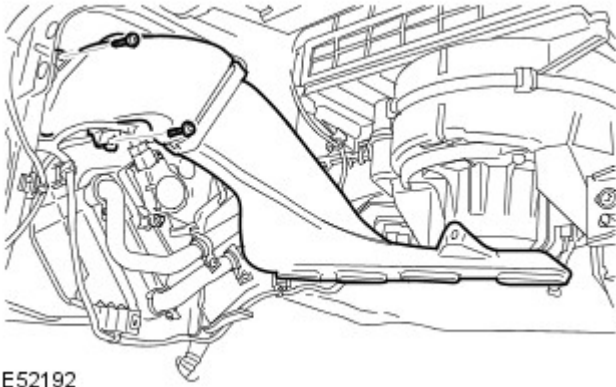
25. Disconnect 2 drain tubes from the heater housing.



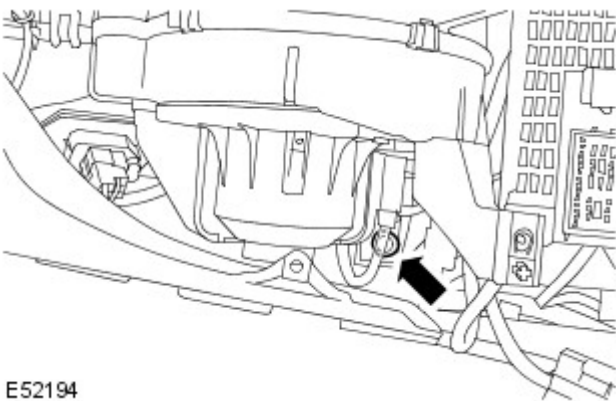
26. Remove the driver side footwell duct.
- Remove the 2 Torx screws.



27. Remove the passenger side footwell duct.
- Remove the 2 Torx screws.

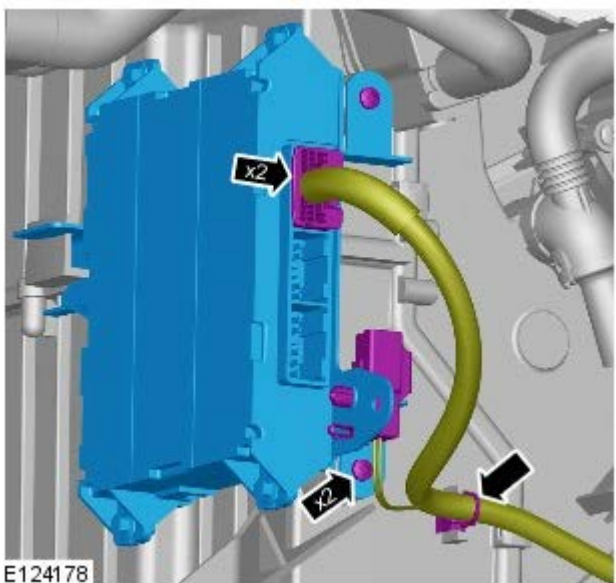


28. Driver side: Remove the heater housing to bulkhead Torx bolt.



29. Passenger side: Remove the heater housing to bulkhead Torx bolt.

- With assistance, remove the heater and evaporator core housing.

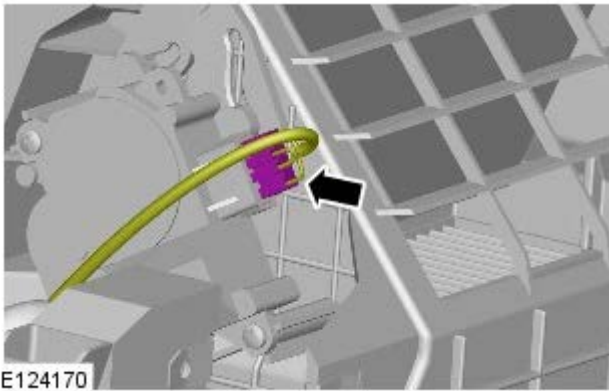


30. Remove the A/C control module.

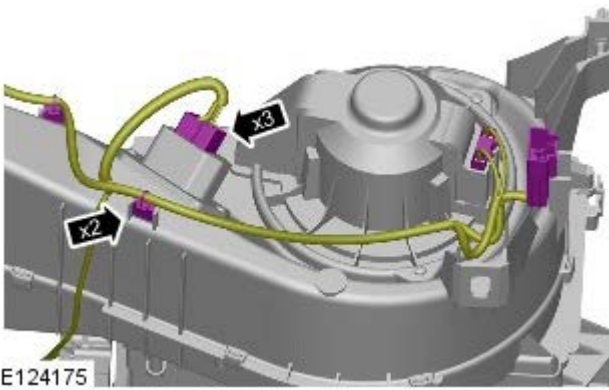
31. Disconnect the evaporator core temperature sensor electrical connector.



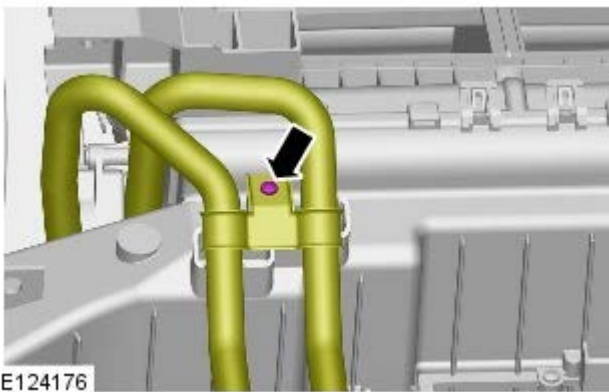
32. Disconnect the electrical connector.



33. Detach the wiring harness.

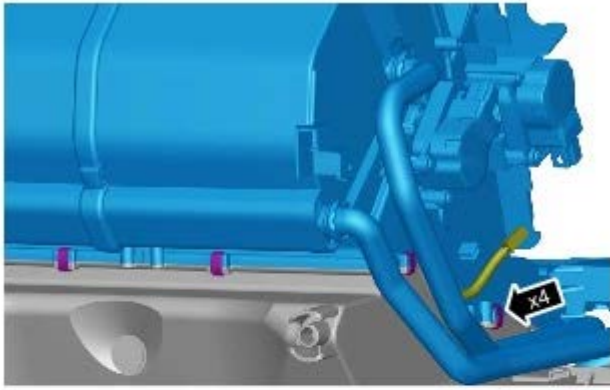


34. Remove the bolt from the support bracket.

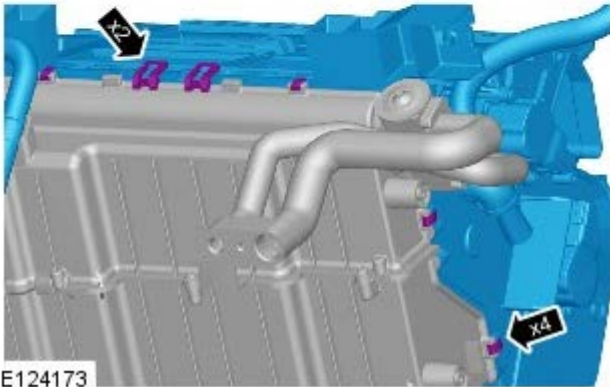


35. Remove the heater and evaporator core housing.

- Remove the 8 clips.

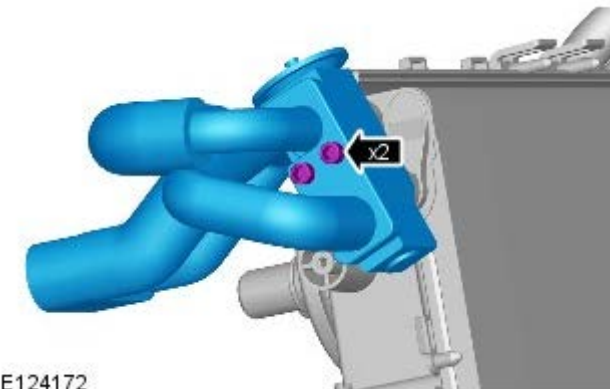


- Carefully release the 2 clips.



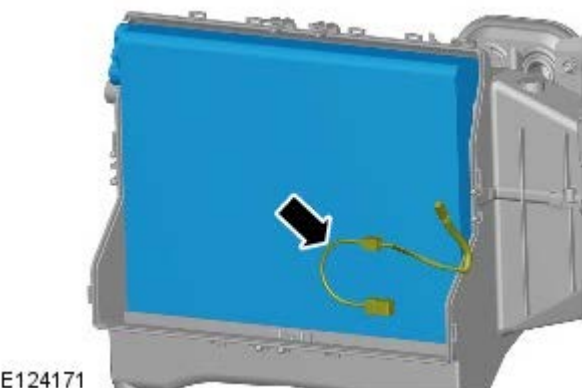
E124173

36. Remove the thermostatic expansion valve.



E124172

37. Remove the evaporator core.
- Release the temperature sensor.



E124171

Installation

1. Install the evaporator core.
 - Secure the temperature sensor.
2. Secure the heater core housing.
 - Install the clips.
3. Install the thermostatic expansion valve.

- Tighten the bolts to 3.5 Nm (2.5 lb.ft).
4. Install the wiring harness.
 5. Install and tighten the bolt.
 6. Connect the temperature sensor electrical connector.
 7. Install the CC module.
 - Tighten the bolts.
 8. Passenger side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).
 - With assistance, install the heater and evaporator core housing.
 9. Driver side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).
 10. Install the footwell ducts.
 - Tighten the Torx screws.
 11. Connect the drain tubes to the heater housing.
 12. Install the adapter panels.
 - Tighten the nuts to 6 Nm (4 lb.ft).
 13. Secure the A/C refrigerant lines.
 - Clean the components.
 - Install new O-ring seals.
 - Tighten the bolt to 5 Nm (4 lb.ft).
 - Tighten the nut to 6 Nm.
 14. Connect the bulkhead heater hoses.
 15. With assistance, install the instrument panel.
 - Tighten the Torx bolts to 25 Nm (18 lb.ft).
 16. Install the instrument panel carrier to bulkhead Torx bolt and tighten to 25 Nm (18 lb.ft).
 17. Install the plenum chamber panel.
For additional information, refer to: [Plenum Chamber](#) (412-01 Air Distribution and Filtering, Removal and Installation).
 18. Secure the heater housing.
 - Tighten the screws.
 19. Connect the steering column intermediate shaft.
 - Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).
 20. Install the heater housing center ducts.
 21. Connect the instrument panel center reinforcement fibre optic cables.
 22. Connect the instrument panel center reinforcement electrical connectors.
 23. Connect the CJB electrical connectors.
 24. Connect the electrical connectors to the passenger side lower A-pillar.
 25. Connect the ground cables to the passenger side lower A-pillar.
 - Tighten the nuts to 10 Nm (7 lb.ft).
 26. Connect the electrical connectors to the driver side lower A-pillar.
 27. Connect the ground cables to the driver side lower A-pillar.

Tighten the nuts to 10 Nm (7 lb.ft).

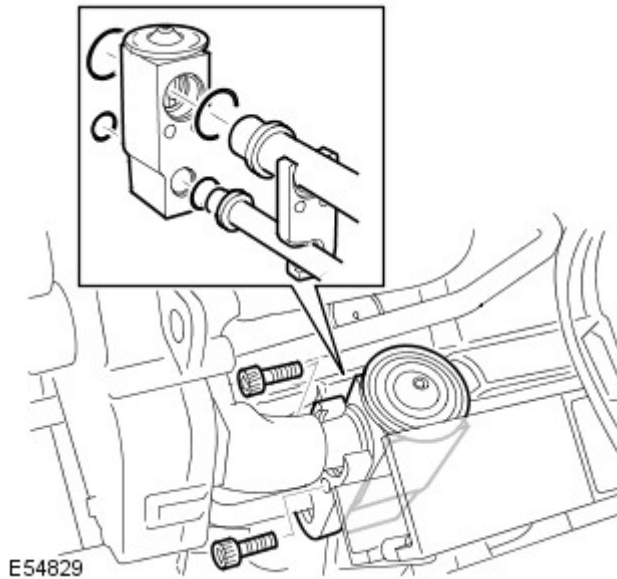
28. Connect the 3 electrical connectors.
29. Install the instrument panel upper section.
For additional information, refer to: [Instrument Panel Upper Section](#) (501-12 Instrument Panel and Console, Removal and Installation).
30. Install the floor console.
For additional information, refer to: [Floor Console](#) (501-12 Instrument Panel and Console, Removal and Installation).
31. Install the front seat.
For additional information, refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).
32. Recharge the A/C system.
For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
33. Refill the cooling system.
For additional information, refer to: [Cooling System Partial Draining, Filling and Bleeding](#) (303-03B, General Procedures).
34. Install the engine cover.
For additional information, refer to: [Engine Cover - V6 S/C 3.0L Petrol](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

Air Conditioning - V6 S/C 3.0L Petrol - Thermostatic Expansion Valve

Removal and Installation

Removal

1. Evacuate the A/C system.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Remove the instrument panel upper section.
For additional information, refer to: Instrument Panel Upper Section (501-12 Instrument Panel and Console, Removal and Installation).



3.  **CAUTION:** Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

Remove the thermostatic expansion valve.

- Remove the cover.
- Remove the 2 Allen bolts.
- Remove and discard the 4 O-ring seals.

Installation

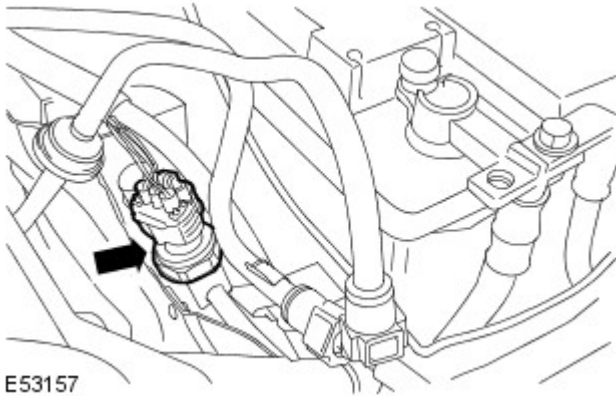
1. Install the thermostatic expansion valve.
 - Clean the components.
 - Install the new O-ring seals.
 - Tighten the Allen bolts to 5 Nm (4 lb.ft).
 - Install the cover.
2. Install the instrument panel upper section.
For additional information, refer to: Instrument Panel Upper Section (501-12 Instrument Panel and Console, Removal and Installation).
3. Recharge the A/C system.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).

Air Conditioning - V6 S/C 3.0L Petrol - Air Conditioning (A/C) Pressure Transducer

Removal and Installation


Removal


1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Recover the A/C refrigerant.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).



E53157

3. CAUTIONS:

 Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

 To prevent damage to components, use an additional wrench when loosening or tightening unions.

Remove the A/C pressure transducer.

- Disconnect the electrical connector.
- Remove and discard the seal.

Installation

1. Install the A/C pressure transducer.
 - Clean the component mating faces.
 - Install a new seal.
 - Tighten the transducer to 10 Nm (7 lb.ft).
 - Connect the electrical connector.
2. Recharge the A/C system.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
3. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).

Auxiliary Climate Control -

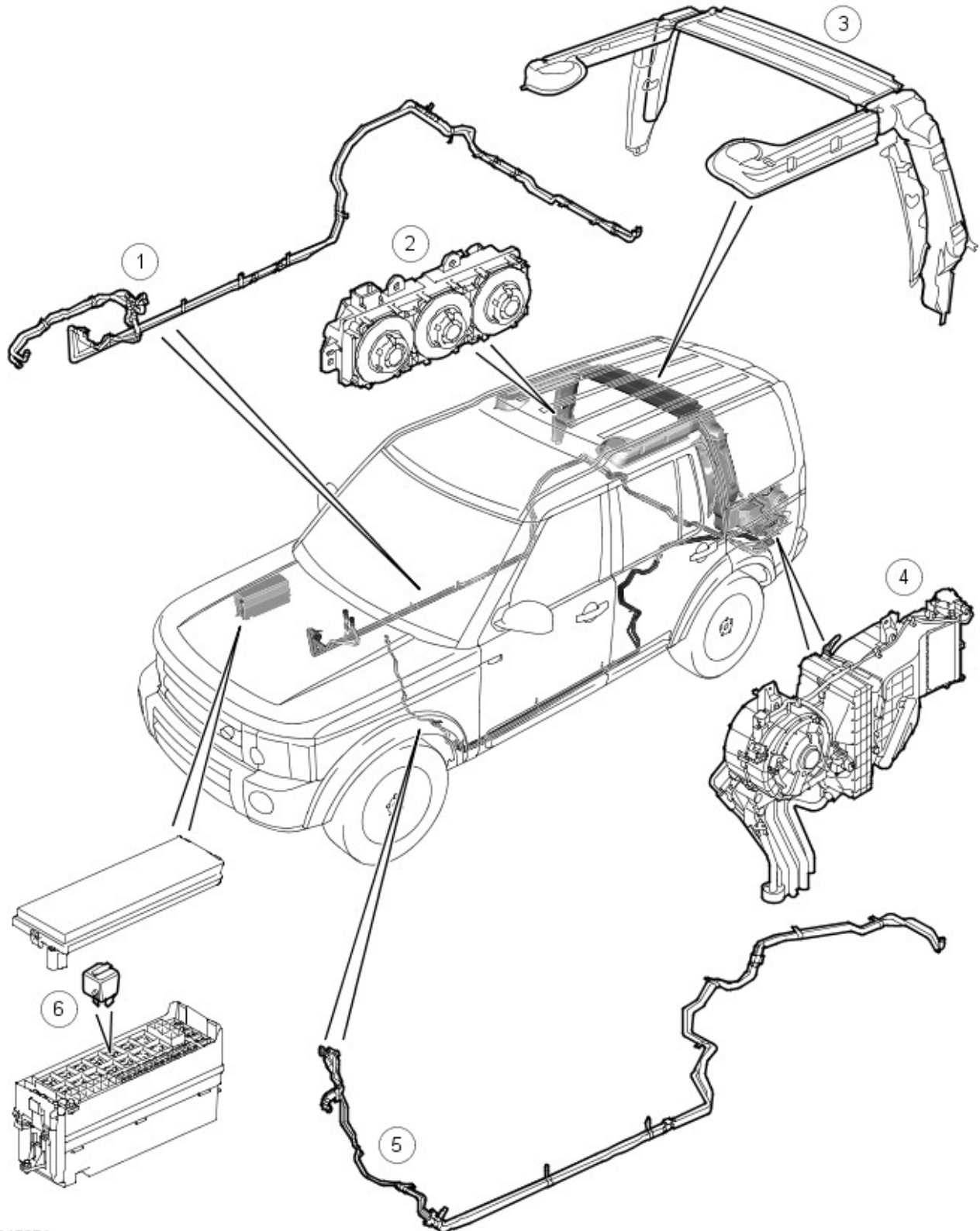
Torque Specifications

Description	Nm	lb-ft
TVX assembly bolts	10	7
Auxiliary climate control assembly bolts	10	7
Auxiliary climate control sealing plate bolts	10	7
A/C pipe bolts	10	7
TVX assembly bolts	10	7

Auxiliary Climate Control - Auxiliary Climate Control

Description and Operation

COMPONENT LOCATIONS



E47874

Item	Part Number	Description
1	-	Heater lines
2	-	ACCM (auxiliary climate control module)
3	-	Air distribution ducts
4	-	Auxiliary climate control assembly
5	-	Refrigerant lines
6	-	Rear blower relay

GENERAL

The auxiliary climate control system provides additional air conditioning for the second and third row seat occupants. The auxiliary climate control system consists of:

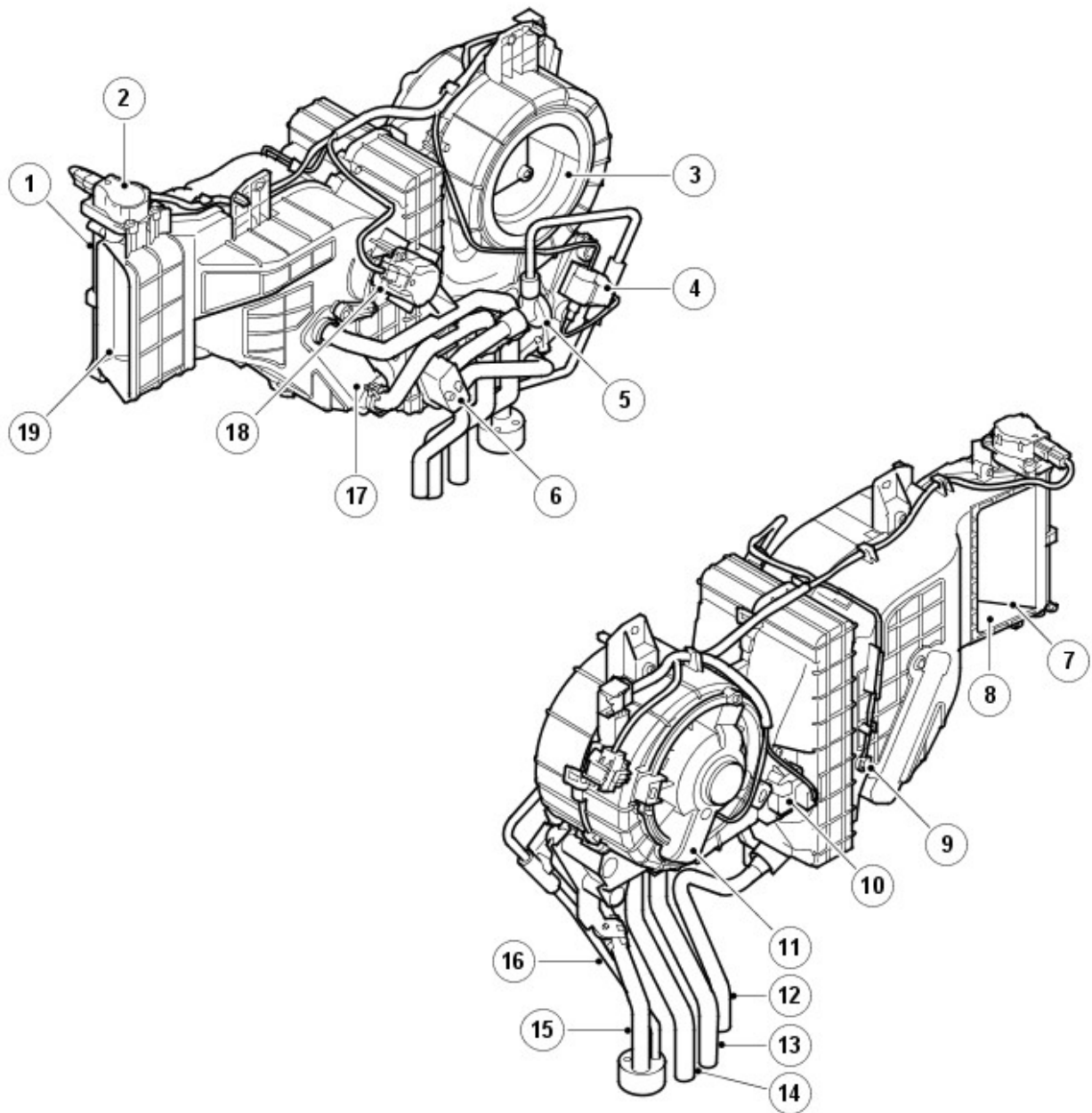
- An auxiliary climate control assembly.
- A refrigerant circuit.
- A heating circuit.
- A distribution system.
- An ACCM.

The automatic temperature control (ATC) module, of the main air conditioning system, is also used in the control of the auxiliary climate control system.

For additional information, refer to: Control Components (412-04 Control Components, Description and Operation).

Cabin air is recirculated through the auxiliary climate control assembly, where the air is temperature regulated and then directed through the distribution system to registers in the roof, on the C pillars and on the left side of the loadspace. The volume, temperature and distribution of the air from the auxiliary climate control assembly can be manually controlled by the ACCM or automatically controlled by the ATC module.

AUXILIARY CLIMATE CONTROL ASSEMBLY



E47875

Item	Part Number	Description
1	-	Casing
2	-	Distribution door motor
3	-	Blower inlet
4	-	Solenoid valve
5	-	Thermostatic expansion valve

6	-	Evaporator connector block
7	-	Distribution door
8	-	Footwell outlet
9	-	Evaporator temperature sensor
10	-	Blower control module
11	-	Blower
12	-	Evaporator drain tube
13	-	Heater core inlet pipe
14	-	Heater core outlet pipe
15	-	Evaporator outlet pipe
16	-	Evaporator inlet pipe
17	-	Heater core
18	-	Temperature blend door motor
19	-	Face level outlet

The auxiliary climate control assembly is a reheat unit, which cools the air to a constant value then reheats it as necessary to produce the required temperature. The assembly is installed on the left side of the loadspace, behind the rear quarter panel. A grille in the rear quarter panel allows air to flow from the loadspace into the auxiliary climate control assembly.

The auxiliary climate control assembly consists of a casing, formed from a series of plastic molding, which contains:

- A blower
- A blower control module
- An evaporator
- A heater core
- A temperature blend door
- A distribution door
- An evaporator temperature sensor.

Refrigerant and coolant lines from the engine compartment are connected to pipes from the evaporator and the heater core immediately below the loadspace floor. Where the pipes, and the evaporator drain tube, pass through the loadspace floor, the aperture is sealed by a seal plate.

Internal passages, integrated into the casing of the auxiliary climate control assembly, guide the air from the blower through the evaporator and heater core to the distribution outlets.

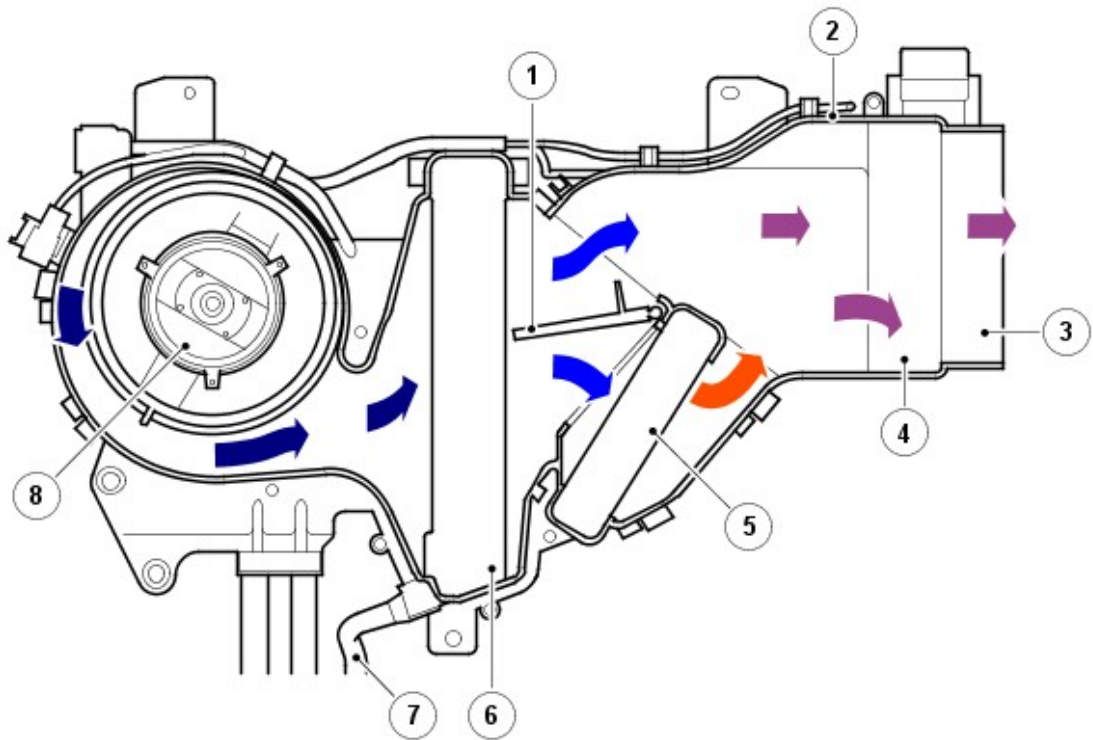
The temperature blend door regulates the flow of air through the heater core to control the temperature of the air leaving the auxiliary climate control assembly. A stepper motor installed on the rear of the casing operates the temperature blend door.

The distribution door regulates the flow of air through the face level outlet and the foot level outlet. A stepper motor installed on the top of the casing operates the distribution door.

The temperature blend stepper motor and the distribution stepper motor are both connected to a Local Interconnect (LIN) bus, which also connects the ACCM with the ATC module. Each stepper motor incorporates a microprocessor which operates the motor in response to LIN bus messages from the ACCM. The stepper motors are powered by a feed from the ATC module, and share a ground connection with the rear blower control module.

The ACCM determines the positions of the distribution and temperature blend doors by using either their closed or open position as a datum and memorizing the steps that it drives the individual stepper motors. Each time the ACCM is activated by the ATC module, it checks the memorized position of the stepper motors against fixed values for the current distribution and temperature settings on the control panel. If there is an error, the ACCM calibrates the applicable stepper motor, to re-establish the datums, by driving them fully closed or open before re-setting them to their nominal selected position. A calibration run can also be invoked using T4.

Air Flow Through Auxiliary Climate Control Assembly

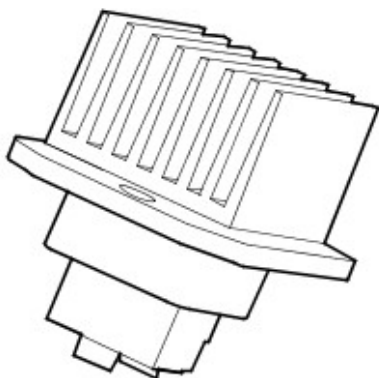


E47876

Item	Part Number	Description
1	-	Temperature blend door
2	-	Auxiliary climate control assembly casing
3	-	Face level outlet
4	-	Distribution door
5	-	Heater core
6	-	Evaporator
7	-	Evaporator drain tube
8	-	Blower

The blower is in the air inlet of the auxiliary climate control assembly, and consists of an open hub, centrifugal fan powered by an electric motor. Operation of the blower is controlled by the ACCM, using the rear blower relay in the battery junction box (BJB) and the blower control module. The blower control module is installed in the auxiliary climate control assembly downstream of the blower, where any heat generated during operation is dissipated by the air flow. A wiring harness on the auxiliary climate control assembly connects the blend door motor, distribution door motor, blower and blower control module to the vehicle wiring.

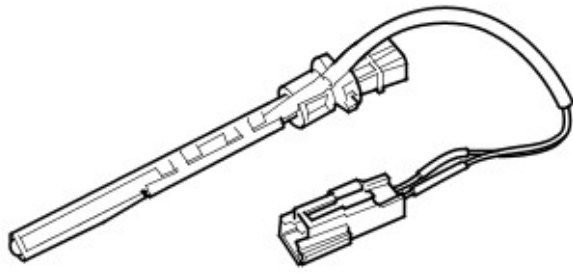
Blower Control Module



E47886

When the blower is required, the ACCM energizes the coil of the rear blower relay. The energized rear blower relay supplies battery power to the blower motor, which is connected to ground through the blower control module. The speed of the blower is controlled by the blower control module, which regulates the blower motor voltage in response to a pulse width modulation (PWM) signal from the ACCM. To vary the blower motor voltage the ACCM varies the duty cycle of the signal.

Evaporator Temperature Sensor



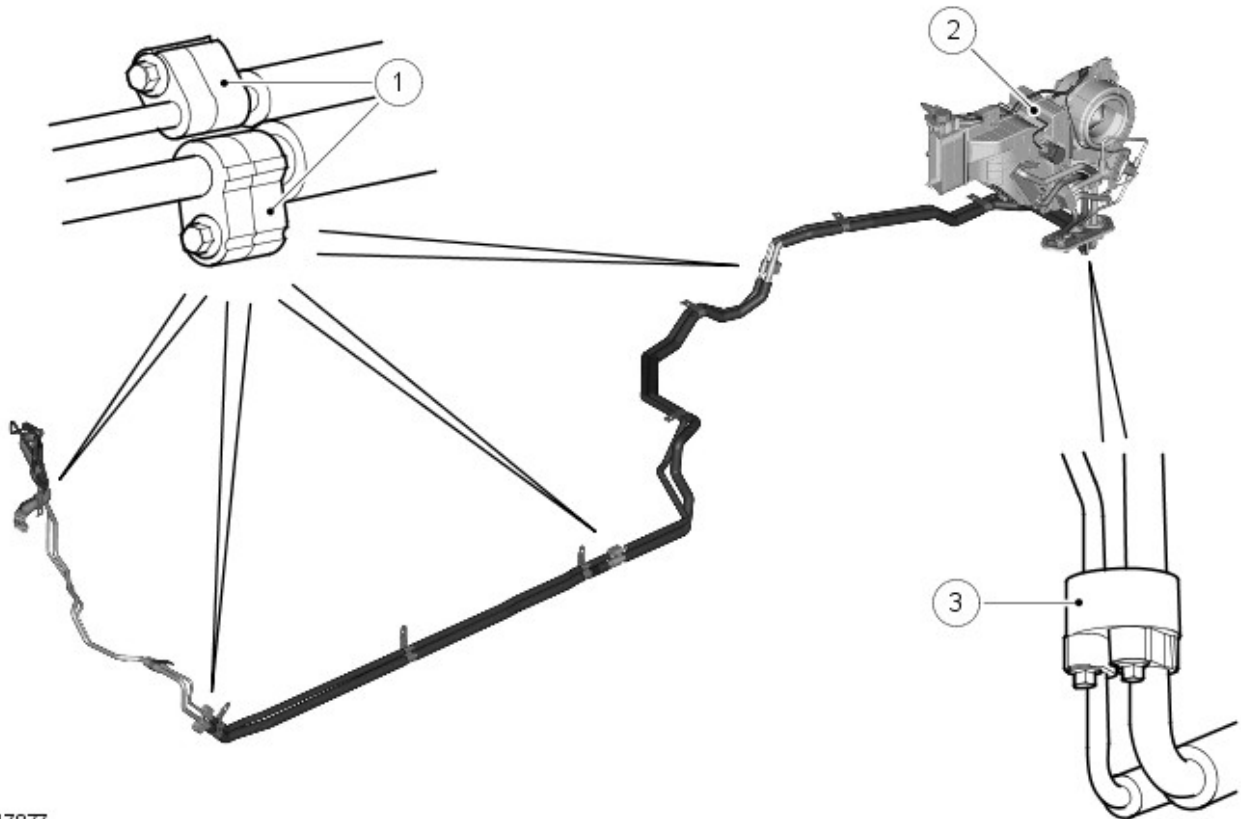
E47884

The evaporator temperature sensor is a negative temperature coefficient (NTC) thermistor installed in the auxiliary climate control assembly on the downstream side of the evaporator. The evaporator temperature sensor supplies a temperature signal to the ACCM.

REFRIGERANT CIRCUIT

Two refrigerant lines, low pressure and high pressure, connect the evaporator in the auxiliary climate control assembly to the front air conditioning (A/C) refrigerant system. On the auxiliary climate control assembly, a solenoid valve and a thermostatic expansion valve control the flow of refrigerant through the evaporator.

Refrigerant Lines

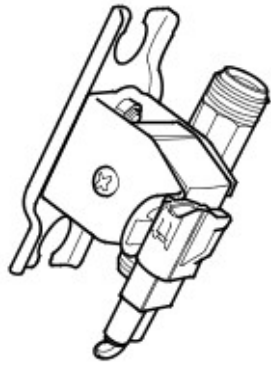


E47877

Item	Part Number	Description
1	-	In-line connections
2	-	Auxiliary climate control assembly
3	-	Connections to auxiliary climate control assembly

The refrigerant lines are routed around the left rear wheel arch and along the left-hand (LH) underside of the vehicle, and connected to the front A/C refrigerant system at the rear of the engine compartment. The refrigerant lines consist of sections of aluminum alloy pipes. All except the front section of the pipes are insulated with foam rubber sleeving.

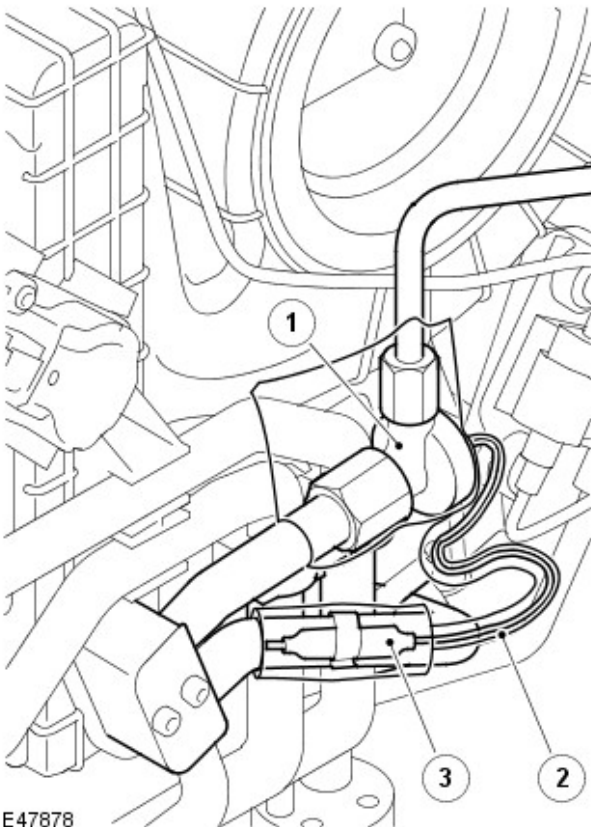
Solenoid Valve



E47885

The solenoid valve allows the auxiliary climate control assembly to be isolated from the front A/C refrigerant system. Operation of the solenoid valve is controlled by the ACCM switching a ground.

Thermostatic Expansion Valve



E47878

Item	Part Number	Description
1	-	Thermostatic expansion valve
2	-	Capillary tube
3	-	Temperature bulb

The thermostatic expansion valve meters the flow of refrigerant into the evaporator, to match the heat load of the air passing through the auxiliary climate control assembly.

The thermostatic expansion valve is installed in the inlet line to the evaporator. Liquid refrigerant flows through the valve to the evaporator. The restriction across the valve reduces the pressure and temperature of the refrigerant and changes it to a fine spray, which improves the evaporation process. Valve opening is controlled by the pressure in a capillary tube containing a temperature sensitive fluid. One end of the capillary tube is connected to a diaphragm housing on the thermostatic expansion valve, the other end of the capillary tube is sealed and attached to the refrigerant outlet line of the evaporator. As the temperature of the refrigerant leaving the evaporator changes, a corresponding change of capillary tube pressure and valve opening are produced. The warmer the refrigerant leaving the evaporator becomes, the greater the volume of refrigerant allowed through the valve.

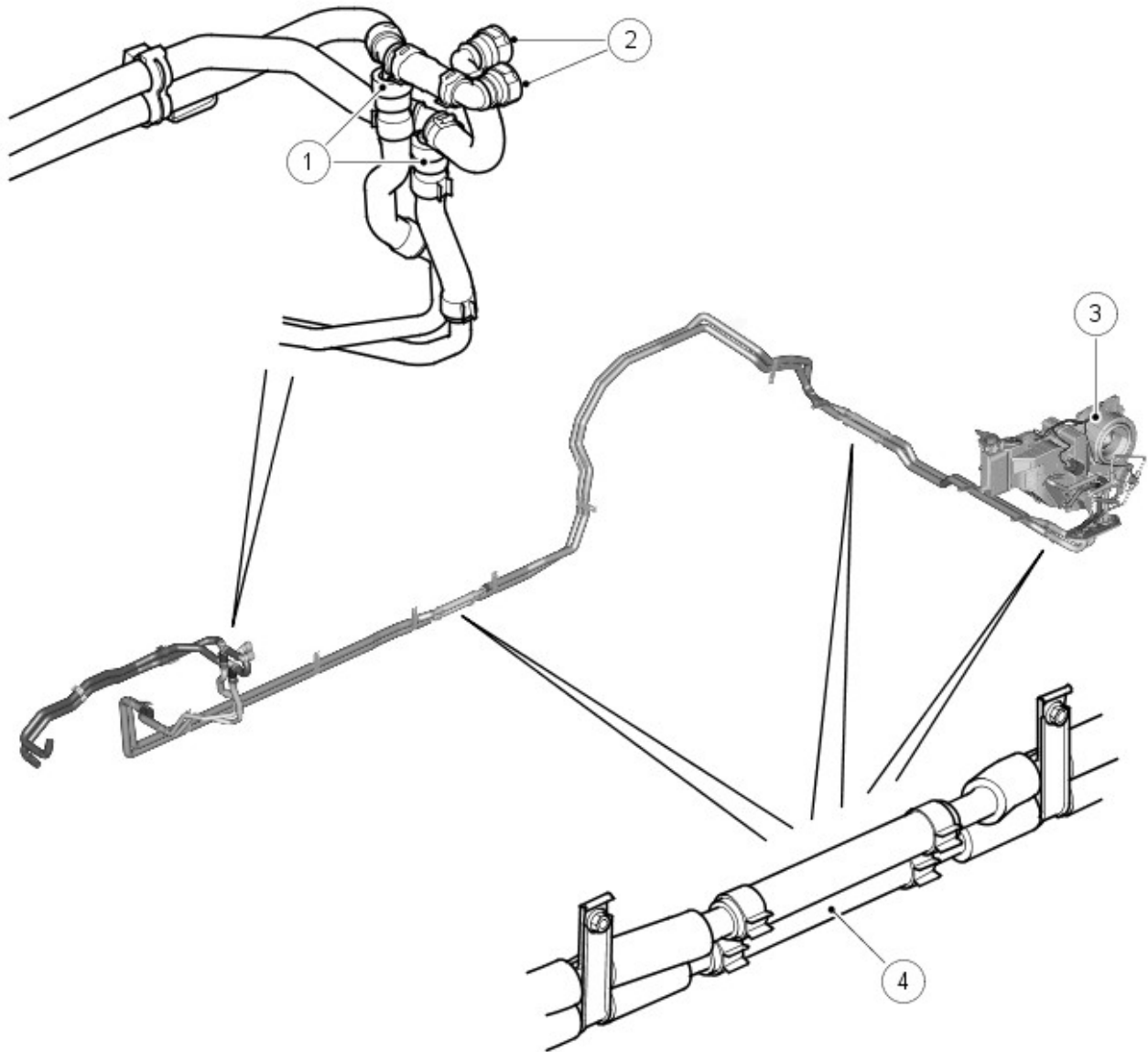
Evaporator

The evaporator is installed in the auxiliary climate control assembly between the blower and the heater matrix, to absorb heat from the recirculated air. Low pressure, low temperature refrigerant changes from liquid to vapor in the evaporator, absorbing large quantities of heat as it changes state. Most of the moisture in the air passing through the evaporator condenses into water, which drains out of the auxiliary climate control assembly through the evaporator drain tube.

HEATING CIRCUIT

Two heater lines, supply and return, connect the heater core in the auxiliary climate control assembly to the engine cooling system. The heater lines are routed along the rear crossmember, around the right rear wheel arch and along the RH underside of the vehicle. The heater lines are connected to the engine cooling system at the rear of the engine compartment. The heater lines consist of sections of aluminum alloy pipes, insulated with foam rubber, which are connected together with rubber hose joints. Quick release fittings connect the heater lines to the engine cooling system.

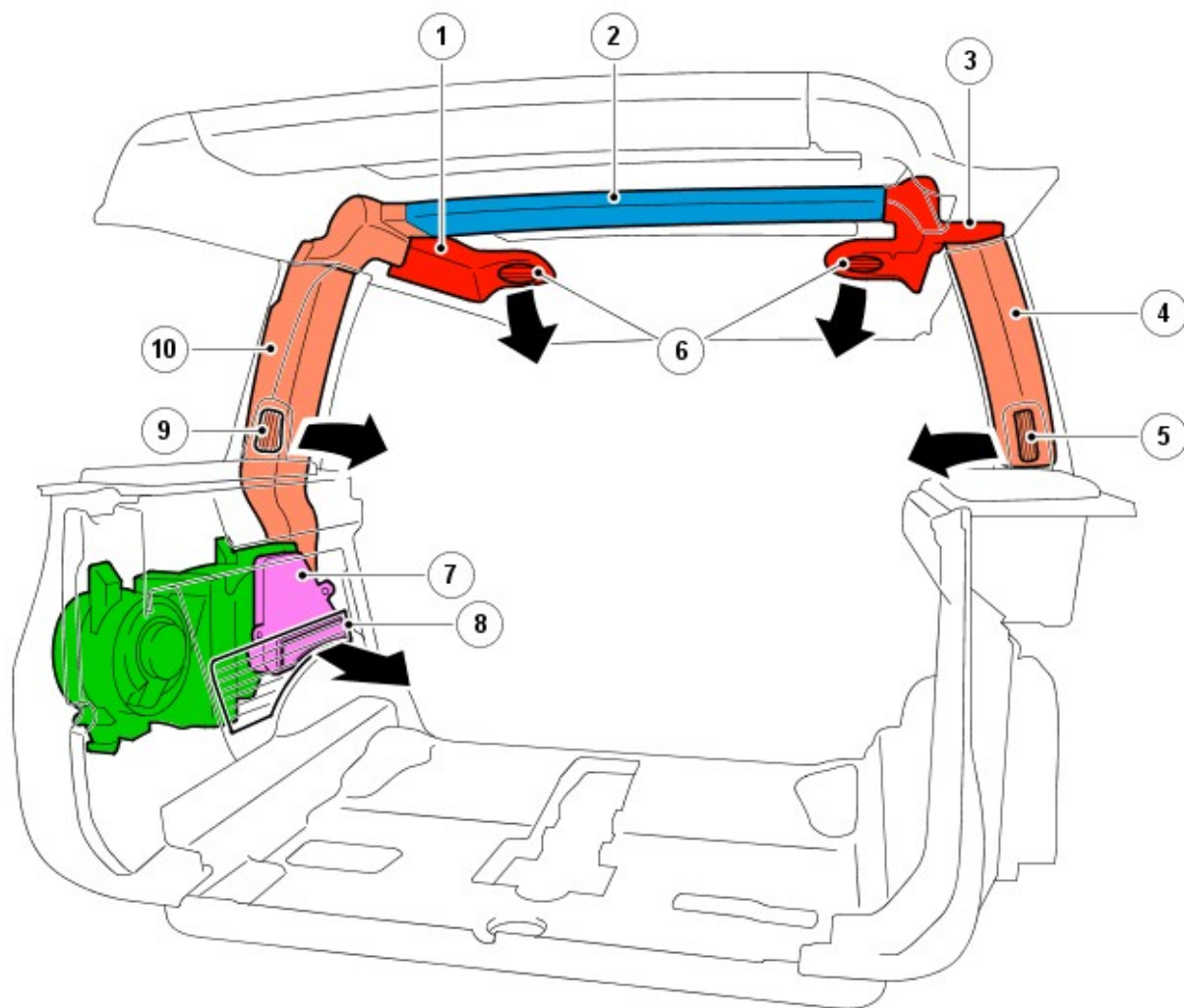
Heater Lines



E47879

Item	Part Number	Description
1	-	Quick release connections to engine cooling system
2	-	Quick release connections to main heater
3	-	Auxiliary climate control assembly
4	-	In-line connections

DISTRIBUTION SYSTEM



E47880

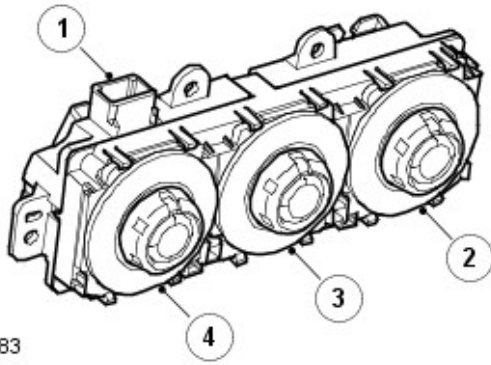
Item	Part Number	Description
1	-	Second row left face level air duct
2	-	Cross-car air duct
3	-	Second row right face level air duct
4	-	Right C pillar air duct
5	-	Third row right face level register
6	-	Second row face level registers
7	-	Third row foot level air duct
8	-	Third row foot level registers
9	-	Third row left face level register
10	-	Left C pillar air duct

The distribution system consists of a network of air ducts that supply air from the outlets of the auxiliary climate control assembly to registers installed in:

- The headliner, to the left and right of the second row interior lamp, to provide face level ventilation for second row seat occupants
- The left and right C pillar finishers, to provide face level ventilation for third row seat occupants
- The loadspace left side molding, to provide foot level ventilation for third row passengers.

The registers can all be adjusted to control the direction and volume of the air flow.

ACCM



E47883

Item	Part Number	Description
1	-	Electrical connector
2	-	Blower switch
3	-	Distribution switch
4	-	Temperature switch

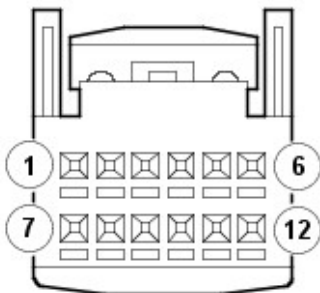
The ACCM allows manual adjustment of the output from the auxiliary climate control assembly. The ACCM is installed in the headliner immediately behind the row 2 interior lamp. An integral control panel contains separate rotary switches for temperature, distribution and blower speed. When the ACCM is in manual mode, amber light emitting diode (LED)s in the switch surrounds illuminate to indicate the current settings of the system and function symbols in the switch surrounds are illuminated when the side lamps or headlamps are on.

The ACCM is disabled when the auxiliary climate control switch on the ATC module is selected off. When the auxiliary climate control switch is selected to automatic or manual, the ACCM is enabled by the connection of a power feed from the ATC module. The same power feed also supplies the stepper motors in the auxiliary climate control assembly.

When it is enabled, the ACCM operates as a slave unit to the ATC module. The ACCM sends status signals on the LIN (local interconnect network) bus to the ATC module, which replies with command signals of the required temperature, distribution and blower settings. The ACCM then outputs the necessary drive signals to the auxiliary climate control assembly:

- In the automatic mode, the command signals are derived from the comfort strategy in the ATC module. The temperature setting is calculated from the mean of the two temperature settings on the ATC module.
- In the manual mode, the command signals reflect the temperature, distribution and blower speed set by the switches on the ACCM control panel. Temperature control by the auxiliary climate control system may be compromised if the temperature settings on the ATC module are set to maximum hot or cold.

ACCM Harness Connector C0695



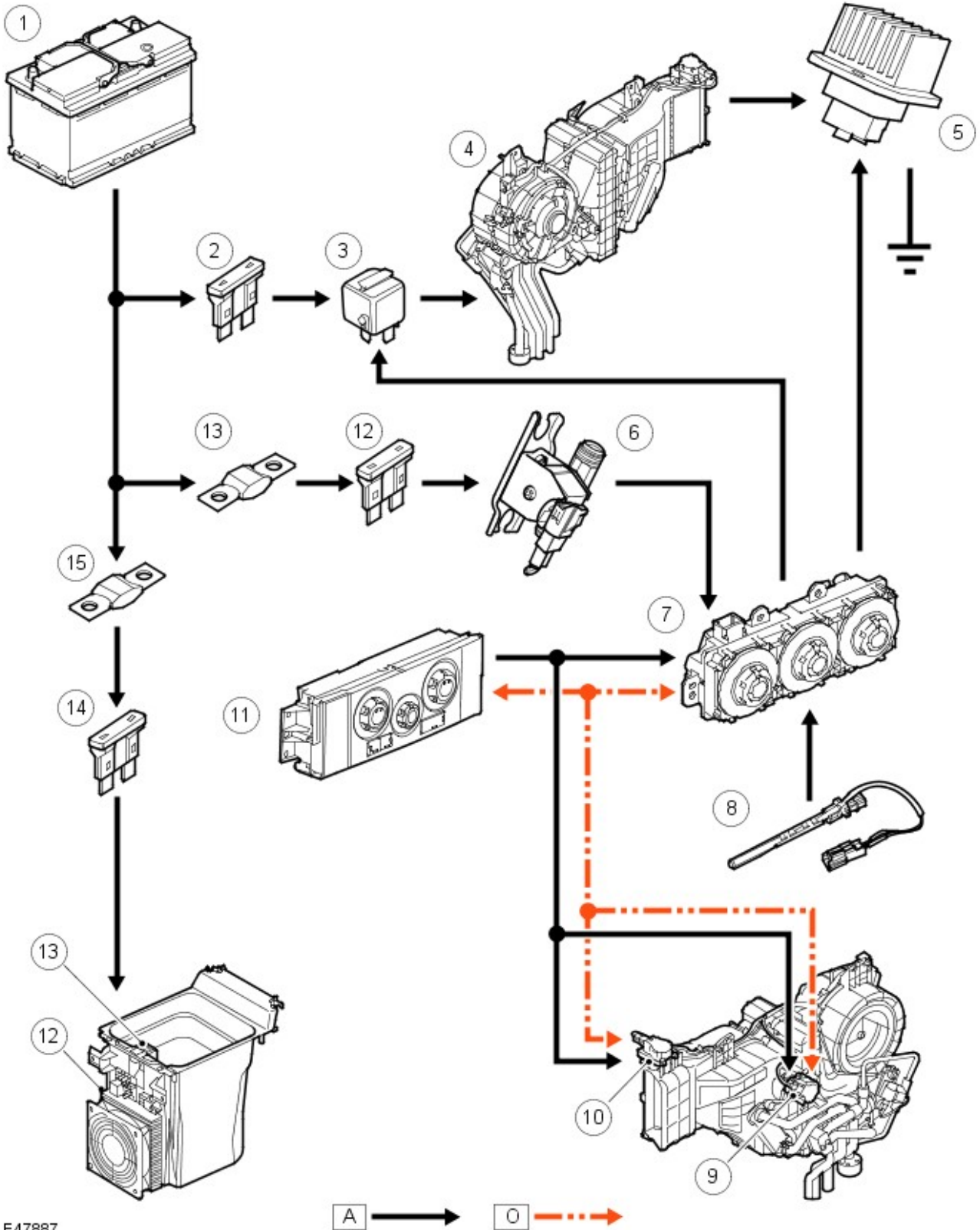
E47930

ACCM Harness Connector C0695 Pin Details

Pin No.	Description	Input/Output
1	Power supply from ATC module	Input
2	LIN bus	Input/Output
3	Ground	Output
4	Rear blower module power drive	Output
5	Blower motor voltage sense	Input
6	Cabin temperature sensor signal	Input
7 and 8	Not used	-
9	Sensor ground	Output
10	Rear blower relay coil drive	Output
11	Solenoid valve drive	Output
12	Evaporator temperature sensor signal	Input

CONTROL DIAGRAM

NOTE: A = Hardwired connection; O = LIN bus



E47887

Item	Part Number	Description
1	-	Battery
2	-	Fuse 22B, central junction box (CJB)
3	-	Rear blower relay
4	-	Rear blower
5	-	Rear blower control module
6	-	Solenoid valve
7	-	ACCM
8	-	Evaporator temperature sensor
9	-	Temperature blend door motor

- 10 - Distribution door motor
- 11 - ATC module
- 12 - Fuse 51P, CJB
- 13 - Fusible link, 17E, BJB

Auxiliary Climate Control - Auxiliary Climate Control

Diagnosis and Testing

Principle of Operation

For a detailed description of the auxiliary climate control system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Auxiliary Climate Control (412-03 Auxiliary Climate Control, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Auxiliary drive belt condition and tension • Air conditioning compressor condition and installation • Air conditioning condenser condition and installation/blockage • Air conditioning hoses and pipes • Air conditioning receiver/drier condition and installation • Cooling fan 	<ul style="list-style-type: none"> • Fuses • Harnesses • Electrical connector(s) • Relays • Sensors • Control panel(s) • Air conditioning compressor

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Poor or no cooling	<ul style="list-style-type: none"> • Auxiliary drive belt fault • Air conditioning compressor fault • Distribution motor/flap fault • Refrigerant leak • In-vehicle temperature sensor fault • Refrigerant pressure sensor fault 	<ul style="list-style-type: none"> • Check the auxiliary drive belt condition and tension (see visual inspection) • Check the compressor operation (observe the compressor as the engine is idling with the air conditioning switched on) • Carry out the distribution motor self test • Using the manufacturer approved diagnostic system, check the Automatic Temperature Control Module (ATC) for related DTCs and refer to the relevant DTC index • Check the refrigerant system using the charging station
Noise	<ul style="list-style-type: none"> • Auxiliary drive belt fault • Air conditioning compressor fault • Air conditioning compressor pulley fouling • Refrigerant overcharged 	<ul style="list-style-type: none"> • Confirm the air conditioning as the source of the noise by listening for the noise with the air conditioning switched off • Check the refrigerant system using the charging station
Water entry into cabin	<ul style="list-style-type: none"> • Heater matrix leak • Blocked evaporator drain tubes 	<ul style="list-style-type: none"> • Check for coolant loss. Pressure test the cooling system as necessary • Check and clear the evaporator drain tubes as necessary

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Automatic Temperature Control Module (ATC) (100-00 General Information, Description and Operation).

Auxiliary Climate Control - Thermostatic Expansion Valve

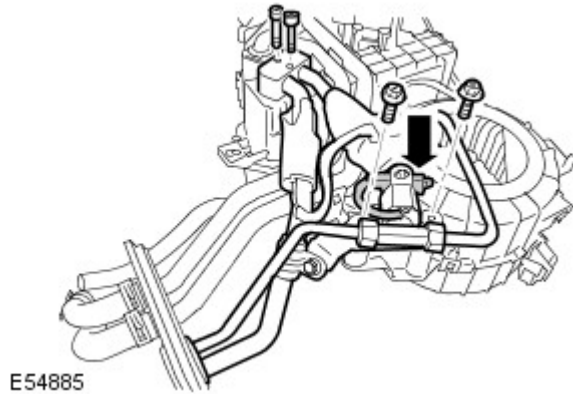
Removal and Installation


Removal



WARNING: Eye protection must be worn.

1. Remove the climate control assembly.
For additional information, refer to: Auxiliary Climate Control Assembly (412-03, Removal and Installation).



2.  **CAUTION:** Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.



NOTE: The receiver drier need only be changed under the following circumstances: There is dirt in the refrigerant circuit (eg. compressor seizure). The system is leaking and refrigerant has been lost to atmosphere. Refrigerant circuit has been open more than 24 hours due to repair.

Remove the TXV assembly.

- Disconnect the electrical connector.
- Remove the 2 bolts.
- Remove the 2 screws.
- Discard the O-ring seals.

Installation

1. Install the TXV assembly.
 - Install new O-ring seals.
 - Install the bolts and tighten to 10 Nm (7 lb.ft).
 - Tighten the screws.
2. Install the climate control assembly.
For additional information, refer to: Auxiliary Climate Control Assembly (412-03, Removal and Installation).

Auxiliary Climate Control - Heater Core

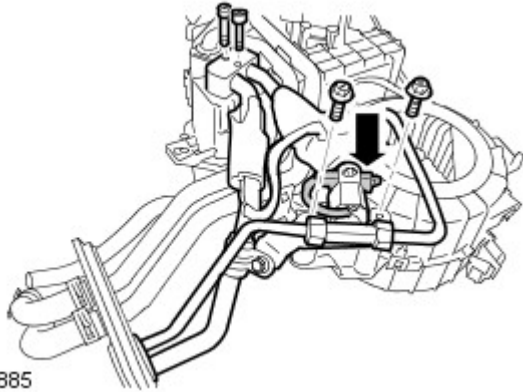
Removal and Installation

Removal




WARNING: Eye protection must be worn.

1. Remove the climate control assembly.
For additional information, refer to: Auxiliary Climate Control Assembly (412-03, Removal and Installation).



E54885

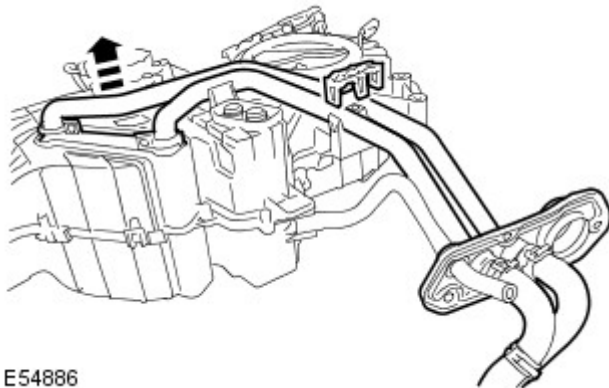
2.  **CAUTION:** Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.




NOTE: The receiver drier need only be changed under the following circumstances: There is dirt in the refrigerant circuit (eg. compressor seizure). The system is leaking and refrigerant has been lost to atmosphere. Refrigerant circuit has been open more than 24 hours due to repair.

Remove the TXV assembly.

- Disconnect the electrical connector.
- Remove the 2 bolts.
- Remove the 2 screws.
- Discard the O-ring seals.

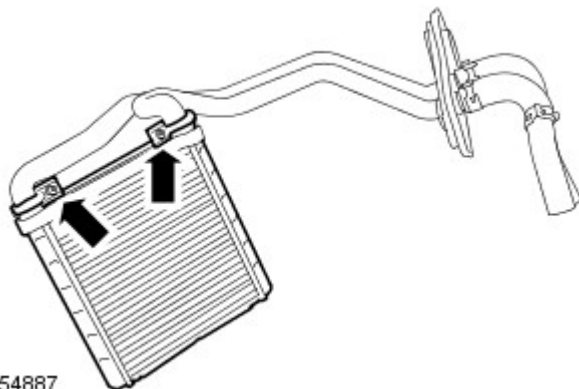


E54886


3.  **CAUTION:** Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

Remove the heater core.

- Carefully release the clips.



E54887

4.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the heater core, inlet and outlet pipes.

- Release the 2 clips.
- Discard the O-ring seals.

Installation

1. Connect the heater core inlet and outlet pipes.
 - Install the new O-ring seals.
 - Position and secure in the clips.
2. Install the heater core.

- Install the heater core.
 - Secure in the 2 clips.
- 3. Install the TXV assembly.
 - Install new O-ring seals.
 - Install the bolts and tighten to 10 Nm (7 lb.ft).
 - Tighten the screws.
- 4. Install the climate control assembly.
For additional information, refer to: Auxiliary Climate Control Assembly (412-03, Removal and Installation).

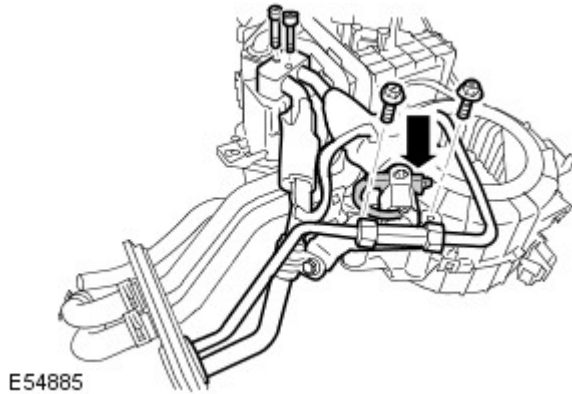
Auxiliary Climate Control - Evaporator Core


Removal and Installation


Removal

 **WARNING:** Eye protection must be worn.

1. Remove the climate control assembly.
For additional information, refer to: Auxiliary Climate Control Assembly (412-03, Removal and Installation).

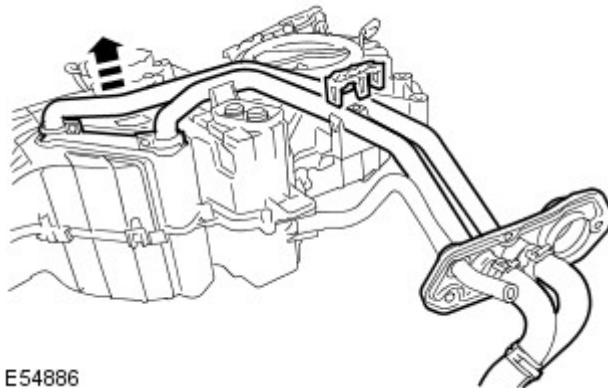



2.  **CAUTION:** Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

 **NOTE:** The receiver drier need only be changed under the following circumstances: There is dirt in the refrigerant circuit (eg. compressor seizure). The system is leaking and refrigerant has been lost to atmosphere. Refrigerant circuit has been open more than 24 hours due to repair.

Remove the TXV assembly.

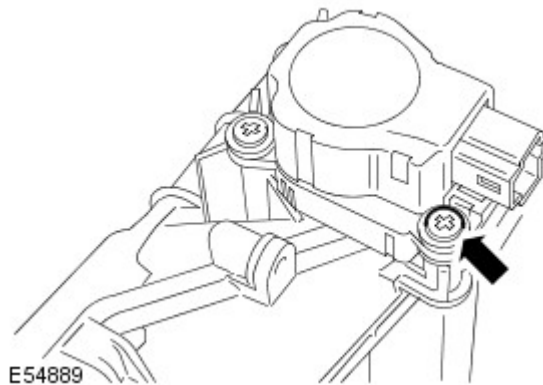
- Remove the 2 bolts.
- Remove the 2 screws.
- Discard the O-ring seals.
- Disconnect the electrical connector.



3.  **CAUTION:** Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

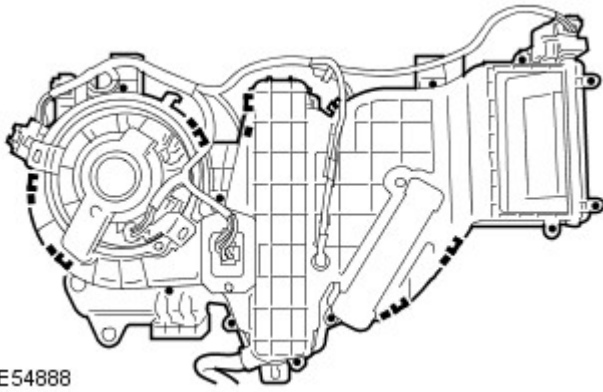
Remove the heater core.

- Carefully release the clips.



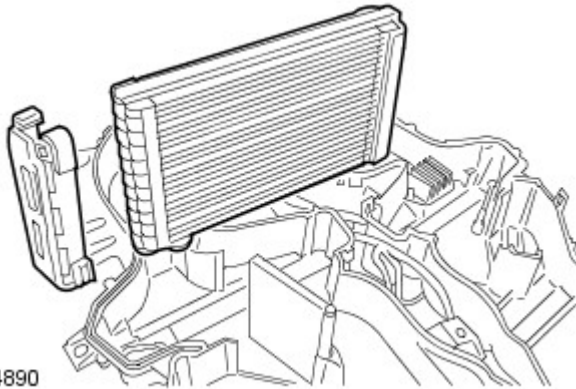
4. Remove 1 screw from the air distribution servo.

5. Separate the climate control unit.
 - Remove the 11 screws.
 - Remove the 6 clips.
 - Release the 7 clips.



E54888

6. Remove the evaporator core.
 - Remove the evaporator end trim.



E54890

Installation

1. Install the evaporator core.
 - Install the evaporator end trim
2. Assemble the climate control unit.
 - Secure the clips.
 - Install the screws.
 - Install the clips.
3. Install the distribution motor.
 - Tighten the screw.
4. Install the heater core.
 - Install the heater core.
 - Secure in the 2 clips.
5. Install the TXV assembly.
 - Install new O-ring seals.
 - Install the bolts and tighten to 10 Nm (7 lb.ft).
 - Tighten the screws.
6. Install the climate control assembly.
For additional information, refer to: Auxiliary Climate Control Assembly (412-03, Removal and Installation).


Auxiliary Climate Control - Auxiliary Climate Control Assembly

Removal and Installation

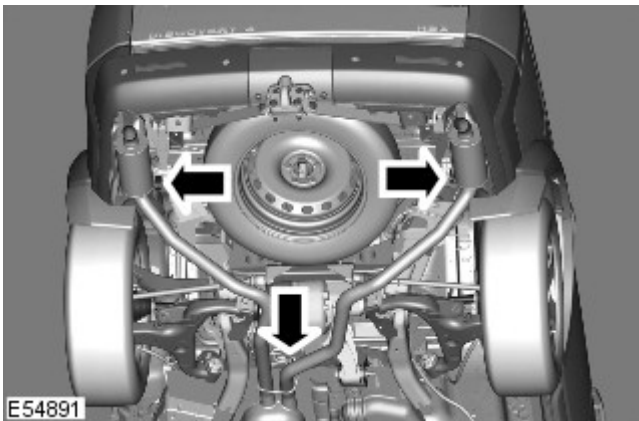
Removal



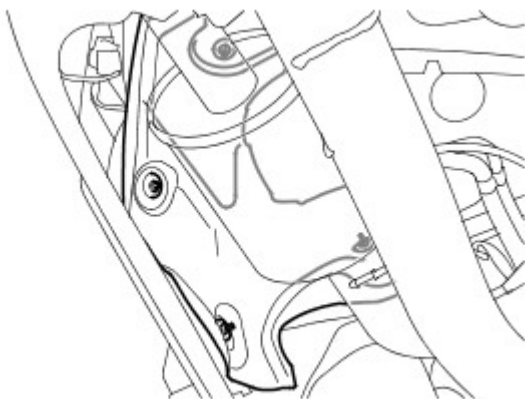
WARNING: Since injury such as scalding could be caused by escaping steam or coolant, do not remove the filler cap from the coolant expansion tank while the system is hot.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the LH C-pillar lower trim panel
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).
3. Evacuate the A/C system.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00, General Procedures).
4.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.




5. Support the exhaust system. Release the center, left and right rear mountings.



6. Remove the exhaust heat shield.
 - Remove the 4 nuts.

7. Remove the spare wheel and tire.
8. Clamp the relevant hose, to minimise coolant loss.

9.  **CAUTION:** Before disconnecting or removing the components, ensure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

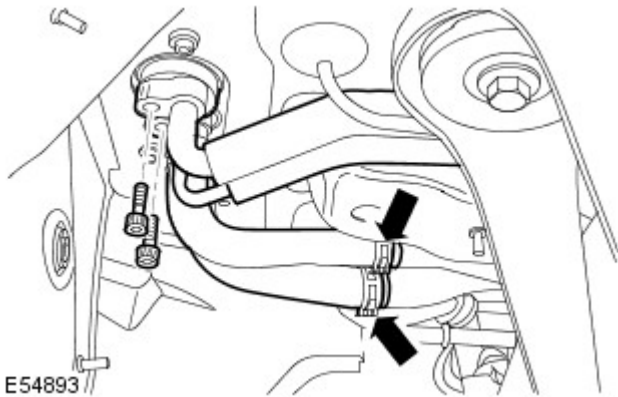



NOTE: The receiver drier need only be changed under


the following circumstances: There is dirt in the refrigerant circuit (eg. compressor seizure). The system is leaking and refrigerant has been lost to atmosphere. Refrigerant circuit has been open more than 24 hours due to repair.

Disconnect the A/C pipes.

- Remove the 2 bolts.
- Discard the O-ring seals.

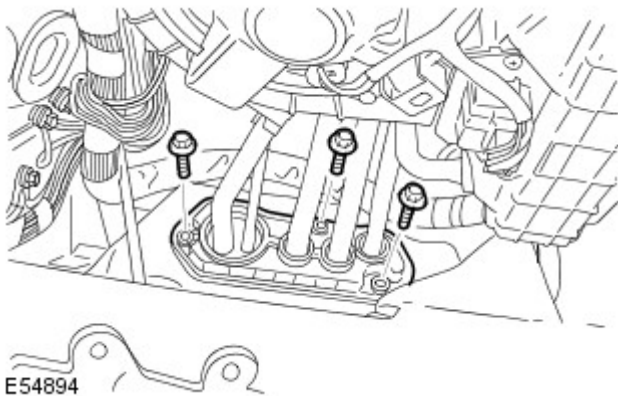


10.  **CAUTION:** Engine coolant will damage the paint finished surfaces. If spilt, immediately remove the coolant and clean the area with water.

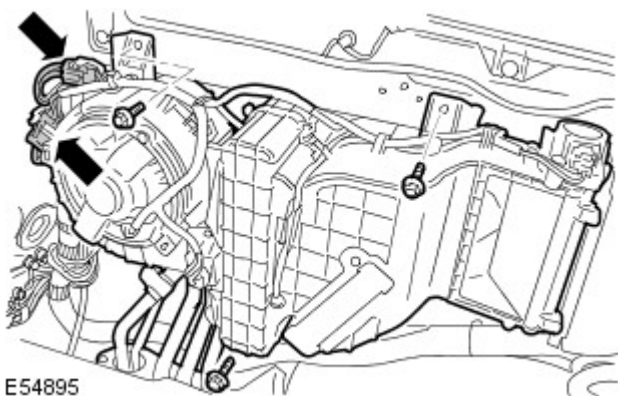
 **NOTE:** Some fluid spillage is inevitable during this operation.

Disconnect the 2 coolant hoses.

- Position a container to collect the fluid.
- Release the 2 clips.



11. Release the sealing plate.
- Remove the 3 bolts.




12. Remove the climate control assembly.
- Disconnect the 2 electrical connectors.
 - Remove the 3 bolts.

Installation

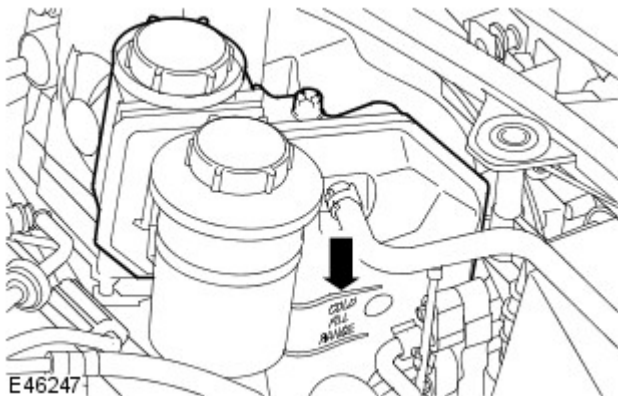
1. Install the climate control assembly.
 - Tighten the bolts to 10 Nm (7 lb.ft).
 - Connect and secure the electrical connectors.
2. Install the sealing plate.
 - Tighten the bolts to 10 Nm (7 lb.ft).
3. Connect and secure the coolant hoses.
 - Secure the clips.
 - Remove the hose clamps.
4. Connect the A/C pipes.
 - Clean the component mating faces.
 - Install the O-ring seals.
 - Tighten the 2 bolts to 10 Nm (7 lb.ft).

5. Install the heat shield.
 - Tighten the 4 nuts.
6. Secure the exhaust mountings.
7. Fill the A/C system.
For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00, General Procedures).
8. Install the C-pillar lower trim panel.
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).
9. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
10. Install the spare wheel and tire.
 - Stow the tool kit.
11. Connect the exhaust extraction hoses to the tail pipes.
12. Remove the coolant expansion tank cap.
 - Top-up the coolant.
13. Start and run the engine.
 - Hold the engine speed at 2,500 RPM for 30 seconds.
 - Return the engine to idle for 30 seconds.
 - Repeat the above procedure a further four times.

14.  **NOTE:** When the coolant bleed is complete and prior to installing the expansion tank cap, top up the expansion tank 30mm above the maximum level.

Install the coolant expansion tank cap.

15. Run the engine until the thermostat opens.
16. Switch the engine off and allow to cool.
17. Check and top-up the coolant if required.

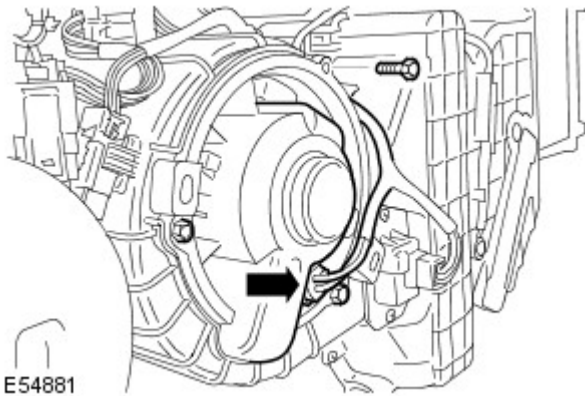



Auxiliary Climate Control - Auxiliary Blower Motor

Removal and Installation

Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the LH C-pillar lower trim panel
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).



3.  **NOTE:** Note the fitted position.

Remove the blower motor.

- Disconnect the electrical connector.
- Remove the 3 screws.

Installation

1. Install the blower motor.
 - Tighten the screws.
 - Connect and secure the electrical connector.
2. Install the C-pillar lower trim panel.
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).
3. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

Auxiliary Climate Control - Auxiliary Temperature Blend Door Actuator

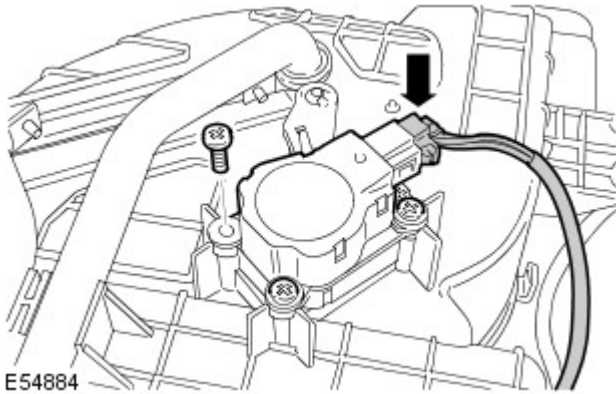
Removal and Installation

Removal



WARNING: Eye protection must be worn.

1. Remove the climate control assembly.
For additional information, refer to: Auxiliary Climate Control Assembly (412-03, Removal and Installation).



2.  **NOTE:** Note the fitted position.

Remove the blend door motor.

- Disconnect the electrical connector.
- Remove the 3 screws.

Installation

1.  **NOTE:** Align to the position noted on removal.

Install the blend motor.

- Tighten the screws.
- Connect and secure the electrical connector.

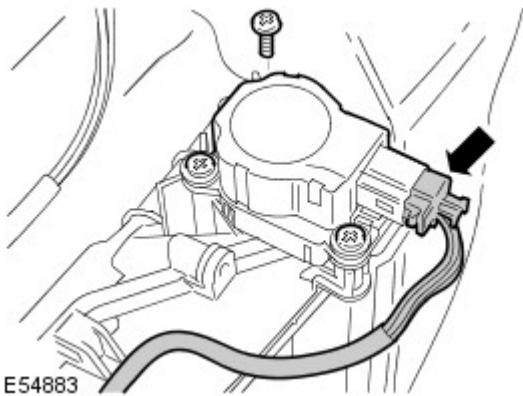
2. Install the climate control assembly.
For additional information, refer to: Auxiliary Climate Control Assembly (412-03, Removal and Installation).

Auxiliary Climate Control - Auxiliary Blend Door Actuator

Removal and Installation

Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the LH C-pillar lower trim panel
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).



3.  **NOTE:** Note the fitted position.

Remove the air distribution motor.

- Disconnect the electrical connector.
- Remove the 3 screws.

Installation

1.  **NOTE:** Align to the position noted on removal.

Install the distribution motor.

- Tighten the screws.
- Connect and secure the electrical connector.

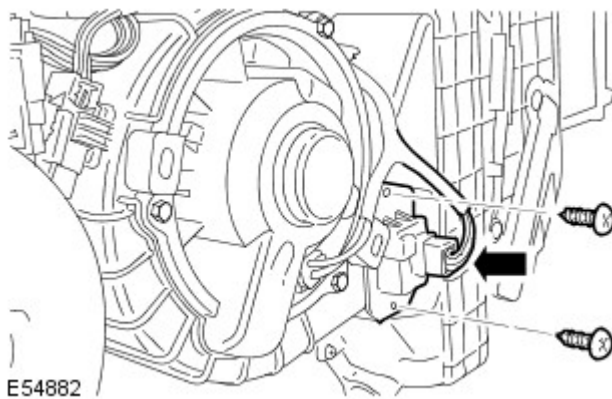
2. Install the C-pillar lower trim panel.
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).
3. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).


Auxiliary Climate Control - Auxiliary Blower Motor Control Module

Removal and Installation

Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the LH C-pillar lower trim panel
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).



3.  **NOTE:** Note the fitted position.

Remove the blower motor resistor.

- Disconnect the electrical connector.
- Remove the 2 screws.

Installation

1.  **NOTE:** Align to the position noted on removal.

Install the resistor.

- Tighten the screws.
- Connect and secure the electrical connector.

2. Install the C-pillar lower trim panel.
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).
3. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

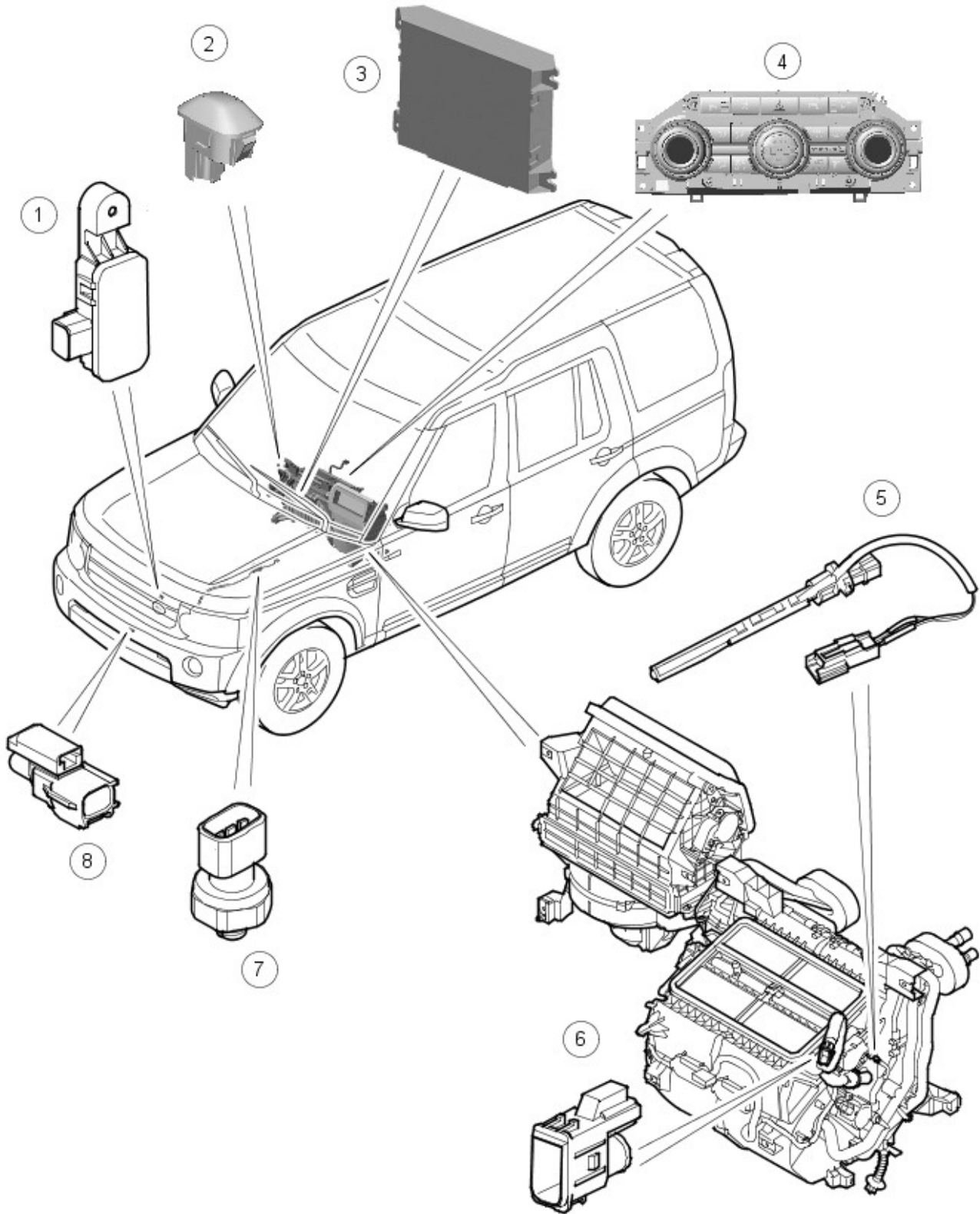
Control Components - Control Components

Description and Operation

COMPONENT LOCATIONS



NOTE: right-hand drive (RHD) installation shown; left-hand drive (LHD) installation similar



E 132921

Item	Part Number	Description
1	-	Pollution sensor (Japan only)

2	-	Sunlight sensor
3	-	automatic temperature control (ATC) module
4	-	Center instrument panel switch pack
5	-	Evaporator temperature sensor
6	-	In-vehicle temperature sensor (all except Japan), or in-vehicle temperature and humidity sensor (Japan only)
7	-	Refrigerant pressure sensor
8	-	Ambient air temperature sensor

GENERAL

The control system operates the air conditioning (A/C) system and the heating and ventilation system to control the temperature, volume and distribution of air from the heater.

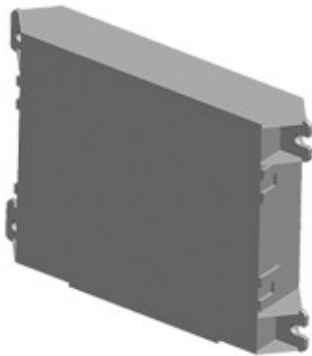
The system is a dual zone system that automatically adjusts the temperature, volume and distribution of the air from the heater to maintain the individual temperature levels selected for the left-hand (LH) and right-hand (RH) sides of the passenger compartment. The system also has manual overrides for the intake air source, blower speed and air distribution. The system includes:

- An ATC module.
- Center instrument panel switch pack
- An ambient temperature sensor.
- A refrigerant pressure sensor.
- An evaporator temperature sensor.
- An in-vehicle temperature sensor.
- A sunlight sensor.

Vehicles in the Japan market also incorporate:

- A pollution sensor.
- A humidity sensor.

ATC MODULE



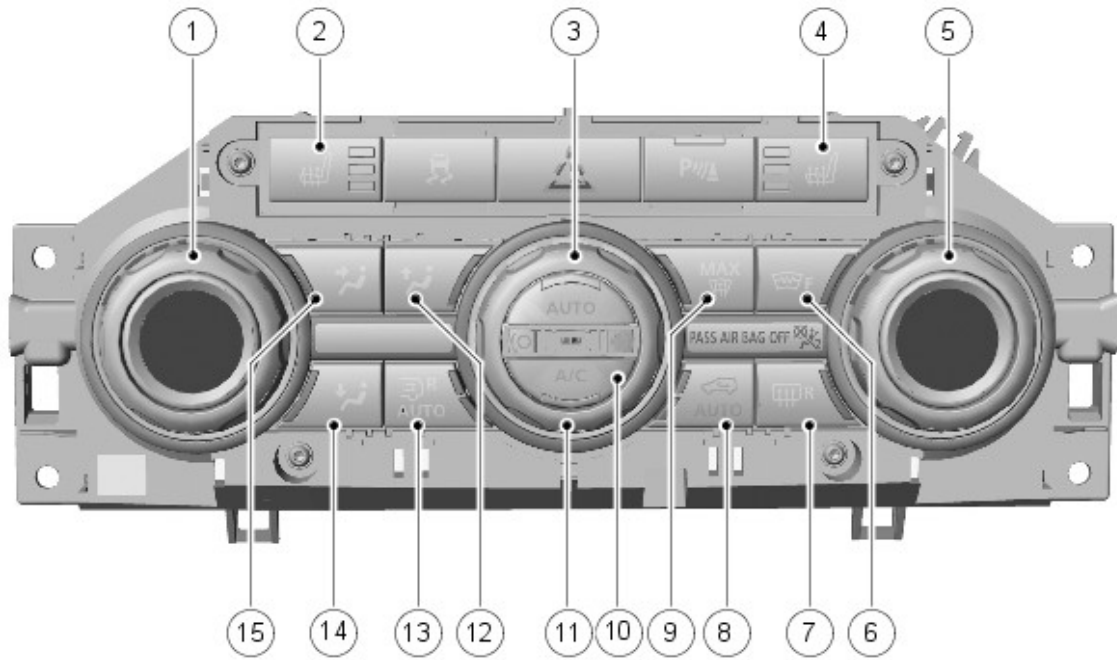
E128058

The [ATC \(automatic temperature control\)](#) module is mounted on the outboard end of the air inlet duct, behind the front passenger side of the instrument panel.

The ATC module processes inputs from the center instrument panel switch pack, system sensors and the medium speed controller area network (CAN) bus, then outputs the appropriate control signals to the A/C system and the heating and ventilation system. In addition to controlling the A/C system and the heating and ventilation system, the ATC module also controls the following:

- The front seat heaters.
For additional information, refer to: Seats (501-10, Description and Operation).
- The rear window heater.
For additional information, refer to: Glass, Frames and Mechanisms (501-11, Description and Operation).
- The windshield heater.
For additional information, refer to: Glass, Frames and Mechanisms (501-11, Description and Operation).
- The windshield washer jets and exterior mirror heaters.
For additional information, refer to: Rear View Mirrors (501-09, Description and Operation).

CENTER INSTRUMENT PANEL SWITCH PACK



E132922

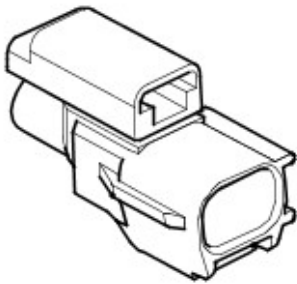
Item	Part Number	Description
1	-	LH temperature switch
2	-	LH front seat heater switch
3	-	Automatic mode switch
4	-	RH front seat heater switch
5	-	RH temperature switch
6	-	Heated windshield switch
7	-	Heated rear window switch
8	-	Defrost program switch
9	-	Air recirculation switch
10	-	A/C (air conditioning) control switch
11	-	Blower control switch
12	-	Windshield and side window distribution switch
13	-	Rear environment
14	-	Footwell distribution switch
15	-	Face distribution switch

The switches on the **Center instrument panel switch pack** have the following functions:

- **LH and RH Temperature Switches:** Adjusts the nominal temperature settings of the LH and RH sides of the passenger compartment. The switch can rotate through 270°, between full cold and full hot. The switch surrounds are graduated in 2° increments between 16 and 28 °C. Minor detents define 1 °C steps over the range of the switch. Amber light emitting diode (LED)s in the switch surround illuminate to indicate the temperature setting. When maximum cold is selected, the ATC module also automatically sets the air source to recirculated air, blower speed to maximum and distribution to face. When maximum hot is selected, the ATC module also automatically sets the air source to fresh air, blower speed to maximum and distribution to footwell.
- **LH and RH Seat Heater Switches:** Activates the heater elements in the seat cushion and seat back at one of two heat levels. The first press of the switch energizes the heater elements at the higher heat setting and illuminates two LEDs in the switch. A second press of the switch sets the heater elements to the lower heat setting and extinguishes one of the LEDs. A further press of the switch de-energizes the heater elements and extinguishes the second LED. The seat heaters remain on until selected off or the engine is turned off.
- **Blower Switch:** For manual adjustment of blower speed. The switch can rotate through 240°, from off to maximum speed. Eight primary detents define the off position and seven blower speeds. Minor detents define small steps between the primary detents. When blower speed is manually adjusted, amber LEDs in the switch surround illuminate to indicate the selected blower speed. The LEDs remain off when blower speed is under automatic control.
- **Automatic Mode Switch:** Activates the automatic modes for the A/C system, blower speed and distribution. Separate amber LEDs in the automatic mode switch illuminate to show when the blower and the distribution are in automatic mode. Manually selecting the blower speed or a distribution switch extinguishes the related LED.
- **A/C control switch:** Controls activation of the A/C compressor. Allows the A/C compressor to be selected off for economy operation. A LED (light emitting diode) switch is illuminated when the A/C compressor is selected

- on.
- **Defrost program switch:** Activates a program that automatically selects: inlet air to fresh air; distribution to screen only; blower to speed 5; rear screen heater on; windshield heater on (where fitted), A/C system to automatic mode. An amber LED in the switch is illuminated while the defrost program is active.
 - **Heated windshield switch:** Energizes the windshield heater for a set time period, until the switch is pressed again or until the engine stops, whichever occurs first. An amber LED in the switch is illuminated while the heater is on.
 - **Heated rear window switch:** Enabled only with the engine running. Pressing the switch energizes the rear window heater for a set time period, until the switch is pressed again or until the engine stops, whichever occurs first. An amber LED in the switch is illuminated while the heater is on.
 - **Air recirculation switch:** For selection of fresh or recirculated air. On models without pollution sensing, an amber LED in the switch is illuminated when recirculated air is selected. On models with pollution sensing, the recirculation switch incorporates two amber LED. The first press of the switch sets the recirculation flaps to automatic mode and illuminates one LED. A second press of the switch manually selects recirculated air and illuminates the second LED. A further press of the switch manually selects fresh air and extinguishes the two LEDs.
 - **Distribution Switches (Windshield, Face and Footwell):** For manual selection of air distribution in any combination of windshield, face and footwell outlets. Each switch has a LED which illuminates when the related distribution mode is selected.

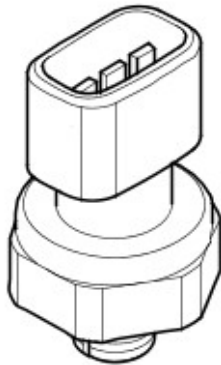
AMBIENT AIR TEMPERATURE SENSOR



E43580

The ambient air temperature sensor is a negative temperature coefficient (NTC) thermistor that provides the ATC module with an input of external air temperature. The sensor is attached to a bracket on the rear of the bumper beam, on the vehicle center-line.

REFRIGERANT PRESSURE SENSOR



E43581

The refrigerant pressure sensor provides the ATC module with a pressure input from the high pressure side of the refrigerant system. The refrigerant pressure sensor is located in the refrigerant line between the condenser and the thermostatic expansion valve.

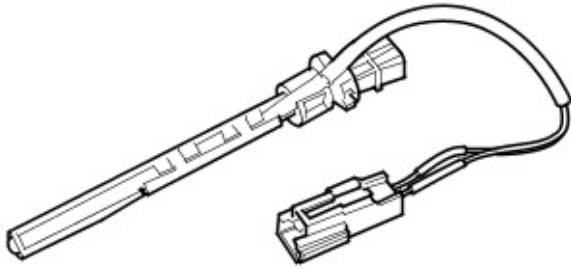
The ATC module supplies a 5 V reference voltage to the refrigerant pressure sensor and receives a return signal voltage, between 0 and 5 V, related to system pressure.

The ATC module uses the signal from the refrigerant pressure sensor to protect the refrigerant system from extremes of pressure and to calculate A/C compressor load on the engine. The ATC module also transmits the A/C compressor load value to the engine control module (ECM), via the medium speed CAN bus, instrument cluster and high speed CAN bus, for use in controlling the speed of the engine cooling fan.

To protect the system from extremes of pressure, the ATC module sets the A/C compressor to the minimum flow position if the pressure:

- Decreases to 1.9 ± 0.2 bar (27.5 ± 3 lbf/in²); the ATC module loads the A/C compressor again when the pressure increases to 2.8 ± 0.2 bar (40.5 ± 3 lbf/in²).
- Increases to 33 ± 1 bar (479 ± 14.5 lbf/in²); the ATC module loads the A/C compressor again when the pressure decreases to 23.5 ± 1 bar (341 ± 14.5 lbf/in²).

EVAPORATOR TEMPERATURE SENSOR

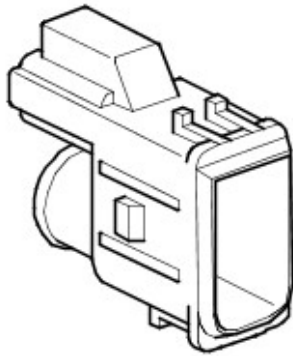


E43582

The evaporator temperature sensor is a NTC thermistor that provides the ATC module with a temperature signal from the downstream side of the evaporator. The evaporator temperature sensor is installed in the right side of the heater assembly casing.

The ATC module uses the input from the evaporator temperature sensor to control the load of the A/C compressor and thus, the operating temperature of the evaporator.

IN-VEHICLE TEMPERATURE SENSOR



E43583

The in-vehicle temperature sensor is a NTC thermistor installed behind a grill in the instrument panel, on the inboard side of the steering column. The sensor is connected to a tube, the other end of which is connected to a venturi on the side casing of the heater. An air bleed from the heater, through the venturi, induces a flow of air down the tube, which draws cabin air through the grill and over the sensor.

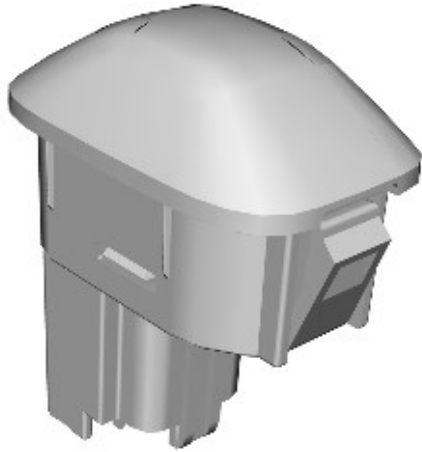
HUMIDITY SENSOR (WHERE FITTED)

The humidity sensor is a capacitive device integrated into the in-vehicle temperature sensor (see above).

The humidity sensor element is constructed from film capacitors on different substrates. The dielectric is a polymer which absorbs or releases water proportional to the relative humidity of the air being drawn through the sensor, and thus changes the capacitance of the capacitor. For protection, the sensor element is contained in a nylon mesh cover.

The humidity sensor and the in-vehicle temperature sensor are connected to a PCB (printed circuit board) inside the sensor housing. The PCB is powered by a 5V feed from the ATC module. Separate signals of temperature and relative humidity are transmitted from the PCB to the ATC module.

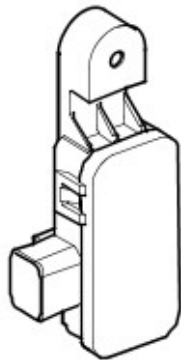
SUNLIGHT SENSOR



E132923

The sunlight sensor consists of two photoelectric cells that provide the ATC module with inputs of light intensity, one as sensed coming from the left of the vehicle and one as sensed coming from the right. The inputs are a measure of the solar heating effect on vehicle occupants, and are used by the ATC module to adjust blower speed, temperature and distribution to improve comfort. The sensor is installed in the center of the instrument panel upper surface and is powered by a 5V feed from the ATC module.

POLLUTION SENSOR (WHERE FITTED)



E43588

The pollution sensor allows the ATC module to monitor the ambient air for the level of hydrocarbons and oxidized gases such as nitrous oxides, sulphur oxides and carbon monoxide. The sensor is attached to a bracket on the front-end carrier, at the top left corner of the condenser.

The pollution sensor is powered by a battery voltage feed from the ATC module, and returns separate signals of hydrocarbon and oxidized gases.

If there is a fault with the pollution sensor, the ATC module disables the automatic operation of the recirculation door.

SYSTEM OPERATION

A/C Compressor Control

The variable displacement A/C compressor is permanently driven by the engine. The flow of refrigerant through the A/C compressor, and the resultant system pressure and evaporator operating temperature, is regulated by the refrigerant solenoid valve. Operation of the refrigerant solenoid valve is controlled by the ATC module using a 400 Hz pulse width modulation (PWM) signal. The duty cycle of the PWM signal is calculated using the following parameters:

- A/C compressor torque.
- A/C compressor torque maximum.
- A/C cooling status.
- A/C demand.
- A/C refrigerant pressure.
- Ambient air temperature.
- Blower speed.
- Engine cranking status.
- Evaporator temperature.
- Transmission gear status.

When A/C is selected, the ATC module maintains the evaporator at an operating temperature that varies with the in-vehicle cooling requirement. The ATC module increases the evaporator operating temperature, by reducing the refrigerant flow, as the requirement for air cooling decreases, and vice versa. During an increase of evaporator operating temperature, to avoid compromising the dehumidification function, the ATC module controls the rate of temperature increase, which keeps the cabin humidity at a comfortable level.

When the economy mode is selected, the PWM signal holds the refrigerant solenoid valve in the minimum flow position, effectively switching off the A/C function.

The ATC module incorporates limits for the operating pressure of the refrigerant system. When the system approaches the high pressure limit, the duty cycle of the PWM signal is progressively reduced until the system pressure decreases. When the system pressure falls below the low pressure limit, the duty cycle of the PWM signal is held at its lowest setting, so that the A/C compressor is maintained at the minimum stroke, to avoid depletion of lubricant from the A/C compressor. The protection algorithm is calculated at a high rate, to enable early detection of the rapid pressure changes possible if a system fault develops.

A/C Compressor Torque

The ATC module uses refrigerant pressure, evaporator temperature and engine speed to calculate the torque being used to drive the A/C compressor. The calculated value is broadcast on the medium speed CAN bus for the ECM, which uses the calculated value for idle speed control and fueling control. The ATC module also compares the calculated value with a maximum A/C compressor torque value received from the ECM over the medium speed CAN bus. If the calculated value exceeds the maximum value, the ATC module signals the refrigerant solenoid valve to reduce the refrigerant flow and so reduce the torque being used to drive the A/C compressor. By reducing the maximum A/C compressor cooling torque value, the ECM is able to reduce the load on the engine when it needs to maintain vehicle performance or cooling system integrity.

Idle Speed Control

In order to maintain A/C cooling performance, the ATC module requests an increase in engine idle speed if the evaporator temperature starts to rise while the refrigerant solenoid valve is already set to the maximum flow rate. The increase in engine idle speed is requested in three stages, using a medium speed CAN bus message to the ECM. For additional information, refer to:

- Electronic Engine Controls (303-14A, Description and Operation),
- Electronic Engine Controls (303-14B, Description and Operation),
- Electronic Engine Controls (303-14C, Description and Operation).

The need for a change in idle speed is determined as follows:

- If the evaporator temperature increases by 3 °C (5.4 °F), or to 6 °C (10.8 °F) above the target operating temperature, over a 10 seconds period, the first stage of idle speed increase is requested.
- When the first stage of idle speed increase is set, if the evaporator temperature increases by 3 °C (5.4 °F), or increases to 12 °C (21.6 °F) above the target operating temperature, over a 9 seconds period, the second stage of idle speed increase is requested.
- When the second stage of idle speed increase is set, if the evaporator temperature increases by 3 °C (5.4 °F), or increases to 15 °C (27 °F) above the target operating temperature, over a 10 seconds period, the third stage of idle speed increase is requested.
- When an idle speed increase is set, if the evaporator temperature decreases by 3 °C (5.4 °F) over a 10 seconds period, the next stage down of idle speed increase is requested.

Electrical Load Management

The ATC module manages the vehicle electrical loads to:

- Maintain the vehicle battery in a healthy state of charge.
- Ensure adequate power is available for defrost demisting during engine warm-up.
- Ensure adequate power is available for A/C during extended periods with the engine at idle speed.
- To maintain system voltage within acceptable limits.
- To provide adequate power to meet customer expectations.

Electrical load management is achieved by increasing the engine idle speed and controlling the electrical load of systems that do not affect the driveability or safety of the vehicle.

During the engine warm-up period, the ATC module manages the electrical load to make sure that the battery voltage is maintained above a pre-determined level. The battery voltage level that is maintained and the duration of the start period varies with ambient air temperature and engine coolant temperature (ECT). After the engine warm-up period, the ATC module manages the electrical load to make sure that the requested electrical load does not exceed the generator output.

The duration of the engine warm-up period depends on the ambient air temperature and the ECT, as detailed in the following table:

Engine Warm-up Times

Ambient Air Temperature, °C (°F)	ECT, °C (°F)			
	<10 (<50)	>10 to <30 (>50 to <86)	>30 to <60 (>86 to <140)	>60 (>140)
	Warm-up Period, Minutes			
>10 (>50)	15	15	15	15
>5 to <10 (>41 to <50)	15	15	15	15
>0 to <5 (>32 to <41)	10	15	15	15
>-10 to <0 (>14 to <32)	10	10	15	15
<-10 (<14)	5	5	10	15

The ATC module calculates the electrical load from the battery voltage and generator output voltage, and compares the result against the maximum load available from the generator. The calculation is averaged across the first 20 seconds after the engine starts, and subsequently averaged every 60 seconds. When the engine is turned off, the ATC module stores the status of the electrical load management for 20 seconds. If the engine is re-started within the 20 seconds, the ATC module resumes electrical load management using the stored status. If the engine is re-started after the 20 seconds, the timers are reset and the ATC module re-calculates the status.

If the electrical load is more than the maximum load available, the ATC module requests an increase of engine idle speed using the medium speed CAN bus message to the ECM. If an electrical load imbalance remains after an increase in engine idle speed, or if the electrical load is more than the capacity of the charging system, the ATC module reduces the electrical load by reducing the power of some vehicle systems or inhibiting their operation. The number of systems controlled depends on the electrical load reduction required. The systems controlled and the order in which their power is reduced or they are inhibited are contained in three priority tables. The table used depends on the ambient air temperature, battery temperature and ECT:

- The cold start table is used when the ambient air temperature is less than 5 °C (41 °F) and the ECT is less than 30 °C (86 °F).
- The hot start table is used when the ambient air temperature is 5 °C (41 °F) or more and the ECT is less than 30 °C (86 °F).
- The continuous table is used when battery temperature is more than 5 °C (41 °F) and the ECT is more than 50 °C (122 °F).
- If none of the above conditions are met, the ATC module adopts the last used table.

Cold Start Electrical Load Management

Priority		System
Power Reduction	Inhibited	
1	-	Air suspension
2	-	Front seat heaters
3	-	Entertainment system
-	4	Front seat heaters
5	-	Rear window heater
6	-	Windshield washer jet and exterior mirror heaters
-	7	Windshield washer jet and exterior mirror heaters
8	-	Windshield heater
9	-	Climate control blower
-	10	Rear window heater
-	11	Windshield heater

Hot Start Electrical Load Management

Priority		System
Power Reduction	Inhibited	
-	1	Front seat heaters; windshield washer jet and exterior mirror heaters
2	-	Windshield heater
3	-	Rear window heater
4	-	Air suspension
5	-	Entertainment system
-	6	Windshield heater
-	7	Rear window heater

Continuous Electrical Load Management

Priority		System
Power Reduction	Inhibited	
-	1	Front seat heaters
2	-	Windshield heater
3	-	Rear window heater
4	-	Air suspension
5	-	Entertainment system

Engine idle speed changes, and electrical load changes of systems not under direct control of the ATC module (air suspension and entertainment), are initiated using the appropriate medium speed CAN bus message. When partial operation is requested:

- The air suspension system still performs height changes but reduces air compressor operation by not replenishing the reservoir.
- The entertainment system restricts the maximum volume level and reduces the output frequency bandwidth.

Cooling Fan Control

The ATC module determines the amount of condenser cooling required from the refrigerant pressure, since there is a direct relationship between the temperature and pressure of the refrigerant. The cooling requirement is transmitted to the ECM in a medium speed CAN bus message. The ECM controls the condenser cooling using the cooling fan. For additional information, refer to:

- Electronic Engine Controls (303-14A, Description and Operation),
- Electronic Engine Controls (303-14B, Description and Operation),
- Electronic Engine Controls (303-14C, Description and Operation).

Air Temperature Control

Air from the evaporator enters the heater assembly, where temperature blend doors direct a proportion of the air through the heater core to produce the required discharge air temperature. The two temperature blend doors operate independently to enable independent temperature selection for the left and right sides of the vehicle interior. The temperature blend doors are operated by stepper motors. The stepper motors are controlled by the ATC module.

The ATC module calculates the stepper motor position required to achieve the selected temperature and compares it against the current position, which is stored in memory. If there is any difference, the ATC module signals the stepper motor to adopt the new position.

Air temperature is controlled automatically unless maximum heating or maximum cooling is selected. The required air temperature may be adjusted between 16 °C (61 °F) and 28 °C (82 °F) using the air temperature control switches. The control algorithms then attempt to maintain the desired set temperature.

Turning the temperature switches fully counterclockwise gives maximum available cooling. Turning the temperature switches fully clockwise gives maximum available heating. When maximum cooling or maximum heating is selected, the comfort algorithm adopts an appropriate strategy for the air distribution, blower speed,

A/C and air source functions, except where a function is under manual control.

The temperature control of one zone can be compromised by the other zone being set to maximum heating or maximum cooling. True maximum heating or maximum cooling can only be obtained with both controls set to the same maximum state.

When the economy mode is selected, the automatic temperature control function still operates, but with no cooling capability the minimum discharge temperature achievable will be ambient air temperature plus any heat pick up in the air intake path.

Air Distribution Control

When the A/C is in the automatic mode, the ATC module automatically controls air distribution according to a comfort strategy. Automatic control is overridden when one of the manual modes is selected. Air distribution remains manually controlled until the automatic mode is selected again. The distribution doors are operated by two stepper motors, which are controlled by the ATC module.

Blower Control

When A/C is selected or the blower speed is manually selected, the ATC module energizes the coil of the blower relay in the battery junction box (BJB). The energized blower relay supplies battery power to the blower motor, which is grounded through the blower control module. The speed of the blower is controlled by a PWM signal from the ATC module to the blower control module. The blower control module regulates the blower motor voltage in relation to the PWM signal.

When the blower is in the automatic mode the ATC module determines the blower speed required from the comfort algorithms. When the blower is in the manual mode, the ATC module operates the blower at one of seven fixed speeds as selected on the center instrument panel switch pack.

Maximum Defrost

The maximum defrost function automatically provides the maximum defrosting of the vehicle. When the maximum defrost function is selected, the ATC module configures the control system as follows:

- Automatic mode off.
- Air inlet to fresh air, manual control.
- Selected temperature unchanged, automatic control.
- Air distribution set to screen mode, manual control.
- Blower speed set to speed 5, manual control.
- Rear screen heater and windshield heater (if applicable) selected on.
- A/C mode in automatic.

The maximum defrost function is cancelled by one of the following:

- Selecting any distribution switch. The system response will be identical to the normal manual distribution control operation.
- Selecting the automatic switch. This will restore the system to fully automatic operation.
- Selecting the maximum defrost switch again. This returns the system to the state in use immediately before the maximum defrost function was first selected.
- Turning the engine off.

The blower speed can be adjusted manually without terminating the maximum defrost function.

Intake Air Control

The source of intake air is automatically controlled unless overridden by manual selection of recirculation. Under automatic control the ATC module determines the required position of the recirculation door from the comfort strategy and the input from the pollution sensor (if fitted). The recirculation door is operated by an electric motor, which is controlled by hardwired analogue signals from the ATC module. A potentiometer in the motor supplies the ATC module with a position feedback signal for closed loop control.

Provided the intake air has not been manually selected to recirculation, the ATC module adjusts the recirculation door to reduce the ram effect produced by the forward motion of the vehicle.

When the ignition switch is turned off, the ATC module evaluates the ambient air temperature. If the ambient air temperature is less than a pre-determined value, the intake air source is set to recirculation, to prevent the ingress of damp air while the vehicle is parked.

When the vehicle is in the transportation mode, the ATC module sets the intake door to recirculation every time the engine is turned off, regardless of the ambient air temperature.

Pollution Sensing

With a pollution sensor fitted to the vehicle, the ATC module controls the intake air source to reduce contamination of the intake air by external pollutants. This function is fully automatic, but can be overridden by manual selection of the intake air source.

Humidity Sensing

With a humidity sensor fitted, the ATC module controls the moisture content of the air in the vehicle. This is achieved by raising the evaporator temperature to increase the humidity of the air entering the vehicle, and reducing the evaporator temperature to reduce the humidity of the air entering the vehicle.

Front Seat Heaters

The front seat heaters are enabled when Power mode 6 engaged, and operate at one of two temperature settings. With the first press of a front seat heater switch the ATC module adopts the higher temperature setting, supplies a power feed to the related front seat heater elements and illuminates two amber LEDs in the switch. At the second press of the switch the ATC module adopts the lower temperature setting and extinguishes one of the LEDs. At the third press of the switch the ATC module de-energizes the heater elements and extinguishes the second LED. The seat heaters remain on until selected off or the engine is turned off.

The ATC module receives an input from a temperature sensor in each front seat, and regulates the power feed of the heater elements to control the seat temperature at the appropriate temperature setting between 35 and 45 °C (95 and 113 °F). The actual temperature settings vary with the type of seat covering, to allow for the different heat conduction properties of the different materials.

When the front seat heaters are activated at the higher temperature setting, the ATC module automatically resets them to the lower temperature after a time delay. The length of the time delay depends on the in-vehicle temperature.

Temperature Reset Time Delay

In-vehicle Temperature, °C (°F)	< -15 (5)	-15 to -10 (5 to 14)	-10 to 0 (14 to 32)	0 to 15 (32 to 59)	15 to 25 (59 to 77)	>25 (77)
Time Delay, minutes	Remains at higher temperature until manually de-selected	20	15	10	5	3

To protect the heater elements, the ATC module disables front seat heating if battery voltage exceeds 16.5 ± 0.3 V for more than 5 seconds. Front seat heating is re-enabled when battery voltage decreases to 16.2 ± 0.3 V.

The ATC module monitors the power feeds to the heater elements and disables the applicable front seat heating if a short or open circuit is detected. The ATC module also disables seat heating if the seat temperature rises significantly above the target temperature setting.

The plausibility of the temperature sensor inputs is also monitored by the ATC module. When seat heating is selected, if one of the temperature sensor inputs is within 5 °C (9 °F) below the target temperature, the ATC module monitors the sensor input for a temperature increase and checks that it is between the minimum and maximum working temperatures. If a temperature sensor input is at the high end of the working range, while the ambient air temperature and the engine temperature are within 10 °C (18 °F) of each other, the ATC module disables front seat heating until the input decreases below the target temperature setting. The ATC module interprets a temperature sensor input value of -45 °C (-49 °F) or below as an open circuit, and temperature sensor input value of 100 °C (212 °F) or more as a short circuit.

Rear Window Heater

The ATC module controls operation of the rear window heater using medium speed CAN messages to operate the rear window heater relay in the central junction box (CJB). The control module in the CJB interprets the CAN messages and switches the ground connection of the relay coil to operate the rear window heater. While the rear window heater relay is energized, a battery power feed is connected to the rear window heater elements. Rear window heater operation is only enabled when the engine is running.

The ATC module operates the rear window heater in heating cycles of varying power and time. The heating cycle used depends on the ambient air temperature and whether it is the initial or subsequent operation during the current Power mode cycle.

When the rear window heater switch is pressed, the ATC module illuminates an LED in the switch and initiates the appropriate heating cycle. The LED remains illuminated until the rear window heater is selected off, the heating cycle is completed or the engine stops. If the engine stalls or turned off, rear window heating resumes if the engine is re-started within 20 seconds.

On the initial selection of rear window heating, the ATC module uses a short or long defrost phase at full power, followed by a low power phase. The defrost phase used depends on the ambient temperature. During the low power phase, the rear window heater relay is cycled off for 80 seconds and on for 40 seconds.

On subsequent operations, during the same Power mode cycle, the ATC module operates the rear window heater at full power for a fixed time period.

Rear Window Heating Phases

Phase	Time, minutes
Short defrost (-5°C (23°F) and above)	10
Long defrost (less than -5°C (23°F))	15
Low power	20
Subsequent operation	10

Windshield Heater

The ATC module controls operation of the windshield heater using the windshield heater relay in the BJB. The ATC module switches the ground connection of the relay coil to operate the windshield heater. While the windshield heater relay is energized, a battery power feed is connected to each of the two windshield heater elements. Windshield heater operation is only enabled when the engine is running.

The ATC module operates the windshield heater in heating cycles of varying power and time. The heating cycle used depends on the ambient air temperature and whether it is the initial or subsequent operation during the current

Power mode cycle.

When the windshield heater switch is pressed, the ATC module illuminates a LED in the switch and initiates the appropriate heating cycle. The LED remains illuminated until the windshield heater is selected off, the heating cycle is completed or the engine stops. If the engine stalls or turned off, windshield heating resumes if the engine is re-started within 20 seconds.

On the initial selection of the windshield heater, the ATC module uses a short or long defrost phase at full power, followed by a low power phase. The defrost phase used depends on the ambient temperature. During the low power phase, the windshield heater relay is cycled off for 80 seconds and on for 40 seconds.

On subsequent operations, during the same Power mode cycle, the ATC module operates the windshield heater at full power for a fixed time period.

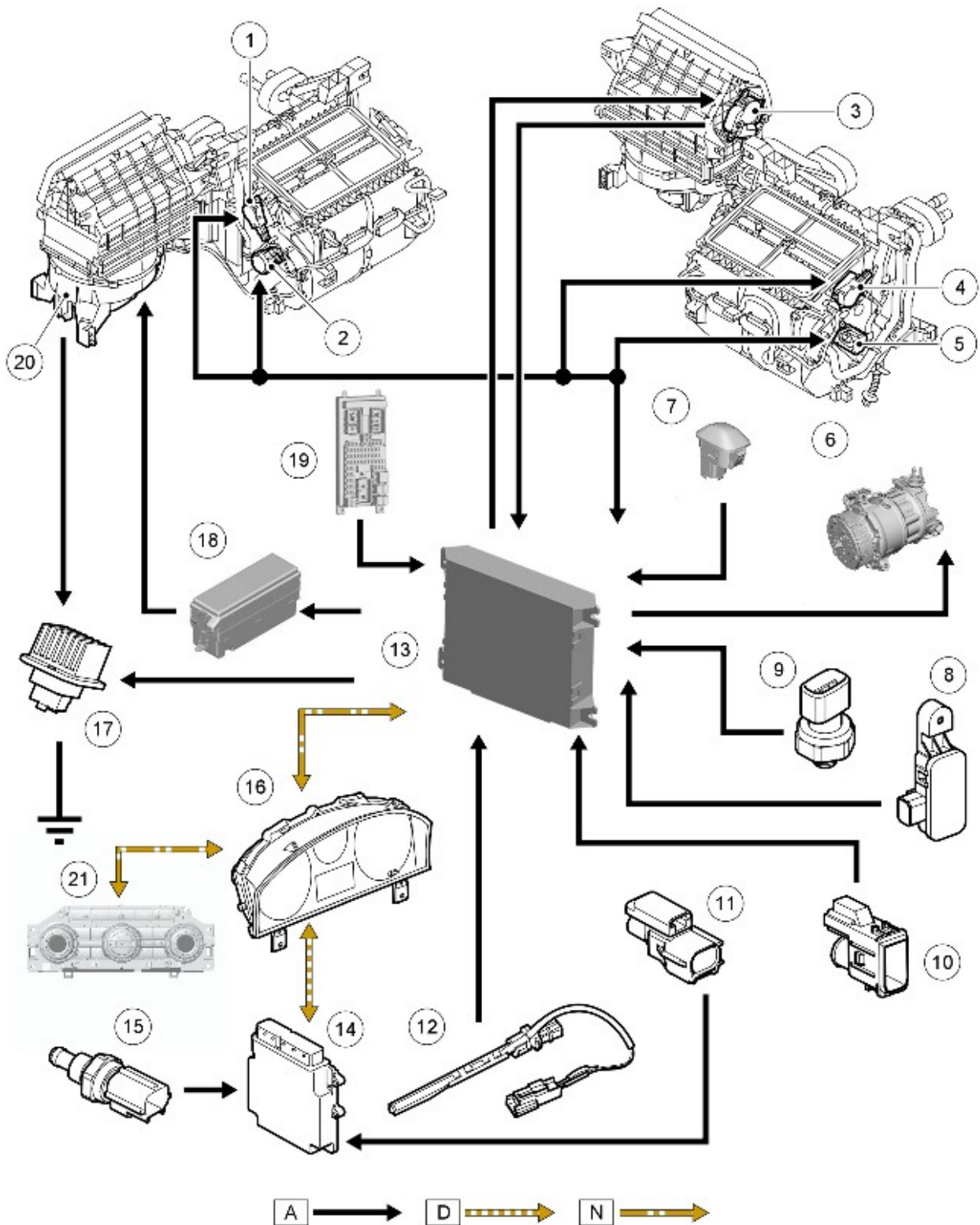
Windshield Heating Phases

Phase	Time, minutes
Short defrost (-5 °C (23 °F) and above)	3
Long defrost (less than -5 °C (23 °F))	5
Low power	10
Subsequent operation	3

CONTROL DIAGRAM



NOTE: **A** = Hardwired connections; **D** = High speed CAN bus; **N** = Medium speed CAN bus



E132924

Item	Part Number	Description
1	-	Face and feet distribution motor
2	-	LH temperature blend motor
3	-	Recirculation motor
4	-	Windshield distribution motor
5	-	RH temperature blend motor
6	-	A/C compressor solenoid valve
7	-	Sunlight sensor
8	-	Pollution sensor
9	-	Refrigerant pressure sensor
10	-	In-vehicle temperature sensor (all except Japan) or in-vehicle temperature and humidity sensor (Japan only)

- 11 - Ambient air temperature sensor
- 12 - Evaporator temperature sensor
- 13 - ATC module
- 14 - ECM
- 15 - ECT sensor
- 16 - Instrument cluster
- 17 - Blower control module
- 18 - [BJB \(battery junction box\)](#)
- 19 - CJB
- 20 - Blower
- 21 - Center instrument panel switch pack

Control Components - Control Components

Diagnosis and Testing

Principle of Operation

For a detailed description of the climate control system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Control Components (412-04 Control Components, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Front End Accessory Drive (FEAD) belt • Refrigerant • Heater control flaps • Ducting • Cabin air filter • Coolant level • Compressor • Cooling fan 	<ul style="list-style-type: none"> • Fuses • Electrical harnesses • Harness connectors • Blower motor • Cooling fan • Actuators

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

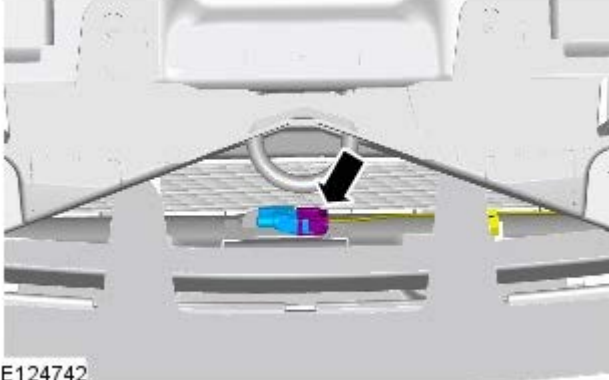
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Climate Control Module (HVAC) (100-00, Description and Operation).

Control Components - Ambient Air Temperature Sensor

Removal and Installation

Removal

1. Remove the front spoiler.
For additional information, refer to: Front Bumper Lower Cover (501-19, Removal and Installation).
2. Remove the ambient air temperature sensor.
 - Disconnect the electrical connector.
 - Release the clip.



Installation

1. To install, reverse the removal procedure.

Control Components - Climate Control Assembly

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



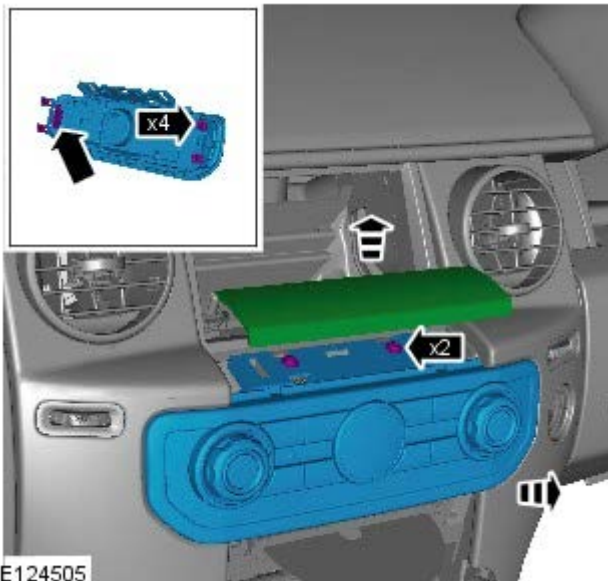
Some variation in the illustrations may occur, but the essential information is always correct.




Make sure that the gear selector lever is in position N before removing any components.

1. Refer to: Floor Console Upper Section (501-12, Removal and Installation).

2. Torque: 2.5 Nm



3.  CAUTION: When installing the lower locating tang of the trim panel, make sure the floor console is not damaged. If necessary protect the surrounding areas using masking tape.

NOTES:



LHD illustration shown, RHD is similar.



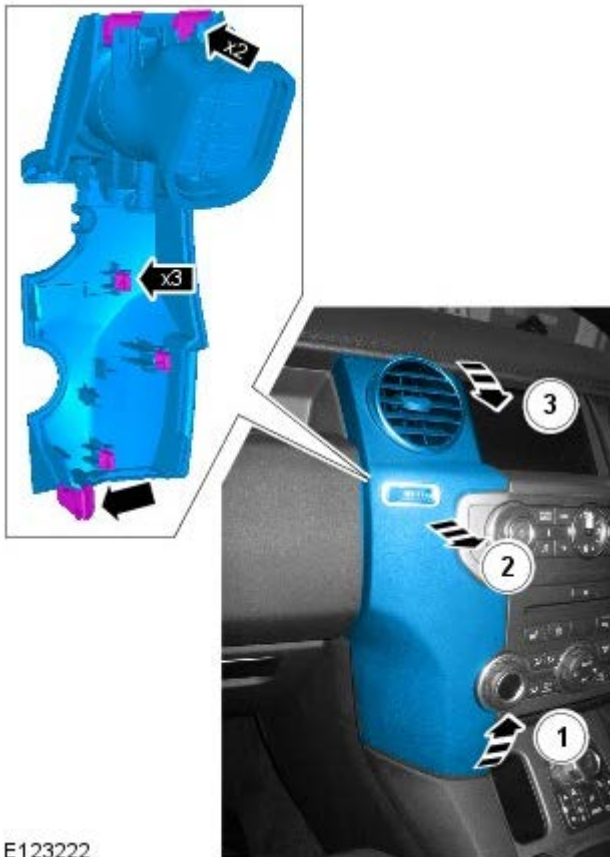
Remove in the sequence shown.




To install, reverse the removal sequence.




E122691




E123222

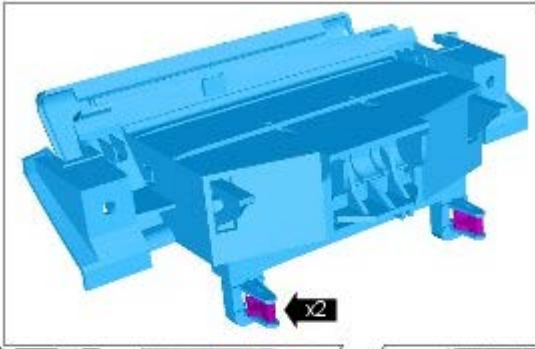
4.  CAUTION: When installing the lower locating tang of the trim panel, make sure the floor console is not damaged. If necessary protect the surrounding areas using masking tape.

NOTES:

 Remove in the sequence shown.

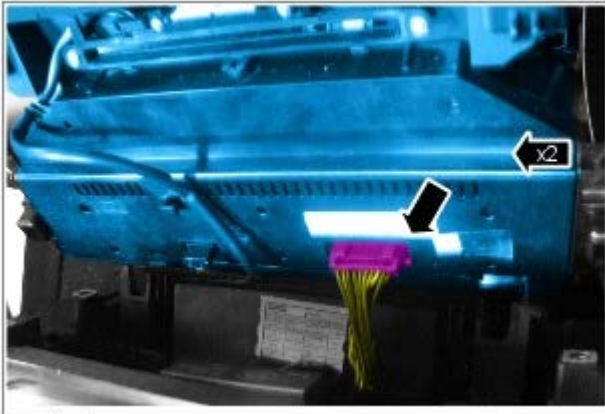
 To install, reverse the removal sequence.

5. Torque: 2.5 Nm



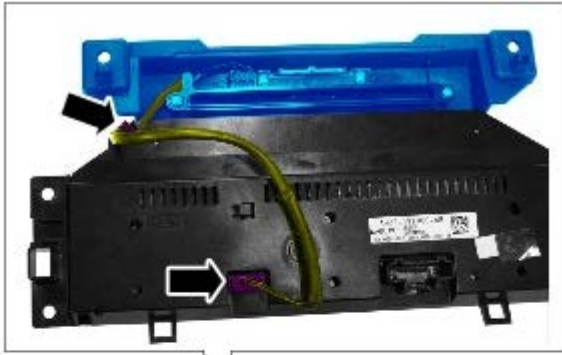
E123298

6. Torque: 2.5 Nm



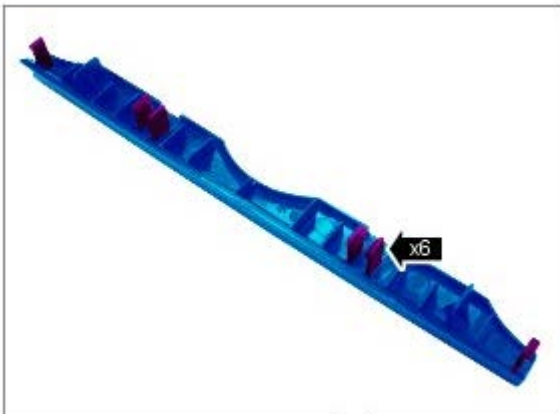
E123220

7.




E125464

8.



E125465

Installation

1.  **NOTE:** Make sure that all the clips are correctly installed.
To install, reverse the removal procedure.

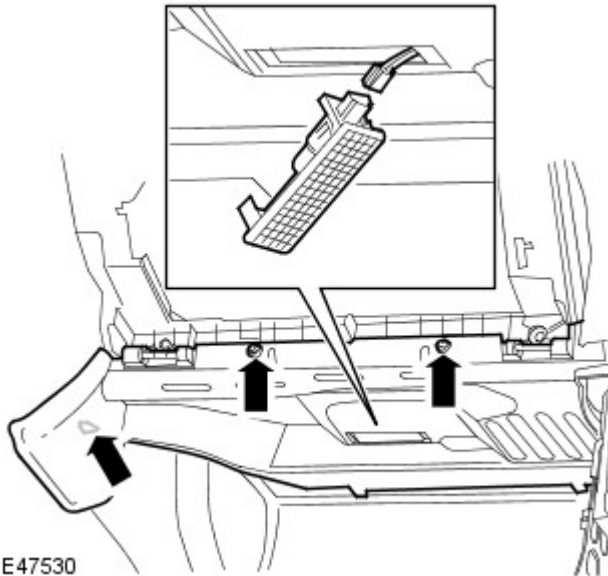
Control Components - Defrost Vent/Register Blend Door Actuator LHD AWD

Removal and Installation

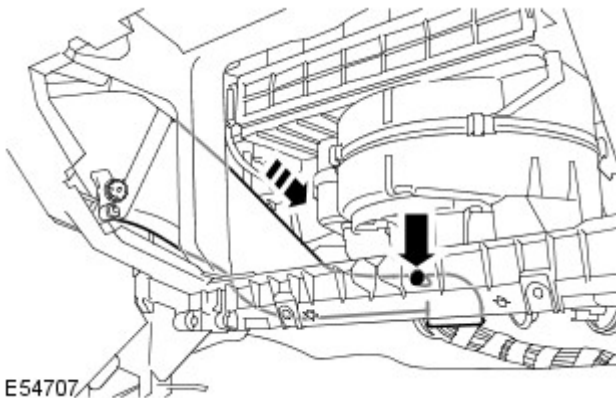
Removal

1. Remove the glove compartment.
For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

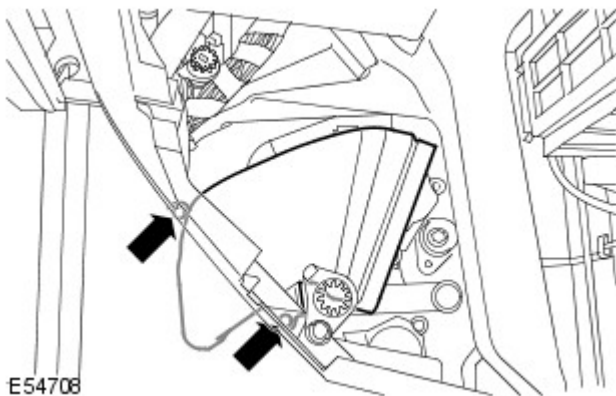
2. Remove the passenger side closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.



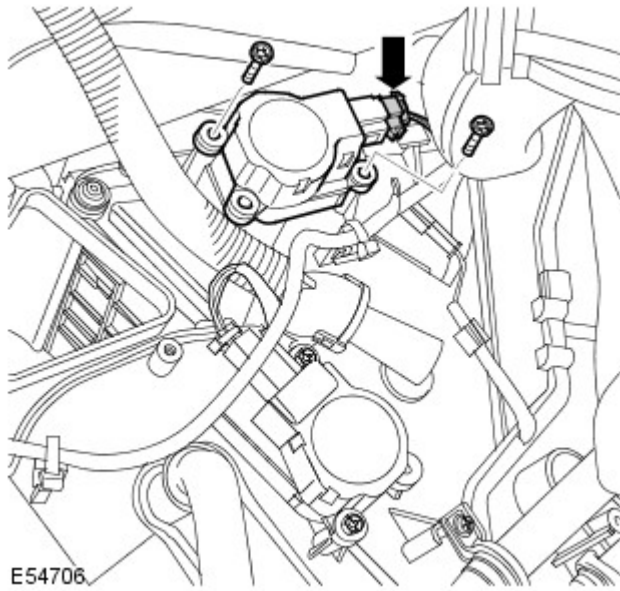
3. Remove the passenger side footwell duct.
 - Remove the clip.



4. Remove the passenger side footwell duct elbow.
 - Remove the 2 Torx screws.



5. Remove the defrost vent/register blend door actuator.
 - Disconnect the electrical connector.
 - Remove the 2 screws.



Installation

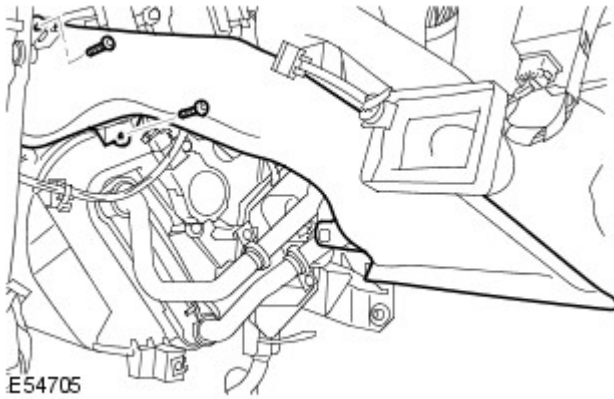
1. Install the defrost vent/register blend door actuator.
 - Tighten the screws to 1 Nm.
 - Connect the electrical connector.
2. Install the passenger side footwell duct elbow.
 - Tighten the screws.
3. Install the passenger side footwell duct.
 - Install the clip.
4. Install the passenger side closing trim panel.
 - Install the interior lamp.
 - Connect the electrical connector.
 - Secure the clip.
5. Install the glove compartment.
For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

Control Components - Defrost Vent/Register Blend Door Actuator RHD AWD

Removal and Installation

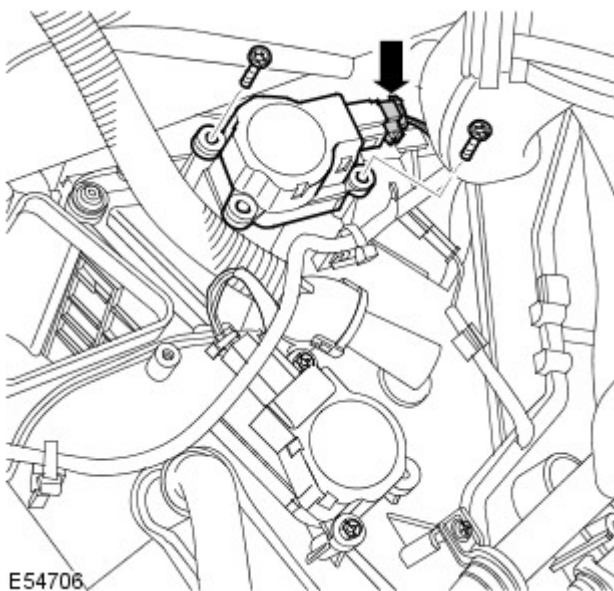
Removal

1. Remove the instrument panel driver side reinforcement.
For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).



2. Remove the driver side footwell duct.
 - Remove the 2 Torx screws.

3. Remove the defrost door actuator.
 - Disconnect the electrical connector.
 - Remove the 2 screws.



Installation

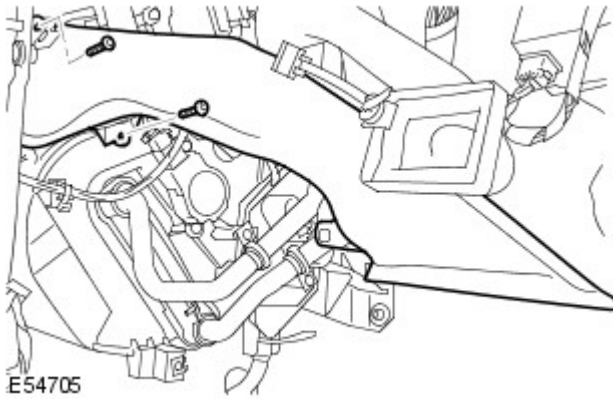
1. Install the defrost door actuator.
 - Tighten the screws.
 - Connect the electrical connector.
2. Install the driver side footwell duct.
 - Tighten the screws.
3. Install the instrument panel driver side reinforcement.
For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).

Control Components - Driver Side Temperature Blend Door Actuator LHD AWD

Removal and Installation

Removal

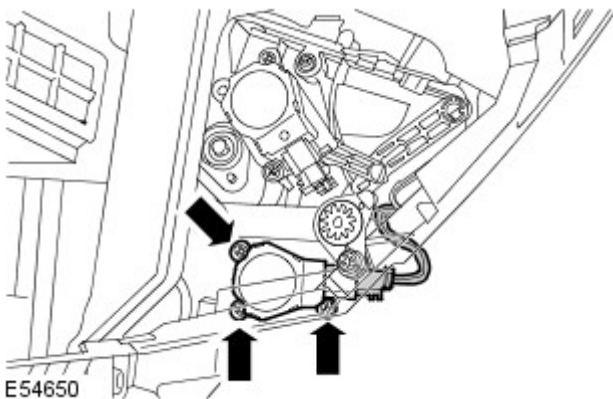
1. Remove the instrument panel driver side reinforcement.
For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).




2.  **NOTE:** RHD illustration shown, LHD is similar.

Remove the driver side footwell duct.

- Remove the 2 Torx screws.



3.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Remove the temperature blend door actuator.

- Disconnect the electrical connector.
- Remove the 3 screws.

Installation

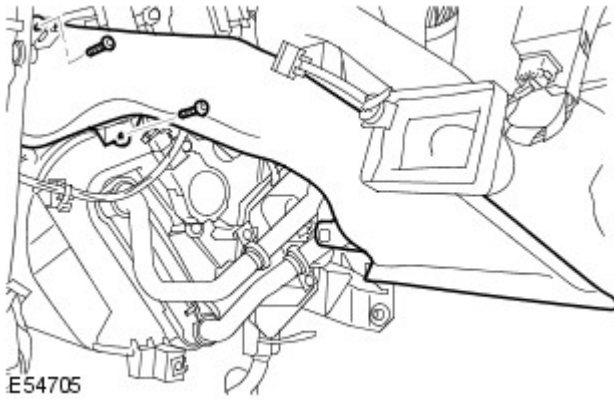
1. Install the temperature blend door actuator.
 - Tighten the screws to 1 Nm.
 - Connect the electrical connector.
2. Install the driver side footwell duct.
 - Tighten the screws.
3. Install the instrument panel driver side reinforcement.
For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).

Control Components - Driver Side Temperature Blend Door Actuator RHD AWD

Removal and Installation

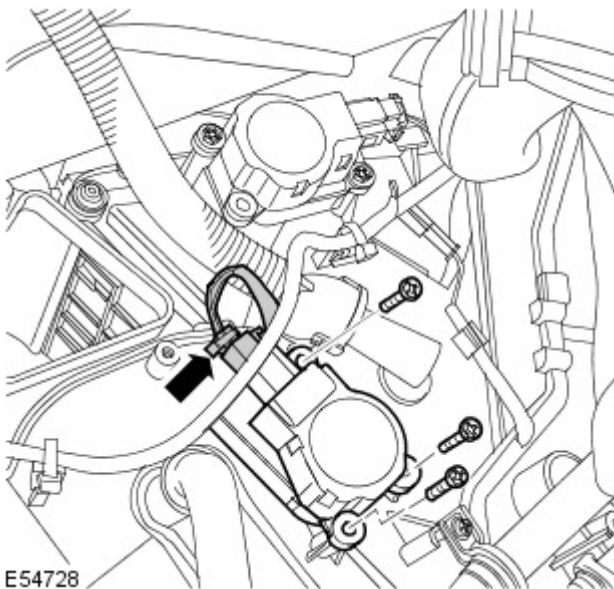
Removal

1. Remove the instrument panel driver side reinforcement.
For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).



2. Remove the driver side footwell duct.
 - Remove the 2 Torx screws.

3. Remove the temperature blend door actuator.
 - Disconnect the electrical connector.
 - Remove the 2 screws.



Installation

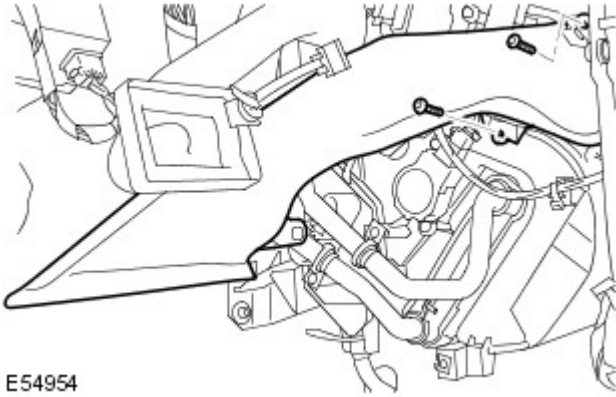
1. Install the temperature blend door actuator.
 - Tighten the screws.
 - Connect the electrical connector.
2. Install the driver side footwell duct.
 - Tighten the screws.
3. Install the instrument panel driver side reinforcement.
For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).

Control Components - Instrument Panel Blend Door Actuator LHD AWD


Removal and Installation

Removal

1. Remove the instrument panel driver side reinforcement.
For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).

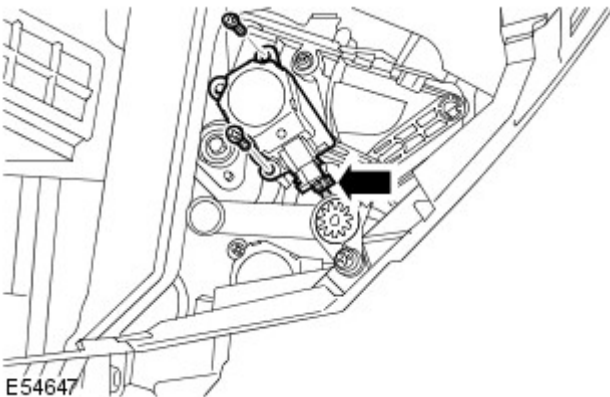


E54954


2.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Remove the driver side footwell duct.

- Remove the 2 Torx screws.



E54647

3.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

Remove the instrument panel blend door actuator.

- Disconnect the electrical connector.
- Remove the 2 screws.

Installation

1. Install the instrument panel blend door actuator.
 - Tighten the screws to 1 Nm.
 - Connect the electrical connector.
2. Install the driver side footwell duct.
 - Tighten the screws.
3. Install the instrument panel driver side reinforcement.
For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).

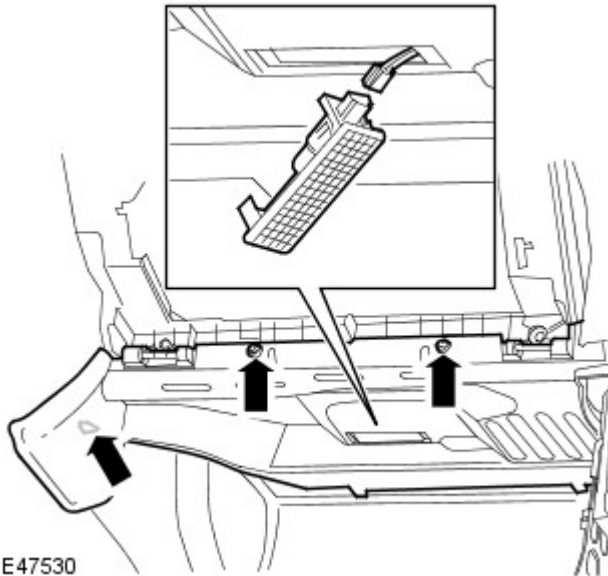
Control Components - Instrument Panel Blend Door Actuator RHD AWD

Removal and Installation

Removal

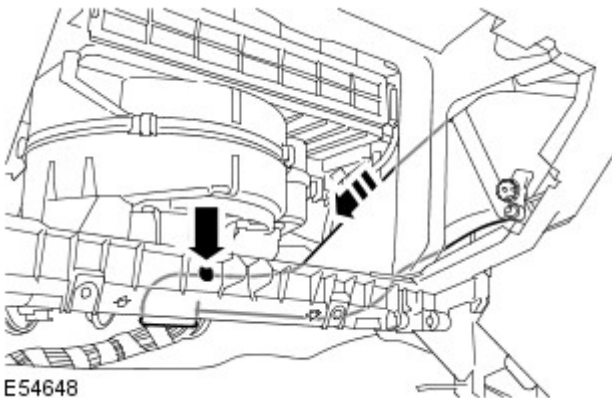
1. Remove the glove compartment.
For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

2. Remove the passenger side closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.



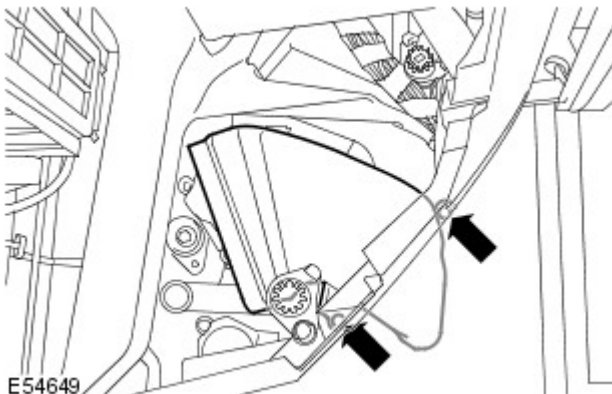
E47530

3. Remove the passenger side footwell duct.
 - Remove the clip.



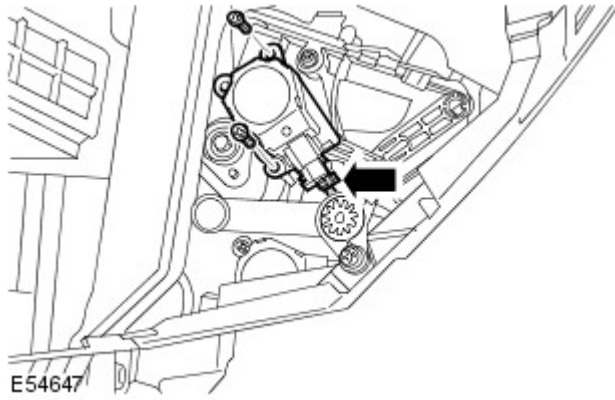
E54648

4. Remove the passenger side footwell duct elbow.
 - Remove the 2 Torx screws.



E54649

5. Remove the instrument panel blend door actuator.
 - Disconnect the electrical connector.
 - Remove the 2 screws.



Installation

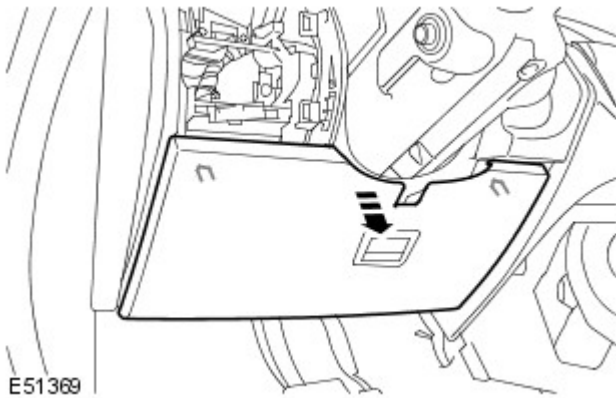
1. Install the instrument panel blend door actuator.
 - Tighten the screws.
 - Connect the electrical connector.
2. Install the passenger side footwell duct elbow.
 - Tighten the screws.
3. Install the passenger side footwell duct.
 - Install the clip.
4. Install the passenger side closing trim panel.
 - Install the interior lamp.
 - Connect the electrical connector.
 - Secure the clip.
5. Install the glove compartment.
For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

Control Components - In-Vehicle Temperature Sensor

Removal and Installation

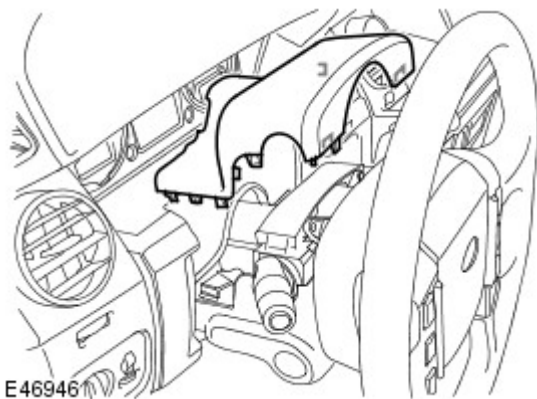
Removal

1. Fully extend the steering column for access.
2. Remove the instrument panel access panel.
 - Release the 2 clips.



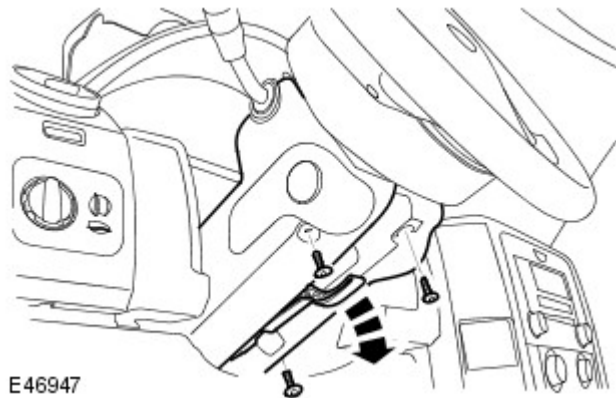
E51369

3. Remove the steering column upper shroud.
 - Release the 6 clips.



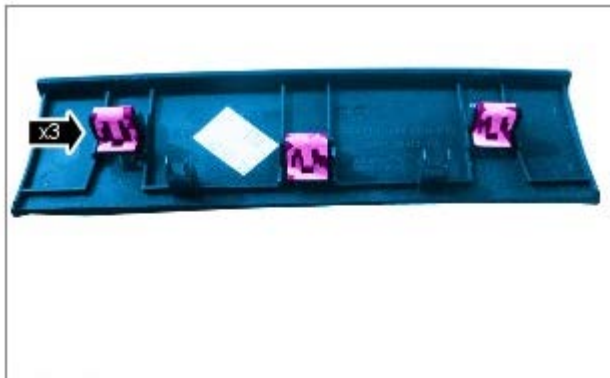
E46946

4. Remove the steering column lower shroud.
 - Remove the 3 Torx screws.
 - Release the steering column adjustment lever.



E46947

5. Remove the center console upper finisher trim.



E123215

6. Remove the audio unit bezel.

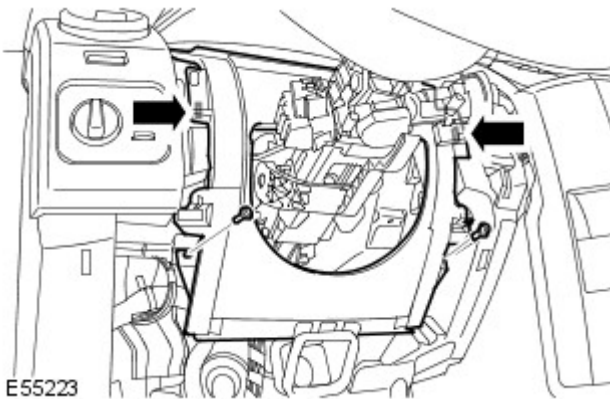


E123217

7. Remove the instrument panel centre finisher.



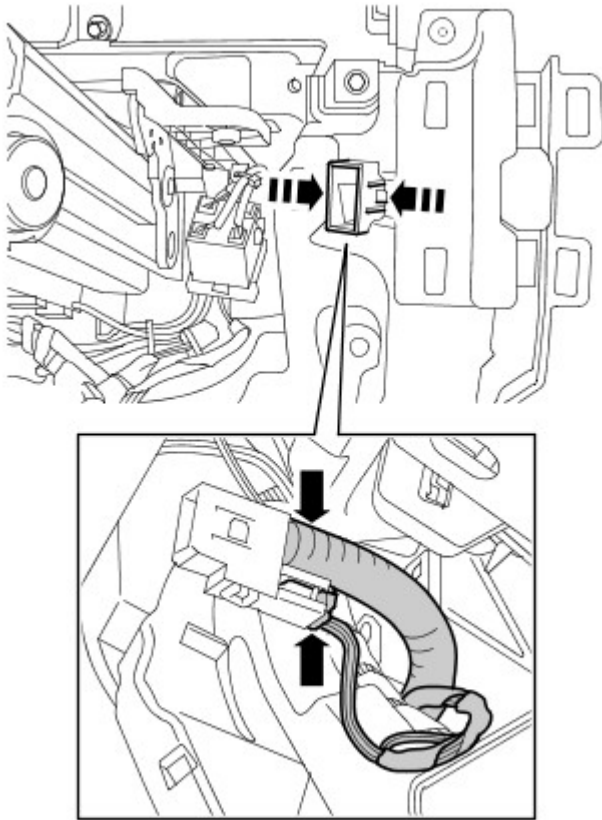
E122691



E55223

8. Release the steering column gaiter panel.
 - Remove the 2 Torx screws.
 - Release the 2 clips.

9. Remove the in-vehicle temperature sensor.
 - Release the 2 clips.
 - Disconnect the electrical connector.
 - Disconnect the hose.



E55224

Installation

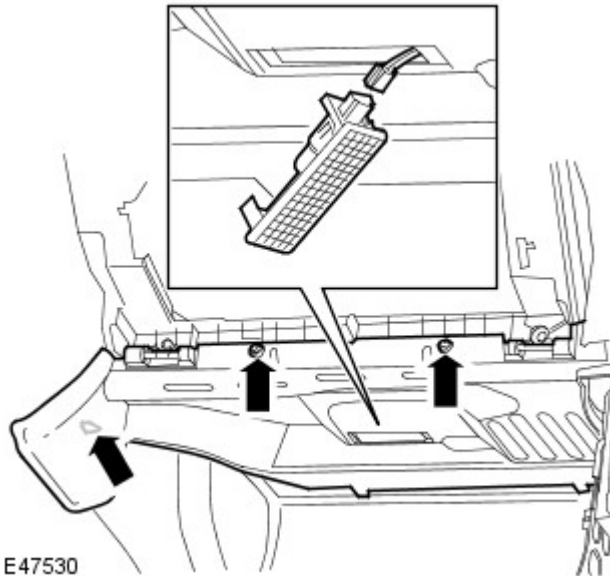
1. Install the in-vehicle temperature sensor.
 - Connect the hose.
 - Connect the electrical connector.
 - Secure the clips.
2. Install the steering column gaiter panel.
 - Secure with the clips.
 - Tighten the Torx screws.
3. Install the instrument panel centre finisher.
4. Install the audio unit bezel.
5. Install the center console upper finisher trim.
6. Install the steering column shrouds.
7. Install the instrument panel access panel.

Control Components - Passenger Side Temperature Blend Door Actuator LHD AWD

Removal and Installation

Removal

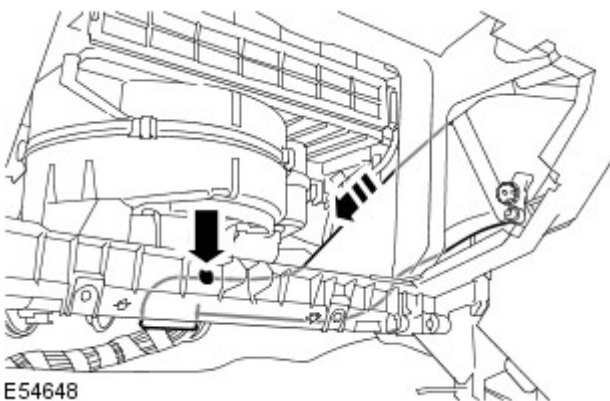
1. Remove the glove compartment.
For additional information, refer to: Glove Compartment (501-12, Removal and Installation).



2.  **NOTE:** RHD illustration shown, LHD is similar.

Remove the passenger side closing trim panel.

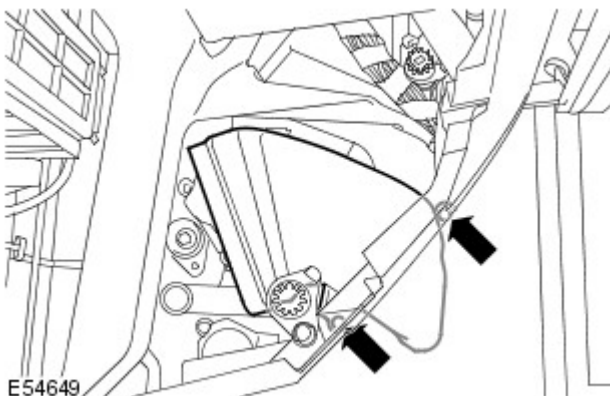
- Release the clip.
- Remove the 2 screws.
- Disconnect the electrical connector.



3.  **NOTE:** RHD illustration shown, LHD is similar.

Remove the passenger side footwell duct.

- Remove the clip.

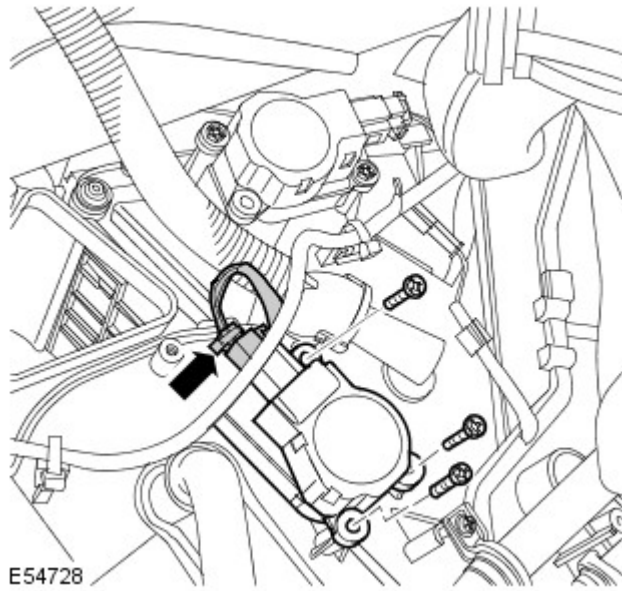


4.  **NOTE:** RHD illustration shown, LHD is similar.

Remove the passenger side footwell duct elbow.

- Remove the 2 Torx screws.

5. Remove the temperature blend door actuator.
 - Disconnect the electrical connector.
 - Remove the 3 screws.



Installation

1. Install the temperature blend door actuator.
 - Tighten the screws to 1 Nm.
 - Connect the electrical connector.
2. Install the passenger side footwell duct elbow.
 - Tighten the screws.
3. Install the passenger side footwell duct.
 - Install the clip.
4. Install the passenger side closing trim panel.
 - Connect the electrical connector.
 - Tighten the screws.
 - Secure the clip.
5. Install the glove compartment.
For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

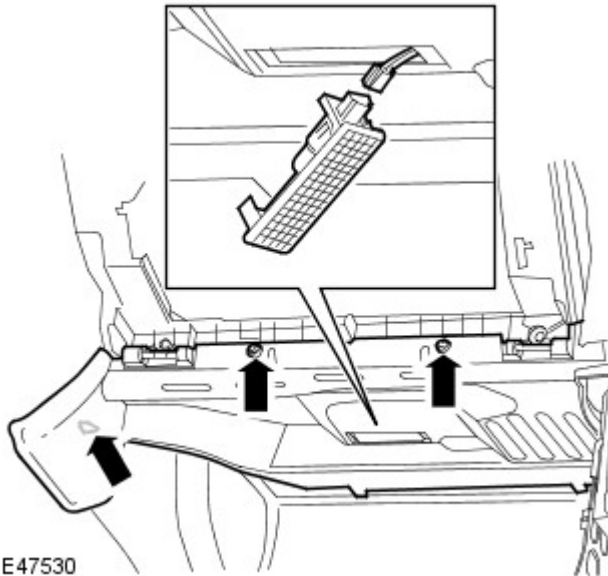
Control Components - Passenger Side Temperature Blend Door Actuator RHD AWD

Removal and Installation

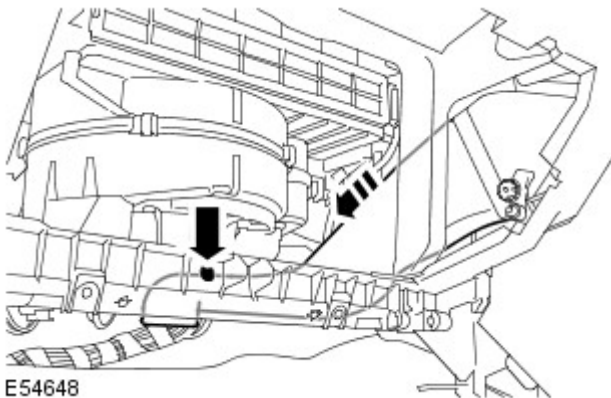
Removal

1. Remove the glove compartment.
For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

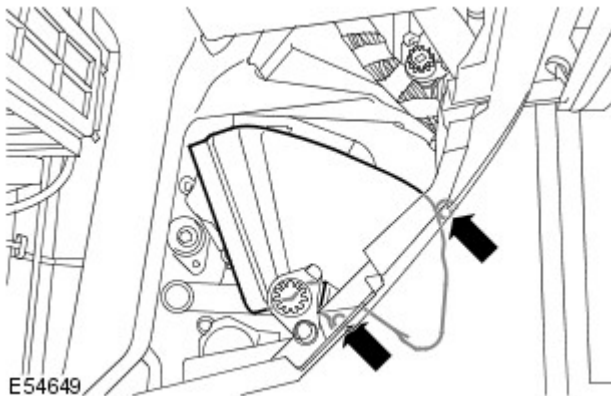
2. Remove the passenger side closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.



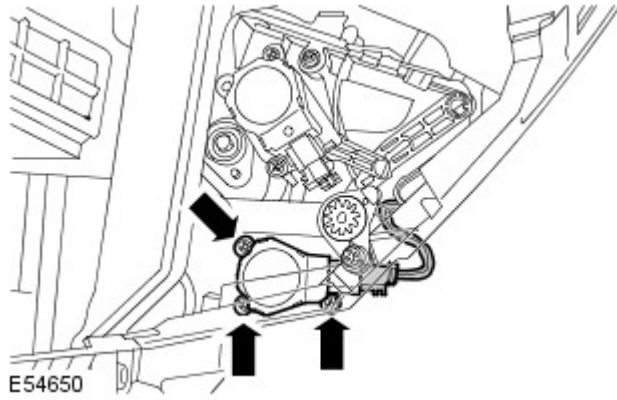
3. Remove the passenger side footwell duct.
 - Remove the clip.



4. Remove the passenger side footwell duct elbow.
 - Remove the 2 Torx screws.



5. Remove the temperature blend door actuator.
 - Disconnect the electrical connector.
 - Remove the 3 screws.



Installation

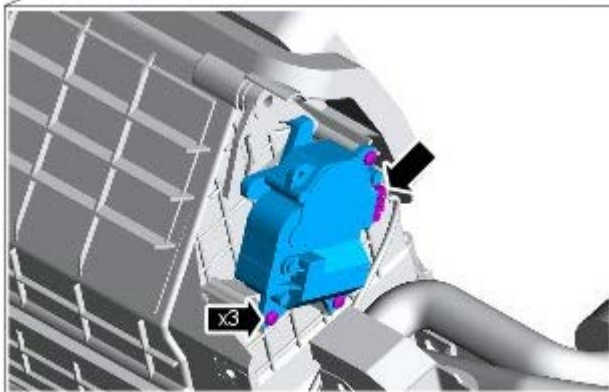
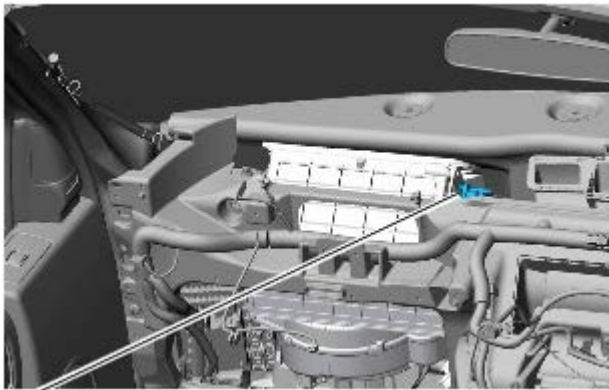
1. Install the temperature blend door actuator.
 - Tighten the screws.
 - Connect the electrical connector.
2. Install the passenger side footwell duct elbow.
 - Tighten the screws.
3. Install the passenger side footwell duct.
 - Install the clip.
4. Install the passenger side closing trim panel.
 - Install the interior lamp.
 - Connect the electrical connector.
 - Secure the clip.
5. Install the glove compartment.
For additional information, refer to: Glove Compartment (501-12, Removal and Installation).

Control Components - Recirculation Blend Door Actuator LHD AWD

Removal and Installation

Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
3. Remove the instrument panel upper section.
For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).



E91604

4.  **NOTE:** RHD illustration shown, LHD is similar.

Remove the recirculation blend door actuator.

- Disconnect the electrical connector.
- Remove the 3 screws.

Installation

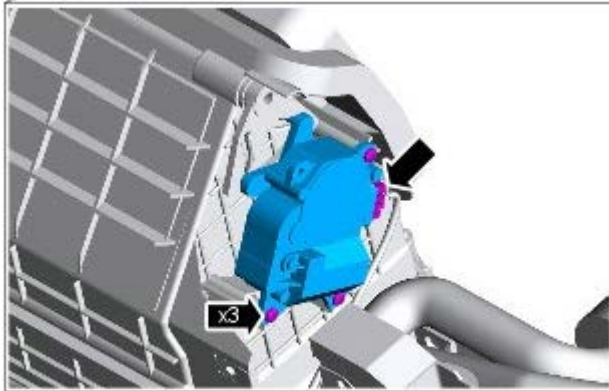
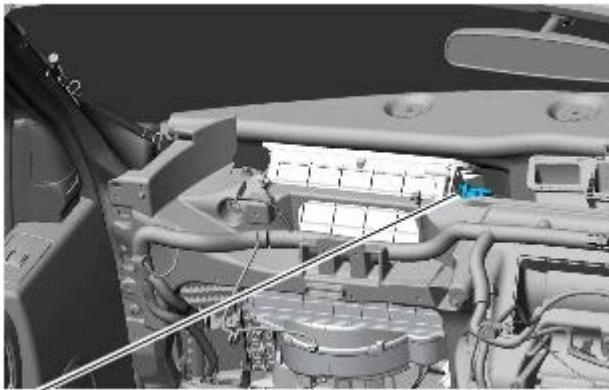
1. Install the recirculation blend door actuator.
 - Align the control arm to the recirculation blend door.
 - Install the 3 screws.
 - Connect the electrical connector.
2. Install the instrument panel upper section.
For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).
3. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

Control Components - Recirculation Blend Door Actuator RHD AWD

Removal and Installation

Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
3. Remove the instrument panel upper section.
For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).
4. Remove the recirculation blend door actuator.
 - Disconnect the electrical connector.
 - Remove the 3 screws.



E91604

Installation

1. Install the recirculation blend door actuator.
 - Align the control arm to the recirculation blend door.
 - Install the 3 screws.
 - Connect the electrical connector.
2. Install the instrument panel upper section.
For additional information, refer to: Instrument Panel Upper Section (501-12, Removal and Installation).
3. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

Control Components - Sunload Sensor

Removal and Installation

Removal

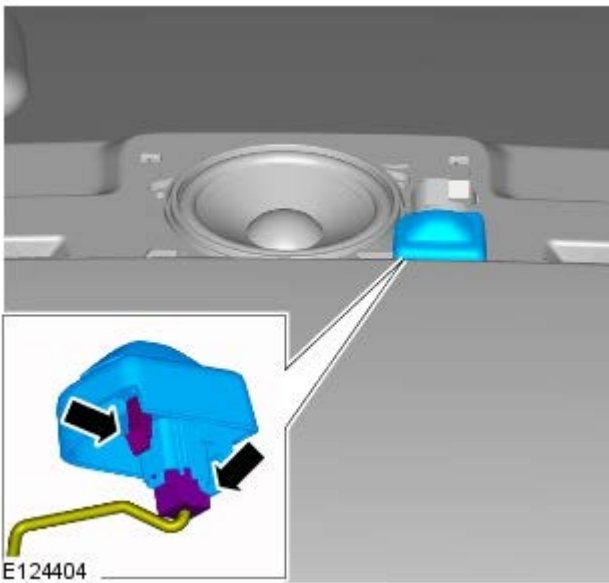


NOTE: Removal steps in this procedure may contain installation details.

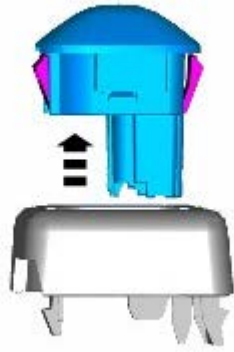
1.



2.



3.



E124405

Installation

1. To install, reverse the removal procedure.

Instrument Cluster -

Description	Nm	lb-ft
Steering column switch assembly	3	2

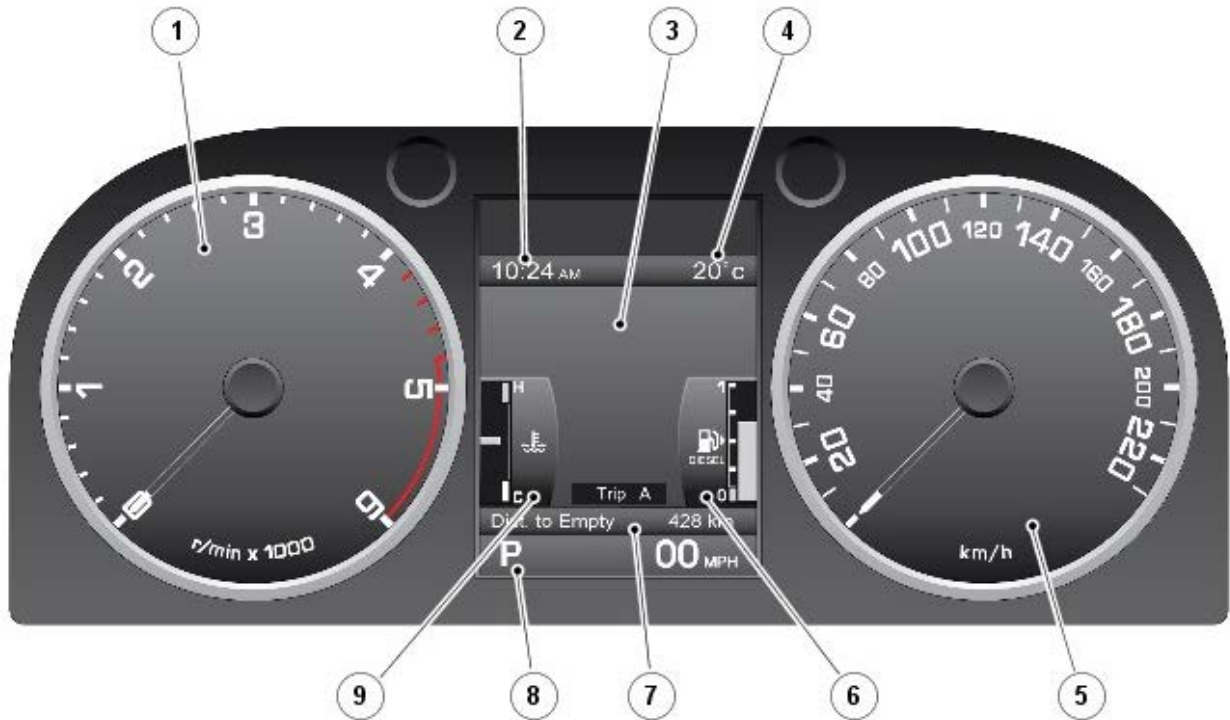
Instrument Cluster - Instrument Cluster

Description and Operation

OVERVIEW

The instrument cluster incorporates large speedometer and tachometer gauges, the instrument cluster also incorporates a TFT (thin film transistor) 5" high-definition display unit.

Instrument cluster overview



E123742

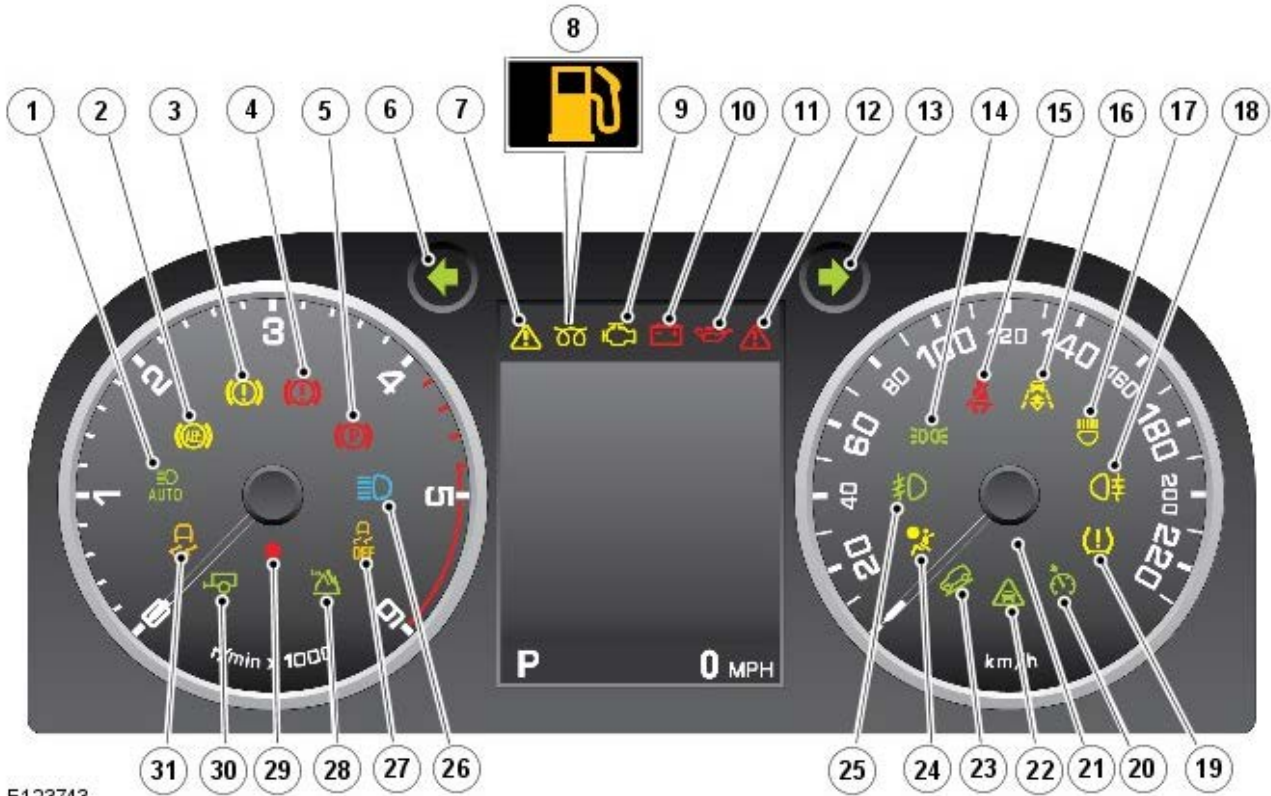
Item	Part Number	Description
1	-	Tachometer
2	-	Clock
3	-	Message center
4	-	External temperature
5	-	Speedometer
6	-	Fuel gauge
7	-	Total distance odometer and trip recorder
8	-	Gear selector position display
9	-	Temperature gauge

The TFT display incorporates a 'Message Center' that communicates vehicle information and status data to the driver. Menus displayed in the message center allow access to a number of vehicle functions through the guidance of the message center menus. The driver operates the message center using the 'menu control' located on the right-hand-side of the steering wheel.

The instrument cluster features a number of warning indicators, where in addition to those located within the speedometer and tachometer gauges, another six indicators are positioned within the TFT unit above the message center.

DESCRIPTION

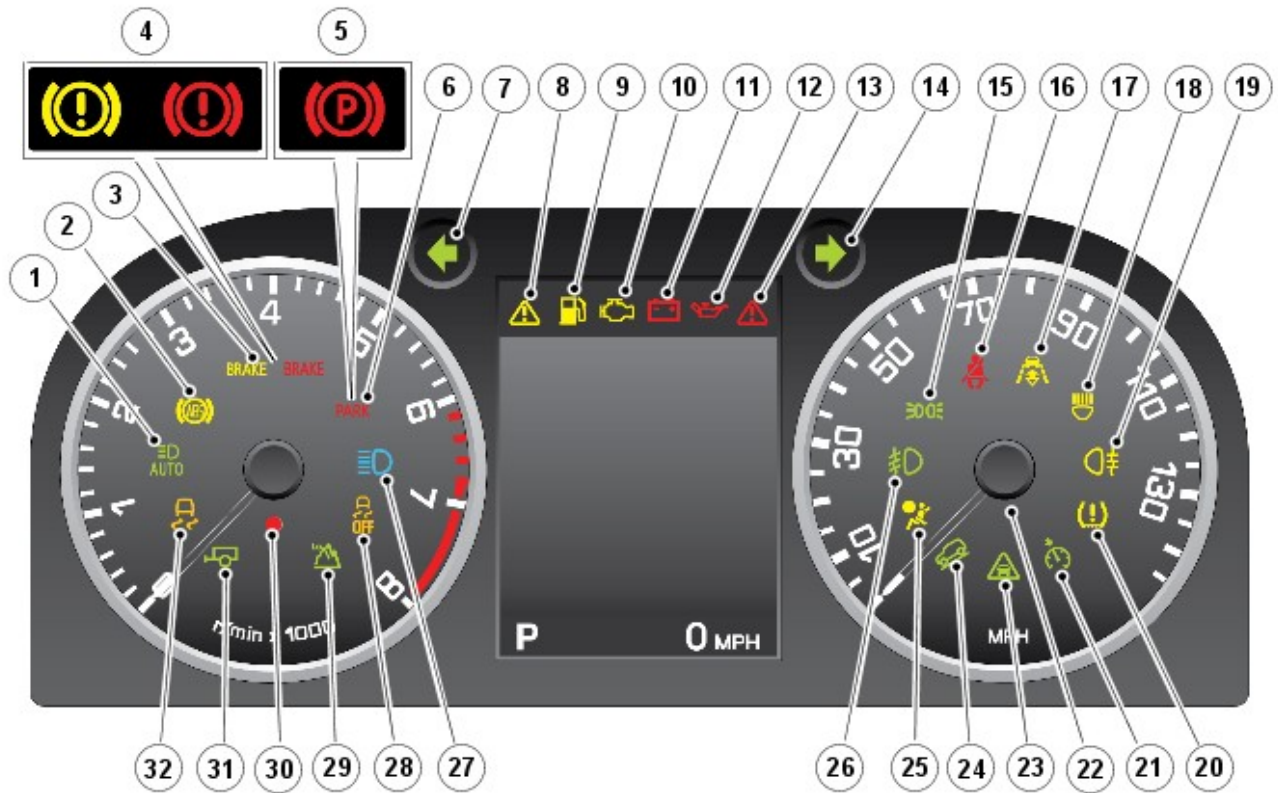
Warning Indicators – ROW Diesel Shown



E123743

Item	Part Number	Description
1	-	Automatic high beam active warning - green
2	-	Anti-lock Brake System (ABS) warning - amber
3	-	Brake system warning – amber
4	-	Brake system warning - red
5	-	Park brake system warning - red
6	-	Left-hand turn signal indicator - green
7	-	Warning/information - amber
8	-	Glow plug warning / Low fuel warning (dual function indicator) – amber
9	-	Check engine MIL warning - amber
10	-	Charge indicator - red
11	-	Oil pressure warning - red
12	-	Critical warning - red
13	-	Right-hand turn signal indicator - green
14	-	Side lamps - green
15	-	Seat belt warning - red
16	-	Adaptive Speed Control active - amber
17	-	Adaptive Front lighting System (AFS) warning - amber
18	-	Rear fog lamps active - amber
19	-	Tire pressure monitoring warning - amber
20	-	Speed control active - green
21	-	Ambient light sensor (reference only)
22	-	Forward alert active - green
23	-	Hill Descent Control (HDC) active - green
24	-	Airbag warning secondary - amber
25	-	Front fog lamps active - green
26	-	High beam warning - blue
27	-	Dynamic Stability Control (DSC) off warning - amber
28	-	Low range selected - green
29	-	Security Light Emitting Diode (LED) - red
30	-	Trailer warning - green
31	-	Dynamic Stability Control (DSC) active warning - amber

Warning Indicators – NAS Gasoline Shown



E123745

Item	Part Number	Description
1	-	Automatic high beam active warning - green
2	-	Anti-lock Brake System (ABS) warning - amber
3	-	Brake system warning USA only – amber/red
4	-	Brake system warning Canada only - amber/red
5	-	Park brake system warning Canada only - red
6	-	Park brake system warning USA only – red
7	-	Left-hand turn signal indicator - green
8	-	Warning/information - amber
9	-	Glow plug warning / Low fuel warning (dual function indicator) – amber
10	-	Check engine MIL warning - amber
11	-	Charge indicator - red
12	-	Oil pressure warning - red
13	-	Critical warning - red
14	-	Right-hand turn signal indicator - green
15	-	Side lamps - green
16	-	Seat belt warning - red
17	-	Adaptive Speed Control active - amber
18	-	Adaptive Front lighting System (AFS) warning - amber
19	-	Rear fog lamps active - amber
20	-	Tire pressure monitoring warning - amber
21	-	Speed control active - green
22	-	Ambient light sensor (reference only)
23	-	Forward alert active - green
24	-	Hill Descent Control (HDC) active - green
25	-	Airbag warning secondary - amber
26	-	Front fog lamps active - green
27	-	High beam warning - blue
28	-	Dynamic Stability Control (DSC) off warning - amber
29	-	Low range selected - green
30	-	Security Light Emitting Diode (LED) - red
31	-	Trailer warning - green
32	-	Dynamic Stability Control (DSC) active warning - amber

Stepper motors are used to actuate the mechanical speedometer and tachometer gauges to provide a smooth and progressive response.

The warning indicators above the message center are functioned using Thin Film Transistor (TFT) technology. LEDs

are used to illuminate the warning indicators in the speedometer and tachometer gauges and provide backlight illumination of the instrument cluster.

A single ambient light sensor is used to measure cabin lighting and adjust the backlight brightness of the instrument cluster accordingly. The instrument cluster also incorporates an anti-glare coating.

When the vehicle is locked the TFT unit goes off. When the vehicle is unlocked, a welcome screen is displayed featuring a Land Rover logo and an image of the vehicle, together with the current date and odometer information.

The coolant temperature and fuel quantity gauges are the default display when the stop/start button is pressed. These can be overwritten by different permutations of screens which are available to cover numerous vehicle functions through a menu selection. Refer to the 'Information and Message Center' section for further information.

Message Center



E123746

Item	Part Number	Description
1	-	Warning Indicators – this area cannot be overwritten by other information
2	-	Message Center – this area can be overwritten by other information
3	-	Gear Selection and Digital Speedometer Display - this area cannot be overwritten by other information

OPERATION

Control Diagram



NOTE: **A** = Hardwired; **D** = High Speed CAN; **N** = Medium Speed CAN; **O** = LIN Bus;

- LIN (local interconnect network) bus connections

However, some vehicle sensors are hardwired directly to the instrument cluster.

The steering lock control module is connected to a hardwired connection to the instrument cluster. Security information from other control modules is passed via the network buses and when the conditions are correct the instrument cluster instructs the steering lock control module to unlock the steering column.

The clockspring is connected to the instrument cluster on a LIN bus connection. The LIN bus passes driver selections made on the steering wheel mounted switches to the instrument cluster for processing and transmission to other control modules.

Instrument Cluster - Instrument Cluster

Description and Operation

The instrument cluster fitted to the armoured vehicle is the same as that fitted to the standard vehicle except that the [SRS \(supplemental restraint system\)](#) warning indicator remains illuminated. For additional information, refer to: Air Bag Supplemental Restraint System (SRS) (501-20B, Description and Operation).

Instrument Cluster - Instrument Cluster

Diagnosis and Testing

Principles of Operation

For a detailed description of the instrument cluster system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Instrument Cluster (413-01 Instrument Cluster, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of damage.

Visual Inspection

Electrical
<ul style="list-style-type: none"> • Battery • Fuses • Wiring harness • Damaged, loose or corroded connectors • Controller Area Network (CAN) circuits • Instrument Cluster (IPC) • Central Junction Box (CJB) • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

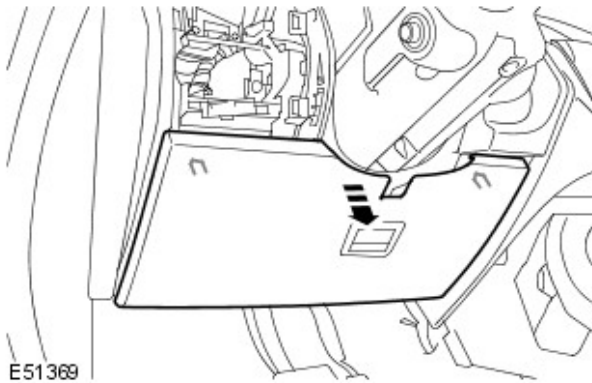
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Instrument Cluster (IPC) (100-00, Description and Operation).

Instrument Cluster - Instrument Cluster

Removal and Installation

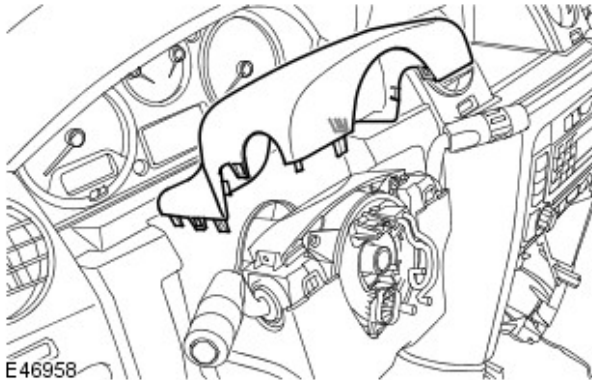
Removal

1. Fully extend the steering column for access.
2. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
3. Remove the steering wheel.
4. Remove the headlamp switch trim panel.
For additional information, refer to: Driver Side Register Trim Panel (412-01, Removal and Installation).
5. Remove the instrument panel access panel.
 - Release the 2 clips.



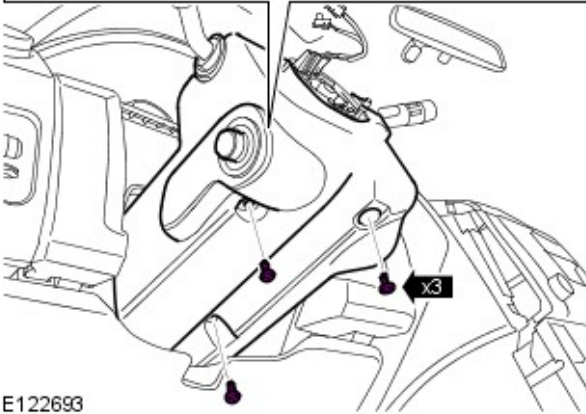
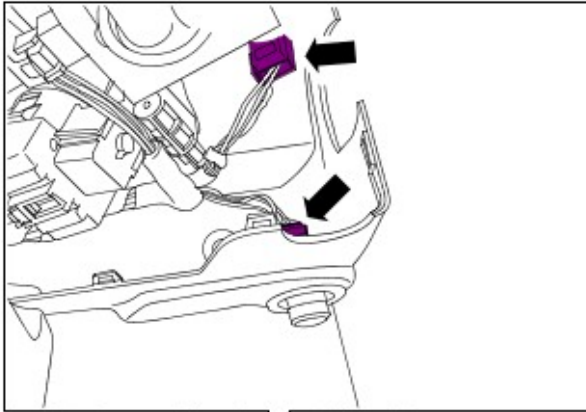
E51369

6. Remove the steering column upper shroud.
 - Release the 6 clips.



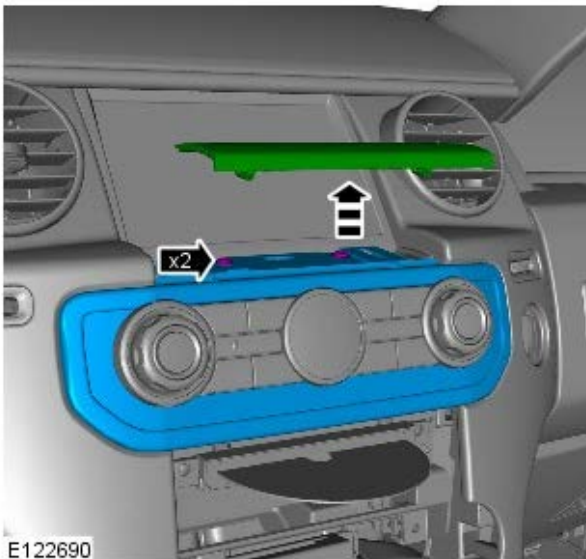
E46958

7. Remove the steering column lower shroud.
 - Remove the 3 Torx screws.
 - Disconnect the electrical connectors.



E122693

8. Remove the audio unit control trim panel.
 - Remove the 2 retaining screws.



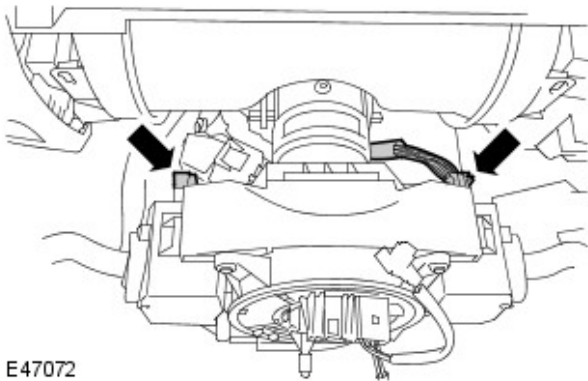
E122690

9. Remove the steering column side trim panel.
 - Release the clips.
 - Disconnect the electrical connector.



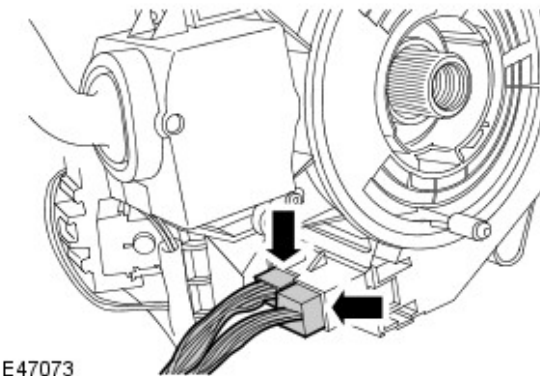
E122691

10. Disconnect the 2 electrical connectors from the steering column multifunction switches.



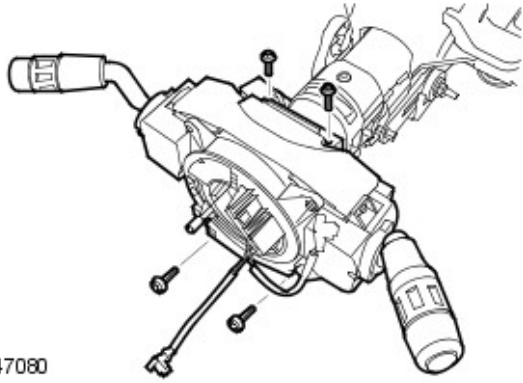
E47072

11. Disconnect the 2 electrical connectors from the clockspring.

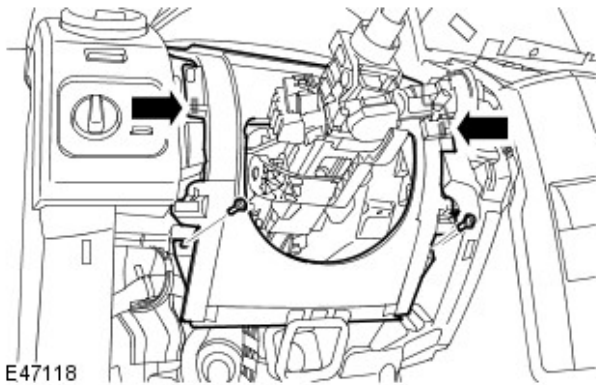


E47073

12. Remove the steering column switch assembly.
 - Remove the 4 Torx bolts.



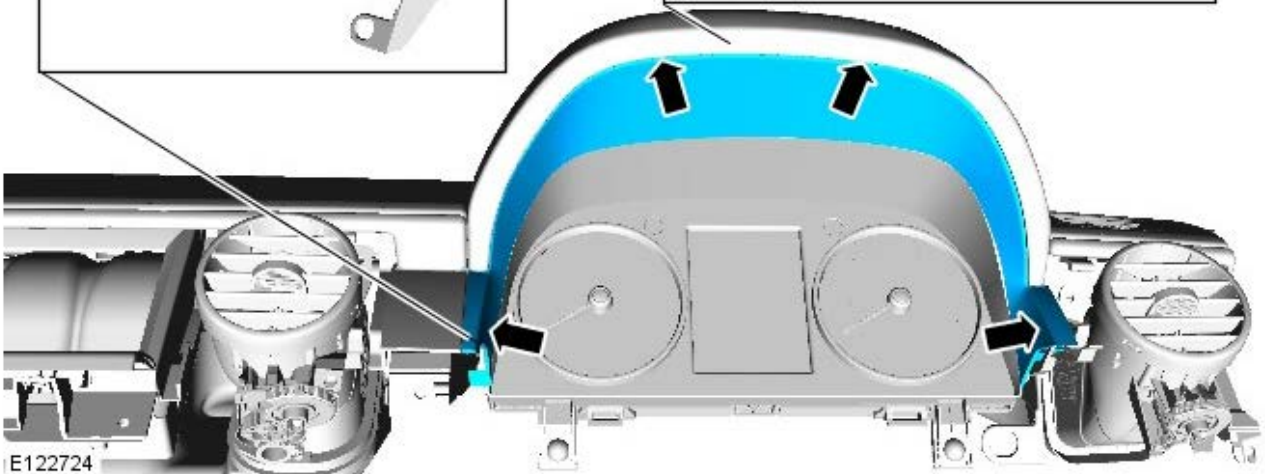
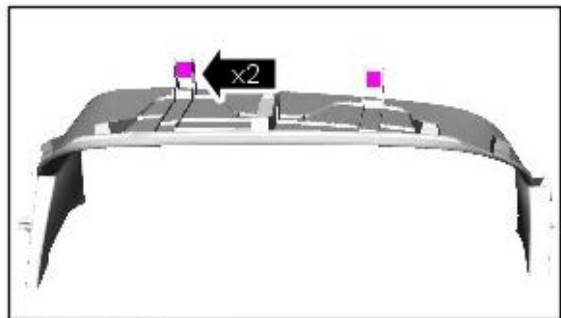
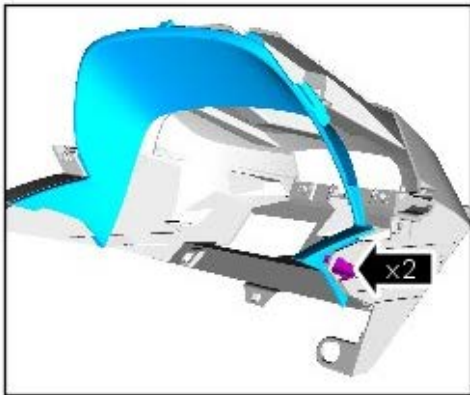
E47080



E47118

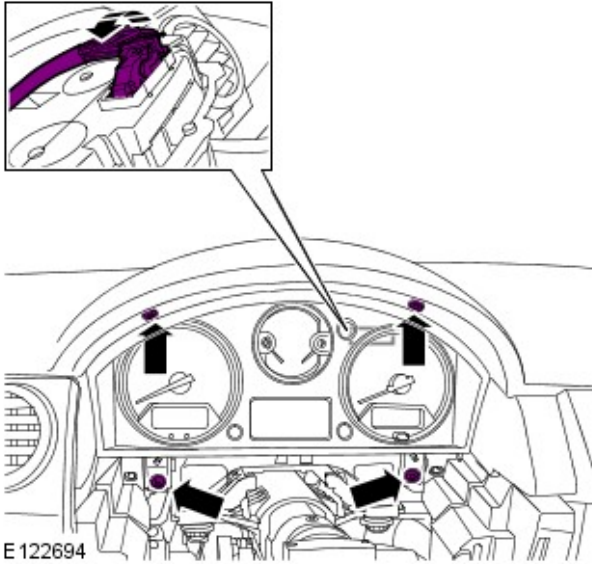
13. Remove the steering column gaiter panel.
- Remove the 2 Torx screws.
 - Release the 2 clips.

14. Remove the instrument cluster trim panel.
- Release the 2 clips.
 - Release the 2 retaining tangs.




E122724

15. Remove the instrument cluster.
- Remove the 2 Torx screws.
 - Remove the 2 retaining screws.
 - Disconnect the electrical connector.



E 122694

Installation

1. Install the instrument cluster.
 - Connect the electrical connector.
 - Tighten the screws.
2. Install the instrument cluster trim panel.
 - Secure the 2 clips.
 - Secure the 2 tangs.
3. Install the steering column gaiter panel.
 - Secure with the clips.
 - Tighten the Torx screws.
4. Install the steering column switch assembly.
 - Tighten the Torx bolts to 3 Nm (2 lb.ft).
5. Connect the clockspring and multifunction switch electrical connectors.
6.  **CAUTION:** When installing the lower locating tang of the trim panel, make sure the floor console is not damaged. If necessary protect the surrounding areas using masking tape.

NOTES:



To install, reverse the removal sequence.



Make sure that all the clips are correctly installed.

Install the steering column side trim panel.

- Secure with the clip.
 - Connect the electrical connector.
7. Install the audio unit control trim panel.
 - Install the 2 retaining screws.
 8. Install the steering column shrouds.
 - Tighten the Torx screws.
 9. Install the instrument panel access panel.
 - Secure with the clips.
 10. Install the headlamp switch trim panel.
For additional information, refer to: Driver Side Register Trim Panel (412-01, Removal and Installation).
 11. Install the steering wheel.
 12. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

13. Using the diagnostic tool, configure the instrument cluster.

Instrument Cluster - Instrument Cluster Lens

Removal and Installation

Removal



CAUTION: Make sure that the dial indicators are not moved during the removal and installation of the lens. If this occurs, you must not attempt to reset them using your hands as this will affect the calibration of the instrument cluster and will require a full instrument cluster calibration to be carried out.




NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Instrument Cluster (413-01, Removal and Installation).





E142894

2.  **CAUTION:** To prevent static damage to the circuits, place the instrument cluster inside the electro static discharge bag and use the gloves provided during this procedure.



E141966

3.  **NOTE:** Gently release by pressing down on the white part of the clips.

4.  **CAUTION:** Take care not to damage the circuit board.



NOTE: Gently release by pressing down on the black part of the clips.



E141967



E141969

Installation



E141967

5. Remove the instrument cluster lens from the electro discharge bag and discard.

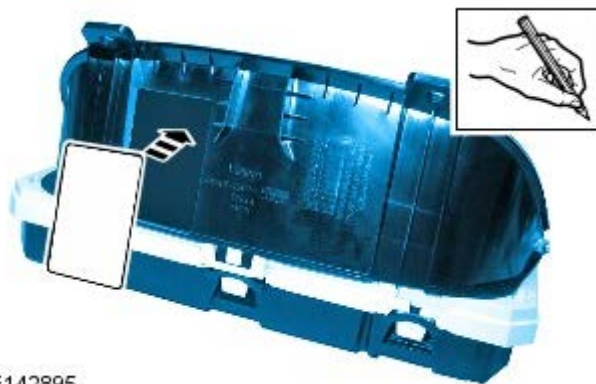
1.  **CAUTION:** Take care not to damage the circuit board.

Gently install the clips.

2. Gently install the clips and remove the instrument cluster from the electro discharge bag.



E141966



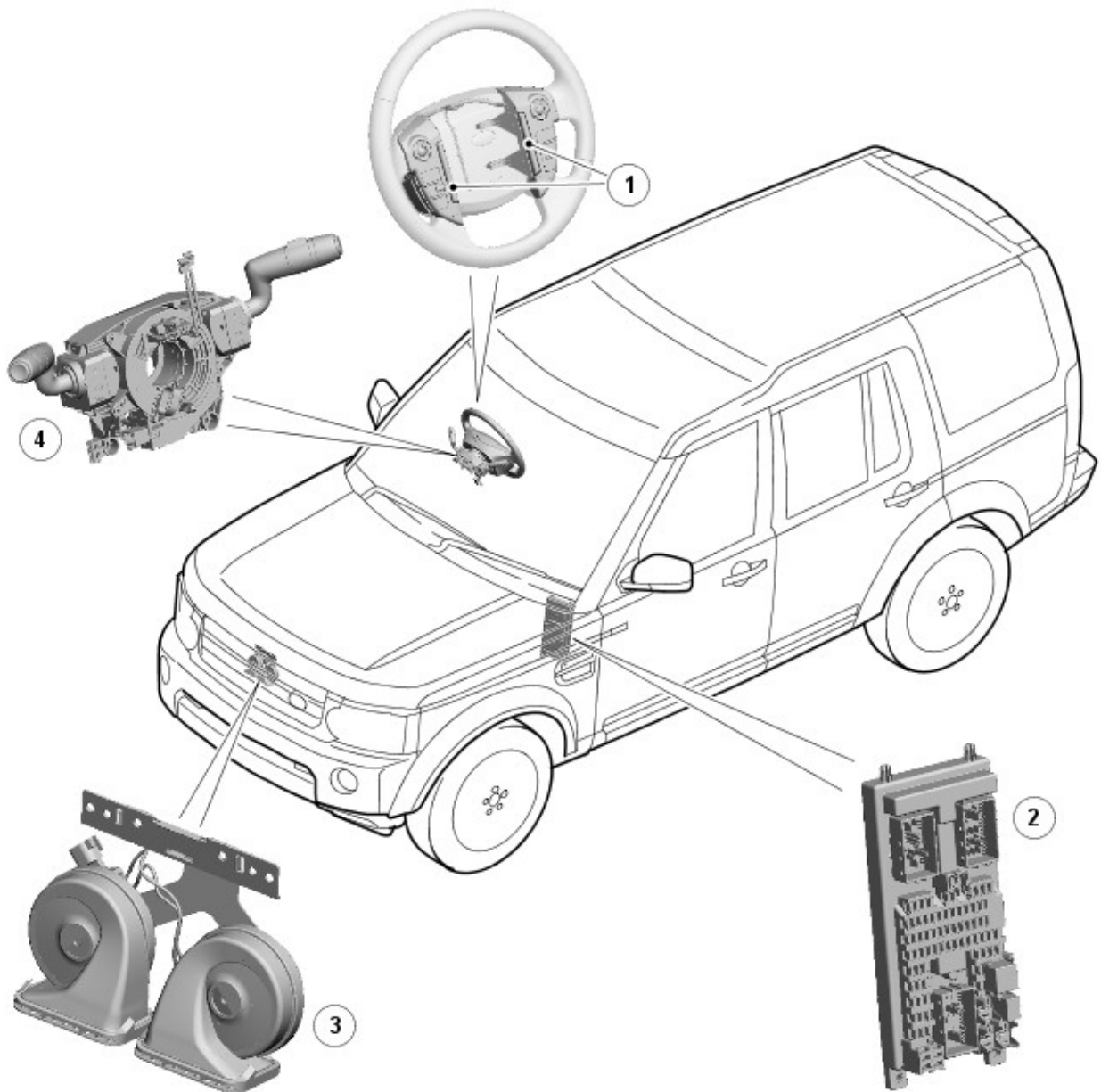
E142895

3. Copy the serial number, build date and assembly number from the old label onto the new label.

4. Refer to: Instrument Cluster (413-01, Removal and Installation).

Horn - Horn

Description and Operation



E140010

Item	Part Number	Description
1	-	Steering wheel horn switches
2	-	Central Junction Box (CJB)
3	-	Horns
4	-	Clockspring

GENERAL

Two horns are fitted to the vehicle; a high tone and a low tone. The horns are mounted on bracket, which is attached centrally to the front end carrier assembly.

The horns are operated by pressing one of the two horn switches, located on each side of the driver airbag, on the steering wheel.

The horns are also used by the vehicle alarm system. When the alarm system requires the horns to operate, the Central Junction Box (CJB) provides a ground, closing the relay contact which in turn supplies battery voltage to operate the horns.

For additional information, refer to: Anti-Theft - Active (419-01A, Description and Operation).

The horn circuit is permanently connected to battery voltage and therefore the horns can be operated at any time, irrespective of ignition switch position.

The horns are controlled by the CJB.

Horn - Horn

Description and Operation

Siren

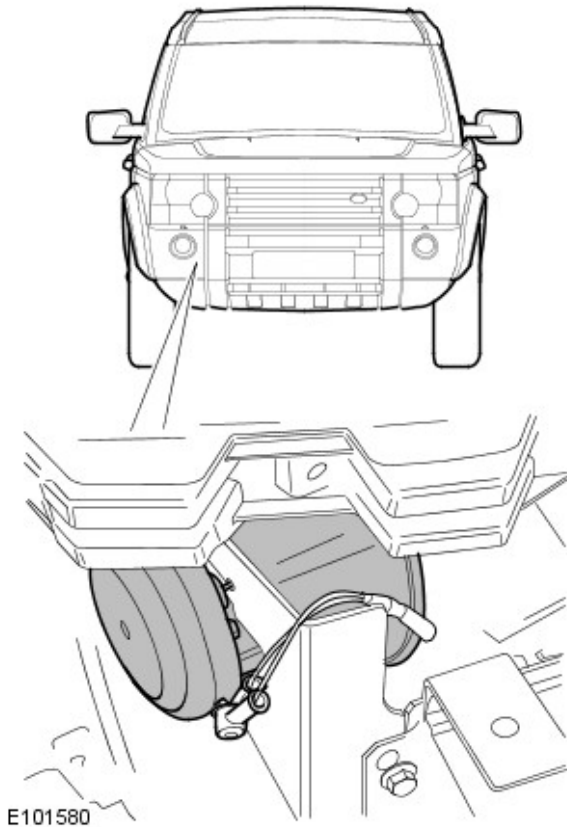
Overview

When activated the siren emits either a 'wail' or 'yelp' tone to alert other road users of the vehicle's presence; in a similar manner to emergency service vehicles.

The siren system comprises:

- a siren speaker located behind the front bumper on right-hand side of the vehicle;
- an amplifier located under the driver's seat;
- a siren switch located in the auxiliary switch pack.

Siren speaker



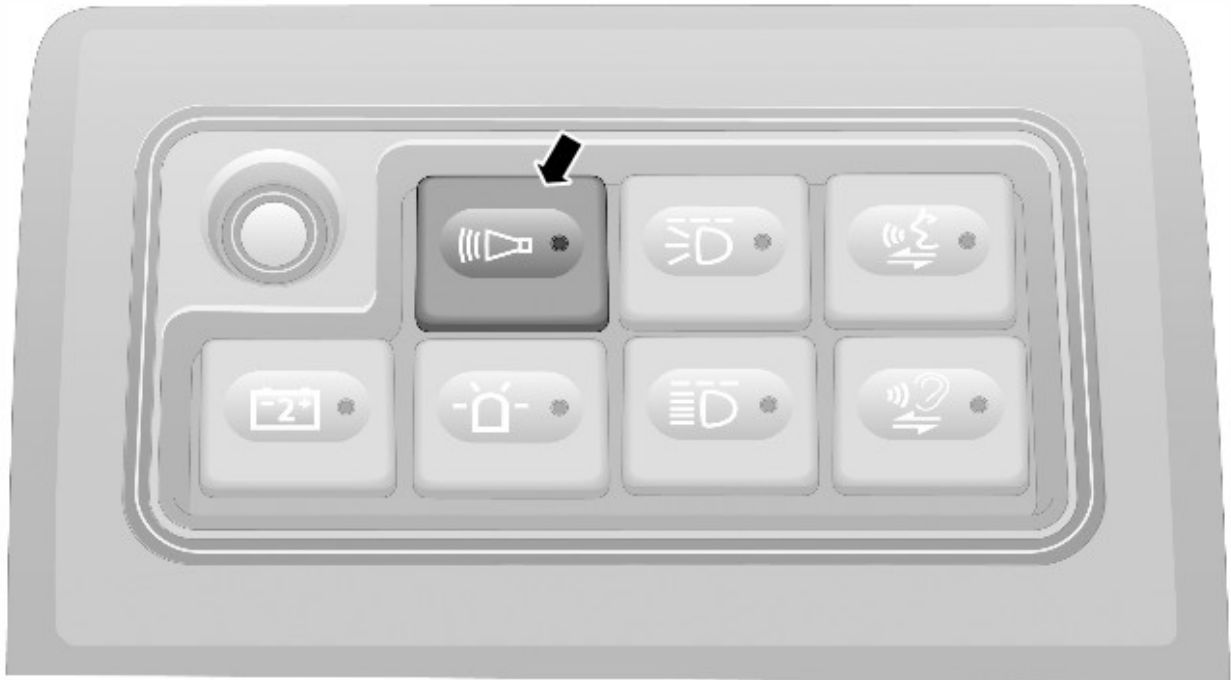
System Operation

The siren is activated when both the:

- ignition switch is 'On', and
- the siren switch, in the auxiliary switch pack, is 'On'.

A status lamp in the siren switch will illuminate when in the 'On' position.

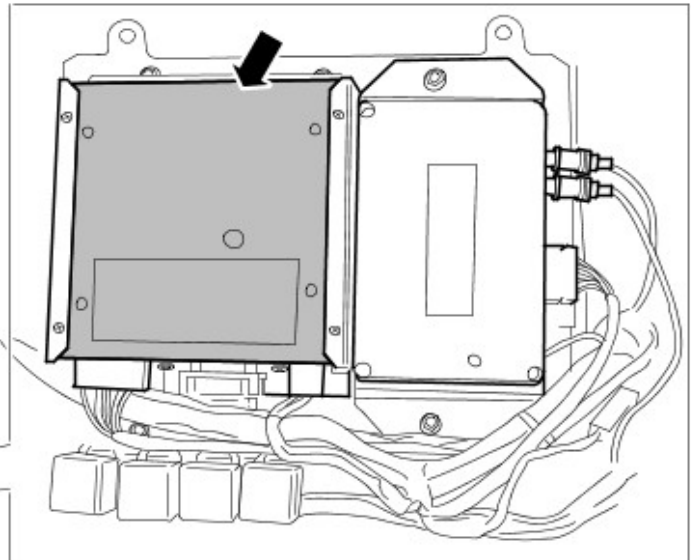
Siren switch with integrated status lamp



E101581

When activated the siren operates via the amplifier in one of two modes, emitting either a 'wail' or a 'yelp' tone.

Siren amplifier (underneath driver's seat)



E102924

Siren tone selection is controlled by the vehicle horn button on the steering wheel:

- A single press and each subsequent single press on the horn button will alternate the siren's 'wail' and 'yelp' tones.
- Two presses in quick succession will silence the siren.
- Pressing the horn button when the siren is in silent mode will restart the siren.

Vehicle horn button



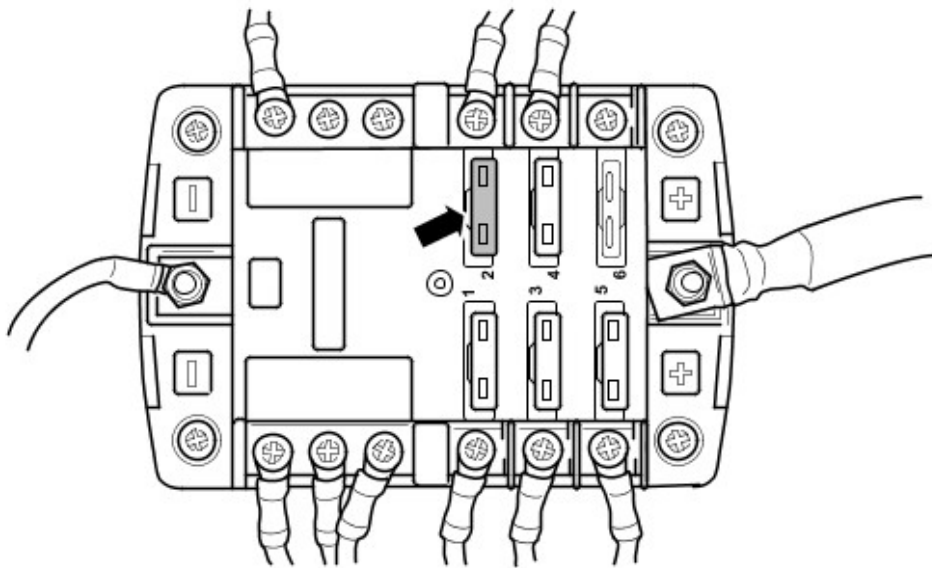
E101583

When the siren switch, in the auxiliary switch pack, is in the 'Off' position the vehicle horn will function as normal.

The electrical system for the siren is supplied by the auxiliary battery, via the armoured vehicle options harness and 20 amp fuse (F2) in the satellite junction box.

For additional information, refer to: Battery and Cables (414-01, Description and Operation).

Satellite junction box with siren fuse (F2) highlighted



E101582



NOTE: The supplementary circuit diagrams for the armoured vehicle are located in Land Rover GTR at: Service Information, Discovery 3, 2008 Electrical Circuit Diagrams.

Horn - Horn

Diagnosis and Testing

Principles of Operation

For a detailed description of the horn system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Horn (413-06 Horn, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Horn(s) condition and installation 	<ul style="list-style-type: none"> • Battery condition and state of charge • Fuses • Relay • Electrical connections • Horn switches • Clockspring • Central Junction Box (CJB) • Battery Junction Box (BJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Horn(s) operate with a muffled tone	<ul style="list-style-type: none"> • Low battery voltage • Horn circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual and test the battery • Refer to the electrical circuit diagrams and test the horn circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Horn(s) inoperative		

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00, Description and Operation).

This section contains no data

Information and Message Center - Information and Message Center

Diagnosis and Testing

Principles of Operation

For a detailed description of the information and entertainment system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Information and Message Center (413-08 Information and Message Center, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Message center screen 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Electrical connector(s) • Battery condition, state of charge • Instrument Cluster (IC)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Instrument Cluster (IC) (100-00 General Information, Description and Operation).

Warning Devices -

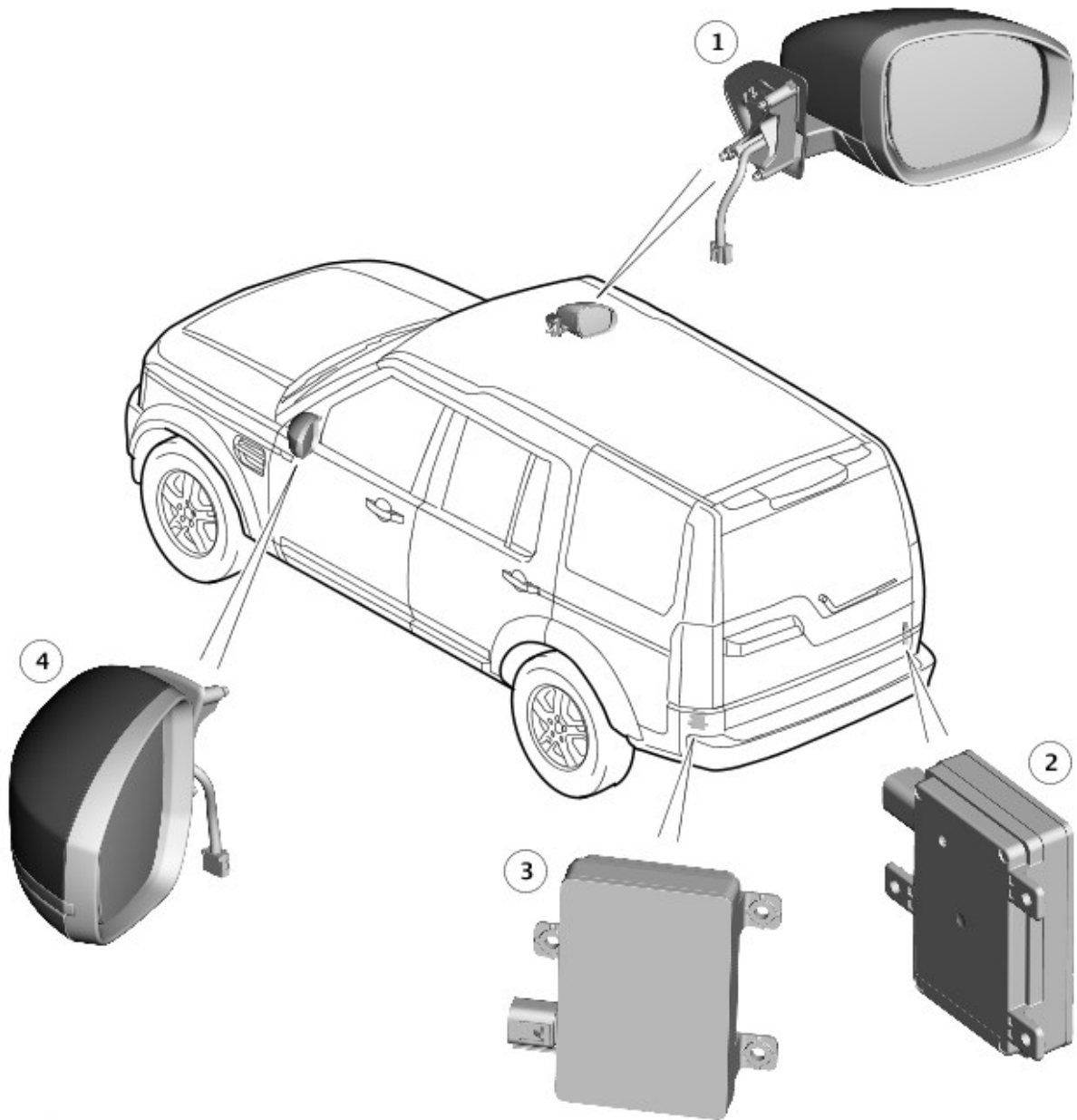
Torque Specifications

Description	Nm	lb-ft	lb-in
Low tire pressure module retaining bolts	10	7	-
General proximity sensor module (GPMS) retaining bolts	10	7	-
Blind spot monitoring sensor bracket retaining bolts	2.5	-	22
Blind spot monitoring sensor retaining bolts	2.5	-	22

Warning Devices - Blindspot Monitoring System

Description and Operation

COMPONENT LOCATION



E161549

Item	Part Number	Description
1	-	Right side door mirror
2	-	Right side Blindspot Monitoring Control Module (BMCM)
3	-	Left Side BMCM
4	-	Left side door mirror

OVERVIEW

Blindspot Monitoring System

Eliminating blindspots is a major element in vehicle body design, but because of the structural requirements, blindspots cannot be entirely eliminated, so the blindspot monitoring system is there to help assist the driver safely crossover in moving traffic.

The blindspot monitoring system comprises off:

- Left BMCM (blindspot monitoring control module).
- Right BMCM.
- Left side door mirror assembly.
- Right side door mirror assembly.

The system uses two radar sensors; they are incorporated in each of a BMCM's, that are located at the rear of the

vehicle (one module each side) and are connected via a private **CAN (controller area network)** bus to exchange information.

Closing Vehicle Sensing

In addition to the functionality provided by the blindspot monitoring system, the closing vehicle sensing system monitors a larger area behind the vehicle.

If a vehicle is identified by the system as being a fast approaching vehicle, it will inform the driver.

Reverse Traffic Detection (RTD)

The RTD (reverse traffic detection) system is a further enhancement to the blindspot monitoring system. It will inform the driver if a vehicle is approaching when in the reversing manoeuvre.

DESCRIPTION

Blindspot Monitoring Control Module (BMCM)

There are two BMCM (blindspot monitoring control module)'s and they are located in the corner of the rear bumper, one on each side.

Each BMCM has an 8 way connector that has power, ground, MS (medium speed) **CAN** bus wires, two private CAN wires and two hard wire connections; one for the status light and one for the alert icon in the mirror.

Each BMCM carries out an auto-alignment self-check every time when in use. This procedure can take up to an hour in some environments; however the operation of the blindspot monitoring system will continue to operate as normal.

Each module will detect a vehicle in the driver's blindspot. Once the vehicle is detected the module illuminates an amber warning 'alert icon' **LED (light emitting diode)** in the relevant exterior door mirror.

If the system displays 'blindspot not available' and there is a misalignment trouble code in the system, the physical sensors must be checked for mounting and body work should be checked for damage or repair.

The blind spot monitoring modules receive vehicle speed on the MS CAN. The system activates at 8mph (13km/h) and remains active until the speed lowers below 3mph (5km/h).



CAUTION: The blindspot monitoring system is designed as a driver aid not a safety device. The driver should always exercise due care and attention whilst driving.

Closing Vehicle Sensing

The closing vehicle sensing system also uses the radar sensors in both BMCM (blindspot monitoring control module)'s.

It uses the same radar signal that allows the BMCM (blindspot monitoring control module)'s to monitor the larger area behind the vehicle.

Reverse Traffic Detection (RTD)

The RTD (reverse traffic detection) system again uses the radar sensors in both BMCM (blindspot monitoring control module)'s.

The radar signal monitors the sides of the vehicle and detects a vehicle if approaching.

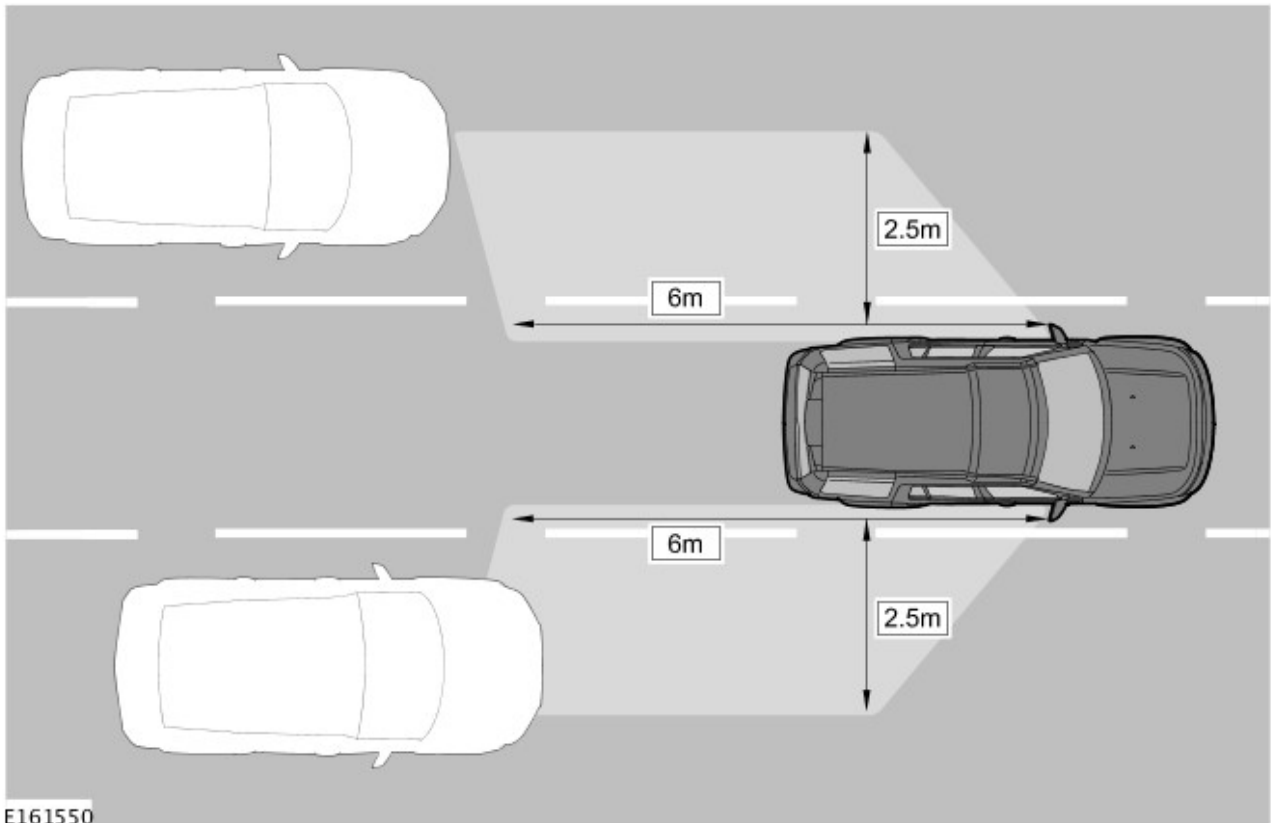
OPERATION

Blindspot Monitoring Control Module (BMCM)

The blindspot monitoring system uses a cross over radar pattern to the rear of the vehicle and is used to determine actual moving vehicles eliminating any stationary roadside objects.

The system monitors an area extending from the exterior mirrors rearwards, to approximately 6 metres behind the rear wheels, and up to 2.5 metres from the side of the vehicle.

The driver will be alerted, with a solid warning lamp in the relevant door mirror.



The system will warn the driver of the presence of vehicles in a defined closing vehicle warning zone, which poses a threat to the driver if a lane change manoeuvre is made.

The driver will be notified of the threat by flashing the existing blindspot icon in the relevant door mirror.



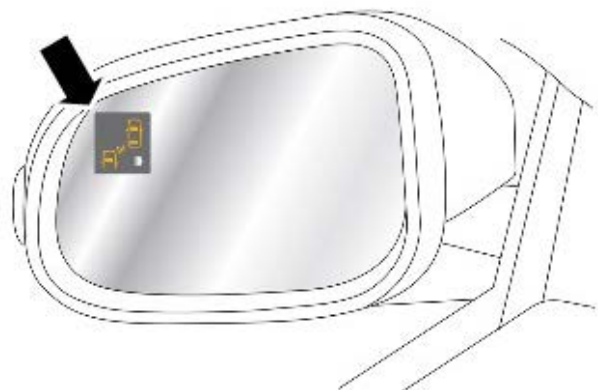
NOTE: If an overtaking vehicle is detected on both sides of the vehicle simultaneously, the warning alert icons in both mirrors will illuminate.

The LED's are located towards the outside extremity of the mirror face, within the peripheral view of the driver but not in any area of the mirror where they could obscure or distract from the image.

1



2



E97753

Item	Part Number	Description
1	-	Warning alert icon
2	-	System status warning indicator

The LED lighting alerts are as follows:

- Amber alert LED icon permanently lit - System operational, vehicle detected in blind spot area.
- No LED's lit – System active no vehicle detected in blind spot area.
- Amber status LED permanently lit - System not active or faulty.
- Amber alert LED icon flashing – System operational, potential hazard.

The system has operating limitations and is automatically turned off under certain operating conditions. During these operating conditions the amber status LED is permanently lit.

The system operating limitations are as follows:

- The system is inactive until vehicle speed is greater than 8mph – 13kph (amber status LED permanently lit).
- The system is inactive if an approved trailer is connected to the vehicle (amber status LED permanently lit).
- The system is inactive when reverse gear or park is selected (amber status LED permanently lit).



NOTE: If RTD (reverse traffic detection) is fitted the standby dot will be off when reverse is selected indicating that the system is active. If RTD is not fitted then the standby dot will be on indicating that the system is not active.

If either of the radar signals are blocked or distorted, for example by water, the radar face of the module is covered in mud, sleet or snow the system may detect this and be disabled with the amber status LED permanently lit together with a 'blindspot monitoring blocked' message displayed in the IC (instrument cluster) message center. The system is disabled until the blockage is cleared.

If there is a fault in the system the amber status LED is permanently lit and a 'blindspot monitoring not available' message displayed in the IC message center. The system is disabled until the fault is rectified.

System fault and blockage warnings are as follows:

- The system is disabled when the radar module signal is blocked (amber status LED permanently lit and IC message).
- The system is disabled by a fault (amber status LED permanently lit and IC message).

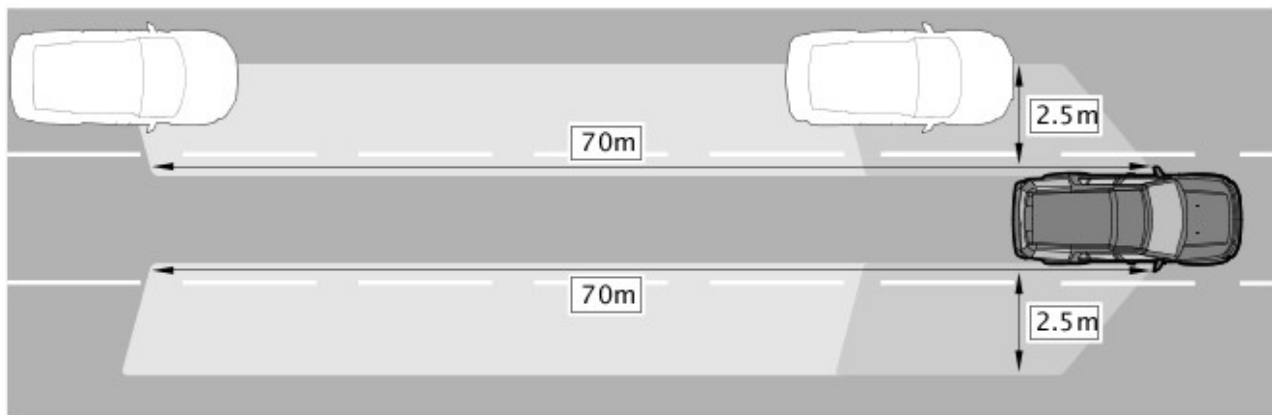
If there is a failure in the communication network and the warning LED cannot be displayed in the mirror, a failure message will be displayed in the IC message center.

When any faults are present in the system, DTC (diagnostic trouble code)'s are stored in both BCM's appropriate to each module. Replacement of modules requires the right module to be configured using the Land Rover approved diagnostic equipment.

Calibration of the modules using the Land Rover approved diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

Closing Vehicle Sensing

The closing vehicle sensing system operates in the same principle as blindspot monitoring however; close vehicle sensing will monitor a larger area extending from the back of the of the blindspot monitoring zone, to approximately 70 metres behind the rear wheels, and up to 2.5 metres from the side of the vehicle.



E161551

This is to alert the driver to the presence of rapidly approaching vehicle beyond the blindspot.

When a vehicle is detected by the system, the following LED lighting sequence will occur:

- Amber alert LED icon flashing – System operational, potential hazard.



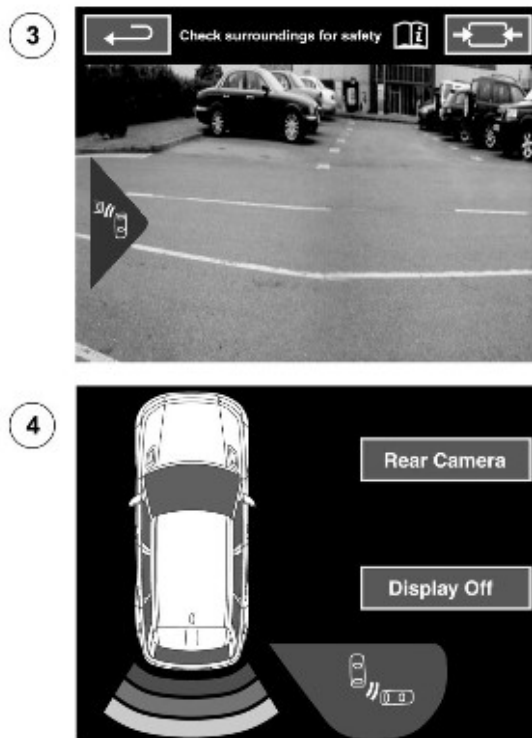
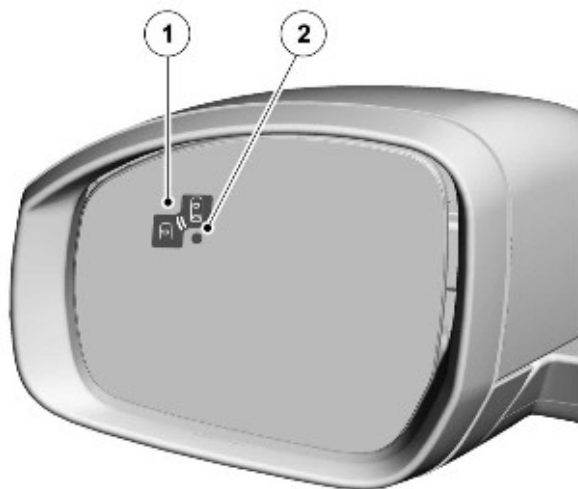
E161552

Item	Part Number	Description
1	-	Warning alert icon

Reverse Traffic Detection (RTD)

The RTD (reverse traffic detection) operates when in reverse gear only and will inform the driver when a less than 3 second time to collision is detected.

An amber warning icon will flash in the relevant exterior mirror and an audible warning will be emitted to indicate the presence of a moving vehicle. The driver is also informed of this with a visual view in the touch screen.



E155963

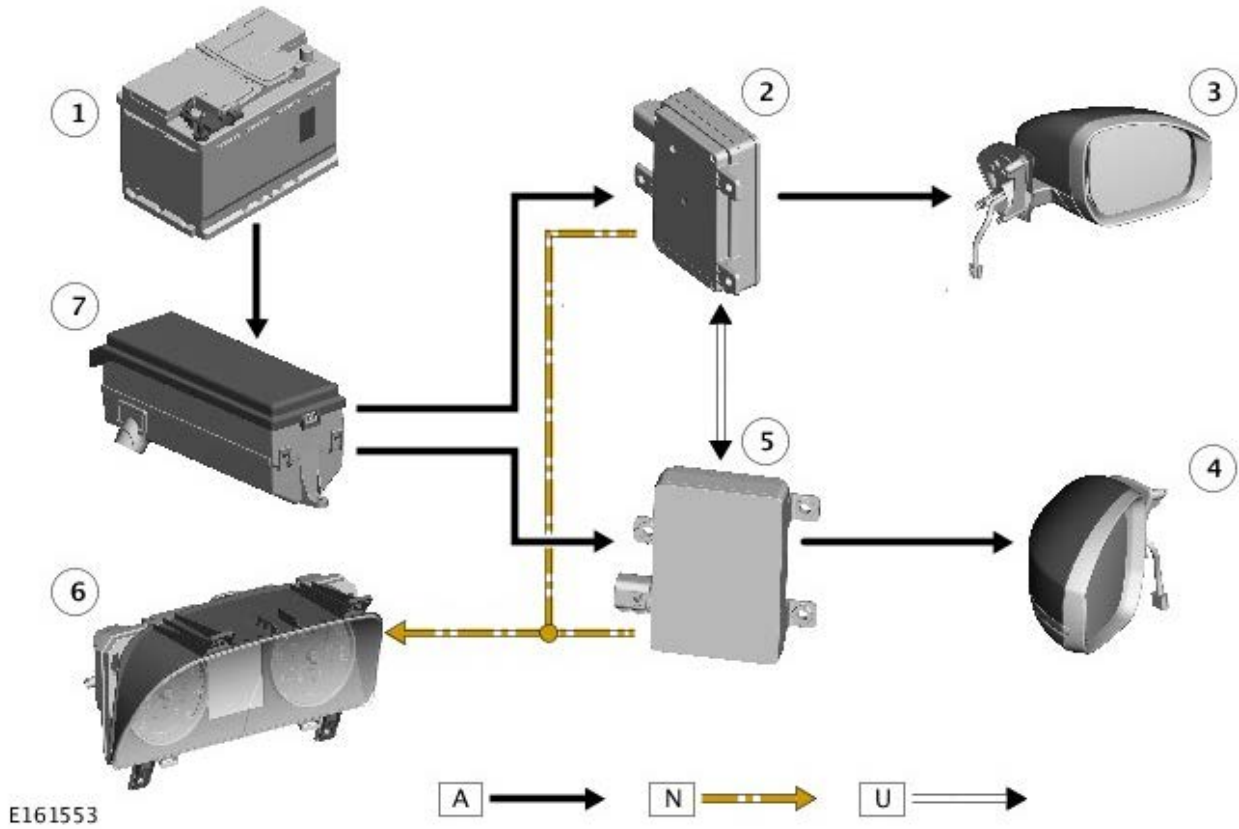
Item	Part Number	Description
1	-	Warning alert icon
2	-	System status warning indicator
3	-	Rear View Camera (RVC) screen
4	-	Parking aid screen

The RVC (rear view camera) and parking aid screen will also show a warning on the relevant side or sides of which a vehicle is approaching on.

The RTD system will automatically disable if any of the radars become partially or completely obscured. The amber warning indicator dot will illuminate in the exterior mirrors and the message 'Reverse Traffic Sensor Blocked' appears

in the Message centre.

CONTROL DIAGRAM



A = Hardwired; N = Medium Speed CAN Bus; U = Private CAN Bus

Item	Part Number	Description
1	-	Battery
2	-	Right side Blindspot Monitoring Control Module (BMCM)
3	-	Right side door mirror
4	-	Left side door mirror
5	-	Left side BMCM
6	-	Instrument Cluster (IC)
7	-	Engine Junction Box (EJB)

Warning Devices - Low Tire Pressure Module

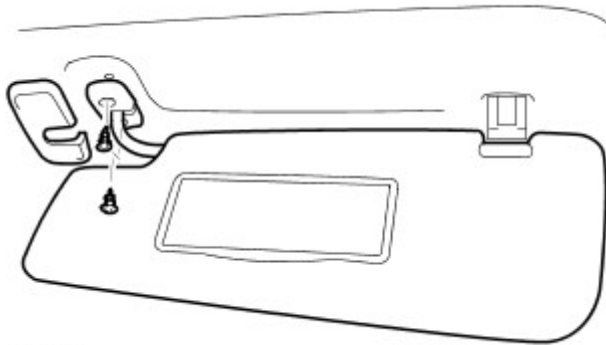
Removal and Installation

Removal



NOTE: If the tire pressure module is to be replaced then T4 must be connected and the correct procedures adhered to, prior to battery disconnection.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the LH A-pillar upper trim panel.
For additional information, refer to: A-Pillar Trim Panel (501-05, Removal and Installation).
3. Remove the LH B-pillar upper trim panel.
For additional information, refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).
4. Remove the LH C-pillar upper trim panel.
For additional information, refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).
5. Remove the LH sun visor.
 - Remove the cover.
 - Remove the 2 screws.
 - Disconnect the electrical connector.



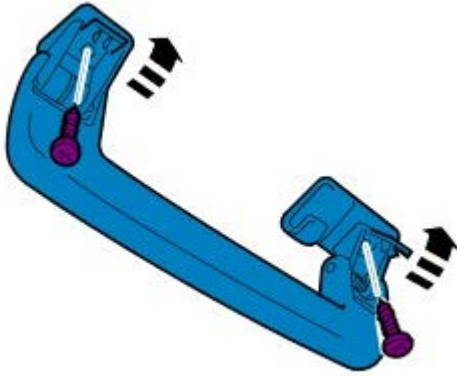
E49766

6. Remove the sun visor retaining clip.
 - Release the screw cover.
 - Remove the screw.

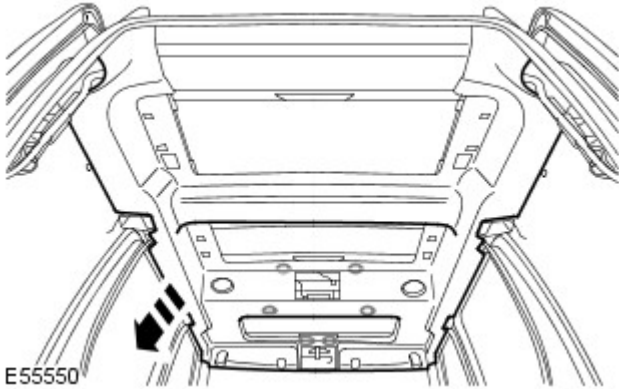


E49688

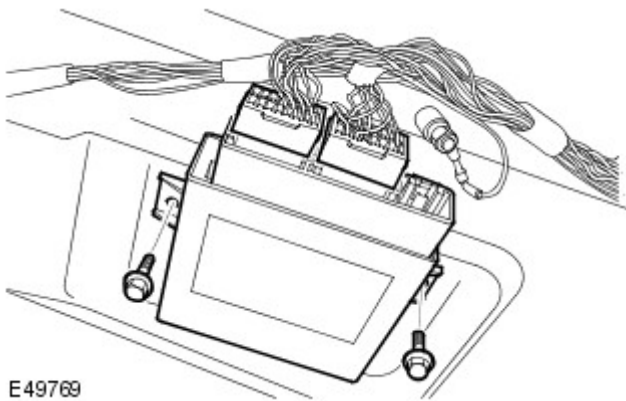
7. Remove the LH passenger assist handles.
 - Carefully release the 6 screw covers.
 - Remove the 6 screws.



E49689



E55550



E49769

8. Release the LH side of the headliner.
 - Release the 6 clips.

9. Remove the low tire pressure module.
 - Disconnect the 2 electrical connectors.
 - Remove the 2 bolts.

Installation

1. Install the low tire pressure module.
 - Tighten the bolts to 10 Nm (7 lb.ft).
 - Connect the electrical connectors.
2. Secure the LH side of the headliner.
 - Carefully secure the clips.
3. Install the LH passenger assist handles.
 - Install the screws.
 - Install the screw covers.
4. Install the sun visor retaining clip.
 - Install the screw.
 - Install the screw cover.
5. Install the LH sun visor.
 - Install the screws.
 - Install the screw covers.
 - Connect the electrical connector.
6. Install the LH C-pillar upper trim panel.
 For additional information, refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).

7. Install the LH B-pillar upper trim panel.
For additional information, refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).
8. Install the LH A-pillar upper trim panel.
For additional information, refer to: A-Pillar Trim Panel (501-05, Removal and Installation).
9. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

Warning Devices - Door Mirror Wade Sensor

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.

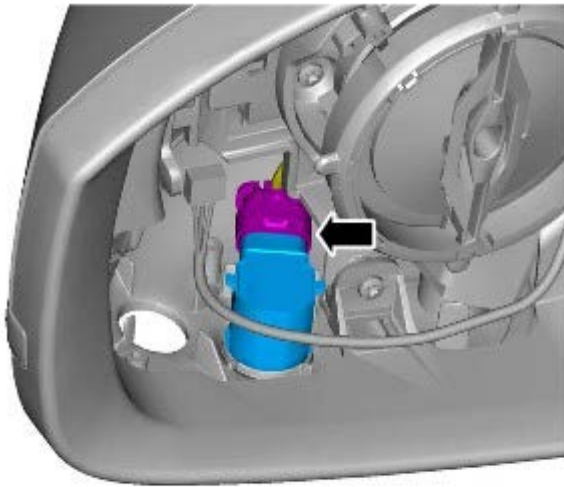



The ignition must be switched off.



LH illustration shown, RH is similar.

1. Refer to: [Side Parking Aid Camera](#) (413-13 Parking Aid, Removal and Installation).



2.  CAUTION: Take extra care not to damage the wiring harnesses.

E160928

Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Warning Devices - General Proximity Sensor Module

Removal and Installation

Removal

NOTES:

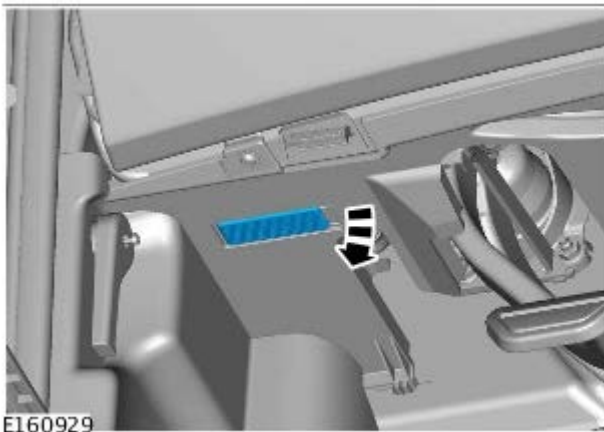
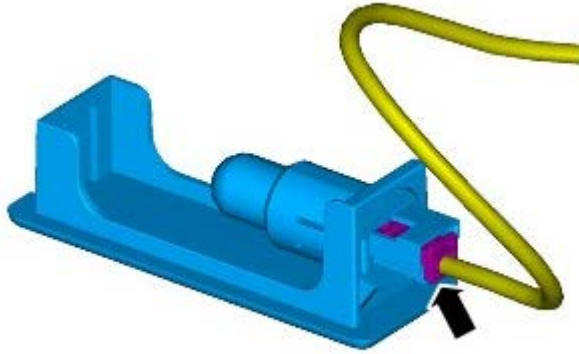


Removal steps in this procedure may contain installation details.

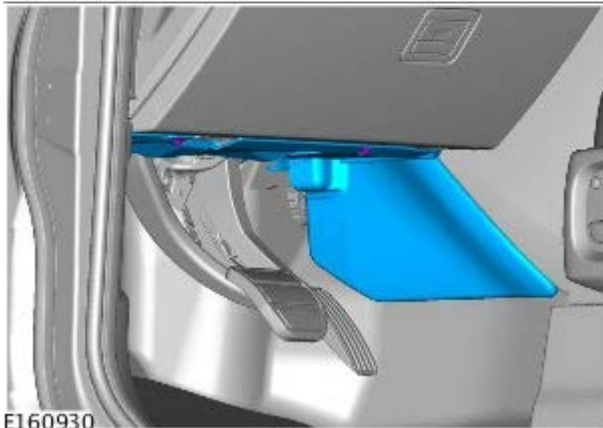
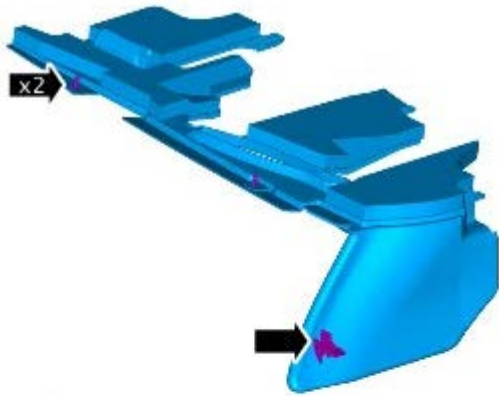


The ignition must be switched off.

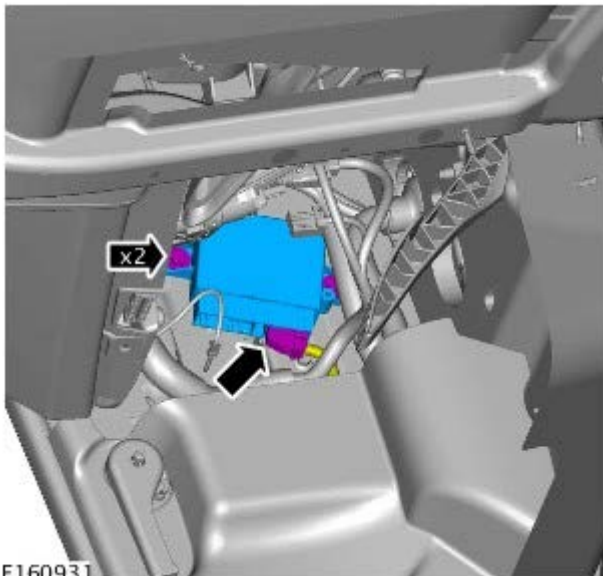
1.




2.



E160930



E160931

3.  CAUTION: Take extra care not to damage the wiring harnesses.

Torque: 10 Nm

Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Warning Devices - Blindspot Monitoring Sensor LH

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



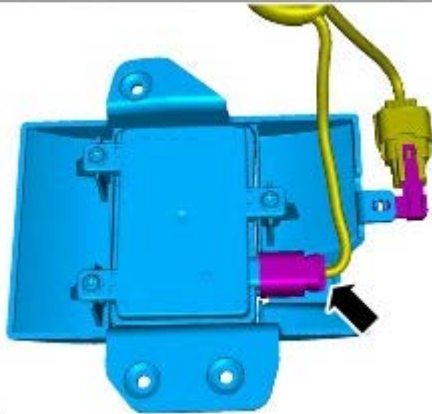
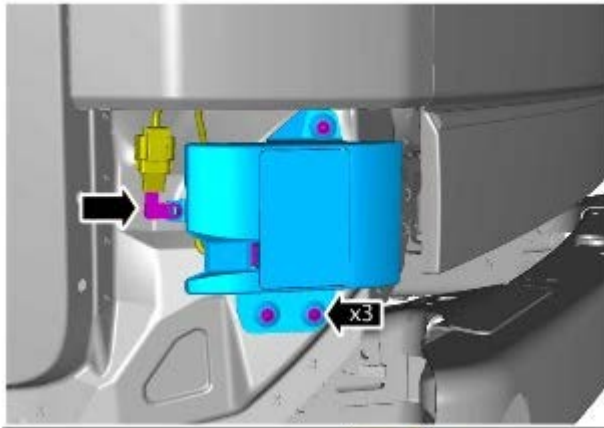
The ignition must be switched off.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

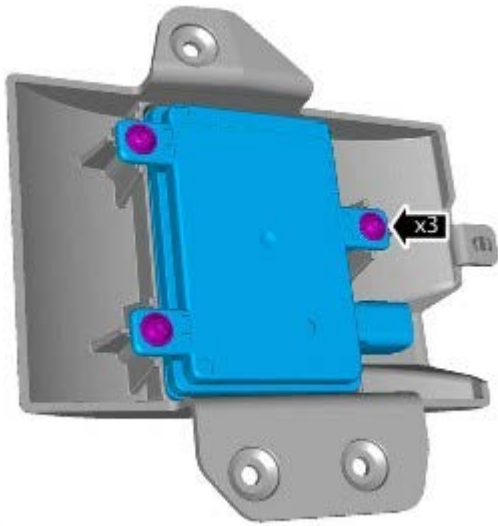
2. Refer to: [Rear Bumper Cover](#) (501-19 Bumpers, Removal and Installation).

3. Torque: 2.5 Nm



E161142

4. Torque: 2.5 Nm



E161141

Installation

1. To install, reverse the removal procedure.

Engine Protection System -

Torque Specifications

Description	Nm	lb-ft
Passive anti-theft system (PATS) module bolts	10	7

Engine Protection System - Engine Protection System

Description and Operation

Fire Suppression System

Overview

The purpose of the fire suppression system is to extinguish engine compartment fires. It is an independent system with no interface with the other vehicle systems.

The fire suppression system comprises:

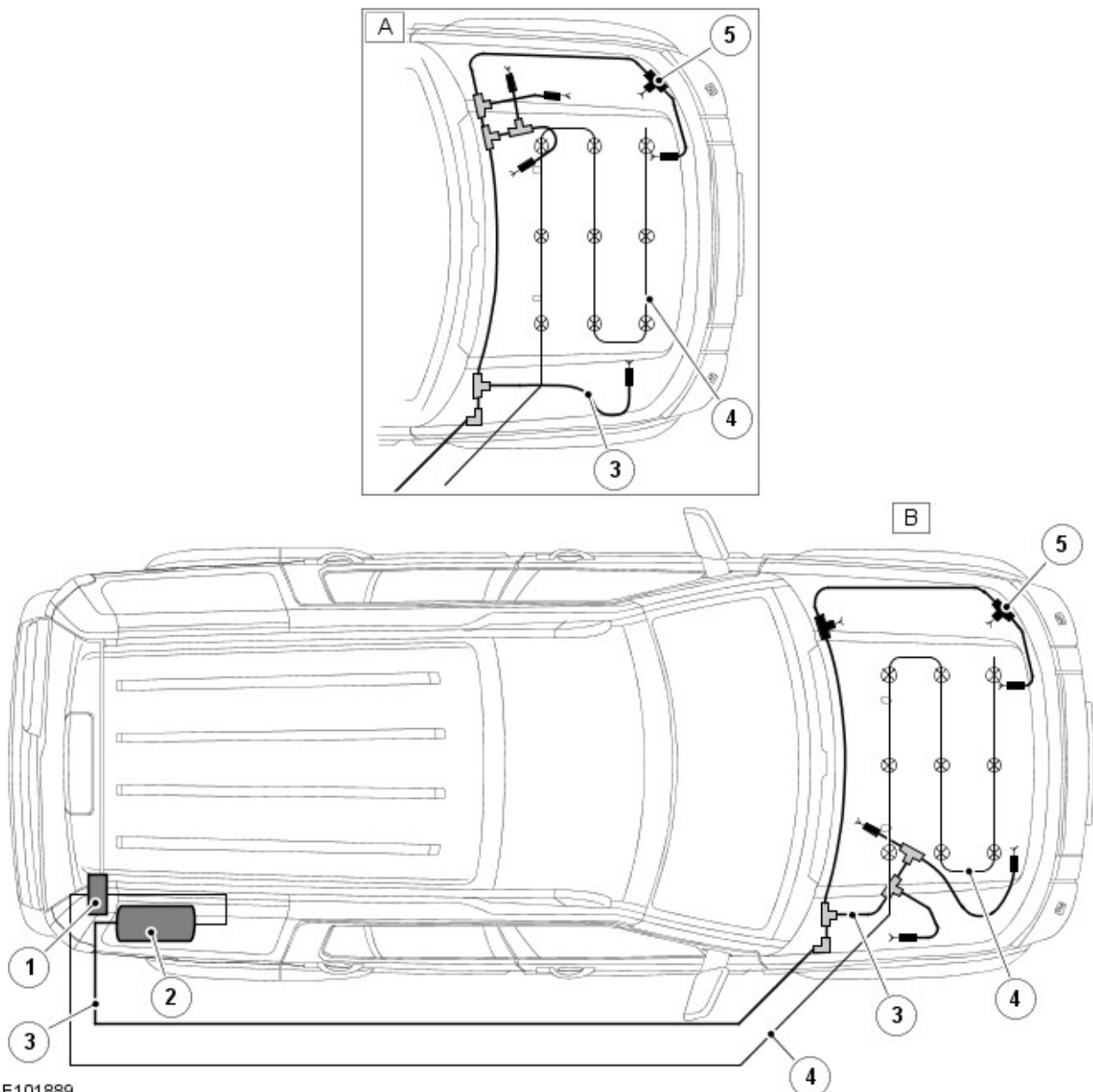
- An operating panel with integral control module and 9 volt battery power supply.
- A manually operated 'Fire' switch mounted in the floor console.
- A four-litre capacity, non-pressurized cylinder; the cylinder contains a fire suppressing foam.
- A gas-generator cartridge fitted to the cylinder.
- A fire detection cable mounted on the underside of the engine compartment lid; the cable incorporates a temperature sensor.
- Six fire suppression nozzles located in the engine compartment.

The non-pressurized cylinder contains an Aqueous Film Forming Foam; a water-based synthetic foam, able to coat the surface of hydrocarbon based liquids, therefore suffocating the flames.



WARNING: Aqueous Film Forming Foam can cause irritation if it comes into contact with the eye or skin.

Fire suppressant system

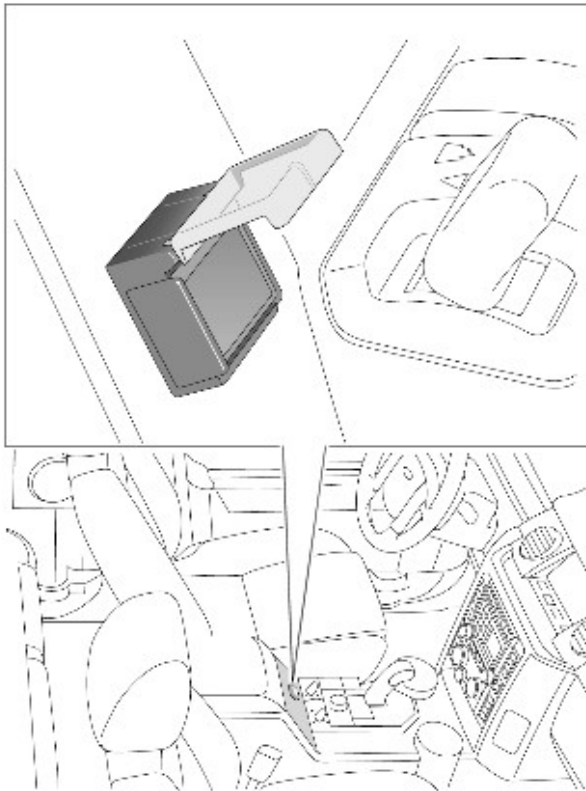


Item	Part Number	Description
A	-	Left-hand-drive (LHD) vehicle (identical to RHD module, except as shown).
B	-	Right-hand-drive (RHD) vehicle.
1	-	Control panel, control module and battery
2	-	Cylinder and gas-generator cartridge
3	-	Foam carrying tube
4	-	Fire detection cable
5	-	Fire suppressant nozzle (6 off)

The system is controlled by the fire suppression control module, which monitors the temperature sensor in the fire detection cable. Should the temperature in the engine compartment reach a trigger threshold due to a fire, the control module sends an initiation signal to the gas-generator cartridge. This cartridge in turn sends a pressure charge into the cylinder containing the Aqueous Film Forming Foam; forcing the foam from the cylinder. The cylinder outlet is connected to tubes which carry the foam to the fire suppressant nozzles strategically positioned in the engine compartment.

The fire suppression system can also be activated manually by pressing the red 'Fire' button mounted in the floor console.

Manual 'Fire' button



E101886

WARNINGS:



Always refer to the manufactures instructions when conducting maintenance on the fire suppression system.



Failure to follow the manufacturer's instructions can damage or degrade the fire suppression system.



Unauthorized modifications to the fire suppression system are not permitted.

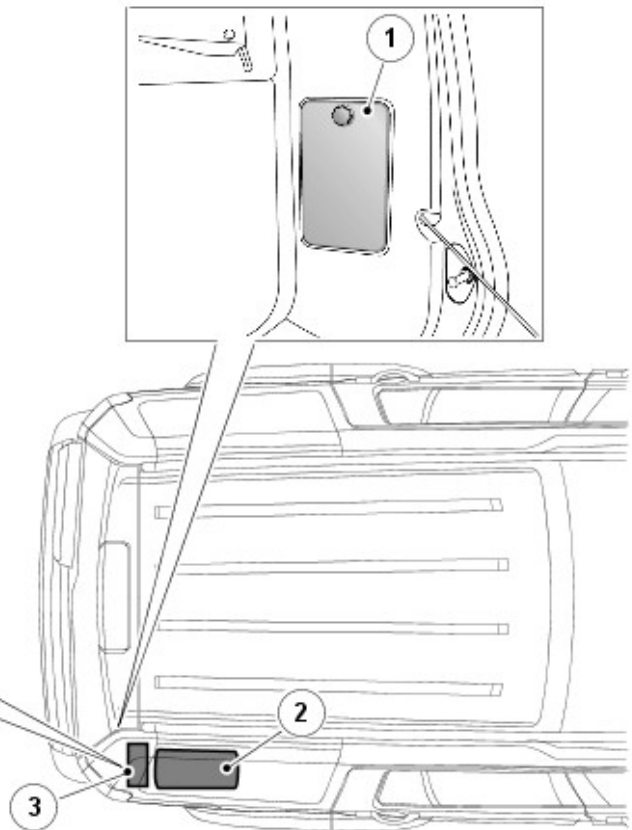
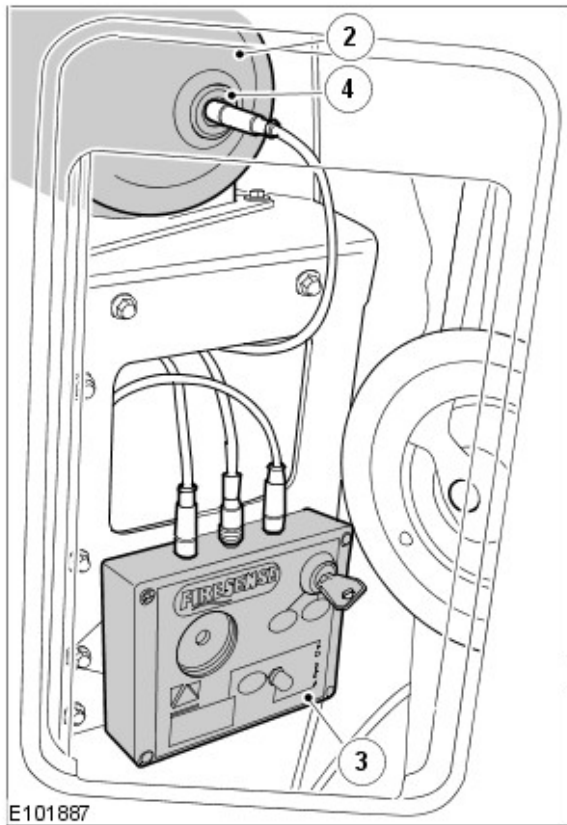
System Operation

Fire Suppression Control Panel and Module

The control module monitors the temperature sensor in the fire detection cable and automatically initiates the fire suppression system should a fire occur in the engine compartment.

The control module will also initiate the fire suppression system if the red 'Fire' button, mounted in the floor console, is pressed.

Fire suppressant control panel



Item	Part Number	Description
1	-	Access panel to control panel
2	-	Cylinder
3	-	Control panel, module and battery
4	-	Gas generator cartridge

WARNINGS:



The fire suppression system will only operate if the key located in the control panel is turned to the 'System Armed' position.



The key in the control panel must be turned to the 'Off/Check' position prior to any maintenance or repair procedures being performed on the fire suppression system. Failure to do this could cause the system to activate.

System Check



WARNING: A system check must be performed weekly.

System check:

- Insert the security key and turn to the 'Off/Check' position.
- Press and hold down the red 'Check' button on the control panel; release once the panel light response (see below) has been noted.

Panel light response:

- Yellow light flashing - battery in good condition.
- Yellow light showing dim glow – replace the battery.



WARNING: If in doubt replace the battery.

- Green light – gas generator cartridge in good condition.
- Green light does not illuminate – the fire suppressant cylinder must be refilled and the gas generator cartridge must be replaced.



WARNING: At this point DO NOT turn the key in the control panel to the 'System Armed' position as this will allow the system to detonate.

- Inside the vehicle, lift up the transparent cover on the manual 'Fire' button and press the button: a sounder will emit a pulsing tone.
- Red light on the control panel – electrical continuity is good.

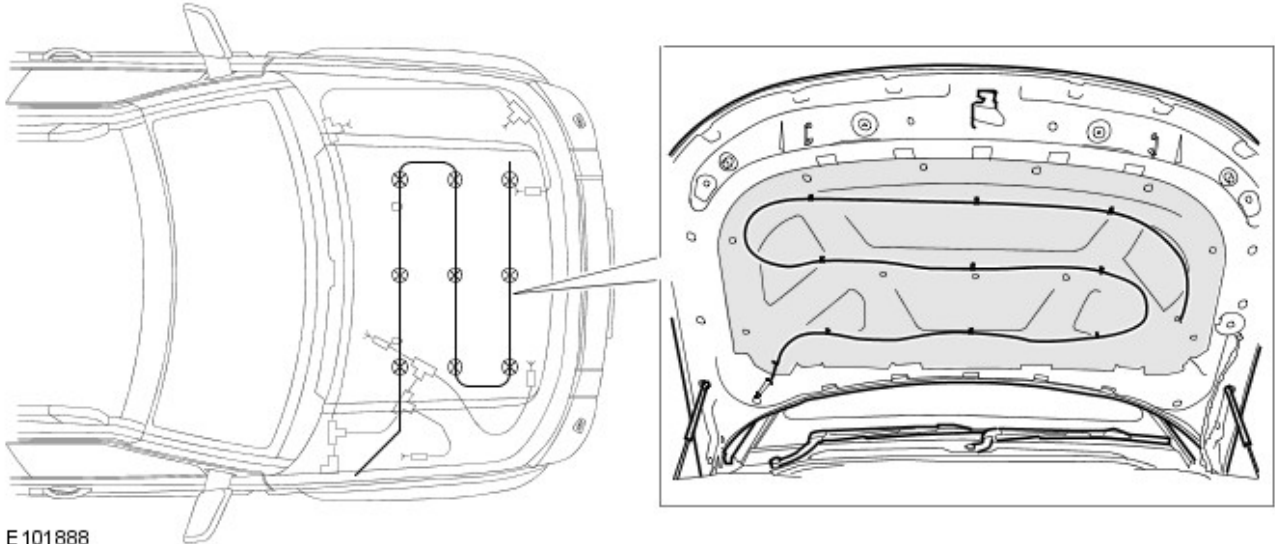
This concludes the check procedure. Turn the key to the 'System Armed' position and remove the key.

Components

Fire Detection Cable

The fire detection cable comprises two metallic strips, separated by a small air gap. The condition of the metallic strips is constantly monitored by the fire suppression control module. If a fire develops in the engine compartment and the temperature exceeds 180°C, the metallic strips start to melt and come into contact with each other. Sensing this, the control module introduces the Aqueous Film Forming Foam into the engine compartment via the fire suppression nozzles.

Fire detection cable



E101888

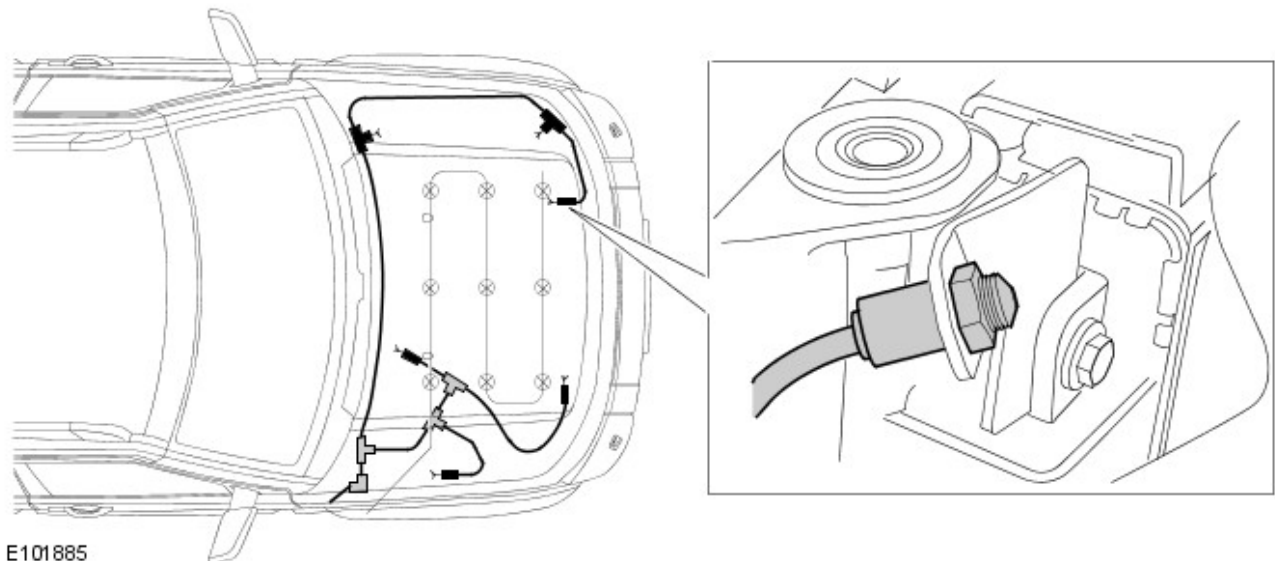
Cylinder and Gas Generator Cartridge

The non-pressurised cylinder has a four-litre capacity; refer to the 'fire suppressant control panel' graphic. The gas generator cartridge provides the propulsion to deliver the Aqueous Film Forming Foam from the cylinder, through the fire suppression nozzles and into the engine compartment. Operation of the gas generator cartridge is controlled by the control module via a hardwired electrical connection.

Fire Suppression Nozzles

Six fire suppression nozzles are strategically positioned to spray Aqueous Film Forming Foam delivered from the cylinder into the engine compartment. The nozzles are positioned as shown in the graphic.

Fire suppression nozzles



E101885



NOTE: Refer to the 'fire suppressant system' graphic, for the position of the nozzles in a left-hand-drive vehicle.

Parking Aid -

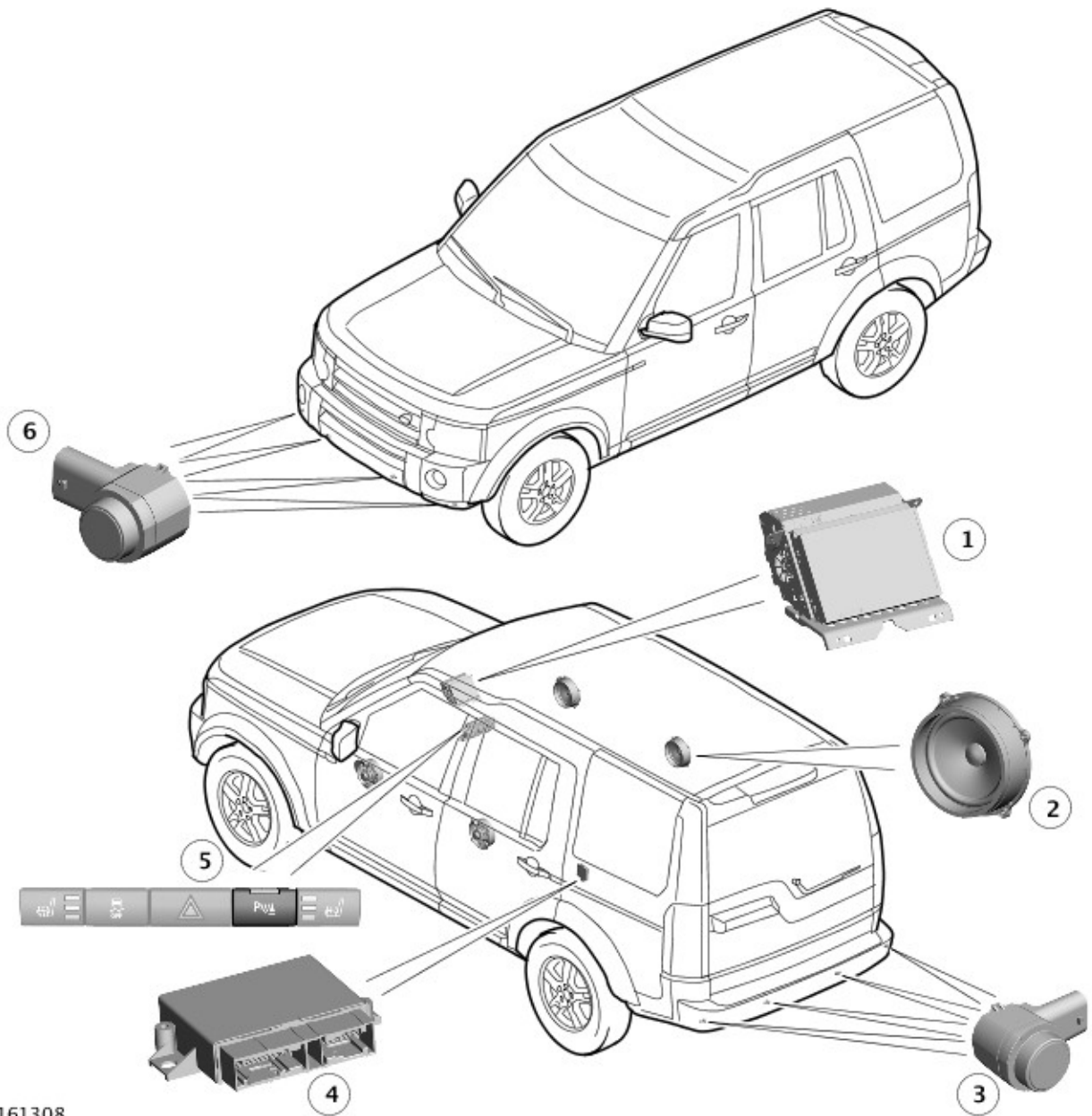
Description	Nm	lb-ft
Parking aid module nuts	5	4

Parking Aid - Parking Aid

Description and Operation

COMPONENT LOCATION

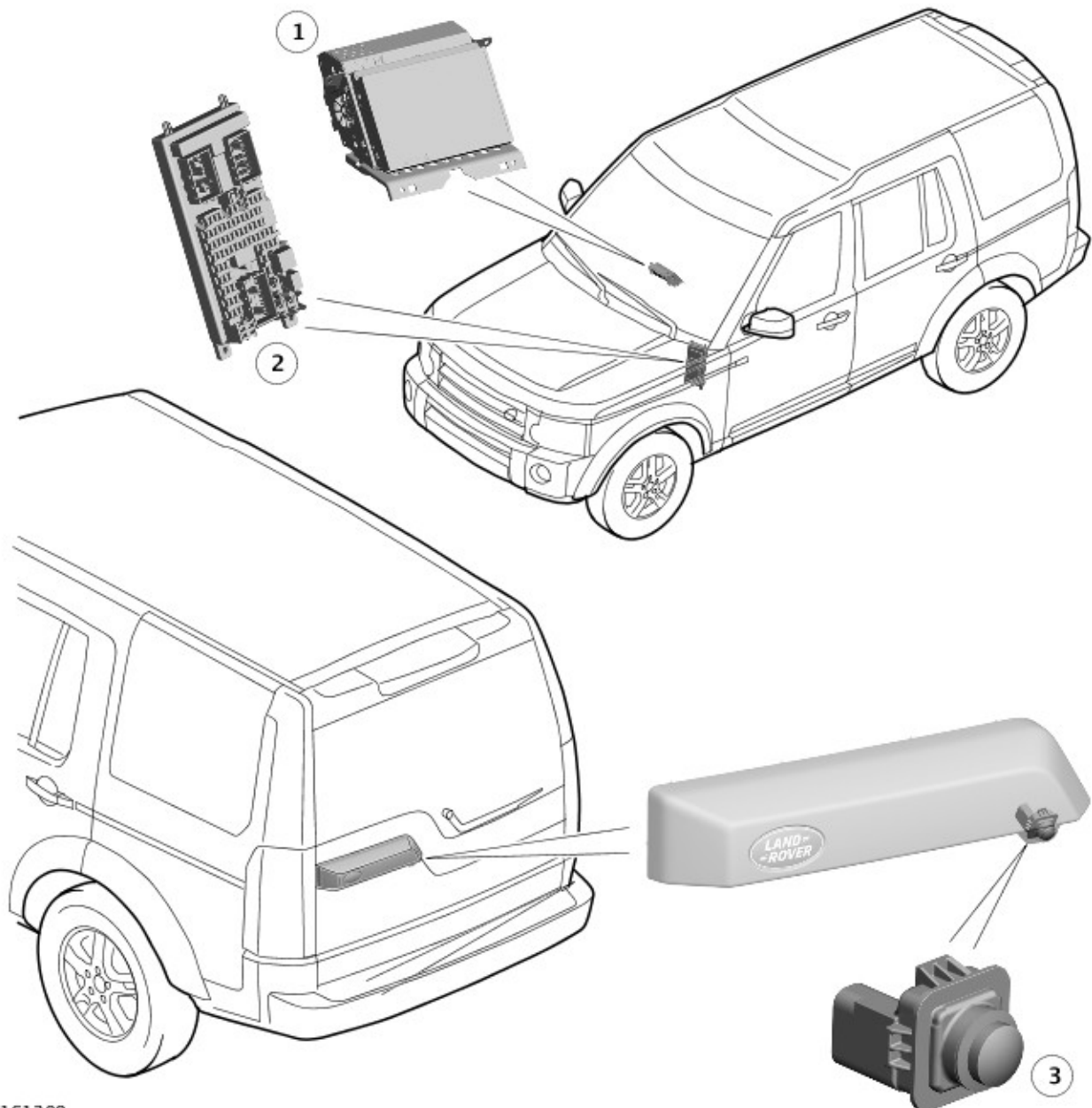
Parking Aid - Component Location



E161308

Item	Part Number	Description
1	-	Touch Screen (TS)
2	-	Speakers
3	-	Rear parking sensors
4	-	Parking Aid Control Module (PACM)
5	-	Parking aid switch
6	-	Front parking aid sensors

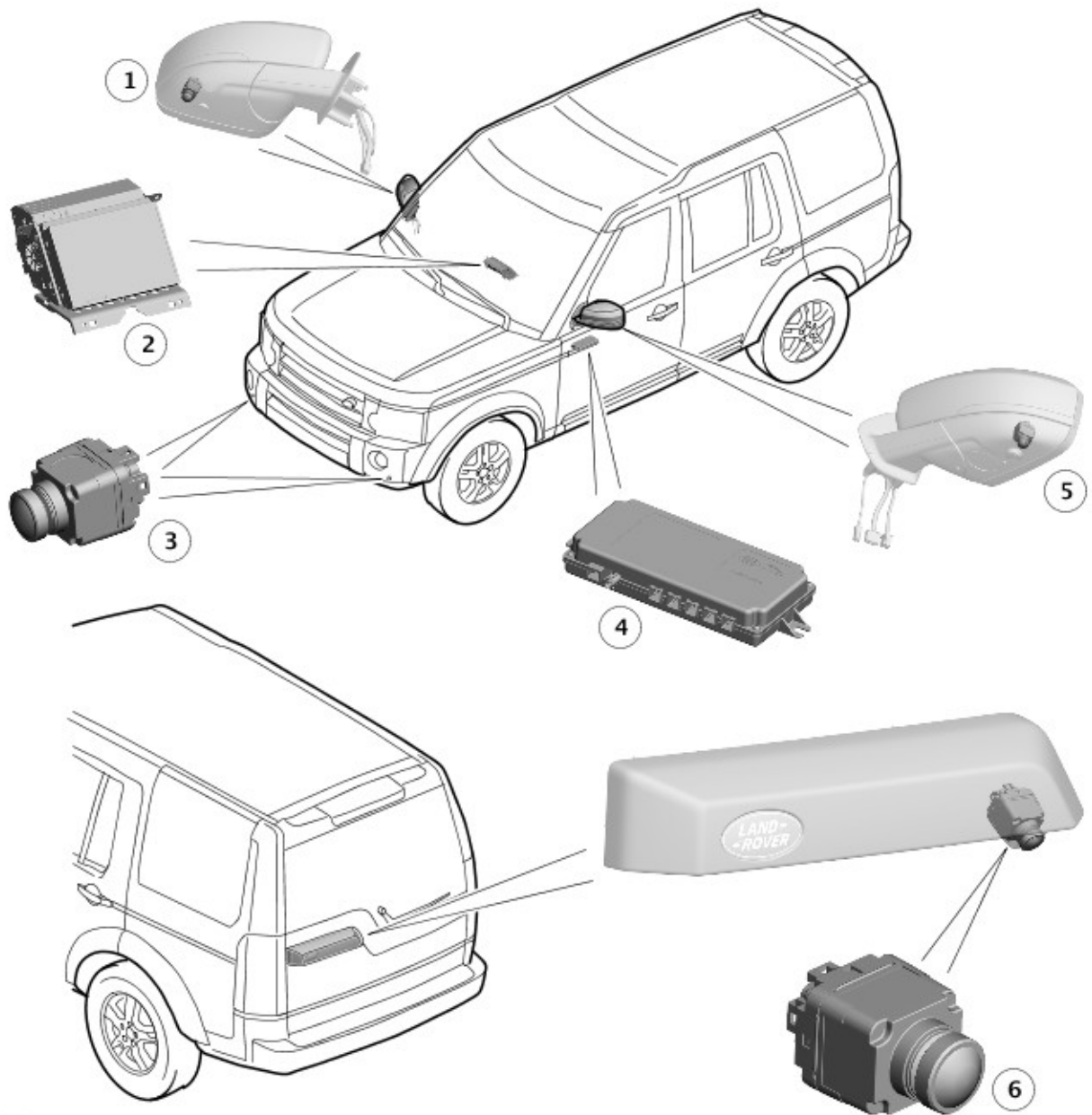
Rear View Camera - Component Location



E161309

Item	Part Number	Description
1	-	Touch Screen (TS)
2	-	Central Junction Box (CJB)
3	-	Rear View Camera (RCV)

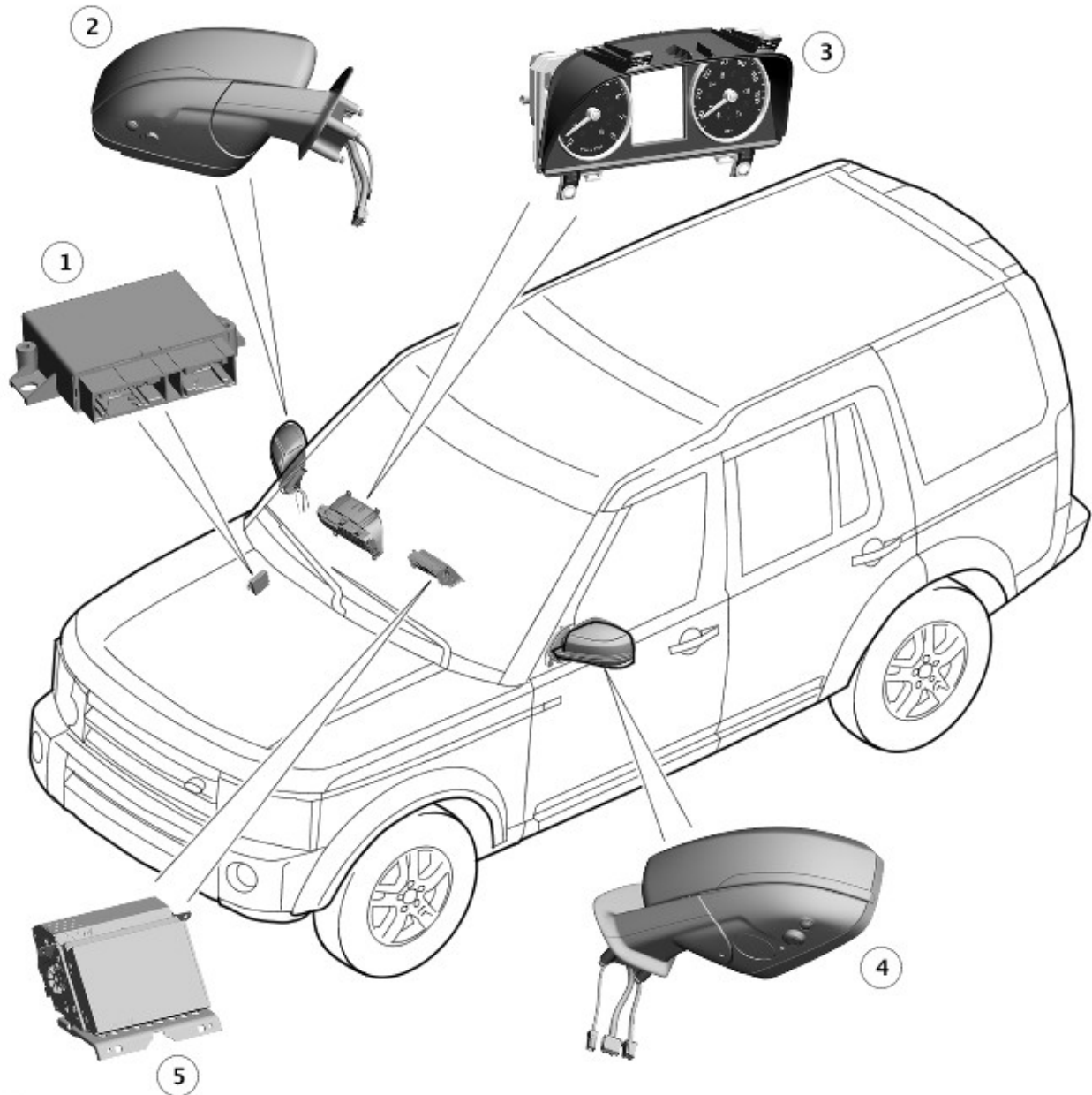
Proximity Camera System - Component Location



E161310

Item	Part Number	Description
1	-	Right door mirror proximity camera
2	-	Touch Screen (TS)
3	-	Front proximity cameras
4	-	Camera Control Module (CCM)
5	-	Left door mirror proximity camera
6	-	Rear proximity camera

Wade Sensing System - Component Location



E161311

Item	Part Number	Description
1	-	General Proximity Sensor Module (GPSM)
2	-	Right door mirror wade sensing sensor
3	-	Instrument Cluster (IC)
4	-	Left door mirror wade sensing sensor
5	-	Touch Screen (TS)

OVERVIEW

Parking Aid

The parking aid system provides an audible warning to the driver when any obstacles are in the path of the vehicle during forward or reverse parking manoeuver.

The system consists off:

- PACM (parking aid control module).
- Parking aid switch.
- Four ultrasonic sensors in the front bumper.
- Four ultrasonic sensors in the rear bumper.

During low speeds, the PACM uses the ultrasonic sensors to monitor the area around the front and rear bumpers. If an object is detected within a monitored area, the module then outputs a warning using the audio system speakers. The sensors can detect solid objects such as posts, walls and other vehicles. Objects very close to the ground may not be detected, but because of their low height may not cause damage to the vehicle.



CAUTION: When washing the vehicle do not aim high pressure water jets directly at the sensors. Do not use

abrasive materials or hard/sharp objects to clean the sensors. Only use approved vehicle shampoo.

Camera Systems



CAUTION: It remains the driver's responsibility to detect obstacles and estimate the vehicle's distance from them when reversing.

The RVC (rear view camera) and Proximity cameras provides additional information to the driver when reversing the vehicle. When reverse gear is selected the camera or cameras, automatically displays a wide-angle colour image of the view from the rear of the vehicle or rear, front and sides of the vehicle onto the touch screen.

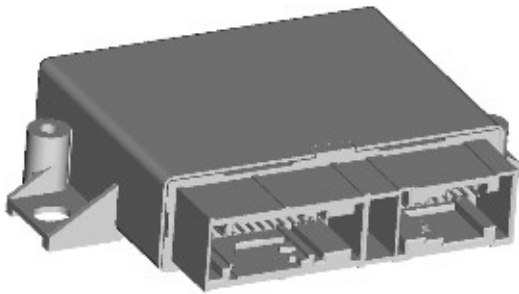
Wade Sensing System

The wade sensing system feature provides intuitive information of the vehicles capability during wading through water. The purpose is to assist the average driver whilst driving through water, particularly when the visibility is poor.

The GPSM (general proximity sensor module) hosts software to deliver the wade sensing functionality using two downward facing, door mirror mounted ultrasonic sensors that are connected to the GPSM, which provide the input signals to the GPSM which measure the reflection from the water surface to calculate the depth of the water through which the vehicle is travelling.

DESCRIPTION

Parking Aid Control Module (PACM)



E156975

The PACM (parking aid control module) is located in the left rear quarter panel, behind the side trim panel of the luggage compartment.

The PACM has two connectors which provide power, ground and HS (high speed) CAN (controller area network) bus connections, front parking aid sensors and rear parking aid sensors.

The HS CAN chassis bus connections provide for the receipt of the following information from other systems:

- ABS (anti-lock brake system) module - Road speed signal.
- TCM (transmission control module) - Reverse gear engaged signal.

The PACM also outputs messages on the HS CAN bus. The GWM (gateway module) processes these messages and converts them into MS (medium speed) CAN bus messages, which are sent to the TS (touch screen). The TS converts then converts the MS CAN comfort messages into MOST (media orientated system transport) signals. These signals are then used by the AAM (audio amplifier module) to emit the applicable warning tones from the front or rear audio speakers when an object is detected by the front or rear parking aid sensors. A warning tone can also be emitted to alert the driver to a fault in the parking aid system.

Parking Aid Switch



E122823

The parking aid switch is located in the center console. It is a non-latching with an integral LED (light emitting diode). The switch receives a 12v output to drive the LED when required. The switch is also connected to ground.

When the switch is operated, the momentary completion of the ground is interpreted by the PACM (parking aid control module) as a signal to enable or disable the parking aid system.



NOTE: The parking aid switch allows the driver to activate or deactivate the parking aid system if operation is required or not required.

General Proximity Sensor Module (GPSM)

The GPSM (general proximity sensor module) incorporates a software, which is able to provide the wade sensing functionality.

The GPSM (general proximity sensor module) is located in the passenger compartment, behind the rear left seat bolster trim panel, above the CCM (camera control module).

The GPSM has two connectors which provide for power, ground and HS (high speed) CAN bus connections, and the sensors in the door mirrors.

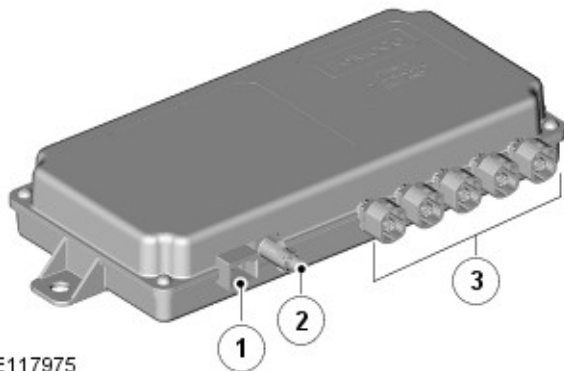
The control module is able to transmit and receive the following important information on the HS CAN chassis bus:

- +/- offset from the ISCM (integrated suspension control module).
- Water depth to the TS (touch screen) and IC (instrument cluster), via the GWM (gateway module).

When the vehicle is started, the GPSM receives the CCF (car configuration file) from the CJB (central junction box), then the CJB energizes the extended ignition relay in the EJB (engine junction box). The ignition relay supply the GPSM with power, and it is ready to operate.

The GPSM has a diagnostic connection via the HS CAN bus to enable faults to be retrieved using the Land Rover approved diagnostic equipment. Additionally an OBD (on-board diagnostic) routine within the GPSM constantly monitors the system and alerts the driver to a system fault by emitting a 3 second continuous tone through the front audio speakers when the ignition is switched on.

Camera Control Module (CCM)



E117975

The CCM (camera control module) is located under the passenger front seat.

Connections to the module include:

- MS (medium speed) CAN bus network.
- Five camera inputs.
- Video signal output to the TS (touch screen).
- Power supply and ground.

The CCM gathers the camera images and analyses and alters them by adjusting perspectives and applying corrections. The resulting processed images are then relayed to the TS via the NTSC (national television system committee) analogue video line.

The CCM also adds guidance and warning overlays to the camera images to create the various driving-aid features

supported by the camera proximity system; for example, visual direction is made available when reversing the vehicle.

The CCM communicates with each individual camera via the LIN (local interconnect network) bus connection. This data link transmits diagnostic information, for example camera serial numbers and fault notifications to the control module. Camera adjustments, for instance a correction to colour-balance are also communicated via the LIN bus link to the camera.

In addition to the data lines, the camera receives a power supply and a ground from the CCM.



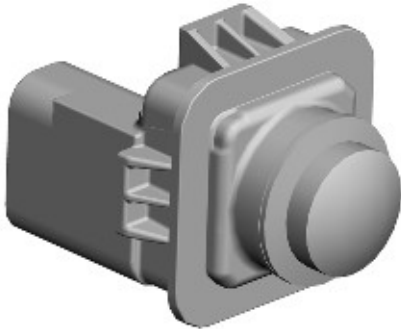
NOTE: Care must be taken when routing, disconnecting and reconnecting the camera harnesses.

Cameras



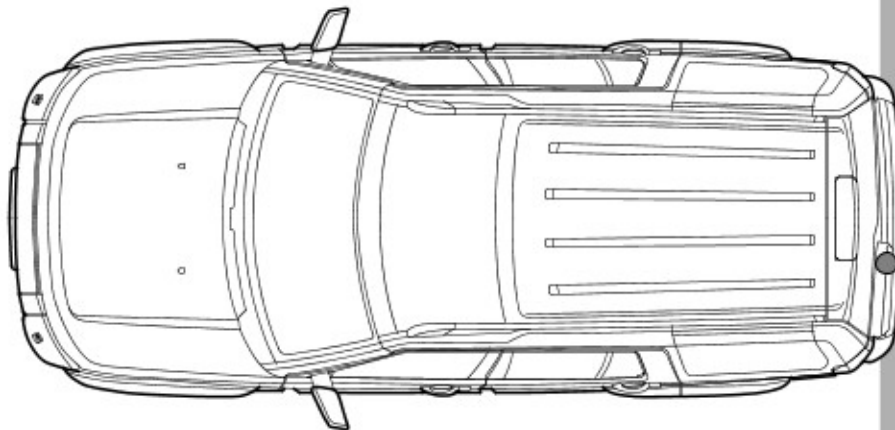
CAUTION:

Rear View Camera



E161312

Rear View Camera Coverage Zone



E161313

Item	Part Number	Description
1	-	Rear camera coverage zone

The RVC (rear view camera) is located in the tailgate external handle.

The RVC is a VGA (video graphics array) resolution analogue camera that provides an image covering a zone approximately 130° wide by 112° deep and is capable of capturing approximately thirty frames per second. An electrical connector on the camera provides power, ground, MS (medium speed) CAN bus and shielded co-axial cable connections. The co-axial cable connection is used for video image transmission between the camera and the TS (touch screen).

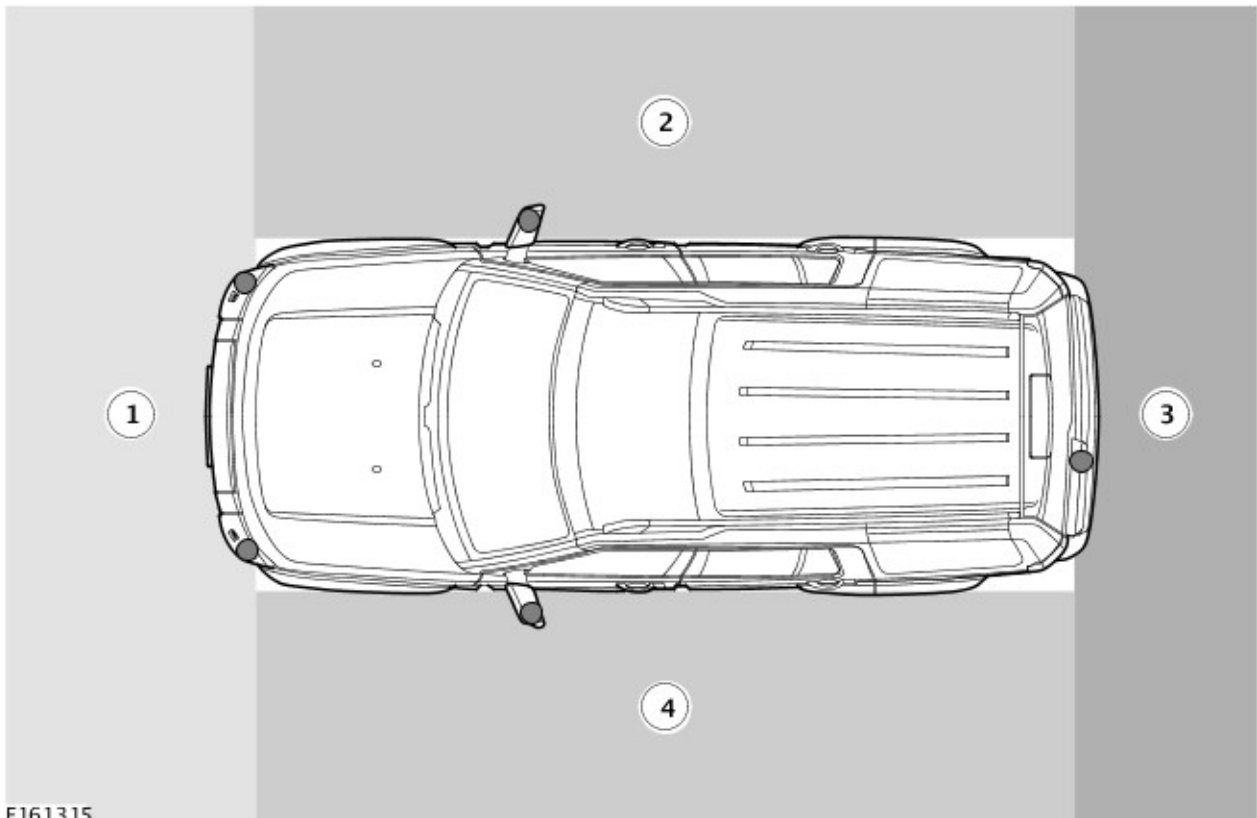
The camera provides additional information to the driver when reversing the vehicle. When reverse gear is selected the camera automatically displays a wide-angle colour image of the view from the rear of the vehicle on the TS. Overlay graphics are displayed by a combination of signals received on the MS CAN by the TS.

The positioning accuracy of the camera is crucial for successful operation, therefore care must be taken when installing a cameras to ensure it sits correctly in the bracket. In the event of camera replacement, a calibration routine must be performed.

Proximity Cameras



E161314



E161315

Item	Part Number	Description
1	-	Front proximity camera coverage zone
2	-	Right door mirror proximity camera coverage zone
3	-	Rear proximity camera coverage zone
4	-	Left door mirror proximity camera coverage zone

The proximity camera system has 5 cameras that are located in the following:

- One camera is located in the tailgate external handle.
- Two cameras are located in the front bumper.
- One camera is mounted in each door mirror.

The proximity camera system uses VGA (video graphics array) resolution cameras, that are permanently powered whenever the ignition is 'on'. Each camera provides an image covering a zone approximately 130° wide by 112° deep and is capable of capturing approximately thirty frames per second.

The cameras employ high-quality digital, HDR (high dynamic range) imaging, which is a set of techniques that allows a greater range of luminance between light and dark areas of an image scene. This allows HDR to more accurately represent the varying intensity levels found in the image scenes that can range from direct sunlight to deep shadows.

Camera Mounting

To reduce the cost of accident repair the mounting of the front bumper cameras feature a 'snap free' bracket. On impact, the bracket will release the camera preventing damage to the camera itself. Depending on the severity of the accident it may also be possible to reuse the brackets as they are manufactured from a memory type plastic.

The positioning accuracy of all the cameras is crucial for the successful operation of the proximity camera system. The camera housings are manufactured using metal to maintain a structural stability in high-ambient temperatures. Without this stability a loss of image focus would be a possibility, therefore care must be taken when mounting the cameras in ensuring they sit correctly into their locations. Secure mounting of the cameras provides an initial 'build up' tolerance accurate to 2 mm. In the event of camera replacement, a calibration routine must be performed.

OPERATION

Parking Aid System

If reverse (R) is the first gear selected after the ignition is switched on, both the front and rear parking aid sensors will become operational. When a forward drive gear is subsequently selected, all of the rear parking aid sensors are de-activated; all of the front parking aid sensors remain operational until vehicle speed increases above 16 km/h (10 mph), park (P) is selected or the parking aid switch is pressed.

If drive (D) is the first gear selected after the ignition is switched on, the front parking aid sensors can be activated by pressing the parking aid switch.



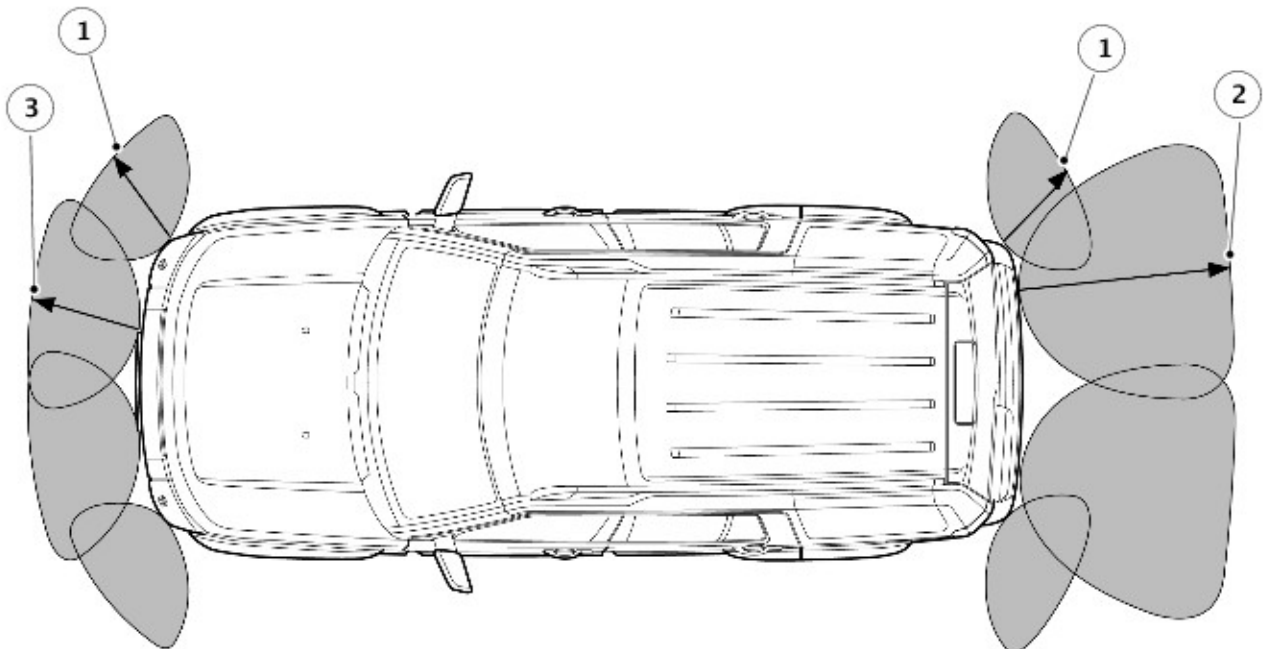
NOTE: The parking aid systems can not be activated while the vehicle is in park (P).

Audible Warnings

The PACM (parking aid control module) processes the distance readings from the parking aid sensors to determine if there are any objects within the detection areas. If there are no objects no audible warning will be emitted. If an object is detected, repeated audible warnings are emitted via the audio system speakers. The time delay between the audible warnings decreases as the distance between the detected object and the vehicle decreases until eventually a continuous tone is emitted from the audio system speakers.

The volume output of the parking aid audible tones can be adjusted using the audio volume control when the parking aid system is activate. The volume can also be adjusted from the TS (touch screen) home menu by selecting Setup, System, Volume presets, Parking aid, then using the + or - soft keys.

Object Detection



E161316

A = Maximum Detection Range; B = Continuous Audio Range

Item Number	Sensor Location	Maximum Detection Range	Audio Tone	Continuous Audio Tone
1	Front/Rear Outer	Approximately 600mm (24 inches)		Approximately 300mm (12 inches)
2	Rear Inner	Approximately 1800mm (71 inches)		Approximately 300mm (12 inches)
3	Front Inner	Approximately 800mm (31 inches)		Approximately 300mm (12 inches)

In the combined mode, the sensors emit a series of ultrasonic impulses and then switch to receiver mode to receive the echo reflected by an obstacle within the detection range. The received echo signals are amplified and converted from an analogue signal to a digital signal by the sensor. The digital signal is passed to the PACM (parking aid control

module) and compared with pre-programmed data stored in an EEPROM (electrically erasable programmable read only memory) within the PACM. The PACM receives this data via the signal line from the sensor and calculates the distance from the object using the elapsed time between the transmitted and received impulse. The duration of the impulse is determined by the module, with the sensor controlling the frequency of the impulse output.

In receiver mode, the sensor receives impulses that were emitted by adjacent sensors. The module uses this information to precisely determine the position and distance of the object.

If no objects are detected there are no further warning tones. If an object is detected, repeated audible tones are emitted from either the front or rear audio speakers as appropriate. The time delay between the tones decreases as the distance between the object and the vehicle decreases, until, at approximately 300 mm (front outer and all rear sensors) or 500 mm (front inner sensors), the audible tone becomes continuous.

When approaching several objects within detection range, the control module recognizes the distance from the vehicle to the nearest object.

The PACM will prioritize the objects detected, the nearest object detected will take priority and the corresponding audio outputs will be emitted. For example if 2 objects are detected (one front one rear) the nearest detected object will take priority and the relevant audible tone will be produced.

If two objects are detected at equal distance (one front one rear) the audible tones will alternate between the front and rear audio speakers.

Diagnostics

The PACM (parking aid control module) has a diagnostic connection via the HS (high speed) CAN bus to enable faults to be retrieved using the Land Rover approved diagnostic equipment. Additionally an OBD routine within the PACM constantly monitors the system and alerts the driver to a system fault by emitting a 3 second continuous tone through the front audio speakers when the ignition is switched on. The parking aid switch LED will also flash 6 times when reverse gear is selected or the parking aid switch is pressed.

Rear View Camera

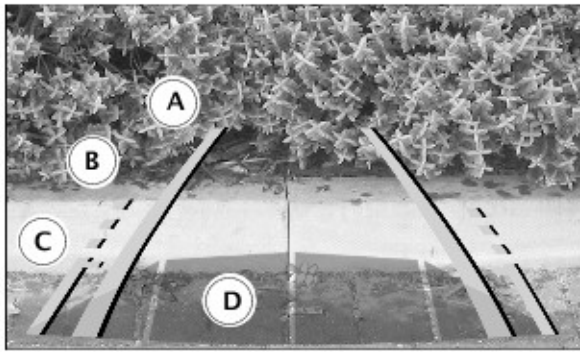
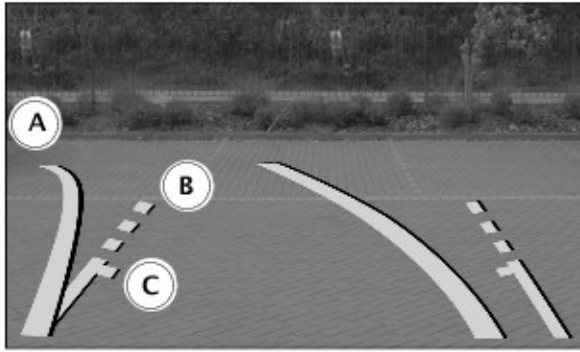
The RVC (rear view camera) receives power at all times when the ignition is on or the engine is running. When R is selected, the rear view camera receives a reverse gear selected signal from the TCM via the HS (high speed) CAN bus. The camera then sends a MS (medium speed) CAN message to the TS (touch screen) to display the image.

When R is deselected, the camera image remains on the touch screen for 5 seconds after the transmission has been put into D, P, N or S. This is to prevent the touch screen switching between screens if the vehicle is being maneuvered into a parking space. If the vehicle forward speed exceeds 16 km/h (10 mph) within the 5 second period, the camera image is removed from the TS.

If the touch screen is switched off, the camera image will be automatically displayed when reverse gear is selected. When reverse gear is deselected and the 5 second period has expired, the TS will revert back to its switched off state.

The rear view images are overlaid with:

- Dashed lines representing the perimeter of the vehicle.
- Solid lines representing the predicted trajectory of the vehicle; calculated from the steering wheel angle sensor.
- Coloured bars representing the distance between the vehicle and the object being approached. Working in conjunction with the rear parking aid sensors, this adds a visual representation to the existing audible warning. The distance data is received from the PACM (parking aid control module) via the MS CAN.



E161317

Item Part Number Description

A	-	Solid line: The projected path based on current steering wheel position.
B	-	Dotted line: The safe working width of the vehicle (including exterior mirrors).
C	-	Luggage compartment access guideline: Do not reverse beyond this point if luggage compartment access is required.
D	-	Parking aid sensor activation: A coloured area appears, to indicate which rear parking aid sensors have been activated.

System Fault

In the event of camera fault, a [DTC \(diagnostic trouble code\)](#) is logged in the camera and an icon is presented to the driver on the TS (touch screen) where the camera image would normally be viewed.

Proximity Camera

The proximity camera system provides the driver with a visual-aid when maneuvering the vehicle at low speeds. The system uses the CCM (camera control module) to capture the camera data and display the resulting images on the TS (touch screen), providing the driver with a 360° view around the vehicle. The camera system is also supported by various driving-aid features where graphical information and warnings are superimposed onto the images displayed on the TS.

Automatic Operation



NOTE: The following is applicable for all vehicles markets except Japan.

- When reverse gear is selected the rear camera view is shown.
- The images will automatically switch off when the vehicle speed exceeds 18Km/h (11 mph) or a forward gear has been selected for more than five seconds.



NOTE: The following is applicable for Japanese vehicle specifications.

- When either 'Drive' or 'Reverse' are selected, the relevant camera view for direction of movement is shown.
- When 'Reverse' is selected, the rear camera and right door mirror camera views will be shown.
- When 'Drive' is selected, the front camera and right door mirror camera views will be shown.
- The images will automatically switch off when the vehicle speed exceeds 18 km/h (11 mph), the automatic camera function will only operate once per ignition cycle.

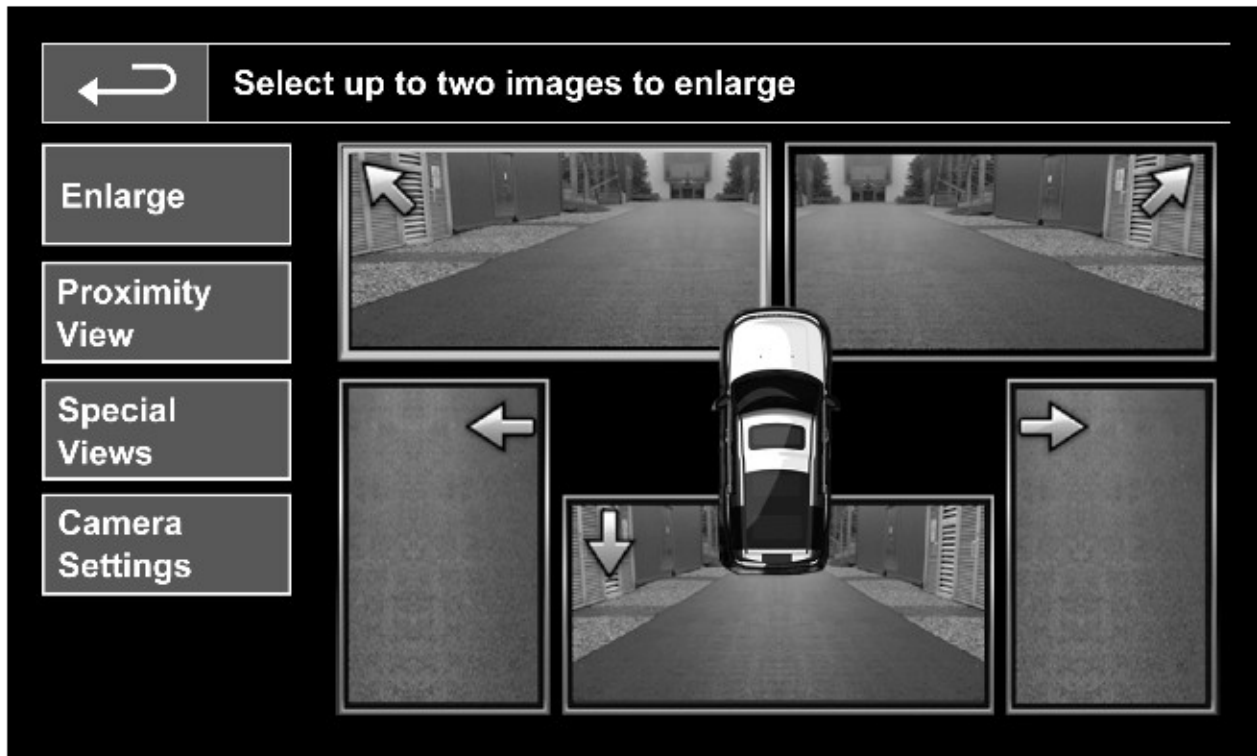
Manual Operation

- The camera views can be accessed by selecting the 'Cameras' icon on the 'Navigation' home screen on the TS (touch screen).

Selecting Views

Camera settings soft key is only visible on Japanese specification vehicles.

Camera home screen frame rate is reduced to 15 frames per second, all other camera views are shown at 30 frames per second.



E161318

- Displayed on the home page are real-time images transmitted from each of the five cameras.
- Any two of the images can be selected and enlarged to view side-by-side on the screen.
- When viewing any two images, any single image can then be selected to view as a full screen image which can be zoomed and panned around using the magnifier and arrow icons.

Manual Proximity View

Selecting proximity view from the camera home screen will display a combination of three images from the front passenger side cameras. These images provide the driver with an enhanced view of the area forward and opposite the driver.

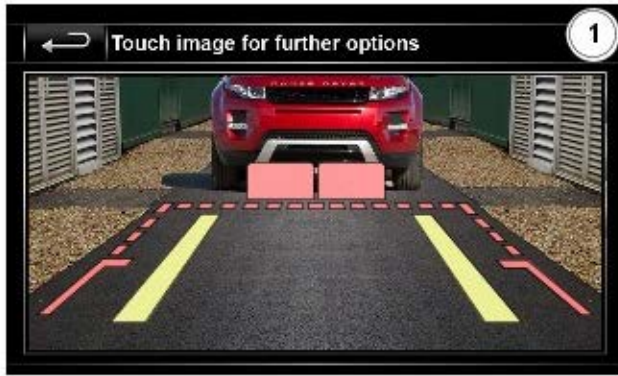
Proximity Camera System

The proximity camera view images are overlaid with:

- Dashed lines representing the perimeter of the vehicle.
- Solid lines representing the predicted trajectory of the vehicle; calculated from the steering angle sensor.
- Coloured bars represent the amount of distance between the vehicle and the object being approached. Working in conjunction with the standard 'rear parking aid' this adds a visual representation to the existing audible warning. The distance data is received from the CCM (camera control module) through the MS (medium speed) CAN bus.

The reversing-aid graphics can be disabled in the settings menu or by touching the TS (touch screen) whilst reverse gear is selected and the camera view is displayed.

Reversing Visual Warnings



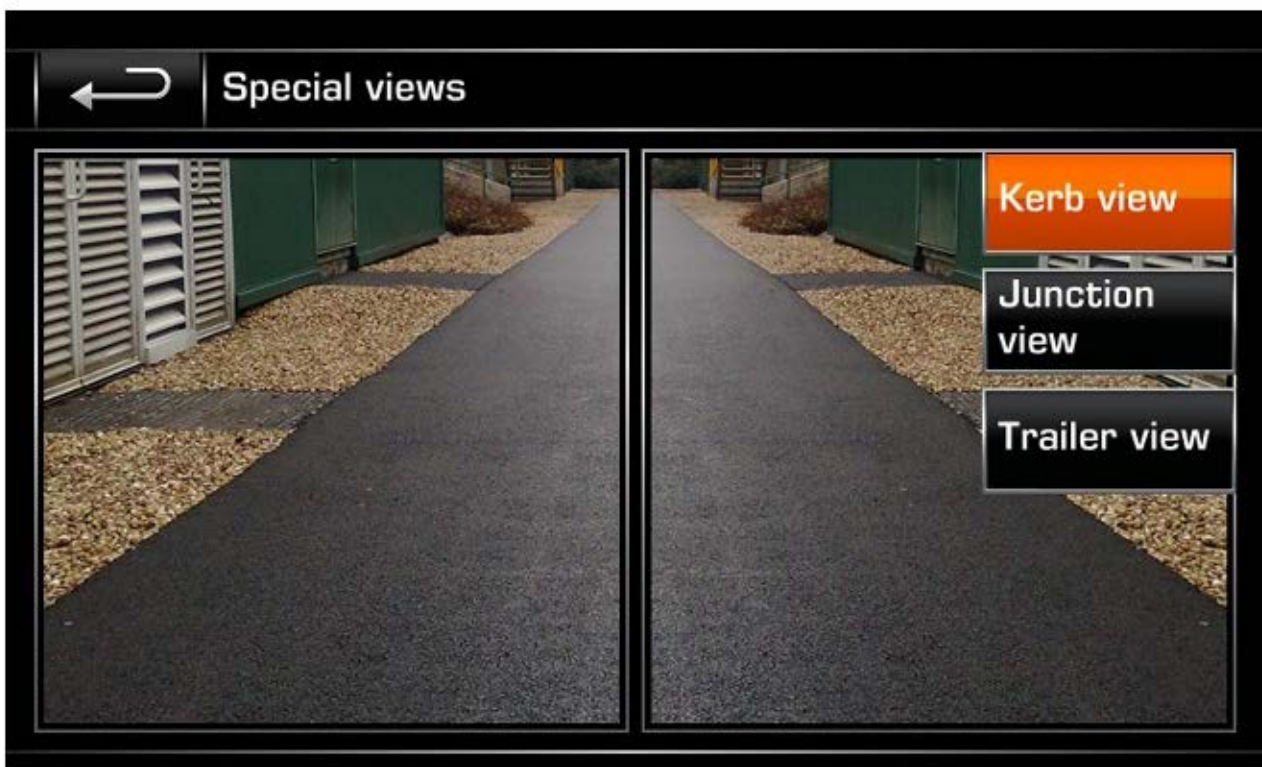
E148937

Item	Part Number	Description
1	-	Object being approached - 'Yellow Strip' with steady intermittent warning tone
2	-	Object being approached - 'Orange Strip' with faster intermittent warning tone
3	-	Object being approached - 'Red Strip' with continuous warning tone

The rear view image will not be displayed when any of the following apply:

- Drive is selected for longer than 5 seconds.
- Drive is selected and the vehicle speed is greater than 18 km/h (11 mile/h).

Special Views



E148971

The special views are a selection of pre-set views that provide the driver with some useful driving aids. These can be considered as a shortcut to some pre-determined images that have been developed to assist the driver in various situations:

- Kerb view: downward view from the two door mirror cameras.
- Junction view: outward view from the two front cameras.
- Trailer view: rear camera view of trailer being towed.

System Calibration

This level of accuracy must be maintained after any service procedures are performed on the vehicle that affects the proximity camera system. Should the control module or any one of the cameras require replacement, static re-calibration must be carried out using the approved Land Rover diagnostic equipment.

Camera replacement is detected by the CCM (camera control module), through the recognition of a new serial number during the 'camera count' procedure that takes place during the 'ignition on' phase via the LIN bus.

If a new camera is installed calibration must be performed using the diagnostic equipment and the vehicle's TS (touch screen). During the calibration procedure, setup software in the control module overlays fine coloured lines on the TS highlighting reference points on the bodywork. For example, the mirror camera image must capture the side repeater indicator, the shut-line of the doors and the lower sill trim.

Direction arrows are pressed to shift the image in the desired direction to meet the reference points viewed on the TS.

Adjustments include:

- Up
- Down
- Left
- Right
- Rotation

When the reference points correspond exactly, the setting is saved and the calibration procedure is complete for that camera.

If body repairs are performed that affect the camera system, a calibration procedure must be executed after the repairs are completed.

System Fault

In the event of camera fault, a **DTC** is logged in the CCM (camera control module), and an icon is presented to the driver on the TS (touch screen) where the camera image would normally be viewed.

Wade Sensing System



CAUTION: Wade sensing should not be used during off-road driving, as rapid increases in water depth cannot be detected in time to deliver a warning message to the driver.

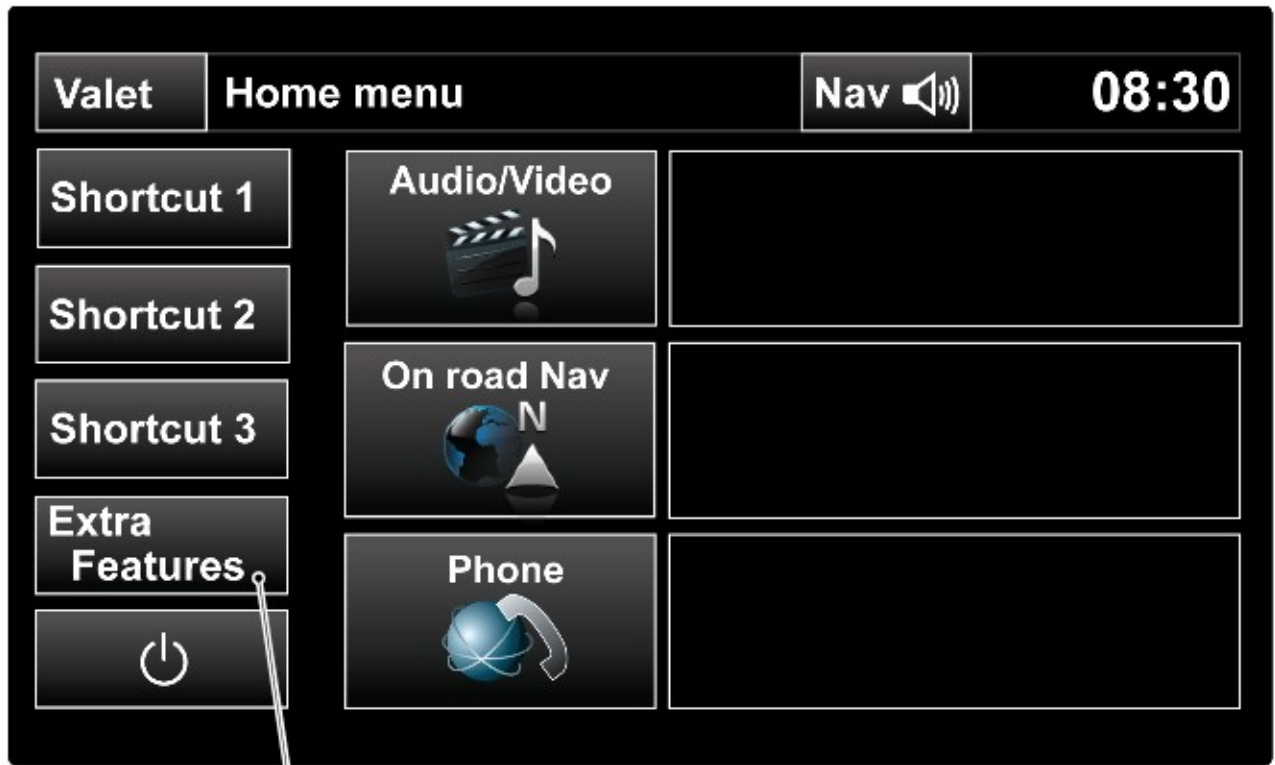
When entering water from a steep gradient, the water level may rise rapidly.

The Wade sensing system cannot detect the true level of water if a layer of ice or snow exists on the surface or if the suspension is in Extended mode.



NOTE: The Parking aid and Intelligent stop/start systems are disabled when Wade sensing is operating.

Wade sensing can be turned on and off from the TS (touch screen) 4x4i section of the Extra features menu.

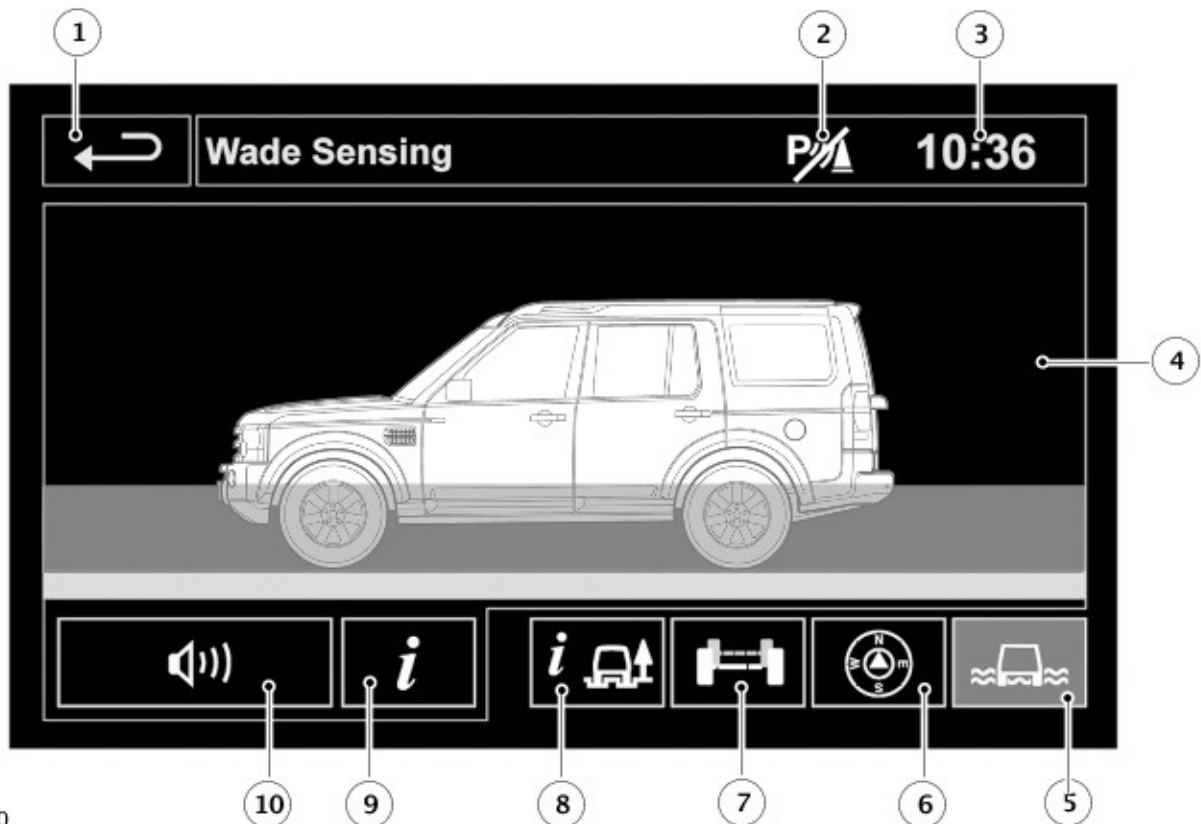


E161319

1

Item	Part Number	Description
1	-	Extra features menu to reach the wade sensing display

When selected, the TS will display current water depth and the maximum wading depth.



E161320

Item	Part Number	Description
1	-	'Back' soft key
2	-	Parking aid system disabled
3	-	Clock
4	-	Wade sensing screen
5	-	Wade sensing selected

- 6 - Compass display
- 7 - 4X4i display
- 8 - Terrain response display
- 9 - Information display
- 10 - Audio on/off soft key

The system will warn the driver as the maximum depth for wading approaches.

If the system's limitations are exceeded, the TS view will grey out and the water depth will not be displayed.

The water depth calculation is based on the reflection from the water surface, which is measured by:

- The sensors located in each door mirror.
- +/- offset from suspension height adjustment from the ISCM (integrated suspension control module) via the HS (high speed) CAN bus.
- +/- depth effect of road gradient.

From these inputs, the information is transmitted from the GPSM (general proximity sensor module) via the HS CAN bus to the GWM (gateway module). The GWM then converts the HS CAN bus messages to MS (medium speed) CAN bus messages, which is received by the TS and IC. The system will then warn the driver via the TS and IC or audible tones transmitted by the audio system.



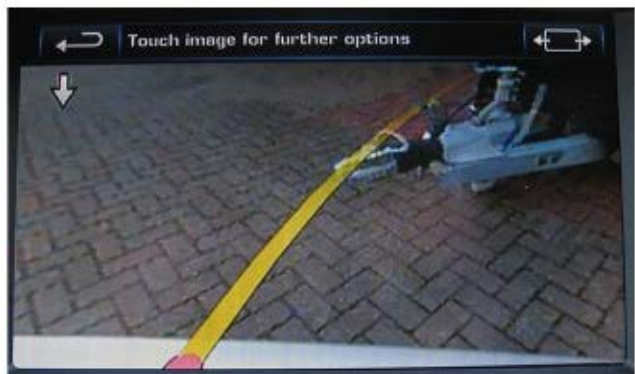
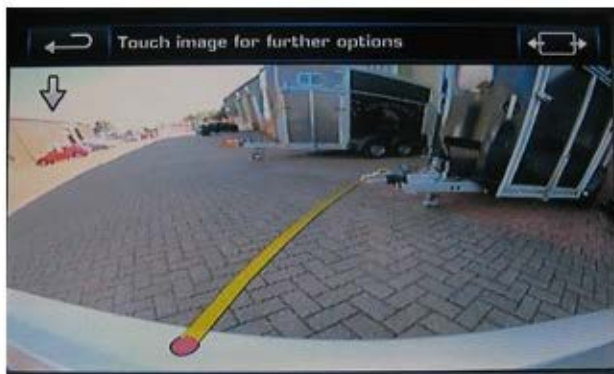
NOTE: The Wade sensing sensors are located on the underside of the exterior mirrors. The sensors and the area below the sensors must be kept clean and free from snow, ice, mud, and other debris. Failure to keep the sensors clean may result in sensor miscalculation.

The exterior mirrors must be in the normal (unfolded) position when using the Wade sensing system.

Tow Assist

The RVC (rear view camera) provides additional information to the driver when hitching a trailer to the vehicle. When reverse gear is selected the camera integrated into the tailgate handle assembly, automatically displays a wide-angle color image of the view from the rear of the vehicle onto the TS.

Within the settings menu the driver can activate the hitch guidance and auto-towball zoom feature. Hitch guidance provides a trajectory line indicating the path of the towball in relation to the steering angle applied to the vehicle. 'Auto-towball Zoom' initiates an automatic image zoom when the trailer is within 60cm of the towball to allow more accurate alignment of vehicle to trailer.



E150703

Item	Part Number	Description
1	-	Touch Screen (TS) image - Auto towball zoom feature
2	-	Towball trajectory line
3	-	Automatic zoom

Tow Assist - New Trailer

When the CJB detects the trailer electrical plug has been connected, the trailer setup screen is displayed automatically

on the TS (touch screen) with the question: 'Has a trailer been connected?'

Selecting 'Yes' will bring up the first of a number of trailer setup screens. On first use the setup screens take the user through a series of configuration options for the connected trailer. To configure a new trailer select 'Add New' and then 'OK'.

Trailer Setup – Step 1 of 6

- Choose from the list of generic trailer descriptive names for the trailer attached, then select 'Next'.

Trailer Setup – Step 2 of 6

- Position the trailer straight behind the vehicle, to allow more accurate positioning of the target. Stick the self adhesive tracking target to the front of the trailer within the orange highlighted zone displayed, then select 'Next'.

Trailer Setup – Step 3 of 6

- Select the correct number of axles for the chosen trailer, then select 'Next'.

Trailer Setup – Step 4 of 6

- Select the preferred camera view for use with this trailer, then select 'Next'.

The side cameras view is more suited to tall and/or long trailers for example caravans. The Reverse Camera view is more suited to small and/or short trailers.

Trailer Setup – Step 5 of 6

Using the numeric pad, enter the Hitch Length of the trailer, then select 'Next'.

Hitch Length is the distance from the hitch point to the pivot point of the trailer. The pivot point will vary depending on the number of axles, and will be:

- The center-line of the axle on a single axle trailer.
- The mid-point between the axles on a twin axle trailer.
- The center line of the center axle on a triple axle trailer.

Trailer Setup – Step 6 of 6

- Using the distance adjustment buttons, set the orange overlay graphics at the width of the trailer wheels and then select 'Finish'.

The orange overlay graphics determine the position of the trailer reverse guidance lines.

A confirmation message will appear to show that the trailer information has been retained.

Finally, highlight the trailer that has been memorized, and select 'OK'.

In order to learn the central position of the trailer, the vehicle must be driven forwards at less than 15mph with the steering wheel in the straight-ahead position. There is currently no confirmation for when this process has completed, however the status can be derived by selecting reverse gear and noting the presence of message 'Trailer tracking in progress'. Whilst tracking feature is learning the central position, the trailer trajectory lines will appear in a light blue color, when process is complete they will change to a dark purple color.

The Tow Assist feature is now ready to use.

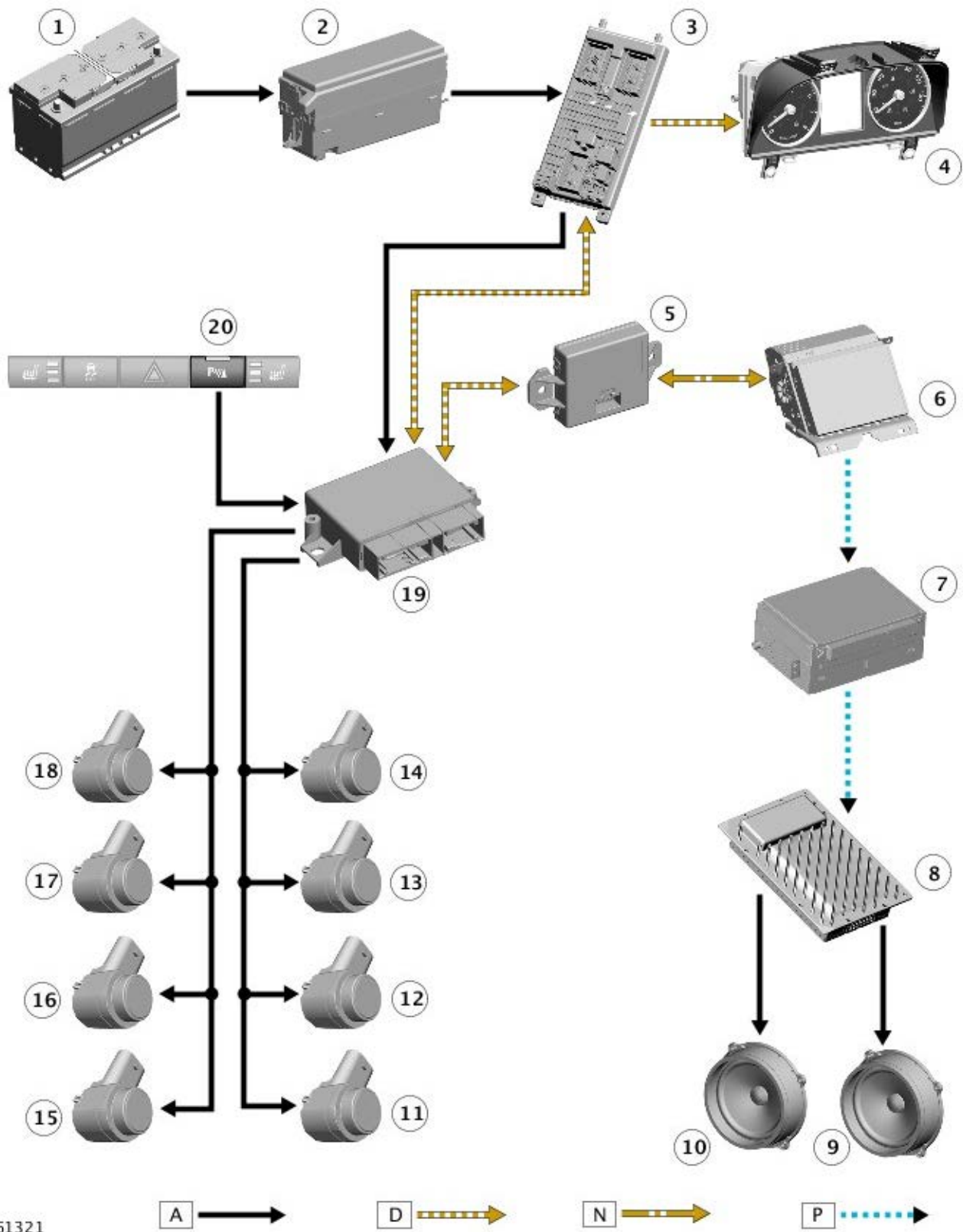
Tow Assist – Previously Saved Trailer

When the **CJB** detects the trailer electrical plug has been connected, the trailer setup screen is displayed automatically on the TS (touch screen) with the question: 'Has a trailer been connected?'

Selecting 'Yes' from the previous screen brings a list of pre-set, or previously saved, trailers. Highlight the required trailer, and select 'OK'.

CONTROL DIAGRAM

Parking Aid - Control Diagram

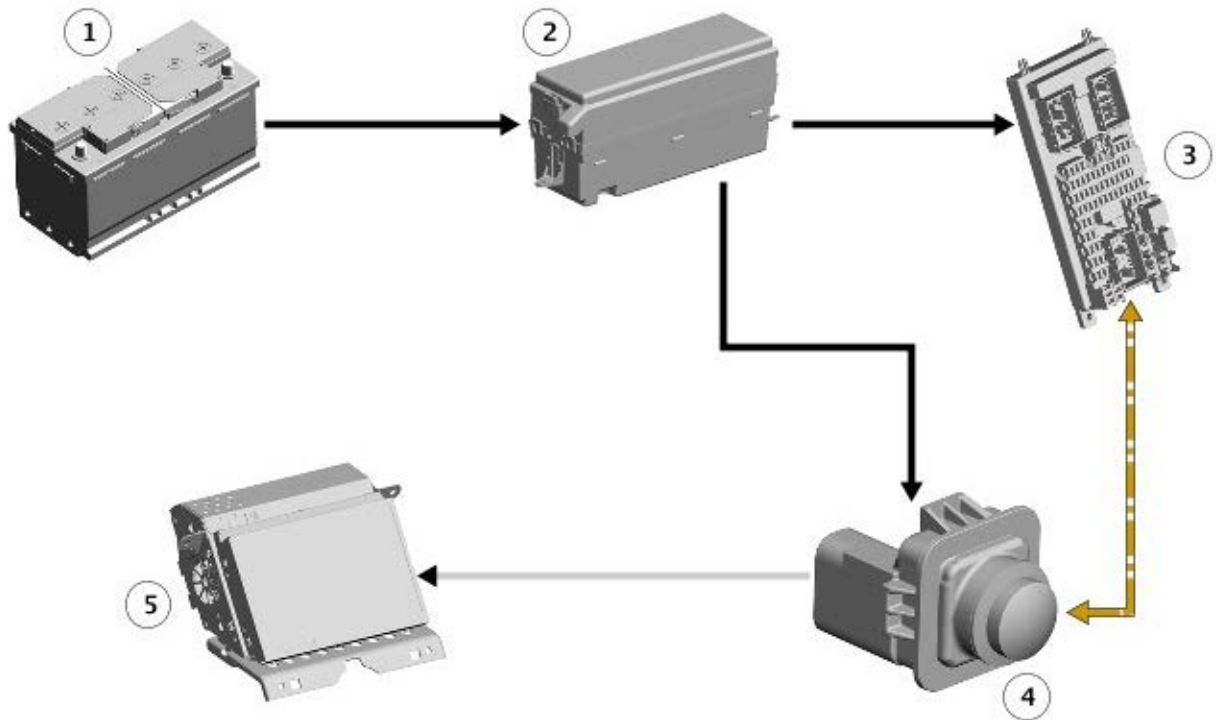


A = Hardwired; D = High Speed CAN Bus; N = Medium Speed CAN Bus; P = MOST (media oriented system transfer).

Item	Part Number	Description
1	-	Battery
2	-	Engine Junction Box (EJB)
3	-	Central Junction Box (CJB)
4	-	Instrument Cluster (IC)
5	-	Gateway Module (GWM)
6	-	Touch Screen (TS)
7	-	Integrated Audio Module (IAM)
8	-	Audio Amplifier Module (AAM)
9	-	Speaker

- 10 - Speaker
- 11 - Front left outer parking sensor
- 12 - Front left inner parking sensor
- 13 - Front right inner parking sensor
- 14 - Front right outer parking sensor
- 15 - Rear left outer parking sensor
- 16 - Rear left inner parking sensor
- 17 - Rear right inner parking sensor
- 18 - Rear right outer parking sensor
- 19 - Parking Aid Control Module (PACM)
- 20 - Parking aid switch

Rear View Camera - Control Diagram



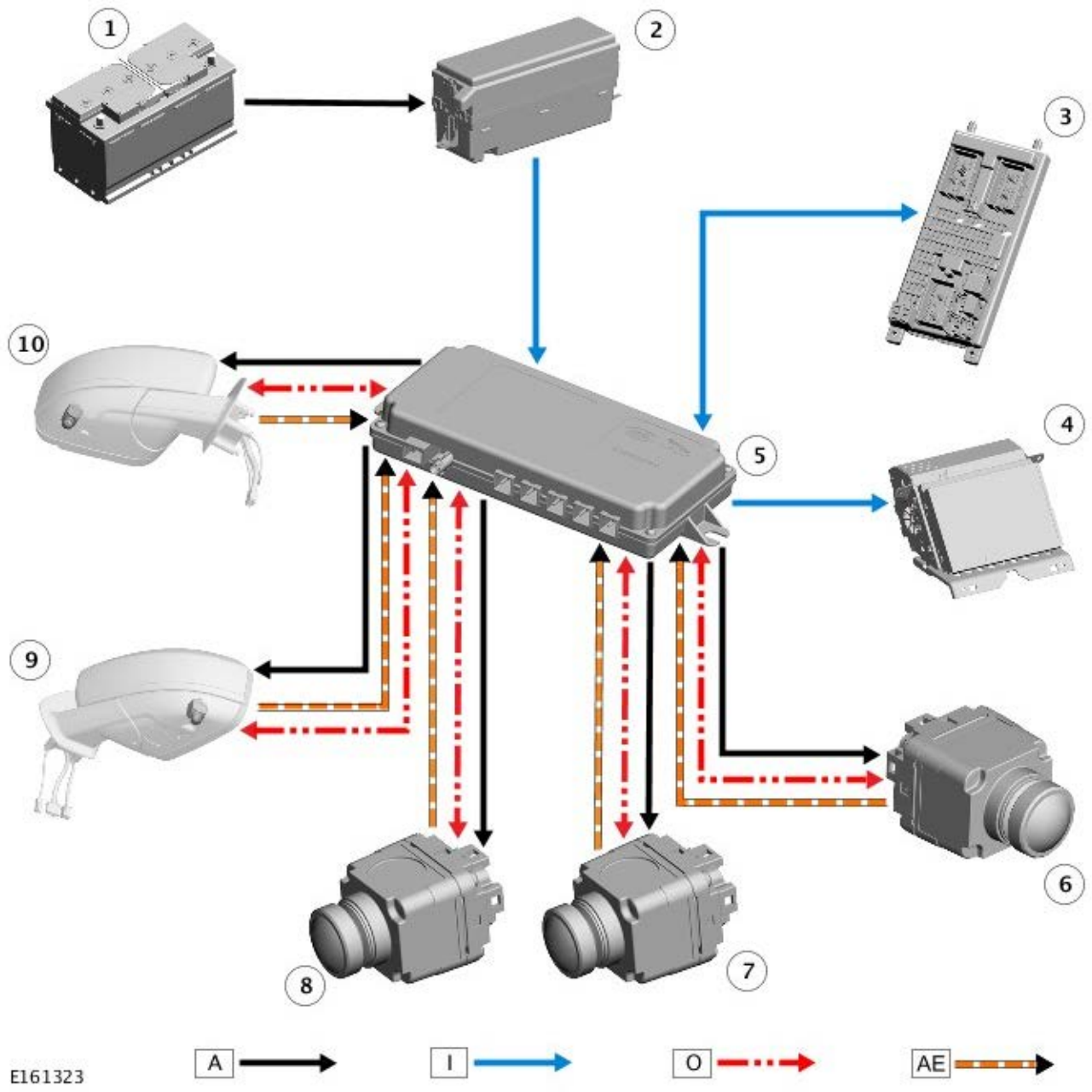
E161322



A = Hardwired; N = Medium Speed CAN Bus; T = Co-Axial

Item	Part Number	Description
1	-	Battery
2	-	Engine Junction Box (EJB)
3	-	Central Junction Box (CJB)
4	-	Rear View Camera (RVC)
5	-	Touch Screen (TS)

Proximity Camera - Control Diagram

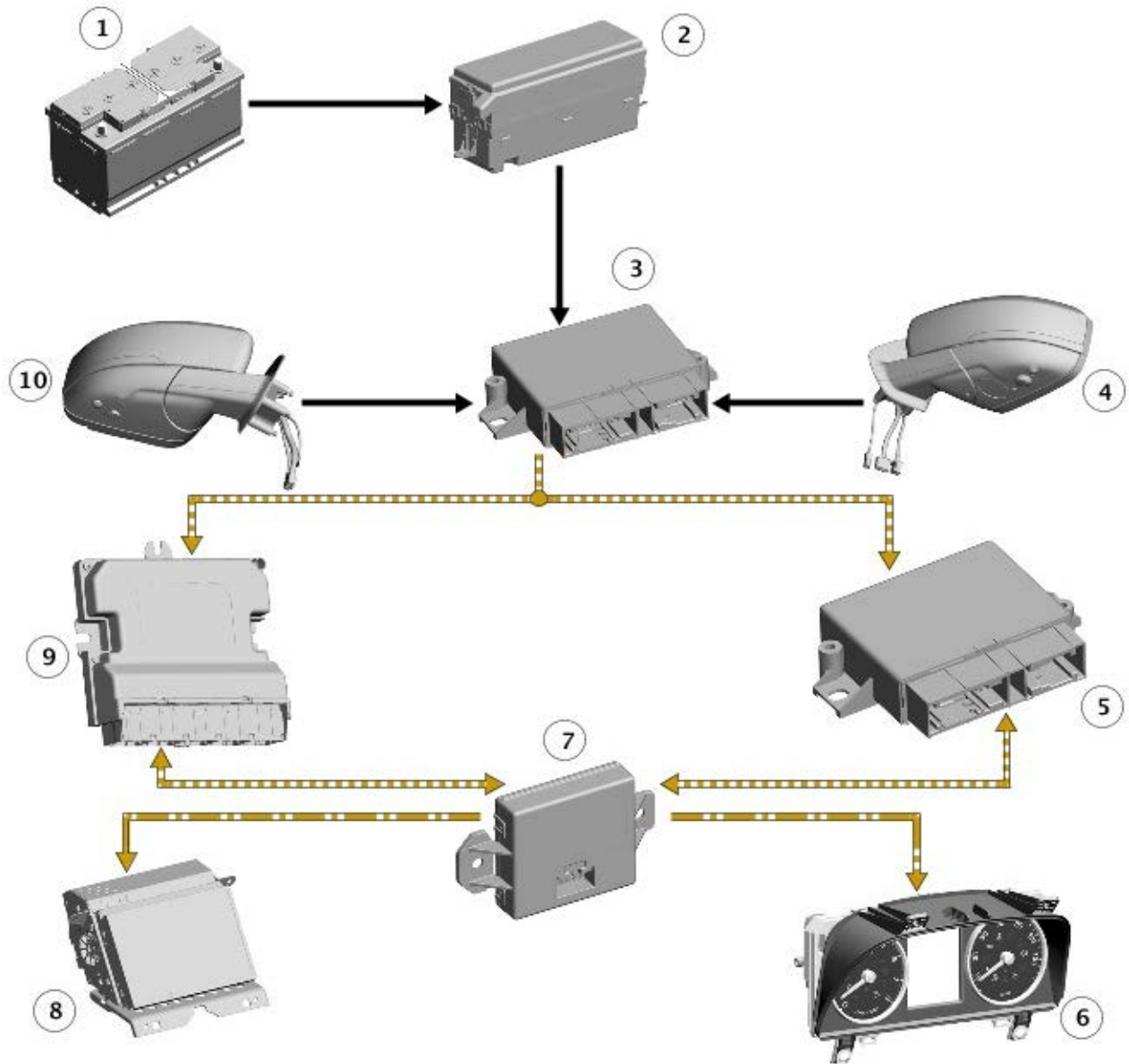


E161323

A = Hardwired; I = CVBS (composite video baseband signal); O = LIN Bus; AE = LDVS (low-voltage differential signalling)

Item	Part Number	Description
1	-	Battery
2	-	Engine Junction Box (EJB)
3	-	Central Junction Box (CJB)
4	-	Touch Screen (TS)
5	-	Camera Control Module (CCM)
6	-	Rear proximity camera
7	-	Front left proximity camera
8	-	Front right proximity camera
9	-	Left door mirror proximity camera
10	-	Right door mirror proximity camera

Wade Sensing - Control Diagram



E161324



A = Hardwired; D = High Speed CAN Bus; N = Medium Speed CAN Bus

Item	Part Number	Description
1	-	Battery
2	-	Engine Junction Box (EJB)
3	-	General Proximity Sensor Module (GPSM)
4	-	Left door mirror wade sensing sensor
5	-	Parking Aid Control Module (PACM)
6	-	Instrument Cluster (IC)
7	-	Gateway Module (GWM)
8	-	Touch Screen (TS)
9	-	Integrated Suspension Control Module (ISCM)
10	-	Right door mirror wade sensing sensor

Parking Aid - Parking Aid

Diagnosis and Testing

Principles of Operation

For a detailed description of the parking aid system, characteristics and limitations refer to the relevant description and operation section in the workshop manual. REFER to: [Parking Aid](#) (413-13 Parking Aid, Description and Operation).

Parking Aid System On-Board Self-Test

As part of the strategy of the system if any DTCs are detected, a long high-pitched tone approx 3 seconds will sound and the parking aid switch (where fitted) indicator LED will flash 6 times at ignition on

- If a fault is present when the parking aid system is activated then the parking aid switch (where fitted) status LED will flash 6 times indicating an issue with front or rear parking aid sensors, wiring switch, parking aid control module or hard wired sounders
- The rear parking aid sounder/rear audio system will emit an error tone for approx 3 seconds at ignition on if a fault is detected with the front or rear sensors, the switch, or if there is a controller area network (CAN) bus error
- (Only applicable to vehicles fitted with front parking aid and a hard wired rear parking aid sounder). If there is a fault with the rear parking aid sounder the error tone will come from the front parking aid sounder unit (integral with the instrument cluster)

Audible and Visual Warnings when Parking Aid System is in Error State

Rear Parking Aid System Fitted and No Parking Aid System Switch Fitted	Rear Parking Aid System Fitted and Parking Aid System Switch Fitted	Front and Rear Parking Aid System Fitted with Parking Aid System Switch Fitted
A long high-pitched error tone will sound at Ignition On for approx 3 seconds	<ul style="list-style-type: none"> • A long high-pitched error tone will sound at ignition on for approx 3 seconds and the parking aid switch indicator LED will flash 6 times at ignition on. Every time the parking aid system is activated within the same ignition cycle, parking aid switch indicator LED will flash 6 times 	<ul style="list-style-type: none"> • A long high-pitched error tone will sound at ignition on for approximately 3 seconds and the parking aid switch indicator LED will flash 6 times at ignition on. Every time the parking aid system is activated within the same ignition cycle the parking aid switch indicator LED will flash 6 times

Inspection and Verification

CAUTIONS:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the warranty policy and procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle



Do not apply any grease based products to any parking aid system connector or pins



NOTE: Check DDW for open campaigns. Refer to the corresponding bulletins and SSMS which may be valid for the specific customer complaint and carry out the recommendations as required.

1. Verify the customer concern
2. Visually inspect for obvious signs of mechanical or electrical damage
3. Ensure that the parking aid sensor face is clear of contamination that could affect the performance of the sensor

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Parking aid sensor condition/damaged • Parking aid sensor installation and holder • Parking aid sensor alignment • Parking aid sensor contamination • Bumper cover(s) 	<ul style="list-style-type: none"> • Battery • Fuse(s) • Relays • Wiring harness • Electrical connector(s)

- Vehicle ride height
- Non standard/non manufacturer approved accessories fitted

- Front parking aid sensor(s)
- Rear parking aid sensor(s)
- Parking aid switch and LED
- Parking aid control module
- Parking aid sounder
- Audio system

4. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step

5. If the cause is not visually evident, check for diagnostic trouble codes (DTCs) and refer to the DTC index

Symptom Chart



CAUTION: Do not apply any grease based products to any parking aid system connector or pins

NOTES:



Please note if this diagnosis is being carried out on a vehicle without a hard wired parking aid speaker, ensure the in car infotainment system is fully functional and configured correctly



Parking aid sensors that are painted incorrectly and not to the manufacturer standards, will not be considered in any warranty claim

Symptom	Possible Causes	Action
NOTE: Permanent/Intermittent fault Parking aid system not functioning correctly. (No DTCs displayed)	<ul style="list-style-type: none"> • Front or rear parking aid sensors dirty • Front or rear parking aid sensor position incorrect • Front or rear parking aid sensor incorrectly installed • Front or rear parking aid sensor coupling rings not installed/incorrectly installed • Parking aid control module or parking aid sensor connector not fully latched • Parking aid sensors painted without being removed from the bumper assembly or not painted to the manufacturer specification 	<ul style="list-style-type: none"> • Clean front or rear parking aid sensors • Check the front or parking aid rear sensor position • Check the front or rear parking aid sensor are correctly installed • Check front or rear parking aid sensor coupling rings are installed/installed correctly • Ensure all parking aid system connectors are correctly latched • Remove parking aid sensor and ensure correctly painted parking aid sensor is installed <ul style="list-style-type: none"> - Parking aid sensors that are painted incorrectly and not to the manufacturer standards, will not be considered in any warranty claim
NOTE: Permanent/Intermittent fault Parking aid system not functioning correctly. (No DTCs displayed). System characteristics or environmental effects	<ul style="list-style-type: none"> • Parking aid sensors incorrectly mounted • Incorrect vehicle ride height • Dirty parking aid sensor face. Ice/snow covered sensor. Debris trapped between parking aid sensor and parking aid sensor body. Heavy rain or water splash from the ground • Non standard, bumper, exhausts/tailpipes, tow bar or external spare wheel mounting • Area around vehicle is not clear 	<ul style="list-style-type: none"> • Ensure the sensors are a tight fit in the holder and locked. Ensure the sensors are central in the holder and bumper and at the correct angle • Ensure vehicle ride height is within the specified limits. Rectify as required • Clean the sensor face as required. Defrost the sensor and dry as required. Clear any debris from the sensor and holder as required. Water flowing over the sensor is a system limitation. (no action required) • Check for non standard, bumper, exhausts/tailpipe, tow bar or external spare wheel mounting that may be being detected by the parking aid system. Rectify as required • Ensure the area around the vehicle is clear of any obstacles, move the vehicle to a suitable area before continuing diagnosis • Ensure no exhaust gas or warm area clouds are in the area around the parking aid sensor detection range • Ensure the vehicle is on level ground and clear of any ramps, potholes or speed bumps, move the vehicle to a suitable area before continuing diagnosis • Remove parking aid sensor and ensure correctly painted parking aid sensor is installed <ul style="list-style-type: none"> - Parking aid sensors that are painted incorrectly

	<p>of obstacles such as channels, gutters or other items on the ground</p> <ul style="list-style-type: none"> • Exhaust gas and warm air clouds creating ghost echoes • Vehicle not on level ground or next to a gradient • Parking aid sensors painted without being removed from the bumper assembly or not painted to the manufacturer specification 	<p>and not to the manufacturer standards, will not be considered in any warranty claim</p>
<p>Parking aid sensors are being returned with no faults found or signs of water ingress/corrosion</p>	<p>Possible issue with sensor connectors not latched correctly</p>	<ul style="list-style-type: none"> • When either no/intermittent operation has been reported the following action should be taken • 1. Using Datalogger, identify the position of the suspect parking aid sensor within the bumper • 2. Visually locate the position of the suspect parking aid sensor. Inspect and provide details in claim if the sensor has any sign of physical damage • 3. Remove the bumper. Disconnect the wiring at the main harness connector. Inspect the main harness connectors and terminals for signs of damage, backed out pins, corrosion and water ingress, or damage to the seals. Provide details in claim if any of the above symptoms are present • 4. Attempt to remove the harness connector from the suspect parking aid sensor without using the connector latch i.e. lightly pull back on ALL wires together, ensuring the harness is held close to the back of the connector, not elsewhere on the wiring harness. DO NOT apply excessive force. If the connector can be removed without using the latch, provide details in claim if connector is loose. If the connector is fully latched, disconnect it from the sensor • 5. Inspect and provide details in claim if the suspect sensor harness connector has any sign of water ingress/corrosion • 6. Inspect and provide details in claim if the suspect parking aid sensor harness connector shows any sign that the terminals have backed-out of the connector or for any damage to the terminal seals. Replace/repair the harness as required and proceed • 7. Remove the suspect parking aid sensor from the bumper. Inspect the parking aid sensor connector for signs of water ingress/corrosion. Provide details in claim if corrosion/water ingress is present • 8. Exchange the suspect parking aid sensor with another parking aid sensor within the bumper that is performing correctly. Reconnect all sensors and reconnect the bumper main harness connector. Repeat step 1. Confirm if the original fault now appears at the new position of the suspect parking aid sensor, if so, proceed to step 10 • 9. If not, carry out the appropriate open circuit and short circuit checks between the original suspect parking aid sensor harness connector and the parking aid control module • 10. Refit the parking aid sensors to their original position in the bumper • 11. Reconnect the parking aid sensor to the bumper harness connector. Reconnect main harness connector and refit the bumper • 12. Repeat Step 1. If fault is still present, replace only the faulty sensor

<p>PINPOINT TEST A : PARKING AID SYSTEM NOT FUNCTIONING CORRECTLY WITH NO DTCS LOGGED</p>	
<p>TEST</p>	<p>DETAILS/RESULTS/ACTIONS</p>

CONDITIONS	
A1: PERMANENT FAULT	
	1 When the parking aid system is activated, there is a vibration on the parking aid sensor membrane. This can be verified by touching the parking aid sensor face with a hard item such as a pencil, ball-pen, small screwdriver, or fingernail. Ensure no damage is caused to sensor painted surface
	Are the parking aid sensor(s) vibrating? Yes GO to A2. No GO to A5.
A2: SENSORS VIBRATING WITH PARKING AID FAULT	
	1 Clean the parking aid sensor face
	Parking aid system functioning correctly? Yes No further action required No GO to A3.
A3: SENSORS VIBRATING WITH PARKING AID FAULT	
	1 Check parking aid sensors correctly mounted. Parking aid sensor holder correctly mounted. Parking aid sensor decoupler ring fitted or fitted correctly. Parking aid sensor positioning correct. Parking aid sensor painted without being removed from the bumper assembly or not painted to manufacturer specification. Rectify as required
	Parking aid system functioning correctly? Yes No further action required No GO to A4.
A4: SENSORS VIBRATING WITH PARKING AID FAULT	
	1 Carry out speaker test. Only applicable to vehicles with rear hard wired parking aid speakers. Check the parking aid speaker wiring circuit and connector. Rectify as required. Check and install a new parking aid speaker as required. Vehicles with audio parking aid system. Confirm audio system is functioning correctly. Refer to the relevant section of the workshop manual
	Parking aid system functioning correctly Yes No further action required
A5: SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 Isolate the fault to front or rear parking aid sensors
	Are all rear parking aid sensors vibrating? Yes GO to A6. No GO to A10.
A6: FRONT SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 Check the parking aid control module is correctly configured. Check and update the car configuration file as required
	Parking aid system functioning correctly? Yes No further action required No GO to A7.
A7: FRONT SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 Check the correct parking aid control module is installed to the vehicle
	Parking aid system functioning correctly? Yes No further action required No GO to A8.
A8: FRONT SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 If all 4 front parking aid sensors are not vibrating, carry out harness test on common ground, power supply. Check main parking aid harness connector to bumper harness connector. Rectify as required
	Parking aid system functioning correctly? Yes No further action required No GO to A9.
A9: FRONT SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 Check and install a new parking aid control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
	Parking aid system functioning correctly Yes No further action required

A10: REAR SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 Check the parking aid control module is correctly configured. Check and update the car configuration file as required
	Parking aid system functioning correctly? Yes No further action required No GO to A11.
A11: REAR SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 If all 4 rear parking aid sensors are not vibrating, carry out harness test on common ground, power supply. Check main parking aid harness connector to bumper harness connector. Rectify as required
	Parking aid system functioning correctly? Yes No further action required No GO to A12.
A12: REAR SENSORS NOT VIBRATING WITH PARKING AID FAULT	
	1 Check and install a new parking aid control module as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
	Parking aid system functioning correctly? Yes No further action required

PINPOINT TEST B : PARKING AID SYSTEM NOT FUNCTIONING CORRECTLY WITH NO DTCS LOGGED	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: PARKING AID SYSTEM GIVES WARNING SIGNAL WITHOUT OBSTACLE	
	1 Clean the parking aid sensor face. Check for any damage to the parking aid sensor face. Rectify as required. Snow, water or ice on sensor face. Parking aid sensor face has been repainted to the incorrect thickness. Rectify as required
	Parking aid system functioning correctly? Yes No further action required No GO to B2.
B2: PARKING AID SYSTEM GIVES WARNING SIGNAL WITHOUT OBSTACLE	
	1 Ensure the vehicle ride height is within manufacturer specified limits. Rectify as required
	Parking aid system functioning correctly? Yes No further action required No GO to B3.
B3: PARKING AID SYSTEM GIVES WARNING SIGNAL WITHOUT OBSTACLE	
	1 Check for any non standard accessories are not fitted, such as tow bar, bike rack, body kit, modified exhaust, lighting or licence plate holder
	Parking aid system functioning correctly? Yes No further action required No GO to B4.
B4: PARKING AID SYSTEM GIVES WARNING SIGNAL WITHOUT OBSTACLE	
	1 Limitations or characteristics of the parking aid system such as vehicle on a gradient, exhaust gas vapour, signal reflection
	Parking aid system functioning correctly? Yes No further action required No For a detailed description of the parking aid system, refer to the relevant description and operation section in the workshop manual. REFER to: Parking Aid (413-13 Parking Aid, Description and Operation).

DTC Index

For a list of diagnostic trouble codes that could be logged on this vehicle, please refer to Section 100-00. REFER to: [Diagnostic Trouble Code \(DTC\) Index - DTC: Parking Aid Control Module \(PACM\)](#) (100-00 General Information, Description and Operation).

Parking Aid - Parking Aid Camera

Removal and Installation

Removal

NOTES:

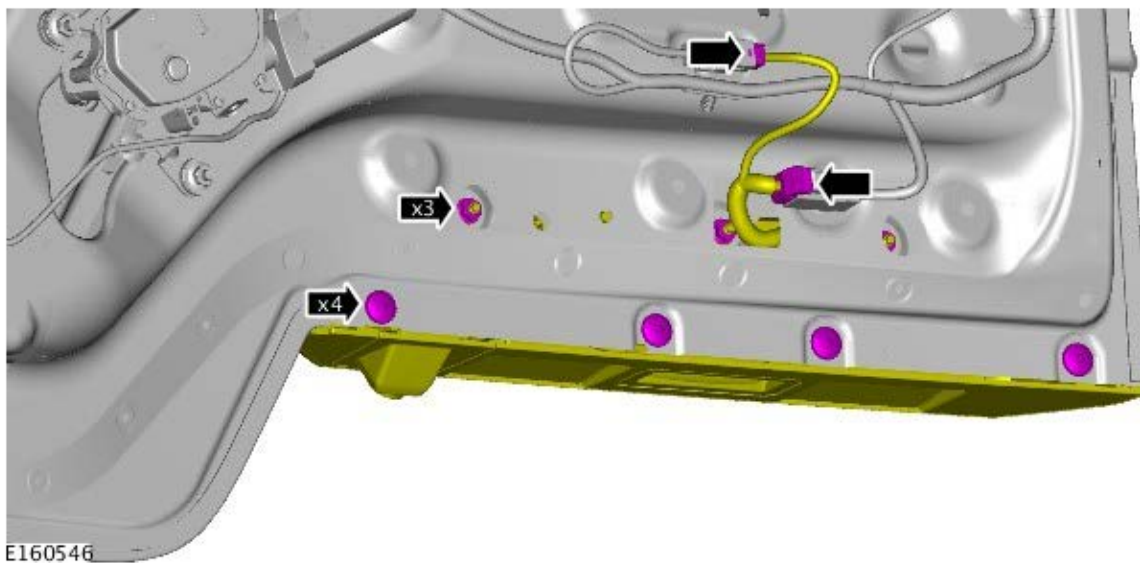


Removal steps in this procedure may contain installation details.

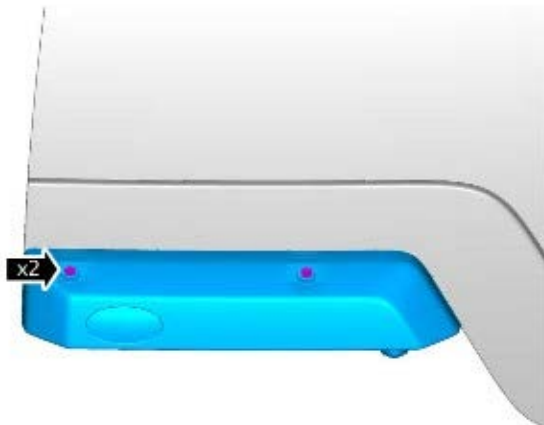


The ignition must be switched off.

1. Refer to: [Liftgate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Torque: 10 Nm



E160546



E160545



NOTE: Vehicles with high line camera system:

3. CAUTIONS:



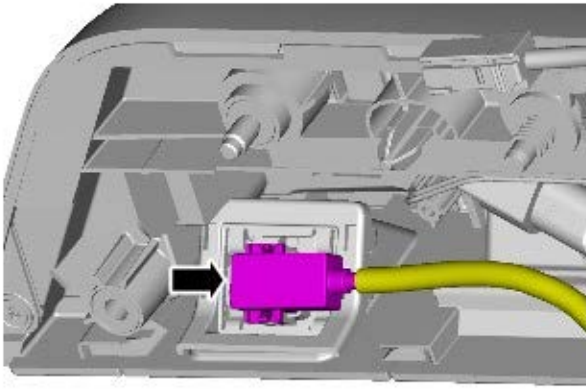
Make sure to protect the paintwork.



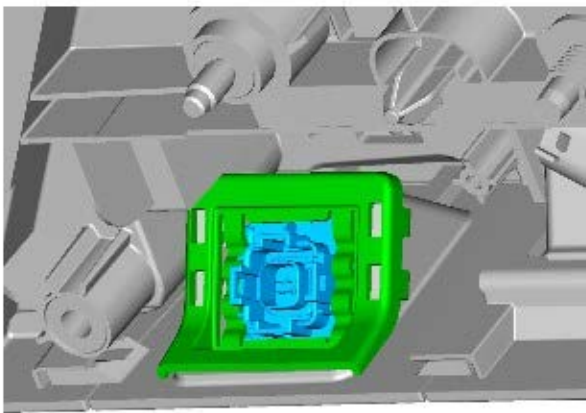
Take extra care not to damage the wiring harnesses.




4. CAUTION: Take extra care not to damage the wiring harnesses.



E160543

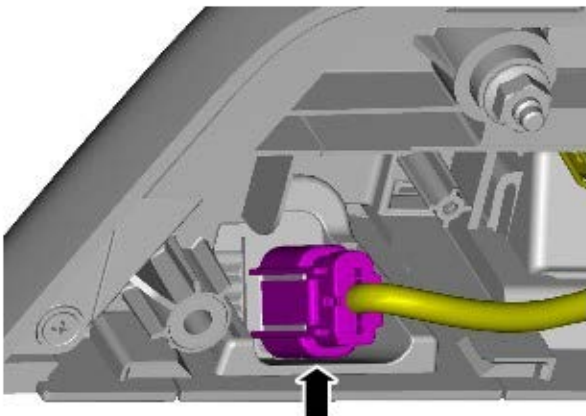


5.  CAUTION: Take extra care not to damage the clip.

 NOTE: Make sure that this component is installed to the noted removal position.

E160544


 NOTE: Vehicles with low line camera system:

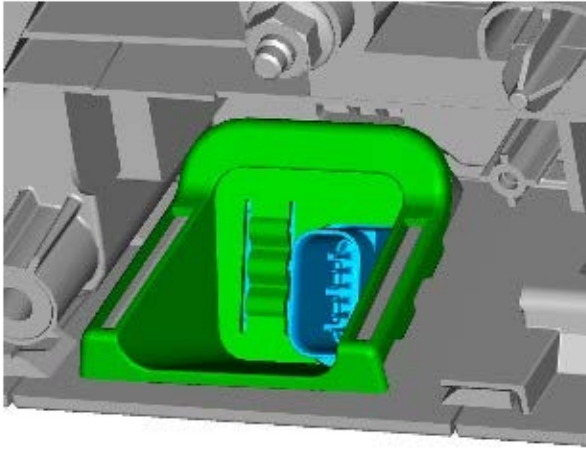


6.  CAUTION: Take extra care not to damage the wiring harnesses.

E161163

7.  CAUTION: Take extra care not to damage the clip.

 NOTE: Make sure that this component is



installed to the noted removal position.

E161162

Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Parking Aid - Parking Aid Camera Module

Removal and Installation

Removal

NOTES:



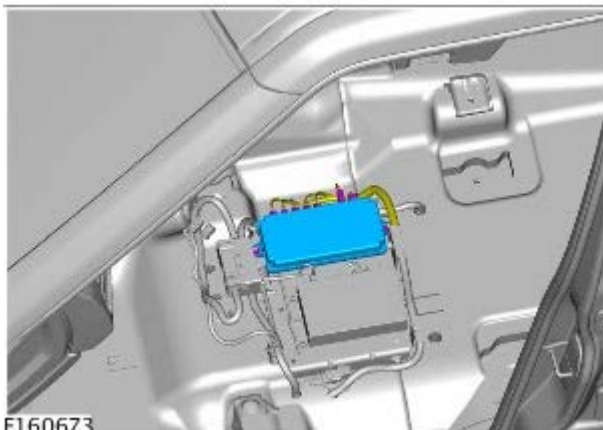
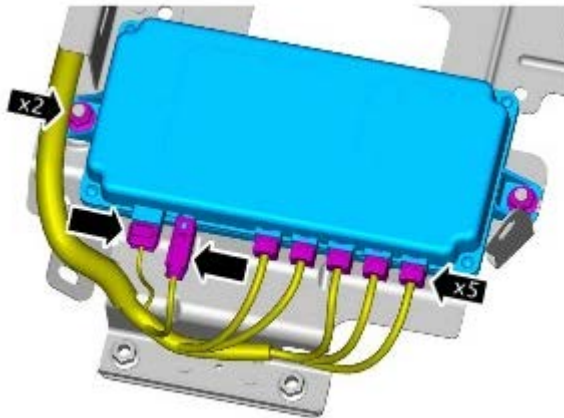
Removal steps in this procedure may contain installation details.



The ignition must be switched off.

1. Move the front seat to the fully forward and fully raised positions to allow access.

2. Torque: 10 Nm



Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Parking Aid - Parking Aid Module

Removal and Installation

Removal

NOTES:



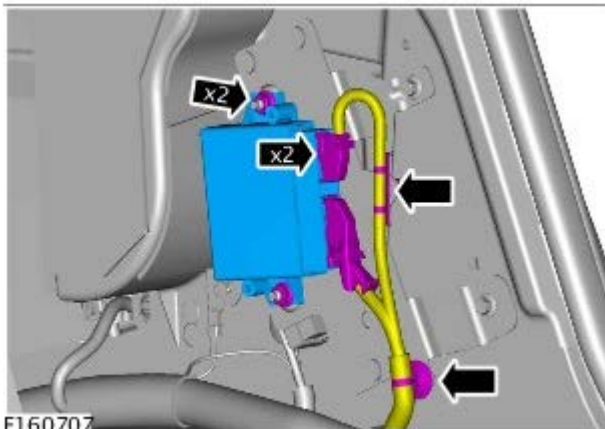
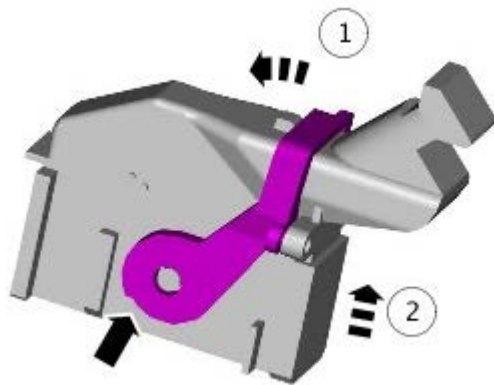
Removal steps in this procedure may contain installation details.



The ignition must be switched off.

1. For additional information, refer to: [Rear Quarter Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. TORQUE: 5 Nm



Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Parking Aid - Front Parking Aid Camera

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



The ignition must be switched off.

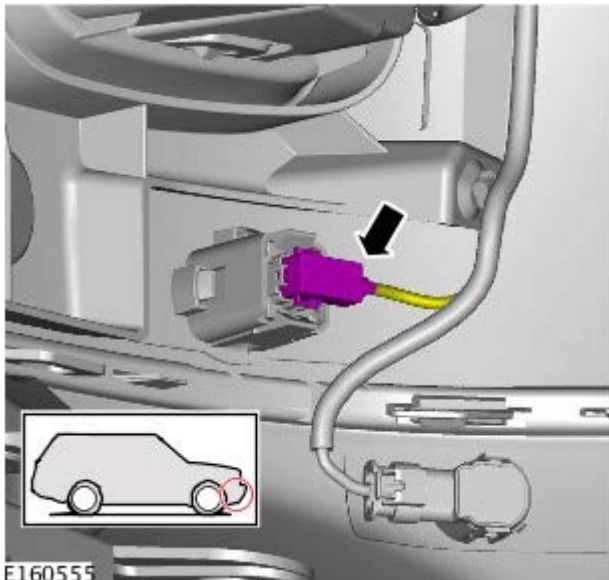



RH illustration shown, LH is similar.

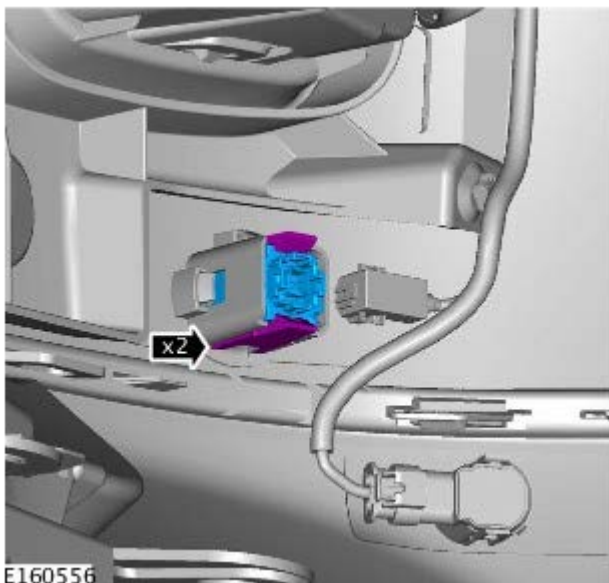
1.  **WARNING:** Make sure to support the vehicle with axle stands.


Raise and support the vehicle.

2. Refer to: [Front Bumper Cover](#) (501-19 Bumpers, Removal and Installation).



3.  **CAUTION:** Take extra care not to damage the wiring harnesses.



4.  **CAUTION:** Make sure that the component is correctly located on the locating dowels.



NOTE: Make sure that this component is installed to the noted removal position.

Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Parking Aid - Front Inner Parking Aid Sensor

Removal and Installation

Removal



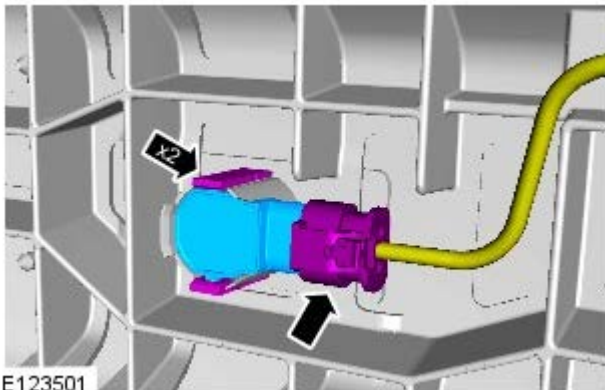
NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.


Raise and support the vehicle.

2. Refer to: [Front Bumper Cover](#) (501-19 Bumpers, Removal and Installation).

3.

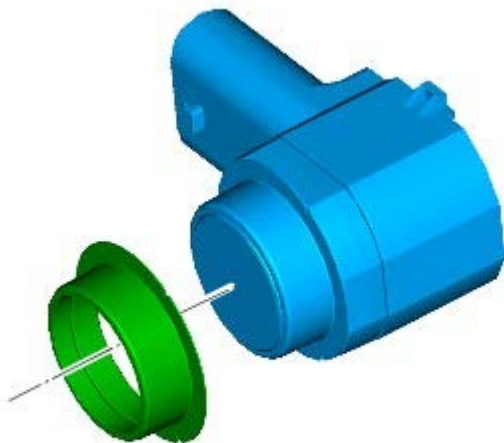


Installation

1.  **CAUTION:** Make sure that the mating faces are clean and free of corrosion and foreign material.



NOTE: Make sure that the grommets are correctly seated.



E161103

2. To install, reverse the removal procedure.

Parking Aid - Front Outer Parking Aid Sensor

Removal and Installation

Removal



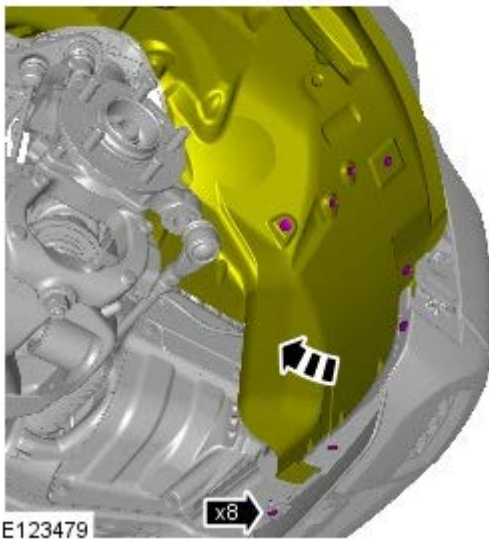
NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

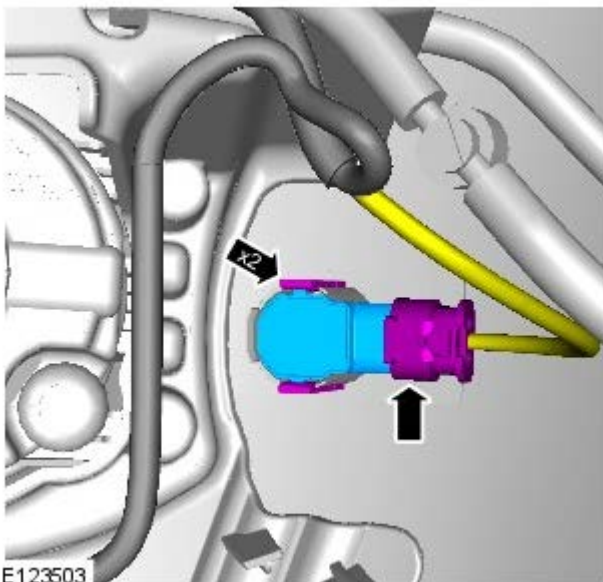
Remove the front wheel and tire.

2. Refer to: [Front Fender Moulding](#) (501-08 Exterior Trim and Ornamentation, Removal and Installation).


3. Torque: 1 Nm

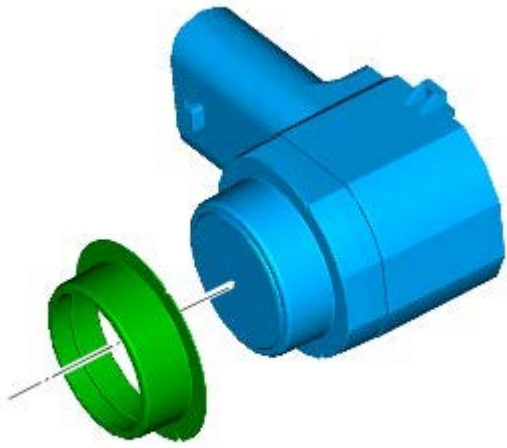



- 4.



Installation

1.  **CAUTION:** Make sure that the mating faces are clean and free of corrosion and foreign material.



 NOTE: Make sure that the grommets are correctly seated.

E161103

2. To install, reverse the removal procedure.

Parking Aid - Rear Inner Parking Aid Sensor

Removal and Installation

Removal


NOTES:



Removal steps in this procedure may contain installation details.



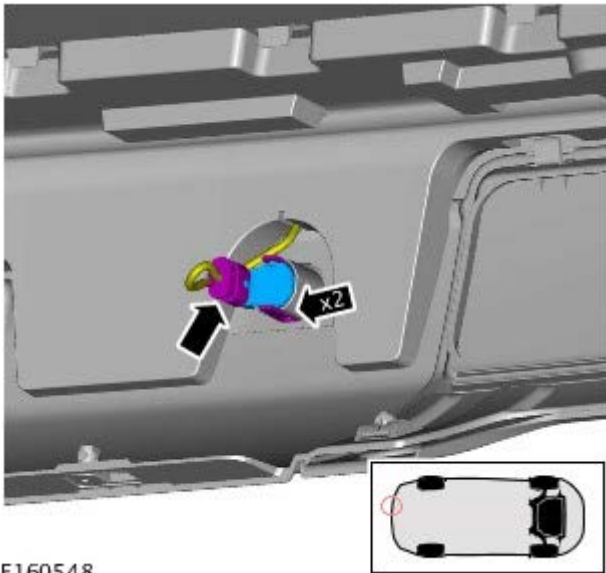
Check the sensor before removing to note if the sensor(s) are painted or unpainted.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.


2. Refer to: [Rear Bumper Cover](#) (501-19 Bumpers, Removal and Installation).

3.



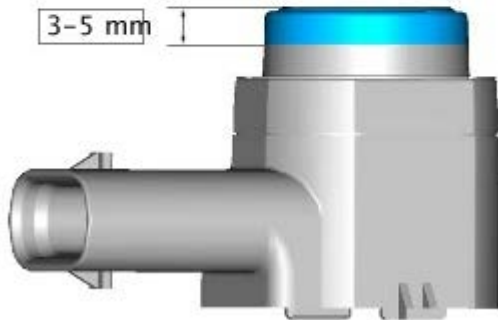
E160548

Installation

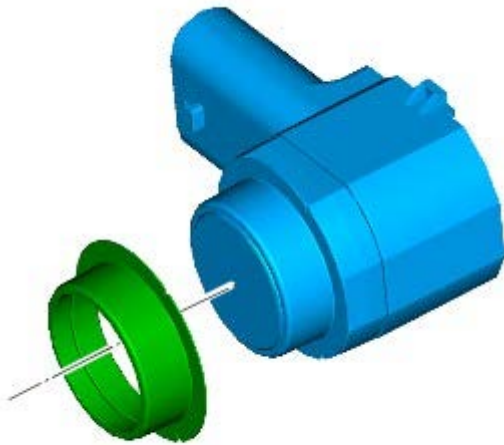
1.  **CAUTION:** If a new sensor is installed, make sure that the area illustrated is the only area painted. Failure to follow this instruction may result in the component malfunctioning.




NOTE: On vehicles that are equipped with black or unpainted bumpers, the sensor(s) do not require painting.




E156793



E161103

2.  CAUTION: Make sure that the mating faces are clean and free of corrosion and foreign material.

 NOTE: Make sure that the grommets are correctly seated.

3. To install, reverse the removal procedure.

Parking Aid - Rear Outer Parking Aid Sensor

Removal and Installation

Removal



WARNING: Observe due care when working near a hot exhaust system.

NOTES:




Removal steps in this procedure may contain installation details.

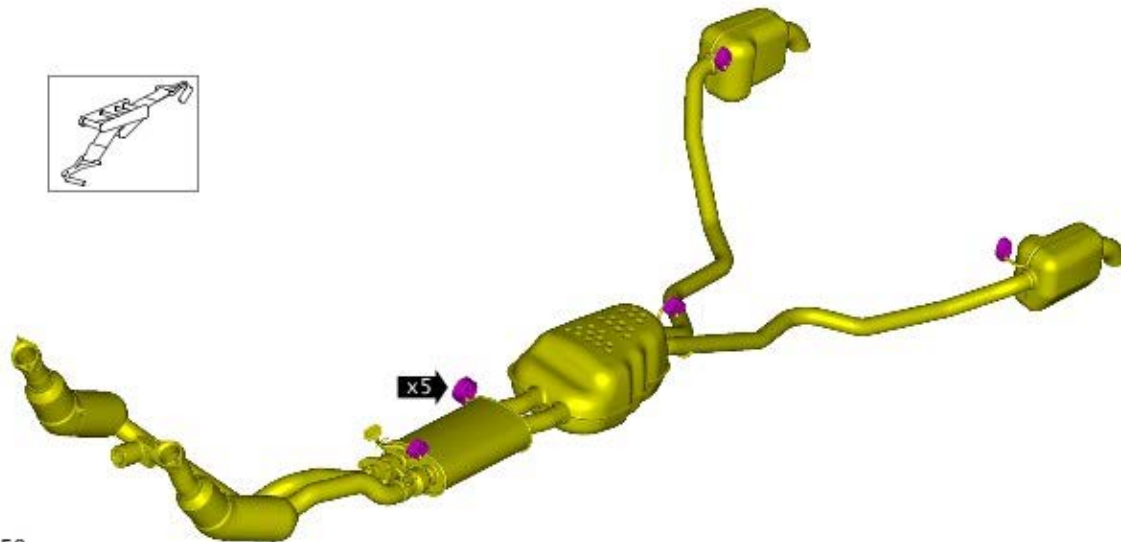
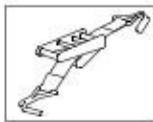


Check the sensor before removing to note if the sensor(s) are painted or unpainted.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

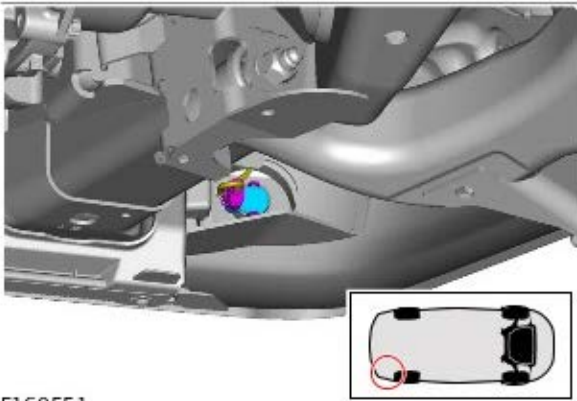
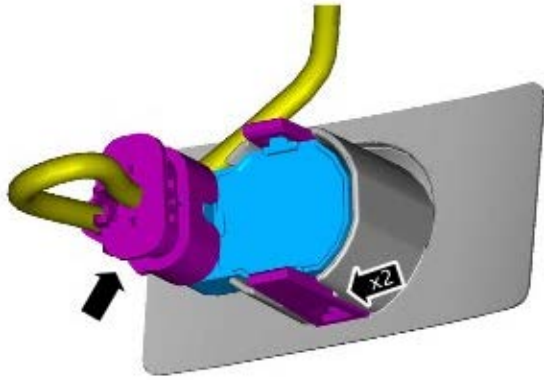
Raise and support the vehicle.

2.  **CAUTION:** Make sure that the exhaust system is supported with suitable retaining straps.



E160550


3.




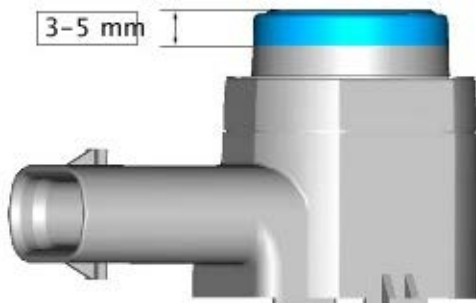
E160551

Installation





1.  **CAUTION:** If a new sensor is installed, make sure that the area illustrated is the only area painted. Failure to follow this instruction may result in the component malfunctioning.

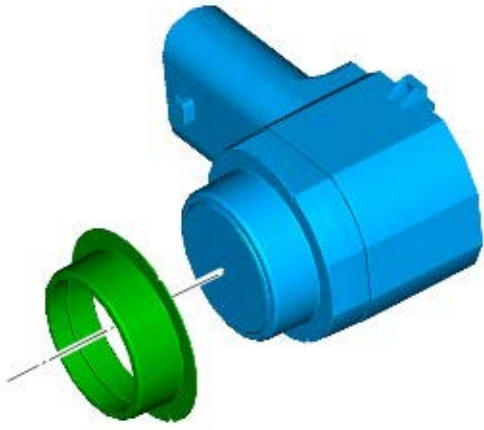
 **NOTE:** On vehicles that are equipped with black or unpainted bumpers, the sensor(s) do not require painting.



E156793

2.  **CAUTION:** Make sure that the mating faces are clean and free of corrosion and foreign material.

 **NOTE:** Make sure that the grommets are correctly seated.



E161103

3. To install, reverse the removal procedure.

Parking Aid - Side Parking Aid Camera

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



The ignition must be switched off.

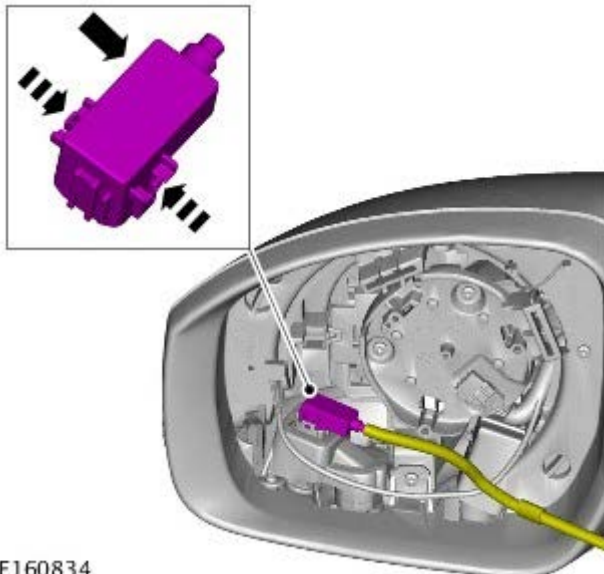


LH illustration shown, RH is similar.

1. Refer to: [Exterior Mirror Motor](#) (501-09 Rear View Mirrors, Removal and Installation).

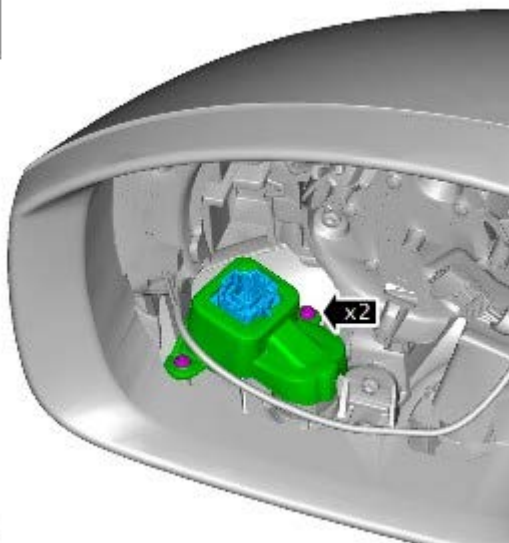


2. **CAUTION:** Take extra care not to damage the wiring harnesses.



E160834

3. Torque: 0.5 Nm



E160833

Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Battery and Charging System - General Information -

Battery

Item	Specifications
All Gasoline (Petrol) Models before 14MY:	
Type	Maintenance free lead-calcium
Capacity	690 amps - 75 amp/hour
Reserve capacity	150 minutes @ 25 amps
All Gasoline (Petrol) Models 14MY onwards:	
Type	Maintenance free lead-calcium
Capacity	825 amps - 90 amp/hour
Reserve capacity	190 minutes @ 25 amps
Diesel Models:	
Type	Maintenance free lead-calcium
Capacity	825 amps - 90 amp/hour
Reserve capacity	190 minutes @ 25 amps

Battery Disconnect/Connect



CAUTION: The vehicle status and battery condition must be established before attempting battery disconnect/connect. Reference must be then made to the following table to establish the relevant procedure to be followed.

Vehicle status	Battery charged Procedure	Battery discharged Procedure
Engine running	1	
Vehicle powered down, locked and alarmed	2	3
Vehicle unlocked	4	5

Procedure 1

Disconnect battery	Connect battery
1. If possible, apply parking brake or alternatively, chock wheels	1. Ensure that all electrical loads are switched OFF
2. Switch off ignition	2. Connect battery leads - GROUND lead last
3. Wait 2 minutes for engine management system to 'power down'	3. Switch on ignition
4. Open the hood	4. Operate parking brake switch several times until parking brake warning lamp is extinguished
5. Disconnect battery - GROUND lead first	

Procedure 2

Disconnect battery	Connect battery
1. Unlock the vehicle and disarm the alarm using the 'plip' button	1. Ensure that all electrical loads are switched OFF
2. Enter the vehicle, turn the ignition key to position II, apply the parking brake or chock the wheels and then turn the ignition key to position 0. Remove the key to 'power down' the ICE system	2. Connect battery leads - GROUND lead last
3. Wait 2 minutes for engine management system to 'power down'	3. Switch on ignition
4. Open the hood	4. Operate parking brake switch several times until parking brake warning lamp is extinguished
5. Disconnect battery - GROUND lead first	



NOTE: 1. **Disconnect battery** - The door unlock process initialises the ICE system.

Procedure 3

Disconnect battery	Connect battery
1. Unlock the vehicle from the left hand front door using the key	1. Ensure that all electrical loads are switched OFF
2. Enter the vehicle, turn the ignition key to position II, apply the parking brake or chock the wheels and then turn the ignition key to position 0. Remove the key to 'power down' the ICE system	2. Connect battery leads - GROUND lead last
3. Wait 2 minutes for engine management system to 'power down'	3. Switch on ignition
4. Open the hood	4. Operate parking brake switch several times until parking brake warning lamp is extinguished
5. Disconnect battery - GROUND lead first	

NOTES:



1. - Disconnect battery - The door unlock process initialises the ICE system



1. Connect battery - If there is insufficient capacity in the battery to disarm the alarm, the alarm may sound on reconnection of the battery - Step 3 will disarm the alarm

Procedure 4

Disconnect battery	Connect battery
1. Enter the vehicle, turn the ignition key to position II, apply the parking brake or chock the wheels and then turn the ignition key to position 0. Remove the key to 'power down' the ICE system	1. Ensure that all electrical loads are switched OFF
2. Wait 2 minutes for engine management system to 'power down'	2. Connect battery leads - GROUND lead last
3. Open the hood	3. Switch on ignition
4. Disconnect battery - GROUND lead first	4. Operate parking brake switch several times until parking brake warning lamp is extinguished

Procedure 5

Disconnect battery	Connect battery
1. Enter the vehicle, turn the ignition key to position II, apply the parking brake or chock the wheels and then turn the ignition key to position 0. Remove the key to 'power down' the ICE system	1. Ensure that all electrical loads are switched OFF
2. Wait 2 minutes for engine management system to 'power down'	2. Connect battery leads - GROUND lead last
3. Open the hood	3. Switch on ignition
4. Disconnect battery - GROUND lead first	4. Operate parking brake switch several times until parking brake warning lamp is extinguished



NOTE: 1. Disconnect battery - If the remote control module (RCM) is not functioning, it will be necessary to manually unlock the vehicle using the key.

Vehicle Jump (Emergency) Starting - Using Another Vehicle

Carry out the following operations in the sequence given
1. Connect one end of the BLACK (-) booster cable to the GROUND (-) battery terminal of the DONOR vehicle
2. Connect the other end of the BLACK (-) booster cable to a good earth point e.g. unpainted metal surface or engine mounting at least 0.5 m (20.0 in) from the battery or fuel lines on the DISABLED vehicle
3. Connect one end of the RED (+) booster cable to the positive (+) battery terminal of the DONOR vehicle
4. Connect the other end of the RED (+) booster cable to the positive (+) battery terminal of the DISABLED vehicle
5. Start the engine of the DONOR vehicle and allow it to idle for a few minutes
6. Start the engine of the DISABLED vehicle
7. Allow engines of both vehicles to idle for a few minutes then switch off the engine of the DONOR vehicle
8. Disconnect the RED (+) booster cable from the battery of the PREVIOUSLY DISABLED vehicle
9. Disconnect the RED (+) booster cable from the battery of the DONOR vehicle
10. Disconnect the BLACK (-) booster cable from the earth point of the PREVIOUSLY DISABLED vehicle
11. Disconnect the BLACK (-) booster cable from the battery of the DONOR vehicle

WARNINGS:



During normal use, batteries emit explosive hydrogen gas sufficient to cause severe explosions and capable of causing serious injury - keep sparks and naked lights away from the engine compartment.



DO NOT attempt to start the disabled vehicle if it is suspected that the electrolyte in the battery is frozen (before 14MY only).



Suitable eye protection must be worn when working in the vicinity of the battery.



Take care when working near rotating parts of the engine.



Prior to attempting to start the disabled vehicle, ensure that the parking brake is applied or suitably chock the wheels. Ensure that 'P' - PARK - Automatic Gearbox or NEUTRAL - Manual Gearbox is selected.

CAUTIONS:



Ensure that all electrical loads are switched OFF prior to connecting booster cables and disconnect booster cables prior to using any electrical equipment.



Ensure that the battery of the DONOR vehicle is of 12 volt capacity and that all electrical loads on the disabled vehicle are switched OFF prior to connecting booster cables.



Ensure that there is no physical contact between the donor and disabled vehicles other than the booster cables.

Vehicle Jump (Emergency) Starting - Using a Slave Battery/Starting Aid

Carry out the following operations in the sequence given
1. Connect the end of the BLACK (-) booster cable to the ground (-) battery terminal of the vehicle
2. Connect the end of the RED (+) booster cable to the positive (+) battery terminal of the vehicle
3. Start the engine of the vehicle and allow it to idle
4. Disconnect the RED (+) booster cable from the battery terminal of the vehicle
5. Disconnect the BLACK (-) booster cable from the battery terminal of the vehicle

WARNINGS:



During normal use, batteries emit explosive hydrogen gas sufficient to cause severe explosions and capable of causing serious injury - keep sparks and naked lights away from the engine compartment.



DO NOT attempt to start the disabled vehicle if it is suspected that the electrolyte in the battery is frozen (before 14MY only).



Suitable eye protection must be worn when working in the vicinity of the battery.



Take care when working near rotating parts of the engine.



Prior to attempting to start the disabled vehicle, ensure that the parking brake is applied or suitably chock the wheels. Ensure that 'P' - PARK - Automatic Gearbox or NEUTRAL - Manual Gearbox is selected.

CAUTIONS:



Ensure that all electrical loads are switched OFF prior to connecting booster cables and disconnect booster cables prior to using any electrical equipment.



Ensure that the slave battery/starting aid are of 12 volt capacity and that all electrical loads on the disabled vehicle are switched OFF prior to connecting booster cables.

Battery and Charging System - General Information - Battery Care Requirements

Description and Operation

1. INTRODUCTION

This document sets out the requirements for care and maintenance of batteries and thereby the standard of battery care at dealers and retailers for new vehicles

This applies to all types of 12 Volt Lead Acid Batteries used in Jaguar and Land Rover vehicles whether they are conventional flooded technology or Absorbed Glass Mat (AGM – also known as Valve Regulated Lead Acid (VRLA)) technology and also applies to both Primary and Auxiliary Batteries. AGM batteries offer improved resistance to cycling as seen in stop start applications.

In order to prevent damage to the battery and ensure a satisfactory service life, all processes detailed within this document must be rigorously adhered to.

It is equally important therefore to note the following key points:

- All new vehicles leave the factory with either a transit relay installed and/or have a transit mode programmed into the vehicle control modules. The transit relay must be removed and the transit mode disabled (where applicable) using an approved diagnostic system, **NOT MORE THAN 72 HOURS** before the customer takes delivery.
- The battery can be discharged by the following mechanisms:
 - **Self Discharge:** -A lead acid battery will very slowly discharge itself due to its own internal chemical processes whether it is connected to a vehicle or not.
 - **Quiescent Discharge:** - The vehicle electrical systems when connected to the battery will draw charge from the battery.

12 Volt Lead Acid Batteries rely on internal chemical processes to create a voltage and deliver current. These processes and the internal chemical structure of the battery can be damaged if the battery is allowed to discharge over a number of weeks / months, or is left in a discharged state for a lengthy time period.

- **On vehicles with conventional ignition keys**, these must not be left in the ignition lock barrel when the transit relay has been removed, otherwise quiescent current will increase and the battery will discharge more rapidly.
- **For keyless vehicles**, the Smart Key must be stored at least 5m away from the vehicle when the vehicle is parked or stored.
- **AGM Batteries are fully sealed and cannot have the electrolyte level topped up.**



NOTE: Dealers and retailers involved in the storage / handling of vehicles and replacement batteries have a responsibility to ensure that only a fully charged battery may be processed through the distribution selling chain.

2. GENERAL RULES FOR BATTERY CARE

2.1 Dealer Demonstration Vehicles

Vehicles used as dealer demonstrator(s), in a showroom, must be connected to a showroom conditioner capable of delivering 50 Amps. This will prevent the battery from being damaged.

2.2 Software Reflash, SDD work or Ignition On related workshop activities

Due to the high electrical current demand and high depth of Discharge that can occur during vehicle software re-flash activities, SDD work or ignition on related work in the workshop, vehicles that are undergoing such activities **MUST** have a power supply capable of delivering 50 Amps or more.

2.3 Extended Vehicle Rework

For any extended vehicle rework that results in consuming vehicle power, either the battery should be disconnected or a suitable power supply connected.

2.4 Jump Starting New vehicles before they have been delivered to the customer

- It is the dealer / retailers responsibility to make sure the battery is not allowed to go flat by following the instructions and processes defined in this manual.
- However, if circumstances dictate that a new vehicle must be jump started due to a flat battery whilst the vehicle is in the dealer / retailers care, **the battery on this vehicle must be replaced with a new one** prior to delivery to the customer at the dealer / retailers liability.
- The vehicle should also undergo investigation as to why the battery went flat.
- Do not connect the jump starting cable to the negative (-) terminal of the battery. Always connect to the recommended earth point. As defined in the owners handbook or service documentation for that vehicle.

2.5 AGM Batteries

- **AGM batteries must not be charged above 14.8 Volts. Doing so will damage them.**
- AGM Batteries must be tested with a capable battery tester as **detailed in the equipment section (Section 5) of this procedure.**



NOTE: Under no circumstances should the battery be disconnected with the engine running because under these conditions the alternator can give a very high output voltage. This high transient voltage will damage the electronic components in the vehicle. Loose or incomplete battery connections may also cause high transient voltage.

3. HEALTH AND SAFETY PRECAUTIONS

WARNINGS:



BATTERY CELLS CONTAIN SULPHURIC ACID AND EXPLOSIVE MIXTURES OF HYDROGEN AND OXYGEN GASES. IT IS THEREFORE ESSENTIAL THAT THE FOLLOWING SAFETY PRECAUTIONS ARE OBSERVED.



Batteries emit highly explosive hydrogen at all times, particularly during charging. To prevent any potential form of ignition occurring when working in the vicinity of a battery:

- Do not smoke when working near batteries.
- Avoid sparks, short circuits or other sources of ignition in the battery vicinity.
- Switch off current before making or breaking electrical connections.
- Ensure battery charging area is well ventilated.
- Ensure the charger is switched off when: a) connecting to a battery; b) disconnecting from the battery.
- Always disconnect the ground cable from the battery terminal first and reconnect it last.



Batteries contain poisonous and highly corrosive acid. To prevent personal injury, or damage to clothing or the vehicle, the following working practices should be followed when topping up, checking electrolyte specific gravity, removal, refitting or carrying batteries:

- Always wear suitable protective clothing (an apron or similar), safety glasses, a face mask and suitable gloves.
- If acid is spilled or splashed onto clothing or the body, it must be neutralized immediately and then rinsed with clean water. A solution of baking soda or household ammonia and water may be used as a neutralizer.
- In the event of contact with the skin, drench the affected area with water. In the case of contact with the eyes, bathe the affected area with cool clean water for approximately 15 minutes and seek urgent medical attention.
- If battery acid is spilled or splashed on any surface of a vehicle, it should be neutralized and rinsed with clean water.
- Heat is generated when acid is mixed with water. If it becomes necessary to prepare electrolyte of a desired specific gravity, SLOWLY pour the concentrated acid into water (not water into acid), adding small amounts of acid while stirring. Allow the electrolyte to cool if noticeable heat develops. With the exception of lead or lead-lined containers, always use non-metallic receptacles or funnels. Do not store acid in excessively warm locations or in direct sunlight.



Due to their hazardous contents, the disposal of batteries is strictly controlled. When a battery is scrapped, ensure it is disposed of safely, complying with local environmental regulations. If in doubt, contact your local authority for advice on disposal facilities.

4. BATTERY CARE REQUIREMENTS

4.1 RECEIPT OF A NEW VEHICLE

Within 24 hours of receipt of a new vehicle, a battery condition check must be carried out in accordance with the battery test process utilizing an appropriate tester as outlined in **the equipment section (Section 5) of this procedure**.



NOTE: The midtronics code must be recorded on the form.

Any actions must be carried out in accordance with the table shown in the **determining battery condition section (Section 6) of this procedure**. The details must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.

For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).

4.2 NEW VEHICLE STORAGE

If the vehicle is to be stored the transit relays MUST be refitted and / or the vehicle put into transport mode.

Transit relay removal / vehicle placed in normal mode should only be completed a maximum of 72 hours prior to handover to customer

For vehicles without either a transit mode or transit relay the battery negative cable must be DISCONNECTED from the battery.

The battery must be tested and/or re-charged every 30 days and MUST be re-charged after every 90 day period.



NOTE: The midtronics code must be recorded on the form.

Any actions must be carried out in accordance with the table shown in the **determining battery condition section (Section 6) of this procedure**. The details must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.

For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).

4.3 PDI / DELIVERY TO CUSTOMER

Before the vehicle is handed over to the customer and as part of the PDI, the condition of the battery needs to be confirmed. The battery condition must be checked in accordance with the battery test process utilizing an appropriate tester as outlined in **the equipment section (Section 5) of this procedure**.



NOTE: The midtronics code must be recorded on the form.

Any actions must be carried out in accordance with the table shown in the **determining battery condition section (Section 6) of this procedure**. The details must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.

For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).

4.4 REPLACEMENT BATTERIES FOR SERVICE

All service replacement batteries must have the battery condition checked within 24 hours of receipt and controlled on a 'First In First Out' basis to ensure batteries are not allowed to age unnecessarily.

For batteries in storage and not yet fitted to a vehicle, they must be stored in a dry environment, not in direct sunlight or under any direct heat source. Any batteries exhibiting any forms of damage or corrosion must not be fitted to any vehicle. Any batteries which are dropped must be scrapped, this applies even if no external damage is apparent.

The battery condition must be checked every 30 days in accordance with the battery test process utilizing an appropriate tester as outlined in **the equipment section (Section 5) of this procedure**.

Any actions must be carried out in accordance with the table shown in the **determining battery condition section (Section 6) of this procedure**. The details must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.

For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).

4.5 BATTERY MAINTENANCE

Any battery whether it is in a vehicle or a replacement part must be tested and/or re-charged every 30 days and MUST be re-charged after every 90 day period.

4.6 BATTERY TEST PROCESS

It is recommended that this test is conducted at least 24 hours after the vehicle engine has been run or the battery charged to avoid the need of surface charge removal. If time constraints make this unacceptable then the surface charge must be removed.

Surface Charge Removal

A vehicle which has had its battery charged or been driven in a 24 hour period before the test, must have its surface charge removed.

- Turn on the ignition but do not start the vehicle
- Switch on the headlamps on high beam for a minimum 3 minutes
- Switch off the headlamps
- Wait a minimum of 5 minutes before recording test results for any battery measurements

Battery Test

The battery may be tested either on a bench or on the vehicle.

The battery condition must be checked in accordance with the battery test process utilizing an appropriate tester as outlined in **the equipment section (Section 5) of this procedure**.



NOTE: The midtronics code must be recorded on the form.

Any actions must be carried out in accordance with the table shown in the **determining battery condition section (Section 6) of this procedure**. The details must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.

For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).



CAUTION: DO NOT connect the tester to any other circuit or chassis point other than the battery negative terminal.

5. EQUIPMENT

All equipment used must be functionally capable of meeting the compliance requirements. Please refer to the approved equipment document.

In the case of batteries fitted to a new vehicle at the dealership, battery condition should be measured using the appropriate hand-held Midtronics tester as follows:

Battery Type	Battery Tester	Battery Tester
	Jaguar	Land Rover
Flooded	Midtronics MCR 394 & 494 Midtronics EXP1080 & GR1/GRX	Midtronics MCR 393 & 493 Midtronics EXP1080 & GR1/GRX
AGM	Midtronics EXP1080, GR1/GRX	Midtronics EXP1080, GR1/GRX

The test results must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.

For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).



NOTE: All equipment must be calibrated

6 DETERMINING BATTERY CONDITION

TESTER RESULTS	ACTION
GOOD BATTERY	Return to service.
GOOD RE-CHARGE	Fully charge battery and return to service.
CHARGE AND RE-TEST	Fully charge battery. Remove surface charge. Re-test battery. If same result replace battery.
REPLACE BATTERY OR BAD CELL BATTERY	Verify surface charge removed. Disconnect battery from vehicle and re-test. If result repeats after surface charge removal, replace battery. DO NOT RECHARGE.
UNABLE TO DO TEST	Disconnect battery from vehicle and re-test.

7 BATTERY CHARGING

It is essential that a suitably ventilated defined area exists in each dealership / retailer for battery charging.



CAUTION: It is very important that when charging batteries using the traction charger or other stand-alone chargers that the charger is set for the correct type of battery before charging commences. If the wrong switch is selected the result would be a battery that is not charged fully and / or overheating can occur. Follow the manufacturers operating instructions.

Batteries **MUST BE** tested and if necessary charged every 30 days and charged after 90 days irrespective of any test. It is recommended that dealers / retailers always have fully charged batteries ready for use.



CAUTION: Do not charge AGM batteries with voltages over 14.8 Volts as this will damage the battery.

A designated controlled area must be allocated for scrap batteries and clearly controlled as such.

To bring a discharged but serviceable battery back to a fully charged condition proceed as follows:

- Check and if necessary top-up the battery electrolyte level. (Flooded maintainable batteries only)
- Charge the battery using a charger as detailed in the approved equipment document following the manufacturers operating instructions.



NOTE: When using the Midtronics Diagnostic Charger, automatic mode must always be used. After charging and analysis, the charger may display 'Top-Off Charging', Hit STOP To End. Do not stop charging until the current falls to 5A or less, otherwise the battery will not be fully charged.

Following charging a post charge battery condition test must be carried out in accordance with the table shown in the **determining battery condition section (Section 6) of this procedure.**



NOTE: The midtronics code must be recorded on the form.

Any actions must be carried out in accordance with the table shown in the **determining battery condition section (Section 6) of this procedure.** The details must be recorded on the New Vehicle Storage Form which is part of the new vehicle storage document.

For additional information, refer to: New Vehicle Storage Form (100-11, Description and Operation).

8 BATTERY REPLACEMENT

If it is determined that a battery requires replacement, always refer to the appropriate section of the workshop manual for instructions on removing and installing the battery from the vehicle.

On in service vehicles fitted with a Battery Monitoring System (BMS), the BMS module must be reset following the installation of a new battery. The BMS module reset procedure must be performed using an approved diagnostic system.

9 CONFIRMING ELECTROLYTE LEVEL

WARNINGS:



BEFORE CHECKING AND TOPPING-UP THE BATTERY ELECTROLYTE, REFER TO THE HEALTH AND SAFETY PRECAUTIONS SECTION.



AGM TECHNOLOGY BATTERIES ARE FULLY SEALED FOR LIFE AND NO ATTEMPT SHOULD BE MADE TO CHECK OR TOP UP THE ELECTROLYTE LEVEL.

On certain types of battery the electrolyte level may need to be checked.

- Make sure the battery is of a type suitable for topping up. These types of batteries will have cell plugs visible on the top face of the battery or a removable access panel to allow access to the cells.
- On batteries with a clear or opaque case and level marks, check the electrolyte level by visual inspection of the maximum level indicator mark on the battery casing indicating adequate level above the battery separators.
- On batteries with black cases, remove the cell plugs or access panel and ensure the electrolyte level is level with the indicator in the cell hole. A flashlight may be required to see the electrolyte level on this type of battery.
- If the electrolyte level is low, top-up using distilled water.



NOTE: Maintenance free and Valve Regulated (AGM) batteries are sealed and therefore cannot be topped up.



CAUTION: **DO NOT** overfill.

Battery and Charging System - General Information - Quiescent Drain

Description and Operation

VEHICLE QUIESCENT CURRENT TESTING

On vehicles fitted with a Battery Monitoring System (BMS), the diagnostic routine for quiescent drain testing in the approved Jaguar or Land Rover diagnostic system should be utilized.

If a customer complains of a vehicle battery that discharges continuously or when left for a prolonged period of time, it is recommended that a quiescent drain test is performed as described below.

The battery drain should be measured using the approved Jaguar or Land Rover diagnostic system or a Digital Multi-Meter (DVOM). A procedure for quiescent drain measurement using the diagnostic system is available in the Diagnosis and Testing section of the Workshop Manual. The vehicle should be in the locked/armed state (for example vehicle alarm fully armed), all doors, engine and luggage compartment lids are open and latched (so as to appear closed from an electrical point of view). The test should take place after the vehicle has entered shutdown mode. The time taken for this to occur after the ignition is switched off varies according to model (Refer to the Topix On line resource for details).

When the vehicle is armed, the effect of the security system Light Emitting Diode (LED) flashing is to cause a pulsation in the measured current drain. In this case, either the average current should be taken (using a Digital Multi-Meter (DVOM) with an averaging system) or the current reading taken, ignoring the brief high current peaks.

EQUIPMENT

Approved Jaguar or Land Rover diagnostic system with current probe **OR** Digital Multi-Meter (DVOM) with current probe.

METHOD OF MEASUREMENT

Using an Approved Jaguar or Land Rover Diagnostic System.

1. Switch off all electrical loads and ensure that the ignition is off
2. Connect the current probe to the approved Jaguar or Land Rover diagnostic system
3. Calibrate the probe
4. Install a clamp around the battery lead/junction box lead
5. Go to the Quiescent Current Testing section in this procedure

Using a digital multimeter

Do not use an in-line DVOM to measure the quiescent drain on vehicles fitted with an electronic throttle (for example Range Rover 2002MY onwards). The current exceeds the maximum amount the fuse in the DVOM is capable of handling.

1. Switch off all electrical loads and ensure that the ignition is off
2. Connect the current probe to the digital multimeter
3. Calibrate the probe
4. Install a clamp around the battery lead/junction box lead
5. Go to the Quiescent Current Testing section in this procedure

QUIESCENT CURRENT TESTING

1. Switch ignition to 'on' or select ignition mode in keyless vehicles and switch to 'off' (do not crank)
2. Remove key from ignition switch (if equipped)
3. Open and latch all doors, hood and luggage compartment lid
4. Lock the vehicle using the remote function on the remote handset. (Single lock only to avoid volumetric alarm arming)
5. Remove any other potential electrical drains such as accessories plugged into accessory sockets
6. Record the amperage readings after the shutdown period referenced in the Topix on line resource for details. Note all cars from 10MY onwards should be less than 30mA after 30 minutes
7. Record the final reading on the battery report form

The preferred method of testing following an excessive current consumption figure is to use a current probe around individual junction box leads to the various suspected circuits to identify a potential cause. This is in preference to the old method of removing fuses for the following reasons:

The drain may be caused by a module remaining active and preventing the quiescent drain from reducing to normal levels

The drain may be caused by a relay winding that is activated. Pulling the fuse can allow this to 'reset' and the drain will be lost and go un-diagnosed

Land Rover Quiescent Drain Values

MODEL	SHUT DOWN PERIOD (minutes)	TYPICAL VALUES BATTERY DRAIN (mA)
Range Rover (LM) - Up to 2009MY	30	<30
Range Rover (LM) - From 2010MY	20 (after lock/arm condition) 2	<30

	33 (unlocked)	<30
Range Rover (LG) From 2013MY	<10 (after lock/arm condition) ²	<20
	<20 (unlocked)	<20
Range Rover Sport (LS) - Up to 2007MY	30	<30
Range Rover Sport (LS) - From 2007MY to 2010MY	30	<30
	33 (unlocked)	<30
Range Rover Sport (LS) - From 2010MY	10 (after lock/arm condition) ²	<20
	30 (unlocked)	<20
Range Rover Evoque (LV) - From 2012MY	20 (after lock and arm condition) ²	<20
	<20 (unlocked)	<20
Discovery 3/LR3 (LA) - Up to 2007MY	30	<30
Discovery 3/LR3 (LA) - From 2007MY to 2010MY	30	<30
	33 (unlocked)	<30
Discovery 4/LR4 (LA) - From 2010MY	<20 (after lock/arm condition) ²	<20
	<20 (unlocked)	<20
Freelander (LN) - Up to 2007MY	30	<30
Freelander 2/LR2 (LF) - From 2007MY	35 (single locked or unlocked)	<25
	15 (double locked)	<25
Defender (LD) - 1998MY to 2007MY	30	<25
Defender (LD) - from 2007MY	<30	<30
Discovery Series 2 (LT)	30	<30



NOTE:

1. The total current drain will be higher if certain approved accessories are fitted (for example: tracker, trailer module, etc.)
2. Applies to vehicles without Tire Pressure Monitoring System (TPMS). Vehicle shut-down period with TPMS is approximately 15 minutes.

Battery and Charging System - General Information - Battery Report Form – In Service Batteries Only

Description and Operation

BATTERY REPORT FORM - IN SERVICE BATTERIES ONLY



NOTE: Fields marked with * are mandatory and must be completed.

General Information										
*Vehicle Identification Number (VIN):				*Repair Date:	Vehicle Model:					
*Mileage:					Engine type:					
Customer Questions										
*1: What is the customer's reason for dealer visit? (tick symptoms as appropriate)				Non crank	Crank but non start	Warning message	Other:			
*2: How long was the vehicle left prior to issue.				*						
*3: How was the car left (Locked/unlocked)				*						
*4: How did you access to the vehicle				Key fob	Manual key	Handle pull				
*5: Has the vehicle required assistance for battery issues previously?						Yes	No			
*6: Is the vehicle used? (tick symptoms as appropriate)				Daily	Every other day	Weekly	Less than weekly			
*7: Average journey length				*						
*8: How many starts do you typically do in a day				*						
*9: Did the customer see any instrument pack warnings prior to the issue?				*						
*10: Have any of the features been used without the engine running in the last 3 days (if fitted?)				Radio	Power point accessory	CD	DVD	USB or IPOD connection	TV	Rear seat entertainment
11: Customer comments:- Please add any additional comments that are relevant.				*						
Diagnostics (Battery Testing)										
1: Loose battery clamps				Yes	*	No	*			
2: Loose hold down clamps				Yes	*	No	*			
3: Corroded terminal posts				Yes	*	No	*			
4: Physical damage/leaks				Yes		No	*			
5: Low electrolyte (Flooded batteries only)				Yes	*	No	*			
6: Battery Date Code				*						
7: FEAD belt tension				OK	*	Not OK	*			
8: Quiescent Drain				mA	*					
9: Vent tube correctly installed				Yes	*	No	*			
10: Number of Times Battery Charged:				*						
10: Vent tube correctly installed				Yes		No				
11: Remove the Surface (414-00 battery care requirements)				Yes	*	No	*			
12: Battery voltage				*						
13: Midtronics test code before charging (EXP-1080)				*						
13a: If Midtronics indicates that the battery needs re-charging, charge the battery following instructions on the recommended battery charger				*						
13b: Midtronics test code after charge				*						
13c: Midtronics test code result after charge				*						
13d: If "good and re-charge" charge the battery following instructions on the recommended battery charger				*						
13e: If "charge and re-test" for both before and after the charge renew the battery				*						
13f: Only renew the battery if "renew battery", "bad cell" or charge and re-test has been displayed twice.				*						
Technician Comments:- Please add any additional comments that are relevant.										
*										
*										
*										
*										
*										

Battery and Charging System - General Information - Charging System

Diagnosis and Testing

Principle of Operation

For a detailed description of the charging system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to:

Generator (414-02B, Description and Operation),
 Generator (414-02B, Description and Operation),
 Generator (414-02B, Description and Operation),
 Generator (414-02C, Description and Operation),
 Generator (414-02C, Description and Operation),
 Generator (414-02C, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Generator • Auxiliary drive belt • Auxiliary drive belt tensioner • Generator pulley • Check the security of the generator fittings 	<ul style="list-style-type: none"> • Generator • Battery • Starter motor • Harnesses and connectors • Fuses • Charge warning indicator function • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Charge warning indicator does not come on	<ul style="list-style-type: none"> • Bulb/circuit fault • Generator fault • Controller Area Network (CAN) circuit fault • Engine Control Module (ECM) fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index
Charge warning indicator stays on / battery discharges	<ul style="list-style-type: none"> • Auxiliary drive belt broken • Generator pulley slipping on shaft • Generator fault • Battery cable fault • Controller Area 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the generator circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index • Check the auxiliary drive belt condition and tension • Check that the pulley does not rotate independently of the generator

	<ul style="list-style-type: none"> Network (CAN) circuit fault Engine Control Module (ECM) fault 	
Charge warning indicator intermittent	<ul style="list-style-type: none"> Auxiliary drive belt slipping Battery cable fault Generator wiring fault Generator fault Controller Area Network (CAN) circuit fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the generator circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index Check the auxiliary drive belt condition and tension Check that the pulley does not rotate independently of the generator
Battery discharges without the charge warning indicator staying on	<ul style="list-style-type: none"> Battery fault Battery quiescent drain Intermittent generator fault 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and test the battery Refer to the relevant section of the workshop manual and test the battery quiescent drain Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index
Noise (mechanical)	<ul style="list-style-type: none"> Auxiliary drive belt slipping Generator fault 	<ul style="list-style-type: none"> Check the auxiliary drive belt condition and tension Remove the auxiliary drive belt and check that the generator rotates freely

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: (100-00)

Diagnostic Trouble Code (DTC) Index - TDV6 3.0L Diesel, DTC: Engine Control Module (PCM) (Description and Operation),
Diagnostic Trouble Code (DTC) Index - V8 5.0L Petrol, DTC: Engine Control Module (PCM) (Description and Operation).

Battery, Mounting and Cables -

General Specification

Item	Specification
Vin Range: Up to 6A381322	
Battery - 4.0 and 4.4 litre petrol engines:	
Voltage	12
Capacity	75 amp/hour, 690 amps
Reserve capacity	150 minutes
Battery - 2.7 litre diesel engine:	
Voltage	12
Capacity	90 amp/hour, 825 amps
Reserve capacity	190 minutes
Vin Range: From 6A381323	
Battery - 4.0 and 4.4 litre petrol engines:	
Type	Flooded Lead Acid
Voltage	12
Capacity	80 amp/hour, 700 amps
Reserve capacity	140 minutes
Battery - 2.7 litre diesel engine:	
Type	Flooded Lead Acid
Voltage	12
Capacity	90 amp/hour, 825 amps
Reserve capacity	190 minutes
Vin Range: From AA000001	
Battery - 4.0 and 5.0 litre petrol engines:	
Type	Flooded Lead Acid
Voltage	12
Capacity	80 amp/hour, 700 amps
Reserve capacity	140 minutes
Battery - 2.7 and 3.0 litre diesel engines:	
Type	Flooded Lead Acid
Voltage	12
Capacity	90 amp/hour, 825 amps
Reserve capacity	190 minutes
Vin Range: From BA587522 to CA617875	
Battery - 4.0 and 5.0 litre petrol engines:	
Type	Flooded Lead Acid
Voltage	12
Capacity	80 amp/hour, 700 amps
Reserve capacity	140 minutes
Vin Range: From BA572502 to BA596276	
Battery - 2.7 and 3.0 litre diesel engines:	
Type	Flooded Lead Acid
Voltage	12
Capacity	90 amp/hour, 950 amps
Reserve capacity	190 minutes
Vin Range: From BA596277 to DA652955	
Battery - 2.7 and 3.0 litre diesel engines:	
Type	AGM
Voltage	12
Capacity	80 amp/hour, 700 amps
Reserve capacity	140 minutes
Vin Range: CA617876 onward	
Battery - 5.0 litre petrol engine:	
Type	Flooded Lead Acid
Voltage	12
Capacity	80 amp/hour, 700 amps
Reserve capacity H7	140 minutes
Reserve capacity H8	160 minutes
Vin Range: DA652956 onward	
Battery - 3.0 litre diesel engine:	
Type	AGM
Voltage	12
Capacity	90 amp/hour, 850 amps
Reserve capacity	150 minutes
Vin Range: EA000001 onward	

Battery - 3.0 litre petrol engine:	
Type	AGM
Voltage	12
Capacity	90 amp/hour, 850 amps
Reserve capacity	150 minutes

Secondary Battery

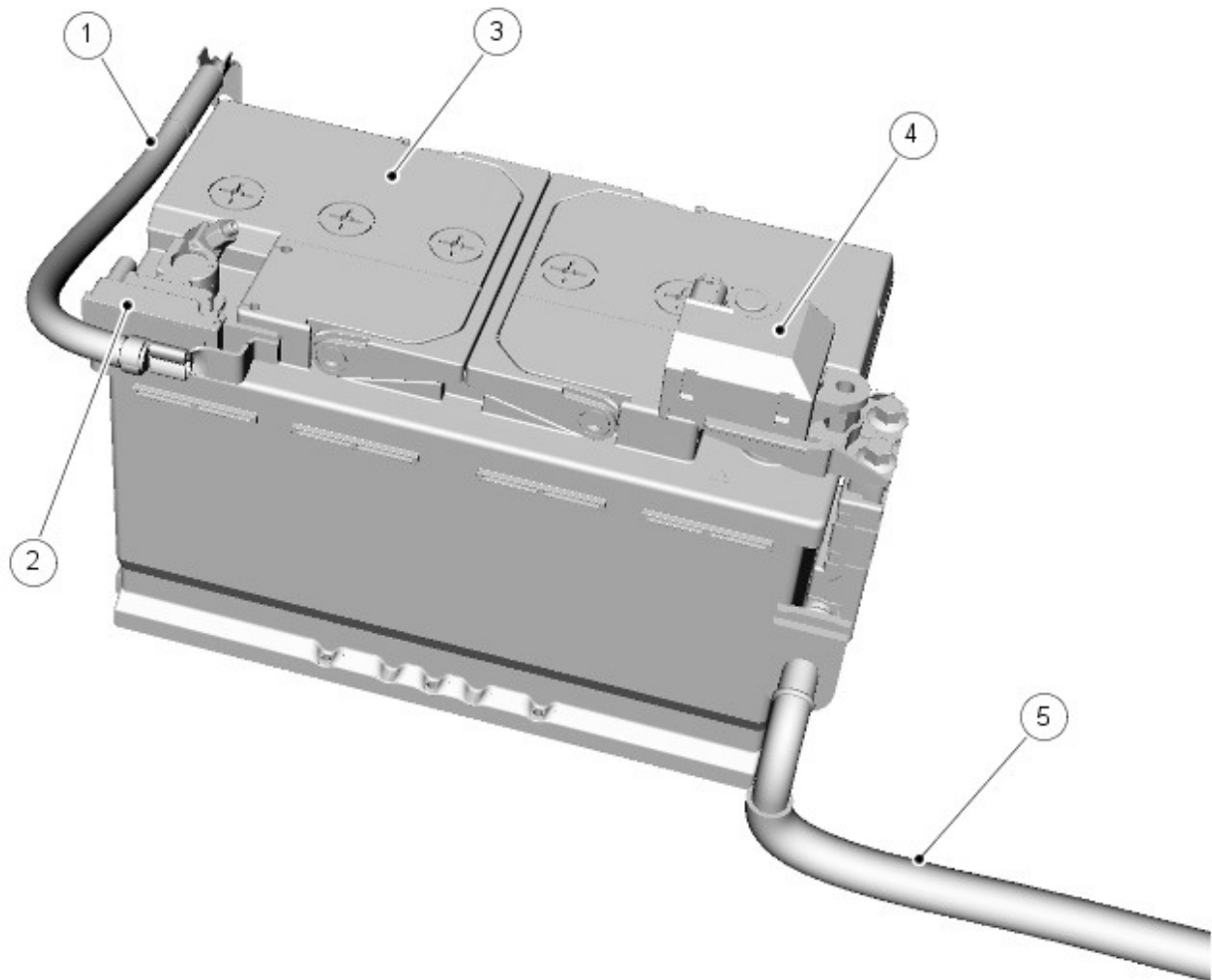
Item	Specification
Vehicles with Stop/Start system	
Voltage	12
Capacity	14 amp/hour

Torque Specifications

Item	Nm	lb-ft	lb-in
Battery terminal nuts	5	-	44
Battery clamp bolts	5	-	44
Battery tray nuts	12	9	-
Secondary battery terminal nuts	6	4	-
Secondary battery clamp bolts	6	4	-
Secondary battery tray nuts	12	9	-

Battery, Mounting and Cables - Battery and Cables

Description and Operation



E133243

Item	Part Number	Description
1	-	-VE battery cable
2	-	Battery monitoring module
3	-	Battery
4	-	Transit relay
5	-	+VE battery cable

GENERAL

The battery is located between the bulkhead and the secondary bulkhead, in a protective box, on the passenger side. It sits in a tray and is secured with clamp plates and bolts.

The battery terminal posts allow for the battery cables to be connected with clamp type connections. The battery positive terminal uses a pyrotechnic attachment, which detaches the battery cable in the event of a crash of a severity to trigger the airbags. For additional information, refer to: Air Bag and Safety Pretensioner Supplemental Restraint System (SRS) (descop 501-20B).

All models are fitted with Delphi lead-calcium, maintenance free battery. Each battery is similar in construction with the battery rating varying according to application. There are two different battery sizes:

- H7 - All petrol variants
- H8 - TdV6

The battery uses 'calcium expanded' technology, which has both positive and negative plates with grids expanded from a strip lead-calcium alloy.

The battery is semi-sealed. Each casing has a vent to allow for thermal expansion and to vent oxygen and hydrogen gases, which are produced under certain charging conditions.

The battery incorporates an integral, temperature compensated hydrometer to provide a visual indication of the relative density and level of the electrolyte. The indicator shows different colours to show battery condition as follows:

- GREEN – shows that the battery is charged and in a serviceable condition
- DARK (turning to black) – shows that the battery is in a low state of charge and requires recharging
- CLEAR or YELLOW – the battery is no longer serviceable and must be replaced.

If the battery shows CLEAR or YELLOW the battery has an internal fault. Do not attempt to charge or jump-start the vehicle with the battery in this condition.

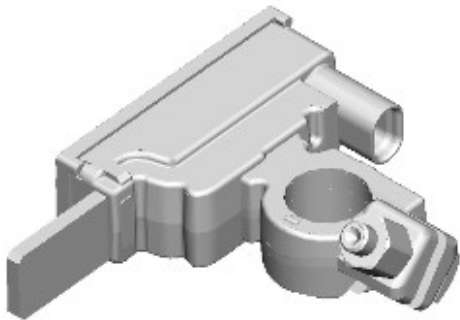
When removing the battery, ensure that the alarm is disarmed and that the ignition is switched off. Always disconnect the negative terminal first and then the positive terminal. When refitting the battery, always fit the positive terminal first followed by the negative terminal.

If the battery requires recharging, always use an approved constant current charger, designed for lead-calcium batteries. DO NOT use a fast charger, permanent damage to the battery may occur.

Delivery Mode

The vehicle is fitted with a transit relay. This is a disposable device and **NOT** for use by the customer. This relay fits in series with the battery and ground; it disconnects the battery from the vehicle's ground and thus eliminates quiescent current during delivery. The relay must be removed before delivery to the customer.

Battery Monitoring System



E115177

Optimal battery health is a fundamental factor in the correct operation of the Stop/Start system, therefore to calculate and communicate the battery status a Battery Monitoring System (BMS) module is introduced.

BMS Low Battery Warning and Energy Management Messages

The BMS continuously monitors the condition of the primary vehicle battery. If excessive battery discharge occurs, the system will begin to shut down non-essential electrical systems in order to protect the battery.

If the BMS calculates that battery condition is not within set parameters, there are 3 messages that can be displayed, 2 on the touch screen and 1 on the message center. These inform the user that the battery is either at a low level of charge or the engine-off power consumption limit has been exceeded.

- **Low Battery - Please switch engine on or system will shutdown in 3 minutes:** is displayed as a **Warning** on the touch screen if the engine is not running. This indicates that the battery has fallen below a predefined threshold. As soon as the battery is charged back above this threshold then the message will be removed.
- **Low Battery - Please start your engine** is displayed on the message center if the engine is not running. This indicates that the battery has fallen below a predefined threshold. As soon as the battery is charged back above this threshold then the message will be removed or it can be manually removed by pressing 'OK'.
- **System will shut down in 3 minutes:** is displayed as an **Energy management** on the touch screen if the engine is not running, and system features are causing excessive battery discharge. After 3 minutes the BMS will begin shutting down vehicle systems. Normal system operation will resume when the engine is started.

This is based on a percentage of battery capacity available for the customer to use with the engine off. The percentage can change based upon several factors.

Once triggered, the resetting of this message will not occur until the vehicle is driven for 10 minutes with the engine running (to allow the battery to recoup any lost charge). However, if the engine is run for less than 10 minutes, the message will only be displayed after an additional 5 minutes with the ignition on but engine off.

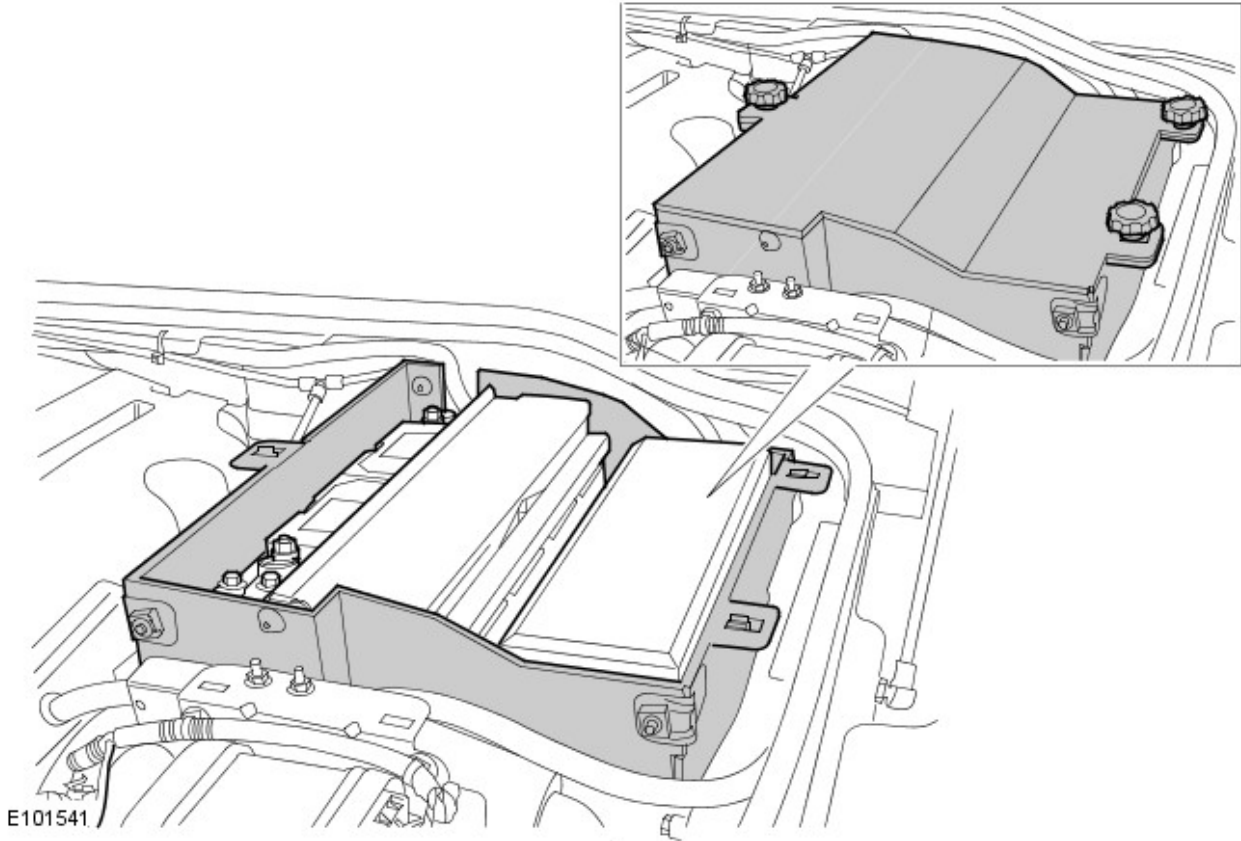
Battery, Mounting and Cables - Battery and Cables

Description and Operation

Battery

To protect the vehicle's electrical system the main battery and battery junction box are enclosed in an armoured casing. The casing-lid can be removed to gain access to the battery and junction box.

Main battery armoured casing



Split Charging

Overview

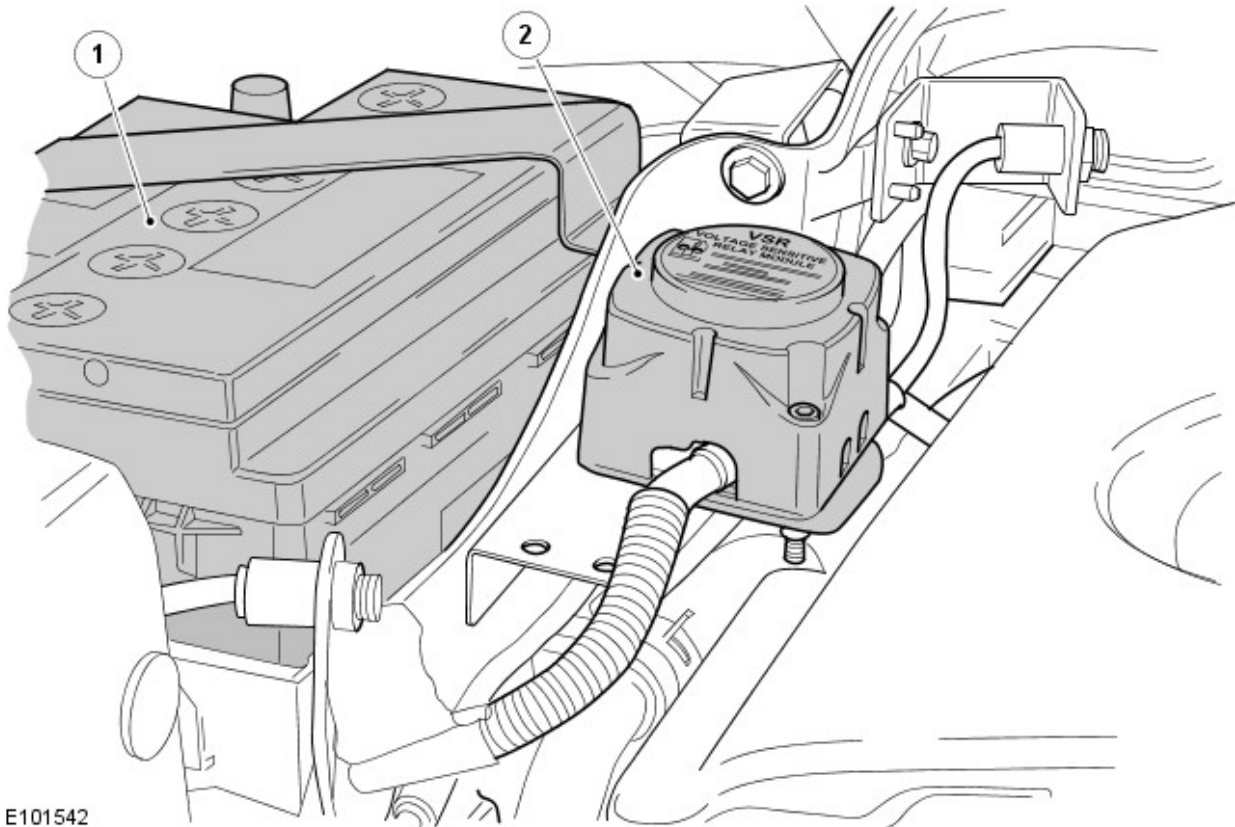
To protect the vehicle's electrical system a split-charging system is employed. This allows the electrically powered accessories associated with the armoured vehicle to be operated independently, therefore preserving the condition of the vehicle's main battery.

System Operation

The split-charging system comprises:

- An auxiliary battery, mounted in the engine compartment on the opposite side to the main battery.
- A voltage sensitive relay, mounted next to the auxiliary battery.
- A satellite junction box, mounted in the base of the floor-console stowage compartment.
- A battery status monitoring switch, located in the auxiliary switch pack.
- A battery status monitoring lamp, located in the auxiliary switch pack.

Auxiliary battery and relay



E101542

Item	Part Number	Description
1	-	Auxiliary battery
2	-	Voltage sensitive relay

NOTES:



All the accessories associated with the armoured vehicle are powered via the satellite junction box. Refer to 'Satellite Junction Box' below.



The generator is the same as fitted to standard vehicles.

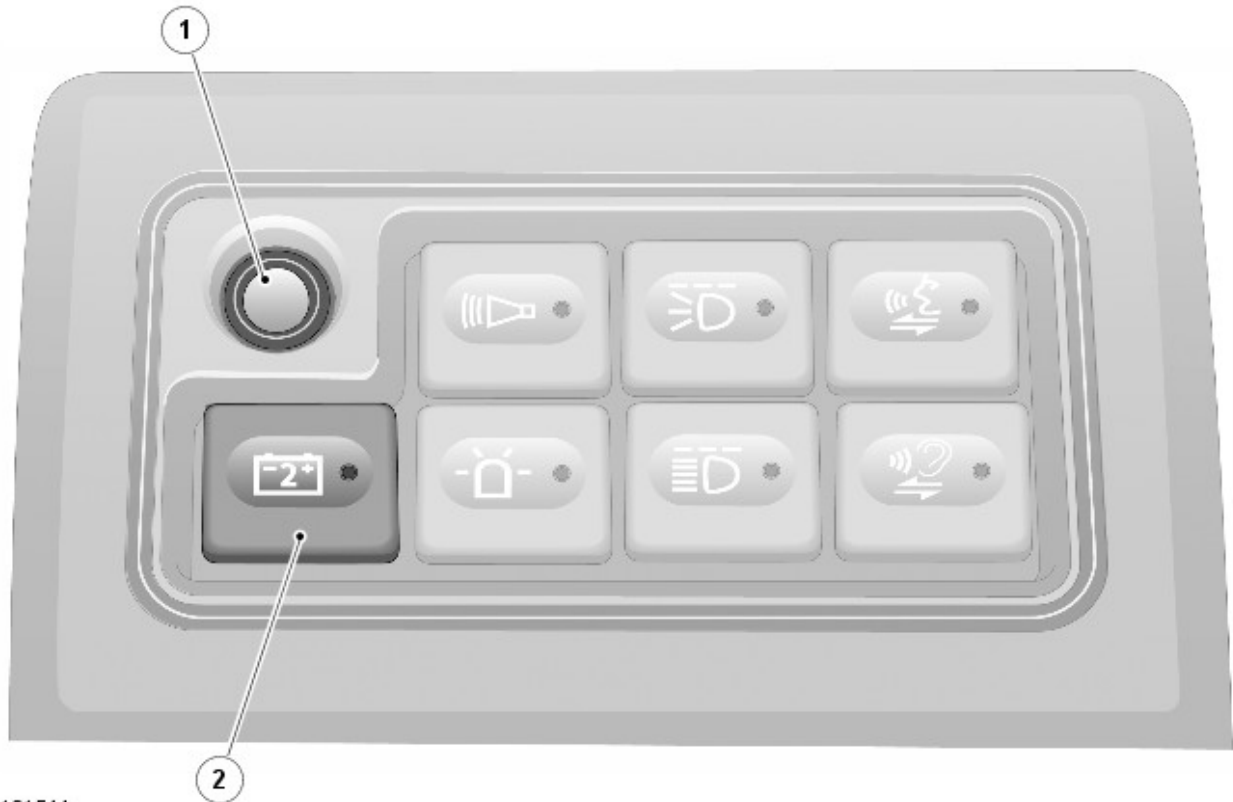
When the engine is running, the voltage sensitive relay monitors the charging voltage from the generator. If the voltage rises above 13.7 volts, the contacts in the relay close, which connects the auxiliary and main battery in parallel. This allows the generator to charge both batteries simultaneously.

If any accessories connected to the satellite junction box are being used when the engine is not running and the main-battery voltage drops below 12.8V, the voltage sensitive relay contacts will open. This removes the main battery from the circuit, leaving the auxiliary battery to power its associated armoured accessories.

The voltage status of the auxiliary battery can be monitored when the ignition is 'Off' by using the switch and status monitoring lamp in the auxiliary switch pack. A lamp in the battery switch will illuminate when the switch is in the 'On' position.

The status monitoring lamp provides an indication of the auxiliary battery's condition; refer to the 'Auxiliary battery status monitoring lamp' table below. The monitoring lamp has integral ambient light detection, which reduces the LED (light emitting diode) brightness under low-light conditions. The lamp is supplied by a 3 Amp fuse (F5) in the satellite junction box.

Auxiliary switch pack



E101544

Item Part Number Description

- 1 - Auxiliary battery, status monitoring lamp
- 2 - Auxiliary battery, status monitoring switch with integral lamp

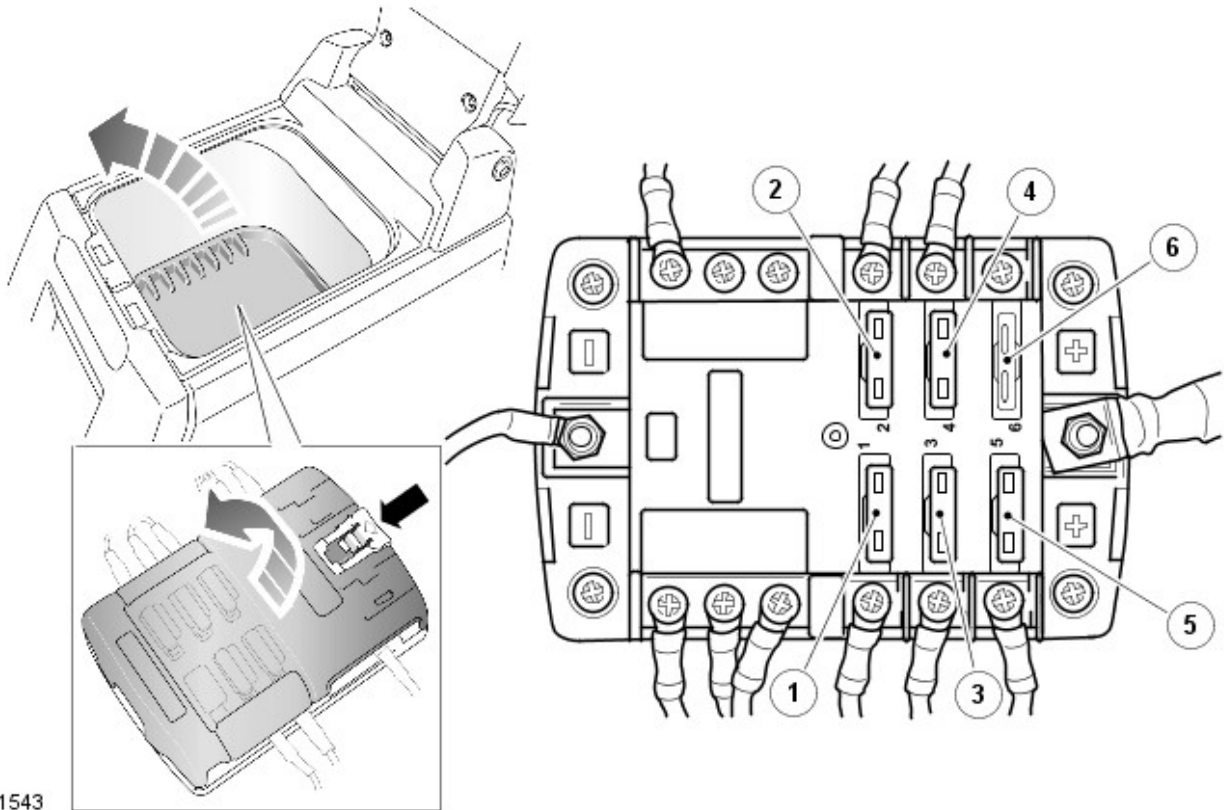
Auxiliary battery status monitoring lamp

Colour	Battery Voltage	Meaning
Slow Flashing RED	Less than 10.5 volts	Extreme under voltage (recharge battery immediately)
Continuous RED	10.5 volts	Battery capacity nearly exhausted
Fluctuating between RED and GREEN	10.5 to 12.5 volts	Battery discharging
Continuous GREEN	More than 12.5 volts	Fully charged, battery at rest
Flashing GREEN	More than 13.8 volts	Battery on charge
Fast Flashing RED	More than 15.25 volts	Battery overcharging (investigate)

Satellite Junction Box

The satellite junction box is mounted in the base of the floor-console stowage compartment. All electrically powered accessories associated with the armoured vehicle are routed through the satellite junction box, via the armoured vehicle options harness.

Satellite junction box



E101543

Item	Part Number	Description
1	-	Intercom system – 5 amp fuse (F1)
2	-	Siren – 20 amp fuse (F2)
3	-	Covert lamps – 5 amp fuse (F3)
4	-	Beacon – 10 amp fuse (F4)
5	-	Battery status monitoring lamp - 3 amp fuse (F5)
6	-	Spare terminal – 30 amp fuse maximum (F6)

NOTES:



It is recommended that any additional electrical equipment (apart from authorised Land Rover accessories) fitted by the end user is connected to the spare terminal (F6) of the satellite junction box, with an appropriately rated fuse not exceeding 30 amps.



The supplementary circuit diagrams for the armoured vehicle are located in Land Rover GTR at: Service Information, Discovery 3, 2008 Electrical Circuit Diagrams.

Battery, Mounting and Cables - Battery

Diagnosis and Testing

Principles of Operation

For a detailed description of the battery system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (414-01 Battery, Mounting and Cables)

Battery and Cables (Description and Operation),
 Battery and Cables (Description and Operation),
 Battery and Cables (Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Generator • Drive belt • Drive belt tensioner • Generator pulley • Check the security of the generator fixings 	<ul style="list-style-type: none"> • Generator • Battery • Battery connections • Starter motor • Harnesses and connectors • Fuses • Charge warning lamp function • Engine Control Module (ECM)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

NOTES:



Generic scan tools may not read the codes listed, or may read only five digit codes. Match the five digits from the scan tool to the first five digits of the seven digit code listed to identify the fault (the last two digits give additional information read by the manufacturer-approved diagnostic system).



When performing electrical voltage or resistance tests, always use a digital multimeter (DMM) accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance, always take the resistance of the DMM leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



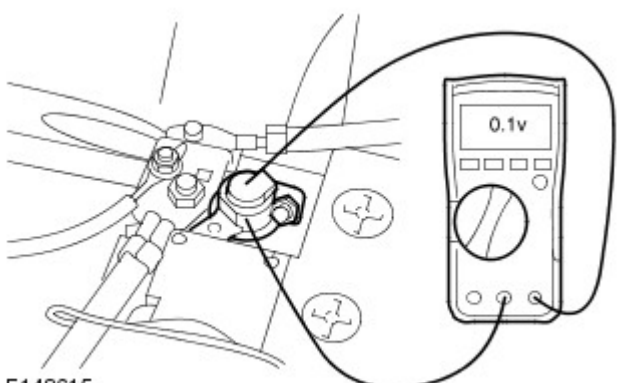
If DTCs are recorded and, after performing the pinpoint tests, a fault is not present, an intermittent concern may be the cause. Always check for loose connections and corroded terminals.

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.


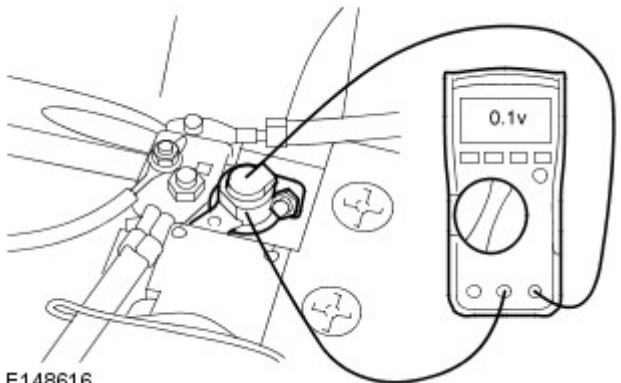
Midtronics EXP-1080 User Guide

Carry out the following: -

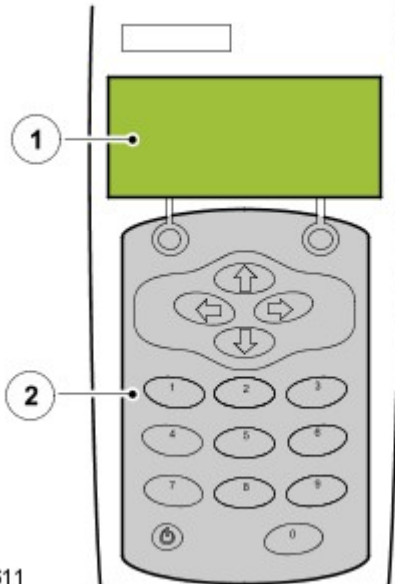
PINPOINT TEST A : VOLTAGE DROP	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: GROUND CIRCUIT	
NOTE: This test checks for high resistance between the battery terminal and the battery clamp	
	1 Start the engine, turn on the following: <ul style="list-style-type: none"> • (1) Air conditioning

 <p>E148615</p>	<ul style="list-style-type: none"> • (2) Blower fan on full speed • (3) Headlights on main beam • (4) Heated screen - rear • (5) Heated screen - front (if installed) • (6) Heated seats (if installed)
	<p>2 Connect the multimeter between the battery negative terminal and the battery clamp as shown in picture below (do not disconnect the battery at this stage)</p>
	<p>3 Set the multimeter to read DC voltage and record the reading</p>
	<p>Is reading equal to or below 0.1 volts? Yes GO to A2. No Switch all electrical loads and engine off, return the vehicle to an ignition off condition. Disconnect the battery negative clamp, clean clamp and terminal then reconnect and repeat test GO to A1.</p>

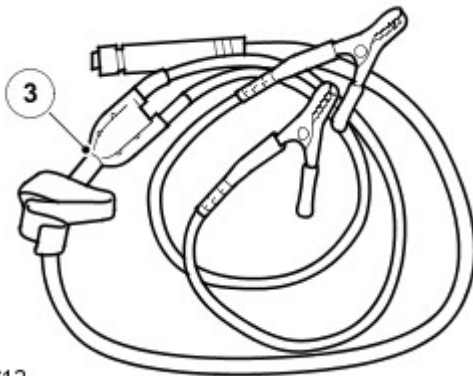
A2: POWER CIRCUIT

<p> NOTE: This test checks for high resistance between the battery terminal and the battery clamp</p>	
 <p>E148616</p>	<p>1 Start the engine, turn on the following:</p> <ul style="list-style-type: none"> • (1) Air conditioning • (2) Blower fan on full speed • (3) Headlights on main beam • (4) Heated screen - rear • (5) Heated screen - front (if installed) • (6) Heated seats (if installed)
	<p>2 Connect the multimeter between the battery positive terminal and the battery clamp as shown in picture below (do not disconnect the battery at this stage)</p>
	<p>3 Set the multimeter to read DC voltage and record the reading</p>
	<p>Is reading equal to or below 0.1 volts? Yes Carry out midtronics battery test procedure No Switch all electrical loads and engine off, return the vehicle to an ignition off condition. Disconnect the battery power clamp, clean clamp and terminal then reconnect and repeat test GO to A2.</p>

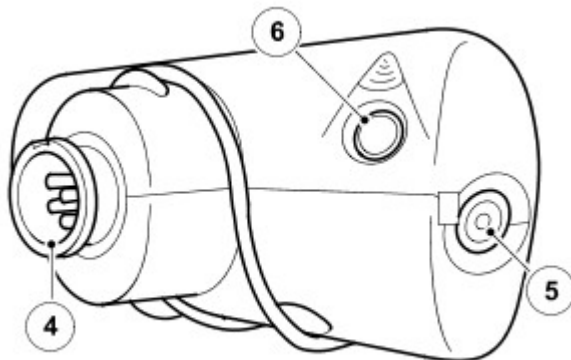
Reference	Description
1	LCD screen with main menu
2	Control panel (key board and power button)
3	Positive and negative fly leads
4	Fly leads connection
5	Temperature sensor
6	Infra-red sensor (data transfer for printer)
7	Amp hour
8	Battery rating (CCA)
9	Rating units



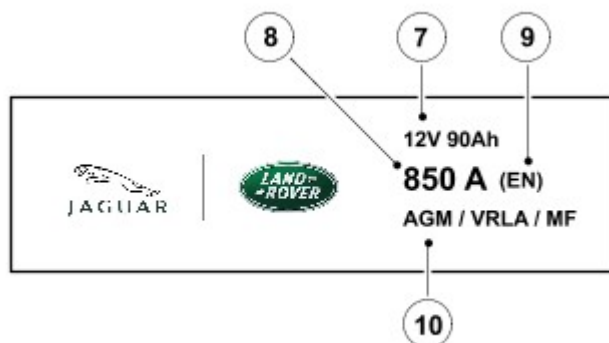
E148611



E148612




E148613



E148614

The following steps must be carried out to ensure correct operation of the EXP-1080 during the battery test procedure

Checks	Action
Battery fluid leakage, check for battery fluid leaks or damage to the battery casing	 <p>NOTE: If visible damage to the case is evident do not return battery under warranty</p> <p>Replace the battery if there is any battery fluid leaks evident</p>
Battery vent pipe routing	Check for routing, ensure there are no kinks
EXP-1080 fly lead, condition of clamps	Clean or replace as required
EXP-1080 fly lead connection	Confirm secure connection



NOTE: The Midtronics EXP-1080 is suitable for testing flooded and absorbed glass mat (AGM) type batteries

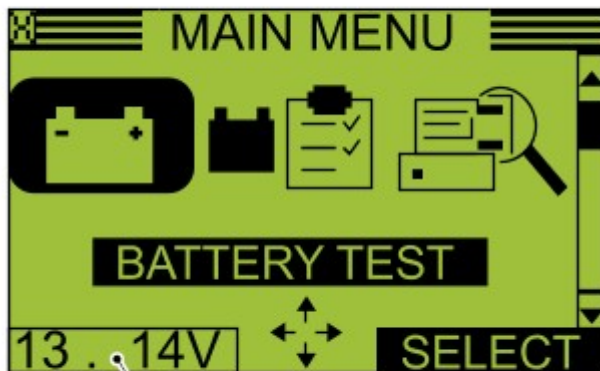
Typical Values

Amp Hour	CCA (Cold Cranking Amps)	Rating Units
12	200	EN
70	760	SAE
80	700	SAE
80	800	SAE
90	800	SAE
95	850	SAE
90	950	SAE
105	950	SAE

Midtronics Battery Test Procedure

This midtronics battery test procedure will confirm the serviceability of the battery

- 1. Connect the fly-lead to the midtronics EXP-1080
- 2. Connect the fly-leads to the battery terminals
 - **Black lead to negative terminal**
 - **Red lead to positive terminal**
 - Confirm the connections are secure
- 3. The EXP-1080 will power on automatically when connected to a battery, screen below is displayed



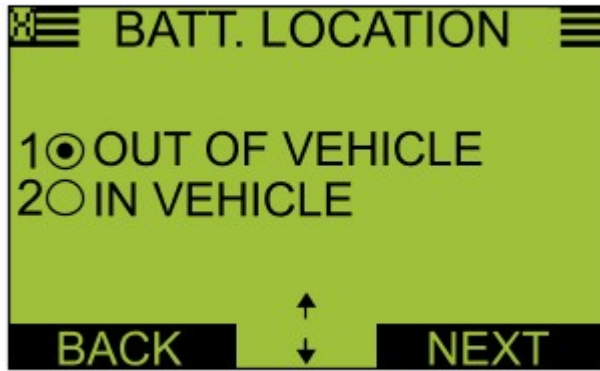
E148617

11



NOTE: MAIN MENU SCREEN

- 4. **Main Menu.** Select **Battery test** and press **SELECT**

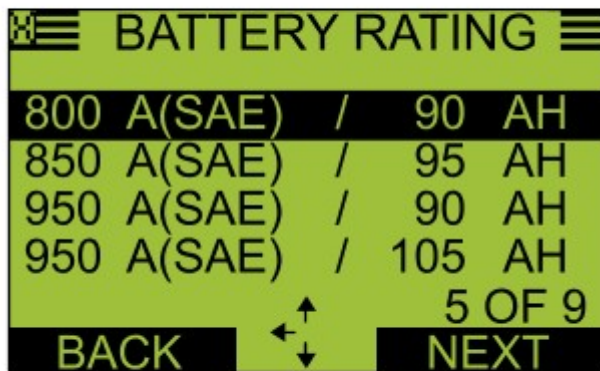


E148618

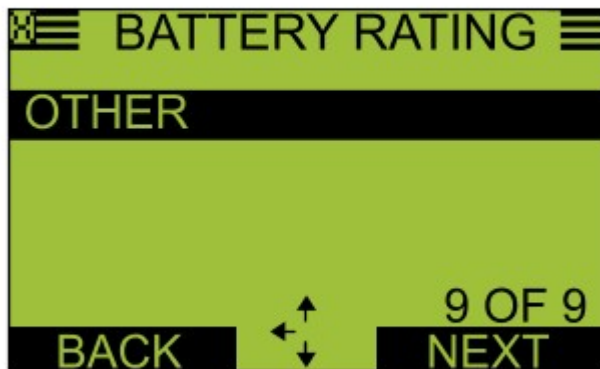


NOTE: BATTERY LOCATION

- 5. **Battery Location.** Select either, **Out of vehicle** or **In Vehicle** as appropriate
- Select **Next**



E148619

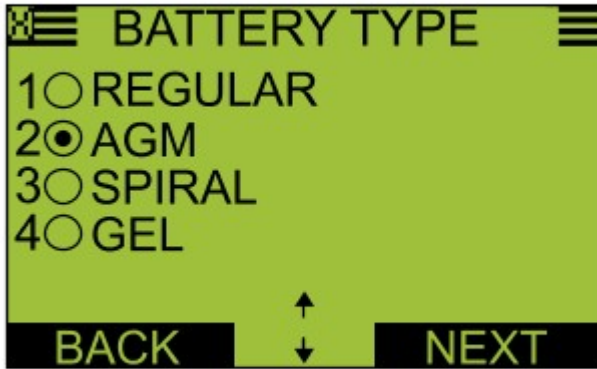


E148620



NOTE: BATTERY RATING

- 6. **BATTERY RATING**. Select the correct battery rating from the pre-installed list, (**Goto step 10**). Or,
- To manually enter the correct battery type, specification and CCA rate. Scroll using the arrow keys on the midtronics panel and select **Other** from the menu
- Select **Next**

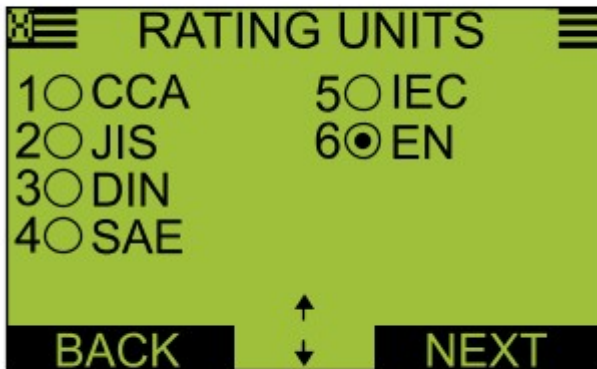


E148621



NOTE: BATTERY TYPE

- 7. **Battery Type**. Select the correct battery type (**Regular** or **AGM**)
- NOTE: All **AGM** batteries are marked (Refer to battery label)
- Select **Next**

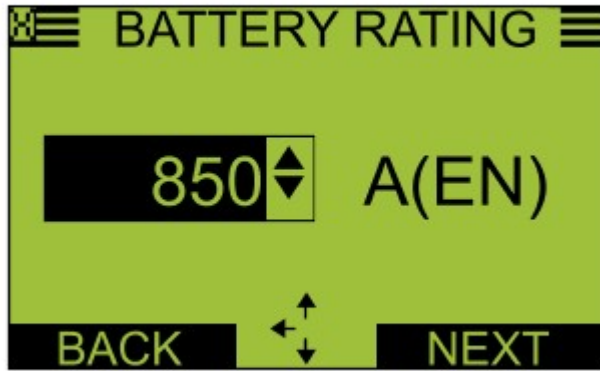


E148622



NOTE: RATING UNITS

- 8. **Rating Units**. Select the correct rating units. Refer to the battery label for correct specification.
Options **EN, DIN, SAE**
- Select **Next**

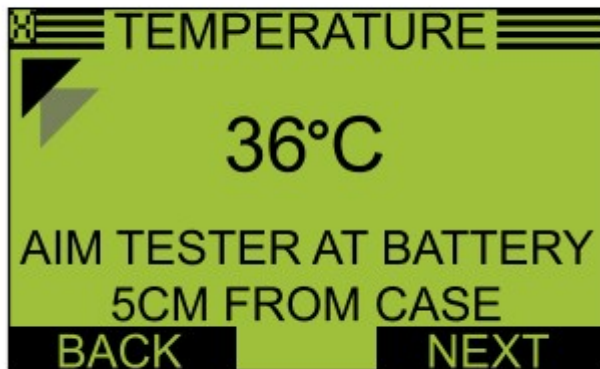


E148623



NOTE: BATTERY RATING

- 9. **BATTERY RATING**. Scroll using the arrow keys on the midtronics panel, select the correct **CCA** rating (For CCA refer to battery label)
- Select **Next**



E148624

NOTES:

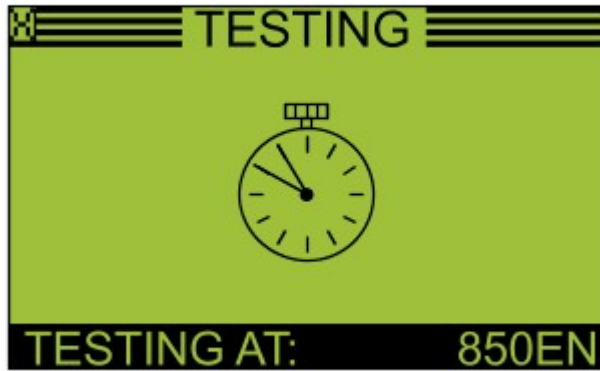


TEMPERATURE



Ensure that the temperature sensor does not touch any part of the battery or vehicle, this will cause damage not be covered under the midtronics warranty and will require the unit to be returned to a service center

- 10. **Temperature**. Aim the temperature sensor towards the battery casing (Maintain distance of 5cm)
- Select **Next**



E148625



NOTE: TESTING

- 11. **Testing**. The screen displays clock hand's rotating, the EXP-1080 will automatically advance when test has completed



E148626

NOTES:

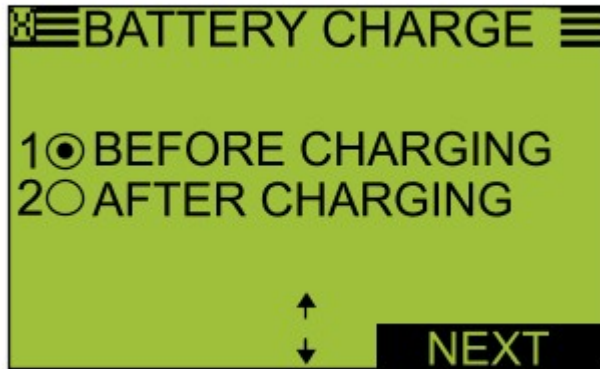


SURFACE CHARGE



If there is no surface charge this step will not show. **Go to next step**

- 11a. **Surface Charge**. Ensure the **ignition state is on**. Switch on the headlights (high beam) until EXP-1080 shows **Turn off headlights** then return ignition state to off



E148627

NOTES:

 BATTERY CHARGE

 If the state of charge is sufficient this step will not show. **Go to next step**


- 11b. **Battery Charge.** Select **Before Charging** if battery has not been on a recommended mains charger for a minimum of 6 hours
- Select **After Charging** if battery has been on a recommended mains charger for a minimum of 6 hours



E148628

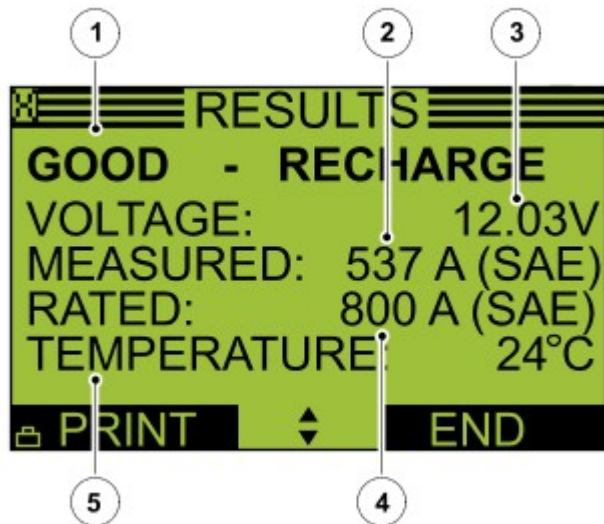
NOTES:

 DEEP SCAN TECHNOLOGY

 This test is automated and will show if required. **Go to next step**

- 12. **Testing.** The EXP-1080 will carry out the deep scan test, then automatically advance when test has completed

Number	Description
1	Battery test result
2	CCA (Measured capacity rating)
3	Voltage
4	CCA (Manually entered)
5	Temperature

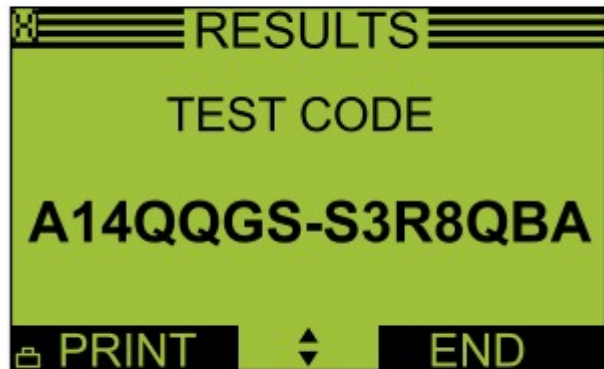


E148629



NOTE: RESULTS

Test Result	Action
GOOD BATTERY	Test complete no action required
GOOD - RE-CHARGE	Charge battery using a recommended mains charger (minimum 50 amp) until charging complete
CHARGE AND RE-TEST	Charge battery using a recommended mains charger (minimum 50 amp) until charging complete. Retest. If the result is the same replace battery
REPLACE BATTERY / BAD CELL BATTERY	Replace battery. Do Not Recharge
UNABLE TO COMPLETE TEST	Disconnect battery from vehicle and re-test



E148630

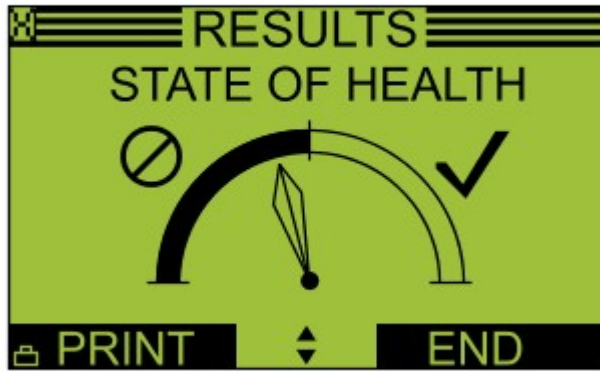
NOTES:



TEST CODE



Battery test code, must be given if a battery, starter motor or generator is exchanged under warranty



E148631

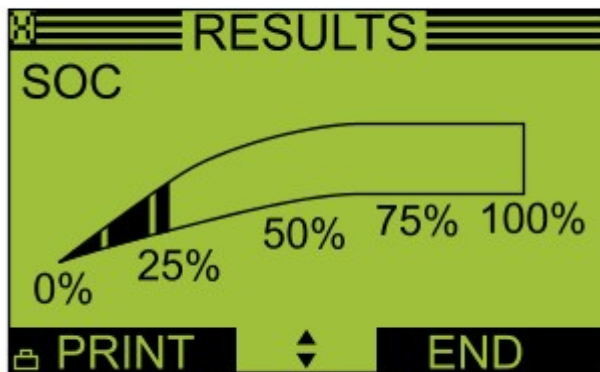
NOTES:



STATE OF HEALTH



General health of the battery and its ability to deliver its specified performance compared with a new battery



E148632

NOTES:



SOC (State Of Charge)



BATTERY STATE OF CHARGE

- **Results.** From the result display use the arrow keys on the control panel to view the test code
- The test code **must** be quoted with every battery claim under warranty

Flooded Battery Care Point

If the vehicle is equipped with a flooded battery, ensure the replacement battery is a flooded battery of the same specification (cold cranking amperage (CCA) / amp hour rating (Ah)) as the original battery

Under no circumstances should you fit a flooded battery to a vehicle that originally had an AGM battery, unless formally instructed by Jaguar/Land Rover

AGM Battery Care Point

If the vehicle is equipped with an absorbed glass mat (AGM) battery, ensure the replacement battery is a AGM battery of the same specification (cold cranking amperage (CCA) / amp hour rating (Ah)) as the original battery,

unless formally instructed by Jaguar/Land Rover

Battery, Mounting and Cables - Auxiliary Battery

Removal and Installation

Removal

NOTES:



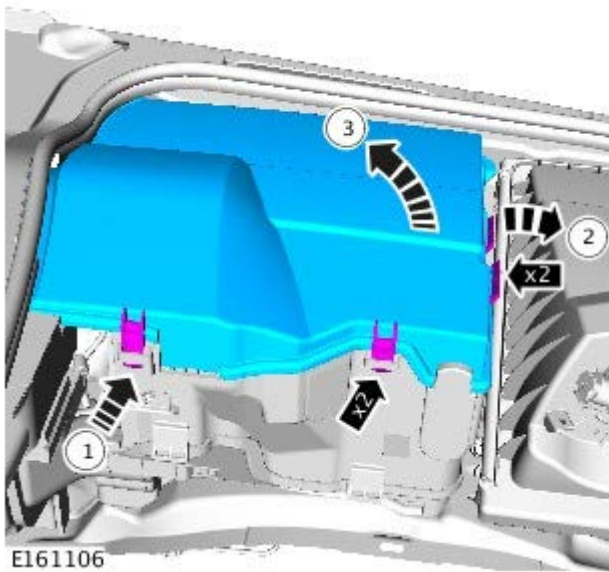
Some variation in the illustrations may occur, but the essential information is always correct.



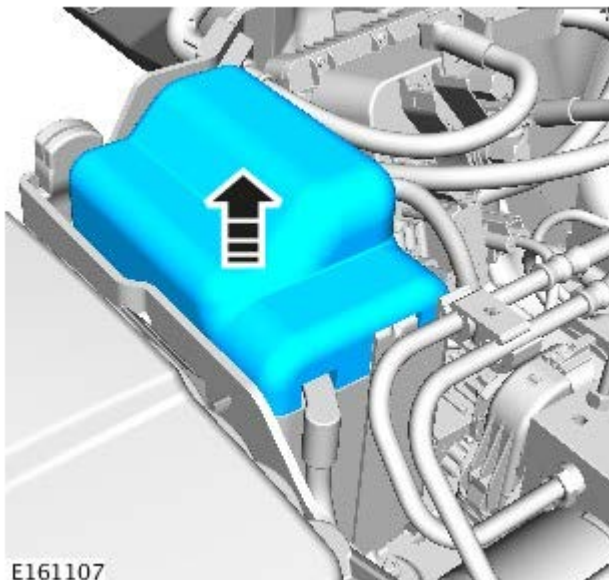
Removal steps in this procedure may contain installation details.

1. Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

2.



E161106



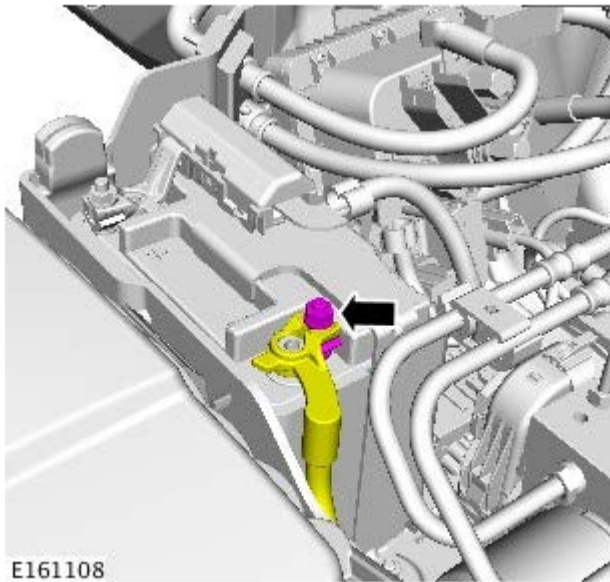
E161107

3.  CAUTION: Care must be taken not to damage the component.

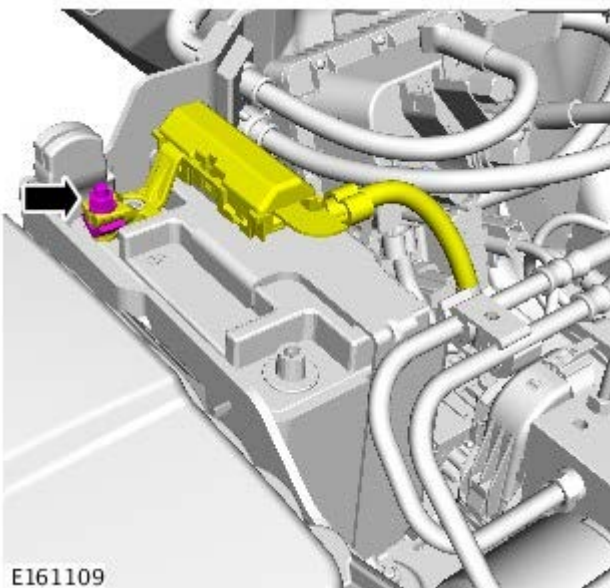


NOTE: Note the orientation of the component.

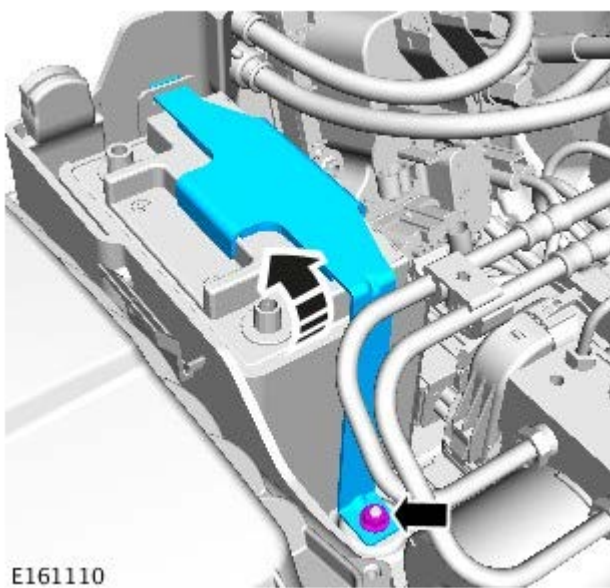
4. Torque: 6 Nm




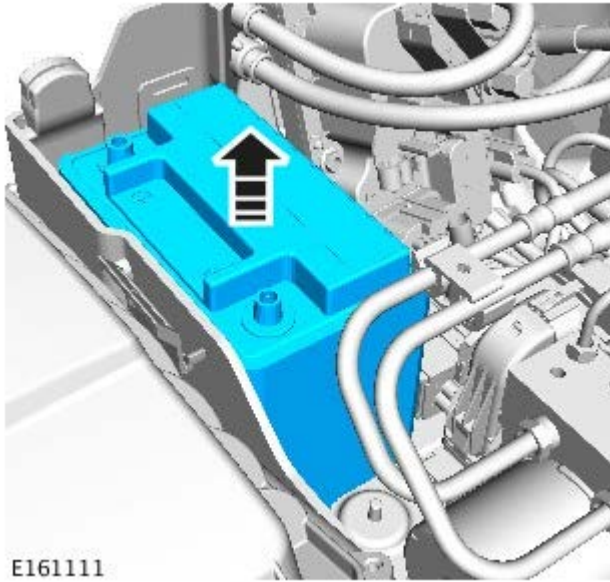
5. Torque: 6 Nm



6. Torque: 6 Nm

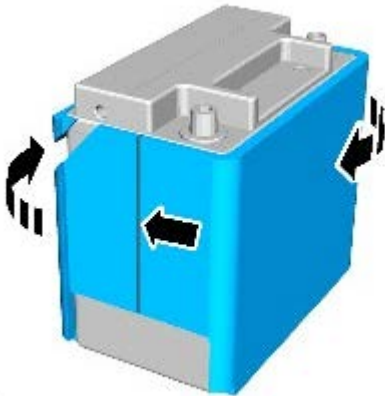
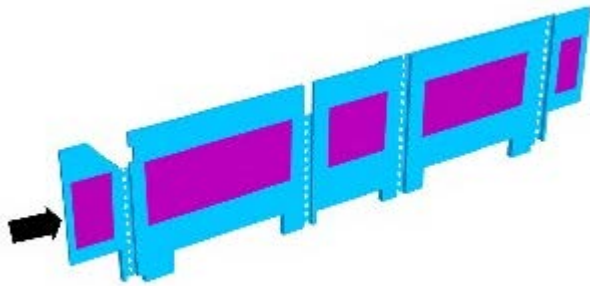


7.  CAUTION: Extra care must be taken to avoid damage to the battery insulator cover on removal. A new insulator cover must be installed if damaged.




E161111


Installation




E161275


1. CAUTIONS:

 Only carry out this step if a new auxiliary battery is being installed or the insulator cover has been damaged.

 Make sure the insulator cover is installed in the correct orientation.

NOTES:

 Make sure that the adhesive backing paper is removed before installation.

 Make sure the insulator cover is correctly installed, by aligning each side, then compressing each corner fold to obtain a consistent thermal protection.

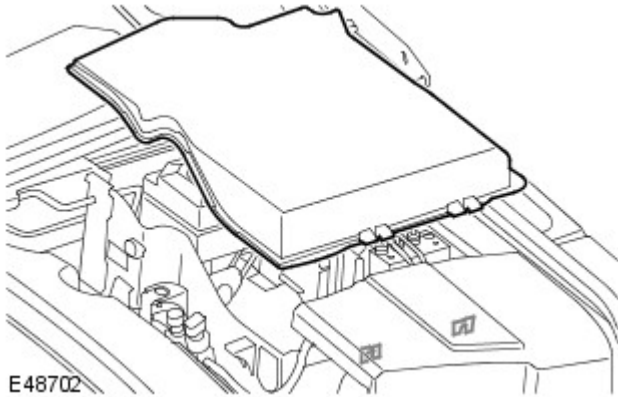
2. To install reverse the removal procedure.

Battery, Mounting and Cables - Auxiliary Battery Tray

Removal and Installation

Removal

1. Remove the battery cover.
 - Release the 2 clips.

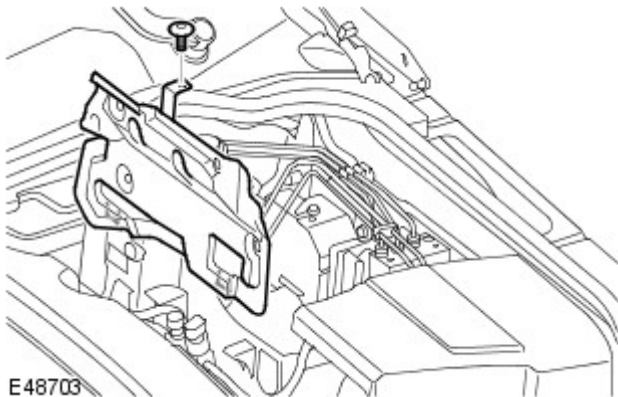


E48702

2. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

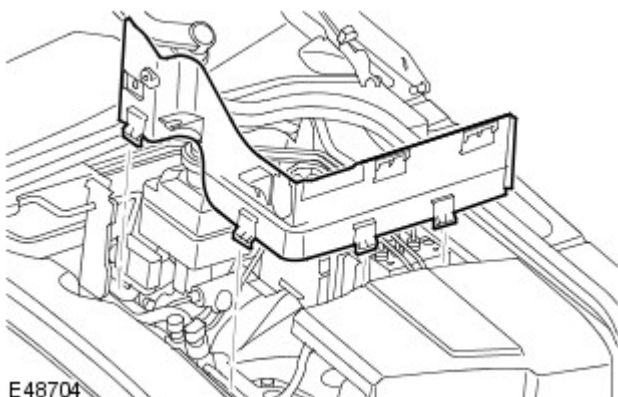
3. If installed, remove the auxiliary battery.

4. Remove the engine compartment upper heat shield.
 - Remove the screw.
 - Release the 2 clips.



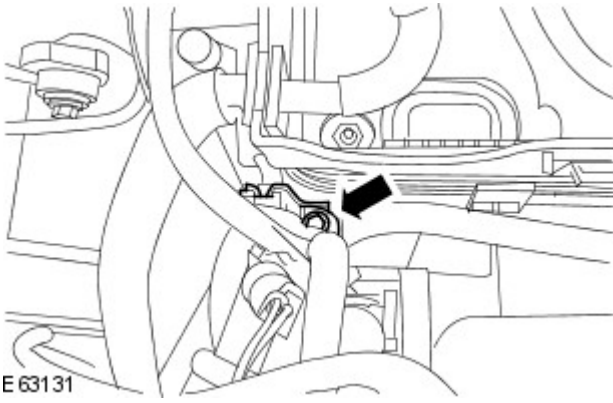
E48703

5. Remove the auxiliary battery compartment side wall.
 - Release the battery positive cable and grommet.
 - Release the four clips.



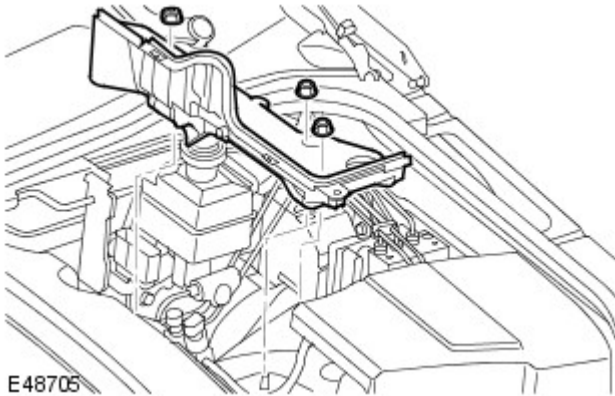
E48704

6. Release the A/C pipes.
 - Remove the retaining screw.



E63131

7. Remove the auxiliary battery tray.
 - Remove the three retaining nuts.



E48705

Installation

1. To install, reverse the removal procedure.
 - Tighten the nuts to 12 Nm (9 lb.ft).

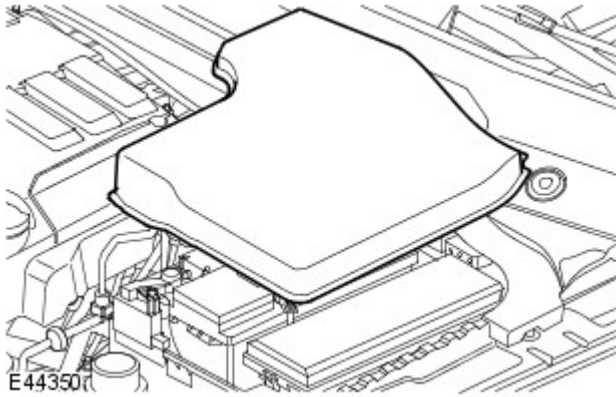
Battery, Mounting and Cables - Battery

Removal and Installation

Removal

1. Secure the hood in the service position.
 - Release the support struts.

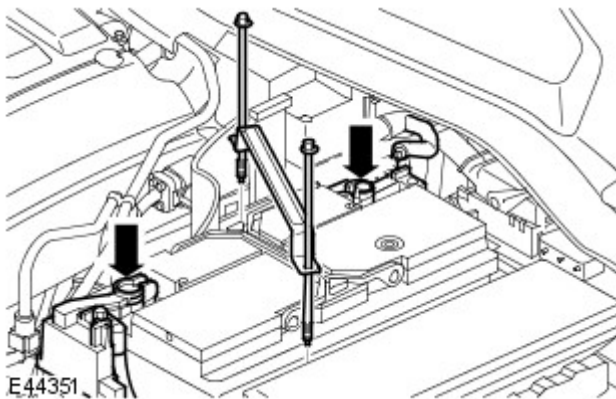
2. Remove the battery cover.



3. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

4. Disconnect the battery positive cable.

5. Remove 2 bolts securing the battery clamp and remove the clamp.



6. Remove the battery.

Installation

1.  **NOTE:** Apply petroleum jelly to the battery terminals.

To install, reverse the removal procedure.

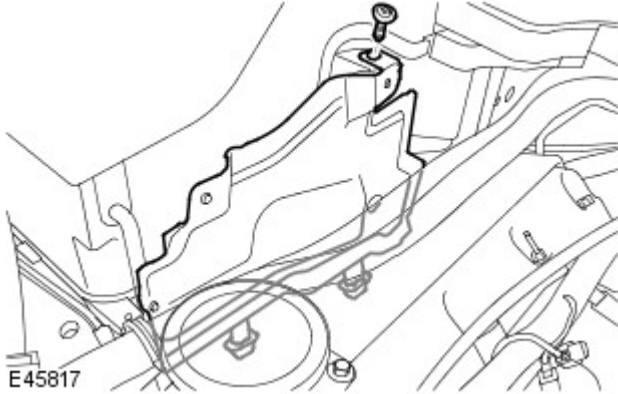
- Tighten the battery clamp bolts to 5 Nm (4 lb.ft).
- Tighten the battery terminals to 5 Nm (4 lb.ft).

Battery, Mounting and Cables - Battery Tray

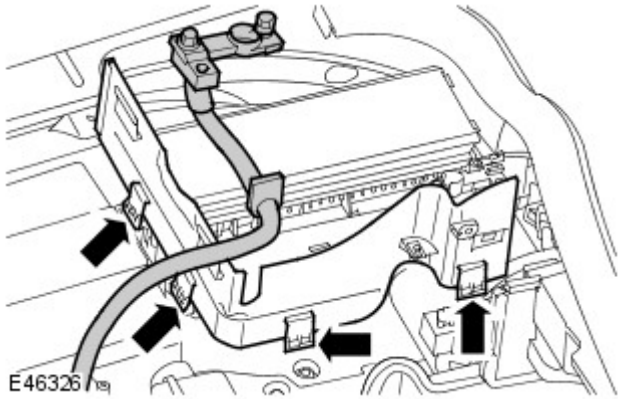
Removal and Installation

Removal

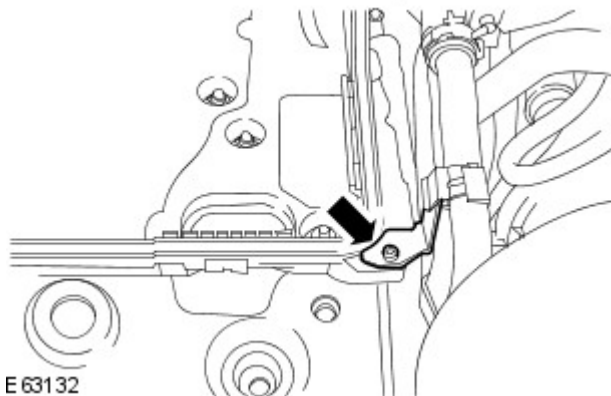
1. Remove the battery.
For additional information, refer to: Battery (414-01, Removal and Installation).



2. Remove the engine compartment upper heat shield.
 - Remove the screw.
 - Release the 2 clips.

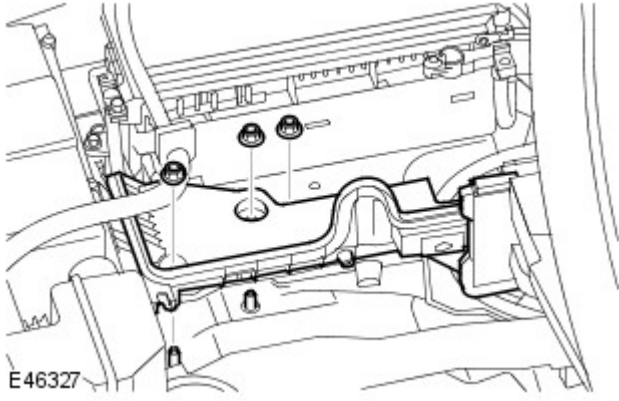


3. Remove the battery compartment side wall.
 - Release the battery positive cable and grommet.
 - Release the four clips.



4. Release the heater pipes.
 - Remove the retaining screw.

5. Remove the battery tray.
 - Remove the three retaining nuts.



E46327

Installation

1. To install, reverse the removal procedure.
 - Tighten the nuts to 12 Nm (9 lb.ft).

Generator and Regulator - V6 S/C 3.0L Petrol -

General Specification

Item	Specification
Generator:	
Make/Type	Denso SC2
Output	90/150 amps @ 25° C
Voltage control	By Power Control Module (PCM)
Voltage setpoint regulation	Controlled by Engine Management System (EMS)

Torque Specifications

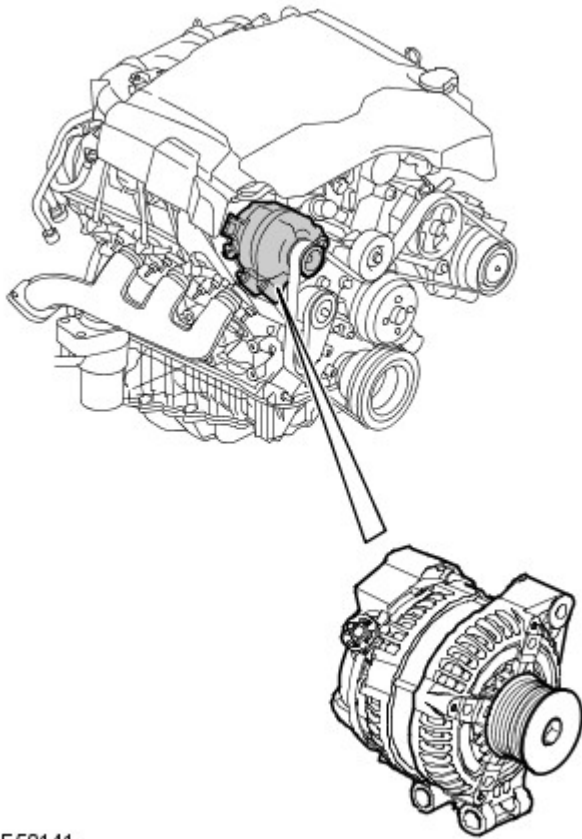
Description	Nm	lb-ft
* Battery harness connection nut	10	7



CAUTION: * Damage to the internal connections will result if this torque is exceeded

Generator and Regulator - V6 S/C 3.0L Petrol - Generator

Description and Operation



E50141

GENERAL

The generator is located at the front RH side of the engine, in front of the RH cylinder head. The generator has an output of 85/150 Amps and is manufactured by Denso. An eight-ribbed polyvee belt drives the generator pulley, which in turn is driven from the engine crankshaft pulley.

The generator pulley incorporates a one-way clutch mechanism, which allows the pulley to free wheel, reducing the amount of inertia applied to the engine during deceleration (coast).

The generator comprises a stator, a rotor, a rectifier pack and a regulator. There is a three-pin connector (C0053) on the generator:

- Pin 1 – Voltage reference line to the battery via the Battery Junction Box (BJB)
- Pin 2 – Pulse Width Modulated (PWM) signal from the Engine Control Module (ECM) to the generator (generator control)
- Pin 3 – PWM signal from the generator to the ECM (generator monitoring)

The generator is connected to earth via its mountings.

The rotor comprises a field winding, wound around an iron core and mounted on a shaft. The iron core has extensions at each end, which form North and South poles as current flows through the field winding. The rotor is located inside the stator and is mounted on bearings for smooth running and to support the rotor due to the high side loading applied by the drive belt tension.

The stator has three sets of coils made from copper wire. The three coil windings are connected in a 'star' connection, where one end of the winding is connected to the other two windings. The output current is supplied from the opposite end of each winding. Rotation of the rotor causes ac current to be produced in the coils.

The rectifier converts the ac current produced in the stator coils into dc (rectified) current required by the vehicle electrical system. The rectifier comprises semi-conductor diodes mounted on a heatsink to dissipate heat. An equal number of the diodes are on the negative and positive side, with an additional diode in the regulator to control feedback through the battery voltage signal line. The rectifier also prevents current flow from the battery to the generator when the output voltage is less than the battery voltage.

The 'smart' regulator controls the output voltage from the generator to protect the battery; at low temperatures battery charge acceptance is very poor so the voltage needs to be high to maximise any re-chargeability, but at high temperatures the charge voltage must be restricted to prevent excessive gassing with consequent water loss. The EMS, which controls the regulator, will calculate the voltage set point required for the ensuing conditions. The 'traditional' regulator controls voltage against generator temperature, which means the battery temperature will lag a long way behind so there will be significant periods of operation when battery charging is compromised. With this system, the EMS can set the voltage by inferring the battery temperature from

information received from its various sensors, hence voltage will follow the battery's needs a lot more accurately.

The regulator has transistors, which rapidly switch on and off to regulate the voltage output according to the voltage sensed internally. The regulator also provides a PWM signal output to the ECM, which uses the signal to adjust the idle speed under varying electrical loads.

Initially, the ignition switch supply provides an excitation current to the rotor at low generator speeds via brushes, which contact slip rings at the end of the rotor shaft. As the generator speed increases the generator becomes self-exciting.

The charge warning lamp function is transmitted to the EMS and then on to the Controller Area Network (CAN) bus to the instrument pack.

LOAD MANAGEMENT SYSTEM

The load management system comprises software resident in the Automatic Temperature Control Module (ATCM).

For additional information, refer to: Control Components (412-04 Control Components, Description and Operation).

Its purpose is to protect battery state-of-charge during abnormal usage of the vehicle. The system will request the Media Orientated System Transport (MOST) ring and the air suspension to go into 'power save' mode, and will modulate features such as seat heating and screen heating to prevent the battery being dragged down to a point where the car becomes unoperational. A 'WARNING - LOW BATTERY' message will be displayed in the message centre.

Generator and Regulator - V6 S/C 3.0L Petrol - Generator

Diagnosis and Testing

For further information,

REFER to: [Charging System](#) (414-00 Battery and Charging System - General Information, Diagnosis and Testing).

Generator and Regulator - V6 S/C 3.0L Petrol - Generator

Removal and Installation

Removal

NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.




Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

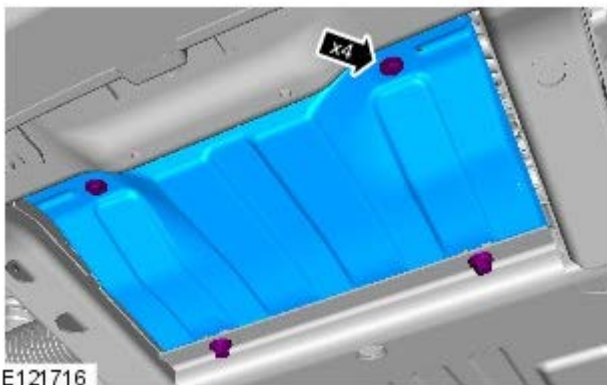
Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

2. Refer to: [Air Cleaner Outlet Pipe T-Connector](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
3. Refer to: [Air Cleaner Outlet Pipe LH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
4. Refer to: [Air Cleaner Outlet Pipe RH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

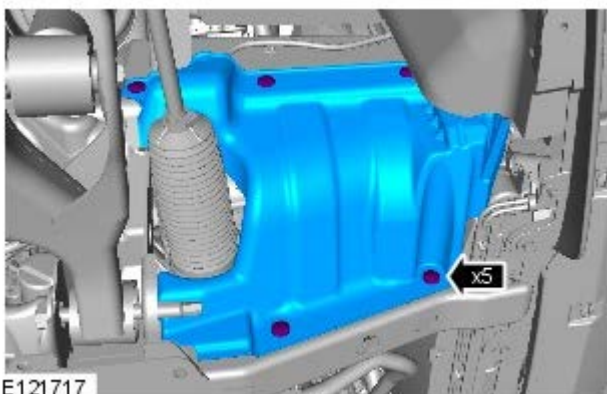
5.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

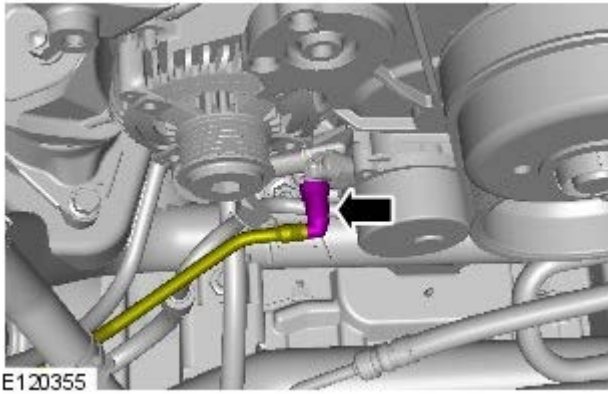
6. Torque: 68 Nm



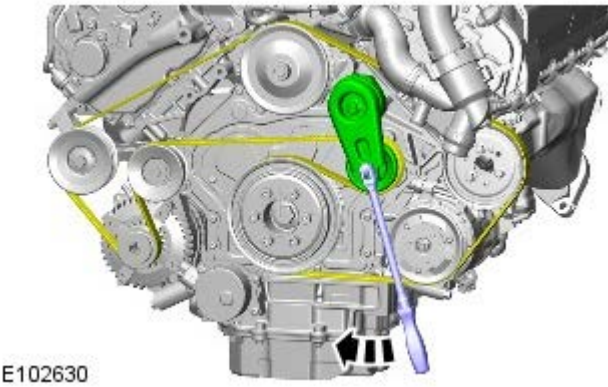
- 7.



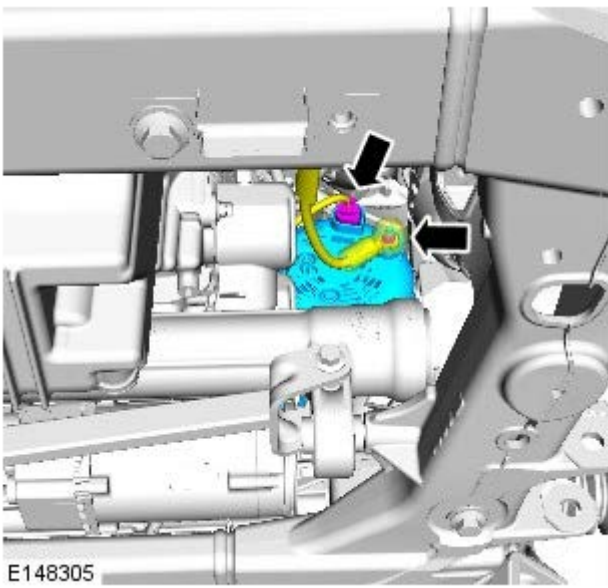
- 8.




9.

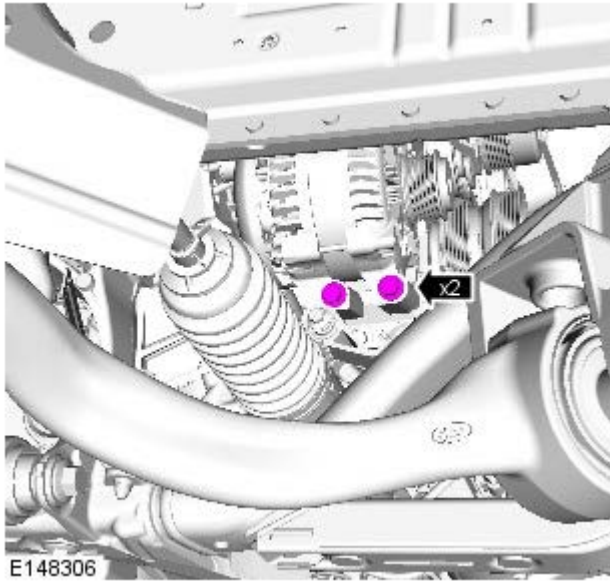


10. Torque: 12 Nm

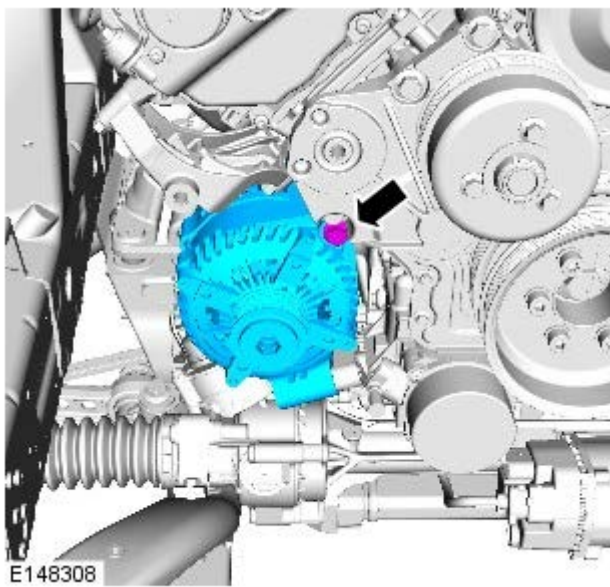


11.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Torque: 48 Nm



12. Torque: 48 Nm



Installation

1. CAUTIONS:

 Make sure that the accessory drive belt is correctly located on each pulley.

 Clean and inspect the accessory drive belt pulleys for damage.

To install, reverse the removal procedure.

Generator and Regulator - TDV6 3.0L Diesel -

Description	Nm	lb-ft	lb-in
Generator retaining bolts	47	35	-
Battery positive cable retaining nut	12	9	-

Generator and Regulator - TDV6 3.0L Diesel - Generator - Component Location

Description and Operation



E117288

Generator and Regulator - TDV6 3.0L Diesel - Generator - Overview

Description and Operation

OVERVIEW

The charging system consists of a 180 Amp output generator and regulator assembly. The generator and regulator assembly generates electrical power for the vehicle electrical system and maintains the battery in a charged state. When the engine is running the generator produces an alternating current, which is converted to a direct current internally. The output from the generator is controlled by the voltage regulator (located inside the generator) and then supplied to the battery through the main battery positive cable.

The generator is mounted on the front right side of the engine and driven at approximately 3 times engine speed by the accessory drive belt.

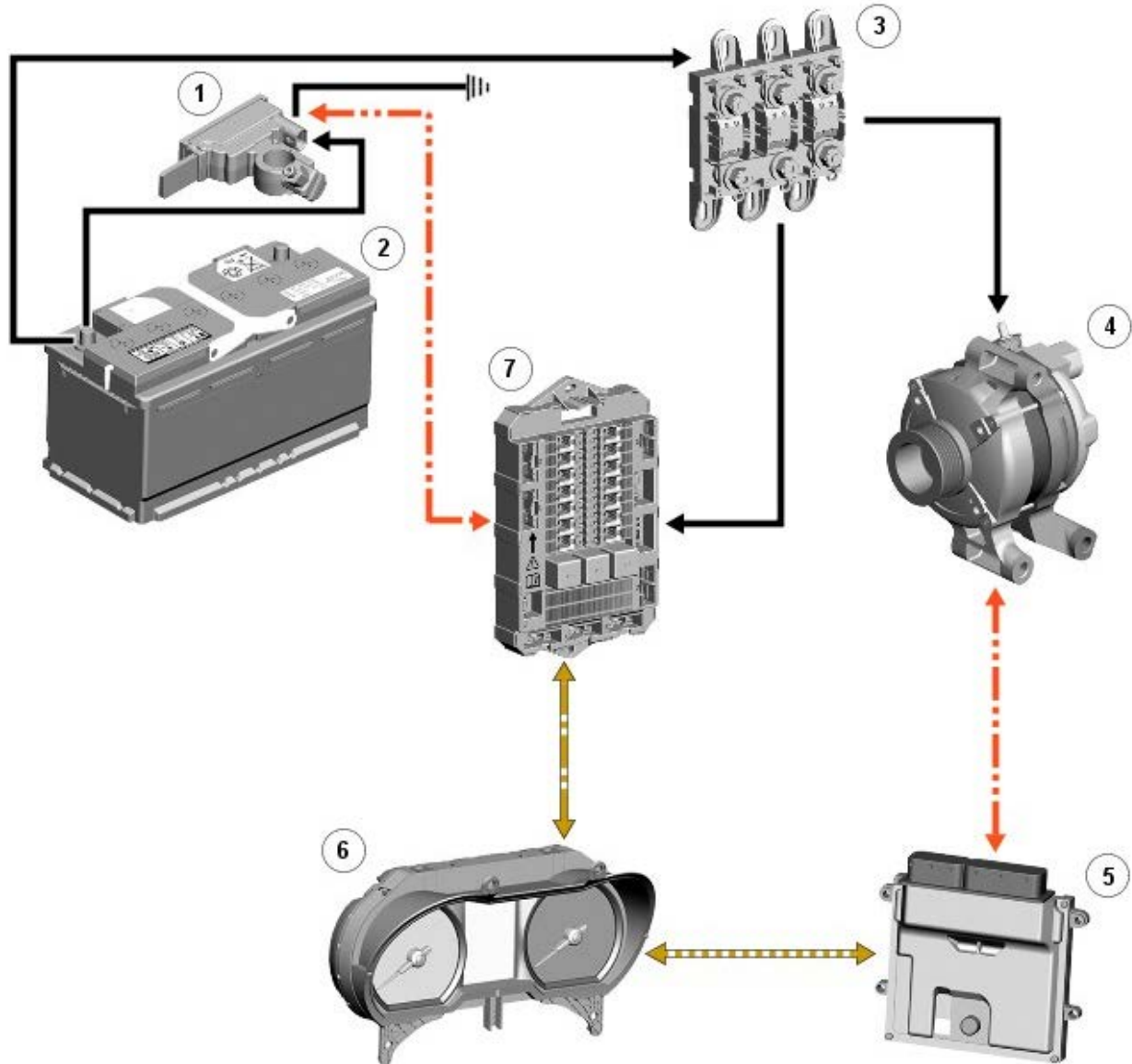
Generator and Regulator - TDV6 3.0L Diesel - Generator - System Operation and Component Description

Description and Operation

Control Diagram



NOTE: **A** = Hardwired; **D** = High speed CAN (controller area network) bus; **N** = Medium speed CAN bus; **O** = LIN (local interconnect network) bus.



E96985



Item Description

- 1 Battery monitoring system module
- 2 Battery
- 3 BJB (battery junction box)
- 4 Generator and regulator
- 5 ECM (engine control module)
- 6 Instrument cluster
- 7 RJB (rear junction box)

System Operation

OPERATION

The output voltage required from the generator and regulator is calculated by the battery monitoring system. Refer to: Battery and Cables (414-01, Description and Operation).

The battery monitoring system signals the calculated voltage to the [ECM](#) via the [RJB](#) and the instrument cluster. The [ECM](#) then transmits the calculated voltage to the generator and regulator on the [LIN \(local interconnect network\)](#) bus connection.

The [ECM](#) will over-ride the voltage value requested by the battery monitoring system if it detects a fault in the generator and regulator. The [ECM](#) also signals the instrument cluster to display a warning message if it detects a fault with the generator and regulator.

Refer to: Instrument Cluster (413-01, Description and Operation).

Component Description

DESCRIPTION

The regulator provides a controlled variable voltage output from the generator. Two electrical terminals are provided on the outer casing of the generator. One terminal supplies the [DC \(direct current\)](#) voltage output from the generator to the battery positive terminal. The second terminal provides the [LIN](#) bus connection between the regulator and the [ECM](#).

Generator and Regulator - TDV6 3.0L Diesel - Generator

Diagnosis and Testing

For further information,
REFER to: Charging System (414-00, Diagnosis and Testing).

Generator and Regulator - TDV6 3.0L Diesel - Generator

Removal and Installation

Removal

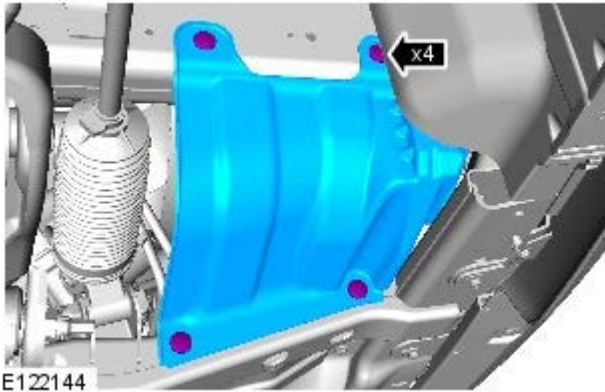
1. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

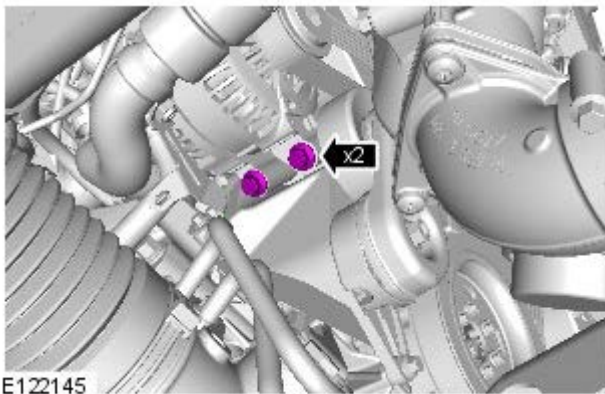
2.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

3.

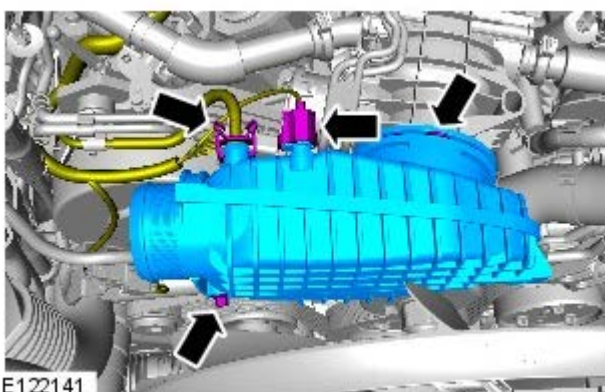


4. Torque: 47 Nm

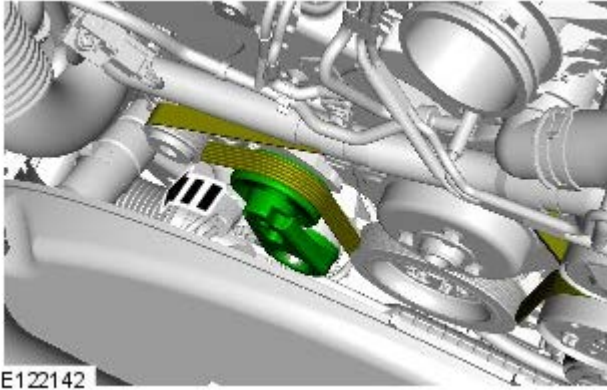


5. Lower the vehicle.
6. Refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).
7. Refer to: Cooling Fan Motor and Shroud (303-03, Removal and Installation).

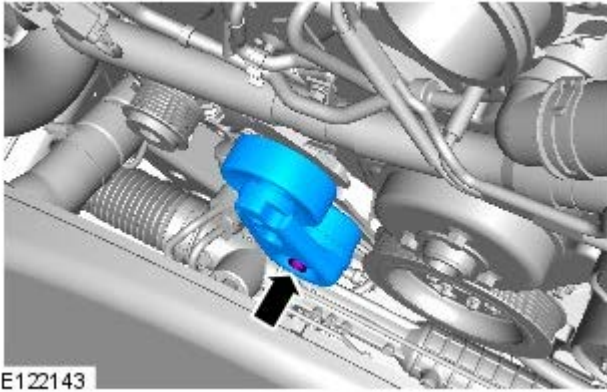
8. Torque: 10 Nm




9.

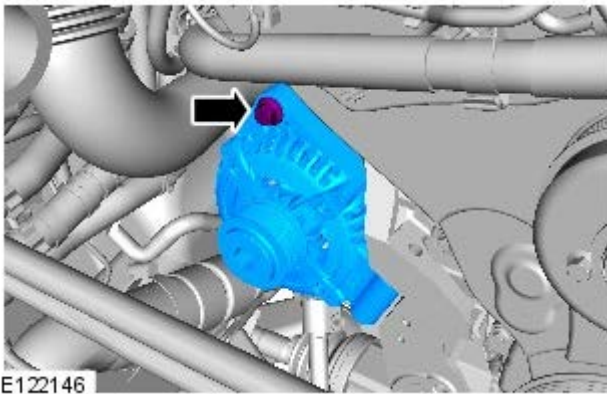


10. Torque: 47 Nm

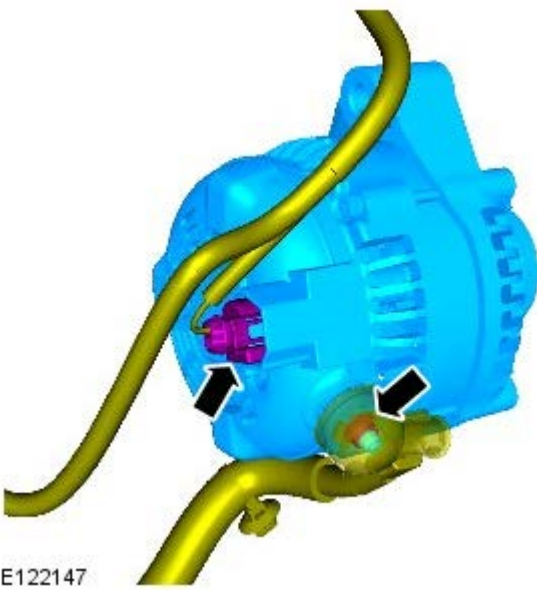


11.  CAUTION: Take extra care not to damage the wiring harnesses.

Torque: 47 Nm



12. Torque: 12 Nm



Installation

1. To install, reverse the removal procedure.

Information and Entertainment System - General Information - Navigation System Map Updates

Description and Operation

Map Update Applicability

Vehicle	Pre - 10MY	10 MY	11 MY	12MY	13MY	14MY
XK	DVD	DVD	DVD	DVD	DVD	DVD
F-Type	-	-	-	-	-	USB
XF	DVD	DVD	DVD	USB	USB	USB
XJ	-	USB	USB	USB	USB	USB
Freelander	DVD	DVD	DVD	DVD	USB	USB
Discovery 3	DVD	-	-	-	-	-
Discovery 4	-	External HD Service Tool	External HD Service Tool	USB	USB	USB
Range Rover Evoque	-	-	-	USB	USB	USB
Range Rover Sport (L320)	DVD	External HD Service Tool	External HD Service Tool	USB	USB	USB
Range Rover Sport (L494)	-	-	-	-	-	USB
Range Rover (L322)	DVD	External HD Service Tool	External HD Service Tool	External HD Service Tool	-	-
Range Rover (L405)	-	-	-	-	USB	USB

Mapping Regions

Region	Mapping Area
1	North America (USA, Canada and Mexico)
2	Western and Eastern Europe
3	Japan
4	Middle East (Bahrain, Jordan, Kuwait, Oman, Qatar, Saudi Arabia and UAE)
5	South Africa
6	South America (Brazil and Argentina)
7	Russia
8	Pacific (Australia and New Zealand)
9	South East Asia (Malaysia and Singapore)

DVD Map Updates



E 142913

Vehicles equipped with the 'remote' navigation module are supplied with a DVD map update which is loaded into and left in the navigation module. Map data is read directly from the DVD. This update can be carried out by the customer.

External HD Service Tool Map Updates



E142915

Discovery 4, Range Rover Sport and Range Rover vehicles, equipped with a HDD (hard disc drive) integrated into the touch screen, are updated at point of service. Dealers are supplied with a set of master pack map update DVD's which are loaded onto the dealer Jaguar/Land Rover approved diagnostic equipment. The map data is then loaded from the diagnostic equipment onto the navigation tool hard drive. The map data is loaded to the touch screen from the navigation tool hard drive.

The following process should be used to update the map data:



NOTE: The navigation update tool does not need the map data loading every time. This is only necessary when a new map update DVD is released.

- Using the approved Jaguar/Land Rover diagnostic equipment select the navigation update tool.



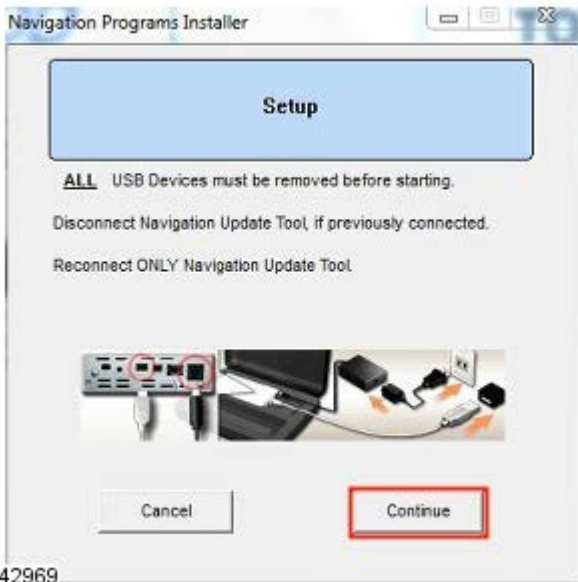
E142966

- Select **Setup** on the navigation update tool.



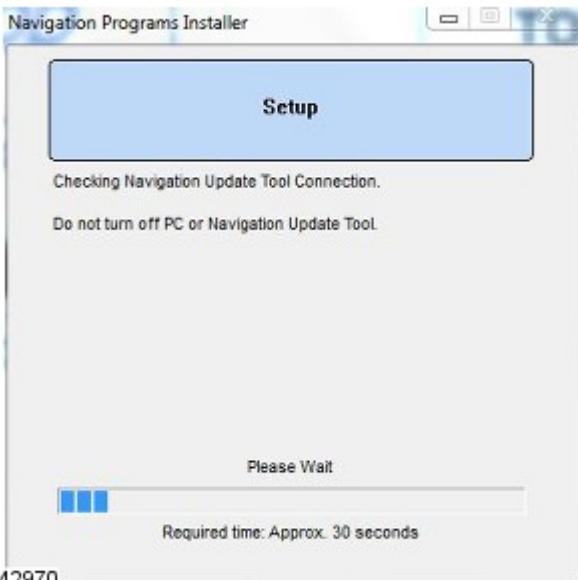
E142967

- Connect the navigation update tool to the Jaguar/Land Rover approved diagnostic equipment using the USB cable and press **Continue** proceed.



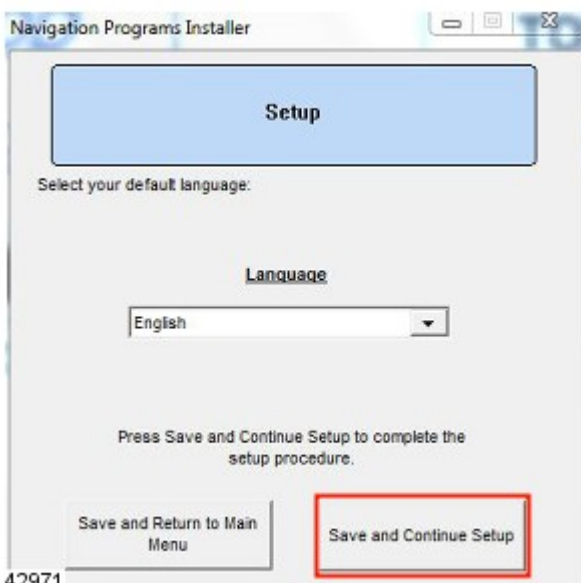
E142969

- The navigation update tool will then check the connection.



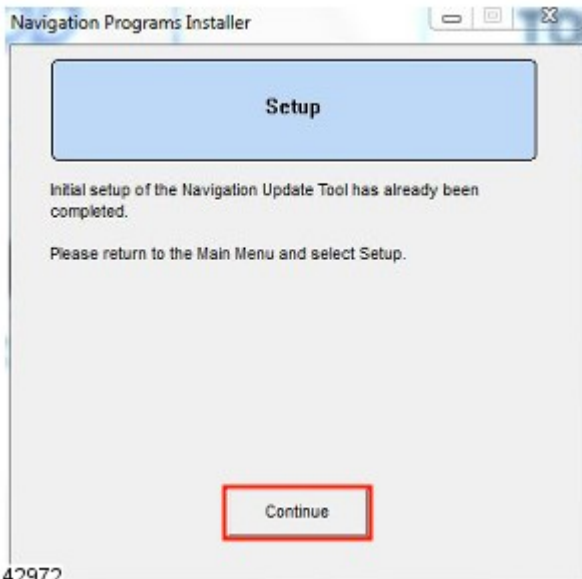
E142970

- Select your preferred language from the drop down menu then press **Save and Continue Setup** to proceed.



E142971

- When the navigation update tool confirms the initial setup is complete, press **Continue** to proceed.



E142972

- The navigation update tool will the return to the main menu screen, select **Load Map Data** to proceed.



E142968

- Disconnect then reconnect, the USB cable connecting to the navigation update tool to the Jaguar/Land Rover approved diagnostic equipment, press **Continue** proceed.



E142973

- The navigation update tool will then check the connection.



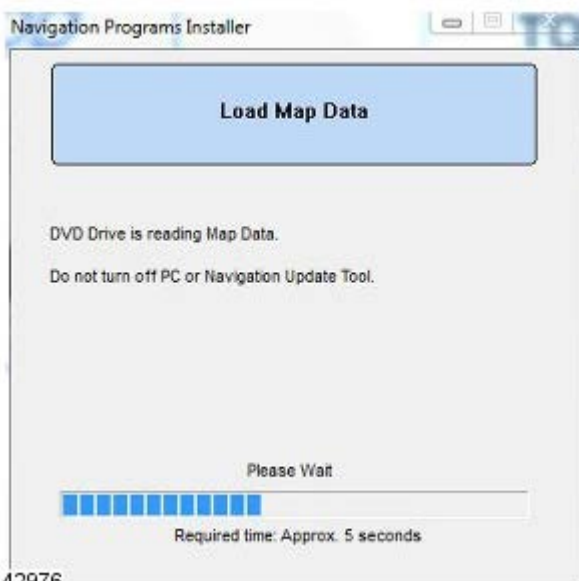
E142974

- Insert map update disk 1 into the DVD drive of the Jaguar/Land Rover approved diagnostic equipment and press **Continue** proceed



E142975

- The navigation update tool will then read the map data



E142976

- Map data will then be copied from disk 1 to the Jaguar/Land Rover approved diagnostic equipment.



E142977

- Insert map update disk 2 into the DVD drive and press **Continue** proceed



E142978

- Map data will then be copied from disk 2 to the Jaguar/Land Rover approved diagnostic equipment.



E142979

- Map data is now ready to be uploaded onto the navigation update tool, press **Continue** proceed.



E142980

- The map data is now being uploaded onto the navigation update tool.



E142981

- Map data upload is now complete.



E142982

- Disconnect the navigation update tool from Jaguar/Land Rover approved diagnostic equipment.
- Connect the navigation update tool to the vehicle using the firewire cable.

- Select **Navigation** using the touch screen display soft key.



E 142956

- Select **Navigation Setup** using the touch screen soft key.



E 142957

- Select **Map Change** using the touch screen.



E 142958

- Select map region using the touch screen display and press **Map Data Update** to continue.



E 142959

- The current map data version and the proposed update map data versions will now be shown, Select the relevant region, using the related touch screen key to proceed.



E142960

- Select **OK** to input the licence key using the touch screen.



E142961

- Input the licence key using the touch screen display and press **OK** to continue.



E142962

- Select **OK** using the touch screen.



E142963

- The map update will begin.



E142964

- When the map update is complete a message will be shown in the touch screen, select **OK** to continue using the touch screen display soft key. The navigation system will restart with the new map data.



E142965

- Disconnect the navigation update tool from the vehicle.

USB Map Updates



E142914

All Gen 2.1 equipped vehicles are supplied with a USB map updates, these updates can be carried out by the customer.

The following process should be used to update the map data:

- Start the engine.
- Navigate to the touch screen **Home Menu** screen.



E 142916

- Insert the USB memory stick containing the map data into the vehicle USB port.



E 142914

- Press **Continue** on the touch screen to proceed with the installation of the map update.



E 142917

- using the touch screen enter the licence code and press **OK** to proceed.



E 142918

-  **NOTE:** Selecting 'Cancel' returns to the 'Home Menu' screen, the map update will continue to run in the background

The map update will begin and a message will be displayed in the touch screen display advising that navigation is unavailable.



E142919

- Map update progress can be viewed as a percentage of the completed download in the **Home Menu** screen.



E142920

- When the update is complete a message is displayed informing the user.



E142921

- The navigation will restart upon completion of the map update.



NOTE: Remove USB stick immediately



E142922

- Turn off the engine.

Exit, lock the vehicle and leave for at 15 minutes before using the navigation system.

Japanese Navigation

The Japanese satellite navigation system uses a separate navigation computer module.

The HDD in the ACM/IAM is not used for navigation downloads in this market.

Map updates are supplied in DVD format. The DVD is loaded into the navigation module. Map data is read directly from the DVD.

Asia Navigation

The Asia market navigation system is an aftermarket unit.

Map updates are supplied in an SD card format. The SD card is loaded into the navigation module. Map data is read directly from the SD card.

Information and Entertainment System - General Information - Cellular Phone

Diagnosis and Testing

Principle of Operation

For a detailed description of the Cellular phone system and operation, refer to the relevant Diagnosis and Testing section of the workshop manual. REFER to:

Audio System (415-01 Audio Unit, Description and Operation),
Antenna (415-02 Antenna, Description and Operation),
Speakers (415-03 Speakers, Description and Operation),
Video System (415-07 Video System, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Check all information and entertainment system modules • Speakers • Switch(s) stuck or damaged • Touch screen display 	<ul style="list-style-type: none"> • Fuses • Electrical harnesses • Harness connectors • Battery condition, state of charge

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, refer to the Symptom Chart below, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Action
Unable to pair	• GO to Pinpoint Test A.
Not Auto Connecting	• GO to Pinpoint Test B.
Poor Quality Audio	• GO to Pinpoint Test C.
No Audio to 3rd Party	• GO to Pinpoint Test D.
No Audio from 3rd Party	• GO to Pinpoint Test E.
No Audio	• GO to Pinpoint Test E.

DTC Index


For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Bluetooth Module (TEL) (100-00 General Information, Description and Operation).

Pinpoint Tests

PINPOINT TEST A : UNABLE TO PAIR	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: 'NO PHONE FITTED' DISPLAY	
<p>NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the bluetooth function is activated and the telephone handset is placed within the vehicle cabin area.</p>	
	1 Carry out checks to determine if 'No Phone Fitted' is shown on vehicle display.

	<p>Is 'No Phone Fitted' displayed?</p> <p>Yes GO to A2.</p> <p>No Locate the connected telephone and if not Customer telephone, disconnect from the system.</p>
A2: TELEPHONE BLUETOOTH DEVICE SEARCH	
	1 Carry out Bluetooth device search using Customer handset.
	<p>Is 'Land Rover' identified in Bluetooth device list?</p> <p>Yes Select device from list, then continue with diagnosis.GO to A3.</p> <p>No Carry out further Bluetooth device search, to a maximum of 4 times, waiting approximately 20 seconds between searches. If 'Land Rover' still not identified in Bluetooth device list, set ignition status to OFF, wait approximately 30 seconds and set ignition status to ON. Carry out further Bluetooth device search, to a maximum of 4 times, waiting approximately 20 seconds between searches. If 'Land Rover' still not identified in Bluetooth device list, contact your local in market support for further assistance.</p>
A3: TELEPHONE HANDSET ERROR	
	1 Check for any error shown on the telephone handset when 'Land Rover' is selected from the Bluetooth device list.
	<p>Was an error immediately shown on the telephone handset?</p> <p>Yes Wait approximately 10 seconds then re-attempt selection, to a maximum of 4 times, waiting approximately 10 seconds between each attempt. If error still being displayed, contact your local in market support for assistance.</p> <p>No Enter PIN '2121' then continue with diagnosis.GO to A4.</p>
A4: PIN ENTRY STATUS	
	1 Check for successful PIN entry.
	<p>Was PIN entry successful?</p> <p>Yes GO to A5.</p> <p>No Wait approximately 10 seconds then re-attempt PIN entry, to a maximum of 4 times, waiting approximately 10 seconds between each attempt. If PIN entry is still un-successful, contact your local in market support for assistance.</p>
A5: 'NO PHONE FITTED' DISPLAY	
	1 Carry out checks to determine if 'No Phone Fitted' is still shown on vehicle display.
	<p>Is 'No Phone Fitted' still displayed?</p> <p>Yes From the telephone handset, select the connect option for the 'Land Rover' device identified in the Bluetooth device list. If 'No Phone Fitted' is still displayed, suspect a telephone handset fault. Carry out Pinpoint test again using known good telephone handset.</p> <p>No The telephone is paired and connected to the system. No further action is required for this symptom.</p>


PINPOINT TEST B : NOT AUTOMATICALLY CONNECTING	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CUSTOMER TELEPHONE IN POSITION 1	
 NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the bluetooth and auto connect functions are activated and the telephone handset is placed within the vehicle cabin area.	
	1 Carry out checks to determine if the Customer telephone is in position 1 in the Bluetooth Module device list.
	<p>Is the Customer telephone in position 1?</p> <p>Yes GO to B2.</p> <p>No Advise Customer that delays in connection will occur if telephone is not listed in position 1.</p>
B2: BLUETOOTH CONNECTION	
	1 Carry out checks to determine if Bluetooth connection to the vehicle has been achieved.
	<p>Has Bluetooth connection to the vehicle been achieved?</p> <p>Yes No further action is required for this symptom.</p> <p>No GO to B3.</p>
B3: 'NO PHONE FITTED' DISPLAY	
	1 Carry out checks to determine if 'Land Rover' is shown in the Customer Bluetooth telephone device display.
	Is 'Land Rover' identified in the Customer Bluetooth device list?

Yes	Select the device to connect then follow pairing instructions.
No	Carry out the 'Unable to Pair' Pinpoint Test. GO to A.

PINPOINT TEST C : POOR QUALITY AUDIO

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

C1: SIGNAL STRENGTH

 **NOTE:** Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.

	1 Check the signal strength displayed on the telephone handset.
	Are at least two signal strength bars shown on the telephone handset display?
Yes	GO to C2.
No	Suspect GSM Network issue. This can explain intermittent audio and dropped calls, and the inability to initiate calls.

C2: POOR AUDIO FROM THIRD PARTY ONLY

	1 Establish from Customer feedback/symptom if there is poor audio from the Third Party only.
	Is the poor audio from the Third Party only?
Yes	Suspect GSM Network issue. This can explain intermittent audio and dropped calls, and the inability to initiate calls.
No	GO to C3.

C3: POOR AUDIO TO THIRD PARTY ONLY

	1 Establish from Customer feedback/symptom if there is poor audio to the Third Party only.
	Is the poor audio to the Third Party only?
Yes	Check and install a new microphone as necessary.
No	GO to C4.

C4: POOR AUDIO WITH VEHICLE STATIONARY

	1 Establish from Customer feedback/symptom if there is poor audio when the vehicle is stationary only.
	Is the poor audio when the vehicle is stationary only?
Yes	Check and install a new microphone as necessary.
No	GO to C5.

C5: THIRD PARTY MOVING VEHICLE

	1 Establish from Customer feedback/symptom if the Third Party is in a moving vehicle.
	Is the Third Party in a moving vehicle?
Yes	There are limitations to the way the system can improve audio, and in this situation it is not possible to determine the source of the audio degradation.
No	GO to C6.


C6: CUSTOMER HEARING ECHO

	1 Establish from Customer feedback/symptom if the Customer is hearing an echo.
	Is the Customer hearing an echo?
Yes	Echo from the Third Party is not vehicle failure, it is the Third Party set-up. No further action is required for this symptom.
No	Contact your local in market support for assistance.

PINPOINT TEST D : NO AUDIO TO THIRD PARTY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------


D1: MICROPHONE DIAGNOSTIC TROUBLE CODES (DTCs)

 **NOTE:** Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.


	1 Using the Manufacturer approved diagnostic system, check for any logged microphone DTCs in Audio Front Control module.
	Is DTC B1D79-01 logged?
Yes	Carry out diagnosis of electrical failure as advised in Action column of DTC Index.
No	

Contact your local in market support for assistance.

PINPOINT TEST E : NO AUDIO FROM THIRD PARTY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: 'IN CALL' DISPLAY	
 NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.	
	1 Carry out checks to determine if 'In Call' is shown on the vehicle display.
	Is vehicle display showing 'In Call'? Yes Contact your local in market support for assistance.
	No Call has ended. No further action is required for this symptom.

PINPOINT TEST F : NO AUDIO

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: AUDIO FROM THIRD PARTY	
 NOTE: Prior to continuing with any diagnosis, ensure that the Customer telephone and level of software is included on the JLR approved list, the telephone battery is fully charged and in a serviceable condition, the telephone is placed within the vehicle cabin area and is connected to the vehicle via bluetooth.	
	1 Establish from Customer feedback/symptom if there is Audio from the Third Party.
	Is there Audio from the Third Party? Yes GO to F2.
	No Refer to the 'No Audio From Third Party' Pinpoint test. GO to E.

F2: AUDIO TO THIRD PARTY

	1 Establish from Customer feedback/symptom if there is Audio to the Third Party.
	Is there Audio to the Third Party? Yes GO to F3.
	No Refer to the 'No Audio To Third Party' Pinpoint test. GO to D.

F3: CD OR RADIO AUDIO

	1 Establish from Customer feedback/symptom if there is Audio from the CD or Radio.
	Is there Audio from the CD or Radio? Yes GO to F4.
	No Suspect MOST ring fault, refer to electrical circuit diagrams and check/rectify MOST ring as necessary.

F4: TELEPHONE HANDSET AUDIO

	1 Establish from Customer feedback/symptom if there is Audio from the telephone handset.
	Is there Audio from the telephone handset? Yes Ensure vehicle is parked. Disconnect and reconnect handset. If issue not resolved, contact your local in market support for assistance.
	No Contact you local in market support for assistance.

Information and Entertainment System - General Information - Information and Entertainment System

Diagnosis and Testing

Principles of Operation

For a detailed description of the information and entertainment system and operation, refer to the relevant Diagnosis and Testing section of the workshop manual. REFER to:

[Audio System](#) (415-01A Audio Unit, Diagnosis and Testing),
[Antenna](#) (415-02 Antenna, Description and Operation),
[Speakers](#) (415-03 Speakers, Diagnosis and Testing),
[Video System](#) (415-07 Video System, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval programme is in operation, prior to the installation of a new module/component.



When performing voltage or resistance tests, always use a digital multimeter accurate to three decimal places, and with an up-to-date calibration certificate. When testing resistance always take the resistance of the digital multimeter leads into account.



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity





Visual Inspection







Mechanical	Electrical
<ul style="list-style-type: none"> • Audio Head Unit (AHU) • Integrated Audio Module (IAM) • Audio Amplifier Module (AAM) • Multi-Function Display (MFD) • Touch Screen (TS) • Satellite Radio Control Module (SRCM) • Digital Radio Control Module (DRCM) • TV Control Module (TVCM) • Rear Seat Entertainment Control Module (RSECM) • Speakers • Scratched/dirty compact discs • Water ingress 	<ul style="list-style-type: none"> • Fuses • Wiring harnesses and connectors • Audio Head Unit (AHU) • Integrated Audio Module (IAM) • Audio Amplifier Module (AAM) • Multi-Function Display (MFD) • Touch Screen (TS) • Satellite Radio Control Module (SRCM) • Digital Radio Control Module (DRCM) • TV Control Module (TVCM) • Rear Seat Entertainment Control Module (RSECM) • Antennae • Speakers




3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index
5. Check DDW for open campaigns. Refer to the corresponding bulletins and SSMs which may be valid for the specific customer complaint and carry out the recommendations as required


Symptom Chart

Symptom	Display	Possible Causes	Action
Audio/video system inoperative at start up	Audio/video soft key greyed out on touch screen	<ul style="list-style-type: none"> • Last used audio/video source inoperative • MOST network fault 	<ul style="list-style-type: none"> • GO to Pinpoint Test A.
Soft key response different to soft key touched	Display normal	<ul style="list-style-type: none"> • Touch screen calibration incorrect 	<ul style="list-style-type: none"> • Perform touch screen calibration. GO to Pinpoint Test C.

Poor audio quality (all sources)	Display normal	<ul style="list-style-type: none"> • MOST harness connections loose • MOST harness connections contaminated • MOST harness misrouted - Too many bends or bend radius less than 25mm • Audio amplifier system fault 	<ul style="list-style-type: none"> • Check MOST harness connectors for security • Check MOST harness connectors for contamination • Check the routing of the MOST harness • Using the manufacturer approved diagnostic system, check the audio amplifier module for related DTCs and refer to the relevant DTC index
One or more speakers inoperative	Display normal	<ul style="list-style-type: none"> • Audio amplifier system fault 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the audio amplifier module for related DTCs and refer to the relevant DTC index
Radio inoperative	-	<ul style="list-style-type: none"> • AM/FM antenna fault • Integrated audio module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
Digital radio inoperative	-	<ul style="list-style-type: none"> • Digital radio antenna fault • Digital radio control module internal failure 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check the digital radio control module for related DTCs and refer to the relevant DTC index
Digital radio no signal reception - New digital radio control module	-	<ul style="list-style-type: none"> • Initial tuning not completed 	 <p>NOTE: Some functions are inhibited when the vehicle is moving.</p> <ul style="list-style-type: none"> • Operate the Auto-tune soft key
Digital radio poor signal reception	-	<ul style="list-style-type: none"> • Tuning not refreshed • Link DAB set to off • L-band antenna set to off in a L-band antenna region • Band 3 antenna set to off in a band 3 antenna region • L-band antenna or link harness damaged • Band 3 antenna or link harness damaged • Software issue 	 <p>NOTE: Some functions are inhibited when the vehicle is moving.</p> <ul style="list-style-type: none"> • Operate the Auto-tune soft key • Operate the Settings soft key, followed by the Options soft key and set Link DAB to on • Operate the Settings soft key, followed by the L band and Band 3 soft key • Operate the Settings soft key, followed by the L band and Band 3 soft key • Check the L-band antenna and link harness for damage • Check the band 3 antenna and link harness for damage • Using the manufacturer approved diagnostic system, re-configure the digital radio control module with the latest level software
Digital radio channel list not displayed	-	<ul style="list-style-type: none"> • Tuning not refreshed • L-band antenna set to off in a L-band antenna region • Band 3 antenna set to off in a band 3 antenna region 	 <p>NOTE: Some functions are inhibited when the vehicle is moving.</p> <ul style="list-style-type: none"> • Operate the Auto-tune soft key • Operate the Settings soft key, followed by the L band and Band 3 soft key • Operate the Settings soft key, followed by the L band and Band 3 soft key
Digital radio interrupted by announcements	-	<ul style="list-style-type: none"> • Announcements set to on 	 <p>NOTE: Some functions are inhibited when the vehicle is moving.</p> <ul style="list-style-type: none"> • Operate the Settings soft key, followed by the Announcements soft key, and set all Announcements to off
Unable to store	-	<ul style="list-style-type: none"> • Preset # soft key not 	<ul style="list-style-type: none"> • Operate the Preset # soft key for at

preset channels in digital radio		operated for sufficient duration	least 2 seconds to store the current station
Digital radio will not select preset station when Preset # soft key operated	-	<ul style="list-style-type: none"> No station stored to relevant Preset # soft key 	<ul style="list-style-type: none"> Store a station to the relevant Preset # soft key and retest
 <p>NOTE: Satellite Digital Audio Radio Service (SDARS) applies to NAS market vehicles only.</p> <p>Satellite radio inoperative</p>	-	<ul style="list-style-type: none"> Satellite radio antenna fault Satellite radio control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the satellite radio control module for related DTCs and refer to the relevant DTC index
 <p>NOTE: Satellite Digital Audio Radio Service (SDARS) applies to NAS market vehicles only.</p> <p>No Satellite Digital Audio Radio Service (SDARS) channels available</p>	No signal or Acquiring signal	<ul style="list-style-type: none"> Vehicle not in USA Poor signal reception Satellite Digital Audio Radio Service (SDARS) system fault 	<ul style="list-style-type: none"> No fault to rectify The vehicle must have clear line of sight to a satellite, which means being outside and having no blockages between the vehicle and the satellite Using the manufacturer approved diagnostic system, check the Satellite Radio Control Module (SRCM) for related DTCs and refer to the relevant DTC index
 <p>NOTE: Satellite Digital Audio Radio Service (SDARS) applies to NAS market vehicles only.</p> <p>Only one Satellite Digital Audio Radio Service (SDARS) channel available (channel 184)</p>	Unsubscribed	<ul style="list-style-type: none"> Channel 184 is available without subscription for a limited period (6 months) 	<ul style="list-style-type: none"> No fault to rectify. Subscribe to Satellite Digital Audio Radio Service (SDARS) to resume service
 <p>NOTE: Satellite Digital Audio Radio Service (SDARS) applies to NAS market vehicles only.</p> <p>No Satellite Digital Audio Radio Service (SDARS) channels available after 6 months without subscribing</p>	Unsubscribed	<ul style="list-style-type: none"> Channel 184 is available without subscription for a limited period (6 months) 	<ul style="list-style-type: none"> No fault to rectify. Subscribe to Satellite Digital Audio Radio Service (SDARS) to resume service
 <p>NOTE: Satellite Digital Audio Radio Service (SDARS) applies to NAS market vehicles only.</p> <p>Some Satellite Digital Audio Radio Service (SDARS) unavailable</p>	Unsubscribed	<ul style="list-style-type: none"> Adult channels blocked by subscription type (family package) 	<ul style="list-style-type: none"> No fault to rectify. Subscribe to Satellite Digital Audio Radio Service (SDARS) full package to receive adult channels
 <p>NOTE: Satellite Digital Audio Radio Service (SDARS) applies to NAS market vehicles only.</p> <p>Satellite Digital Audio Radio Service (SDARS) pay channels unavailable</p>	Unsubscribed	<ul style="list-style-type: none"> Payment not made 	<ul style="list-style-type: none"> No fault to rectify
Compact disc player inoperative	-	<ul style="list-style-type: none"> Incompatible/damaged compact disc Integrated audio module internal failure 	<ul style="list-style-type: none"> Insert a known good disc and retest Using the manufacturer approved diagnostic system, check the integrated audio module for related

			DTCs and refer to the relevant DTC index
Unable to upload files to the hard drive	-	<ul style="list-style-type: none"> Incompatible/damaged compact disc Integrated audio module internal failure 	<ul style="list-style-type: none"> Insert a known good disc and retest Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
Auxiliary audio inoperative	-	<ul style="list-style-type: none"> Incompatible/faulty auxiliary device Auxiliary device link cable fault Integrated audio module internal failure 	<ul style="list-style-type: none"> Connect a known good auxiliary device to the auxiliary socket and retest Connect a known good auxiliary device to the auxiliary socket using a known good link cable and retest Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
USB audio/video inoperative	-	<ul style="list-style-type: none"> Incompatible/faulty USB device Integrated audio module internal failure 	<ul style="list-style-type: none"> Connect a known good USB device to the auxiliary socket and retest Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
USB audio/video inoperative - Apple devices	-	<ul style="list-style-type: none"> Incompatible/faulty Apple device Bluetooth® and USB connections made in the incorrect order Integrated audio module internal failure 	<ul style="list-style-type: none"> Check Apple device compatibility table below. Connect a known good Apple device to the auxiliary socket and retest Audio streaming is supported via the USB cable but this must be connected after the cellular phone connects via Bluetooth® - Best practice is to start the engine (causing the Bluetooth® connection to be made) before connecting the USB cable Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
Television inoperative	-	<ul style="list-style-type: none"> TV antenna fault TV control module internal failure 	 <p>NOTE: Some functions are inhibited when the vehicle is moving.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the TV control module for related DTCs and refer to the relevant DTC index
DVD player inoperative	-	<ul style="list-style-type: none"> Incompatible/damaged compact disc Incorrect region set Integrated audio module internal failure 	 <p>NOTE: Some functions are inhibited when the vehicle is moving.</p> <ul style="list-style-type: none"> Insert a known good disc and retest Change region setting Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
Unable to pair mobile phone to vehicle via Bluetooth®	-	<ul style="list-style-type: none"> Incompatible mobile phone 	 <p>NOTE: Installing new components will not improve connectivity with an incompatible mobile phone.</p> <ul style="list-style-type: none"> Check mobile phone compatibility by referring to: www.landrover.com/Owners/Bluetooth and following the instructions on the page

Echo when using a mobile phone via Bluetooth®	-	Noise cancelling set to On in mobile phone and vehicle	Set noise cancelling to Off in mobile phone
Navigation system inoperative (integrated navigation system)	-	<ul style="list-style-type: none"> Navigation antenna fault Integrated audio module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
Navigation system inoperative (with navigation control module)	-	<ul style="list-style-type: none"> Navigation antenna fault Navigation control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the navigation control module for related DTCs and refer to the relevant DTC index
Traffic message channel inoperative	-	<ul style="list-style-type: none"> FM/TMC antenna fault VICS antenna fault Integrated audio module internal failure 	 <p>NOTE: Vehicle Information and Communication System (VICS) is a type of Traffic Message Channel system used in the Japan market only.</p> <ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the integrated audio module for related DTCs and refer to the relevant DTC index
Rear seat entertainment system inoperative	-	<ul style="list-style-type: none"> Rear seat entertainment control module internal failure 	<ul style="list-style-type: none"> Using the manufacturer approved diagnostic system, check the rear seat entertainment control module for related DTCs and refer to the relevant DTC index

USB/CD Data Disk Audio File Compatibility



NOTE: Before attempting a repair to the in-vehicle infotainment system following concerns regarding no playback of audio files stored either on a USB data storage device or on a CD data disc, check below to ensure that the audio files in question are encoded in a compatible format

There are a number of variables that can be set (either automatically or by the user) at the point of creating the audio file that may contribute to an audio file being encoded in an incompatible format. These include:

- The **type of audio file** created (MP3/WMA/AAC)
- The specification of **Variable Bit Rate** (VBR) or **Constant Bit Rate** (CBR) encoding
- If CBR encoding is being used, then a particular **bit rate** value (measured in kilobits per second - kbps) may be selected
- The rate of **sampling frequency**, measured in kilohertz (kHz), may also be selected

Diagnostic Procedures For Audio Files

Identify File Type: if a customer reports issues with audio file playback, first confirm that the data source is operating normally and is not locked or corrupted. This may be achieved by reading the USB storage device or data disk via a PC and confirming that the audio files can be seen/accessed as expected. If the storage device/data disk appears to be operating normally, the next step is to ascertain the file type of those files that will not play through the infotainment system. There are three types of compatible audio file, either **MP3** (which must have a file extension of .mp3); or **WMA** (which must have a file extension of .wma); or **AAC** (which must have a file extension of either .aac or .m4a). If the affected audio files are not of these types, then successful playback via the infotainment system may not be possible.

Further information about the audio file may be accessed via the file properties tab either when viewing the file in Windows Explorer or when playing the file via a digital media player programme. In such a way, it should be possible to ascertain some or all of the required information concerning the file's specified encoding type/bit rate/sampling frequency. Once this information has been obtained, use the tables detailed below to check if the suspect audio file is compatible with the vehicle infotainment system.

Playback Of Audio Files Stored On A USB Storage Device

USB MP3 Files (only if file extension is '.mp3'): Playback of MP3 audio files encoded in Variable Bit Rate (VBR) format is supported at bit rates between 8-320 kbps. For Constant Bit Rate (CBR) files, see table below for compatible sampling rates and bit rates.

File Format/Encoding Format	Sampling Rate	Bit Rates	Notes
MP3 (MPEG 2.5*)	All available are supported	8-160 kbps playback supported	*For MPEG 2.5 format audio files, playback cannot be guaranteed but an attempt will be made to play

MP3 (MPEG 2)	All available are supported	8-160 kbps playback supported	-
MP3 (MPEG 1)	All available are supported	32-128 kbps; 160-320 kbps playback supported	Playback of MPEG 1 audio files with a bit rate of 144 kbps is not supported

USB WMA Files (only if file extension is '.wma'): Playback of WMA audio files encoded in Variable Bit Rate (VBR) format and created using Windows Media Player Version 8.0 and/or Version 9.0 is supported at bit rates between 5-384 kbps. For Constant Bit Rate (CBR) files, see table below for compatible sampling rates and bit rates. Note that WMA CBR files created using Windows Media Player Versions 7.0, 8.0 and 9.0 can be supported, while playback will be attempted but cannot be guaranteed for files created using Windows Media Player Versions 4.0, 4.1, 9 Beta and 9.1.

File Format/Encoding Format	Sampling Rate	Bit Rates	Notes
WMA - Constant Bit Rate (CBR)	At sampling rates of 8 KHz playback supported only at specified bit rates	5-8 kbps (mono); 12 kbps (stereo) playback supported. 31 kbps (mono) playback cannot be guaranteed but an attempt will be made to play	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 11.03 KHz playback supported only at specified bit rates	8-10 kbps (mono) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 16 KHz playback supported only at specified bit rates	10-12 kbps and 16 kbps (mono); 16-20 kbps (stereo) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 22.05 KHz playback supported only at specified bit rates	16-20 kbps (mono); 20, 22 and 36 kbps (stereo) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 32 KHz playback supported only at specified bit rates	20 kbps (mono); 32, 40, 48 kbps (stereo) playback supported. 32 kbps (mono); 22, 36, 44, 64, 384 kbps (stereo) playback cannot be guaranteed but an attempt will be made to play	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 44.1 KHz playback supported only at specified bit rates	20, 32 and 48 kbps (mono); 32, 48, 64, 80, 96, 128, 160, 192, 256 and 320 kbps (stereo) playback supported. 15 kbps (mono) playback cannot be guaranteed but an attempt will be made to play	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 48 KHz playback supported only at specified bit rates	64, 96, 128, 160, 192 and 256* kbps (stereo) playback supported. 32 kbps (mono) & 48, 63, 95, 127, 191 and 320 kbps (stereo) playback cannot be guaranteed but an attempt will be made to play	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported. *All available versions can be supported at a bit rate of 256 kbps for this sampling rate only

USB AAC Files (only if file extension is '.aac' or '.m4a'): Playback of AAC audio files encoded in Variable Bit Rate (VBR) format is supported at bit rates between 8-320 kbps. For Constant Bit Rate (CBR) files, see table below for compatible sampling rates and bit rates.

--	--	--	--

File Format/Encoding Format	Sampling Rate	Bit Rates	Notes
AAC - Constant Bit Rate (CBR)	At sampling rates of between 8-32 KHz, playback cannot be not guaranteed but may be possible at some bit rates	8-320 kbps playback cannot be not guaranteed, but may be possible in some cases	-
	At sampling rates of between 44.1 - 48 KHz, playback supported at specified bit rates	48-80 kbps; 96-128 kbps; 160-256 kbps; 320 kbps playback supported	Playback at other bit rates between 44.1-576 kbps may be possible, but cannot be verified
	At sampling rates of between 64-96 KHz, playback cannot be not guaranteed but an attempt will be made to play at some bit rates	96-768 kbps playback cannot be not guaranteed but an attempt will be made to play	Playback at other bit rates between 64-1152 kbps cannot be not guaranteed but an attempt will be made to play

Playback Of Audio Files Stored On A CD Data Disk

CD Data Disk MP3 Files (only if file extension is '.mp3'): Playback of MP3 audio files encoded in Variable Bit Rate (VBR) format is supported at bit rates between 8-320 kbps. For Constant Bit Rate (CBR) files, see table below for compatible sampling rates and bit rates.

File Format/Encoding Format	Sampling Rate	Bit Rates	Notes
MP3 (MPEG 2.5*)	All available are supported	8-160 kbps playback supported	*For MPEG 2.5 format audio files, playback cannot be guaranteed but an attempt will be made to play
MP3 (MPEG 2)	All available are supported	8-160 kbps playback supported	-
MP3 (MPEG 1)	All available are supported	32-128 kbps; 160-320 kbps playback supported	Playback of MPEG 1 audio files with a bit rate of 144 kbps is not supported

CD Data Disk WMA Files (only if file extension is '.wma'): Playback of WMA audio files encoded in Variable Bit Rate (VBR) format and created using Windows Media Player Version 9.0 is supported at bit rates between 32-192 kbps. For Constant Bit Rate (CBR) files, see table below for compatible sampling rates and bit rates. Note that WMA CBR files created using Windows Media Player Version 9.0 can be supported, while playback will be attempted but cannot be guaranteed for files created using Windows Media Player Versions 4.0, 4.1, 7.0, 8.0, 9 Beta and 9.1.

File Format/Encoding Format	Sampling Rate	Bit Rates	Notes
WMA - Constant Bit Rate (CBR)	At sampling rates of 22.05 KHz playback supported only at specified bit rates	32 kbps (stereo) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 32 KHz playback supported only at specified bit rates	32, 36, 40, 44 and 48 kbps (stereo) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 44.1 KHz playback supported only at specified bit rates	32 and 48 kbps (mono); 32, 48, 64, 80, 96, 128, 160 & 192 kbps (stereo) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported
	At sampling rates of 48 KHz playback supported only at specified bit rates	64, 96, 128, 160 & 192 kbps (stereo) playback supported	'Lossless', 'Professional' or 'Voice' format files created in Windows Media Player Version 9.0 cannot be supported. DRM (Digital Rights Management) protected files cannot be supported

CD Data Disk AAC Files (only if file extension is '.aac' or '.m4a'): Playback of AAC audio files encoded in Variable Bit Rate (VBR) format is supported at bit rates between 8-320 kbps. For Constant Bit Rate (CBR) files, see table below for compatible sampling rates and bit rates.

File Format/Encoding Format	Sampling Rate	Bit Rates	Notes
AAC - Constant Bit Rate (CBR)	At sampling rates of between 8-24 KHz playback supported at specified bit rates	32-40 kbps; 48-80 kbps; 96-128* kbps playback supported	*112 & 128 kbps bit rate playback not supported for audio files with a sampling rate of 8 KHz

At sampling rates of between 16-32 KHz playback supported at specified bit rates	160-256* kbps playback supported	*224 & 256 kbps bit rate playback not supported for audio files with a sampling rate of 16 KHz
At sampling rates of between 32-48 KHz playback supported at specified bit rates	48-80 kbps; 96-128 kbps; 160-256 kbps; 320 kbps playback supported	-

Portable Audio Interface Panel/USB Power Supply

If DTC B1252-19 (USB Port General Electrical Failures - Circuit current above threshold) has been logged, the IAM has detected a current draw from the Portable Audio Interface Panel in excess of 1.7 Amps. In these circumstances, the power supply to the Portable Audio Interface Panel will be cut for an ignition cycle. To reset the system and restore power, the vehicle needs to be locked (with ignition off) and armed for at least 5 minutes.





The USB port on the Portable Audio Interface Panel is able to supply current to a maximum of 500mA. It should be noted that any portable devices connected via the USB port that required more power may not charge or power up correctly and that this may affect the operation of this device with the infotainment system.

Apple Device Compatibility

The following table lists some Apple devices and their compatibility with the information and entertainment system using a USB cable.


Fully Supported	Partially Supported	Not Supported
<ul style="list-style-type: none"> iPod® Classic - 6th/7th generation iPod® Nano - 3rd/4th/5th/6th generation iPod® Touch - 2nd/3rd/4th generation iPhone™ 3/3S iPhone™ 4/4S iPad™ - 1st generation (with iOS 4.0 or later) 	<ul style="list-style-type: none"> iPod® Classic - 4th/5th generation iPod® Nano - 1st/2nd generation iPod® Touch - 1st generation iPhone™ 	<ul style="list-style-type: none"> iPod® Classic - 1st/2nd/3rd generation iPod® Shuffle - 1st/2nd/3rd/4th generation

Pinpoint Tests

PINPOINT TEST A : SOURCE TESTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: SOURCE TEST 1	
 NOTE: Soft key confirmation tones will not be audible if this preference is set to off (Set-up / System / Button feedback)	
1 Operate the available soft keys	
Was there an audible confirmation tone to indicate that the soft key input was detected?	
Yes Audio amplifier module and MOST network functioning. GO to A2.	
No Audio amplifier module fault or MOST ring break. GO to A2.	
A2: SOURCE TEST 2	
NOTES:	
 Operating the steering wheel mode switch briefly will cycle through the audio/video sources as follows: Radio - DAB/SDARS - My Music - My Video	
 Operating the steering wheel mode switch for >2 seconds will cycle through the minor sources as follows: (Radio) FM1 - FM2 - FM3 - AM1 - AM2, and (My Music) DVD/CD - iPod® - BT - Stored CDs - USB - AUX	
 Depending on vehicle specification, various audio/video sources may be installed and are contained in the control modules as follows: <ul style="list-style-type: none"> Integrated Audio Module (IAM) - including radio, CD, iPod®, USB, my music, my video, phone and navigation Digital Radio Control Module (DRCM) Satellite Radio Control Module (SRCM) Television Control Module (TVCM) Rear Seat Entertainment Control Module (RSECM) 	
1 Cycle through the audio/video sources by operating the steering wheel mode switch	
Did the audio/video soft key return to normal and/or the selected source function normally?	


	Yes MOST network functioning. GO to A3. No Possible MOST ring break. GO to A3.
A3: SOURCE TEST 3	
	1 Operate the Navigation soft key (or switch)
	Did the navigation system start up and display a map? Yes GO to A4. No GO to A4.
A4: SOURCE TEST 4	
	1 Operate the Phone soft key (or switch)
	Is the phone menu displayed? Yes GO to Pinpoint Test B. No GO to Pinpoint Test B.

PINPOINT TEST B : FUSE PULL TESTS

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: FUSE PULL TEST 1	
	1 Remove the fuse from the missing audio/video source control module circuit
	2 Inspect the fuse
	Has the fuse blown? Yes Refer to the electrical circuit diagrams and test the circuit for short circuit to ground. Repair as necessary. Install a new fuse. GO to B2. No Wait at least 30 seconds and re-install the fuse. GO to B2.
B2: FUSE PULL TEST 2	
 NOTE: Depending on vehicle specification, various audio/video sources may be installed and are contained in the control modules as follows: <ul style="list-style-type: none"> • Integrated Audio Module (IAM) - including radio, CD, iPod®, USB, my music, my video, phone and navigation • Digital Radio Control Module (DRCM) • Satellite Radio Control Module (SRCM) • Television Control Module (TVCM) • Rear Seat Entertainment Control Module (RSECM) 	
	1 Set the ignition to off
	2 Set the ignition to on
	3 Check the operation of the touch screen and all audio/video sources
	Has full audio/video functionality been restored? Yes If the missing source was part of the integrated audio module, using the manufacturer approved diagnostic system, re-configure the integrated audio module with the latest level software. Tests complete No GO to B3.
B3: FUSE PULL TEST 3	
	1 Refer to the electrical circuit diagrams and identify the next control module connected to the MOST network
	Is there another control module that has not been reset? Yes GO to B4. No MOST ring break present. REFER to: Communications Network (418-00 Module Communications Network, Diagnosis and Testing).
B4: FUSE PULL TEST 4	
	1 Remove the fuse from the next control module circuit
	2 Inspect the fuse
	Has the fuse blown? Yes Refer to the electrical circuit diagrams and test the circuit for short circuit to ground. Repair as necessary. Install a new fuse. GO to B2. No Wait at least 30 seconds and re-install the fuse. GO to B2.

PINPOINT TEST C : TOUCH SCREEN CALIBRATION

TEST	DETAILS/RESULTS/ACTIONS
------	-------------------------

CONDITIONS	
C1: TOUCH SCREEN CALIBRATION	
 NOTE: A suitable stylus (for example the stylus supplied with a Panasonic CF-19) will be required for this procedure.	
	1 Operate the Valet soft key continuously until the engineering mode screen is displayed (approximately 20 seconds)
	2 Scroll down and select Touch Calibration
	3 Select OK
	4 Tap the touch screen to proceed
	5 Using a suitable stylus, tap the touch screen at the points indicated until a pass/fail result is displayed
	Was the touch screen calibration successful? Yes Calibration complete No Calibration failed. GO to C1.

Pinpoint Tests For Suspected Loudspeaker Faults In Harman/Kardon Audio Systems

 **NOTE:** See separate Pinpoint Tests (below) for sub-woofer faults

PINPOINT TEST D : NO SOUND OUTPUT FROM LOUDSPEAKER(S)	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: NO SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check loudspeaker operation
	Is the harness connector securely connected to the audio amplifier module and the loudspeaker unit(s)? Yes Proceed to the next step GO to D2. No Reconnect wiring harness to audio amplifier module/loudspeaker unit(s)
D2: NO SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check integrated audio module (IAM) operation
	Is the integrated audio module (IAM) operational? Yes Proceed to the next step GO to D3. No Check the integrity of the power supply circuits/fuses to the integrated audio module and rectify as required. Check the IAM for related DTCs and refer to the relevant DTC index
D3: NO SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check which loudspeakers are operational
	Are all loudspeakers working? Yes Proceed to the next step GO to D4. No Use the fader control to direct audio output to different loudspeaker locations to establish which units are non-operational. Refer to the electrical circuit diagrams and check the circuits between the audio amplifier module and the affected loudspeaker units for short circuit to ground, open circuit, high resistance. Repair circuit(s) as required. If fault persists, replace non-operational loudspeaker unit(s) as required
D4: NO SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check for signs of water ingress
	Does the loudspeaker drive unit show any signs of water damage? Yes Replace the loudspeaker unit(s) as required No Proceed to the next step GO to Pinpoint Test E.

PINPOINT TEST E : POOR OR WEAK SOUND OUTPUT FROM LOUDSPEAKER(S)	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: POOR OR WEAK SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check connections to loudspeaker units
	Are the connectors inserted securely into the loudspeaker units? Yes Proceed to the next step GO to E2. No Ensure all connectors are securely attached to the loudspeaker units
E2: POOR OR WEAK SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check integrity of vehicle power supply fuses
	Are the vehicle/audio amplifier module power supply fuses functional? Yes

	Proceed to the next step GO to E3.
No	Replace fuse(s) as required
E3: POOR OR WEAK SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check power and ground circuits to the infotainment system components
	Are all the necessary power and ground feeds present?
Yes	Proceed to the next step GO to E4.
No	Refer to the electrical circuit diagrams and check the infotainment power and ground circuits for short circuit to ground, open circuit, high resistance. Repair circuit(s) as required
E4: POOR OR WEAK SOUND OUTPUT FROM LOUDSPEAKER(S)	
	1 Check power supply voltage at power supply connectors
	Is the power supply voltage measured at the power supply connectors between 12 and 14 volts?
Yes	No further action
No	Refer to the electrical circuit diagrams and check the infotainment power supply circuits for short circuit to ground, open circuit, high resistance. Repair circuit(s) as required. Refer to the relevant section of workshop manual and battery care manual. Check battery state of charge and starting/charging system performance and rectify as required

PINPOINT TEST F : LOUDSPEAKER VIBRATING (BUZZING) EXCESSIVELY	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: LOUDSPEAKER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check for extreme bass/treble settings
	Is the audio system output settings for bass and/or treble set too high?
Yes	Adjust settings to appropriate levels
No	Proceed to the next step GO to F2.
F2: LOUDSPEAKER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check loudspeaker unit(s) fixing screws are securely fastened
	Are all loudspeaker fixing screws fully secured to the surrounding trim?
Yes	Proceed to the next step GO to F3.
No	Tighten the fixing screws to the correct torque as directed in the workshop manual
F3: LOUDSPEAKER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check if the wiring harness is resting against the internal surface of the loudspeaker
	Is there any cabling or other parts of the wiring harness resting against the internal surface of the loudspeaker?
Yes	Re-route and secure the wiring harness so that it is not resting against any internal surfaces of the loudspeaker
No	Proceed to the next step GO to F4.
F4: LOUDSPEAKER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check security of trim in the vicinity of the loudspeaker units
	Is the trim secure in the vicinity of the loudspeaker units?
Yes	No further action
No	Secure loose trim components to ensure no vibration
F5: AUDIO OUTPUT DISTORTED	
	1 Check for extreme bass/treble settings
	Is the audio system output settings for bass and/or treble set too high?
Yes	Adjust settings to appropriate levels
No	No further action

Pinpoint Tests For Suspected Sub-Woofer Faults In Harman/Kardon Audio Systems



NOTE: See separate Pinpoint Tests (above) for other loudspeaker faults

PINPOINT TEST G : NO SOUND OUTPUT FROM SUB-WOOFER	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: NO SOUND OUTPUT FROM SUB-WOOFER	
	1 Check sub-woofer operation
	Is the harness connector securely connected to the audio amplifier module and the sub-woofer unit?
Yes	

	Proceed to the next step GO to G2.
No	Reconnect wiring harness to audio amplifier module/sub-woofer unit
G2: NO SOUND OUTPUT FROM SUB-WOOFER	
1	Check integrated audio module (IAM) operation
	Is the integrated audio module (IAM) operational?
Yes	Proceed to the next step GO to G3.
No	Check the integrity of the power supply circuits/fuses to the integrated audio module and rectify as required. Check the IAM for related DTCs and refer to the relevant DTC index
G3: NO SOUND OUTPUT FROM SUB-WOOFER	
1	Check which sub-woofers are operational
	Are all sub-woofers working?
Yes	Proceed to the next step GO to G4.
No	Use the fader control to direct audio output to different sub-woofer locations to establish which units are non-operational. Refer to the electrical circuit diagrams and check the circuits between the audio amplifier module and the affected sub-woofer units for short circuit to ground, open circuit, high resistance. Repair circuit(s) as required. If fault persists, replace non-operational sub-woofer unit(s) as required
G4: NO SOUND OUTPUT FROM SUB-WOOFER	
1	Check for signs of water damage around sub-woofer unit(s)
	Are there any signs of water damage around sub-woofer unit(s)?
Yes	Dis-assemble sub-woofer moulding and check loudspeaker condition. If the sub-woofer drive unit shows signs of water damage, replace the sub-woofer unit(s) as required
No	Proceed to the next step GO to G5.
G5: NO SOUND OUTPUT FROM SUB-WOOFER	
1	Check for any visible loose components on sub-woofer drive unit
	Are there any visible loose components (ie: loose wires) on the sub-woofer drive unit
Yes	Replace the sub-woofer unit(s) as required
No	No further action

PINPOINT TEST H : POOR OR WEAK SOUND OUTPUT FROM SUB-WOOFER(S)	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: POOR OR WEAK SOUND OUTPUT FROM SUB-WOOFER(S)	
1	Check connections to sub-woofer units
	Are the connectors inserted securely into the sub-woofer units?
Yes	Proceed to the next step GO to H2.
No	Ensure all connectors are securely attached to the sub-woofer units
H2: POOR OR WEAK SOUND OUTPUT FROM SUB-WOOFER(S)	
1	Check integrity of vehicle power supply fuses
	Are the vehicle/audio amplifier module power supply fuses functional?
Yes	Proceed to the next step GO to H3.
No	Replace fuse(s) as required
H3: POOR OR WEAK SOUND OUTPUT FROM SUB-WOOFER(S)	
1	Check power and ground circuits to the infotainment system components
	Are all the necessary power and ground feeds present?
Yes	Proceed to the next step GO to H4.
No	Refer to the electrical circuit diagrams and check the infotainment power and ground circuits for short circuit to ground, open circuit, high resistance. Repair circuit(s) as required
H4: POOR OR WEAK SOUND OUTPUT FROM SUB-WOOFER(S)	
1	Check power supply voltage at power supply connectors
	Is the power supply voltage measured at the power supply connectors between 12 and 14 volts?
Yes	No further action
No	Refer to the electrical circuit diagrams and check the infotainment power supply circuits for short circuit to ground, open circuit, high resistance. Repair circuit(s) as required. Refer to the relevant section of workshop manual and battery care manual. Check battery state of charge and starting/charging system performance and rectify as required

PINPOINT TEST I : SUB-WOOFER VIBRATING (BUZZING) EXCESSIVELY

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
I1: SUB-WOOFER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check for extreme bass/treble settings
	Is the audio system output settings for bass and/or treble set too high?
	Yes Adjust settings to appropriate levels
	No Proceed to the next step GO to I2 .
I2: SUB-WOOFER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check sub-woofer unit(s) fixing screws are securely fastened
	Are all sub-woofer fixing screws fully secured to the surrounding trim?
	Yes Proceed to the next step GO to I3 .
	No Tighten the fixing screws to the correct torque as directed in the workshop manual
I3: SUB-WOOFER VIBRATING (BUZZING) EXCESSIVELY	
	1 Check security of trim in the vicinity of the sub-woofer units
	Is the trim secure in the vicinity of the sub-woofer units?
	Yes No further action
	No Secure loose trim components to ensure no vibration

PINPOINT TEST J : SUB-WOOFER AUDIO OUTPUT DISTORTED	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
J1: SUB-WOOFER AUDIO OUTPUT DISTORTED	
	1 Check for extreme bass/treble settings
	Is the audio system output settings for bass and/or treble set too high?
	Yes Adjust settings to appropriate levels
	No Proceed to the next step GO to J2 .
J2: SUB-WOOFER AUDIO OUTPUT DISTORTED	
	1 Check if the distortion continues when sub-woofer casing is removed
	Does the distortion continue when sub-woofer casing is removed?
	Yes Replace the sub-woofer unit(s) as required
	No No further action

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: (100-00 General Information)

[Diagnostic Trouble Code \(DTC\) Index - DTC: Audio Amplifier Module \(AAM\)](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: Audio Head Unit \(AHU\) - Low Line](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: Digital Radio Control Module \(DRCM\)](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: Integrated Audio Module \(IAM\) - High Line](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: Integrated Control Panel \(ICP\)](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: Rear Integrated Control Panel \(RICP\)](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: Multi-Function Display \(MFD\)](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: Navigation Control Module \(NCM\) - India & Israel](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: Navigation Control Module \(NCM\) - Extended Markets](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: Rear Seat Entertainment Control Module \(RSECM\)](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: Satellite Radio Control Module \(SRCM\)](#) (Description and Operation),
[Diagnostic Trouble Code Index: Touch Screen - DTC: Touch Screen \(TS\)](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: TV Control Module \(TVCM\) - Digital](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: Telephone Interface Module \(TIM\)](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: TV Control Module \(TVCM\) - Hybrid](#) (Description and Operation),
[Diagnostic Trouble Code \(DTC\) Index - DTC: TV Control Module \(TVCM\) - Conditional Access System](#) (Description and Operation).

Information and Entertainment System - General Information - Navigation System

Diagnosis and Testing

Principles of Operation

For a detailed description of the information and entertainment system and operation, refer to the relevant Diagnosis and Testing section of the workshop manual. REFER to: (415-01 Information and Entertainment System)

Audio System (Description and Operation),
 Audio System (Description and Operation),
 Audio System (Description and Operation).

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Principles of Operation

The information in this section is intended to help with basic diagnosis of the navigation system.

For a detailed description of the Navigation System, refer to the relevant Description and Operation section in the Workshop Manual.

Touch Screen (TS) and Navigation Diagnostics

Fault codes and diagnostics can be retrieved/achieved using the manufacturer approved diagnostic system

Hard Key Test

The hard key test is used to check the operation of the hard switches.

If switch operation is normal, the switch colour on the screen will change when a hard switch is pressed. (Power switch operation cannot be checked on this screen.)

Touch Switch Test

The touch switch test calibrates the touch switch coordinates and checks touch switch operation.

Start Calibration - Calibrates the switch coordinates. Calibrate the coordinates by touching each of the "+" marks in the four corners of the screen.



NOTE: Do not touch any locations other than the "+" marks. (Touching other locations may invalidate the calibration.)

Touch Switch Check - Checks for deviation in the coordinates. Check the coordinates of the touched location by verifying the displayed values. Touch and hold "press here" to return to the previous screen. If there is a large deviation in the coordinates, calibrate the touch switch using the "Start Calibration" function.

DTC Information

Search for the meaning of the displayed DTC.

Vehicle Configurations

Display the status of each vehicle system.

Speed Lock Configuration - Display the status of compulsory navigation settings (setting status of switches that cannot be operated) when driving.

Configurations

Display primary system information.

Vehicle Signals

Display the status of vehicle signals inputted to the Touch Screen (TS). These signals include:

- Lights (on or off)
- Ambient light sensor voltage
- Backlight dimming duty
- Graphic illumination dimming duty

- Vehicle speed, GPS speed, MOST km/h
- Battery voltage
- Reverse gear / electric park brake position (on or off)
- Speed inhibit
- MOST Fibre Optic Transceiver (FOT) temperature
- Output audio allocation

Video Inputs Test

This screen will allow the testing of video inputs that are connected to the Touch Screen (TS). These include:

- Companion camera
- Rear view / proximity camera
- TV/DVD

Self Test

Performs system self-diagnosis and displays the diagnostic results.

If an abnormality is present, a DTC is displayed.

MOST Test

Display the MOST connection status, and reception/transmission messages related to MOST.

"Mpr" displays the number of MOST devices existing on MOST. When "0" or "1" is displayed, communication is not possible.

Colour bar

This function allows the technician to test the colours generated by the Touch Screen (TS). A second screen displays six solid colours, selecting the colour will fill the screen with the chosen colour and pressing the Touch Screen (TS) again will revert back to the colour test screen.

Loading

Update the navigation program.

For details on the update method, refer to the "Navigation Update Tool" operation manual.

HDD information

Display information on the Hard Disc Drive (HDD).

SMART test (Self-Monitoring Analysis and Reporting Technology) is initiated from this screen

Vehicle information

Display information on the vehicle.

- Car configuration - Displays information on vehicle environment settings.
 - Unit (distance) - Units of distance
 - Unit (time) - Units of time
 - Language - Displayed language
 - Fuel information - Remaining fuel quantity
 - Mileage information - Vehicle mileage display
 - Time information - Current time display
 - Override information - Status of switch operation inhibitions (Setting status of switches that cannot be operated.)
- GPS information - Display GPS related information.
 - Received position - Displays the latitude and longitude (displayed in degrees, minutes, and seconds) for the position information calculated by GPS.
 - Map matched position - Displays the latitude and longitude (displayed in degrees, minutes, and seconds) for the position information being used for map matching.
 - Satellites - Number of acquired satellites.
 - Current address - Address of the current location.
 - Satellite Information - Displays satellite information for up to 12 GPS satellite search targets.
 - Measurement HDOP - Positioning accuracy.
 - Status - Positioning status.
 - Date - Displays the current date and time in the following order: day, month, year, hour, minute, second. The year is displayed using the four-digit western calendar; time is displayed in Greenwich Mean Time (GMT).
- Vehicle sensor - Display vehicle signals inputted to the Touch Screen (TS).
 - REV - Reverse signal status.
 - Speed - Current vehicle speed.
 - Speed pulse count - Speed pulse count value.
 - Distance calibration - Learning information for distance calibration.
 - Voltage/Offset - Gyro sensor output voltage value/voltage correction value.
 - Relative bearing - Relative bearing (0° when navigation is started.)
 - Gyro sense - Learning value for gyro sensitivity.
 - Reset - Resets the gyro sensor relative bearing value.
- RDS-TMC information - Display RDS-TMC related information.
 - Date/time (GMT) - Date and time for the TMC signal.
 - Frequency - TMC signal frequency.

- PI code - Personal identification code for the broadcast station.
- PS name - Broadcast station name.
- Country code - Database country code.
- LTN - Database location number (location table number.)
- Service ID - Service provider identification number.
- Air data - TMC data.

Microphone

Check the volume for the voice recognition microphone inputted to the Touch Screen (TS). These include:

- PTT switch status - Checks the PTT switch connection. When the PTT switch is pressed, a signal will be outputted, and the indicator displays in green.
- Microphone input level judging - If a sampling of the user's voice command is at or above the threshold value, the indicator displays in blue.
- Microphone level - Displays the microphone input level.

Voice output check

Check the audio output.

- ON (Normal) - Outputs ADPCM voice (1 kHz sine wave) for five seconds.
- ON (Max) - Outputs ADPCM voice (maximum 1 kHz sine wave) for five seconds.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of damage, water ingress and system integrity.
3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Visual Inspection

Electrical
<ul style="list-style-type: none"> • Battery • Fuses <ul style="list-style-type: none"> - Central and Battery Junction Boxes - Megafuses • Wiring harness • Damaged, loose or corroded connectors • Touch Screen (TS) • GPS antenna • TV antenna • Satellite antenna • FM antenna • Companion camera • Rear view camera • Microphone • Accessory USB Unit (AUU) • Steering wheel controls • Clock spring • Integrated Head Unit (IHU) • Audio amplifier • Anti-lock Brake System control module (ABS) • Wheel speed sensors • Vehicle Information and Communication System (VICS Japan only) receiver • VICS beacon antenna (Japan only) • Controller Area Network (CAN) circuits • Media Oriented System Transport (MOST) system • Gigabit Video Interface (GVIF) • Central Junction Box (CJB) • Terrain response • Mobile telephone

Symptom Chart

Symptom	Possible Cause	Action
Black screen (navigation and audio screens do not display)	<ul style="list-style-type: none"> • Temperature in passenger compartment too low • Condensation in passenger compartment • Electrical harness open/short circuit, disconnected 	<ul style="list-style-type: none"> • GO to Pinpoint Test A.

	<ul style="list-style-type: none"> • Component failure 	
The navigation screen does not display, even when the "NAVIGATION" button is pressed (screen does not change)	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure 	<ul style="list-style-type: none"> • GO to Pinpoint Test B.
The hard switches do not respond	<ul style="list-style-type: none"> • Component failure • Switch failure 	<ul style="list-style-type: none"> • GO to Pinpoint Test C.
The audio screen cannot be operated (does not display)	<ul style="list-style-type: none"> • Media Oriented System Transport (MOST) system • Electrical harness open/short circuit, disconnected 	<ul style="list-style-type: none"> • GO to Pinpoint Test D.
The screen does not dim	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure 	<ul style="list-style-type: none"> • GO to Pinpoint Test E.
Noise on the screen, screen colour is abnormal	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure 	<ul style="list-style-type: none"> • GO to Pinpoint Test F.
The touch switches do not respond	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure 	<ul style="list-style-type: none"> • GO to Pinpoint Test G.
There is considerable deviation between the displayed vehicle position and the actual position	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure 	<ul style="list-style-type: none"> • GO to Pinpoint Test H.
The GPS no reception mark does not disappear	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure • No reception from satellite 	<ul style="list-style-type: none"> • GO to Pinpoint Test I.
No sound is emitted	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure • Incorrect system settings 	<ul style="list-style-type: none"> • GO to Pinpoint Test J.
There is no navigation voice guidance	<ul style="list-style-type: none"> • Volume level set too low • The amplifier and speakers are incorrectly connected 	<ul style="list-style-type: none"> • GO to Pinpoint Test K.
Voice recognition does not function	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure 	<ul style="list-style-type: none"> • GO to Pinpoint Test L.
The vehicle position rotates randomly	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure • Vehicle on a turntable in a parking building 	<ul style="list-style-type: none"> • GO to Pinpoint Test M.
The vehicle mark display is unstable	<ul style="list-style-type: none"> • Electrical harness open/short circuit, disconnected • Component failure • No reception from satellite 	<ul style="list-style-type: none"> • GO to Pinpoint Test N.
The vehicle position does not update	<ul style="list-style-type: none"> • HDD contaminated/damaged • Electrical harness open/short circuit, dis- 	<ul style="list-style-type: none"> • GO to Pinpoint Test O.

	<ul style="list-style-type: none"> connected Component failure 	
The map display is incomplete	<ul style="list-style-type: none"> HDD contaminated/damaged Electrical harness open/short circuit, disconnected Component failure 	<ul style="list-style-type: none"> GO to Pinpoint Test P.
Calls cannot be received or placed with Bluetooth®; Bluetooth® cannot connect with the vehicle	<ul style="list-style-type: none"> Incompatible Bluetooth® telephone Incorrect initial connection settings Electrical harness open/short circuit, disconnected Component failure 	<ul style="list-style-type: none"> GO to Pinpoint Test Q.
The map cannot be updated	<ul style="list-style-type: none"> Refer to the "Navigation Update Tool" operation manual 	<ul style="list-style-type: none"> Refer to the "Navigation Update Tool" operation manual
An error screen displays on the navigation screen	<ul style="list-style-type: none"> Access to the map data has not been granted 	<ul style="list-style-type: none"> GO to Pinpoint Test R.
The dual view cannot be switched	<ul style="list-style-type: none"> Incorrect car configuration data received Media Oriented System Transport (MOST) system Component failure 	<ul style="list-style-type: none"> GO to Pinpoint Test S.

Pinpoint Tests

NOTES:



If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval Program is in operation, prior to the installation of a new module/component.




The built in diagnostics are accessed as follows:

- 1. With the vehicle at rest, place the ignition switch "ON", or start the engine.
- 2. Press and hold the Touch Screen (TS) in the centre at the top of the screen for approximately 5 seconds and then press and hold the Touch Screen (TS) at the top left corner of the screen for approximately 5 seconds.
- 3. A 'Diag PIN Entry' box will appear' Type in the access code 753.
- 4. Once this code has been accepted the Diagnostic Menu screen will be displayed.


PINPOINT TEST A : BLACK SCREEN (NAVIGATION AND AUDIO SCREENS DO NOT DISPLAY.)	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: THE SCREEN SAVER FUNCTION WORKS	
	1 Check the screen saver function works.
	Does the screen saver function work? Yes Operation is normal. No Proceed to the next step. GO to A2.
A2: THE DISPLAY BACKLIGHT EMITS LIGHT	
	1 Check the display backlight emits light.
	Does the display backlight emits light? Yes Proceed to the next step. No GO to A12.
A3: THE SCREEN IS TURNED OFF	
	1 Check the screen is not turned off.
	Do the navigation and audio screens display when the screen is turned on? Yes Operation is normal.

	<p>No GO to A4.</p>
A4: THE VEHICLE INTERIOR TEMPERATURE IS -20°C OR LESS	
	<p>1 Check the cabin internal temperature.</p>
	<p>Is the cabin internal temperature -20°C or lower? Yes Raise the cabin internal temperature, re-test the vehicle. No GO to A5.</p>
A5: CONDENSATION IS FORMING INSIDE THE VEHICLE	
	<p>1 Check for condensation occurring inside the passenger compartment.</p>
	<p>Is condensation occurring inside the passenger compartment? Yes Dry out the passenger compartment, re-test the vehicle. No GO to A6.</p>
A6: THE LED FOR THE POWER SUPPLY BUTTON IS FLASHING. (RANGE ROVER ONLY)	
	<p>1 Check the status of the audio power button LED.</p>
	<p>Is the audio power button flashing? Yes Carry out MOST Ring diagnostics to locate fault. No GO to A7.</p>
A7: ONLY THE NAVIGATION SCREEN OR AUDIO SCREEN IS BLACK	
	<p>1 Check to see if only the navigation screen is blank.</p>
	<p>Is only the navigation screen blank? Yes Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index. No GO to A8.</p>
A8: ONLY THE BACK MONITOR SCREEN IS BLACK	
	<p>1 Check to see if only the audio screen is blank.</p>
	<p>Is only the audio screen blank? Yes Proceed to the next step. No GO to A10.</p>
A9: AFTER INITIATING THE "VIDEO INPUT TEST" DIAGNOSIS, VIDEO CAN BE DISPLAYED	
	<p>1 Carry out the "Video Input Test" diagnosis' (PIN code 753).</p>
	<p>Are the results of the "Video Input Test" diagnosis' normal? Yes Re-check the system. No Refer to the electrical circuit diagrams and check the cameras control module.</p>
A10: ONLY THE TV SCREEN IS BLACK	
	<p>1 Check to see if only the TV screen is black.</p>
	<p>Is only the TV screen blank? Yes Proceed to the next step. No GO to A12.</p>
A11: AFTER INITIATING THE "VIDEO INPUT TEST" DIAGNOSIS, VIDEO CAN BE DISPLAYED	
	<p>1 Carry out the "Video Input Test" diagnosis' (PIN code 753).</p>
	<p>Are the results of the "Video Input Test" diagnosis' normal? Yes Re-check the system. No Refer to the electrical circuit diagrams and check the TV control module.</p>
A12: THE CONNECTIONS BETWEEN THE VISUAL NAVIGATION AND POWER SUPPLY WIRING HARNESS AND CONNECTORS ARE CORRECT	
	<p>1 Check the display and power supply harness, power, auxiliary and ground circuits, for short, open circuits and are correctly connected.</p>
	<p>Was a fault identified with the display and power supply harness, power auxiliary and ground connections? Yes Rectify the fault and re-test the vehicle. No Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index.</p>
PINPOINT TEST B : THE NAVIGATION MAP SCREEN DOES NOT DISPLAY, EVEN WHEN THE "NAVIGATION" BUTTON IS PRESSED (SCREEN DOES NOT CHANGE.)	

 **NOTE:** When re-confirming the symptoms after inspecting the wiring harness/connector, turn the ignition status to OFF, wait for the Audio power button LED on the display to turn OFF, then turn the ignition status to ON and run the diagnosis again from the beginning.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

B1: NO RESPONSE TO PRESSING NAVIGATION MENU

 **NOTE:** 15 minutes are required for the program to update. If the ignition is accidentally turned OFF, turn the ignition ON again, and wait for 15 minutes.

	1 Check that the ignition was not turned 'OFF' during a navigation software update.
	Was the ignition turned 'OFF' during a navigation software update? Yes Wait for 15 minutes with the ignition ON. Then turn the ignition to OFF then ignition ON. No Refer to electrical circuit diagrams and check integrity of navigation system wiring harness and connectors. GO to B2.

B2: NO RESPONSE TO PRESSING NAVIGATION MENU

	1 Wait for 15 minutes with the ignition ON. Then turn the ignition to OFF then ignition ON.
	Does the navigation screen displays when the "NAVIGATION" button is pressed? Yes Operation is normal. No Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST C : THE HARD SWITCHES DO NOT RESPOND.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

C1: CHECK FOR FOREIGN OBJECTS

	1 Check for foreign objects near to the button.
	Are there any foreign objects close to the button causing it to be pressed? Yes Remove foreign objects and re-test vehicle. No GO to C2.

C2: DISPLAY DIAGNOSTICS CHECK

	1 Check to see if the display diagnostics can be displayed.
	Can the display diagnostics be displayed? Yes Proceed to the next step. No Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index.

C3: HARD KEY TEST

	1 Carry out the display diagnostics hard key test.
	Is the operation normal when carrying out the display diagnostics hard key test? Yes Operation is normal. No Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST D : THE AUDIO SCREEN CANNOT BE OPERATED (DOES NOT DISPLAY.)

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

D1: CD CHANGER CHECK

	1 Check to see if a CD changer is installed.
	Is a CD changer installed? Yes Proceed to the next step. No Normal operation, CD screen will not be displayed when there is no CD changer installed.

D2: THE AUDIO SCREEN DISPLAYS WHEN THE "AUDIO VIDEO" HARD SWITCH IS PRESSED.

	1 The audio screen displays when the "AUDIO VIDEO" hard switch is pressed.
	Does the audio screen displays when the "AUDIO VIDEO" hard switch is pressed? Yes Proceed to the next step. No Refer to the hard switches do not respond diagnosis.

D3: THE AUDIO SCREEN DISPLAYS WHEN "AUDIO VIDEO" ON THE "HOME MENU" IS PRESSED.

	1 The audio screen displays when "Audio Video" on the "Home Menu" is pressed.
	Does the audio screen displays when "Audio Video" on the "Home Menu" is pressed?

	<p>Yes Proceed to the next step.</p> <p>No Refer to the touch switches do not respond diagnosis.</p>
D4: EACH SWITCH (AM FM, CD, IPOD/USB, TV/DVD.) ON THE AUDIO SCREEN RESPONDS.	
	1 Each switch (AM FM, CD, iPod/USB, TV/DVD.) on the audio screen responds.
	Does each switch (AM FM, CD, iPod/USB, TV/DVD.) on the audio screen respond? Yes Carry out MOST Ring diagnostics to locate fault. No GO to D5.
D5: THE IGNITION IS TURNED FROM IGNITION ON TO OFF, AND AFTER WAITING FOR APPROXIMATELY 30 SECONDS, THE TOUCH SCREEN (TS) POWER SUPPLY LED WENT OUT. WHEN THE IGNITION IS TURNED TO ON, THE AUDIO SCREEN CAN BE OPERATED.	
	1 The ignition is turned from Ignition ON to OFF, and after waiting for approximately 30 seconds, the Touch Screen (TS) power supply LED went out.
	When the ignition is turned to ON, can the audio screen be operated? Yes Operation is normal. No Carry out MOST Ring diagnostics to locate fault.

PINPOINT TEST E : THE SCREEN DOES NOT DIM.	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CHECK FOR FOREIGN OBJECTS	
	1 Check for foreign objects adhered to the display light sensor. <ul style="list-style-type: none"> • Range Rover - Top right of display • Discovery/Range Rover Sport - Instrument panel
	Are there any foreign objects adhered to the display light sensor? Yes Remove foreign objects and re-test vehicle. No GO to E2.
E2: DISPLAY LIGHT SENSOR CHECK	
	1 Check to see if display screen switches to low light when sensor is covered.
	Does the display screen switch to low light when the sensor is covered? Yes Operation is normal. No GO to E3.
E3: VEHICLE LIGHT SWITCH TESTS	
	1 Check to see if display screen switches to low light when the vehicle light switch is pressed.
	2 When the vehicle exterior lights are switched on, check diagnostic menu "Vehicle Signals" lights on the diagnostics screen is "ON."
	Does the display screen switch to low light when the vehicle light switch is pressed? Yes Operation is normal. No Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST F : NOISE ON THE SCREEN; SCREEN COLOUR IS ABNORMAL.	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: DISPLAY POWER AND GROUND CHECKS	
	1 Refer to electrical circuit diagrams and check battery power and power ON relay voltage, and ground resistance.
	Is the battery power and power ON relay voltage between 10.5 and 16 volts, and continuity to ground? Yes Proceed to the next step. No Check and rectify the vehicle wiring harness and connectors.
F2: CONTRAST CHECK	
	1 Check to see if the screen colour is normal when the screen setting (contrast) is re-ret to the default values.
	Is the screen colour normal with the default values? Yes Operation is normal. No GO to F3.

F3: CABIN INTERNAL TEMPERATURE CHECK	
	1 Check the cabin internal temperature.
	Is the cabin internal temperature -20°C or lower? Yes Raise the cabin internal temperature and re-test. No GO to F4.
F4: ADDITIONAL SCREEN CHECKS	
	1 Check all other screens.
	Are all other screens beside the navigation display screen normal? Yes Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index. No GO to F5.
F5: COLOUR BAR CHECK	
	1 Carry out the display diagnostics colour bar check test.
	Are the results of the display diagnostics colour bar check normal? Yes Operation is normal. No Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST G : THE TOUCH SWITCHES DO NOT RESPOND.	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: TOUCH SWITCH TEST	
	1 The touch switches not responding on the navigation screen only
	Are the touch switches not responding on the navigation screen only? Yes Proceed to the next step. No Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index.
G2: TOUCH SWITCH CHECK	
	1 Carry out the touch switch check in the display diagnostics.
	Are the results of the display diagnostics touch switch check normal? Yes Check the symptoms again. Operation is normal. No GO to G3.
G3: START CALIBRATION ROUTINE	
	1 Carry out the start calibration routine from the display diagnostics touch switch test.
	Is normal operation resumed after correction? Yes Operation is normal. No Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST H : THERE IS CONSIDERABLE DEVIATION BETWEEN THE DISPLAYED VEHICLE POSITION AND THE ACTUAL POSITION.	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: GPS MARK DISPLAY CHECK	
	1 The GPS no reception mark is displayed.
	Is the GPS no reception mark displayed on the display screen? Yes Refer to GPS no reception mark does not disappear diagnosis. No GO to H2.
H2: LOCATION CHECK	
	1 Check for symptom occurring in particular locations - parallel roads, elevated roads, loop roads, parking centres (buildings) etc.
	Does the symptom occur in a particular location? Yes In places where the vehicle position is hard to specify, the vehicle position may be matched incorrectly and result in position discrepancies. Additionally, a new road layout will mean the Gyro does not match the map position. No Proceed to the next step.
H3: DISTANCE CALIBRATION CHECK	



NOTE: Refer to diagnostic menu "Vehicle Sensor" – Distance Calibration, this value should be approximately 200mm, a large deviation from this value indicates a speed signal fault or incorrect wheel size.

	1 Check to see if distance calibration is being performed.
	Is distance calibration being performed?
	Yes Monitor the condition until distance calibration is complete (drive for over 10km/6.2 miles)
	No GO to H4.

H4: VEHICLE SIGNAL INSPECTION

	1 Check vehicle sensor display screen, from vehicle information diagnostics menu for the following: vehicle speed signal, REV: ON is indicated when the gear shift lever is in the REV position and gyro sensor input status are normal.
	Are the vehicle speed signal, REV signal, and gyro sensor input status normal?
	Yes GO to H5.
	No Refer to the electrical circuit diagrams and check the integrity of the wiring harness and connectors, and CAN circuit, to the Touch Screen (TS).

H5: TIRE CHECK

	1 Check to see if new tires have recently been installed.
	Have new tires been recently installed?
	Yes From the navigation map screen, enter the navigation menu, select navigation setup then select calibration, press 'Distance' then drive the vehicle for 10 to 20 km. Operation will return to normal after performing distance calibration and driving the vehicle for 10 to 20 km.
	No Adjust the current location, and after the GPS no signal mark has disappeared, drive the vehicle for a while to monitor conditions.

PINPOINT TEST I : THE GPS NO RECEPTION MARK DOES NOT DISAPPEAR.

NOTES:



[Move the vehicle to an open area, radio waves from satellites may not be received inside buildings.](#)



[Correct the vehicle cursor to the current location.](#)

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
I1: RETRO-INSTALL INSTALLATIONS CHECK	
	1 Check to see if there are any retro-install installations (anti-theft, radar, etc.)
	Are there any retro-install installations?
	Yes GO to I2.
	No GO to I3.
I2: RETRO-INSTALL INSTALLATIONS RF CHECK	
	1 Turn power supply (including back-up power) to OFF status.
	Does the GPS no reception mark disappear?
	Yes GPS reception may deteriorate when devices receiving radio waves are retro-installed. Alter the position of the retro-install device, and re-test vehicle.
	No GO to I4.
I3: SATELLITE RECEPTION CHECKS	
	1 Check to see if a 'P' or 'T' is displayed in the 'STS' column of the navigation diagnostics GPS information screen after 10 minutes have passed.
	Is a 'P' or a 'T' displayed?
	Yes Wait for reception of another satellite so that position calculation can be performed.
	No Refer to the electrical circuit wiring diagrams and check the integrity of the wiring harness and connectors to the GPS antenna. Proceed to the next step.
I4: GPS ANTENNA REPLACEMENT	
	1 Install a new GPS antenna.
	Does the GPS no signal mark disappears when the GPS antenna is replaced.
	Yes Fault has been rectified.
	No Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST J : NO SOUND IS EMITTED.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
J1: SOUND OUTPUT CHECK	
	1 Check sound output across all systems.
	Is there no sound output across all systems? Yes GO to J2. No GO to J3.
J2: VOLUME LEVEL CHECK	
	1 Check the volume level is not set too low.
	Is the volume level set too low? Yes Increase the volume level and re-test vehicle. No GO to J3.
J3: INTEGRITY OF AMPLIFIER AND SPEAKER WIRING.	
	1 The amplifier and speaker wiring harnesses are correctly connected.
	Are the amplifier and speaker wiring harnesses correctly connected? Yes Check the MOST devices. GO to J4. No Refer to the electrical circuit diagrams and check integrity of amplifier and speaker wiring harness and connections.
J4: ONLY VOICE RECOGNITION DOES NOT OUTPUT	
	1 Check to see if only voice recognition does not output.
	Is there no output only from the voice recognition? Yes GO to J5. No Proceed to step 8.
J5: VOICE GUIDANCE	
	1 Check the volume level for voice guidance is not set too low.
	Is the volume level for voice guidance set too low? Yes Increase the volume level and re-test vehicle. No GO to J6.
J6: VOICE GUIDANCE SETTINGS	
	1 Check to see if the voice guidance is set to 'OFF' in the navigation settings.
	Is the voice guidance set to 'OFF' in the navigation settings? Yes Set to 'ON' and re-test the vehicle. No GO to J7.
J7: ADDITIONAL ITEMS	
	1 Check to see if the following items apply. <ul style="list-style-type: none">• There is no destination set• There is no movement along the route
	Do the two items apply? Yes Normal operation, confirm customer symptom and re-test vehicle. No Check MOST connection at the Touch Screen (TS), check the MOST devices.Proceed to the next step.
J8: ONLY VOICE RECOGNITION DOES NOT OUTPUT	
	1 Check to see if only voice recognition does not output.
	Is there no output only from the voice recognition? Yes Refer to the there is no navigation voice guidance diagnosis. No GO to J9.
J9: SOUND IS ONLY ABSENT WHEN USING THE AUDIO SYSTEM OR TELEPHONE.	
	1 Check to see if sound is only absent when using the audio system or telephone.
	Does only the audio system or telephone sound not output? Yes Check MOST connection at the Touch Screen (TS), check the MOST devices. No Refer to the electrical circuit diagrams and check integrity of wiring harness and connections.

PINPOINT TEST K : THERE IS NO NAVIGATION VOICE GUIDANCE.

TEST	DETAILS/RESULTS/ACTIONS
------	-------------------------

CONDITIONS	
K1: SOUND MISSING AUDIO SYSTEM ONLY	
	1 Sound is only absent from the audio system (CD, radio.)
	Is sound only absent from the audio system (CD, radio.)? Yes GO to K4. No Proceed to the next step.
K2: VOICE MISSING NAVIGATION SYSTEM ONLY	
	1 Voice is only absent from the navigation system.
	Is voice only absent from the navigation system? Yes GO to K3. No GO to K3.
K3: NAVIGATION VOICE GUIDANCE CANNOT BE HEARD	
	1 Operate the navigation replay switch and raise the volume.
	Can navigation voice guidance be heard after pressing the navigation replay switch, and raising the volume? Yes Operation is normal. No Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index.
K4: INTEGRITY OF AMPLIFIER AND SPEAKER WIRING.	
	1 The amplifier and speaker wiring harnesses are correctly connected.
	Are the amplifier and speaker wiring harnesses correctly connected? Yes GO to K5. No Refer to the electrical circuit diagrams and check integrity of amplifier and speaker wiring harness and connections.
K5: VOLUME LEVEL CHECK	
	1 Check the volume level is not set too low.
	Is the volume level set too low? No Increase the volume level and re-test vehicle. No Refer to the electrical circuit diagrams and check integrity of complete audio system.

PINPOINT TEST L : VOICE RECOGNITION DOES NOT FUNCTION.	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
L1: AUDIO SOUND IS MUTED WHEN PTT SWITCH IS DEPRESSED	
	1 Check to see if the audio sound is muted when the PTT switch is depressed.
	Is the audio sound muted? Yes GO to L3. No GO to L2.
L2: PTT SWITCH STATUS	
	1 Check to see if the PTT switch status is ok in the navigation diagnostics, manual check, microphone test.
	Is the PTT switch status, in navigation diagnostics, ok? Yes Check MOST connection at the Touch Screen (TS), check the MOST devices. No Replace the MOST master, or the gateway module.
L3: TALK BACK	
	1 Check to see if there is talk back when other voice recognition demands are executed.
	Is there talk back? Yes System operation is normal, (advise change in manner of speech, as incorrect recognition is occurring). No GO to L4.
L4: HARNESS/CONNECTOR CHECKS	
	1 Refer to the electrical circuit diagrams and check integrity of Touch Screen (TS) harness and connections.
	Has a fault been identified with the Touch Screen (TS) harness or connections? Yes Rectify the fault and re-test the vehicle. No Check and install a new Touch Screen (TS) as required. Refer to the new module/component

installation note at top of DTC Index.

PINPOINT TEST M : THE VEHICLE POSITION ROTATES RANDOMLY.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
M1: VEHICLES CURRENT POSITION MARK TURNS ON ITS OWN	
	1 Determine if the ignition status was turned to Auxiliary or On, while the vehicle was on a turntable in a parking building etc.
	Was ignition status set to Auxiliary or On? Yes The angular speed of the vehicle at the time of the ignition status change will be logged as the standard value. To re-set the standard value, turn ignition status to 'OFF' then to 'Auxiliary' or 'On' with the vehicle stationary. Re-test the vehicle. No Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index.

PINPOINT TEST N : THE VEHICLE MARK DISPLAY IS UNSTABLE.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
N1: VEHICLE SPEED SIGNAL	
	1 The vehicle speed signal is being properly inputted under "Vehicle Sensor" on the "Vehicle information" diagnostics screen.
	Is the vehicle speed input correctly? Note: MOST and navigation system module speeds are approximately the same. Yes GO to N2. No Carry out MOST ring circuit checks. Check the Anti-Lock Brake System Module for related DTCs and refer to the relevant DTC Index. Carry out network integrity tests using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required. Rectify the fault and re-test the vehicle.

N2: CHECK NUMBER OF SATELLITES

	1 "0" is displayed in the "Satellites" column under "GPS Information" (on the "Vehicle information" diagnostics screen.)
	Is the number of satellites displayed on the screen 0? Yes Refer to GPS no reception mark does not disappear diagnosis. No GO to N3.

N3: CHECK IF SYMPTOMS ARE OCCURRING IN PARTICULAR LOCATIONS

	1 Confirm if the 'car current position not stable' symptom is occurring in particular locations.
	Is the 'car current position not stable' symptom occurring in particular locations? Yes System operation is normal. Signal reflections from buildings or a particular location may be responsible. No Refer to GPS no reception mark does not disappear diagnosis.

PINPOINT TEST O : THE VEHICLE POSITION DOES NOT UPDATE.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
O1: VEHICLE POSITION DOES NOT UPDATE	
	1 Check the GPS no reception mark.
	Has the GPS no reception mark disappeared? Yes GO to O2. No Refer to GPS no reception mark does not disappear diagnosis.
O2: VEHICLE POSITION DOES NOT UPDATE	
	1 Check the map screen scroll function.
	Can the map screen be touched scrolled? Yes GO to O3. No Initiate the "SMART test" on the "HDD information" diagnostics screen.
O3: VEHICLE POSITION DOES NOT UPDATE	
	1 The vehicle speed signal is being properly inputted under "Vehicle Sensor" on the "Vehicle information" diagnostics screen.
	Is the vehicle speed input correctly? Note: MOST and navigation system module speeds are approximately the same. Yes Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index. No

Carry out MOST ring circuit checks. Check the Anti-Lock Brake System Module for related DTCs and refer to the relevant DTC Index. Carry out network integrity tests using the manufacturer approved diagnostic system. Refer to electrical circuit diagrams and check CAN circuits if required. Repair wiring harness as required. Rectify the fault and re-test the vehicle.

PINPOINT TEST P : THE MAP DISPLAY IS INCOMPLETE.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
P1: MAP DISPLAY IS INCOMPLETE	
	1 Check to see if the map screen displays correctly when it is touch scrolled.
	Does the map screen display correctly when it is touch scrolled? Yes GO to P2. No Initiate the "SMART test" on the "HDD information" diagnostics screen.
P2: MAP DISPLAY IS INCOMPLETE	
	1 Check to see if the map screen scale can be reduced.
	Can the map screen scale be reduced? Yes GO to P3. No Initiate the "SMART test" on the "HDD information" diagnostics screen.
P3: MAP DISPLAY IS INCOMPLETE	
	1 Check to see if a point of interest search can be performed.
	Can a point of interest search be performed? Yes Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index. No Initiate the "SMART test" on the "HDD information" diagnostics screen.

PINPOINT TEST Q : CALLS CANNOT BE RECEIVED OR PLACED WITH BLUETOOTH®; BLUETOOTH® CANNOT CONNECT WITH THE VEHICLE.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
Q1: DISPLAY CHECK	
	1 Press the telephone button.
	Is 'Telephone not connected' displayed on the screen? Yes GO to Q2. No Proceed to step 7.
Q2: BLUETOOTH® COMPATIBILITY CHECK	
	1 Check to see if the telephone handset is Bluetooth® compatible.
	Is the telephone handset Bluetooth® compatible? Yes GO to Q3. No Use a Bluetooth® compatible telephone handset.
Q3: HANDSET POWER CHECK	
	1 Check to see if the handset is switched 'ON'.
	Is the telephone handset switched 'ON'? Yes GO to Q4. No Switch handset 'ON' and re-test.
Q4: INITIAL CONNECTION SETTINGS	
	1 Check to see if the initial connection settings to the in-vehicle system have been performed.
	Have the initial connection settings to the in-vehicle system been performed? Yes GO to Q5. No Perform the initial connection settings.
Q5: HANDSET COMMUNICATION CHECK	
	1 Check to see if the telephone handset recognizes the in-vehicle system.
	Does the telephone handset recognize the in-vehicle system? Yes GO to Q6. No Re-test using a different Bluetooth® compatible telephone handset. If the fault is still evident, suspect the telephone module. Refer to the new module/component installation note at the top of this procedure.
Q6: HANDSET COMMUNICATION CHECK	
	1 Switch the Bluetooth® telephone handset 'OFF' then back 'ON' again.

	Does the telephone handset recognize the in-vehicle system? Yes Operation is normal. No Suspect the telephone module. Refer to the new module/component installation note at the top of this procedure.
--	---

Q7: HANDSET COMMUNICATION CHECK

	1 Check to see if the telephone is within communications range.
	Is the telephone within a 10 metre range of the Bluetooth® telephone module? Yes GO to Q8. No Move the telephone handset to within a 10 metre range of the Bluetooth® telephone module.

Q8: HANDSET COMMUNICATION CHECK

	1 Check to see if when transmitting, the telephone handset is also receiving.
	When transmitting, is the telephone handset also receiving? Yes Check MOST connection at the Touch Screen (TS), check the MOST devices. No Replace the telephone handset.

PINPOINT TEST R : AN ERROR SCREEN DISPLAYS ON THE NAVIGATION SCREEN.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
R1: MAP DATA CANNOT BE READ	
	1 Access to the map data has not been granted.
	Has new Touch Screen (TS) been installed? Yes Initiate the "Map Lock routine." No Check that a valid activation code for the particular map version installed is available and is being used, it may be necessary to purchase a new activation code from Navteq. If the activation code is valid but map cannot be activated, check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index. Initiate the "Map Lock routine."

PINPOINT TEST S : THE DUAL VIEW CANNOT BE SWITCHED.

 **NOTE:** Prior to troubleshooting, verify that the vehicle and the Touch Screen (TS) are compatible with Dual Directional View.

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
S1: AUDIO VIDEO HARD SWITCH CHECK	
	1 The audio screen displays when the "AUDIO VIDEO" hard switch is pressed.
	Does the audio screen displays when the "AUDIO VIDEO" hard switch is pressed? Yes GO to S2. No Refer to the hard switches do not respond diagnosis.
S2: AUDIO SOURCE	
	1 TV or DVD is the audio source.
	Does TV or DVD display? Yes GO to S3. No Switch the audio source to TV or DVD and carry out diagnosis again.
S3: VIDEO AND SOUND CORRECTLY DISPLAYED	
	1 Video with sound is displayed on the passenger side from the audio screen after the "AUDIO VIDEO" hard switch is pressed.
	Is video with sound displayed on the passenger side from the audio screen after the "AUDIO VIDEO" hard switch is pressed? Yes Operation is normal. No GO to S4.
S4: VIDEO AND SOUND INCORRECTLY DISPLAYED	
	1 Video with sound is incorrectly displayed on the passenger side from the audio screen after the "AUDIO VIDEO" hard switch is pressed
	Is video with sound incorrectly displayed on the passenger side from the audio screen after the "AUDIO VIDEO" hard switch is pressed? Yes Refer to the black screen (navigation and audio screens do not display) diagnosis. No GO to S5.

S5: VEHICLE CONFIGURATION	
	<p>1 The following set values are present on the "Vehicle Configuration" diagnostics screen.</p> <ul style="list-style-type: none"> • HLDF = Dual view • HLDF is fitted • Hand of Drive is correct for vehicle being tested
	<p>Are values present on the "Vehicle Configuration" diagnostics screen.</p> <p>Yes Check and install a new Touch Screen (TS) as required. Refer to the new module/component installation note at top of DTC Index.</p> <p>No Contact dealer technical support to assist in re-configuring the Car Configuration File (CCF) using the manufacturers approved diagnostic system. Clear the DTC, switch off the ignition and allow sufficient time for the infotainment relay to power down. Check MOST connection at the Touch Screen (TS), check the MOST devices.</p>

DTC Index

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Integrated Audio Module (IAM) - High Line (100-00 General Information, Description and Operation).

Audio Unit -

Torque Specifications

Description	Nm	lb-ft
Audio amplifier bolts	10	7

Audio Unit - Audio System

Diagnosis and Testing

For additional information.

REFER to: Information and Entertainment System (415-00, Diagnosis and Testing).

Audio Unit - Audio Unit

Removal and Installation

Removal

NOTES:

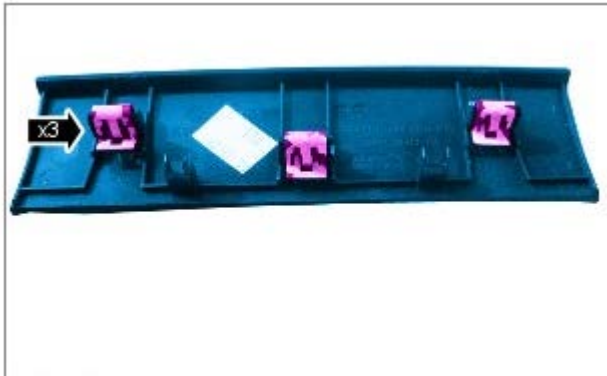


Some variation in the illustrations may occur, but the essential information is always correct.



Removal steps in this procedure may contain installation details.

1.



E123215

2. Torque: 2.5 Nm



E123216

3.



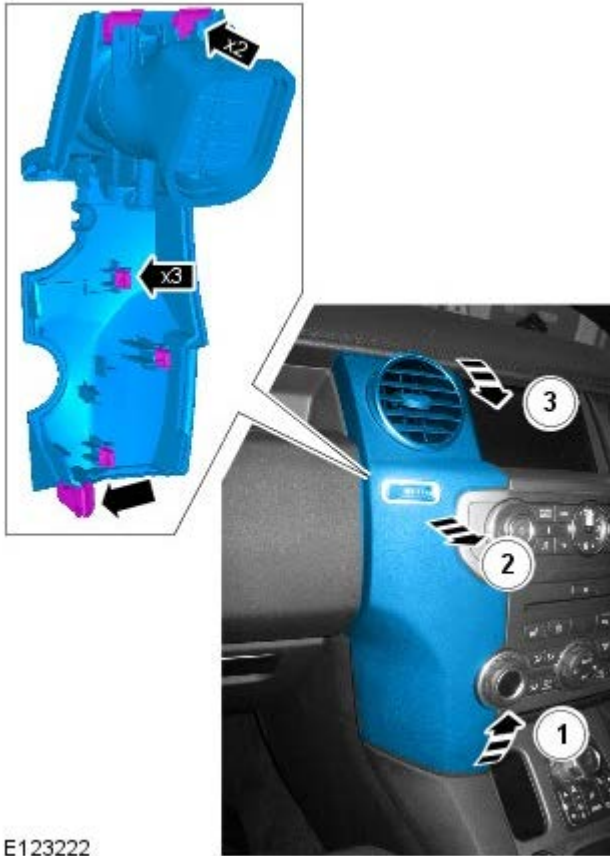
E123217



E122691

4.  NOTE: LHD illustration shown, RHD is similar.

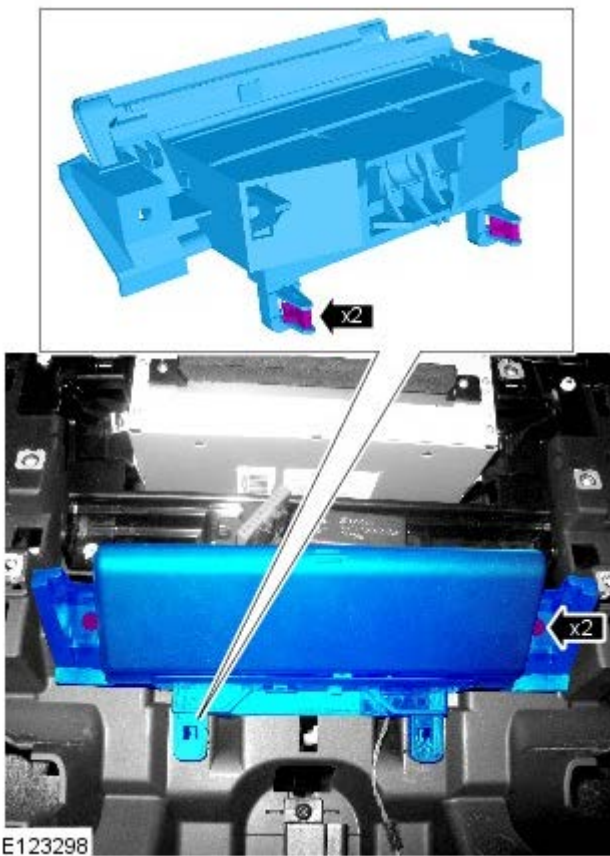
- 5.



E123222

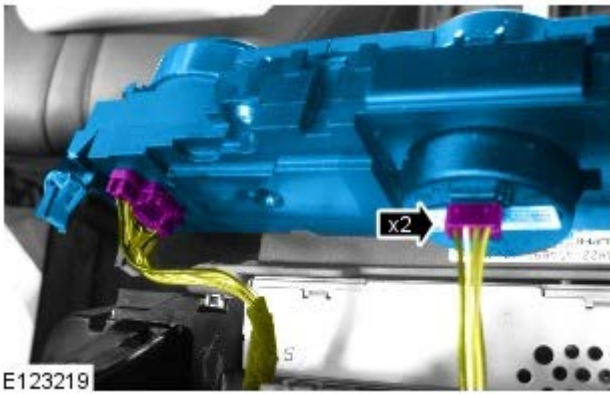
6. Refer to: Floor Console Upper Section (501-12, Removal and Installation).

7. Torque: 2.5 Nm



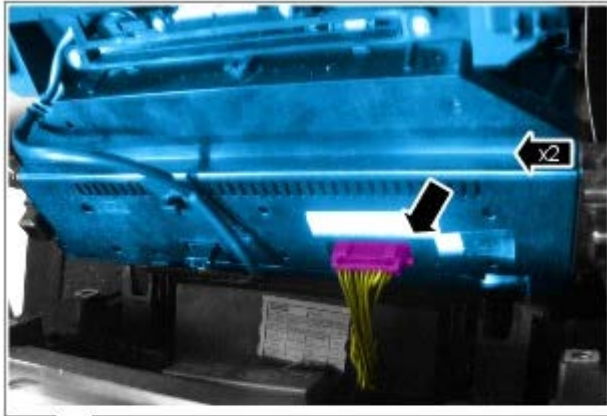
E123298

8.



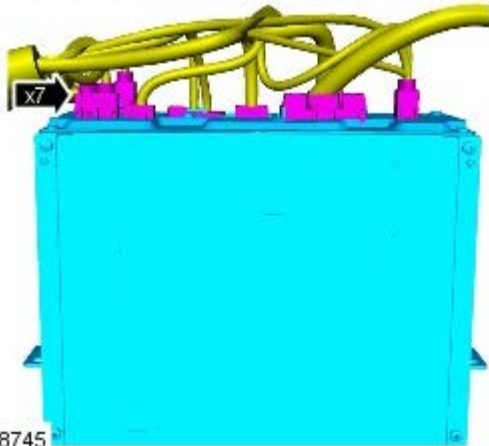
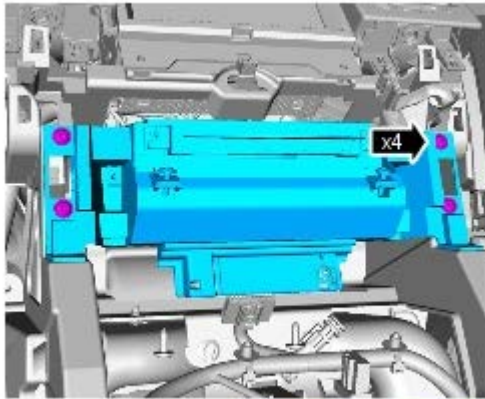
9.

10. Torque: 2.5 Nm




E123220

11. Torque: 2.5 Nm



E138745

12.  NOTE: Do not disassemble further if the component is removed for access only.

Torque: 2.5 Nm



E122787

Installation

1. To install, reverse the removal procedure.

Audio Unit - Audio Amplifier

Removal and Installation

Removal

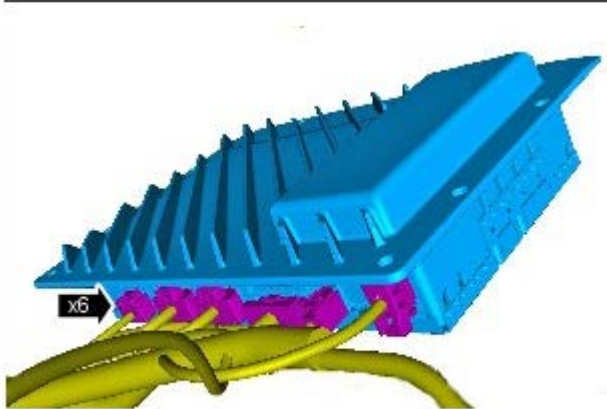
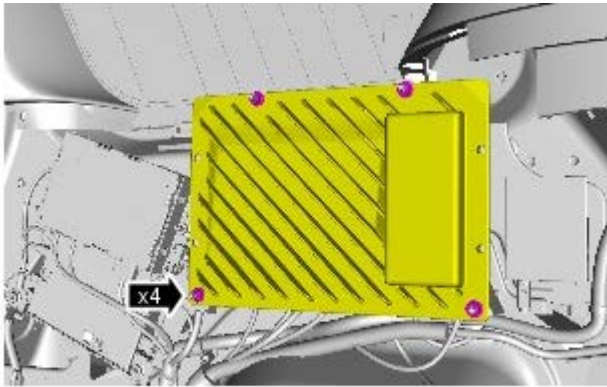


NOTE: Removal steps in this procedure may contain installation details.

1.  NOTE: RH side only.

Refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).

2. Torque: 9 Nm



E139083

Installation

1. To install, reverse the removal procedure.
2. Using the diagnostic tool, calibrate the component.

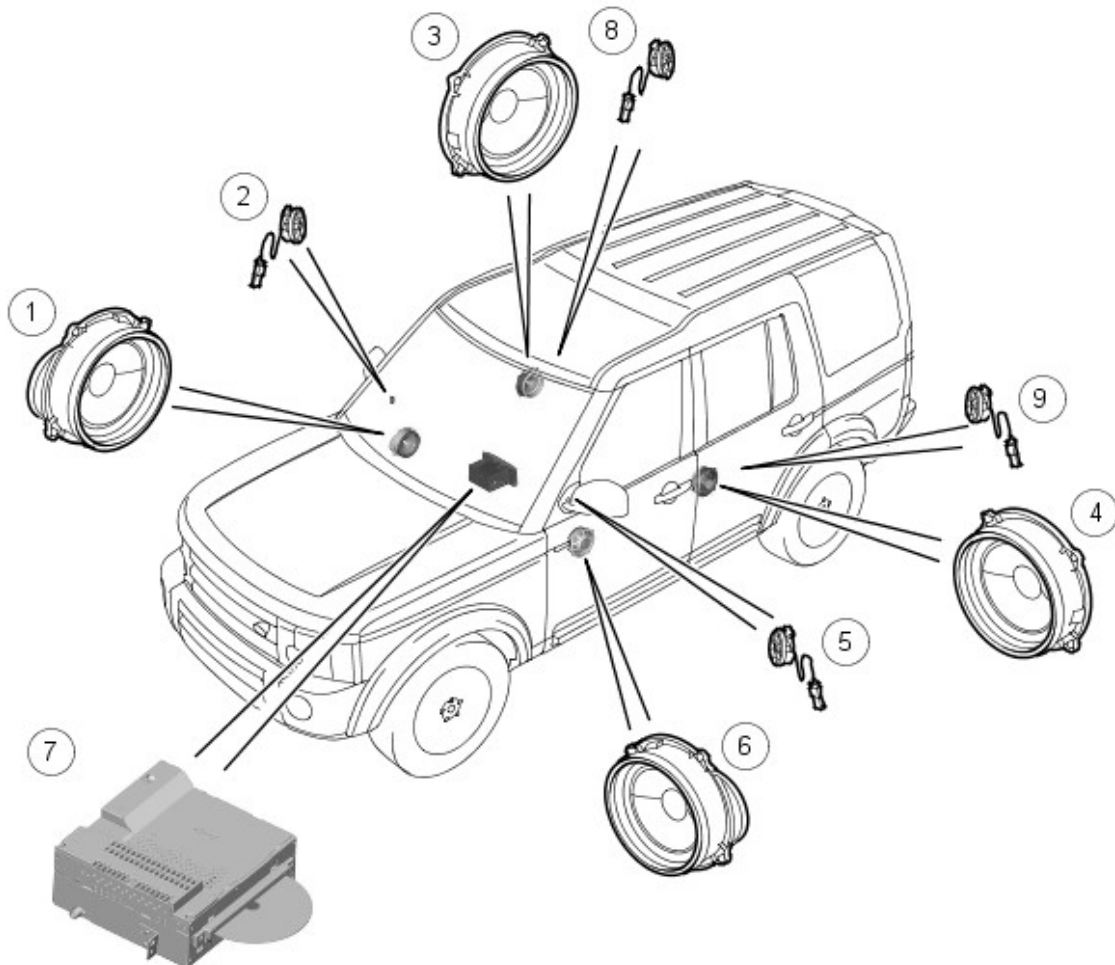
Information and Entertainment System - Speakers

Description and Operation

The speaker configuration depends on the level of audio and head unit fitted to the vehicle. The following details the speaker configuration and control for each system.

LOW LINE AUDIO SYSTEM

Low Line Audio System Speaker Component Location



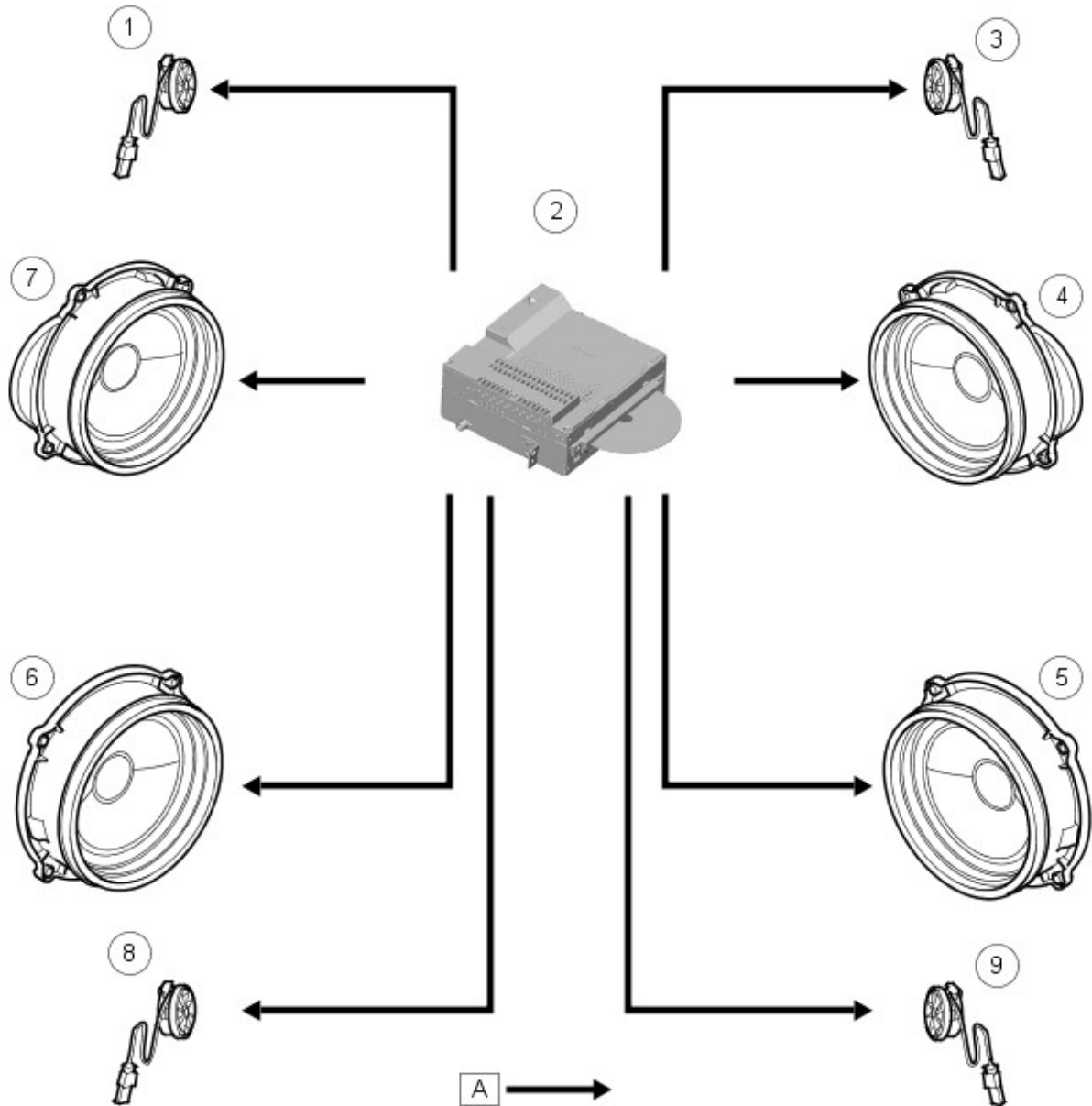
E132119

Item	Part Number	Description
1	70451	Front RH door mid/bass speaker
2	-	Front RH door tweeter
3	-	Rear RH door full range speaker
4	-	Rear LH door full range speaker
5	-	Front LH door tweeter
6	-	Front LH door mid/bass speaker
7	-	Head unit
8	-	Rear RH door tweeter
9	-	Rear LH door tweeter

Low Line Audio System Speaker Control Diagram



NOTE: A= Hardwired



E132120

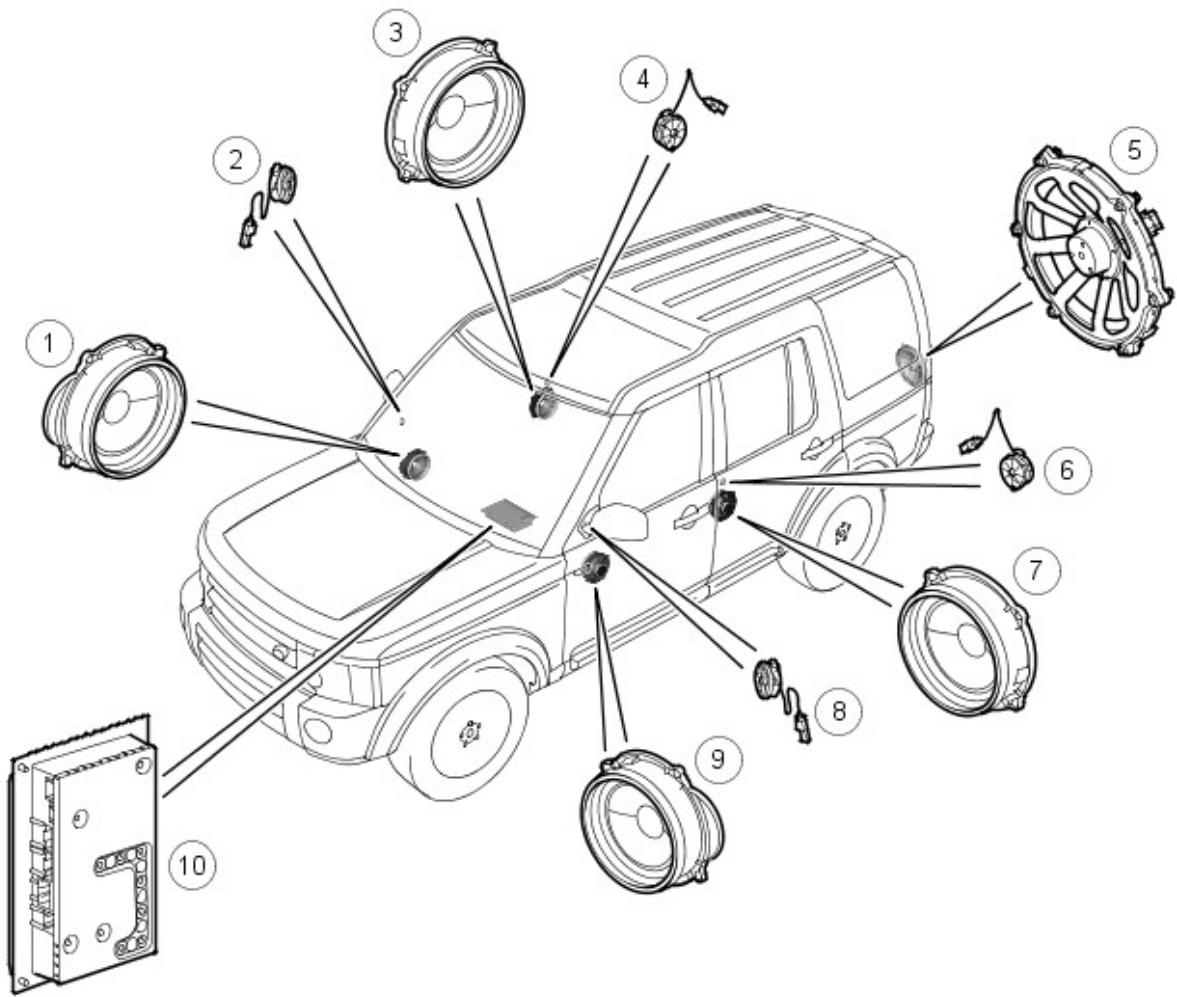
Item	Part Number	Description
1	-	Front LH tweeter
2	-	Head unit
3	-	Front RH tweeter
4	-	Front RH mid/bass speaker
5	-	Rear RH full range speaker
6	-	Rear LH full range speaker
7	-	Front LH mid/bass speaker
8	-	Rear LH tweeter
9	-	Rear RH tweeter

The low line audio speaker system is driven directly from the audio head unit
 For additional information, refer to: Audio System (415-01B, Description and Operation).
 .The system comprises:

- Head unit
- Two front door mounted mid/bass speakers (one per side)
- Two front door mounted tweeters (one per side)
- Two rear door mounted full range speakers (one per side)
- Two rear door mounted tweeters (one per side)

HIGH LINE-HARMAN/KARDON AUDIO SYSTEM

High line-Harman/Kardon Audio System Speaker Component Location



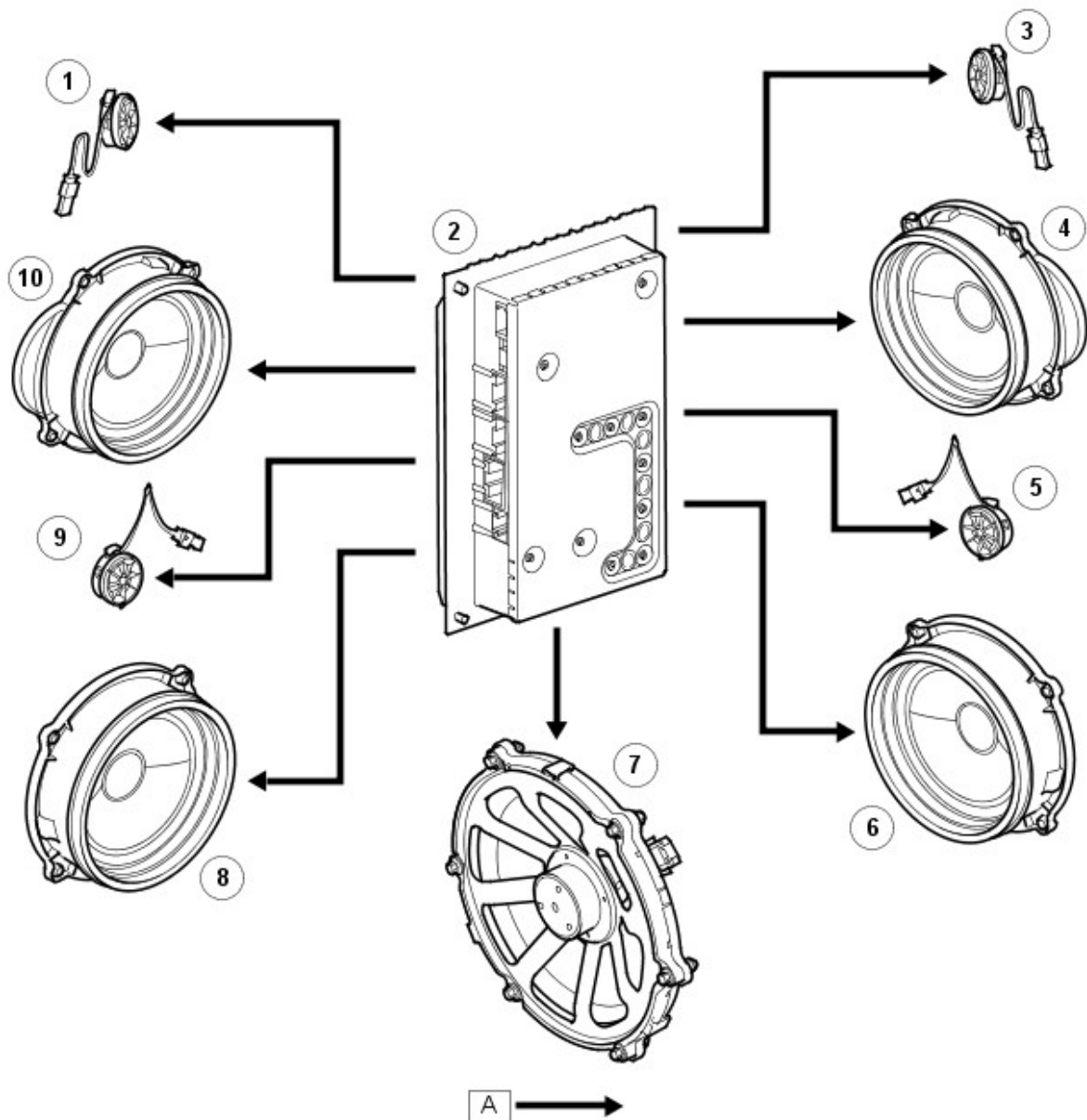
E49743

Item	Part Number	Description
1	-	Front RH mid/bass speaker
2	-	Front RH tweeter
3	-	Rear RH mid/bass range
4	-	Rear RH tweeter
5	-	Sub-woofer
6	-	Rear LH tweeter
7	-	Rear LH mid/bass range
8	-	Front LH tweeter
9	-	Front LH mid/bass speaker
10	-	High line amplifier

High line-Harman/Kardon Audio System Speaker Control Diagram



NOTE: A= Hardwired



E48353

Item	Part Number	Description
1	-	Front LH tweeter
2	-	High line amplifier
3	-	Front RH tweeter
4	-	Front RH mid/bass speaker
5	-	Rear RH tweeter
6	-	Rear RH mid/bass speaker
7	-	Sub-woofer
8	-	Rear LH mid/bass speaker
9	-	Rear LH tweeter
10	-	Front LH mid/bass speaker

The High line-Harman/Kardon audio speaker system is driven by an amplifier located under the RH front seat. The amplifier is controlled by the Integrated Head Unit (IHU) on the MOST bus and supplies 6x50 watts output, giving a total system power rating of 300 watts

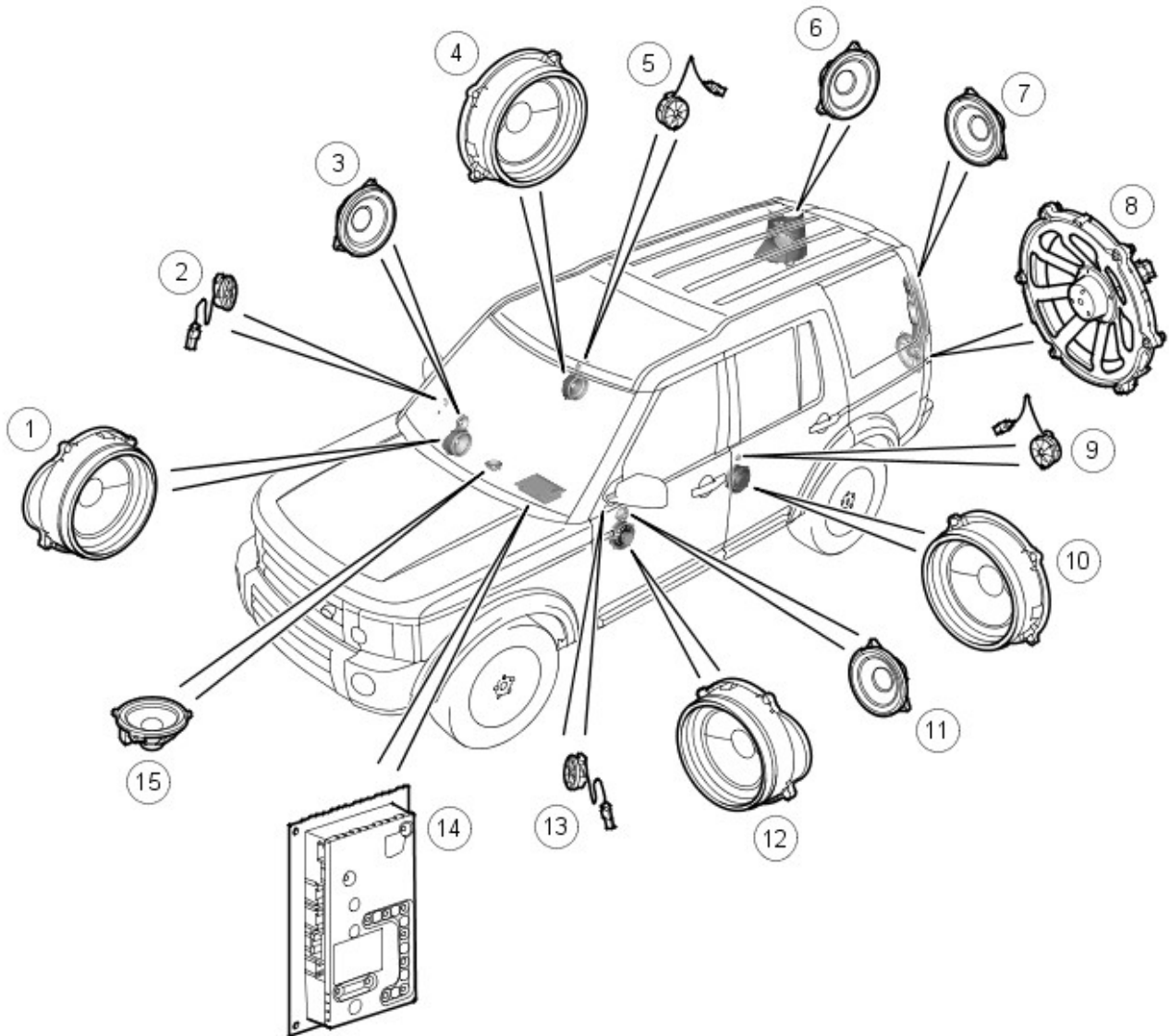
For additional information, refer to: Audio System (415-01B, Description and Operation).

. The system comprises:

- Integrated Head Unit (IHU) Head unit.
- Two front door mounted mid/bass range speakers (one per side).
- Two front door mounted tweeters (one per side).
- Two rear door mounted mid/bass range speakers (one per side).
- Two rear door mounted tweeters (one per side).
- A sub-woofer located in the lower tailgate.
- An audio amplifier located under the front RH seat.

PREMIUM AUDIO SYSTEM - HARMAN/KARDON LOGIC7

Premium Audio - Harman/Kardon LOGIC7 Audio System Speaker Component Location



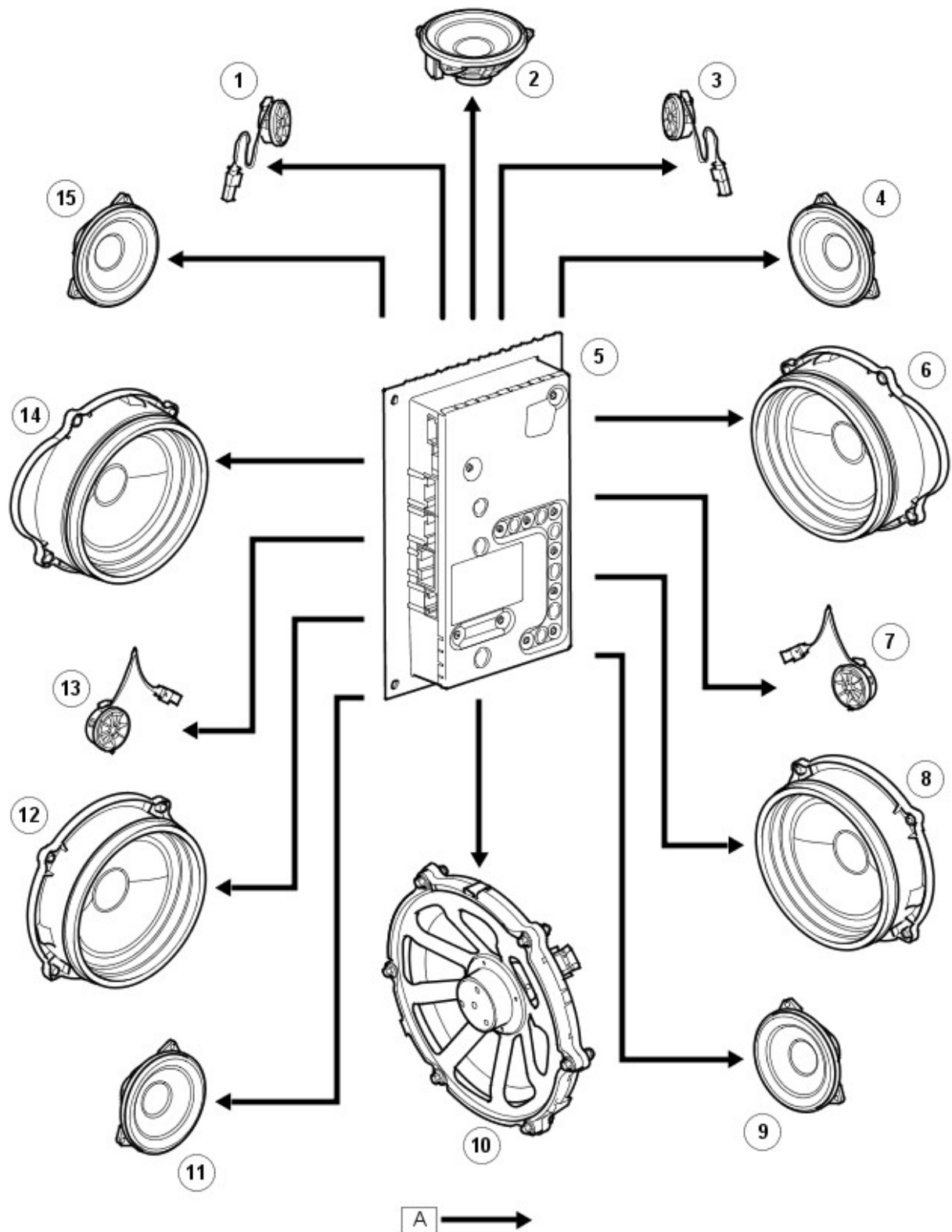
E49744

Item	Part Number	Description
1	-	Front RH bass speaker
2	-	Front RH tweeter
3	-	Front RH mid range speaker
4	-	Rear RH mid/bass speaker
5	-	Rear RH tweeter
6	-	Rear RH surround speaker
7	-	Rear LH surround speaker
8	-	Sub-woofer
9	-	Rear LH tweeter
10	-	Rear LH mid/bass speaker
11	-	Front LH mid range speaker
12	-	Front LH bass speaker
13	-	Front LH tweeter
14	-	Premium amplifier
15	-	Front centre fill speaker

Premium Audio - Harman/Kardon LOGIC7 Audio System Speaker Control Diagram



NOTE: A= Hardwired



E48354

Item	Part Number	Description
1	-	Front LH tweeter
2	-	Front centre fill speaker
3	-	Front RH tweeter
4	-	Front RH mid range speaker
5	-	Premium amplifier
6	-	Front RH bass speaker
7	-	Rear RH tweeter
8	-	Rear RH mid/bass range speaker
9	-	Rear RH surround speaker
10	-	Sub-woofer
11	-	Rear LH surround speaker

- | | | |
|----|---|--------------------------------|
| 12 | - | Rear LH mid/bass range speaker |
| 13 | - | Rear LH tweeter |
| 14 | - | Front LH bass speaker |
| 15 | - | Front LH mid range speaker |

The Premium Audio - Harman/Kardon LOGIC7 audio speaker system is driven by an amplifier located under the RH front seat. The amplifier is controlled by the Integrated Head Unit (IHU) on the MOST bus and supplies 12x50 watts output, giving a total system power rating of 600 watts. The system comprises:

- Integrated Head Unit (IHU) Head unit
- Two front door mounted mid range speakers (one per side)
- Two front door mounted bass speakers (one per side)
- Two front door mounted tweeters (one per side)
- Two rear door mounted mid/bass range speakers (one per side)
- Two rear door mounted tweeters (one per side)
- A sub-woofer located in the lower tailgate
- Two rear surround speakers in the E post (one per side)
- One centre fill speaker located in the centre of the instrument panel
- Premium amplifier

Information and Entertainment System - Intercom System

Description and Operation

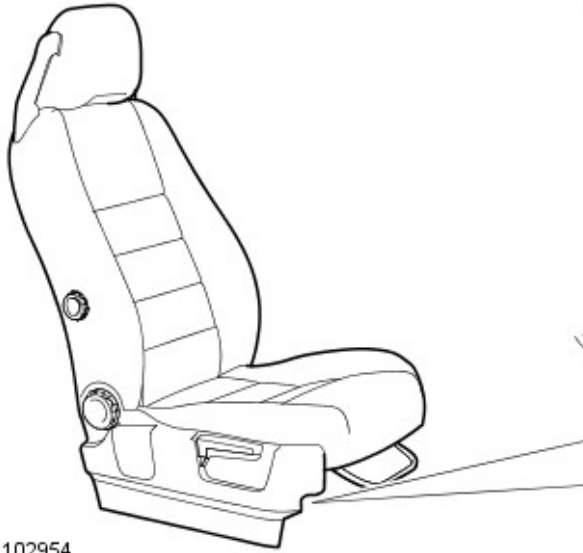
Overview

The intercom system allows the vehicle occupants to have a two-way conversation with persons outside the vehicle. This provides a communication system that does not compromise the occupant's security by opening the vehicle's doors or driver's window.

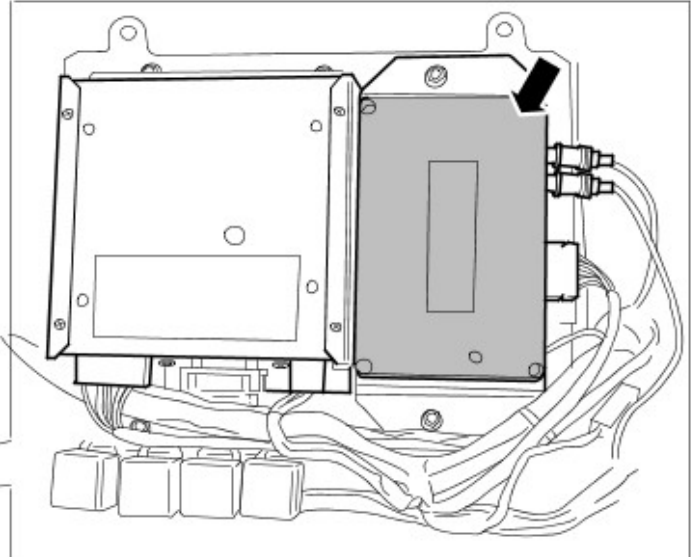
Interior and exterior microphones and speakers are controlled by switches in auxiliary switch pack.

The system comprises:

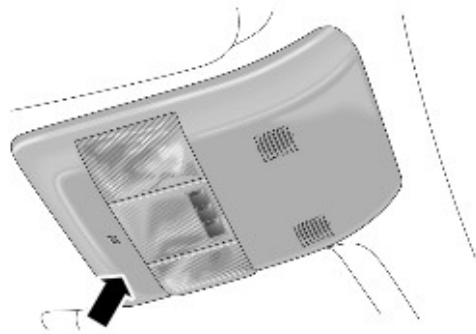
Speaker amplifier located underneath the driver's seat



E102954

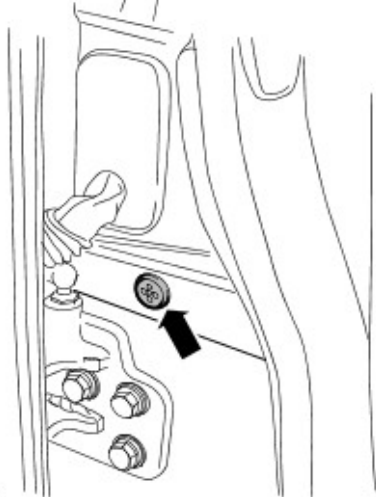


Internal microphone located above the driver in the roof console.



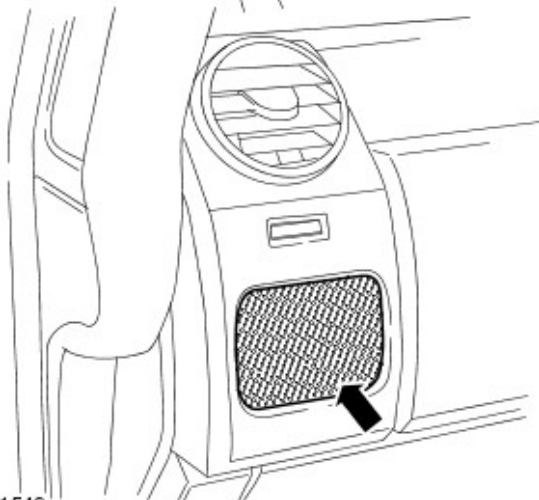
E102955

External microphone located in the driver-side 'B/C' pillar



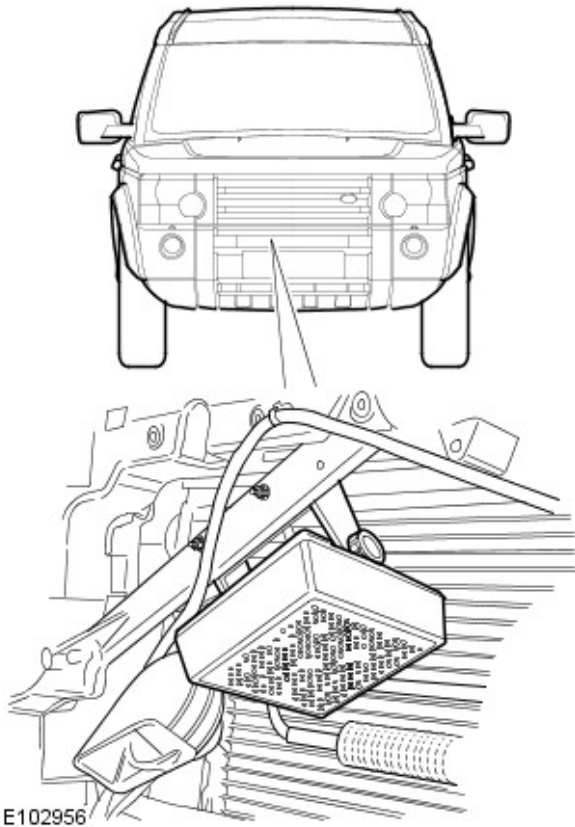
E101548

Internal speaker located on the passenger-side fascia



E101549

External speaker located behind the front grille



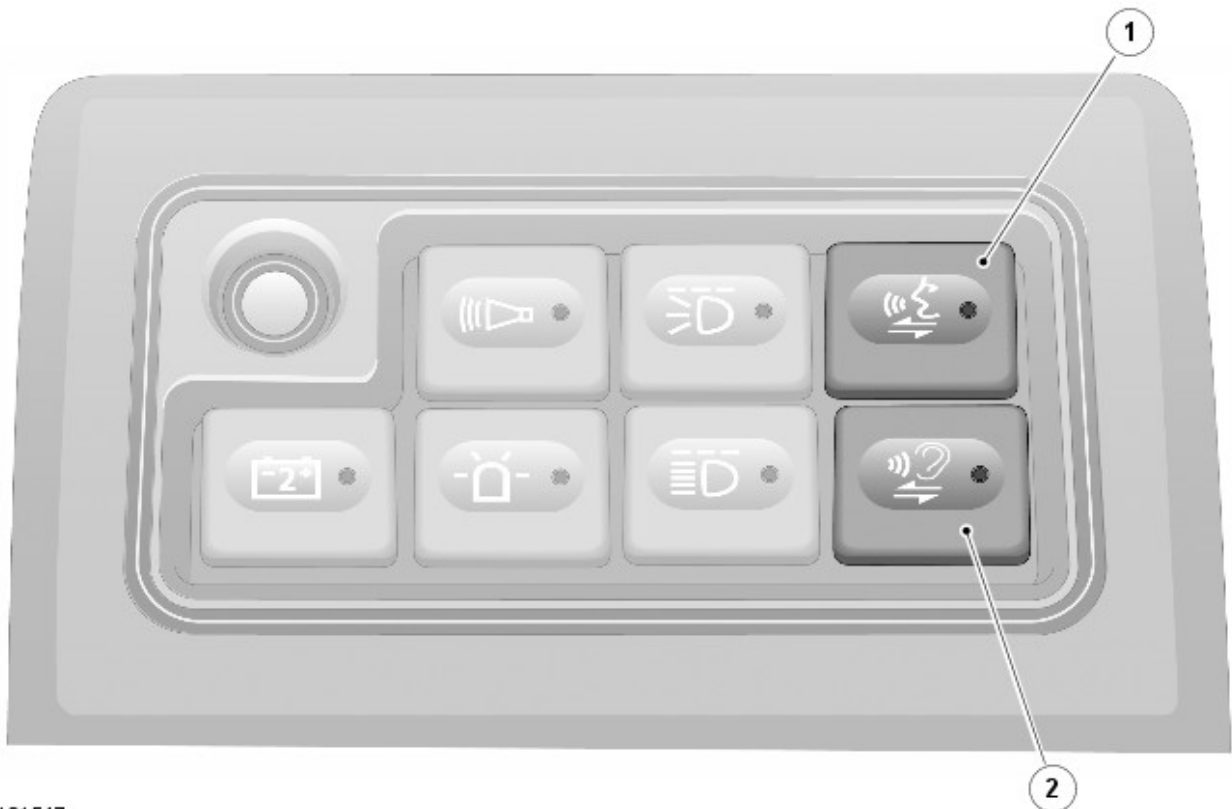
E102956

System Operation

With the vehicle ignition on:

- Pressing the "push to talk" switch allows the driver to talk to persons outside the vehicle.
- Pressing the "push to listen" switch enables the vehicle occupants to listen to conversation outside the vehicle.

Auxiliary switch pack

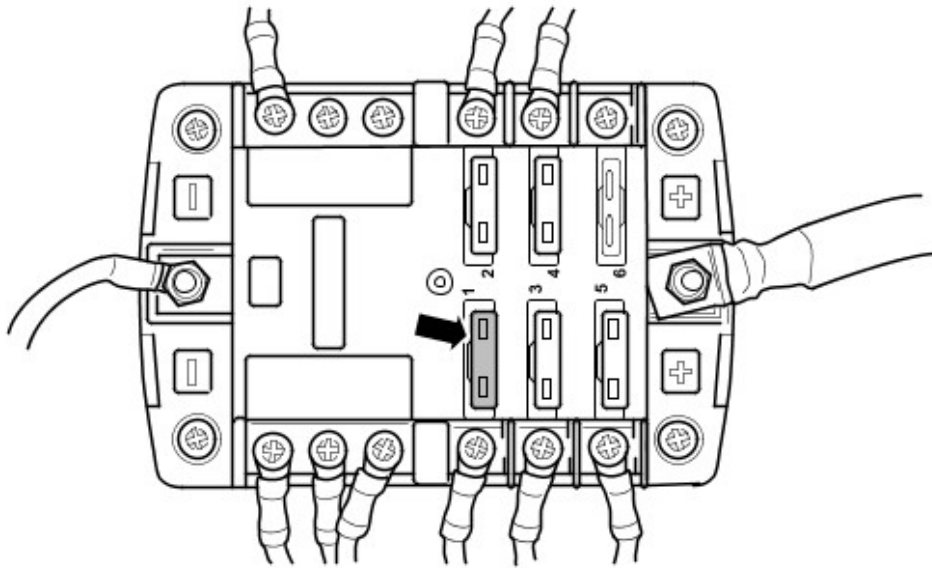


E101547

Item	Part Number	Description
1	-	Push to talk
2	-	Push to listen

The electrical system for the intercom is supplied by the auxiliary battery, via the armoured vehicle options harness and 5 amp fuse (F1) in the satellite junction box.
For additional information, refer to: Battery and Cables (414-01, Description and Operation).

Satellite junction box with intercom fuse (F1) highlighted



E101550

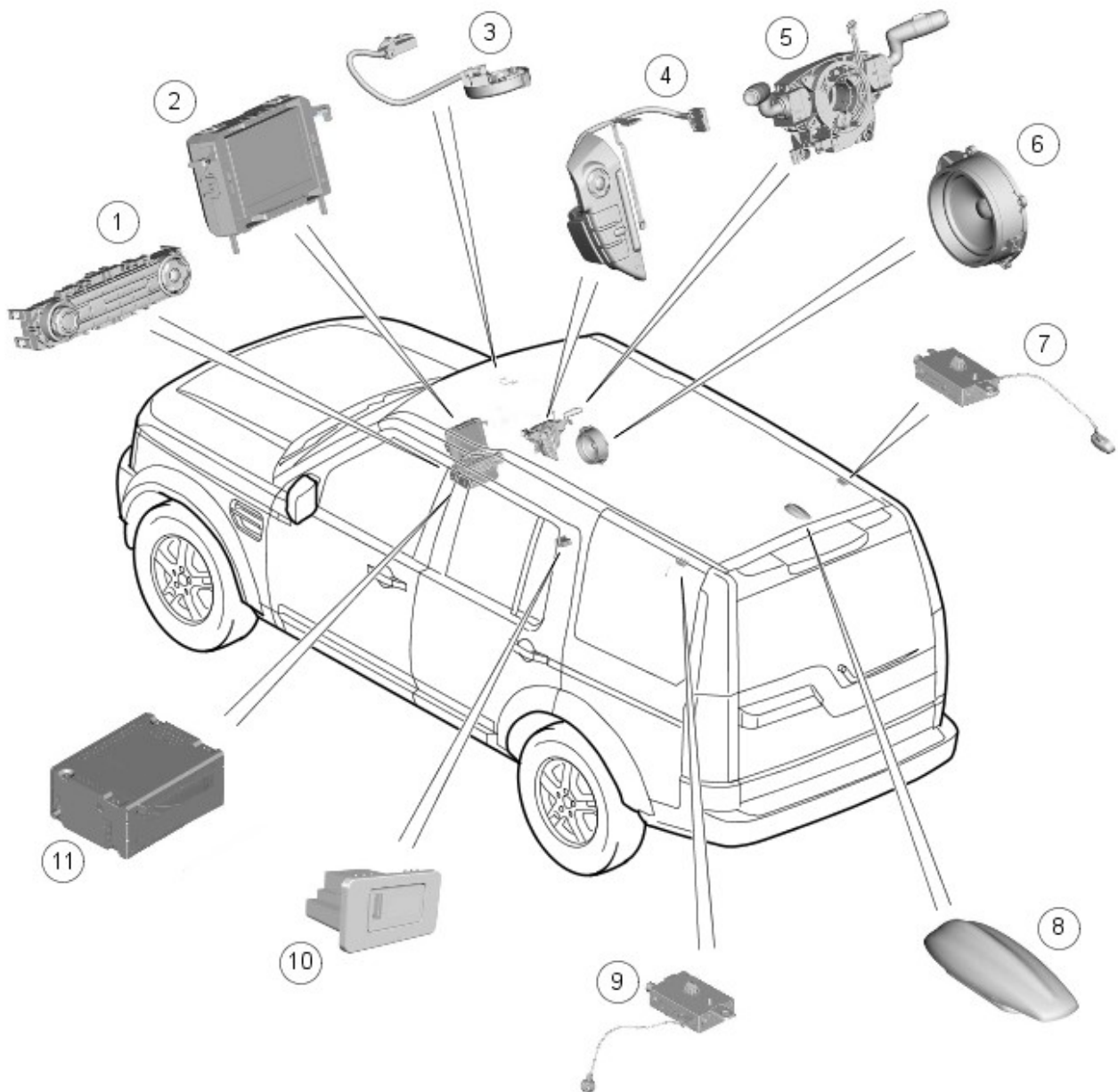


NOTE: The supplementary circuit diagrams for the armoured vehicle are located in Land Rover GTR at: Service Information, Discovery 3, 2008 Electrical Circuit Diagrams.

Information and Entertainment System - Audio System - Component Location

Description and Operation

Component Location - Lo-Line Audio

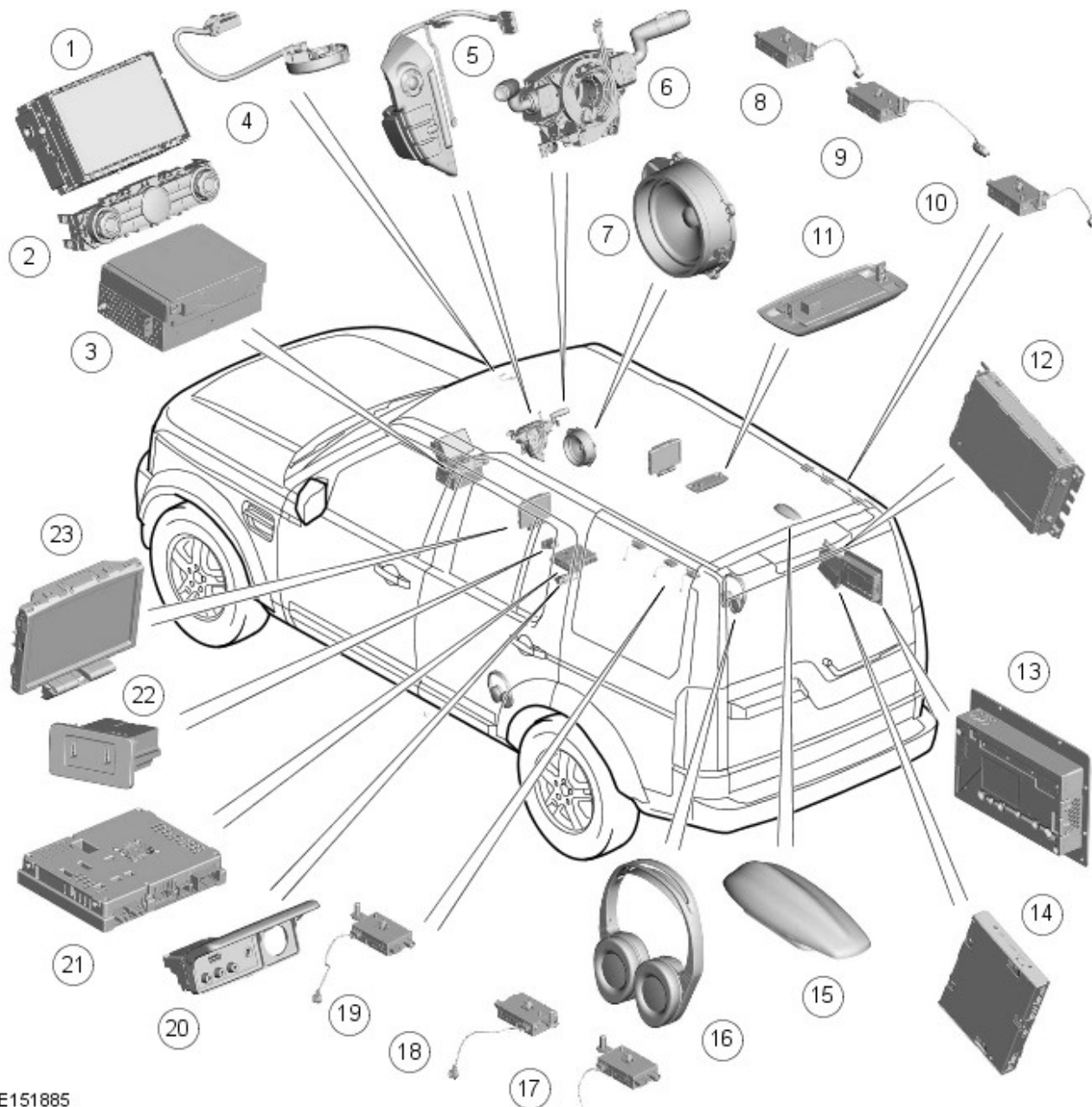


E151884

Item Description

- 1 Integrated Control Panel (ICP)
- 2 Multi Function Display (MFD)
- 3 Microphone
- 4 Steering wheel audio controls
- 5 Clockspring
- 6 Speakers
- 7 AM/FM antenna amplifier
- 8 DAB L/DMB antenna amplifier
- 9 FM2/DABIII/DMB/VICS antenna amplifier
- 10 Portable audio interface panel
- 11 Audio Head Unit (AHU)

Component Location - Mid-Line, High-Line and Premium Audio



E151885

Item Description

- 1 Touch Screen (TS)
- 2 Integrated Control Panel (ICP)
- 3 Integrated Audio Module (IAM)
- 4 Microphone
- 5 Steering wheel audio controls
- 6 Clockspring
- 7 Speakers
- 8 TV antenna amplifier
- 9 AM/FM antenna amplifier
- 10 TV antenna amplifier
- 11 Wireless headphone transmitter AM/FM1 antenna amplifier
- 12 Digital Audio Broadcasting (DAB) Digital Multimedia Broadcasting (DMB)/Satellite Digital Audio Radio Service (SDARS) receiver
- 13 Audio Amplifier Module (AAM)
- 14 Rear Seat Entertainment Control Module (RSECM)
- 15 Digital Audio Broadcasting (DAB) L-Band/Satellite Digital Audio Radio Service (SDARS) / Digital Multimedia Broadcasting (DMB) antenna
- 16 Wireless headphones
- 17 TV antenna amplifier
- 18 FM2/DABIII/DMB/SDARS/VICS antenna amplifier
- 19 TV antenna amplifier
- 20 Audio/Video input/output panel (AVIO)

- 21 Television tuner module
- 22 Portable audio module
- 23 Rear Liquid Crystal Displays (LCD)

Information and Entertainment System - Audio System - Overview

Description and Operation

OVERVIEW

The audio system is available in four versions:

Lo-Line System

- 80W - Amplifier integral with Audio Head Unit (AHU)
- 8 speakers
- single slot CD (compact disc) player
- Multi-Function Display (MFD) unit
- CAN (controller area network) based system.
- 3.5mm jack plug.

Mid-Line System

- 600W Harman Kardon sound system - separate Audio Amplifier Module (AAM)
- 11 speakers including passive sub-woofer
- single slot CD player.
- Touch Screen (TS)
- HD Radio™ receiver
- Media Oriented System Transport (MOST) based system.
- 3.5mm jack plug.

High-Line System

- 600W Harman Kardon sound system - separate Audio Amplifier Module (AAM)
- 11 speakers including passive sub-woofer
- single slot CD player and virtual multi-changer
- Touch Screen (TS)
- HD Radio™ receiver
- 40GB HDD storage
- Media Oriented System Transport (MOST) based system.
- Auxiliary input - USB and MP3/iPod
- 3.5mm jack plug.

Premium System

- 1200W Harman Kardon Logic 7 sound system - separate Audio Amplifier Module (AAM)
- 17 speakers including passive sub-woofer
- single slot CD player and virtual multi-changer
- Touch Screen (TS)
- HD Radio™ receiver
- 40GB HDD storage
- Media Oriented System Transport (MOST) based system.
- Auxiliary input - USB and MP3/iPod
- 3.5mm jack plug.

All sound systems include:

- MP3-compatible, single slot CD player
- AM / FM radio
- EON, RDS, PTY, TA
- 3.5mm jack plug

All systems can be specified with Bluetooth™

Hi-Line and Premium systems can be specified with:

- Hard Drive Navigation system (except Asian markets) with virtual CD multi-changer and single slot DVD (digital versatile disc) for front Touch Screen Display (TSD)
- Interactive Voice (Navigation required)
- Digital audio tuner (DAB)/Digital Multimedia Broadcasting (DMB) (Europe and Asia only) or Satellite Digital Audio Radio Service (SDARS) receiver (NAS only).

The Lo-Line system comprise an AHU and a MFD. The AHU has the following functions:

- AM/FM tuner
- single CD player
- integral audio power amplifier
- Bluetooth™ and audio streaming capability
- DAB/DMB tuner.

The Mid-Line systems comprise an Integrated Audio Module (IAM) and TS. The IAM has the following function:

- AM/FM tuner
- single CD player
- separate audio power amplifier
- Bluetooth™ and audio streaming capability

- DAB/DMB tuner.

The Hi-Line system comprise an Integrated Audio Module (IAM) and TSD. The IAM has the following function:

- AM/FM tuner
- single CD player 40GB HDD virtual multi-changer (The 40GB hard drive is used by the audio for storing music and also stores the operating system and files for the navigation system (not applicable to Asian market vehicles).
- Bluetooth™ and audio streaming capability
- DAB/DMB tuner.

The Premium system comprise an Integrated Audio Module (IAM) and TSD. The IAM has the following function:

- AM/FM tuner
- single CD player 40GB HDD virtual multi-changer (The 40GB hard drive is used by the audio for storing music and also stores the operating system and files for the navigation system (not applicable to Asian market vehicles).
- Bluetooth™ and audio streaming capability
- DAB/DMB tuner + DMB radio capability.

Digital Audio Broadcasting (DAB)/Digital Multimedia Broadcasting (DMB) is available for most European and Asian markets and gives access to digital radio channels for better sound quality and enhanced functionality depending on local service availability. The DAB/DMB module is located behind the right side luggage compartment trim panel on Mid-Line, High-Line and Premium systems or in the AHU on the Lo-Line system. The DAB/DMB system receives reception signals from the following sources to ensure optimum signal strength.

- DAB band L/DMB antenna located in the roof pod.
- DAB band III/DMB antenna located in the left rear side window.

For NAS vehicles with Mid-Line, High-Line and Premium systems, the digital format adopted is Satellite Digital Audio Radio Service (SDARS) which specifically links to the Sirius network. The system operates in the S-band frequency range, and as a result of the use of satellite transmission, has the ability to provide CD quality audio broadcasts over very large areas (typically continents). The SDARS receiver is located behind the right luggage compartment trim panel. The system receives reception signals from the satellite radio antenna located in the roof pod. SDARS is not available on Lo-Line systems.

HD Radio™ Technology is a free digital radio format broadcast available in NAS market. HD Radio™ digital broadcasts are transmitted alongside the analogue AM and FM signals by stations broadcasting HD Radio™ signals. The HD Radio™ receiver is integrated into the AM FM tuner on NAS variants of the IAM.

Primary user control of the Mid-Line, High-Line and Premium audio systems is via the ICP and the Touch Screen (TS) which are located in the center of the instrument panel. Control signals from the ICP are relayed on the medium speed CAN bus to the IAM. The IAM relays the control signals to the rest of the audio system on the Media Oriented System Transport (MOST) ring. The TS is the timing master for the MOST ring and also hosts a gateway function between the medium speed CAN bus and the MOST ring.

The primary user control of the Lo-Line audio system is via the ICP and the MFD, which are located in the center of the instrument panel. Control signals from the ICP are relayed on the medium speed CAN bus to the MFD. The control signals are passed to the AHU on a dedicated CAN bus.

Information and Entertainment System - Audio System - System Operation and Component Description

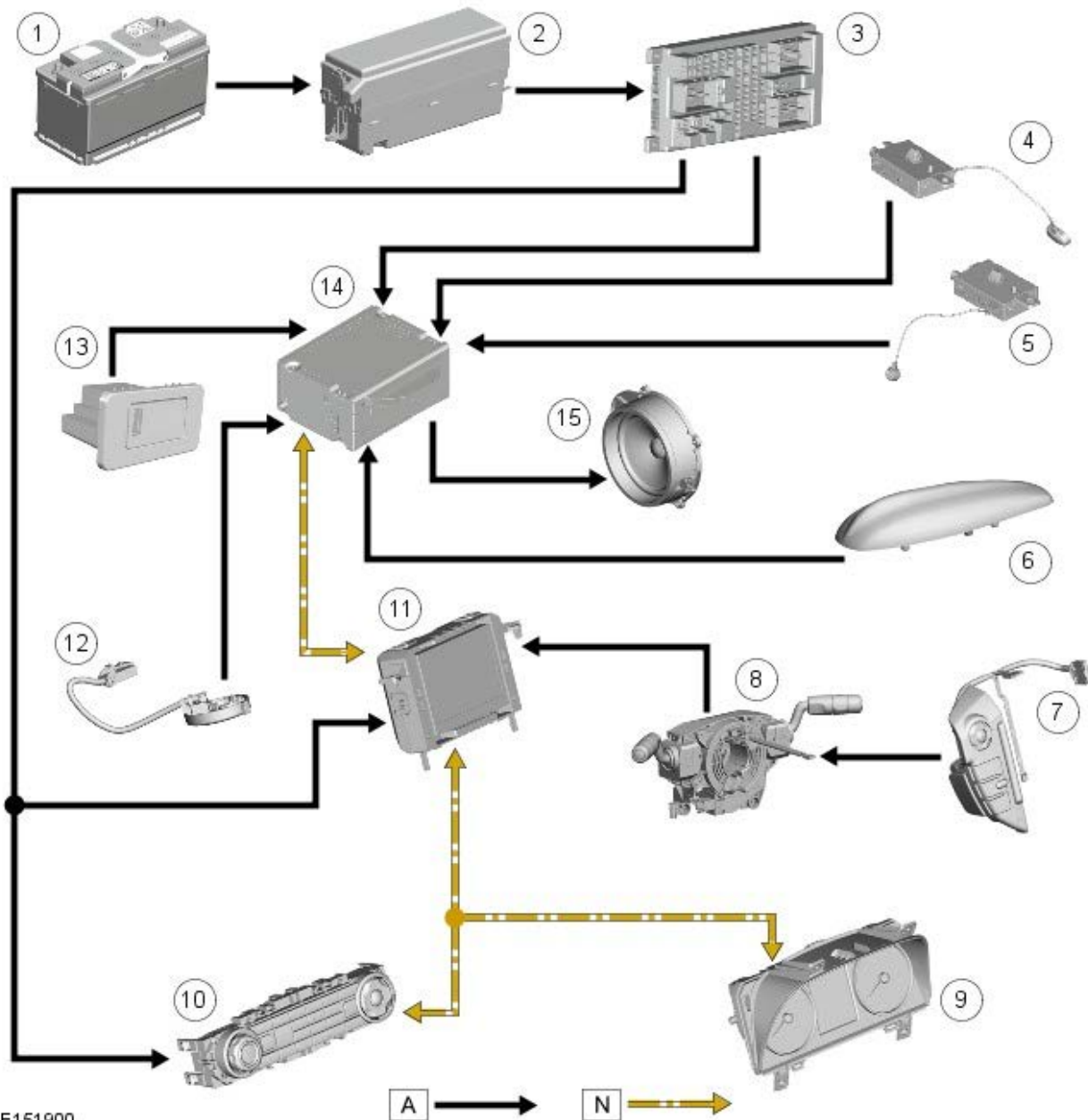
Description and Operation

Control Diagram



NOTE: **A** = Hardwired connection; **F** = RF transmission; **I** = CVBS; **N** = Medium speed CAN (controller area network); **P** = MOST; **AE** = LVDS; **AG** = Infra-red

CONTROL DIAGRAM - LO-LINE AUDIO SYSTEM



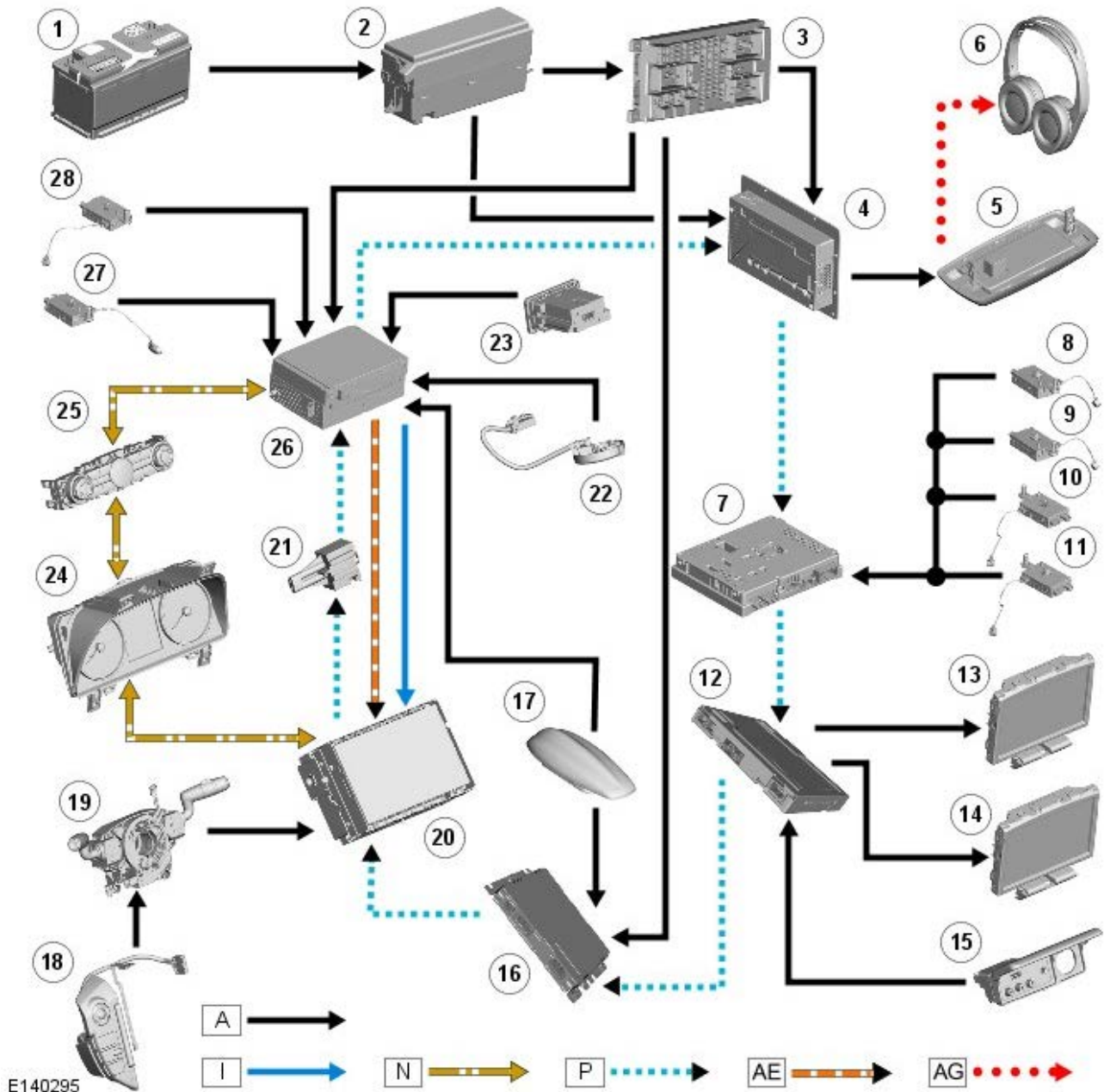
E151900

Item Description

- 1 Battery
- 2 Battery Junction Box (BJB)
- 3 Central Junction Box (CJB)
- 4 AM/FM antenna
- 5 FM2/DAB/DMB III antenna
- 6 Roof pod
- 7 Steering wheel audio switches
- 8 Clockspring
- 9 Instrument Cluster (IC)
- 10 Integrated Control Panel (ICP)
- 11 Multi Function Display (MFD)

- 12 Microphone
- 13 Portable audio interface panel
- 14 Audio Head Unit (AHU)
- 15 Vehicle speakers

CONTROL DIAGRAM - MID-LINE, HI-LINE AND PREMIUM AUDIO SYSTEMS



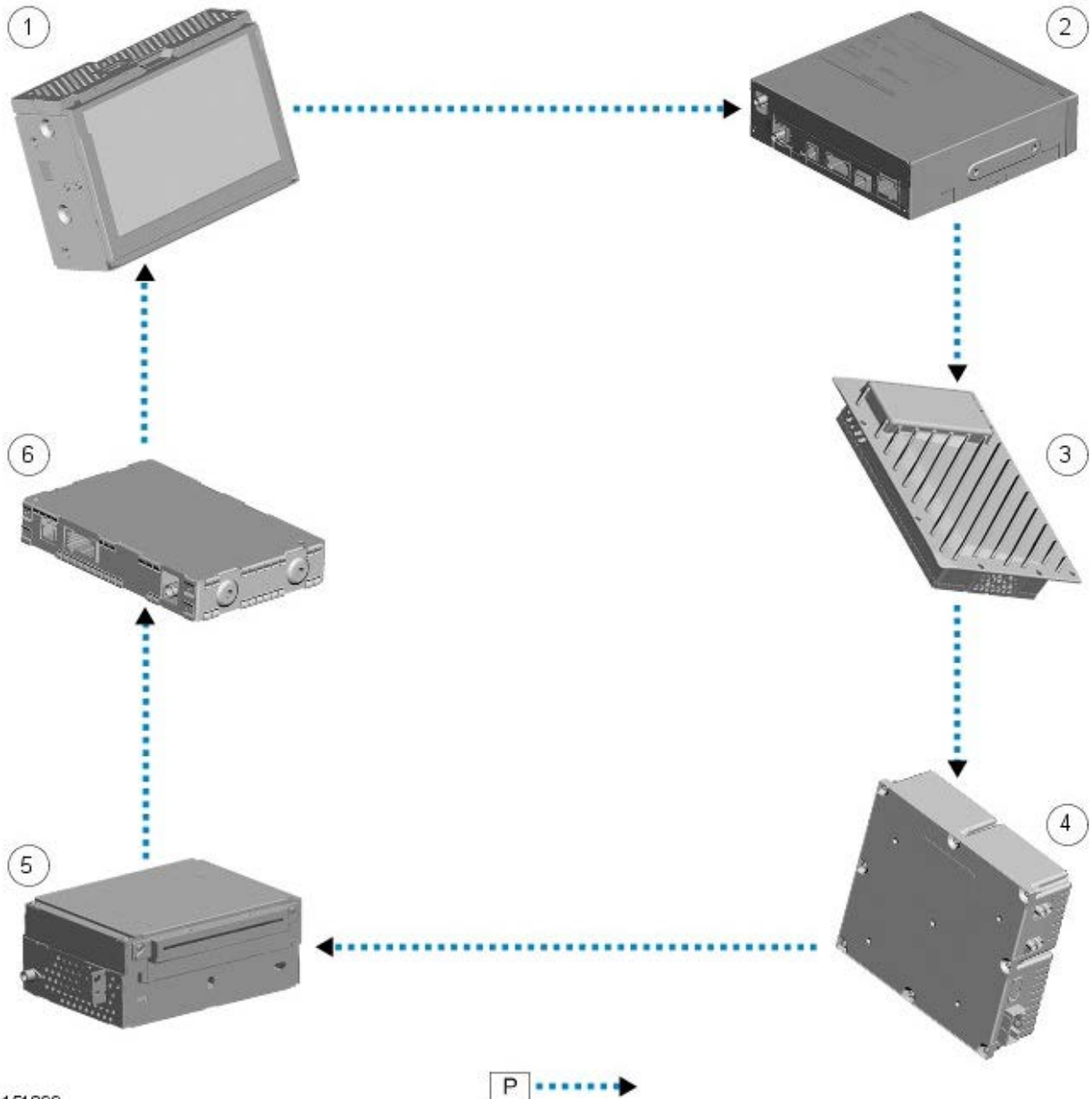
Item Description

- 1 Battery
- 2 Battery junction box (BJB)
- 3 Central junction box (CJB)
- 4 Audio Amplifier Module (AAM)
- 5 Headphone emitter
- 6 Headphones
- 7 TV Module
- 8 TV antenna 1
- 9 TV antenna 2
- 10 TV antenna 3
- 11 TV antenna 4
- 12 Rear Seat Entertainment Control Module (RSECM)
- 13 Right Rear Seat Entertainment Screen (RSE)
- 14 Left Seat Entertainment Screen (RSE)
- 15 Audio Visual Input/Output (AVIO) panel
- 16 Digital Audio Broadcasting (DAB), Digital Multimedia Broadcasting (DMB)/Satellite Digital Audio Radio Service

(SDARS) Module

- 17 Roof pod
- 18 Steering wheel audio switches
- 19 Clockspring
- 20 Touch Screen (TS)
- 21 MOST diagnostic connector
- 22 Microphone
- 23 Portable audio interface panel
- 24 Instrument Cluster (IC)
- 25 Integrated Control Panel (ICP)
- 26 Integrated Audio Module (IAM)
- 27 FM2/DAB/VICS antenna
- 28 AM/FM antenna

CONTROL DIAGRAM - MOST



E151899

Item Description

- 1 Touch Screen (TS)
- 2 Navigation computer (Japanese market only)
- 3 Audio Amplifier Module (AAM)
- 4 TV tuner (if fitted)
- 5 Integrated Audio Module (IAM)
- 6 DAB/DMB receiver or Satellite Digital Audio Radio Service (SDARS) receiver (NAS only)

System Operation

PRINCIPLES OF OPERATION

LO-LINE AUDIO SYSTEM

The components of the Lo-Line audio system are connected on a dedicated CAN bus and also the medium speed CAN bus.

Information is passed between the AHU and the MFD on a dedicated CAN bus. The MFD and the Integrated Control Panel (ICP) communicate on the medium speed CAN bus.

Lo-Line Audio System Gateway Function

The MFD is the gateway between medium speed CAN bus and other CAN based vehicle systems. A typical example of information transfer is vehicle speed information from the ABS (anti-lock brake system) module used to control the automatic volume control function. The vehicle speed information from the ABS module is sent on the high speed CAN bus and collected by the IC gateway. The signal is passed to the medium speed CAN bus, processed by the multi-function display and passed onto the AHU on the dedicated CAN bus. The AHU calculates the volume adjustment required and adjusts the output to the speaker system.

HI-LINE AND PREMIUM AUDIO SYSTEMS

The components of the Hi-Line and Premium audio/infotainment system are all connected on the Media Oriented Systems Transport (MOST) ring. The MOST ring is a fibre optic communications bus for multimedia applications. Audio and control information is passed around the MOST ring and can be picked up by any of the systems units. For example, radio station tuning/selection input by the vehicle user into the Touch Screen (TS) is sent along the MOST ring and collected by the Integrated Audio Module (IAM) which then selects the requested radio station.

MOST technology uses a plastic optical fibre which forms a network connecting the audio and multimedia system components. Each component in the ring is connected to the plastic optical fiber through a device known as a Fiber Optical Transceiver (FOT). Each FOT has two optical connections; one connection is sensitive to light and is the input, the second connection forms the light source and is the output. The system operates by connecting the output from one FOT to the input of another FOT.

The light signals are sent in one direction only and are formed in the following way:

- Electrical signals are converted into an electrical current
- The current then drives an LED (light emitting diode) in the FOT to produce a high intensity red light
- The LED transmits the light through a fiber optic cable
- A photo diode in the FOT at the opposite end of the fiber optic cable detects the light.

The following components may be connected to the MOST ring dependant on the vehicle equipment level:

- IAM
- TS
- DAB/DMB receiver
- SDARS receiver (NAS only)
- Audio Amplifier Module (AAM)
- Navigation computer (Japan only)
- TV tuner (if fitted).
- Rear Seat Entertainment Control Module (RSECM)

MOST is a synchronous network. A timing master supplies the clock information and all other devices on the network synchronize their operation to this clock. The timing master for the MOST network on this vehicle is the TS. This unit controls and manages the MOST ring and the system components. An Optical Bus tester is used in conjunction with approved Land Rover diagnostic equipment to diagnose the MOST system.

The Optical Bus tester emits a visible, high intensity red light which can be connected into the ring at any point to test the ring integrity. Disconnecting a MOST connector will reveal if the high intensity red light is visible. If a break occurs in the MOST ring, fault codes are stored in the TS which can be retrieved using approved Land Rover diagnostic equipment.

Hi-Line and Premium Audio System Gateway Functions

The TS is the gateway between medium speed CAN bus and the MOST systems.

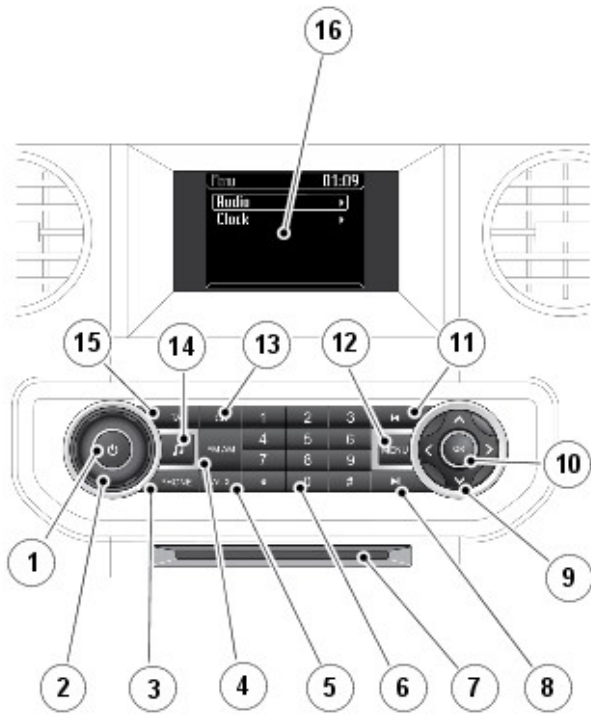
Dynamic Volume Control

The cabin noise is measured via the fitted microphone. The AAM uses this signal to calculate the volume level.

Component Description

LO-LINE AUDIO SYSTEM

Multi-Function Display and Integrated Control Panel



E140296

Item Description

- 1 Audio on/off
- 2 Volume control
- 3 Phone menu switch
- 4 FM (frequency modulation)/AM (amplitude modulation) waveband switch
- 5 Auxiliary mode switch
- 6 Radio preset/CD (compact disc) select switches/telephone keypad
- 7 CD slot
- 8 Seek up/CD next track/manual tuning up/USB or iPod next track
- 9 Audio menu navigational controller
- 10 OK switch
- 11 Seek down/CD previous track/manual tuning up/USB or iPod previous track
- 12 Audio menu switch
- 13 CD mode switch
- 14 Tone switch
- 15 Traffic information switch
- 16 Multi-Function Display (MFD)

The Lo-Line audio systems are based around an Audio head Unit (AHU) which communicates on the medium speed CAN with other audio and entertainment system modules. The Integrated Control Panel(ICP) communicates on the medium speed CAN with the Multi Function Display (MFD).

The ICP has a rotary control for audio volume control. The control can also be pressed to turn the audio system on and off.

Audio Head Unit



E140297

The AHU is located in the instrument panel, behind the ICP and the [ATC \(automatic temperature control\)](#) module.

The AHU contains the following functionality:

- [AM/FM](#) radio dual tuner with diversity
- Single disc [CD/MP3](#) player
- AAM
- DAB/DMB tuner
- Bluetooth phone
- Auxiliary input (for any device featuring a 3.5mm jack plug output)
- Provide audible beeps for the parking aid system (if fitted).

The audio head unit communicates with the multi-function display on a dedicated [CAN](#) bus. The MFD communicates with the other vehicle systems on the medium speed [CAN](#) bus and is therefore the 'gateway' for the lo-line audio system.

The AHU contains an internal 80W which directly drives the vehicle speakers.

The AHU incorporates an AM/FM tuner which allows for the storage of 2 banks of FM presets FM1/FM-AST containing 10 presets each and 2 banks of AM presets AM1/AM-AST containing 10 presets each. The FM-AST & AM-AST bank gives the 10 strongest AM stations stored by an FM or AM autostore. Pre-set stations are stored in the AHU memory. The radio tuner also incorporates the following radio functions:

- AM Auto Store (AM-AST)
- FM Auto Store (FM-AST)
- FM station list
- Presets
- Traffic announcements (TA) – Europe only
- RDS (radio data system) EON (Enhanced Other Networks) function (Radio Broadcast Data System (RBDS) in NAS markets)
- Seek station
- Tune up/down
- Scan
- PTY

A Digital Audio Broadcasting (DAB) tuner is incorporated into the AHU. This allows the reception of digital broadcast stations which can be received via the DAB/DMB III antenna located in the left rear side window or via the DAB/DMB L antenna in the roof pod.

The system allows for the storage of 2 banks of DAB/DMB presets DAB1/2/DMB containing 10 presets each and allows DMB radio capability.

All radio antennas are routed into the AHU. The head unit supplies a power output to the antenna except for AM which has a separate power feed to the AAM.

The AHU also supports optional Bluetooth™ telephone functionality and audio streaming.

The audio head unit also supports optional portable audio, devices are connected to the head unit via the portable audio interface panel.

The head unit incorporates a power management function. Should the vehicle battery level drop below a predetermined level, the unit will switch off if the engine is not started within 3 minutes. The AHU receives medium speed [CAN](#) signals from other vehicle systems which it uses to determine the wake up/shut down process.

Auxiliary audio input is available via the aux input panel. The panel allows the connection of 3.5mm jack plug or optional USB/iPod connectivity.

CD Player

The [CD](#) player has the capability to play MP3 files. The MP3 discs follow a format of folders and files within the folder, folder depth of up to six levels is allowed. It is also possible to place all the files in the root directory on the [CD](#).

The random and repeat features follow the normal [CD](#) random and repeat feature functions.

When an [CD](#) error occurs, the audio head unit will alert the user by showing a message related to the error in the multi-function display. This will be displayed while the [CD](#) audio mode is selected until the error is corrected. The [CD](#) related error does not affect other areas of the audio head unit and a different audio source can be selected.

Error Message in IAM display	Cause
Mechanism error	Mechanical Error, CD stuck, Servo related error, etc..
Disc error	Invalid Disc, CDROM (read only memory) inserted, disc inserted upside-down, etc.

Adaptive Volume Control (AVC)

AVC controls the audio volume in relation to vehicle speed. As vehicle speed increases the audio level is adjusted to compensate for extra road and vehicle noise.

There are 8 steps (0-7) of AVC. The AVC settings can be changed by selection in the multi-function display menu.

The vehicle speed signal is used to enable the audio head unit to calculate the volume adjustment required. The vehicle speed signal is received over the medium speed [CAN](#). The signal is an average of the four wheel speed sensor signals. Should an invalid speed signal be received the AVC will not alter the output volume.

Multi-Function Display

The MFD is located in the instrument panel, above the ICP.

The MFD is connected to other vehicle systems on the medium speed CAN bus and to the audio head unit on a dedicated CAN bus. The MFD receives information from other vehicle systems on the medium speed CAN bus and passes it to the audio head unit on the dedicated CAN bus.

The MFD features a 5" colour TFT LCD (Thin Film Transistor Liquid Crystal Display) screen. Switches surrounding the screen operate the audio functions, with the exception of the parking aid switch. Additional controls for audio are also available on the ICP.

The MFD has controls for radio, CD, auxiliary input and telephone. A 'Menu' switch allows for the selection and adjustment of audio settings, clock settings and language. Each menu can be scrolled through using a 'four-way' menu navigation control switch and the selected menu can be displayed by pressing the 'OK' switch in the center of the control switch.

The following functions can be selected from the menu:

- Regionalisation
- Alternative frequency (AF)
- News
- Adaptive Volume Control (AVC)
- Tone adjustment
- DAB/DMB Service link
- CD repeat and shuffle

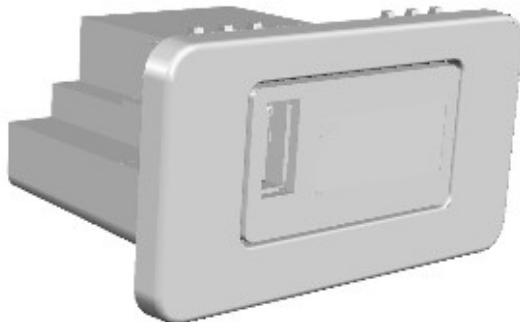
Clock functions:

- Time
- Date

Language:

- Select language from list

Portable Audio Interface Panel (Optional Fit)



E151886

The portable audio interface is located in the floor console cubby box. The interface is a media hub between the portable input device and the audio head unit.

Devices that can be connected include:

- **USB (universal serial bus)** mass storage devices (for example a memory stick). Devices must use FAT or FAT32 file format.
- iPod® (iPod Classic, iPod touch, iPhone and iPod Nano are supported - full functionality for older devices cannot be guaranteed). iPod Shuffle functionality cannot be guaranteed.
- Auxiliary device (personal audio, MP3 players).
- Devices with Bluetooth® connectivity. Devices must support A2DP and AVRCP Bluetooth® protocols).

When connecting a portable storage device, press the AUX switch on the multi-function display to select that device input. Depending on the device connected, many of the controls on the multi-function display and ICP can be used.



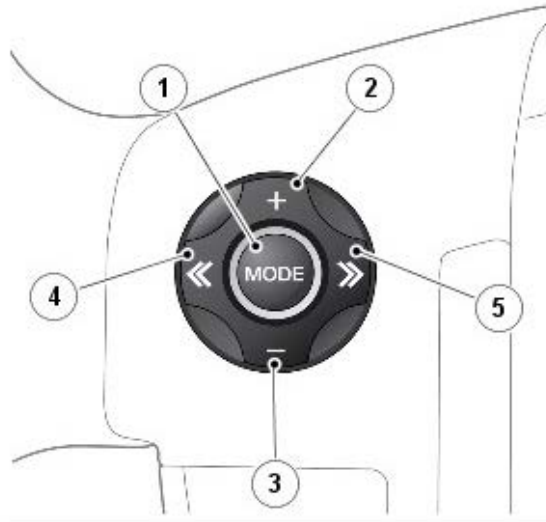
NOTE: It is recommended to disconnect an iPod when leaving the vehicle. Failure to do so may result in the iPod battery discharging.

To maximize playback quality, it is recommended to use loss-less compression for any media files on iPod. Failing this, it is recommended that compressed files utilise a minimum bitrate of 192 kb/s (a higher bitrate is strongly recommended for increased quality playback).

For media files delivered via **USB** or MP3 players, the highest compression rate supported is 320 kbits per second (kbps). If anything less than 128 kbps is used, Digital Signal Processing (DSP) functionality may be lost.

Some MP3 players may have a file system that is not supported by the audio head unit. To use an MP3 player, it must be set to **USB** Removable Device or Mass Storage Device mode. Only music that has been added to the device in this mode can be played.

STEERING WHEEL CONTROLS



E140298

Item Description

- 1 2. Mode switch
- 2 Volume increase
- 3 Volume decrease
- 4 Seek down
- 5 Seek up

The steering wheel mounted audio control switches are located on the left side of the steering wheel. The operation of each steering wheel audio switch is via a resistive ladder. The MFD processes the received voltage to determine the function selected. This information is then passed to the AHU on the medium speed **CAN** bus to carry out the request.

The steering wheel audio switch controls the following functions:

- **MODE** - Press repeatedly to scroll through all audio/video sources.
- **Short press up** -
 - To select the next radio preset
 - To select the next track on chosen audio source
- **Short press down** -
 - To select the previous radio preset
 - To select the previous track or start of current track on chosen audio source
- With radio manual seek mode activated, further short presses will change the frequency in single increments. A further long press will scan forwards through the current waveband until the switch is released.
- **Long press up** -
 - To auto seek up the frequency to the next radio station.
- **Long press down** -
 - To auto seek down the frequency to the next radio station.
- Volume increase for current audio source
- Volume decrease for current audio source

MID-LINE, HI-LINE AND PREMIUM AUDIO SYSTEMS

Touch Screen Display and Integrated Control Panel



E151901

Item Description

- 1 Touch screen (TS) off switch
- 2 Touch screen
- 3 Audio/video menu switch
- 4 Phone menu switch
- 5 Mode switch
- 6 Menu navigational controller
- 7 Info switch
- 8 Seek up/CD next track/manual tuning up
- 9 CD eject switch
- 10 CD slot
- 11 Seek down/CD previous track/manual tuning down
- 12 Tone switch
- 13 Volume control
- 14 Audio on/off

The Mid-Line, Hi-Line and Premium audio systems are based around an Integrated Audio Module (IAM) which communicates on the MOST with other audio and entertainment system modules. The Integrated Control Panel (ICP) communicates on the medium speed CAN with the Touch Screen (TS).

The ICP has a rotary control for audio volume control. The control can also be pressed to turn the audio system on and off.

The ICP duplicates many of the TS audio user control features. Any volume setting made whilst in audio, TV, phone, navigation or voice activation mode will be memorized for that system. The ICP communicates with the TS on the medium speed CAN bus. The TS converts control/command signals from the ICP and then distributes the information

onto the MOST system to the audio system and other information and entertainment systems.

Integrated Audio Module (IAM)



E140303

The IAM is located in the instrument panel, behind the Integrated Control Panel (ICP) and the [ATC](#) module.

Two levels of IAM are available; IAM 1 and IAM3. IAM3 is the high level unit and supports the following features in addition to the features supported by IAM1:

- Navigation
- TMC/VICS
- Off Road Navigation
- DVD
- 40GB Hard Disc Drive (HDD) - virtual CD/DVD - allows the storage of up to 10 CDs to create a 'virtual' multi-changer.
- Voice recognition
- Rear Seat Entertainment (RSE)

Both versions of the IAM contain the following functionality:

- AM/FM radio tuner with diversity
- HD Radio™ receiver (NAS only)
- [CD](#)/MP3 player (Single [CD](#))
- Auxiliary audio/video is available via a portable audio interface panel. The panel allows for the connection of portable audio/video via 2 USB's (optional fit), iPod connectivity (optional fit) and a 3.5mm jack plug.
- Bluetooth® and audio streaming.

When the vehicle systems become active the TS is woken up by [CAN](#) bus activity and subsequently wakes up the IAM via the MOST.

The IAM incorporates an AM/FM tuner which allows for the storage of 3 banks of FM presets FM1/2/3 containing 6 presets each and 3 banks of AM Presets AM1/AM2/AMA containing 6 presets each. The AMA bank gives the 6 strongest AM stations stored by an AM autostore. Pre-set stations are stored in the IAM and TS memory. The radio tuner also incorporates the following radio functions:

- HD Radio™ (NAS only)
- AM Auto Store (AST)
- FM station list
- Presets
- Traffic announcements (TA) – Europe only
- RDS (radio data system) EON (Enhanced Other Networks) function (Radio Broadcast Data System (RBDS) in NAS markets)
- Seek station
- Tune up/down
- Scan
- PTY

When the optional Digital Audio Broadcasting (DAB) tuner is specified, the audio system is fitted with a separate DAB/DMB receiver. This allows the reception of digital broadcast stations which can be received via the FM2/DAB/DMB III antenna located in the left rear quarter glass or via the DAB/DMB III antenna in the roof pod.

In NAS markets, Satellite Digital Audio Radio Service (SDARS) can be specified, the audio system is fitted with a separate SDARS tuner. This allows for the reception of the satellite digital broadcast stations which are received via an SDARS antenna located in the roof pod.

All radio antennas are routed into the IAM. The IAM supplies a power output to the antenna except for AM which has a separate power feed to the AAM.

The IAM incorporates a power management function. Should the vehicle battery level drop below a predetermined level, the unit will limit its functionality. The AHU receives medium speed [CAN](#) signals from other vehicle systems which it uses to determine the wake up/shut down process.

Calibration of the IAM using approved Land Rover diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates. If the IAM is replaced it must be configured as a new module using approved Land Rover diagnostic equipment.

CD Player/DVD Player (where fitted)

The CD player has the capability to play MP3 files. The MP3 discs follow a format of folders and files within the folder. It is also possible to place all the files in the root directory on the CD.

The random and repeat features follow the normal CD random and repeat feature functions.

When an CD error occurs, the AHU will alert the user by showing a message related to the error in the multi-function display. This will be displayed while the CD audio mode is selected until the error is corrected. The CD related error does not affect other areas of the AHU and a different audio source can be selected.

Error Message in IAM display	Cause
Mechanism error	Mechanical Error, CD stuck, Servo related error, etc..
Disc error	Invalid Disc, CDROM (read only memory) inserted, disc inserted upside-down, etc.

The IAM has the ability to load audio files and 'rip' the music onto the internal hard drive, a 10GB partition is reserved to store music. It is possible to store up to 10 uncompressed albums onto the hard drive. Only CDDA files can be loaded into the virtual changer.

File compatibility for the single slot CD mechanism includes:

- CD audio
- MP3 – (MPEG Layer III)
- WMA – (Microsoft Windows Media Audio)
- WAV – (waveform)
- AAC – (Advanced Audio Coding. Apple iTunes - only through iPod interface).

NOTES:



The CD player may take a longer time to load an MP3 disc, if there are more tracks than on a normal CD. To minimise loading time, a rigid folder structure is recommended.



In the event of customer complaints relating to audio quality, file compression should be taken into consideration during diagnosis.

Dynamic Volume Control (DVC)

DVC controls the audio output parameters in relation to the noise inside the cabin (road noise, wind noise, etc.) and vehicle speed. No customer settings are available for adjustment.

Touch Screen (TS)

The TS is an 8" color touch sensitive display, located in the instrument panel, above the ICP.

The TS is the Bus Master for the MOST system and contains the timing master for the MOST system.

When the vehicle systems become active the TS is woken up by CAN bus activity and subsequently wakes up the other audio module via the MOST.

The TS forms the basis of the audio system. It communicates with the rest of the audio/infotainment system on the MOST ring and allows control of the audio system and other infotainment systems from a single point. The TS communicates with the IAM on the MOST ring and provides the primary user interface and display of the audio system controls. No configuration procedure is required if the TS is replaced.

Calibration of the TS using approved Land Rover diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

The TS provides user control of the following systems:

System	Functions
Audio	Radio display AM/FM or DAB, DMB radio, auxiliary and portable audio, digital TV or CD (compact disc)
Climate control	Air conditioning, distribution, seats, heated steering wheel, automatic air recirculation
Telephone	Digit dialer, phone book, last ten calls (made, received, missed)
Navigation	Destination, stored locations, navigation setup, route options, 4x4 info
Vehicle	Security parking, valet mode, trip computer, clock, brightness, contrast, system settings, vehicle settings, display settings

Clock

The TS contains the master clock functionality. Other vehicle infotainment modules that require clock functionality use the time supplied from the TS.

The clock is available to any control module that is connected to an interconnecting bus, for example, either of the CAN buses or the MOST ring.

The clock display configurable to show in AM/PM or 24 hour format. Midnight is shown as 12:00AM or 00:00 respectively. The default condition, if not specified, after power on or delivery, should default to 12:00PM or 00:00. Depending upon the market set the clock will default to either 12 or 24 hour format.

The time is adjusted from the TS. Under conditions when any bus system could be asleep or shut down, the TS does not allow clock adjustments.

Integrated Control Panel (ICP)

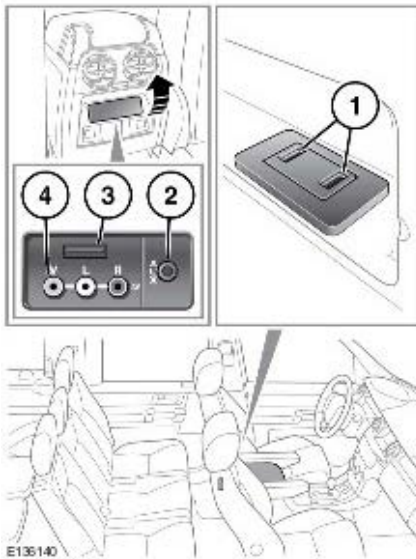
The ICP is located in the instrument panel, above the [ATC](#) module.

The ICP has a rotary control for audio volume control. The control can also be pressed to turn the audio system on and off.

The ICP duplicates many of the TS audio user control features. Any volume setting made whilst in audio, TV, phone, navigation or voice activation mode will be memorized for that system. The ICP communicates with the TSD on the medium speed [CAN](#) bus. The TS converts control/command signals from the ICP and then distributes the information onto the MOST system to the audio system and other information and entertainment systems.

A slot below of the ICP allows a CD to be inserted into the IAM.

Portable Audio Interface Panel and AVIO Panel



Item Description

- 1 [USB](#)/iPod socket
- 2 3.5 mm AUX socket
- 3 [USB](#)/iPod socket
- 4 AV sockets

Both the front and the rear auxiliary input connectors are located in the floor console. AUX (Auxiliary Input) mode allows extra equipment to be connected to the vehicle's audio system. Items such as a personal stereo, MP3 player, hand-held navigation unit etc, can be plugged in to the vehicle's audio system.

To listen to an auxiliary input source portable devices must be connected via 3.5 mm stereo jack sockets or [USB](#) ports. If the device has a line out socket it is preferable that this is used for connection.

Portable Audio Interface

The portable audio interface is located in the floor console cubby box and is fitted to all Hi-Line and Premium audio specified vehicles. The interface is a media hub between the portable input device and the IAM. The interface contains two [USB](#) ports.

Devices that can be connected to the portable audio interface include:

- [USB](#) mass storage devices (for example a memory stick). Devices must use FAT or FAT32 file format.
- iPod® (iPod Classic, iPod touch, iPhone and iPod Nano are supported - full functionality for older devices cannot be guaranteed). iPod Shuffle functionality cannot be guaranteed.
- Auxiliary device (personal audio, MP3 players).
- Devices with Bluetooth® connectivity. Devices must support A2DP and AVRCP Bluetooth® protocols).

When connecting a portable storage device, select AUX on the TS to select that device input. Depending on the device connected, many of the audio controls on the TSD and ICP can be used.



NOTE: It is recommended to disconnect an iPod when leaving the vehicle. Failure to do so may result in the iPod battery discharging.

To maximise playback quality, it is recommended to use lossless compression for any media files on iPod. Failing this, it is recommended that compressed files utilise a minimum bitrate of 192 kb/s (a higher bitrate is strongly recommended for increased quality playback).

For media files delivered via [USB](#) or MP3 players, the highest compression rate supported is 320 kbits per second (kbps). If anything less than 128 kbps is used, Digital Signal Processing (DSP) functionality may be lost.

Some MP3 players may have a file system that is not supported by the IAM. To use an MP3 player, it must be set to [USB](#) Removable Device or Mass Storage Device mode. Only music that has been added to the device in this mode can be played.

AVIO Panel

The Audio Video Inout/Output (AVIO) panel is located at the rear of the floor console. The AVIO panel is only fitted to vehicles with RSE installed.

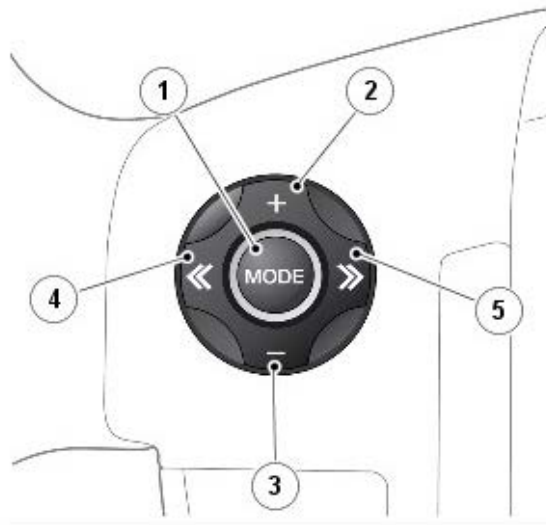
The panel contains one USB port, one 3.5mm jack plug and three Audio/Video (AV) plug sockets. The AVIO panel is connected directly to the Rear Seat Entertainment (RSE) module.

The AV sockets allow for the connection of video (yellow socket), right audio (red socket) and left audio (white socket) from a remote device such as a PlayStation™. The USB socket allows for the connection of a portable media device.

Aux Panel

The aux panel is located at the rear of the floor console. The aux panel contains one 3.5mm jack plug. If the vehicle is fitted with RSE the aux panel is replaced by the AVIO panel.

Steering Wheel Controls



E140298

Item Description

- 1 Volume increase
- 2 Mode switch
- 3 Seek up
- 4 Volume decrease
- 5 Seek down

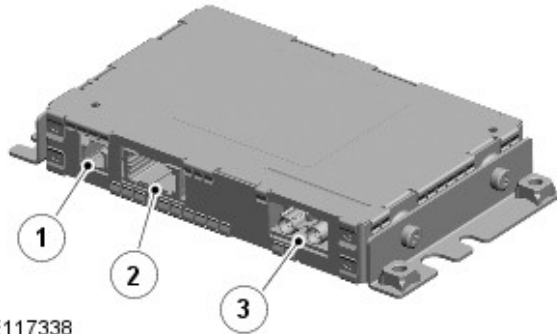
The steering wheel mounted audio control switches are located on the left side of the steering wheel. The switches are a resistive ladder type which return a different voltage to the ICP in response to different switches being pressed.

The steering wheel audio switch controls the following functions:

- MODE - Press repeatedly to scroll through all audio/video sources.
- Short press up -
 - To select the next radio preset
 - To select the next track on chosen audio source
 - When telephone is in use, press to scroll up lists of calls or phonebook entries.
- Short press down -
 - To select the previous radio preset
 - To select the previous track or start of current track on chosen audio source
 - When telephone is in use, press to scroll down lists of calls or phonebook entries.
- With radio manual seek mode activated, further short presses will change the frequency in single increments. A further long press will scan forwards through the current waveband until the switch is released.
- Long press up -
 - To auto seek up the frequency to the next radio station.
- Long press down -
 - To auto seek down the frequency to the next radio station.
- Volume increase for any audio source
- Volume decrease for any audio source

Digital Audio Broadcasting (DAB)

DAB/DMB Receiver



E117338

Item Description

- 1 Power supply and ground connection
- 2 MOST bus connector
- 3 L-band and Band III antenna connection

DAB/DMB is a digital radio network designed to provide reliable, multi-service broadcasting for reception by mobile, portable and fixed receivers.

DAB/DMB provides a clear signal with minimal interference, hiss or fading. After a channel (or station) has been tuned and stored, it does not need retuning.



NOTE: Radio signals travel in a straight line so large obstacles, such as tall buildings, can shield the vehicle from the signal causing temporary loss of reception (known as dead spots).

Digital radio is transmitted from regional terrestrial transmitters. Local digital radio channels are not available outside the range of a transmitter. To receive new local channels during vehicle movement around a country, the auto-tune function is used to build new channel lists.



NOTE: When the vehicle DAB radio is first used the system will not receive any digital stations until the auto-tune function has been completed.

Digital radio channels are organized into groups called ensembles (also known as multiplexes). Some individual channels may also provide a number of subchannels. For example, if several sports events are being held simultaneously, the channel may temporarily choose to broadcast each different event on a separate subchannel.

DAB/DMB is broadcast across Europe, Canada and parts of Asia. System transmission is via a terrestrial network, on two separate broadcasting bands:

- DAB/DMB band-L
- DAB/DMB band III

The DAB/DMB system requires additional components to be added to the audio system. DAB/DMB antennas and a receiver are fitted to allow reception of the service.

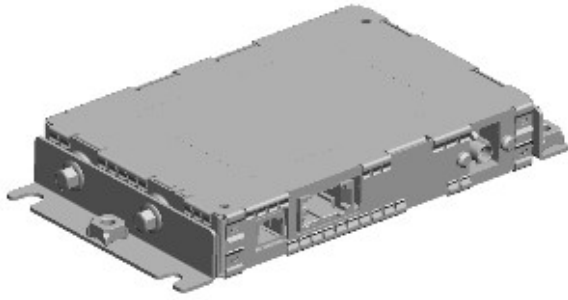
Operation of the DAB/DMB system is the same as the radio operation with selections made through the TS and ICP to access and navigate the system functions.

The DAB/DMB receiver is a dedicated tuner which is controlled by the IAM on the MOST ring. The receiver processes the signals from the DAB/DMB antennas. Information is transmitted on the MOST ring and processed by the IAM. The processed information is sent out to the power and broadcast through the speaker system.

No configuration procedure is required if the DAB/DMB receiver is replaced. Calibration of the DAB/DMB receiver using Land Rover approved diagnostic equipment enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

Satellite Digital Audio Radio Service (SDARS)

SDARS Receiver



E139370

The SDARS systems operate in the S-Band frequency range (2.3 GHz) and, as a result of the use of satellite transmission have the ability to provide digital audio broadcasts over very large areas (typically continents). SDARS service providers transmit a signal from their up-link facility (which is the original point of transmission of data, voice or other information through an antenna system) to a satellite where the signal is then down linked to both the terrestrial repeater network and the individual SDARS car radios. The radio switches between the satellite signal and the repeater signal depending on the strength of the signal at any given time.

LandRover will be using the Sirius Satellite Radio service provider in the USA.

The SDARS systems comprise:

- Satellites
- Ground repeaters
- Up-link ground stations
- Radio receiver systems

The SDARS system uses three satellites on an inclined elliptical orbit. This ensures that each satellite spends approximately 16 hours a day over the continent of the USA, with at least one satellite over the country at any one time.

The satellites beam their signals down to the ground where the signal is picked up by receivers or is transmitted to repeater stations to cover built up areas where the signal is obscured.

SDARS is a subscription based service which requires the user to contact Sirius to obtain a subscription. In order to obtain a subscription the SDARS unit ID number will need to be retrieved from the unit. This is achieved as follows:

- When the vehicle first receives live signal within the US or Canada, the HLDf shall display ch184 as the tuned channel (labeled as Preview). The radio text shall display Call 1888-539-Sirius. Alternatively, when the radio is subscribed, unsubscribed channels shall also display this information in the radio text
- The ESN/SID can always be found the following way, no matter what the subscription status of the radio. Press **Settings** on the HLDf, then select **Sat Info** switch in the settings view. This shall display the ESN/SID and the phone number. If a cell phone is paired to the Bluetooth system, the user can select the green phone switch in the Sat info view to call the call center.

If no subscription has been taken, the HLDf will display the Sirius telephone number. To subscribe to Sirius use the displayed phone this number. The user will need payment details, the Sirius ID number and details of the required package.

The SDARS function is accessed by pressing the **SAT** switch. To toggle through the Sat bands, select the + switch next to the **SAT** switch. This shall list SAT 1, SAT 2, SAT 3. Select any of these to change Sat band.

The SDARS module is located in the rear right side of the luggage compartment. The SDARS module is connected to the rest of the audio system on the MOST ring. This allows control signals and received audio to be routed around the system to the relevant module. The SDARS antenna is located in the roof mounted pod. The antenna is hardwired to the SDARS module.

HD Radio™

HD Radio™ technology is a free digital radio format broadcast available in the NAS market and may become available for other markets in the future. HD Radio™ digital broadcasts are transmitted alongside the analogue AM and FM signals by stations broadcasting HD Radio™ signals. HD Radio™ technology has the ability to deliver improved sound quality and content to the listener, blending between analogue and a digital audio streams of the primary station and delivering extra multicast stations on the same frequency. The HD Radio receiver is integrated into the AM FM tuner on NAS variants of the IAM.

Audio Amplifier Module (AAM)



E139623

The audio system has two amplification options dependent on the audio system specified:

- Internal (Lo-Line system)
- Audio Amplifier Module (AAM) (Mid-line' High-line and Premium systems)

The AAM is located in the rear right quarter of luggage compartment. It is connected to the audio system via the MOST bus. Speaker connections are hardwired.

WhiteFire® Digital Wireless Headphones and Transmitter



E121826

Item Description

- 1 WhiteFire® digital wireless headphones
- 2 WhiteFire® digital infrared transmitter

Digital Wireless Headphones headphone system includes Dolby® headphone surround when listening to the DVD source. It is possible to install the vehicle with up to 2 sets of headphones. Each headset contains 2 AAA batteries.



NOTE: The headphones are connected to the AAM only (Mid-line, High-line and Premium systems).

The controls located on the earpiece include the power switch, volume control and channel browse switch. To select a different channel press the browse switch, conformation via an audible beep can then be heard followed by the audio transmission on that channel.

Antennas

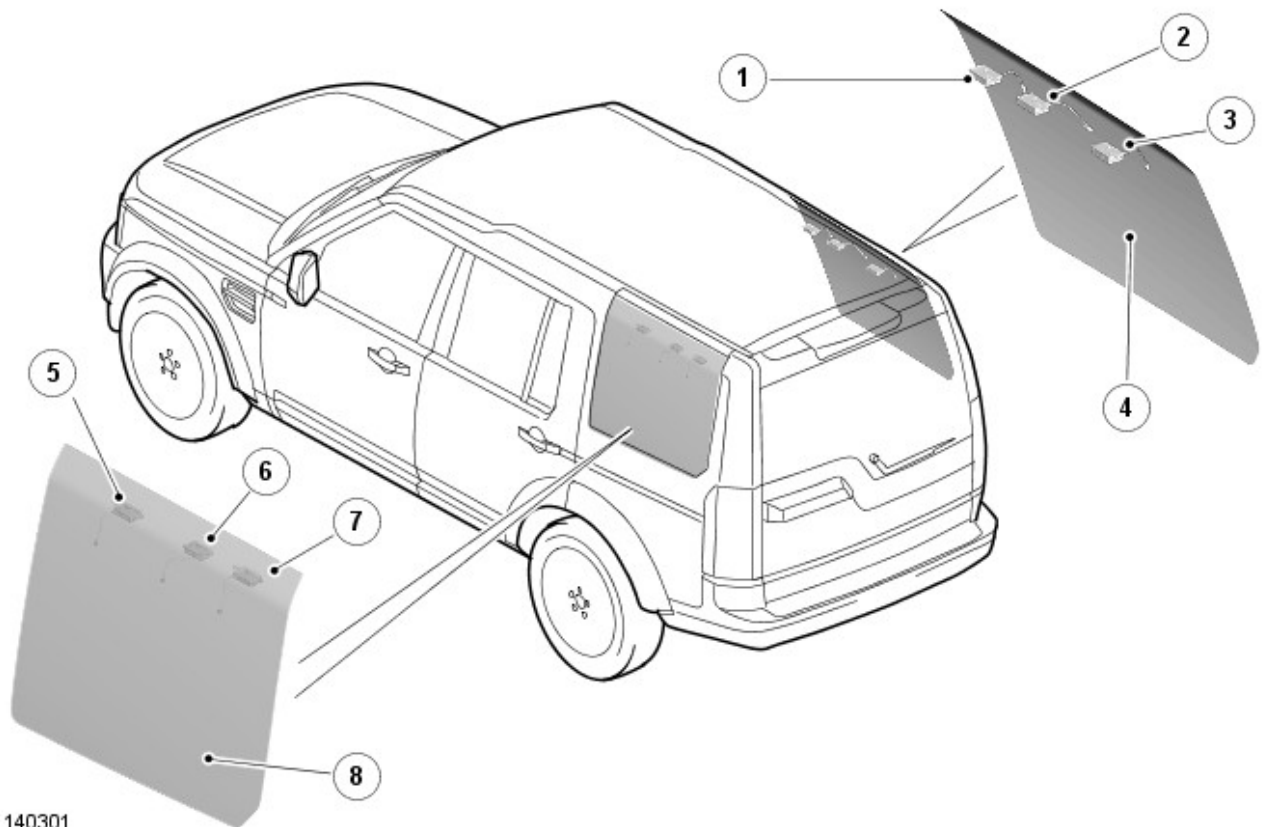
Digital Audio Broadcasting and DAB/DMB L-Band/Satellite Digital Audio Radio Service (SDARS) Antenna



E96387

The DAB/DMB L-band/SDARS antenna is located in the roof pod and is shared with the navigation system Global Positioning Satellite (GPS) antenna where fitted.

The DAB/DMB III antenna is located in the leftrear side window

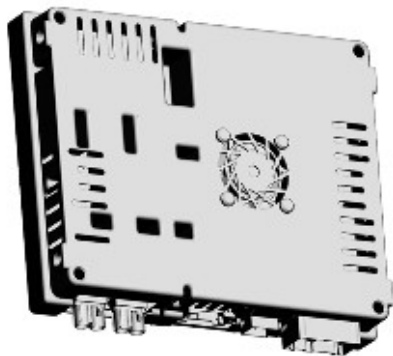


E140301

Item Description

- 1 TV4 antenna
- 2 AM/FM antenna
- 3 TV3 antenna
- 4 Right rear quarter glass
- 5 TV1 antenna
- 6 FM2/DAB/DMB III antenna
- 7 TV2
- 8 Left rear quarter glass

TV Tuner



E121834

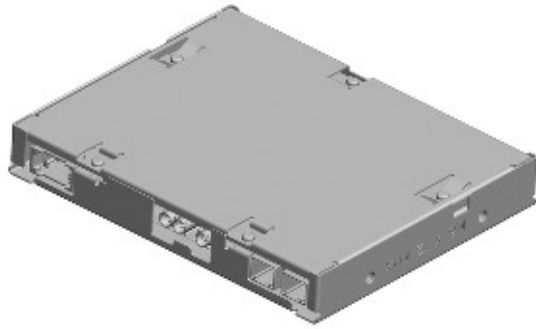
The TV tuner is located below the front right seat. The TV tuner forms part of the entertainment system and is available on vehicles fitted with satellite navigation. The TV images can also be viewed on the RSE rear screens when fitted.

TV audio output is sent from the TV tuner on the MOST to the AAM.

Refer to: Video System (415-07 Video System, Description and Operation).

REAR SEAT ENTERTAINMENT (RSE)

RSE Module



E122295

The RSE system consists of the following components:

- Two 8" [LCD \(liquid crystal display\)](#) screens (mounted in the back of the front headrests)
- DVD video player (IAM)
- Rear AVIO panel connectivity
- RSE module
- Two headphone sets.

The fibre optic, Media Orientated System Transport (MOST) based system provides video and audio entertainment for the rear seat occupants. The RSE system provides control of a number of audio and video sources, channelling the output independently to the rear seat passengers via personal infrared digital wireless headphones and video screens or allows output over the main vehicle audio speaker system. The video images can also be displayed on the front Touch Screen Display if the vehicle is below a predetermined speed threshold (or dual view is selected by the passenger).

The video display screens mounted in rear of the front seat headrests can display video pictures from a number of sources and are controlled via the RSE remote control for the rear seat entertainment controls.

The RSE module is located in the right side of the luggage compartment and manages the request signals from the RSE remote control. The module is connected directly to both rear video displays via a medium speed [CAN](#) link. Video signals are communicated via the LVDS (Low Voltage Differential Signal) to one or both screens as requested.

The RSE module is connected directly to the following modules for the purpose of processing audio, video, input and output signals:

- TS - DVD video and TV to rear screens
- AAM - Process audio signals for output on vehicle speaker system or headphones
- TV Module - TV signals processed and passed to TS and rear screens
- AVIO panel - process audio and video signals from remote source.

Refer to: Video System (415-07 Video System, Description and Operation).

Information and Entertainment System - Digital Audio Module

Removal and Installation

Removal

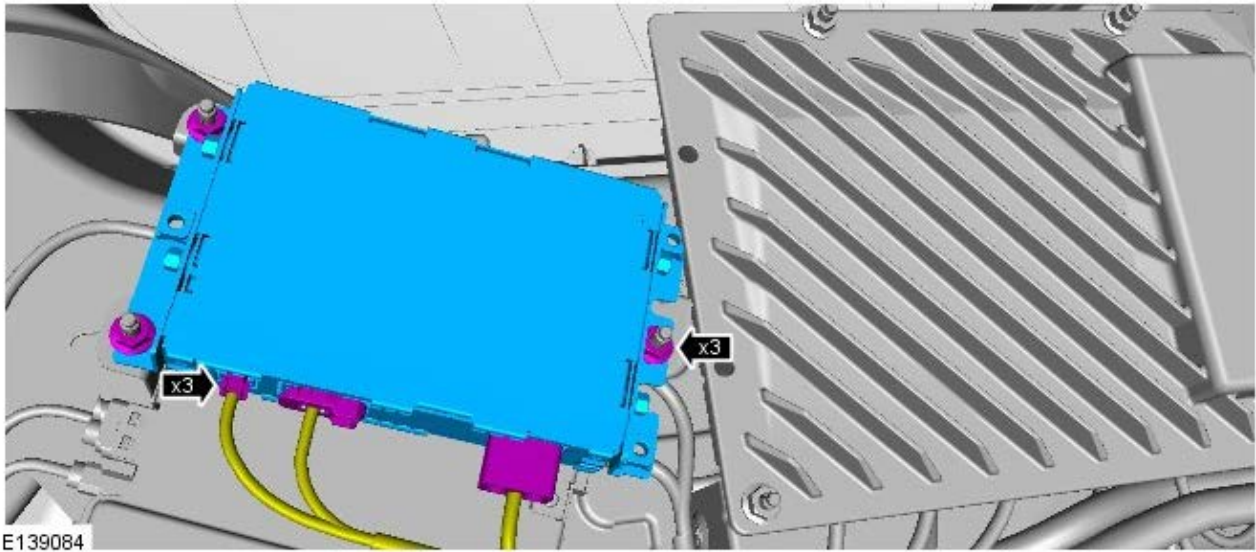


NOTE: Removal steps in this procedure may contain installation details.

1.  **NOTE:** RH side only.

Refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).

2. Torque: 9 Nm



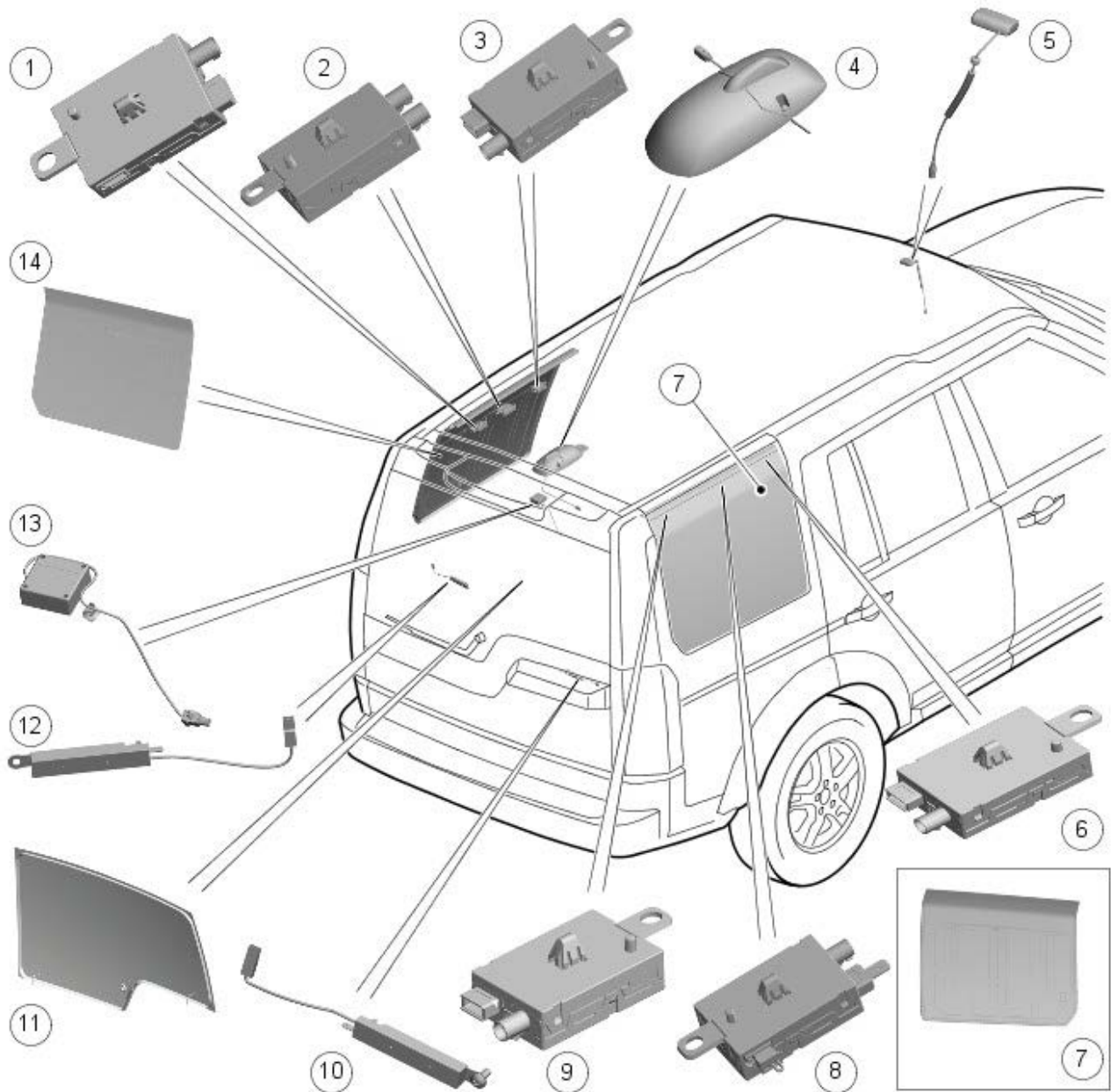
Installation

1. To install, reverse the removal procedure.
2. Using the diagnostic tool, calibrate the component.

Antenna - Antenna

Description and Operation

COMPONENT LOCATION



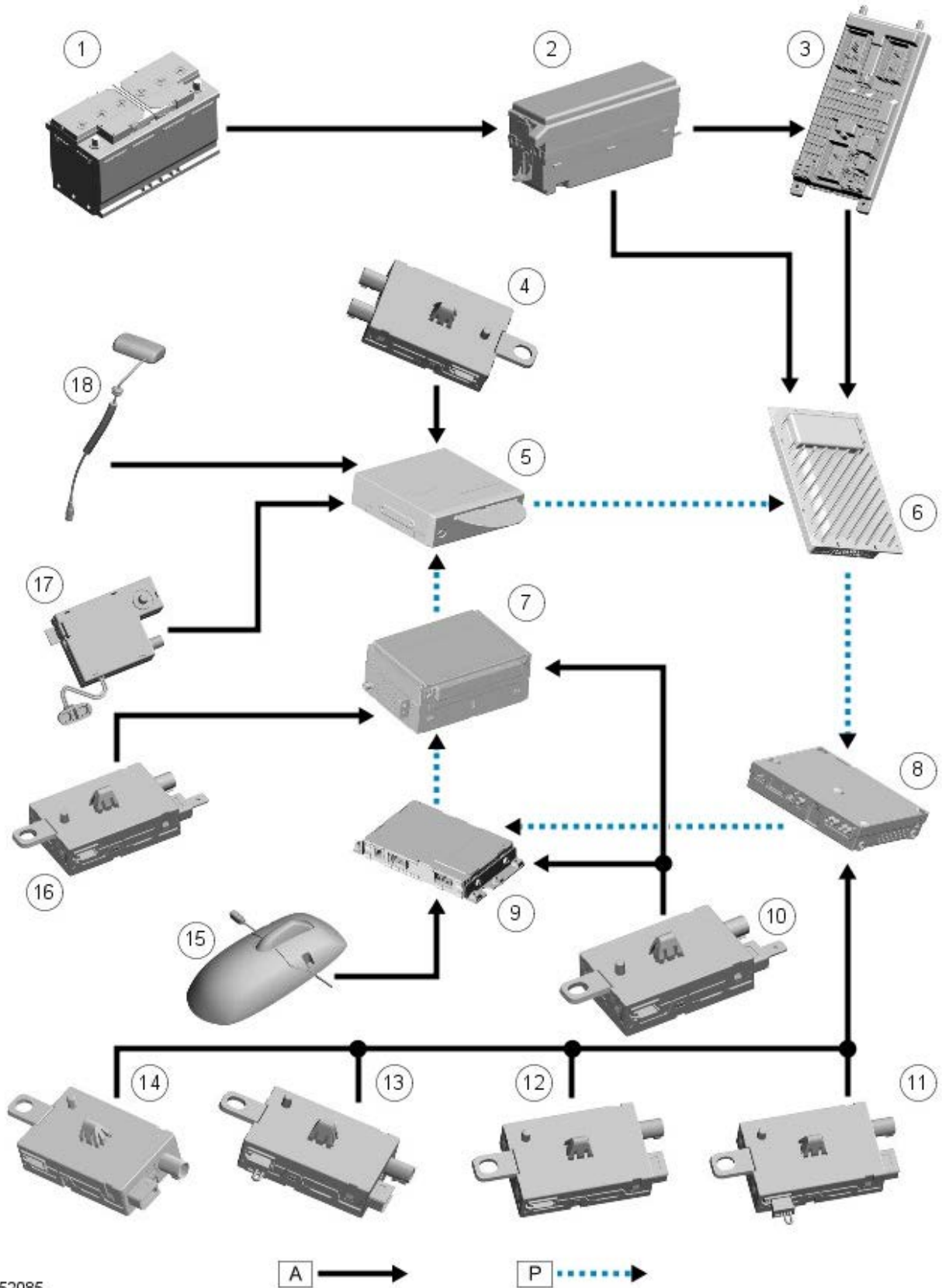
E150930

Item	Part Number	Description
1		TV antenna amplifier
2		FM2 antenna amplifier or FM2/DAB (shown) or FM2/VICS amplifier - Market dependent
3		TV antenna amplifier
4		Roof pod - contains SDARS and DAB L-Band antennas
5		VICS beacon antenna (Japan only)
6	-	TV antenna amplifier
7	-	Rear right quarter window
8	-	AM/FM antenna amplifier
9	-	TV antenna amplifier (shown) or TV/Teleststart antenna amplifier
10	-	Rear right RF filter
11	-	Rear window
12	-	Rear left RF filter
13	-	GPS antenna
14	-	Rear left quarter window

CONTROL DIAGRAM



NOTE: A = Hardwired; P = MOST



E152085

Item	Part Number	Description
1		Battery
2		Battery Junction Box (BJB)
3		Central Junction Box (CJB)
4	-	VICS antenna (Vehicle Information and Communication System) - Japan only
5	-	Navigation module
6	-	Audio Amplifier Module (AAM)

7	-	Integrated Audio Module (IAM)
8	-	TV module
9	-	DAB (Digital Audio Broadcasting) or SDARS (Satellite Digital Audio Radio Service) Tuner module
10	-	FM2/DAB Antenna Amplifier
11	-	TV antenna amplifier 1
12	-	TV antenna amplifier 2
13	-	TV antenna amplifier 3
14	-	TV antenna amplifier 4
15	-	Roof pod - contains SDARS and DAB L-Band antennas
16	-	AM/FM antenna amplifier
17	-	GPS antenna
18	-	Beacon antenna - Japan only

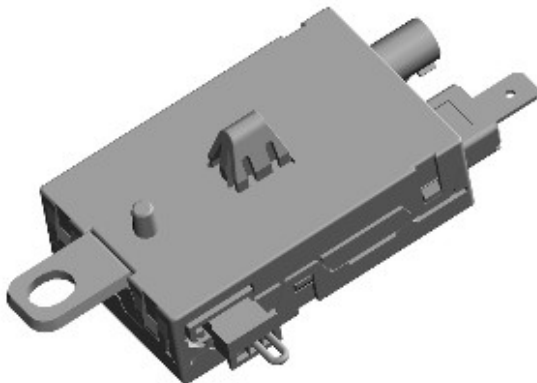
SYSTEM OPERATION

The antenna systems fitted to the vehicle comprise:

- AM (glass mounted)
- FM (glass mounted)
- FM2 (glass mounted)
- DAB (glass mounted (Band 3) and within roof pod (L-Band))
- TV (glass mounted, where fitted)
- GPS antenna (rear spoiler mounted, where fitted)
- SDARS (roof pod mounted NAS only)
- VICS antenna and beacon antenna (Japan only where fitted)

COMPONENT DESCRIPTION

FM antenna amplifier



E152098

The AM/FM and FM2 antennas are located above the left and right rear quarter window glasses on all vehicles. The antenna amplifiers connect to the elements on the glass that make up the antenna structure. The FM system uses the combined signal output of both antenna amplifiers to give the best reception. The Traffic Message Channel (TMC) signals are received through the normal FM radio signals as part of the RDS sideband network.

GPS ANTENNA

The GPS antenna is located in the right side of the upper tailgate mounted spoiler. The GPS antenna is connected to the navigation module by a coaxial cable.

TV ANTENNA AMPLIFIER

Where a television system is specified there are four TV antenna elements two in each of the rear quarter window glasses. Each element has an antenna amplifier which is connected to the TV tuner module using a coaxial cable.

SATELLITE DIGITAL AUDIO RADIO SYSTEM (SDARS) ANTENNA (NAS ONLY)

The SDARS antenna and Dab L-Band antennas are mounted in the roof pod (where fitted). The antennas are connected to the SDARS module (NAS only, if fitted) or DAB module (if fitted) using coaxial cables.

VICS BEACON antenna - Japan only

The antenna comprises two separate antenna elements:

- A printed monopole antenna for receiving terrestrial microwave signals
- An Infra Red detector for receiving signals from fixed IR beacons

Antenna - Antenna

Diagnosis and Testing

For additional information.

REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).

Speakers -

Torque Specifications

Description	Nm	lb-ft
Tailgate speaker to casing bolts	10	7
Tailgate speaker to tailgate Torx screws	10	7

Speakers - Speakers

Diagnosis and Testing

For additional information.

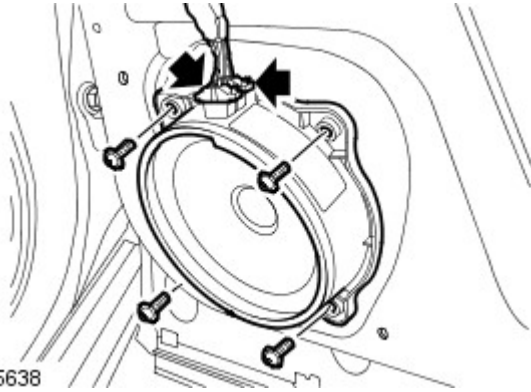
REFER to: Information and Entertainment System (415-00 Information and Entertainment System - General Information, Diagnosis and Testing).

Speakers - Front Door Speaker

Removal and Installation

Removal

1. Remove the front door trim panel.
For additional information, refer to: Front Door Trim Panel (501-05, Removal and Installation).
2. Remove the front door speaker wiring harness.
3. Remove the front door speaker.
 - Remove the 4 screws.
 - Disconnect the electrical connector.



M865638

Installation

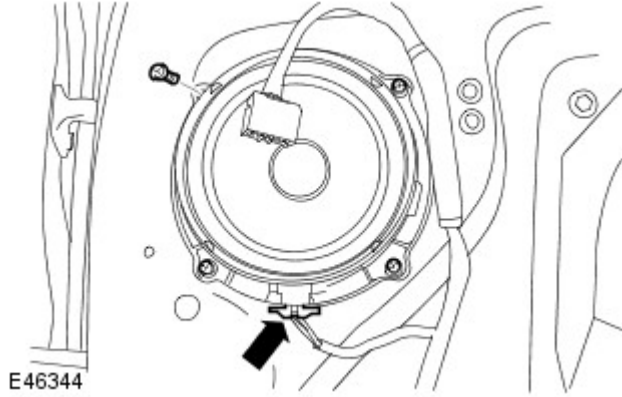
1. Install the front door speaker.
 - Connect the electrical connector.
 - Install the screws.
2. Install the front door speaker wiring harness.
3. Install the front door trim panel.
For additional information, refer to: Front Door Trim Panel (501-05, Removal and Installation).

Speakers - Rear Door Speaker

Removal and Installation

Removal

1. Remove the rear door trim panel.
For additional information, refer to: Rear Door Trim Panel (501-05, Removal and Installation).
2. Remove the speaker.
 - Disconnect the electrical connector.
 - Remove the 4 screws.



Installation

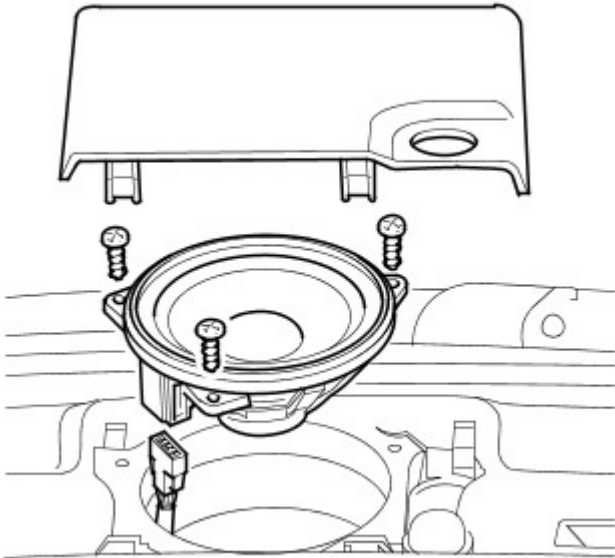
1. Install the speaker
 - Tighten the screws.
 - Connect the electrical connector.
2. Install the rear door trim panel.
For additional information, refer to: Rear Door Trim Panel (501-05, Removal and Installation).

Speakers - Instrument Panel Speaker

Removal and Installation

Removal

1. Remove the instrument panel speaker.
 - Remove the speaker grille.
 - Remove the 3 screws.
 - Disconnect the electrical connector.



E47228

Installation

1. To install, reverse the removal procedure.

Speakers - Quarter Panel Speaker

Removal and Installation

Removal



NOTE: The procedure to remove the quarter panel speaker is shown in the D-pillar trim panel procedure.

1. Remove the D-pillar trim panel.
For additional information, refer to: D-Pillar Trim Panel (501-05, Removal and Installation).

Installation

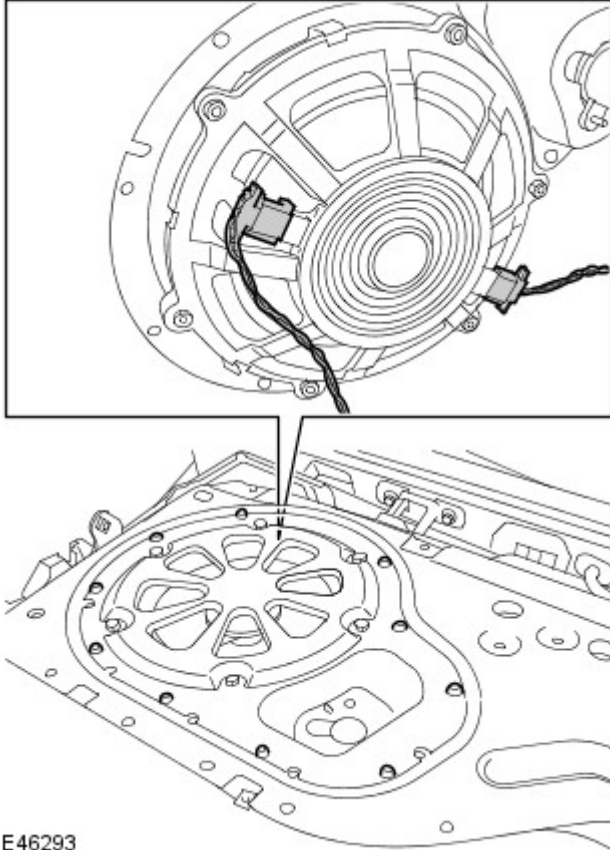
1. Install the D-pillar trim panel.
For additional information, refer to: D-Pillar Trim Panel (501-05, Removal and Installation).

Speakers - Tailgate Speaker

Removal and Installation

Removal

1. Remove the tailgate trim panel.
For additional information, refer to: Tailgate Trim Panel (501-05, Removal and Installation).




E46293

2. Remove the tailgate speaker assembly.
 - Remove the 10 Torx bolts.
 - Disconnect the 2 electrical connectors.



E46294

3.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the tailgate speaker.

- Remove the 6 bolts.

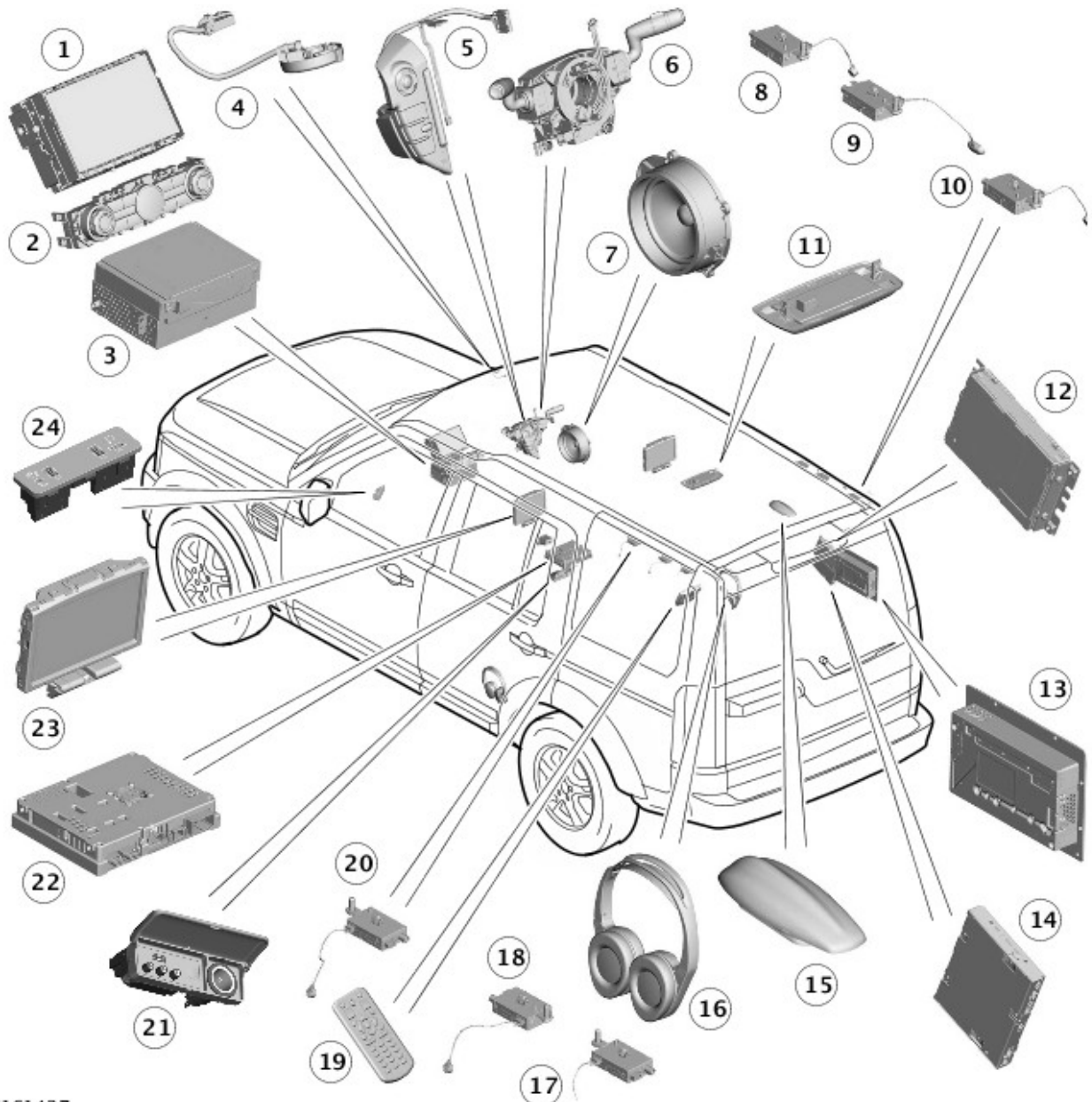
Installation

1. Install the tailgate speaker.
 - Tighten the bolts to 10 Nm (7 lb.ft).
2. Install the tailgate speaker assembly.
 - Connect the electrical connectors.
 - Tighten the Torx bolts to 10 Nm (7 lb.ft).
3. Install the tailgate trim panel.
For additional information, refer to: Tailgate Trim Panel (501-05, Removal and Installation).

Video System - Video System

Description and Operation

COMPONENT LOCATION



E161427

Item	Part Number	Description
1	-	Touch Screen (TS)
2	-	Integrated Control Panel (ICP)
3	-	Integrated Audio Module (IAM)
4	-	Microphone
5	-	Left steering wheel audio switchpack
6	-	Clockspring
7	-	Vehicle speakers
8	-	TV antenna amplifier
9	-	AM/FM1 antenna amplifier
10	-	TV antenna amplifier
11	-	Wireless Headphone Transmitter
12	-	Digital Radio Control Module (DRCM)
13	-	Audio Amplifier Module (AAM)
14	-	Rear Seat Entertainment Module (RSE)
15	-	Digital Radio L-Band/Satellite Digital Audio Radio Service (SDARS) antenna
16	-	Wireless headphones
17	-	
18	-	
19	-	Remote control
20	-	
21	-	
22	-	
23	-	
24	-	

17	-	TV antenna amplifier
18	-	FM2/DABIII/VICS antenna amplifier
19	-	RSE remote control
20	-	TV antenna amplifier
21	-	Audio video input/output (AVIO) panel
22	-	TV Control Module (TVCM)
23	-	Rear Seat Entertainment (RSE) Screen
24	-	Portable audio interface panel

OVERVIEW

The fiber optic, MOST (media orientated system transport) based system provides video and audio entertainment for the front and rear seat occupants. The system allows rear seat occupants to view [DVD \(digital versatile disc\)](#) video and [TV \(television\)](#) on two RSE (rear seat entertainment) screens, listen to audio output via the vehicle speakers or wireless headphones or display video images on the RSE screens from an external source, such as a video player or games console.

TV and DVD video images can also be displayed on the TS (touch screen) if the vehicle is below a predetermined speed threshold or has dual-view TS fitted (where market regulations allow).

The system comprises the following components:

- RSE control module.
- TV control module.
- Four TV Antennas.
- Four TV Antenna amplifiers.
- Two RSE screens.
- RSE remote control.
- Wireless headphones.
- AVIO panel.

The RSE system also uses other components which form part of the audio system as follows:

- TS (touch screen).
- IAM (integrated audio module).

For additional information, refer to: (415-01B Information and Entertainment System)

[Audio System](#) (Description and Operation),
[Audio System](#) (Description and Operation),
[Audio System](#) (Description and Operation).

- AAM (audio amplifier module).

For additional information, refer to: [Audio System](#) (415-01B Information and Entertainment System, Description and Operation) / [Audio System](#) (415-01B Information and Entertainment System, Description and Operation) / [Audio System](#) (415-01B Information and Entertainment System, Description and Operation).

- Headphones transmitter.
- Vehicle speakers.

For additional information, refer to: [Speakers](#) (415-01B Information and Entertainment System, Description and Operation).

DESCRIPTION

Touch Screen (TS)



E161428

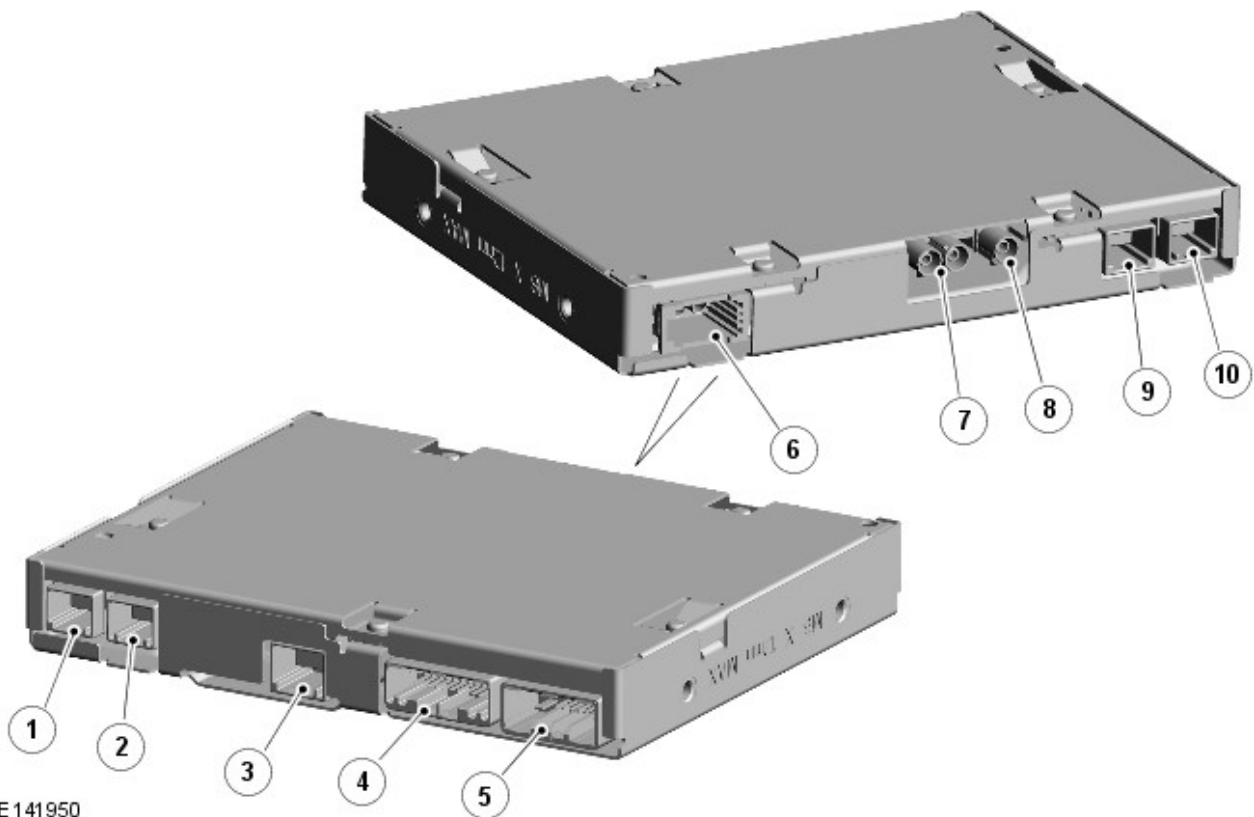
The TS (touch screen) is located in the center of the instrument panel and is the driver control interface for the infotainment system. The TS comprises an 8 inch color, touch sensitive display. The TS is connected to the MOST (media oriented system transfer) ring and communicates with the other components in the audio/infotainment system.

The TS communicates with the RSE (rear seat entertainment) control module and TVCM (television control module) via MOST ring. CVBS (composite video baseband signal) is used to transmit video images from/to the RSE control module and TVCM.

The TS also provides driver display and control of the audio system, telephone, the rear view camera, proximity cameras, and the navigation system.

Two versions of the TS are available; single view and dual view.

Rear Seat Entertainment (RSE) Control Module



E141950

Item	Part Number	Description
1	-	Low Voltage Differential Signalling connector (LVDS) - video output to left Rear Seat Entertainment (RSE) screen
2	-	LVDS connector - video output to right RSE screen
3	-	Audio Visual Input/Output (AVIO) panel connector - Universal Serial Bus (USB) input
4	-	Connector - AVIO panel audio/video input, Medium Speed (MS) Controller Area Network

		(CAN) to RSE screens, RSE remote control data
5	-	Connector - 12V power supply to RSE screens, 12V power supply to RSE remote control docking station, power supply from Auxiliary Junction Box (AJB) and ground
6	-	Connector - Media Oriented System Transport (MOST)
7	-	CVBS connector - TV video output to Touch Screen (TS)/Video input from TS
8	-	Not used
9	-	Not used
10	-	LVDS connector - video input from TV control module

The RSE (rear seat entertainment) module is located in the rear right side of the luggage compartment.

The RSE control module manages the request signals from the RSE remote control, receives video and audio inputs from the IAM (integrated audio module), TVCM (television control module) and AVIO (audio visual input/output) panel and outputs TV video to the TS (touch screen) and RSE screens and audio to the AAM (audio amplifier module).

The RSE control module is connected directly to the following modules for the purpose of processing audio, video, input and output signals:

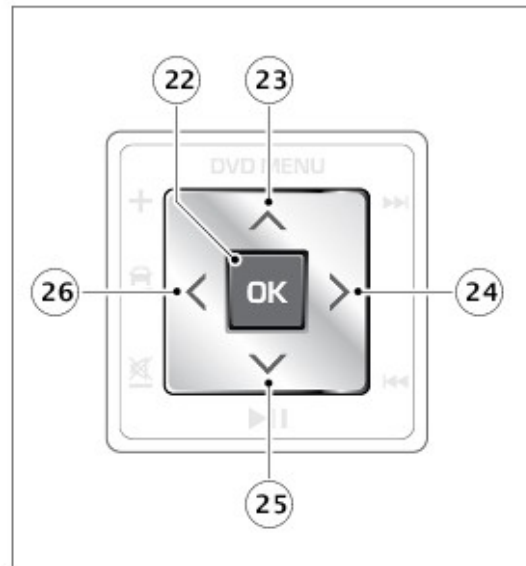
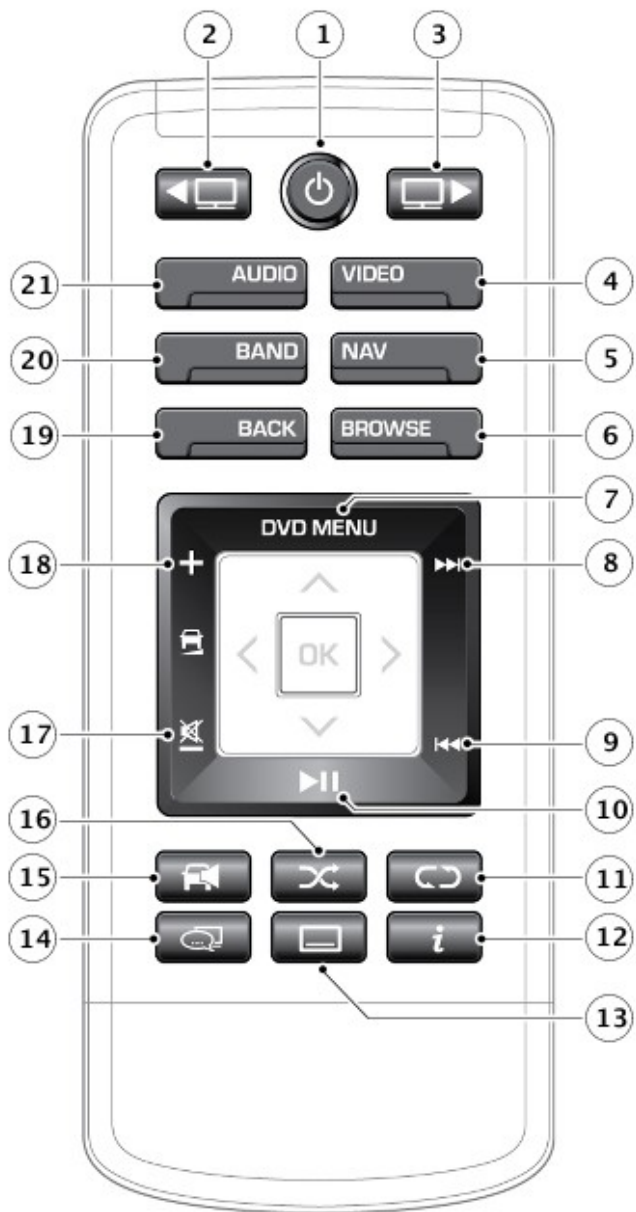
- TS - Connected via CVBS video - Processes DVD video from IAM to RSE screens.
- Audio amplifier module - Connected via MOST - Processes audio signals for output on vehicle speaker system or headphones.
- TVCM - Connected via LVDS (low voltage differential signalling) - TV signals are processed and passed to TS and RSE screens.
- Rear screens/RSE remote control - Connected to RSE screens via LVDS and MS (medium speed) [CAN \(controller area network\)](#) - Processes wireless infra-red signals.
- AVIO panel - Connected via audio/video/[USB \(universal serial bus\)](#) - Processes audio and video signals from remote source.

The RSE control module receives a permanent power supply via a fused connected from the [EJB \(engine junction box\)](#).

Rear Seat Entertainment (RSE) Remote Control



NOTE: To prevent accidental damage, always store the remote control in the stowage area provided when not in use.



E159850

Item	Part Number	Description
1	-	Press and release to power on/off screen
2	-	Left screen select
3	-	Right screen select
4	-	Video source select.
5	-	Navigation summary. Japan and Brazil only: 1/12 screen segment select
6	-	Browse/TV channel list
7	-	DVD menu
8	-	Next track/file/channel/station
9	-	Previous track/file/channel/station
10	-	Play/Pause for all non-live media (USB/iPod/CD/DVD/Data Disc)
11	-	Repeat. Japan and Brazil only: Repeat and 'Red' selections
12	-	Information. Japan and Brazil only: Information and 'Yellow' selections
13	-	Subtitles on/off. Japan and Brazil only: Subtitles on/off and 'Green' selections
14	-	Audio/Video stream selection
15	-	Cabin audio volume on/off
16	-	Shuffle. Japan and Brazil only: Shuffle and 'Blue' selections
17	-	Cabin audio volume decrease/mute
18	-	Cabin audio volume increase
19	-	Up 1 level
20	-	Radio band select. Japan and Brazil only: Radio band select and interactive TV select
21	-	Audio source select Left screen select

22	-	Select
23	-	Cursor control: Up
24	-	Cursor control: Right
25	-	Cursor control: Down
26	-	Cursor control: Left

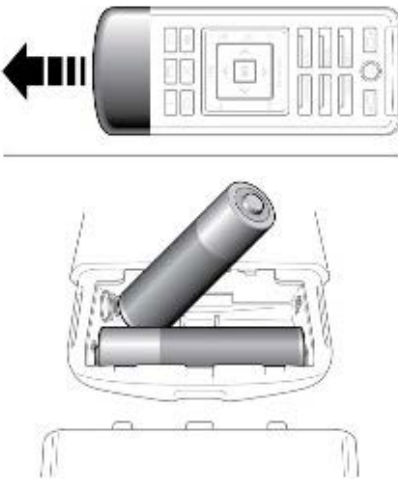
The RSE (rear seat entertainment) remote control is located in the rear seat center armrest.

The RSE remote control allows independent multimedia control for left and right rear seat passengers.

The RSE remote control is a has a number of switches to control the audio/video functions.

The RSE remote control allows selection of various entertainment system functions. When selected, activate menus displayed in the RSE screens mounted in the head restraints. The menus can be navigated using a five-way switch on the RSE remote control. For example, the user can select and press a soft key on the touch screen to activate a list of available radio stations in the RSE touch screen and then use the five-way switch to browse the list and select a radio station.

Rear Media Remote Control Battery



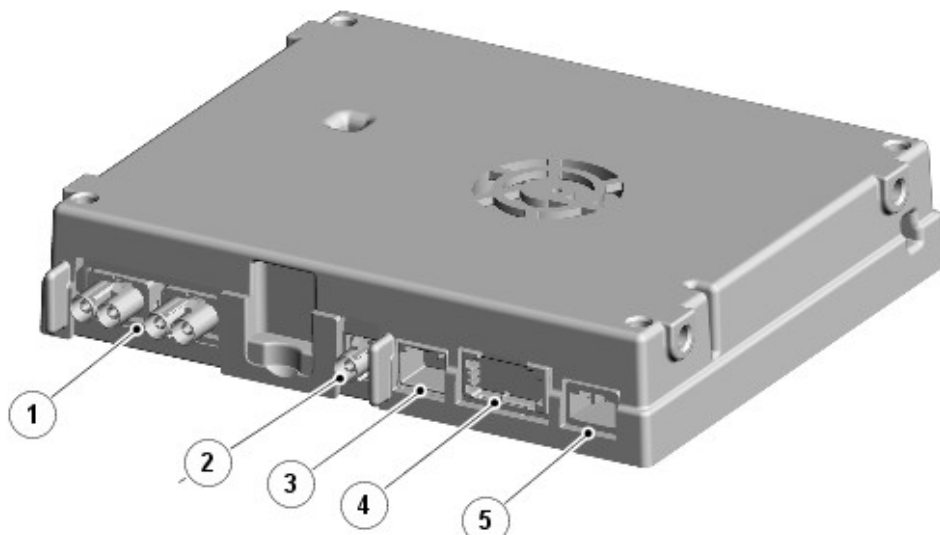
The RSE (rear seat entertainment) remote control is powered by 2 AAA batteries located inside the chrome cover. Low battery power is indicated by the remote control button flashing 3 times when pressed.

The RSE remote control transmits an infra-red digital signal in response to operation of a switch or soft key. The infra-red signal is received by a receiver sensor located on each RSE screen. The RSE remote control also allows selection of an auxiliary input from the AVIO panel (video or games console) or selection of audio (radio or [CD \(compact disc\)](#)).

The RSE remote control can be used to control functions including radio, CD/ DVD, plug-in audio devices, and TV (television), by displaying options in the TS (touch screen), which activate menus displayed on the RSE screens in the head restraint, which are navigated using the five-way switch on the RSE remote control. The RSE remote can also be used to activate the RSE screens without the need to use the TS (touch screen).

Infra-red transmission takes place between the RSE remote control and the RSE screens. User requests are passed onto the RSE control module to be processed via the MS (medium speed) [CAN bus](#).

Television Control Module (TVCM)



Item	Part Number	Description
1	-	Connectors - Antennas
2	-	Composite Video Baseband Signal (CVBS) connector - to Touch Screen (TS)
3	-	Low-Voltage Differential Signalling (LVDS) connector - to Rear Seat Entertainment (RSE) control module
4	-	Connector - Media Oriented System Transport (MOST)
5	-	Connector - power from AJB (auxiliary junction box) and ground

The TVCM (television control module) is located under the right side front seat. The TVCM is connected to the infotainment system using one harness connector, one LVDS (low-voltage differential signalling) connector (for RSE (rear seat entertainment) vehicles), one single FACRA connector for CVBS (composite video baseband signal) connection to the TS (touch screen) (non RSE vehicles), one MOST (media oriented system transfer) connector and two dual FACRA connectors for the antenna connections.

The RSE video output is passed from the TVCM on LVDS to the RSE control module and from the RSE control module on CVBS to the TS. On a vehicle with RSE fitted the CVBS output from the TVCM is not used.

The front seat occupants can view the TV transmissions on the TS if the vehicle is stationary (market dependent). If the vehicle is fitted with a dual view TS then the front passenger can view the TV transmissions even when the vehicle is moving, but the driver will only be able to watch TV transmissions (or video) when stationary. This can vary depending on local market laws. When the RSE system is fitted, the TVCM allows the rear seat occupants to view television transmissions on the RSE screens.

Due to analogue transmissions Worldwide being switched off, Land Rover are introducing more TVCM to support the numerous digital TV standards that are being implemented. To ensure that analogue and digital transmissions are received in all markets, three types of TV control module are available. The type of TVCM fitted is dependant on which digital standard is supported in different markets (if at all).

- Digital Hybrid TVCM - this TV control module supports digital DVB-T standard (MPEG2 only) and analogue TV transmissions. This TVCM is only fitted to markets that still have significant analogue broadcasts and minor digital coverage or to vehicles in markets that still have significant analogue broadcasts and where Land Rover do not currently have a TVCM that supports the digital TV standard in that market. This TV control module requires the use of a link lead that combines the power/ground and CVBS output into one connector that mates with the connectors on this type of module.
- DVB-T TVCM - this TVCM is digital only (no analogue tuner) and supports both MPEG2 and MPEG4 digital compression standards. This TVCM is fitted in any market that has significant DVB-T coverage (most of Europe and some of the rest of the World).
- ISDB-T TVCM - this TVCM is for the Japanese and Brazilian markets and receives ISDB-T digital broadcasts only (no analogue). This TVCM uses the same connections as the DVB-T TVCM as above, the only difference is the software. The Japanese variety also has a slot for a conditional access card between the antenna and CVBS connectors (annotation 1 & 2 on the TVCM picture above).
- DTMB & CMMB TVCM – this TVCM is for the Chinese market only and receives both DTMB & CMMB (CMMB mode is especially for mobile reception. It has a lower bit rate hence lower resolution. This modulation standard is more robust and is therefore able to offer greater coverage). It also uses the same connections as the DVB-T TVCM above.

The TVCM is connected on the MOST ring which it uses to output its audio signals to the AAM (audio amplifier module). Video output from the TVCM is on an LVDS cable to the RSE control module or a CVBS screened co-axial cable to the TS in vehicles without the RSE system. Four further connections provide for the signal input from four TV antenna amplifiers which are in turn attached to four antennas in the rear quarter windows. For additional information, refer to: [Antenna](#) (415-02 Antenna, Description and Operation).

The TVCM contains four internal tuners; all of the tuners are connected to the antennas. The tuners receive the RF (radio frequency) modulated audio and video signals. The tuner, or combination of tuners with the strongest signal, are automatically used to display the required TV channel (Japan and Brazil Only).

One of the internal tuners is always used to scan the locality for receivable channels (background scanning). The tuner can detect different frequencies transmitting the same channel and can select the strongest signal for use.

In certain areas signal strengths will vary. When in an area of weak reception, a break-up in picture and sound quality, or a blank screen or frozen picture and audio muting may occur. Dependant on the type of TVCM fitted, it may be of benefit to switch between analogue and digital TV stations.

The main advantage of digital TV reception is the improved picture quality. Four TV antennas are located in the rear quarter windows. In the event of a loss of digital reception, a 'loss of reception' message is displayed. The TV system also has a programme diversity function as well as antenna diversity that allows the current tuned programme to be maintained as the vehicle passes through regions with different transmitters broadcasting on different frequencies. This function only occurs where the reception data for the presently tuned channel matches the data of the new signal.

The system offers a choice of aspect ratios, between 4:3, 16:9 and zoom. The zoom ratio will always try to fill the screen and avoid the black bars/squashed image. For digital signals the broadcaster will usually send the correct format for the transmitted programme and this will remove one of the incorrect formats from the screen (4:3 or 16:9). The "Zoom" option is always available and will always be selected as the default format. If the format is unknown (typical for analogue) then all three format options will be displayed. The TS offers picture quality using a resolution of 800x480 pixels for single view and 400x480 pixels for dual view.

TV Control Module - Japan

Japanese market vehicles are fitted with a TVCM unique to that market. The control module has a slot to allow a B-CAS (BS Conditional Access Systems Co., Ltd.) card to be inserted. All digital TV's in Japan (home systems included) require a conditional B-CAS access card. This card decrypts the TV broadcast signal to allow it to be displayed as all broadcasts in Japan are encrypted. Without this card there will be no picture or audio.

B-CAS (BS conditional access systems co.,Ltd.) is a vendor and operator of the ISDB (integrated services digital broadcasting) CAS system in Japan. All ISDB receiving apparatus requires a B-CAS card under regulation, the B-CAS card is supplied as the standard accessory in Japan.

ISDB is a Japanese standard for digital television and digital radio used by the country's radio and television stations.

TV Antennas

TV antennas are located in the rear side windows. Refer to the Antennas section.

For additional information, refer to: [Antenna](#) (415-02 Antenna, Description and Operation).

Wireless Headphones



E141953

Item	Part Number	Description
1	-	Headphones transmitter
2	-	Wireless headphones

The headphones transmitter is located in the roof headliner near the front overhead console assembly.

The headphones transmitter transmits audio output for reception by the wireless headphones for the front and rear seat passengers. The headphone transmitter is connected to the AAM (audio amplifier module) via a LVDS (low voltage differential signal) plug connector. Audio data is relayed to the headphone transmitter from the AAM via the LVDS line. The AAM also supplies the power and ground for the headphones transmitter. The audio signal, is then passed on to the wireless headphones via a Whitefire® digital infra-red signal to any seating position within the interior of the vehicle. The digital signal means that each headphone user is able to listen to a different audio source.



NOTE: Providing an audio source is directed to the headphones transmitter, faint red lights can be seen behind the smoked glass cover of the transmitter. This can be useful for diagnosis to prove audio infra-red transmission is active.

The headphone system includes Dolby® headphone surround sound when listening to the DVD source.



NOTE: There is no docking station to store the wireless headphones, therefore charging of the batteries is not supported via the vehicle electrical system.

The system can support up to three pairs of wireless headphones. When a dual-view screen is fitted, the front passenger can listen to TV/DVD (digital versatile disc) and when RSE (rear seat entertainment) screens are fitted, rear passengers can listen to selected source on RSE screen. The headphones have an adjustable headband which operates on a ratchet mechanism.

The left side and the right side of the wireless headphone houses the infra-red receiver sensors which receive the transmitted signals from the headphones transmitter. Two AAA batteries are located below a sliding cover. When inserting the batteries it is important that the battery polarity is observed as marked in the battery compartment.

The right side of the wireless headphone houses the volume control, a channel switch and a power 'ON' LED (light emitting diode). The channel switch allows the user to select alternative audio channels (rear left/right, dual-view

audio source) when active. The power 'ON' LED is illuminated when the on/off switch on the right side of the wireless headphone is operated. The LED will remain on and the wireless headphones powered until the switch is operated for a second time. If the wireless headphones have not received an infra-red signal from the headphones transmitter for several minutes, they will automatically switch off to prevent battery drain.

Rear Seat Entertainment (RSE) Screens



E135724

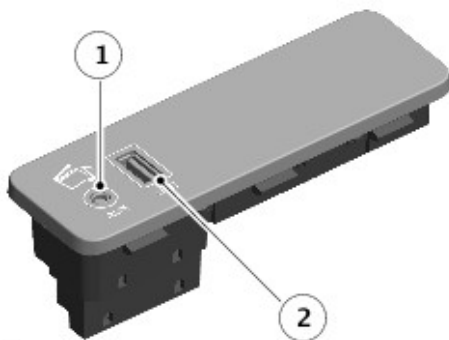
The RSE (rear seat entertainment) screens are located in the rear of the front seat head restraints. The screen is secured in the head restraint with one screw and 2 metal clips which are covered by a removable surround. The screen is an 8 inch, auto dimming (selectable via RSE remote control settings), 800X480 resolution TFT (thin film transistor) monitor.

An infrared receiver sensor is located centrally in the bottom portion of the screen surround. The sensor receives infrared transmissions from the RSE remote control and passes them to the RSE control module on a CAN bus system which is only connected between the RSE control module and the RSE screens. The RSE control module can then transmit any relevant messages onto the MOST (media oriented system transport) ring. All screen settings can only be changed using the RSE Screen.

The screen should be cleaned with a lightly, water moistened cloth. Do not use chemical agents or domestic products to clean the screen or any part of the surround.

Each RSE screen is connected to the RSE control module using a 12 pin harness connector and 2 pin LVDS video connector.

Portable Audio Interface Panel



E161429

Item	Part Number	Description
1	-	3.5mm jack plug - MP3 connection
2	-	Universal Serial Bus (USB) connector

The portable audio interface panel is located in the glovebox and is fitted to all audio systems. The interface contains one USB port and a 3.5mm jack plug connector.

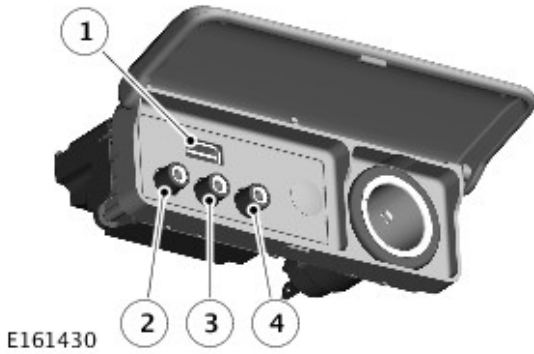
The portable audio interface panel is connected to the vehicle with two harness connectors. The harness connector from the USB ports has gold plated pins.

Devices that can be connected to the portable audio interface panel include:

- USB mass storage devices (for example a memory stick). Devices must use FAT or FAT32 file format.
- iPod® (iPod Classic, iPod touch, iPhone and iPod Nano are supported - full functionality for older devices cannot be guaranteed). iPod Shuffle functionality cannot be guaranteed.
- Auxiliary device (personal audio, MP3 players).

- Devices with Bluetooth® connectivity. Devices must support A2DP and AVRCP Bluetooth® protocols).

Audio Visual Input/Output (AVIO) Panel



Item	Part Number	Description
1	-	Universal Serial Bus (USB)
2	-	Yellow socket - Composite video input
3	-	White socket - Left audio input
4	-	Red socket - Right audio input

The AVIO (audio visual input/output) panel is located at the rear of the floor console.

The panel provides for the connection of auxiliary audio and video inputs from an external source, such as a games console, via three AV sockets on the panel.

The sockets are connected to the RSE (rear seat entertainment) control module and allow the auxiliary input video to be played on the RSE screens and the audio to be played on the vehicle speakers or on the wireless headphones. The auxiliary input video cannot be displayed on the TS (touch screen).

The single **USB** plug allows for the attachment of an USB input, such as iPod®/iPhone®, an MP3 player or a USB memory stick. This plug is connected directly to the RSE control module and allows audio to be selectable on the RSE screens and played on the wireless headphones or through the vehicle speakers. It will also allow standard definition Div X video files to be played from a USB memory stick.

The AVIO panel is connected to the RSE control module using a single 20 pin harness connector.

OPERATION

Television

The television system has various levels of user control through the TS (touch screen), the ICP (integrated control panel) and the left steering wheel switchpack. The system includes 6 analogue and 12 digital channel pre-sets. As with the audio system, the user can tune up or down through the channels and store a channel by a long press of the selected preset button. The system offers a choice of screen aspect ratios.

For the digital bands, the options available on the TS are the correct aspect ratio for the broadcast and "zoom" which will fit the picture to the screen (no black bands). For analogue TV all aspect ratio options will be available including 16:9, 4:3 and zoom. Two antennas are used because the system is dynamic and each one is connected to an individual tuner. The TV control module evaluates which antenna has the strongest signal and will use a combination of antennas to generate the TV image and sound. At any point in time the TV control module is using either one or two of the antennas and it's tuners to scan the TV frequencies and generate an up to date channel list.

The television system is primarily controlled from the TS and the ICP which are located in the center of the instrument panel and also the left steering wheel switchpack. Control signals from the TS are sent on the MOST (media oriented system transport) ring to the TVCM (television control module). The TVCM uses a dedicated CVBS (composite video baseband signal) bus to transmit video signals to the TS. Where RSE is fitted, the TV can also be controlled using the RSE remote control and the video output will be delivered to the RSE control module via an LVDS (low voltage differential signalling) video link. The TV video feed is then forwarded on to the TS from the RSE control module via a CVBS output.

Control signals from the ICP and the left steering wheel switchpack are relayed on the MS (medium speed) **CAN** bus to the TS. The TS relays the control signals to the TVCM on the MOST ring. The TS is the bus master for the MOST ring and also hosts a gateway function between the MS CAN bus and the MOST ring.

The TVCM audio output signals are sent on the MOST ring to the AAM (audio amplifier module) for speaker output.

Rear Seat Entertainment (RSE)

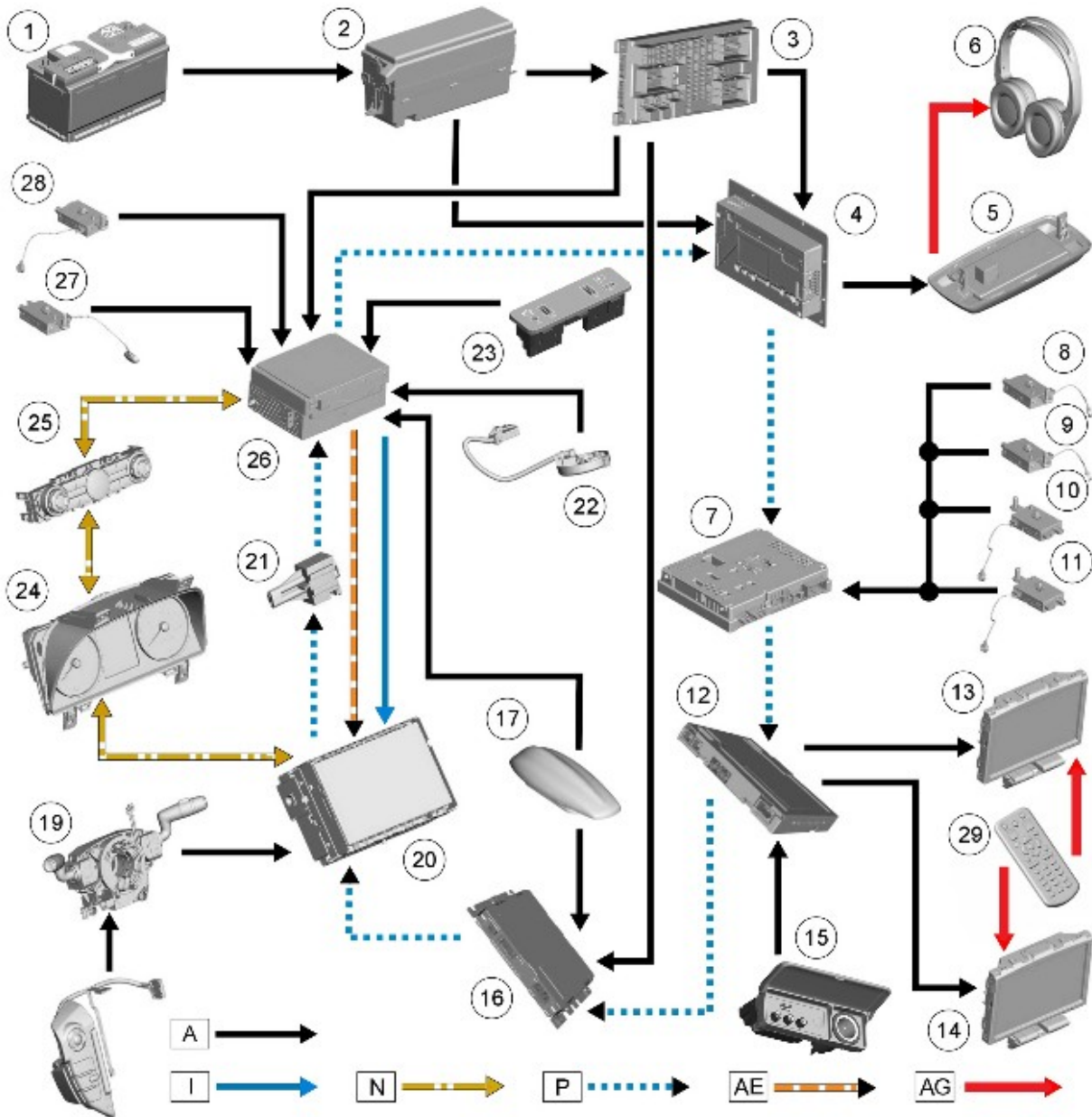
The RSE (rear seat entertainment) control module is connected directly to both rear RSE screens via a MS (medium speed) **CAN** bus and a LVDS (low-voltage differential signaling) connection. Infra-red signals from the RSE remote control are received by the RSE screens and user requests are communicated via a MS CAN link to the RSE control module. Video signals are communicated via the LVDS to one or both screens as requested.

The RSE control module communicates with the audio system via the MOST connection. Audio input from the AVIO (audio video input/output) panel is processed by the RSE control module and passed on the MOST ring to the AAM (audio amplifier module) to allow audio output to be played on the vehicle speakers or on the wireless headphones.

Video input from the TVCM (television control module) and the AVIO panel is also processed by the RSE control module and passed to the two RSE screens. The TV Video is also passed to the TS (touch screens) on separate video connection. The RSE control module also controls the power supplies to the RSE screens and relays the infra-red RSE remote control signals received by the RSE screen infra-red sensors. The infra-red signals are passed from the RSE screens to the RSE control module on a local CAN bus system. The navigation system route can also be displayed on the RSE screens

A time limit operation is active when the ignition is off and the vehicle is unlocked (Power mode 4) and the system is manually switched on using the TS. The system will operate for a maximum of ten minutes. The battery voltage is continually monitored by the IAM (integrated audio module). If the IAM detects that the battery voltage has fallen to a predetermined level, the IAM will shut the infotainment system down to prevent further battery drain. Once the system has shut down due to low battery voltage, it can only be restarted when the engine is running and the battery voltage has risen above the threshold level for more than one minute.

CONTROL DIAGRAM



E161431

A = Hardwired; I = CVBS (composite video baseband signal); N = Medium Speed CAN Bus; P = MOST (media oriented system transfer); AE = LVDS (low-voltage differential signalling); AG = Infra Red Signal

Item	Part Number	Description
1	-	Battery
2	-	Battery Junction Box (BJB)
3	-	Central Junction Box (CJB)
4	-	Audio Amplifier Module (AAM)
5	-	Wireless headphone transmitter
6	-	Wireless headphones
7	-	TV tuner

8	-	TV antenna
9	-	TV antenna
10	-	TV antenna
11	-	TV antenna
12	-	Rear Seat Entertainment (RSE) module
13	-	Rear right TFT screen
14	-	Rear left TFT screen
15	-	Audio video input/output (AVIO) panel
16	-	TV Control Module (TVCM)
17	-	Digital Radio L-Band/Satellite Digital Audio Radio Service (SDARS) Antenna
18	-	Left steering wheel audio switchpack
19	-	Clockspring
20	-	Touch Screen (TS)
21	-	MOST diagnostic connector
22	-	Microphone
23	-	Portable audio interface panel
24	-	Instrument Cluster (IC)
25	-	Integrated Control Panel (ICP)
26	-	Integrated Audio Module (IAM)
27	-	FM2/DAB3 Antenna
28	-	AM/FM1 Antenna
29	-	RSE remote control

Video System - Video System

Diagnosis and Testing

Principle of Operation

For a detailed description of the video system and operation, refer to the relevant Diagnosis and Testing section of the workshop manual. REFER to: Video System (415-07 Video System, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Touch Screen (TS) installation and condition • Rear Seat Entertainment (RSE) screen installation and condition • Digital Versatile Disc (DVD) multi-changer installation and condition • Television antennae (two in each rear side window) 	<ul style="list-style-type: none"> • Fuses • Electrical harnesses • Fibre optic cable harnesses • Infotainment relay • Display screens • DVD multi-changer • TV Control Module (TVCM) • Rear Seat Entertainment Control Module (RSECM) • Television antenna amplifiers (4) • Remote control and batteries

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
The DVD does not operate	<ul style="list-style-type: none"> • DVD multi-changer fuse blown • No power to display screens • Condensation 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the DVD power circuit for short circuit to ground • Refer to the electrical circuit diagrams and test the DVD player power and ground circuits for open circuit, high resistance • Wait at least one hour for the condensation to dry out
Remote control operation is unstable	<ul style="list-style-type: none"> • Handset batteries low on power • Remote control receiver sensor or transmitter is dirty 	<ul style="list-style-type: none"> • Check and renew the batteries as necessary • Check and clean the receiver and transmitter as necessary
There is no picture	<ul style="list-style-type: none"> • The display screen is set to an incorrect mode 	<ul style="list-style-type: none"> • Use the switch on the back of the handset to select the correct mode
Playback does not start	<ul style="list-style-type: none"> • Disc is loaded upside-down • An incorrect format of disc is loaded • Parental lock is set • The setup menu is displayed 	<ul style="list-style-type: none"> • Check that the disc is correctly loaded • Check that the disc format is compatible • Cancel parental lock or check the rating of the disc • Press SET for at least 2 seconds to turn the setup menu off
The picture is unclear or noisy	<ul style="list-style-type: none"> • The disc is being fast forwarded or rewind • The vehicle battery power is low 	<ul style="list-style-type: none"> • The picture may be slightly distorted in fast forward or rewind modes • Check the vehicle battery condition and state of charge
The image	<ul style="list-style-type: none"> • The disc is scratched 	<ul style="list-style-type: none"> • Load an undamaged disc.

"freezes"		
NO MAG is displayed	<ul style="list-style-type: none"> • There is no magazine loaded into the DVD multi-changer 	<ul style="list-style-type: none"> • Load a magazine
NO DISC is displayed	<ul style="list-style-type: none"> • There is no disc loaded into the magazine • The disc is dirty 	<ul style="list-style-type: none"> • Load a disc into the magazine • Clean the disc as necessary
REGIONAL CODE VIOLATION is displayed	<ul style="list-style-type: none"> • The disc loaded does not match the regional code number 	<ul style="list-style-type: none"> • Load a disc which matches the regional code number
VIDEO SIGNAL IS NOT CORRECT is displayed	<ul style="list-style-type: none"> • An NTSC disc is loaded into a PAL system, or vice versa 	<ul style="list-style-type: none"> • Load a disc of the correct format
HI TEMP is displayed	<ul style="list-style-type: none"> • The system protective circuit is activated as it has detected a high temperature 	<ul style="list-style-type: none"> • Turn the power OFF on the unit and then back on again. If the display does not clear, leave the power off until the temperature decreases and turn the power ON again

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

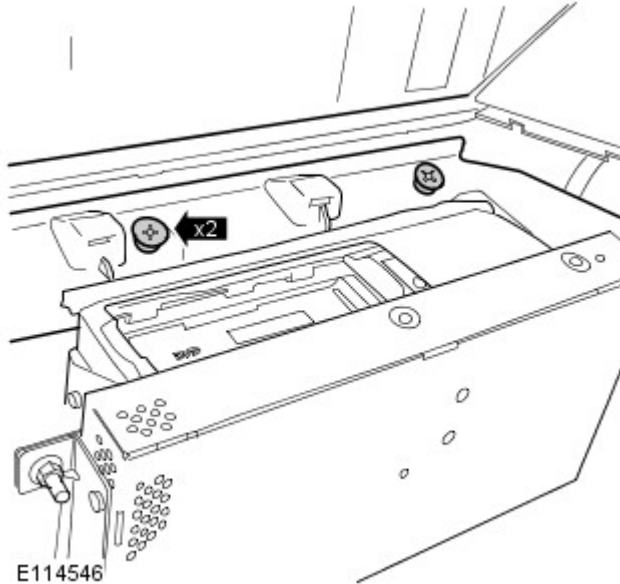
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Rear View Camera (RVC) (100-00, Description and Operation).

Video System - Digital Versatile Disc (DVD) Player

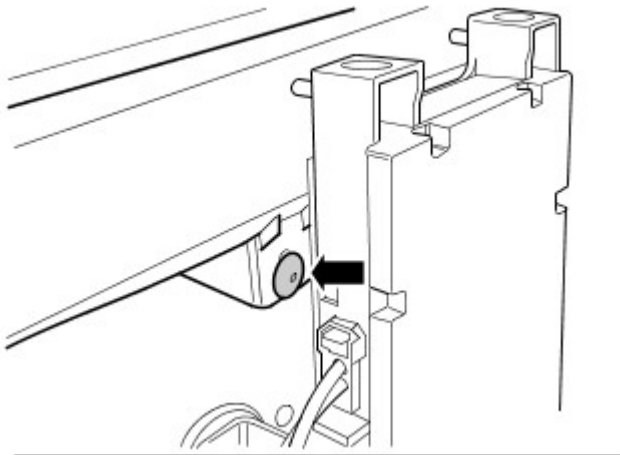
Removal and Installation

Removal

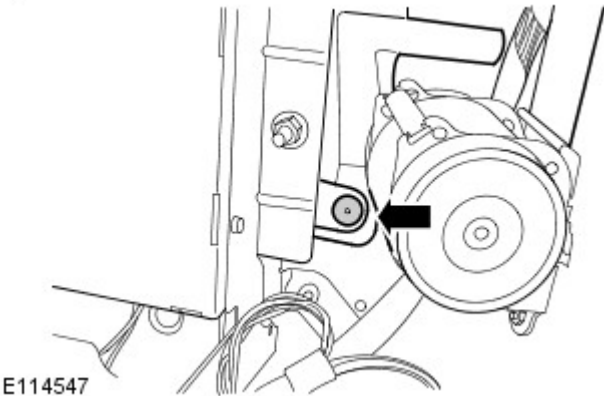
1. Remove the RH rear quarter trim panel.
For additional information, refer to: Loadspace Trim Panel RH (501-05, Removal and Installation).




2. Release the rear quarter trim panel mounting bracket.
 - Remove the 2 screws.



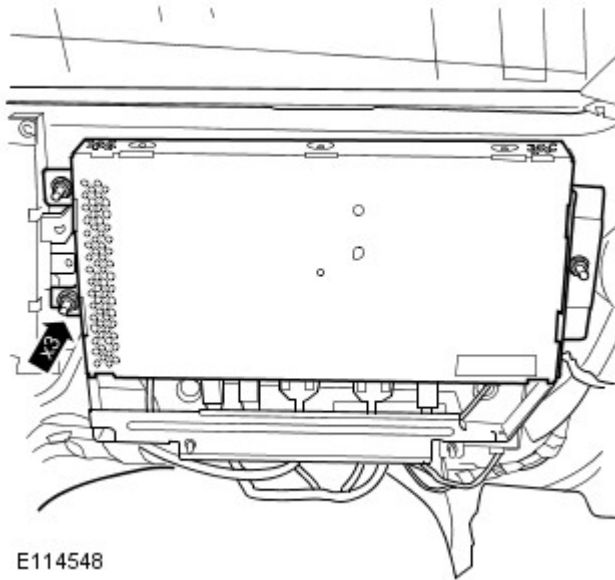
3. Remove the rear quarter trim panel mounting bracket.
 - Release the 2 clips.



4.  **CAUTION:** Make sure that the fiber optic cables are not bent to a radius of less than 25 mm.

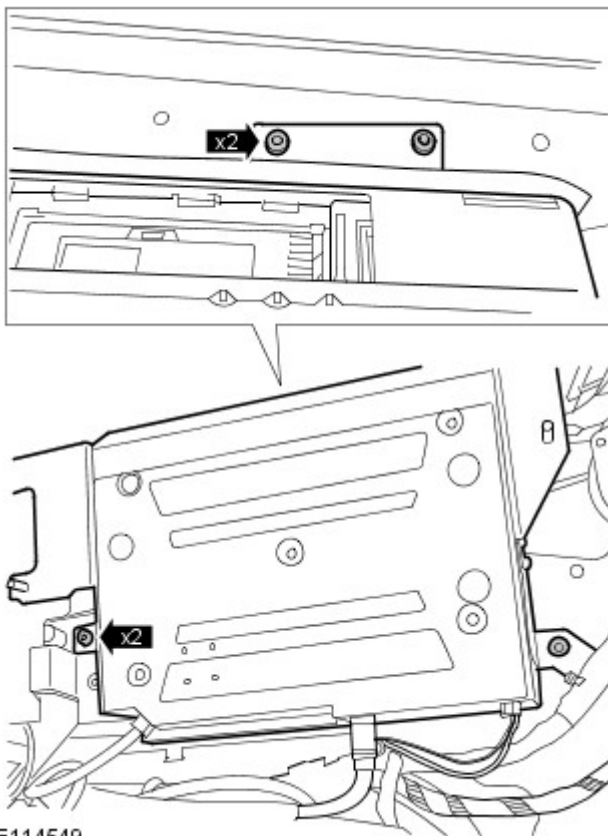
Release the rear seat entertainment module.

- Remove the 3 nuts. TORQUE: 10 Nm
- Position aside.




E114548


5. Release the DVD player from the body.
 - Remove the 4 Torx bolts.



E114549

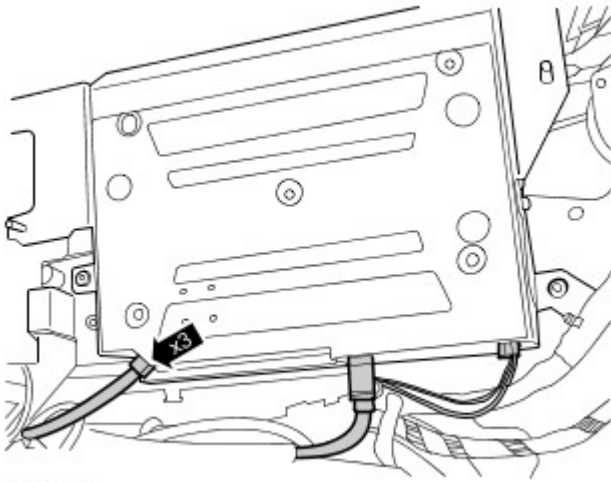
6. CAUTIONS:

 Make sure that the fiber optic cables are not bent to a radius of less than 25 mm.

 Make sure that the optical connectors are clean and free of foreign material.

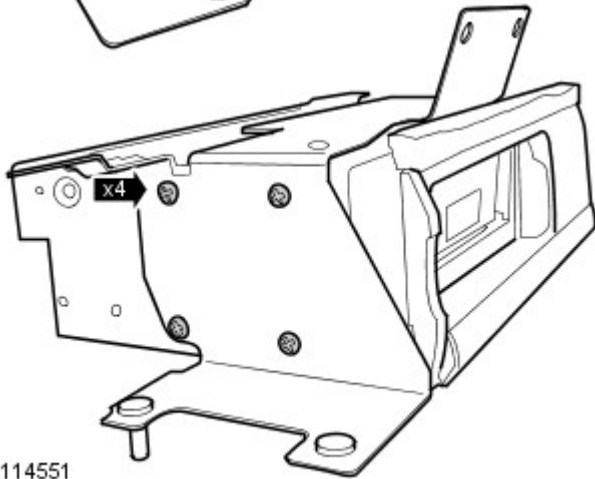
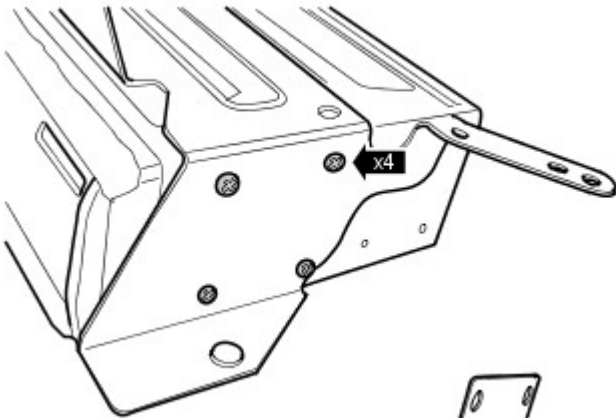
Remove the DVD player.

- Disconnect the 3 electrical connectors.



E114550

7. Remove the DVD player mounting bracket.
 - Remove the 8 screws.



E114551

Installation

1. To install, reverse the removal procedure.

Video System - Video Display

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1.



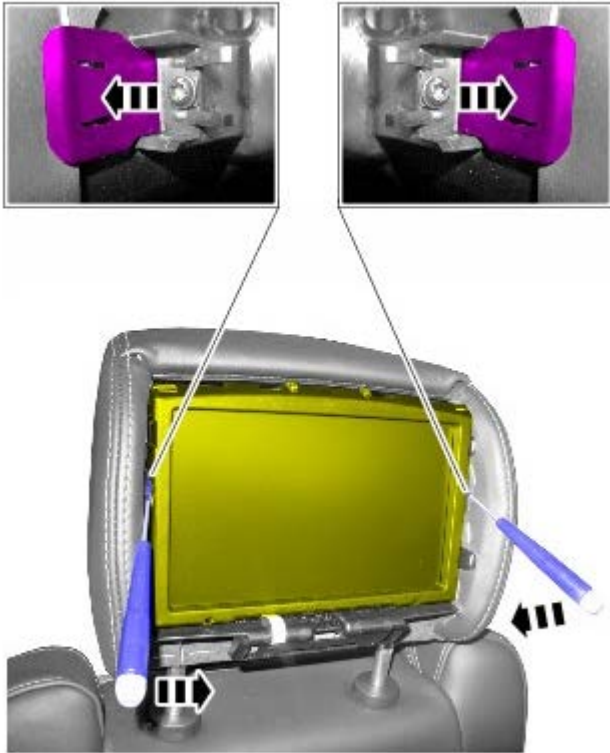
E139117

2.



E142169

3.



E139118

4.



E139119

Installation

- 1. To install, reverse the removal procedure.

Exterior Lighting -

Sealants

Item	Land Rover Kit Part No.
High mounted stop lamp (HMSL) sealant	BHM 705L

Bulb	Type	Rating
* Halogen headlamps - Low beam	Halogen H7	55W
* Halogen headlamps - High beam	Halogen H7	55W
+ * Xenon headlamps - Low/High beam	Xenon D2S	35W
Front fog lamps	Halogen H11	55W
Rear fog lamps	Bayonet	21W
Turn signal indicators - Front	Bayonet	21W
Turn signal indicators - Rear	Bayonet	21W
Turn signal indicators - Side Repeaters	Capless	5W
Side lamps - Front	Bayonet	5W
** Stop/Tail lamps	Bayonet - Twin filament	21W/5W
High mounted stop lamp (HMSL)	LED's	-
License plate lamps	Festoon	5W
Reverse lamps	Bayonet	21W
Cornering lamp/Static bending lamp	Halogen H8	35W
NAS - Side marker lamps - front/rear	Capless	3W



WARNING: + Refer to the General Information - Electrical Precautions section of this manual prior to carrying out any procedures on the Xenon headlamp system fitted to certain vehicles.

NOTES:



* NAS vehicles - Cornering lamps are not fitted to these vehicles.

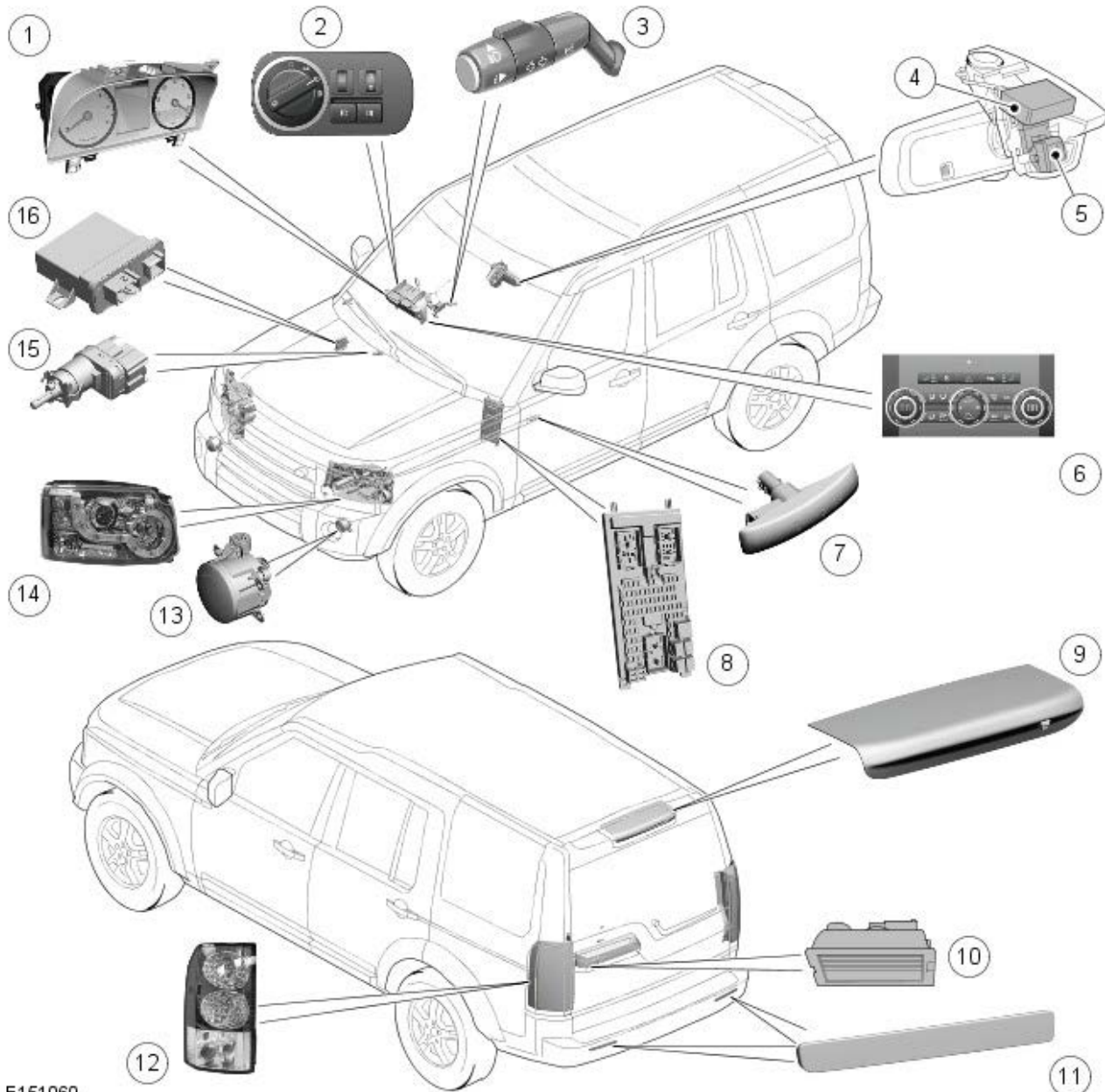


** Note: 21W filament is not functional on lower tail lamp.

Exterior Lighting - Exterior Lighting

Description and Operation

Exterior Lighting Component Location



E151060

Item	Part Number	Description
1	-	Instrument Cluster (IC)
2	-	Lighting control switch
3	-	Left steering column multifunction switch
4	-	Rain/light sensor
5	-	Auto High Beam (AHB) control module and image sensor
6	-	Hazard warning lamp switch
7	-	Side repeater turn signal indicator lamp
8	-	Central Junction Box (CJB)
9	-	High Mounted Stop Lamp (HMSL)
10	-	License plate lamps
11	-	Reflector
12	-	Tail lamp assembly
13	-	Front fog lamp
14	-	Headlamp assembly
15	-	Stop lamp switch
16	-	Adaptive Front lighting System (AFS) control module

Overview

Three types of headlamp are available; Halogen, Xenon or Xenon with Adaptive Front lighting System (AFS). The headlamps share a common, clear lens.

The headlamps are located behind the front carrier assembly. Each headlamp is secured to the front carrier assembly with two locking plates. The locking plate slides in grooves in the rear of the headlamp and two holes in each plate locate on pins on the carrier. Each locking plate is pressed down to lock the pins in the locking plate holes. The locking plates allow removal of the headlamp from the carrier for bulb changing without the requirement for special tools.

The rear of the headlamp unit has removable access panels which allow access to the bulbs for replacement. A large rubber cover allows access to the low/high beam bulb on both halogen and xenon headlamps. Another removable rubber cover provides access to the high beam only halogen bulb which is retained by a push fit. A smaller cover can also be rotated anti-clockwise to provide access to the turn signal indicator lamp bulb. The indicator bulb is a PH24WY orange bulb and is clipped into the cover and is pulled to remove. Below this cover is a removable cover which provides access to the side lamp bulb on halogen headlamps or the cornering lamp/static bending lamp bulb on xenon headlamps and the side marker lamp bulb on NAS models. On xenon headlamps the side lamps are LED's and therefore are not serviceable components.

The headlamps have two adjustment screws on the rear which allow for the manual setting of the vertical and horizontal alignment. On NAS vehicles the headlamp is regarded as Visual Optically Left (VOL) aiming. The adjustment screws have to be turned equal amounts to maintain the correlation in the vertical axis only. There is no horizontal adjustment. Refer to the Service Repair Procedures manual for headlamp alignment data.

Each headlamp has an integral sixteen pin connector which provides inputs and outputs for the various functions of the headlamp assembly. The usage of the pins differs between model variants, refer to the Electrical Reference Library (ERL) for pin details.

The low beam headlamps are switched on when the ignition is in ignition mode 6 and:

- the lighting control switch is in the headlamp position
- the lighting control switch is in the AUTO position and a 'lights on' signal is received by the CJB from the rain/light sensor.

The low beam headlamps can also be operated by the headlamp delay feature.

The high beam headlamps are switched on when the ignition is in ignition mode 6 and:

- the low beam headlamps are selected on in the headlamp position or activated via the AUTO feature
- The left steering column multifunction switch is pushed forward away from the driver
- The auto high beam system (if fitted) has switched on the high beam headlamps.

The high beam headlamps will be switched off when:

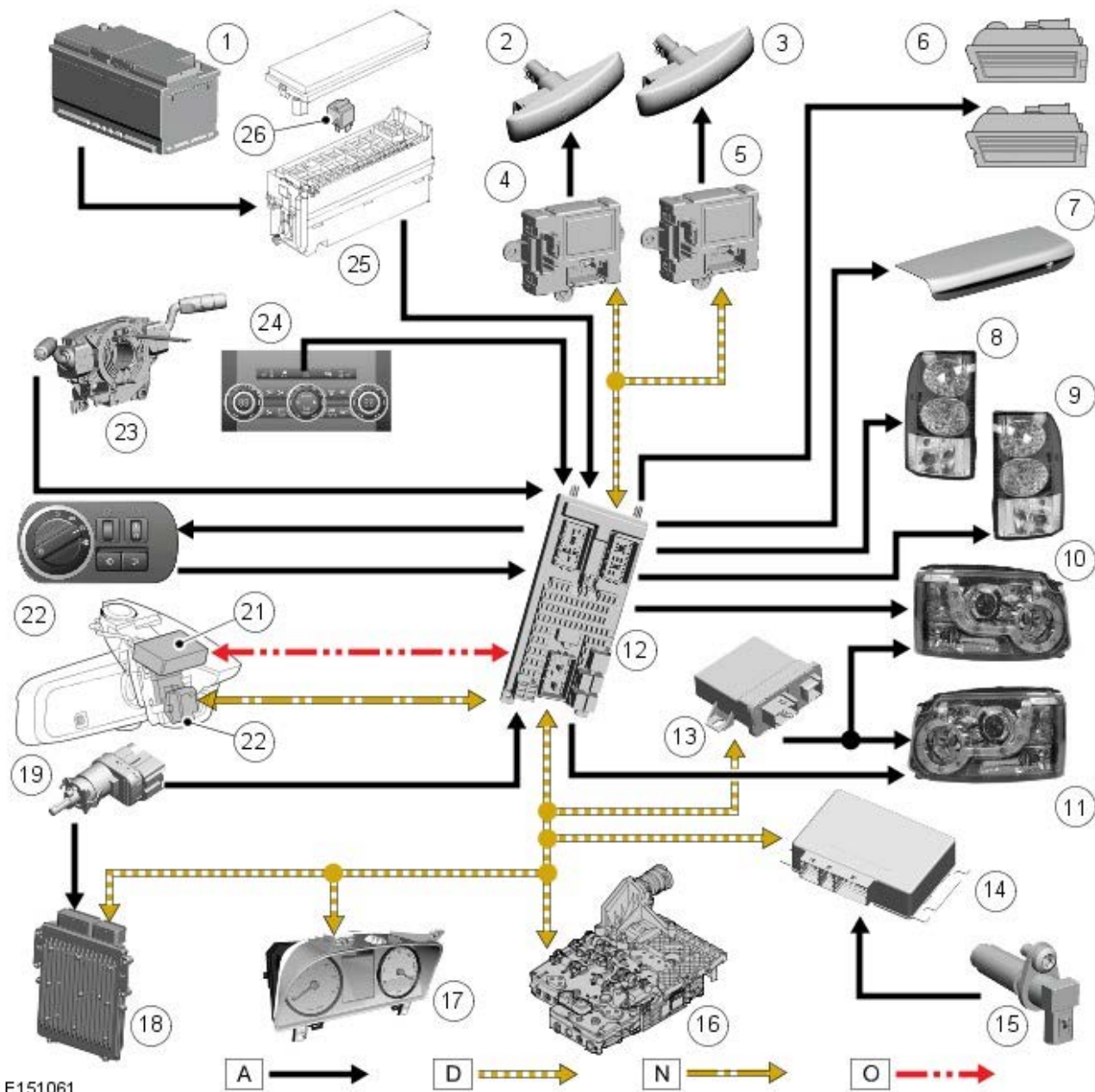
- The left steering column multifunction switch is moved rearward towards the driver
- The low beam headlamps are switched off
- The ignition mode is changed to the accessory mode 4 or ignition off
- The AHB system (if fitted) has switched off the high beam headlamps.

System operation

CONTROL DIAGRAM



NOTE: **A** = Hardwired; **D** = High Speed CAN Bus; **N** = Medium speed CAN bus; **O** = LIN Bus



E151061

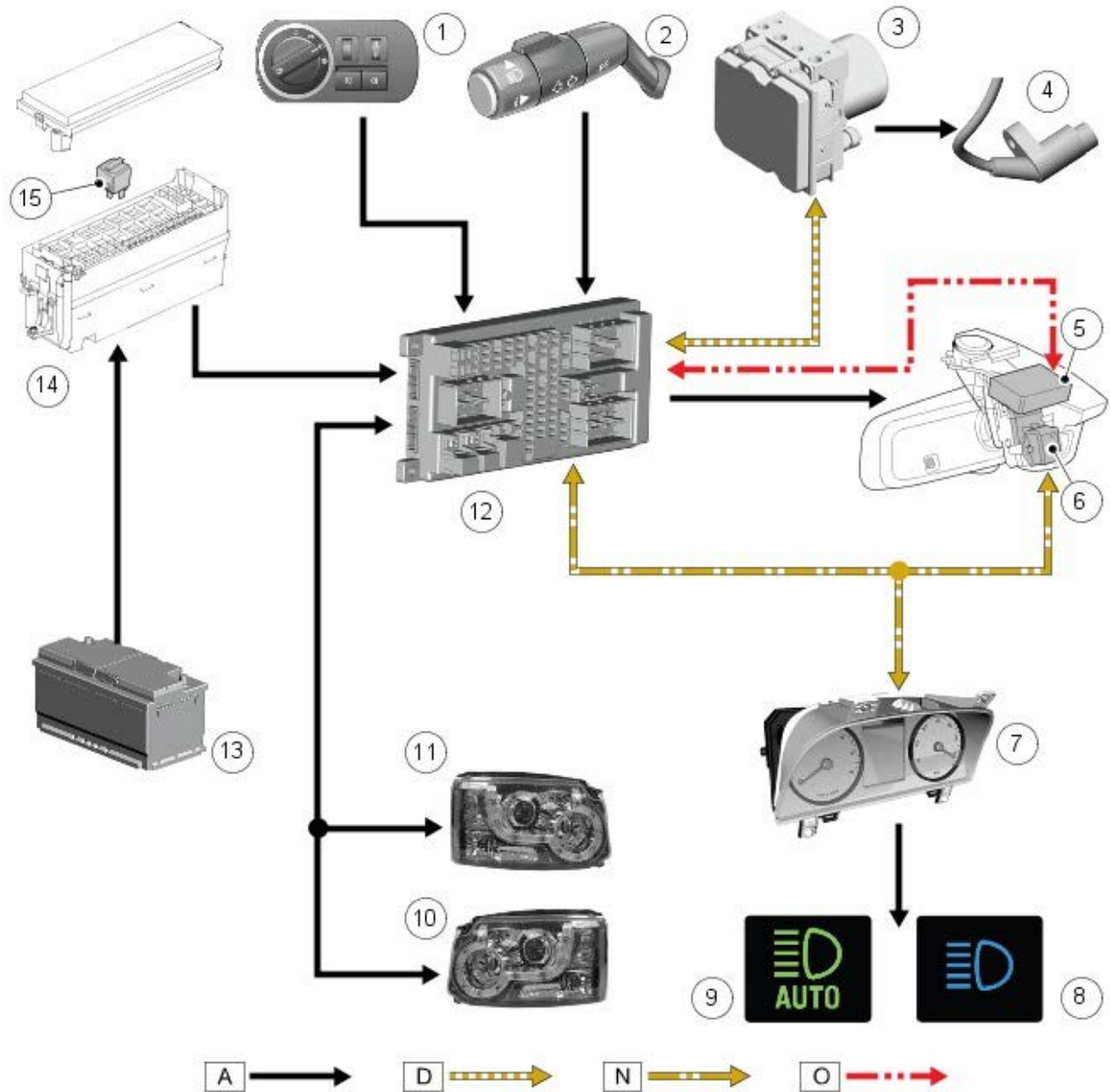
Item	Part Number	Description
1	-	Battery
2	-	Left side repeater turn signal indicator
3	-	Right side repeater turn signal indicator
4	-	Left Door module
5	-	Right Door module
6	-	License plate lamps (2 off)
7	-	High Mounted Stop Lamp (HMSL)
8	-	Left tail lamp assembly
9	-	Right tail lamp assembly
10	-	Left headlamp assembly
11	-	Right headlamp assembly
12	-	Central Junction Box (CJB)
13	-	AFS control module
14	-	Transfer box control module
15	-	Transmission reverse switch (manual transmission only)
16	-	Transmission Control Module (TCM) (Automatic transmission only)
17	-	Instrument Cluster (IC)
18	-	Engine Control Module (ECM)
19	-	Stop lamp switch
20	-	Auto High Beam (AHB) image sensor and control module
21	-	Rain/light sensor

- 22 - Lighting control switch
- 23 - Left steering column multifunction switch
- 24 - Hazard warning indicators switch
- 25 - Battery Junction Box (BJB)
- 26 - Auto High Beam (AHB) relay

AUTO HIGH BEAM CONTROL DIAGRAM



NOTE: **A** = Hardwired; **D** = High Speed CAN; **N** = Medium Speed CAN; **O** = LIN Bus



E151062

Item	Part Number	Description
1	-	Lighting control switch
2	-	Left steering column multifunction switch
3	-	Anti-lock Brake System (ABS) module
4	-	Wheel speed sensor
5	-	Rain/light sensor (Ref)
6	-	Auto High Beam (AHB) control module and image sensor
7	-	Instrument Cluster (IC)
8	-	High beam warning indicator
9	-	Auto High Beam (AHB) warning indicator
10	-	Left headlamp assembly
11	-	Right headlamp assembly
12	-	Central Junction Box (CJB)

13	-	Battery
14	-	Battery Junction Box (BJB)
15	-	Auto High Beam relay (AHB)

GENERAL

The exterior lighting system comprises the following exterior lamps:

- Front and rear side lamps
- License plate lamps
- Side marker lamps (if fitted)
- Front and rear turn signal indicator lamps
- Side turn signal indicator lamps
- Stoplamps and high mounted stop lamp
- Reversing lamps
- Rear fog lamps
- Front fog lamps (if fitted)
- Cornering/Static bending lamps (if fitted) - All except NAS
- Low and high beam headlamps.

Exterior Bulb Type/Rating and LED Table

The following table shows the bulbs/LED's used for the exterior lighting system and their type and specification (where applicable).

Bulb	Type	Rating
Halogen Headlamps - Low beam	Halogen H7	55W
Xenon headlamps - Low/High Beam	Xenon D3S	35W
Headlamps - High Beam	Halogen H7	55W
Front fog lamps	Halogen H11	55W
Rear fog lamps	Bayonet P21	21W
Turn signal indicator lamps - Front	PY24W	24W
Side repeater turn signal indicator lamps	Capless W5W	5W
Turn signal indicator lamps - Rear	12 LED's	-
Side lamps - Front - High specification Halogen and Xenon headlamps	10 LED's	-
Side lamps - Front - Base Specification Halogen headlamps only	Capless W5W	5W
Stop lamps	12 LED's	-
Side lamps - Rear	12 LED's (each side lamp)	-
High mounted stop lamp	LED's	-
License plate lamps	Capless W5W	5W
Reverse lamps	Bayonet P21	21W
Cornering lamp/Static bending lamp	Halogen H8	35W
NAS - Side marker lamp - Front	Capless W3W	3W
NAS - Side marker lamp - Rear	Capless W5W Rear	5W

The bulbs and the Light Emitting Diode (LED)'s are driven by Metal Oxide Semiconductor Field Effect Transistors (MOSFET's) within the Central Electronics Module (CEM) which is an integral component of the Central Junction Box (CJB). An exception to this is the front and rear position lamps, front fog lamps and the reversing lamps which are supplied with power via relays within the CJB and are protected by conventional fuses.

CENTRAL JUNCTION BOX

The CJB is located behind the glovebox compartment and is connected to the vehicle wiring harness with 8 multiplugs.

The CJB receives four permanent battery power supplies via the Battery Junction Box (BJB).

The lighting circuits are not all protected by conventional fuses as some are protected by MOSFET's. The control circuitry within the CJB for each individual circuit can detect and isolate a problem circuit.

Failure of a lamp is not notified to the driver. If a turn signal indicator fails the turn signal warning indicator in the IC will flash at double speed.

Input Signals for Lamp Control

The CJB receives inputs from the following switches:

- Lighting control switch for side lamps, headlamps and auto headlamps (if fitted)
- Momentary push switches for front and rear fog lamps
- Left steering column multifunction switch for turn signal indicators and high beam/headlamp flash and Auto High Beam system
- Brake pedal switch
- Momentary push switch for hazard warning.

The switches are supplied with a 10mA supply from the CJB and switch to ground when operated. The CJB detects that a switch has been operated (ON) when its closing resistance is less than 100 Ohm and is detected as OFF when its resistance is more than 10K Ohm.

The lighting control switch uses a binary system which is detected by the CJB which determines the selected position. The output from the lighting control switch is shown in the following table:

Switch State	Switch 1	Switch 2
Off	1	1
Side lamps	1	0
Headlamps	0	0
Auto headlamps	0	1

The CJB also receives ignition status via hard wired connections from the stop/start switch.

A reverse gear engaged signal is also received on the high speed Controller Area Network (CAN) bus from the Transmission Control Module (TCM) to enable the CJB to activate the reverse lamps.

The CJB can receive a hazard warning indicator activation message from the Restraints Control Module (RCM), via the high speed CAN bus, in the event of a crash. The CJB can also activate the hazard warning indicators to signify vehicle locking to the driver.

On vehicles with Auto High Beam (AHB), the auto high beam control module outputs signals on the medium speed CAN bus to the CJB to control the high beam headlamps. Power for the auto high beam control module is supplied via a relay located in the EJB.

Circuit Protection

Operation of the lamps is performed using overload proof Metal Oxide Semiconductor Field Effect Transistors (MOSFETs). The MOSFETs can detect overload, load interruption with the lamps switched on and short circuit to positive with the lamps switched off.

The MOSFETs are protected against short circuits, removing the requirement for the lamps circuits to be protected by fuses. The MOSFETs respond to heat generated by increased current flow caused by a short circuit. Normally this would cause the fuse to blow. The MOSFETs react to the heat increase and cut the supply to the affected circuit. Once the fault has been rectified or the MOSFET has cooled, the MOSFET will automatically reset and operate the circuit normally.

If an overload occurs, the current flow is dependant on the temperature of the related MOSFET and can be up to 20 times the rated current of the lamp. The MOSFET heats up and deactivates the load applied to the circuit. When the MOSFET cools the circuit is once again reactivated. This thermal cycling occurs continuously in the event of an overload occurring.

A number of lamps are controlled by relays and these circuits are protected by conventional fuses.

Bulb Monitoring

Bulb failure monitoring is performed by the CJB processor. The lamps are cold and warm monitored by the MOSFETs in order to detect bulb failure.



NOTE: Relay controlled lamps have no diagnostic monitoring.

The CJB processor provides outputs to each MOSFET. The output switches the MOSFET to supply the required output to power the applicable lighting circuit. The microprocessor evaluates the circuits by detecting the returned signals from the controlling MOSFET.

When the bulb or LED is functioning normally, the output signal voltage from the controlling MOSFET is 0V. If a bulb or LED in the circuit fails, an open circuit occurs and the MOSFET outputs a signal of 5V to the processor. The signal is interpreted as a bulb or LED failure and generates a Diagnostic Trouble Code (DTC) which can be retrieved using an approved Land Rover diagnostic system.

Warm monitoring is performed continuously when the lights are switched on by evaluating the diagnostic output of the MOSFET switches. Cold monitoring is performed at 32 second intervals when the lights are switched off. The MOSFETs briefly switch on the lights for approximately 1 millisecond (this is insufficient to illuminate the bulb or LED) and checks the bulb or LED as per warm monitoring.

Cold monitoring is not possible for the low/high beam headlamps of vehicles using xenon bulbs. On these vehicles the cold monitoring of the low/high beam headlamps is switched off in the CJB. The CJB detects a failed xenon bulb via a reduction in current flow to the affected headlamp's xenon control module.

When a xenon bulb fails, the control module's current consumption falls to 60mA, which the CJB detects as unsuccessful bulb illumination.

Alarm Indications

The CJB can also display alarm visual indications for alarm arm, disarm and triggered conditions.

If the hazard warning lamps are active when a lock or unlock request is made, the hazard warning cycle is interrupted to allow the visual indication of the requested lock cycle. When visual indication is completed, the hazard warning operation will continue.

If the vehicle is involved in crash of a severity for the RCM to initiate deployment of the airbags, the control module outputs a hazard warning lamps on request on the medium speed CAN bus to the CJB. The hazard warning lamps will be activated and will continue until the RCM outputs a message to deactivate the hazard warning lamps.

Redundant Data Storage

The CJB stores data relating to the Vehicle Identification Number (VIN), total mileage and service interval indicator. This data is received by the CJB from the IC and used as a back-up in the event of IC replacement.

If the CJB is to be replaced, an approved Land Rover diagnostic system must be connected to the vehicle and the CJB replacement procedure followed to ensure that the stored data is transferred to the new unit.

Low Voltage Operation

If the battery voltage falls below 11.2V, the CJB operates the minimum lighting to preserve the remaining battery charge.

Crash Signal Activation

In the event of an accident of a severity to activate and deploy the airbags, the RCM requests various electrical operations to assist with the crash situation. The RCM requests via the bus systems to the CJB to activate the hazard warning lamps.

Security System Activation

In the event of the security system being triggered, the CJB requests activation of the hazard warning lamps.

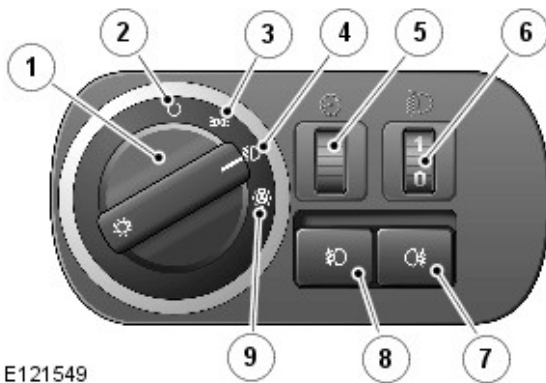
Instrument Panel and Switch Illumination Dimming

The CJB controls the IC backlighting illumination and also illumination of all instrument panel switches.

The CJB supplies a power output to all switch illumination bulbs at a voltage determined by the position of the manual dimmer rheostat. The switch illumination is activated when the lighting control switch is in the side lamp or headlamp position.

LIGHTING CONTROL SWITCH

The lighting control switch is located in the driver's side of the instrument panel, below the outer fresh air vent. The switch contains a rotary switch for selecting the vehicle exterior lighting functions, a rheostat for instrument illumination dimmer, a front fog lamp switch and a rear fog lamp switch.



E121549

Item	Part Number	Description
1	-	Lighting rotary control switch
2	-	OFF position
3	-	Side lamps position
4	-	Headlamps position
5	-	Instrument illumination dimmer control
6	-	Manual headlamp leveling control
7	-	Rear fog lamp switch
8	-	Front fog lamp switch
9	-	Auto headlamps position

The rotary side and headlamp control switch has 2 connections to the CJB. These 2 connections supply a hardwired binary code to the CJB which correspond to the switch position selection made.

The front and rear fog lamp switches operate by completing earth paths for a reference voltage from the CJB when the switch is pressed. The fog lamp switches are momentary, non-latching switches which briefly complete an earth path which is sensed by the CJB.

Lighting Control Switch Illumination

The switch legends on the lighting control switch are illuminated at the same brightness as the instrument panel switches when the lighting control switch is moved from the 'O' (off) position to the side, headlamp or AUTO position.

Manual Headlamp Leveling Control (if fitted)

The manual headlamp leveling control is only available on vehicles with coil spring suspension and is used to lower the headlamps when an excessive load is placed on the rear of the vehicle, altering the vehicle attitude and raising the headlamp beam.

The control uses a rotary thumbwheel which is connected to a rheostat which gives a variable output to the leveling Direct Current (DC) motors. The motors respond to the output and move to adjust the headlamp position as required.

The control has three marked positions; 0 to 3. The rotary wheel moves in 6, half positions to give fine adjustment control over the headlamp position. The positions relate to vehicle loading or driving conditions as follows: Position 0

is the normal position for unladen driving. Positions 1 to 3 lower the headlamp beam to compensate for a drop in height of the rear of the vehicle.

- 0 = Driver only or driver and front seat passenger
- 0.5 = Driver, front seat passenger
- 1 = All seats occupied
- 1.5 = All seats occupied and maximum rear axle loading
- 2 = Driver only and maximum rear axle loading
- 3 = Can be used under certain driving conditions, i.e. off-road

Dimmer Control

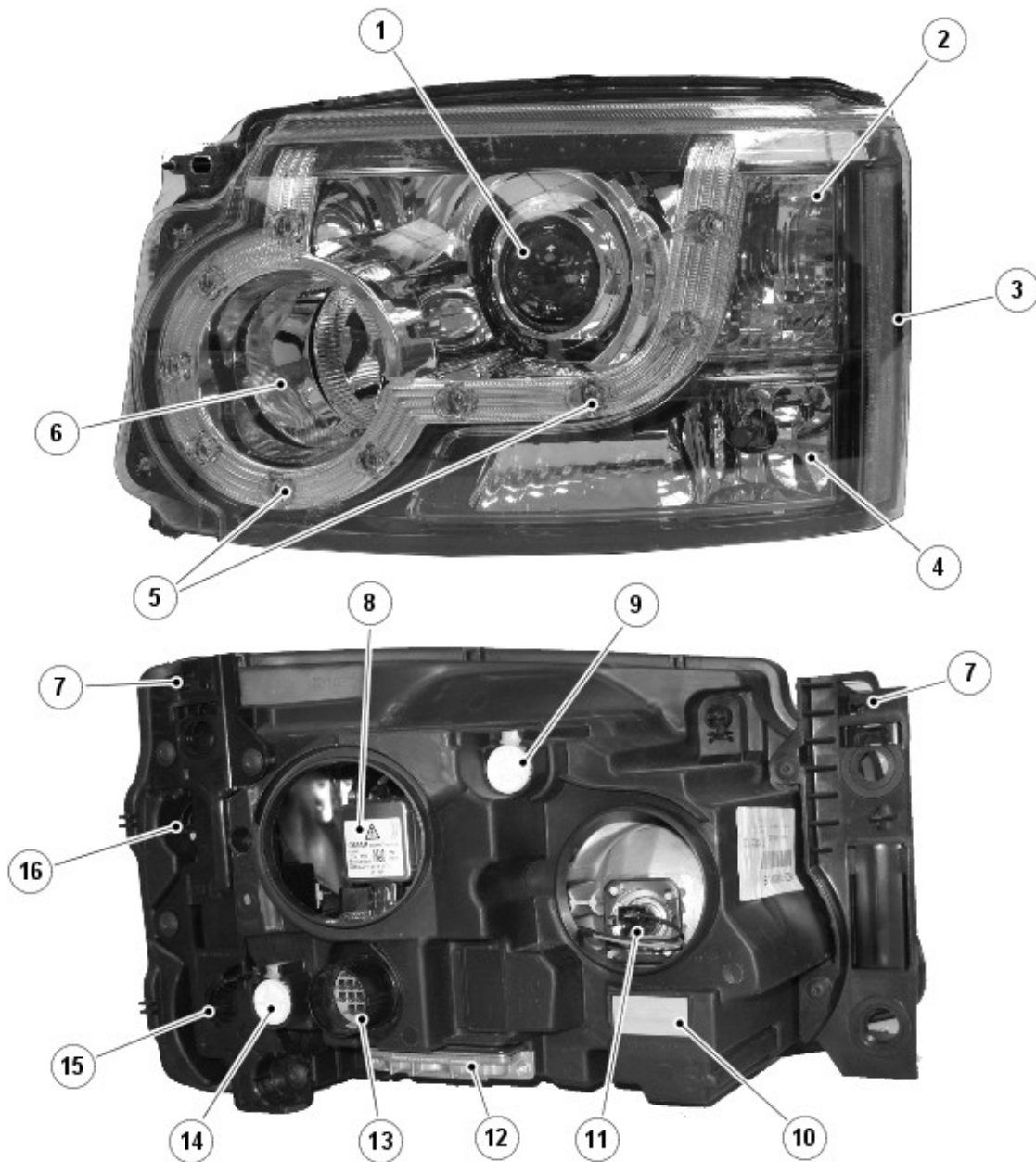
The CJB provides a Pulse Width Modulation (PWM) output to control the illumination brightness of the instrument panel and other fascia illumination. The dimmer switch operates using a rotary thumbwheel which is connected to a rheostat.

The rheostat is a variable resistor which provides a high or low resistance according to its set position. The CJB provides an output to the rheostat measure the voltage passing through to ground. The CJB measures this voltage and uses it to calculate a PWM output of between 8 and 12V to determine the brightness of the illumination.

Automatic Headlamps

Refer to Automatic Headlamps in this section.

HEADLAMP ASSEMBLY



E121550

Item	Part Number	Description
1	-	Low beam headlamp
2	-	Turn signal indicator lamp

3	-	Side marker lamp (NAS only)
4	-	Side lamp (base specification halogen headlamps only), cornering lamp (Xenon headlamps) or cornering/static bending lamp (AFS headlamps)
5	-	Side lamp LED's (high specification halogen and xenon headlamps only)
6	-	High beam halogen 'fill-in' headlamp
7	-	Locking plate
8	-	Low beam halogen bulb (halogen headlamps) or xenon bulb (xenon headlamps)
9	-	Vertical adjuster
10	-	Waterproof breather
11	-	High beam 'fill-in' lamp bulb
12	-	Headlamp Leveling Control Module (HLCM)
13	-	Electrical connector
14	-	Horizontal adjuster
15	-	Side lamp or cornering/static bending lamp cover (hidden)
16	-	Turn signal indicator lamp access cover (hidden)

Common Headlamp Features

Turn Signal Indicator Lamp

The turn signal indicator lamp is incorporated into the outer part of the headlamp assembly. The lamp is located above the side lamp on halogen headlamps and the static bending/cornering lamp on Xenon headlamps. The turn signal indicator lamp uses an PH24W orange colored bulb module. The module is fitted into a holder which is connected via contacts on the headlamp housing to the main connector in the headlamp housing. The module is a snap fit in the holder and needs to be pulled sharply to remove. The holder is fitted with a seal and is located into an aperture in the headlamp housing and rotated to lock into position. Access to the holder requires removal of the headlamp from the front carrier assembly and removal of the outer locking plate from the headlamp.

The turn signal indicator lamps are operated by the left steering column multifunction switch or by the hazard flasher switch. The steering column multifunction switch is only active with the ignition in ignition mode 6, the hazard flasher switch is active at all times. When active, the turn signal indicator lamps will flash at a frequency cycle of 400ms on and 400ms off.

If a bulb fails, the remaining turn signal indicator lamps bulbs continue to flash at normal speed. The turn signal indicators in the IC will flash at double speed to indicate the failure to the driver.

Side Lamp - Base Specification Halogen Headlamps

The side lamp is incorporated into the outer part of the headlamp assembly and is located below the turn signal indicator lamp.

The side lamp uses a capless W5W wedge fitting bulb which locates into a holder which is connected via wires to the main connector on the headlamp housing. The holder is a push fit into a receptacle in the headlamp housing. The bulb is accessible via a removable cover at the rear of the headlamp housing. Access to the cover requires removal of the headlamp from the front carrier assembly and removal of the outer locking plate from the headlamp.

The side lamps are operated by selecting side lamps or headlamps on the lighting control switch. The side lamps are operational at all times and are not dependant on the ignition switch position. The side lamps will also be illuminated when the lighting control switch is in the AUTO position and a 'lights on' signal is received by the CJB from the rain/light sensor.

Side Lamp - High Specification Halogen and Xenon Headlamps

The side lamps on halogen headlamps (except for base specification models) and on all Xenon headlamps are LED's. The 10 LED's are arranged around the outer part of the halogen fill-in lamp and the xenon projector module.

The side lamps are operated by selecting side lamps or headlamps on the lighting control switch. The side lamps are operational at all times and are not dependant on the ignition switch position. The side lamps will also be illuminated when the lighting control switch is in the AUTO position and a 'lights on' signal is received by the CJB from the rain/light sensor.

Cornering Lamp - Xenon (non-AFS headlamps only)



NOTE: The cornering lamps are not fitted to NAS market vehicles

The cornering lamps are an optional feature designed to illuminate the direction of travel when cornering at low speeds. The design of the lens projects a spread of light from the vehicle at approximately 45 degrees to the vehicle axis.

The cornering lamp is incorporated into the outer part of the headlamp assembly and shares the same housing and reflector as the side lamp.

The cornering lamp uses a 35W Halogen H8 bulb which locates in a holder which is connected on the headlamp housing. The holder is located in an aperture in the headlamp housing and rotated to lock. The bulb is accessible via a removable cover at the rear of the headlamp housing.

The cornering lamps are controlled by the left steering column multifunction switch with the lighting control switch in the headlamp position and the ignition in ignition power mode 6. The cornering lamps are supplied power via the ignition circuit to ensure that they do not function with the headlamp delay feature. The cornering lamps are deactivated if the vehicle speed exceeds 25 mph (40 km/h).

Only one cornering lamp will illuminate at any one time. If the left turn signal indicators are selected on, the left cornering lamp will be illuminated and visa versa, providing the vehicle speed and lighting control switch positions are correct. Cornering lamps are disabled when reverse gear is selected.

Cornering/Static Bending Lamps (Xenon AFS headlamps only)



NOTE: The cornering/static bending lamps are not fitted to NAS market vehicles

The cornering/static bending lamps are a standard feature on AFS headlamps designed to illuminate the direction of travel when cornering at low speeds. The design of the lens projects a spread of light from the vehicle at approximately 45 degrees to the vehicle axis. The static bending lamps are powered by the CJB and controlled by the AFS control module. The cornering lamp functionality is controlled by the CJB as described for non-AFS headlamps.

The cornering lamp and static bending lamp is incorporated into the outer part of the headlamp assembly.

The cornering/static bending lamp uses a 35W Halogen H8 bulb which locates in a holder which is connected via wires to the main connector on the headlamp housing. The holder is located in an aperture in the headlamp housing and rotated to lock. The bulb is accessible via a removable cover at the rear of the headlamp housing.

AFS Control

On headlamps with AFS, the cornering lamp function is as described previously for the Xenon non-AFS headlamps.

The static bending lamps operate with a steering angle sensor signal which is received by the AFS control module. The AFS control module sends a static bending lamp on request to the CJB which activates the static bending lamp bulb.

The static bending lamp operation is variable with the speed of the vehicle and the steering wheel angle. The static bending lamps illuminate at 0 mph (0 km/h) when the steering wheel rotation reaches 20 degrees. At 43 mph (70 km/h) the static bending lamps will illuminate when the steering wheel angle reaches 10 degrees. The static bending lamps will be switched off when the vehicle speed exceeds 43 mph (70 km/h).

The operation of the static bending lamps is controlled by the AFS control module. When the operation parameters of the lamp are reached, the CJB fades the static bending lamp bulb on using a PWM voltage over a period of approximately 2 seconds. When the lamp is switched off, the CJB fades the bulb off by decreasing the PWM voltage.

Halogen Headlamps

The halogen headlamps use a projector module for the low beam headlamp and a complex surface reflector for the halogen high beam lamp. The low and high beam bulbs are quartz halogen H7, with a rating of 55W. The bulbs are retained in the headlamp unit with conventional wire retaining clips.

The projector module comprises a reflector, the lens and the halogen bulb. The projector module only operates as a low beam halogen headlamp.

The high beam lamp reflector is divided into separate parabolic segments, with each segment having a different focal length.

The halogen headlamp uses a side lamp bulb which is located in the position used by the cornering/static bending lamp on xenon headlamps. The lens pattern for the side lamp in this position differs from the lens pattern used for the cornering/static bending lamp.

The halogen headlamps do not require adhesive decals to be applied to the clear outer lens to mask the beam cut-off when driving in opposite drive hand markets. A tourist lever mechanism is located on the right side of the projector module. This mechanism moves to blank off a portion of the beam spread to enable the vehicle to be driven in opposite drive hand markets without applying blanking decals to the headlamp lens. The beam is changed by removing the access cover at the rear of the lamp assembly and moving a small lever located near the bulb holder, at the side of the projector module. Make sure that the headlamps are off before removing the access cover.



CAUTION: This lever can be very hot if the lamps have been operating. Allow sufficient time to cool before operating the lever.

Xenon Headlamps

Safety Precautions



WARNING: The Xenon system generates up to 28000 volts and contact with this voltage could lead to fatality. Make sure that the headlamps are switched off before working on the system.

The following safety precautions must be followed when working on the xenon headlamp system:

- **DO NOT** attempt any procedures on the xenon headlamps when the lights are switched on.
- Handling of the D3S Xenon bulb must be performed using suitable protective equipment, e.g. gloves and goggles. The glass part of the bulb must not be touched.
- Only operate the lamp in a mounted condition in the reflector.

The xenon headlamps use a complex surface reflector for the Halogen fill in high beam lamp only lighting unit, which is of the same design as the high beam unit used on the Halogen headlamps. This type of reflector has the reflector divided into separate parabolic segments, with each segment having a different focal length.

The high beam bulbs are quartz halogen H7, with a rating of 55W. The bulbs are retained in the headlamp unit with conventional wire retaining clips.

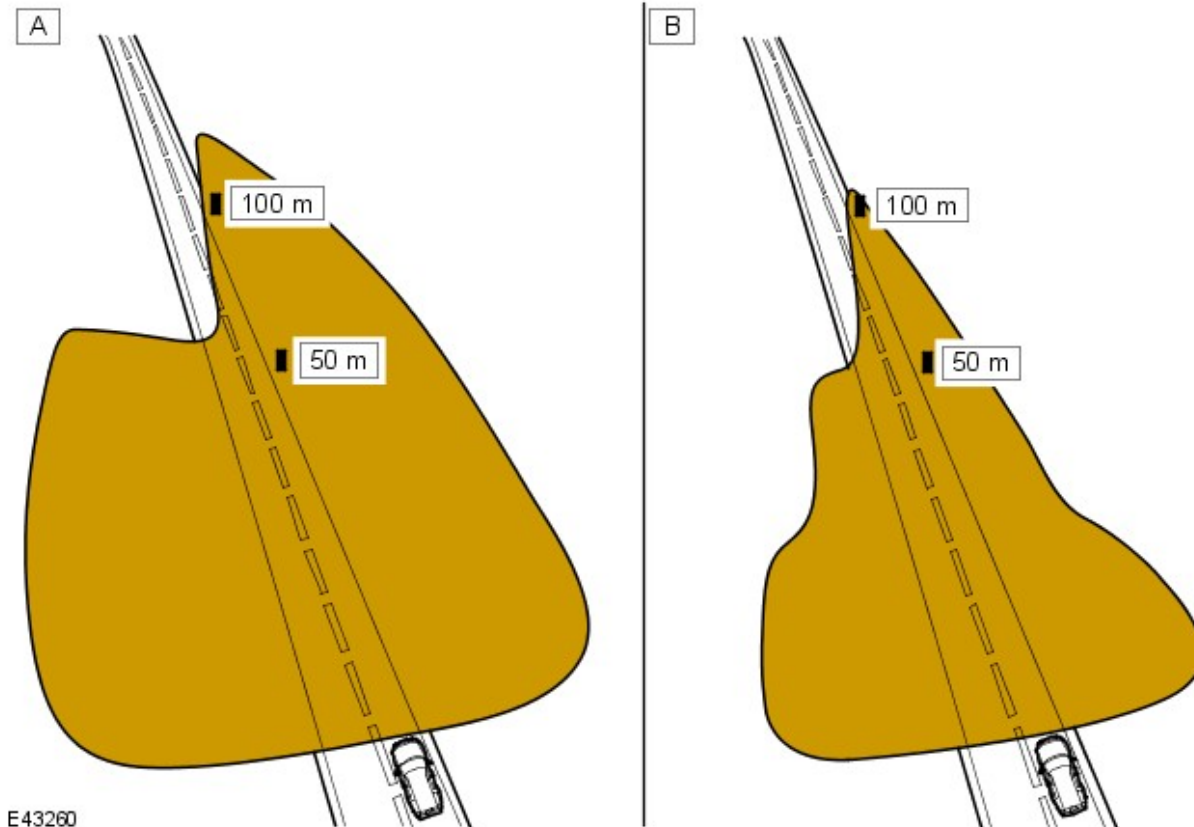
The Bi-Xenon™ (the Bi-Xenon™ trademark is the property of Hella KGaA Hueck & Co., Germany) projector module headlamp operates as both low beam and high beam headlamp unit. The Xenon lamp (or High Intensity Discharge (HID) lamp), comprises an ellipsoidal lens with a solenoid controlled shutter to change the beam output from low to high beam. The bulb is retained with a locking ring which must be rotated to facilitate removal of the D3S bulb.



NOTE: If the lighting control switch is in the OFF position, the xenon lamps do not operate when the high beam 'flash' function is operated. If the lighting switch is in the headlamps position or AUTO position with the low beam lamps active, the xenon low beam will remain on when the high beam 'flash' function is operated.

The xenon headlamp system is controlled by the CJB using a control module for each headlamp and an igniter. The control modules and the igniters provide the regulated power supply required to illuminate the xenon bulbs through their start-up phases of operation.

Xenon/Halogen Headlamp Beam Comparison

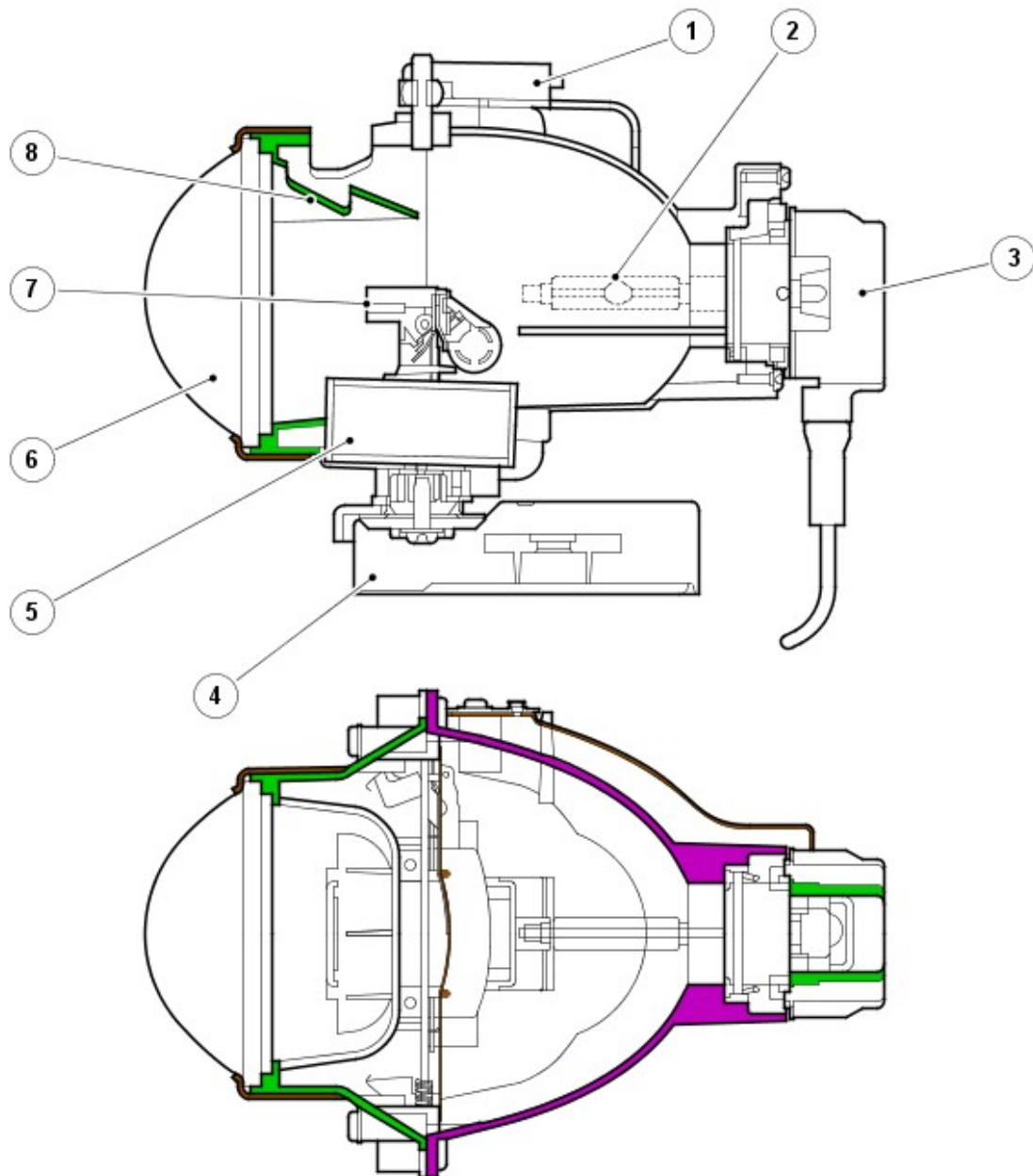


Item	Part Number	Description
A	-	Xenon
B	-	Halogen

The Xenon low/high beam headlamps use ellipsoidal technology for the lens and reflector providing improved night time visibility compared to conventional halogen headlamps. The Xenon headlamps provide the following benefits when compared to halogen headlamps:

- Longer bulb life - Approximately 3 to 5 times longer than a halogen bulb
- Increased light output - Xenon headlamps output 3 to 4 times more light on the road surface than halogen headlamps
- Blue/White light which is closer to natural daylight - Xenon lamps produce a blue/white light compared to a yellow light produced by a halogen bulb
- Improved night time driving visibility - Xenon lamps produce a wider and brighter beam in front of the vehicle than conventional halogen bulbs
- Lower running temperatures
- Lower power consumption
- Mercury free.

Xenon Headlamp Construction



E43261

Item	Part Number	Description
1	-	Bracket
2	-	D3S xenon bulb
3	-	D3S connector
4	-	Swivel actuator (AFS lamp only)
5	-	Solenoid
6	-	Aspheric lens
7	-	Shade
8	-	Shade
9	-	Lens support

The Xenon headlamp is a self contained unit located within the headlamp assembly. The unit comprises a reflector, an adaptor ring, the lens, a shutter controller and the Xenon 35W D3S bulb, which as an assembly is known as the projector module.

The reflector is curved and provides the mounting for the xenon bulb. The bulb locates in a keyway to ensure correct alignment in the reflector and is secured by rotating a locking ring on the projector module to lock. The bulb has a pin connector which is a push to lock fitting.

The shutter controller is a solenoid which operates the shutter via a lever mechanism. The shutter is used to change the beam projection from low beam to high beam and visa versa.

A tourist lever mechanism is located on the right side of the projector module. This mechanism moves to blank off a portion of the beam spread to enable the vehicle to be driven in opposite drive hand markets without applying blanking decals to the headlamp lens. The beam is changed by removing the access cover at the rear of the lamp assembly and moving a small lever located near the bulb holder, at the side of the projector module. Make sure that the headlamps are off before removing the access cover.

The Xenon bulbs illuminate when an arc of electrical current is established between two electrodes within the bulb. The xenon gas sealed in the bulb reacts to the electrical excitation and the heat generated by the current flow. The xenon gas reaction to the controlled current flow between the electrodes produces the blue/white light.

To operate at full efficiency, the xenon bulb goes through three stages of operation before full output for continuous operation is achieved. The three phases are; start-up phase, warm-up phase and continuous phase.

In the start-up phase, the bulb requires an initial high voltage starting pulse of 18000 to 28000 volts to establish the arc. This is produced by the igniters. The warm-up phase begins once the arc is established. The Xenon control modules regulate the supply to the bulbs to 2.6A which gives a lamp output of 75W. During this phase, the Xenon gas begins to illuminate brightly and the environment within the bulb stabilizes ensuring a continual current flow between the electrodes. When the warm-up phase is complete, the xenon control modules change to continuous phase. The supply voltage to the bulb is reduced and the operating power required for continual operation is reduced to 35W.

The Xenon system is controlled by the CJB, the two xenon control modules and the two igniters. The xenon control modules (one per headlamp) receive an operating voltage from the CJB when the headlamps are switched on. The modules regulate the power supply required through the phases of start-up.

The igniters (one per headlamp) generate the initial high voltage required to establish the arc. The igniters have integral coils which generate high voltage pulses required for start-up. Once the xenon bulbs are operating, the igniters provide a closed circuit for regulated power supply from the control modules.

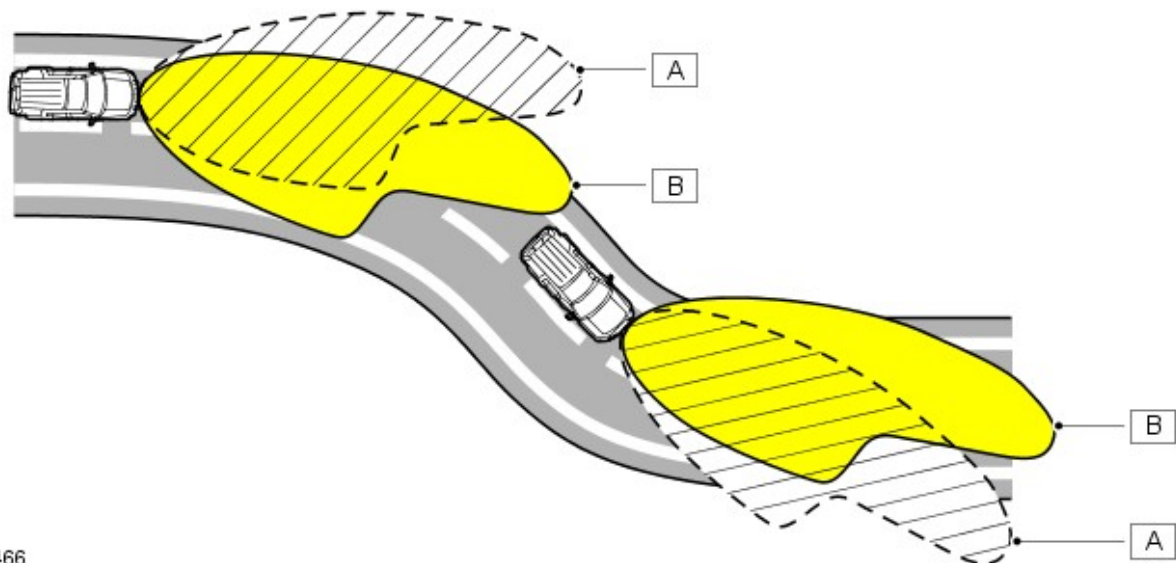
ADAPTIVE FRONT LIGHTING SYSTEM (AFS)

The AFS is a system to improve driver visibility under differing driving conditions. AFS provides a larger visible area which is illuminated when cornering by adjusting the position of the beam distribution on the road. Horizontal adjustment is made automatically to the most suitable orientation for the driving conditions using steering angle and information from other vehicle sensors.

AFS is only available with adaptive Bi-Xenon™ headlamps. The 'Xenon' module within the headlamp is controlled by actuator motors which rotate the projector module on its horizontal axis to adjust the beam output to suit the cornering conditions and vehicle inclination. Only the adaptive bi-xenon™ lamp projector module swivels, the non adaptive xenon and halogen high beam lamp units remains static.

The AFS system is controlled by an AFS control module which is located at the bottom of the passenger side 'A' pillar. The control module controls the horizontal alignment of the adaptive Bi-Xenon™ projector module. The operation of the static bending lamp is controlled by the AFS control module, but powered by the CJB.

AFS Concept



E43466

Item	Part Number	Description
A	-	Conventional headlamp beam distribution
B	-	AFS swivel headlamp beam distribution

AFS Control Module

The AFS control module is connected to the high speed CAN bus and receives inputs from other vehicle systems on the status of the following parameters:

- Steering angle - from steering angle sensor
- Vehicle speed - from ABS module
- Low beam status - from IC
- Suspension height - from air suspension control module
- Odometer value - for diagnostics only
- Engine running - from ECM
- Gear position - From transmission control module or transfer box control module
- Engine crank - from ECM
- Exterior/interior temperature - for diagnostics only.

The AFS will only operate when the AFS control module receives an engine running signal on the CAN bus. When the engine running signal is received, the AFS control module performs an initialization routine which is only performed at engine crank (power mode 9).

The AFS will also function when the lighting control switch is in the AUTO position and the AFS control module receives a lights on signal from the rain/light sensor and an engine running signal.

The AFS control module then monitors the inputs from the other vehicle systems to control the AFS functionality according to cornering angles and vehicle speed.

The AFS control module is connected to each headlamp on a private Local Interconnect Network (LIN) bus. The AFS control module then drives the DC motor actuators inside the headlamp assembly.

The AFS control module controls the swiveling angle of each projector module using speed and steering angle signals. The angles of each projector module differ to give the correct spread of light, For example, when turning left, the left projector module will have a greater swiveling angle than the right projector module

Reverse mode disables the swivel function when reverse gear is selected. The AFS projector modules move to their central straight ahead position and the static bending lamp, if active, will go off. When reverse gear is deselected, the AFS projector modules will move to a position to match the steering angle and the static bending lamp will illuminate if the operating conditions are correct (for example vehicle speed above 1.86 mph (3 km/h)).

Xenon Headlamp Assembly with AFS Construction

The AFS xenon headlamp construction is similar to the non-AFS xenon headlamp assembly. The AFS assembly contains an additional carrier frame which provides the location for the AFS components. The remaining lamps are as described previously for the Xenon headlamp assembly. The functionality of the static bending lamp on the AFS headlamp is different from the functionality of the cornering lamp on the xenon headlamp.

The carrier frame has a radial bearing at the top and a thrust washer at the bottom which provide the horizontal pivot points for the xenon projector module. The lamp module lower pivot has a splined end which locates in the mating splines of the AFS horizontal actuator motor. The carrier frame is suspended on two flexible mountings at the top which provide for the vertical pivot points for the xenon projector module which allow for the vertical adjustment of the projector module. The bottom of the carrier frame is attached to the AFS vertical actuator motor.

The AFS actuator motors are dc motors which are driven by a power output from the CJB in response to signals from the AFS control module.

The actuators contain a potentiometer which is connected via wires with gold plated connector pins to the AFS control module. The two wires to each actuator provide a feedback signal to the AFS control module to give the precise position of the xenon projector module.

The AFS control module receives vehicle speed signals from the ABS module to adjust the projector module vertically to increase the beam range as the vehicle speed increases.

Initialization

When the AFS control module receives an engine running signal, the control module performs the initialisation procedure which ensures that the headlamps are correctly aligned on their horizontal axis.

The AFS swivel initialization is completed in less than 1 second. The left and right AFS motors flick the headlamps to calibrate the centre position of the headlamps.

Failure Mode

In the event of a failure of the AFS system, a warning indicator in the IC is illuminated to warn the driver. The AFS warning indicator illuminates when the ignition is in accessory power mode 4 or ignition power mode 6 and will flash continuously until the fault is rectified. The AFS warning indicator will also be illuminated if a failure of the steering angle sensor or the vehicle speed signal is detected.

Illumination of the AFS warning indicator does not necessarily mean that there is a fault with the AFS system. The fault may be caused by a failure of another system preventing the AFS system operating correctly.

The AFS control module performs a diagnostic routine every time AFS is requested. If any fault is found, the AFS control module will suspend the operation of the AFS function.

If the AFS system has failed with the xenon projector module in a position other than the correct straight ahead position, the AFS control module will attempt to drive the xenon projector module to the zero (straight ahead) position. If this is not possible, the AFS control module will lower the projector module using the leveling actuator motors to prevent excess glare to oncoming vehicles.

The AFS control module software can detect an internal failure of the control module control circuits. The control module will power the projector modules to the zero position and prevent further operation.

Faults can be investigated by interrogating the AFS control module using an approved Land Rover diagnostic system to check for fault codes.

AUTOMATIC HEADLAMP OPERATION

The automatic headlamp function is a driver assistance system. The driver can override the system operation by selection of side lamp or headlamp on if the ambient light conditions require front and rear lighting to be active. The automatic headlamp system uses a light sensor and the CJB, which are connected via the LIN bus to control the headlamp functionality.

A light sensor is incorporated in the rain/light sensor located on the inside of the windshield, below the rear view mirror. The wiper system also uses the rain/light sensor for automatic wiper operation.

For additional information, refer to: Wipers and Washers (501-16, Description and Operation).

The light sensor measures the ambient light around the vehicle in a vertical direction and also the angular light level from the front of the vehicle. The rain/light sensor uses vehicle speed signals, wiper switch position and the park position of the front wipers to control the system.

The automatic headlamp operation uses ambient light levels which are monitored by photodiode incorporated in the rain/light sensor. The rain/light sensor sends a lights on/off request to the CJB on the LIN bus, which responds by switching on the low beam headlamps, front side lamps and rear tail lamps.

The automatic headlamps are activated under the following conditions:

- Twilight
- Darkness
- Rain
- Snow
- Tunnels
- Underground or multistoried car parks.

Operation of the automatic headlamps requires the ignition to be in ignition mode 6, the lighting control switch to be in the 'AUTO' position and a lights on request signal from the light sensor.

HEADLAMP LEVELING

Headlamp leveling provides for the adjustment of the vertical aim of the headlamps. The leveling system is primarily required to minimise glare to other road users when a heavy load is in the rear of the vehicle.

Two systems of headlamp leveling are available; manual and static.

Manual Headlamp Leveling

Manual headlamp leveling is only available on vehicles with halogen headlamps and coil spring suspension.

The manual system comprises the following components:

- Two headlamp leveling motors
- Headlamp leveling rheostat rotary control.

When the ignition is in ignition mode 6, power is supplied to the lighting control switch via the ignition relay in the battery junction box and to the headlamp leveling motor in each headlamp assembly via the CJB. When the lighting control rotary switch is moved to the side lamp or headlamp position, the supply from the ignition relay is passed to the leveling rotary control.

Movement of the leveling rotary control produces a variable voltage output, which is sensed by the motors. The motors react to the supplied voltage and move the headlamp to the requested position which relates to the supplied voltage from the leveling rotary control.

The headlamps can only be lowered from their unladen position to compensate for changes in vehicle attitude due to loading.

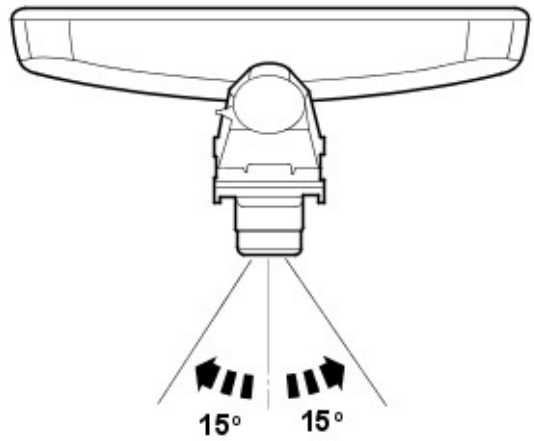
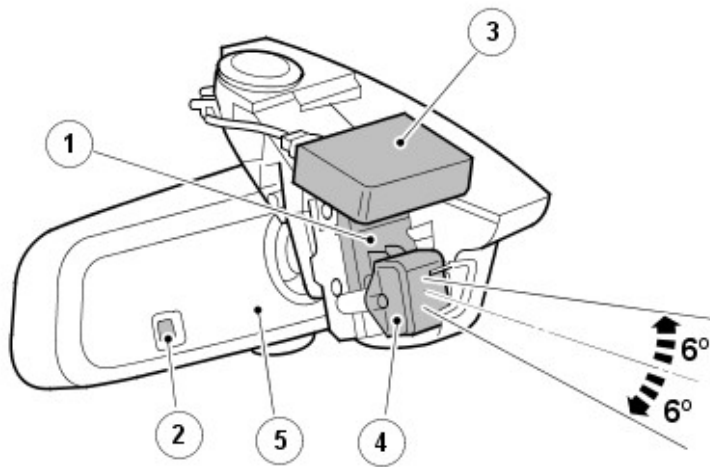
Vehicle Headlamp Leveling

Vehicle headlamp leveling is only available on vehicles with air suspension.

Vehicle headlamp leveling is performed by the air suspension system and the air suspension control module. The suspension system constantly monitors the vehicle attitude and adjusts the height of the front and/or rear of the vehicle accordingly. This maintains the correct vehicle attitude and consequently maintains the correct headlamp beam alignment.

The vehicle leveling system is fully automatic, therefore the lighting control switch does not have the manual leveling rotary control.

HIGH BEAM ASSIST



E117701

Item	Part Number	Description
1	-	Rear view mirror calibration bracket
2	-	Ambient light sensor (High beam assist)
3	-	Rain/light sensor (Auto headlamps)
4	-	Image sensor
5	-	Auto High Beam Control Module (AHBCM)

High beam assist is a driving aid which automatically controls the high beam function. If required, the system can be overridden by the driver.



CAUTION: The high beam assist system is designed as a driving aid only. Should the road conditions require, it is the driver's responsibility to consider other road users and operate the high beam headlamps in a safe manner. In certain circumstances the driver will be required to intervene.

High Beam Assist Warning Indicator



E117699

Item	Part Number	Description
1	-	Warning indicator (green)

The high beam assist system is controlled by a high beam assist control module which is located in the interior rear view mirror body and by the CJB. The module and the CJB are connected via the medium speed CAN bus.

The high beam assist control module receives a power supply from the CJB when the ignition is in power mode 6 (ignition on). The rear view mirror also includes a low resolution camera (image) sensor which detects headlamps and tail lamps of preceding vehicles. The sensor is connected to the control module which evaluates the image data, checking for light intensity and location.

If conditions are correct, the control module will activate the high beam assist by sending a high or low beam request message to the CJB via the medium speed CAN bus. The CJB then controls the shutter in the Xenon projector module

together with the high beam fill-in lamp.

High Beam Assist Operation

The high beam assist operates as part of the automatic headlight system. When driving at night with the lighting control switch in the automatic position and the left steering column multifunction switch in the central position, with sufficient darkness (approximately 1 lux or less) and a suitable road speed, the high beam assist will automatically operate the high beam lighting when necessary. A warning symbol in the IC confirms to the driver when the high beam assist system is selected and enabled.

NOTES:



The function of the normal 'blue' high beam indicator remains unchanged and it always reflects the actual status of the high beam lamps



The exterior lighting 'on' threshold for the auto headlamps system is approximately 100 lux which is measured by the rain/light sensor. At light levels below this value the low beam headlamps and exterior lights will be switched on. The high beam assist will not function until the light level has reached approximately 1 lux. At light levels above 1 lux high beam is not required and therefore is not activated.

Activation (system ready)

High beam assist will only activate and illuminate the warning indicator to show system is ready or 'primed' for high beam control, when the following conditions are met:

- High beam assist has been first 'enabled' via the IC menu
- Lighting control switch is in the 'Auto' position
- Left steering column multifunction switch in the central position
- The ambient light level is below 100 lux – refer to 'Light Levels' section that follows
- The system has not been overridden or cancelled – refer to 'Override' section that follows
- The camera (image) sensor view is not blocked.

High Beam Control

When activated, high beam assist will switch the headlamps to high beam when all the following conditions occur:

- No relevant oncoming traffic
- No relevant preceding traffic
- In non-urban environment, i.e. with no street lighting
- Ambient light level is below 1 lux – refer to 'Light Levels' section that follows
- Road speed is suitable – refer to 'Road Speed' section that follows.

Low Beam Control

When activated, high beam assist will switch the headlamps to low beam when any of the following conditions occur:

- Relevant Oncoming traffic is present
- Relevant Preceding traffic is present
- In urban environment, i.e. with street lighting
- Ambient light level is above 1 lux – refer to 'Light Levels' section that follows
- Road speed is not suitable – refer to 'Road Speed' section that follows
- Unrecognisable reflective inputs from road signs or markings – refer to 'System Limitations' section that follows.

Light Levels

The exterior lighting 'on' threshold for the normal 'auto headlamps' feature is approximately 100 lux and is measured by the windscreen mounted 'rain/light' sensor. When the light level falls to this value the low beam headlamps and exterior lights will be switched on together with the high beam assist warning indicator.

This warns the driver that the system is activated and ready to automatically switch on the high beam headlamps when the light level falls a little further to approximately 1 lux, as measured by the 'ambient light sensor' located in the mirror body. High beam is generally not required with light levels above 1 lux.

Road Speed

A road speed signal is received by the CJB from the Anti-lock Braking System (ABS) module via the high speed CAN bus. When the other activation conditions are correct, the CJB will switch the headlamps to high beam when the road speed has increased above 40 km/h (25 mph).

When the road speed falls to below 24 km/h (15mph), the CJB will switch the headlamps to low beam. The 10 mph (15 km/h) difference between the on and off road speed thresholds prevents the system continually switching between high and low beam at low speeds.

Override

The driver can manually override the high beam assist system at any time. When the high beam assist system is activated, pulling the left steering column multifunction switch to the high beam 'flash' position or pushing it forward to the high beam position will de-activate the system and the high beam assist warning indicator in the IC will extinguish.

When the multifunction switch is returned to the central position, from a forward high beam position, the system is re-activated and the high beam assist warning indicator will illuminate again.

Correct Performance

In addition, high beam assist will only exhibit best performance if all of the following conditions are met:

- No false inputs are received by the camera (image) sensor, such as reflected light from certain static signs – refer to 'System Limitations' section that follows
- Headlamps are correctly aligned
- High beam assist system has been set for correct 'hand of traffic' via the driver menu settings – refer to 'Setting Hand of Traffic' section that follows
- Headlamps have been set for correct 'hand of traffic' via the mechanical tourist lever in headlamp casing – refer to 'Setting Hand of Traffic' section that follows
- Camera (image) sensor has been through a self learning 'auto aim' calibration procedure if any components have been replaced – refer to 'Calibration' section that follows
- There are no large reflective items, white papers, etc., sitting on top of the dash board in near view of the camera (image) sensor, or stickers placed directly in front of the camera (image) sensor

Driver Menu Features

The high beam assist feature must first be enabled using the configuration menu available in the IC. However if required, the high beam assist system can be permanently disabled leaving the basic 'Auto Lamps' system still operative.

Within this menu the system can also be configured for driving on the alternate side of the road (Hand of Traffic). This enables the system to be used in different regions and it's setting is important for correct operation.

Setting 'Hand of Traffic' and High Beam Assist 'Enable'

To set the high beam assist options the following steps must be sequenced:

- With the ignition in power mode 6 (ignition on), and the engine not running, use the controls on the steering wheel to select on the IC menu:
 - Menu > Vehicle Set-up > High Beam Assist
- Configure the 'Hand of Traffic' setting by selecting the appropriate 'Drive on Left' (of road) or 'Drive on Right' (of road) to the applicable Market condition
- Enable the feature by setting 'Activate Assist' if not already selected.

NOTES:



Enabling or disabling high beam assist will not affect the 'Hand of Traffic' settings once set.



The headlamps still require manual adjustment using the tourist lever for driving abroad in countries where the alternate side of the road is used.

The IC menu also includes a 'High Beam Assist Sensitivity' selection. This is a requirement option for NAS market vehicles only but it is not recommended for normal use and has been superseded.



NOTE: In other markets the 'Sensitivity' selection is greyed out and cannot be selected.

For additional information, refer to: Instrument Cluster (413-01, Description and Operation).

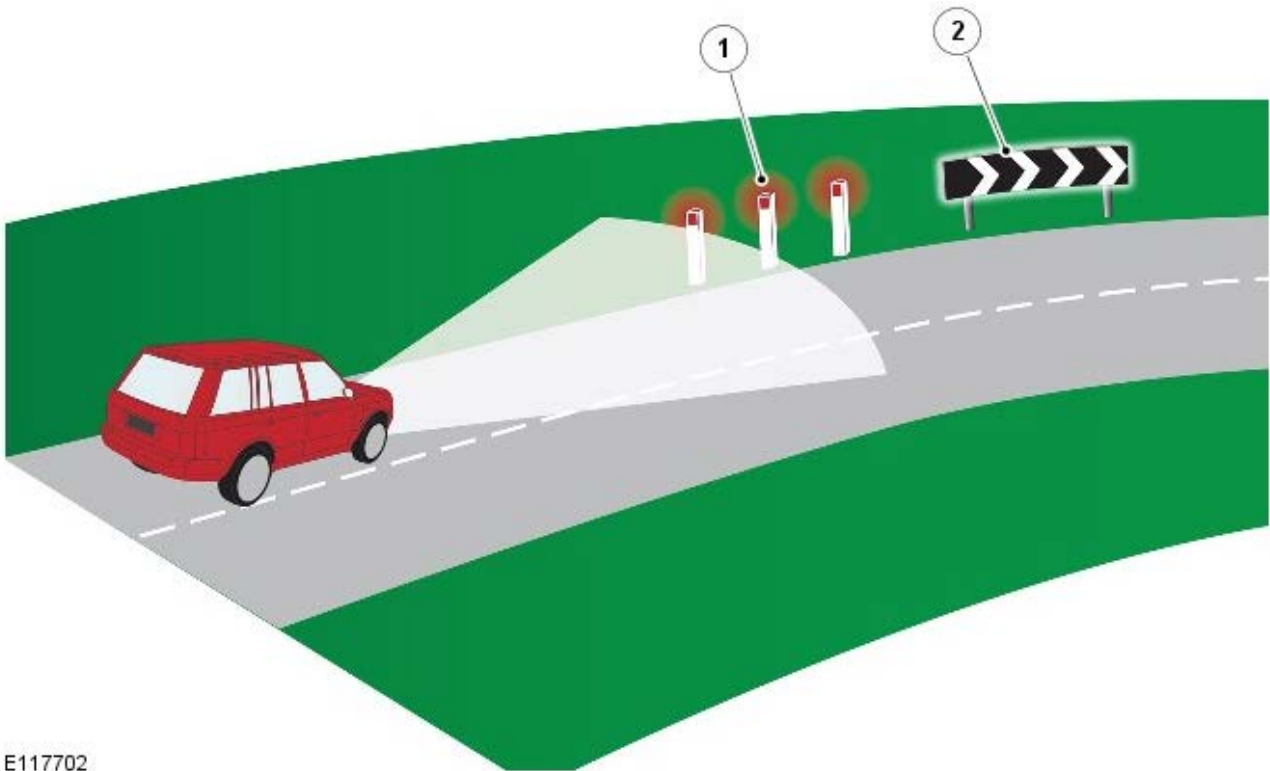
System Limitations

The high beam assist system can occasionally have difficulty distinguishing between light from other vehicles or reflected light from static highly reflective road signs.

These situations may cause the high beam assist system to undesirably operate the high beam headlamps or take no action at all. Examples of these situations are as follows:

- Dips, hollows or crests in the road
- Highly reflective static Road signs
- Tight bends
- Poorly illuminated vehicles e.g. cyclists or small mopeds
- Motorway central barriers
- Extreme weather conditions e.g. Fog, heavy snow
- Exterior domestic or industrial lighting

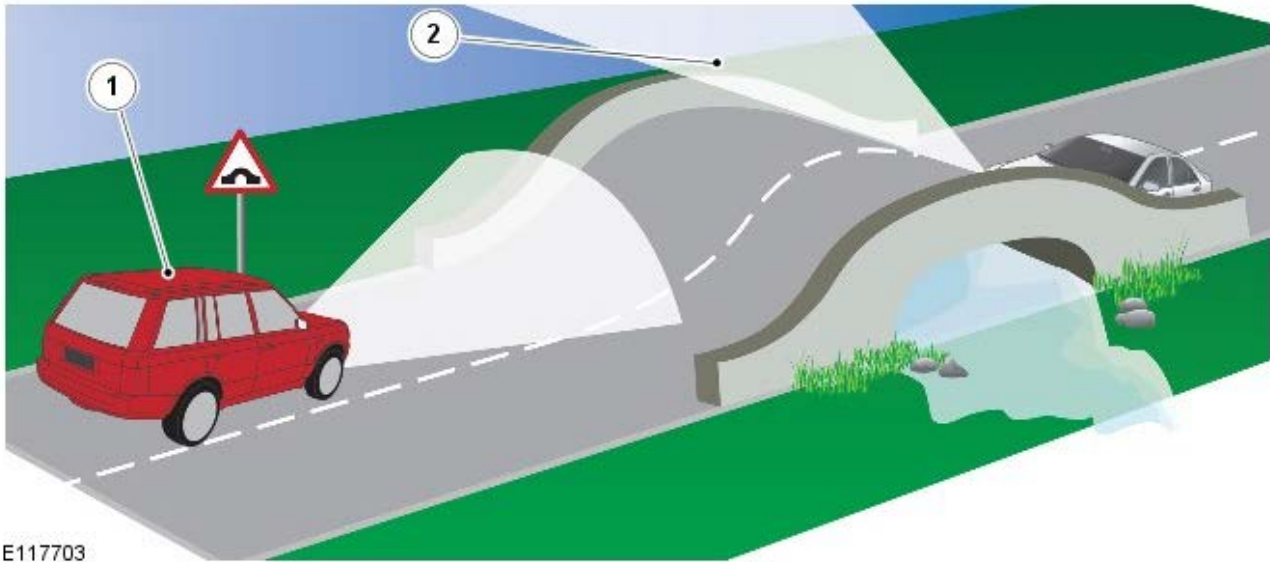
Reflective Static Signs



E117702

Item	Part Number	Description
1	-	Red reflective signs could be detected as rear tail lamps
2	-	Large reflective signs could affect the system

Manual Deactivation



E117703

Item	Part Number	Description
1	-	Vehicle equipped with high beam assist
2	-	Oncoming vehicle headlamps can be seen by the driver before the high beam assist image sensor detects the oncoming light input

There are situations when a driver is able to judge if a high beam deactivation is desirable before the high beam assist system actually operates, for example over a crest of a hill. Headlamps from an oncoming vehicle can sometimes be seen on the horizon prior to the detection sensor receiving an input. It is the driver's preference to determine if early intervention is desired in this and similar situations.

System Diagnosis



NOTE: Windshield stickers, stone chips, dirt and general road film will affect the successful operation of the image sensor if sufficient blocking is present. Avoid placing reflective objects on the instrument panel, for example white paper which can affect the image sensor.

High beam assist has a self diagnosis capability by comparing data from the ambient light sensor input (located in the rear view mirror) to light levels detected by the image sensor. If a deviation is detected it is assumed that the ambient light available to the image sensor is being restricted by dirt or other blockage and the system will be deactivated. Diagnostic Trouble Code (DTC)'s are stored in the control module's memory and can be accessed using an approved Land Rover diagnostic system. Within the diagnostic system is a procedure to test the basic operation of the camera function.

In the event of a fault, the warning strategy to the driver is as follows:

- Image sensor internal fault - green icon will extinguish with no additional message to driver
- CJB has lost all communication with image sensor - green icon will extinguish with no additional message to driver
- Image sensor blocked - green icon will extinguish with an additional "High Beam Assist Sensor Blocked" message within the message centre

System Calibration

To achieve effective operation of the high beam assist system, a calibration routine is performed on vehicle build and system tolerances are set to an accuracy of +/- 0.2 degrees.

This initial calibration is a 'one time only' procedure. Should the high beam assist components or the windshield require replacement at the dealership, an automatic calibration routine will be performed. This 'auto aim' calibration procedure is a continual process that takes place during a normal drive cycle at night and could take between 10 - 30 minutes dependant on the following driving conditions:

- If sufficient road markings (lane markings) are visible to the image sensor - approximately 10 minutes
- If insufficient road markings are visible, the system uses the tail lights of preceding vehicles - approximately 30 minutes.

NOTES:



Until this calibration is complete the system may not react correctly during operation. This should be made clear to the customer before vehicle handover. During any calibration or rectification work the headlamps should be checked for correct alignment.



Due to mechanical calibration tolerance the correct mirror assembly must be used for the vehicle model types in question and it is not exchangeable with other vehicle model types.

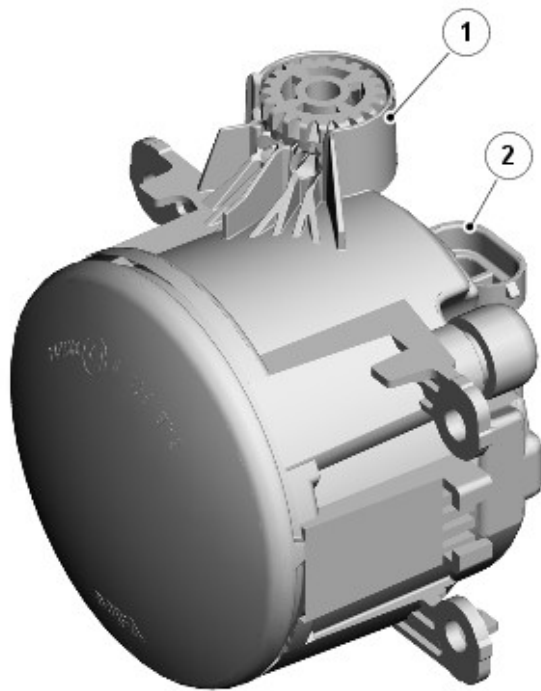


After any rectification work and before any calibration drives, the headlamps should be checked for correct alignment.

DAYTIME RUNNING LAMPS (DRL)

For additional information, refer to: Daytime Running Lamps (DRL) (417-04, Description and Operation).

FRONT FOG LAMP (If Fitted)



E120184

Item	Part Number	Description
1	-	Vertical adjustment wheel
2	-	Electrical connector

Front fog lamps are an optional fitment on low specification vehicles and a standard fitment on high specification vehicles.

Two front fog lamps are located in apertures in the front bumper. The front fog lamps are located in the front bumper. Each lamp is secured to three lugs in the bumper and retained with self tapping screws and fasteners. Each lamp has an adjustment wheel which provide for the vertical alignment of the beam. Access to the adjustment wheel requires removal of the lamp bezel.

The fog lamp uses a 55W halogen H11 bulb which is located in a holder. The holder is located in a hole in the rear of the fog lamp housing and is turned to lock in position.

The front fog lamps are controlled by the lighting control switch. When the ignition is in ignition mode 6 and the lighting control switch is in the side lamp or headlamp position, the lighting control fog lamp switch can be pushed to activate the front fog lamps.

If the switch is pushed a second time the front fog lamps are switched off. A front fog lamp warning indicator is illuminated in the IC when the front fog lamps are active.

If the fog lamps are active when the lighting control switch is moved to the off position or the ignition is switched off, the fog lamps are de-activated and will need to be reselected on (if required) when the side lamps or headlamps are next selected on.

Front Fog Lamps Functionality (NAS and Canadian Markets Only)

The front fog lamps are powered by an additional relay (relay 5) which is located in the EJB in the engine compartment.

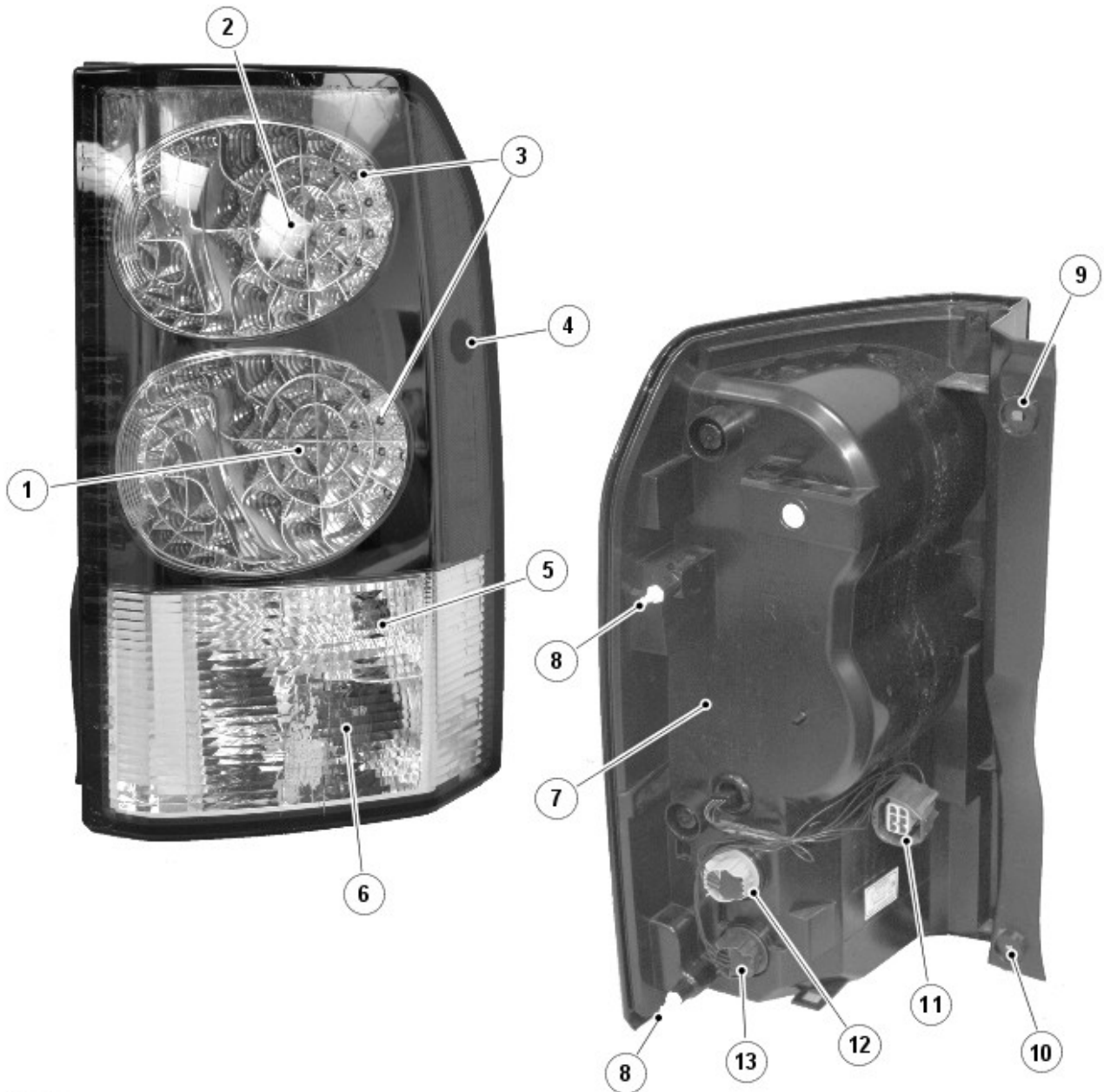
The front fog lamps operate as described previously but with the following differences which cover local laws governing lamp usage.

If the low beam headlamps and the front fog lamps are on at the same time, when the high beam headlamps are switched on, the front fog lamps will be automatically switched off. When the high beam headlamps are switched off, the front fog lamps will be switched back on automatically.



NOTE: The front fog lamps will also be switched off if the headlamp high beam flash function is operated.

REAR LAMP ASSEMBLY



E121551

Item	Part Number	Description
1	-	Turn signal indicator lamp LED's
2	-	Stop lamp LED's
3	-	Side lamp LED's
4	-	Side marker lamp (NAS only)
5	-	Reverse lamp
6	-	Fog lamp
7	-	Side marker lamp bulb holder (NAS only)
8	-	Location studs
9	-	Attachment hole
10	-	Attachment hole
11	-	Electrical connector
12	-	Reverse lamp bulb holder
13	-	Fog lamp bulb holder

The rear lamp assembly is a one piece unit which contains a stop lamp, a rear side lamp, a turn signal indicator lamp, a second rear side lamp, a reversing lamp and a fog lamp. Light Emitting Diode (LED)'s are used for the tail lamp, stop lamp and turn signal indicator lamp. Reversing lamp and fog lamp use bayonet fitting bulbs. These are located in holders which fit into the applicable hole in the lamp housing and are locked by rotating. Each bulb holder is connected by wires to a connector on the rear of the lamp housing.

The rear lamp assembly is located in a recess in the vehicle body. Two studs on the outer edge of the lamp housing locate in the vehicle body. The lamp is secured with two screws which are located on the inner edge of the lamp housing, near the tailgate aperture.

Rear Stop Lamp

The upper lamp is the inner section of the upper of the two main lamps and uses 12 LED's.

The stop lamp is activated when the ignition is in ignition mode 6 and the brake pedal switch is active (by depressing the brake pedal). The high mounted stop lamp will also be activated when the brake pedal is pressed.

The stop lamps can also be activated by the ABS when Hill Descent Control (HDC) is active. A signal from the ABS module energises a relay which supplies power to the stop lamps and high mounted stop lamp. For additional information, refer to: Anti-Lock Control - Traction Control (206-09A, Description and Operation).

Turn Signal Indicator Lamp

The turn signal indicator lamp is the inner section of the lower of the two main lamps and uses 12 LED's.

The turn signal indicator lamps are operated by the left steering column multifunction switch or by the hazard flasher switch. The steering column multifunction switch is only active with the ignition switch is in ignition mode 6, the hazard flasher switch is active at all times. When active, the turn signal indicator lamps will flash at a frequency cycle of 400ms on and 400ms off.

Side Lamp

The side lamp is the outer ring of both upper lamps and use 12 LED's in each lamp.

The lamps are operated by selecting side lamps or headlamps on the lighting control switch. The lamps are operational at all times and are not dependant on the ignition switch position. The lamps will also be illuminated when the lighting control switch is in the AUTO position and a 'lights on' signal is received by the CJB from the rain/light sensor.

On NAS market vehicles a side marker lamp is incorporated into the side of the lamp assembly and uses a 5W capless wedge bulb.

Reversing Lamp

The reversing lamp is located below the tail lamp and uses a 21W bayonet fitting bulb.

The reverse lamp is active when the ignition is in ignition mode 6 and the CJB receives a reverse selected signal on the CAN bus. Both manual and automatic transmissions have a reverse switch which senses when reverse is selected.

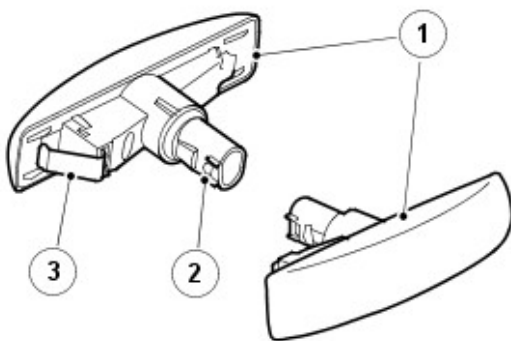
Rear Fog Lamp

The rear fog lamp is located at the bottom of the rear lamp and uses a 21W bayonet fitting bulb.

The rear fog lamp is controlled by a non-latching switch on the lighting control switch. When the ignition is in ignition mode 6 and the lighting control switch is in the side lamp or headlamp position, the rear fog lamp switch can be pressed to activate the rear fog lamps. A second press of the switch will de-activate the rear fog lamps. A rear fog lamp warning indicator is illuminated in the IC when the rear fog lamps are active.

If the rear fog lamps are active when the lighting control switch is moved to the off position or the ignition is switched off, the fog lamps are de-activated and will need to be reselected on (if required) when the side lamps or headlamps are next selected on.

SIDE REPEATER LAMP



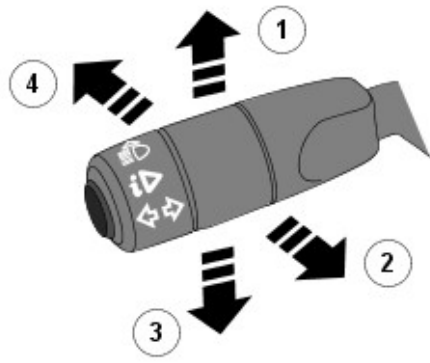
E43272

Item	Part Number	Description
1	-	Side repeater
2	-	Bulb holder
3	-	Clip

The side repeater turn signal indicator lamps are located in the driver and passenger doors, below each door mirror. The lamps are clipped into an aperture in the door panel and can be removed by sliding rearwards and releasing the front edge of the lamp from the door. The side repeater lamps use a W5W capless bulb which is located in a holder.

The side repeater lamps have the same functionality as the front and rear turn signal indicator lamps and are operated by the left steering column multifunction switch or by the hazard flasher switch. The steering column multifunction switch is only active with the ignition is in ignition mode 6, the hazard flasher switch is active at all times. When active, the side repeater lamps will flash at a frequency cycle of 400ms on and 400ms off. If a lamp bulb fails, the remaining turn signal indicator lamps continue to flash at the normal rate.

LEFT HAND STEERING COLUMN MULTIFUNCTION SWITCH



E43273

Item	Part Number	Description
1	-	Right turn signal lamp
2	-	Headlamp flash
3	-	Left turn signal lamp
4	-	Headlamp high beam

The steering column multifunction switch is located on the left side of the steering column and controls the following functions:

- Headlamp low/high beam
- Auto high beam function
- Headlamp high beam flash
- Left/right turn signal indicator lamps
- Trip computer functions.

For additional information, refer to: Information and Message Center (413-08, Description and Operation).

The high beam on and flash functions are connected on separate wires to the CJB. When the switch is operated in either position an earth path is completed which is sensed by the CJB which activates the selected function.

The turn signal indicator lamps are connected and operate in a similar way with the earth path completed through a separate wire which is sensed by the CJB which activates the applicable turn signal indicator lamps. The turn signal indicators have a 'lane change' feature which operates the turn signal indicators 3 times when the left steering column switch is operated against spring pressure and released. This feature is controlled by the CJB.

HAZARD FLASHERS

The hazard flashers are controlled by a non-latching switch in the centre of the instrument panel. The hazard flashers operate at all times when selected and are not dependant on ignition mode.

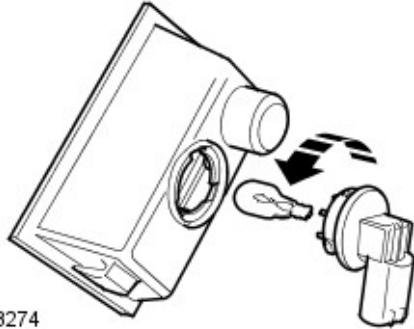
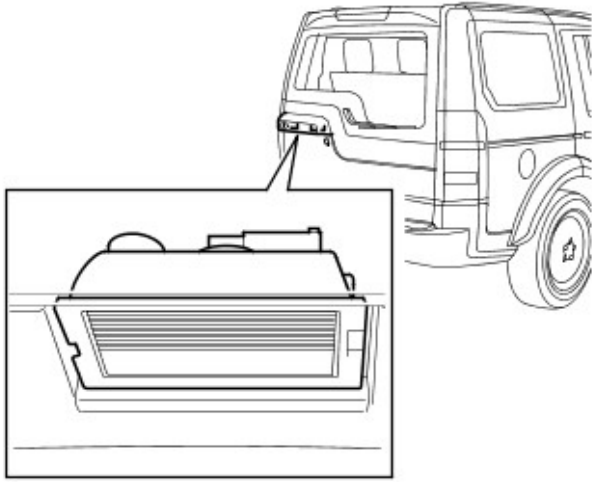
When the hazard flashers are selected on, all of the front, rear and side turn signal indicator lamps operate as previously described and both left and right turn signal warning indicator in the IC also flash. The hazard warning flashers flash at a rate of 380ms on and 380ms off. When the hazard flashers are active, they override any request for turn signal indicator lamp operation.

If a trailer is fitted, the trailer turn signal indicator lamps will flash at the same frequency as the vehicle indicators. The trailer warning indicator in the IC will also flash. If a trailer bulb is defective, the trailer warning indicator will not flash.

The hazard flashers can also be activated by a crash signal from the Restraints Control Module (RCM). This is received by the CJB which activates the hazard flashers. The hazard flashers can be cancelled by changing the ignition mode to accessory mode 4 or off or the crash mode is cancelled by the RCM.

For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B, Description and Operation).

LICENSE PLATE LAMPS

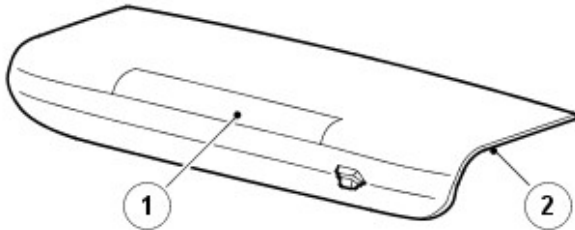


E43274

Two license plate lamps are fitted in the tailgate handle, above the license plate in the upper tailgate. Each lamp uses a 5W capless wedge type bulb. The lamps are secured in the upper tail gate handle with integral clips. The lamps can be released from the handle using a small, flat blade screwdriver.

The license plate lamps are active at all times when the side lamps or headlamps are switched on.

HIGH MOUNTED STOP LAMP



E43275

Item	Part Number	Description
1	-	High Mounted Stop Lamp (HMSL)
2	-	Housing

The HMSL is located in the upper tailgate. The stop lamp housing also provides location for the tail door window washer jet.

The lamp comprises a plastic housing with a red coloured lens. The lamp is illuminated by a number of LED's.

The HMSL is activated, along with the stop lamps, when the ignition is in ignition mode 6 and the brake pedal switch is active (by depressing the brake pedal).

The HMSL and the stop lamps can also be activated by the ABS when Hill Descent Control (HDC) is active. A signal from the ABS module energises a relay which supplies power to the stop lamps.

For additional information, refer to: Anti-Lock Control - Traction Control (206-09A, Description and Operation).

TRAILER LIGHTING

Several different types of trailer socket can be fitted to the vehicle depending on market specifications. Refer to the Electrical Reference Library for specific socket details.

The CJB monitors the turn signal lamps and can detect if more than two lamps are fitted (the side repeater turn signal indicator lamps are not monitored). When a trailer is detected, the trailer warning indicator in the IC will flash

in synchronisation with the turn signal indicators.

If one or more of the turn signal indicator lamps on the vehicle or the trailer are defective, the trailer warning indicator will not flash to alert the driver to the bulb failure.

DIAGNOSTICS

The diagnostic socket is located in the lower instrument panel closing panel, on the driver's side, below the steering column. Various lighting system functions are monitored by different systems which can store fault information. This can be retrieved using an approved Land Rover diagnostic system or other suitable scan tool.

AFS Control Module Fault Monitoring

The AFS control module has the capability to monitor faults within the AFS. The control module can store Diagnostic Trouble Codes (DTC's) relating to the symptoms shown in the following table.

DTC Symptom Description	Customer Symptom	Possible Cause
Left or right AFS actuator - Communication failure	Swivelling does not function	Open circuit or short circuit to earth
Left or right AFS Actuator failure	Swivelling does not function	Open circuit or short circuit to earth
Left or right Leveling Motor Failure	Leveling does not function	Open circuit or short circuit to earth or 12V
CAN bus failure	Swivelling and leveling do not function. Other vehicle system functions perhaps also inoperative	Open circuit or short circuit to earth or 12V

Central Junction Box (CJB)

The CJB monitors the status of the lighting circuits, relays and switches. If a fault occurs, the CJB stores a fault code applicable to the specific fault which can be retrieved using an approved Land Rover diagnostic system or other suitable scan tool.

Exterior Lighting - Exterior Lighting

Description and Operation

Beacon

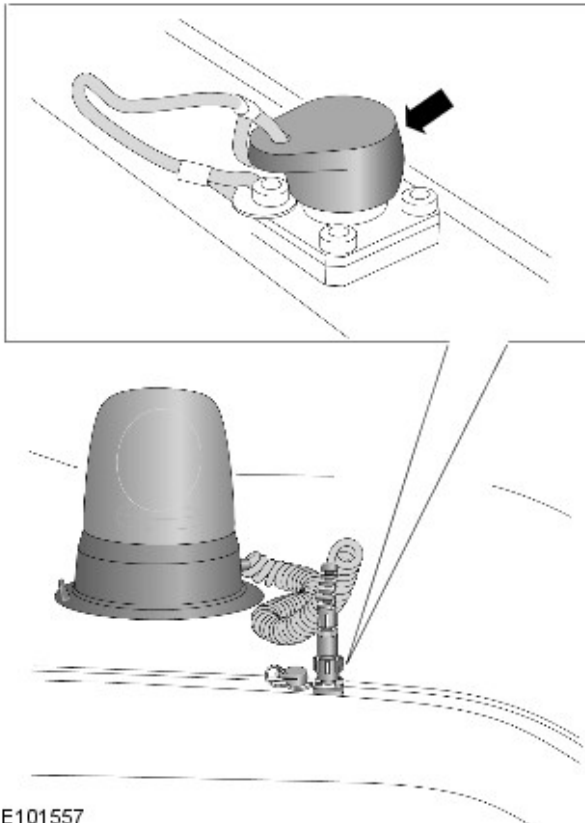
Overview

When activated, the beacon provides a flashing blue warning light to alert other road users of the vehicle's presence; in a similar manner to emergency service vehicles.

The beacon system comprises:

- a detachable rotating beacon with a magnetic base;
- an electrical socket with a weather cover, located on the vehicle's roof;
- a beacon switch located in the auxiliary switch pack.

Roof mounted beacon and socket with weather cover



E101557

System Operation

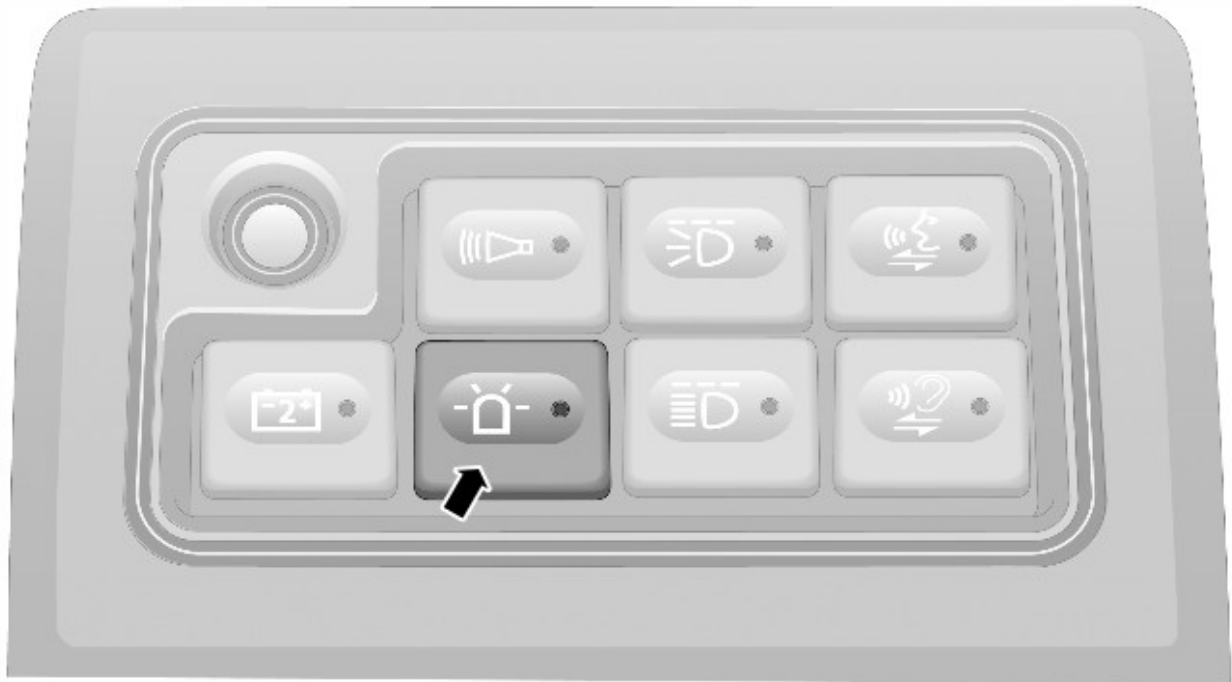
The beacon is activated when both the:

- ignition switch is 'On', and
- the beacon switch, in the auxiliary switch pack, is 'On'.

A status lamp in the beacon switch will illuminate when the switch is in the 'On' position.

The beacon attaches magnetically to the roof panel above the driver and connects electrically to a roof mounted socket. The beacon contains a 55 Watt halogen bulb and blue rotating reflector operated by the beacon switch in the auxiliary switch pack.

Beacon switch with integrated status lamp

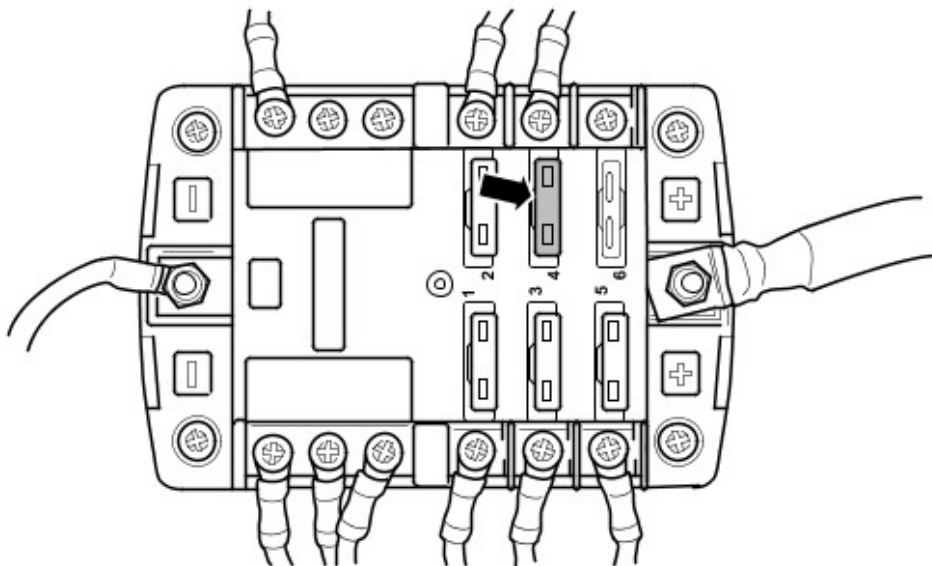


E101558

The electrical system for the beacon is supplied by the auxiliary battery, via the armoured vehicle options harness and 10 amp fuse (F4) in the satellite junction box.

For additional information, refer to: Battery and Cables (414-01, Description and Operation).

Satellite junction box with beacon fuse (F4) highlighted



E101559



NOTE: The supplementary circuit diagrams for the armoured vehicle are located in Land Rover GTR at: [Service Information, Discovery 3, 2008 Electrical Circuit Diagrams.](#)

Covert Lamps

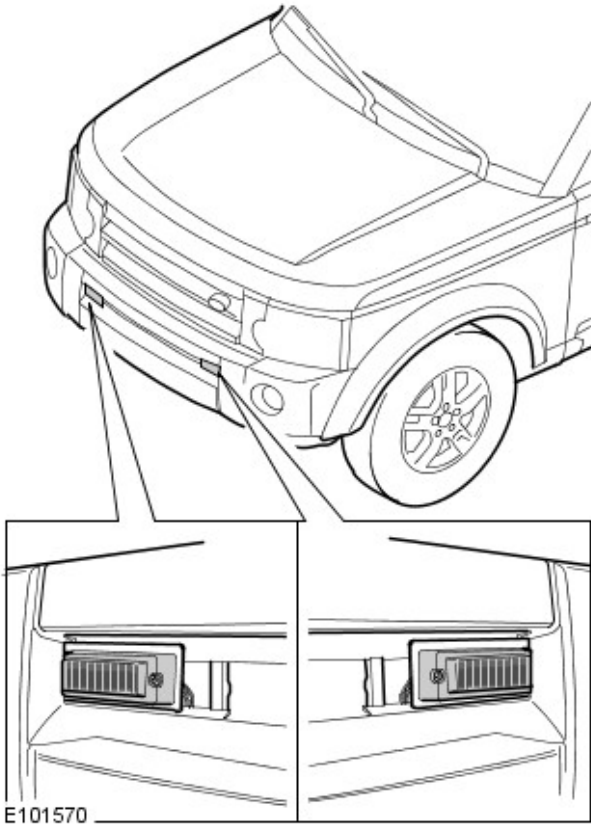
Overview

When activated, the covert lamps provide a blue alternating 'triple-flash' pattern from two lamps at the front of the vehicle. This is to alert other road users of the vehicle's presence; in a similar manner to emergency service vehicles.

The covert lamp system comprises:

- two blue LED (light emitting diode) lamps mounted in the front bumper;
- a covert-lamp switch located in the auxiliary switch pack.

Covert lamps



System Operation

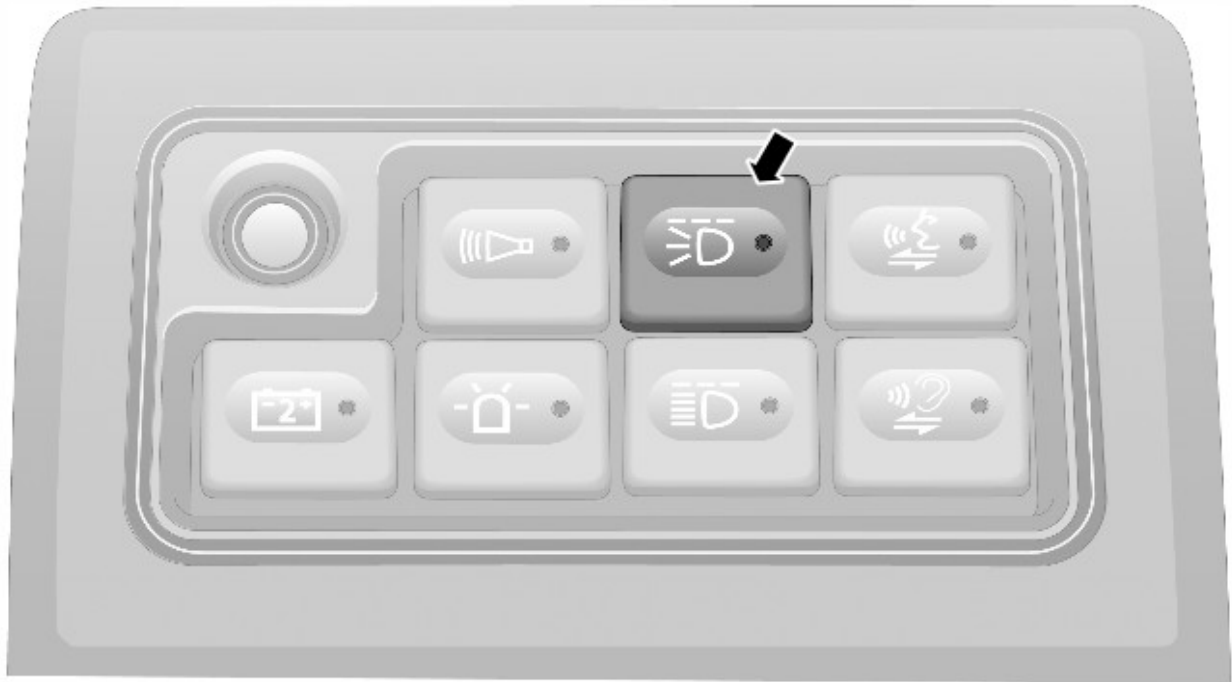
The covert lamps are activated when both the:

- ignition switch is 'On', and
- the covert lamp switch, in the auxiliary switch pack, is 'On'.

A status lamp in the covert lamp switch will illuminate when the switch is in the 'On' position.

When in the 'On' position, the contacts in the covert-lamp switch close, providing a battery feed to both the left-hand and right-hand lamps. Control of the lamp's triple-flash effect is through non-serviceable electronics contained in each lamp. Synchronisation of the lamp's alternating pattern is via a single wire in the options harness.

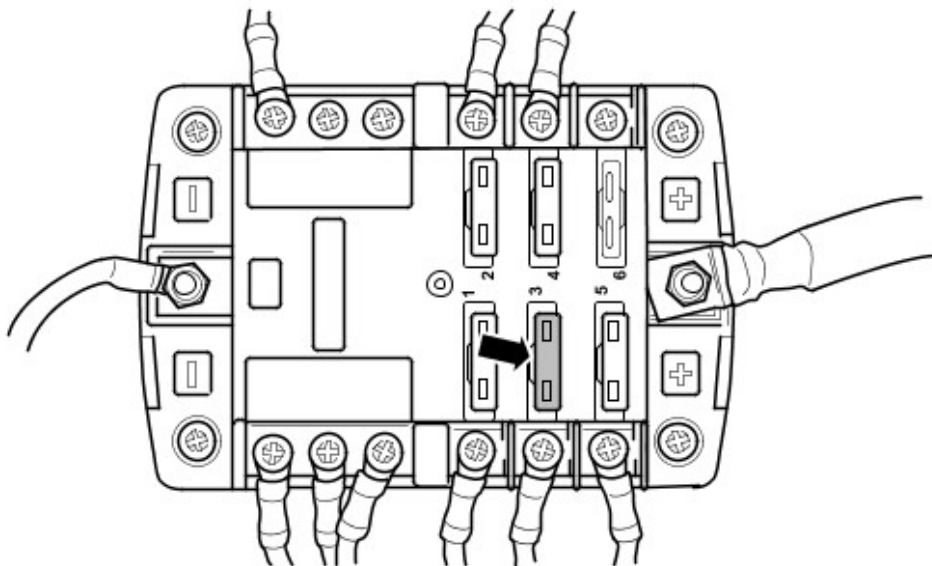
Covert-lamp switch with integrated status lamp



E101571

The electrical system for the covert lamps is supplied by the auxiliary battery, via the armoured vehicle options harness and 5 amp fuse (F3) in the satellite junction box.
For additional information, refer to: Battery and Cables (414-01, Description and Operation).

Satellite junction box with covert lamp fuse (F3) highlighted



E101572



NOTE: The supplementary circuit diagrams for the armoured vehicle are located in Land Rover GTR at: [Service Information, Discovery 3, 2008 Electrical Circuit Diagrams.](#)

Headlamp Flash

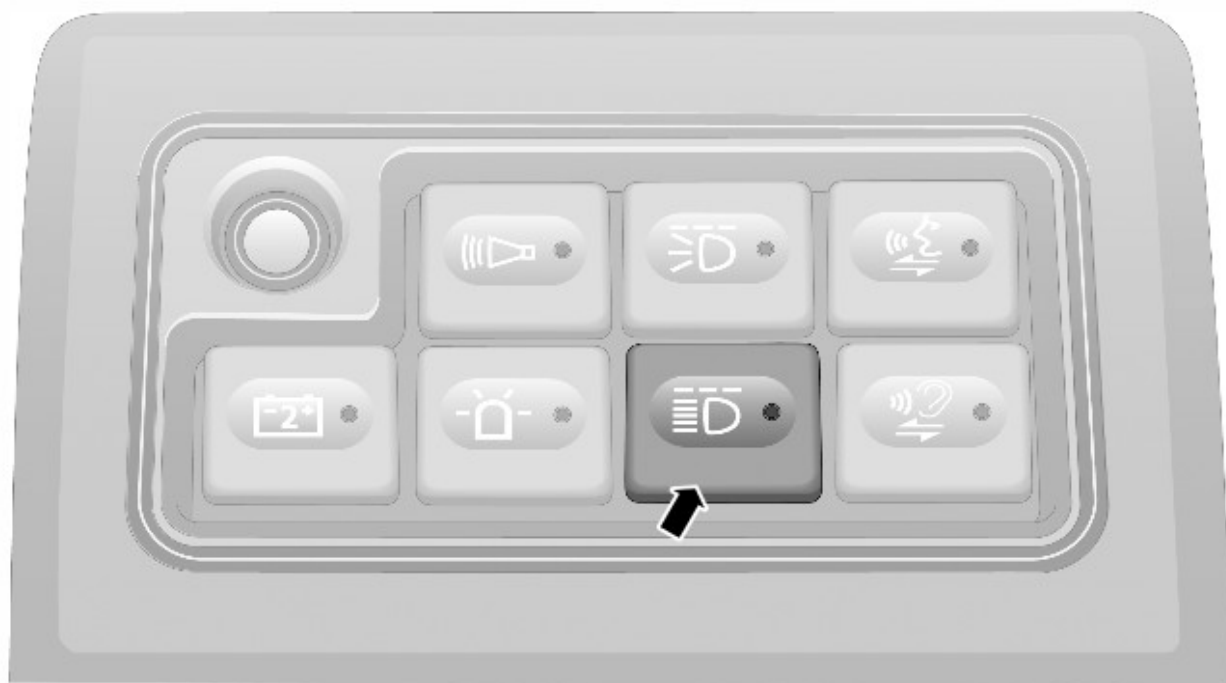
Overview

When activated, the headlamp flash feature causes the headlamps to flash alternately. This is used to alert other road users of the vehicle's presence; in a similar manner to emergency service vehicles.

System Operation

Headlamp flash does not contain any additional components over the standard vehicle other than a headlamp flash switch mounted in the auxiliary switch pack. The software to control the system is contained within the [LCM \(lighting control module\)](#). When the flashing headlamp facility is selected, the LCM will alternately flash the headlamps. The system utilises the halogen bulbs in the vehicle headlamp assemblies.

Headlamp flash switch with integrated status lamp



E101599

Headlamp flash is activated when both the:

- ignition switch is 'On', and
- the headlamp flash switch, in the auxiliary switch pack, is 'On'.

A status lamp in the headlamp switch will illuminate when the switch is in the 'On' position.

The flashing headlamp feature is enabled using Land Rover approved diagnostic equipment.



NOTE: The supplementary circuit diagrams for the armoured vehicle are located in Land Rover GTR at: Service Information, Discovery 3, 2008 Electrical Circuit Diagrams.

Exterior Lighting - Headlamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

Safety Information



WARNING: The xenon headlamp system generates up to 28,000 volts. Make sure that the headlamps are switched off before working on the system. Failure to follow this instruction may result in personal injury.

The following safety precautions must be followed when working on the xenon headlamp system:

1. DO NOT attempt any procedures on the xenon headlamps when the lights are switched on.
2. Handling of the xenon bulb must be performed using suitable protective equipment, e.g. gloves and goggles. The glass part of the bulb must not be touched.
3. Xenon bulbs must be disposed of as hazardous waste.
4. Only operate the lamp in a mounted condition in the reflector.

There are comprehensive instructions on the correct procedures for xenon headlamp system repairs in the workshop manual, refer to section 100-00 - General Information, Standard Workshop Procedures.

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Headlamp(s) condition and installation • Bulb(s) condition and installation • Bulb holder(s) condition and installation • Lighting control switch condition and installation • Steering column left multifunction switch condition and installation 	<ul style="list-style-type: none"> • Fuses • Relays • Wiring harness • Loose or corroded connector(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Headlamp Leveling Control Module (HLCM) • Xenon Bulb Control Modules (XBCM) • Instrument Cluster (IC) • Steering Angle Sensor Module (SASM) • Transmission Control Module (TCM) • Engine Control Module (ECM) • Anti-lock Brake System (ABS) control module • Air suspension control module • Local Interconnect Network (LIN) circuits • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Low beam lamp(s) inoperative	<ul style="list-style-type: none"> • Bulb failure • Fuse(s) blown 	<ul style="list-style-type: none"> • Check the bulb condition • Check the fuse condition
High beam lamp(s)	<ul style="list-style-type: none"> • Circuit fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the low/high

inoperative	<ul style="list-style-type: none"> Lighting control switch fault Steering column left multifunction switch fault 	<ul style="list-style-type: none"> beam circuits for open circuit Test the operation of the lighting control switch Test the operation of the steering column left multifunction switch fault Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Low beam lamp(s) dim	<ul style="list-style-type: none"> Incorrect bulb rating Tourist lever set in the wrong position Circuit fault Lighting control switch fault Steering column left multifunction switch fault 	<ul style="list-style-type: none"> Check the bulb condition and rating Check the tourist lever is set correctly Refer to the electrical circuit diagrams and test the low/high beam circuits for high resistance Test the operation of the lighting control switch Test the operation of the steering column left multifunction switch fault
High beam lamp(s) dim		
Low beam lamp(s) stuck on	<ul style="list-style-type: none"> Circuit fault Lighting control switch fault Steering column left multifunction switch fault Headlamp timer function fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the headlamp low/high beam circuits for short circuit to power Test the operation of the lighting control switch Test the operation of the steering column left multifunction switch fault Test the operation of the headlamp timer Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
High beam lamp(s) stuck on		
Headlamp low/high beam switching function inoperative	<ul style="list-style-type: none"> Circuit fault Steering column left multifunction switch fault Xenon lamp shutter mechanism fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the low/high beam switching circuit for short circuit to ground, short circuit to power, open circuit, high resistance Test the operation of the steering column left multifunction switch fault Test the operation of the xenon lamp shutter mechanism Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Warning indicator(s) inoperative	<ul style="list-style-type: none"> Fuse(s) blown Lighting control switch fault Steering column left multifunction switch fault Circuit fault Instrument cluster fault 	<ul style="list-style-type: none"> Check the fuse(s) Test the operation of the lighting control switch Test the operation of the steering column left multifunction switch fault Refer to the electrical circuit diagrams and test the warning indicator circuit for short circuit to ground, short circuit to power, open circuit, high resistance Using the manufacturer approved diagnostic system, check the Instrument Cluster (IC) for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Headlamp Leveling Control Module (HCM) (100-00 General Information, Description and Operation) /

Diagnostic Trouble Code (DTC) Index - DTC: Rear View Mirror (100-00 General Information, Description and Operation).

Exterior Lighting - Headlamp Leveling

Diagnosis and Testing

Principle of Operation

For a detailed description of the headlamp leveling system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Headlamp leveling motor(s) and linkage(s) condition and installation • Lighting control switch condition and installation • Steering column left multifunction switch condition and installation 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Loose or corroded connector(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Headlamp Leveling Control Module (HLCM) • Engine Control Module (ECM) • Anti-lock Brake System (ABS) control module • Air suspension control module • Local Interconnect Network (LIN) circuits • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Headlamp leveling system inoperative	<ul style="list-style-type: none"> • Fuse(s) blown • Leveling motor/linkage fault • Headlamp leveling circuit short circuit to ground, open circuit, high resistance • Air suspension system fault 	<ul style="list-style-type: none"> • Check the fuse(s) condition • Check the headlamp leveling motor and linkage condition • Refer to the electrical circuit diagrams and test the headlamp leveling circuit for short circuit to ground, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the air suspension control module for related DTCs and refer to the relevant DTC index
Headlamp alignment incorrect		

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Headlamp Leveling Control Module (HCM) (100-00 General Information, Description and Operation) /

Diagnostic Trouble Code (DTC) Index - DTC: Rear View Mirror (100-00 General Information, Description and Operation).

Exterior Lighting - Stoplamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Stop lamp condition and installation • Bulbs and installation • Bulb holders and installation • Brake pedal switch condition and installation 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Loose or corroded connector(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Engine Control Module (ECM) • Anti-lock Brake System control module (ABS) • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Stop lamp(s) inoperative	<ul style="list-style-type: none"> • Bulb failure • LED lamp failure • Fuse(s) blown • Stop lamp circuit short circuit to ground, short circuit to power, open circuit, high resistance • Brake pedal switch fault 	<ul style="list-style-type: none"> • Check the bulb(s) • Check the LEDs • Check the fuses • Refer to the electrical circuit diagrams and test the stop lamp circuit for short circuit to ground, open circuit, high resistance • Using the manufacturer approved diagnostic system, check datalogger signal - Brake Switch (0x0416) • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index
Stop lamp(s) dim	<ul style="list-style-type: none"> • Stop lamp circuit high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the stop lamp circuit for high resistance
Stop lamp(s) stuck on	<ul style="list-style-type: none"> • Brake pedal switch fault • Stop lamp circuit short circuit to power 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check datalogger signal - Brake Switch (0x0416) • Refer to the electrical circuit diagrams and test the stop lamp circuit for short circuit to power • Using the manufacturer approved diagnostic system, check the Engine Control Module (ECM) for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00, Description and Operation).

Exterior Lighting - Turn Signal, Cornering and Hazard Lamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Turn signal indicator lamp(s) condition and installation • Cornering lamp(s) condition and installation • Bulbs condition and installation • Bulb holders condition and installation • Lighting control switch condition and installation • Steering column left multifunction switch condition and installation • Hazard warning lamp switch condition and installation 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Loose or corroded connector(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Steering Angle Sensor Module (SASM) • Anti-lock Brake System control module (ABS) • Instrument Cluster (IC) • Headlamp Leveling Control Module (HLCM) • Restraints Control Module (RCM) • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Turn signal indicator / hazard warning lamp(s) inoperative	<ul style="list-style-type: none"> • Bulb failure • Fuse(s) blown • Turn signal indicator / hazard warning lamp(s) circuit short circuit to ground, open circuit, high resistance • Steering column left multifunction switch fault • Hazard warning lamp switch fault 	<ul style="list-style-type: none"> • Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the turn signal indicator / hazard warning lamp(s) circuits for short circuit to ground, open circuit, high resistance • Test the operation of the steering column left multifunction switch • Test the operation of the hazard warning lamp switch • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Turn signal indicator / hazard warning lamp(s) dim	<ul style="list-style-type: none"> • Incorrect bulb rating • Turn signal indicator / hazard warning lamp(s) circuit high resistance • Steering column left multifunction switch fault • Hazard warning lamp switch fault 	<ul style="list-style-type: none"> • Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the turn signal indicator / hazard warning lamp(s) circuits for high resistance • Test the operation of the steering column left multifunction switch • Test the operation of the hazard warning lamp switch
Turn signal indicator / hazard warning lamp(s) stuck on	<ul style="list-style-type: none"> • Turn signal indicator / hazard warning lamp(s) circuit short circuit to power • Steering column left 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the turn signal indicator / hazard warning lamp(s) circuits for short circuit to power • Test the operation of the steering column left

	<ul style="list-style-type: none"> multifunction switch fault Hazard warning lamp switch fault 	<ul style="list-style-type: none"> multifunction switch Test the operation of the hazard warning lamp switch Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Warning indicator(s) inoperative	<ul style="list-style-type: none"> Fuse(s) blown Steering column left multifunction switch fault Hazard warning lamp switch fault Warning indicator circuit short circuit to ground, open circuit, high resistance Instrument cluster fault 	<ul style="list-style-type: none"> Check the fuse(s) Test the operation of the steering column left multifunction switch Test the operation of the hazard warning lamp switch Refer to the electrical circuit diagrams and test the warning indicator circuit for short circuit to ground, open circuit, high resistance Using the manufacturer approved diagnostic system, check the Instrument Cluster (IC) for related DTCs and refer to the relevant DTC index
Cornering lamp(s) inoperative	<ul style="list-style-type: none"> Bulb failure Fuse(s) blown Cornering lamps circuit short circuit to ground, open circuit, high resistance Steering column left multifunction switch fault Lighting control switch fault 	<ul style="list-style-type: none"> Check the bulb condition Check the fuse condition Refer to the electrical circuit diagrams and test the cornering lamps circuit for short circuit to ground, open circuit, high resistance Test the operation of the steering column left multifunction switch Test the operation of the lighting control switch
Cornering lamp(s) dim	<ul style="list-style-type: none"> Incorrect bulb rating Cornering lamps circuit high resistance Steering column left multifunction switch fault Lighting control switch fault 	<ul style="list-style-type: none"> Check the bulb condition and rating Refer to the electrical circuit diagrams and test the cornering lamps circuit for high resistance Test the operation of the steering column left multifunction switch Test the operation of the lighting control switch
Cornering lamp(s) stuck on	<ul style="list-style-type: none"> Steering column left multifunction switch fault Lighting control switch fault Cornering lamps circuit short circuit to power 	<ul style="list-style-type: none"> Test the operation of the steering column left multifunction switch Test the operation of the lighting control switch Refer to the electrical circuit diagrams and test the cornering lamps circuit for high resistance Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00, Description and Operation).

Exterior Lighting - Parking, Rear and License Plate Lamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Tail lamp(s) condition and installation • License lamp(s) condition and installation • Bulbs and installation • Bulb holders and installation • Lighting control switch and installation • Rain/light sensor condition and installation 	<ul style="list-style-type: none"> • Fuses • Relays • Wiring harness • Loose or corroded connector(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Rain/light sensor control module • Local Interconnect Network (LIN) circuits • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Tail / license plate lamp(s) inoperative	<ul style="list-style-type: none"> • Bulb failure • Fuse(s) blown • Tail / license plate lamp(s) circuit short circuit to ground, open circuit, high resistance • Lighting control switch fault 	<ul style="list-style-type: none"> • Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the tail / license plate lamp(s) circuit for short circuit to ground, open circuit, high resistance • Test the operation of the lighting control switch • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Tail / license plate lamp(s) dim	<ul style="list-style-type: none"> • Incorrect bulb rating • Tail / license plate lamp(s) circuit high resistance • Lighting control switch fault 	<ul style="list-style-type: none"> • Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the tail / license plate lamp(s) circuit for high resistance • Test the operation of the lighting control switch
Tail / license plate lamp(s) stuck on	<ul style="list-style-type: none"> • Tail / license plate lamp(s) circuit short circuit to power • Lighting control switch fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the tail / license plate lamp(s) circuit for short circuit to power • Test the operation of the lighting control switch • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Tail / license plate lamp(s) inoperative when the	<ul style="list-style-type: none"> • Fuse(s) blown • Lighting control switch 	<ul style="list-style-type: none"> • Check the fuse(s) • Test the operation of the lighting control

<p>automatic headlamp switch option is selected</p>	<p>fault</p> <ul style="list-style-type: none"> • Autolamps circuit short circuit to ground, short circuit to power, open circuit, high resistance • Rain/light sensor fault • Rain/light sensor LIN circuit fault 	<p>switch</p> <ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the autolamps circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Refer to the electrical circuit diagrams and test the rain/light sensor power and ground circuits for open circuit, high resistance • Refer to the electrical circuit diagrams and test the rain/light sensor LIN circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
---	---	---

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00, Description and Operation).

Exterior Lighting - Front Fog Lamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Front fog lamp condition and installation • Bulb and installation • Bulb holder and installation • Adjuster screw • Fog lamp switch condition and installation 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Loose or corroded connector(s) • Fog lamp warning indicator • Fog lamp switch • Battery Junction Box (BJB) • Central Junction Box (CJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Fog lamp inoperative	<ul style="list-style-type: none"> • Bulb failure • Fuse(s) blown • Front fog lamp circuit short circuit to ground, open circuit, high resistance • Front fog lamp switch fault 	<ul style="list-style-type: none"> • Check the bulb condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the front fog lamp circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Test the operation of the front fog lamp switch
Fog lamp dim	<ul style="list-style-type: none"> • Incorrect bulb rating • Front fog lamp circuit short circuit to power • Front fog lamp switch fault 	<ul style="list-style-type: none"> • Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the front fog lamp circuits for short circuit to power • Test the operation of the front fog lamp switch
Fog lamp lighting coverage poor	<ul style="list-style-type: none"> • Fog lamp alignment incorrect 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual and adjust the front fog lamps alignment
Warning lamp inoperative	<ul style="list-style-type: none"> • Fuse(s) blown • Front fog lamp switch fault • Instrument cluster fault 	<ul style="list-style-type: none"> • Check the fuse(s) • Test the operation of the front fog lamp switch • Using the manufacturer approved diagnostic system, check the Instrument Cluster (IC) for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00, Description and Operation).

Exterior Lighting - Rear Fog Lamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Rear fog lamp condition and installation • Bulb holder and installation • Bulb and installation • Rear fog lamp switch condition and installation 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Loose or corroded connector(s) • Rear fog lamp warning indicator • Rear fog lamp switch • Battery Junction Box (BJB) • Central Junction Box (CJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Rear fog lamp inoperative	<ul style="list-style-type: none"> • Bulb failure • Fuse(s) blown • Rear fog lamp circuit short circuit to ground, open circuit, high resistance • Rear fog lamp switch fault 	<ul style="list-style-type: none"> • Check the bulb condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the rear fog lamp circuit for short circuit to ground, open circuit, high resistance • Test the operation of the rear fog lamp switch • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Rear fog lamp dim	<ul style="list-style-type: none"> • Incorrect bulb rating • Rear fog lamp circuit high resistance • Rear fog lamp switch fault 	<ul style="list-style-type: none"> • Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the rear fog lamp circuit for high resistance • Test the operation of the rear fog lamp switch
Warning lamp inoperative	<ul style="list-style-type: none"> • Fuse(s) blown • Rear fog lamp switch fault • Instrument cluster fault 	<ul style="list-style-type: none"> • Check the fuse(s) • Test the operation of the rear fog lamp switch • Using the manufacturer approved diagnostic system, check the Instrument Cluster (IC) for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00, Description and Operation).

Exterior Lighting - Reversing Lamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Reverse lamp condition and installation • Reverse lamp bulb and installation • Reverse lamp bulb holder and installation 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Loose or corroded connector(s) • Reverse lamp relay • Battery Junction Box (BJB) • Central Junction Box (CJB) • Transmission Control Module (TCM) • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Reverse lamp(s) inoperative	<ul style="list-style-type: none"> • Bulb failure • Fuse(s) blown • Reverse lamp circuit short circuit to ground, short circuit to power, open circuit, high resistance • Missing reverse switch signal 	<ul style="list-style-type: none"> • Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the reverse lamp circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Reverse lamp(s) dim	<ul style="list-style-type: none"> • Incorrect bulb rating • Reverse lamp circuit high resistance 	<ul style="list-style-type: none"> • Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the reverse lamp circuit for high resistance

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00, Description and Operation).

Exterior Lighting - Trailer Lamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.

NOTES:



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Prior to carrying out fault diagnosis of the trailer lamp system, verify the operation of the towing vehicle lighting system with the trailer lighting plug(s) disconnected from the vehicle socket(s).

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Trailer lamp(s) condition and installation • Bulbs and installation • Bulb holders and installation • Trailer socket(s), plug(s) and installation 	<ul style="list-style-type: none"> • Fuses • Relays • Stop lamp switch • Wiring harness • Loose or corroded connector(s) • Trailer socket(s) ground circuit(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Trailer fuse box • Trailer relay box • Instrument Cluster (IC) • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Trailer stop lamp(s) inoperative	<ul style="list-style-type: none"> • Bulb failure • Fuse(s) blown • Trailer stop lamp circuit short circuit to ground, open circuit, high resistance • Brake lamp switch fault 	<ul style="list-style-type: none"> • Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer stop lamp circuit for short circuit to ground, open circuit, high resistance • Using the manufacturer approved diagnostic system, check datalogger signal - Brake Switch (0x0416)
Trailer stop lamp(s) dim	<ul style="list-style-type: none"> • Incorrect bulb rating • Trailer stop lamp circuit high resistance • Brake lamp switch fault 	<ul style="list-style-type: none"> • Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the trailer stop lamp circuit for high resistance • Using the manufacturer approved diagnostic system, check datalogger signal - Brake Switch (0x0416)
Trailer stop lamp(s) stuck on	<ul style="list-style-type: none"> • Trailer stop lamp circuit short circuit to power • Brake lamp switch fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the trailer stop lamp circuit for short circuit to power • Using the manufacturer approved diagnostic system, check datalogger signal - Brake Switch (0x0416)
Trailer fog	<ul style="list-style-type: none"> • Bulb failure 	<ul style="list-style-type: none"> • Check the bulb condition

lamp(s) inoperative	<ul style="list-style-type: none"> • Fuse(s) blown • Trailer fog lamp circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer fog lamp circuit for short circuit to ground, open circuit, high resistance
Trailer fog lamp(s) dim	<ul style="list-style-type: none"> • Incorrect bulb rating • Trailer fog lamp circuit high resistance 	<ul style="list-style-type: none"> • Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the trailer fog lamp circuit for high resistance
Trailer fog lamp(s) stuck on	<ul style="list-style-type: none"> • Trailer fog lamp circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the trailer fog lamp circuit for short circuit to power
Trailer tail / license plate lamp(s) inoperative	<ul style="list-style-type: none"> • Bulb failure • Fuse(s) blown • Trailer tail / license plate lamp circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer tail / license plate lamp circuit for short circuit to ground, open circuit, high resistance
Trailer tail / license plate lamp(s) dim	<ul style="list-style-type: none"> • Incorrect bulb rating • Trailer tail / license plate lamp circuit high resistance 	<ul style="list-style-type: none"> • Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the trailer tail / license plate lamp circuit for high resistance
Trailer tail / license plate lamp(s) stuck on	<ul style="list-style-type: none"> • Trailer tail / license plate lamp circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the trailer tail / license plate lamp circuit for short circuit to power
Trailer turn signal lamp(s) inoperative	<ul style="list-style-type: none"> • Bulb failure • Fuse(s) blown • Trailer turn signal lamp circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer turn signal lamp circuit for short circuit to ground, open circuit, high resistance
Trailer turn signal lamp(s) dim	<ul style="list-style-type: none"> • Incorrect bulb rating • Trailer turn signal lamp circuit high resistance 	<ul style="list-style-type: none"> • Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the trailer turn signal lamp circuit for high resistance
Trailer turn signal lamp(s) stuck on	<ul style="list-style-type: none"> • Trailer turn signal lamp circuit short circuit to power 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the trailer turn signal lamp circuit for short circuit to power
Trailer reverse lamp(s) inoperative	<ul style="list-style-type: none"> • Bulb failure • Fuse(s) blown • Trailer reverse lamp circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Check the bulb condition • Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer reverse lamp circuit for short circuit to ground, open circuit, high resistance
Trailer reverse lamp(s) dim	<ul style="list-style-type: none"> • Incorrect bulb rating • Trailer reverse lamp circuit high resistance 	<ul style="list-style-type: none"> • Check the bulb condition and rating • Refer to the electrical circuit diagrams and test the trailer reverse lamp circuit for high resistance
Trailer reverse lamp(s) stuck on	<ul style="list-style-type: none"> • Trailer reverse lamp circuit short circuit to power • Trailer reverse lamp relay fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the trailer reverse lamp circuit for short circuit to power • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Warning lamp(s) inoperative	<ul style="list-style-type: none"> • Fuse(s) blown • Instrument cluster fault 	<ul style="list-style-type: none"> • Check the fuse condition • Using the manufacturer approved diagnostic system, check the Instrument Cluster (IC) for related DTCs and refer to the relevant DTC index
Trailer battery power inoperative	<ul style="list-style-type: none"> • Fuse(s) blown • Trailer battery power circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer battery power circuit for short circuit to ground, open circuit, high resistance
Trailer ignition power inoperative	<ul style="list-style-type: none"> • Fuse(s) blown • Trailer ignition power circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Check the fuse condition • Refer to the electrical circuit diagrams and test the trailer ignition power circuit for short circuit to ground, open circuit, high resistance

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00, Description and

Operation).

Exterior Lighting - Autolamps

Diagnosis and Testing

Principle of Operation

For a detailed description of the exterior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Exterior Lighting (417-01 Exterior Lighting, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Lighting control switch and installation • Rain/light sensor condition and installation • Steering column right multifunction switch condition and installation 	<ul style="list-style-type: none"> • Fuses • Relays • Wiring harness • Loose or corroded connector(s) • Battery Junction Box (BJB) • Central Junction Box (CJB) • Rain/light sensor control module • Local Interconnect Network (LIN) circuits • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Side and headlamp(s) inoperative when the autolamps option is selected	<ul style="list-style-type: none"> • Fuse(s) blown • Lighting control switch fault • Steering column left multifunction switch fault • Autolamps circuit short circuit to ground, short circuit to power, open circuit, high resistance • Rain/light sensor fault • LIN circuit fault 	<ul style="list-style-type: none"> • Check the fuse(s) • Test the operation of the lighting control switch • Test the operation of the steering column left multifunction switch • Refer to the electrical circuit diagrams and test the autolamps circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Lighting control switch illumination inoperative	<ul style="list-style-type: none"> • Fuse(s) blown • Lighting control switch fault 	<ul style="list-style-type: none"> • Check the fuse(s) • Test the operation of the lighting control switch • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: (100-00)

Diagnostic Trouble Code (DTC) Index - DTC: Headlamp Leveling Control Module (HCM) (Description and Operation),

Diagnostic Trouble Code (DTC) Index - DTC: Rear View Mirror (Description and Operation),
Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (Description and Operation).

Exterior Lighting - Headlamp Adjustment

General Procedures

NOTES:



With self leveling suspension, make sure the vehicle is at the standard ride height.



The headlamp setting is 1.2 % below horizontal and parallel.



NAS vehicles have vertical adjustment only.

1. Align the headlamp beam setting equipment to one headlamp.

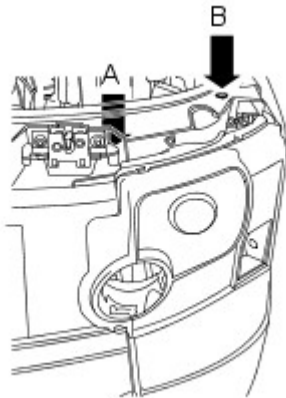
2. Switch the headlamps on and to dipped beam.



3. **NOTE: NAS vehicles have vertical adjustment only.**

Adjust the headlamps with a Philips screwdriver.

- Rotate the adjusters A and B by an equal amount for vertical alignment.
- Rotate the adjusters A or B for horizontal alignment.



E49808

4. To adjust the second headlamp, repeat the above procedure.

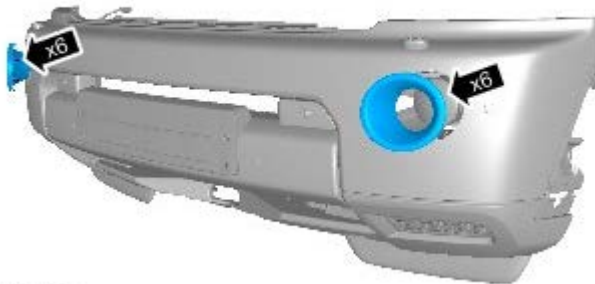
Exterior Lighting - Front Fog Lamp Adjustment

General Procedures

Check



NOTE: With self leveling suspension, make sure the vehicle is at the standard ride height.



E123793

1. NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.

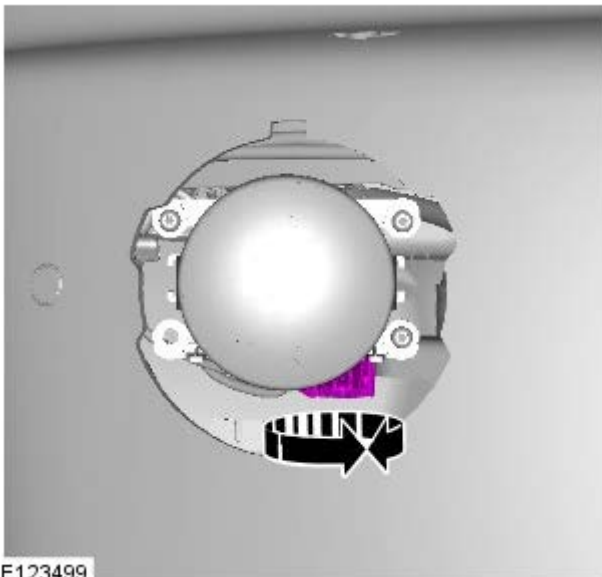


The fog lamp setting is 2% below horizontal.

Adjustment



NOTE: With self leveling suspension, make sure the vehicle is at the standard ride height.



E123499

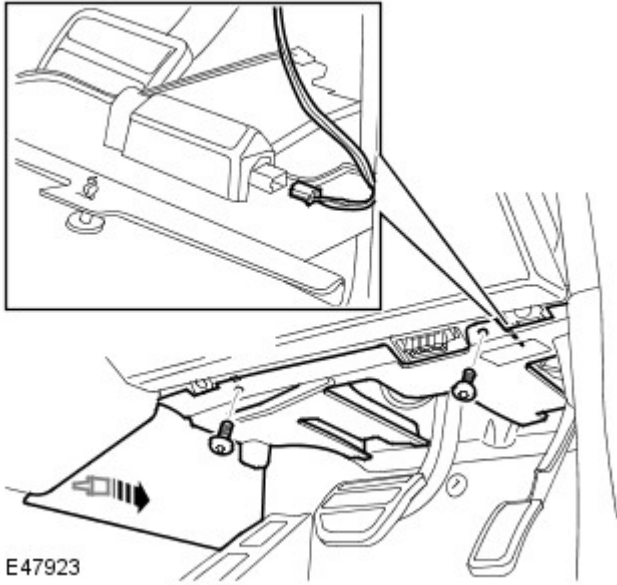
1.  NOTE: The procedure must be carried out on both sides.

Exterior Lighting - Stoplamp Switch

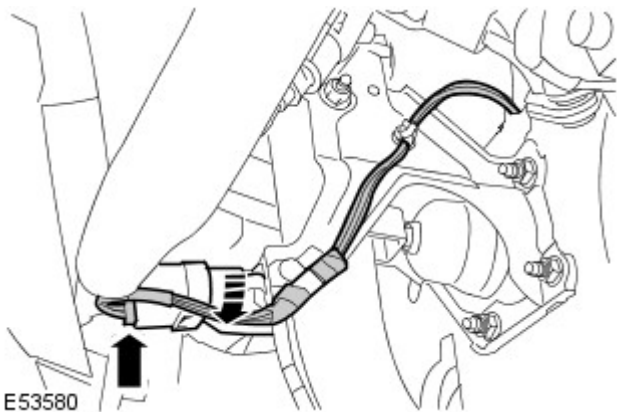
Removal and Installation

Removal


1. Remove the closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.



E47923



E53580


2.  **CAUTION:** The brake pedal **MUST NOT** be depressed during this operation. Failure to comply will result in damage to the stoplamp switch.


Remove the stoplamp switch.

- Disconnect the electrical connector.
- Rotate the switch clockwise.

Installation

1. **CAUTIONS:**

 The brake pedal **MUST NOT** be depressed during this operation. Failure to comply will result in damage to the stoplamp switch.

 Make sure that excessive force is not used when installing the stoplamp switch. Failure to follow this instruction may result in damage to the stoplamp switch.

Install the stoplamp switch.

- Rotate the switch counterclockwise.
- Connect the electrical connector.

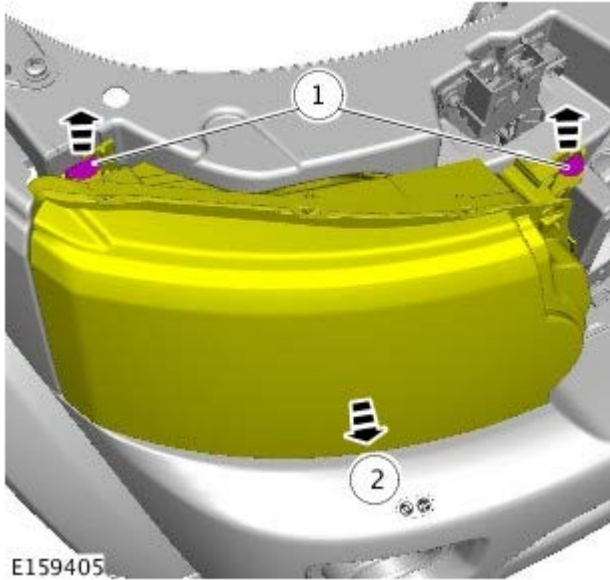
2. Install the closing trim panel.
 - Connect the electrical connector.
 - Secure the clip.
 - Tighten the screws.


Exterior Lighting - Headlamp Assembly

Removal and Installation

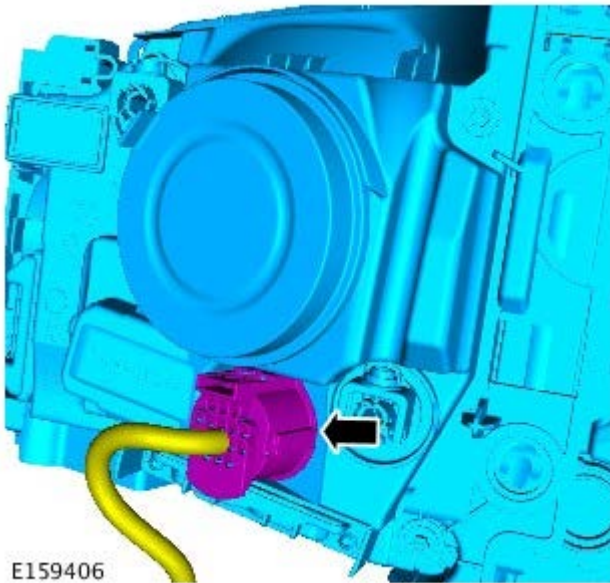
Removal


1. Refer to: [Radiator Grille](#) (501-08 Exterior Trim and Ornamentation, Removal and Installation).

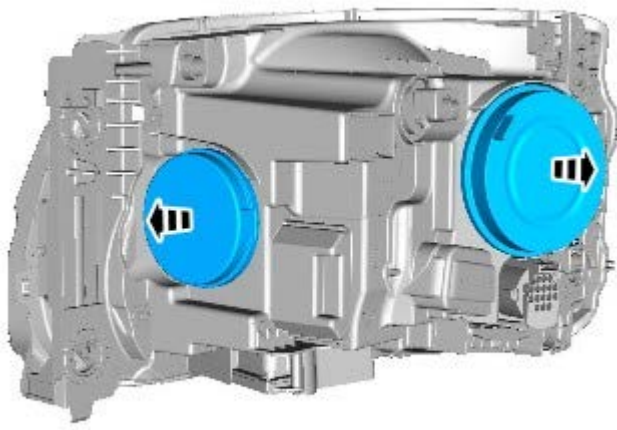


2.  CAUTION: Always protect paintwork and glass when removing exterior components.

- 3.

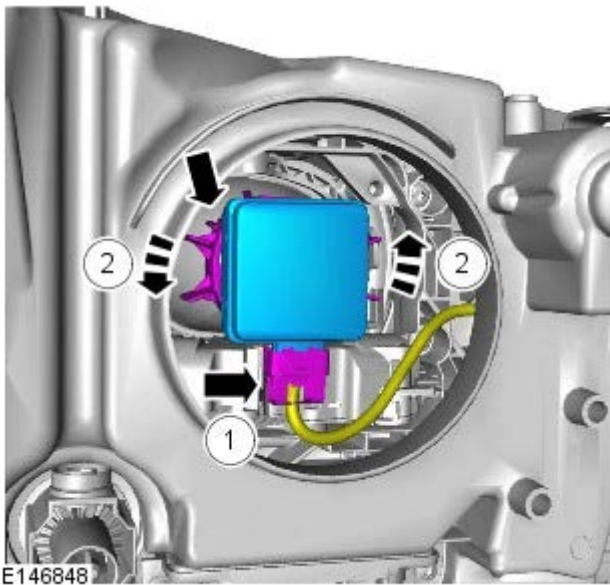


4.  NOTE: Do not disassemble further if the component is removed for access only.



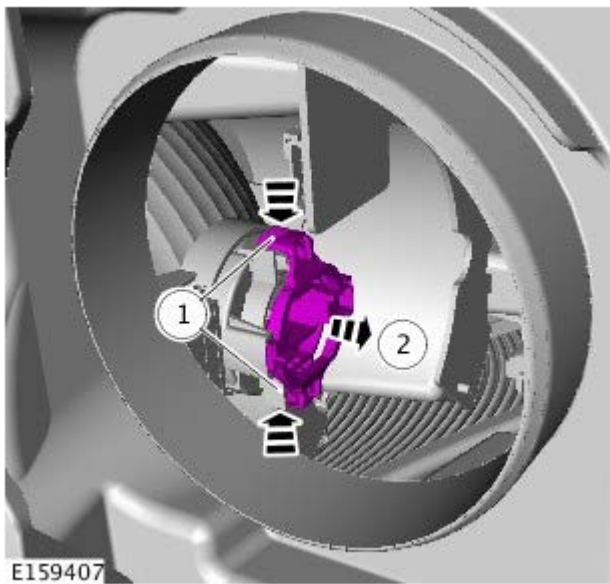
E159404

5.



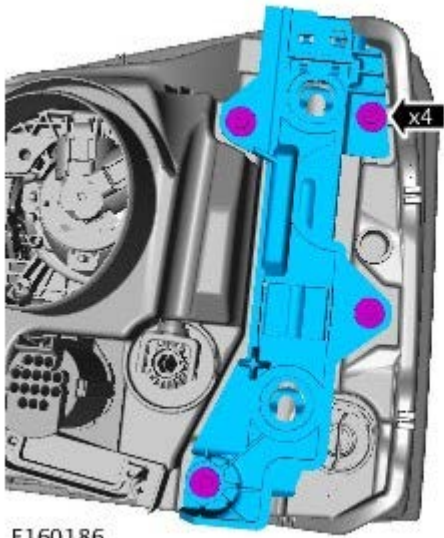
E146848

6.



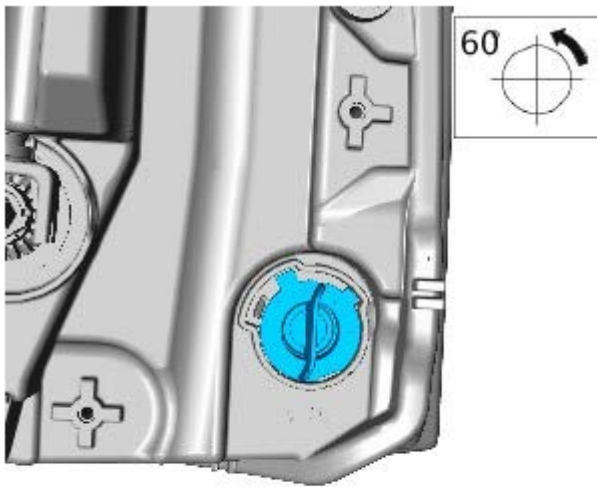
E159407

7.



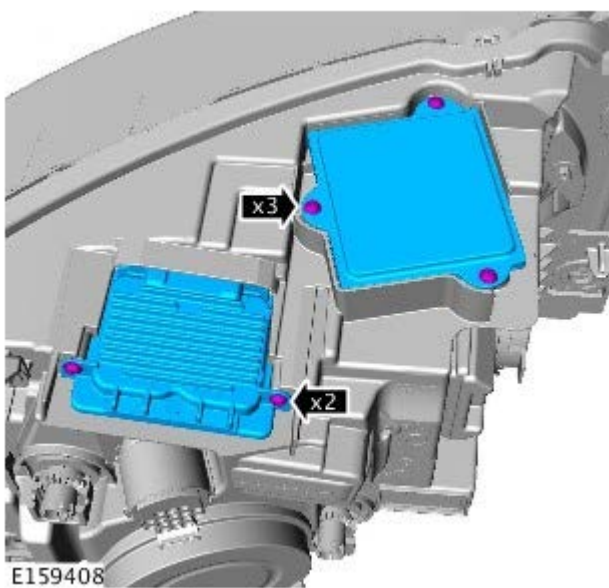
E160186

8.



E160185

9.



E159408

Installation

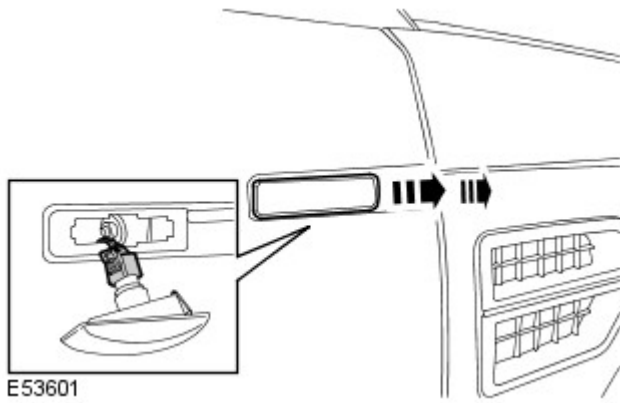
1. To install reverse the removal procedure.

Exterior Lighting - Side Turn Signal Lamp

Removal and Installation

Removal

1. Remove the side turn signal lamp.
 - Push the lamp forwards to release it from the door.
 - Disconnect the electrical connector.



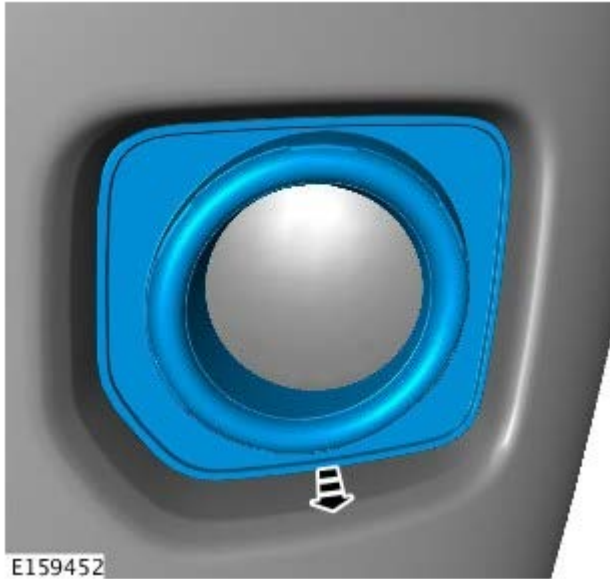
Installation


1. To install, reverse the removal procedure.

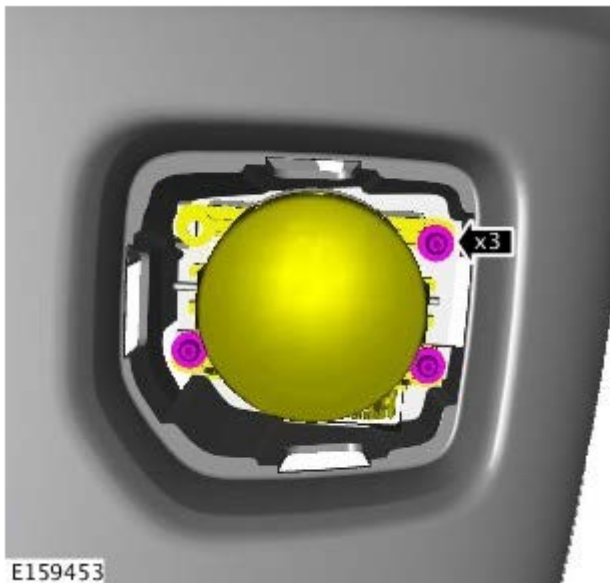
Exterior Lighting - Front Fog Lamp

Removal and Installation

Removal

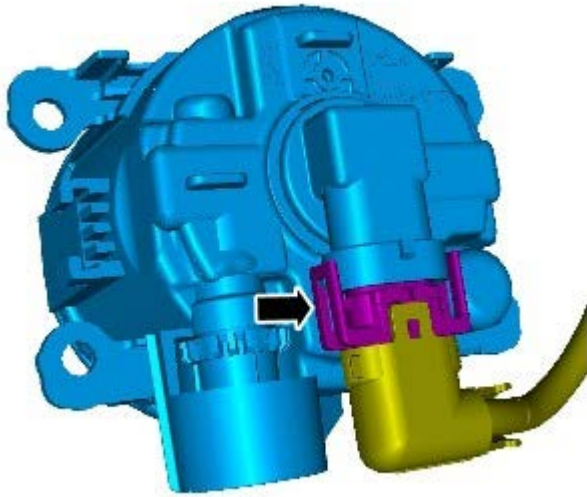


1.  CAUTION: Always protect paintwork and glass when removing exterior components.



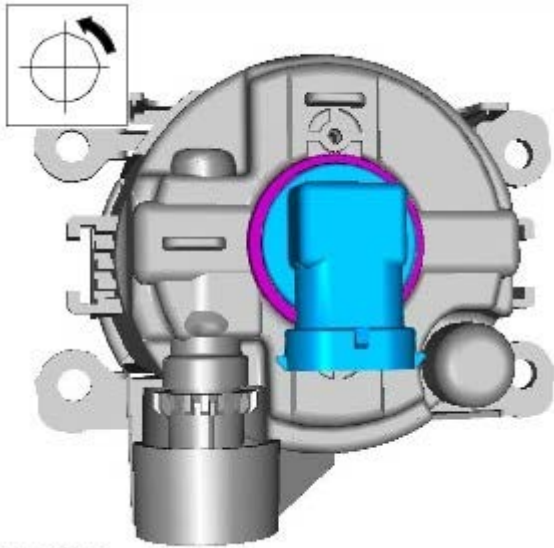
- 2.

- 3.



E159454

4.



E159455

Installation

1. To install, reverse the removal procedure.

Exterior Lighting - High Mounted Stoplamp

Removal and Installation

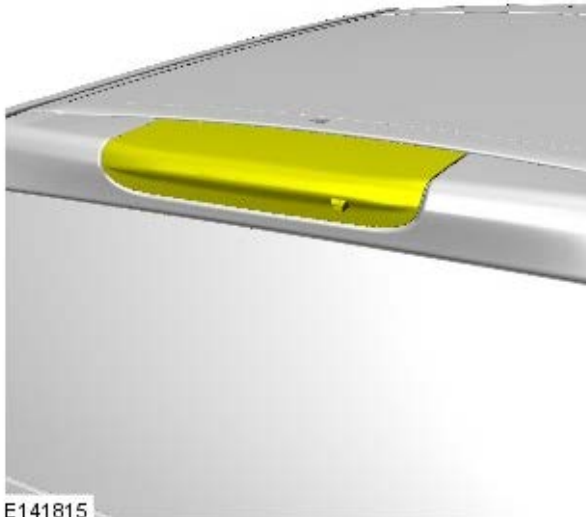
Removal

1. For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

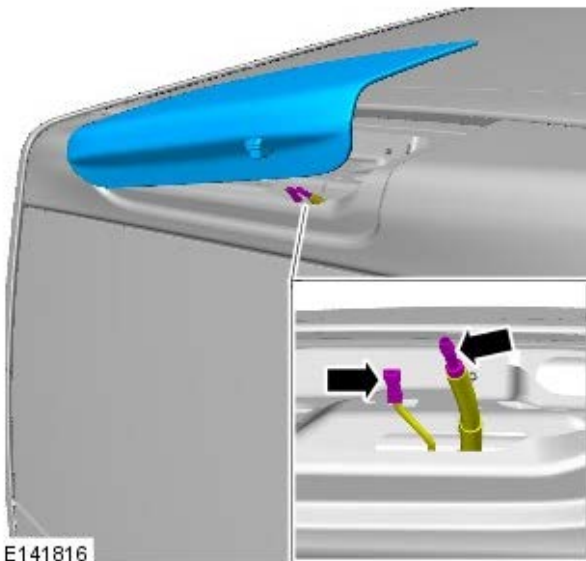
2. CAUTIONS:

 Using a selection of appropriate glazing knife blades, carefully cut through the sealant.


 Protect the surrounding paintwork to avoid damage.



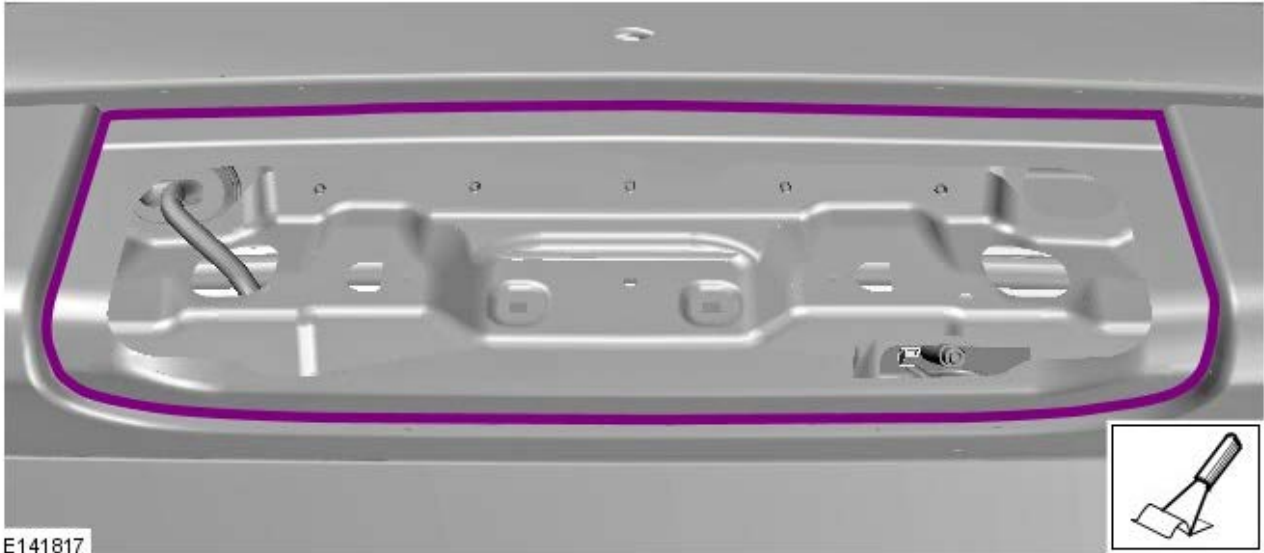
3.  NOTE: Discard the component.




Installation

1.  CAUTION: Make sure that the mating faces are clean and free of foreign material.


 NOTE: Apply etch primer to any bare metal, apply primer over the etch primer.

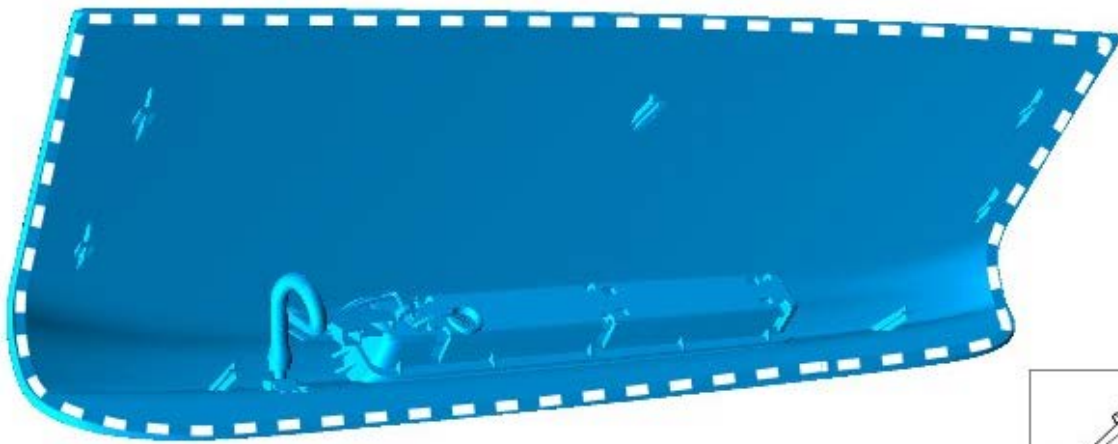


2.  CAUTION: Touching the adhesive surface will impair rebonding.

NOTES:

 Apply activator to the high mounted stop lamp.


 Apply an 8.0 mm wide continuous bead of sealant, 15.0 mm in, from the outer edge of the high mounted stoplamp.

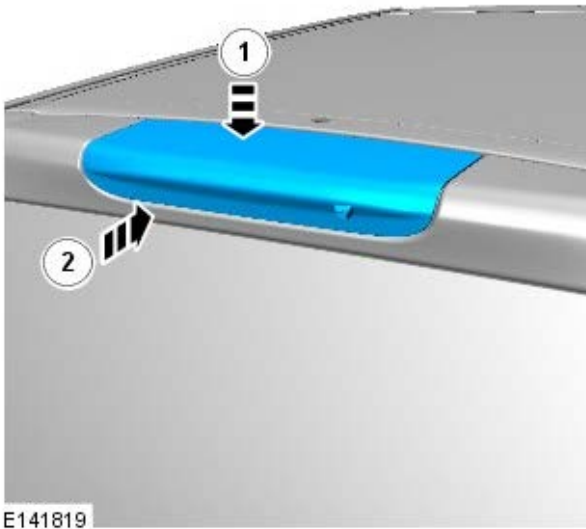


E141818

3. CAUTIONS:

 Make sure that the component is correctly located on the locating dowels.

 Make sure that no excess sealant residue is evident.



4. For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Exterior Lighting - Adaptive Front Lighting Module

Removal and Installation

Removal

1. Passenger side: Remove the cowl side trim panel.
For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).
2. Remove the CJB.
For additional information, refer to: Central Junction Box (CJB) (418-00, Removal and Installation).
3. Remove the adaptive front lighting module.
 - Disconnect the electrical connector.
 - Remove the bolt.



E55696

Installation

1. Install the adaptive front lighting module.
 - Tighten the bolt to 10 Nm (7 lb.ft).
 - Connect the electrical connector.
2. Install the CJB.
For additional information, refer to: Central Junction Box (CJB) (418-00, Removal and Installation).
3. Install the cowl side trim panel.
For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).

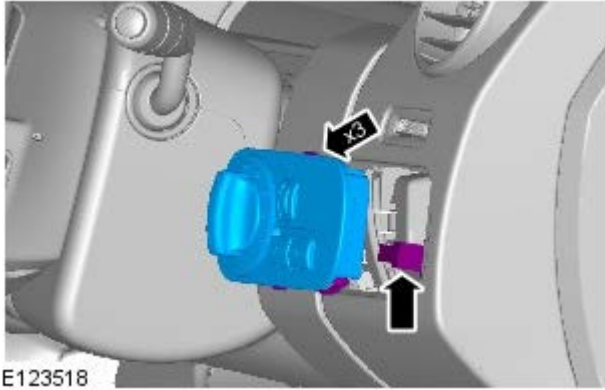
Exterior Lighting - Headlamp Switch


Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.



1.  CAUTION: Protect the surrounding trim to avoid damage.



NOTE: The ignition must be switched off.

Installation

1. To install, reverse the removal procedure.

Exterior Lighting - Approach Lamp Vehicles With: Parking Aid Camera

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



RH illustration shown, LH is similar.



The ignition must be switched off.

1. Refer to: Exterior Mirror Cover (501-09, Removal and Installation).

2. CAUTIONS:

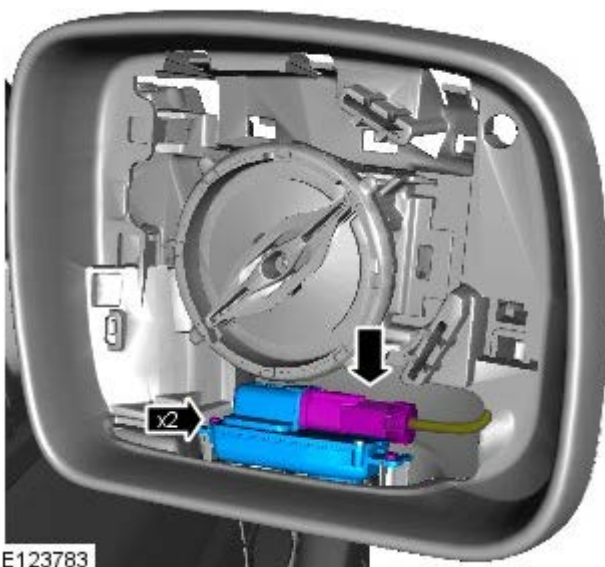


Take extra care not to damage the component.



Take extra care not to damage the wiring harnesses.

Torque: 0.5 Nm



E123783

Installation

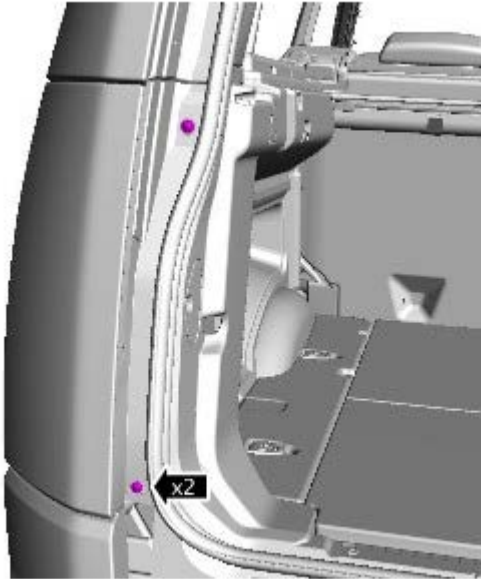
1. To install, reverse the removal procedure.

Exterior Lighting - Rear Lamp Assembly


Removal and Installation

Removal

1.



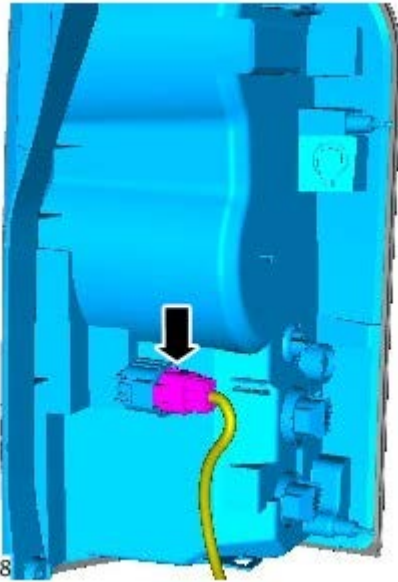
E159420

2.  CAUTION: Always protect paintwork and glass when removing exterior components.

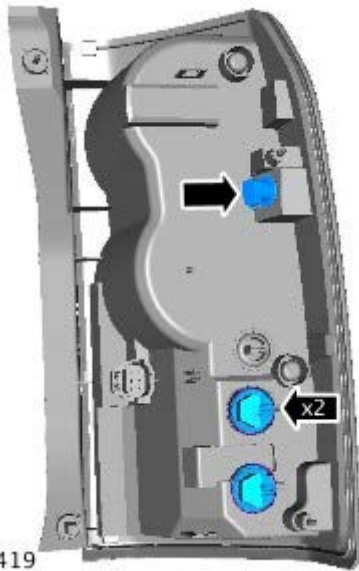


E159421


3.



E159418



E159419

4.  NOTE: Do not disassemble further if the component is removed for access only.

Installation

1. To install, reverse the removal procedure.

Interior Lighting -

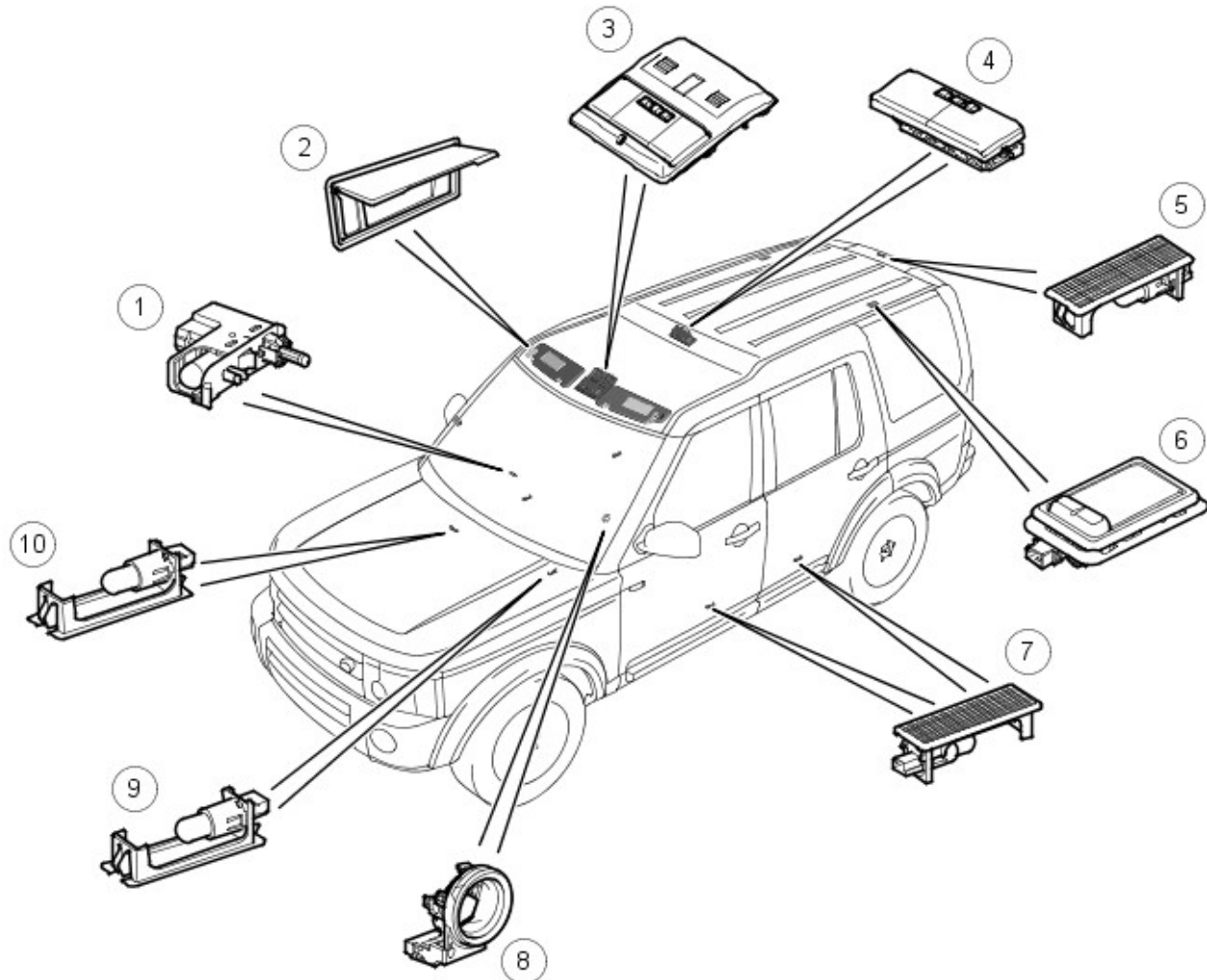
Lamp bulbs

Bulb	Type	Rating
Puddle lamps	Capless	W5W
Footwell lamps	Capless	W5W
Map lamps	Capless	W5W
Courtesy lamps	Capless	W5W
Interior lamps	Capless	W5W
Loadspace lamps	Capless	W5W

Interior Lighting - Interior Lighting

Description and Operation

Interior Lighting Component Location



E43678

Item	Part Number	Description
1	-	Glove compartment lamp and switch
2	-	Vanity mirror lamps
3	-	1st row interior lamp and map reading lamps
4	-	2nd row interior lamp and map reading lamps
5	-	Luggage compartment lamp
6	-	3rd row map lamps (if fitted)
7	-	Puddle lamps
8	-	Ignition switch glow ring
9	-	Driver footwell lamp
10	-	Passenger footwell lamp

GENERAL

The interior lighting system comprises the following interior lamps:

- Interior lamps
- Map reading lamps
- Glove compartment lamp
- Luggage compartment lamps

- Vanity mirror lamps
- Footwell lamps
- Puddle lamps
- Ignition switch illumination

Interior Bulb/Type Rating

The following table shows the bulbs used for the interior lighting system and their type and specification.

Bulb	Type	Rating
Front and rear interior lamps	Capless	5W
Front and rear map reading lamps	Capless	5W
Luggage compartment lamp	Capless	5W
Vanity mirror lamps	Festoon	14V 0.1A (0.14W)
Door puddle lamps	Capless	5W
Lower instrument panel footwell lamps	Capless	5W
Glove compartment lamp	Festoon	5W

CENTRAL JUNCTION BOX

The Central Junction Box (CJB) is an integrated unit located behind the instrument panel on the passenger side of the bulkhead. The CJB contains fuses, relays and a number of microprocessors which control the power supply and functionality of the interior lighting system and other vehicle systems.

The interior lamps are controlled by the CJB and have two modes of operation: manual and automatic. In the manual mode the interior lamps can be switched on and off using the momentary and latching switches adjacent to each lamp or disabled completely using the same switches. In the automatic mode the interior lamp functionality is controlled by the CJB on receipt of various input signals.

Input signals

The CJB receives the following inputs which affect the operation of the interior lamps:

- Ignition switch
- Door switches
- Tailgate switch
- Glove compartment lamp switch
- Unlock signal
- Interior lamp switches
- Map reading lamp switches
- Battery saver relay
- Vanity mirror lamp switches

Circuit Protection

The CJB provides circuit protection for all interior lamp circuits. The following interior lamp circuits are protected by Field Effect Transistors (FETS):

- Luggage compartment lamps
- Footwell lamps
- Ignition switch glow ring
- Puddle lamps.

The above components are protected by FETs which can detect overloads and short circuits. The FETs respond to heat generated by increased current flow caused by a short circuit. On a normal circuit this would cause the fuse to blow, rendering that component and circuit inoperative. The FETs respond to the heat increase and disconnect the supply to the affected circuit. When the fault is rectified or the FET has cooled, the FET will reset and operate the circuit normally.

The following interior lamps circuits are protected by Fuse 1P (10A) in the CJB:

- Glove compartment lamp
- Map reading lamps
- Vanity mirror lamps.

Interior Lamp Time-out

The interior lamps are controlled by a timer within the CJB which allows a 60 delay period for the lamps to remain on after the ignition has been switched off or when the vehicle is unlocked. The following interior lamps are subject to the delay period:

- Interior lamps
- Footwell lamps
- Luggage compartment lamps
- Puddle lamps
- Ignition switch glow ring.

The delay period can be adjusted to suit the driver's requirements, refer to following section for adjustment details.

The time-out delay is activated when the CJB receives one of the following signals:

- The CJB receives an unlock signal from the remote handset
- Ignition switch is moved from the crank position (III) or the ignition position (II) or to the auxiliary position (I) to the off position (0).

If a second occurrence of one of the above actions occurs within the time-out period, the timer will be reset and the delay period will start again.

The time-out delay is deactivated when the CJB receives one of the following signals:

- The CJB receives a lock signal from the remote handset
- Ignition switch is moved from the off position (0) or the auxiliary position (I) to the ignition position (II) or the crank position (III).
- The CJB receives a door opened signal (even if door is subsequently closed)

Interior Lamp Time-out Personalisation

The vehicles customer personalisation options allow the driver or a Land Rover or authorised dealer to adjust the interior lamp switch-off delay period to suit their specific requirements. The default delay period of 60 seconds can be adjusted to the following values; OFF, 10 seconds, 20 seconds, 40 seconds, 60 seconds, 120 seconds or 240 seconds.

With the vehicle stationary and the ignition switch in any position, pressing the trip computer button on the end of the left hand steering multifunction switch gives access to the Customer Personalisation options. Using the audio search buttons on the steering wheel the options can be scrolled through. The options are displayed in the message center. When the headlamp delay option is reached the settings can be changed using the audio search buttons on the steering wheel. When the selection has been made, confirmation is performed by pressing the trip computer button.

For additional information, refer to: Information and Message Center (413-08, Description and Operation).

Battery Saver

The battery saver feature provides automatic shut-off of the interior lamps after a period of 15 minutes in order to prevent excessive drain on the battery. The lamp(s) fade off as described in the 'Interior Lighting' section that follows.

The battery saver feature is additional to the time-out delay feature and prevents battery drain when an lamp is accidentally left switched on, e.g. glove compartment left open.

When the ignition switch is moved from the ignition position (II) or the auxiliary position (I) to the off position (0), the CJB starts a timer which automatically switch off all interior lamps when the 15 minute period has expired.

Once the timer has expired and the lamps are off, any one of the following will 'wake-up' the battery saver and the interior lamps will function again. The timer will be restarted as soon as an input from one of the following is received by the CJB:

- Ignition switch position changed to auxiliary (I), ignition (II) or crank (III)
- Any door, including the tailgate is opened
- Unlock request is received
- Front interior lamp switch is pressed.

DELIVERY MODE

Delivery mode is set at the factory on vehicles to minimise battery drain. The modes enables the switching off of non-critical electrical components, including the interior lighting. The delivery mode feature can be cancelled by the dealer at pre-delivery inspection using T4.

CRASH ILLUMINATION

When a crash signal is received from the restraints control module, the central junction box activates the interior lamps once the vehicle speed has reduced to 5 km/h (3.1 mph). The lamps remain on until they are switched off manually or the crash signal no longer exists.

For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20B, Description and Operation).

INTERIOR LIGHTING

Interior lighting is lighting provided to enable the safe entry and departure from the vehicle for the driver and passengers in low ambient light conditions, without any manual switching of the interior lamps.



NOTE: The term interior lamps also includes the door mirror approach lamps.

When the interior lighting system switches the interior lamps on, the central junction box ramps the lamps on up to full power over period of 1.3 seconds. When the system switches the lamps off, after the time-out delay period has expired, the central junction box fades the lamps off over a period of 2.6 seconds.

The interior lighting system will illuminate the interior lamps when one of the following events occurs:

- The central junction box receives an unlock signal from the remote handset
- Any door is opened including the tailgate
- The ignition switch is turned from the ignition position (II) or the auxiliary position (I) to the off position (0).

The interior lighting system will turn off the interior lamps when one of the following events occurs:

- Once the delay time-out timer has expired since the lamps were either activated or the last door is closed and the vehicle is not locked
- The ignition switch is in the off position (0) and an external lock (using the key or the remote handset) is requested with all doors closed

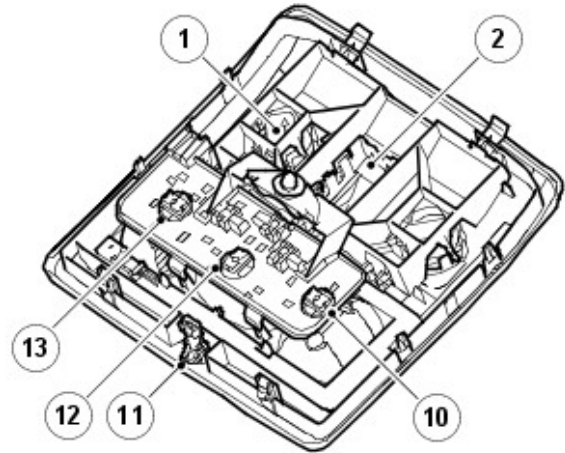
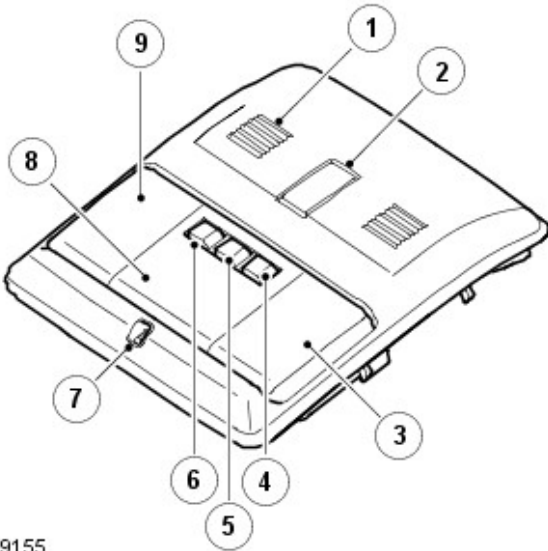
The ignition switch is turned from the off position (O) or the auxiliary position (I) to the ignition position (II) with all doors closed

- The last door is closed while or after the vehicle is externally locked using the key or the remote handset
- The last door is closed when the ignition switch is in the ignition position.

The interior lamps can be permanently switched off, preventing automatic operation when a door is opened or the vehicle is unlocked using the remote handset. This is achieved by pressing and holding the central switch of the 1st row interior lamp for 3 seconds. The interior lamps will remain off until the procedure is repeated.

ROW 1 AND 2 INTERIOR LAMP ASSEMBLY

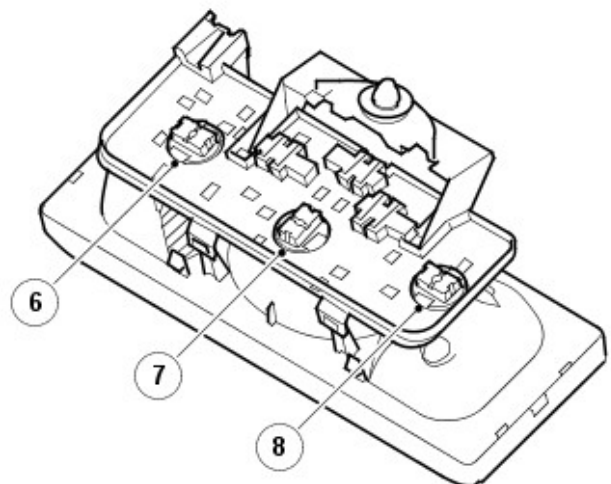
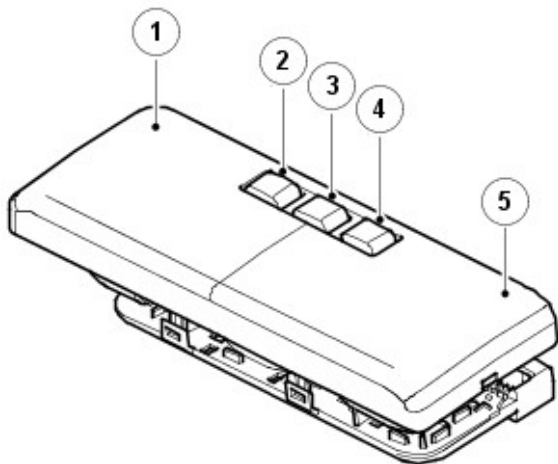
Row 1 Interior Lamp



E49155

Item	Part Number	Description
1	-	Microphone
2	-	Sunroof switch
3	-	Map reading lamp
4	-	Map reading lamp switch
5	-	Interior lamp switch
6	-	Map reading lamp switch
7	-	Waterfall lighting LED
8	-	Interior lamp
9	-	Map reading lamp
10	-	Map reading lamp bulb holder
11	-	LED connector
12	-	Interior lamp bulb holder
13	-	Map reading lamp bulb holder

Row 2 Interior Lamp (Low line shown)



E49156

Item	Part Number	Description
1	-	Map reading lamp
2	-	Map reading lamp switch
3	-	Interior lamp switch
4	-	Map reading lamp switch
5	-	Map reading lamp
6	-	Map reading lamp bulb holder
7	-	Interior lamp bulb holder
8	-	Map reading lamp bulb holder

The row 1 and 2 interior lamp assemblies are common to all models, however, their location can differ between model specification. Both lamp assemblies have three switches; one for the main interior lamp and two for the map reading lamps.

On low line specification vehicles, the interior lamps are located directly into apertures in the headlining with a bezel finish surround.

On high line specification vehicles, the row 1 (front) interior lamp is located in a housing which can also contain the sunroof switch and/or the voice activation microphones, depending on specification. The row 2 (rear) interior lamp is also located in a housing which contains the rear heating controls.

The main interior lamps operate as part of the automatic interior lighting system. The map reading lamps only operate manually.

Both the interior and map reading lamps use 5W capless bulbs.

The row 1 interior lamp unit also contains an LED for the waterfall lighting. Waterfall lighting is part of the lighting control switch functionality which also controls the brightness of the switch and instrument cluster display illumination. Waterfall lighting provides very limited illumination for the center of the fascia and the center console, when the vehicle is being driven, without affecting the driver's night vision.

Main Interior Lamp

The main interior lamps operate independently of the ignition switch position and can be operated automatically by one of a number of inputs to the CJB or manually by pressing the central switch on the lamp assembly. The switch is a momentary switch which is connected directly to and completes a circuit to the CJB. This completed circuit is a signal for the CJB to activate or deactivate the row 1 interior lamp (and also the row 2 interior lamp, if fitted). The lamps will remain on until the switch is pressed a second time.

The interior lamps can be permanently switched off as previously described by pressing and holding the central switch for at least 3 seconds. The 3 second completion of the circuit is sensed by the CJB which grants the permanent off request.

Map Reading Lamps

Both row 1 and 2 interior lamp assemblies contain map reading lamps which are located adjacent to the main interior lamp. The lamps are operated by two momentary switches on the lamp unit, which are located on either side of the main interior lamp switch.

ROW 3 MAP READING LAMPS

The row 3 map reading lamps are located in the headlining, above the rear side windows. These map reading lamps are only fitted to vehicles fitted with the seven seat, third row seating option.

The lamps operate independently of the ignition switch position. The lamps have a latching rocker switch which allows the lamps to be manually switched on and off. The map reading lamps have a non-adjustable beam.

The lamps are not part of the automatic interior lighting system and therefore can only be switched on manually.

The map reading lamps use 5W capless bulbs.

GLOVE COMPARTMENT LAMP

The glove compartment lamp is located inside the glove compartment and contains an integral switch. The switch is operated when the glove compartment lid is opened and closed, switching the lamp on and off.

The glove compartment lamp uses a 5W festoon bulb.

PUDDLE LAMPS

Each door is fitted with a puddle lamp which illuminates the ground below the door when the door is opened. The puddle lamps are located in the bottom of the door trim panel on each front and rear door.

The puddle lamps are part of the automatic interior lighting functionality. Each lamp uses a 5W capless bulb.

FOOTWELL LAMPS

Two footwell lamps are located under the instrument panel, one on each side, to illuminate the footwell area. The footwell lamps are controlled by the CJB and operate as part of the interior lighting functionality.

The footwell lamps use a 5W capless bulb.

LUGGAGE COMPARTMENT LAMP

A luggage compartment lamp is located in a central position in the rear header trim panel at the rear of the vehicle, above the tail gate aperture. The luggage compartment lamp is controlled by the CJB and operates as part of the interior lighting functionality.

The luggage compartment lamp uses a 5W capless bulb.

VANITY MIRROR LAMPS

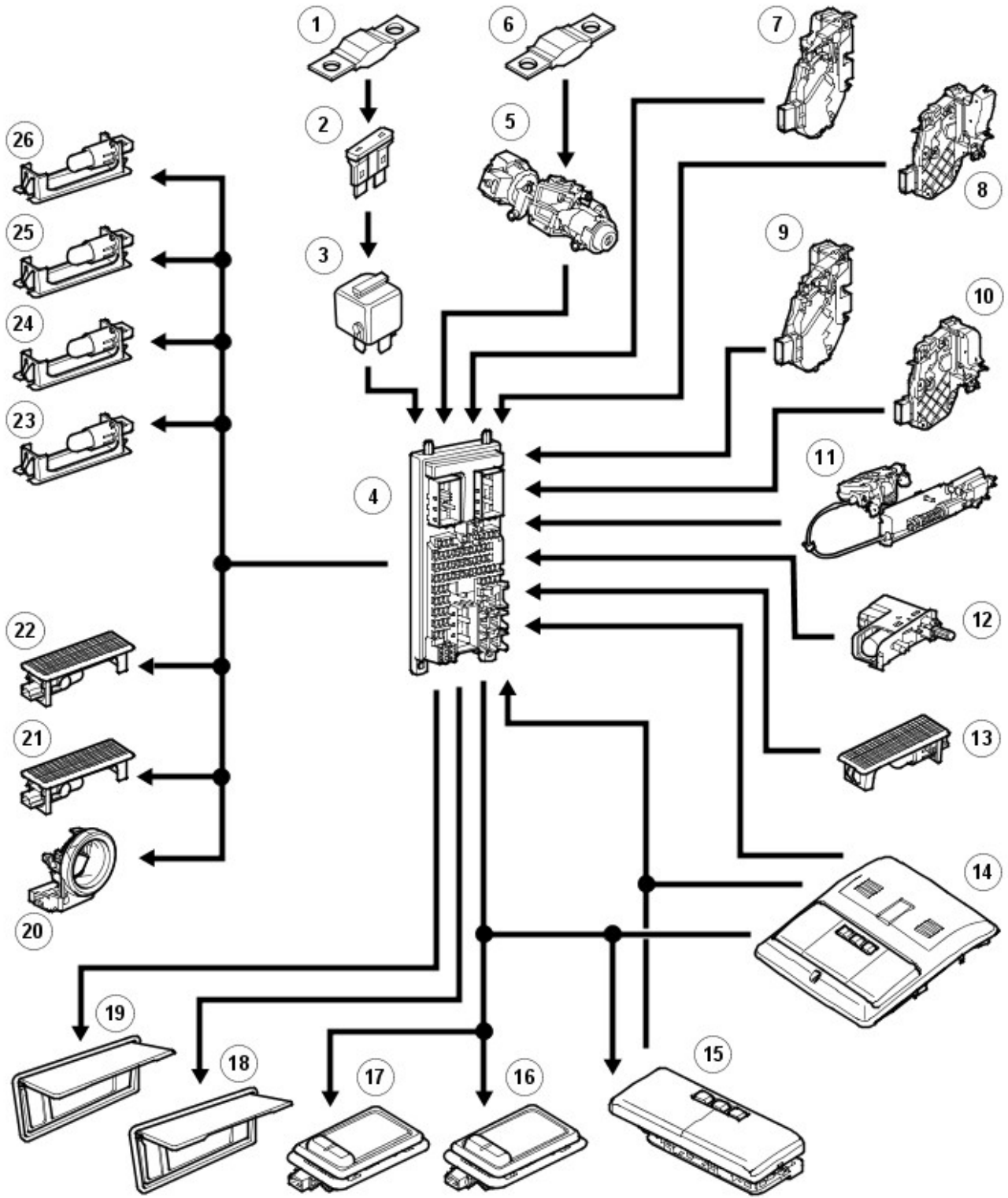
Four vanity mirror lamps are fitted, two in each vanity mirror. The lamps are illuminated when the mirror cover is raised. The vanity mirror lamps operate independently of the ignition switch position and separately to the interior lighting functionality, although they are subject to the battery saver feature of the CJB.

The vanity mirrors use low voltage, 1.2W festoon type bulbs.

CONTROL DIAGRAM



NOTE: A = Hardwired



E43681

A →

Item	Part Number	Description
1	-	Fusible link 15E (40A) (Permanent 12V supply)
2	-	Fuse 1P (10A)
3	-	Battery saver relay (located inside CJB)
4	-	Central Junction Box (CJB)
5	-	Ignition switch
6	-	Fusible link 11E (30A)
7	-	Passenger door CDL motor
8	-	Driver's door CDL motor
9	-	RH rear door CDL motor
10	-	LH rear door CDL motor
11	-	Tailgate release motor

12	-	Glove compartment lamp
13	-	Luggage compartment lamp
14	-	Row 1 interior lamp assembly
15	-	Row 2 interior lamp assembly
16	-	Row 3 RH map reading lamp
17	-	Row 3 LH map reading lamp
18	-	RH vanity mirror lamp
19	-	LH vanity mirror lamp
20	-	Ignition switch glow ring illumination
21	-	RH footwell lamp
22	-	LH footwell lamp
23	-	RH rear puddle lamp
24	-	LH rear puddle lamp
25	-	RH front puddle lamp
26	-	LH front puddle lamp

Interior Lighting - Interior Lighting

Diagnosis and Testing

Principle of Operation

For a detailed description of the interior lighting system and operation, refer to the relevant Description and Operation section of the workshop manual.

REFER to: Interior Lighting (417-02 Interior Lighting, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Main interior lamp condition and installation • Map reading lamp(s) condition and installation • Vanity mirror lamp(s) condition and installation • Glovebox lamp condition and installation • Footwell lamp(s) condition and installation • Door mirror approach lamp(s) condition and installation • Puddle lamp(s) condition and installation • Luggage compartment lamp condition and installation 	<ul style="list-style-type: none"> • Bulbs • Fuses • Battery Junction Box (BJB) • Central Junction Box (CJB) • Wiring harness • Loose or corroded connector(s) • Main interior lamp switch • Map reading lamp switches • Vanity mirror lamp switches • Glove compartment lamp switch • Waterfall lighting LED • Luggage compartment lamp switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Main interior lamp inoperative	<p>NOTE: Operate the main interior lamp switch for 3 seconds to toggle automatic mode on/off</p> <ul style="list-style-type: none"> • Main interior lamp toggled off • Bulb(s) failure • Fuse(s) blown • Main interior lamp circuit short circuit to ground, open circuit, high resistance • Main interior lamp switch fault 	<ul style="list-style-type: none"> • Check that the main interior lamp is not toggled off • Check the bulb(s) condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the main interior lamp circuit for short circuit to ground, open circuit, high resistance • Test the operation of the main interior lamp switch
Waterfall lighting LED inoperative	<ul style="list-style-type: none"> • LED failure • Fuse(s) blown • LED circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Check the LED condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the LED circuit for short circuit to ground, open circuit, high resistance
Map reading lamp(s) inoperative	<ul style="list-style-type: none"> • Bulb(s) failure • Fuse(s) blown • Map reading lamp circuit short circuit to ground, open circuit, high resistance • Map reading lamp switch fault 	<ul style="list-style-type: none"> • Check the bulb(s) condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the map reading lamp circuit for short circuit to ground, open circuit, high resistance • Test the operation of the map reading lamp switch
Vanity mirror lamp(s) inoperative	<ul style="list-style-type: none"> • Bulb failure • Fuse(s) blown • Vanity mirror lamp circuit 	<ul style="list-style-type: none"> • Check the bulb condition • Check the fuse(s) • Refer to the electrical circuit diagrams and test the

	<ul style="list-style-type: none"> short circuit to ground, open circuit, high resistance Vanity mirror lamp switch fault 	<ul style="list-style-type: none"> vanity mirror lamp circuit for short circuit to ground, open circuit, high resistance Test the operation of the vanity mirror lamp switch
Glovebox lamp inoperative	<ul style="list-style-type: none"> Bulb failure Fuse(s) blown Glovebox lamp circuit short circuit to ground, open circuit, high resistance Glovebox lamp switch fault 	<ul style="list-style-type: none"> Check the bulb condition Check the fuse(s) Refer to the electrical circuit diagrams and test the glovebox lamp circuit for short circuit to ground, open circuit, high resistance Test the operation of the glovebox lamp switch
Footwell lamp inoperative	<ul style="list-style-type: none"> Bulb failure Fuse(s) blown Footwell circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Check the bulb condition Check the fuse(s) Refer to the electrical circuit diagrams and test the footwell circuit for short circuit to ground, open circuit, high resistance
Door mirror approach lamp(s) inoperative	<ul style="list-style-type: none"> Bulb failure Fuse(s) blown Door mirror approach lamp circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Check the bulb condition Check the fuse(s) Refer to the electrical circuit diagrams and test the door mirror approach lamp circuit for short circuit to ground, open circuit, high resistance
Puddle lamp(s) inoperative	<ul style="list-style-type: none"> Bulb failure Fuse(s) blown Puddle lamp circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> Check the bulb condition Check the fuse(s) Refer to the electrical circuit diagrams and test the puddle lamp circuit for short circuit to ground, open circuit, high resistance
Luggage compartment lamp inoperative	<ul style="list-style-type: none"> Bulb failure Fuse(s) blown Luggage compartment lamp circuit short circuit to ground, open circuit, high resistance Luggage compartment lamp switch fault 	<ul style="list-style-type: none"> Check the bulb condition Check the fuse(s) Refer to the electrical circuit diagrams and test the luggage compartment lamp circuit for short circuit to ground, open circuit, high resistance Test the operation of the luggage compartment lamp switch

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00, Description and Operation).

Daytime Running Lamps (DRL) - Daytime Running Lamps (DRL)

Description and Operation

DRL use the full intensity low beam headlamps which are permanently illuminated when the vehicle is being driven. DRL are used in a number of markets and there are two systems to cover these markets.

DRL CANADIAN MARKET

DRL for this market use full intensity low beam headlamps. The side marker lamps and license plate lamps will be on, but instrument cluster illumination will be off. DRL are active when the following parameters are met:

- Parking brake is off on vehicles with manual transmission or PARK is not selected on vehicles with automatic transmission
- Ignition switch is in the ignition position (II)
- The central junction box receives an engine running signal
- The lighting control switch is in the off or side lamps position.

NOTES:



If the lighting control switch is moved to the headlamp position, DRL are deactivated and normal side lamp and headlamp functionality is operational.



Adaptive Front lighting System (AFS) (where fitted) is not available when the DRL are active.



When DRL are active, the headlamp flash function using the left hand steering column multifunction switch will operate normally. The high beam headlamp function using the left hand steering column multifunction switch will be deactivated.

When the parking brake is applied on manual transmission vehicles or the selector lever is in the PARK position on automatic transmission vehicles, DRL are turned off. This is to reduce battery discharge during long periods of engine idling in cold climate conditions. When the parking brake is released or the selector lever is moved from the PARK position, normal DRL functionality is restored.

DRL DENMARK, HOLLAND, NORWAY, SWEDEN, FINLAND & POLAND

DRL for these markets use full intensity low beam headlamps. Side lamps and license plate lamps will be on, but instrument cluster illumination will be off. DRL are active when the following parameters are met:

- Ignition switch is in the ignition position (II)
- The central junction box receives an engine running signal
- The lighting control switch is in the off position.



NOTE: When DRL are active, the headlamp flash function using the left hand steering column multifunction switch will operate normally. The high beam headlamp function using the left hand steering column multifunction switch will be deactivated.

If the lighting control switch is moved to the side lamp or headlamp positions, DRL are deactivated and normal side lamp and headlamp functionality is operational.

Daytime Running Lamps (DRL) - Daytime Running Lamps (DRL)

Diagnosis and Testing

Principles of Operation

For a detailed description of the Daytime Running Lamps (DRL) and operation, refer to the relevant Description and Operation section.

REFER to: Daytime Running Lamps (DRL) (417-04, Description and Operation).

Inspection and Verification



1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Headlight assembly for damage/water ingress • LED assembly • Exterior light switch damaged/stuck 	<ul style="list-style-type: none"> • Fuse(s) • Daytime running lights wiring harness • Electrical connector(s) • Central Junction Box (CJB)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom chart

Symptom	Possible Causes	Action
Daytime running lights inoperative	<ul style="list-style-type: none"> • Daytime running lights working as specified or within system limitations • Daytime running lights not configured correctly •  NOTE: Signal supply, ground supply and power supply circuits <p>Daytime running lights circuit short to ground, short to power, open circuit</p> <ul style="list-style-type: none"> • Daytime running light assembly internal failure 	<ul style="list-style-type: none"> • Refer to the relevant Description and Operation section for information regarding correct operation. REFER to: Daytime Running Lamps (DRL) (417-04, Description and Operation). • Re-configure the central junction box as required. Update the car configuration file as required. • Refer to the relevant circuit diagram and check daytime running lights circuit short to ground, short to power, open circuit and repair as required. Check for related DTCs and refer to the relevant DTC index. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (BCM) (100-00, Description and Operation). •  NOTE: Part of headlight assembly <p>Check and install a new daytime running light assembly as required.</p>

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (BCM) (100-00, Description and Operation).

Module Communications Network -

Torque Specifications

Description	Nm	lb-ft
Central junction box bracket retaining nuts	10	7
Central junction box bracket retaining bolts	25	18
Engine compartment ground cable nuts	25	18
Body panel ground cable nuts	25	18
Vehicles with auxiliary heating - Heater pipes to body panel nut	10	7
Wiring harness to plenum chamber nuts	4	3
Vehicles with auxiliary climate control - A/C lines to body panel nut	10	7
Battery ground cable to body nut	25	18
Battery junction box retaining bolt	6	4
Ground cables to the lower A-pillar nut	10	7
Battery positive cable to the battery junction box (BJB) nut	25	18

Module Communications Network - Communications Network

Diagnosis and Testing

Principles of Operation

For a detailed description of the Communications Network, refer to the relevant Description and Operation sections in the workshop manual.

Inspection and Verification

CAUTIONS:



Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



Electronic modules are sensitive to static electrical charges. If exposed to these charges, damage may result.

1. Verify the customer concern
2. Visually inspect for obvious signs of damage and system integrity

Visual Inspection

Electrical
<ul style="list-style-type: none"> • Fuses (refer to electrical guide) • Wiring harness • Correct engagement of electrical connectors • Loose or corroded connections • Routing of fibre optic harnesses • Correct engagement of optical connectors • Correct placement of optical connectors (ring order) • Correct assembly of optical connectors (backout, etc) • Damage to fibre (chafing, abrasion, kinking, cuts, etc)

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index

Symptom Chart

Symptom	Possible Causes	Action
MOST network fault - Touch Screen (TS) soft keys greyed out and inoperative	<ul style="list-style-type: none"> • MOST ring broken • Control module on MOST network power or ground circuit open circuit, high resistance • Control module on MOST network internal failure 	<ul style="list-style-type: none"> • GO to Pinpoint Test B.
MOST network fault - Touch Screen (TS) blank	<ul style="list-style-type: none"> • Touch Screen (TS) power or ground circuit open circuit, high resistance • Wake up signal not received by the Touch Screen (TS) • Touch Screen (TS) internal failure 	<ul style="list-style-type: none"> • GO to Pinpoint Test H.

Controller Area Network (CAN)

Control Module Connections to the CAN Harness

Control modules are connected to the CAN harness either in a 'loop' or 'spur' configuration. In the 'loop' type configuration the CAN harness loops into the module (via two connector pins) and then loops out of the module (via another two connector pins). In the 'spur' type configuration, a harness spur is spliced into the main 'backbone' of the CAN harness and the module is connected to the harness spur via two connector pins.

CAN Harness Architecture

For a detailed description of the CAN Networks and architecture, refer to the relevant Description and Operation section in the Workshop Manual.

CAN Network Integrity Tests

If a control module is suspected of non-communication, the Network Integrity test application available on the manufacturer approved diagnostic system can be used to confirm if communication is possible between the control modules on the vehicle and the manufacturer approved diagnostic system (via the J1962 diagnostic connector). The results from the test can be used to determine if either a single module or multiple modules are failing to communicate.

CAN Terminating Modules

If the Network Integrity test indicates that one or more module on one of the CAN networks (HS or MS) are failing to communicate, there are several checks that can be made. The first step is to identify if both of the CAN terminating modules on each individual CAN Bus are communicating. If both CAN terminating modules for each individual CAN Bus are communicating (identified via the Network Integrity test), then it can be confirmed that the main 'backbone' of the CAN harness is complete. The main 'backbone' of the CAN harness consists of all the modules connected to the CAN harness via a 'loop' configuration and also includes the two terminating modules.

Communication with both CAN terminating modules via the Network Integrity test confirms the physical integrity of the main 'backbone' of the CAN harness (and the harness spur to the J1962 diagnostic connector). This means that there is no requirement to check the resistance of the CAN Network. This is because the standard check for 60 ohms across the CAN High and CAN Low lines will not provide any additional information regarding the physical condition of the CAN harness, beyond what has already been determined from the Network Integrity test.

Non-Communication of a Terminating Module

If a Network Integrity test reveals a terminating module is failing to communicate it can indicate a break in the main 'backbone' of the CAN harness. The first checks should always be to confirm the power and ground supplies to the non-communicating module are correct. Providing these are correct, the resistance between the CAN High and CAN Low lines at the J1962 connector can be checked to determine the integrity of the main 'backbone' of the CAN harness. After disconnecting the battery a reading of 120 ohms would indicate an open circuit in the main 'backbone' of the CAN harness. Alternatively, a reading of 60 ohms would indicate that there is no open circuit fault with the main 'backbone' of the CAN harness.

It is worth noting that even if one of the terminating modules is disconnected from the CAN harness, communications between the modules still connected may still be possible. Therefore communication between the manufacturer approved diagnostic system and the connected modules may also be possible.

Locating CAN Harness Open Circuits

In the case where multiple modules, including a terminating module, are failing to communicate, having first confirmed the power and ground supplies are correct, the approximate location of the open circuit can be identified from analysis of the Network Integrity test results and reference to the relevant CAN network circuit diagrams. For example, if an open circuit existed in a certain position on the CAN harness, any module positioned on the Network between the J1962 connector and the open circuit should return a response during the Network Integrity test. No responses would be returned from any modules past the open circuit fault in the Network.

CAN Harness 'Spur' Type Configuration Circuits

If, after the initial checks (Network Integrity test using the manufacturer approved diagnostic system, and power and ground supplies to the module have been checked and confirmed as correct), a module that is connected to the CAN harness via a 'spur' type configuration is suspected of not communicating, then the physical integrity of the CAN harness 'spur' can be checked.

This is most easily undertaken by individually checking the continuity of the CAN High and CAN Low lines between the non-communicating module connector (with the module disconnected) and the J1962 diagnostic connector.

'Lost Communications' DTCs

As well as the methods described so far in this document, which can be used to determine the location of an open circuit in the CAN harness, 'Lost Communications' DTCs can also be used for this purpose. Lost communication DTCs mean that a module is not receiving CAN information from another module.

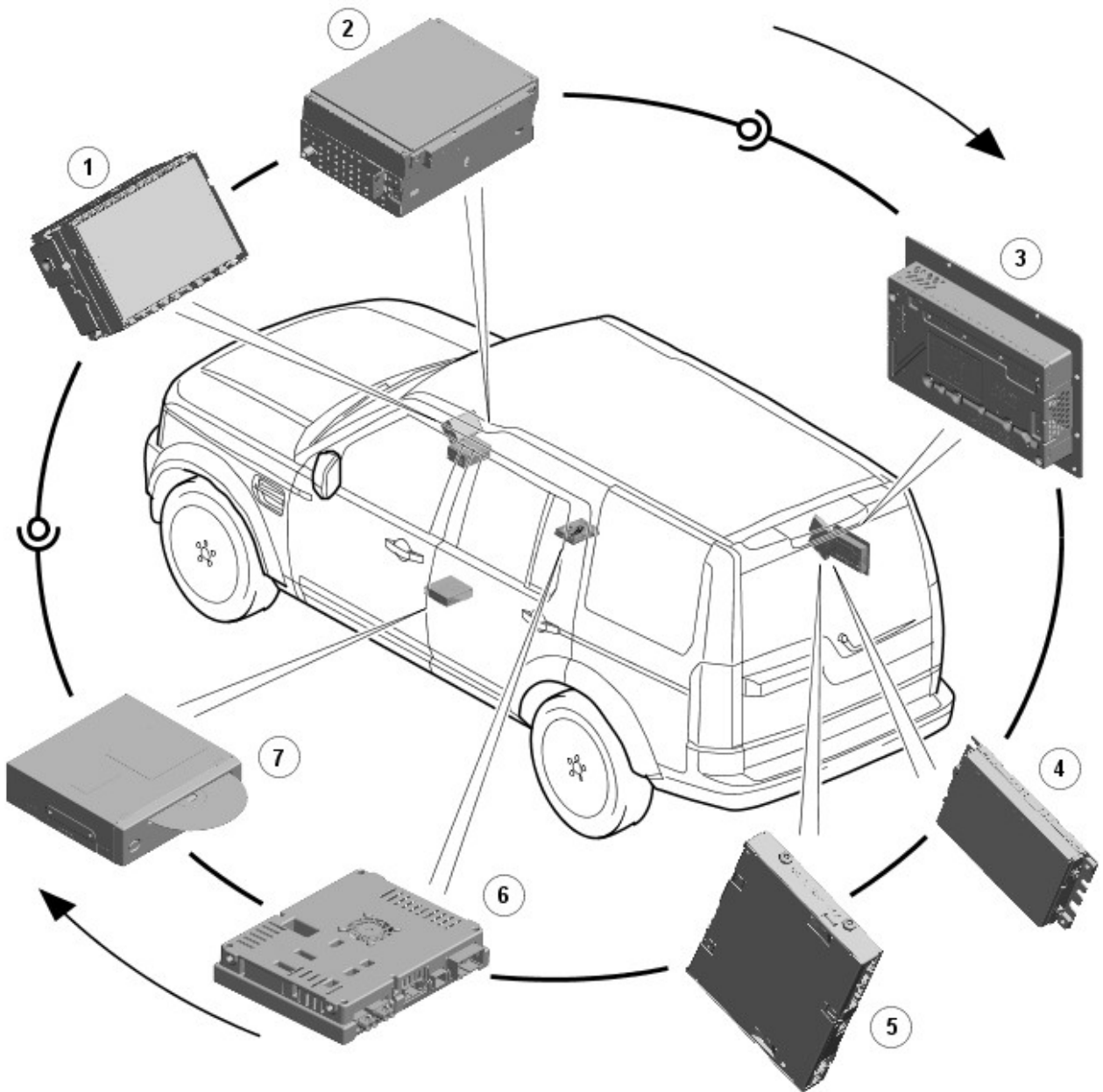
For example, if a global DTC read were to be carried out, only DTCs stored in the modules that the manufacturer approved diagnostic system could communicate with would be displayed. If there was an open circuit fault in a certain position on the CAN harness, the modules that could display DTCs would all be prior to the open circuit on the Network, and these modules should display 'Lost Communications' DTCs with all the modules located on the Network past the open circuit fault.

'Bus off' DTCs

The references to bus and its condition refer to the network concerned and the modules on that network.

If a module logs a 'Bus Off' DTC, it means that the module has detected CAN transmission errors and has disabled it's own CAN transmissions and disconnected itself from the network in an attempt to allow the rest of the network to function. At this point the 'Bus Off' DTC is set. A common cause of 'Bus Off' DTCs can be a short circuit in the CAN network.

Media Oriented Systems Transport (MOST)



E151629



NOTE: Items 1, 2 and 3 will always be present. The remaining items are optional and/or market specific.

Item	Description
1	Touch Screen (TS)
2	Integrated Audio Module (IAM)
3	Audio Amplifier Module (AAM)
4	Digital Radio Control Module (DRCM)
5	Rear Seat Entertainment Control Module (RSECM)
6	TV Control Module (TVCM)
7	Navigation Control Module (NCM) - Japan

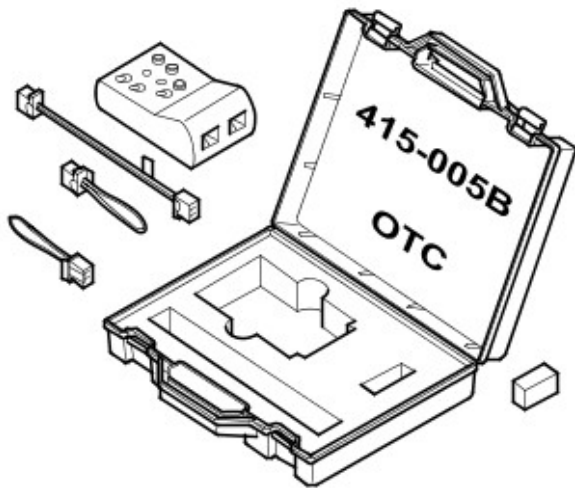
Overview

The basic guidelines are covered in the description and operation section, such as not attempting to repair fibre optic cables, but additional precautions include:

- Do not touch the exposed ends of the optical fibres (grease from skin can contaminate the fibre)
- Whenever the fibre optic cable is disconnected, cover the connectors to prevent dust contamination
- Do not expose the fibre optic cable to heat
- Do not bend the fibre optic cable through less than a 25 mm (one inch) radius
- Do not use laser pens to test the fibre optic cable's ability to pass light

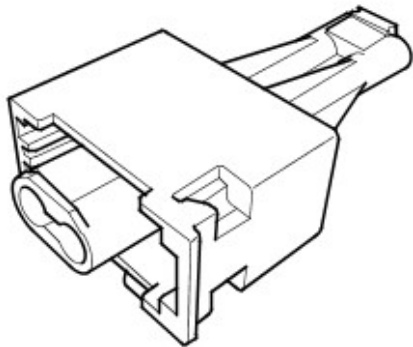
MOST Diagnostic Tools

There are two dedicated tools for testing the MOST system:



E150402

MOST tester: The MOST tester is connected to the MOST network in place of a control module. It will confirm receipt of any existing MOST signal and transmit it to the next control module on the network. Perform the following tests to validate the operation of the MOST tester. GO to Pinpoint Test [A](#).





E150401

MOST prism: The MOST prism is connected in the same way as the MOST tester but will simply reflect any existing signal onward to the next control module. Using the MOST prism before or after a long run of harness may cause a ring break as a good signal may be too weak after travelling the extended distance. Also, the MOST prism will pass light in either direction so will not detect reversed MOST terminals elsewhere in the network. For these reasons, the MOST tester is the preferred tool and should be used unless limited access does not permit it

MOST Ring Break Indication

A ring break in the MOST network is indicated by the Touch Screen (TS) soft keys being greyed out and inoperative. Possible causes of ring breaks are listed in the symptom chart

Pinpoint Tests

PINPOINT TEST A : MOST TESTER TESTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: MOST TESTER BATTERY TEST	
	<ol style="list-style-type: none"> Set the MOST tester power switch to 'on' Is the power LED illuminated? Yes Test passed. GO to A2 . No Test failed. Install a new battery into the MOST tester. GO to A1 .
A2: 2+0 INPUT/OUTPUT TEST	
NOTES:	
 '2+0' indicates that the loop harness connector consists of 2 fibre optic terminals and 0 electrical terminals.	
 The MOST tester may continue to emit a tone or illuminate the LED after the test switch is released. This does not indicate a fault.	
	<ol style="list-style-type: none"> Set the MOST tester power switch to 'on' Set the connector selector switch to '2+0' Set the indication switch to 'beep' or 'LED' Remove the covers from the MOST tester 2+0 connector and the 2+0 loop harness connector

	5 Connect the 2+0 loop harness to the MOST tester 2+0 connector
	6 Operate the test switch and check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? Yes Test passed. GO to A3. No Test failed. MOST tester or 2+0 harness fault

A3: 2+4 INPUT/OUTPUT TEST

NOTES:



2+4' indicates that the loop harness connector consists of 2 fibre optic terminals and 4 electrical terminals.



The MOST tester may continue to emit a tone or illuminate the LED after the test switch is released. This does not indicate a fault.

	1 Set the MOST tester power switch to 'on'
	2 Set the connector selector switch to '2+4'
	3 Set the indication switch to 'beep' or 'LED'
	4 Remove the covers from the MOST tester 2+4 connector and the 2+4 loop harness connector
	5 Connect the 2+4 loop harness to the MOST tester 2+4 connector
	6 Operate the test switch and check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? Yes Test passed. GO to A4. No Test failed. MOST tester or 2+4 harness fault

A4: ADAPTER HARNESS AND PRISM TEST



NOTE: The MOST tester may continue to emit a tone or illuminate the LED after the test switch is released. This does not indicate a fault.

	1 Set the MOST tester power switch to 'on'
	2 Set the connector selector switch to '2+0'
	3 Set the indication switch to 'beep' or 'LED'
	4 Remove the covers from the MOST tester 2+0 connector, the prism, and the adapter harness connectors
	5 Connect the adapter harness to the MOST tester 2+0 connector
	6 Connect the prism to the adapter harness
	7 Operate the test switch and check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? Yes Test passed No Test failed. MOST tester, adapter harness or prism fault

PINPOINT TEST B : MOST NETWORK INITIAL TESTS

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

B1: MOST NETWORK INITIAL TEST 1



NOTE: When connecting the MOST tester, use the 2+0 or 2+4 socket as appropriate and set the connector selector switch to match the socket in use


	1 Switch on the audio/video system
	2 Disconnect the MOST harness connector from the Audio Amplifier Module (AAM)
	3 Set the MOST tester power switch to 'on'
	4 Connect the MOST harness connector to the MOST tester
	5 Check the Touch Screen (TS) for indication of a MOST network fault
	Has the MOST network been restored? Yes The disconnected control module is causing the MOST network fault. GO to Pinpoint Test E. No The disconnected control module is not causing the MOST network fault. GO to B2.

B2: MOST NETWORK INITIAL TEST 2


	1 Check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? Yes MOST signal received. The MOST network fault is located downstream of the MOST tester. GO to Pinpoint Test C. No MOST signal not received. The MOST network fault is located upstream of the MOST tester. Disconnect the MOST harness connector from the MOST tester and reconnect it to the control module. GO to Pinpoint Test D.

PINPOINT TEST C : MOST NETWORK DOWNSTREAM TESTS



TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

C1: MOST NETWORK DOWNSTREAM TEST 1	
	1 Refer to the electrical circuit diagrams and identify the succeeding control module on the MOST network
	Is this control module the Touch Screen (TS)? Yes GO to Pinpoint Test E . No GO to C2 .
C2: MOST NETWORK DOWNSTREAM TEST 2	
	1 Disconnect the MOST harness connector
	2 Direct the MOST harness connector at a suitable surface and check for the presence of red light
	Is red light present? Yes Disconnect the MOST harness connector from the MOST tester and reconnect it to the control module. GO to C3 . No The fault is in the MOST harness between the MOST tester and the disconnected MOST harness connector. Install a new MOST harness as necessary
C3: MOST NETWORK DOWNSTREAM TEST 3	
 NOTE: When connecting the MOST tester, use the 2+0 or 2+4 socket as appropriate and set the connector selector switch to match the socket in use	
	1 Connect the succeeding MOST harness connector to the MOST tester
	2 Check the Touch Screen (TS) for indication of a MOST network fault
	Has the MOST network been restored? Yes The disconnected control module is causing the MOST network fault. GO to Pinpoint Test E . No The disconnected control module is not causing the MOST network fault. GO to C1 .



PINPOINT TEST D : MOST NETWORK UPSTREAM TESTS

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: MOST NETWORK UPSTREAM TEST 1	
	1 Disconnect the MOST harness connector from the Integrated Audio Module (IAM)
	2 Direct the MOST harness connector at a suitable surface and check for the presence of red light
	Is red light present? Yes The MOST network fault is in the Integrated Audio Module (IAM) or the MOST harness to the succeeding control module. GO to D2 . No The MOST network fault is located upstream of the Integrated Audio Module (IAM). Reconnect the MOST harness connector to the Integrated Audio Module (IAM). GO to Pinpoint Test G .
D2: MOST NETWORK UPSTREAM TEST 2	
 NOTE: When connecting the MOST tester, use the 2+0 or 2+4 socket as appropriate and set the connector selector switch to match the socket in use	
	1 Connect the MOST harness connector to the MOST tester
	2 Check the Touch Screen (TS) for indication of a MOST network fault
	Has the MOST network been restored? Yes The disconnected control module is causing the MOST network fault. GO to Pinpoint Test E . No The fault is in the MOST harness between the MOST tester and the succeeding control module. Install a new MOST harness as necessary

PINPOINT TEST E : CONTROL MODULE TESTS

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: CONTROL MODULE TEST 1	
NOTES:	
 When connecting the MOST tester, use the 2+0 or 2+4 socket as appropriate and set the connector selector switch to match the socket in use	
 The MOST tester may continue to emit a tone or illuminate the LED after the test switch is released. This does not indicate a fault.	
	1 Connect the MOST tester to the relevant control module using the adapter harness
	2 Operate the test switch and check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? Yes MOST signal received. Tests inconclusive. Reconnect the MOST harness connector to the control module and confirm that the MOST network fault is still present. Repeat the tests from the beginning. GO to Pinpoint Test B . No

	GO to E2.
E2: CONTROL MODULE TEST 2	
	1 Refer to the electrical circuit diagrams and test the relevant control module power and ground circuits for open circuit, high resistance
	Are the power and ground circuits within specification? Yes GO to E3. No Repair the power and/or ground circuit
E3: CONTROL MODULE TEST 3	
	1 Reconnect the MOST harness to the control module
	2 Check the Touch Screen (TS) for indication of a MOST network fault
	Has the MOST network been restored? Yes Tests inconclusive. Repeat the tests from the beginning. GO to Pinpoint Test B. No Install a new control module

PINPOINT TEST F : MOST NETWORK FINAL DOWNSTREAM TEST	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: MOST NETWORK FINAL DOWNSTREAM TEST 1	
NOTES:	
 When connecting the MOST tester, use the 2+0 or 2+4 socket as appropriate and set the connector selector switch to match the socket in use	
 The MOST tester may continue to emit a tone or illuminate the LED after the test switch is released. This does not indicate a fault.	
	1 Disconnect the MOST harness connector from the MOST tester
	2 Reconnect the MOST harness connector to the control module
	3 Disconnect the MOST harness connector from the Touch Screen (TS)
	4 Connect the MOST harness connector to the MOST tester
	5 Operate the test switch and check the MOST tester beep/LED
	Did the MOST tester emit a tone or illuminate the LED? Yes GO to F2. No The fault is in the harness between the Touch Screen (TS) and the preceding control module. Install a new MOST harness as necessary
F2: MOST NETWORK FINAL DOWNSTREAM TEST 2	
	1 Disconnect the MOST harness connector from the MOST tester
	2 Reconnect the MOST harness connector to the Touch Screen (TS)
	3 Check the Touch Screen (TS) for indication of a MOST network fault
	Has the MOST network been restored? Yes Tests inconclusive. Repeat the tests from the beginning. GO to Pinpoint Test B. No GO to Pinpoint Test H.

PINPOINT TEST G : MOST NETWORK FINAL UPSTREAM TESTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: MOST NETWORK FINAL UPSTREAM TEST 1	
	1 Disconnect the MOST harness connector from the Touch Screen (TS)
	2 Direct the Touch Screen (TS) at a suitable surface and check for the presence of red light
	Is red light present? Yes The fault is in the MOST harness between the Touch Screen (TS) and the succeeding control module. Install a new MOST harness as necessary No GO to Pinpoint Test H.

PINPOINT TEST H : TOUCH SCREEN (TS) TESTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: TOUCH SCREEN (TS) TEST 1	
	1 Using the manufacturer approved diagnostic system, check the Touch Screen (TS) for related DTCs
	Is communication possible between the manufacturer approved diagnostic system and the Touch Screen (TS)? Yes Refer to the relevant DTC index No GO to H2.

H2: TOUCH SCREEN (TS) TEST 2	
	1 Refer to the electrical circuit diagrams and test the Touch Screen (TS) power and ground circuits for open circuit, high resistance
	Are the power and ground circuits within specification? Yes GO to H3. No Repair the power and/or ground circuit
H3: TOUCH SCREEN (TS) TEST 3	
	1 Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and test the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance
	Is the medium speed CAN bus within specification? Yes Install a new Touch Screen (TS) No Repair the medium speed CAN bus circuit

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.
REFER to: (100-00)

Diagnostic Trouble Code (DTC) Index - DTC: Audio Amplifier Module (AAM) (Description and Operation),
 Diagnostic Trouble Code (DTC) Index - DTC: Digital Radio Control Module (DRCM) (Description and Operation),
 Diagnostic Trouble Code (DTC) Index - DTC: Integrated Audio Module (IAM) - High Line (Description and Operation),
 Diagnostic Trouble Code (DTC) Index - DTC: Rear Seat Entertainment Control Module (RSECM) (Description and Operation),
 Diagnostic Trouble Code (DTC) Index - DTC: Satellite Radio Control Module (SRCM) (Description and Operation),
 Diagnostic Trouble Code Index: Touch Screen - DTC: (TS) (Description and Operation),
 Diagnostic Trouble Code (DTC) Index - DTC: TV Control Module (TVCM) (Description and Operation).

Module Communications Network - Battery Junction Box (BJB) V6 S/C

3.0L Petrol

Removal and Installation

Removal

NOTES:



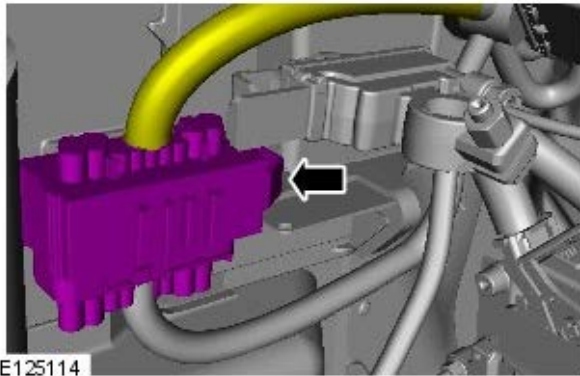
Some variation in the illustrations may occur, but the essential information is always correct.



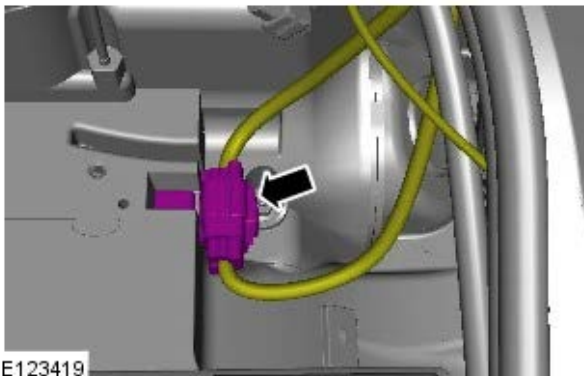
Removal steps in this procedure may contain installation details.

1. For additional information, refer to: Battery (414-01, Removal and Installation).
2. For additional information, refer to: Air Cleaner LH (303-12, Removal and Installation).
3. For additional information, refer to: Air Cleaner RH (303-12, Removal and Installation).

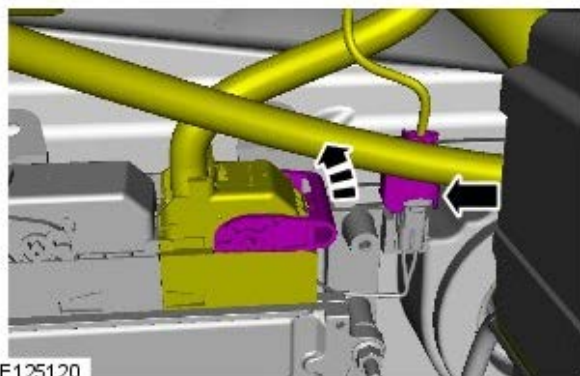
4.



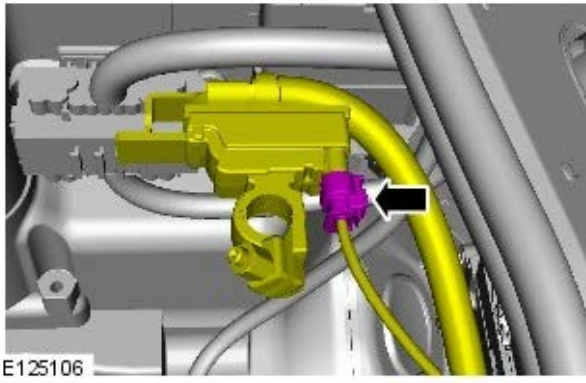
5.



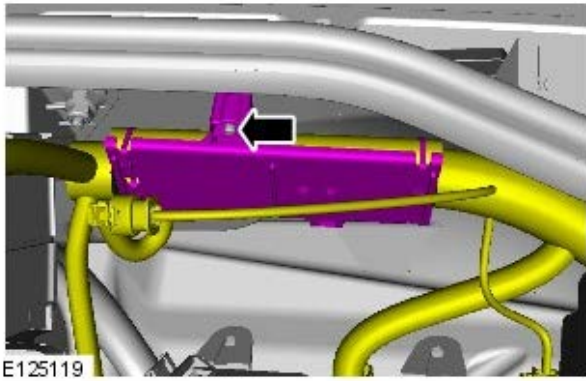
6.



7.

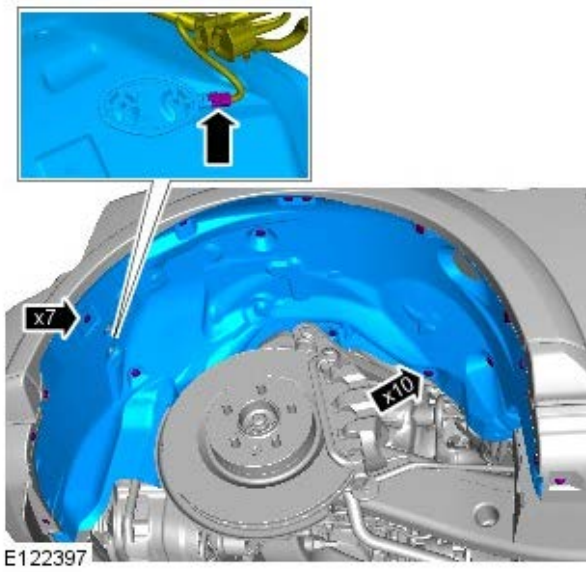


8.

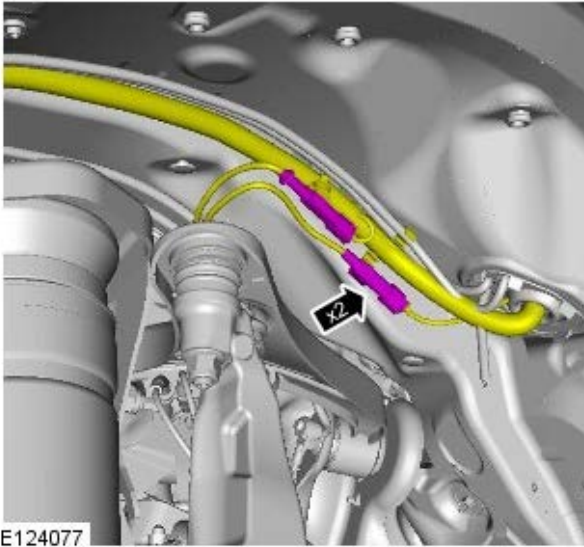


9. Remove the front LH road wheel and tire.

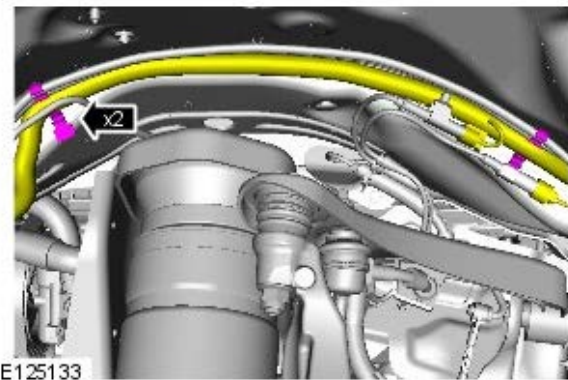
10.



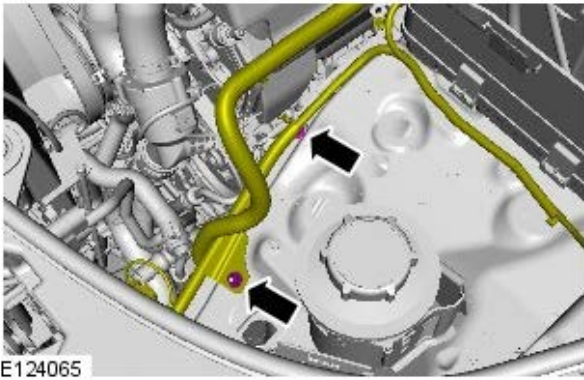
11.



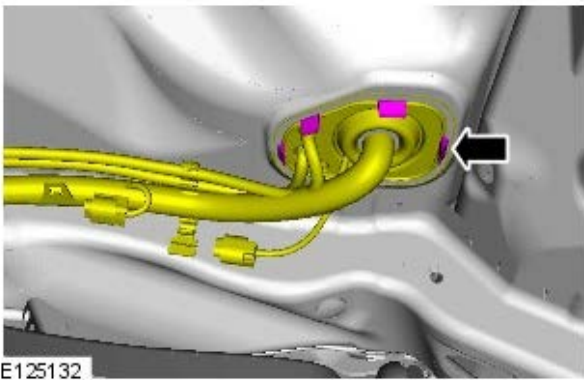
12.



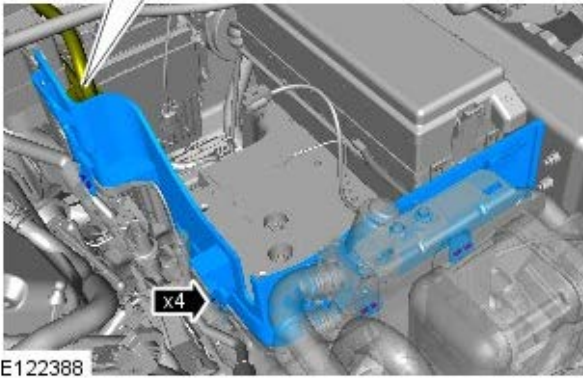
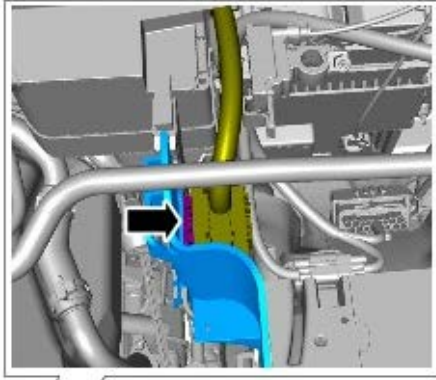
13. TORQUE: 10 Nm



14.

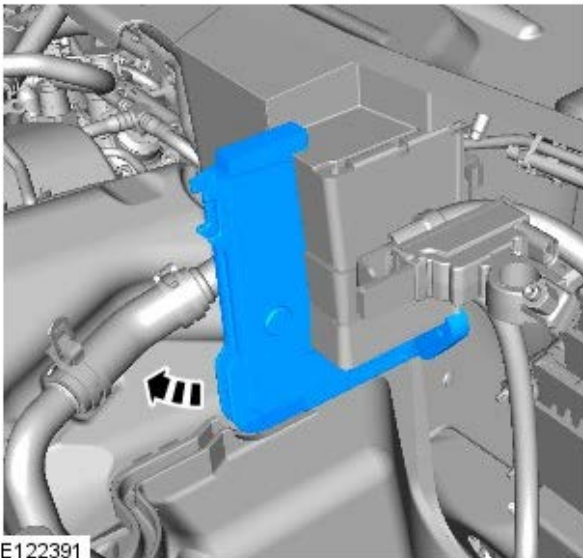


15.  NOTE: RHD illustration shown, LHD is similar.



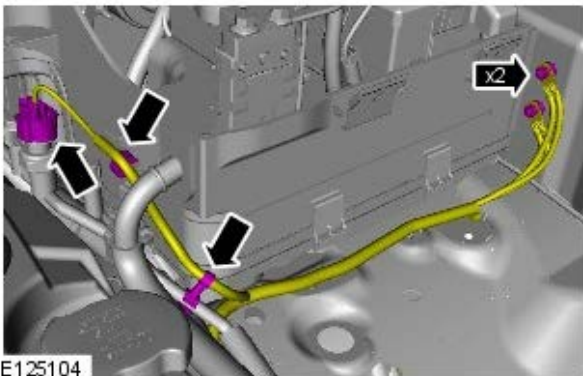
E122388

16.



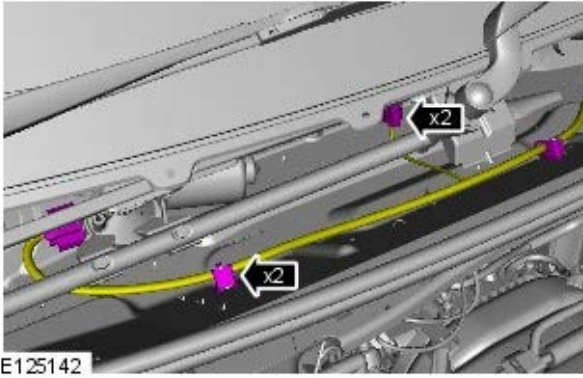
E122391

17. TORQUE: 12 Nm



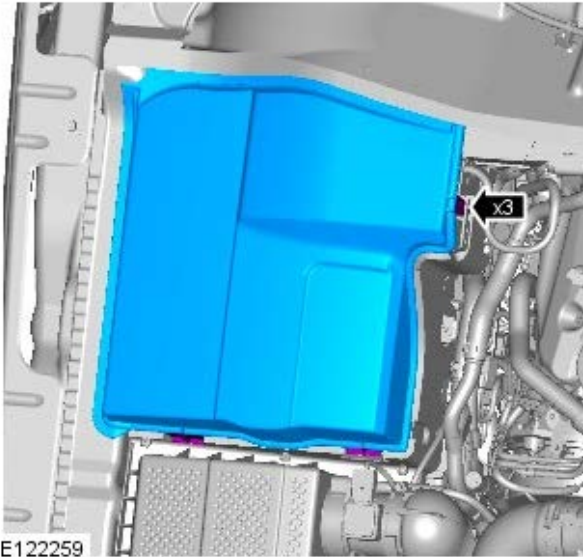
E125104

18.



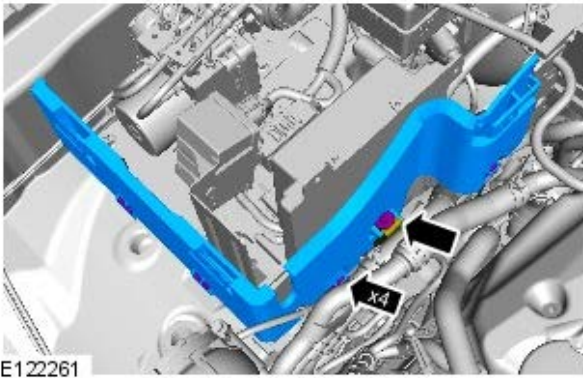
E125142

19.



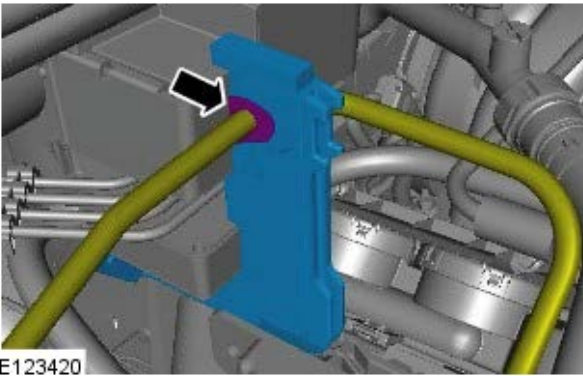
E122259

20. TORQUE: 10 Nm



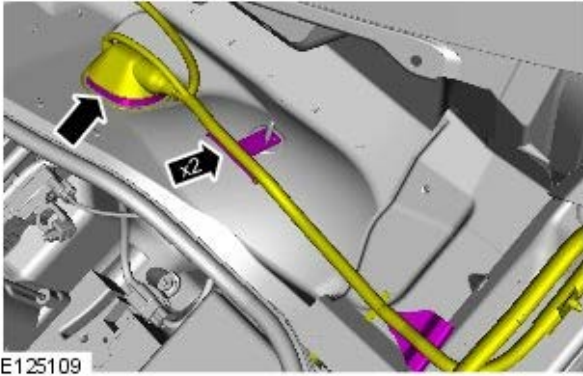
E122261

21.



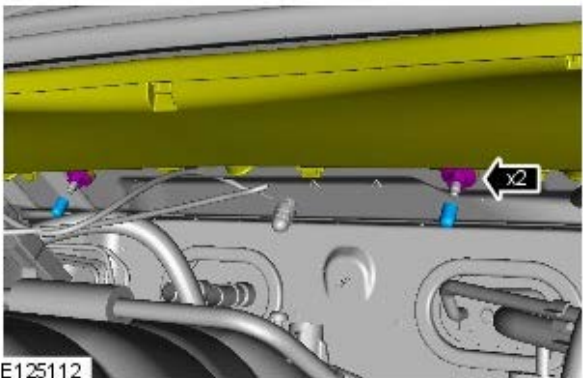
E123420

22.



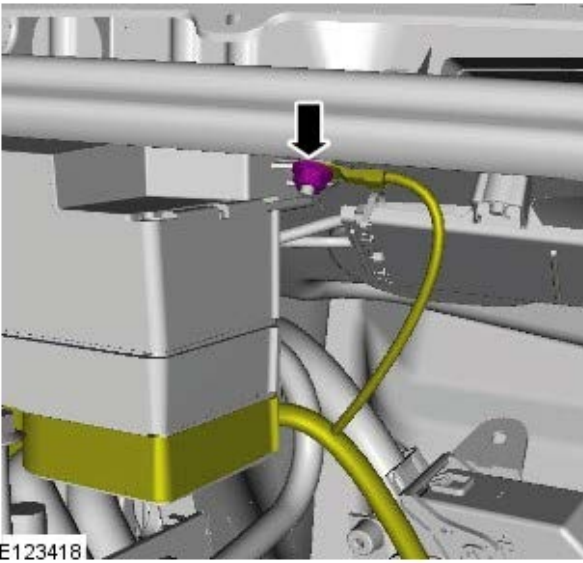
E125109

23. TORQUE: 10 Nm



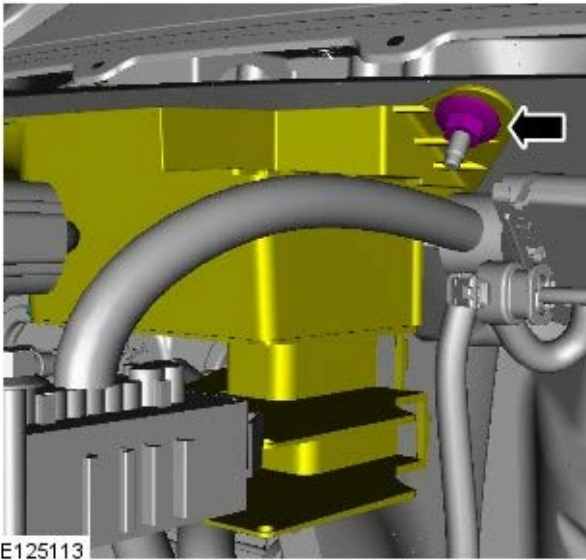
E125112

24. TORQUE: 10 Nm



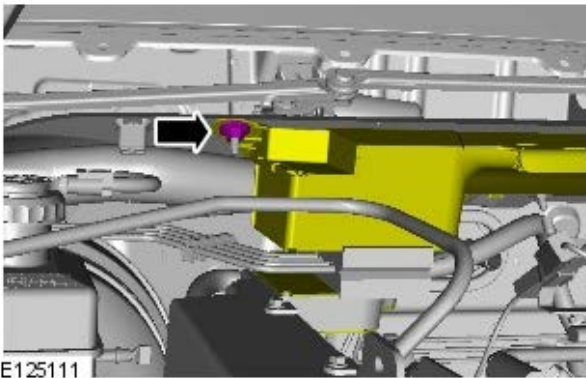
E123418

25. TORQUE: 10 Nm



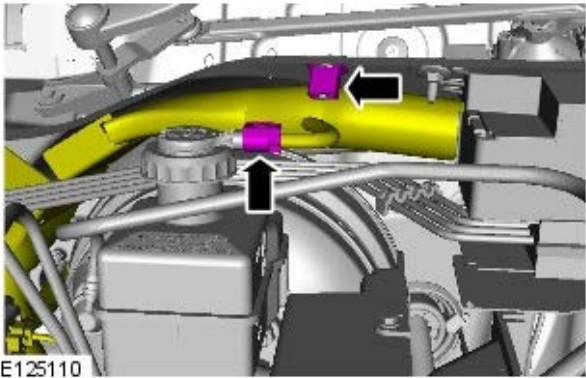
E125113

26. TORQUE: 10 Nm



E125111

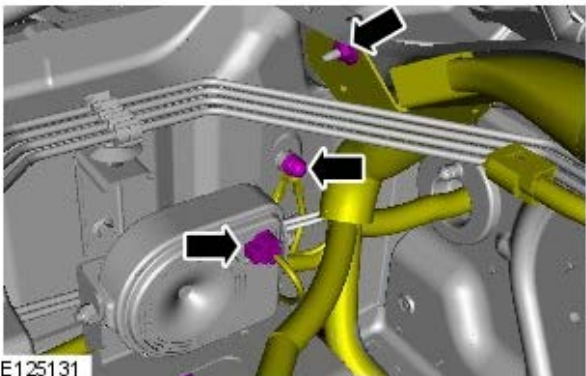
27.



E125110

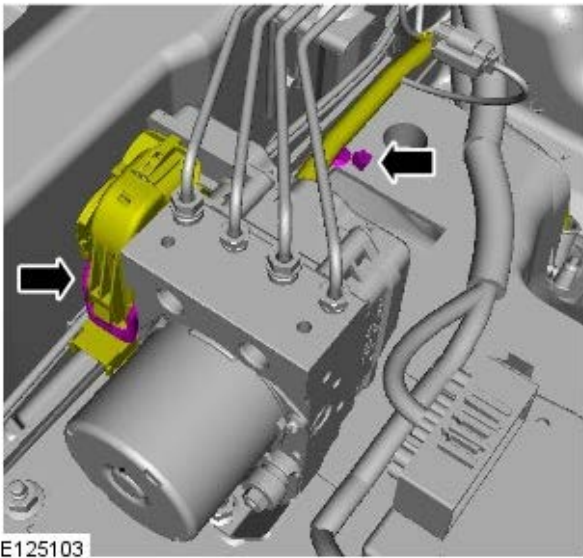
28. For additional information, refer to: Brake Booster (206-07, Removal and Installation).

29. TORQUE: 10 Nm



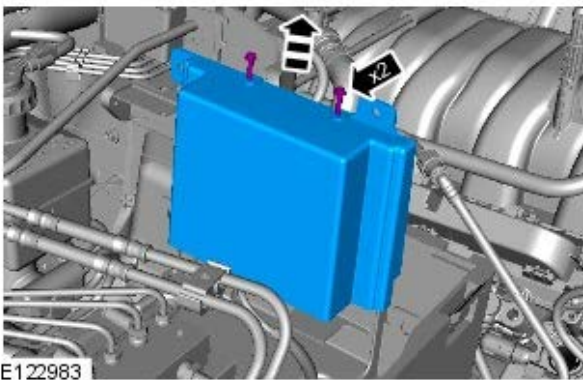
E125131

30.



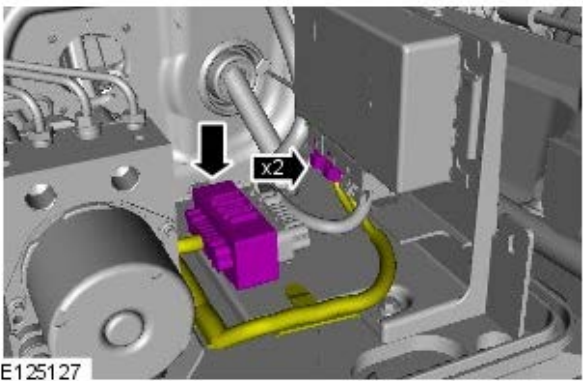
E125103

31.



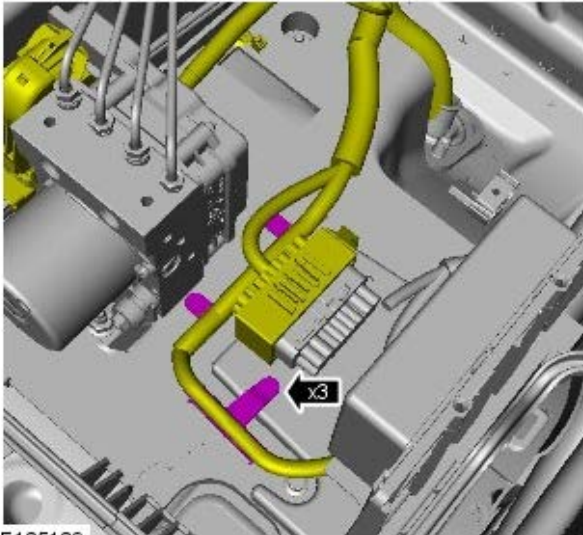
E122983

32.



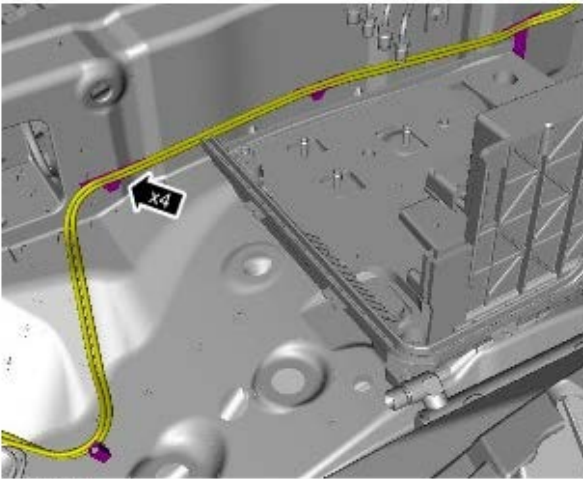
E125127

33.



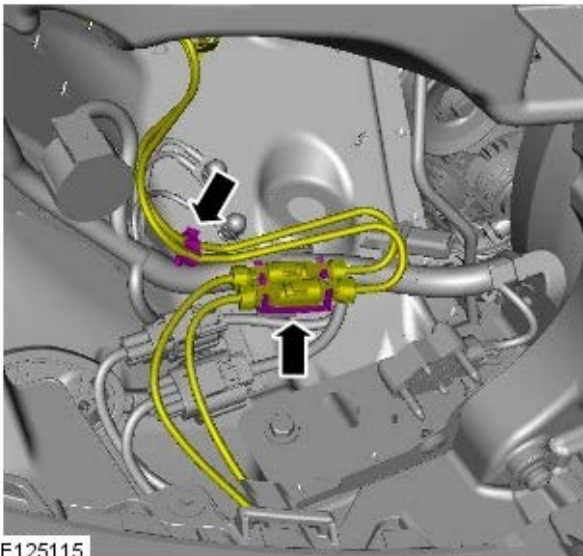
E125129

34.



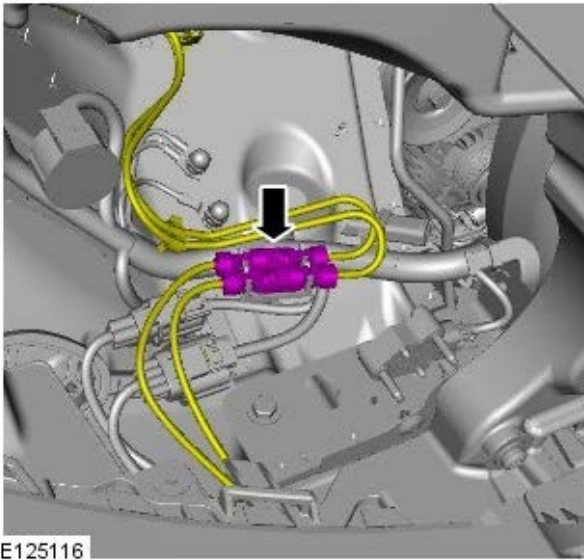
E125125

35.



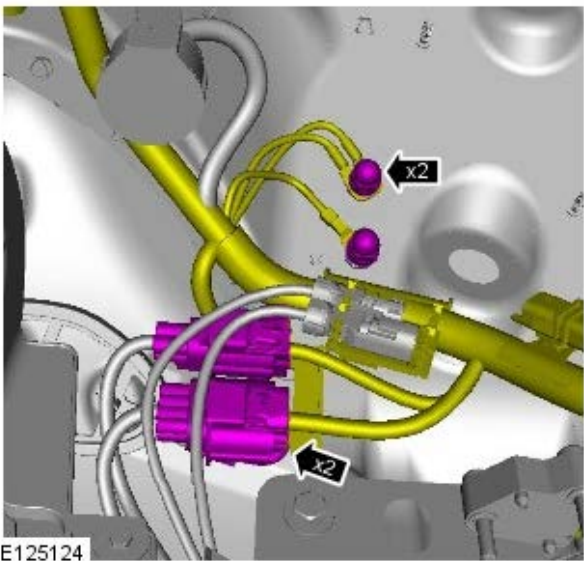
E125115

36.



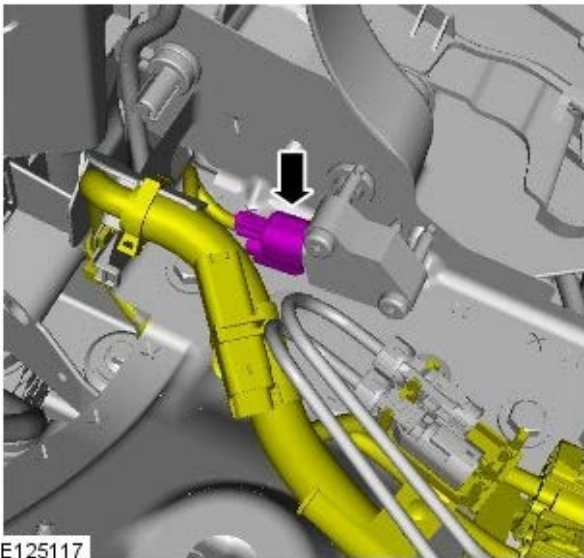
E125116

37. TORQUE: 10 Nm



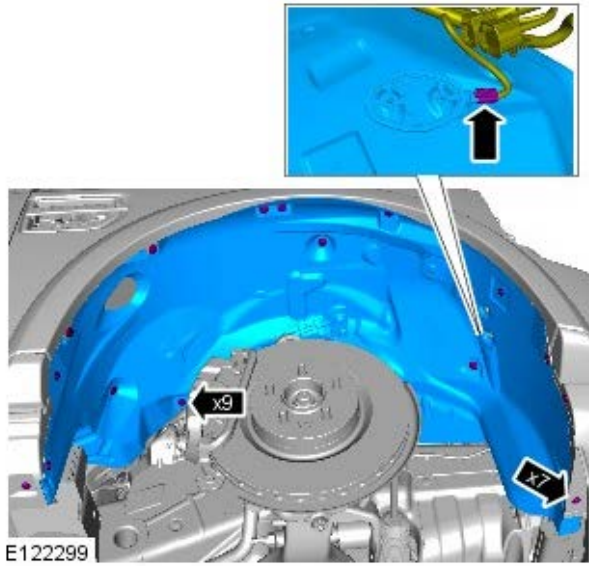
E125124

38.

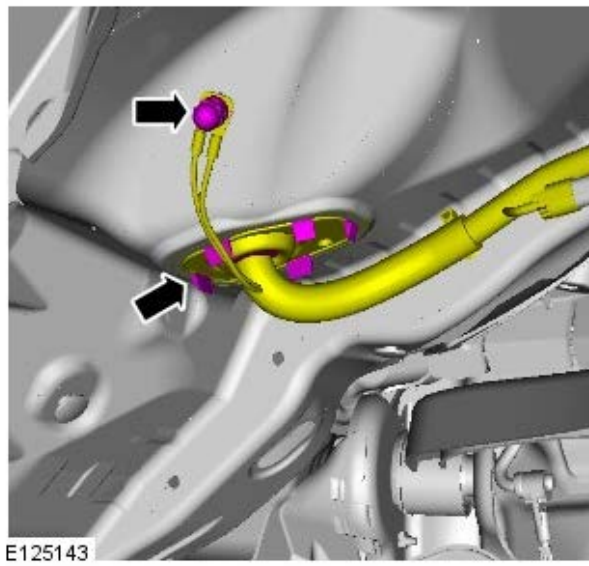


E125117

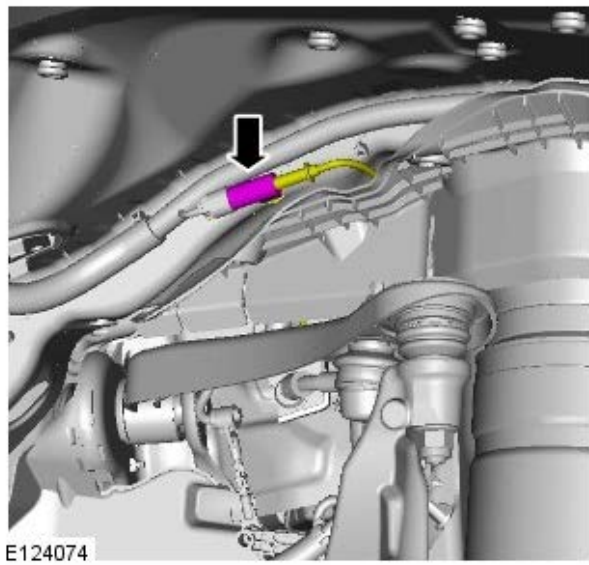
39.



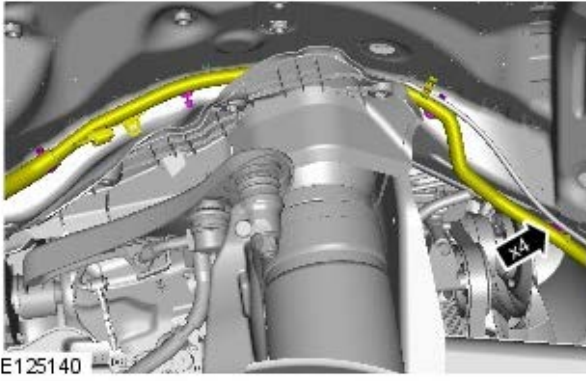
40.



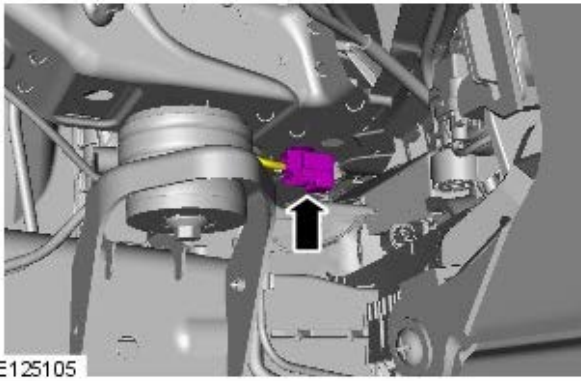
41.



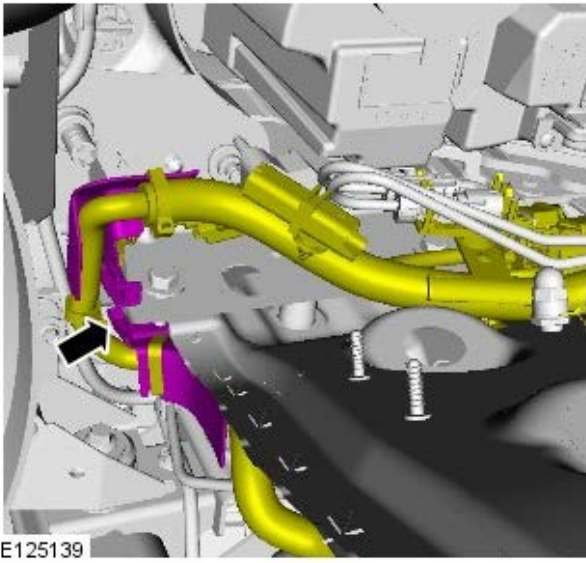
42.



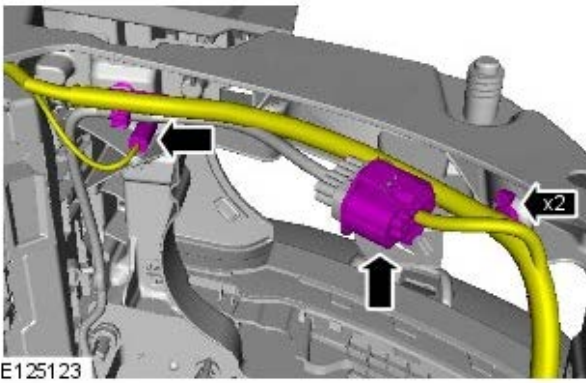
43.



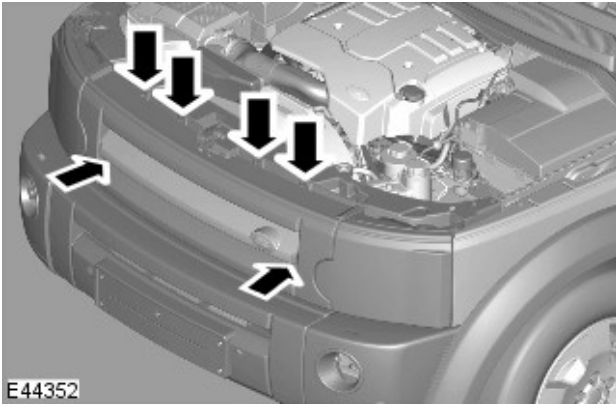
44.



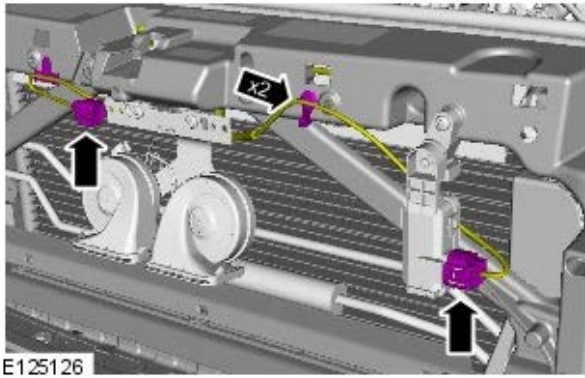
45.



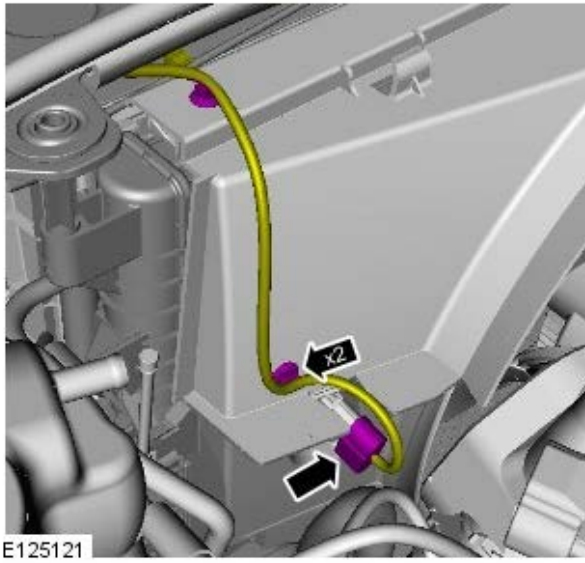
46.



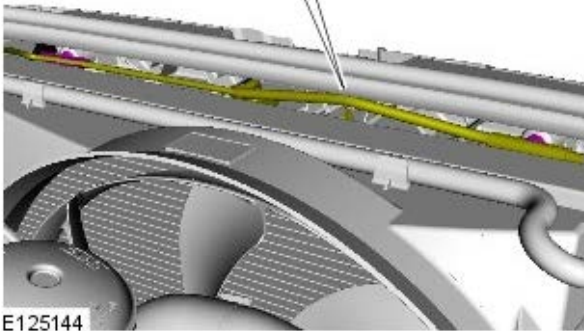
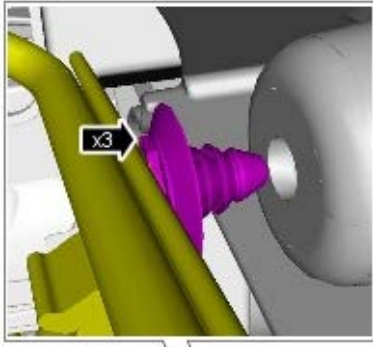
47.



48.

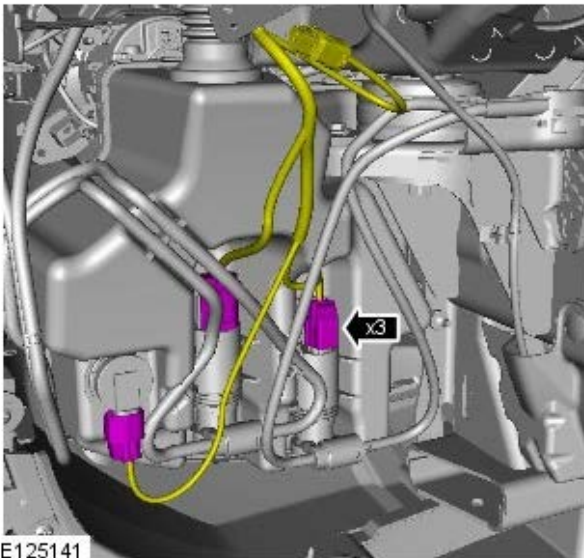


49.



E125144

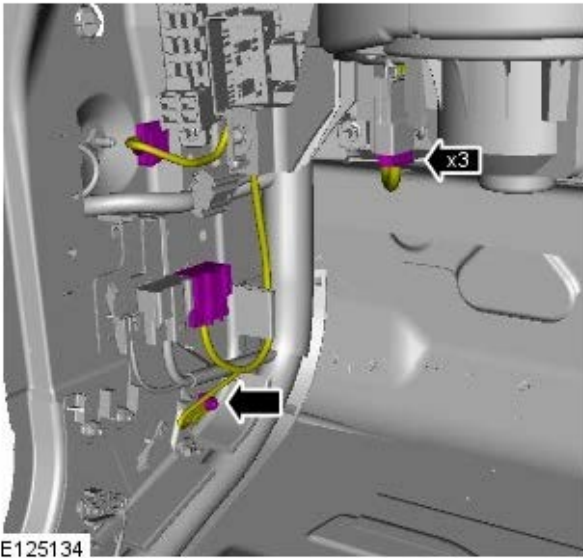
50.



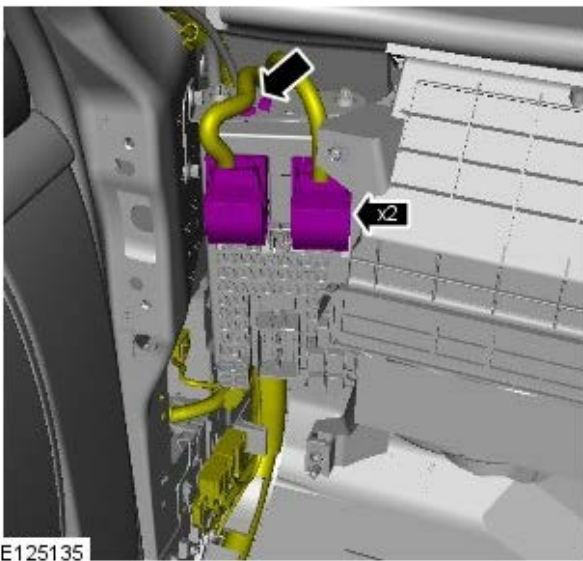
E125141

51. For additional information, refer to: Instrument Panel (501-12, Removal and Installation).

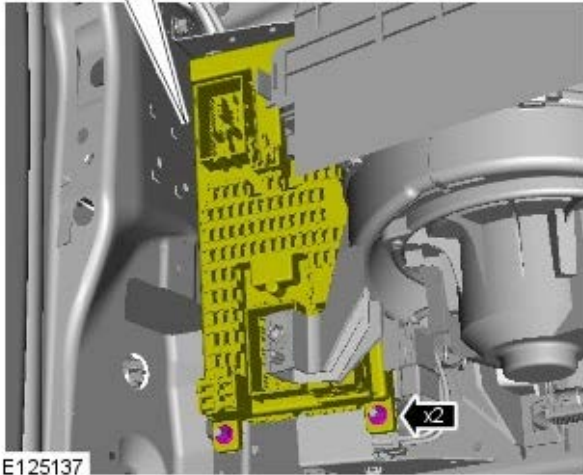
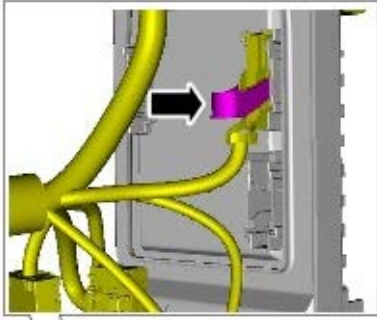
52. TORQUE: 10 Nm



53.

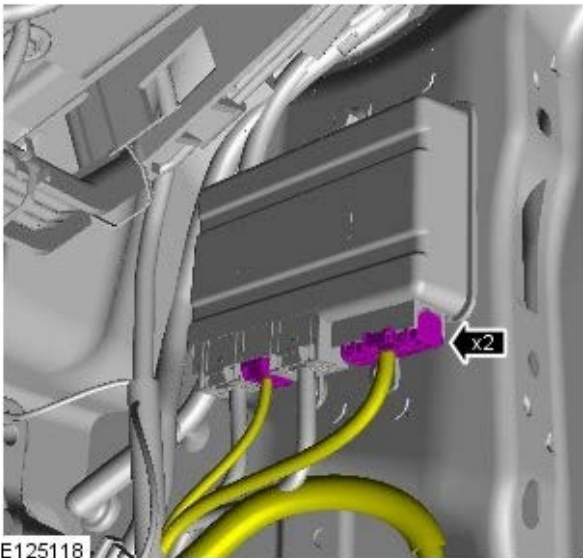


54. TORQUE: 10 Nm



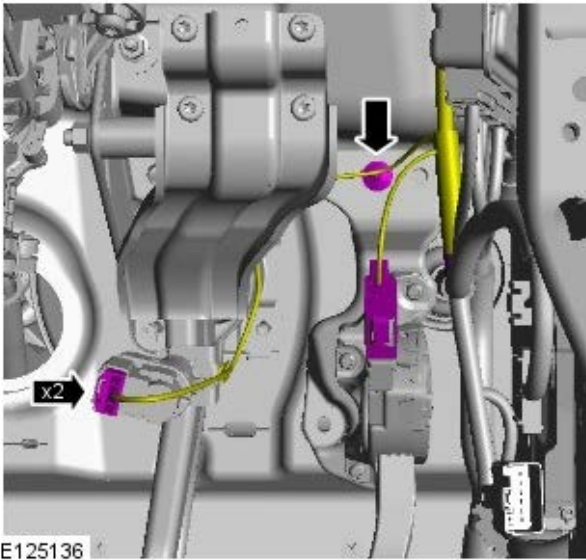
E125137

55.

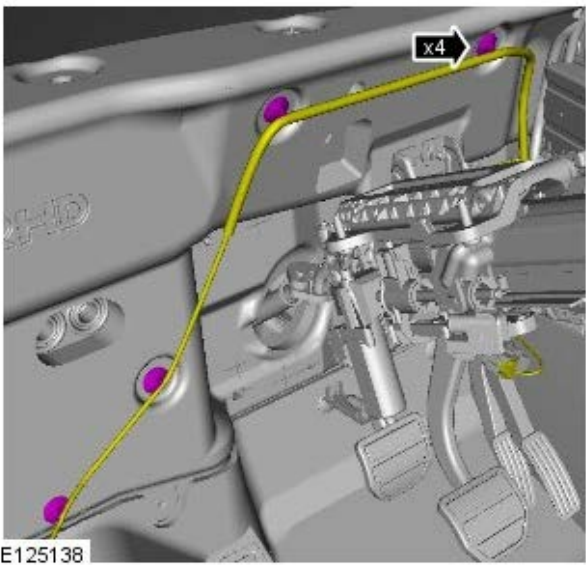


E125118

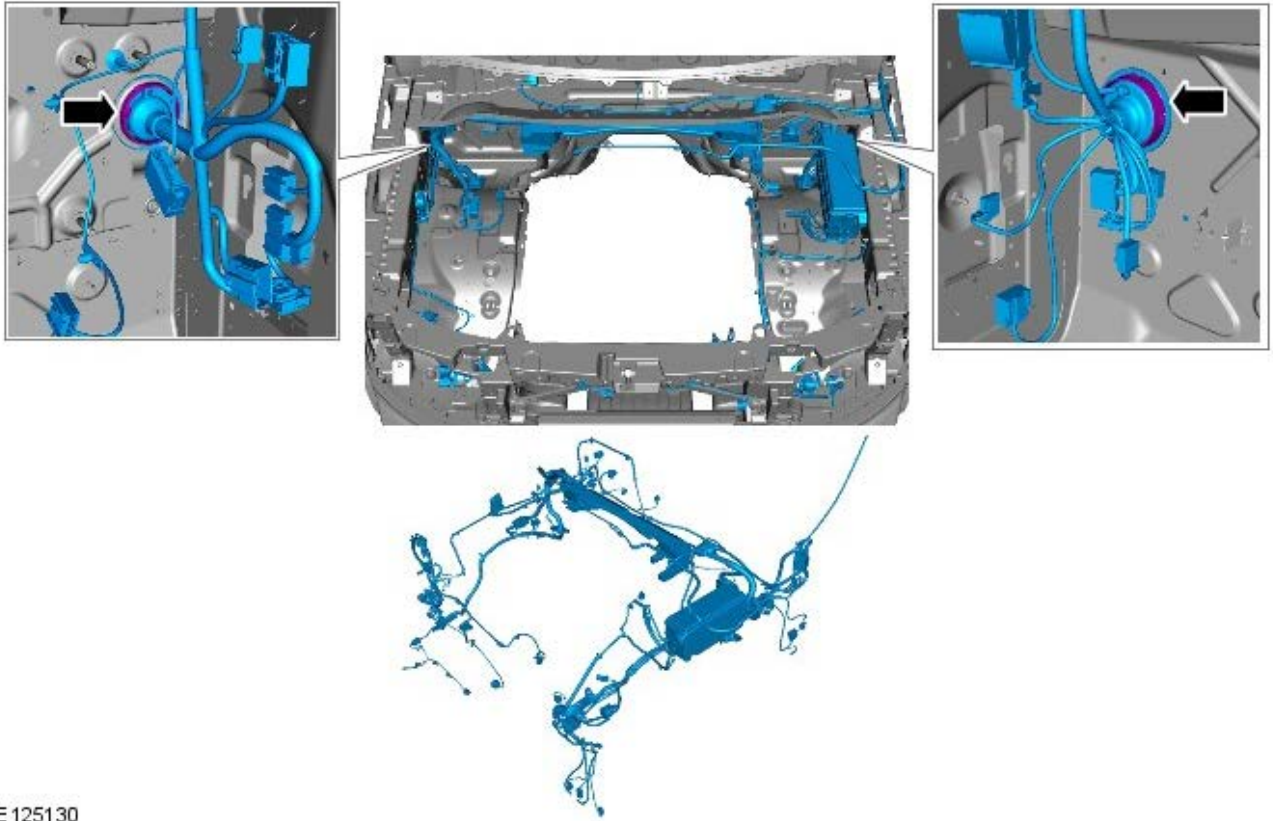
56.



57.



58.



E125130

Installation

1. To install, reverse the removal procedure.

Module Communications Network - Battery Junction Box (BJB) TDV6

3.0L Diesel

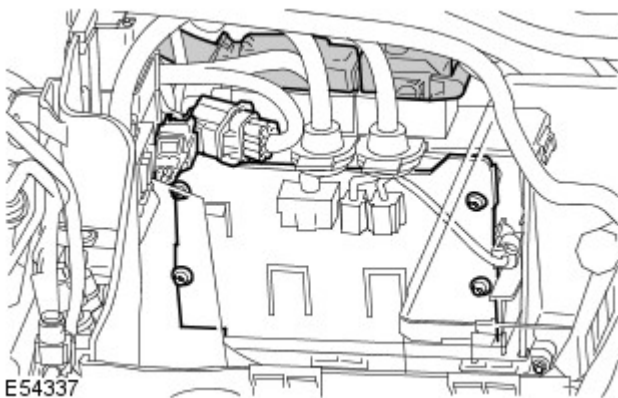
Removal and Installation

Removal

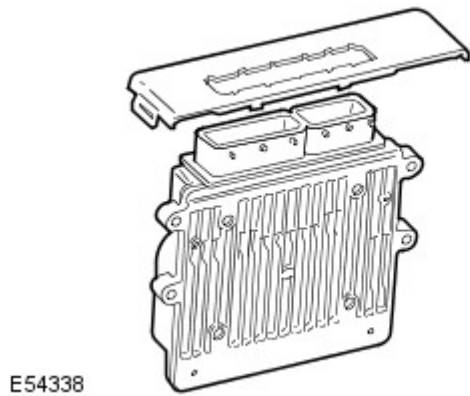


NOTE: The BJB is an integral component of the engine compartment wiring harness and cannot be removed separately.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the engine cover.
For additional information, refer to: Engine Cover - 2.7L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Remove the radiator grille.
For additional information, refer to: Radiator Grille (501-08 Exterior Trim and Ornamentation, Removal and Installation).
5. Remove the air cleaner assembly.
6. Remove the four-wheel drive control module.
For additional information, refer to: Four-Wheel Drive (4WD) Control Module (308-07 Four-Wheel Drive Systems, Removal and Installation).
7. Remove the battery tray.
For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
8. Remove the auxiliary battery tray.
For additional information, refer to: Auxiliary Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
9. Remove the ECM cover.
 - Disconnect 2 electrical connectors for access.
 - Disconnect the 2 ECM electrical connectors.
 - Remove the 4 Torx screws.
10. Remove the ECM.
 - Remove the ECM top cover.



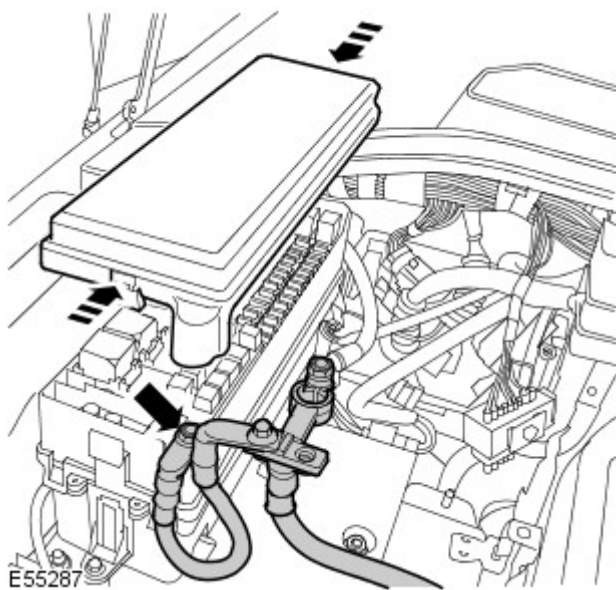
E54337



E54338

11. Remove the BJB cover.
 - Release the clip.

12. Disconnect the battery positive cable from the BJB.
 - Remove the nut.

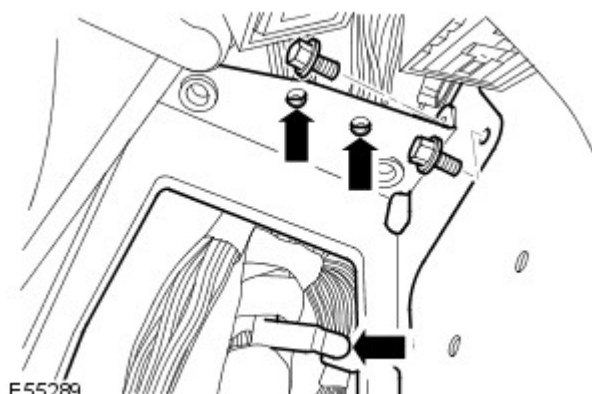


E55287

13. Remove both cowl side trim panels.
For additional information, refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).

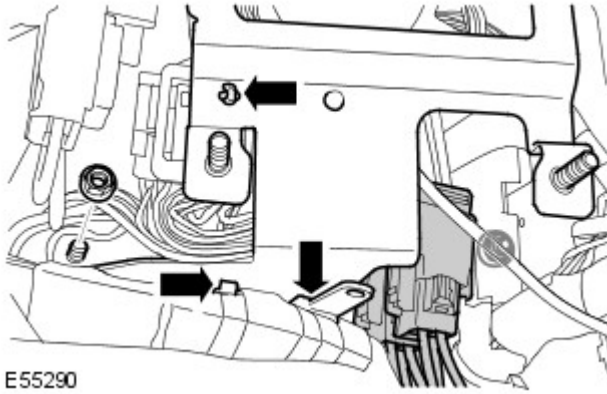
14. Remove the CJB.
For additional information, refer to: Central Junction Box (CJB) (418-00 Module Communications Network, Removal and Installation).

15. Release the CJB bracket.
 - Release the 3 upper wiring harness clips.
 - Remove the 2 bolts.

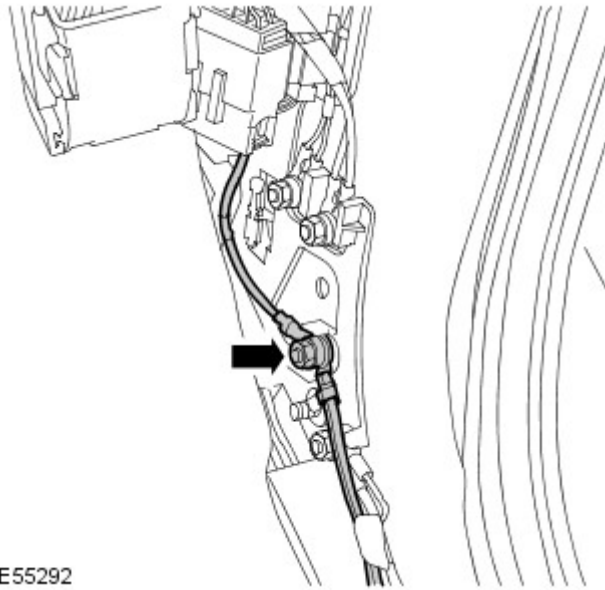


E55289

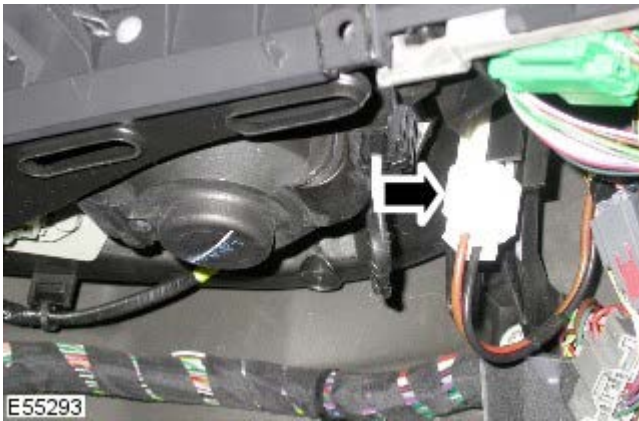
16. Remove the CJB bracket.
 - Disconnect the 2 electrical connectors.
 - Release the 3 lower wiring harness clips.
 - Remove the 2 nuts.



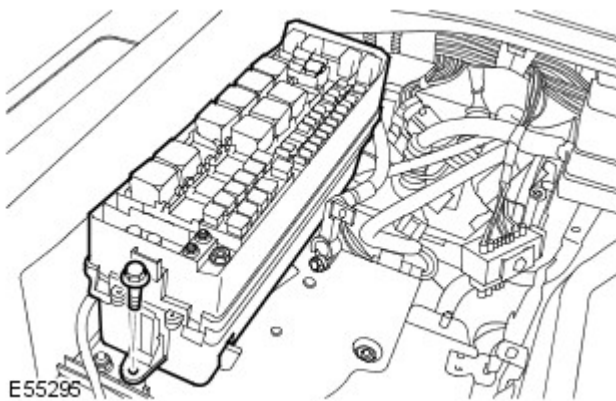
17. Release the 2 ground cables from the lower A-pillar.
- Remove the nut.



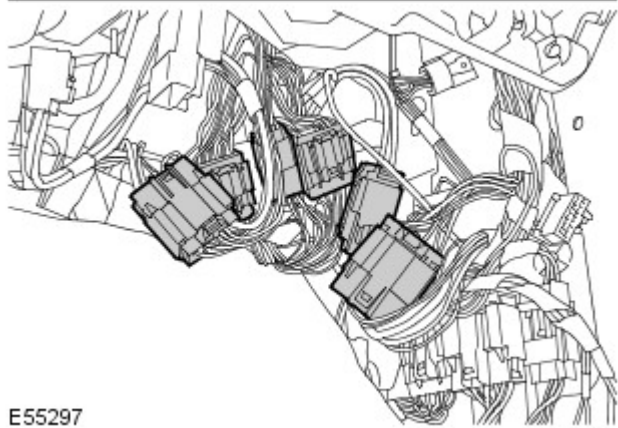
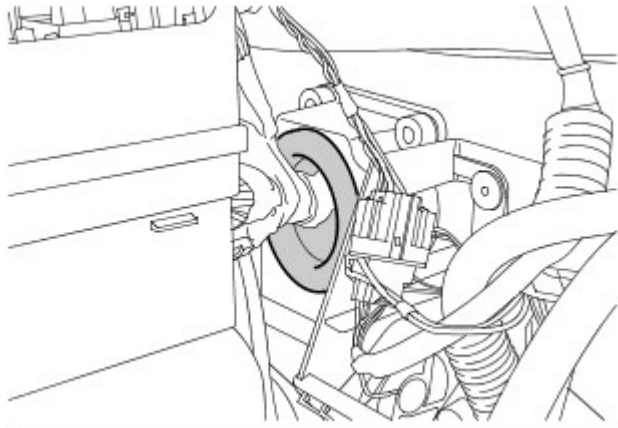
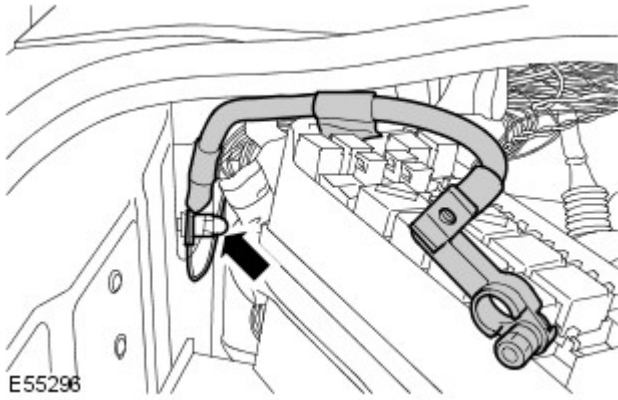
18. Disconnect the heater motor electrical connector.



19. Release the BJB from the bracket.
- Remove the bolt.



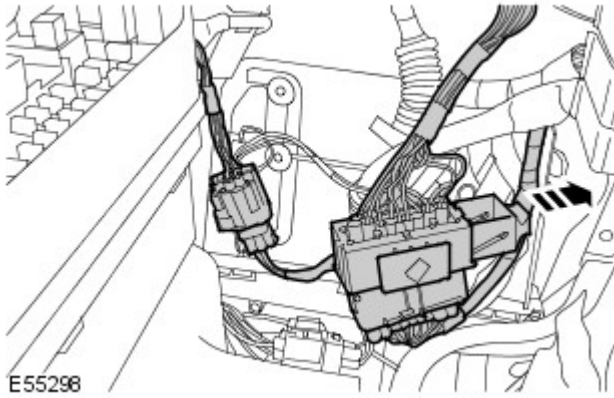
20. Remove the battery ground cable.
- Remove the nut.
 - Release the additional ground cable.



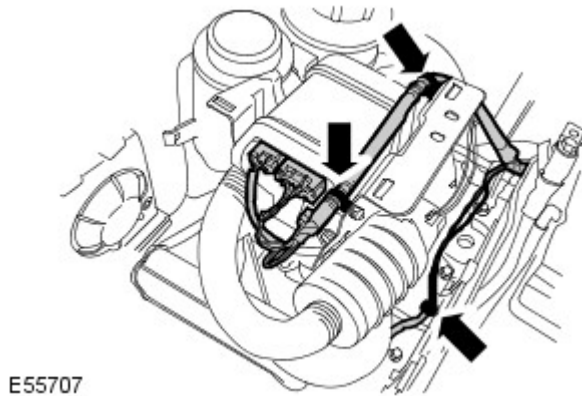
21. Release the BJB wiring harness from the bulkhead.
 - Disconnect the 6 electrical connectors.
 - Release the grommet.

E55297

22. Raise and support the vehicle.
23. Remove both front fender splash shields.
For additional information, refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).
24. Remove both headlamps.
For additional information, refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).
25. Passenger side: Disconnect the engine wiring harness electrical connector.
26. Passenger side: Disconnect the transfer case electrical connector.



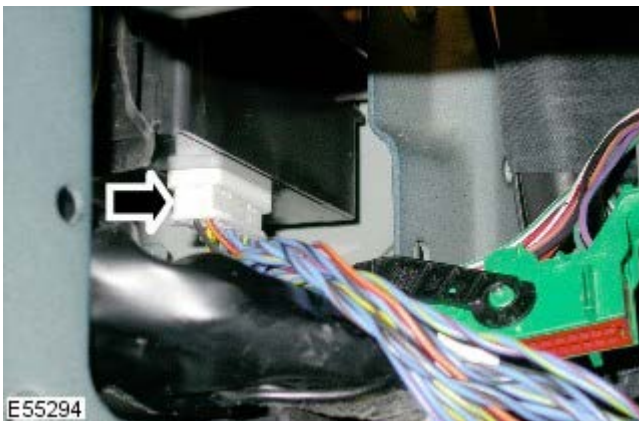
27. LH side: Release the wiring harness from the fuel fired heater.
- Disconnect the 3 electrical connectors.
 - Release the 3 clips.



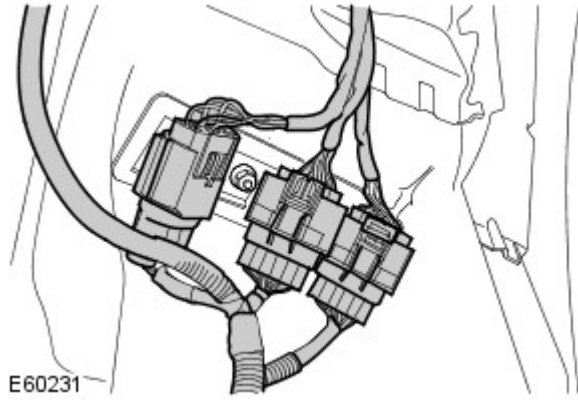
28. LH side: Disconnect the washer jet hose.



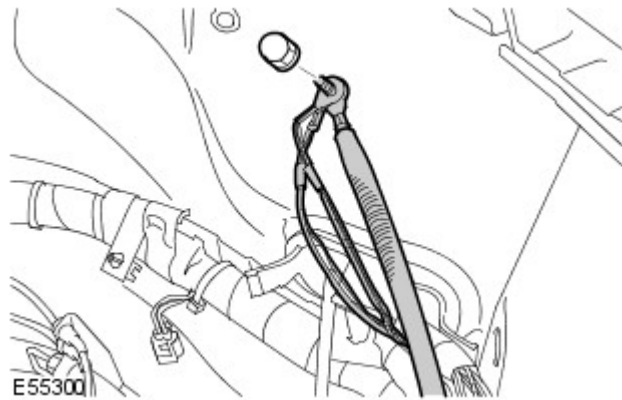
29. LH side: Disconnect the adaptive front lighting module electrical connector.



30. LH side: Disconnect the 3 body panel electrical connectors.

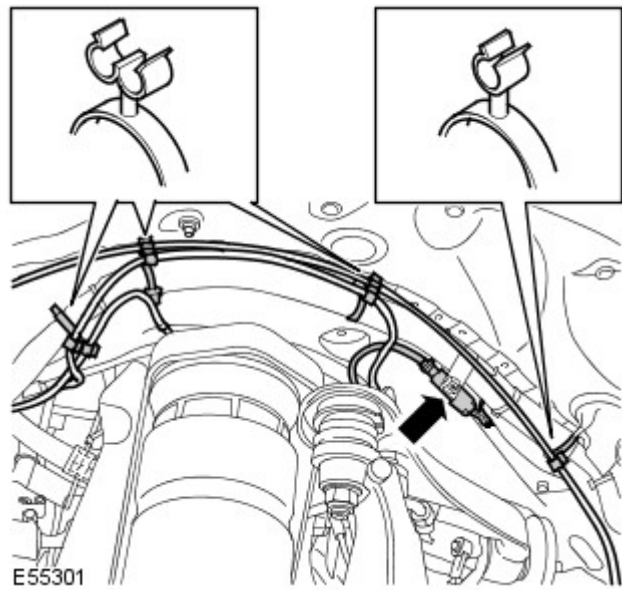


31. LH side: Release the 3 body panel ground cables.
- Remove the nut.

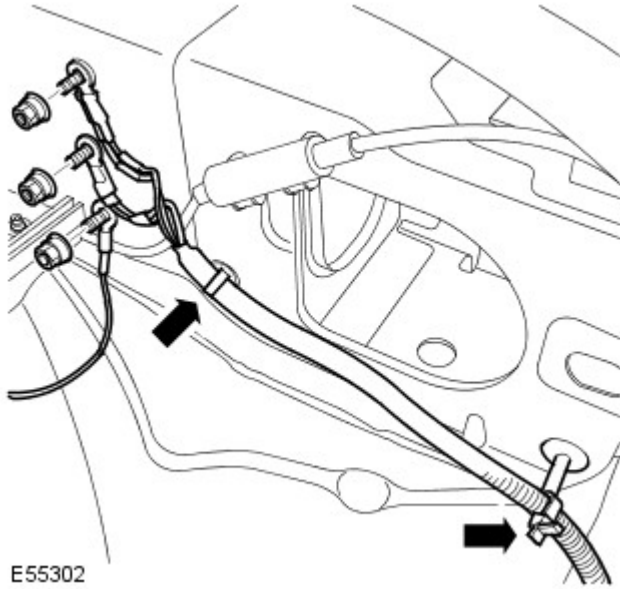


32. LH side: Release the 2 air suspension pipes from the wiring harness.
- Release the 7 clips.

33. LH side: Disconnect the ABS electrical connector.

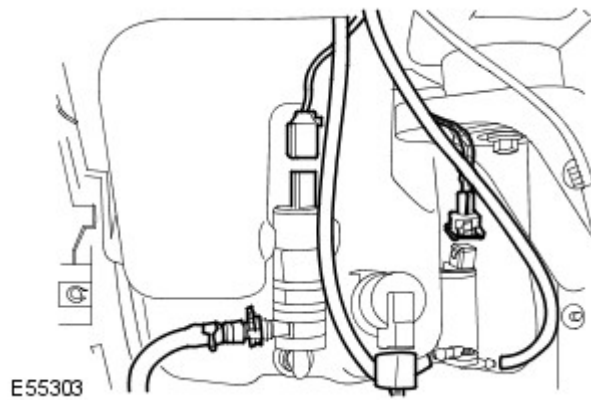


34. LH side: Release 3 engine compartment ground cables.
- Remove the 3 nuts.
 - Release the 2 clips.



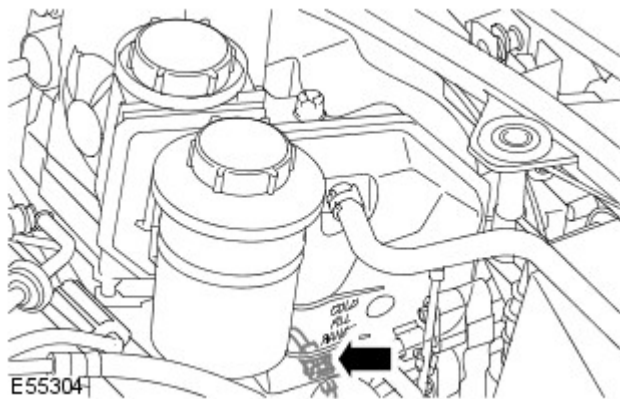
E55302

35. LH side: Release the washer reservoir wiring harness.
- Disconnect the 3 electrical connectors.
 - Disconnect the 2 washer jet hoses.



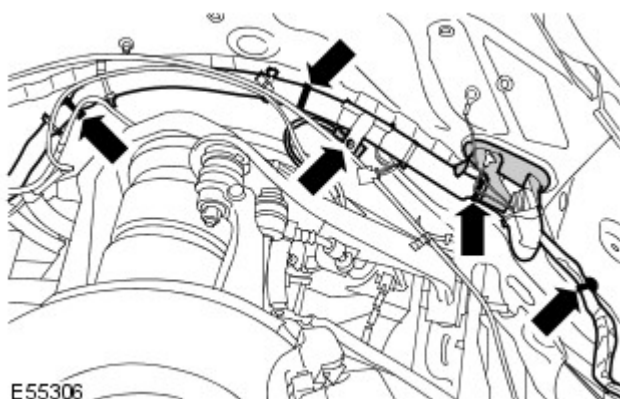
E55303

36. LH side: Disconnect the coolant expansion tank level switch electrical connector.



E55304

37. LH side: Disconnect the brake pad wear sensor electrical connector.

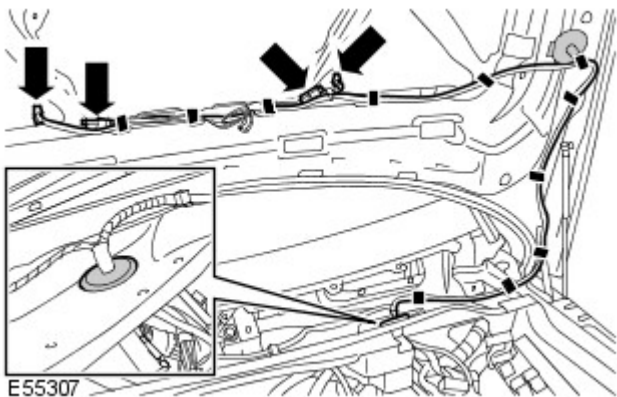
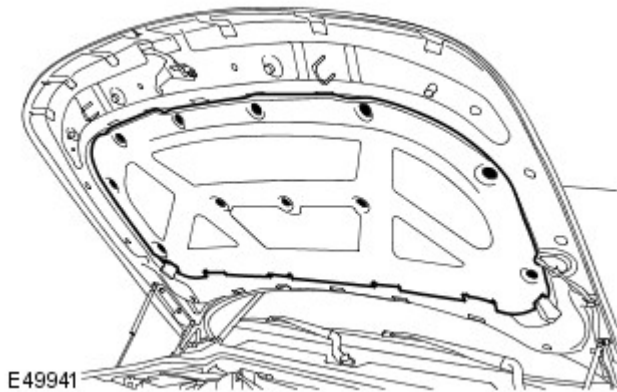


E55306

38. LH side: Release the wiring harness.
- Release the grommet.
 - Release the 4 clips.

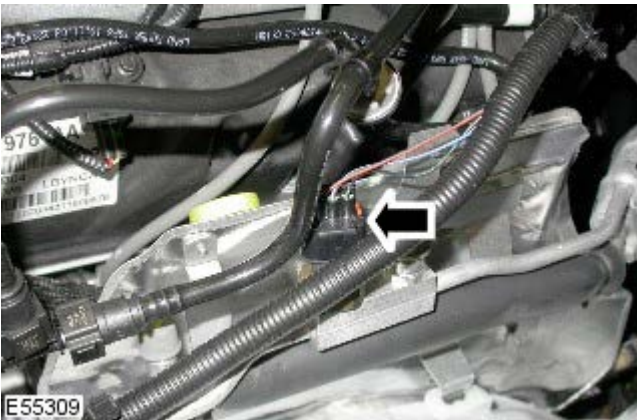
39. Remove the windshield wiper motor.
For additional information, refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).

40. Remove the hood pad.
• Remove the 11 clips.



41. Release the hood wiring harness.
• Disconnect the 2 washer jet hoses.
• Disconnect the 2 electrical connectors.
• Release the 10 clips.
• Remove the wiring harness cover.
• Release the grommet.

42. Disconnect the A/C pressure transducer electrical connector.

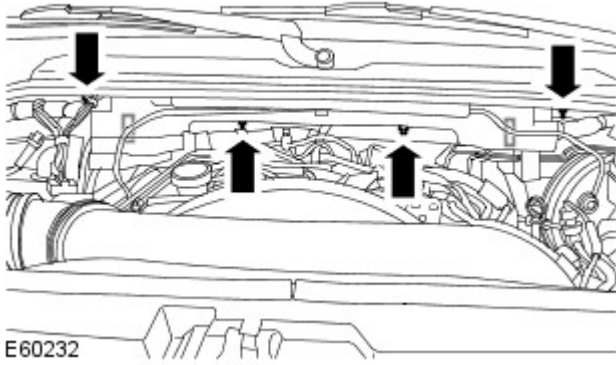


43.  **NOTE:** 4.0L illustration shown, 2.7L Diesel is similar.

Disconnect the battery to engine compartment wiring harness electrical connector.

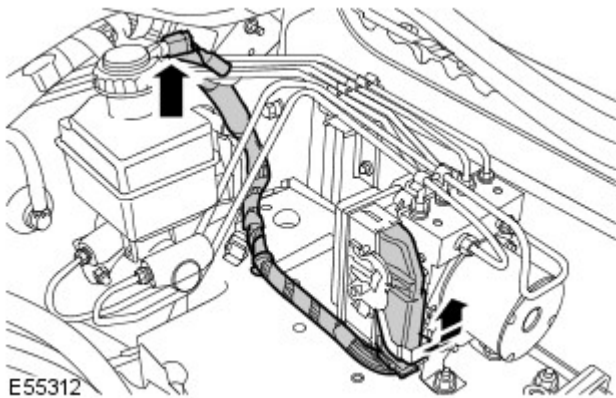


44. Release the wiring harness from the plenum.
• Remove the 3 nuts.
• Release the clip.



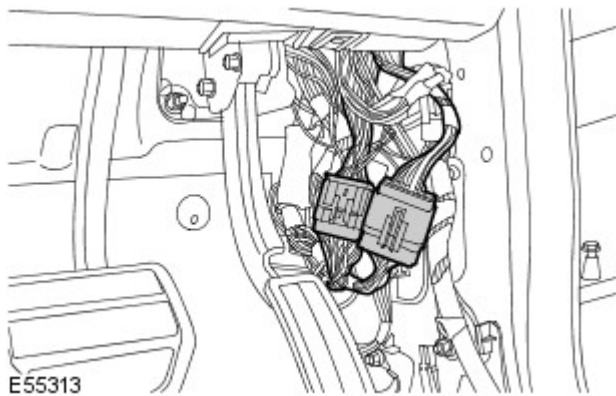
45. Disconnect the brake fluid reservoir electrical connector.

46. Disconnect the ABS module electrical connector.

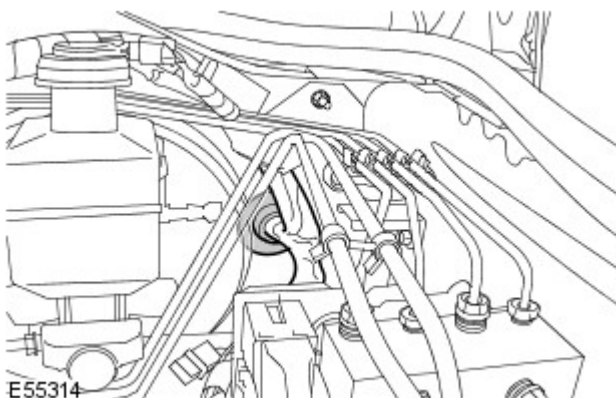


47. Remove the air suspension control module.
For additional information, refer to: Air Suspension Control Module (204-05 Vehicle Dynamic Suspension, Removal and Installation).

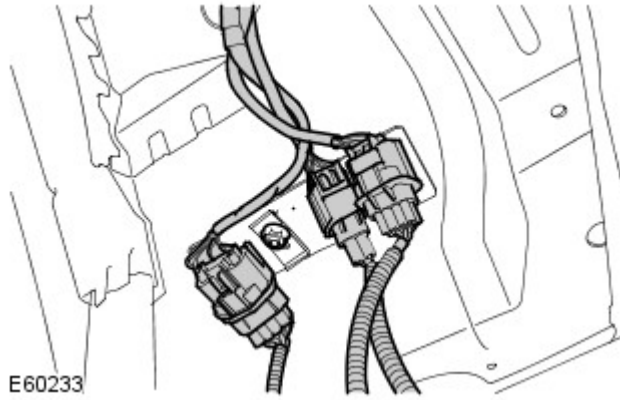
48. Driver side: Disconnect 2 electrical connectors from the lower A-pillar.



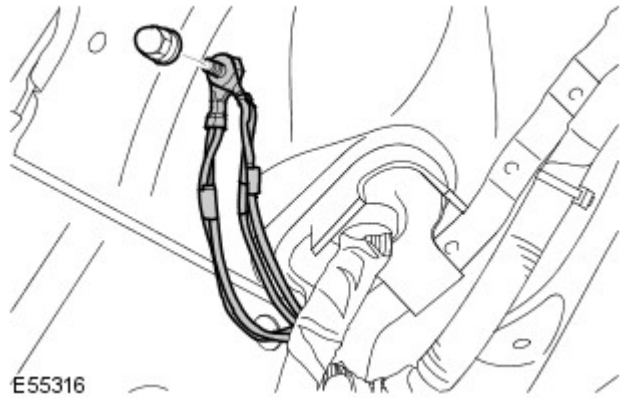
49. Driver side: Release the wiring harness from the bulkhead.
• Release the grommet.



50. RH side: Disconnect the 3 body panel electrical connectors.

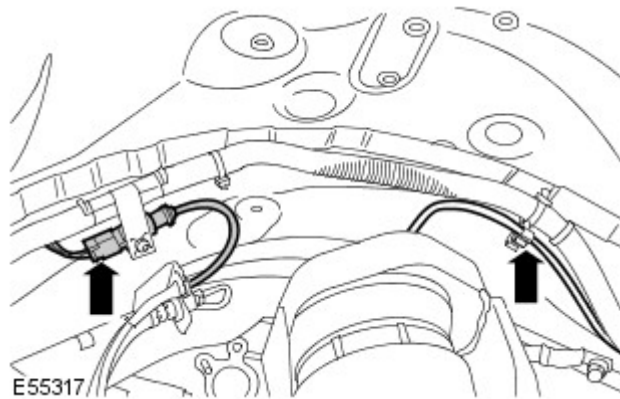


51. RH side: Release the 3 body panel ground cables.
- Remove the nut.

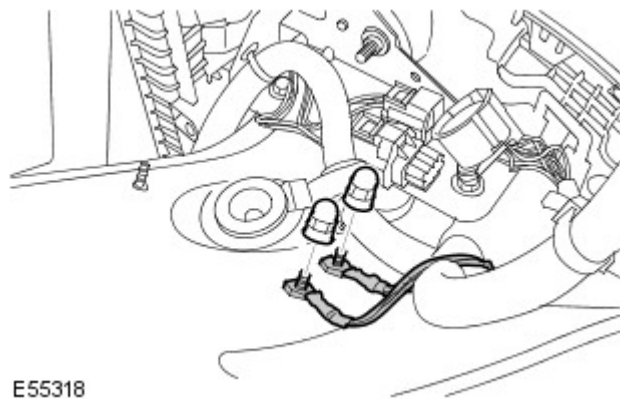


52. RH side: Disconnect the ABS electrical connector.

53. RH side front: Release the air suspension pipe from the wiring harness clip.

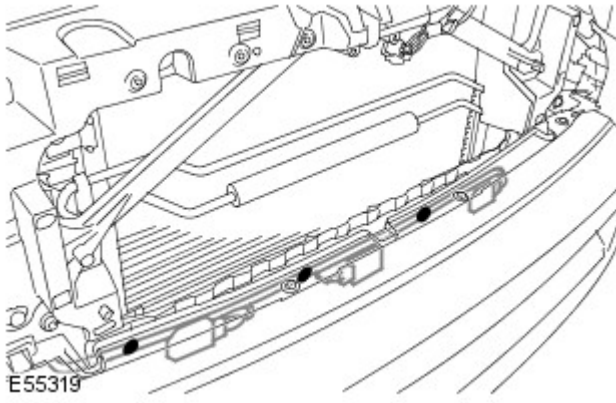


54. RH side: Release 2 engine compartment ground cables.
- Remove the 2 nuts.

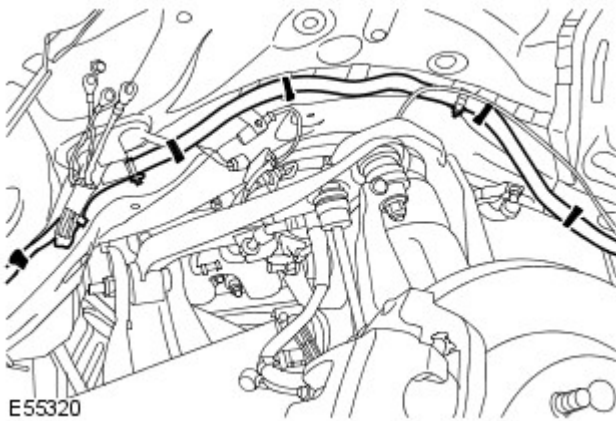
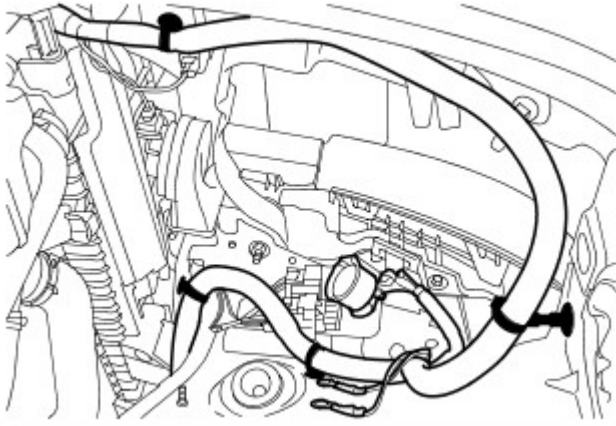


55. Disconnect the ambient air temperature sensor electrical connector.

56. Disconnect both front impact severity sensor electrical connectors.
- Release the 3 clips.

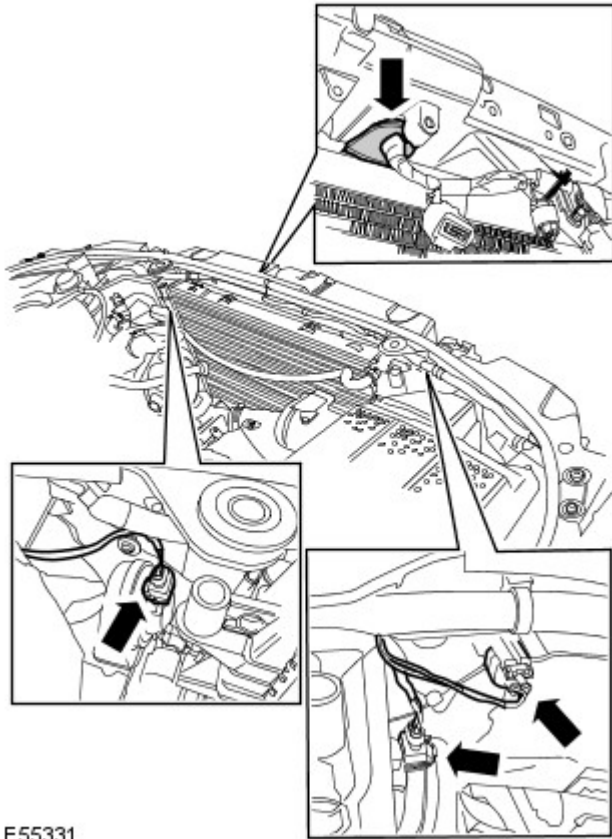


57. RH side: Release the wiring harness.
- Release the 9 clips.



58. Disconnect the hood switch electrical connector.

59. Disconnect both horn electrical connectors.

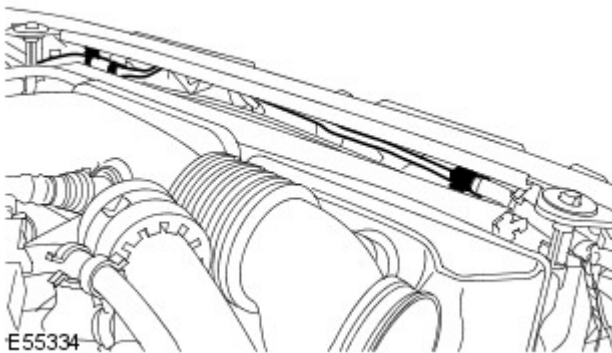


E55331

60. If installed, disconnect the speed control module electrical connector.
61. If installed, disconnect the pollution sensor electrical connector.
 - Release the clip.
 - Release the grommet.

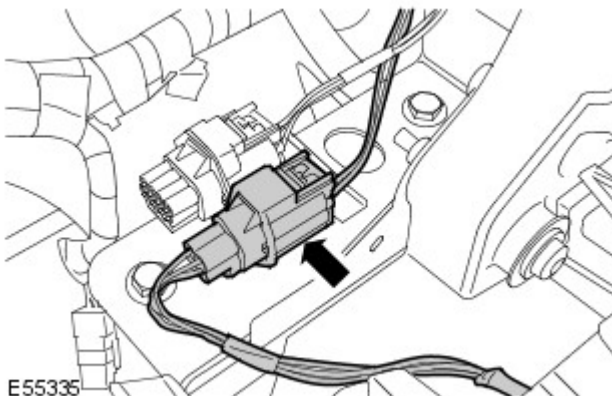
62.  **NOTE:** 4.0L illustration shown, 2.7L Diesel is similar.

- Release the hood release cable.
- Release from the 3 clips.



E55334

63. Disconnect the front bumper wiring harness electrical connector.



E55335

64. With assistance, remove the BJB and wiring harness.

Installation

1. With assistance, install the BJB and wiring harness.
2. Connect the front bumper wiring harness electrical connector.
3. Attach the hood release cable.
 - Secure with the clips.
4. If installed, connect the pollution sensor electrical connector.
 - Install the grommet.
 - Secure the clip.
5. If installed, connect the speed control module electrical connector.
6. Connect the horn electrical connectors.
7. Connect the hood switch electrical connector.
8. RH side: Secure the wiring harness.
 - Secure the clips.
9. Connect both front impact electrical connectors.
 - Secure the clips.
10. RH side: Attach the air suspension pipe.
11. Connect the ambient air temperature sensor electrical connector.
12. RH side: Attach the engine compartment ground cables.
 - Tighten the nuts to 25 Nm (18 lb.ft).
13. RH side: Connect the ABS electrical connector.
14. RH side: Attach the body panel ground cables.
 - Tighten the nut to 25 Nm (18 lb.ft).
15. RH side: Connect the body panel electrical connectors.
16. Driver side: Attach the wiring harness to the bulkhead.
 - Install the grommet.
17. Driver side: Connect the lower A-pillar electrical connectors.
18. Install the air suspension control module.
For additional information, refer to: Air Suspension Control Module (204-05 Vehicle Dynamic Suspension, Removal and Installation).
19. Connect the ABS module electrical connector.
20. Connect the brake fluid reservoir electrical connector.
21. Attach the wiring harness to the plenum.
 - Secure the clips.
 - Tighten the nuts to 4 Nm (3 lb.ft).
22. Connect the battery to engine compartment wiring harness electrical connector.
23. Connect the A/C pressure transducer electrical connector.
24. Attach the hood wiring harness.
 - Install the grommet.
 - Install the cover.
 - Secure with the clips.
 - Connect the electrical connectors.
 - Connect the washer jet hoses.

25. Install the hood pad.
 - Install the clips.
26. Install the windshield wiper motor.
For additional information, refer to: Windshield Wiper Motor (501-16 Wipers and Washers, Removal and Installation).
27. LH side: Attach the wiring harness.
 - Install the grommet.
 - Secure the clips.
28. LH side: Connect the brake pad wear sensor electrical connector.
29. LH side: Connect the coolant expansion tank level switch electrical connector.
30. LH side: Attach the washer reservoir wiring harness.
 - Connect the washer jet hoses.
 - Connect the electrical connectors.
31. LH side: Attach the engine compartment ground cables.
 - Secure the clips.
 - Tighten the nuts to 25 Nm (18 lb.ft).
32. LH side: Connect the ABS electrical connector.
33. LH side: Attach the air suspension pipes.
 - Secure the clips.
34. LH side: Attach the body panel ground cables.
 - Tighten the nut to 25 Nm (18 lb.ft).
35. LH side: Connect the body panel electrical connectors.
36. LH side: Connect the adaptive front lighting module electrical connector.
37. LH side: Connect the washer jet hose.
38. LH side: Attach the wiring harness to the fuel fired heater.
 - Connect the electrical connectors.
 - Secure with the clips.
39. Passenger side: Connect the transfer case electrical connector.
40. Passenger side: Connect the engine wiring harness electrical connector.
41. Install the headlamps.
For additional information, refer to: Headlamp Assembly (417-01 Exterior Lighting, Removal and Installation).
42. Install the fender splash shields.
For additional information, refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).
43. Attach the BJB wiring harness to the bulkhead.
 - Connect the electrical connectors.
 - Install the grommet.
44. Install the battery ground cable.
 - Attach the additional ground cable.
 - Tighten the nut to 25 Nm (18 lb.ft).
45. Secure the BJB to the bracket.
 - Tighten the bolt to 6 Nm (4 lb.ft).
46. Connect the heater motor electrical connector.
47. Connect the ground cables to the lower A-pillar.
 - Tighten the nut to 10 Nm (7 lb.ft).

48. Install the CJB bracket.
 - Tighten the nuts to 10 Nm (7 lb.ft).
 - Secure the clips.
 - Connect the electrical connectors.
 - Tighten the bolts to 25 Nm (18 lb.ft).
49. Install the CJB.

For additional information, refer to: Central Junction Box (CJB) (418-00 Module Communications Network, Removal and Installation).
50. Connect the battery positive cable to the BJB.
 - Tighten the nut to 25 Nm (18 lb.ft).
51. Install the BJB cover.
 - Secure the clip.
52. Install the ECM.
 - Install the ECM top cover.
53. Install the ECM cover.
 - Tighten the Torx screws.
 - Connect the electrical connectors.
54. Install the auxiliary battery tray.

For additional information, refer to: Auxiliary Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
55. Install the battery tray.

For additional information, refer to: Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).
56. Install the four-wheel drive control module.

For additional information, refer to: Four-Wheel Drive (4WD) Control Module (308-07 Four-Wheel Drive Systems, Removal and Installation).
57. Install the air cleaner assembly.
58. Install the radiator grille.

For additional information, refer to: Radiator Grille (501-08 Exterior Trim and Ornamentation, Removal and Installation).
59. Install the engine cover.

For additional information, refer to: Engine Cover - 2.7L Diesel (501-05 Interior Trim and Ornamentation, Removal and Installation).
60. Connect the battery ground cable.

For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).

Module Communications Network - Central Junction Box (CJB)

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



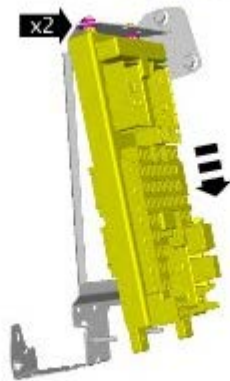
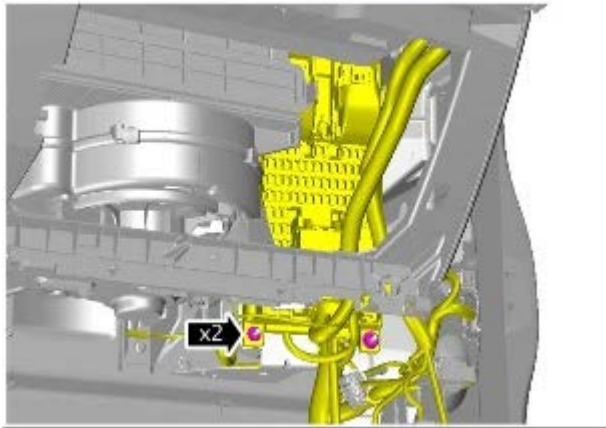
Left hand drive illustration shown, right hand drive similar.

1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

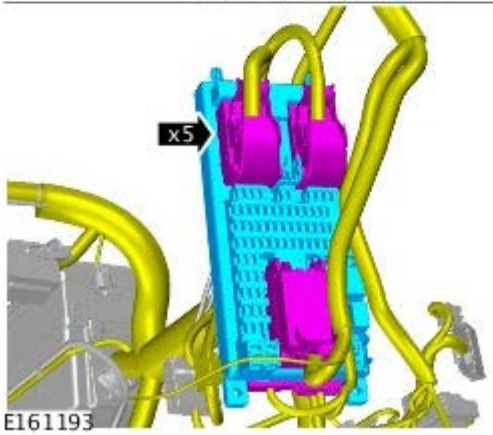
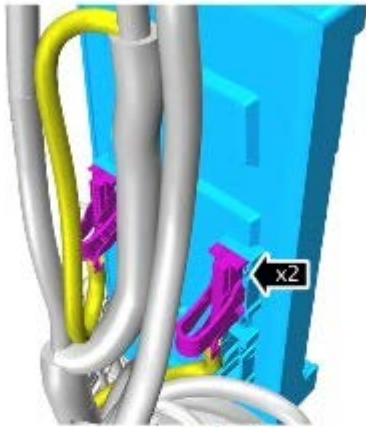
2. Refer to: [Glove Compartment](#) (501-12 Instrument Panel and Console, Removal and Installation).

3. *Torque: 5 Nm*



E161192

- 4.



Installation

1. To install, reverse the removal procedure.
2. If a new central junction box (CJB) is to be installed, use Land Rover approved equipment to upload the stored data.

Module Communications Network - Gateway Module

Removal and Installation

Removal

NOTES:

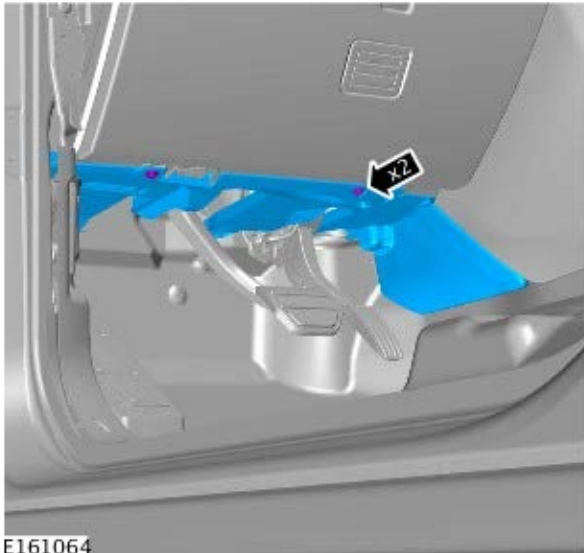


Removal steps in this procedure may contain installation details.



Left hand drive illustration shown, right hand drive similar.

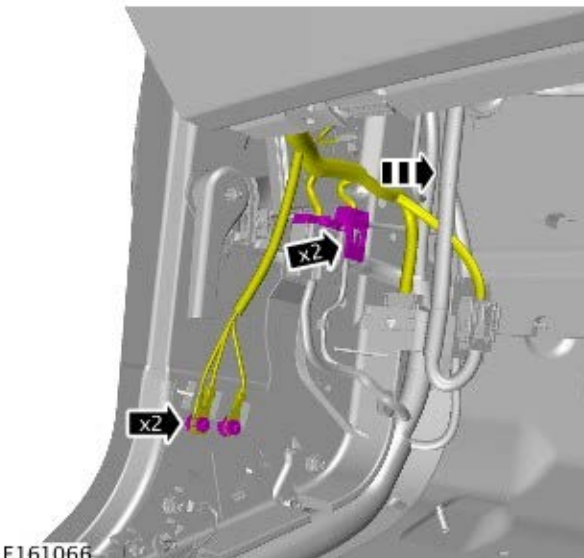
1.



E161064

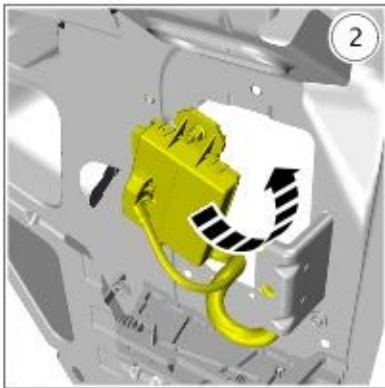
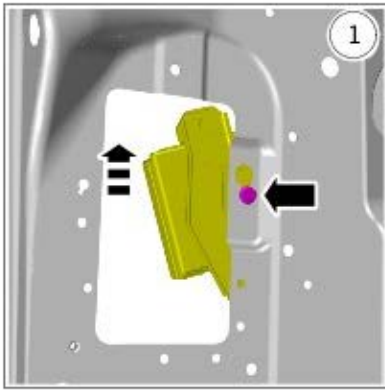
2. Refer to: [Cowl Side Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

3.  NOTE: Left hand drive only.

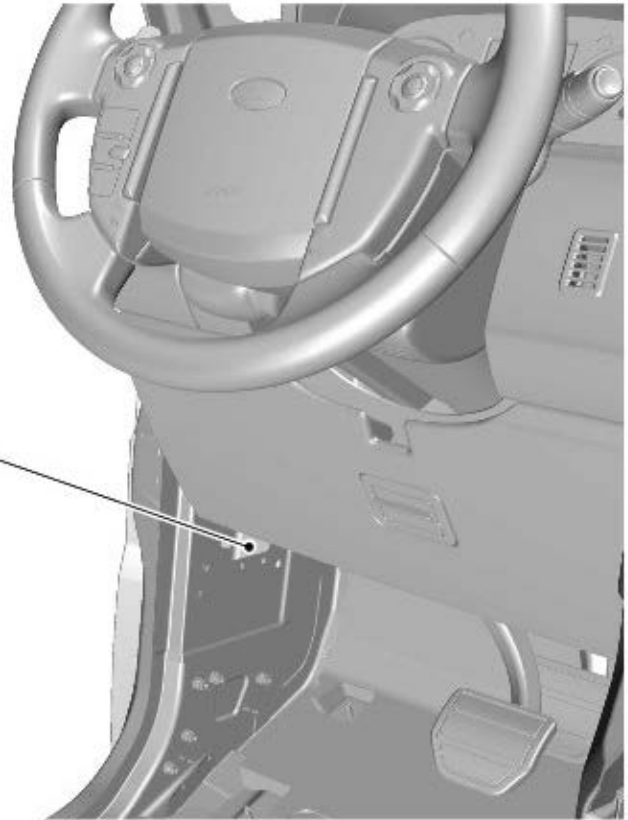


E161066

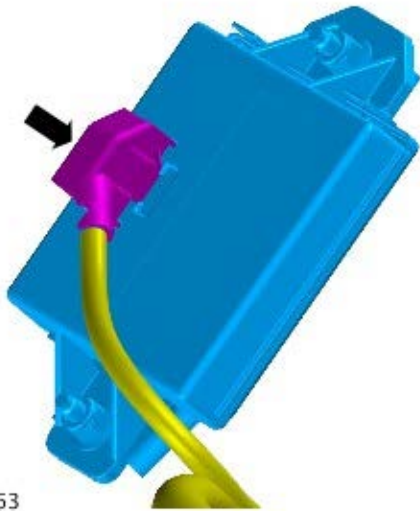
4.  NOTE: Loosen but do not fully remove the bolt.




E161065



5.



E161063

6.  NOTE: Do not disassemble further if the component is removed for access only.



E161067

Installation

1. To install, reverse the removal procedure.
2. If a new module has been installed, configure using the Landrover approved diagnostic equipment.

Module Communications Network - Quiescent Current Control Module

Removal and Installation

Removal

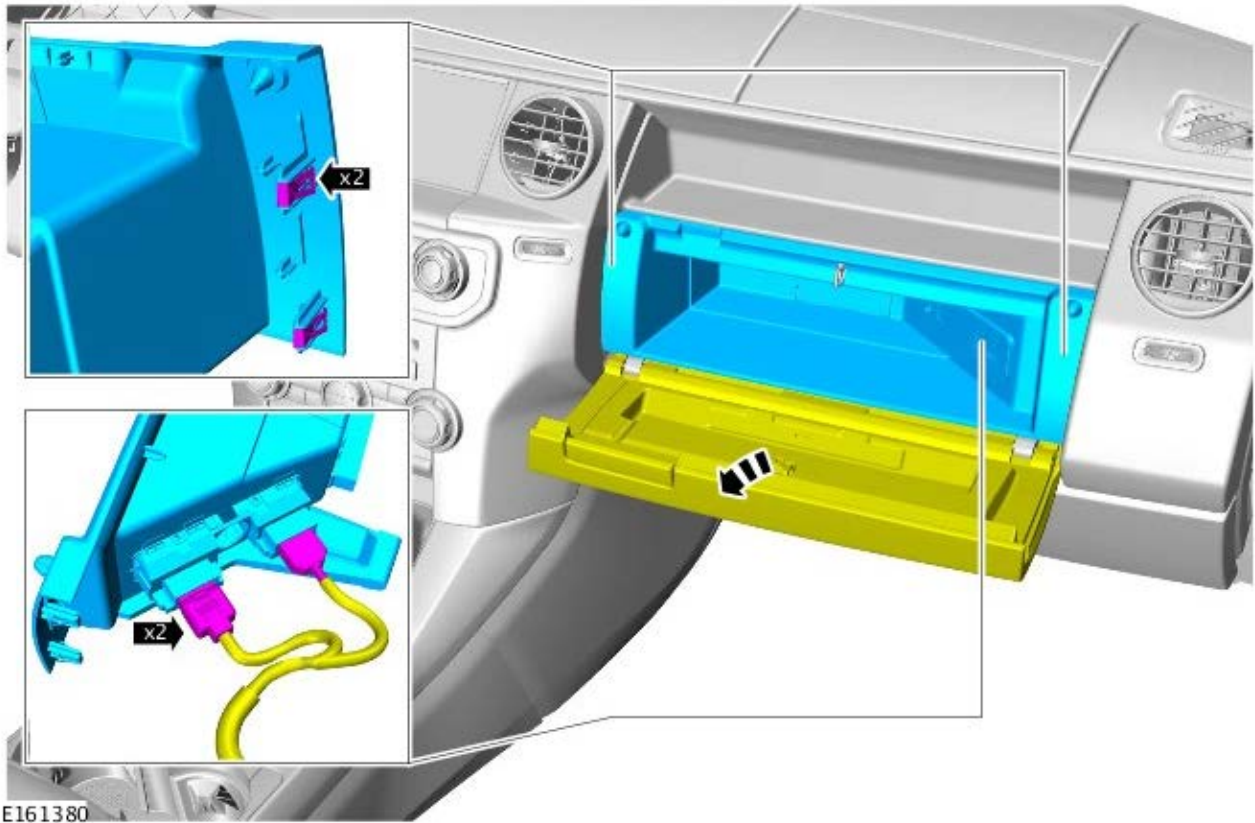


NOTE: Removal steps in this procedure may contain installation details.

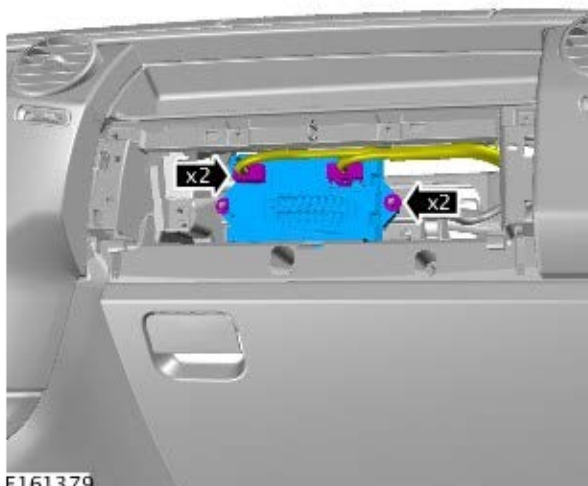
1. Disconnect the battery ground cable.

Refer to: [Specifications](#) (414-00 Battery and Charging System - General Information, Specifications).

- 2.



- 3.



Installation

1. To install, reverse the removal procedure.

-
2. If a new module has been installed configure, using a Land Rover approved diagnostic equipment.

Wiring Harnesses -

Torque Specifications

Description	Nm	lb-ft
Electrical harness bridge bolts - 4.0 Litre	45	33
Fusebox main feed cable bolt - 4.0 Litre	10	7
Purge valve bolt - 4.4 Litre	6	4
A/C compressor mounting bracket bolts - 4.4 Litre	25	18
A/C compressor bolts - 4.4 Litre	25	18
Upper suspension arm and brake line heat shield nuts and bolts - 4.4 Litre	10	7
Road wheel nuts	140	103
Cylinder head ground connector bolt	10	7
Wiring harness support bracket bolts - 4.4 Litre	10	7
Fusebox main feed cable bolt	10	7
Radiator access panel bolts	10	7
* Starter motor solenoid nut	8	6
PAS pump mounting bracket bolts	25	18

* **Caution: damage to the internal connections will result if this torque is exceeded**

Wiring Harnesses - Wiring Harness

Description and Operation

Introduction



CAUTION: Do **not** use any other heat shrink sleeve other than the approved glue lined heat shrink sleeve mentioned in the repair procedure.

The purpose of this document is to promote quick and efficient minor repair to harness connectors or cables using approved methods. Repairs may only be made to cables and connectors which have been mechanically, **not electrically** damaged. It also applies where the whole extent of the damage can be clearly identified and rectified.

Care and neatness are essential requirements in making a perfect repair.

Caution:

This harness repair guide, does not approve repairs to any of the following circuits:

1. Any media orientated system transport network harnesses.
2. Supplement restraint system (SRS) firing circuits (Air bags).
3. Link lead assemblies, which are unique to safety critical circuits such as anti-lock brake system (ABS) and thermocouple circuits. An example of this is the ABS wheel speed sensors with moulded connectors.
4. 4. Screened cables, leads and wiring harness(s).

If any harness(s) with defective electrical connector terminals or wires from the above circuits are a concern, new components must be installed.

Repair Components



CAUTION: Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

The wiring harness repair components comprises:

- Pre-terminated wiring harness(s) of different sizes and types
- Three sizes of butt splice connectors
- A selection of colored cable identification sleeves
- Two sizes of glue lined heat shrink sleeves

A suitable heat source, for shrinking heat shrink sleeves will be required.

The pre-insulated diamond grip range of electrical connector terminals and in-line, butt splice connectors are the **only** acceptable product for the repairs of wiring harnesses. The butt connectors not only grip the wire but also the insulation, making a very secure joint.

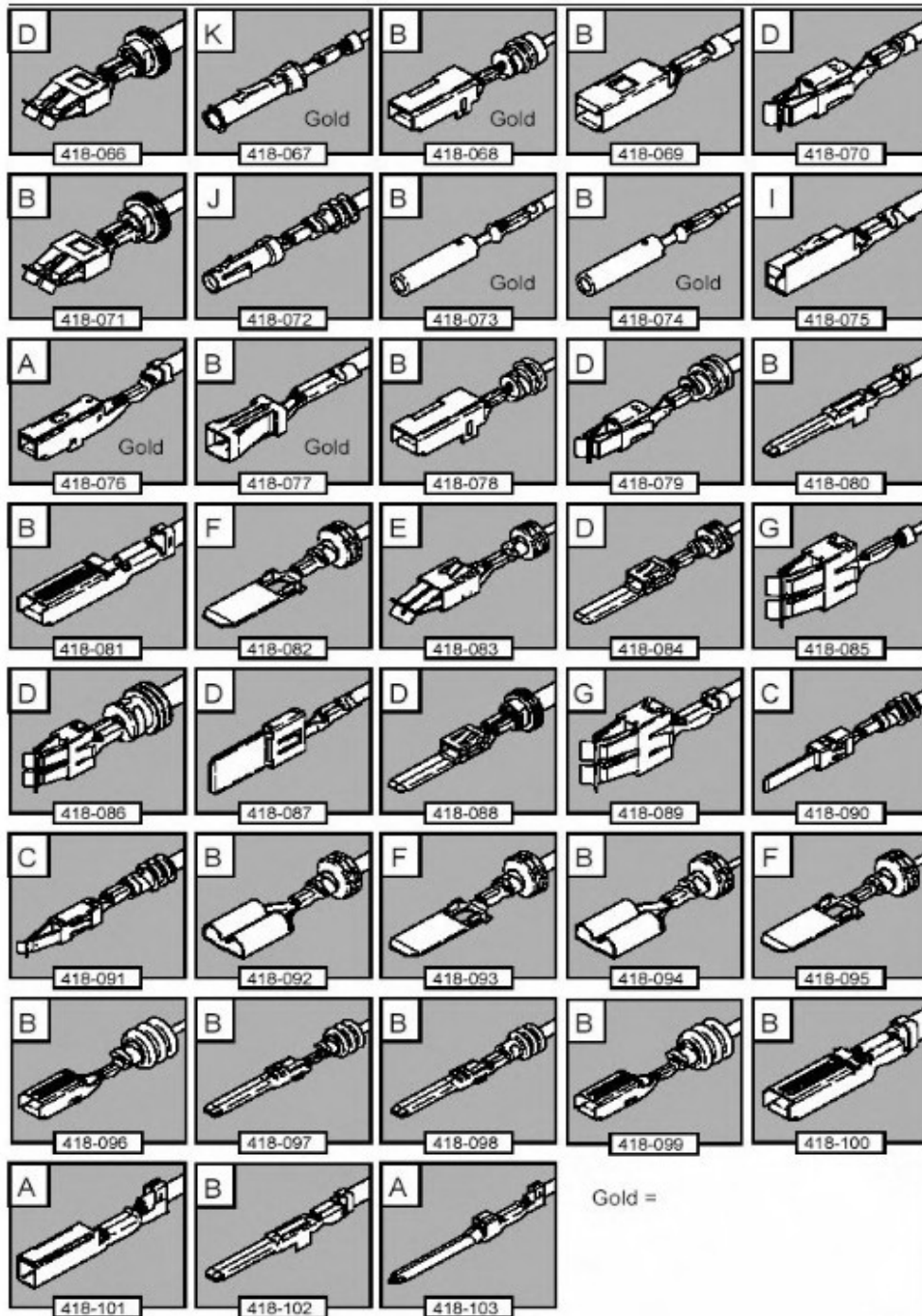
If an electrical connector terminal is not available approval for the repair is **NOT** given and in these circumstances a new wiring harness must be installed.

Pre-Terminated Wiring Harness(s) and Butt Splice Connectors

The pre-terminated wiring harness(s) are supplied with the insulation in one of three colors, red, blue or yellow. The colors do not apply to any particular circuit but to the harness wire size. See the Relationship Table in the Repair Method section.

Butt splice connectors are also supplied with red, blue or yellow coverings, which must be matched to the pre-terminated wiring harness insulation color.

Pre-Terminated Wiring Harness(s)



E130741

The illustration shows:

- The pre-terminated wiring harness(s) which are available via Jaguar/Land Rover authorised parts.
- The part number of the pre-terminated wiring harness
- The letter showing the extractor tip which must be used to remove this type of electrical connector terminal
- Those electrical connector terminals which are gold

Some of the pre-terminated wiring harness(s) have seals installed to the insulation for sealed connector applications. It is essential for prevention of moisture ingress that a sealed pre-terminated wiring harness must be used where a sealed terminal was removed.



CAUTION: Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

Two sizes of heat shrink sleeving are available. Each heat shrink sleeve contains a sealant glue. These must be used when connecting wiring harness(s) or electrical connector terminal(s) at all times. The smaller diameter heat shrink sleeve is to be used with the red and blue butt splice connectors and the larger diameter sleeve with the yellow butt splice connectors.

For ease and speed, some of the pre-terminated wiring harness(s) may already have the insulation partly stripped at the splice end. If the repair requires insulation to be stripped from the cable, refer to the Relationship Table for the correct length of insulation to be stripped.

The Pre-Terminated Wiring Harness(s) illustration shows the electrical connector terminal type, the part number of the pre-terminated wiring harness and the letter of the extractor tip which must be used to extract the electrical connector terminal from the connector housing. Additionally, those electrical connector terminal(s) which are gold are identified, all others are therefore, tinned and not gold.

Wiring Harness Cable Identification Sleeves

A selection of colored sleeves are available for maintaining the wiring harness cable identification on the pre-terminated wiring harness. Place the correct colored sleeve(s) over the pre-terminated wiring harness insulation as near to the electrical connector as possible with the main wiring harness cable color nearest to the electrical connector.

For example, if the original wiring harness cable color is pink with a black trace put the pink wiring harness cable identification sleeve on the pre-terminated wiring harness first followed by a black sleeve, and slide both along the wiring harness cable to the electrical connector terminal.

List of Parts

Description	Part Number	Quantity
Pre-Terminated Wiring Harness(s)	418-066 to 418-103 inclusive	10 each
Glue Lined Heat Shrink Pack – small diameter	418-104	25 per pack
Glue Lined Heat Shrink Pack – larger diameter	418-105	10 per pack
Case Assembly Comprising – carry case, lid, inner lid, base, insert, trays foam spacers	418-106	1
Butt Splice Connector – Red	418-107	50 per pack
Butt Splice Connector – Blue	418-108	50 per pack
Butt Splice Connector – Yellow	418-109	20 per pack
Sleeve Identification Pack – for Red insulation	418-112	500
Sleeve Identification Pack – for Blue insulation	418-113	500
Sleeve Identification Pack – for Yellow insulation	418-114	500

Harness repair components can be ordered from Jaguar/Land Rover authorised parts.

Repair Tools

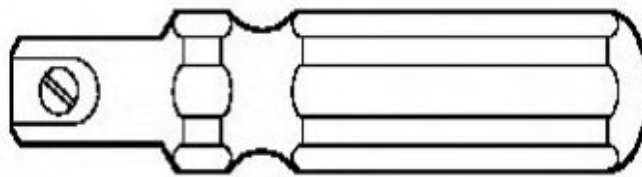
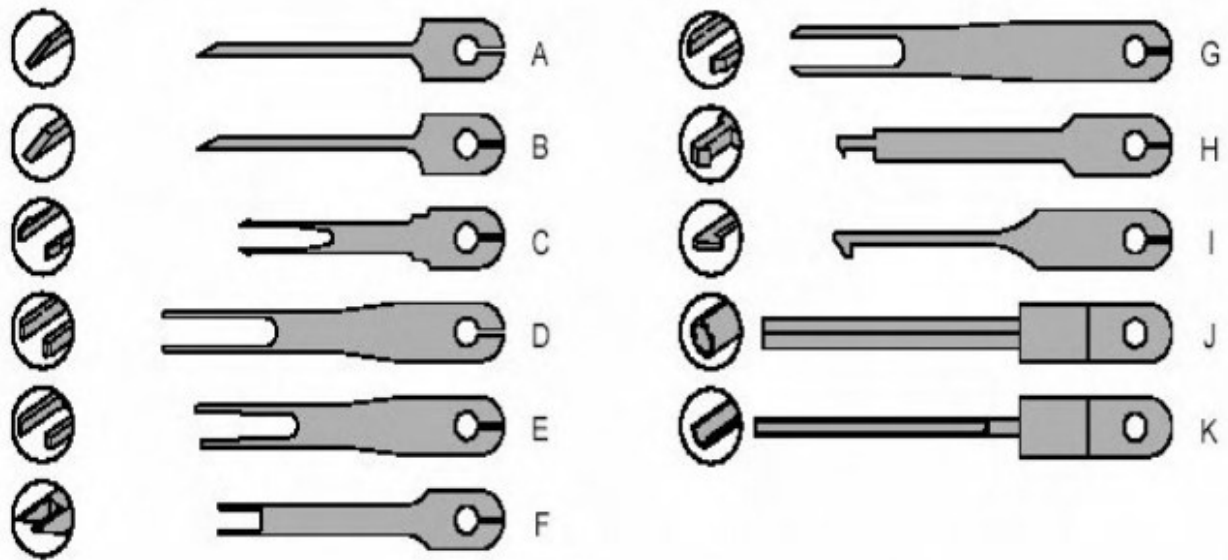
The wiring harness repair tools comprises:

- Crimping pliers
- A wire cutter and insulation stripper
- An electrical connector terminal extraction handle and tips

Extraction Handle and Tips

The extraction handle, in conjunction with the correct tip, is used to remove a terminal from an electrical connector. Each tip is marked with an identification letter, A to K inclusive. Each tip has been specially designed to extract a particular type of electrical connector terminal. The use of any other tool is **not** recommended and is liable to cause damage to the electrical connector. The tip is fastened to the handle by a screw which holds the tip firmly yet allows it to be easily replaced.

Extraction Handle and Tips

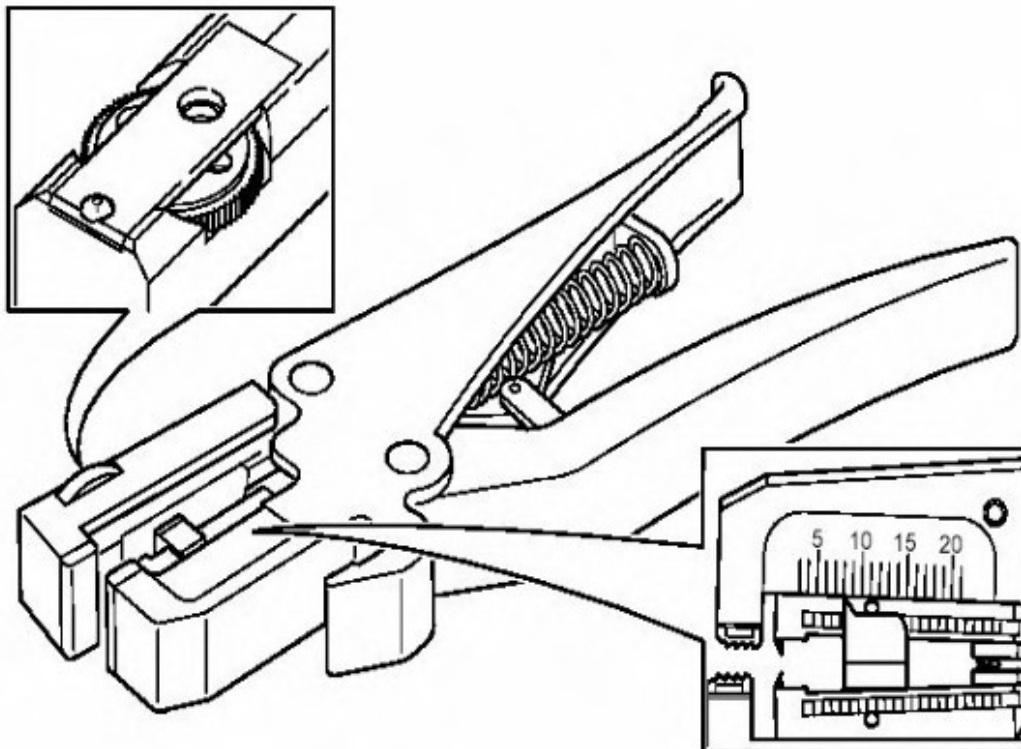


E130742

Insulation Stripper

The moving jaw has an adjuster wheel which has a series of holes in it. Turning the wheel and placing the cable in the matching size hole will automatically adjust the jaw to the correct pressure. Note that some wiring harness(s) may have a harder insulation and slight adjustment of the wheel may be needed to make a clean strip but exercise care not to damage the wire.

Insulation Stripper



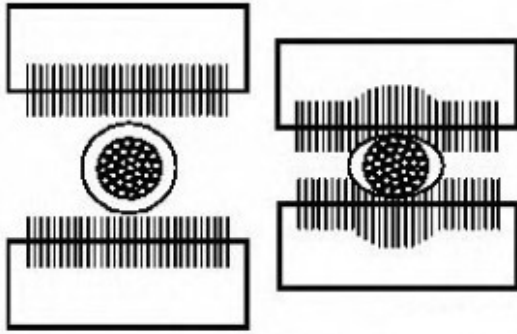
E130743

By pressing the outer edges of the wiring harness cable length stop together the adjuster can be slid up or down the jaw. This decreases or increases the length by which the wiring harness cable insulation will be stripped from the pre-terminated wiring harness or wiring harness wire. The adjuster has a position indicator to align with a graduated scale and this sets the correct length in millimetres, of insulation to be stripped. The amount of insulation to be

stripped is shown in the Relationship Table.

The illustration shows the insulation stripper tool and a wiring harness correctly gripped in the jaws. A wire cutter is provided on the outer side of the fixed jaw.

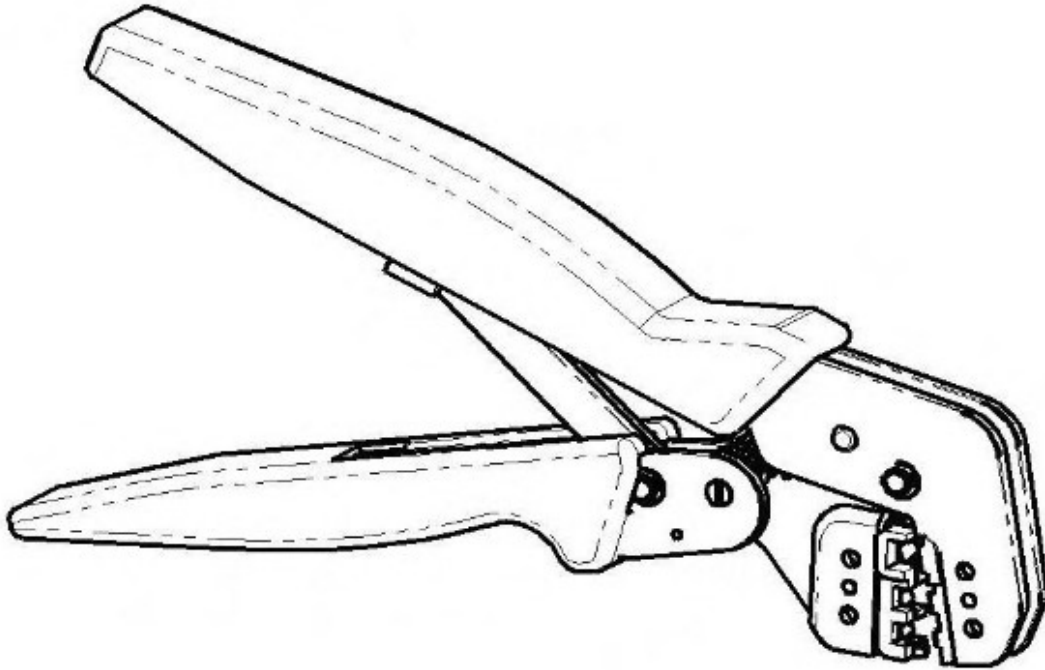
Cable Correctly Gripped in Stripper Blades



E130744

Crimping Pliers

Crimping Pliers



E130745

The crimping pliers have a moving jaw and a stationary jaw, with three different sized crimping enclosures. Each of the enclosures is identified by a red, blue or yellow coloured dot which corresponds to the three colours of the pre-terminated wiring harness(s) and butt splice connector colors.

Description	Part Number	Quantity
Extraction Tool Handle	418-110	1
Extraction Tip Pack consists of 2 spare screws plus	418-S111	1
Tip A	418-118	1
Tip B	418-119	1
Tip C	418-120	1
Tip D	418-121	1
Tip E	418-122	1
Tip F	418-123	1
Tip G	418-124	1
Tip H	418-125	1
Tip I	418-126	1
Tip J	418-127	1
Tip K	418-128	1

Crimping Pliers	YRW500010	1
Wire Stripping Tool	418-117	1

Harness repair tools can be ordered from:

Bosch Automotive Service Solutions

Ironstone Way

Brixworth Industrial Estate

Brixworth

Northants

NN6 9UD

United Kingdom

Telephone: +44 (0) 1327 303400

Fax: +44 (0) 1327 303499

Email: css.uk@bosch-automotive.com

Repair Methods



CAUTION: Several different types and sizes of terminal may be found in a single electrical connector housing.

It is necessary to identify:

- The conductor (wire) size of the affected wiring harness
- The electrical connector range from which the damaged wiring harness is to be removed
- The terminal type

Use of the approved diagnostic tool will greatly assist in the quick identification of electrical connectors and faulty pin terminal(s).

Reference can also be made to the vehicle Electrical Guides, held by Dealers, to identify wiring harness(s) and electrical connector(s).

By using the Relationship Table, the wiring harness conductor (wire) size can be related to a suitable pre-terminated wiring harness by the color of the insulation. Also, the correct length of insulation to be stripped from the wiring harness lead is identified.

Relationship Table

CABLE RANGE	SPLICE	STRIP LENGTH
0.35 mm ² to 1.50 mm ²	RED	6.00 to 7.00 mm
1.00 mm ² to 2.50 mm ²	BLUE	6.00 to 7.00 mm
4.00 mm ² to 6.00 mm ²	YELLOW	9.00 to 9.50 mm

Electrical Connector Terminal Extraction

It must be noted that some electrical connector(s) have anti-backout devices which prevent the terminals from being removed from the electrical connector. Some examples of these are shown in following illustrations. The anti-backout device must be released before attempting to remove the terminal from the electrical connector. Some anti-backout devices require a special tip to release the device. Most can be released by carefully using a suitable small screwdriver.

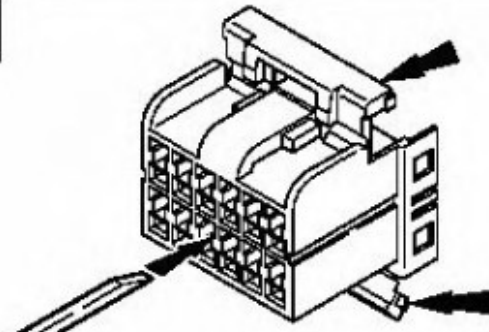
Various types of electrical connector have seals installed internally or externally to prevent moisture ingress. These normally do not have to be removed but make sure that they are installed when the electrical connectors are connected.

The illustrations show examples of each tip used on different types of electrical connector(s). There are a large number of different types of electrical connector used on vehicles therefore only one example using each tip is shown. Technicians experience and judgement will dictate which type of tip should be used for those electrical connector(s) which are not shown. Care should be exercised to avoid further damage when removing the terminals from the electrical connector.



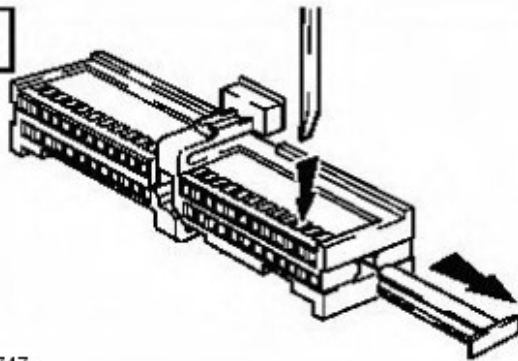
NOTE: Examples of the extraction tips and anti-backout tips.

A



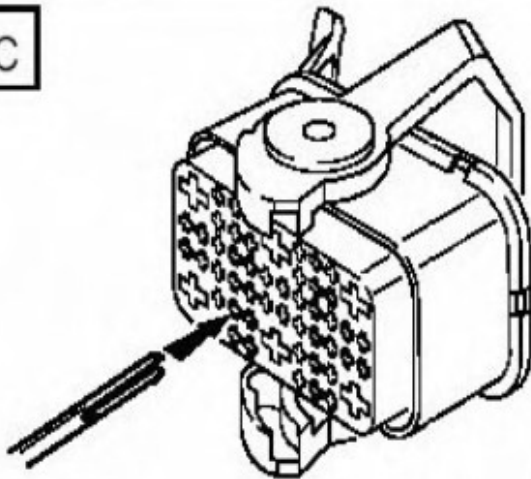
E130746

B



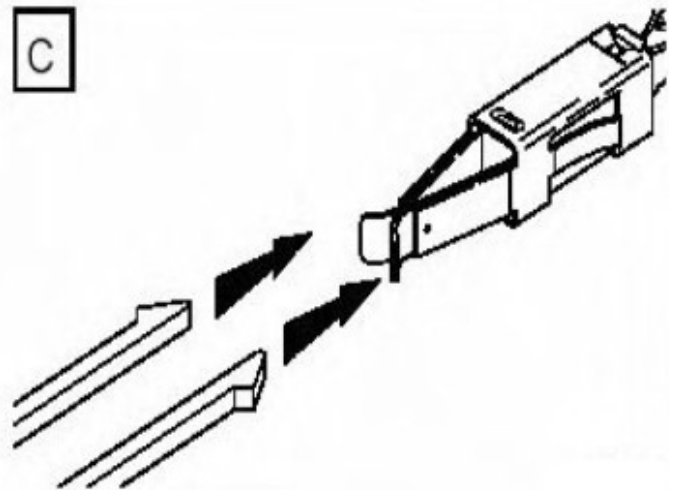
E130747

C

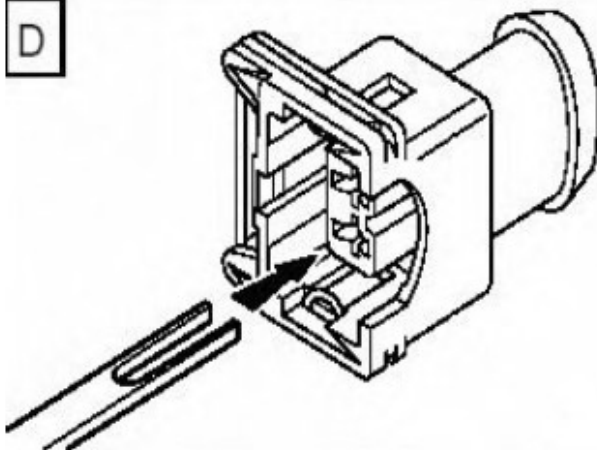


E130748

C

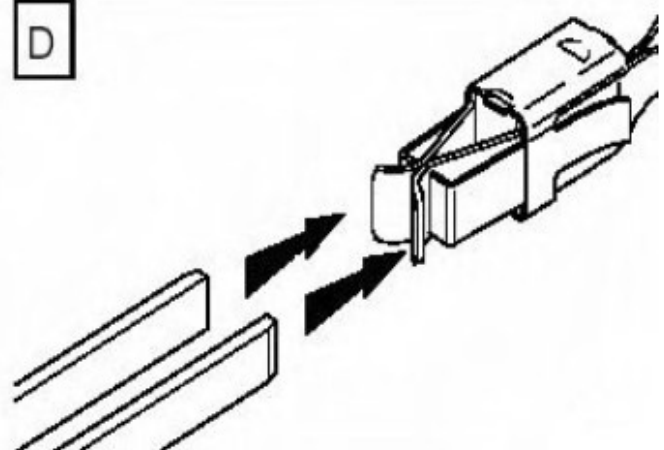


D

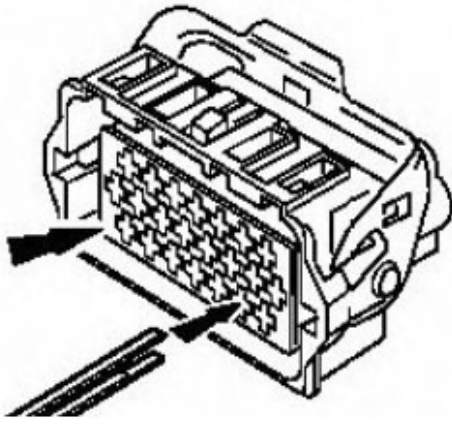


E130749

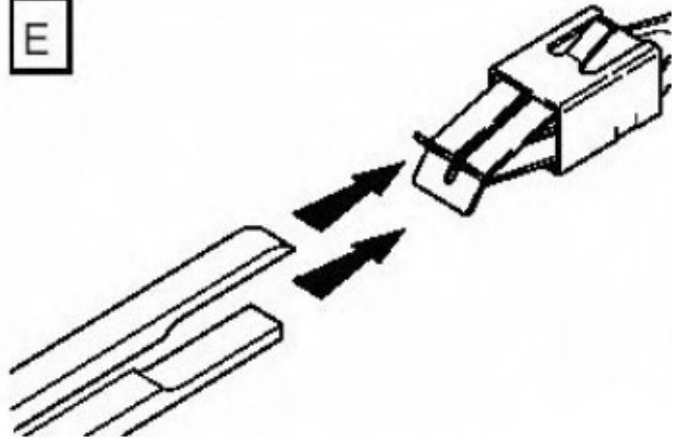
D



E

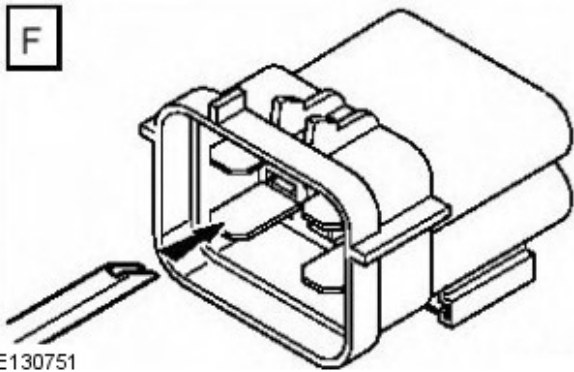


E



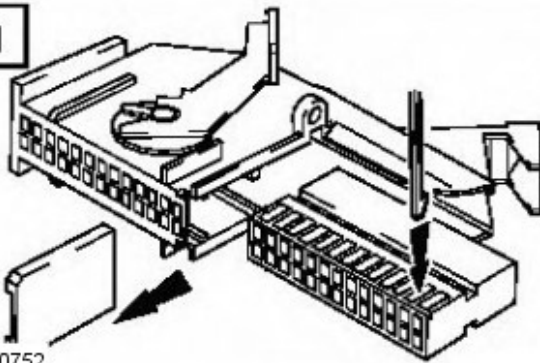
E130750

F



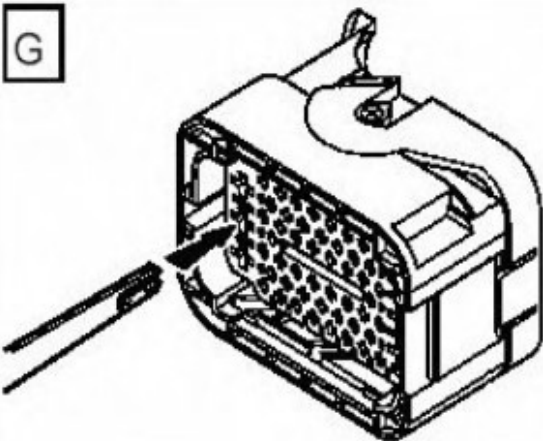
E130751

I

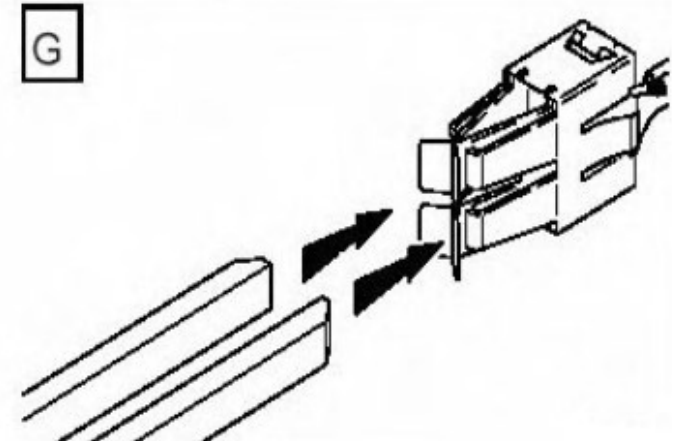


E130752

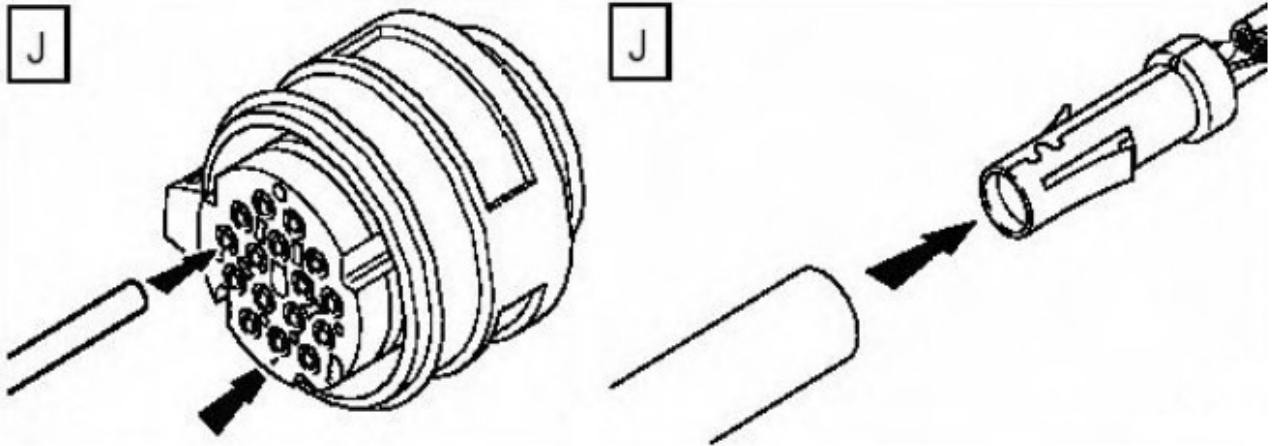
G



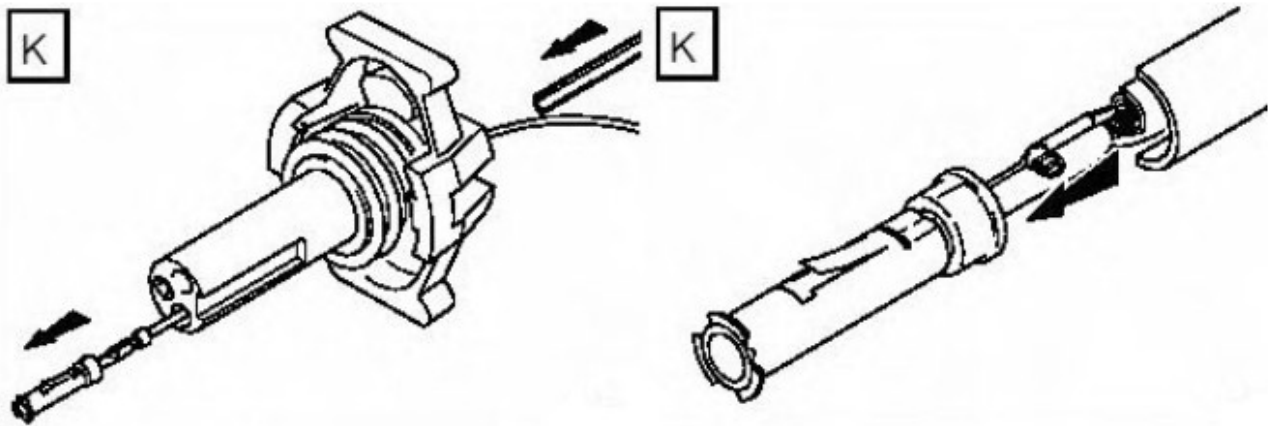
G



E130753



E130754



E130755



NOTE: The chart shows the electrical connector types, terminal pins/sockets, extractor tip and anti-backout tip.

Electrical connector terminal type	Pin or socket	Extractor tip	Anti-backout tip
Multilock 040 series	D	A	
Multilock 040 series	B	A	
Multilock 070 series	B	B	
Multilock 040 series	D	B	
Econoseal III 070 series	D	B	
Econoseal III 070 series	B	B	
Econoseal III 070 series	B	B	
Econoseal III J2	D	B	
Econoseal III 250 series	B	F	
Econoseal III 250 series	D	B	
Econoseal III 250 series	B	F	
Econoseal III 250 series	D	B	
Micro-timer II 1.5mm	D	C	
Micro-timer II 1.5mm	B	C	
Std power timer 4.8 flat	D	G	
Std power timer 5.8 flat	B	D	
Std power timer 5.8 flat	B	D	
Std power timer 2.8 flat	D	D	
Std power timer 4.8 flat	D	G	
Std power timer 5.8 flat	B	D	
Ford 2.8 flat	D	E	H
Multilock 070 series	D	B	
Multilock 070 series	B	B	
Junior power timer 2.8 flat	D	D	
Sumitomo TS90 connector	B	B	H

Modu IV gold plated	D	B	
Multilock 040 series gold plated	D	A	
Micro qualock	D	I	
EECV	D	B	
EECV	D	B	
Kostal dia 1.50 series	D	J	
AMP 6.3 flat	D	B	
Junior power timer 2.8 flat	D	D	
2.8 series	D	B	I
Sumitomo TS90 connector	D	B	H
Ducon 0.60 gold plated	D	K	
AMP 6.3 flat	D	D	
Econoseal III 250 series	B	F	

Repair Procedure

CAUTIONS:



Do not use crimping pliers, insulation strippers, butt splice connectors, heat shrink sleeves or pre-terminated wiring harness(s) that are not supplied with by authorised Jaguar/Land Rover parts. Each part has been designed to be used only with the other parts available from Jaguar/Land Rover parts.



Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

It is not correct to make more than five repair joints on the wiring harness to any electrical connector and if more damage is found at the same electrical connector then a new wiring harness must be installed.

1. Remove the faulty terminal from the electrical connector using the extractor tool and correct tip. Make sure that any anti-backout device is released before trying to remove the terminal.



2. **CAUTION:** A number of electrical connector terminals are gold plated or gold flashed. When defective, they must be installed with a gold pre-terminated wiring harness(s). It is not always easy to identify the female as gold but the male pins are visually easier, therefore always check both male and female terminals to identify those which are gold. Under no circumstances are gold and tin terminals to be mixed as this will lead to early failure of the electrical contact.



NOTE: Never use a harness lead with a smaller diameter than the original harness lead.

Select the correct size and type of pre-terminated wiring harness and butt splice connector.

3. Using the wire cutter on the stripping tool, cut the pre-terminated wiring harness and the harness cable to the required length.



4. **NOTE:** See illustration: **Stripping Insulation**

From the Relationship Table, find the correct length of insulation to be stripped from the pre-terminated wiring harness and set the adjustable cable length stop to the correct length. Place the pre-terminated wiring harness in the wire stripper and remove the insulation.


5. Put the cable identification sleeve(s) on to the wiring harness with the main cable colour nearest to the terminal.
6. During this next step do not over tighten. Place the selected butt splice connector in the crimping tool, matching the aperture and the butt connector colours. Make sure that the window indentation in the butt connector is resting over the guide bar on the lower jaw. Partially close the grip until the butt connector is securely held in the aperture. This will give support to the butt connector while the pre-terminated wiring harness is inserted into it.



7. **NOTE:** See illustration: **Splice Correctly Located**

Insert the pre-terminated wiring harness into the butt connector and make sure that the wire is against the wire stop. Close the grip firmly, crimping the lead to the butt connector. When the handles have been completely closed the butt connector will be freed from the tool as the handles are released. If the handles have not been completely closed then the jaws will hold the butt connector and it cannot be removed from the tool until the crimp is fully made by closing the handles completely.

8. Make sure that the harness cable has been squarely cut and the correct length of insulation removed. If more than one splice is needed the butt connectors must be not be crimped to the wiring harness at the same distance from the connector. The splices must be staggered to prevent a bulk of splices in the same area of the wiring harness.
9. It is preferable to cover the butt splice joint with heat shrink sleeve. This is desirable not essential, except where the electrical connector is a sealed electrical connector. Use the smaller diameter sleeve for red and blue pre-terminated wiring harness(s) and the large diameter sleeve for the yellow pre-terminated wiring harness(s). It is advisable to place the heat shrink over the completed joint but in some instances the sleeve will not pass over the terminal. Check, and if required, place the correct size sleeve onto the harness cable or pre-terminated wiring harness before crimping the butt splice to the wiring harness.
10. Place the harness cable into the butt splice with the splice window over the guide bar. Make sure that the cable harness wire is against the stop in the butt splice, crimp the butt splice connector to the wiring harness.
11. Gently pull the harness cables each side of the butt splice to make sure that a secure joint has been made.

12.  **WARNING:** Do not use a naked flame in areas where fuel or oil have been spilt. Clean the area of residual oil and fuel and wait until the fuel spill has fully evaporated.

CAUTIONS:



When using a heat source make sure that it is localised and causes no damage to surrounding materials.

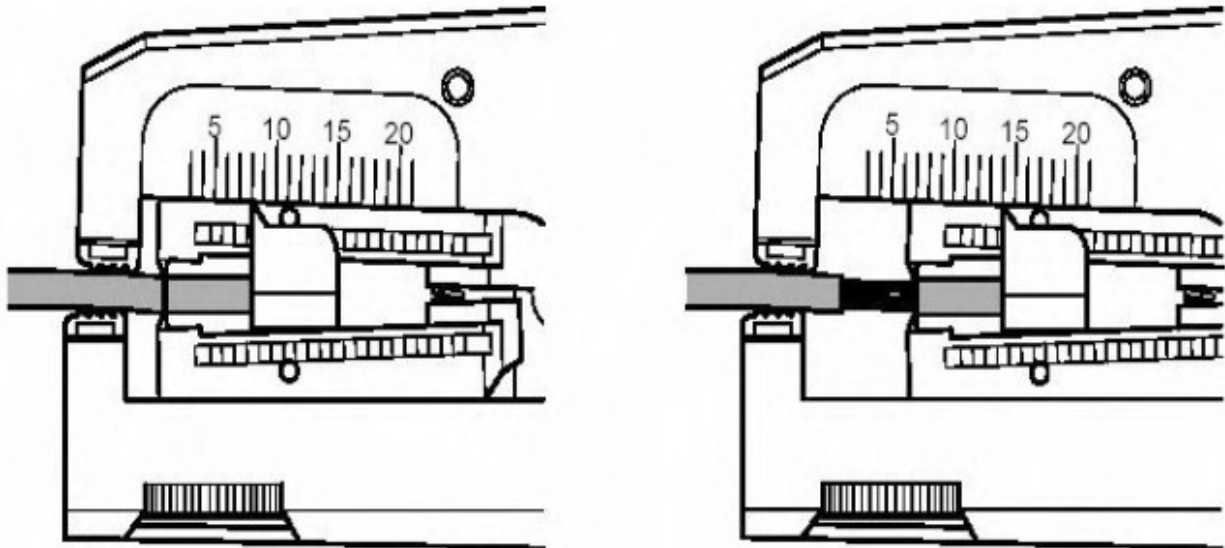


Where the repair procedure indicates that a glue lined heat shrink sleeve should be applied, apply sufficient heat to the glue lined heat shrink to melt the glue in order to provide a water tight seal. Do **not** over heat the glue lined heat shrink sleeve so that the wiring harness insulation becomes damaged.

Using a suitable heat source, shrink the sleeve over the butt splice.

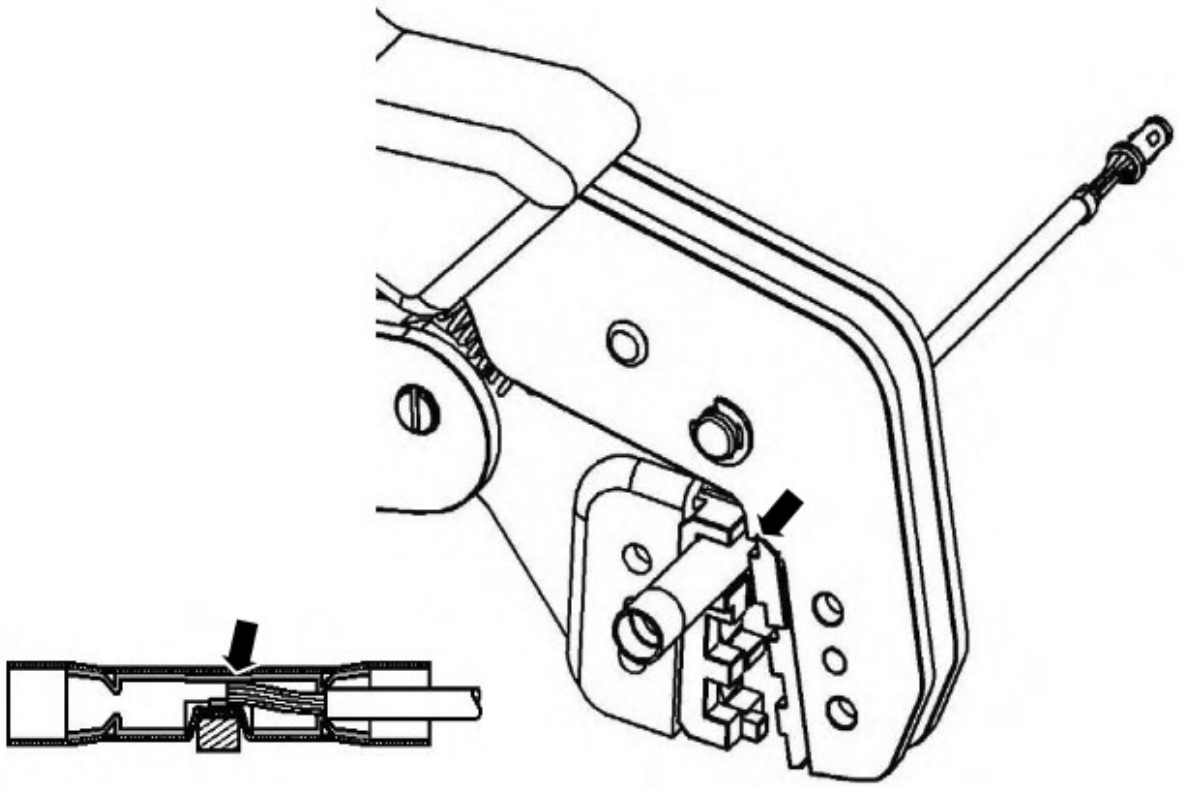
13. If further pre-terminated wiring harness(s) are to be installed to the same electrical connector, make sure that the lead is cut at a different length to the previous joint. This makes sure that the splices will, where possible, be staggered on the wiring harness and prevent a bulk of splices in one area.
14. When all of the splices have been made, fit the terminal(s) to the electrical connector, taking care that the terminals are correctly orientated.
15. Install the wiring harness cover and secure with adhesive electrical tape. Do not cover the wiring harness right to the electrical connector as the terminals must have a little movement and not be firmly bound to the electrical connector or wiring harness. Make sure that the cable identification sleeve(s) are showing at the wiring harness electrical connector.

Stripping Insulation



E130756

Splice Correctly Located



E130757

Wiring Harnesses - Wiring Harness Repair

General Procedures

1. For additional information, refer to: [Wiring Harness](#) (418-02 Wiring Harnesses, Description and Operation).

Wiring Harnesses - Engine Wiring Harness V6 S/C 3.0L Petrol

Removal and Installation

Removal



CAUTION: Note of the routing of the wiring harnesses.

NOTES:




Some variation in the illustrations may occur, but the essential information is always correct.



Removal steps in this procedure may contain installation details.

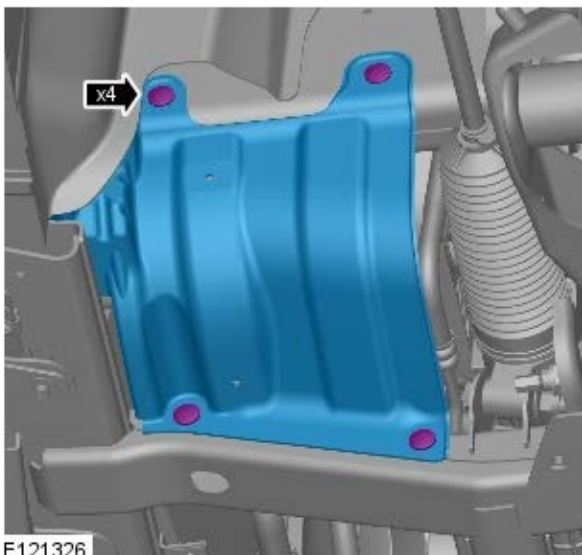


LHD shown, RHD is similar.

1. Refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
2.  WARNING: Make sure to support the vehicle with axle stands.

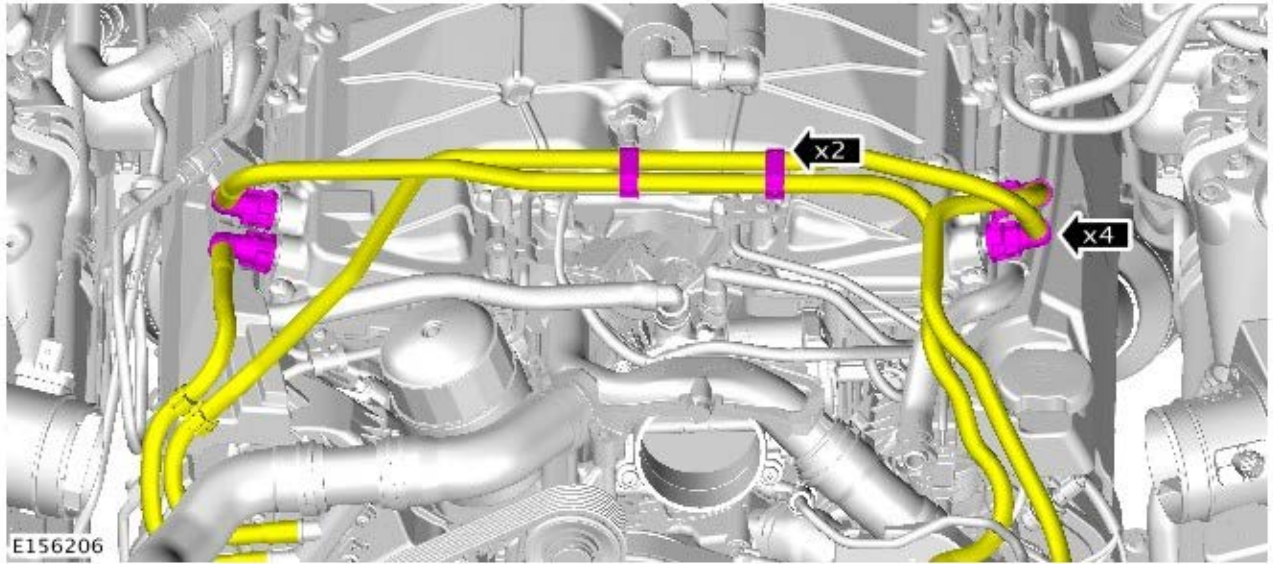
Raise and support the vehicle.
3. Refer to: [Air Cleaner Outlet Pipe LH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
4. Refer to: [Air Cleaner Outlet Pipe RH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).
5. Refer to: [Cooling System Partial Draining, Filling and Bleeding](#) (303-03B Engine Cooling - V6 S/C 3.0L Petrol, General Procedures).
6. Refer to: [Exhaust System](#) (309-00B Exhaust System - V6 S/C 3.0L Petrol, Removal and Installation).

7.

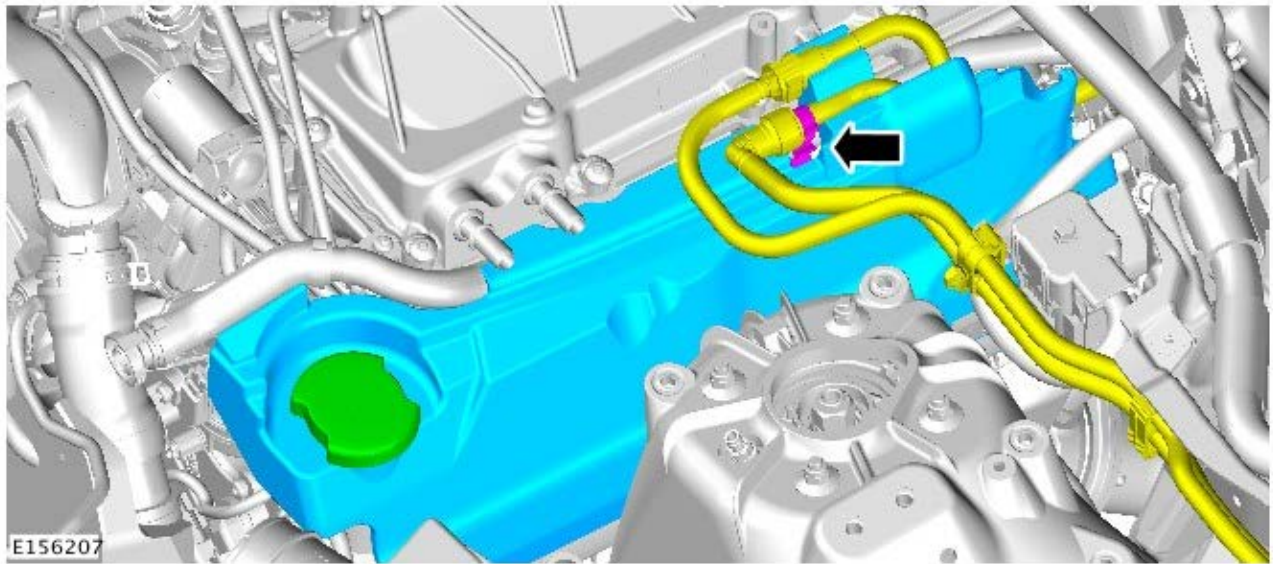


E121326

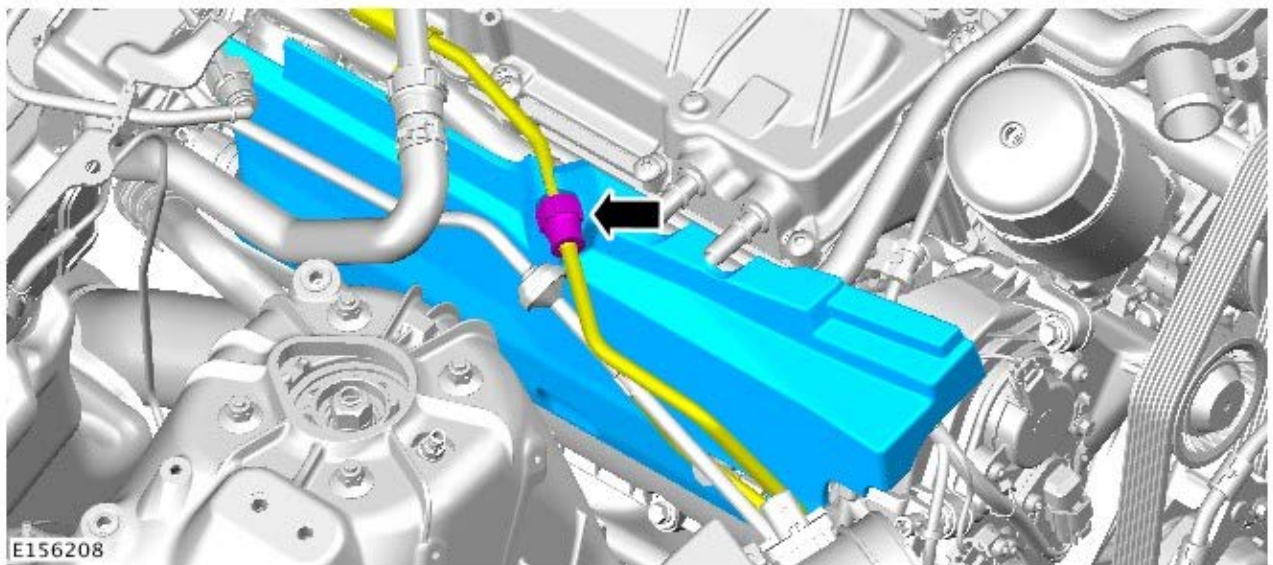
8.  CAUTION: Be prepared to collect escaping coolant.



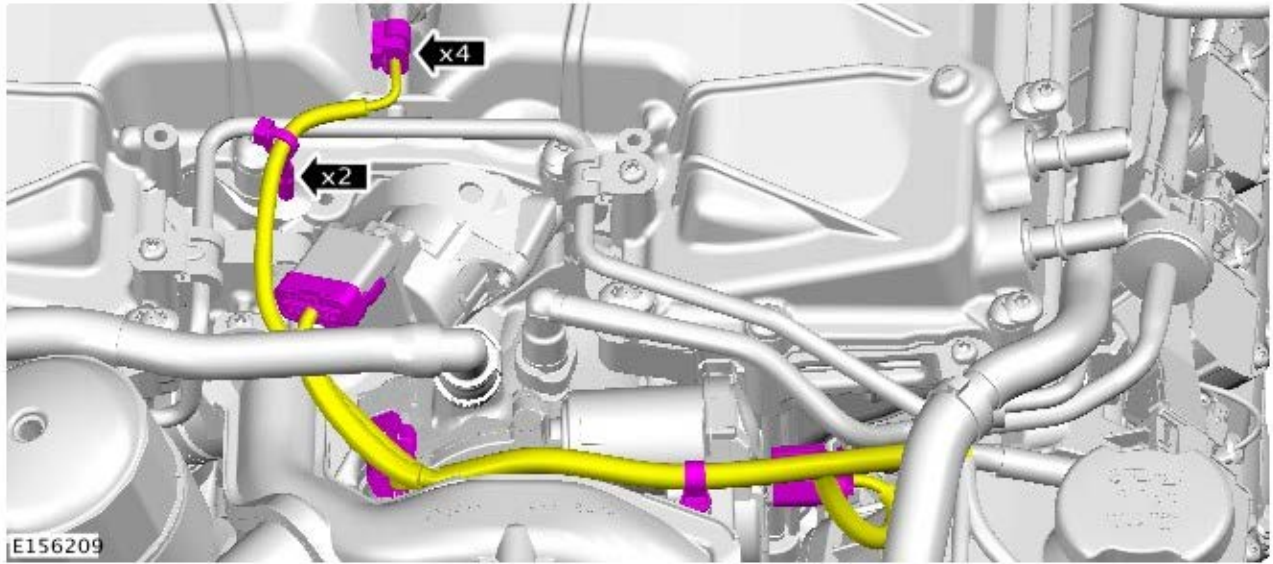
9.



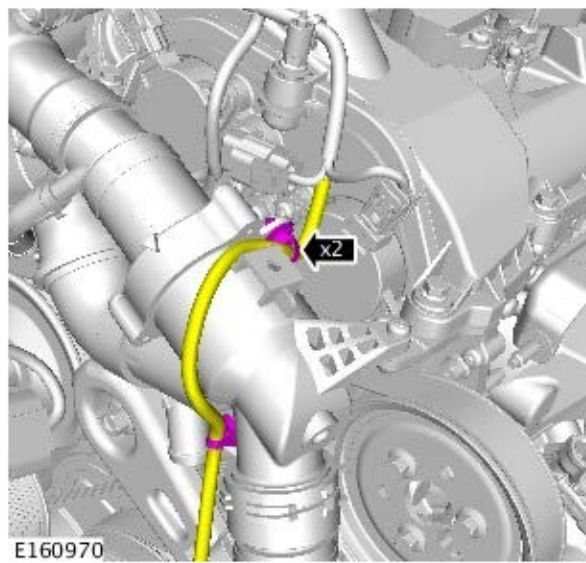
10.



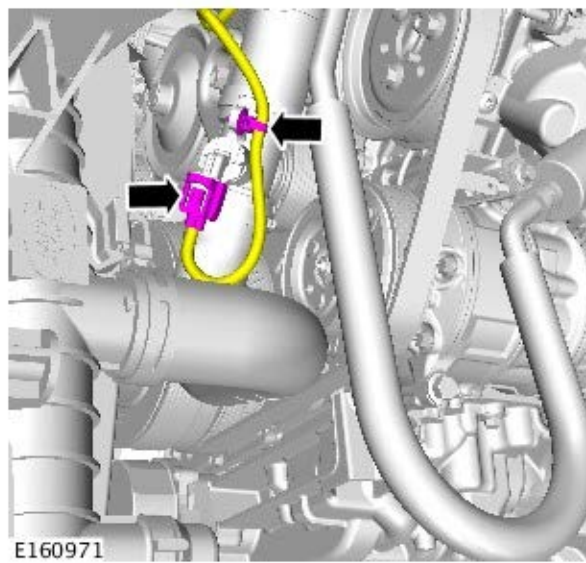
11.



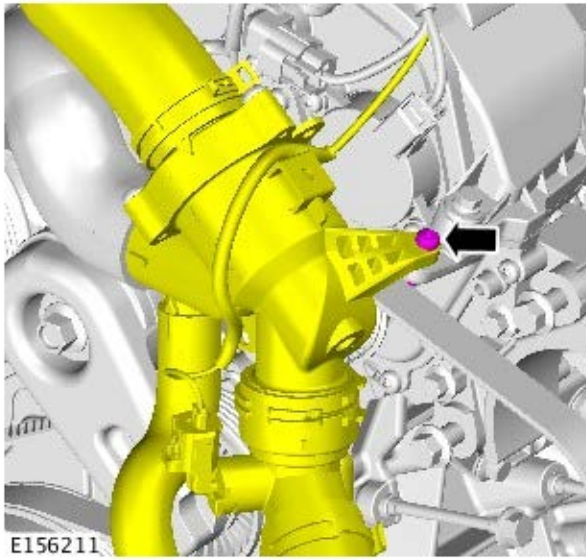
12.



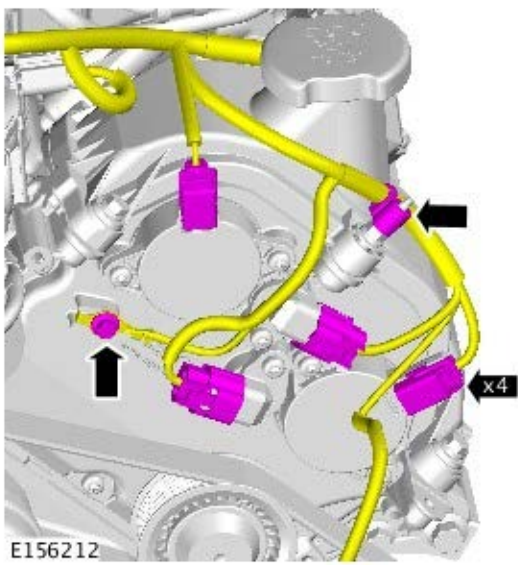
13.



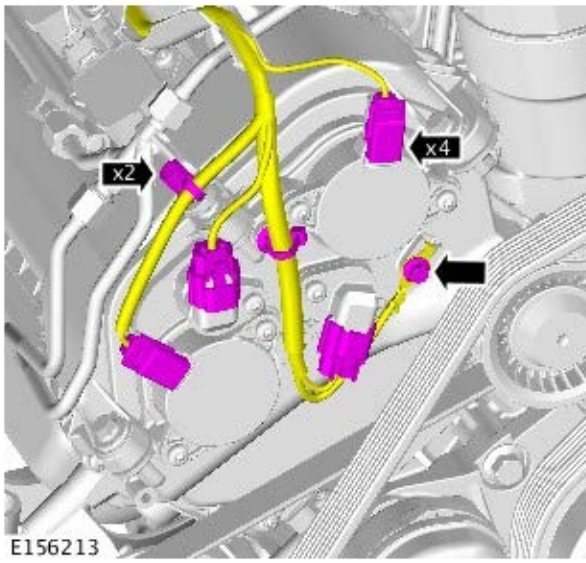
14. Torque: 10 Nm



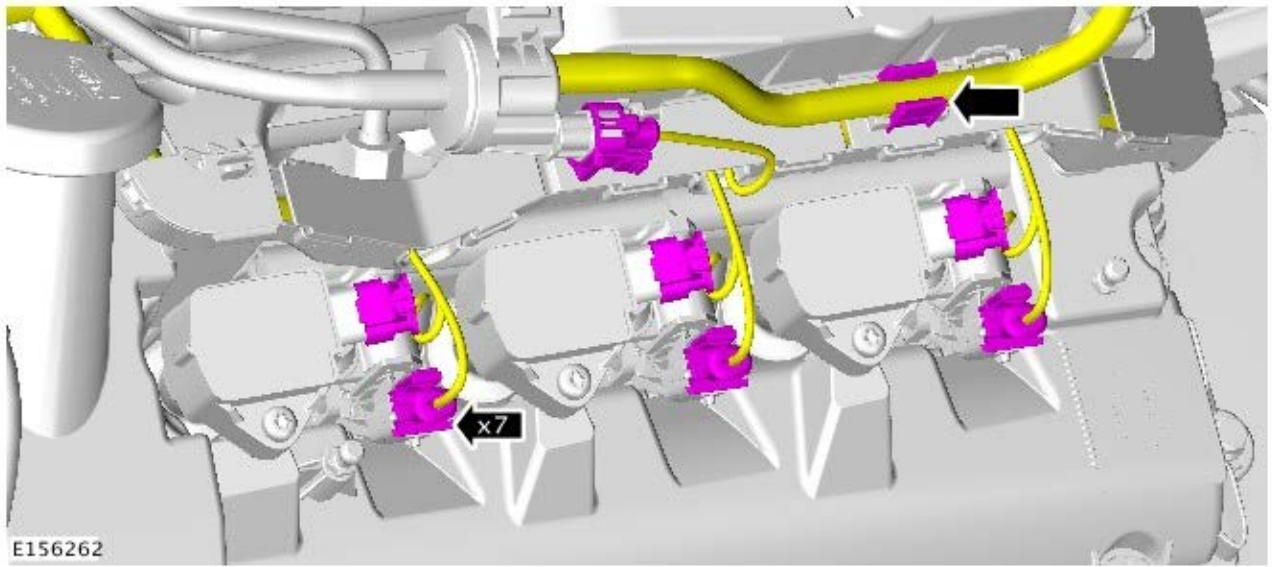
15. Torque: 10 Nm



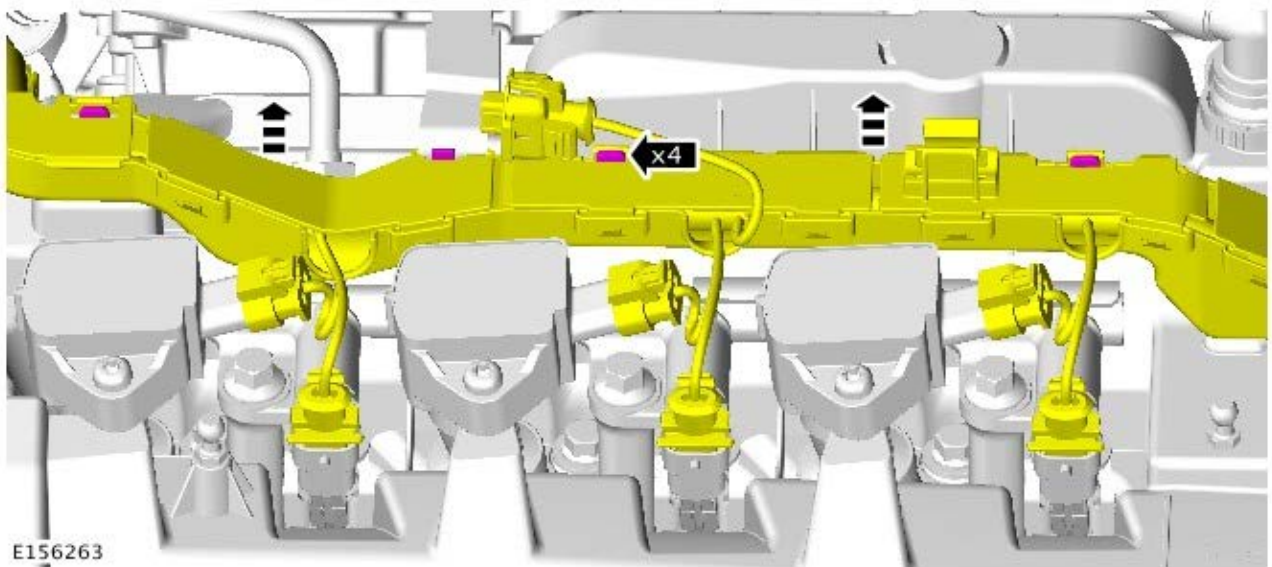
16. Torque: 10 Nm



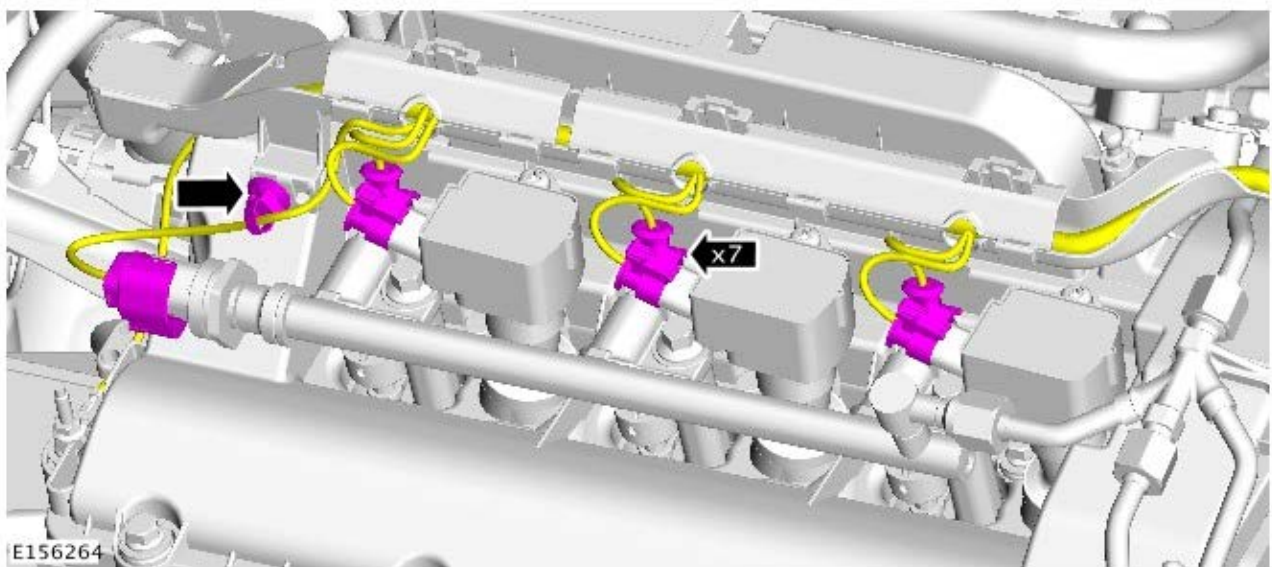
17.



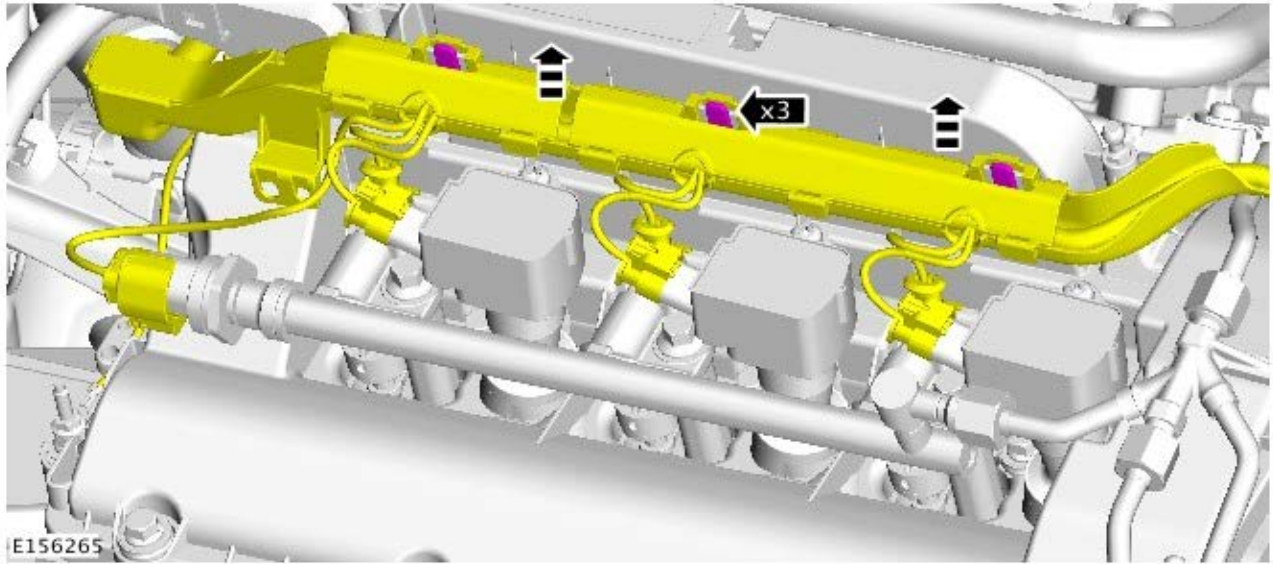
18.



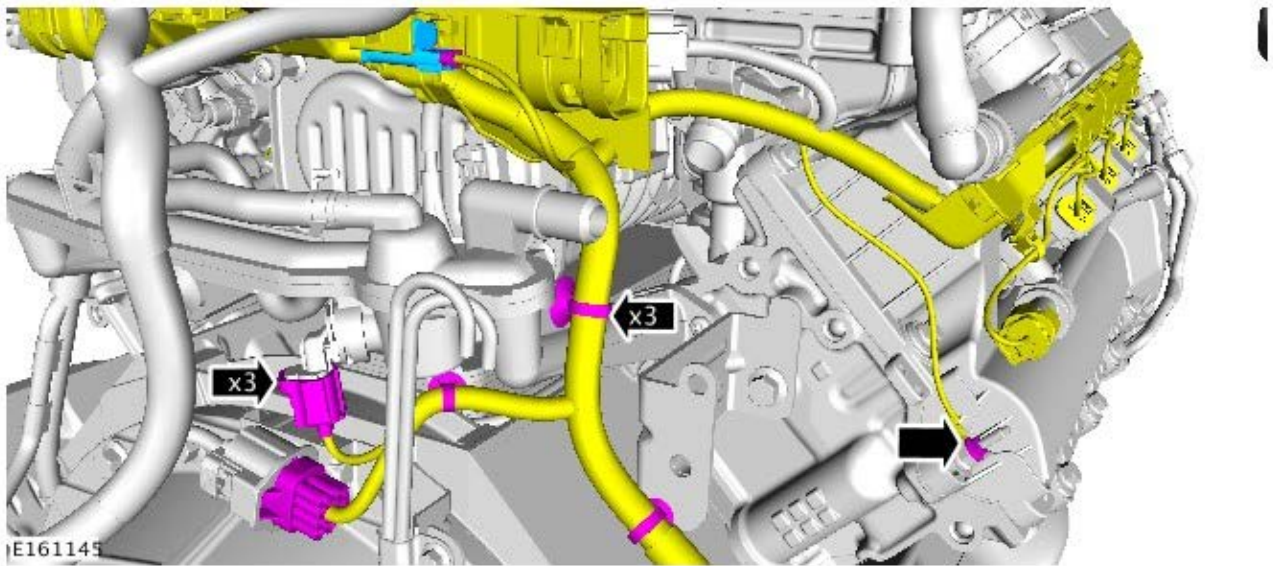
19.



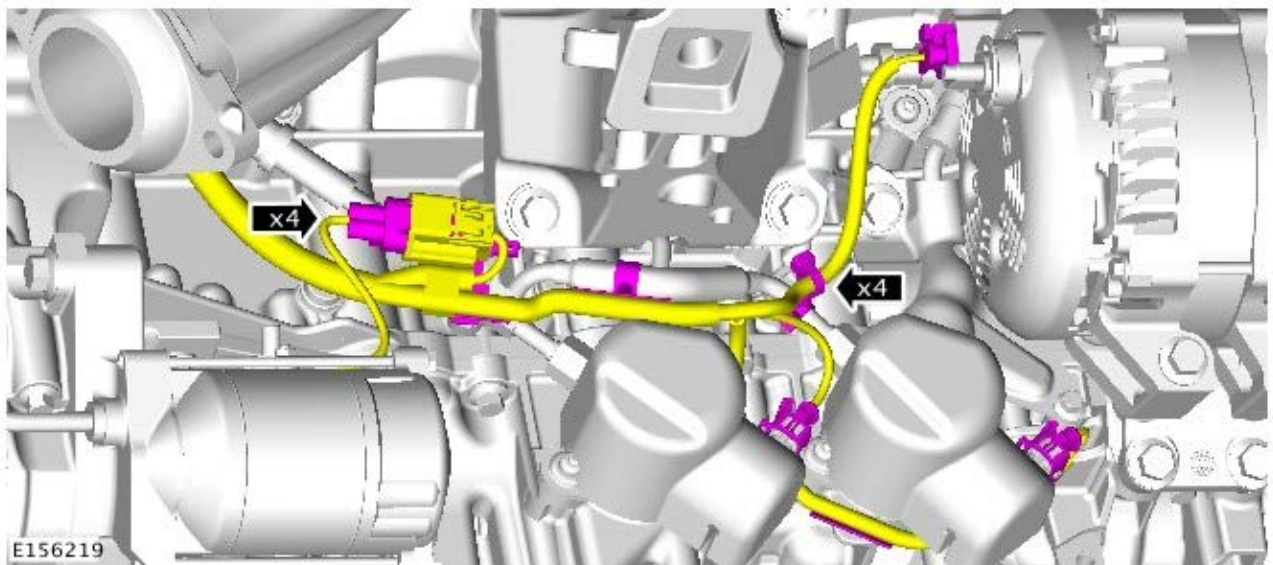
20.



21. Torque: 13 Nm



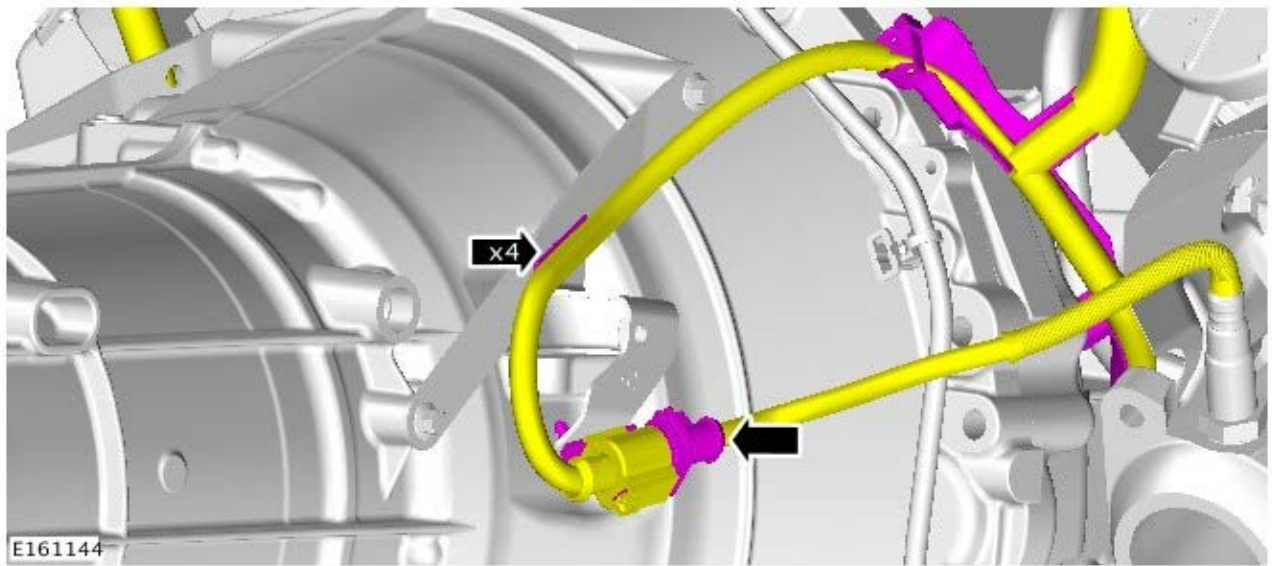
22.



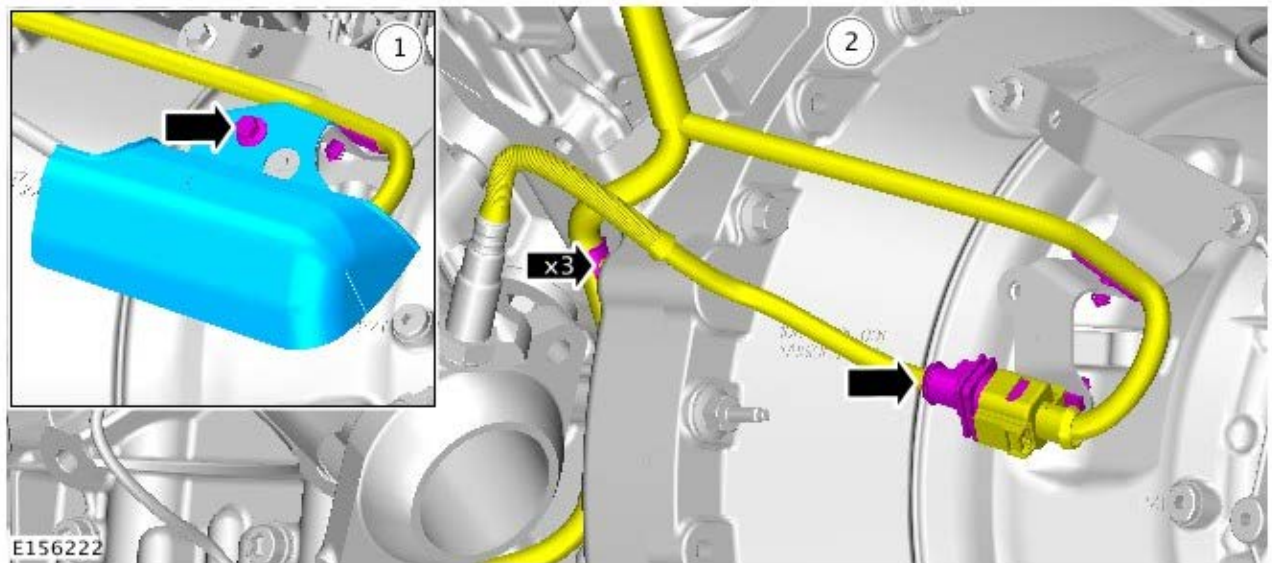
23.



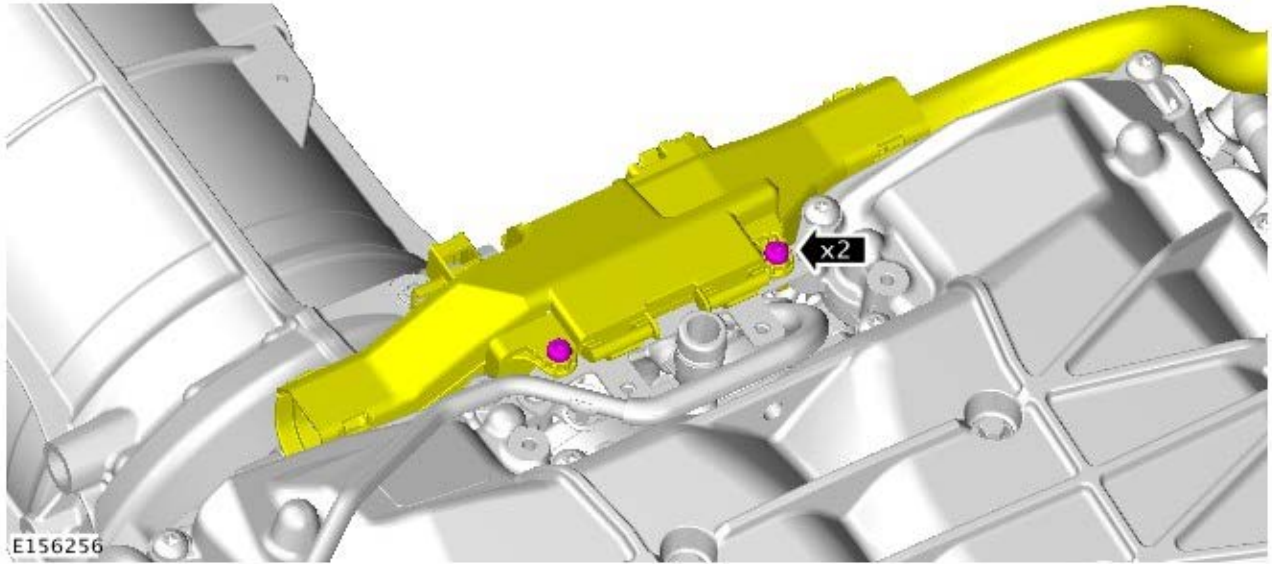
24. Torque: 11 Nm



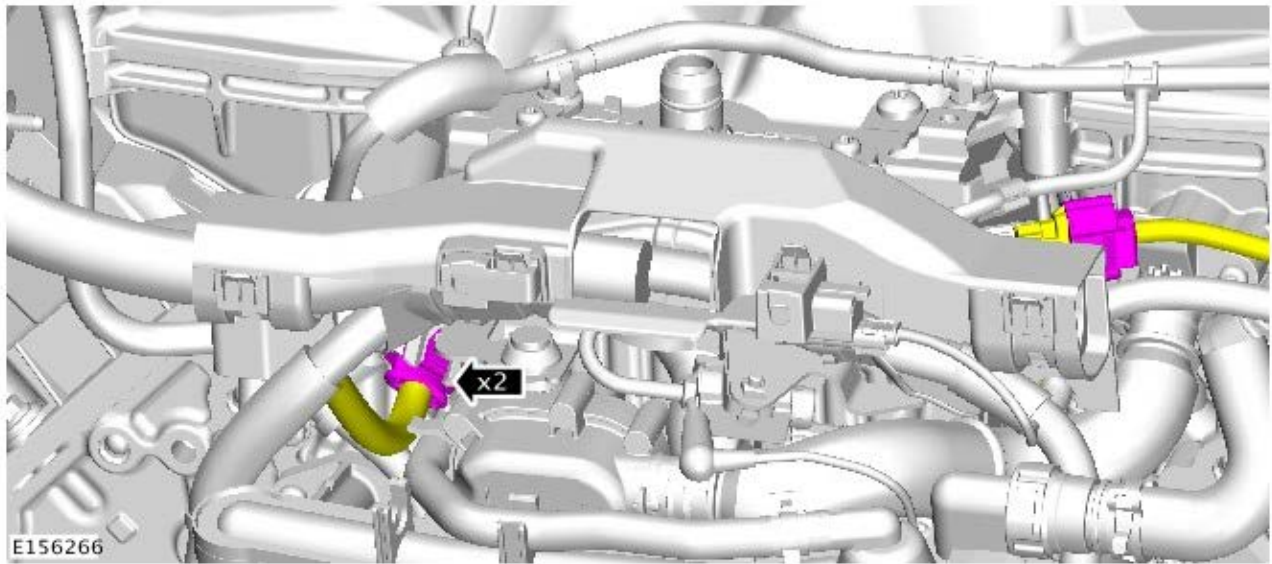
25. Torque: 11 Nm



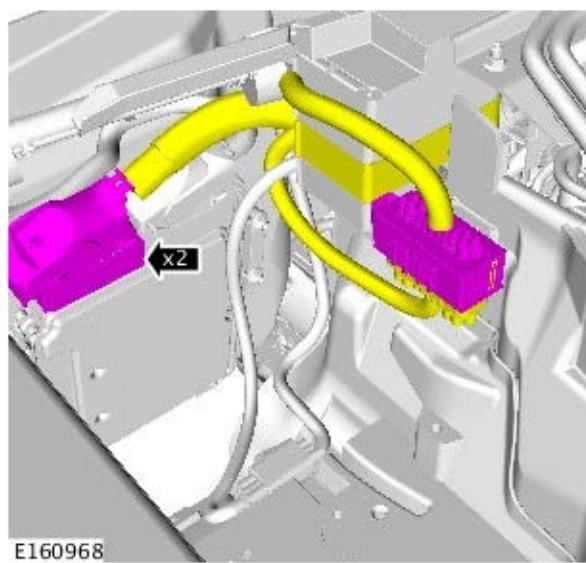
26. Torque: 10 Nm



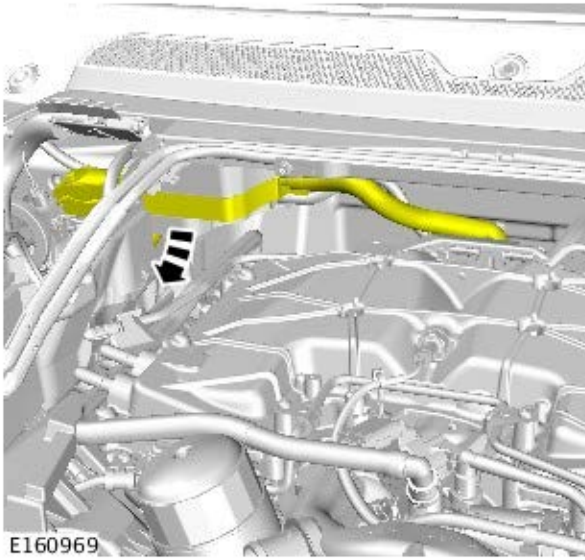
27.



28.

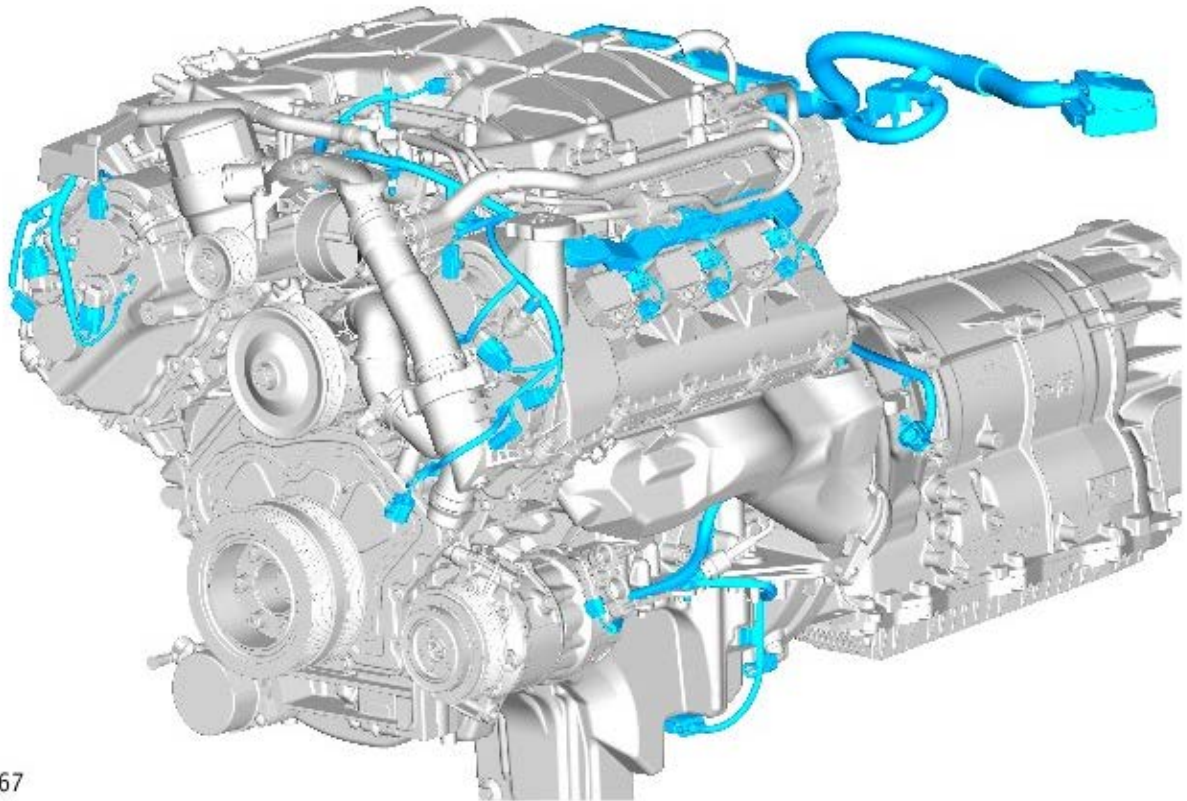


29.




E160969

30.



E156267

Installation

1.  CAUTION: Make sure the electrical harness is not trapped during the installation.

To install, reverse the removal procedure.

Wiring Harnesses - Engine Wiring Harness TDV6 3.0L Diesel

Removal and Installation

Removal

NOTES:




RHD shown, LHD is similar.



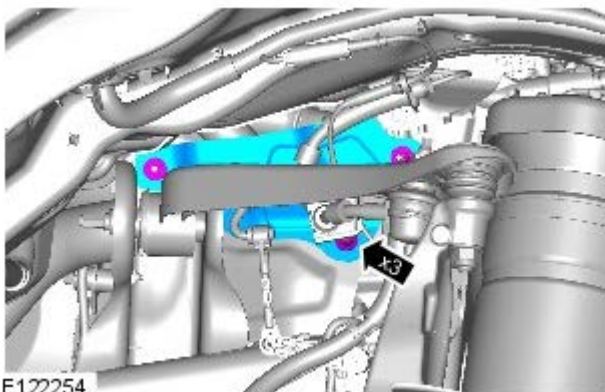
Some variation in the illustrations may occur, but the essential information is always correct.



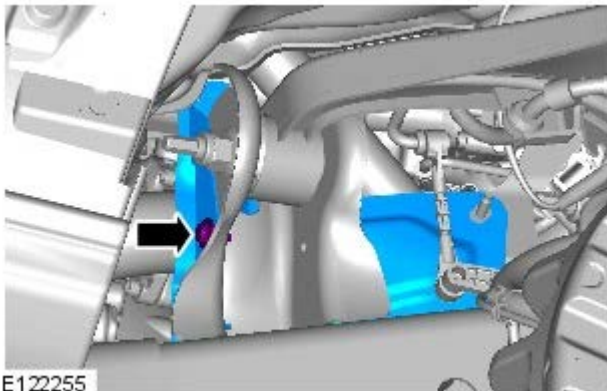
Removal steps in this procedure may contain installation details.

1. Remove the battery.
For additional information, refer to: Battery (414-01, Removal and Installation).
2. For additional information, refer to: Engine Cover - 3.0L Diesel (501-05, Removal and Installation).
3. For additional information, refer to: Exhaust System (309-00, Removal and Installation).
4. For additional information, refer to: Starter Motor (303-06, Removal and Installation).
5. For additional information, refer to: Generator (414-02, Removal and Installation).
6. For additional information, refer to: Exhaust Gas Recirculation (EGR) Valve LH (303-08, Removal and Installation).
7. For additional information, refer to: Air Conditioning (A/C) Compressor (412-03, Removal and Installation).
8. For additional information, refer to: Power Steering Pump - 3.0L Diesel (211-02, Removal and Installation).
9.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
10. Remove the front road wheels and tires.
 - TORQUE: 140 Nm

11. TORQUE: 9 Nm

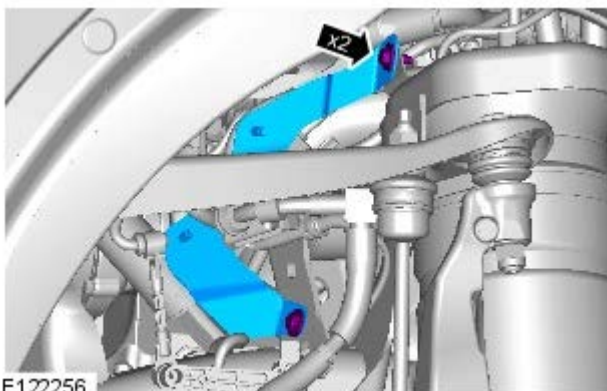


12. TORQUE: 9 Nm



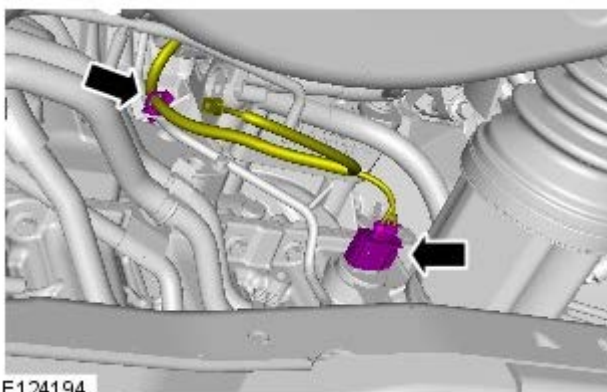
E122255

13. TORQUE: 9 Nm



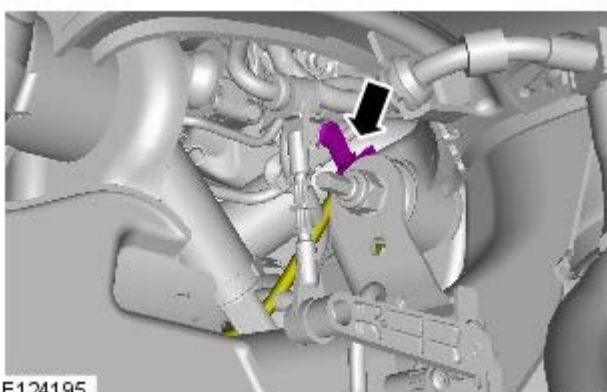
E122256

14.



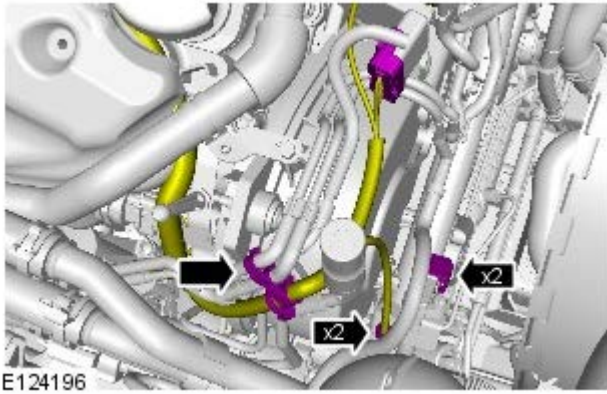
E124194

15.

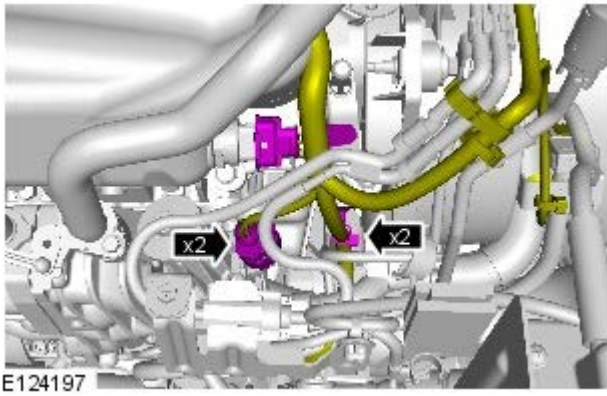


E124195

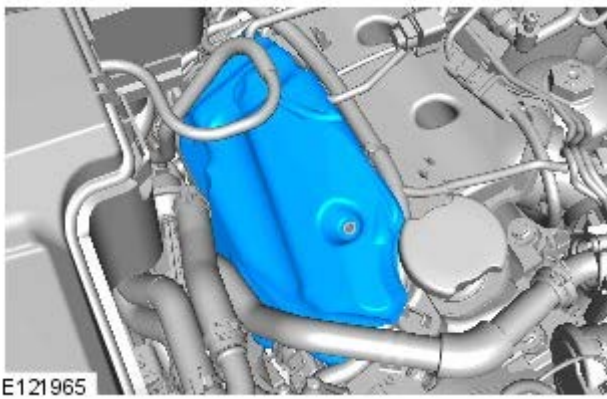
16.



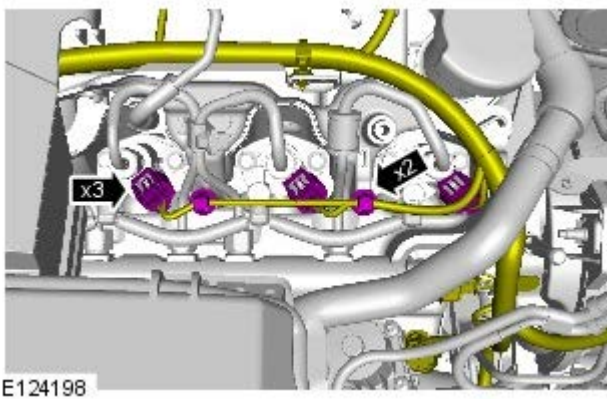
17.



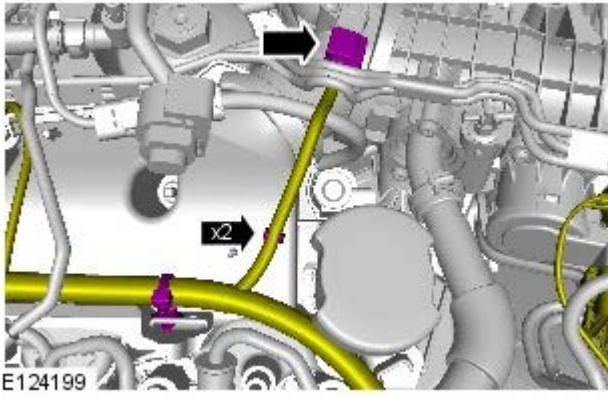
18.



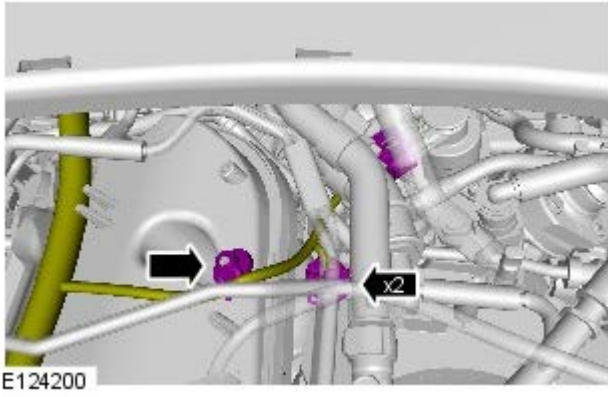
19.



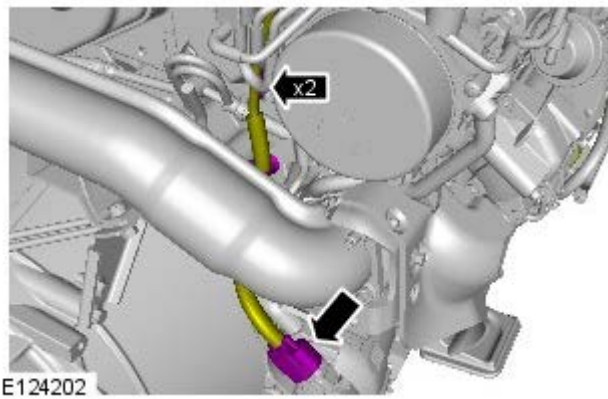
20.




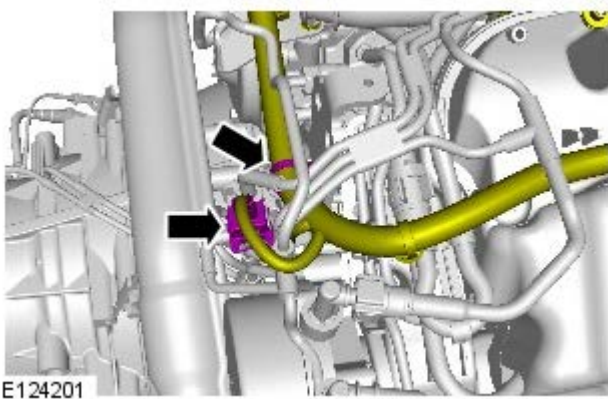
21.



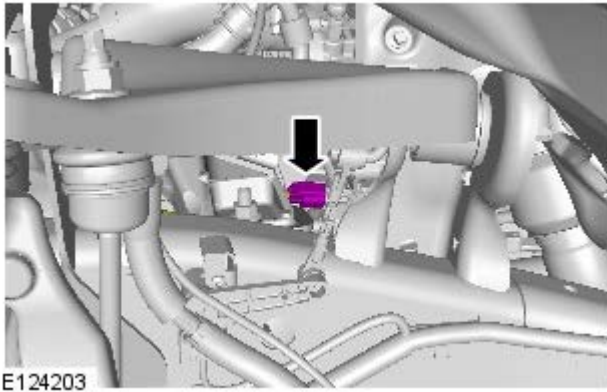
22.  NOTE: Engine shown removed for clarity.



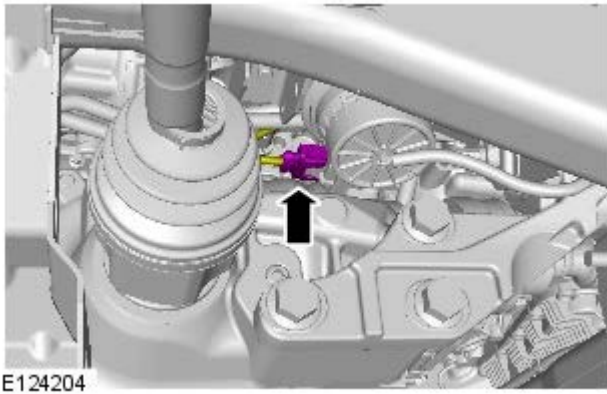
23.  NOTE: Engine shown removed for clarity.



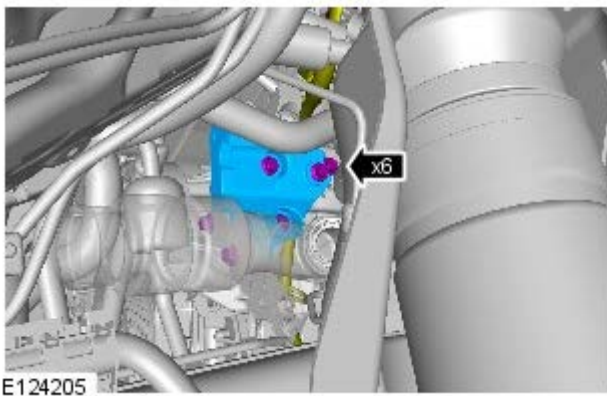
24.



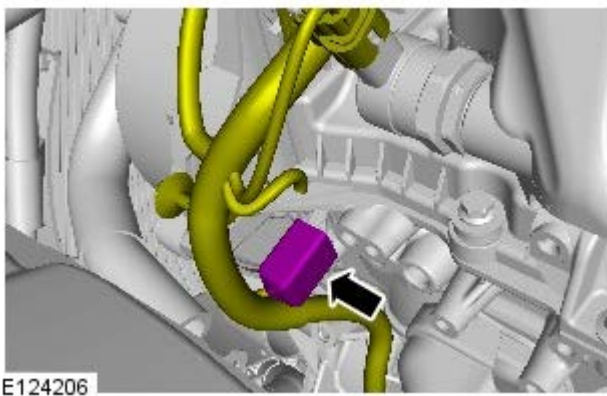
25.



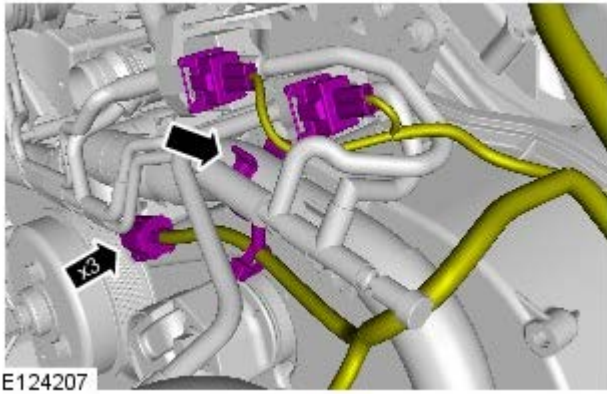
26. TORQUE: 25 Nm



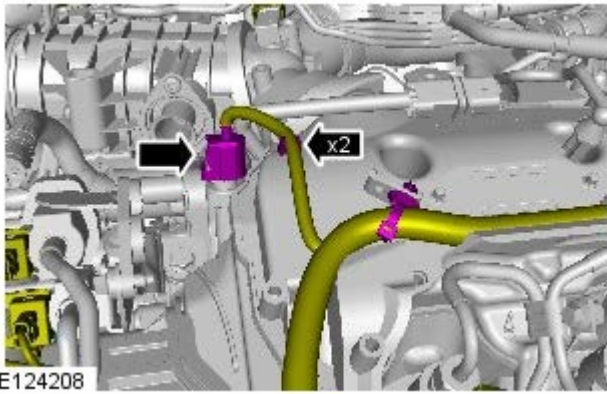
27.



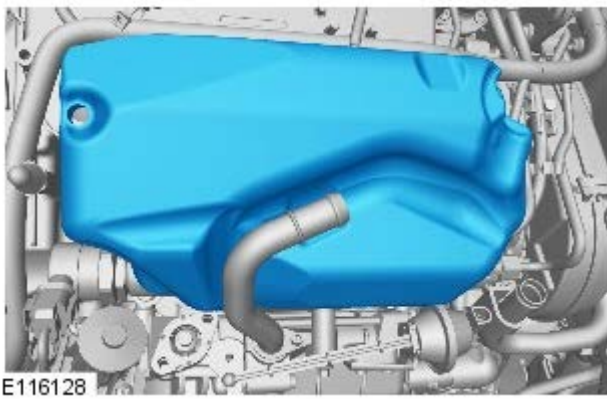
28.



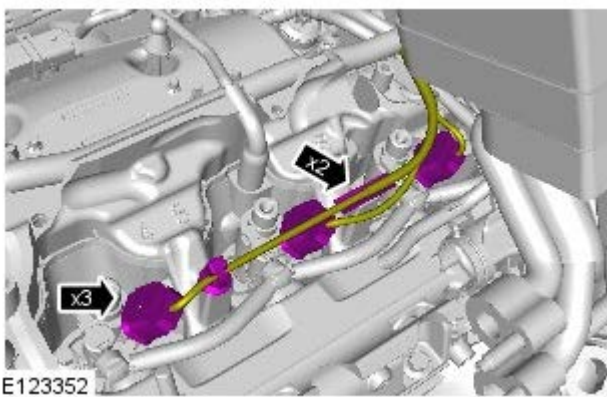
29.



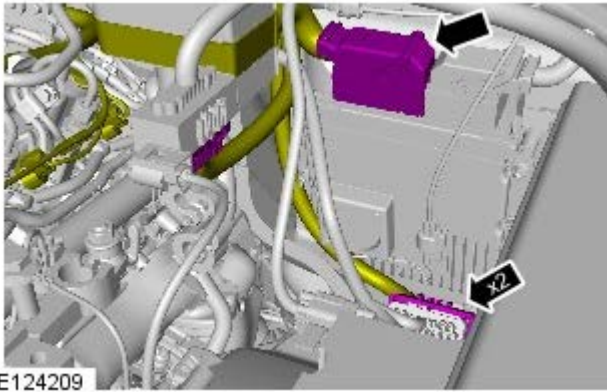
30.



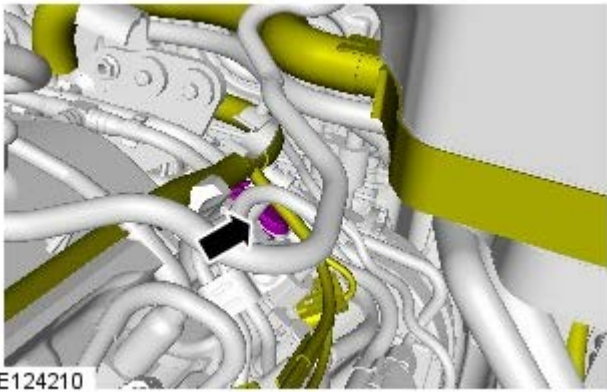
31.



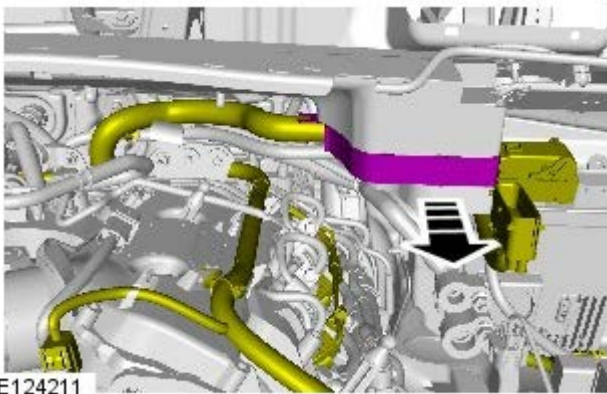
32.



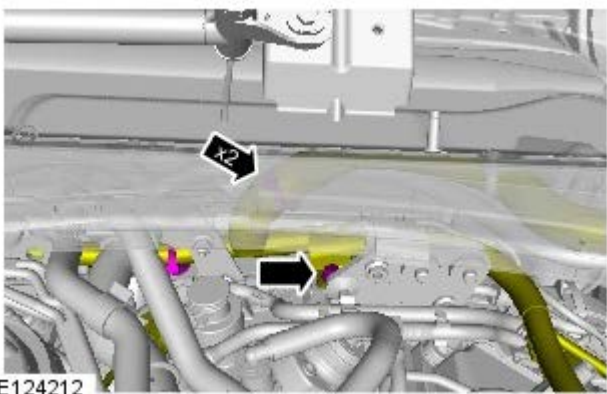
33.





34.

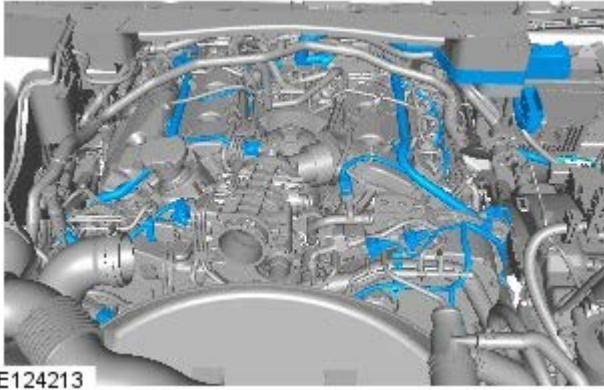


35. TORQUE: 10 Nm



36.  CAUTION: Take extra care not to damage the wiring harnesses.

 NOTE: Note the position of the wiring harnesses to aid installation.



E124213

Installation

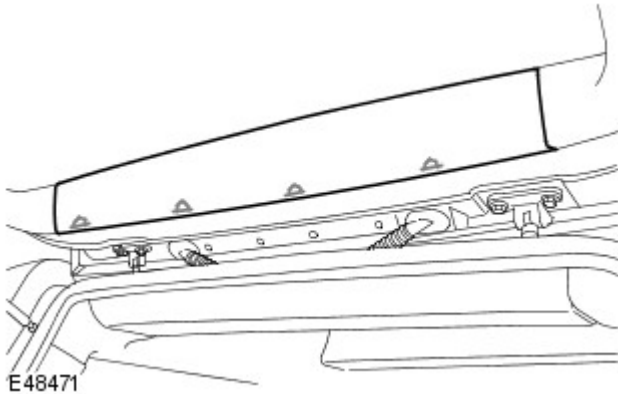
1. To install, reverse the removal procedure.

Wiring Harnesses - Liftgate Wiring Harness

Removal and Installation

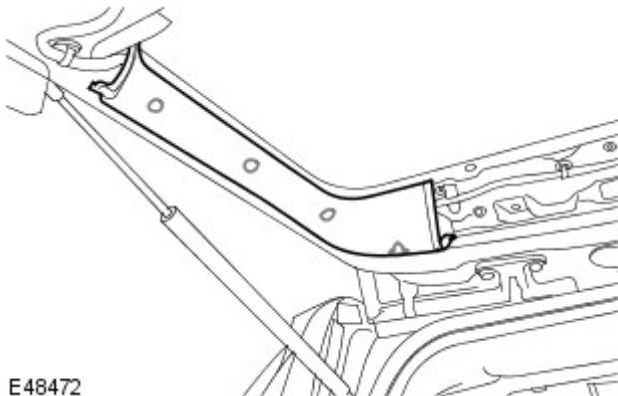
Removal

1. Open the liftgate and tailgate.
2. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
3. Remove the liftgate lower trim panel.
For additional information, refer to: Liftgate Trim Panel (501-05, Removal and Installation).
4. Remove the liftgate upper trim panel.
 - Release the 4 clips.



E48471

5. Remove the liftgate side trim panel.
 - Release the 5 clips.
 - Repeat the above procedure for the other side.



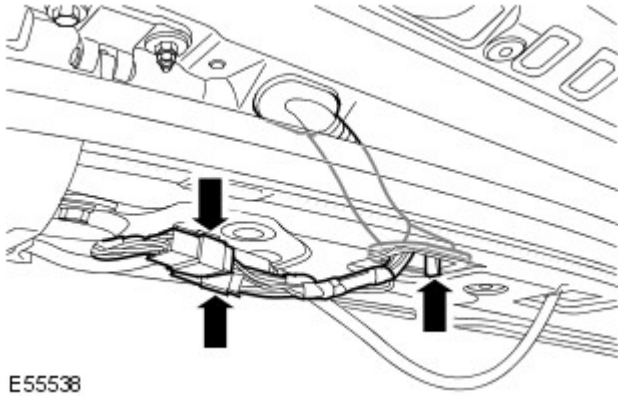
E48472

6. Remove the rear headliner trim panel.
 - Release the 7 clips.
 - Disconnect the electrical connector.



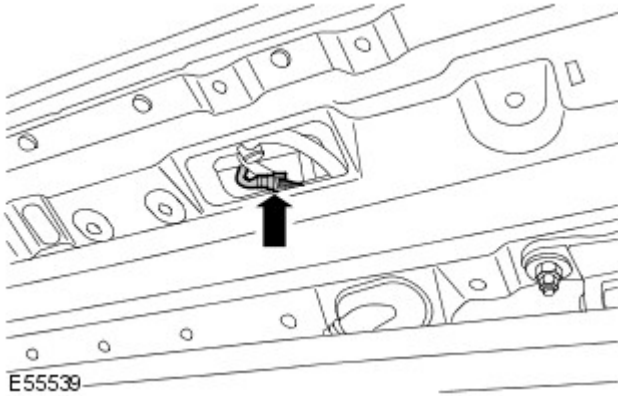
E49690

7. Release the liftgate wiring harness.
 - Disconnect the 2 electrical connectors.
 - Release the grommet.



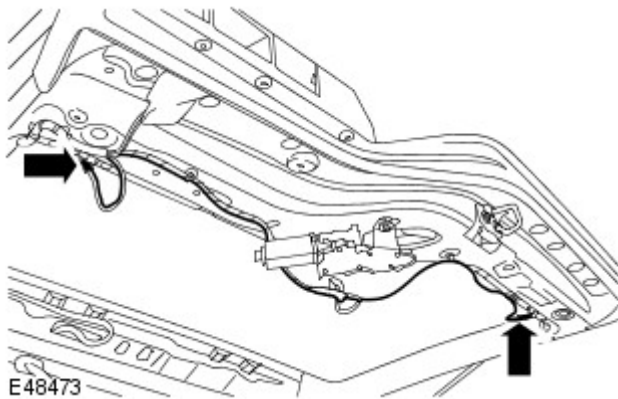
E55538

8. Disconnect the high mounted stoplamp electrical connector.



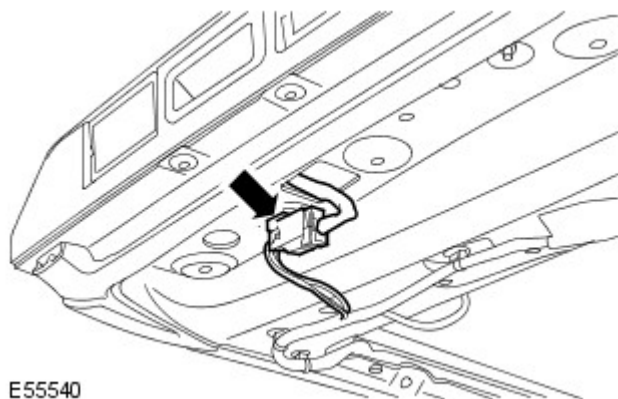
E55539

9. Disconnect both heated rear window electrical connectors.



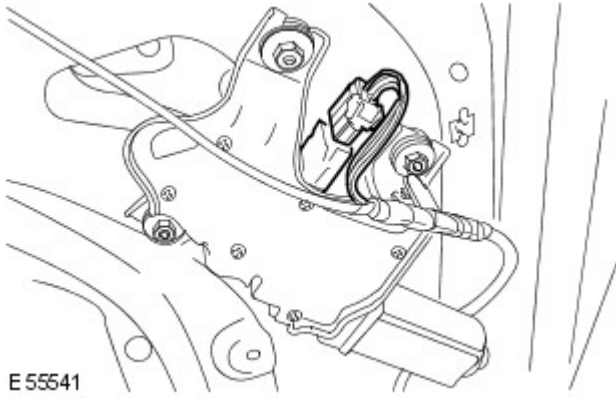
E48473

10. Disconnect the license plate lamp electrical connector.

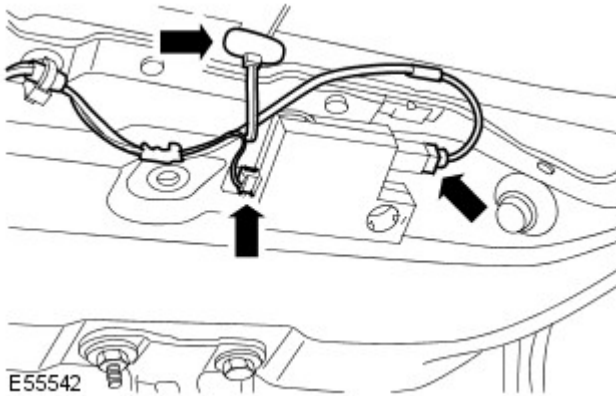


E55540

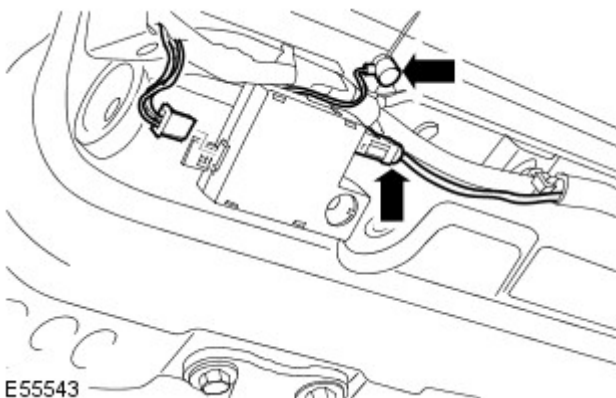
11. Disconnect the wiper motor electrical connector.



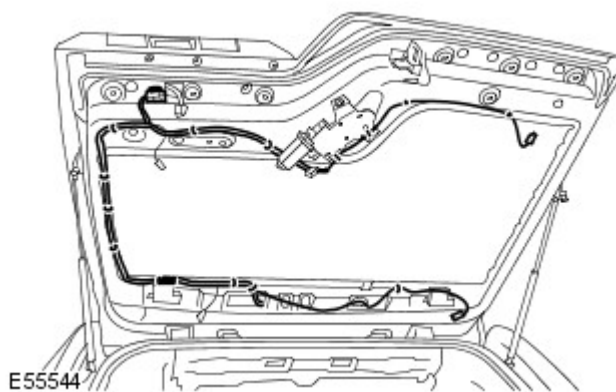
12. If installed, disconnect the diversity amplifier electrical connector and antenna cable.



13. If installed, disconnect the navigation system traffic amplifier electrical connector and antenna cable.



14. Remove the liftgate wiring harness.
 - Release the 15 clips.



Installation

1. Install the liftgate wiring harness.
 - Secure the clips.
2. If installed, connect the navigation system traffic amplifier electrical connector and antenna cable.
3. If installed, connect the diversity amplifier electrical

connector and antenna cable.


4. Connect the wiper motor electrical connector.
5. Connect the license plate lamp electrical connector.
6. Connect the heated rear window electrical connectors.
7. Connect the high mounted stoplamp electrical connector.
8. Attach the liftgate wiring harness.
 - Install the grommet.
 - Connect the electrical connectors.
9. Install the rear headliner trim panel.
 - Connect the electrical connector.
 - Secure with the clips.
10. Install the liftgate side trim panel.
 - Secure with the clips.
 - Repeat the above procedure for the other side.
11. Install the liftgate upper trim panel.
 - Secure with the clips.
12. Install the liftgate lower trim panel.
For additional information, refer to: Liftgate Trim Panel (501-05, Removal and Installation).
13. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

Wiring Harnesses - Frame Wiring Harness

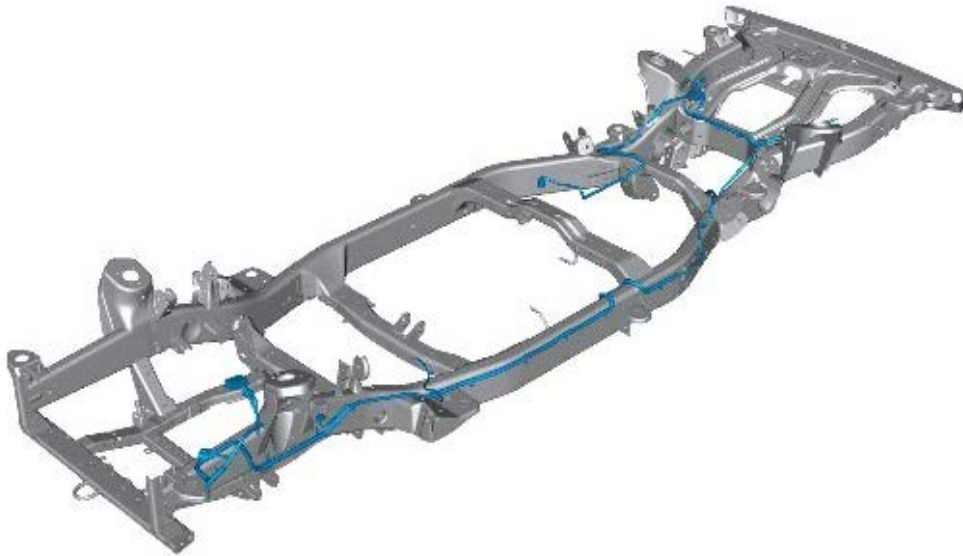
Removal and Installation

Removal


All vehicles

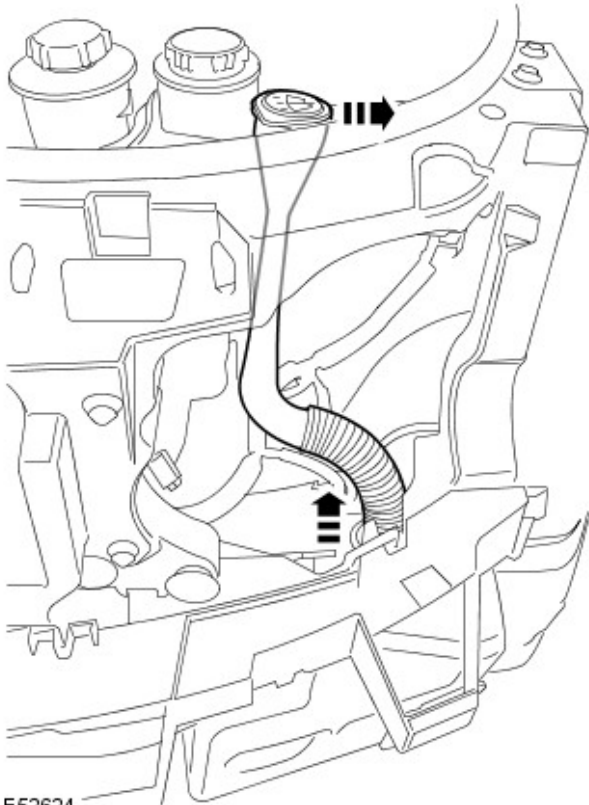
1.  NOTE: All of the clips on the harness can be accessed with the integrated body installed to the frame. The graphic is to give guidance of the routing of the harness.

The frame wiring harness routing.



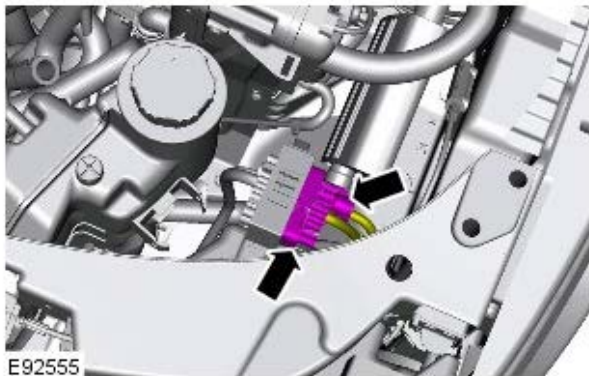
E92590

2. Open the upper liftgate and lower tailgate.
3. Remove the spare wheel and tire.
4.  WARNING: Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.
Raise and support the vehicle.
5. Remove the wheels and tires.
6. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
7. Remove the LH front wheel arch liner.
For additional information, refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).
8. Remove the windshield washer reservoir filler neck.



E52624

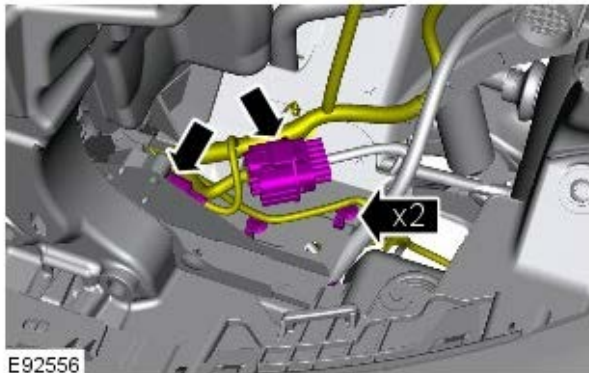
9. LH side behind the front headlamp: Disconnect the frame wiring harness electrical connector.



E92555

10. LH side behind the front panel: Disconnect the 2 electrical connectors from the frame wiring harness.

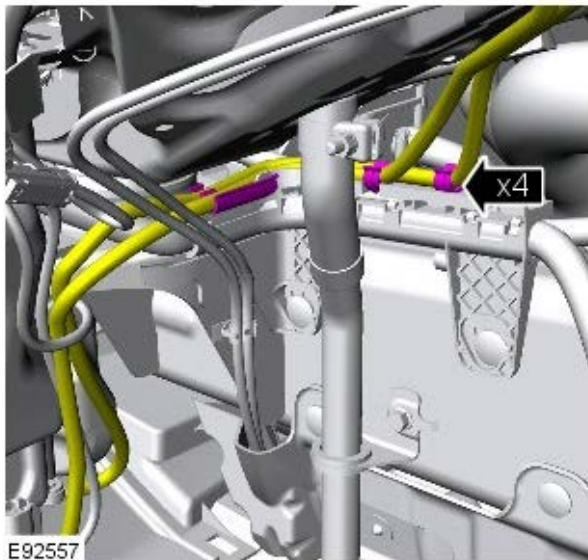
11. LH side behind headlamp: Release the 2 clips from the inner fender.



E92556

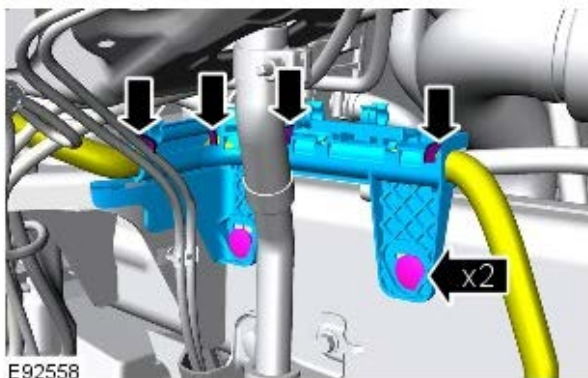
12. LH side behind headlamp: Reposition the frame wiring harness down to the inner fender.

13. LH side front: Release the 2 windshield washer jet hoses.



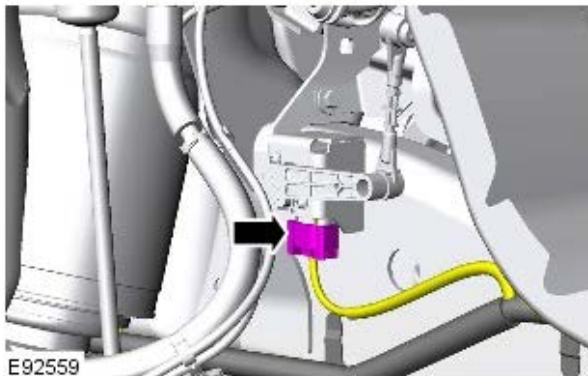
E92557

14. Remove the frame wiring harness carrier.
 - Remove and discard the 4 tie straps.
 - Release the 2 clips.



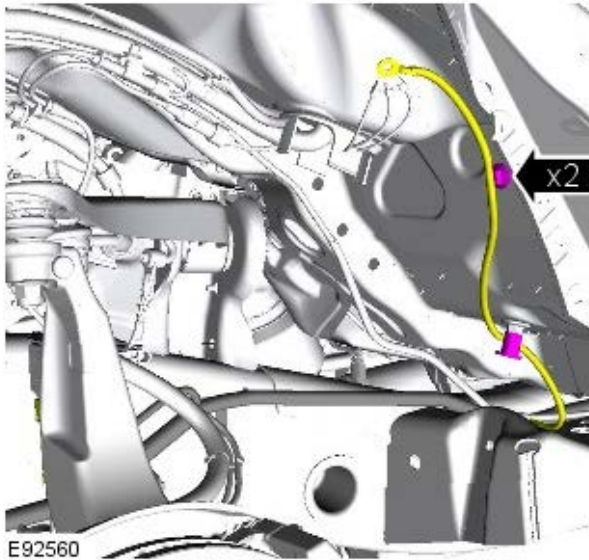
E92558

15. LH side front: Disconnect the height sensor electrical connector.



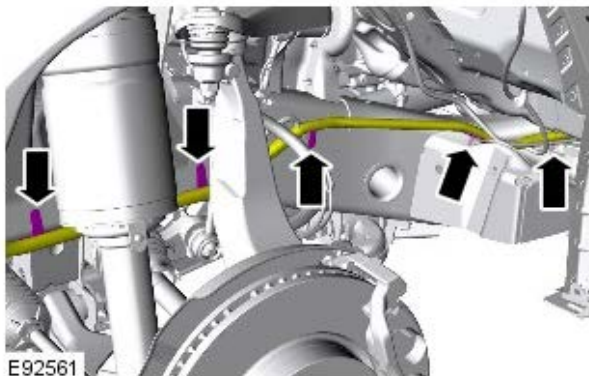
E92559

16. Disconnect the ground cable from the wheel arch earth stud.
 - Release the 2 clips.



E92560

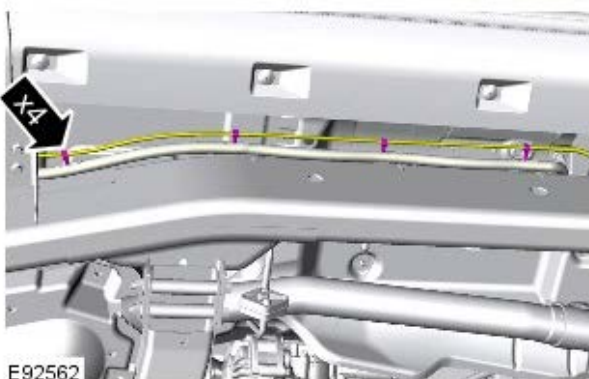
17. LH front side: Release the frame wiring harness from the frame.
 - Release the 5 clips.



E92561

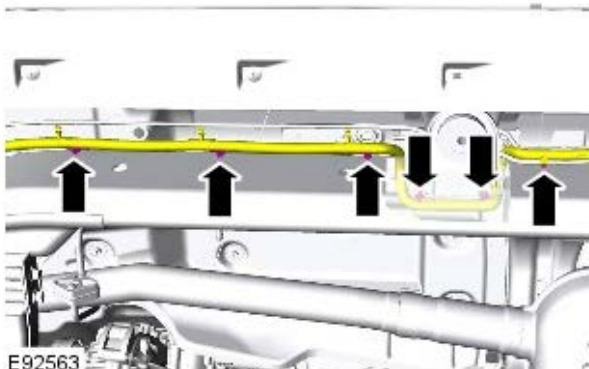
18. Remove the air suspension reservoir.
For additional information, refer to: Air Suspension Reservoir (204-05 Vehicle Dynamic Suspension, Removal and Installation).

19. LH side: Release air suspension line from the frame wiring harness.
 - Release the 4 clips.



E92562

20. LH side: Release the frame wiring harness from the frame.
 - Release the 6 clips.



E92563

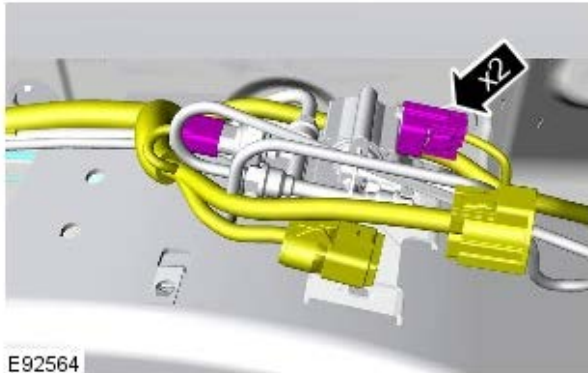
21. Remove the air suspension silencer.
For additional information, refer to: Air Suspension Muffler (204-

All except vehicles with diesel engine

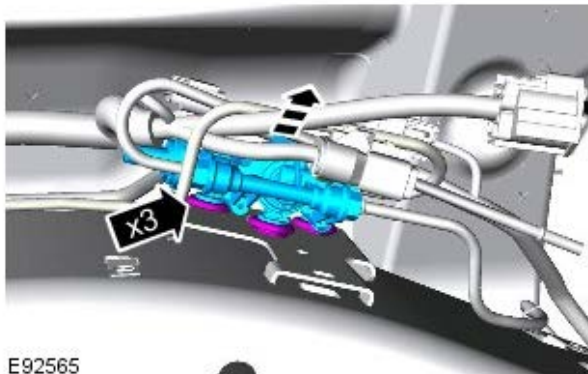
22. Remove the evaporative emission canister.
For additional information, refer to: Evaporative Emission Canister (303-13 Evaporative Emissions - 4.0L, Removal and Installation).

All vehicles

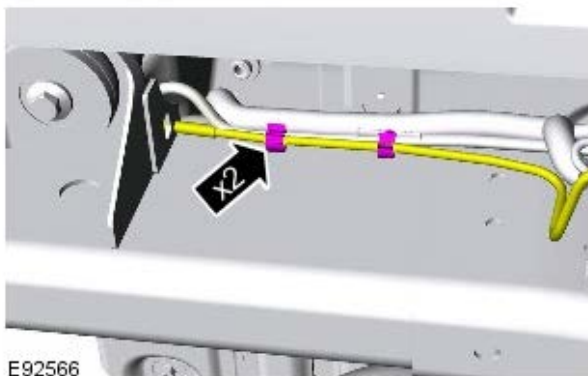
23. Disconnect the 2 electrical connectors from the air suspension solenoid.




24. Release the air suspension compressor valve block.
 - Release the 3 grommets.



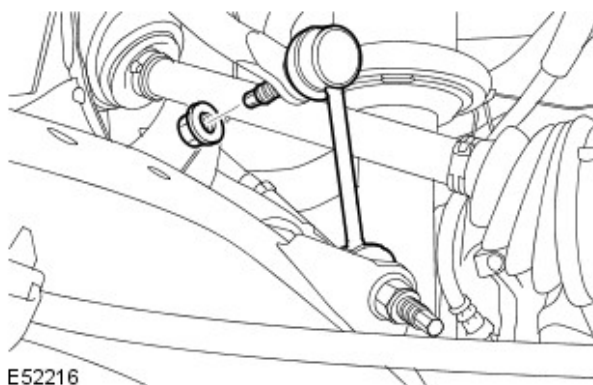
25. LH side: Release air suspension line from the frame wiring harness.



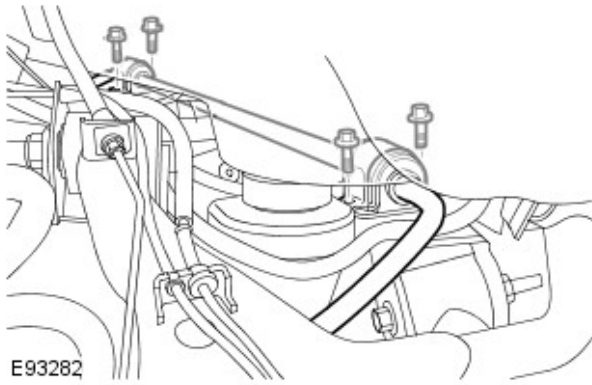
26.  **CAUTION:** Use a wrench on the hexagon provided to prevent the ball joint rotating.

Release both stabilizer bar links.

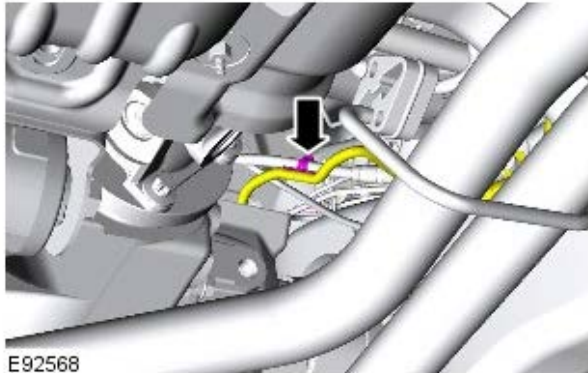
- Remove the 2 nuts.



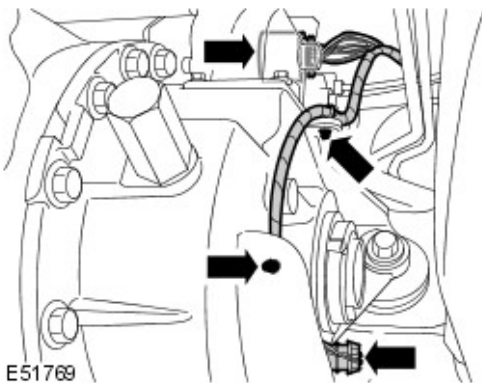
27. Release the stabilizer bar.



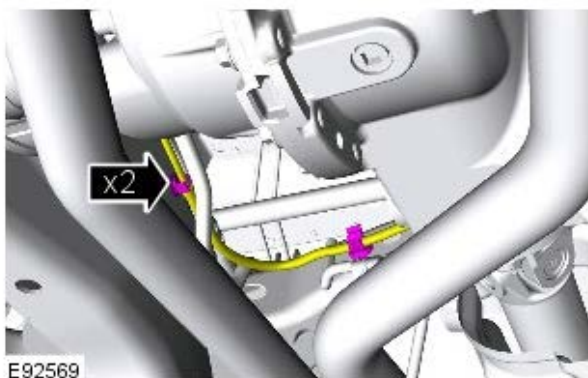
- Remove the 4 bolts.



28. Release the frame wiring harness from the parking brake cable.

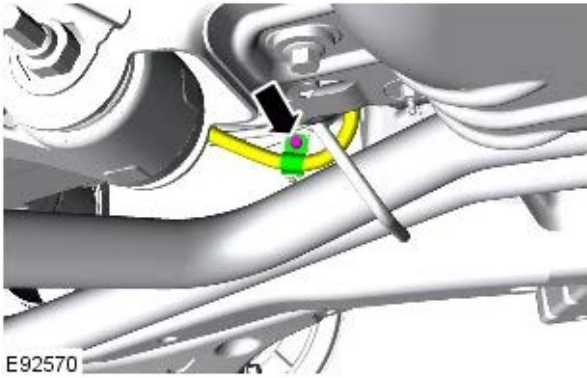


29. Vehicles with differential locking motor: Disconnect the 2 electrical connectors.
- Release the 2 wiring harness clips.

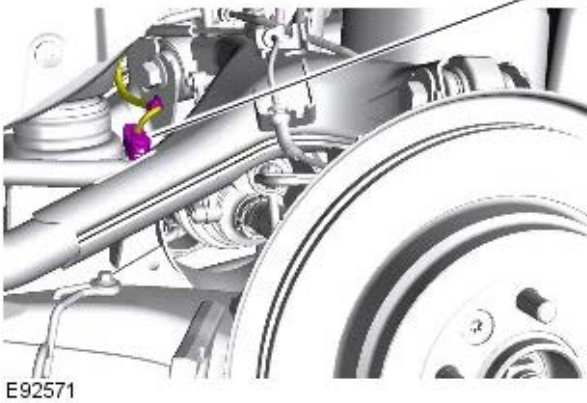
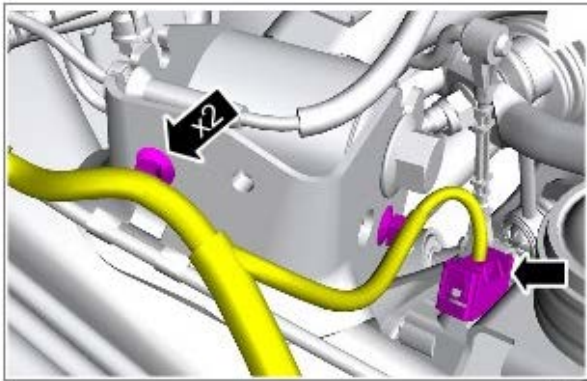


30. Release the parking brake emergency release cable.
- Release the 2 clips.

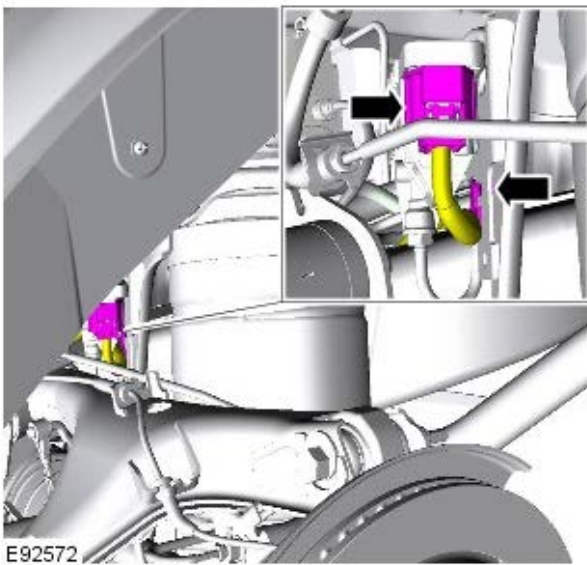
31. LH side: Release the frame wiring harness.
- Remove the bolt.



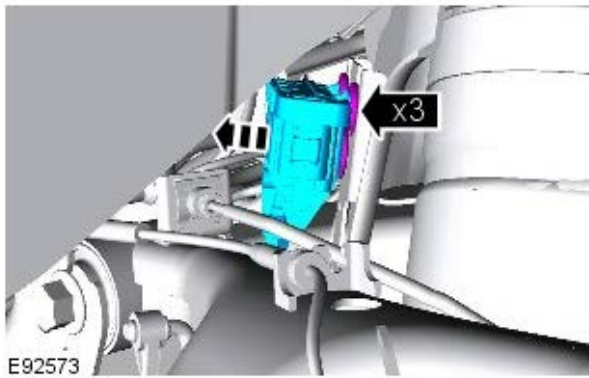
32. Disconnect the electrical connector from the rear LH height sensor.
- Release the 2 clips.



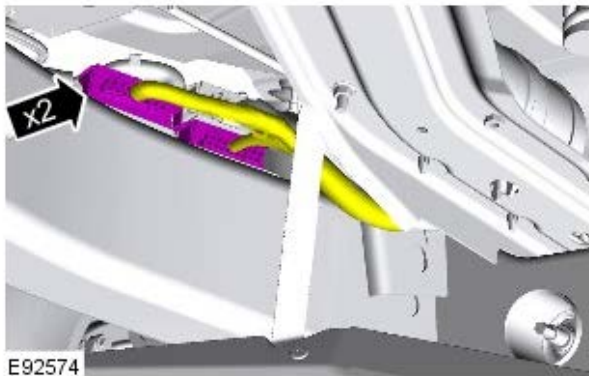
33. LH side rear: Disconnect the air suspension rear valve block electrical connector.
- Release the clip.



34. Release the valve block from its mounting bracket.
- Release the 3 grommets.

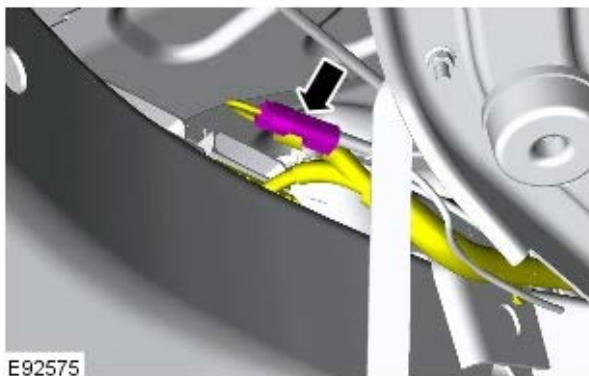


35. Reposition the frame wiring harness to above the frame.



36. LH side rear: Disconnect the 2 electrical connectors from the frame wiring harness.

- Release the 2 electrical connectors.



37. Disconnect the LH rear ABS sensor.

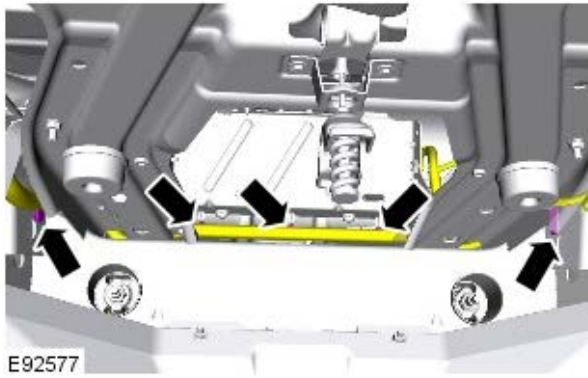
- Release the clip.



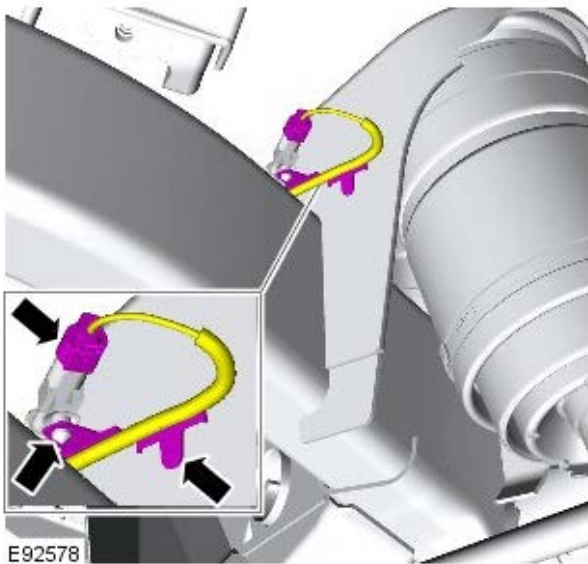
38. Release the parking brake actuator mount bracket.

39. Spare wheel aperture: Release the frame wiring harness.

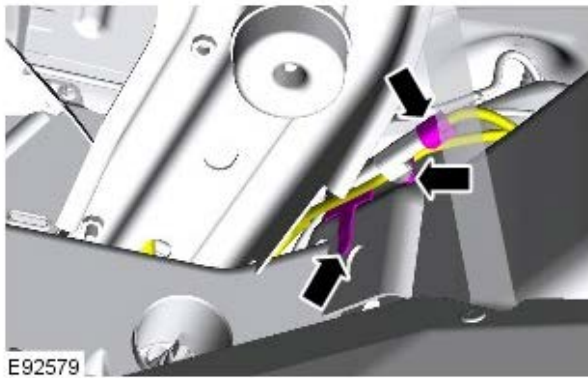
- Release the 5 clips.



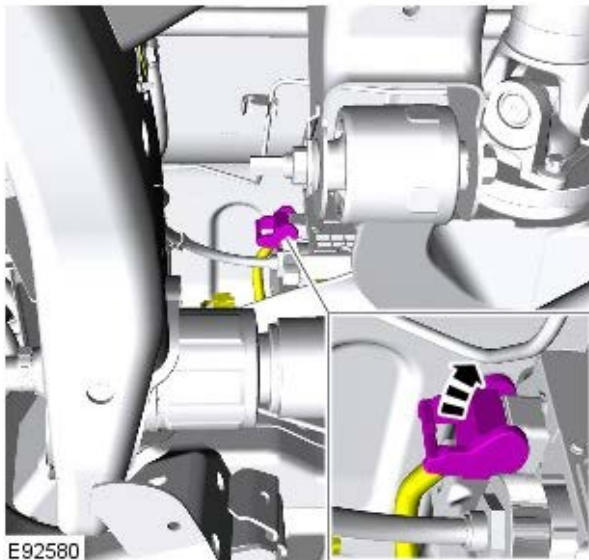
40. RH side rear: Disconnect the ABS sensor electrical connector.
- Release the 2 clips.



41. RH side rear: Disconnect the low brake pad warning lamp electrical connector.
- Release the 2 clips.

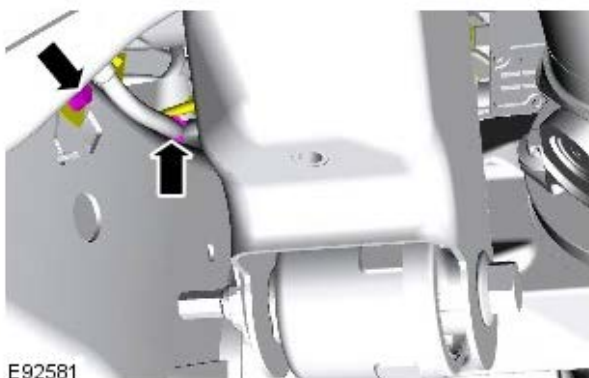


42. Disconnect the electronic parking brake actuator electrical connector.
- Release the clip.



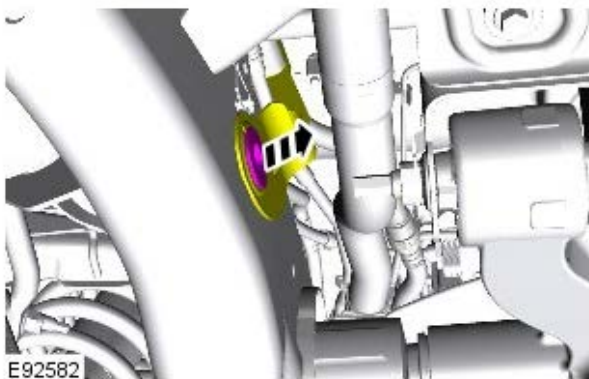
E92580

43. Release the RH parking brake cable.
 - Remove the bolt.
 - Release the clip.



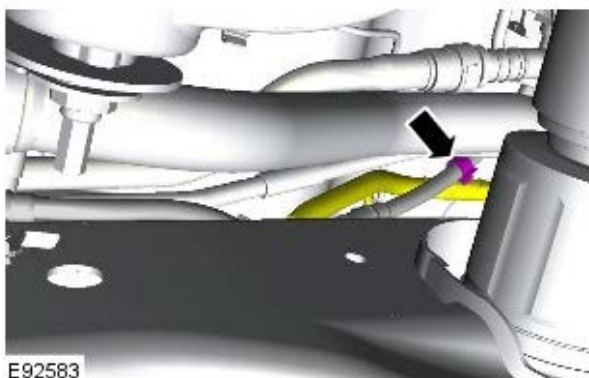
E92581

44. Release the fuel line support bracket.
 - Remove the inner section of the fuel line support bracket.
 - Release the clip.



E92582

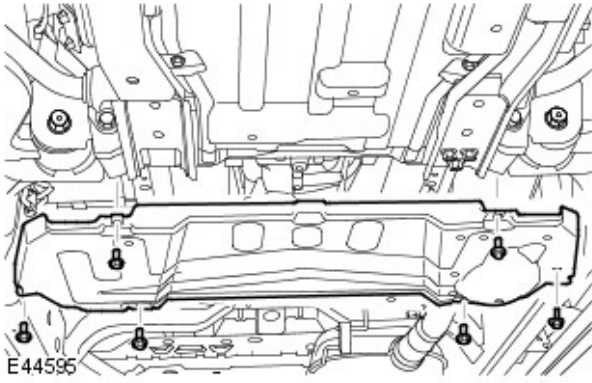
45. Release the frame wiring harness from the parking brake cable.



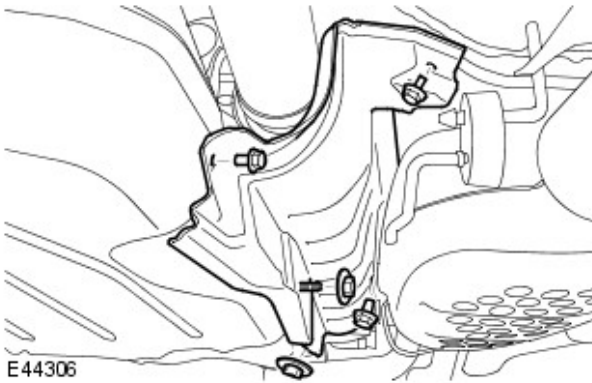
E92583

46. RH side: Release the frame wiring harness from the frame.

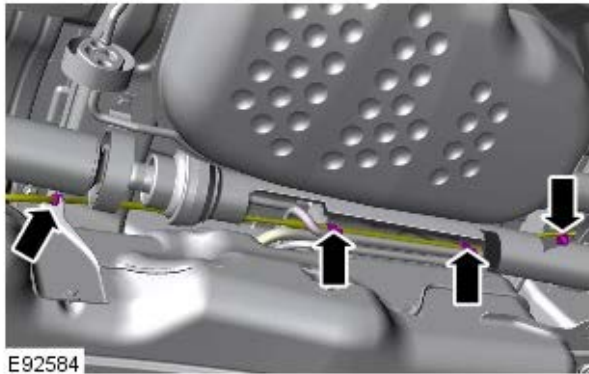
47. Remove the transmission under shield.
 - Remove the 6 bolts.





48. Remove the fuel tank heat shield.
- Remove the 3 bolts and 2 nuts.



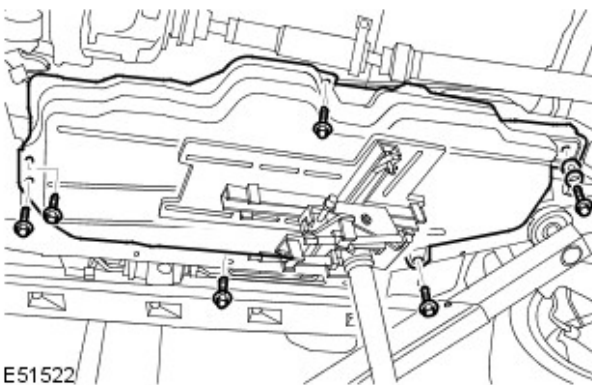
49. Release the parking brake emergency release cable.
- Release the 4 clips



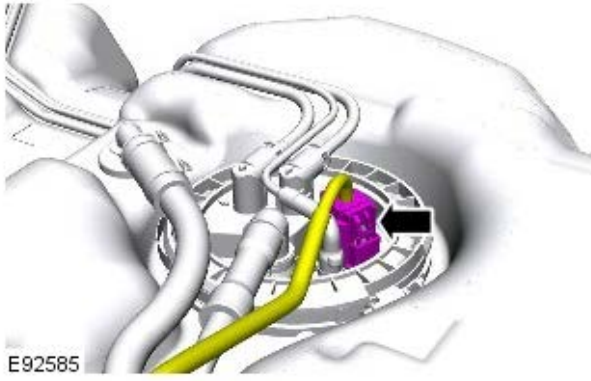
50.  **WARNING:** Secure the component to the transmission jack.

 **CAUTION:** Note the rear bolt is fitted with 2 washers.

- Using a transmission jack, lower the fuel tank.
- Remove the 6 bolts.



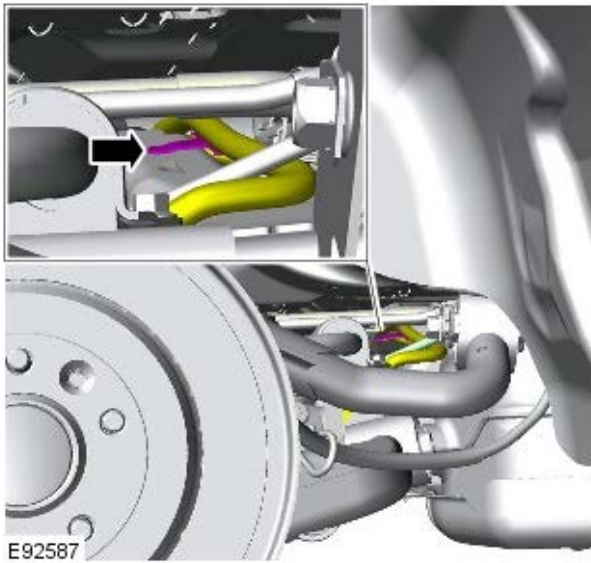
51. Disconnect the fuel pump module electrical connector.



52. Release the frame wiring harness from the fuel tank.

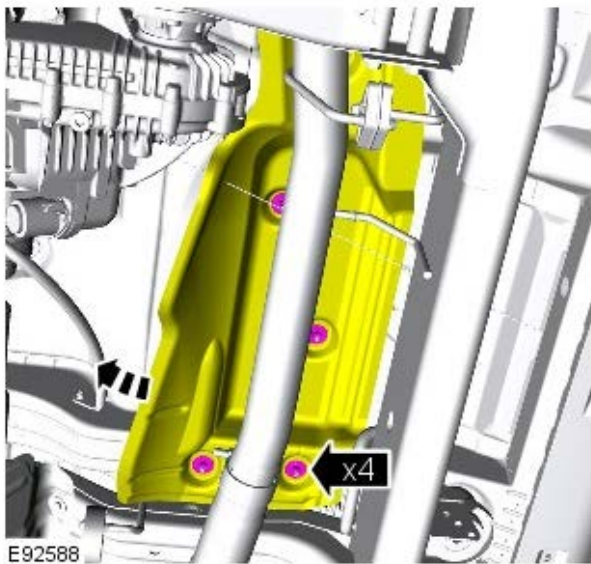


53. Rear of fuel tank: Release the frame wiring harness from the top of the frame crossmember.
• Release the clip.

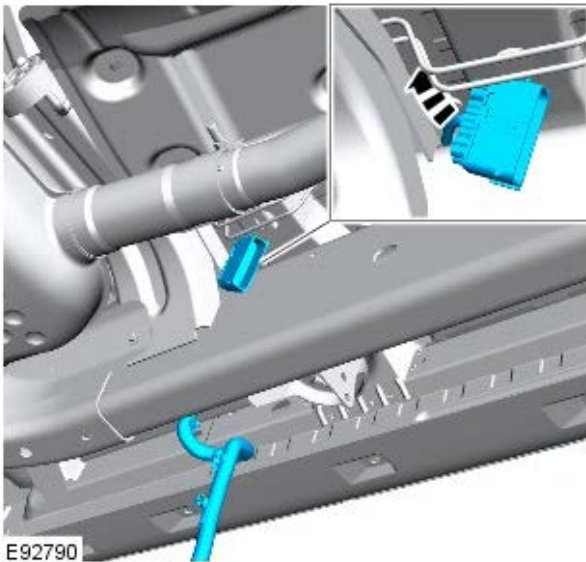
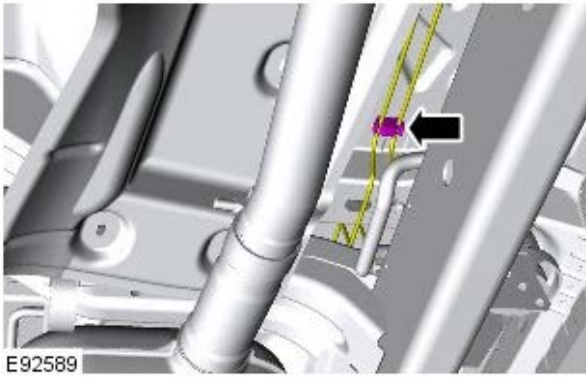


54. Secure the fuel tank.

55. Release the exhaust heat shield for access.



56. Release the brake pipes.



57. With assistance, remove the frame wiring harness.
- Position both ends of the frame wiring harness to the LH center body mount.
 - Route the front end of the frame wiring harness between the body and center crossmember.
 - With assistance, remove the frame wiring harness.

Installation

1. Check the old frame wiring harness against the new frame wiring harness to make sure that they are the same.

2.  **NOTE:** Make sure the wiring harness is routed correctly.

With assistance, install the frame wiring harness.

- Route all of the frame wiring harness electrical connectors and clips into position.

3. Secure the brake pipes.
4. Secure the exhaust heat shield.

5.  **WARNING:** Secure the component to the transmission jack.

6.  **CAUTION:** Note the rear bolt is fitted with 2 washers.

Using a transmission jack, lower the fuel tank.

- Remove the 4 bolts.

6. Connect the fuel pump module electrical connector.
7. RH side: Secure the frame wiring harness to the fuel tank.
8. Rear of fuel tank: Secure the frame wiring harness to the top of the frame crossmember.

9.  **CAUTION:** Note the rear bolt is fitted with 2 washers.

Install the fuel tank.

- Tighten the bolts to 45 Nm (33 lb.ft).

10. Secure the parking brake emergency release cable.
 - Secure in the 4 clips.
11. Install the fuel tank heat shield.
 - Tighten the bolts to 6 Nm (4 lb.ft).
 - Tighten the nuts to 3 Nm (2 lb.ft).
12. Install the transmission under shield.
 - Tighten the bolts to 10 Nm (7 lb.ft).
13. RH side: Secure the frame wiring harness to the frame.
14. Secure the frame wiring harness to the RH parking brake cable.
15. Secure the RH parking brake cable bracket.
 - Install the inner section of the parking brake cable bracket.
16. Secure the RH parking brake cable.
 - Secure the clip.
 - Tighten the new bolts to 22 Nm (16 lb.ft).
17. Connect the electronic parking brake actuator electrical connector.
 - Secure the clip.
18. RH side rear: Connect the low brake pad warning lamp electrical connector.
 - Secure the 2 clips.
19. RH side rear: Connect the ABS sensor electrical connector.
 - Secure the 2 clips.
20. Spare wheel aperture: Secure the frame wiring harness.
 - Secure the 5 clips.
21. Secure the parking brake actuator mount bracket.
 - Tighten the bolts to 22 Nm (16 lb.ft).
22. Connect the LH rear ABS sensor.
 - Secure the clip.
23. LH side rear: Connect the 2 electrical connectors to the frame wiring harness.
 - Secure the electrical connectors.
24. Reposition the rear valve block electrical connector.
25. Reposition the RH side rear height sensor electrical connector.
26. LH side rear: Connect the air suspension valve block electrical connector.
 - Secure the clip.
27. Connect the electrical connector to the rear LH height sensor.
 - Secure the clip.
28. Secure the valve block to its mounting.
29. LH side: Secure the frame wiring harness.
 - Tighten the bolt to 22 Nm (16 lb.ft).
30. Secure the parking brake emergency release cable.
 - Secure the clips.
31. Secure the frame wiring harness to the LH parking brake cable.
32. Attach both stabilizer bar links.
 - Tighten the nuts to 115 Nm (85 lb.ft).
33. Secure the stabilizer bar.
 - Tighten the bolts to 62 Nm (46 lb.ft).
34. Install the rear wheels and tires.
35. Secure the air suspension compressor valve block.

36. Connect the electrical connectors to the air suspension solenoid.
37. Install the air suspension silencer.
For additional information, refer to: Air Suspension Muffler (204-05 Vehicle Dynamic Suspension, Removal and Installation).
38. LH side: Secure the air suspension line to the frame wiring harness.
39. LH side: Secure the frame wiring harness to the frame.
 - Secure the 6 clips.
40. Install the air suspension reservoir.
For additional information, refer to: Air Suspension Reservoir (204-05 Vehicle Dynamic Suspension, Removal and Installation).
41. Connect the ground cable to the wheel arch earth stud.
 - Tighten the nut to 25 Nm (18 lb.ft).
 - Secure the 2 clips.
42. LH side front: Connect the height sensor electrical connector.
43. Install the frame wiring harness carrier.
 - Install new tie straps.
 - Secure to the clips.
44. LH side front: Secure the 2 windshield washer jet hoses.
45. Reposition the frame wiring harness through the inner fender.
46. LH side behind headlamp: Secure the 2 clips to the inner wing.
47. LH side behind the front panel: Connect the 2 electrical connectors to the frame wiring harness.
48. LH side behind the front headlamp: Connect the frame wiring harness electrical connector.
49. Install the windshield washer reservoir filler neck.
50. Install the LH front wheel arch liner.
For additional information, refer to: Fender Splash Shield (501-02 Front End Body Panels, Removal and Installation).
51. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).

Wiring Harnesses - Front Parking Aid Camera Wiring Harness - Front Section

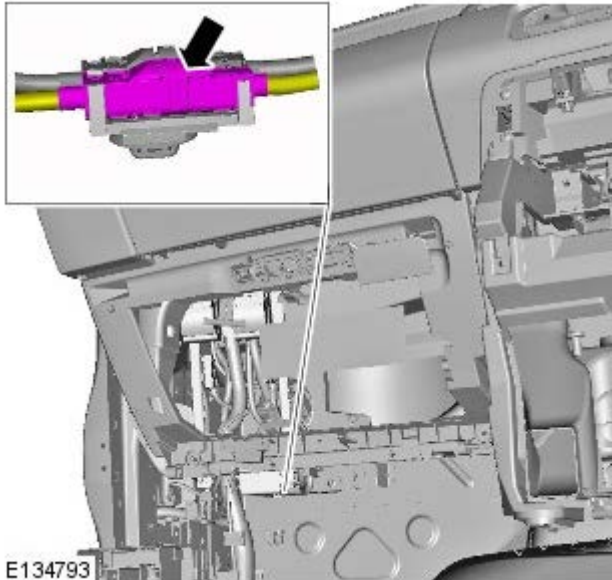
Removal and Installation

Removal



CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

1. Remove the central junction box (CJB). For additional information, refer to: Central Junction Box (CJB) (418-00, Removal and Installation).



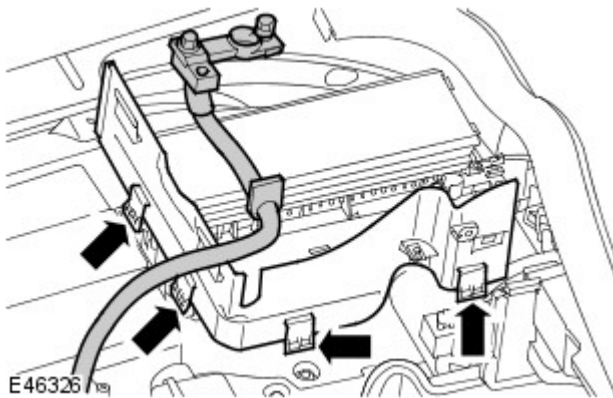
E134793

2.  **NOTE:** The left hand front camera wiring harness connectors are coloured magenta, the right hand front camera wiring harness connectors are coloured blue.

Disconnect the electrical connector.

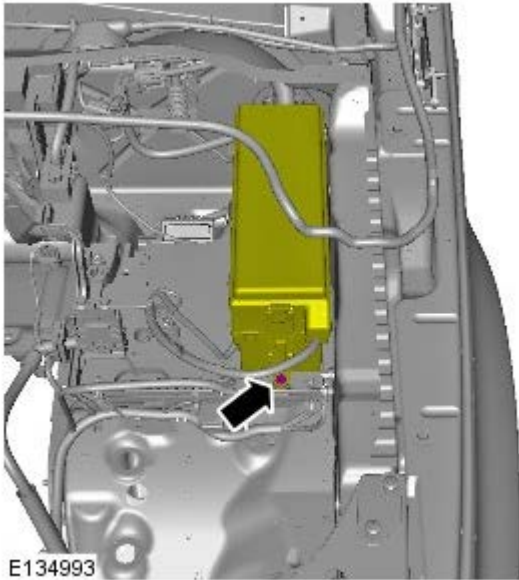
3. Remove the battery. For additional information, refer to: Battery (414-01, Removal and Installation).

4. Remove the battery compartment side wall.
 - Release the battery positive cable and grommet.
 - Release the 4 clips.

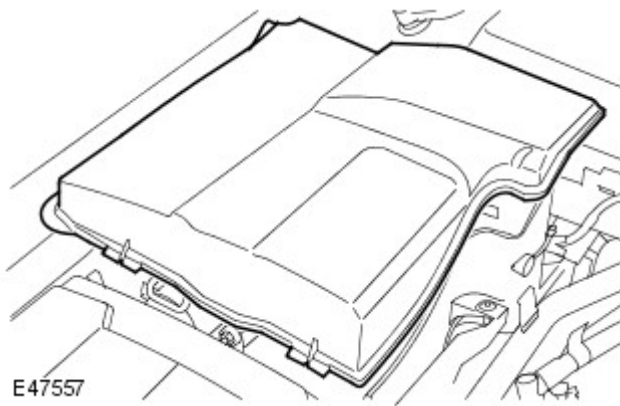


E46326

5. Release the engine compartment fuse box.
 - Remove the bolt.

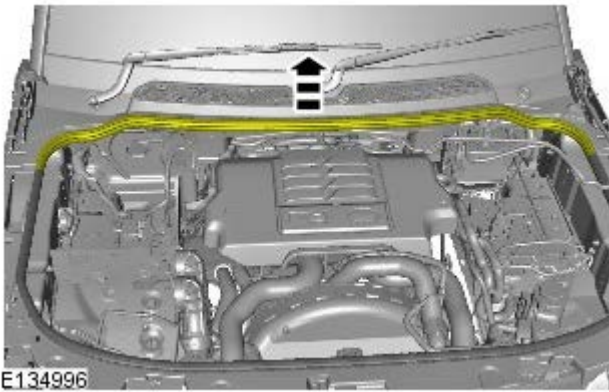


6. Remove the brake master cylinder cover.

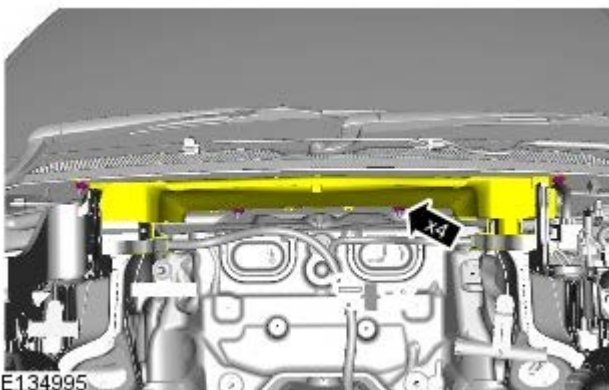


7. Remove the air cleaner. For additional information, refer to: Air Cleaner (303-12C, Removal and Installation).

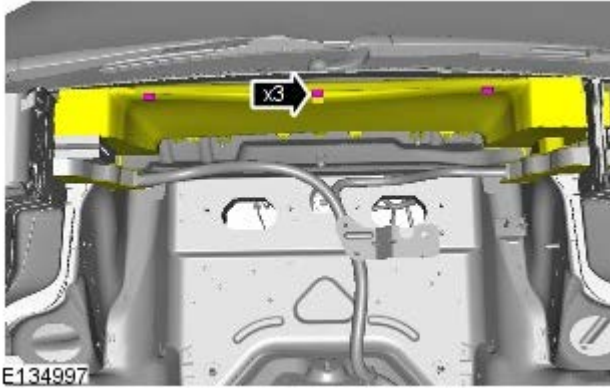
8. Release the hood seal.




9. Release the wiring harness carrier.
• Remove the 4 nuts.



10. Release the 3 clips.

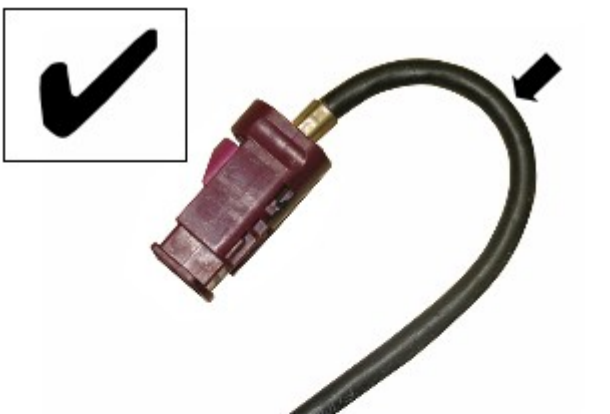



11.  NOTE: The left hand front camera wiring harness connectors are coloured white, the right hand front camera wiring harness connectors are coloured green.

Disconnect the electrical connector.



Installation

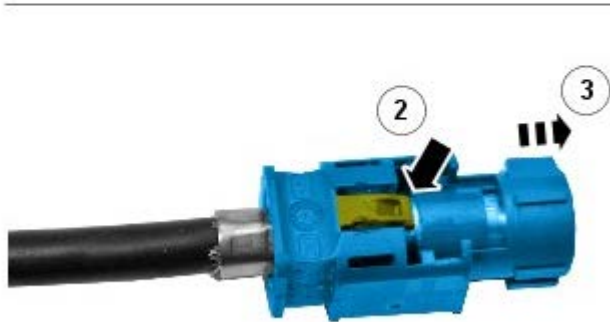


1.  CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

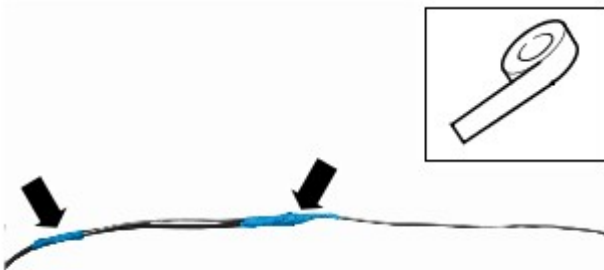
Install the camera overlay wiring harness



E135323




E133998



E134896



E134898

2.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.

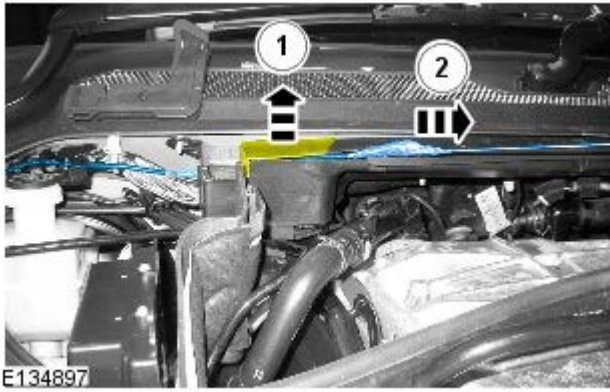
Remove the connector from the camera overlay wiring harness.

- Remove the locking tab.
- Carefully release the clip.
- Apply suitable tape to protect the end of the camera overlay wiring harness.

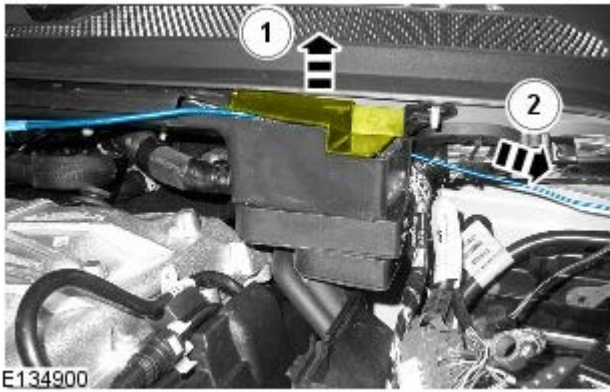
3. Using suitable tape, secure a suitable rod to the camera overlay wiring harness.

4. Carefully feed the camera overlay wiring harness under the bracket.

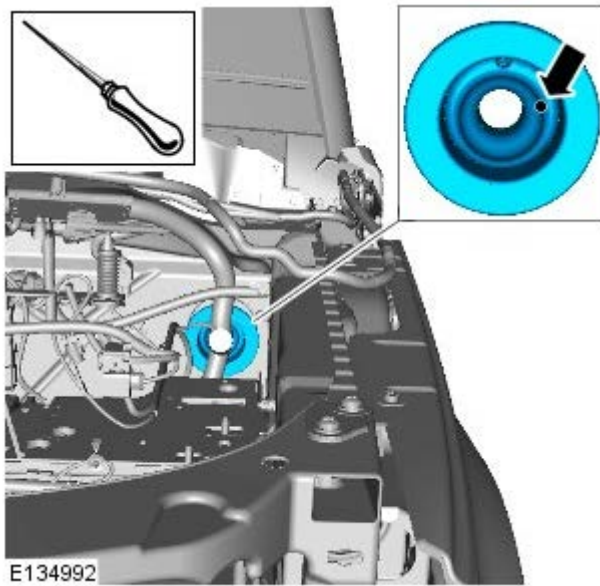
5. Carefully feed the camera overlay wiring harness through the wiring harness carrier.



6. Carefully feed the camera overlay wiring harness through the wiring harness carrier.



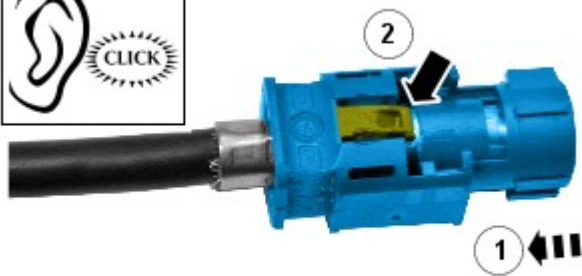
7. Using a suitable tool, make a hole in grommet in the position shown.




8. With the aid of another technician, carefully feed the camera overlay wiring harness through the grommet.



E134899




E134007

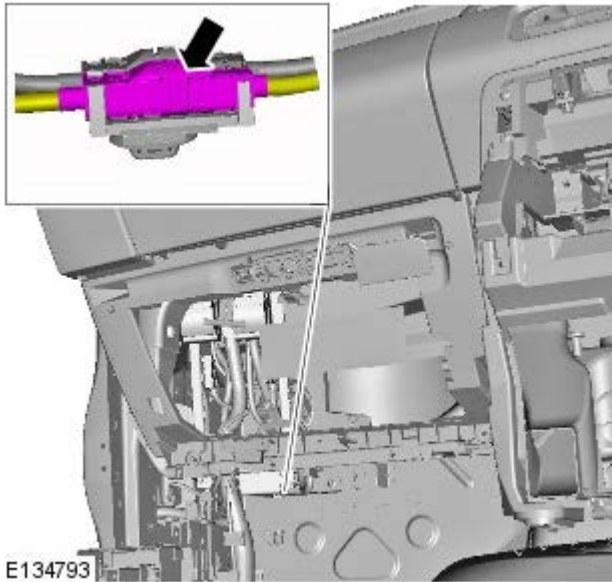
9.  **NOTE:** Some variation in the illustrations may occur, but the essential information is always correct.


Install the connector to the camera overlay wiring harness.

- Remove the protective tape.
- Install the electrical connector.
- Secure the locking tab.


10.  **NOTE:** The left hand front camera wiring harness connectors are coloured magenta, the right hand front camera wiring harness connectors are coloured blue.

Connect the electrical connector.



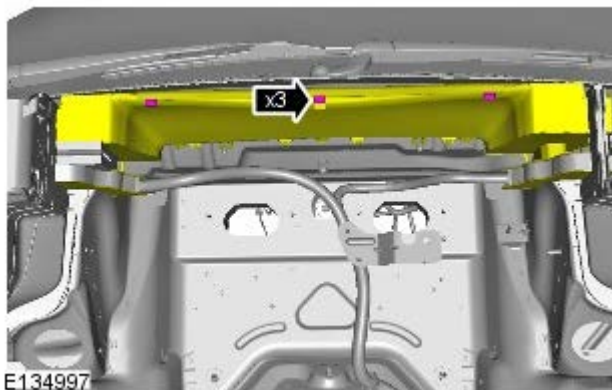
11.  NOTE: The left hand front camera wiring harness connectors are coloured white, the right hand front camera wiring harness connectors are coloured green.

Connect the electrical connector.

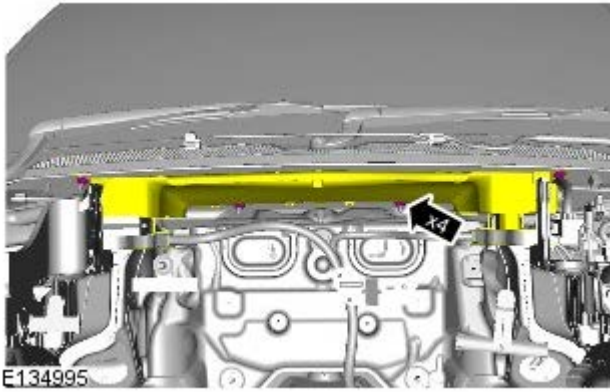
12.  CAUTION: Make sure that excessive force is not used when installing the tie straps to the wiring harness. Failure to follow this instruction may result in damage to the harness.

Using suitable tie straps, secure the camera overlay wiring harness to the main body wiring harness.

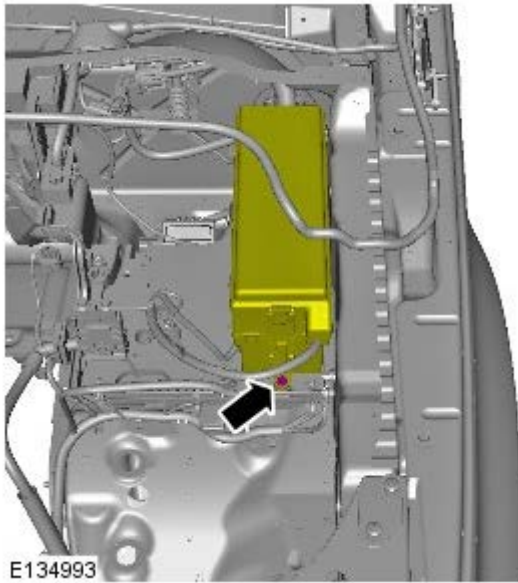
13. Secure the 3 clips.



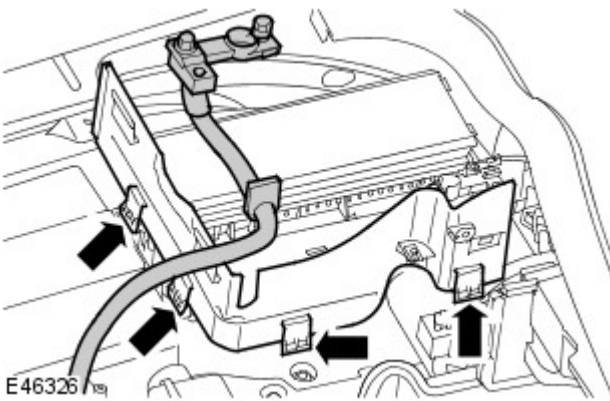
14. Secure the wiring harness carrier.
- Tighten the 4 nuts.



15. Secure the engine compartment fuse box.
 - Tighten the bolt.

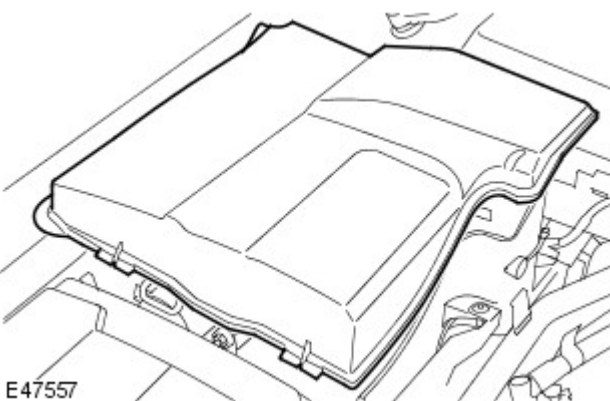


16. Install the battery compartment side wall.
 - Secure the 4 clips.
 - Install the battery positive cable and grommet.



17. Install the air cleaner. For additional information, refer to: Air Cleaner (303-12C, Removal and Installation).

18. Install the brake master cylinder cover.



19. Secure the hood seal.
20. Install the CJB. For additional information, refer to: Central Junction Box (CJB) (418-00, Removal and Installation).
21. Install the battery. For additional information, refer to: Battery (414-01, Removal and Installation).

Wiring Harnesses - Front Parking Aid Camera Wiring Harness - Main Body Section

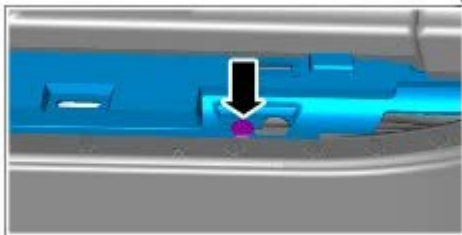
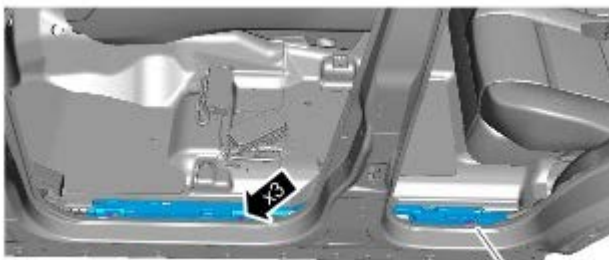
Removal and Installation

Removal

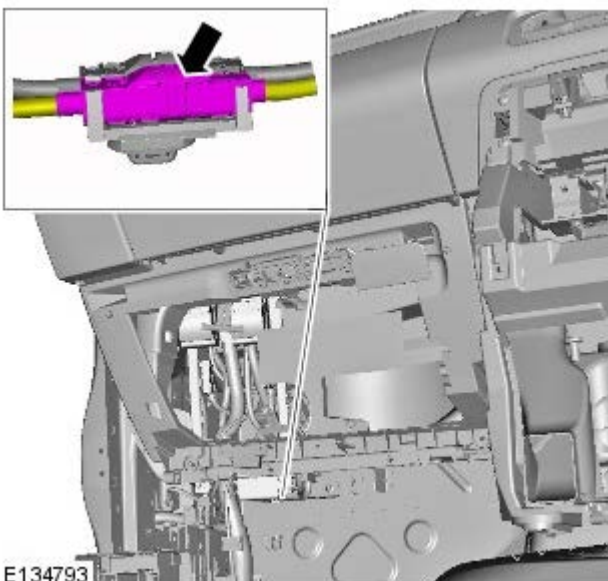


CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.


1. Remove the LH front seat. For additional information, refer to: Front Seat (501-10, Removal and Installation).
2. Remove the central junction box (CJB). For additional information, refer to: Central Junction Box (CJB) (418-00, Removal and Installation).
3. Remove the LH scuff plate trim panel. For additional information, refer to: Scuff Plate Trim Panel (501-05, Removal and Installation).
4. Release the wiring harness cover.
 - Release the 3 clips.




E134771

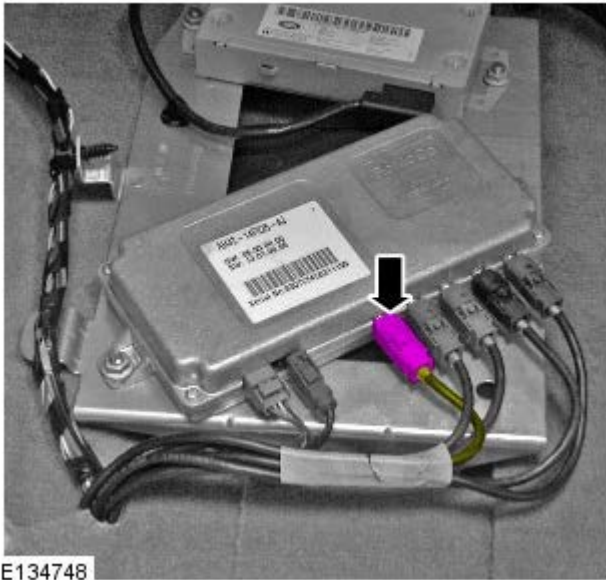


E134793

5.  **NOTE:** The left hand front camera wiring harness connectors are coloured magenta, the right hand front camera wiring harness connectors are coloured blue.

Disconnect the electrical connector.

6.  **NOTE:** The left hand front camera wiring harness connectors are coloured white, the right hand front camera wiring harness connectors are coloured black.




E134748

Disconnect the electrical connector.

Installation



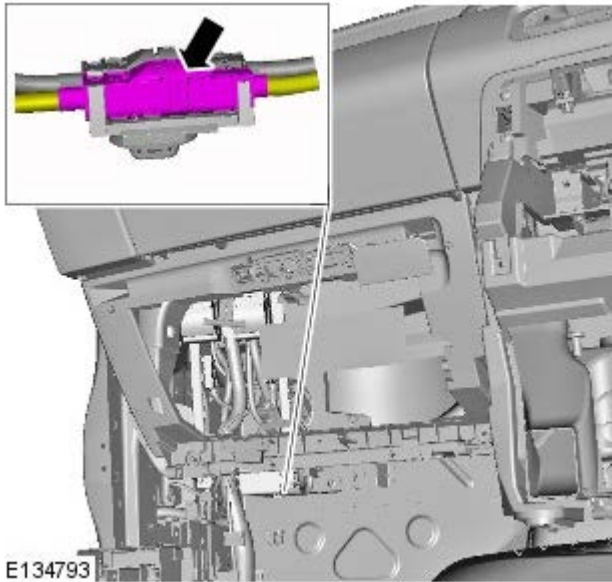
E135323

1.  **CAUTION:** Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.


Install the camera overlay wiring harness

2.  **NOTE:** The left hand front camera wiring harness connectors are coloured magenta, the right hand front camera wiring harness connectors are coloured blue.

Connect the electrical connector.

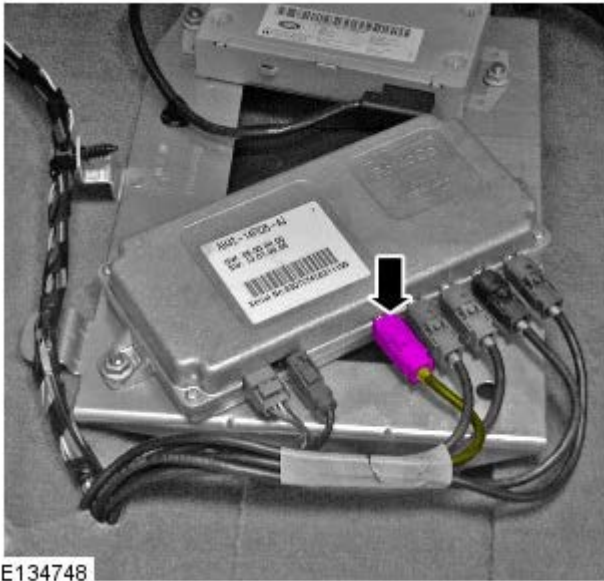


E134793


3.  **CAUTION:** Make sure that excessive force is not used when installing the tie straps to the wiring harness. Failure to follow this instruction may result in damage to the harness.

Feed the camera overlay wiring harness along the main wiring harness to the camera module.

- Using suitable tie straps, secure the camera overlay wiring harness to the main body wiring harness.

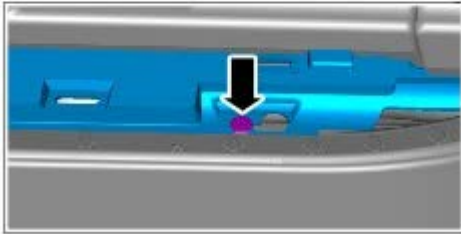
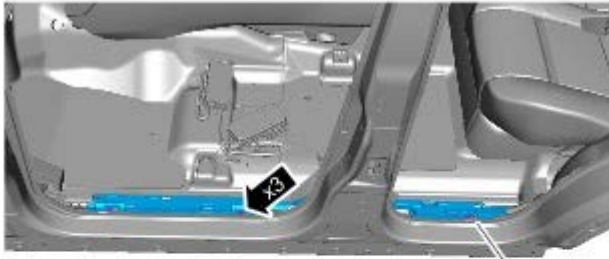


E134748

4.  **NOTE:** The left hand front camera wiring harness connectors are coloured white, the right hand front camera wiring harness connectors are coloured black.

Connect the electrical connector.

5. Install the wiring harness cover.
- Secure the 3 clips.



E134771

6. Install the LH scuff plate trim panel. For additional information, refer to: Scuff Plate Trim Panel (501-05, Removal and Installation).
7. Install the CJB. For additional information, refer to: Central Junction Box (CJB) (418-00, Removal and Installation).
8. Install the LH front seat. For additional information, refer to: Front Seat (501-10, Removal and Installation).

Wiring Harnesses - Left Hand Parking Aid Camera Wiring Harness

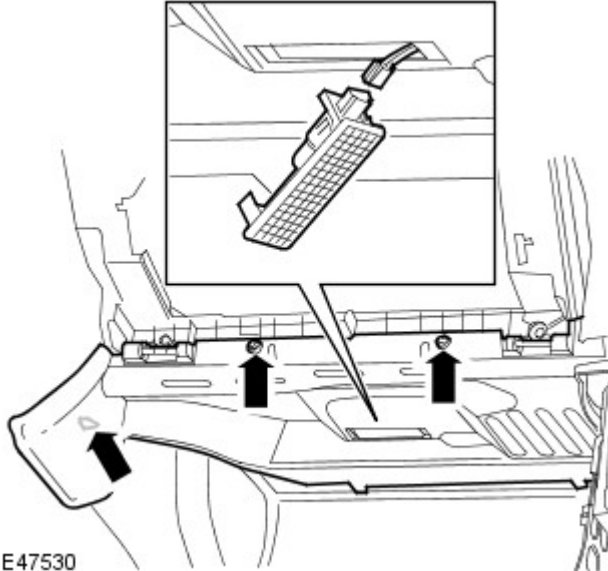
Removal and Installation

Removal



CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

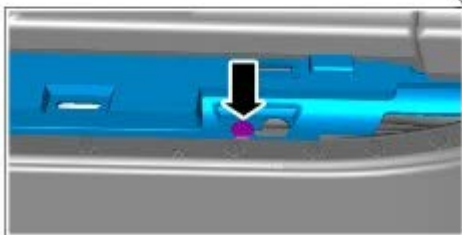
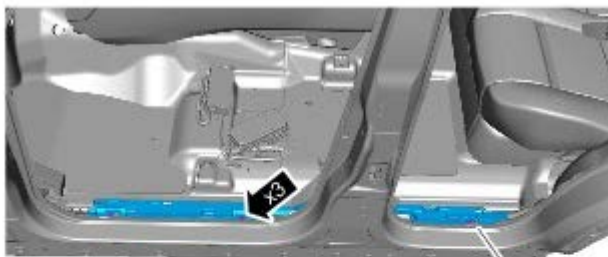
1. Remove the closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.




E47530

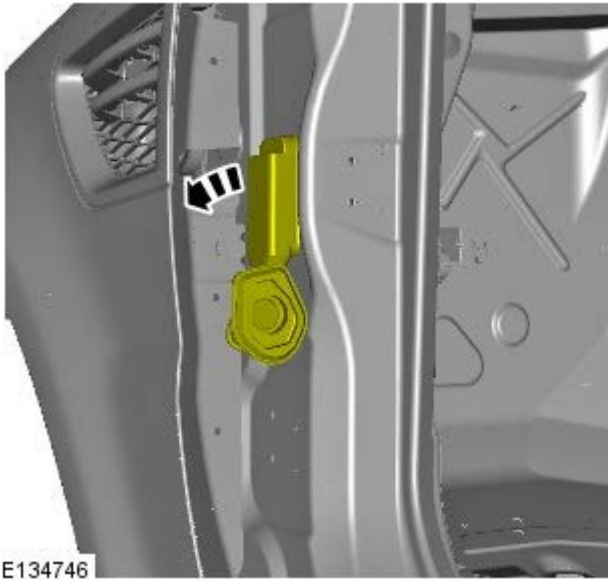
2. Remove the cowl side trim panel. For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).
3. Remove the LH front seat. For additional information, refer to: Front Seat (501-10, Removal and Installation).
4. Remove the LH scuff plate trim panel. For additional information, refer to: Scuff Plate Trim Panel (501-05, Removal and Installation).

5. Release the wiring harness cover.
 - Release the 3 clips.

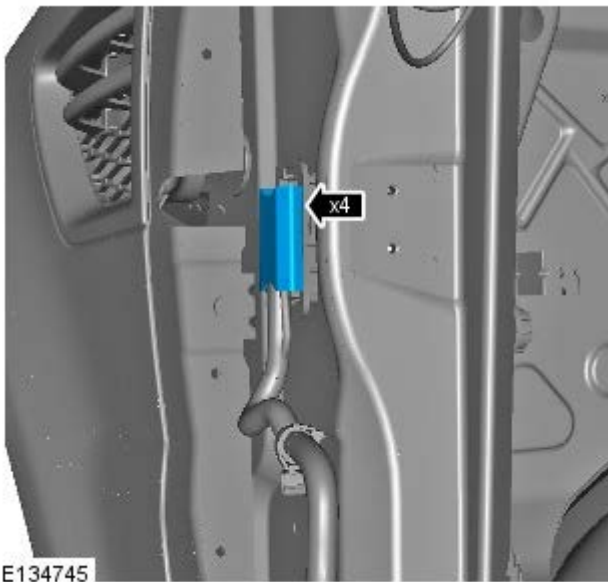


E134771

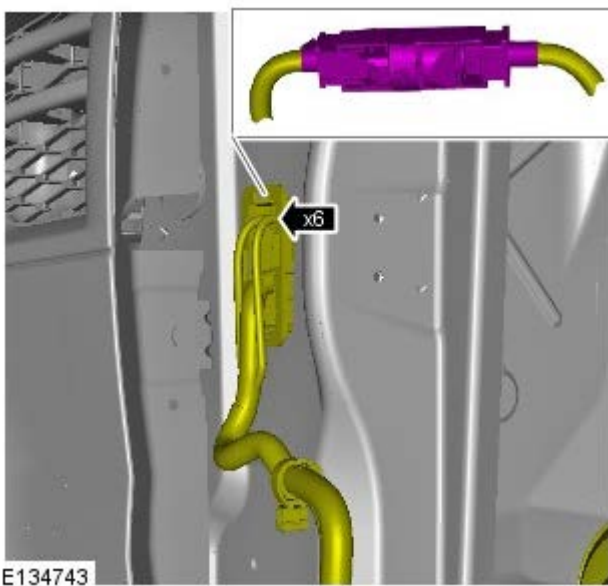
6.  **NOTE:** Door shown removed for clarity.
Release the gaiter.



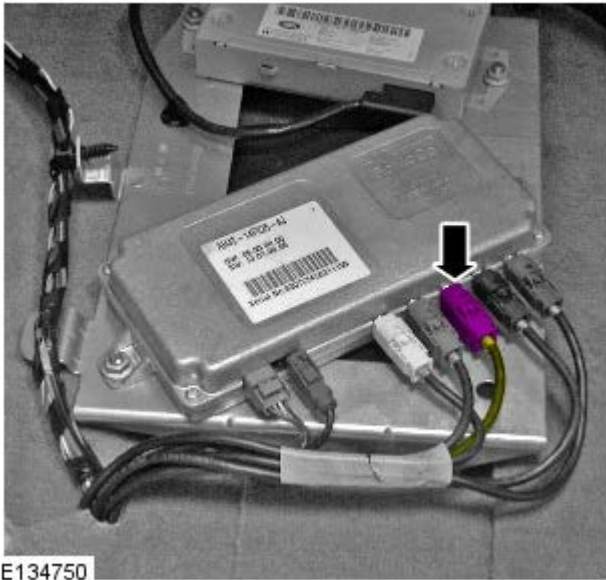
7. Remove the wiring harness cover.
 - Release the 4 clips.



8. Disconnect the electrical connector.
 - Release the electrical connector bracket.
 - Release the 6 clips.



9. Disconnect the electrical connector.




E134750

Installation

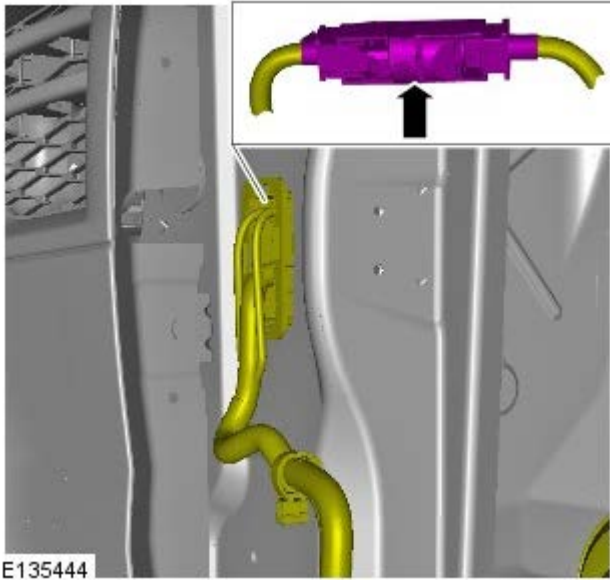


E135323

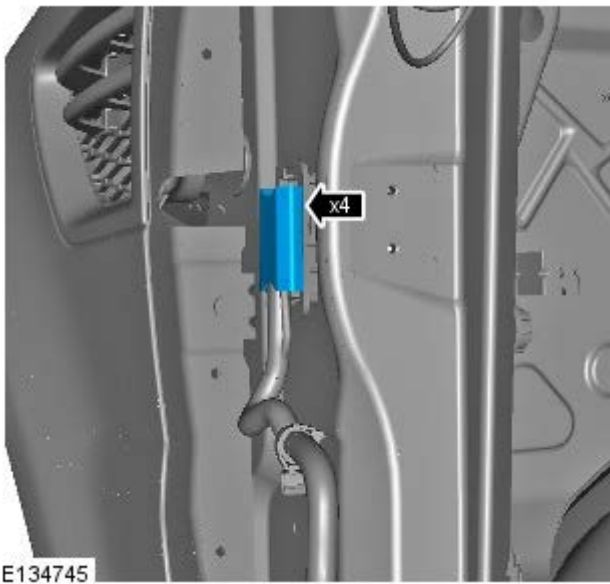
1.  **CAUTION:** Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

Install the camera overlay wiring harness.

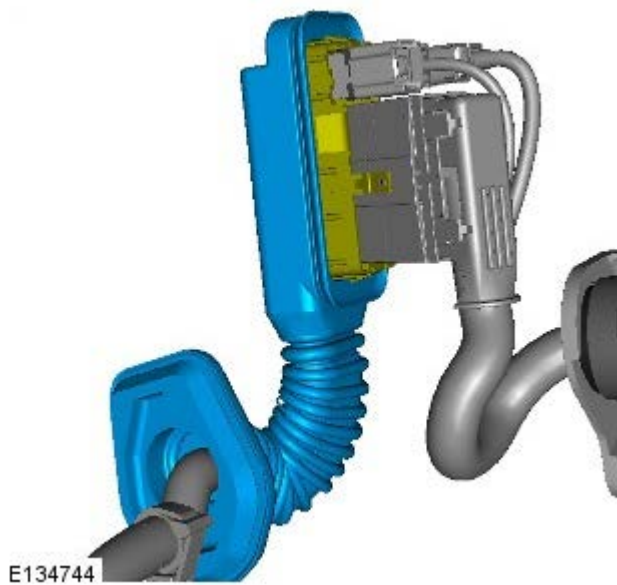
2. Connect the electrical connector.



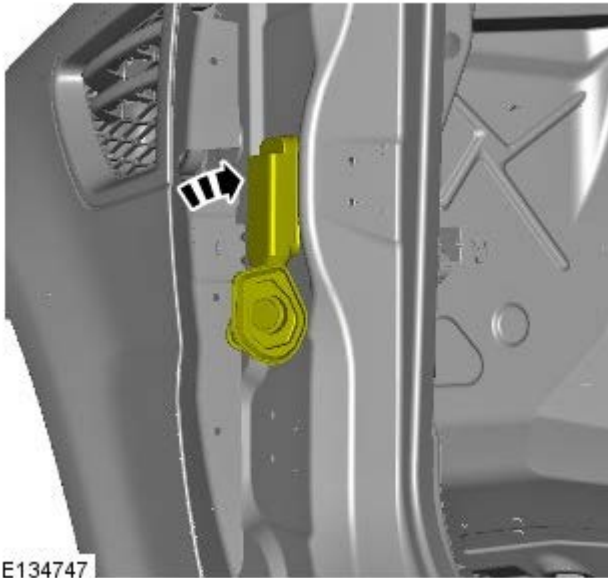
3. Install the wiring harness cover.
 - Secure the 4 clips.




4. Install the gaiter.



5. Secure the bracket.
 - Secure the 6 clips.

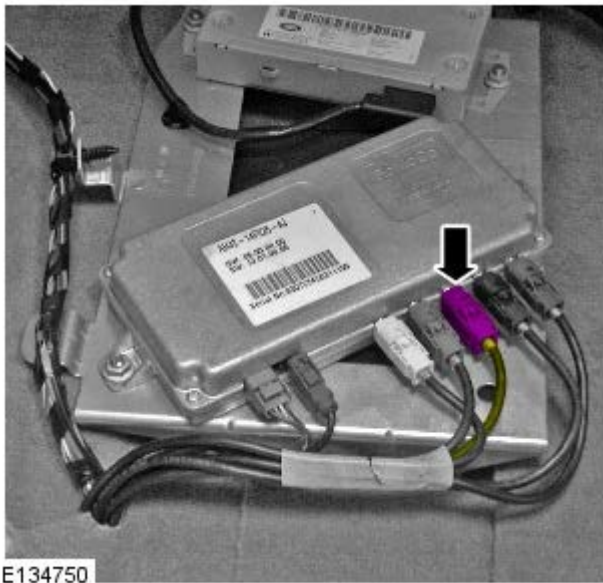


6.  **CAUTION:** Make sure that any tie straps used are not tightened excessively on the camera wiring harness and link leads, Failure to follow this instruction may result in damage to the harness.

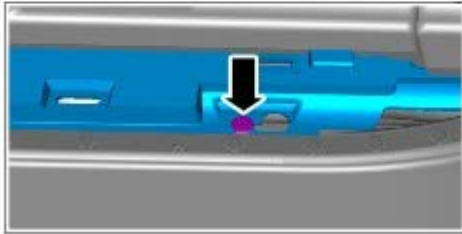
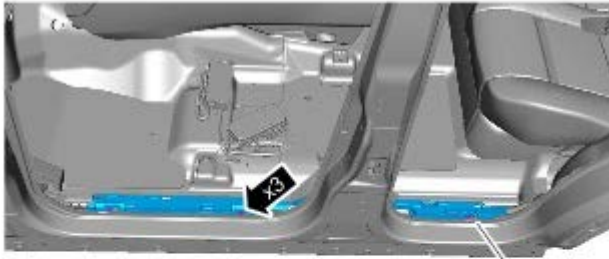
Feed the camera overlay wiring harness along the main wiring harness to the parking aid camera module.

- Using suitable tie straps, secure the camera overlay wiring harness to the main body wiring harness.

7. Connect the electrical connector.

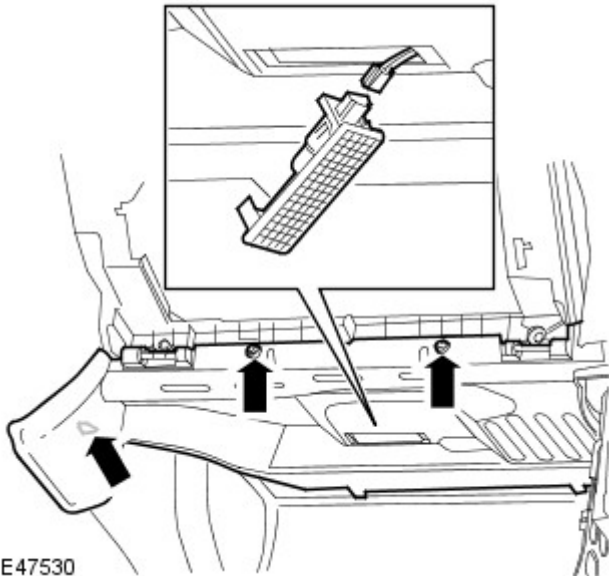


8. Install the wiring harness cover.
- Secure the 3 clips.



E134771

9. Install the LH scuff plate trim panel. For additional information, refer to: Scuff Plate Trim Panel (501-05, Removal and Installation).
10. Install the LH front seat. For additional information, refer to: Front Seat (501-10, Removal and Installation).
11. Install the cowl side trim panel. For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).
12. Install the closing trim panel.
 - Connect the electrical connector.
 - Secure the clip.
 - Tighten the screws.



E47530

Wiring Harnesses - Right Hand Parking Aid Camera Wiring Harness

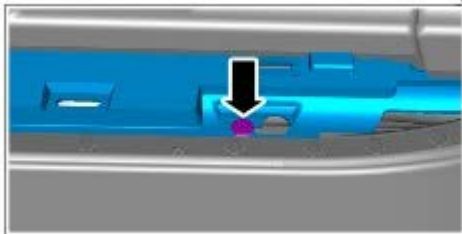
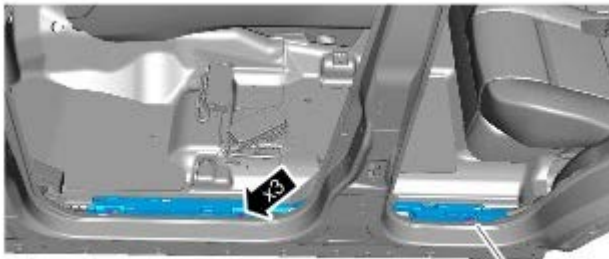
Removal and Installation

Removal



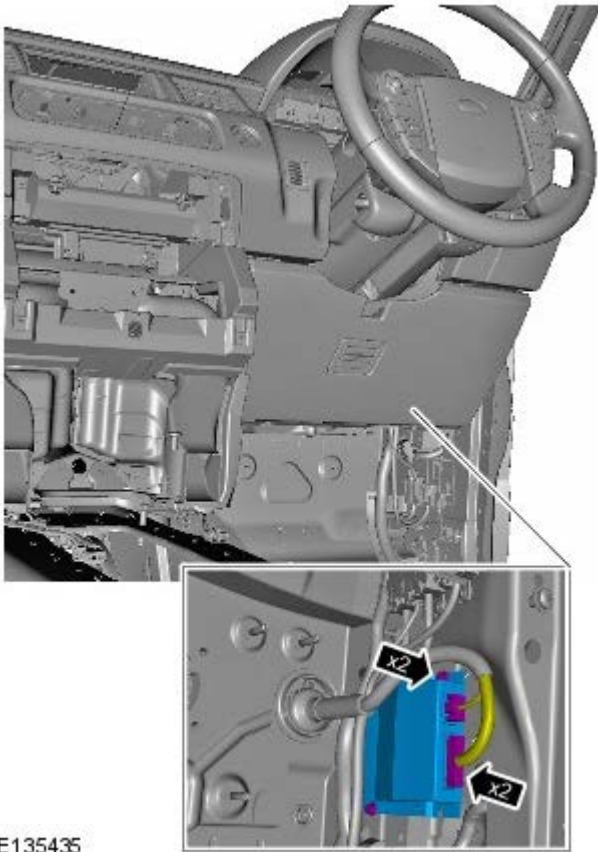
CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

1. Remove the LH front seat. For additional information, refer to: Front Seat (501-10, Removal and Installation).
2. Repeat procedure for the other side.
3. Remove the floor console. For additional information, refer to: Floor Console (501-12, Removal and Installation).
4. Remove the LH scuff plate trim panel. For additional information, refer to: Scuff Plate Trim Panel (501-05, Removal and Installation).
5. Repeat procedure for the other side.
6. Release the wiring harness cover.
 - Release the 3 clips.



E134771

7. Repeat procedure for the other side.
8. Remove the RH cowl side trim panel. For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).
9. Remove the accelerator pedal assembly. For additional information, refer to: Accelerator Pedal (310-02A, Removal and Installation).
10. Remove the dynamic response module.
 - Remove the 2 bolts.
 - Disconnect the 2 electrical connectors.



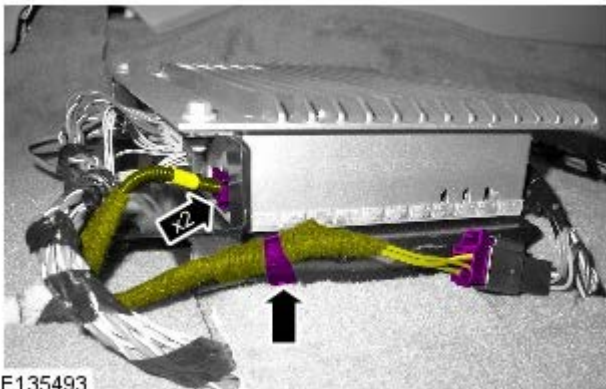
E135435

11. Disconnect the 2 electrical connectors.
 - Release the 3 clips.



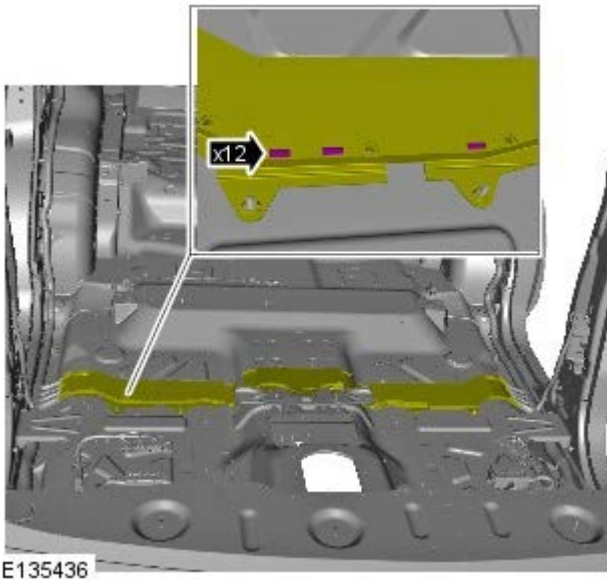
E135494

12. Disconnect the 2 electrical connectors.
 - Release the clip.

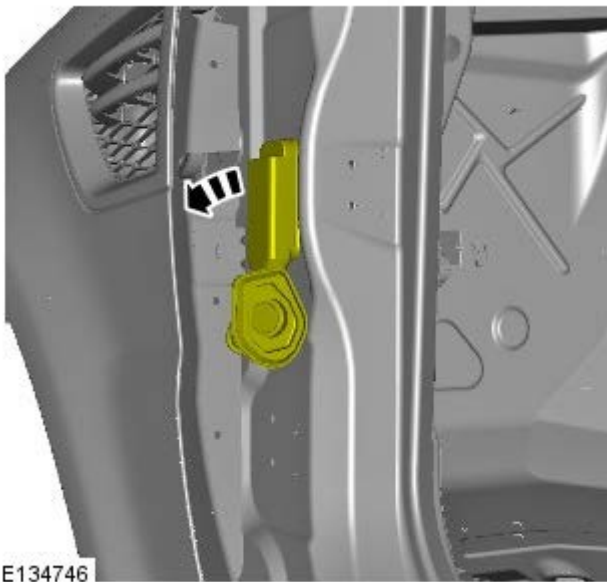


E135493

13. Release the wiring harness cover.
 - Reposition the floor covering for access.

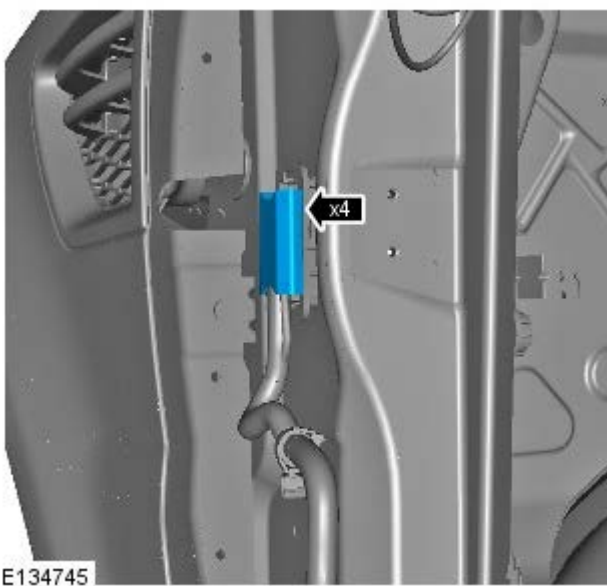


- Using a suitable tool, carefully cut through the wiring harness cover retaining tape.
- Release the 12 clips.



14. NOTES:

- ⚠ Door shown removed for clarity.
 - ⚠ Left-hand shown, right-hand similar.
- Release the gaiter.

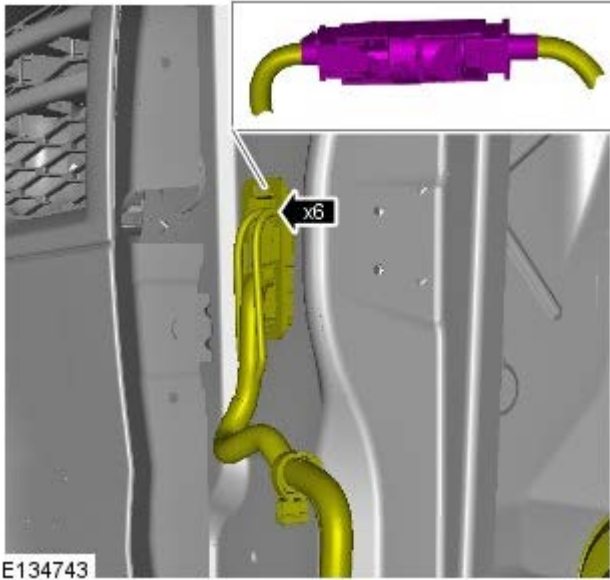


15. ⚠ NOTE: Left-hand shown, right-hand similar.

- Remove the wiring harness cover.
- Release the 4 clips.

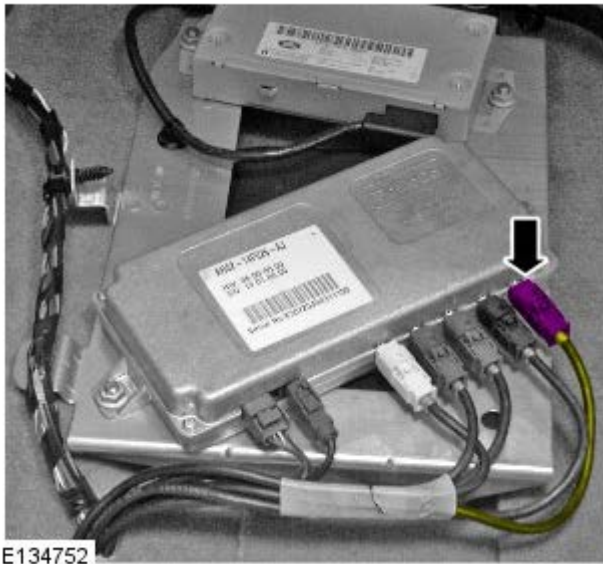
16. ⚠ NOTE: Left-hand shown, right-hand similar.

Disconnect the electrical connector.




- Release the electrical connector bracket.
- Release the 6 clips.

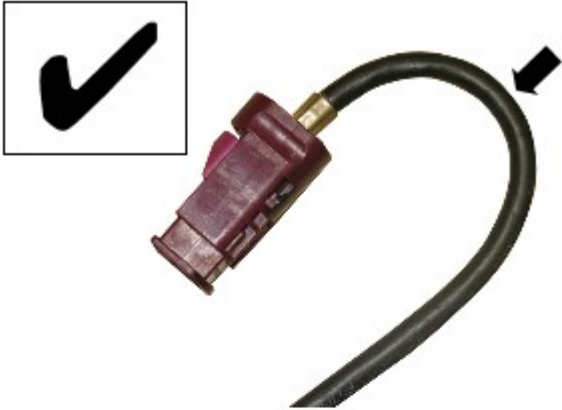
17. Disconnect the electrical connector.




Installation

1.  CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

Install the camera overlay wiring harness

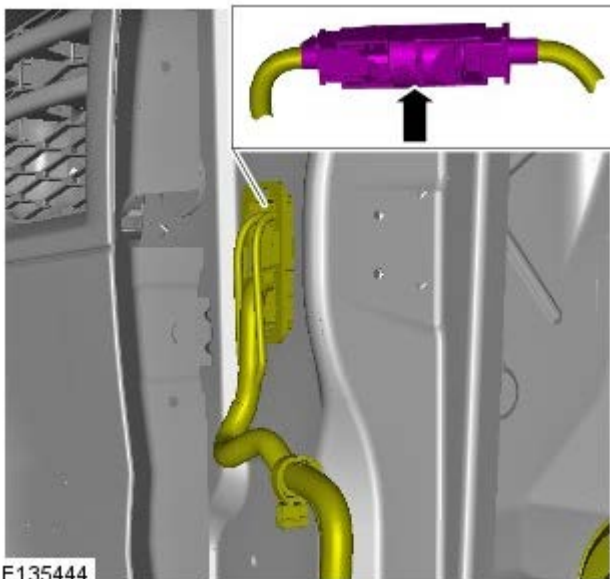


E135323

2.  **CAUTION:** Make sure that excessive force is not used when installing the tie straps to the wiring harness. Failure to follow this instruction may result in damage to the vehicle.

Carefully feed the camera overlay wiring harness along the main body wiring harness from the camera module to the RH A-pillar.

- Using suitable tie straps, secure the camera overlay wiring harness to the main body wiring harness.



E135444

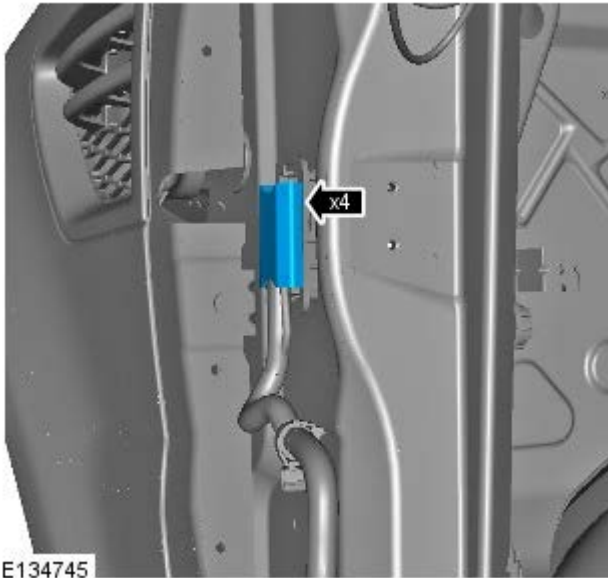
3.  **NOTE:** Left-hand shown, right-hand similar.

Connect the electrical connector.

4.  **NOTE:** Left-hand shown, right-hand similar.

Install the wiring harness cover.

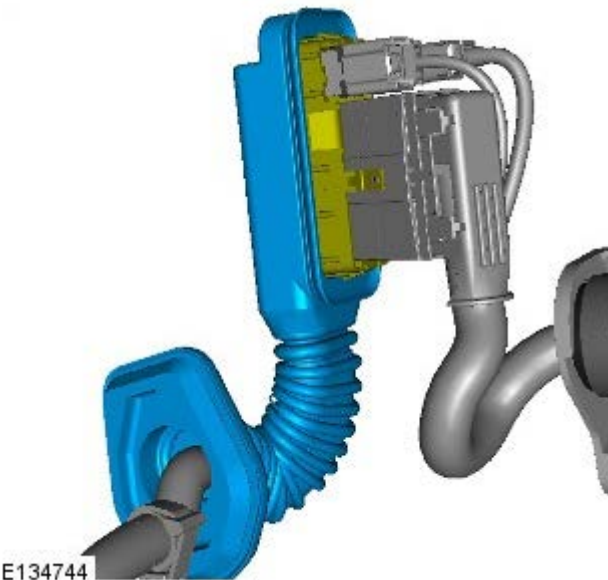
- Secure the 4 clips.



E134745

5.  NOTE: Left-hand shown, right-hand similar.

Install the gaiter.

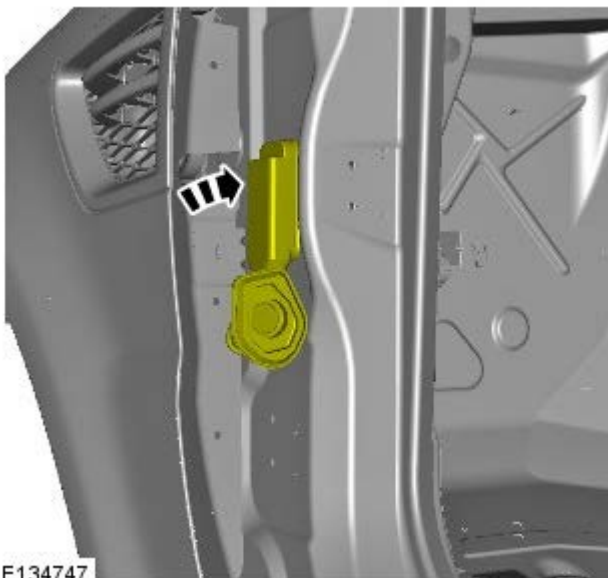


E134744

6.  NOTE: Left-hand shown, right-hand similar.

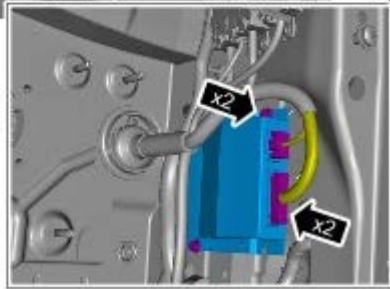
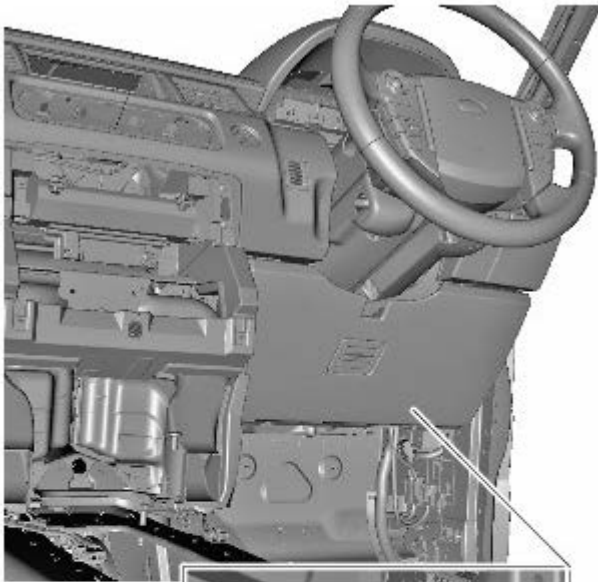
Secure the bracket.

- Secure the 6 clips.

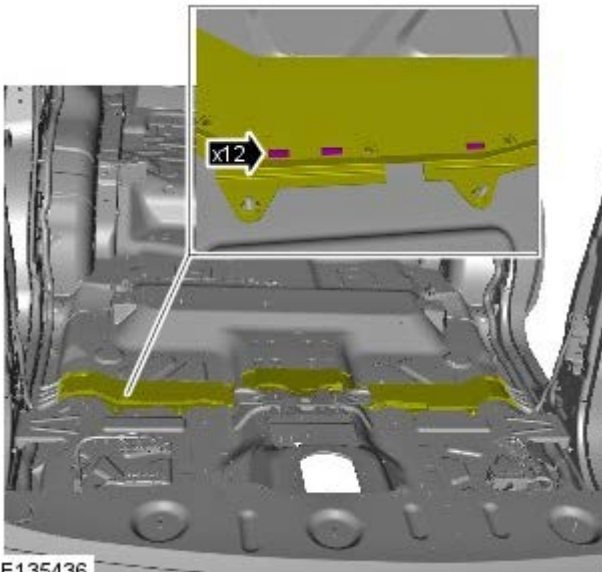


E134747

7. Install the dynamic response module.
- Connect the 2 electrical connectors.
 - Tighten the 2 bolts.



E135435



E135436

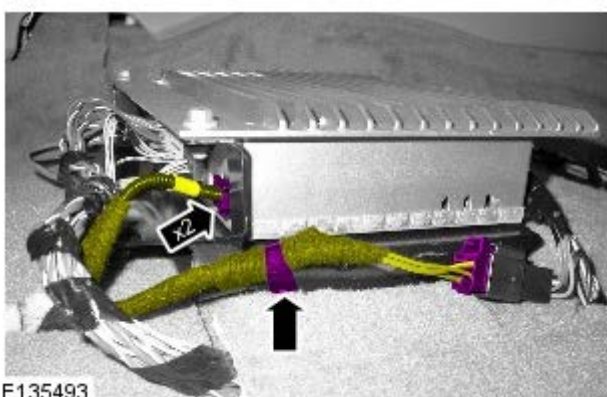
8. Secure the wiring harness cover.
 - Secure the 12 clips.
 - Re-apply suitable tape to the wiring harness cover in the positions previously secured.
 - Install the floor covering.

9. Connect the 2 electrical connectors.
 - Secure the 3 clips.



E135494

10. Connect the 2 electrical connectors.
 - Secure the clip.



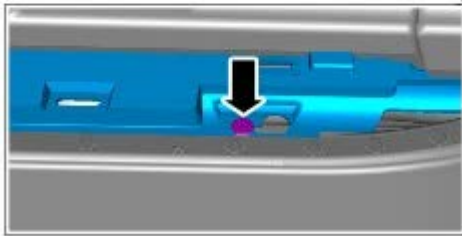
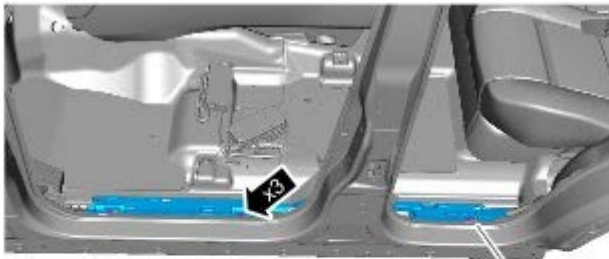
E135493

11. Connect the electrical connector.



E134752

12. Install the accelerator pedal assembly. For additional information, refer to: Accelerator Pedal (310-02A, Removal and Installation).
13. Install the RH cowl side trim panel. For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).
14. Install the LH wiring harness cover.
 - Secure the 3 clips.



E134771

15. Repeat procedure for the other side.
16. Install the LH scuff plate trim panel. For additional information, refer to: Scuff Plate Trim Panel (501-05, Removal and Installation).
17. Repeat procedure for the other side.
18. Install the floor console. For additional information, refer to: Floor Console (501-12, Removal and Installation).
19. Install the LH front seat. For additional information, refer to: Front Seat (501-10, Removal and Installation).
20. Repeat procedure for the other side.

Wiring Harnesses - Rear Parking Aid Camera Wiring Harness

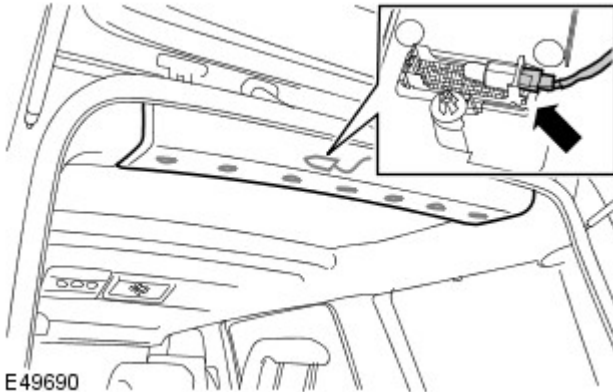
Removal and Installation

Removal



CAUTION: Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

1. Remove the LH D-pillar trim panel.
For additional information, refer to: D-Pillar Trim Panel (501-05, Removal and Installation).



E49690

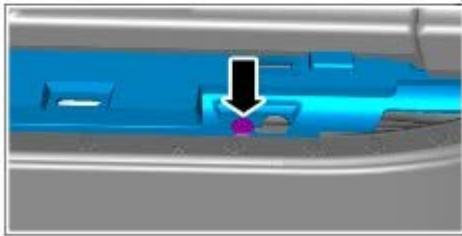
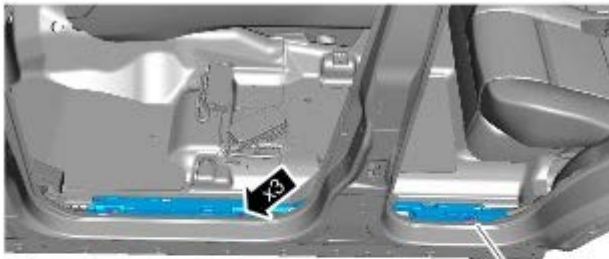
2. Remove the rear headliner trim panel.
 - Release the 7 clips.
 - Disconnect the electrical connector.

3. Disconnect the electrical connector.



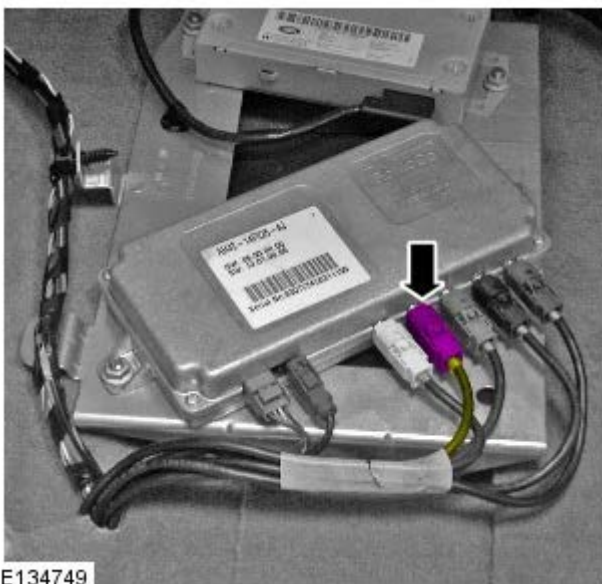
E135785

4. Remove the LH front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).
5. Remove the LH scuff plate trim panel.
For additional information, refer to: Scuff Plate Trim Panel (501-05, Removal and Installation).
6. Release the wiring harness cover.
 - Release the 3 clips.




E134771

7. Disconnect the electrical connector.

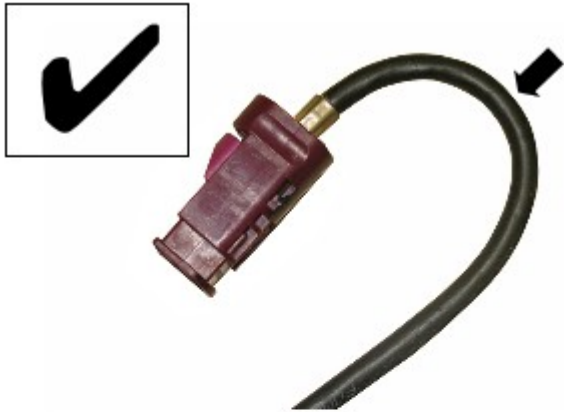


E134749

Installation


1.  **CAUTION:** Make sure that the camera overlay wiring harness is not bent excessively during this procedure. Failure to follow this instruction may result in damage to the harness.

Install the camera overlay wiring harness



E135323

2. Feed the camera overlay wiring harness along the main wiring harness to the parking aid camera module.

3.  **CAUTION:** Make sure that excessive force is not used when installing the tie straps to the wiring harness. Failure to follow this instruction may result in damage to the harness.

Using suitable tie straps, secure the camera overlay wiring harness to the main body wiring harness.

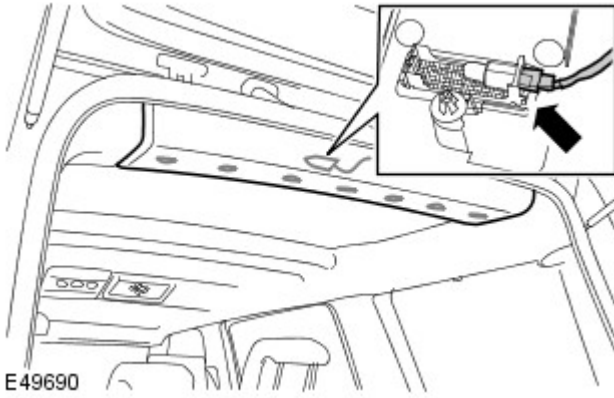
4. Connect the electrical connector.



E135785

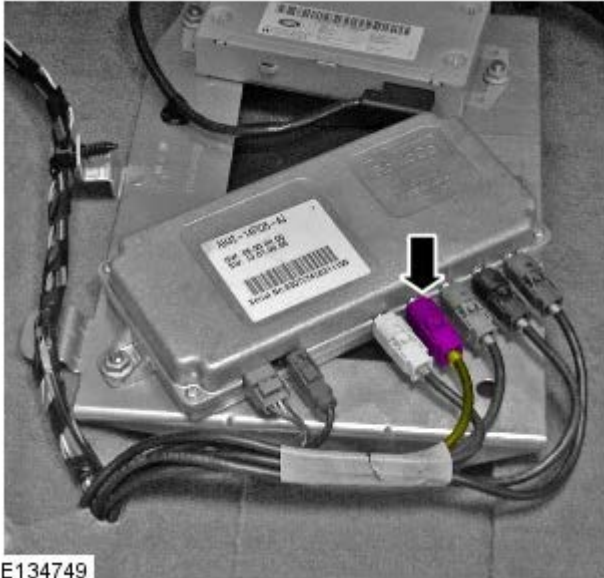
5. Install the LH D-pillar upper trim panel.
For additional information, refer to: D-Pillar Trim Panel (501-05, Removal and Installation).

6. Install the rear headliner trim panel.
 - Connect the electrical connector.
 - Secure the 7 clips.



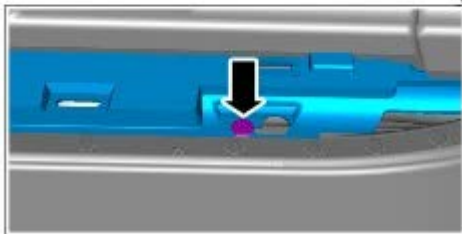
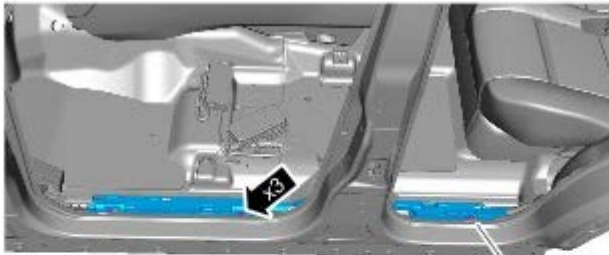
E49690

7. Connect the electrical connector.



E134749

8. Secure the wiring harness cover.
 - Secure the 3 clips.



E134771

9. Install the LH scuff plate trim panel.
For additional information, refer to: Scuff Plate Trim Panel (501-05, Removal and Installation).
10. Install the LH front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).


Wiring Harnesses - Suspension Air Supply Unit Wiring Harness

Removal and Installation

Removal

 **WARNING:** Steps 1 and 2 must be carried out within 10 minutes of each other. Failure to follow this instruction may result in personal injury.

 **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

 **NOTE:** New air suspension components are supplied with new Voss connectors tightened to the correct torque. Therefore, do not install new Voss connectors if a new component is being installed.

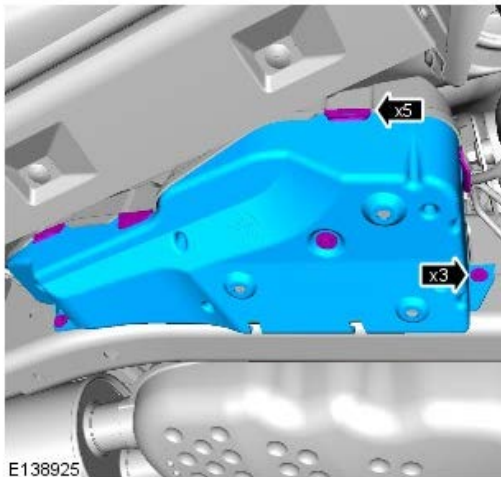
1.  **CAUTION:** Make sure the ignition switch is turned off, the park brake is on and the selector lever is in park.

Open the front door.

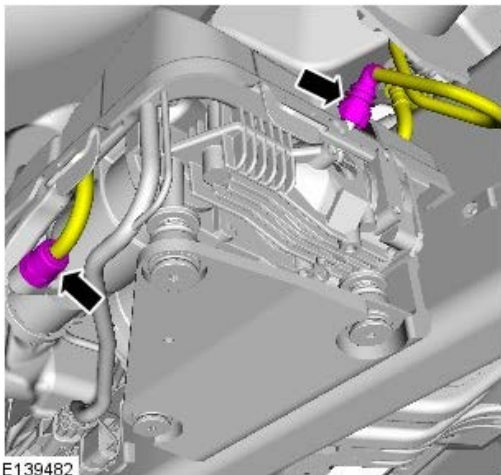
2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle. Make sure at least one of the wheels is off the ground.

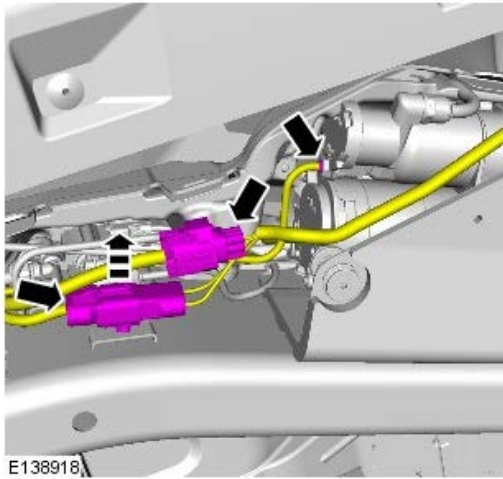
3.



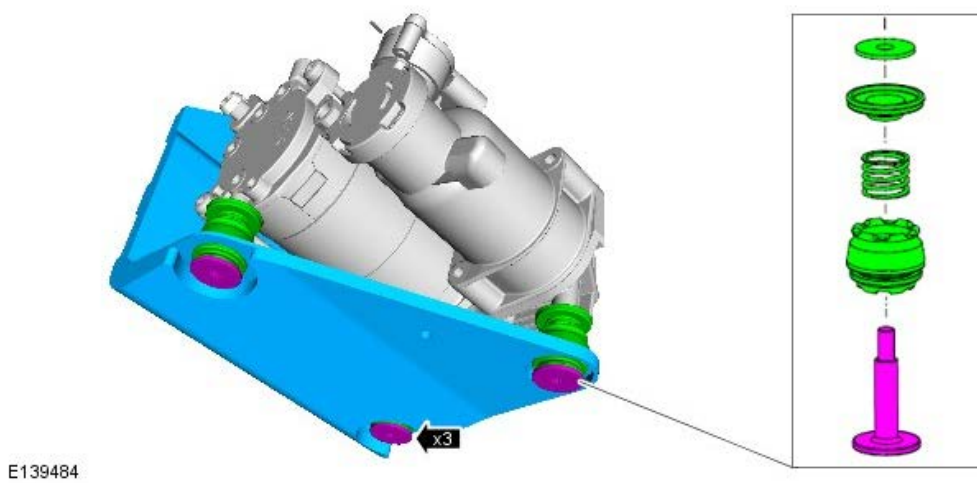
4.  **CAUTION:** Always plug any open connections to prevent contamination.



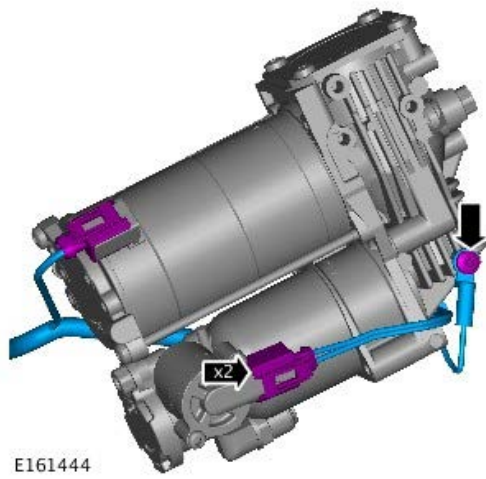
5.  **CAUTION:** Always plug any open connections to prevent contamination.



6.  NOTE: Note the orientation of the component prior to removal.

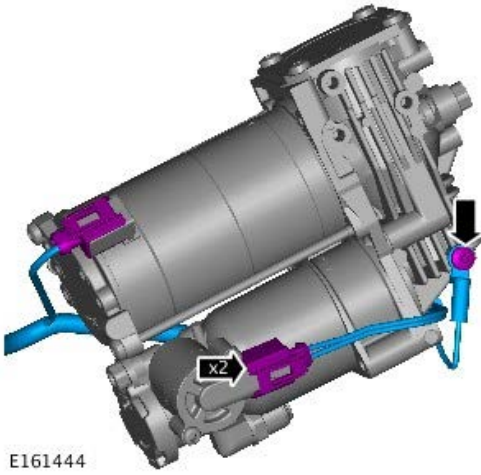


7.

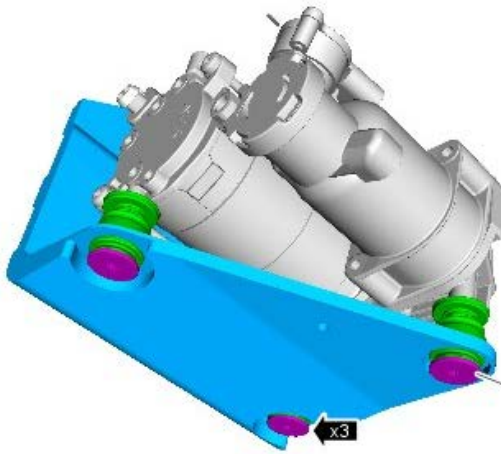


Installation

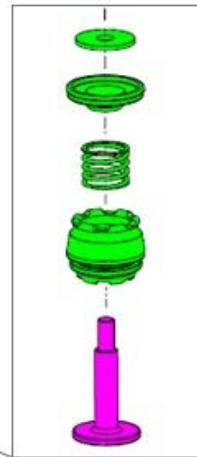
1. Torque: 10 Nm




E161444




E139484



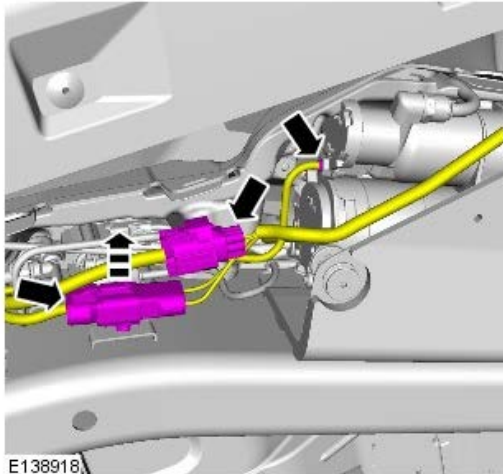
2. CAUTIONS:

 Make sure that these components are installed to the noted removal position.

 Make sure that the self tapping bolts remains aligned during the tightening process.

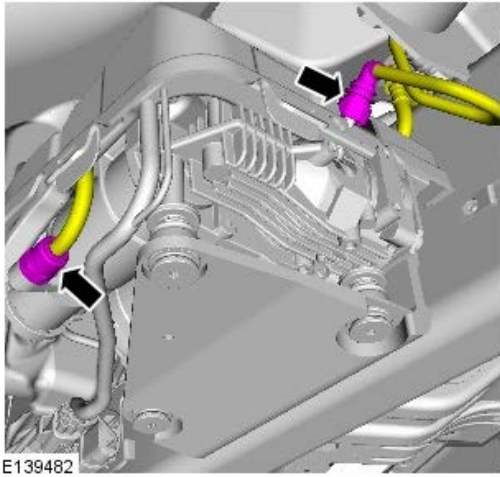
Torque: 10 Nm

3.

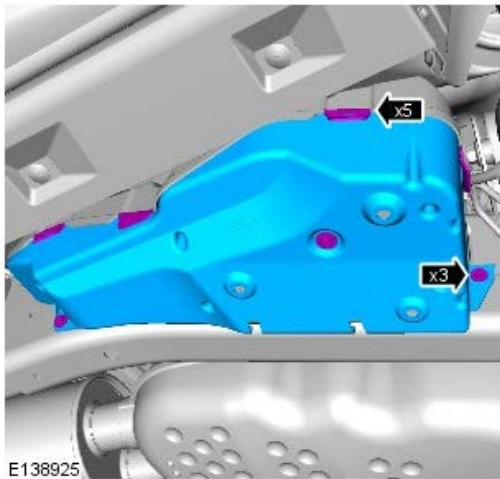


E138918

4.



5. Torque: 9 Nm



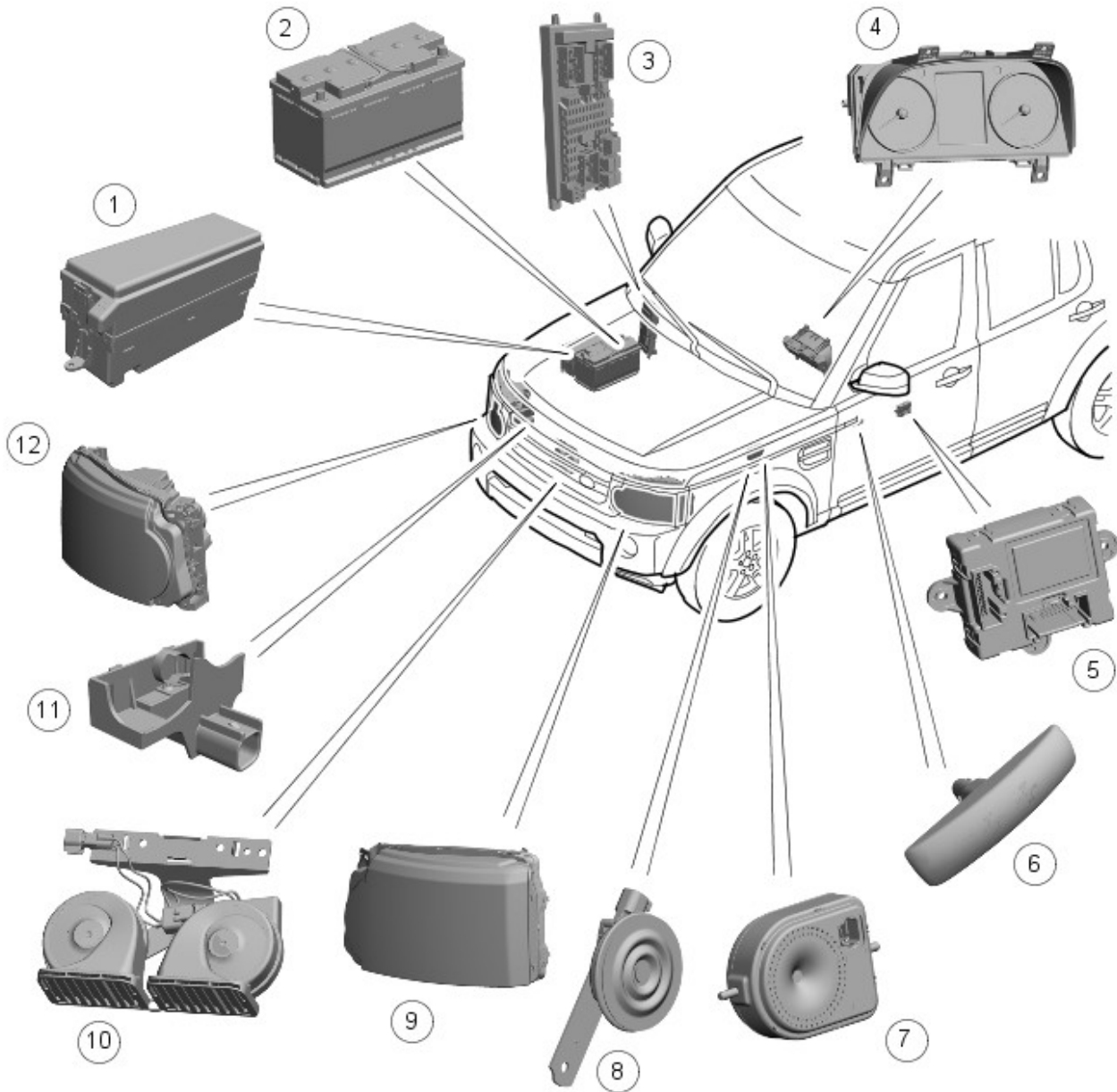
Anti-Theft - Active -**Torque Specifications**

Description	Nm	lb-ft
RH Hood latch Torx bolts	10	7
Security antenna	6	4

Anti-Theft - Active - Anti-Theft - Active

Description and Operation

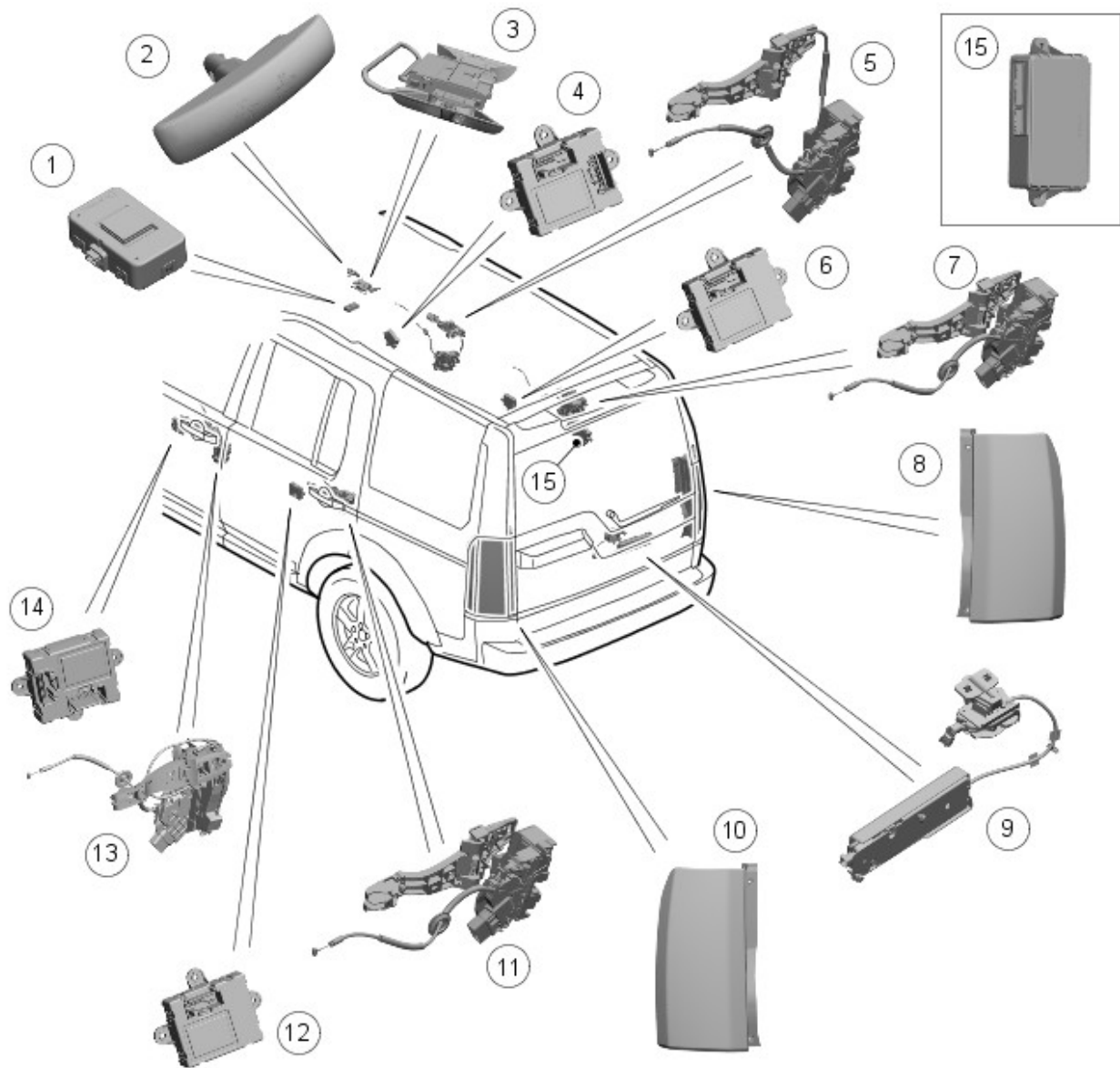
COMPONENT LOCATION - SHEET 1 OF 2



E139822

Item	Part Number	Description
1	-	BJB (battery junction box)
2	-	Battery
3	-	CJB (central junction box)
4	-	Instrument cluster
5	-	LH (left-hand) front door module
6	-	LH front side repeater lamp
7	-	Battery backed-up sounder and inclination sensor (if fitted)
8	-	Passive sounder (if fitted)
9	-	LH headlamp
10	-	Horns
11	-	Bonnet switch
12	-	RH (right-hand) headlamp

COMPONENT LOCATION - SHEET 2 OF 2



E139823

Item	Part Number	Description
1	-	Radio frequency receiver
2	-	RH front side repeater lamp
3	-	Interior motion sensor
4	-	RH front door module
5	-	RH front door latch
6	-	RH rear door module
7	-	RH rear door latch
8	-	RH tail lamp
9	-	Upper tailgate motor
10	-	LH tail lamp
11	-	LH rear door latch
12	-	LH rear door module
13	-	LH front door latch
14	-	LH front door module
15	-	RFA (Remote Function Actuator)

OVERVIEW

The active anti-theft system is available with three different levels of vehicle protection depending on market specification:

- Hinged panel sensing
- Hinged panel and intrusion sensing
- Hinged panel, intrusion and inclination sensing.

The system is controlled by software in the **CJB** which indicates an alarm trigger condition:

- Visually, using the direction indicators.
- Audibly, using the vehicle horn and, depending on market specification, either a passive or active sounder.

The passive sounder is an anti-theft disc horn and the active sounder is a BBUS (battery backed-up sounder).

The BBUS is an intelligent unit which communicates to the **CJB** over a **LIN (local interconnect network)** connection. The BBUS is fitted with an inclination sensor.

Monitoring of the hinged panels is carried out using switches located in each door latch assembly, the hood latch assembly, and the tailgate latch assembly. The condition of the switches is monitored by the **CJB**.

Monitoring of front door lock status is carried out using switches located in the door latch mechanisms. The condition of the switches is monitored by the front door modules and transmitted to the **CJB** over the medium-speed **CAN (controller area network)**.

Monitoring of the cabin interior is carried out using an interior motion sensor, which comprises an ultrasonic sound wave sensor to determine if there is movement within the cabin. Information from the interior motion sensor is communicated to the **CJB** over a **LIN** connection.

When armed, the active anti-theft system can be triggered in one of the following ways:

- A door ajar switch indicates a door is open.
- The hood or upper tailgate ajar switches indicate that either is open.
- Either front door latch mechanism indicates a door has been unlocked.
- The emergency key blade is used to open the **LH** front door.
- The **CJB** is disconnected (this may result in only a partial trigger).
- An attempt is made to start the engine without a valid signal from the Smart Key.
- The BBUS is disconnected (partial trigger only).
- The vehicle battery is disconnected on a vehicle fitted with a BBUS (partial trigger only).
- The inclination sensor detects a change in vehicle attitude.
- The interior motion sensor detects movement within the cabin.
- Panic alarm from the Smart Key.

CAUTIONS:



The interior motion sensor electrical connections, particularly those to the sensors mounted in the roof console, are very delicate and must be handled with care.



The interior motion sensor is an electro-statically sensitive part and should only be handled in an electro-statically controlled environment.

Alarm Indicator

The alarm indicator is a **LED (light emitting diode)** located in the instrument cluster, operation of the alarm indicator is controlled by a hardwired input the **CJB**. When the ignition is off the indicator gives a visual indication of the active anti-theft system to show if the alarm system is active or not active.

The alarm **LED** will begin to flash once every 2 seconds to indicate that the vehicle alarm is armed.

Door Modules

The door modules provide the interface between the door latch-motors, the door latch-switches and the **CJB**. The door modules provide door switch status information and enable the door latch-motors on request from the **CJB** or the Remote Function Actuator.

Remote Function Actuator (RFA)

The Remote Function Actuator interfaces with the Central locking, RF (radio frequency) receiver and collects RF signal information which is transmitted from the Smart Key. This information is translated into commands which are passed on the medium-speed **CAN** to the:

- **CJB**,
- front door modules, and
- instrument cluster.

The Remote Function Actuator also monitors:

- four interior antennas,
- two load-space antennas,
- four door handle antennas and one rear bumper antenna, if passive entry is fitted.

On vehicles with passive entry, the additional fast latch motors are controlled via the Remote Function Actuator and the locking status is passed to the **CJB** on the medium speed **CAN**.

Passive Anti-Theft Horn

The passive anti-theft horn is hardwired to the **CJB** and activates when the alarm is triggered.

Battery Backed-Up Sounder (BBUS)

The BBUS uses an integral sounder to produce an audio warning when the alarm is triggered. An inclination sensor is incorporated into the BBUS, to monitor vehicle attitude, see Inclination Sensor.

Operation of the BBUS is controlled by the CJB via exchange signals on the LIN. Under normal operation the BBUS is powered by a permanent battery power supply from the CJB. However, if the power feed is disrupted an integral rechargeable battery powers the BBUS.

On receipt of the arming signals, the BBUS sounder and the inclination sensor respond with a status signal. If there is no response to the arming signals within 12 seconds, the CJB assumes there is a fault and sends a disarm signal to the sounder or the inclination sensor, as appropriate. The CJB also stores a related fault code.

If the alarm is subsequently triggered, with the BBUS sounder disarmed, the CJB uses the passive anti-theft horn or vehicle horn to sound the audio warning.

Inclination Sensor

The inclination sensor measures the longitudinal and lateral angle of the vehicle over a range of $\pm 16^\circ$ from the horizontal. When the anti-theft alarm system is armed in the intrusion detection mode, the BBUS stores the current angles in memory and monitors the inclination sensor readings. If the vehicle attitude changes in either direction by more than the alarm limit, the BBUS activates the sounder.

Interior Motion Sensor

When the vehicle is double locked, the interior motion sensor monitors for movement in the vehicle's cabin.

The interior motion sensor consists of a micro-controller, two acoustic transmitters and one acoustic receiver. The receiver and one of the transmitters face forward and the other transmitter faces rearward to ensure complete coverage of the vehicle's cabin.

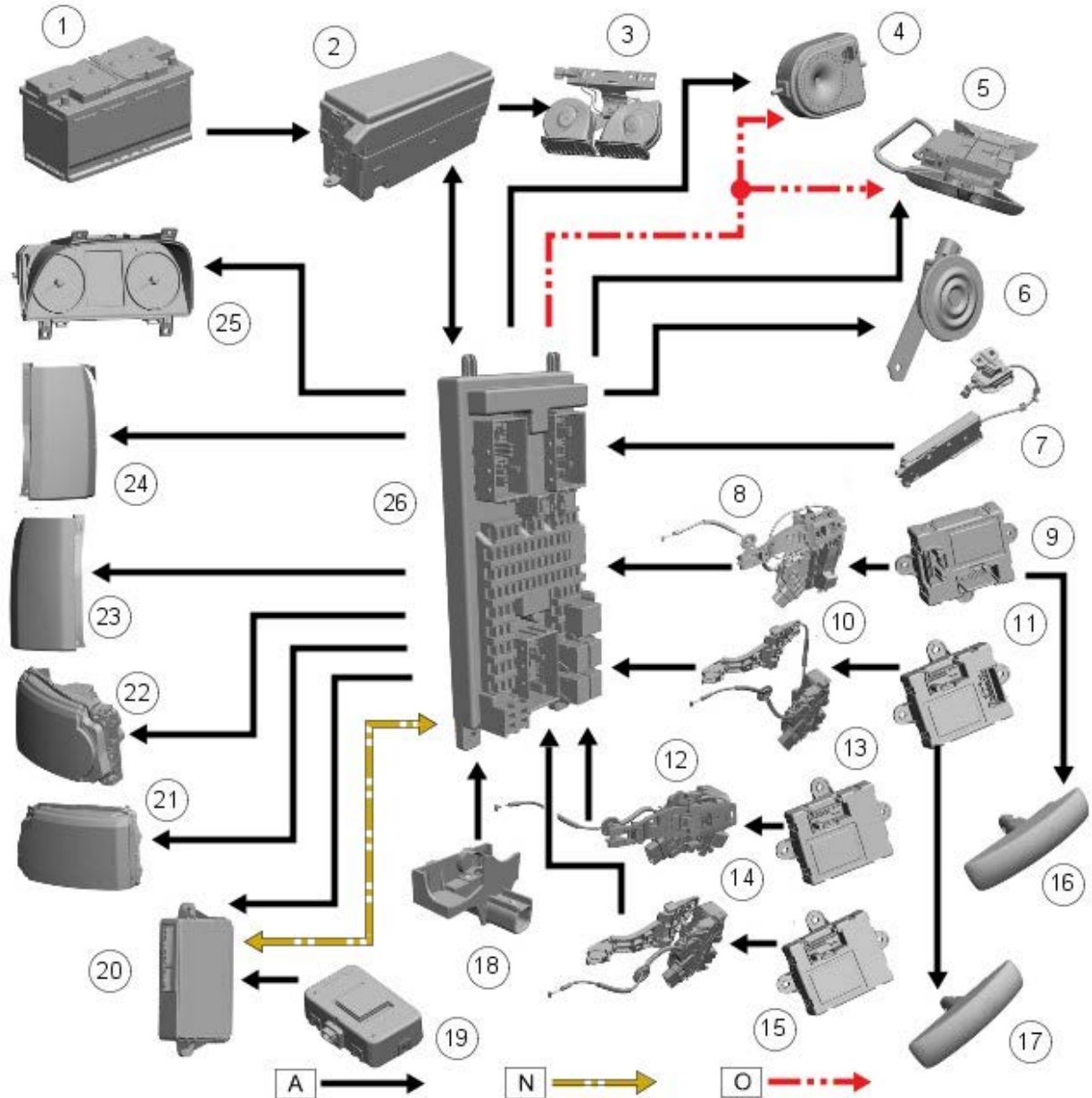
The interior motion sensor is powered by a feed from the CJB and activates and de-activates the interior motion sensor. When the interior motion sensor is active it outputs ultrasonic pulses from the transmitters and checks the echoes picked up by the receiver for changes to the passenger compartment profile. If it detects a change of profile, indicating movement in the passenger compartment, the interior motion sensor reports the alarm to the CJB.

Each time the interior motion sensor is armed, it performs a self-test. If there are no faults the interior motion sensor sends an acknowledgment signal to the CJB. If the CJB does not receive the acknowledgment signal it de-activates the interior motion sensor.

CONTROL DIAGRAM



NOTE: **A** = Hardwired; **N** = Medium Speed CAN bus; **O** = LIN bus



E139829

Item	Part Number	Description
1	-	Battery
2	-	BJB
3	-	Horns
4	-	Battery backed-up sounder with integrated inclination sensor (if fitted)
5	-	Interior motion sensor
6	-	Passive sounder (if fitted)
7	-	Upper tailgate motor
8	-	LH front door latch
9	-	LH front door module
10	-	RH front door latch
11	-	RH front door module
12	-	LH rear door latch
13	-	LH rear door module
14	-	RH rear door latch
15	-	RH rear door module
16	-	LH front side repeater lamp
17	-	RH front side repeater lamp
18	-	Bonnet switch
19	-	Radio frequency receiver
20	-	RFA (Remote Function Actuator)
21	-	LH headlamp

22	-	RH headlamp
23	-	LH tail lamp
24	-	RH tail lamp
25	-	Instrument cluster
26	-	CJB

PRINCIPLES OF OPERATION

The active anti-theft system arms and disarms in conjunction with the locking and unlocking of the central locking system.

For additional information, refer to: Handles, Locks, Latches and Entry Systems (501-14, Description and Operation).

Depending on the configuration of the CJB, the active anti-theft system can be armed and disarmed when the locking system is activated with the Smart Key. Visual and audible confirmation of the arming and disarming is provided by the direction indicators and the BBUS.

On vehicles not fitted with the interior motion sensor and BBUS, the anti-theft alarm system is armed in the perimeter mode when the vehicle is either single or double locked.

On vehicles with the interior motion sensor the anti-theft alarm system is armed in one of two modes:

- Single Locking: only the hinged panels are monitored.
- Double Locking: the hinged panels the vehicle interior, and if the BBUS is incorporated the vehicle attitude, are monitored.

When the vehicle is double-locked, the CJB sends an arming signal to the BBUS and interior motion sensor. If the CJB does not receive an acknowledgment signal from the BBUS and the interior motion sensor, the CJB disables the associated alarm feature for the remainder of the armed cycle.

Locking and Arming the Vehicle



NOTE: The vehicle will only lock, if all door, tailgate and hood apertures are closed. If a lock attempt is made when an aperture is open, the vehicle will not lock and two audible error warnings will sound.

Single locking:

- Pressing the lock button briefly on either the door handle or Smart Key, will initiate the CJB to arm the anti-theft alarm system in the perimeter mode and send an arming signal to the sounder in the BBUS. This secures the vehicle and prevents the doors being opened from outside of the vehicle; however they can still be unlocked and opened from inside the vehicle. The hazard warning lamps will flash once as confirmation and 'if enabled' an audible warning will also sound. The alarm indicator in the instrument cluster will flash continuously.

Double locking:

- Pressing the lock button twice within three seconds on either the door handle or Smart Key, will initiate the CJB to arm the anti-theft alarm system in the perimeter mode and interior motion detection mode. The CJB will also send an arming signal to the BBUS. Double locking secures the vehicle and prevents the doors being unlocked or opened from inside or outside of the vehicle, except with a recognized Smart Key. The perimeter alarm and interior motion protection are turned on. The hazard warning lamps will flash twice, with a long second flash as confirmation and if enabled an audible warning will also sound.
- The vehicle set-up menu in the message center allows the intrusion detection and inclination protection to be temporarily disabled the next time the vehicle is locked using the Smart Key. This feature prevents accidental triggering of the active anti-theft system during transportation of the vehicle or if a pet is left in the vehicle. The sensor override functionality will be active for one lock/unlock cycle only and will default back to sensor active mode automatically.

Emergency Disarming

If the alarm has been triggered and cannot be disarmed with the Smart Key, it can be disarmed using the emergency Smart Key blade. This is achieved by unlocking the left-hand front door with the key blade and deactivating the alarm by:

- pressing the unlock button on the Smart Key, or by
- pressing the engine START/STOP button with the Smart Key inside the vehicle.

Anti-Theft - Active - Hood Switch

Removal and Installation

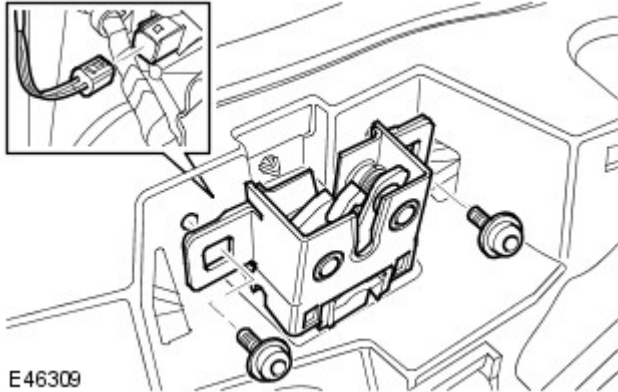
Removal



NOTE: Before installing a new hood switch, diagnose the hood switch by using a digital multimeter. Make sure that continuity through hood switch is present when the switch is pressed (hood closed condition). Repeat the test to make sure continuity IS NOT present when the switch IS NOT pressed. If the hood switch continuity is NOT present, continue with this procedure. If the continuity is present, install the original hood switch to the vehicle.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).

2. Release the RH hood latch.
 - Remove the 2 Torx bolts.
 - Disconnect the electrical connector.



3. Remove the hood switch.

Installation

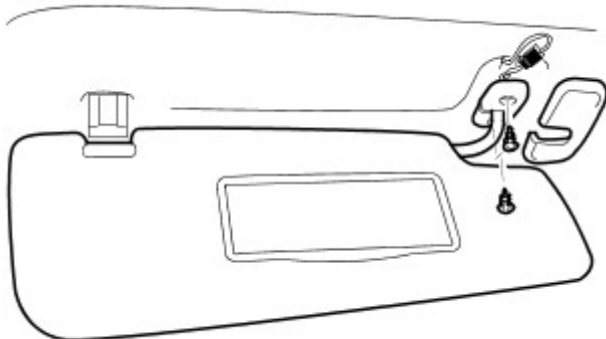
1. Install the hood switch.
2. Install the RH hood latch.
 - Connect the electrical connector.
 - Tighten the Torx bolts to 10 Nm (7 lb.ft).
3. Open and close the hood to check the hood latch operation.
4. Adjust the hood latch.
 - Loosen the 2 hood latch Torx bolts.
 - Lower the hood and check for alignment.
 - Open the hood and tighten the Torx bolts to 10 Nm (7 lb.ft).
 - Check for the correct operation of the hood safety catch.
 - If necessary, repeat the above adjustment procedure.

Anti-Theft - Active - Antenna

Removal and Installation

Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the RH A-pillar upper trim panel.
For additional information, refer to: A-Pillar Trim Panel (501-05, Removal and Installation).
3. Remove the RH B-pillar upper trim panel.
For additional information, refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).
4. Remove the RH C-pillar upper trim panel.
For additional information, refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).
5. Remove the RH sun visor.
 - Remove the screw covers.
 - Remove the 2 screws.
 - Release and disconnect the electrical connector.



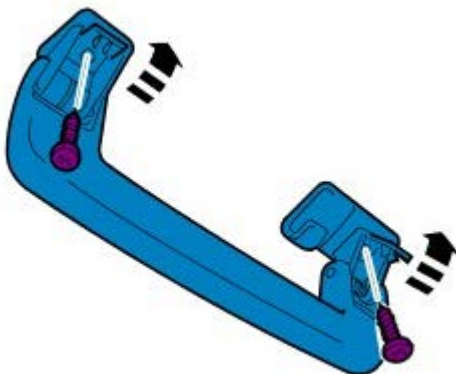
E49687

6. Remove the sun visor retaining clip.
 - Release the screw cover.
 - Remove the screw.



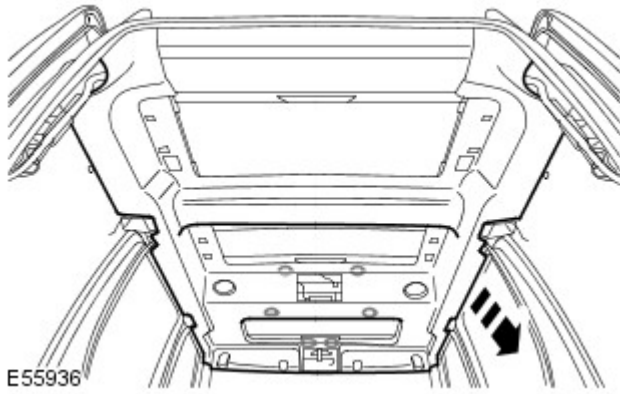
E49688

7. Remove the RH passenger assist handles.
 - Carefully release the 6 screw covers.
 - Remove the 6 screws.



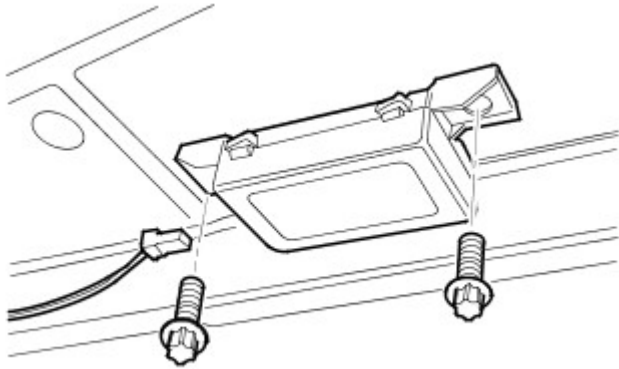
E49689

8. Release the RH side of the headliner.
 - Release the 6 clips.



E55936

9. Remove the alarm antenna.
 - Disconnect the electrical connector.
 - Remove the 2 bolts.



E49765

Installation

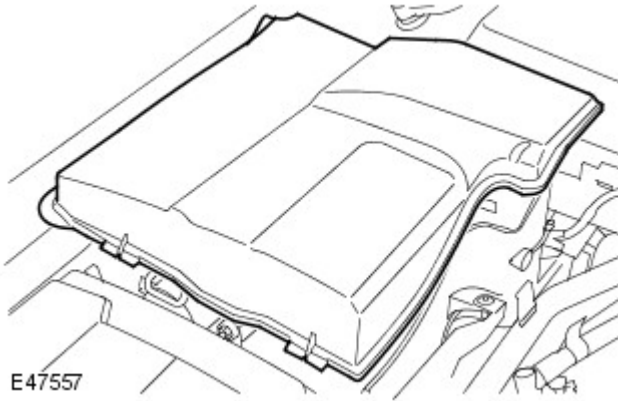
1. Install the alarm antenna.
 - Connect the electrical connector.
 - Tighten the bolts to 10 Nm (7 lb.ft).
2. Secure the RH side of the headliner.
 - Carefully secure the clips.
3. Install the RH passenger assist handles.
 - Install the screws.
 - Install the screw covers.
4. Install the sun visor retaining clip.
 - Install the screw.
 - Install the screw cover.
5. Install the RH sun visor.
 - Connect and secure the electrical connector.
 - Install the screws.
 - Install the screw covers.
6. Install the RH C-pillar upper trim panel.
For additional information, refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).
7. Install the RH B-pillar upper trim panel.
For additional information, refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).
8. Install the LH A-pillar upper trim panel.
For additional information, refer to: A-Pillar Trim Panel (501-05, Removal and Installation).
9. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

Anti-Theft - Active - Anti-Theft Alarm Horn with Integral Battery

Removal and Installation

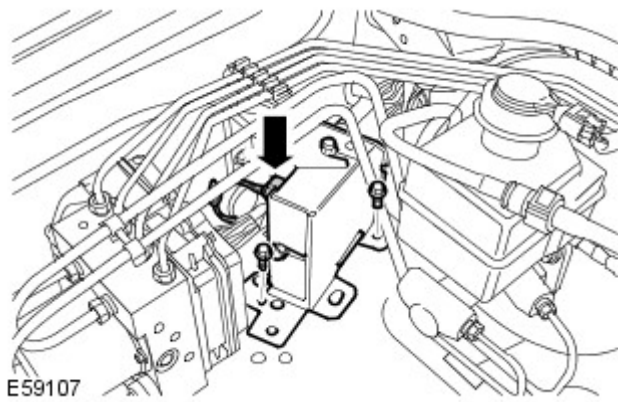
Removal

1. Remove the auxiliary battery box cover.
 - Release the 2 clips.



E47557

2. Remove the anti-theft alarm horn.
 - Disconnect the electrical connector.
 - Remove the 2 bolts.



E59107

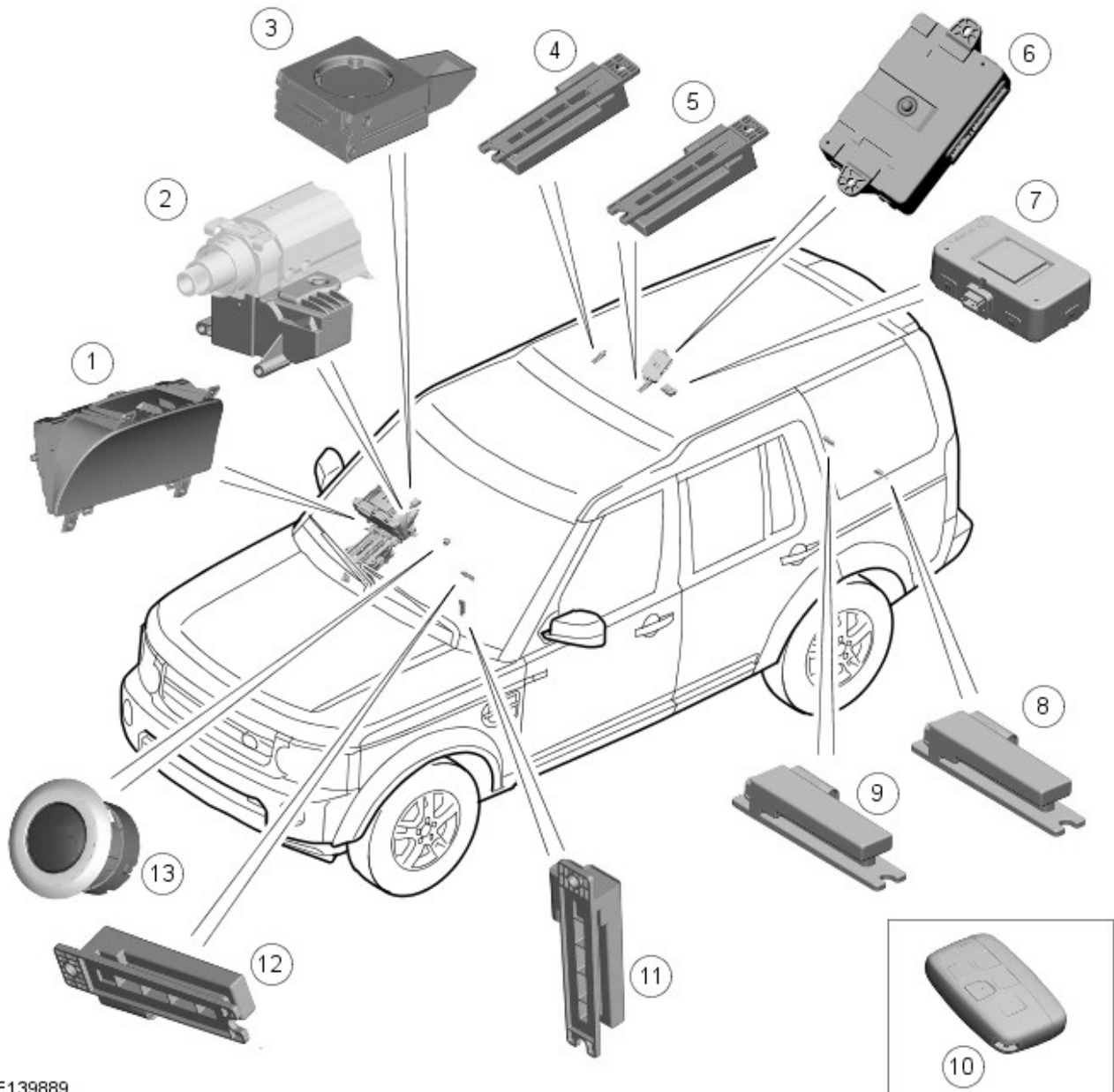
Installation

1. Install the anti-theft alarm horn.
 - Tighten the bolts to 10 Nm (7 lb.ft).
 - Connect the electrical connector.
2. Install the auxiliary battery box cover.

Anti-Theft - Passive - Anti-Theft - Passive

Description and Operation

COMPONENT LOCATION



E139889

Item	Part Number	Description
1	-	Instrument cluster
2	-	Steering column lock
3	-	Immobilizer Antenna Unit (IAU)
4	-	Interior Antenna – roof lining
5	-	Interior Antenna – roof lining
6	-	Keyless Vehicle Module (KVM)
7	-	Radio frequency receiver
8	-	Interior Antenna – luggage compartment
9	-	Interior Antenna – luggage compartment
10	-	Smart Key
11	-	Interior Antenna – front compartment
12	-	Interior Antenna – front compartment
13	-	Start/Stop switch

OVERVIEW

Passive Start

The passive start system relies on the detection of a uniquely coded Smart Key and low frequency antennas strategically situated within the vehicle. The antennas ensure the Smart Key is always within the active transmission zone of the antennas wherever the Smart Key is placed inside the vehicle. For this reason the orientation and positioning of the antennas is critical to the correct functioning of the system. The Smart Key also operates the passive entry system.

For additional information, refer to: Handles, Locks, Latches and Entry Systems (501-14, Description and Operation).

The system provides a secure interface between the **CJB (central junction box)** and the **ECM (engine control module)** to prevent unauthorized starting of the engine. This is achieved by immobilization of the engine crank system and the fuel system, using encoded data exchange between the Smart Key and multiple control modules.

Engine starting is initiated when the encoded data exchange between the Smart Key and the control modules is verified. The engine management system will then allow engine crank and fueling when an authorization data message is received from the **CJB**.

The engine can be started by pressing the start/stop button and depending on the type of transmission:

- Automatic; when the drive selector is in the 'Park' position and the brake pedal is pressed.
- Manual; when the gear selector is in 'Neutral' and the clutch pedal is pressed.

COMPONENT DESCRIPTION

Immobilizer Antenna Unit

The IAU (immobilizer antenna unit) is used if the keyless vehicle module is unable to authorize the Smart Key. If the keyless vehicle module is unable to identify the Smart Key, for example if the Smart Key battery voltage is low or there is local RF interference, the transponder within the Smart Key can be read in the conventional manner. The driver will be alerted to this by a chime and a message in the instrument cluster message center 'SMART KEY NOT FOUND REFER TO HANDBOOK'.

Refer to Keyless Start Backup section.

Low Frequency Antenna

Six LF (low Frequency) antennas for the passive start system are positioned in specific locations within the vehicle.

The keyless vehicle module transmits an LF signal via the antennas which is received by the Smart Key. The Smart Key then responds by transmitting a RF (radio Frequency) signal which is received by the RF receiver and passed to the KVM (Keyless Vehicle Module) for authorization.

Keyless Vehicle Module

The keyless vehicle module controls signal transmissions to and from the Smart Key and provides authorization to allow the vehicle to be started. The module has a medium-speed **CAN (controller area network)** connection to the **CJB** for authorizing vehicle starting.

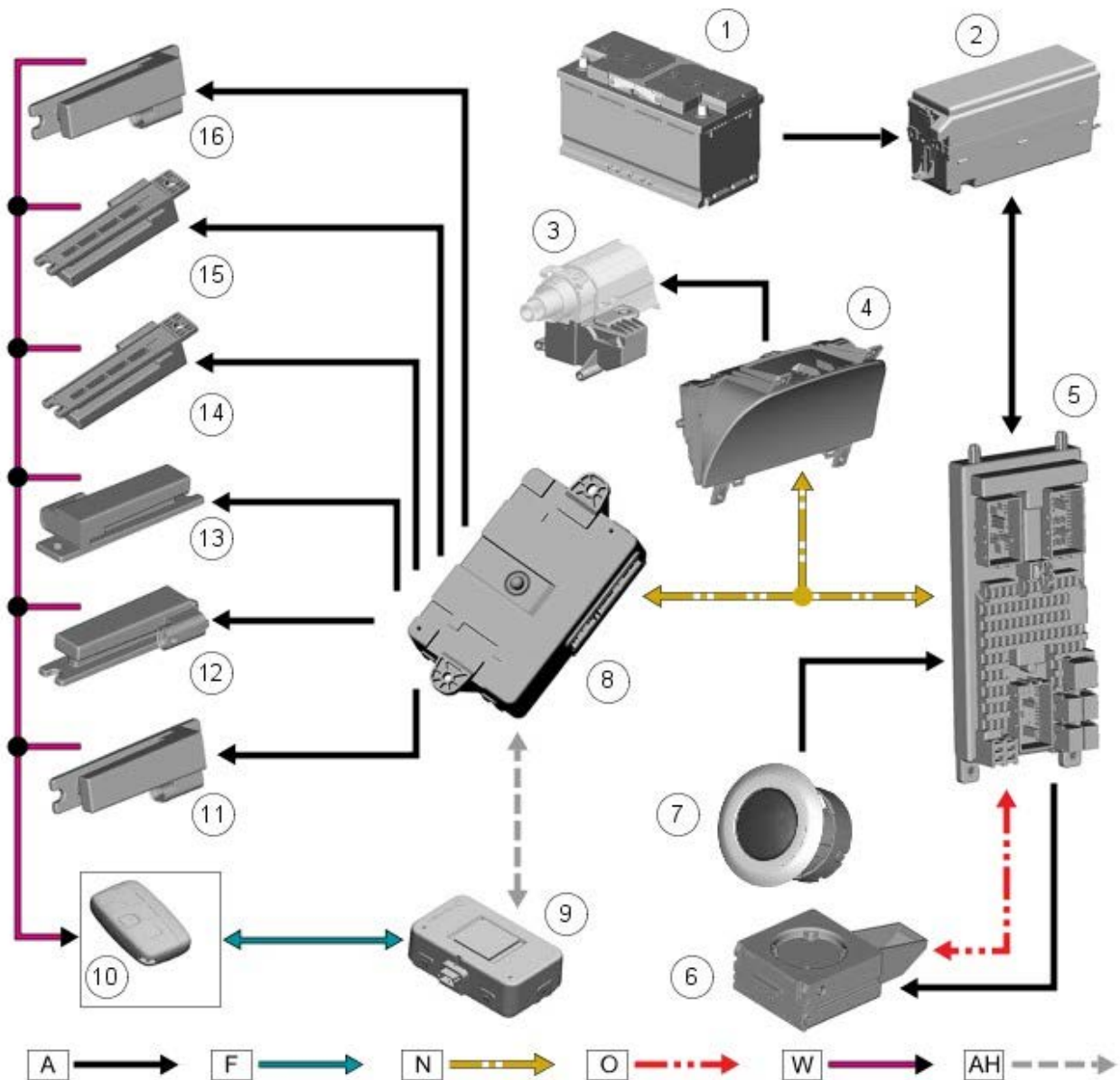
Radio Frequency Receiver

The RF (radio frequency) receiver transmission is received from the Smart Key to enable key identification.

CONTROL DIAGRAM



NOTE: **A** = Hardwired connection; **F** = RF Transmission; **N** = Medium speed CAN bus; **O** = LIN (local interconnect network) bus; **W** = LF Transmission; **AH** = Serial Communications Link



E139890

Item	Part Number	Description
1	-	Battery
2	-	BJB (battery junction box)
3	-	Steering column lock
4	-	Instrument cluster
5	-	CJB
6	-	Immobilizer Antenna Unit (IAU)
7	-	Start/Stop switch
8	-	KVM (Keyless Vehicle Module)
9	-	Radio frequency receiver
10	-	Smart Key
11	-	Interior Antenna – luggage compartment
12	-	Interior Antenna – luggage compartment
13	-	Interior Antenna – front compartment
14	-	Interior Antenna – front compartment
15	-	Interior Antenna – roof lining
16	-	Interior Antenna – roof lining

PRINCIPLES OF OPERATION

Passive Start

At the request of the CJB the KVM (Keyless Vehicle Module) prompts each of the internal low-frequency antennas to output a signal. When the Smart Key is in the vehicle cabin, it detects the low-frequency signals and responds with a

RF radio frequency data-identification signal back to the KVM via the RF receiver.

If the data received matches that stored in the KVM it continues the passive start process by communicating a 'Smart Key valid' signal to the CJB via the medium speed CAN bus.

Once the CJB receives the authorization and confirms the response with an internal calculation, it passes coded data to the ECM on the high speed CAN bus. Upon confirmation from the ECM the ignition is enabled.

Before CJB sends a mobilization signal to the ECM it will exchange encrypted data with the electric steering lock mechanism to authorize unlocking of the steering column. The instrument cluster only provides a ground for the steering lock motor.

The CJB will enable the fuel pump relay which, on diesel vehicles operates the fuel pump and on gasoline vehicles sends a battery voltage supply to the fuel pump driver module to operate the fuel pump in conjunction with the ECM.



NOTE: If the KVM fails to locate the Smart Key, a message 'SMART KEY NOT FOUND REFER TO HANDBOOK' will appear in the instrument cluster message center and the keyless start back-up process will have to be used to mobilize and start the vehicle.

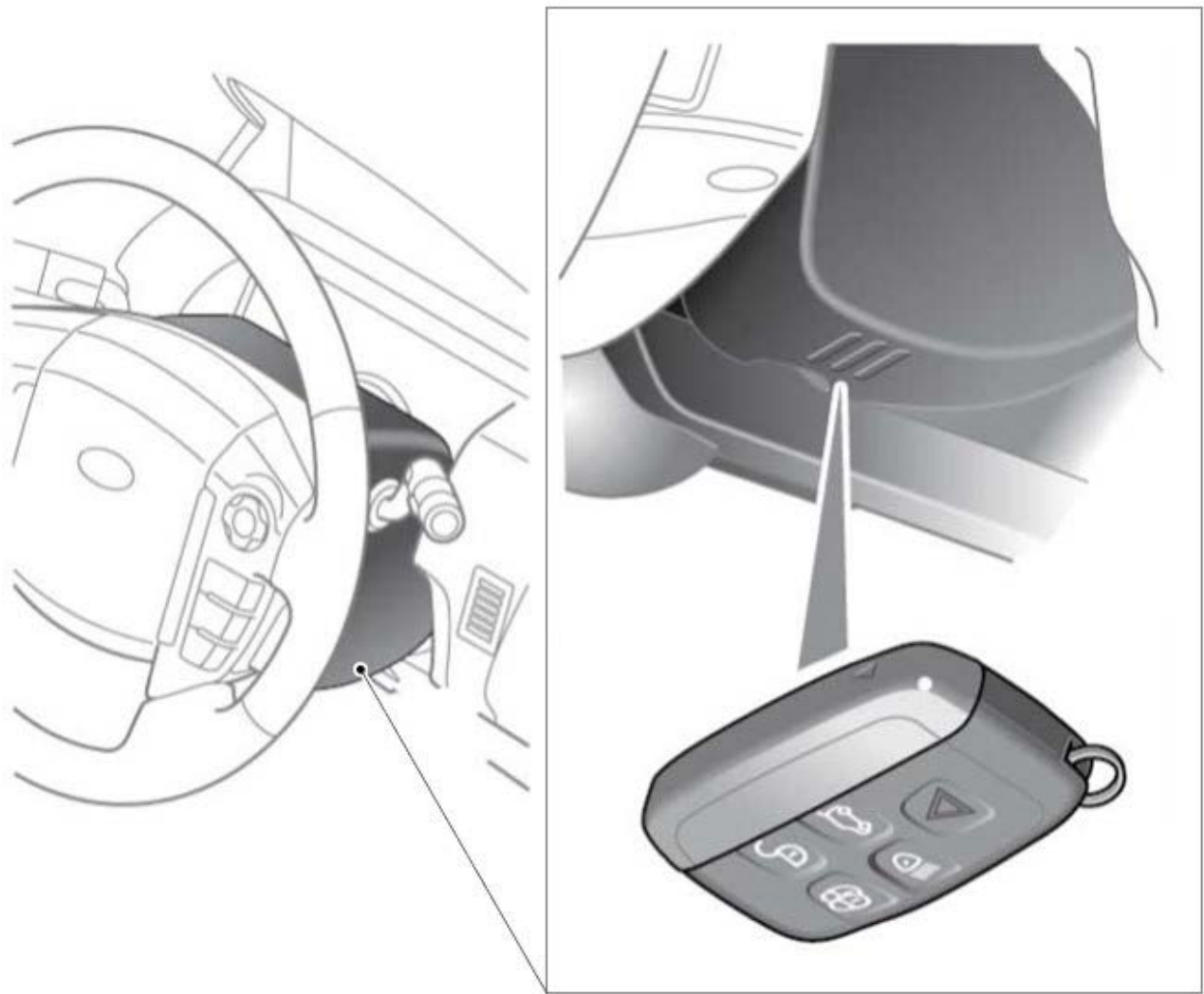
To ensure optimum long term reliability of the smart key the battery must be replaced with a brand new, unused battery. If a used battery is installed the "SMART KEY BATTERY LOW" message may not be cleared. To avoid contamination of the contacts the battery should be removed from its packaging and installed into the smart key while wearing gloves. To confirm that the replacement battery is working correctly press the unlock button twice while holding the smart key outside the vehicle, then enter the vehicle with the smart key, press the start button and confirm that the "SMART KEY BATTERY LOW" message is not displayed.

Keyless Start Backup

If the vehicle has been unlocked using the emergency key blade or the Smart Key is not detected by the vehicle, it will be necessary to use the keyless start backup to disarm the alarm and start the engine. The following process must be followed in this event:

- Position the Smart Key against the underside of the fascia, on the outboard side of the steering column, with the buttons facing downwards. This is the location of the IAU (immobilizer antenna unit).
- Holding the Smart Key in position and the brake / clutch pedal depressed, press the start/stop button to start the engine.

Smart Key positioned next to immobilizer antenna unit



E139891

This process bypasses the data exchange between the KVM and the **CJB**; this is an inductive process and will operate if the battery in the Smart Key is discharged. A transponder within the Smart Key is detected by the IAU. The IAU confirms the code output from the transponder and communicates this code confirmation with the **CJB** via a **LIN** bus connection. The **CJB** then initiates the vehicle start process in the normal manner.

Anti-Theft - Passive - Passive Anti-Theft System (PATS) Module

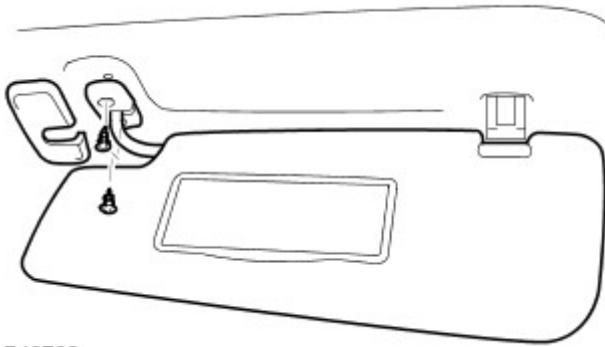
Removal and Installation

Removal



NOTE: If the PATS module is to be replaced then T4 must be connected and the correct procedures adhered to, prior to the battery disconnection.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the RH A-pillar upper trim panel.
For additional information, refer to: A-Pillar Trim Panel (501-05, Removal and Installation).
3. Remove the RH B-pillar upper trim panel.
For additional information, refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).
4. Remove the RH C-pillar upper trim panel.
For additional information, refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).
5. Remove the RH sun visor.
 - Remove the screw covers.
 - Remove the 2 screws.



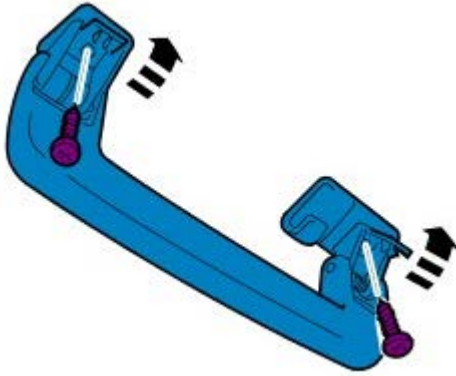
E49766

6. Remove the sun visor retaining clip.
 - Release the screw cover.
 - Remove the screw.



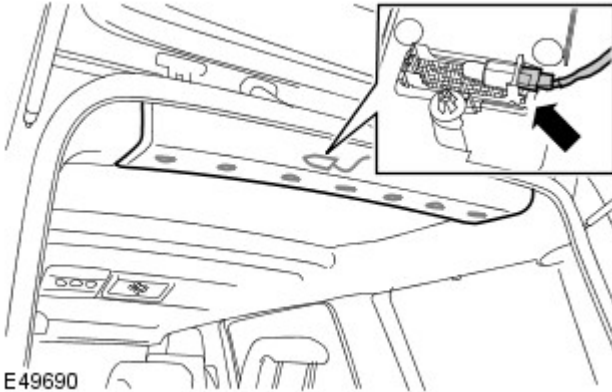
E49688

7. Remove the RH passenger assist handles.
 - Carefully release the 4 screw covers.
 - Remove the 4 screws.



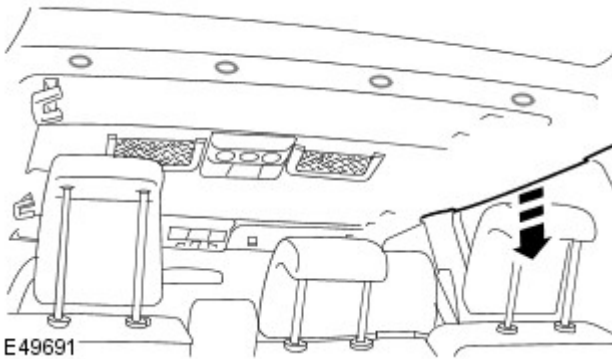
E49689

8. Remove the rear headliner trim panel.
 - Release the 7 clips.



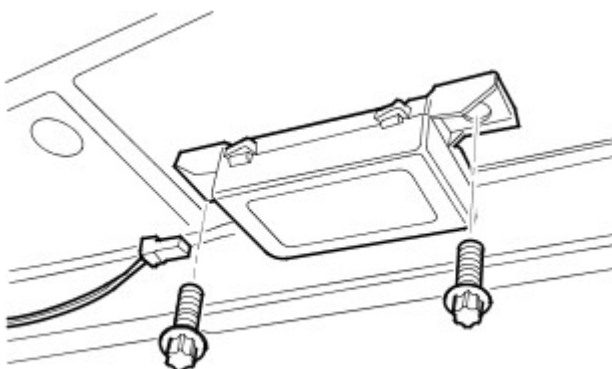
E49690

9. Release the RH side of the headliner.
 - Carefully release the 4 clips.



E49691

10. Remove the PATS module.
 - Disconnect the electrical connector.
 - Remove the 2 bolts.



E49765

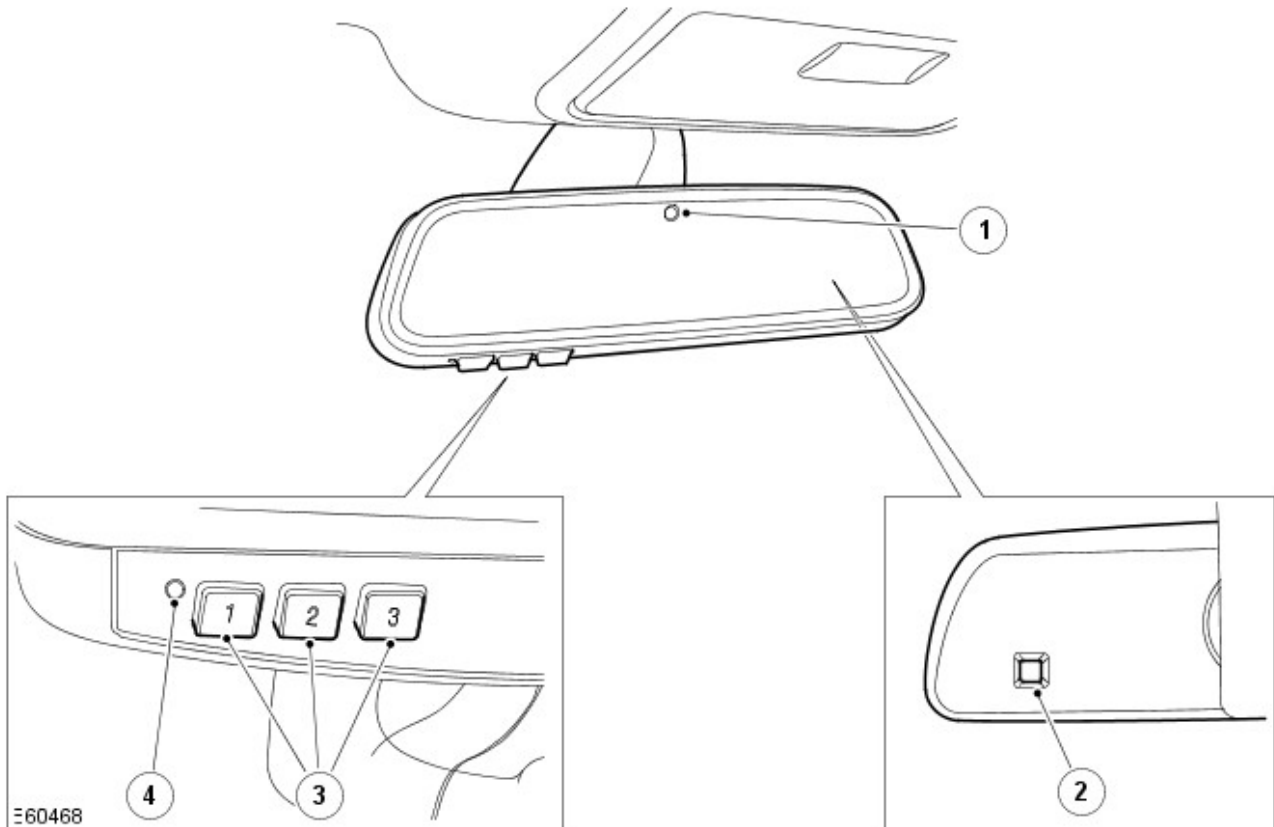
Installation

1. Install the PATS module.
 - Connect the electrical connector.
 - Tighten the bolts to 10 Nm (7 lb.ft).
2. Secure the RH side of the headliner.
 - Carefully secure the clips.

3. Install the rear headliner trim panel.
 - Secure the clips.
4. Install the RH passenger assist handles.
 - Install the screws.
 - Install the screw covers.
5. Install the sun visor retaining clip.
 - Install the screw.
 - Install the screw cover.
6. Install the RH sun visor.
 - Install the screws.
 - Install the screw covers.
7. Install the RH C-pillar upper trim panel.
For additional information, refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).
8. Install the RH B-pillar upper trim panel.
For additional information, refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).
9. Install the LH A-pillar upper trim panel.
For additional information, refer to: A-Pillar Trim Panel (501-05, Removal and Installation).
10. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
11. Initiate a new PATS module using T4.

Remote Convenience - Universal Transmitter

Description and Operation



Item	Part Number	Description
1	-	Rear light sensor
2	-	Front light sensor
3	-	Universal transmitter channel button (market dependant)
4	-	Universal transmitter light emitting diode (LED) (market dependant)

WARNING: The universal transmitter must not be used with any garage door that lacks safety 'stop' and 'reverse' features, as required by federal safety standards (this includes any garage or door opener model manufactured before April 1 1982). A garage door opener which cannot 'detect' an object in the path of a closing door and then automatically 'stop' and 'reverse' the door, does not meet current federal safety standards. Using a garage door opener without these features increases the risk of serious injury or death.

NOTE: HomeLink is a registered trademark owned by Johnson Controls Inc.

The universal transmitter can operate up to 3 home or office remotely operated systems (e.g. garage door/gate openers, lighting and security systems), replacing the individual hand held transmitters required for each system. The universal transmitter can learn the radio frequency codes of most current transmitters.

NOTE: Universal transmitter frequencies vary across markets

The universal transmitter incorporates 3 buttons, one for each channel, and an amber LED installed on the underside of the interior mirror. When one of the buttons is pressed the universal transmitter outputs the radio signal programmed for the related channel (if any) and illuminates the LED to confirm transmission.

For information on programming the universal transmitter, refer to the 'Owners Handbook'.

Remote Convenience - Universal Transmitter

Diagnosis and Testing

Principles of Operation

For a detailed description of the universal transmitter system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Universal Transmitter (419-02 Remote Convenience, Description and Operation).

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical damage.

Visual Inspection

Mechanical
<ul style="list-style-type: none"> • Damaged universal transmitter • Damaged receiver

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Symptom Chart

Symptom	Possible Causes	Action
Universal transmitter inoperative	<ul style="list-style-type: none"> • Universal transmitter • Receiver unit 	Refer to the electrical circuits and check universal transmitter and receiver unit circuits.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

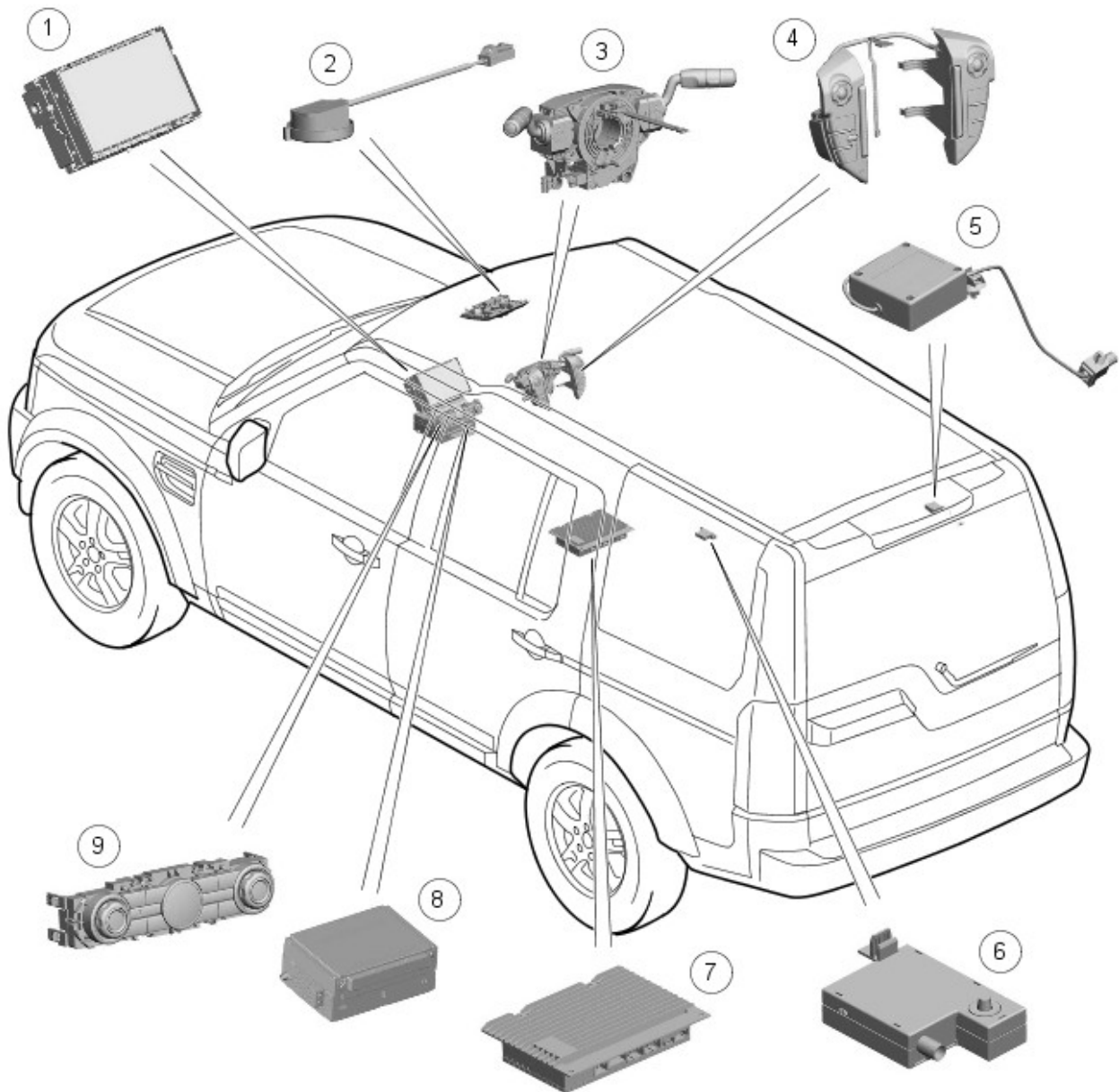
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Remote Function Actuator (RFA) (100-00, Description and Operation).

Navigation System - Navigation System

Description and Operation

COMPONENT LOCATION

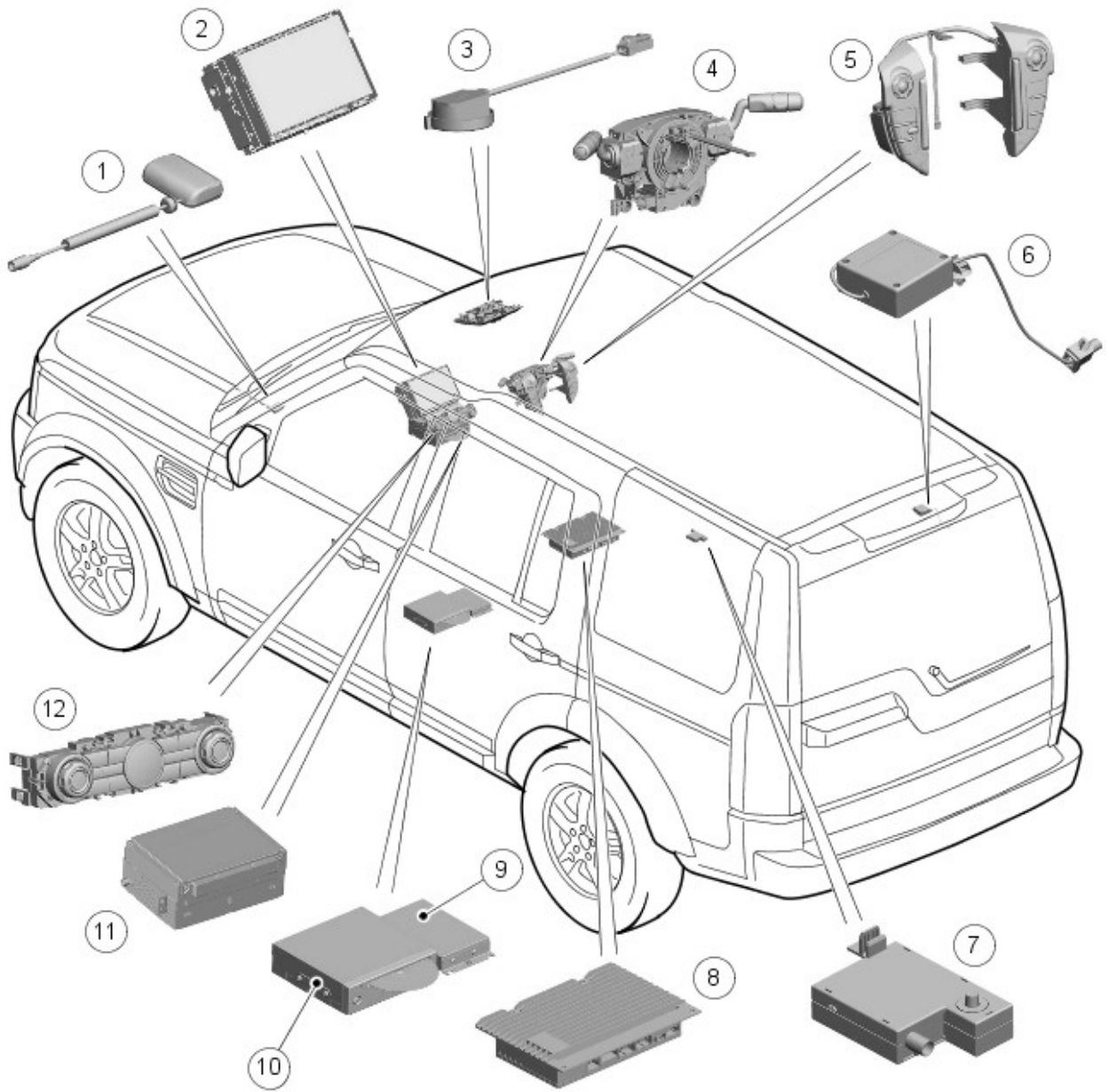
Component Location (ROW)



E151903

Item	Part Number	Description
1	-	TS (Touch Screen)
2	-	Microphone - voice recognition
3	-	Clockspring
4	-	Steering wheel switches
5	-	GPS (global positioning system) antenna
6	-	TMC (Traffic Message Channel) antenna amplifier
7	-	Audio Amplifier Module (AAM)
8	-	IAM (Integrated Audio Module), incorporating the navigation module
9	-	Integrated Control Panel (ICP), incorporating the navigation switch

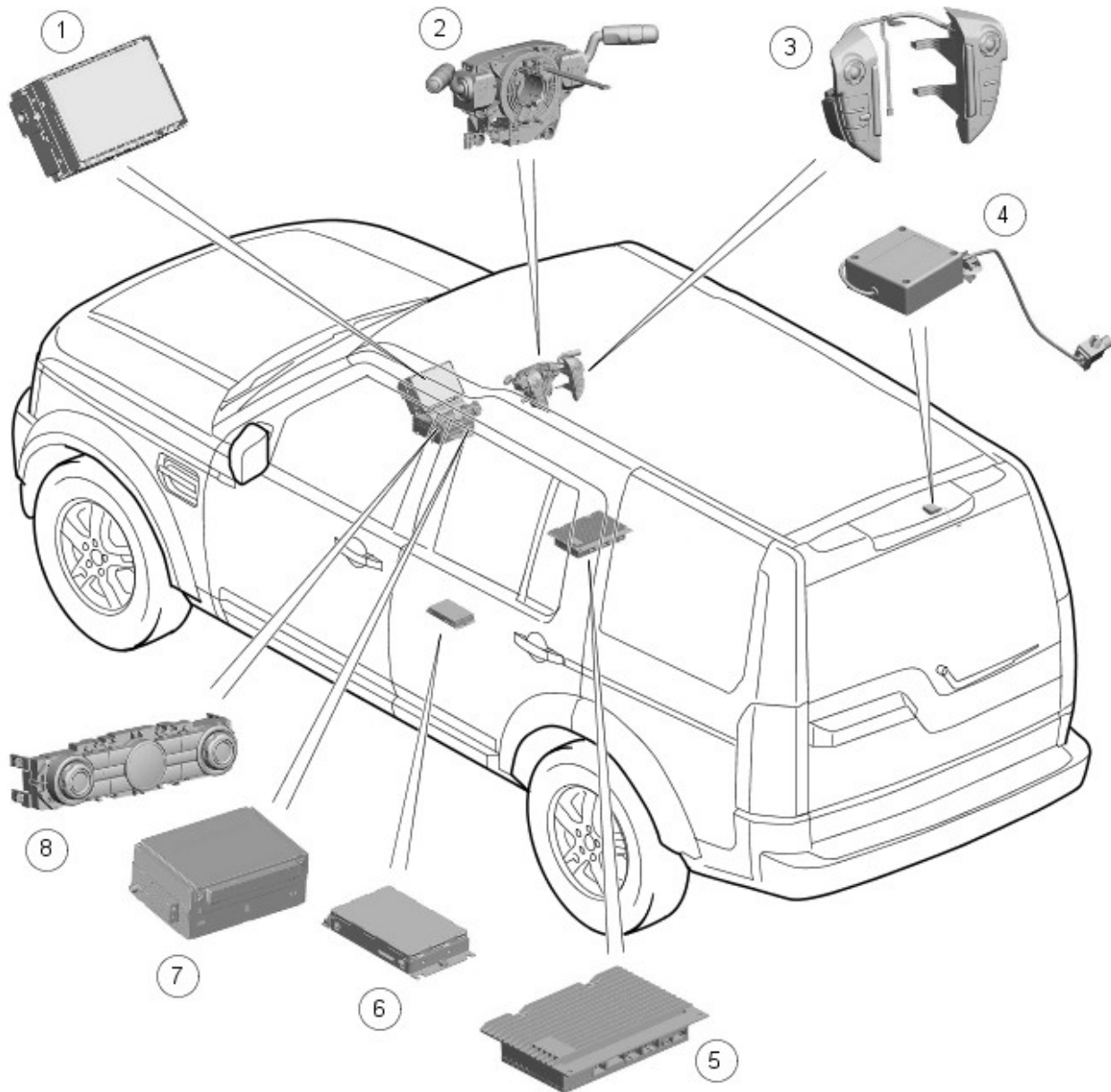
Component Location (Japan)



E151904

Item	Part Number	Description
1	-	VICS (Vehicle Information and Communication System) beacon antenna
2	-	TS (Touch Screen)
3	-	Microphone - voice recognition
4	-	Clockspring
5	-	Steering wheel switches
6	-	GPS antenna
7	-	VICS antenna amplifier
8	-	Audio Amplifier Module (AAM)
9	-	Navigation video interface module
10	-	Navigation computer module
11	-	IAM (Integrated Audio Module)
12	-	Integrated Control Panel (ICP), incorporating the navigation switch

Component Location (Asia)



E151905

Item	Part Number	Description
1	-	TS (Touch Screen)
2	-	Clockspring
3	-	Steering wheel switches
4	-	GPS antenna
5	-	Audio Amplifier Module (AAM)
6	-	Navigation computer module
7	-	IAM (Integrated Audio Module)
8	-	Integrated Control Panel (ICP), incorporating the navigation switch

OVERVIEW

The navigation system provides audible and visual route guidance information to enable the driver to reach a desired destination. The system allows the driver to choose the route using minor or major roads or highways with the option of three routes. Directions to hospitals, museums, monuments and hotels are also available.

The navigation system is integrated with the audio/video system and shares a number of components common to all systems. Map information is stored on a hard disk drive located in the IAM (Integrated Audio Module). Map uploads to the hard drive can be uploaded by the customer from a Universal Serial Bus (USB) memory stick (not applicable to Japan/Asia specification vehicles).

The navigation system has various levels of user control through the TS (Touch Screen) and the voice recognition system. System volume adjustment can be made using the Integrated Control Panel, TS and steering wheel controls.

There are a number of navigation system variants specific to various markets. On all systems the GPS signal is received by the GPS antenna.

The European navigation system includes the TMC (Traffic Messaging Channel) function, which receives traffic

information from an [FM \(frequency modulation\)](#) antenna.

For additional information, refer to: Antenna (415-02, Description and Operation).

On a pre-selected route, the system will offer re-routing options depending on traffic conditions.

All NAS (North America Specification) vehicles are configured to receive TMC. TMC is transmitted in the USA and is available in areas of other NAS markets.

The navigation system is primarily controlled from the TS which is located in the center of the instrument panel. Control signals from the TS are sent on the MOST (Media Oriented System Transport) ring to the navigation computer. The Asia navigation system is different in that the control signals are transmitted via the medium-speed [CAN \(controller area network\)](#). On all systems the navigation computer uses a dedicated GVIF (Gigabit Video InterFace) bus to transmit video signals to the TS.

Depending upon the audio system version fitted, the navigation audio output signals are sent on the MOST ring to the IAM (Integrated Audio Module) or the power amplifier for speaker output.

Japanese market vehicles have a modified system from other markets. These vehicles have an additional [DVD \(digital versatile disc\)](#) navigation computer module and a navigation video interface module located below the left front seat.

The Japanese navigation system includes the VICS (Vehicle Information and Communication System) function. The VICS supplies information to enable the navigation computer to re-route the navigation guidance or to inform the vehicle driver of traffic conditions in the vehicles vicinity. Information is provided to the system through an [FM](#) antenna and a VICS beacon antenna.

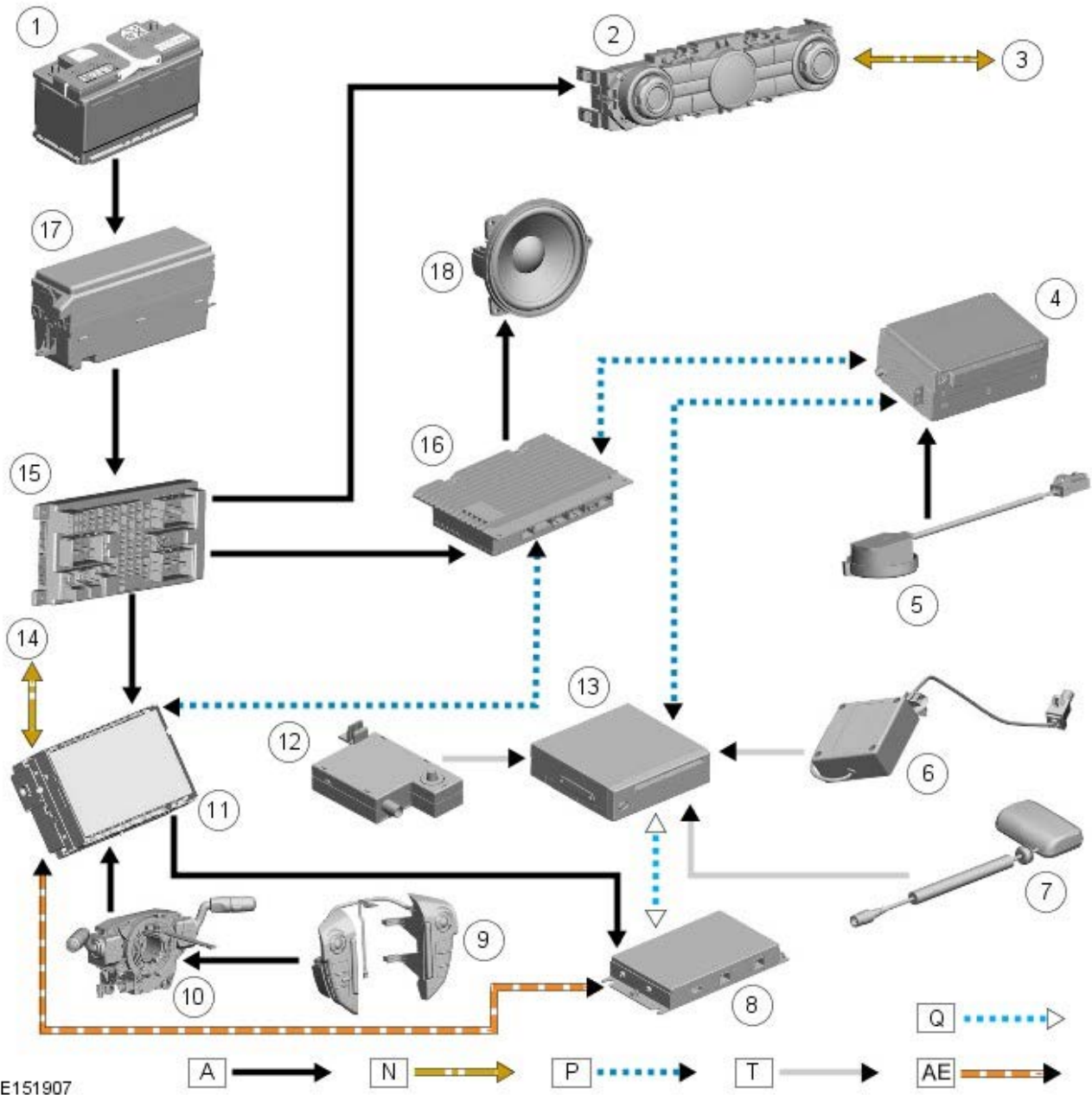
For additional information, refer to: Antenna (415-02, Description and Operation).

Asia markets have a unique system which is fitted to the vehicles by the dealer or port of entry. These vehicles have a separate navigation computer located below the [LH \(left-hand\)](#) front seat.

CONTROL DIAGRAM (ROW)



NOTE: **A** = Hardwired; **N** = Medium Speed CAN; **P** = MOST; **T** = Coaxial; **AE** = LVDS; **AF** = Firewire.

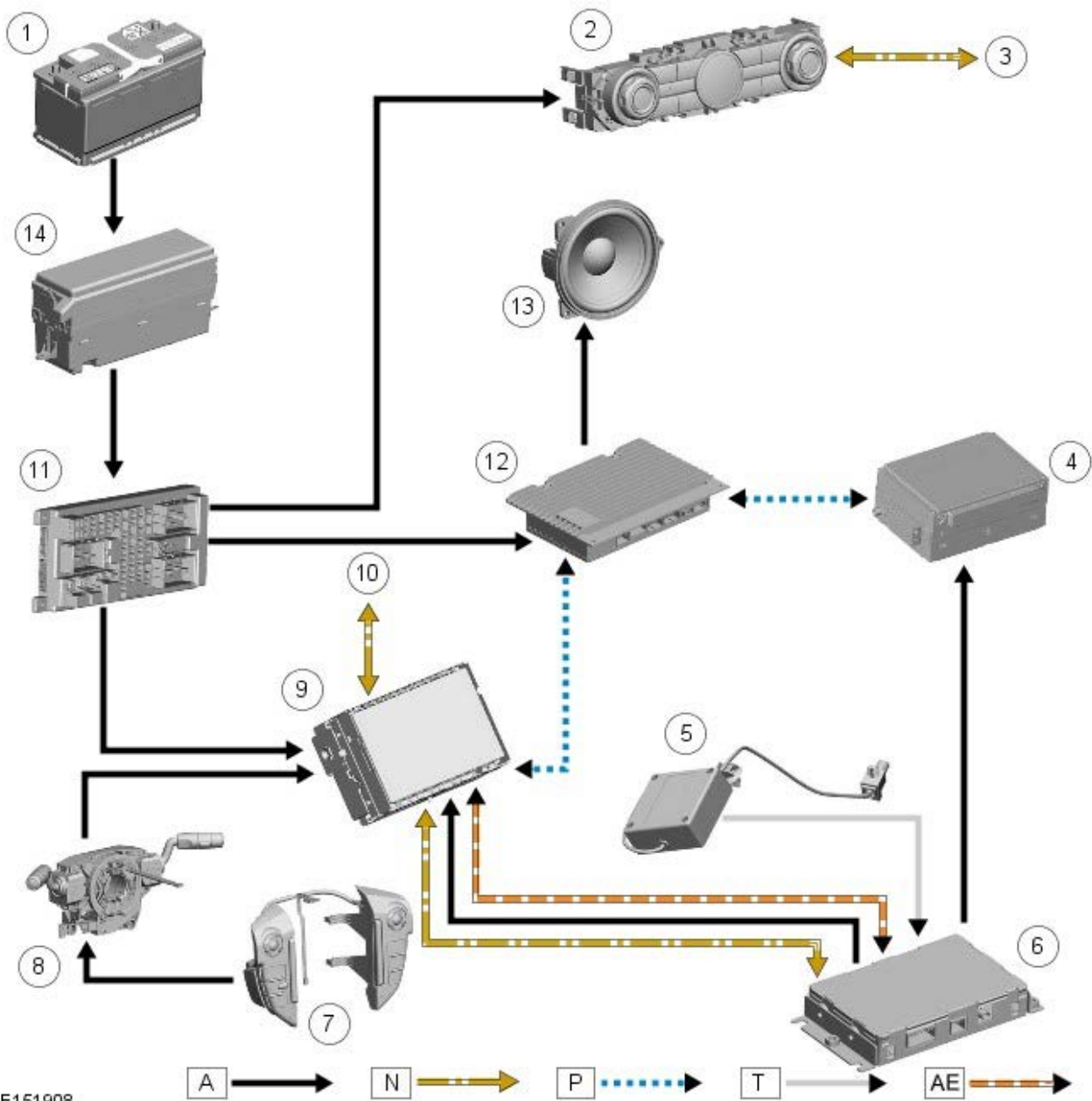


Item	Part Number	Description
1	-	Battery
2	-	Integrated Control Panel (ICP), incorporating the navigation switch
3	-	Medium speed CAN bus connection to other vehicle systems
4	-	IAM (Integrated Audio Module), incorporating the navigation module
5	-	Microphone - voice recognition
6	-	GPS antenna
7	-	VICS (Vehicle Information and Communication System) beacon antenna
8	-	Navigation video interface module
9	-	Steering wheel switches
10	-	Clockspring
11	-	TS (Touch Screen)
12	-	VICS antenna amplifier
13	-	Navigation computer module
14	-	Medium speed CAN bus connection to other vehicle systems
15	-	CJB (Central Junction Box)
16	-	Audio Amplifier Module (AAM)
17	-	BJB (Battery Junction Box)
18	-	Speakers

CONTROL DIAGRAM (Asia)



NOTE: **A** = Hardwired; **N** = Medium Speed CAN; **P** = MOST; **T** = CoAxial; **AE** = LVDS.



E151908

Item	Part Number	Description
1	-	Battery
2	-	Integrated Control Panel (ICP), incorporating the navigation switch
3	-	Medium speed CAN bus connection to other vehicle systems
4	-	IAM (Integrated Audio Module)
5	-	GPS antenna
6	-	Navigation video interface module
7	-	Steering wheel switches
8	-	Clockspring
9	-	TS (Touch Screen)
10	-	Medium speed CAN bus connection to other vehicle systems
11	-	CJB (Central Junction Box)
12	-	Audio Amplifier Module (AAM)
13	-	Speakers
14	-	BJB (Battery Junction Box)

SYSTEM OPERATION

GLOBAL POSITIONING SYSTEM

The navigation system receives GPS information via the GPS antenna. The GPS signals are used by the navigation system to calculate the vehicle's position. Once the driver has input a desired destination, the navigation system can calculate a route, based on the driver's pre-determined preferences or the default settings in the navigation system.

The navigation system is accessed from the TS (Touch Screen) home menu.

Navigation is initiated by the driver inputting a destination. This can be achieved by:

- Entering an address using the TS
- Entering a post code
- Choosing a previous destination
- Choosing a point of interest from the map disc database
- Choosing the home location
- Choosing a memory stored location

The driver is then guided to the destination by a scrolling map display and voice guidance. The display can be varied by scale and display type.

Selection of 'Navigation' on the TS home menu and subsequent sub-menu selection sends a control request signal to the navigation computer on the MOST (Media Oriented System Transport) ring Rest of World/Japan only. The requested control information is processed by the IAM for ROW; or the dedicated navigation computer for Japan and Asia.

- On ROW vehicles, if voice guidance is operational, the voice signals are passed from the IAM to the AAM on the MOST ring for output on the speaker system.
- On Japan vehicles, if voice guidance is operational, the voice signal information is relayed from the navigation computer on the MOST to the AAM for output on the speaker system.

The navigation audio output is through the front speakers whilst the background audio, for example radio or CD (compact disc), is played at a reduced volume on the rear speakers. On Asia vehicles the radio or CD output is muted while the navigation audio output is transmitted.

The GPS signal is available to the navigation system at all times when the vehicle ignition is switched on.

Navigation voice commands are made using the voice recognition system. The TS processes the analogue signal from the voice recognition switch. This is passed from the TS onto the MOST system to the voice recognition control software which is integral with the IAM (ROW) or navigation computer (Japan). Voice control of the navigation system is not available on Asia specification vehicles.

The TS sends an instruction via the MOST ring to the IAM to turn on the microphone facility. The microphone is hardwired to the IAM. For the ROW system, spoken voice commands are processed by the IAM. The processed commands are then sent to the TS to determine which control signals need to be sent to the navigation system.

For the Japan system, the analogue voice signals are relayed from the IAM via the MOST ring directly to the navigation computer (for processing). Navigation commands are handled internally within the navigation computer without the need for communicating with the TS for control.

TRAFFIC MESSAGE CHANNEL



NOTE: TMC (Traffic Messaging Channel) is not available in all markets.

TMC is a function of the FMRDS (radio data system). The system broadcasts real-time traffic and weather information. Data messages are received and decoded by the IAM integral receiver. The IAM processes the received information and alerts the driver of a problem on the planned route and calculates an alternative route to avoid the incident. All TMC events on the map can be viewed not just the ones on the calculated route.

TMC traffic information systems conform to a global standard that has been adopted by traffic data gatherers, information service providers, broadcasters and vehicle/receiver manufacturers.

All TMC receivers use the same list of event codes, while the location database (on the IAM hard drive) contains both a country-specific set of location codes for the strategic European road network.

TMC traffic data is currently broadcast in many European countries and the USA.

Each traffic incident is sent as a TMC message. One message consists of an event code and a location code in addition to time details. The message is coded and can be translated by the IAM into the market language. Location code tables assign numbers to locations on the road network. These location tables are integrated in the maps stored on the IAM hard disk drive. The source of traffic information is typically police, traffic cameras and local network stations.

The TMC system uses the existing FM antenna and audio system antenna amplifiers to pass the signals to the IAM. For additional information, refer to: Antenna (415-02, Description and Operation).

VEHICLE INFORMATION AND COMMUNICATION SYSTEM

The VICS (Vehicle Information and Communication System) is broadcast only in the Japanese market and is similar to the TMC used outside of Japan. VICS gives countrywide coverage and broadcasts of real-time traffic and weather information.

The VICS supplies information to enable the navigation computer to re-route the navigation guidance or to inform the vehicle driver of traffic conditions in the vehicles vicinity.

Information is provided to the system through three methods:

- RF (radio frequency) microwave transmission
- Infra-red transmission
- FM multiplex transmissions.

In certain areas the information is transmitted using an Infra-Red signal or alternately a RF (Radio Frequency) microwave signal, both of which are received by the VICS beacon antenna. Additional information is transmitted on

the FM wavelength and is received by the FM antenna. The received FM signal is passed to the navigation computer via an RF (radio frequency) antenna amplifier.

The RF transmissions are generally transmitted from road side beacons mainly on expressways. The information transmitted is as follows:

- Traffic congestion
- Travel time to next intersection
- Traffic conditions in surrounding areas and expressway turn offs
- Traffic accidents
- Speed limits
- Lane regulations
- Tire change
- Parking availability at expressway service areas and parking areas.

Infra-Red transmissions are transmitted from road side beacons on major trunk roads. The information transmitted is:

- Traffic congestion and travel time
- Traffic accidents
- Breakdowns
- Road works restrictions
- Parking availability.

FM transmissions are broadcast as part of the FM multiplex broadcasting system from NHK (Japanese Broadcasting Corporation) FM stations. Information transmitted is:

- Traffic congestion and travel time for wide areas
- Traffic accidents, road works, speed limits and lane restrictions for a wide area.

The traffic data is split from the normal FM transmissions by the diversity antenna module.

VOICE CONTROL



NOTE: Only basic voice controls are available for Japanese specification vehicles. Voice control is not available on Asia specification vehicles.

The voice system provides the driver with the option of voice control for a range of supported functions. In addition to the navigation system, the system also supports the following:

- phone system
- notepad functions
- radio
- satellite radio
- Digital Audio Broadcasting (DAB)
- single CD
- CD autochanger
- USB and auxiliary connection functions.

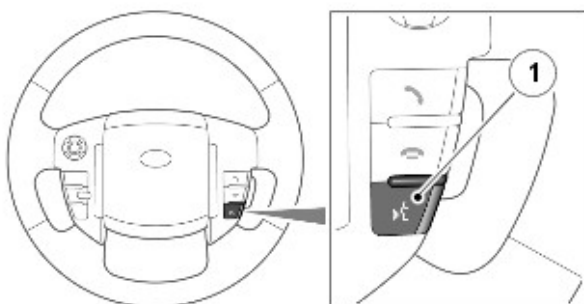
The voice system adopts a concept known as 'Say What You See' (not applicable to Japan specification vehicles). Each of the voice functions are supported by 'Help' commands, saying 'Help' at each point in the conversation will give a context sensitive explanation of what the user can do at that point. The voice menu shown in the TS always guides the user through the flow showing not only examples of what they can say next, but also confirmation of where they are in the conversation flow.

The 'notepad' facility allows voice notes to be recorded. Nametags for radio tuning, phone dialing and navigation locations allow the system to be personalized and there is a help and tutorial function to provide advice on using the system.

Voice control is a key component of the navigation system, allowing hands free control when issuing navigation commands.

The system is controlled by the voice switch on the steering wheel. Voice commands are picked up by a dedicated microphone. When giving a voice command, audible feedback will be heard through the vehicle's audio speakers.

Voice Control Switch



E139535

Item	Part Number	Description
------	-------------	-------------

1	-	Voice control switch - push to talk
---	---	-------------------------------------

Efficient operation of voice control is reliant on the user understanding some of the following basic operating conditions:

- Face forwards, sitting in a normal driving position.
- After pressing the voice switch, always wait for the end of the tone before speaking.
- Speak naturally, as if you were talking to a passenger or on the phone without pausing between words.
- When the system asks for more information, always wait for the end of the tone before responding.
- Always say numbers correctly.
- Excessive noise, for example while driving with windows open, may cause voice command mis-recognition. For example if it is too noisy to use the phone, it is likely that voice commands will not be recognized.

Most accents are understood without difficulty, but if the system does not recognize the command it will respond "SORRY" and allow two more attempts to say the command.

Voice feedback is given in the same language as the command recognition. It is possible to change the language of the speech control system.

Voice control is mainly a software based system. The software responsible for controlling the voice system is resident in the following control modules:

- Integrated Audio Module (IAM) (All markets except Japan)
- Navigation computer (Japan markets only)
- Touch Screen (TS).

Some of these modules contain more than one software component. Voice control communication between these modules takes place via the MOST network. A voice control microphone is located in the front overhead console and is hardwired to the IAM.

When the push to talk switch is pressed on the steering wheel, a voltage is received at the TS via the clockspring assembly. This voltage is sent on a single wire from the switch, through a resistive ladder. The whole process is then initiated via the MOST network, for example the TS starts the voice session and carries out the resulting action requested by the user, but the IAM maintains the dialogue with the user. The accompanying voice instruction is sent to the audio amplifier for broadcast over the speakers from the IAM. If a recognized user instruction is received via the microphone, this is then processed by the IAM and sent to the TS to perform the required action.



NOTE: Should a priority view be required in the TS (for example; Parking aid) this will prevent or cancel the current voice session.

Voice Tags

Voice tags allow the user to store voice entries as shortcuts to control various functions, for example routing to navigation locations, dialing numbers and tuning to radio stations. The voice tags sub-menu accesses controls for navigation, phone, radio and depending on specification DAB radio or SDARS.

For additional information, refer to: Audio System (415-01B, Description and Operation).

Voice Training

The voice system allows two different users to create separate profiles, providing training for a User 1 and User 2. Voice training is used to help the system recognize the user's voice more accurately, and when training is activated for each user, a pop-up is displayed to confirm that training is in process for that user. The pop-up informs the user that voice training must be fully completed in order to activate the new voice profile, and offers the option of 'OK' to initiate the session and store data in that User profile, or 'Cancel' to return to the previous menu. Voice training phrases will be shown in the TS Menu and the user will be requested to say each phrase after the listening tone.



NOTE: Voice training can only be conducted stationary with the engine running and with the climate control NOT in defrost due to background noise.

Voice tags and training are stored in a non-volatile memory within the IAM. Disconnection of the battery would not cause any customer data loss.

NOTES:



To enable new voice tags and training to be written to memory, a period of ten minutes after the last key off cycle must take place. Should the battery be disconnected before this time then data may be lost.



If the IAM is replaced then all voice tags and training will be lost.



If either the IAM or the TS are replaced, it is recommended that the vehicle language settings and voice language settings (if vehicle language is not supported by voice control) are reset to the same setting."

Navigation Destination Entry by Voice

Destination entry uses phonetic transcriptions of the navigation data (stored as part of the map data) to offer the user the ability to enter an address or postcode into the Navigation system by voice. The user simply follows the visual and audible instructions given by the voice system and enters their desired address in a step-by-step manner (e.g. city, then street, then house number). At each address entry stage, the user's voice command is matched against the phonetic map data and a list of likely recognition candidates is presented in a "picklist" for the user to

select from. If the chosen address has more than one location associated with it, the voice system will work with the user to determine the exact address they wish to navigate to.

Dialing from the G2P Phonebook

Provided the phonebook has been downloaded via Bluetooth, the voice system is able to perform a grapheme-to-phoneme (G2P) transcription of each of the names stored in the phonebook. This is then used by the voice system to allow the user to dial a contact by saying the name stored in the phonebook, there is no need to store a voice tag first. The user's voice command is matched against the phonebook entries and a list of likely recognition candidates is presented in a "picklist" for the user to select from. If the chosen contact has more than one number associated with it, the voice system will work with the user to determine the exact number they wish to dial.



NOTE: For regularly used contacts with more than one number, the user can store a voice tag as a shortcut.

SYSTEM COMPONENTS

Touch Screen Display and Integrated Control Panel



E124877

Item	Part Number	Description
1	-	Touch Screen
2	-	Access Audio/Video Menu
3	-	Scroll up down (menu control)
4	-	Mode
5	-	Traffic/News information
6	-	Access Phone Menu
7	-	Search up/increase
8	-	Search down/increase
9	-	Access Navigation Menu
10	-	Tone hard key
11	-	Audio on/off
12	-	Volume
13	-	Access TS Home Menu

The TS and Integrated Control Panel are located in the center of the instrument panel and are the driver's interface with the navigation system. The TS is connected to the MOST ring and communicates with the other components in the audio/infotainment system.

The screen processes its own video for system operation but receives the navigation graphics from the IAM (ROW) or the navigation computer (Japan/Asia).

The TS is a seven inch touch sensitive, 1280 X 480 pixels LCD (liquid crystal display) VGA screen.

In addition to the navigation system the TS and the ICP provides the driver with display and control of various other vehicle functions.

Integrated Audio Module (IAM)



E151909



NOTE: The Japanese/Asia satellite navigation system does not store map data on the IAM. All other functions of the IAM are applicable to the Japanese market. Refer to the following sections 'JAPANESE NAVIGATION SYSTEM' or 'ASIAN NAVIGATION SYSTEM' for details of the Japanese/Asia navigation system.

The IAM is located in central position in the instrument panel, behind the Integrated Control Panel.

The IAM is a multi functional unit

For additional information, refer to: Audio System (415-01B, Description and Operation).

The IAM is connected on the MOST ring to the other audio system components. The driver can control navigation functions by using soft keys on the TS or by voice commands.

The 40 GB hard drive is used for storing the information for satellite navigation (not applicable to Japan/Asia specification vehicles). A 10GB partition is provided for storing music files, the remaining 30GB is used for map data storage.

Hard Disc Drive

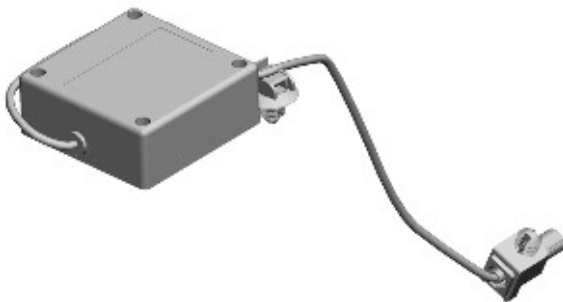
The integral hard drive for the navigation system (not applicable to Japan/Asia specification vehicles) removes the requirement of a separate navigation computer. The IAM stores the navigation map data locally within the 30GB hard drive partition. By storing the information in this way and processing it within the IAM, navigation display, route calculation speeds and accuracy are vastly improved. Map upgrades and software are loaded directly into the IAM from a Universal Serial Bus (USB) memory stick (not applicable to Japan/Asia specification vehicles).

The map images are transmitted from the IAM to the TS via a LVDS (Low Voltage Differential Signal) link cable. Turn by turn instructions are displayed in the instrument cluster using messages transmitted on the medium-speed CANbus.

The IAM communicates on the MOST ring with the rest of the audio system. If the IAM is replaced it must be configured as a new module using an approved diagnostic system.

Calibration of the IAM using an approved diagnostic system enables updates to be downloaded as new technology becomes available or any fault concerns require software updates.

Global Positioning System Antenna



E124882

The GPS antenna passes signals from the GPS satellites to the navigation computer for processing.

The GPS antenna is designed with 50 ohm output impedance. The IAM or navigation computer is fitted with 50 ohm fakra II connectors to ensure compatibility with the antenna. For optimum performance 50 ohm low loss coaxial cable

is used between the antenna and IAM or navigation computer.

It is possible for the GPS antenna to lose the signal from the GPS satellites:

- In hilly or tree lined areas
- Built up areas with tall buildings
- In multi storey car parks
- In garages
- In tunnels
- On bridges
- During heavy rain or thunderstorms.

When the signal is lost the IAM or navigation computer will continue to give guidance using memory mapped data from the stored map software (or from the map [DVD](#) until the signal is restored).

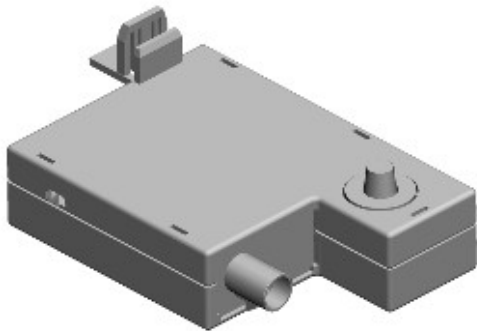
Microphone



E124819

A single microphone is used for hands-free operation using the voice control system. The microphone has an integrated noise suppression system for hands-free use. The microphone is a standard directional type, hardwired to the IAM. When replacing the microphone extra care must be taken to make sure it is fitted into its securing clips for correct positioning and orientation.

TMC Antenna Amplifier



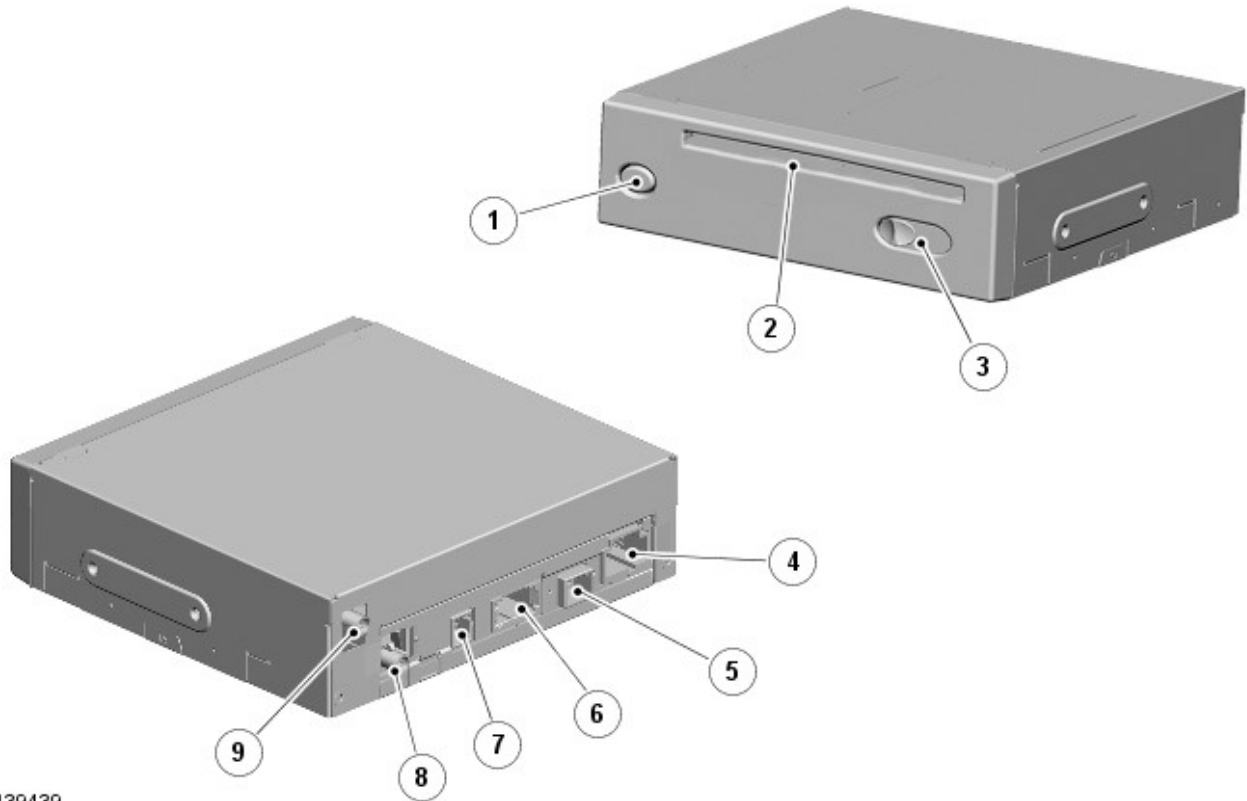
E124881

The TMC (traffic message channel) antenna amplifier is connected to the FM antenna. The TMC signals are received through the normal radio signals via the RDS (radio data system) and are routed separately from the radio signals via the TMC antenna amplifier to the Touch Screen Display unit.

JAPANESE NAVIGATION SYSTEM

The Japanese satellite navigation system uses a separate navigation computer module with map data supported by an [DVD](#) disc. Additional components are: a navigation computer module and a navigation video interface module.

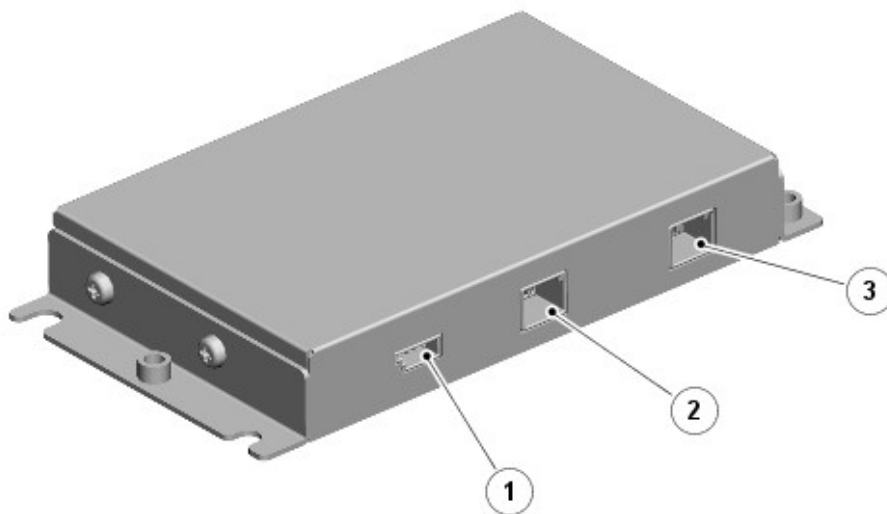
Navigation Computer Module



E139439

Item	Part Number	Description
1	-	DVD eject switch
2	-	DVD loading slot
3	-	DVD eject lock
4	-	Power and ground connections
5	-	GVIF video output connector
6	-	MOST connector
7	-	VICS beacon antenna connector
8	-	GPS antenna connector
9	-	VICS FM antenna connector

Navigation Video Interface Module



E139440

Item	Part Number	Description
1	-	GVIF video input from navigation module connector
2	-	LVDS video output to TS connector
3	-	Power, ground and 5V signal voltage from TS connector

Navigation Computer Module

The navigation computer module is a [DVD](#) drive which reads map data direct from a [DVD](#). The navigation computer

module is connected on the MOST ring and communicates with the TS to initiate navigation video and audio output. The GPS antenna is connected directly to the navigation computer module.

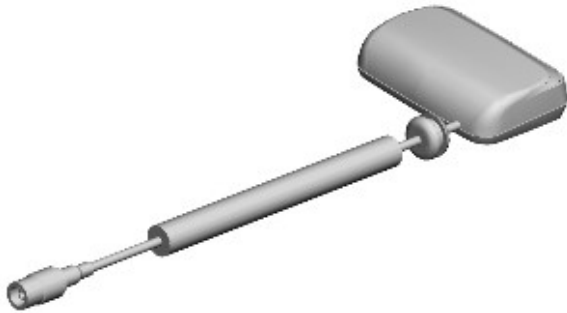
The navigation computer module outputs the video signals in a Gigabyte Video InterFace (GVIF) format to a navigation video interface module which converts the GVIF input to a Low-Voltage Differential Signaling (LVDS) video signal output which is then passed to the TS. Audio output is on the MOST ring to the audio amplifier. VICS FM transmission signals are received by the navigation computer module via an FM antenna and a VICS antenna amplifier. Infra-red and RF microwave VICS transmissions are also received by the VICS beacon antenna and are passed to the navigation computer module.

Navigation Video Interface Module

The navigation video interface module converts the GVIF video output to LVDS video signal which is compatible with the TS.

A 5V signal output from the TS is connected to the video interface module. The signal voltage initiates a power up of the video interface module when the TS is active.

VICS Beacon Antenna

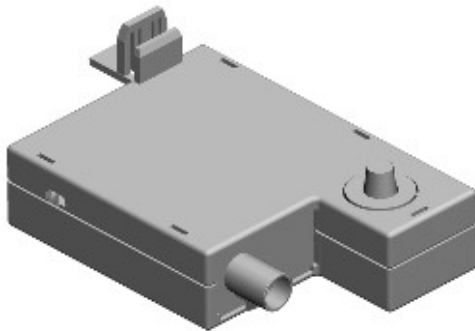


E124822

The VICS beacon antenna is connected to the TS via a screened co-axial cable.

The VICS (vehicle information and communication system) beacon antenna receives infra red and RF (radio frequency) traffic data signals from road side transmitters. The antenna is connected to the navigation computer which incorporates a VICS (vehicle information and communication system) antenna amplifier.

VICS Antenna Amplifier

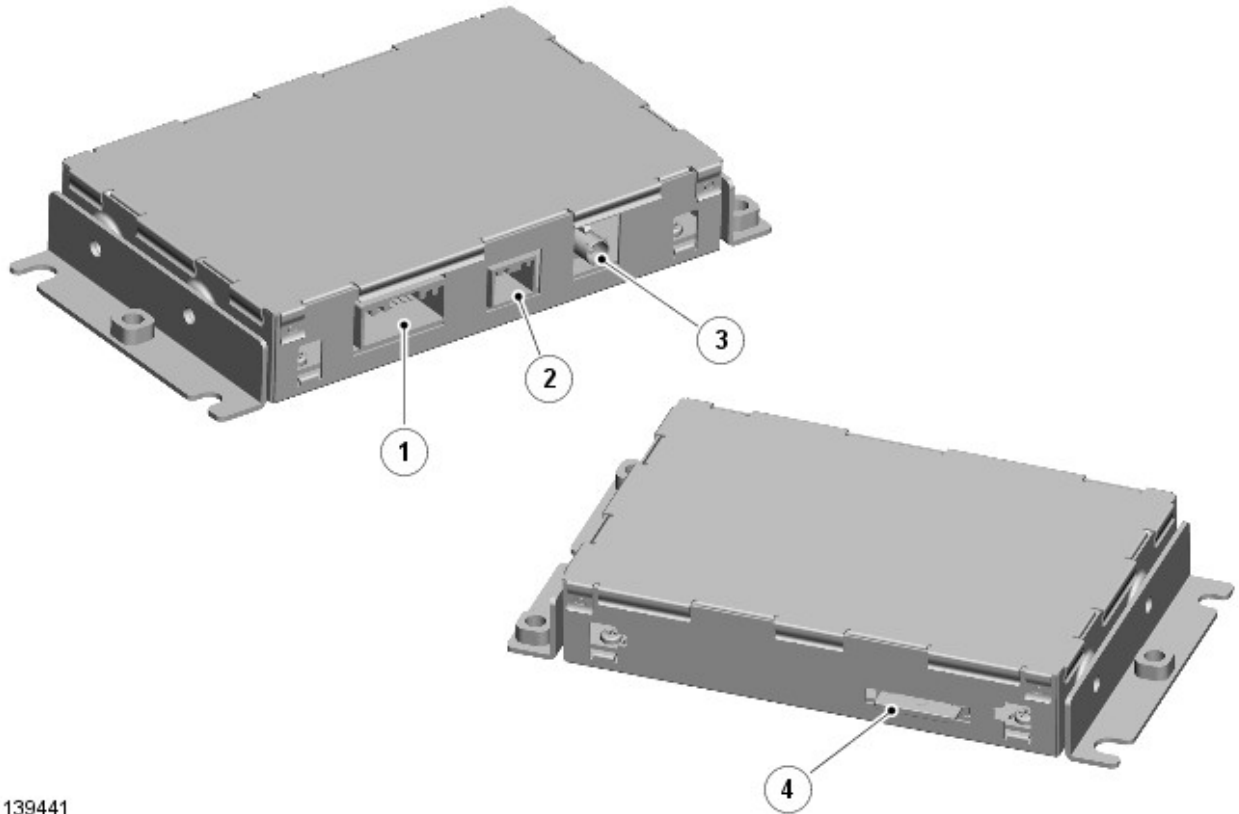


E124881

The VICS antenna amplifier is connected to the TS unit.

ASIAN NAVIGATION SYSTEM

Navigation Computer Module - Asia



E139441

Item	Part Number	Description
1	-	Power, CAN and audio connector
2	-	LVDS video output to TS
3	-	GPS antenna connector
4	-	SD storage card slot

In some Asian markets the vehicle is delivered with UK line item, or an after market navigation system is fitted at PDI (pre-delivery inspection) by the dealer or at Port of Entry (POE). A medium speed CAN based navigation computer module is fitted below the front left seat.

The navigation computer module outputs the video signals in a LVDS format direct to the TS. Audio output is passed to the IAM which converts the signals and passes them to the audio amplifier on the MOST ring. When Audio is required, such as a Voice guidance instruction, the Asia navigation computer module communicates to the vehicle audio system using a hard wire connection between the TS and the Asia navigation computer module. TS co-ordinates and vehicle power mode status are obtained through the medium speed CAN. Map data is stored via a multimedia Secure Digital (SD) card accessible through an access point on the module.

CO2 OPTIMIZED NAVIGATION



NOTE: CO2 Optimized Navigation is not available on Asia navigation systems.

When entering a destination, the navigation system give the option to select three routes. When this option is selected, three alternative routes options are displayed on the map.

The roads on the map are shown in three different colors to highlight each route. Leaves are used alongside each of the three calculated routes to indicate the most fuel efficient.

In addition to the color coding, leaf symbols are displayed with three leaves being the most efficient route and one leaf being the least efficient route.



E137155

Select route 1, 2 or 3 by touching the respective box displayed on the right side of the map in the TS.

Navigation System - Navigation System

Diagnosis and Testing

Principles of Operation



NOTE: This navigation system is installed in selected Asia market vehicles only.

For a detailed description of the navigation system, refer to the relevant Description and Operation section of the workshop manual. REFER to:

[Navigation System](#) (419-07 Navigation System, Description and Operation),
[Navigation System](#) (415-01, Description and Operation),
[Navigation System](#) (415-01, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern
2. Visually inspect for obvious signs of damage, water ingress and system integrity

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Navigation control module • Audio amplifier module • Touch screen • Loudspeakers 	<ul style="list-style-type: none"> • Fuses • Loose or corroded connector(s) • Navigation control module • Audio amplifier module • Touch screen • Loudspeakers

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart

Symptom Chart

Symptom	Possible Causes	Action
Navigation soft key missing from Touch Screen (TS) menu	<ul style="list-style-type: none"> • Car configuration file incorrectly configured 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
"Please insert map SD card to enter navigation" message after launching navigation	<ul style="list-style-type: none"> • Map SD card missing 	<ul style="list-style-type: none"> • Insert map SD card into the navigation control module
"Agree" message after launching navigation	<ul style="list-style-type: none"> • Car configuration file incorrectly configured 	<ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, check and up-date the car configuration file as necessary
Blank screen after launching navigation	<ul style="list-style-type: none"> • Video in signal missing <ul style="list-style-type: none"> - Navigation Control Module (NCM) not installed - LVDS circuit short circuit to ground, short circuit to power, open circuit, high resistance - Navigation Control Module (NCM) power or ground circuit open circuit, high resistance - Medium speed CAN bus circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • GO to Pinpoint Test A.

Unable to detect position	<ul style="list-style-type: none"> GPS signal missing <ul style="list-style-type: none"> - GPS receiver circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> GO to Pinpoint Test B.
No navigation audio	<ul style="list-style-type: none"> Telephone mute circuit short circuit to ground Navigation audio circuits short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the telephone mute circuit for short circuit to ground Refer to the electrical circuit diagrams and test the audio circuits for short circuit to ground, short circuit to power, open circuit, high resistance

Pinpoint Tests



NOTE: If the control module or a component is suspect and the vehicle remains under manufacturer warranty, refer to the Warranty Policy and Procedures manual (section B1.2), or determine if any prior approval Program is in operation, prior to the installation of a new module/component.

PINPOINT TEST A : NAVIGATION CONTROL MODULE TESTS	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CONFIRM INSTALLATION	
NOTES:	
The navigation control module is installed at the factory for China, Hong Kong, Taiwan and Macau market vehicles.	
The navigation control module is not installed at the factory for Korea, India and Israel market vehicles.	
	1 Verify if the Navigation Control Module (NCM) has been installed. Has the Navigation Control Module (NCM) been installed (refer to the Navigation Control Module Locations table)? Yes GO to A2. No If applicable to market, install a new navigation control module.
A2: NAVIGATION CONTROL MODULE POWER AND GROUND TEST	
	1 Verify that the red LED on the Navigation Control Module (NCM) is illuminated (adjacent to the round connector). Is the red LED illuminated? Yes Refer to the electrical circuit diagrams and test the LVDS circuit to the Touch Screen (TS) for short circuit to ground, short circuit to power, open circuit, high resistance No GO to A3.
A3: NAVIGATION CONTROL MODULE POWER/GROUND TEST	
	1 Refer to the electrical circuit diagrams and test the Navigation Control Module (NCM) power and ground circuits for short circuit to ground, short circuit to power, open circuit, high resistance. Are the Navigation Control Module (NCM) power and ground circuits within specification? Yes GO to A4. No Repair the power or ground circuit as necessary
A4: MEDIUM SPEED CAN TEST	
	1 Using the manufacturer approved diagnostic system, perform a CAN network integrity test. Refer to the electrical circuit diagrams and test the medium speed CAN bus circuit for short circuit to ground, short circuit to power, open circuit, high resistance Is the medium speed CAN bus circuit within specification? Yes Repair the medium speed CAN bus circuit as necessary No Install a new navigation control module

PINPOINT TEST B : GPS TEST	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: GPS SIGNAL TEST	
	1 Remove the map SD card from the navigation control module
	2 Launch navigation by operating the navigation soft key on the Touch screen (TS)

	Is "GPS open" or "GPS short" displayed in a red box?
	Yes Refer to the electrical circuit diagrams and check the GPS receiver circuit to short circuit to ground, short circuit to power, open circuit, high resistance
	No "GPS open" and "GPS short" displayed in green boxes indicates that the GPS signal is correct

Navigation Control Module Locations

Model	Location
XF - X250	Under the front left seat
XJ - X351	In the luggage compartment behind the left side trim panel
XK - X150	Navigation system not fitted
F-Type - X152	In the luggage compartment under the load floor at the right side
Freelander 2 - L359	Under the front right seat
Discovery 4 - L319	Under the front left seat
Evoque - L538	In the luggage compartment under the load floor at the right side
Range Rover - L405	In the luggage compartment under the load floor at the left side
Range Rover Sport - L320	Under the front left seat
Range Rover Sport - L494	In the luggage compartment under the load floor at the left side

DTC Index

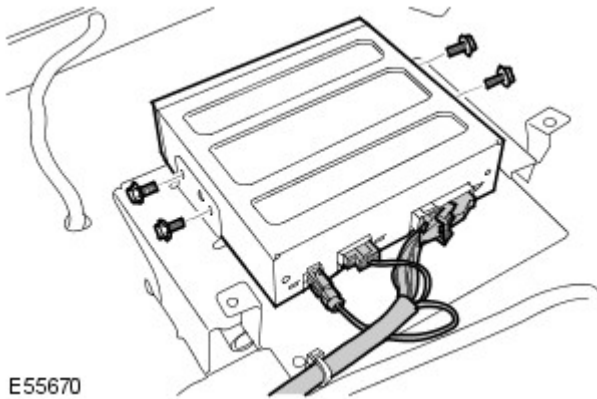
For a list of diagnostic trouble codes that could be logged on this vehicle, please refer to Section 100-00. REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Navigation Control Module (NCM) (100-00, Description and Operation) / [Diagnostic Trouble Code Index: Touch Screen - DTC: Touch Screen \(TS\)](#) (100-00 General Information, Description and Operation).

Navigation System - Navigation System Compact Disc (CD) Unit

Removal and Installation

Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
3. Remove the LH front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).
4. Remove the CD unit.
 - Remove the 4 bolts.
 - Disconnect the antenna cable.
 - Disconnect the 2 electrical connectors.



Installation

1. Install the CD unit.
 - Tighten the bolts to 6 Nm (4 lb.ft).
 - Connect the electrical connectors.
 - Connect the antenna cable.
2. Install the LH front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).
3. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

Navigation System - Navigation System Display Module

Removal and Installation

Removal

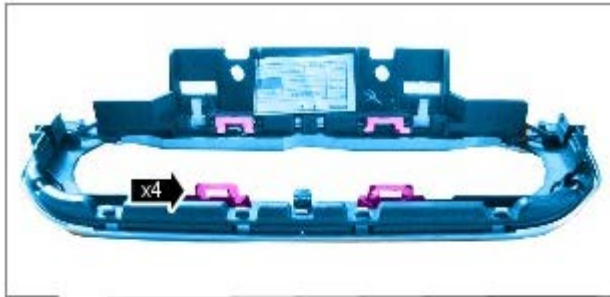
1.



2. Torque: 2.5 Nm




3.



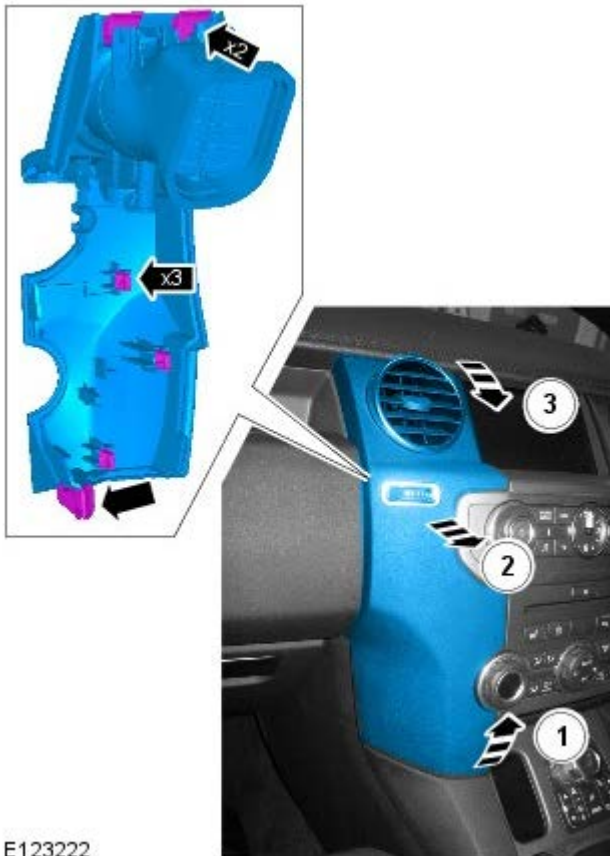
E123217



E122691

4.  NOTE: LHD illustration shown, RHD is similar.

- 5.



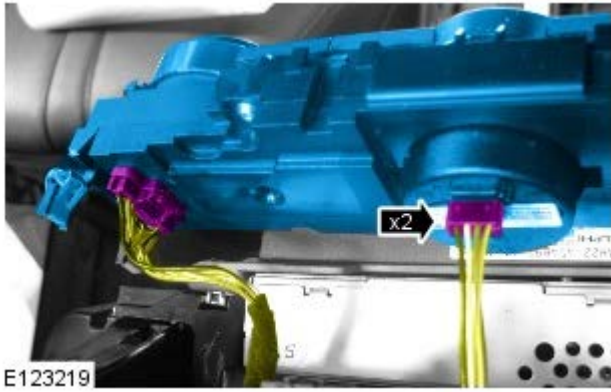
E123222

6.




E123218

7.



8. Torque: 2.5 Nm



9.  NOTE: Do not disassemble further if the component is removed for access only.



E122791

Installation

1. To install, reverse the removal procedure.
2. If a new component has been installed, configure using Land Rover approved diagnostic equipment.

Navigation System - Navigation System Traffic Amplifier

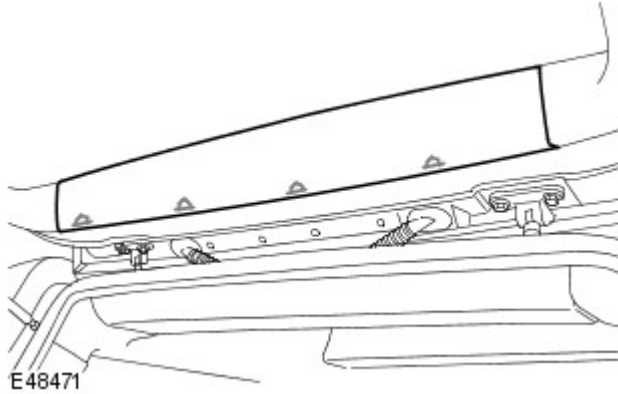
Removal and Installation

Removal

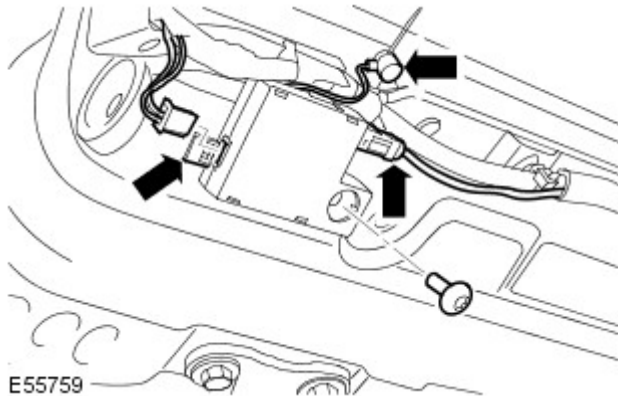


NOTE: The navigation system traffic amplifier is located on the LH side of the liftgate. The diversity amplifier is located on the RH side of the liftgate. The procedure is similar for both components.

1. Remove the liftgate upper trim panel.
 - Release the 4 clips.



2. Remove the navigation system traffic amplifier.
 - Disconnect the 2 antenna cables.
 - Disconnect the electrical connector.
 - Remove the Torx bolt.
 - Release the clip.



Installation

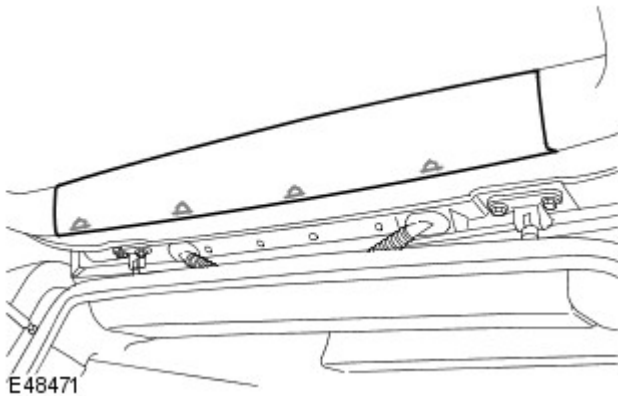
1. Install the navigation system traffic amplifier.
 - Secure the clip.
 - Tighten the Torx bolt to 10 Nm (7 lb.ft).
 - Connect the electrical connector.
 - Connect the antenna cables.
2. Install the liftgate upper trim panel.
 - Secure with the clips.

Navigation System - Navigation System Antenna

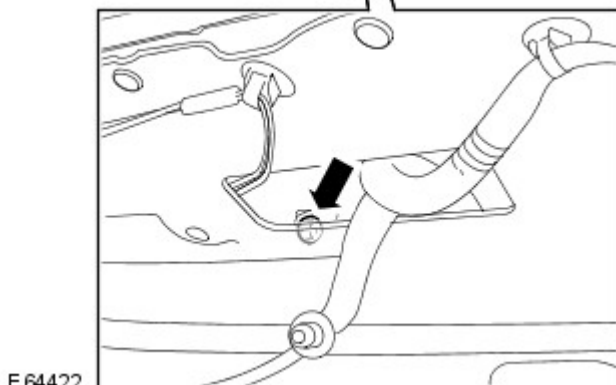
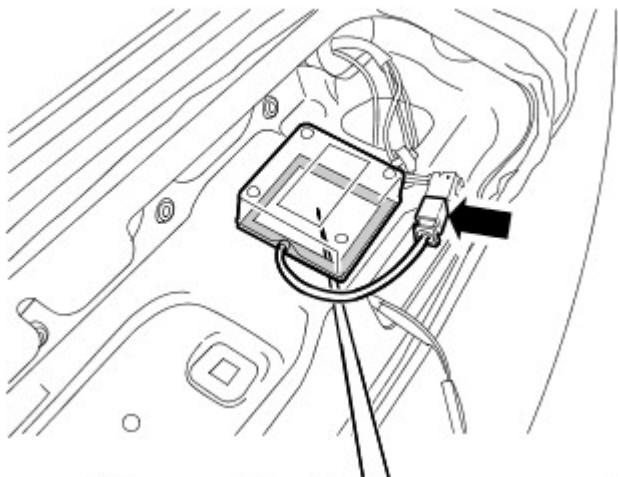
Removal and Installation

Removal

1. Remove the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the high mounted stoplamp.
For additional information, refer to: High Mounted Stoplamp (417-01, Removal and Installation).
3. Remove the liftgate trim panel.
 - Release the 4 clips.



4. Remove the navigation system antenna.
 - Remove the screw.
 - Release and disconnect the electrical connector.
 - Cut through the adhesive retaining pad.



Installation

1. Clean the adhesive contact area.
2. Install the antenna.
 - Connect and secure the electrical connector.
 - Tighten the screw.
3. Install the liftgate upper trim panel.
 - Secure the clips.

4. Install the high mounted stoplamp.
For additional information, refer to: High Mounted Stoplamp (417-01, Removal and Installation).
5. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

Cellular Phone -

Torque Specifications

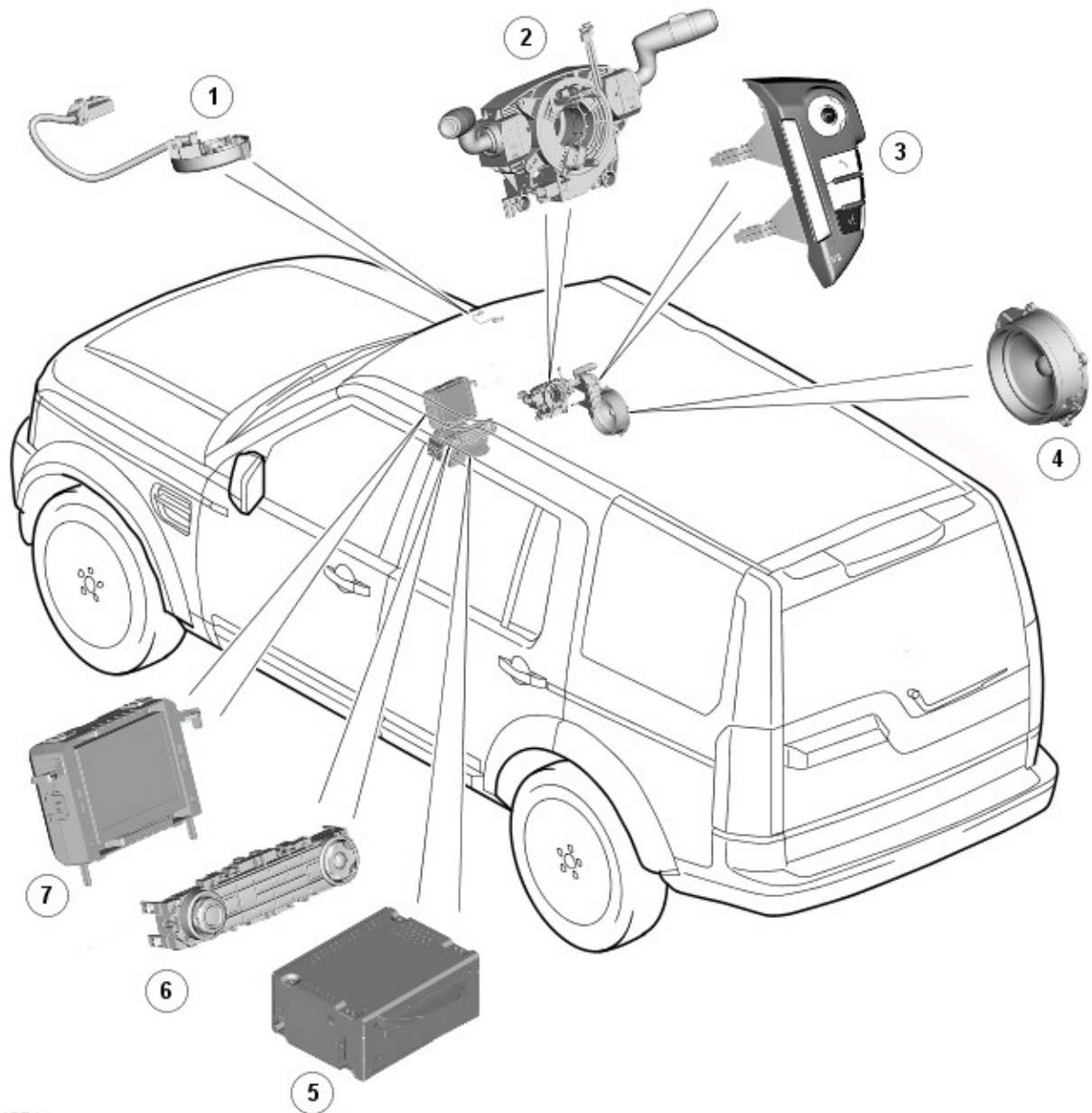
Description	Nm	lb-ft
Cellular phone antenna Torx screw	10	7

Cellular Phone - Cellular Phone

Description and Operation

Component Location

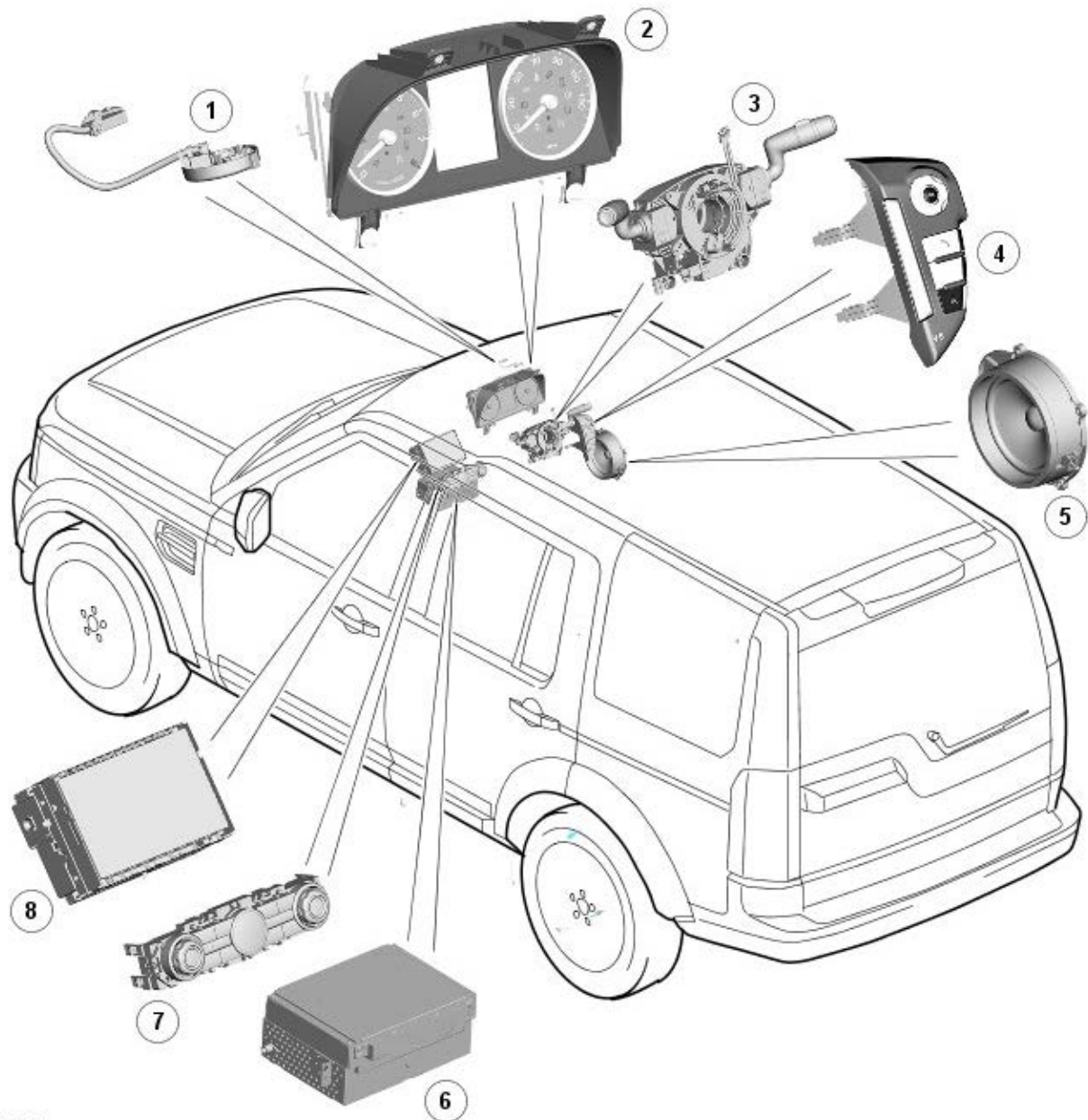
Cellular Phone Component Location - Lo-Line Audio



E141854

Item	Part Number	Description
1	-	Microphone
2	-	Clockspring
3	-	Steering wheel switches
4	-	Vehicle speakers
5	-	Audio head unit
6	-	Integrated control panel (ICP)
7	-	Multi-function display

Cellular Phone Component Location - Mid-Line, High-Line and Premium Audio



E141855

Item	Part Number	Description
1	-	Microphone
2	-	Instrument cluster
3	-	Clockspring
4	-	Steering wheel switches
5	-	Vehicle speakers
6	-	Integrated audio module (IAM)
7	-	Integrated control panel (ICP)
8	-	Touch screen display (TSD)

OVERVIEW

The Bluetooth® telephone system uses the customer's own Bluetooth® capable telephone handset in conjunction with the vehicle information and entertainment system. The system is controlled by the audio head unit on Lo-Line audio systems or the Integrated Audio Module (IAM) on Hi-Line and Premium audio systems. Both the audio head unit and the IAM have a Bluetooth® antenna incorporated into the unit.

Telephone handsets must be paired with the audio head unit or the IAM, requiring the input of a PIN (personal identification number) before they can be used with the vehicle system.

Once paired, any telephone handset can be 'connected' to the vehicle without re-entering the PIN. In addition, previously connected devices will be connected automatically the next time they are present in the vehicle and the ignition is in power mode 6 (ignition on) or power mode 7 (engine running).

Bluetooth® wireless technology allows electronic devices to communicate wirelessly through a short-range RF network. Bluetooth® wireless technology can simultaneously handle data and voice transmissions which allows the vehicle's Bluetooth® telephone system to provide hands free operation of the user's Bluetooth® telephone.

The Land Rover Bluetooth® system supports Bluetooth® Hands-Free Profile (HFP), Advanced Audio Distribution Profile (A2DP) and Audio Video Remote Control Profile (AVRCP).

Lo-Line Audio Bluetooth® System

The Bluetooth® telephone system uses the audio head unit and the multi-function display which communicate on a dedicated medium speed CAN (controller area network) bus. The system allows the driver to connect their own Bluetooth® enabled phone into the integrated phone system using Bluetooth® technology. Bluetooth® technology allowing hands free operation of a Bluetooth® mobile (cell) phone.

The system comprises:

- Audio head unit
- Multi-function display
- Microphone
- Steering wheel control switches.

Pairing of new handsets is achieved by searching for the vehicle Bluetooth® system on the user's telephone handset.

The user must use their own Bluetooth® telephone handset to search for the vehicle, the vehicle name (Land Rover) will be displayed in user's handset. Once selected, the user enters a PIN on their Bluetooth® handset. The code is selected randomly by the audio head unit and is displayed on the multi-function display for the user to enter into their handset (or device).

Up to 6 telephone handsets can be paired with the vehicle, but only one handset can be used at a time for making or receiving a call. The multi-function display will show some telephone handset functionality, including dialing and (if compatible) the telephone handset phone book. The signal strength and battery level can also be displayed if the telephone handset supports this feature. The displayed information allows the user to operate the telephone handset without touching the telephone.



NOTE: There is no physical connection or cradle between the telephone handset and the audio head unit. Communication between the telephone handset and the vehicle system is only via Bluetooth®. This can limit the available functions dependant on the telephone handset used.

The system allows the driver to make, receive and end telephone calls using the multi-function display or steering wheel switches.

Compatible Bluetooth® mobile telephones can communicate with the vehicle's in-built telephone system. Pairing and connection must be made with the ignition on, the engine running or in 10 minute accessory mode.

Mid-Line, Hi-Line and Premium Audio Bluetooth® Systems

The Bluetooth® telephone system uses the Media Oriented System Transport (MOST) ring for communication with the other components in the entertainment and information system.

The system comprises:

- Integrated Audio Module (IAM)
- Instrument cluster (for telephone information in message center)
- Touch Screen Display (TSD)
- Microphone
- Steering wheel control switches
- Audio power amplifier.

Pairing of new handsets is achieved by selection of 'Search New' from the device list screen. The system has two pairing modes; 'vehicle to device' and 'device to vehicle'. Up to 10 Bluetooth® devices can be paired to the vehicle.



NOTE: There is no physical connection or cradle between the telephone handset and the IAM. Communication between the telephone handset and the vehicle system is only via Bluetooth®. This can limit the available functions dependant on the telephone handset used.

The system allows the driver to make, receive and end telephone calls using the TSD or steering wheel switches. On Hi-Line and Premium audio systems the Land Rover Advanced Voice system can be specified.

Compatible Bluetooth® mobile telephones can communicate with the vehicle's in-built telephone system. Pairing and connection must be made with the ignition on or the engine running.

SYSTEM OPERATION

Lo-Line Audio Bluetooth® System

Primary user control of the Bluetooth® telephone system is via the multi-function display and the steering wheel switches. Press the 'PHONE' button on the multi-function display to access the telephone sub-menu options.

Incoming calls are received from the Bluetooth® phone by the audio head unit. The information is processed by the audio head unit and passed to the integral audio power amplifier for audio output through the vehicle's audio speaker system. The telephone information is passed to the multi-function display on a dedicated medium speed CAN bus for display of the appropriate information.

Users can dock their Bluetooth® telephone using their telephone and the multi-function display. The system will try to automatically dock to the last telephone used by the system. Automatic searching for a handset will occur for the first minute after ignition on (power mode 6). If the handset is not available during this time, then docking will require manual control using the select phone option in the phone menu.



NOTE: Pairing a telephone for the first time has to be done from the handset, a pin will appear on the multi-function display.

Mid-Line, Hi-Line and Premium Audio Bluetooth® System

The Bluetooth phone system is controlled from the TSD, via voice control and the steering wheel mounted switches. Signals from the steering wheel switches are sent via the clockspring to the TSD. The TSD sends control signals on the MOST ring to the IAM, where these signals are sent via Bluetooth to the connected mobile phone. Speech is picked up by the microphone and sent to the IAM. Audio from the mobile phone is sent from the IAM on the MOST ring to the audio amplifier and is output on the vehicle speaker system.

The upgraded hands free profile of this system allows the display of the network signal strength, network operator and telephone battery level indication on the vehicle display, where the telephone handset supports this function. Also, if applicable, the telephone handset will show a "car" or "headset" symbol to indicate it is in hands free profile.

All Bluetooth® Systems

Telephone handset manufacturers continually update hardware and software to standard specifications laid down by the Bluetooth® Special Interest Group (SIG), which defines how Bluetooth® should work in an automotive environment. However, because different makes and models may use different software, not all telephone handsets are fully compatible with Land Rover, but through testing individual telephone handset models, Land Rover has produced a list of compatible telephone handsets and the appropriate software version for Land Rover Bluetooth® connectivity.

Refer to the Bluetooth® Connectivity section of the Land Rover website at www.landrover.com, for a list of compatible phones. The list also describes how to check the software version of each individual telephone manufacturer. This list must be consulted by users, sales and service teams to confirm whether customer's telephone handsets are compatible or not. Performance will vary, based on the phone's software version, battery condition, coverage and the network provider. Telephones are warranted by their manufacturer, not Land Rover.

Land Rover is continually validating compatible telephone handset and software combinations. The most up-to-date compatibility list will always be available on-line from Land Rover.



NOTE: To achieve full Bluetooth® telephone handset functionality, it is crucial that the telephone software level matches the version detailed in the list of compatible telephone handsets.

BLUETOOTH®

Bluetooth® is a short-range Radio Frequency (RF) technology that operates at 2.4 GHz and is capable of transmitting voice and data wirelessly. The effective range of Bluetooth® devices is 32 feet (10 meters) with a data transfer rate of 1 Mbps.

Bluetooth® is a wireless RF connection which operates with the user's own telephone handset. It does not have to be fixed into the vehicle and is designed to function without an external aerial. The telephone handset can be located anywhere within the cabin, even in a bag, or jacket pocket. It can work from the luggage compartment, although the signal could be compromised. The telephone handset can be charged from the 12 volt power socket or USB (if supported) while in use.

Lo-Line Systems

The Bluetooth® system supports Advanced Audio Distribution Profile (A2DP) and Audio Video Remote Control Profile (AVRCP). Bluetooth® Audio Streaming and its control are an optional selection. The operation of Bluetooth® Audio Streaming depends up on the features supported in the handset.

Mid-Line, Hi-Line and Premium Systems

The Bluetooth® system supports Bluetooth® Hands-Free Profile (HFP), Phonebook Access Profile (PBAP), Advanced Audio Distribution Profile (A2DP) and Audio Video Remote Control Profile (AVRCP).

COMPONENT DESCRIPTION

DESCRIPTION - LO-LINE AUDIO BLUETOOTH® TELEPHONE SYSTEM

Audio Head Unit

The audio head unit is located in the instrument panel, behind the ICP.

The audio head unit contains the following functionality:

- Bluetooth™ phone
- **AM (amplitude modulation)/FM (frequency modulation)** radio dual tuner with diversity
- Single disc **CD (compact disc)**/MP3 player
- Integrated 80W (4x20W) Amplifier
- DAB tuner (if fitted)
- **USB (universal serial bus)**/iPod connectivity (if fitted)
- Auxiliary input (for any device featuring a 3.5mm jack plug output)
- Provides audible beeps for the park aid system, if fitted.

The audio head unit communicates with the multi-function display on a dedicated **CAN** bus. The multi-function display communicates with the other vehicle systems on the medium speed **CAN** bus and is therefore the 'gateway' for the lo-line audio system.

The audio head unit contains an internal 80W amplifier which directly drives the vehicle speakers. Amplifier comprises

4 x 20W channels.

When the Bluetooth® telephone is specified, the audio head unit supports the Bluetooth™ telephone functionality and audio streaming. Bluetooth® telephone software and a Bluetooth® antenna are located within the audio head unit. The software within the head unit processes the Bluetooth® wireless signals from the users Bluetooth® telephone and allows audio output and data display on the multi-function display.

A microphone, located in the overhead console, is hardwired directly to the audio head unit which processes the microphone input into a Bluetooth® output to the users Bluetooth® telephone. Audio from the users Bluetooth® telephone is transmitted via the Bluetooth® to the audio head unit, which processes the signals and outputs them on the vehicle speaker system via the integral audio power amplifier.

Multi-Function Display

The multi-function display is located in the instrument panel, above the ICP.

The multi-function display is connected to other vehicle systems on the medium speed CAN bus and to the audio head unit on a dedicated CAN bus. The multi-function display receives information from other vehicle systems on the medium speed CAN bus and passes it to the audio head unit on the dedicated CAN bus.

The multi-function display features a 5" color Thin Film Transistor (TFT) Liquid Crystal Display (LCD) screen. Buttons surrounding the screen operate the infotainment system functions, with the exception of the parking aid button. Additional controls for audio are also available on the ICP.

The multi-function display has controls for radio, CD, auxiliary input and telephone. A 'Menu' button allows for the selection and adjustment of audio settings, clock settings and language. Each menu can be scrolled through using a 'four-way' menu navigation control switch and the selected menu can be displayed by pressing the 'OK' button in the center of the control switch.

The multi-function display also processes signals from the steering wheel switches for telephone functions. The operation of each steering wheel switch is via a resistive ladder and the multi-function display processes the received voltage to determine the function selected. This information is then passed to the audio head unit on the dedicated CAN bus to carry out the request.

Answering/Rejecting/Ending calls

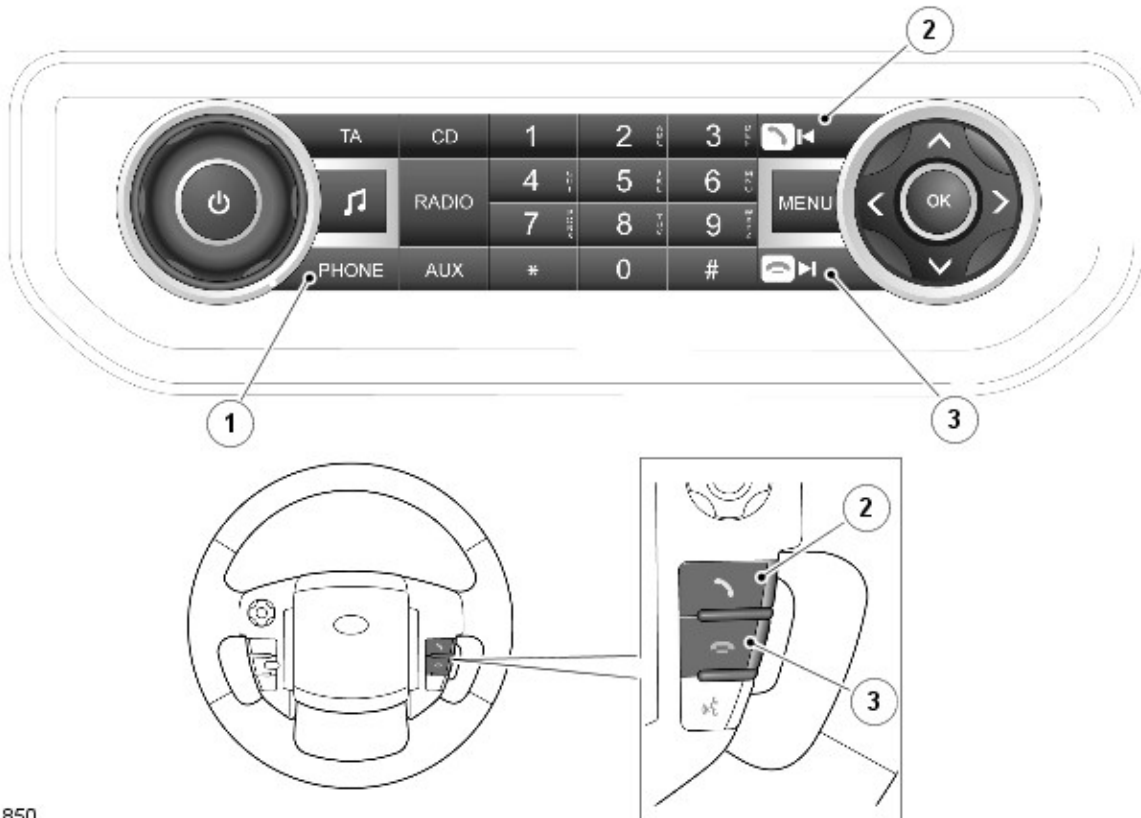
- Press the accept call button on the steering wheel control to answer an incoming call
- To reject or end a call, press the end call button or the steering wheel control

Dialed

- From the PHONE home screen, use the numeric keypad to enter a telephone number
- Press OK or the steering wheel control accept call switch to dial the number.

If the audio system is in use when a phone call is active, the audio source is suppressed for the duration of the call. Parking aid warnings are not suppressed.

Bluetooth® Telephone Controls



E141850

Item	Part Number	Description
------	-------------	-------------

- 1 - PHONE button - press to select the telephone mode
- 2 - Press to answer call or dial number
- 3 - Press to end call or reject incoming call.

Microphone



E142032

The directional type microphone is fitted to the driver's side of the overhead console so that it is directed towards the driver. It is connected to the audio head unit for hands free telephony.

Bluetooth®

The Bluetooth® phone system allows the user to pair and connect their own mobile phone handset (Bluetooth® enabled only) to the vehicle telephone system.

Once connected, the user can use the vehicle hands free functions. The Bluetooth® system limits the functions to those available in the Bluetooth® hands free profile.

The available features include:

- Make/receive calls
- Dial voicemail number
- Signal strength, network operator and battery level indication on the multi-function display (if supported by the telephone handset software)
- Phonebook download (if supported by the telephone handset)
- Dialed calls (if supported by the telephone handset)
- Missed calls (if supported by the telephone handset)
- Received calls (if supported by the telephone handset).

Bluetooth® Pairing

Before a Bluetooth® phone handset can be used on the vehicle hands free system, the phone must be 'paired' to the Bluetooth® phone system. The following steps describe the 'pairing' process:



NOTE: The process of pairing and connecting your phone with the vehicle using the mobile phone will vary depending on the type of mobile phone used.

- Switch the ignition on and ensure that the audio system is active and that no other phone is currently connected to the vehicle's Bluetooth® system.
- Using the mobile phone, search for Bluetooth® devices. On some phones, this is referred to as a new paired device. See the telephone's operating instructions for further information.
- When the vehicle's Bluetooth® system is discovered (named Land Rover), select this device from the list.
- When prompted, enter the Bluetooth® PIN (Personal Identification Number) into the mobile phone. This number is randomly generated by the vehicle system and will be displayed on the screen.
- Once the phone is paired and connected to the system, it can dock automatically. If it does not automatically dock, connect manually with the Bluetooth® system, via the mobile phone. Consult the telephone's instructions for further information.



NOTE: Some telephones require the Bluetooth® pairing to be set as 'authorised' or 'trusted' in order to automatically connect. Refer to the telephone operating instructions for further information.

Changing the connected phone

Up to 6 mobile phones can be paired with the vehicle in the same way. However, only one can be connected and ready for use as a phone at any one time.

To connect a different paired phone, follow the steps below:

- Press the **Phone** button.
- A menu will appear. Choose 'Select Phone'.
- Identify and select the phone from the displayed list.
- Once the phone is connected to the system, a confirmation message will be displayed.

DESCRIPTION - MID-LINE, HI-LINE AND PREMIUM AUDIO BLUETOOTH® TELEPHONE SYSTEM

Integrated Audio Module (IAM)



E140303

The IAM is located in the instrument panel, behind the Integrated Control Panel (ICP). The IAM communicates with the Bluetooth® phone using internal hardware and a Bluetooth® antenna and software for telephone functionality.

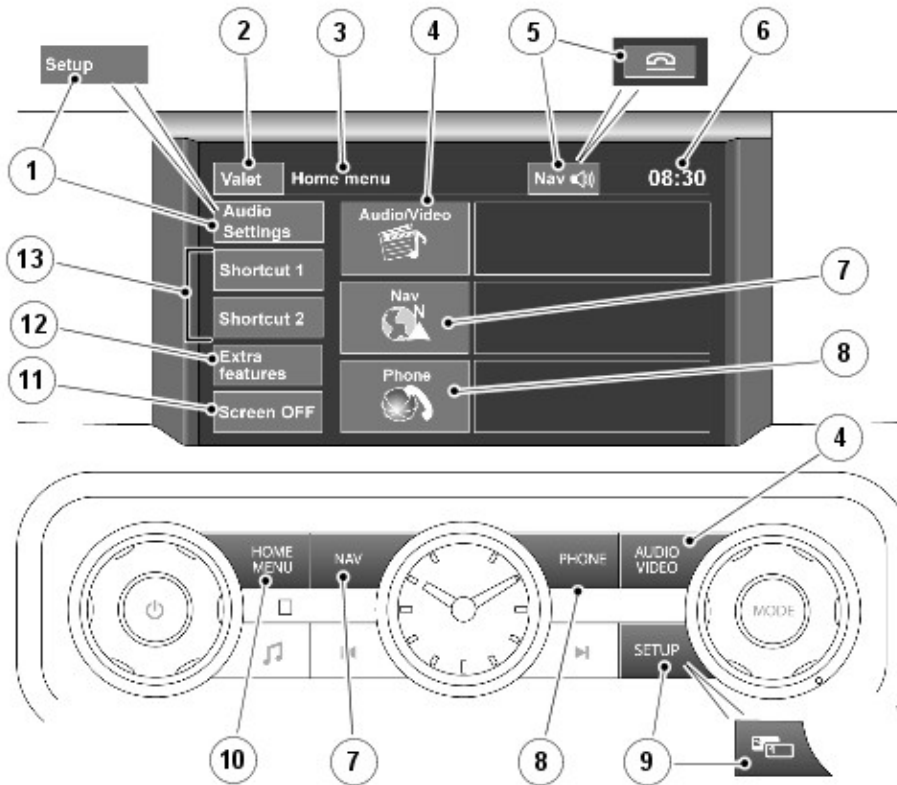
The IAM is connected to the Media Oriented system Transport (MOST) ring and communicates with the TSD and audio amplifier in order to provide the telephone feature in the vehicle.

When the Bluetooth® telephone is specified, the IAM supports the Bluetooth™ telephone functionality and audio streaming. Bluetooth® telephone software and a Bluetooth® antenna are located within the IAM. The software within the IAM processes the Bluetooth® wireless signals from the users Bluetooth® telephone and allows audio output, voice input and data display on the TSD.

The hands free microphone is hardwired to the IAM. The microphone is also used by the Land Rover Voice system for telephone and other infotainment system operation.

For additional information, refer to: Audio System (415-01B, Description and Operation).

Touch Screen Display (TSD)



E141851

Item	Part Number	Description
1	-	Audio settings menu
2	-	Valet mode
3	-	Menu title
4	-	Audio/Video menu
5	-	End a call when using the phone or last given navigation instruction repetition
6	-	Time display
7	-	Navigation menu
8	-	Phone menu
9	-	Touch screen setup menu
10	-	Home menu
11	-	Turn off the touch screen display
12	-	Extra features menu
13	-	Home menu presets

The Touch Screen Display (TSD) provides the user interface of the Bluetooth® telephone system.

The Touch Screen Display (TSD) forms the basis of the telephone system. It communicates with the rest of the audio/infotainment system on the MOST ring and allows control of the telephone system and other infotainment systems from a single point.

The TSD communicates with the Integrated Audio Module (IAM) on the MOST ring and provides the driver interface and driver display of the telephone system. The TSD also provides driver display and control of the audio, the rear view camera, the navigation system, the Traffic Message Channel and the rear seat entertainment.

The telephone system and other systems are operated by a combination of the physical buttons located on each side of the screen and the 'virtual' buttons (icons) displayed on the touch screen, in addition to the steering wheel mounted switches. For clarification, the physical buttons on the TSD are referred to as 'buttons' and the touch screen virtual buttons are referred to as 'icons'.

For additional information, refer to: Audio System (415-01B, Description and Operation).

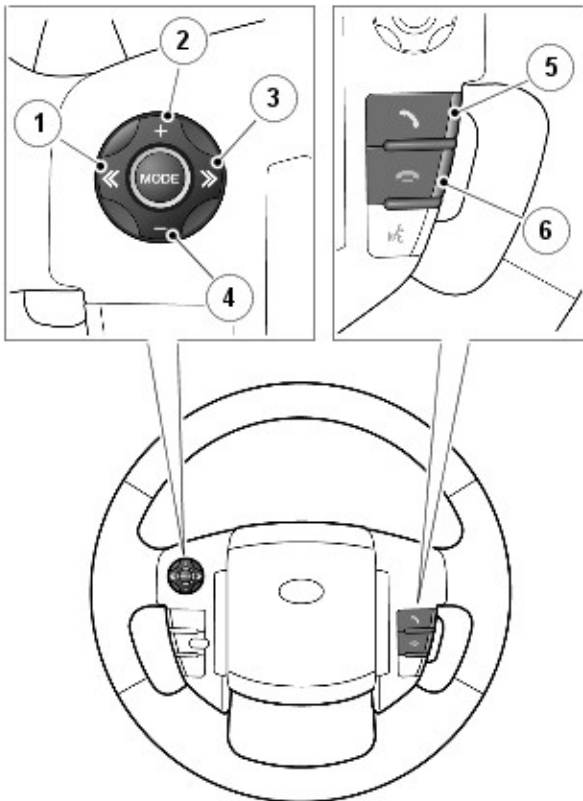
Microphone



E142032

The directional type microphone is fitted to the driver's side of the overhead console so that it is directed towards the driver. It is connected to the Integrated Audio Module (IAM) for hands free telephony, voice control and dynamic volume control (DVC) systems. The IAM has an integrated noise suppression and echo cancellation system for hands-free telephone use.

Steering Wheel Control Switches



E141852

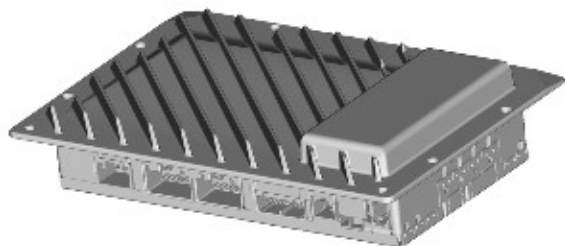
Item	Part Number	Description
1	-	Press to scroll up a displayed list.
2	-	Press to increase volume when in a call.
3	-	Press to scroll down a displayed list.

- 4 - Press to decrease volume when in a call.
- 5 - Press and release to access last 10 dialled list or dial a number/contact. Press and hold to access phonebook list view.
- 6 - Press to end a call or to reject an incoming call.

The steering wheel switches for the telephone system are located on the **LH (left-hand)** side of the steering wheel. The driver is able to use these switches for several phone related functions including:

- Accept incoming calls.
- Reject incoming calls.
- Make phone calls from the phones own phone book (phone book/call lists).

Audio Power Amplifier



E136029

The audio power amplifier is located below the front **LH** seat. It is connected to the audio system via the MOST bus. Speaker connections from the amplifier are hardwired.

Telephone audio during a call is played through the front speakers.

Bluetooth®

The Bluetooth® phone system allows the user to pair and connect their own mobile phone handset (Bluetooth® enabled only) to the vehicle telephone system.

Once connected, the user can use the vehicle hands free functions. The Bluetooth® system limits the functions to those available in the Bluetooth® hands free profile.

The available features include:

- Make/receive calls
- Dial voicemail number
- Signal strength, network operator and battery level indication on the TSD (if supported by the telephone handset software)
- Phonebook download (if supported by the telephone handset)
- Dialed calls (if supported by the telephone handset)
- Missed calls (if supported by the telephone handset)
- Received calls (if supported by the telephone handset).

Bluetooth® Pairing

Before a Bluetooth® phone handset can be used on the vehicle hands free system, the phone must be 'paired' to the Bluetooth® phone system. The following steps describe the 'pairing' process.

There are two ways of pairing a mobile phone to the vehicle system: From vehicle to device or from device to vehicle.



NOTE: The process of pairing and connecting your phone with the vehicle using the mobile phone will vary depending on the type of mobile phone used. Selecting 'search new' only appears if pairing for the 1st time, subsequent attempts to use the 'search new' soft key needs to be accessed by pressing the Change Phone 1st soft key.

- Switch the ignition system on and ensure that the touch screen is active.
- From the home menu, select **Phone**.
- A menu will appear. Select **Search new**.



NOTE: The vehicle's Bluetooth® system is discoverable for only 3 minutes.

Device to Vehicle

- Select **Device To Vehicle** option. On some phones, this is referred to as new paired device. See your phone's operating instructions for further information.
- When the vehicle's Bluetooth® system is discovered (named Land Rover), follow the on-screen instructions. Select **Yes** when prompted, to confirm the pairing. Either the phone or the vehicle system will ask for a PIN (Personal Identification Number). When prompted, enter a PIN of your choice and select **OK** to confirm.
- Enter the same PIN into the other device.
- Once your phone is paired and connected to the system, a confirmation message will be displayed before switching to the Digit Dial screen.

Vehicle to Device

- Select **Vehicle To Device** option.
- Identify your phone from the displayed list and select the corresponding **Pair and Connect** option.
- A **PIN** will be displayed in the TSD, enter this **PIN** into your phone.
- Once your phone is paired and connected to the system, a confirmation message will be displayed before switching to the Digit Dial screen.



NOTE: Some mobile phones require the Bluetooth® pairing to be set as 'authorized' or 'trusted' in order to automatically connect. Please refer to your phone's operating instructions for further information.

Changing the connected phone

Up to 10 mobile devices (mobile telephones or other Bluetooth® audio devices) can be paired with the vehicle in the same way. However, only one can be connected and ready for use as a phone at any one time.



NOTE: Bluetooth audio devices will use one of the 10 allocated pairing slots, but will not be displayed in the telephone device list if they do not support telephony function.

To connect a different paired phone, follow the steps below:

- From the Home menu, select **Phone**.
- A menu will appear. Select **Change phone**.
- Identify and select the phone from the displayed list.
- Once the phone is connected to the system, a confirmation message will be displayed before switching to the Digit Dial screen.

Advanced Land Rover Voice Control (Mid-Line, Hi-Line and Premium Systems Only)

The advanced Land Rover system provides the driver with the option of voice control for a range of supported functions. The following systems include Land Rover Voice functionality:

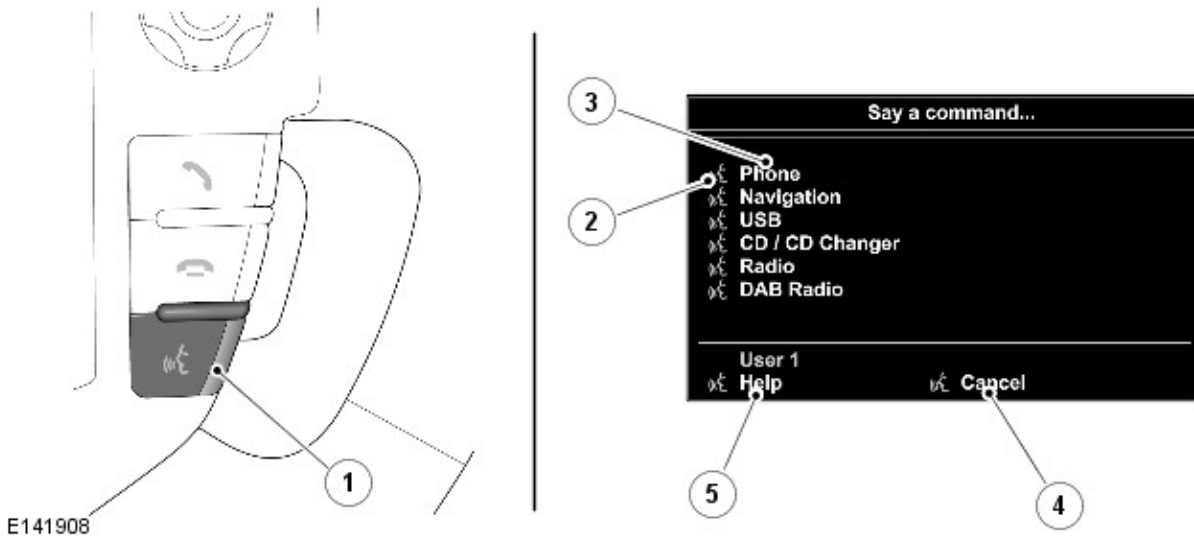
- Bluetooth® Telephone system
- Navigation system
- Vehicle notepad
- Radio, SDARS and DAB (if fitted)
- **CD** player
- Hard disk drive/virtual CD player
- USB and auxiliary connections.

There is a help and tutorial function to provide advice on using the system. The 'notepad' facility allows voice notes to be recorded. Voice tags for phone dialling, radio stations and navigation locations allow the system to be personalized.

The system allows the vehicle user to concentrate fully on driving the vehicle, without any need to divert their eyes from the road ahead in order to check information read outs on the vehicle instrument panel information units. The voice control system also feeds back audible information to the vehicle user.

The advanced Land Rover Voice system uses a 'visual prompter' system known as 'Say What You See' (SWYS). Each of the Advanced Land Rover Voice functions are supported by 'Help' commands; saying "Help" at each point in the conversation will give a context sensitive explanation of what the user can do at that point. The SWYS is shown in the TSD.

Voice control is mainly a software based system. The software for controlling the voice system is resident in the IAM and the TSD. The IAM and TSD each contain more than one voice control software component and communication between the two modules is via the MOST ring. A voice control microphone is located in the front overhead console and is hardwired to the IAM.



Item	Part Number	Description
1	-	Voice button
2	-	Voice symbol
3	-	SWYS command list
4	-	When displayed, say Cancel to cancel the current voice session
5	-	When displayed, say Help to get assistance during a voice session

Advanced Land Rover Voice is a key component of the Bluetooth® telephone system, allowing hands free control and use of the Bluetooth® enabled phone.



NOTE: Telephony voice commands are only accessible when a Bluetooth® device is docked to the vehicle.

The system is operated by the voice button on the LH side of the steering wheel. Voice commands are detected by the microphone in the overhead console. When giving a voice command audible feedback will be heard through the vehicle's audio speakers.

Efficient operation of Advanced Land Rover Voice is reliant on the user understanding some of the following basic operating conditions;

- Face forwards, sitting in a normal driving position
- After pressing the voice button, always wait for the end of the audible tone before speaking
- Speak naturally, as if you were talking to a passenger or on the phone without pausing between words
- When the system asks for more information, always wait for the end of the tone before responding
- Always say numbers clearly but at a natural pace
- Excessive noise, for example while driving with windows open, may cause voice command mis-recognition. If it is too noisy to use the phone, it is likely that voice commands will not be recognized

Most accents are understood without difficulty, but if the system does not recognize the command it will respond "SORRY" and allow two more attempts to say the command.

Voice feedback is given in the same language as the command recognition. It is possible to change the language of the speech control system by changing the system language.

Starting a Voice Session

To start a voice session the driver must press the voice button briefly. An audible tone can be heard, followed by the presentation of the voice command menu list in the SWYS pop-up in the TSD. A voice symbol alongside each item in the list indicates that the system is listening for one of the available commands. Always wait for the listening tone before using the command. To end the voice session press and hold the voice button.

When the voice button is pressed on the steering wheel, a voltage signal is received by the TSD via the clockspring. The voltage is sent on a single wire through a resistive ladder. The voice system activation is processed on the MOST ring, for example the voice menu list is retained in and presented by the TSD. The accompanying voice instruction is sent to the audio power amplifier from the IAM on the MOST ring for broadcast over the vehicle speakers. When a recognized user instruction is received by the IAM via the microphone, the instruction is processed by the IAM and sent to the TSD to perform the required action.

Voice Tutorial

There is a voice tutorial that can be accessed either by giving the 'voice tutorial' command or by pressing the 'voice tutorial' button located in the 'operating guide' option in the 'Voice settings' menu on the TSD. The tutorial gives information on how to use the voice system, useful tips and how an experienced user can speed up their interaction with the voice system by turning voice feedback off, using barge-in and saying shortcut commands.

Voice Training

The voice system allows two different users to create separate profiles, providing training for a User 1 and User 2. Voice training is used to help the system recognize the users voice more accurately. When training is activated for

each user, a message is displayed to confirm that training is in progress for that user. The message informs the user that voice training must be fully completed in order to activate the new voice profile and offers the option of 'OK' to initiate the session and store data in that user profile, or 'Cancel' to return to the previous menu. Once activated, another message indicates that training is in progress. Voice training phrases will be shown in the TSD voice menu and the user will be requested to say each phrase after the listening tone.



NOTE: Voice training can only be conducted when the vehicle is stationary with the engine running and the climate control NOT in defrost due background noise.

Voice tags and training are stored in a non-volatile memory in the IAM. Disconnection of the vehicle battery will not cause any loss of data stored.

NOTES:



To enable new voice tags and training to be written to memory, a period of 10 minutes after the last ignition off cycle must take place. Should the battery be disconnected before this time then the data may be lost.



If the IAM is replaced then all stored data will be lost. If either the IAM or TSD are replaced, it is recommended that the vehicle language settings and voice language settings (if vehicle language is not supported by voice control) are reset to the same setting.

Voice Tags

Voice tags allow the user to store voice entries as shortcuts to control dialling numbers (as well as to recall radio stations and plot to navigation locations). The voice tags sub-menu accesses controls for navigation, telephone, radio and DAB/SDARS (where fitted).

Phone Dial Number

Phone dial number allows the user to verbally enter a dial string into the voice system to allow the user to dial that number using a connected Bluetooth® telephone.

Voice Caller Announce

When enabled in the Phone settings, the Voice system will announce the name of the incoming caller identity through the system speakers.

Dialing from GP2 Phonebook

Provided the phonebook has been downloaded via Bluetooth®, the voice system is able to perform a grapheme-to-phoneme (GP2) transcription of each of the names stored in the phonebook. This is then used by the voice system to allow the user to use the 'phone dial contact' command to dial a contact by saying the name stored in the phonebook, there is no need to store a voice tag first.



NOTE: The phonebook must be fully downloaded for speech to build a recognition dictionary. It does not use the cached version that the phone does. This is why in some circumstances the phonebook can be seen on the TSD, but if the phonebook has not yet been fully downloaded, then the voice system will give the audible error feedback 'this function is currently unavailable'.

The users' voice command is matched against the phonebook entries and a list of likely recognition candidates is displayed in a 'picklist' for the user to select from. If the chosen contact has more than one number associated with it, the voice system will work with the user to determine the exact number they wish to dial.



NOTE: For regularly used contacts with more than one number, the user can store a voice tag as a shortcut.

Command List

A full list of all shortcut voice commands can be found on the TSD by pressing the 'command list' button in the 'voice settings' menu. Select a device name from the list to see all the shortcut commands available to interact with that device. Pressing the 'i' button next to any command shows alternative ways of saying the same command.

Navigation Destination Entry by Voice

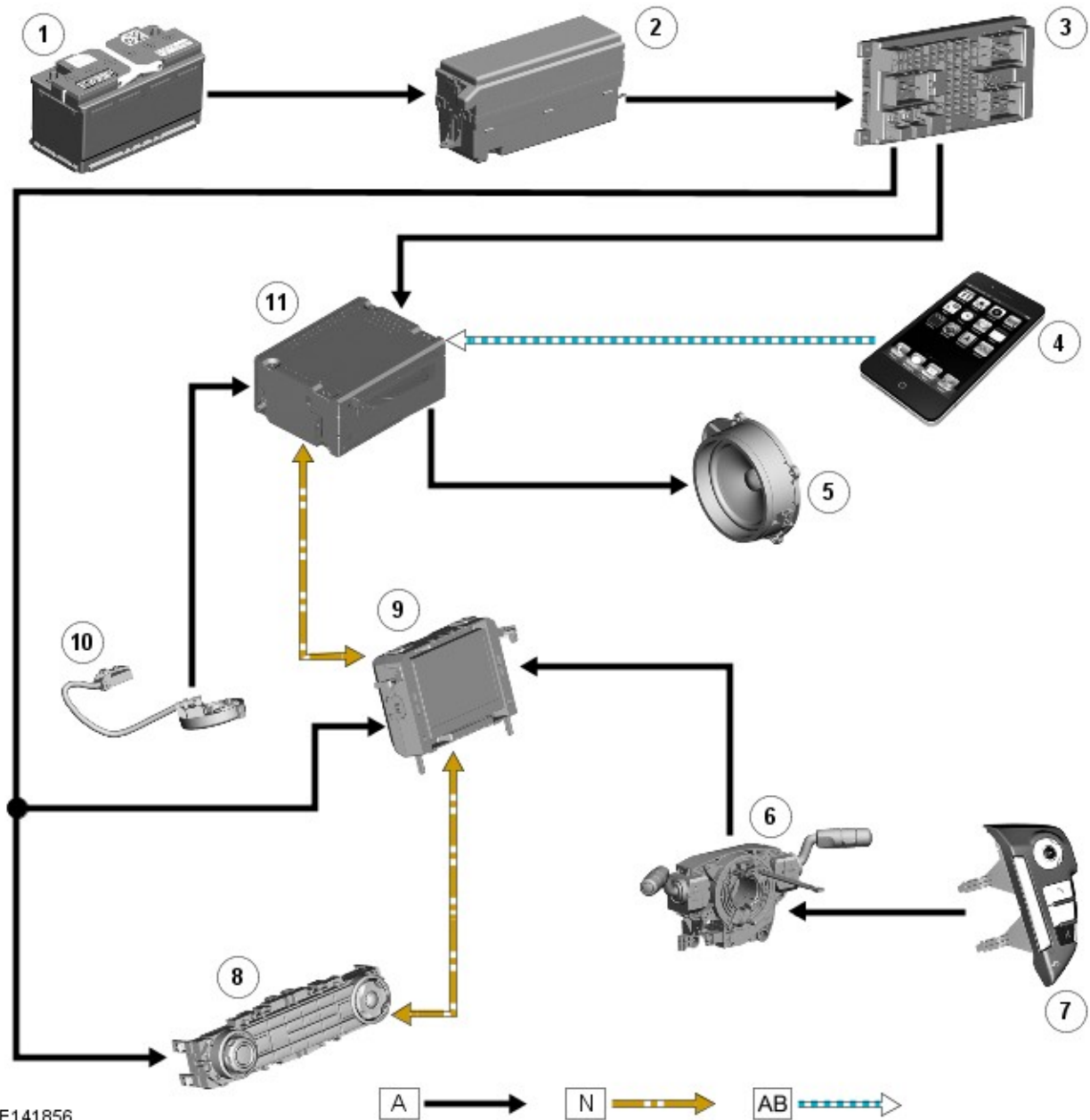
Destination entry uses phonetic transcriptions of the navigation data (stored as part of the map data) to offer the user the ability to enter an address or postcode into the Navigation system by voice. The user simply follows the visual and audible instructions given by the voice system and enters their desired address in a step-by-step manner (e.g. city, then street, then house number). At each address entry stage, the user's voice command is matched against the phonetic map data and a list of likely recognition candidates is presented in a "picklist" for the user to select from. If the chosen address has more than one location associated with it, the voice system will work with the user to determine the exact address they wish to navigate to.

CONTROL DIAGRAM

CONTROL DIAGRAM - LO-LINE AUDIO BLUETOOTH® TELEPHONE SYSTEM



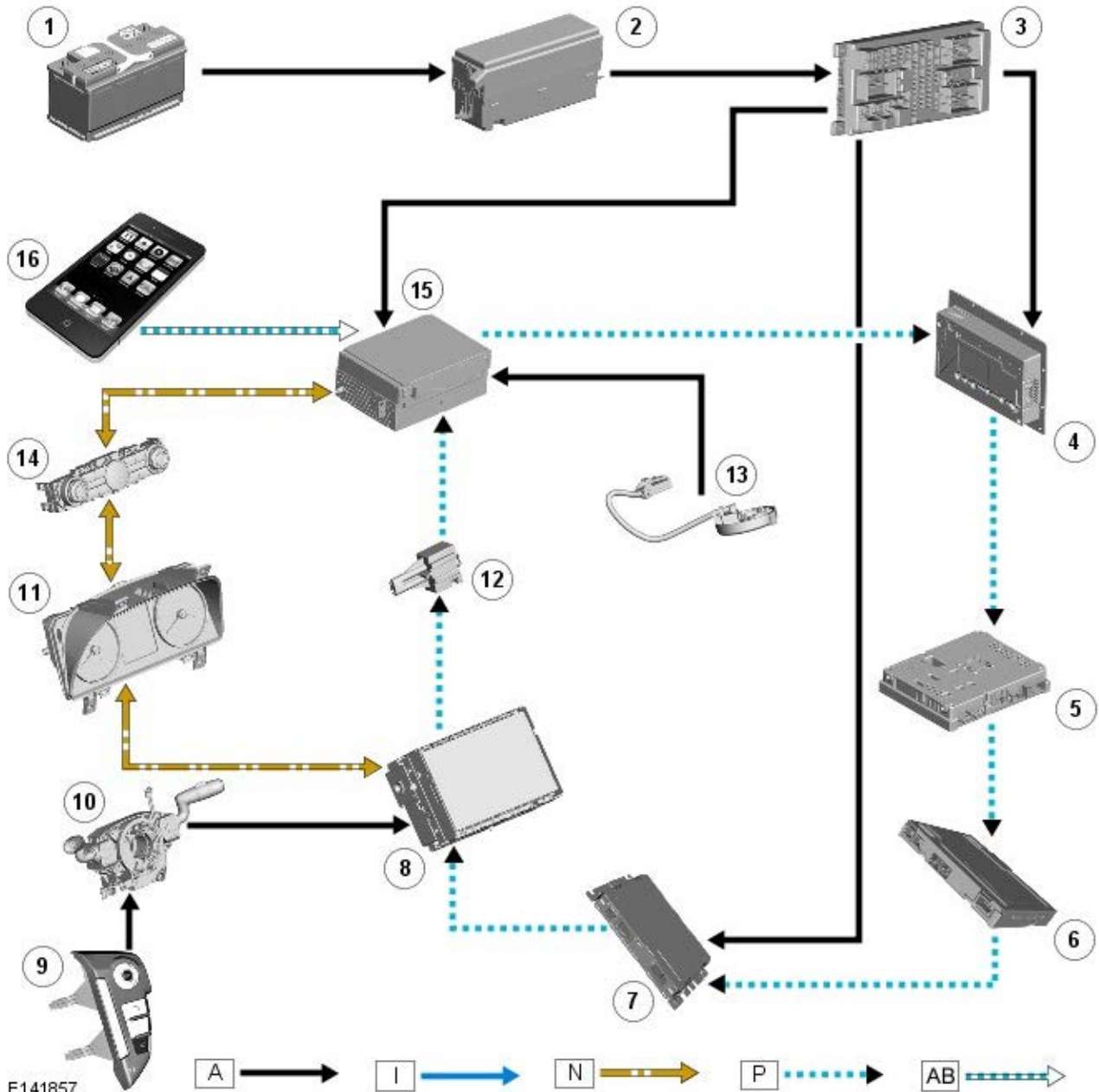
NOTE: **A** = Hardwired; **N** = Medium Speed CAN bus; **P** = MOST; **AB** = Bluetooth®



E141856

Item	Part Number	Description
1	-	Battery
2	-	EJB (engine junction box)
3	-	CJB (central junction box)
4	-	Customer telephone
5	-	Vehicle speakers
6	-	Clockspring
7	-	Steering wheel switches
8	-	Integrated control panel (ICP)
9	-	Multi-function display
10	-	Microphone
11	-	Integrated audio module (IAM)

CONTROL DIAGRAM - MID-LINE, HI-LINE AND PREMIUM AUDIO BLUETOOTH® TELEPHONE SYSTEM



Item	Part Number	Description
1	-	Battery
2	-	EJB
3	-	CJB
4	-	Audio power amplifier
5	-	TV tuner (Reference only)
6	-	Rear Seat Entertainment (RSE) module (Reference only)
7	-	DAB/SDARS receiver (Reference only)
8	-	Touch screen display (TSD)
9	-	Steering wheels switches
10	-	Clockspring
11	-	Instrument cluster
12	-	MOST diagnostic connector
13	-	Microphone
14	-	Integrated Control Panel (ICP)
15	-	Integrated audio module (IAM)
16	-	Customer telephone

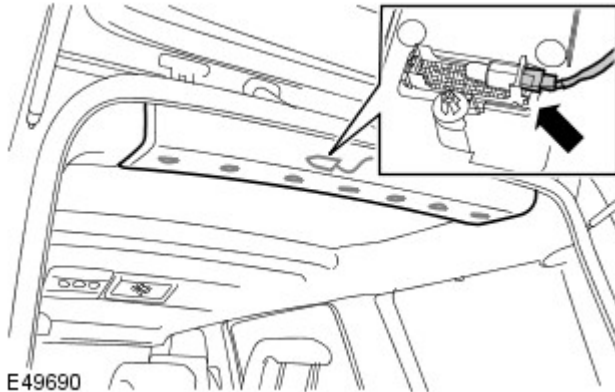
Cellular Phone - Cellular Phone Antenna Vehicles With: Metal Roof Panel

Removal and Installation

Removal



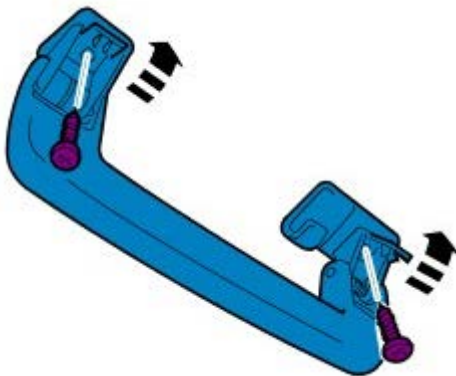
NOTE: For certain markets, the SDARS antenna is also part of the cellular phone antenna.



E49690

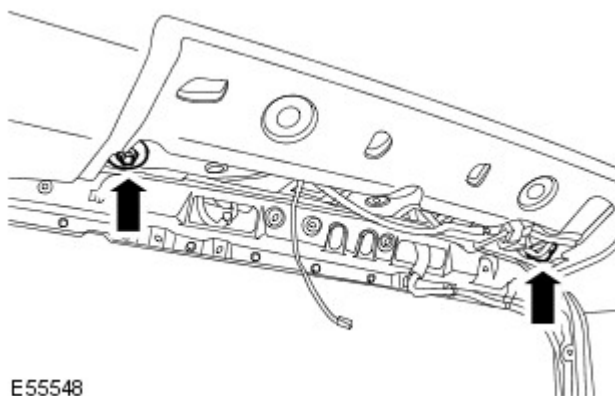
1. Remove the rear headliner trim panel.
 - Release the 7 clips.
 - Disconnect the interior light electrical connector.

2. If installed remove the LH third row seat passenger assist handle.
 - Carefully release the screw covers.
 - Remove the 2 screws.



E49689

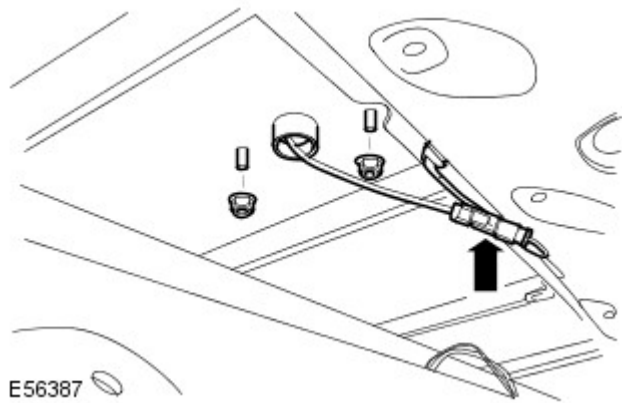
3. If installed, remove the RH third row seat passenger assist handle.
 - Carefully release the screw covers.
 - Remove the 2 screws.



E55548

4. Release the rear of the headliner.
 - Release the 2 clips.

5. Remove the cellular phone antenna.
 - Disconnect the electrical connector.
 - Remove the 2 nuts.




Installation

1. Install the cellular phone antenna.
 - Tighten the nuts to 10 Nm (7 lb.ft).
 - Connect the electrical connector.
2. Attach the rear of the headliner.
 - Secure with the clips.
3. Install the RH third row seat passenger assist handle, if installed.
 - Tighten the screws.
 - Attach the covers.
4. Install the LH third row seat passenger assist handle, if installed.
 - Tighten the screws.
 - Attach the covers.
5. Install the rear headliner trim panel.
 - Secure in the clips.
 - Connect the electrical connector.

Cellular Phone - Cellular Phone Antenna Vehicles With: Glass Roof Panel

Removal and Installation

Special Tool(s)

 <p>419-002</p> <p>E57688</p>	<p>Torx bit, phone/SDARS antenna 419-002</p>
--	--

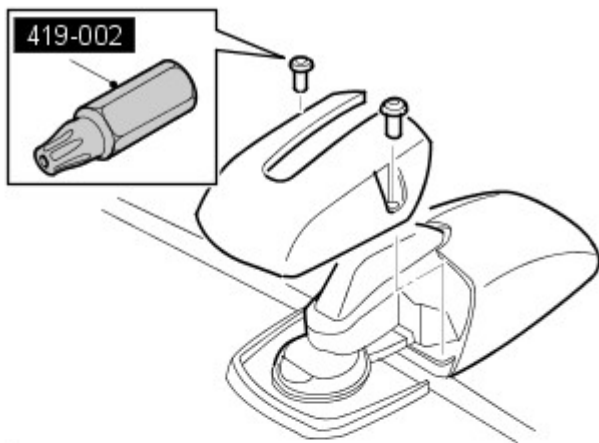
Removal



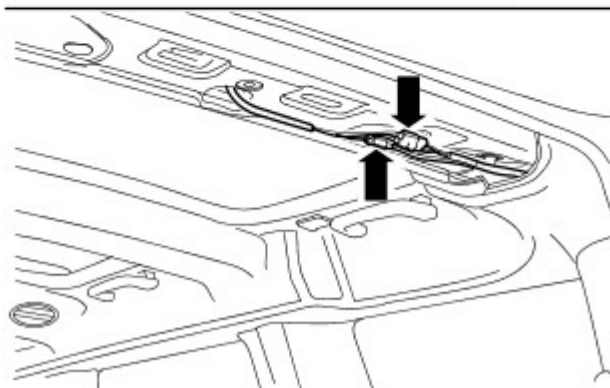
NOTE: For certain markets, the SDARS antenna is also part of the cellular phone antenna.



1. Remove the rear headliner trim panel.
 - Release the 7 clips.
 - Disconnect the interior light electrical connector.



2. Remove the cellular phone antenna.
 - Disconnect the electrical connector.
 - Using the special tool, remove the 2 Torx bolts.



Installation

1. Install the cellular phone antenna.
 - Tighten the bolts to 6 Nm (4 lb.ft).
 - Connect the electrical connector.
2. Install the rear headliner trim panel.
 - Secure in the clips.
 - Connect the electrical connector.

Cellular Phone - Transceiver Module

Removal and Installation

Removal

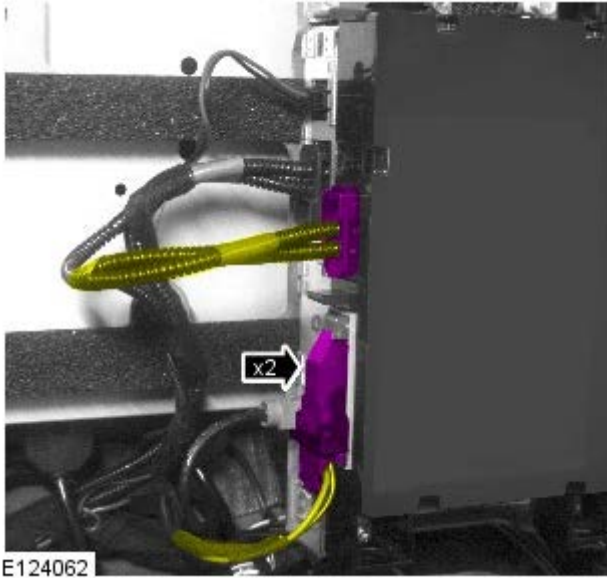


NOTE: Removal steps in this procedure may contain installation details.

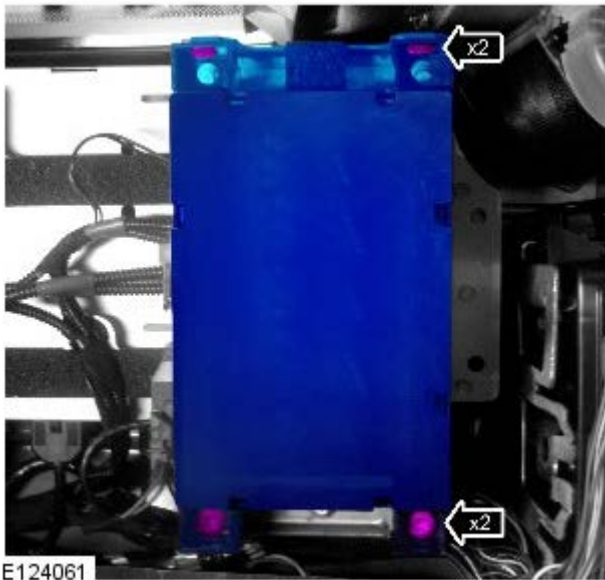
1. Remove the RH lower rear quarter trim panel.

Refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).

2.



3. Torque: 10 Nm



Installation

1. To install, reverse the removal procedure.

Multifunction Electronic Modules - Driver Door Module (DDM)

Diagnosis and Testing

Principles of Operation

For a detailed description of the Driver/Passenger door systems and operation, refer to the relevant Description and Operation sections in the workshop manual.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Switches/mechanisms 	<ul style="list-style-type: none"> • Fuses • Electrical connectors • Harnesses • Modules

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of DTCs that may be logged on this vehicle, refer to the DTC Index in section 100-00.
 REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Driver/Passenger Door Module (DDM/PDM) (100-00, Description and Operation).

Multifunction Electronic Modules - Driver Seat Module (DSM)

Diagnosis and Testing

Principles of Operation

For a detailed description of the Driver/Passenger seat systems and operation, refer to the relevant Description and Operation sections in the workshop manual.

Inspection and Verification

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Switches/mechanisms 	<ul style="list-style-type: none"> • Fuses • Electrical connectors • Harnesses • Modules

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

DTC Index

For a list of DTCs that may be logged on this vehicle, refer to the DTC Index in section 100-00.

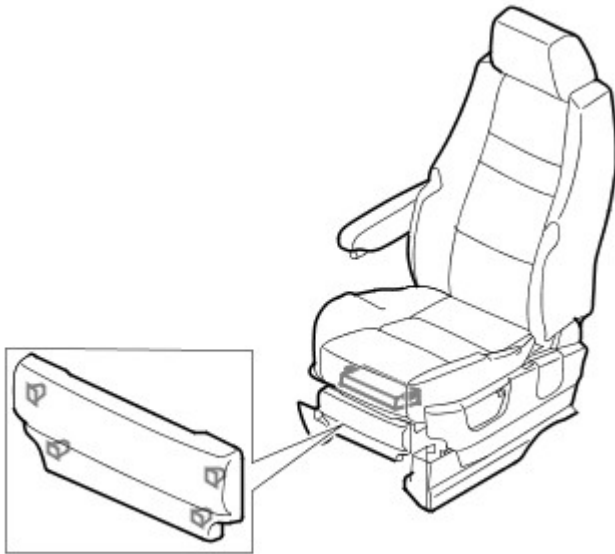
REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Driver/Passenger Front Seat Module (DSM/PSM) (100-00, Description and Operation).

Multifunction Electronic Modules - Driver Seat Module (DSM)


Removal and Installation

Removal

1. Remove the front seat cushion front access cover.
 - Release the 4 clips.



E93329

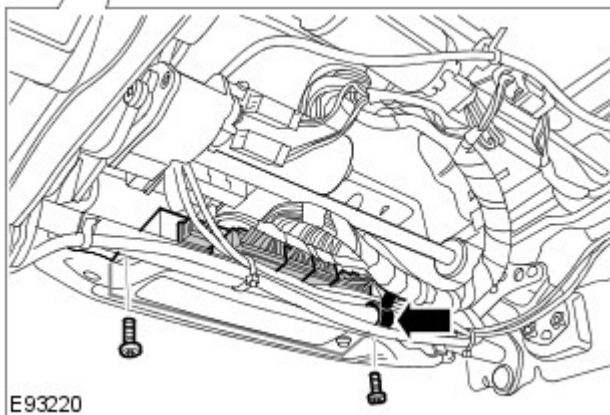
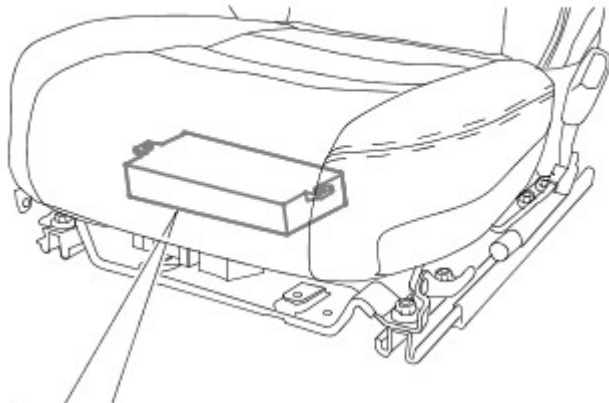
2.  **CAUTION:** Note of the routing of the wiring harnesses.



NOTE: Raise the seat base for access.


Remove the driver seat module.

- Remove the 2 Torx screws.
- Release the harness clip.
- Disconnect the 5 electrical connectors.



E93220

Installation

1.  **CAUTION:** Make sure that the wiring harnesses are correctly routed.

Install the driver seat module.

- Connect the electrical connectors.
- Attach the wiring harness clip.
- Install and tighten the Torx screws.

2. Install the access cover.

- Secure in the 4 clips.
3. If a new module has been installed, carry out initialization.
 - Using each adjustment switch in turn, move the seat fully in all directions.

Multifunction Electronic Modules - Rear Entertainment Control Module

Removal and Installation

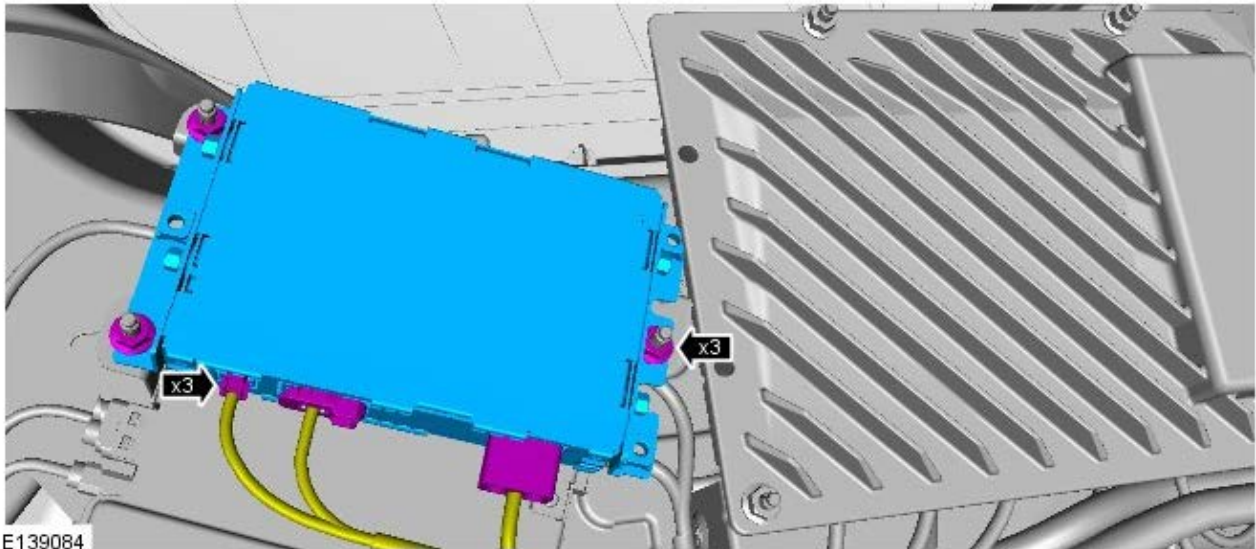
Removal



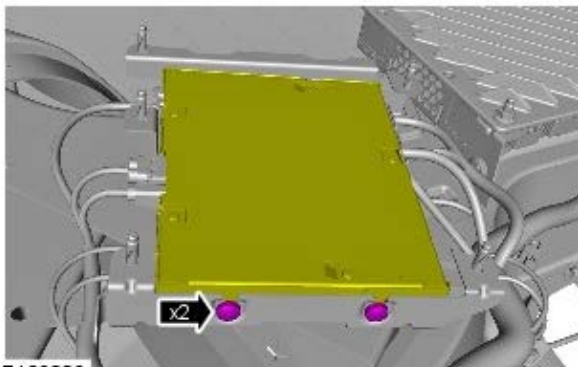
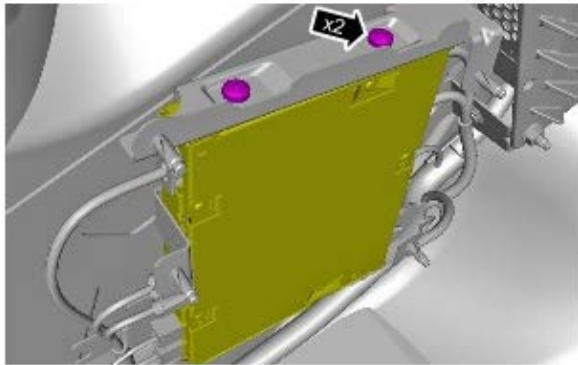
NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Remote Keyless Entry (RKE) Module (501-14, Removal and Installation).

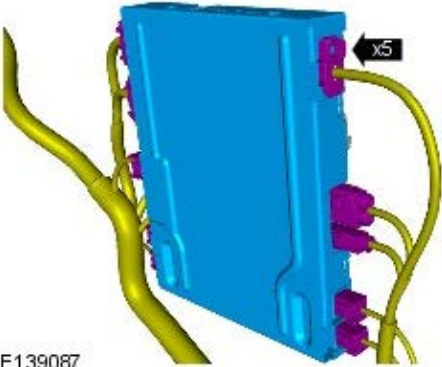
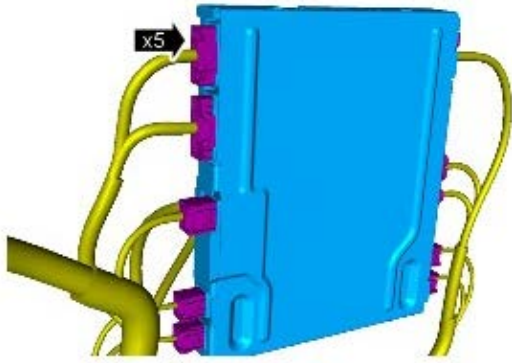
2. Torque: 9 Nm



3. Torque: 9 Nm



4.



E139087

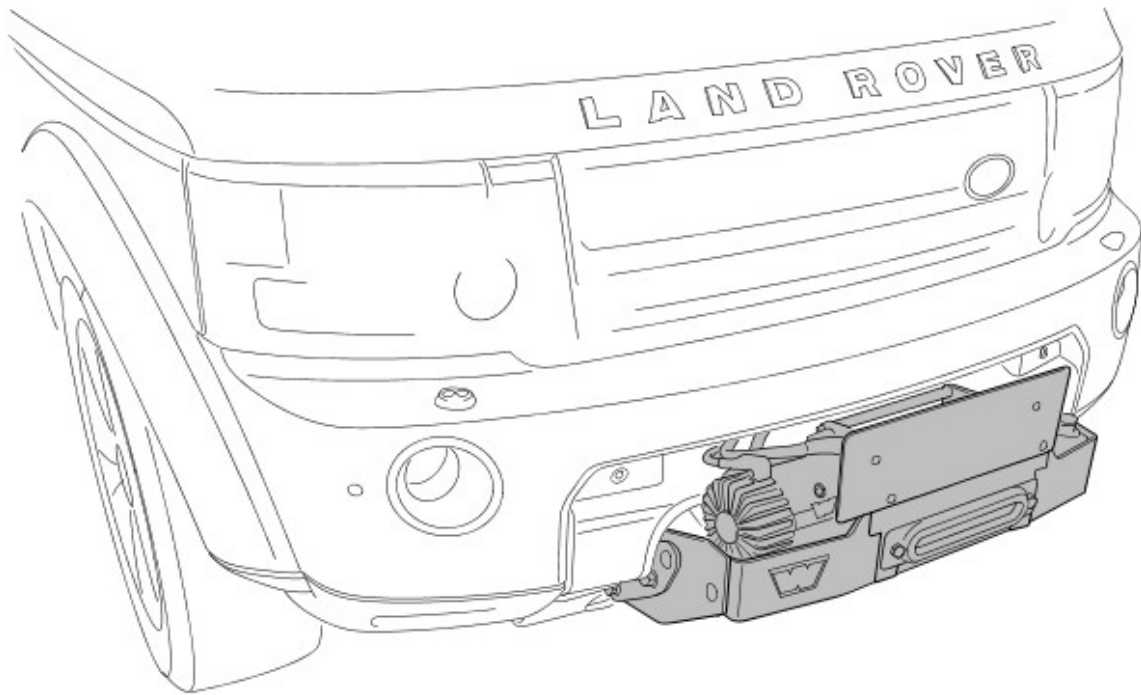
Installation

1. To install, reverse the removal procedure.
2. Using the diagnostic tool, calibrate the component.

Winch - Winch - Component Location

Description and Operation

COMPONENT LOCATION



E136475

Winch - Winch - Overview

Description and Operation

OVERVIEW

The 9.5XP winch is manufactured by WARN in the U.S.A. The winch features a 6 Horse Power (HP) High Output Parallel Series Wound winch motor.

The winch has 3-stage planetary gearing and full-face contact drum seals, motor and end housing gaskets for extreme duty water resistance.

SPECIFICATIONS:

- WARN Part number: 70100 (12V)
- Rated Line Pull: 9,500 lbs. (4310 kgs) single-line
- Intended Use/Application: Vehicle Recovery
- Motor: 12V 6 hp, High Output Parallel Series Wound
- Remote Control: Remote switch, 12' (3.7m) lead
- Geartrain: 3-Stage Planetary Gear Ratio: 156:1
- Lubrication: 76 Moly low temperature
- Clutch (freespooling): Sliding Ring Gear
- Brake: Automatic Direct Drive Cone
- Wire Rope: 100', 5/16" diameter (30m, 8mm diam.)
- Fairlead: Hawse
- Recommended Battery: 650 CCA minimum for winching
- Battery Leads: 2 gauge, 85" (2.20m)
- Finish: High-gloss dark gray powder coat
- Drum Diameter/Length: 2.5"/9.0" (6.4cm/23cm)
- Weight: 87 lbs. (39.5 kgs.) (winch only, not including mounting cradle).

12V DC PERFORMANCE SPECIFICATIONS:

Line Pull Lbs.(Kgs.)	Line Speed FT./min(M/min.)	Motor Current	Pull by Layer: Layer/Lbs(Kgs.)
0	38 (11.6)	70 Amps	1/9500 (4313)
2000 (910)	16.8 (5.1)	175 Amps	2/8650 (4927)
4000 (1818)	12.8 (3.9)	262 Amps	3/7920 (3595)
6000 (2720)	10.1 (3.1)	335 Amps	4/7400 (3359)
8000 (3630)	8.8 (2.7)	425 Amps	5/6940 (3150)
9500 (4310)	7.6 (2.3)	480 Amps	-

The above performance figures are based on the first layer of the drum.

Winch - Winch - System Operation and Component Description

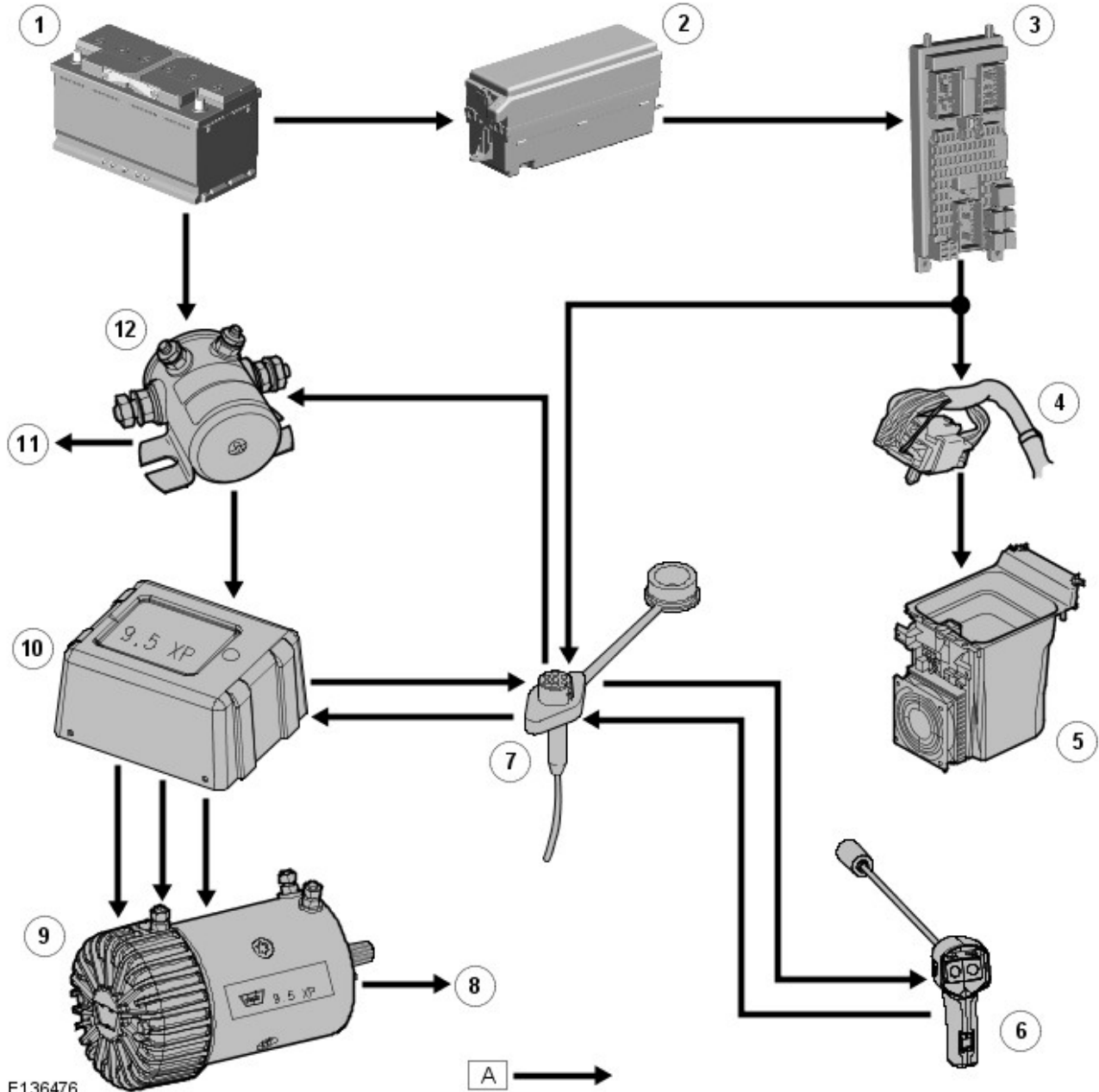
Description and Operation

Control Diagram



NOTE: A = Hardwired

Vehicle connection

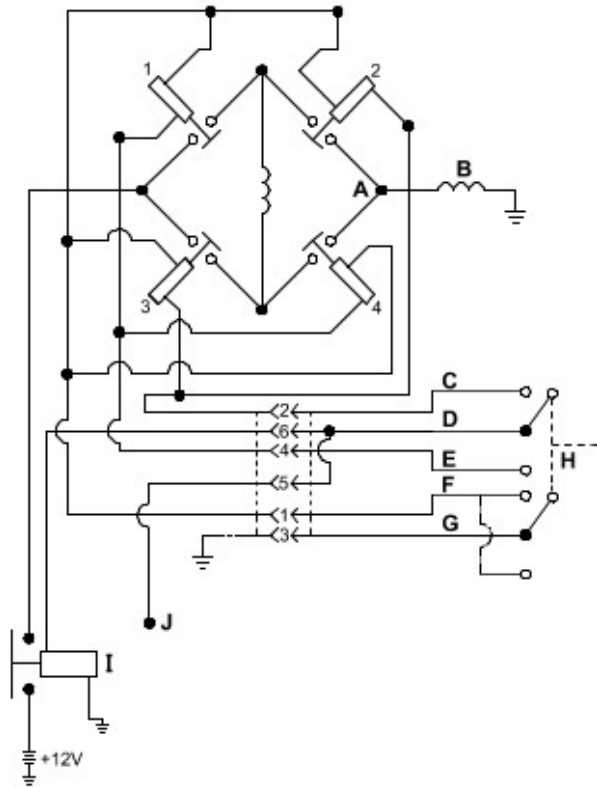


E136476

Item Description

- 1 Battery
- 2 Battery Junction Box (BJB)
- 3 Central Junction Box (CJB)
- 4 Harness connector (C2053-12 LR3 or C2754S-13 LR4) (ref only)
- 5 Floor console cool box (ref only)
- 6 Remote control
- 7 Remote control socket
- 8 Winch motor ground
- 9 Winch motor
- 10 Control box
- 11 Winch power interrupt solenoid ground
- 12 Winch power interrupt solenoid

Winch Schematic Electrical Circuit Diagram

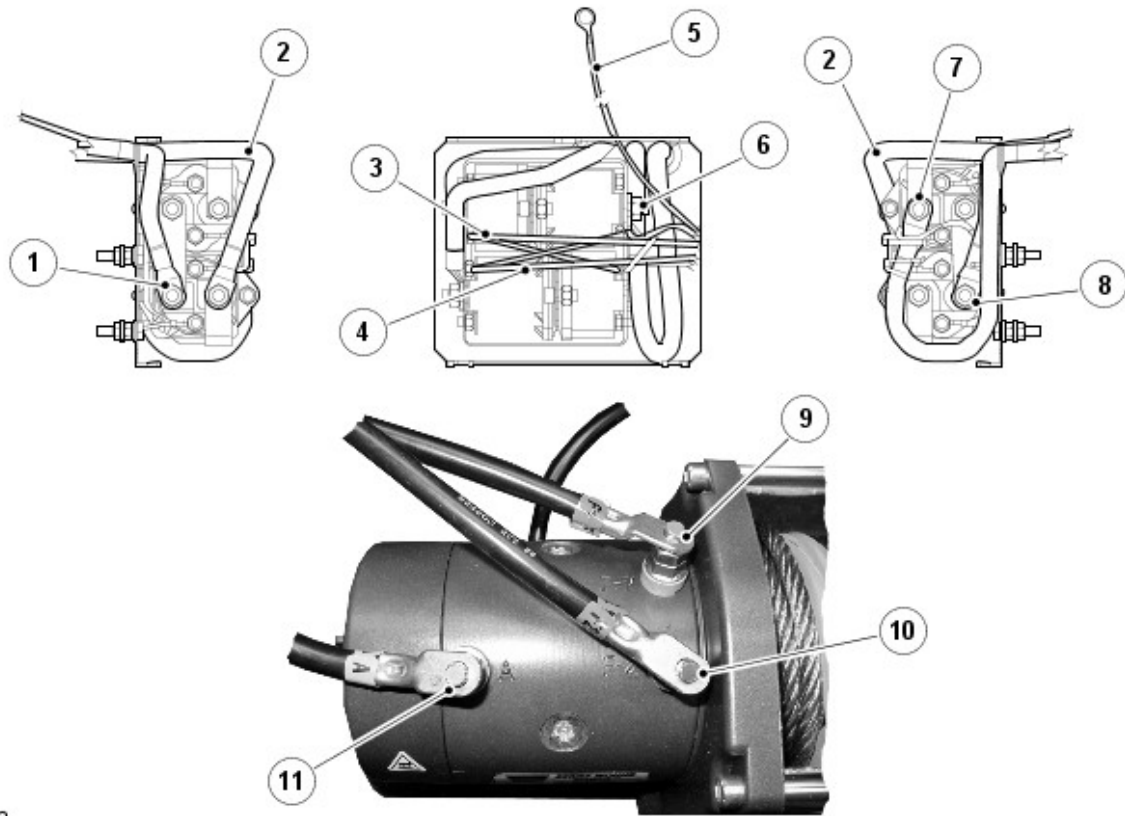


E136477

Item Description

- A Field
- B Armature
- C Black wire
- D White wire
- E Green wire
- F Brown wire
- G Red wire
- H Remote control assembly
- I Winch power interrupt solenoid
- J Ignition power supply - Blue wire

Winch Motor/Control Box Connections



E137052

Item Description

- 1 Field cable F1
- 2 Armature cable A
- 3 Black wire
- 4 Green wire
- 5 Motor ground wire
- 6 Battery positive (+) cable
- 7 Battery positive (+) cable terminal
- 8 Field cable F2
- 9 Field cable F1
- 10 Field cable F2
- 11 Armature cable A

System Operation

OPERATION

 **WARNING:** Observe all Warnings and Cautions detailed in the WARN Winch Operator's Guide and the WARN Basic Guide to Winching Techniques before and during winch operation.

The winch motor is powered by the vehicle battery. The motor provides rotational power to the gear mechanism, which in turn rotates the winch drum and winds the cable.

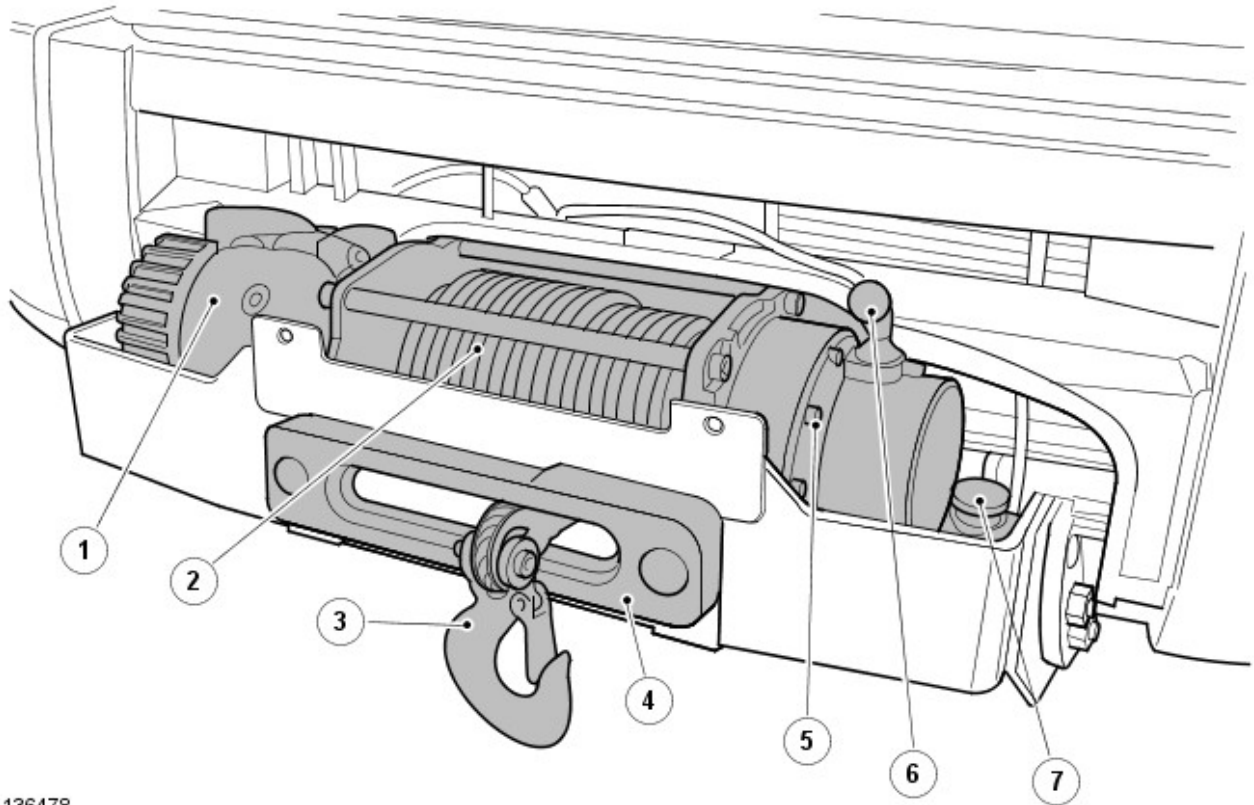
A remote control is used to operate the winch. The remote lead plugs into a remote control connector which is connected to the control box and allows the operator to control the winch winding direction while standing at a safe distance from the wire rope.

The clutch allows rope to be pulled off the drum without motor operation. Refer to the WARN Basic Guide to Winching Techniques.

Component Description

DESCRIPTION

Winch



E136478

Item Description

- 1 Motor
- 2 Winch drum and wire rope
- 3 Latching hook
- 4 Fairlead
- 5 Gear train housing
- 6 Clutch lever
- 7 Remote control socket

The winch is mounted on a bracket which is attached to the vehicle chassis frame. Two additional brackets are attached to the front bumper armature mounting plates. The brackets allow the attachment of the winch mounting bracket. The winch is secured to the bracket with four bolts, washers and nuts.

The winch control box is located on the rear of the front bumper armature. Two additional holes are drilled in the armature and the control box is attached with two bolts, washers and nuts.

The winch control box manages the power supplies to the winch motor and also receives the input from the remote control for winch operation. A remote control socket is located at the **LH (left-hand)** end of the winch mounting bracket and allows for the connection of the remote control.

The winch will operate with the ignition on and the engine not running, but this is not recommended due to excessive battery drain. Therefore it is recommended that the engine is running at all times when the winch is in operation.

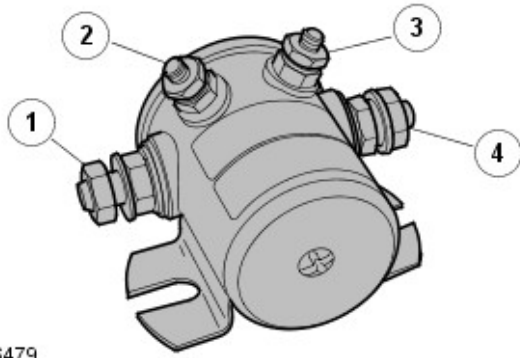
Winch/Vehicle Electrical Connections

A blue wire from the winch remote control socket is routed via a joint below the **EJB (engine junction box)**, through the vehicle bulkhead grommet behind the **EJB**. The blue wire is then routed behind the glove compartment and along the floor console to connector C0253-12 on LR3 vehicles (up to VIN 513325) and C2754S-13 on LR4 vehicles (from VIN 513326), which is located below the cup holder, behind the transmission selector lever. The wire is spliced into the green/white wire into the connector. This connection on the blue wire provides an ignition on signal to the winch control box when the remote control is plugged in.

A red cable is attached from the battery positive (+) terminal to the positive terminal on the winch power interrupt solenoid. This connection is the main power supply to the winch power interrupt solenoid for the winch motor and control box. The winch power interrupt solenoid is located on the plenum in the driver's side of the engine compartment.

A white wire from the winch remote control socket is connected to the winch power interrupt solenoid and energizes the solenoid relay when the ignition on signal is received. A large red wire from the winch power interrupt solenoid is routed to the winch control box. Power is not supplied to the winch control box until the remote control is connected to the remote control socket and the ignition is on.

Winch Power Interrupt Solenoid

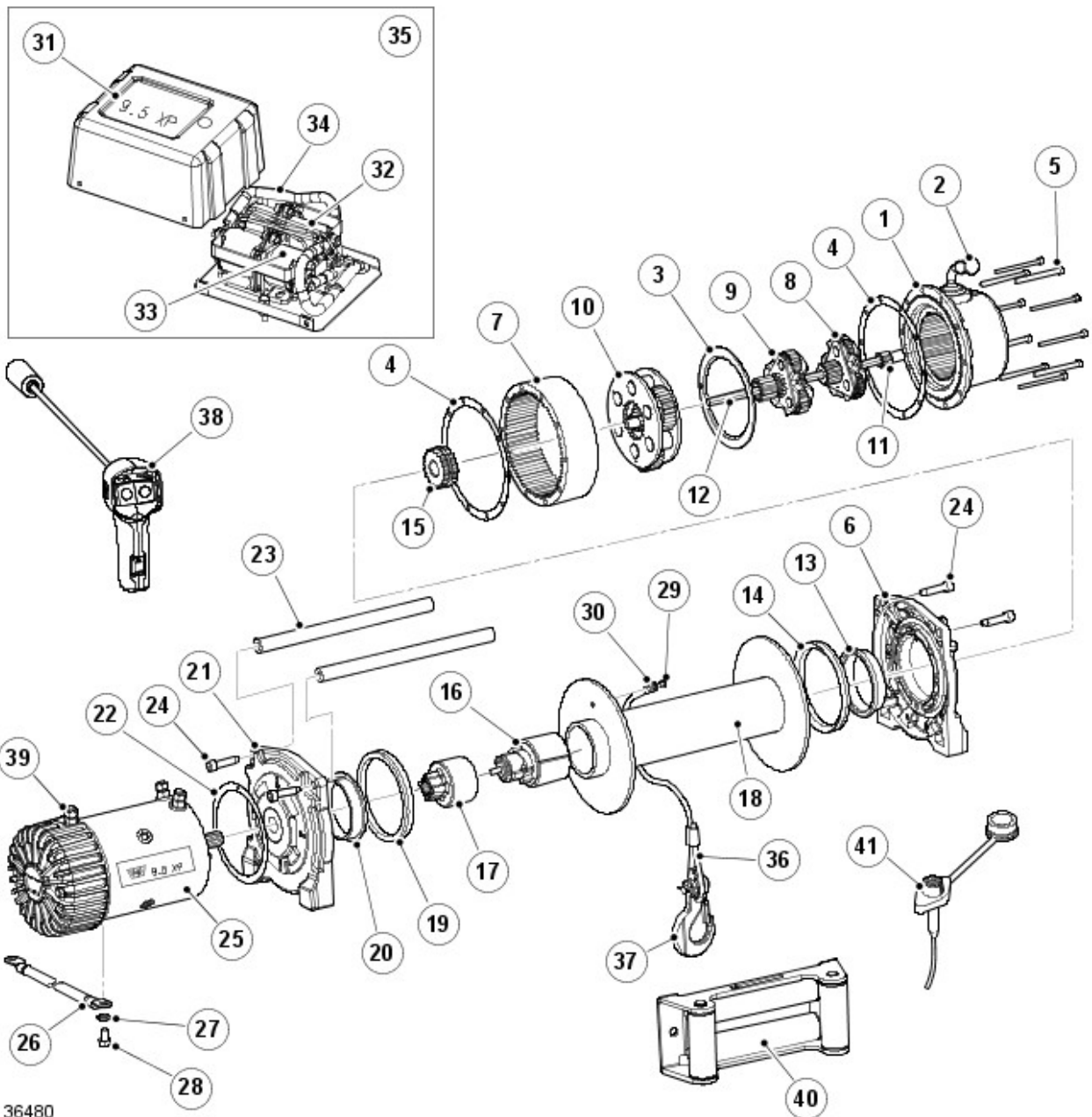


E136479

Item Description

- 1 Power to winch motor
- 2 Ground
- 3 Solenoid power supply (ignition on)
- 4 Power supply from vehicle battery

Winch Exploded View



E136480

Item Description

- 1 End housing assembly
- 2 Clutch lever

- 3 Nylon thrust washer
- 4 Housing gasket
- 5 Socket head capscrew (10 off)
- 6 Gear support drum
- 7 Ring gear
- 8 Planet carrier assembly (stage 1)
- 9 Planet carrier assembly (stage 2)
- 10 Planet carrier assembly (stage 3)
- 11 Sun gear
- 12 Drive shaft
- 13 Drum bushing
- 14 V-ring seal
- 15 Drive spline
- 16 Brake assembly
- 17 Motor coupler
- 18 Drum assembly
- 19 V-ring seal
- 20 Drum bushing
- 21 Motor drum support
- 22 Motor gasket
- 23 Tie rod (2 off)
- 24 Socket head cap screw (4 off)
- 25 Motor (4.5" Series wound)
- 26 Electrical cable (black)
- 27 Helical washer
- 28 Hex head cap screw
- 29 Button head cap screw
- 30 Terminal kit
- 31 Control pack cover
- 32 High current solenoid - Power in (2 off)
- 33 Solenoid - Power out (2 off)
- 34 Electrical cable (red)
- 35 Control pack 9.5XP
- 36 Wire rope assembly
- 37 Latching hook
- 38 Remote control assembly
- 39 Nut (3 off)
- 40 Fairlead Hawse (roller type shown)
- 41 Remote control socket assembly



NOTE: The WARN part numbers for the above components are listed on the WARN web site: www.warn.com

Winch - Winch

Diagnosis and Testing

Principle of Operation

For a detailed description of the winch system and operation, refer to the relevant Description and Operation section in the workshop manual. REFER to: (419-12)

Winch (Description and Operation),
Winch (Description and Operation),
Winch (Description and Operation).

Inspection and Verification



WARNING: Observe all Warnings and Cautions detailed in the WARN Winch Operator's Guide before and during winch operation.



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault, and may also cause additional faults in the vehicle being tested and/or the donor vehicle.

1. Verify the customer concern.
2. Visually inspect for obvious signs of damage and system integrity.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Incorrect installation • Winch motor • Gearbox • Wire rope 	<ul style="list-style-type: none"> • Fuses • Battery (650 CCA minimum) • Loose, corroded or damaged electrical connections • Winch power interrupt solenoid • Control box • Remote control

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.

Symptom Chart



Symptom	Possible causes	Action
No winch operation	<ul style="list-style-type: none"> • Battery/power or ground supply fault • Remote control internal failure • Control box internal failure • Winch motor internal failure 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams, check the winch power interrupt solenoid supply fused link ((Fuse 16 to vin 513325)(Fuse 59p from vin 513326)) central junction box • For midtronics battery test GO to Pinpoint Test A. • For remote control circuit checks GO to Pinpoint Test C. • For winch circuit checks GO to Pinpoint Test B.
No winch operation (Clicking sound when remote control switch is activated)	<ul style="list-style-type: none"> • Battery/power or ground supply fault • Control box internal failure 	<ul style="list-style-type: none"> • For midtronics battery test GO to Pinpoint Test A. • For winch circuit checks GO to Pinpoint Test B.
Winch lacks power, pulls slowly, stalls	<ul style="list-style-type: none"> • Battery/power or ground supply fault • Winch motor internal failure • Gearbox internal failure 	<ul style="list-style-type: none"> • For midtronics battery test GO to Pinpoint Test A. • For winch circuit checks GO to Pinpoint Test B.
When the remote control is activated, winch operates in only one direction	<ul style="list-style-type: none"> • Battery/power or ground supply fault • Remote control internal failure • Control box internal failure 	<ul style="list-style-type: none"> • For remote control circuit checks GO to Pinpoint Test C. • For winch circuit checks GO to Pinpoint Test B.
Difficulty in spooling rope from drum by hand	<ul style="list-style-type: none"> • Wire rope incorrectly wound 	<ul style="list-style-type: none"> • Confirm the rope is spooled correctly onto the drum • Install a new winch as required.











	<ul style="list-style-type: none"> on drum (Rubbing/binding) Distorted drum flange Worn drum bushes 	<p>REFER to: Winch (419-12, Removal and Installation). Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component</p>
	<ul style="list-style-type: none"> Damaged free spool clutch (inside gear train) Corroded clutch ring gear 	<ul style="list-style-type: none"> Install a new winch gearbox as required. REFER to: Winch Gear Assembly (419-12, Removal and Installation). Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
Winch does not hold load	<ul style="list-style-type: none"> Rope is spooled onto the drum in the wrong direction Winch drum brake is worn or broken 	<ul style="list-style-type: none"> Confirm the rope is spooled correctly onto the drum Confirm the clutch is fully engaged Install a new winch as required. REFER to: Winch (419-12, Removal and Installation). Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component
Remote control fault	<ul style="list-style-type: none"> Winch remote connector terminals damaged Remote switch internal failure 	<ul style="list-style-type: none"> For remote control circuit checks GO to Pinpoint Test C.
Clutch lever fault	<ul style="list-style-type: none"> Cable under load Clutch or gearbox mechanism internal failure 	<ul style="list-style-type: none"> Rotate clutch lever on winch. If clutch lever will not rotate, remove tension from the rope and hook by powering out for about 1 second Attempt to rotate the clutch lever with tension removed. If clutch lever still does not rotate, Install a new winch gearbox as required. REFER to: Winch Gear Assembly (419-12, Removal and Installation). Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component

PINPOINT TEST A : BATTERY TEST

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: MIDTRONICS BATTERY TEST	
	1 Confirm that the vehicle battery charged, in good condition, and the correct specification (650 CCA minimum)
	2 Using a Midtronics hand held tester or the Midtronics GR-1 diagnostic charger, carry out the "Midtronics battery test" as detailed in the battery care manual. Refer to (Service/Maintenance information/Battery care manual)
	3 Record battery diagnostic result on the provided form
	Does the battery pass the "Midtronics battery test"? Yes Check for correct operation, refer to the symptom chart above if customer concern is still evident No Install a new battery as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. Check for correct winch operation

PINPOINT TEST B : CIRCUIT CHECKS


TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: WINCH POWER INTERRUPT SOLENOID - CONNECTIONS	
NOTES:	
	The winch power interrupt solenoid supplies power to the winch control box
	The ignition feed is supplied to the remote control connector (terminal 5) linked internally to (terminal 6) then supplied to (solenoid terminal 3) to energize the winch power interrupt solenoid
	1 Refer to the landrover electrical circuit diagrams, check the winch power interrupt solenoid supply fused link (Fuse 16 to vin 513325)(Fuse 59p from vin 513326) central junction box

	<p>2 Refer to the winch circuit diagrams REFER to: Winch (419-12, Description and Operation).</p>
	<p>3 Confirm the circuit connections to the winch power interrupt solenoid (Terminal 1 - power to winch control box, Terminal 2 - solenoid ground, Terminal 3 - solenoid power ((C2053-12 to vin 513325)(C2754S-13 from vin 513326)), Terminal 4 - battery supply)</p>
	<p>Are all the electrical connections to the winch power interrupt solenoid clean and secure? Yes GO to B2. No Clean and secure the electrical connections. Check for correct winch operation</p>
B2: WINCH POWER INTERRUPT SOLENOID - OPERATION	
	<p>1 With the ignition state on, and the remote control connected</p>
	<p>2 Using a multimeter, check for battery voltage between terminal 1 (power to winch control box) and terminal 2 (winch power interrupt solenoid ground)</p>
	<p>Is battery voltage present? (approx. 12 volts) Yes GO to B3. No Replace the winch power interrupt solenoid as required. REFER to: Winch Solenoid (419-12, Removal and Installation). Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. Check for correct winch operation</p>
B3: POWER SUPPLY - CONTROL BOX	
<p> WARNING: Ensure the winch clutch is in free spool mode (Refer to winch operation manual)</p>	
<p> NOTE: The winch power interrupt solenoid supplies power to the winch control box</p>	
	<p>1 With the ignition state on, and the remote control connected</p>
	<p>2 Using a multimeter, check for battery voltage between the red power feed to the control box and vehicle ground</p>
	<p>Is battery voltage present? (approx. 12 volts) Yes GO to B4. No Carry out circuit checks to investigate the loss of supply. Rectify as required. Check for correct winch operation</p>
B4: CONTROL BOX INPUT - REMOTE CONTROL	
<p> WARNING: Ensure the winch clutch is in free spool mode (Refer to winch operation manual)</p>	
<p>NOTES:</p>	
<p> The winch control box controls the winch motor direction</p>	
<p> Power out - The remote control supplies power to remote connector terminal 2 and grounds terminal 1</p>	
<p> Power in - The remote control supplies power to remote connector terminal 4 and grounds terminal 1</p>	
	<p>1 Refer to the winch circuit diagrams REFER to: Winch (419-12, Description and Operation).</p>
	<p>2 Using a multimeter, monitor terminal 2 (Black), terminal 4 (Green) and terminal 1 (White)</p>
	<p>Do the terminals 2 and 4 (Power) and terminal 1 (Ground) respond correctly when the remote control is used? Yes GO to B5. No Carry out circuit checks to investigate the loss of supply. Rectify as required. Check for correct winch operation</p>
B5: CONTROL BOX - OUTPUT	
<p> WARNING: Ensure the winch clutch is in free spool mode (Refer to winch operation manual)</p>	
<p>NOTES:</p>	
<p> When activated the winch control box supplies power to the winch motor</p>	
<p> Power out - The control box supplies power to the winch motor terminal F1 and connects winch motor terminal F2 to terminal A(Armature)</p>	
<p> Power in - The control box supplies power to the winch motor terminal F2 and connects winch motor</p>	


terminal **F1** to terminal **A**(Armature)

	1 Refer to the winch circuit diagrams REFER to: Winch (419-12, Description and Operation).
	2 Using a multimeter, monitor terminals F1 , F2
	Do the terminals F1 , and F2 respond correctly when the remote control is used? Yes GO to B6. No Check the connections to the control box. If all the connections are clean and secure, install a new control box as required. REFER to: Winch Control Unit (419-12, Removal and Installation). Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. Check for correct winch operation



B6: MOTOR CONNECTIONS

 WARNING: Ensure the winch clutch is in free spool mode (Refer to winch operation manual)	
	1 Refer to the winch circuit diagrams REFER to: Winch (419-12, Description and Operation).
	2 Check the connections to the winch motor
	Are all the connections clean and secure? Yes GO to B7. No Clean and secure the electrical connections. Check for correct winch operation

B7: WINCH MOTOR TEST

 WARNING: Ensure the winch clutch is in free spool mode (Refer to winch operation manual)	
	1 Disconnect the positive lead from the battery (leave the ground lead attached)
	2 Label and disconnect the three cables that run from the control pack to the three posts on the winch motor
	3 Stamped next to the three posts on the winch motor will be A , F1 and F2 . Connect a test cable (Jump leads work well) from A to F1 and supply power from the battery to F2 . The winch motor should operate
	4 Connect a test cable from A to F2 and supply power from the battery to F1 . The winch motor should operate in the opposite direction
	Does the winch motor operate in both directions? Yes Check for correct operation, refer to the symptom chart above if customer concern is still evident No Check the connections to the winch motor. If all the connections are clean and secure, install a new winch motor as required. REFER to: Winch Motor (419-12, Removal and Installation). Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. Check for correct winch operation

PINPOINT TEST C : REMOTE CONTROL

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: REMOTE CONTROL - CONTINUITY TEST	
NOTES:	
	Visually inspect the winch remote connector terminals for damage, repair or replace as required
	The winch remote should be tested for continuity using a multimeter
	1 With the winch remote disconnected check for continuity, using the instructions below
	2 Move the switch to the power out position - Check for continuity between terminals (1) and (3), Check for continuity between terminals (2) and (6)
	3 Move the switch to the power in position - Check for continuity between terminals (1) and (3), Check for continuity between terminals (4) and (6)
	Did the winch remote pass the continuity test (Resistance less than 1 ohm)? Yes Check for correct operation, refer to the symptom chart above if customer concern is still evident No Install a new winch remote as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component. Check for correct winch operation

Winch - Winch

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.

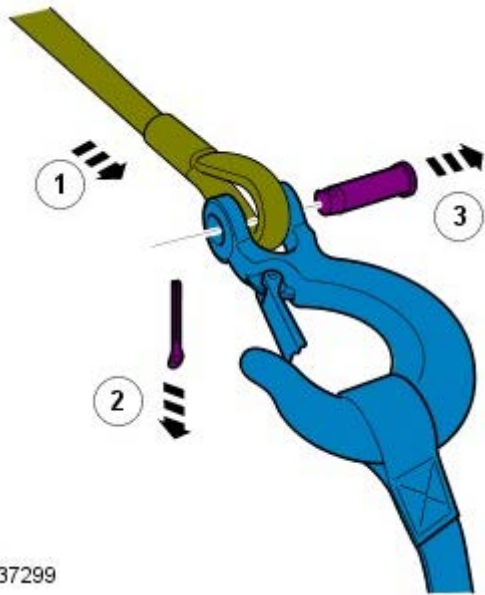


Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.

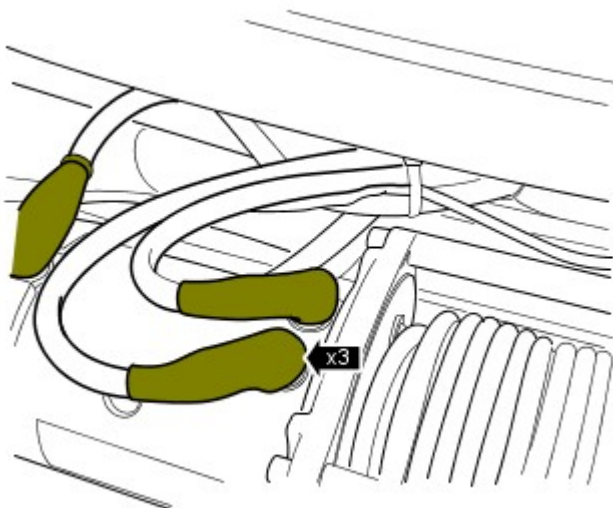
Refer to: Specifications (414-00, Specifications).

- 2.




E137299

- 3.

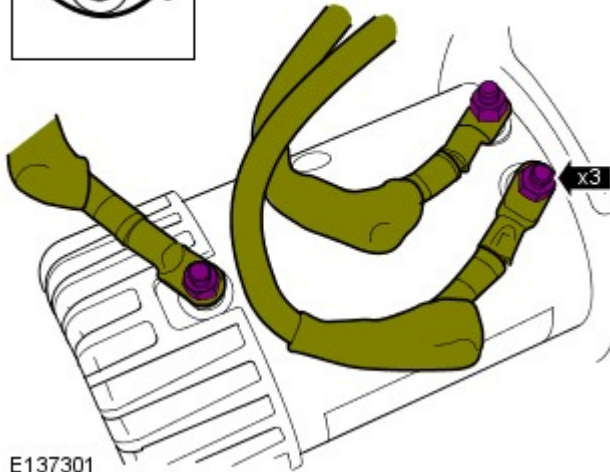


E137300

4.  **CAUTION:** To prevent damage to components, use an additional wrench when loosening or tightening terminals.



NOTE: Note the position of the wiring harnesses to aid installation.

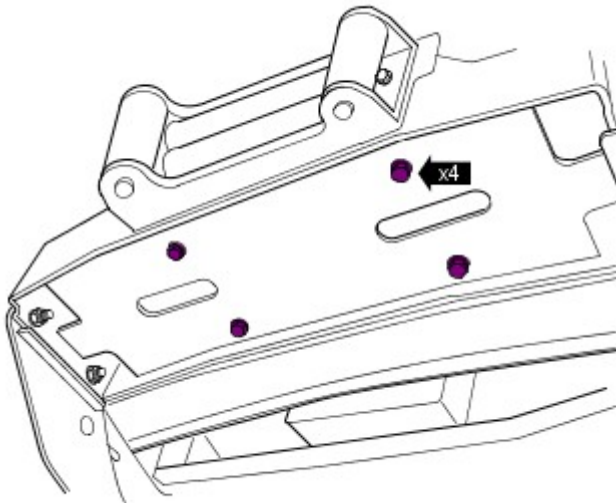


E137301

Torque: 25 Nm

5.

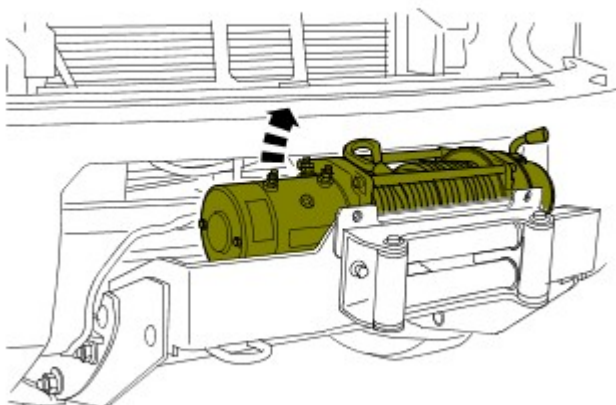
- Torque: 40 Nm



E137302

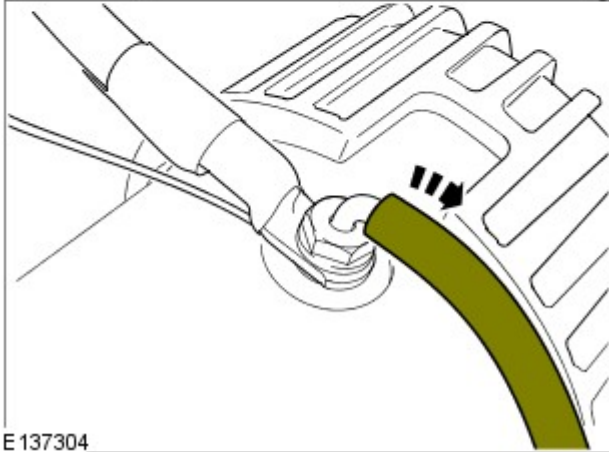
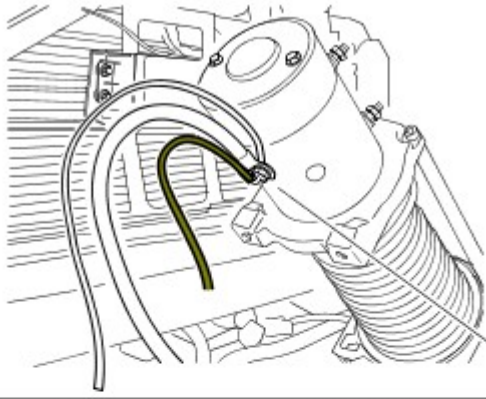
6.

- Raise the motor end of the winch to gain access to the winch ground point.



E137303

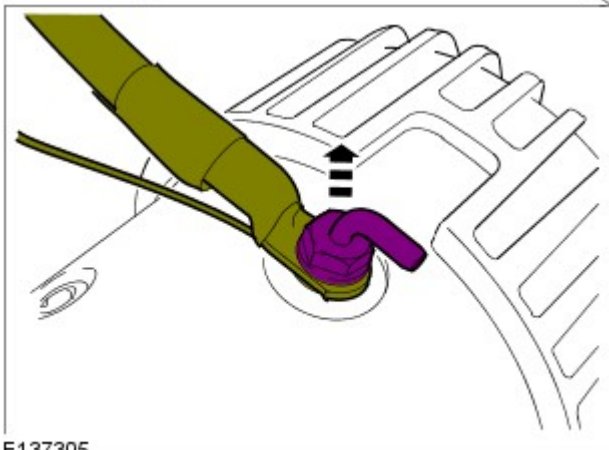
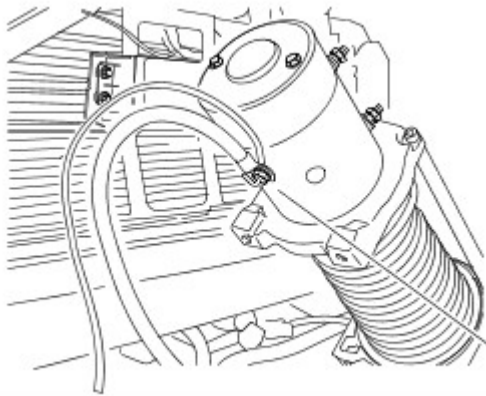
7.



E137304

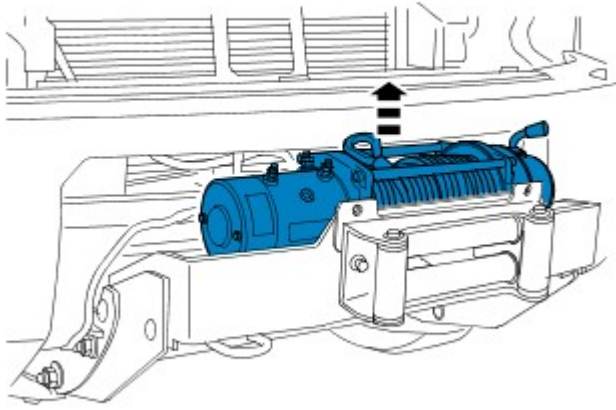
8.

- Torque: 25 Nm



E137305

9.  **WARNING:** This step requires the aid of another technician.



E137306

Installation

1. To install, reverse the removal procedure.

Winch - Winch Motor

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

2. Refer to: Winch (419-12, Removal and Installation).



3. CAUTIONS:



If the armature is dislodged from the motor, the motor brushes will need to be reset to allow reinstallation.



Make sure that the armature shaft is removed with the motor housing.



Use a suitable tool if required to move the armature with the motor.

- Torque: 8 Nm



E136739

Installation

1. To install, reverse the removal procedure.

Winch - Winch Solenoid

Removal and Installation

Removal



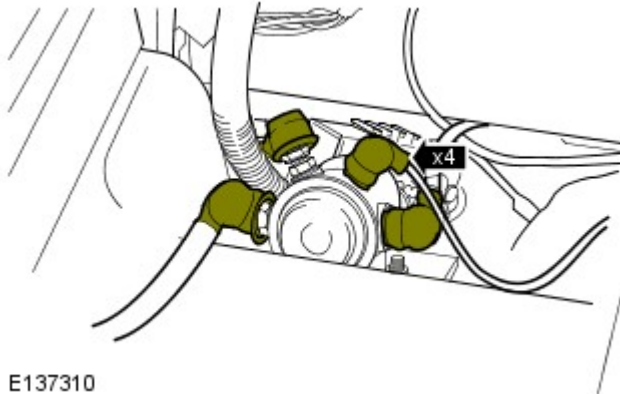
NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

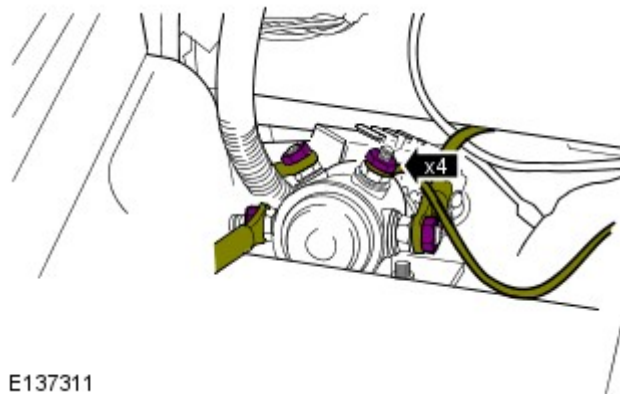
Refer to: Specifications (414-00, Specifications).

2. Refer to: Battery Tray (414-01, Removal and Installation).


3.



E137310



E137311

4.  CAUTION: To prevent damage to components, use an additional wrench when loosening or tightening terminals.

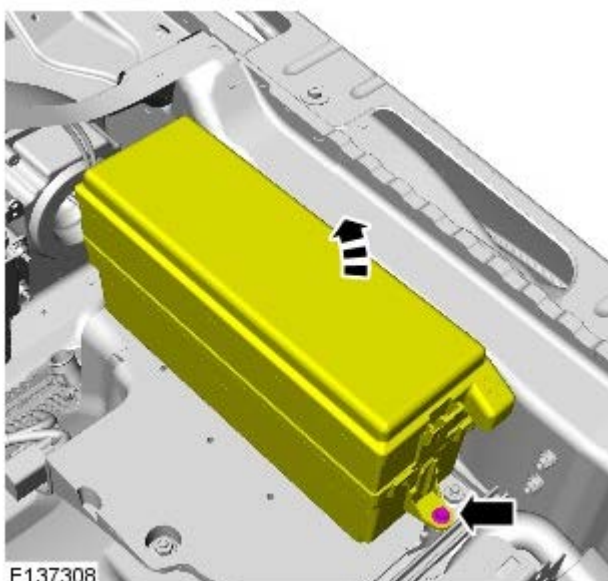


NOTE: Note the position of the electrical connectors.

- Torque:
Two center terminals 10 Nm
Two outer terminals 7 Nm

5.

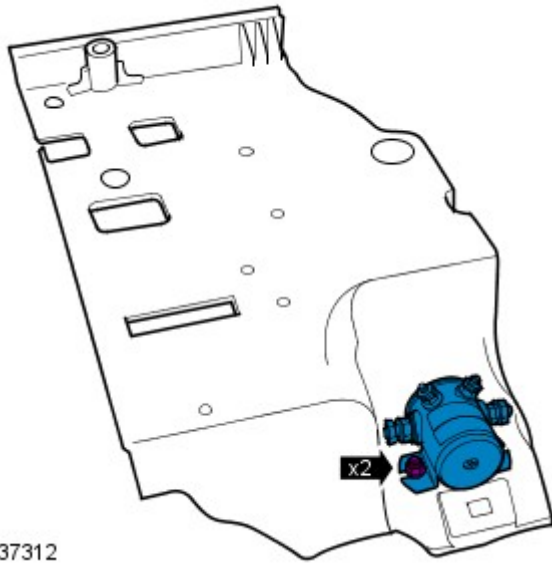
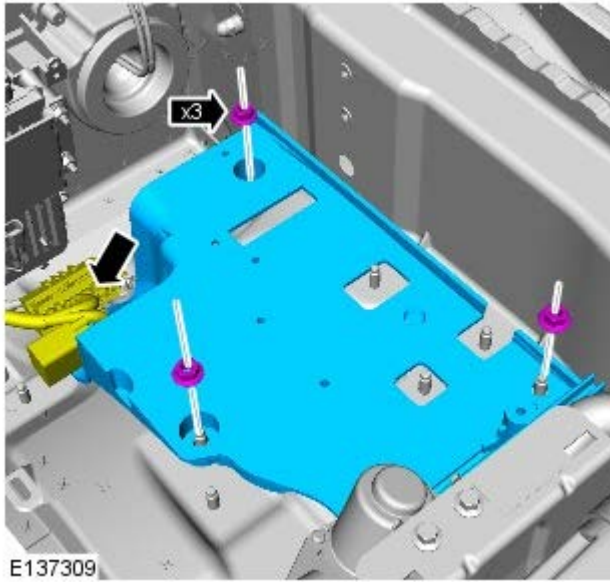
- Torque: 5 Nm



E137308

6.

- Torque: 12 Nm



Installation

7.
 - Torque: 10 Nm

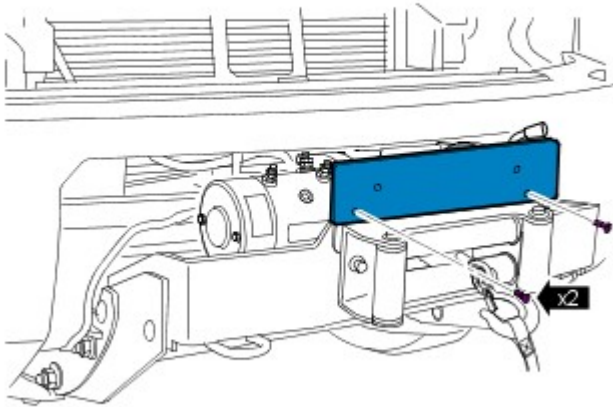
1. To install, reverse the removal procedure.

Winch - Licence Plate Panel

Removal and Installation

Removal

1.
 - If installed: Remove the license plate.
- 2.



E137298

Installation

1. To install, reverse the removal procedure.

Winch - Winch Cable Roller Assembly

Removal and Installation

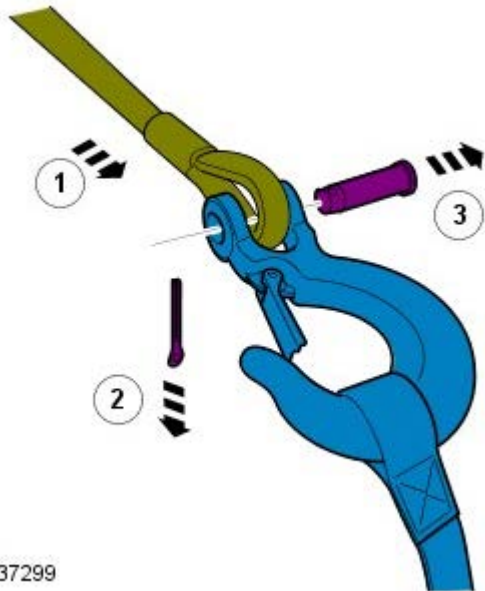
Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Licence Plate Panel (419-12, Removal and Installation).

2.



E137299

3.

- Torque: 43 Nm



E137315

Installation

1. To install, reverse the removal procedure.

Winch - Winch Control Unit

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

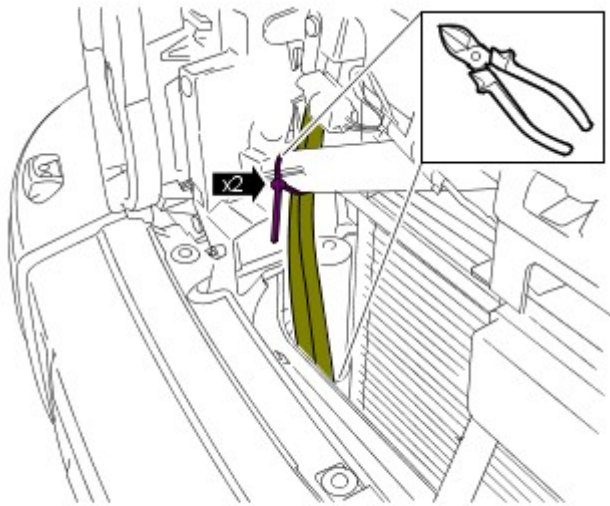
1. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

2. Refer to: Battery (414-01, Removal and Installation).

3. Refer to: Winch (419-12, Removal and Installation).

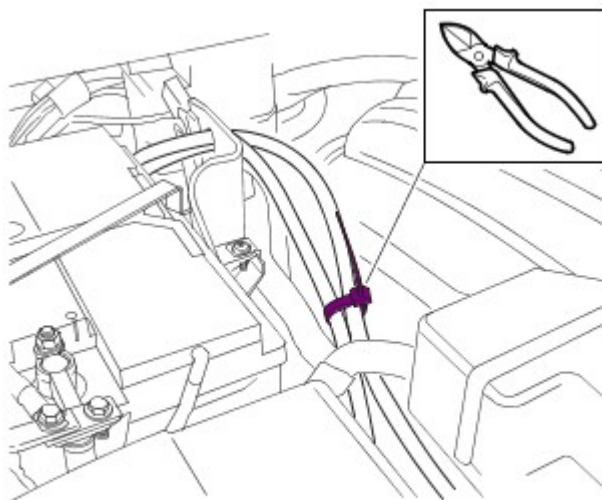
- 4.



E138614

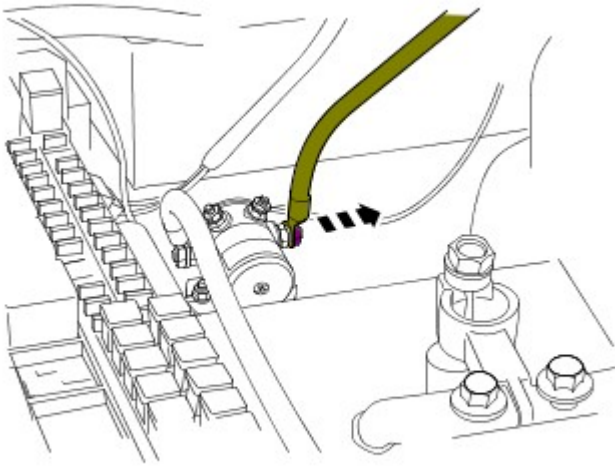
5. Refer to: Front Bumper Cover (501-19, Removal and Installation).

- 6.



E138615

- 7.



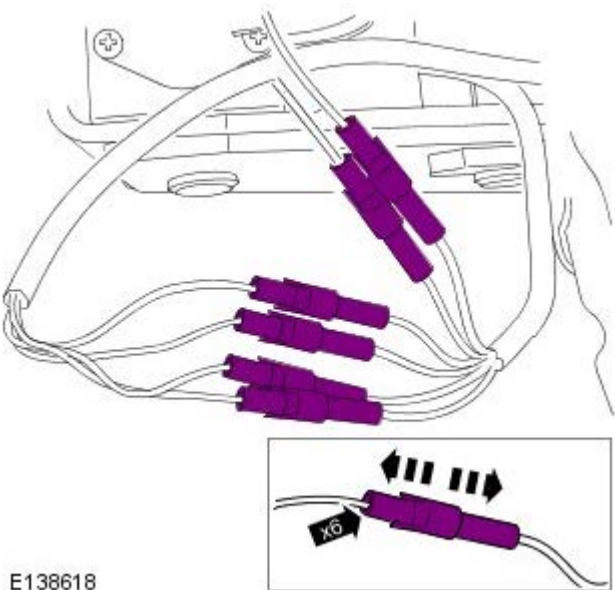
E138616

8.



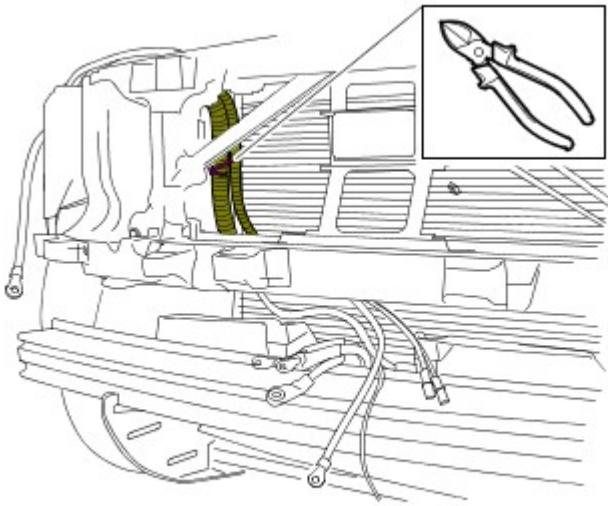
E138617

9.



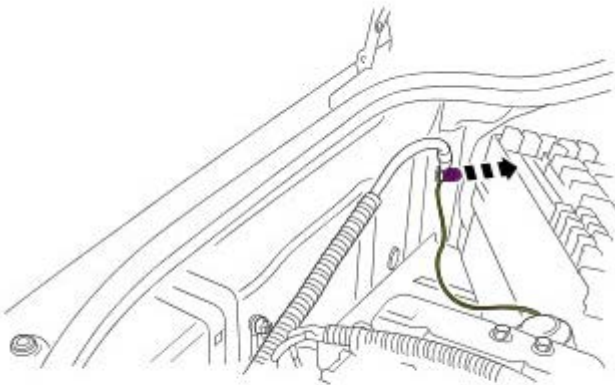
E138618

10.



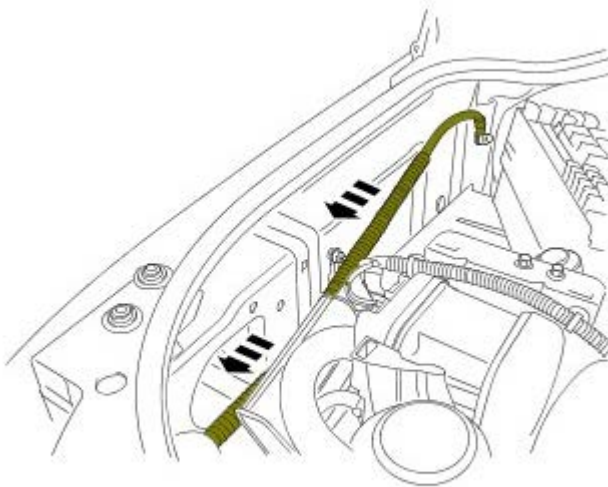
E138619

11.



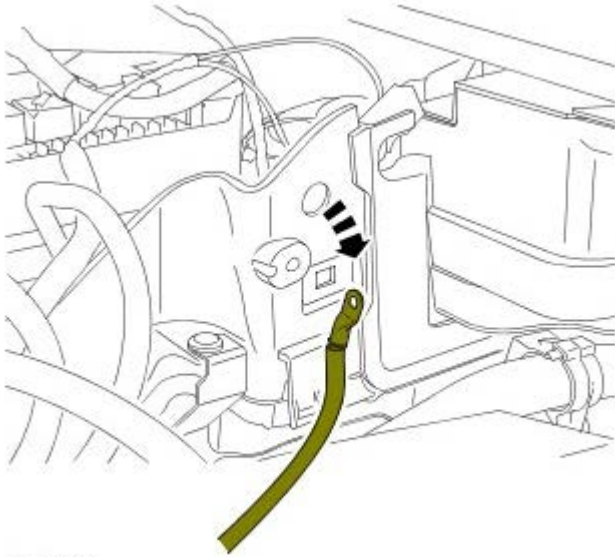
E138620

12.



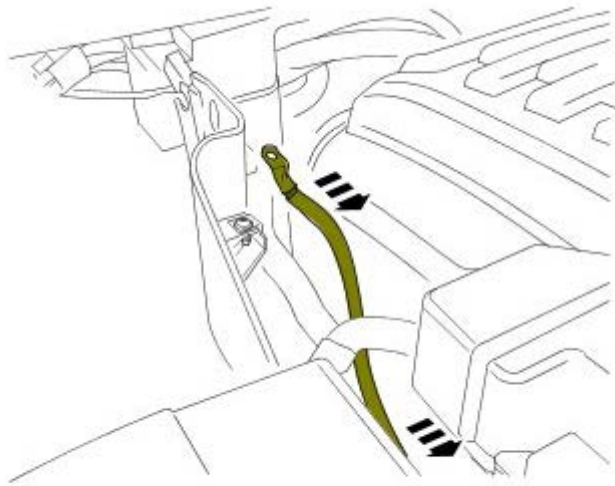
E138621

13.



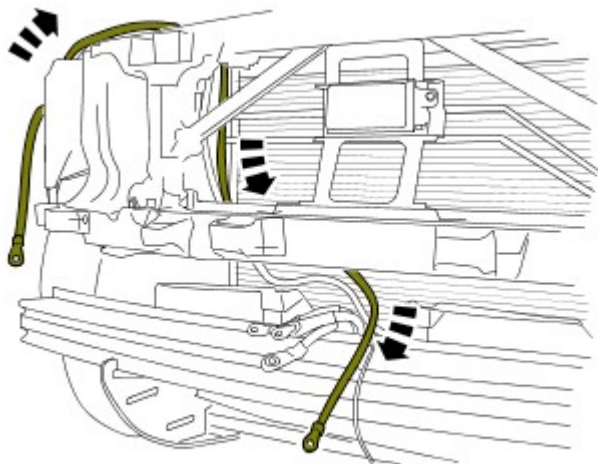
E138622

14.



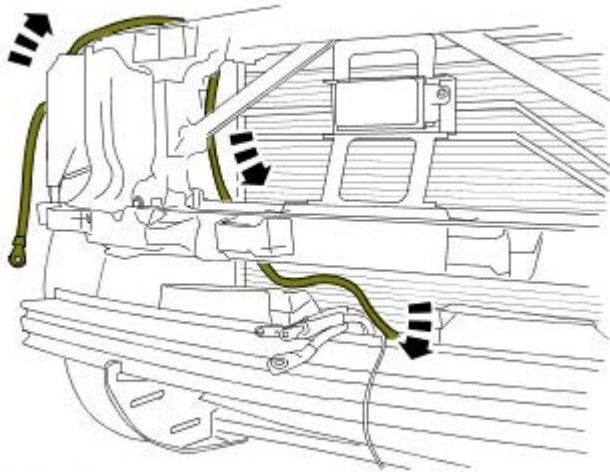
E138623

15.

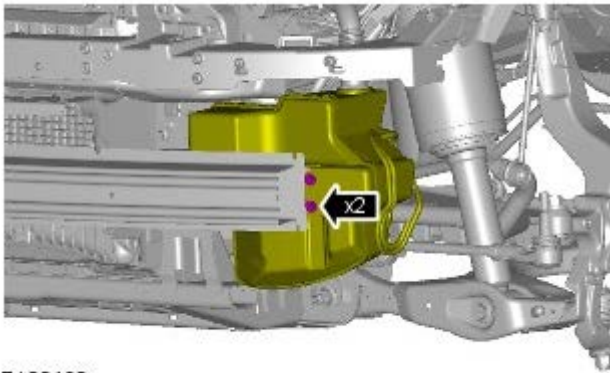


E138625

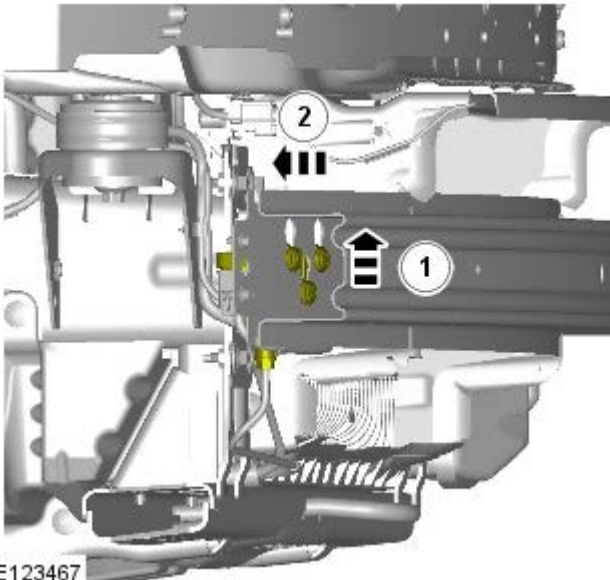
16.




E138626






E123468

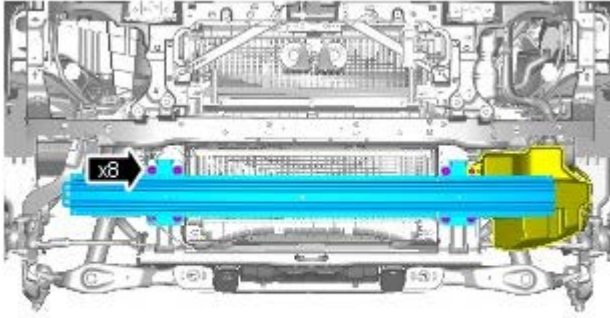


E123467

17.  NOTE: Support as necessary.
Torque: 10 Nm

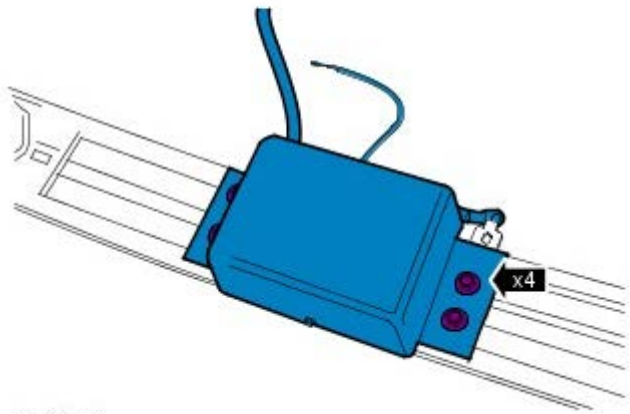
18.  CAUTION: Take extra care not to damage the component.
 NOTE: Support as necessary.

19.  NOTE: With assistance remove the component.
Torque: 25 Nm




E123469

20. Torque: 10 Nm



E137307

Installation

1.  CAUTION: Do not route wires over sharp edges. Take care to avoid chaffing, and damage to the insulation.

To install, reverse the removal procedure.

Winch - Winch Gear Assembly

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

2. Refer to: Winch (419-12, Removal and Installation).



E138329

3. CAUTION: Mark the components to aid installation.

- Torque: 10 Nm

- 4.



E138330

5. CAUTION: Make sure that the mating faces are clean and free of foreign material.



NOTE: Remove and discard the gasket.



E138331

Installation

1. NOTES:

 Align to the position noted on removal.

 Install a new gasket.

To install, reverse the removal procedure.

Front End Body Panels -

Torque Specifications

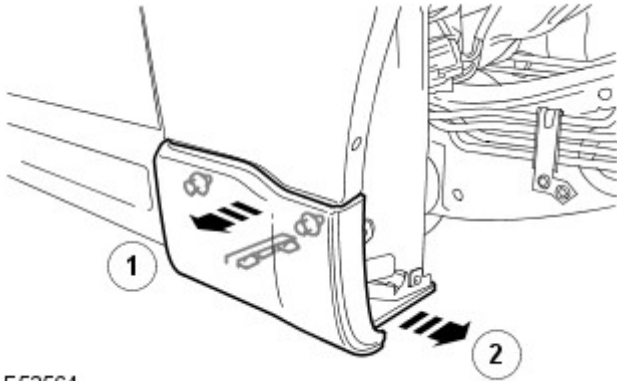
Description	Nm	lb-ft
Engine undershield bolts	62	46
Front fender bolts	10	7
Front fender nut	10	7

Front End Body Panels - Fender

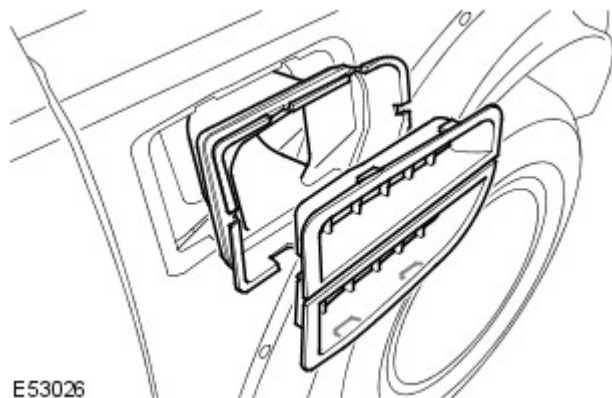
Removal and Installation

Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the plenum chamber panel.
For additional information, refer to: Plenum Chamber (412-01, Removal and Installation).
3. Remove the headlamp assembly.
For additional information, refer to: Headlamp Assembly (417-01, Removal and Installation).
4. Remove the fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).
5. Remove the fender moulding.
For additional information, refer to: Fender Moulding (501-08, Removal and Installation).
6. Remove the fender lower moulding.
 - Release the 4 clips.

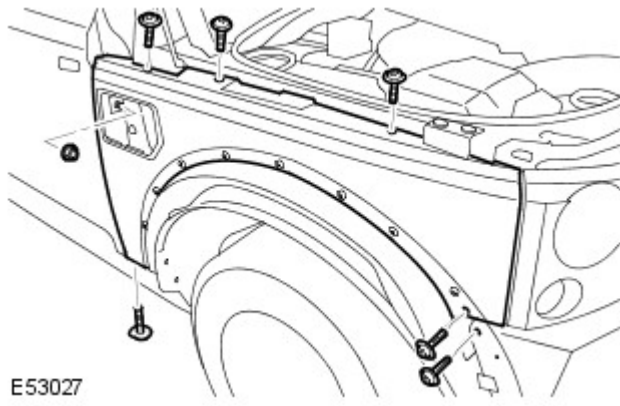


E52564



E53026


7. Remove the fender air intake grille.
 - Release the 4 clips.
 - Remove the air ducting.
8. Remove the front fender.
 - Remove the 6 Torx bolts.
 - Remove the nut.



E53027



E52568

9.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the fender rear trim.

- Remove the 3 clips.

Installation

1. Install the fender rear trim.
 - Secure in the 3 clips.
2. Install the front fender.
 - Install the bolts and tighten to 10 Nm (7 lb.ft).
 - Install the nut and tighten to 10 Nm (7 lb.ft)
3. Install the fender air intake grille.
 - Install the air ducting.
4. Install the lower fender moulding.
 - Secure in the clips.
5. Install the fender moulding.

For additional information, refer to: Fender Moulding (501-08, Removal and Installation).
6. Install the fender splash shield.

For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).
7. Install the headlamp assembly.

For additional information, refer to: Headlamp Assembly (417-01, Removal and Installation).
8. Install the plenum chamber panel.


For additional information, refer to: Plenum Chamber (412-01, Removal and Installation).
9. Connect the battery ground cable.

For additional information, refer to: Specifications (414-00, Specifications).

Front End Body Panels - Fender Splash Shield

Removal and Installation

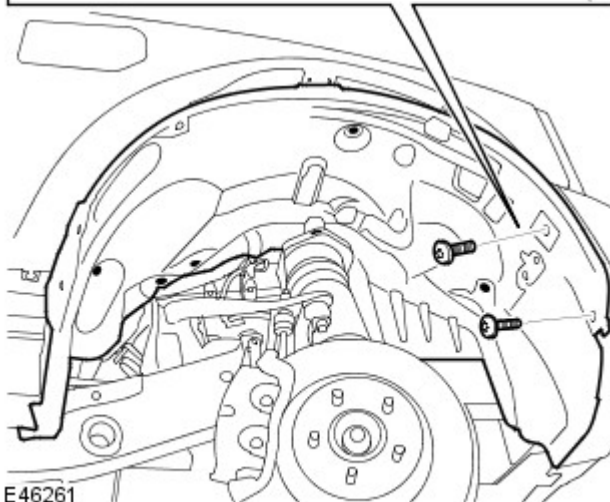
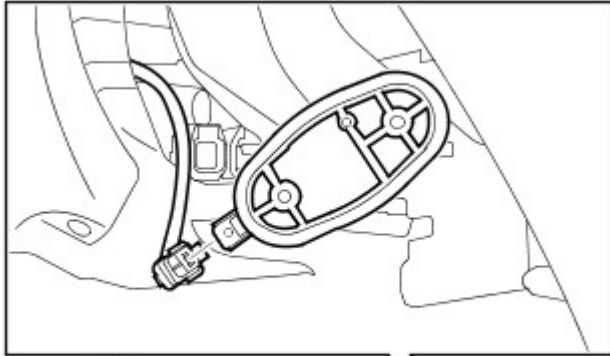
Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

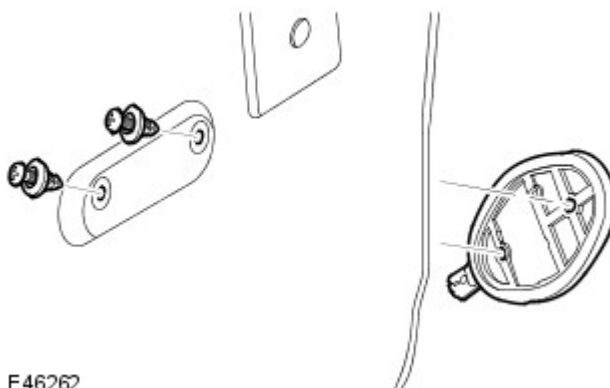
Raise and support the vehicle.

2. Remove the fender moulding.
For additional information, refer to: Fender Moulding (501-08, Removal and Installation).


3. Remove the fender splash shield.
 - Remove the 2 screws.
 - Remove the 6 retainers.
 - Disconnect the electrical connector.



E46261



E46262

4.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the tire pressure antenna.

- Remove the 2 retainers.

Installation

1. Install the tire pressure antenna.
 - Install the retainers.
2. Install the fender splash shield.
 - Connect the electrical connector.
 - Install the retainers.

- Install the screws.
3. Install the fender moulding.
For additional information, refer to: Fender Moulding (501-08, Removal and Installation).

Front End Body Panels - Engine Undershield

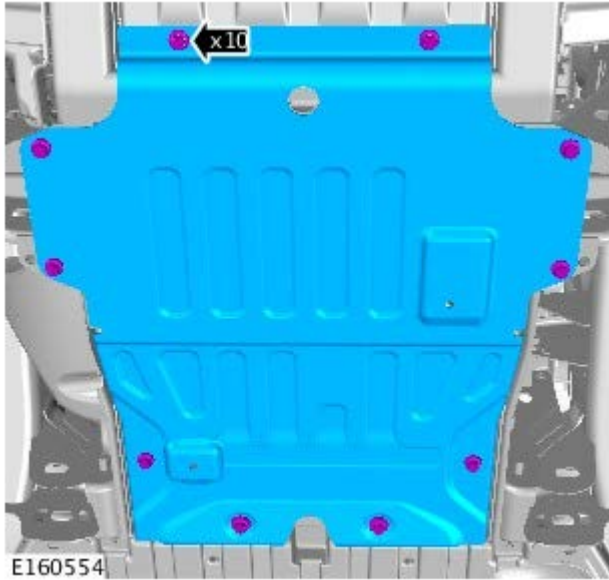
Removal and Installation

Removal

1.  **WARNING:** Make sure to support the vehicle with axle stands.

Raise and support the vehicle.

2. Torque: 62 Nm



Installation

1. To install, reverse the removal procedure.

Body Closures - Body Closures

Description and Operation

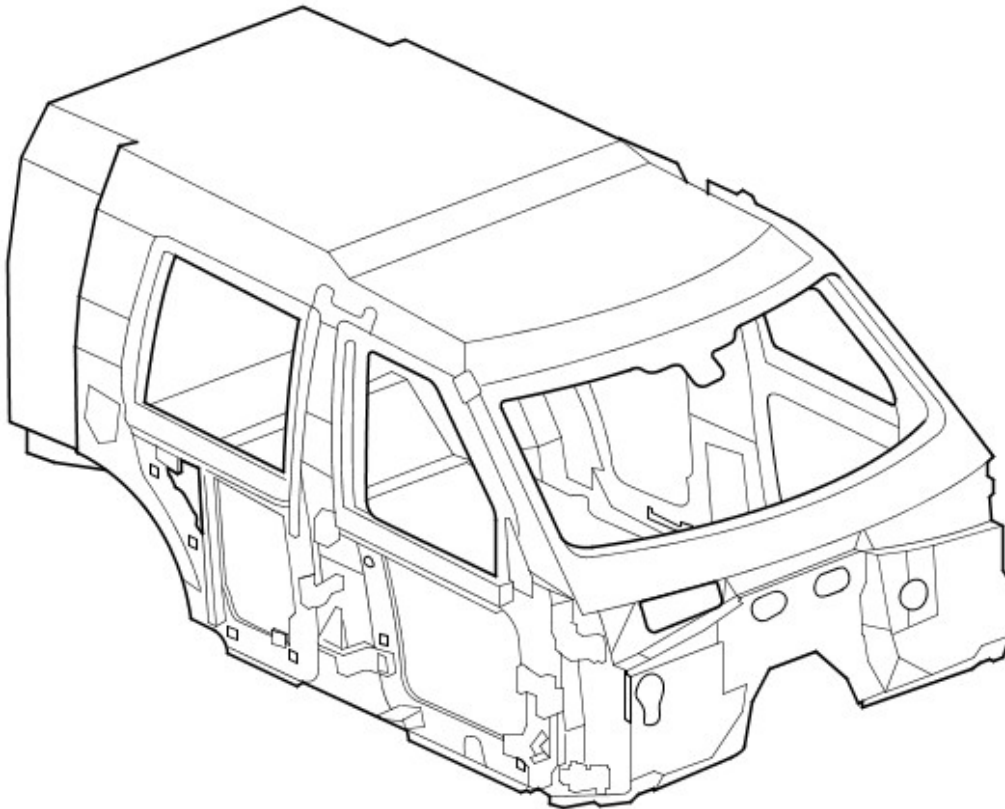
Body Protection



WARNING: The weight of the armoured components fitted to the vehicle are far in excess of those fitted to the standard vehicle. As an example, the windshield weighs approximately 100 Kg (220 lb). Therefore, always be aware of the weight of components and have suitable lifting equipment available before attempting to remove any component from the vehicle.

Body Shell

Armoured cell



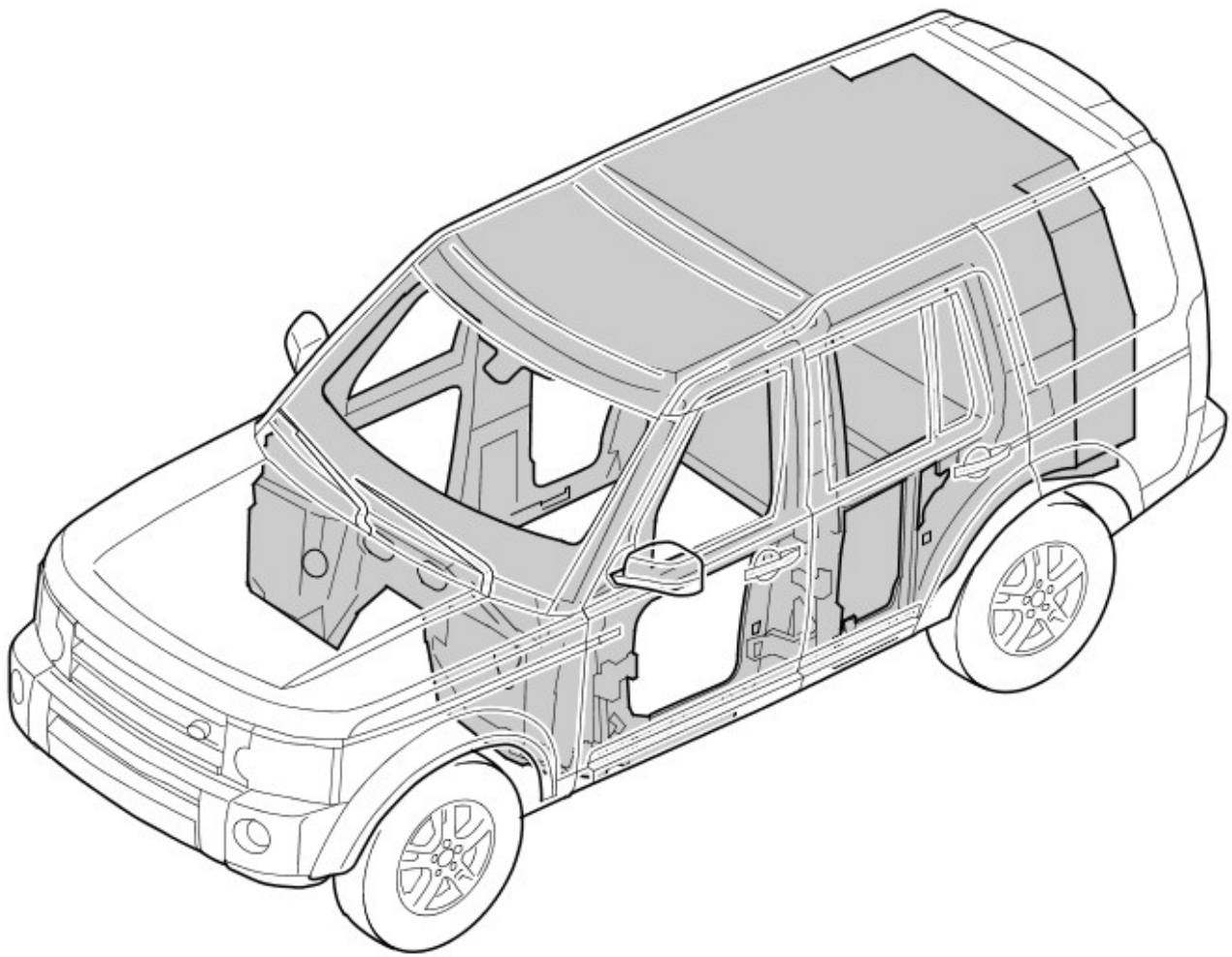
E101511

The vehicle passengers are protected by a steel armoured cell assembled inside the vehicle's bodywork. The cell provides armoured protection to the following areas of the vehicle:

- Bulkhead
- Roof
- Rear three-quarter panels
- 'A' posts
- 'B/C' posts
- 'D' posts
- Sills
- Floor pan

In addition to the floor pan armour, floor protection is also provided by a woven Kevlar blanket, available as an optional fit.

Armoured cell in position



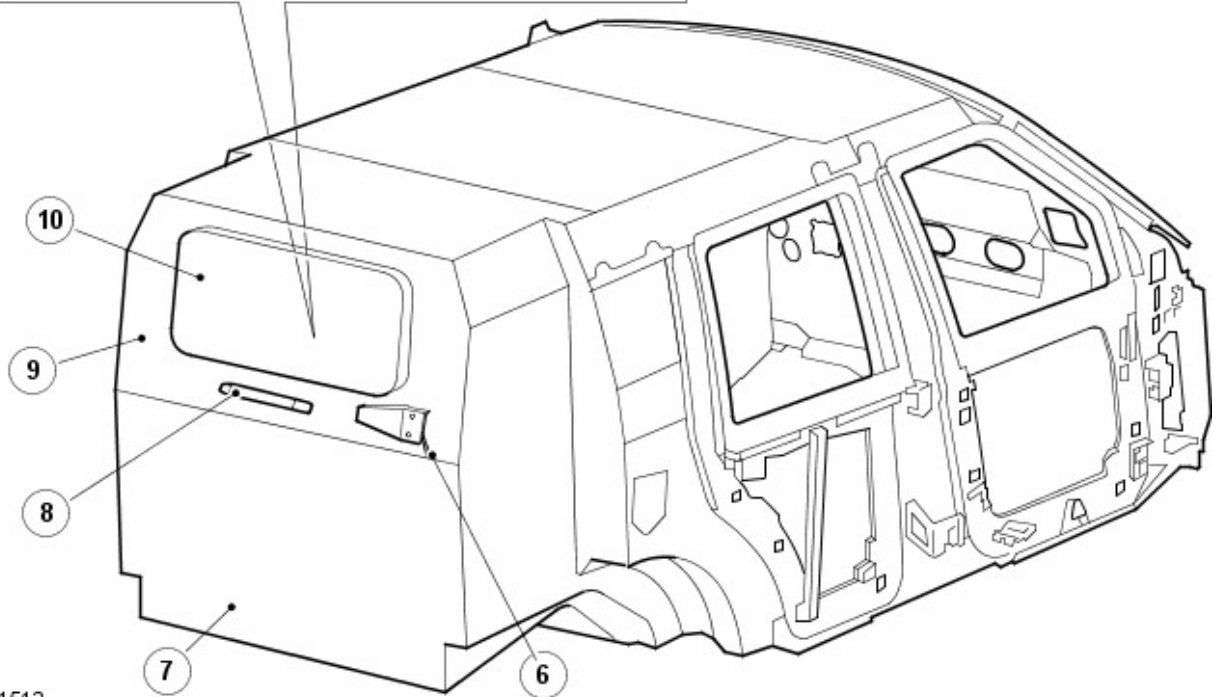
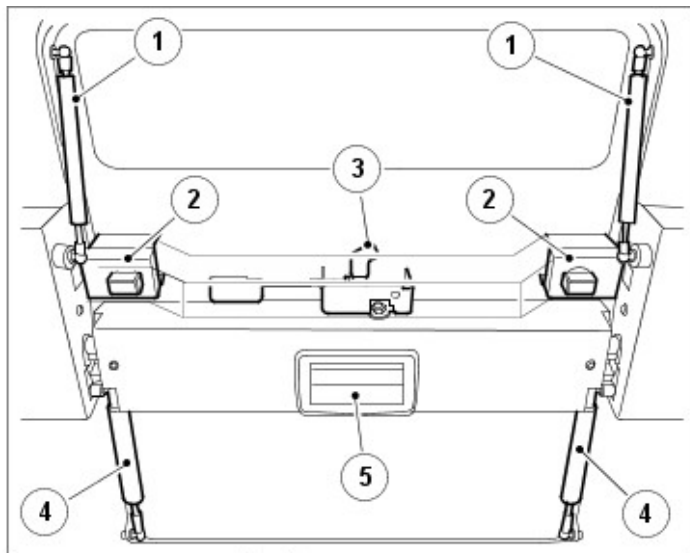
E101513

Doors and Tailgate

The vehicle's doors are reinforced with steel armour, with the exception of the tailgate which remains standard. The armoured cell offers rear-end protection to the vehicle's occupants with the option of either:

- a solid armoured rear end with armoured window; or
- an armoured rear access with armoured window.

Armoured cell rear-access



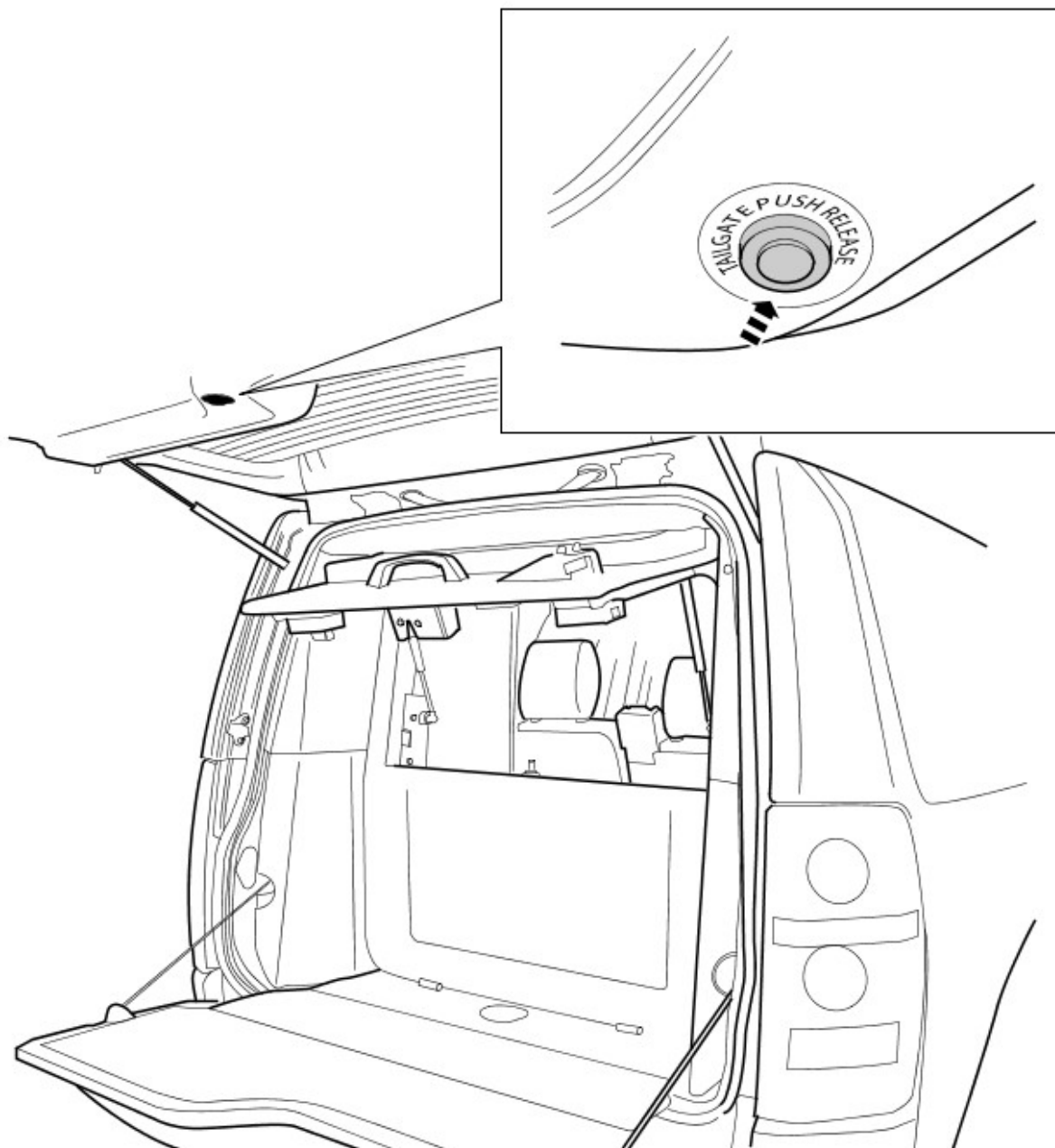
E101512

Item	Part Number	Description
1	-	Upper access panel - gas struts
2	-	Upper access panel - dead locks
3	-	Upper access panel – internal release lever
4	-	Lower access panel – gas struts
5	-	Lower access panel – internal release handle
6	-	Upper access panel – external release lever
7	-	Lower access panel
8	-	Upper access panel - grab handle
9	-	Upper access panel
10	-	Armoured glass window *

*
For additional information, refer to: Glass, Frames and Mechanisms (501-11, Description and Operation).

The armoured access option replicates the vehicle's tailgate by having upper and lower access panels. The access panels can be opened manually both internally and externally if the dead-locks are in the unlocked position. Gas struts fitted to the access panels aid their opening and reduce involuntary shutting.


Tailgate interior release button



E101515

A release button fitted to the interior of the vehicle's upper standard tailgate provides access to the tailgate from inside the vehicle. The release button is a momentary type switch, wired in parallel to the standard release switch on the exterior tailgate handle.

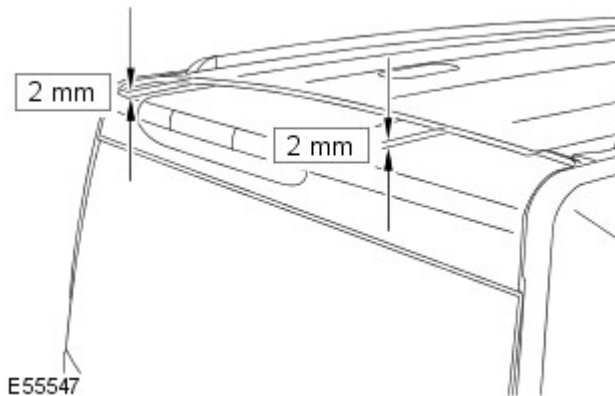
The door hinges, spindles and door stop mechanisms, on the driver and passenger doors are reinforced to support the additional weight of the armour. Gas struts have been fitted to aid door opening and reduce involuntary shutting.

 **CAUTION:** It is recommended that the driver and passenger doors are not opened until the vehicle has come to a complete stop. The combined effect of the vehicle's residual speed and the weight of the door could overcome the door stop mechanism.

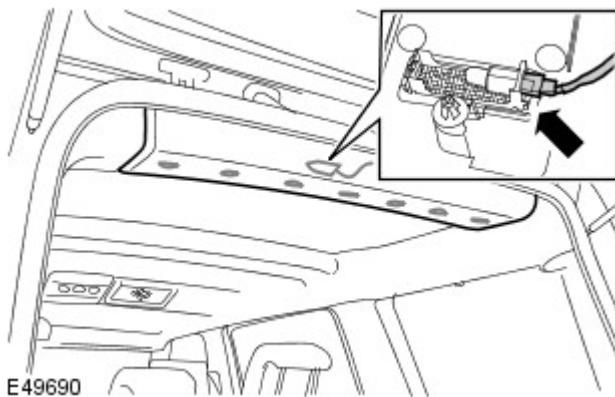
Body Closures - Liftgate Alignment

General Procedures

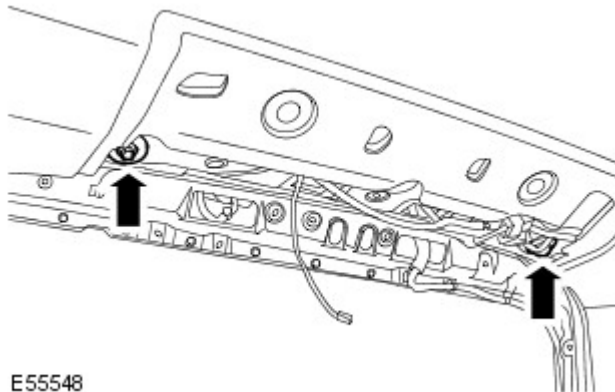
1. With the liftgate closed, check the alignment of the liftgate to roof panel. The liftgate should be central in its aperture. Profile of the liftgate to roof panel should be 2 mm below flush.



2. Remove the rear headliner trim panel.
 - Release the 7 clips.
 - Disconnect the electrical connector.

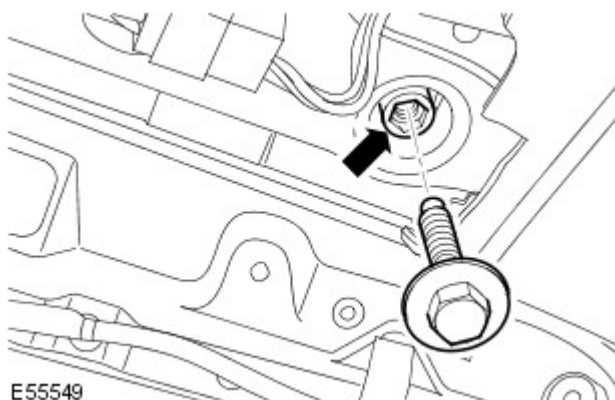


3. Loosen, but do not remove both liftgate hinge to body bolts.



4. Position the liftgate central to the aperture.

5. Remove the LH liftgate to body bolt.



6.  **CAUTION:** When setting the liftgate profile, make sure

that the liftgate hinge NOT being adjusted has its retaining bolt fitted.



NOTE: Turning the Allen key clockwise will raise the liftgate.

Using a 13 mm Allen key, adjust the LH liftgate hinge until a profile of 2 mm below flush to the roof panel is achieved.

- Install the bolt and tighten to 40 Nm (30 lb.ft).

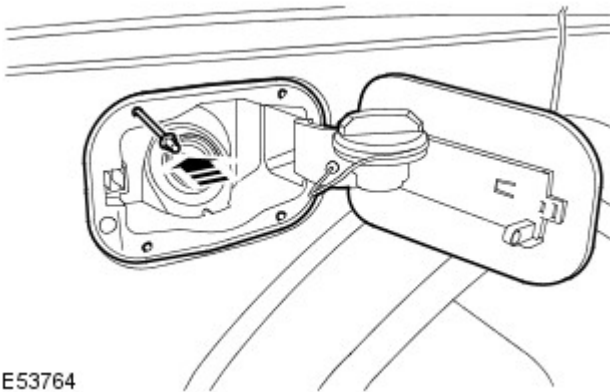
7. Repeat the above procedure for the RH liftgate hinge.
8. Check for correct operation of the liftgate, and if necessary adjust the liftgate and tailgate strikers.
9. Install the rear headliner trim panel.
 - Connect the electrical connector.
 - Secure with the clips.

Body Closures - Fuel Filler Door Assembly

Removal and Installation


Removal


1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the fuel filler interlock catch assembly.
For additional information, refer to: Fuel Filler Interlock Catch (501-03, Removal and Installation).



E53764

3. WARNINGS:

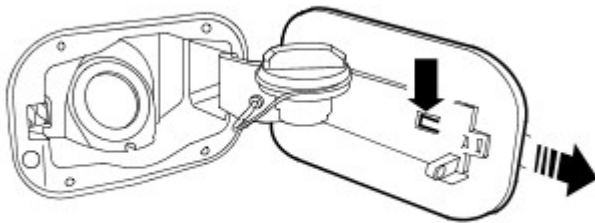
 Place the vehicle in a well ventilated, quarantined area and arrange ' No Smoking/Petrol Fumes' signs about the vehicle.

 Do not carry or operate cellular phones when working on or near any fuel related components. Highly flammable vapors are always present and may ignite. Failure to follow these instructions may result in personal injury.

Remove the fuel filler door and inner assembly.

- Open the fuel filler door and remove the cap.
- Using a 2mm metal rod, pierce the inner assembly and release the 4 clips.
- Release from the filler neck.
- Replace the filler cap.

4. Remove the fuel filler door.
 - Release the clip.



E55132

Installation

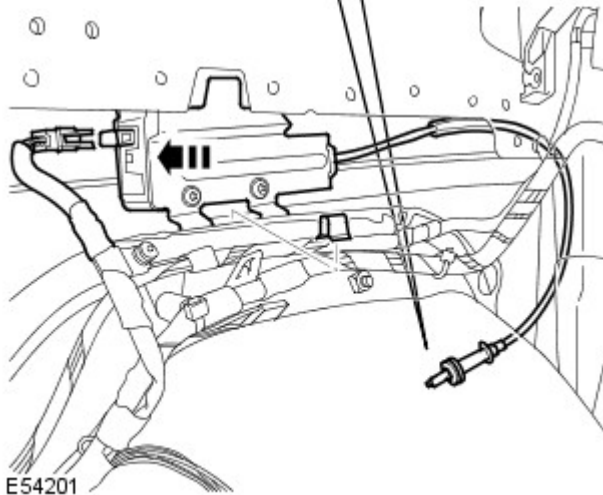
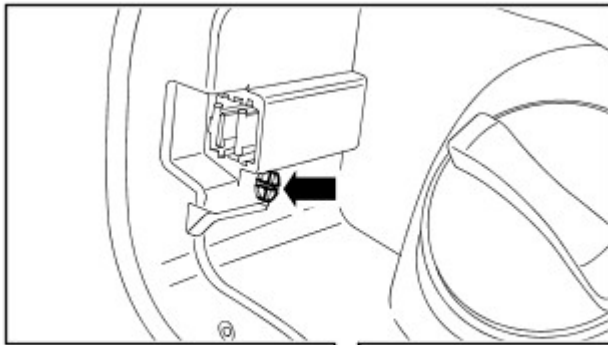
1. Install the filler door.
2. Install the fuel filler door assembly.
 - Clean the component mating faces.
 - Install the filler cap.
 - Close the fuel filler door.
3. Install the fuel filler interlock catch assembly.
For additional information, refer to: Fuel Filler Interlock Catch (501-03, Removal and Installation).
4. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

Body Closures - Fuel Filler Interlock Catch

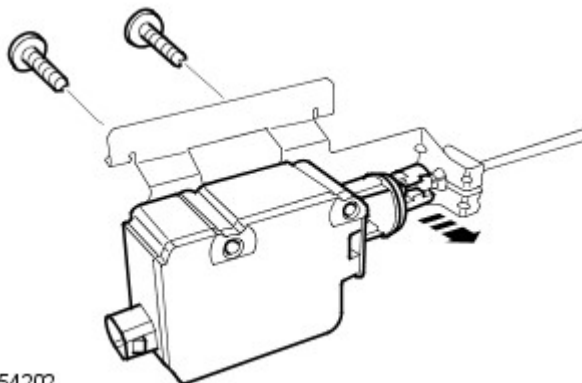
Removal and Installation

Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the C-pillar lower trim panel.
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).
3. Remove the fuel filler interlock catch assembly.
 - Remove the clip.
 - Release the cable.
 - Disconnect the electrical connector.




E54201



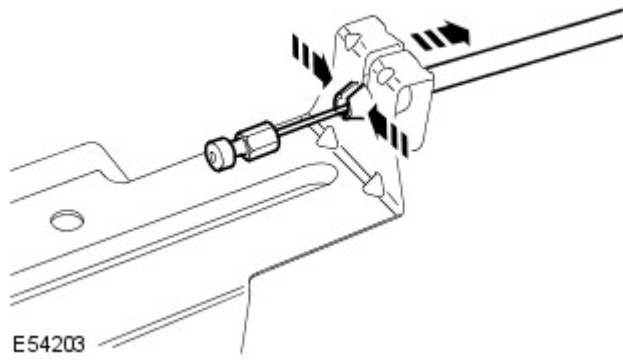
E54202

4. Remove the solenoid.
 - Remove the 2 Torx screws.
 - Release the cable.

5.  **NOTE:** Do not disassemble further if the component is removed for access only.

Release and remove the cable.

- Release the clip.



Installation

1. Install the cable.
 - Secure the clip.
2. Install the solenoid.
 - Attach the cable.
 - Install the Torx screws.
3. Install the fuel filler flap latch assembly.
 - Connect and secure the electrical connector.
 - Carefully secure the clips.
4. Install the C-pillar lower trim panel.
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).
5. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

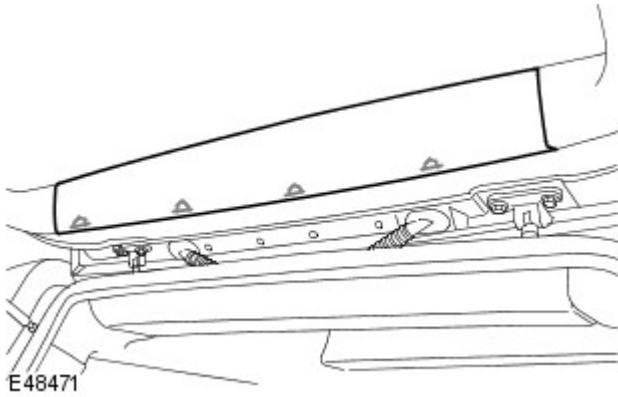
Body Closures - Liftgate

Removal and Installation

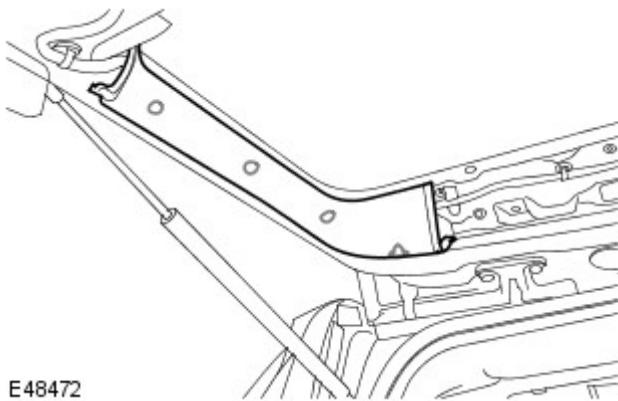
Removal

1. Open the liftgate and tailgate.
2. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

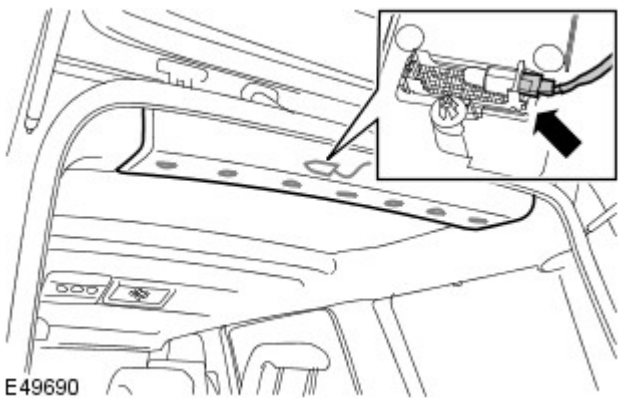
3. Remove the liftgate upper trim panel.
 - Release the 4 clips.



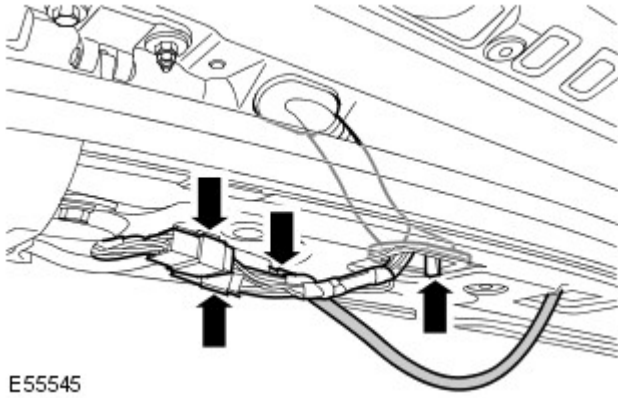
4. Remove the liftgate side trim panel.
 - Release the 5 clips.
 - Repeat the above procedure for the other side.



5. Remove the rear headliner trim panel.
 - Release the 7 clips.
 - Disconnect the electrical connector.

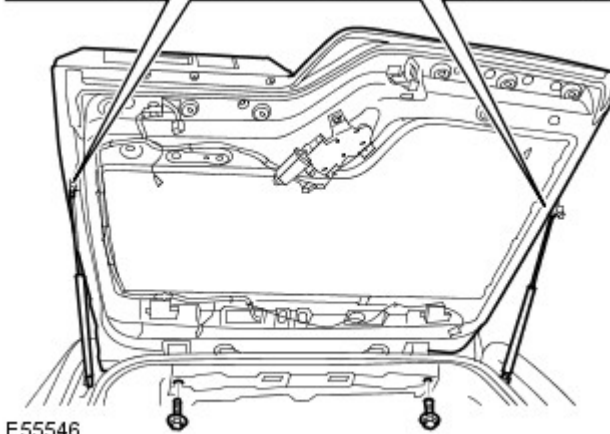
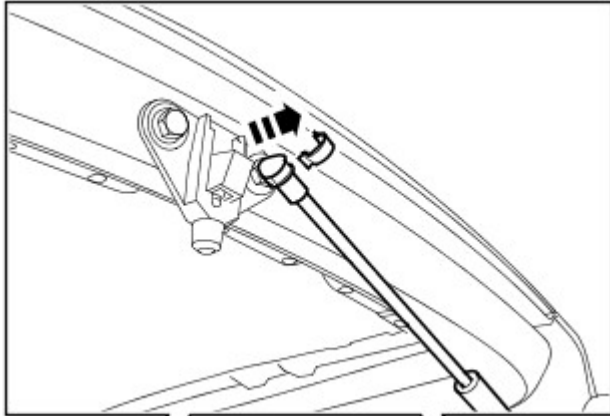


6. Disconnect the washer jet hose.
 - Release the grommet.
7. Release the liftgate wiring harness.
 - Disconnect the 2 electrical connectors.
 - Release the grommet.



E55545

8. With assistance, remove the liftgate assembly.
 - Release the clips and disconnect the struts.
 - Remove the 2 bolts.



E55546

Installation

1. With assistance, install the liftgate assembly.
 - Tighten the bolts to 40 Nm (30 lb.ft).
 - Connect the struts and secure with the clips.
2. Attach the liftgate wiring harness.
 - Install the grommet.
 - Connect the electrical connectors.
3. Connect the washer jet hose.
 - Install the grommet.
4. Install the liftgate side trim panel.
 - Secure with the clips.
 - Repeat the above procedure for the other side.
5. Install the liftgate upper trim panel.
 - Secure with the clips.
6. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
7. Check and adjust the liftgate to roof panel profile.

For additional information, refer to: Liftgate Alignment (501-03, General Procedures).

Interior Trim and Ornamentation -

Torque Specifications

Description	Nm	lb-ft
Safety belt lower anchorage to seat Torx bolt	40	30
Tailgate support strut spigot	25	18
C-pillar lower trim panel Torx screw	8	6
C-pillar upper trim panel Torx screw	3	2
A-pillar trim panel Torx screw	3	2
* Safety belt anchorage Torx bolt	40	30
Foot rest nuts	10	7

* **New bolt must be fitted**

Interior Trim and Ornamentation - Engine Cover V6 S/C 3.0L Petrol

Removal and Installation

Removal

NOTES:

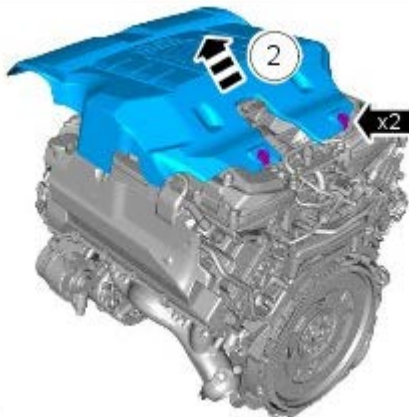
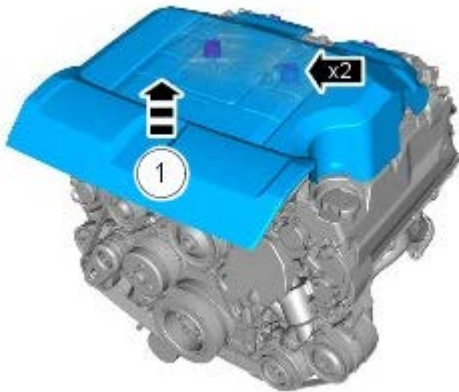


Some variation in the illustrations may occur, but the essential information is always correct.



Removal steps in this procedure may contain installation details.

1.



E142130

Installation

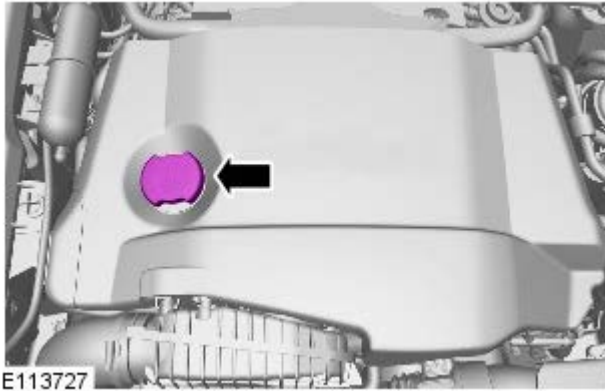
1. To install, reverse the removal procedure.

Interior Trim and Ornamentation - Engine Cover TDV6 3.0L Diesel

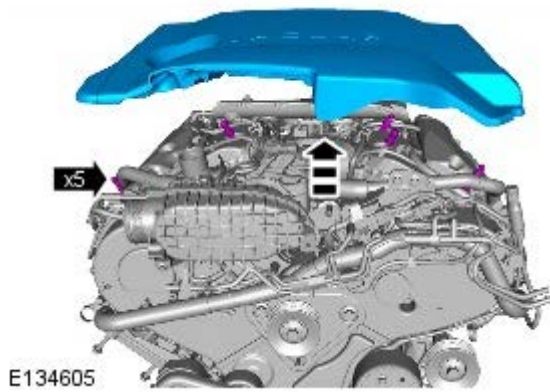
Removal and Installation

Removal

1. Remove the oil filler cap.



- 2.



Installation

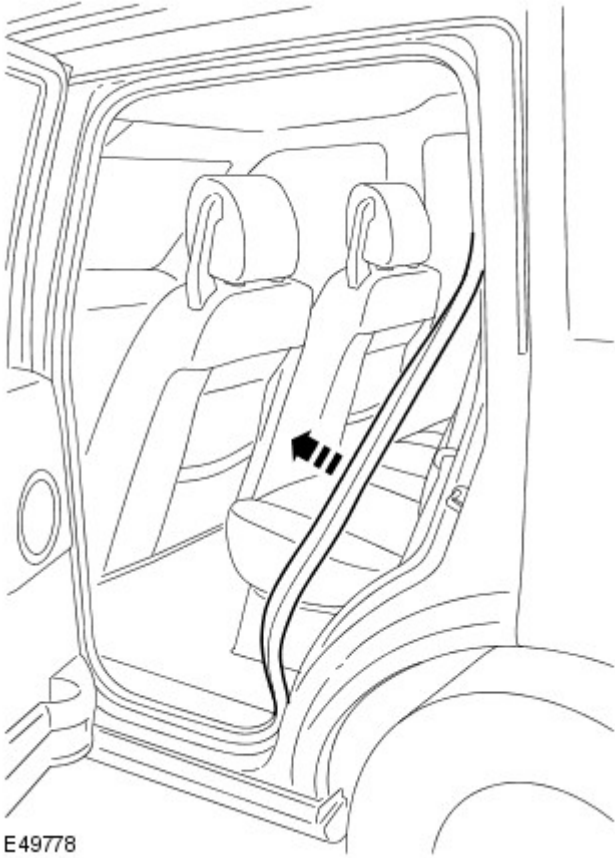
1. To install, reverse the removal procedure.

Interior Trim and Ornamentation - Rear Quarter Trim Panel

Removal and Installation

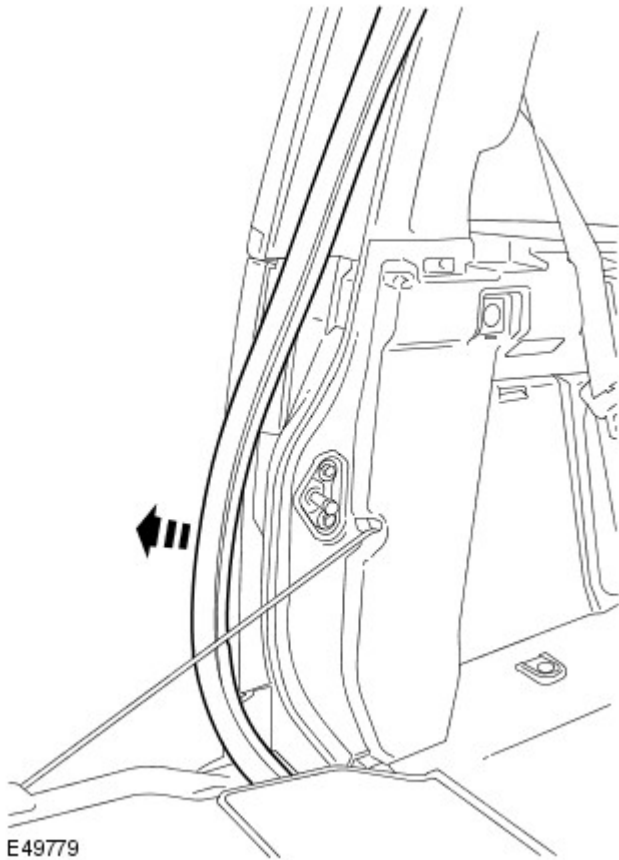
Removal

1. Fold down the rear seat backrest.
2. Release the door aperture weatherstrip.



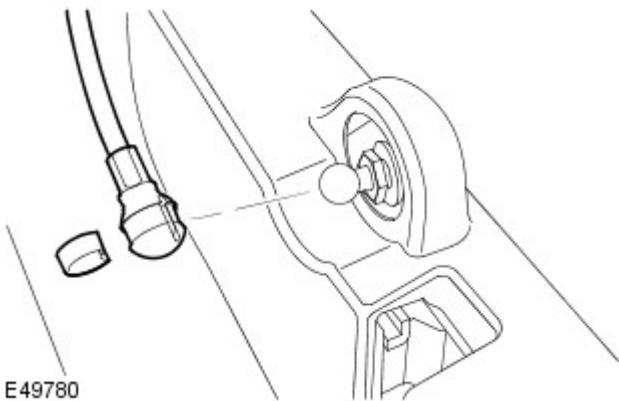
3. Release the safety belt anchor.
 - Remove and discard the bolt.

4. Release the tailgate aperture seal.



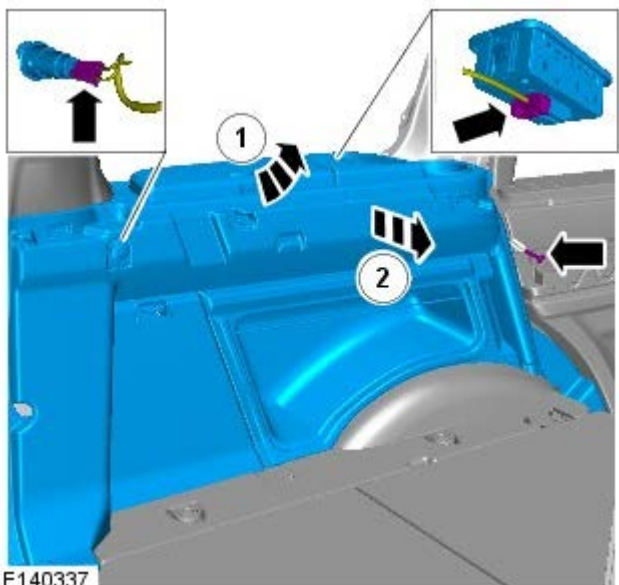
E49779

5. Remove the support spigot from the tailgate.
 - Release the clip.



E49780

6. Remove the rear quarter trim panel.
 - Remove the Torx screw.
 - Lift the storage box lid and using a firm grip, release the window clips by pulling the trim inboard.
 - Release the remaining 6 plastic clips using a suitable tool.
 - Disconnect the 2 electrical connectors.



E140337

7.  NOTE: Do not disassemble further if the component is

removed for access only.

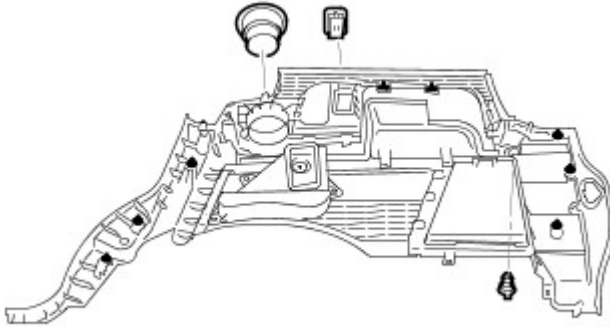
Remove the stowage tray.

- Release the cover.

8. Remove the audio control switch.

- Release the 2 clips.

9. Remove the accessory socket.



E49782

Installation

1. Install the accessory socket.

2. Install the audio control switch.

- Secure the clips.

3. Install the stowage tray.

- Install the cover.

4. Install the rear quarter trim panel.

- Install the clips.
- Tighten the Torx screw to 8 Nm (6 lb.ft).
- Connect the electrical connector.

5. Install the support spigot to the tailgate.

- Install the clip.

6. Install the tailgate aperture seal.

7. Install the safety belt anchor.

- Tighten the Torx bolt to 40 Nm (30 lb.ft).

8. Install the door aperture weatherstrip.

9. Return the seat backrest to the upright position.

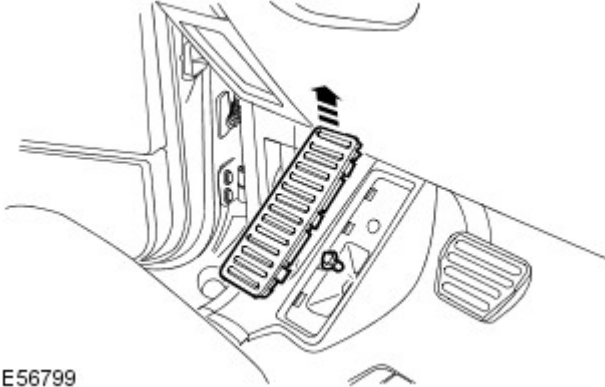
Interior Trim and Ornamentation - Cowl Side Trim Panel

Removal and Installation

Removal

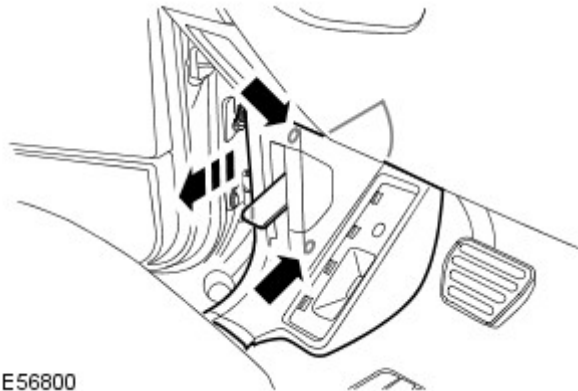
1. Remove the front scuff plate trim panel.
For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).

2. Driver side: Remove the footrest trim panel bolt.
 - Remove the cover.



E56799

3. Remove the cowl side trim panel.
 - Driver side: Release the hood release lever.
 - Release from the 2 clips.



E56800

Installation

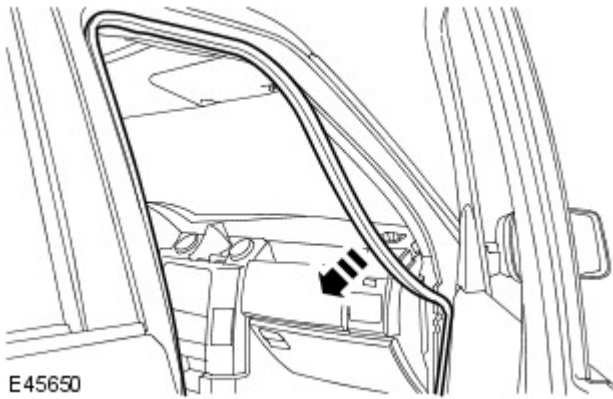
1. Install the cowl side trim panel.
 - Align the hood release lever.
 - Secure with the clips.
2. Driver side: Tighten the footrest trim panel bolt to 5 Nm (4 lb.ft).
 - Install the cover.
3. Install the front scuff plate trim panel.
For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).

Interior Trim and Ornamentation - A-Pillar Trim Panel

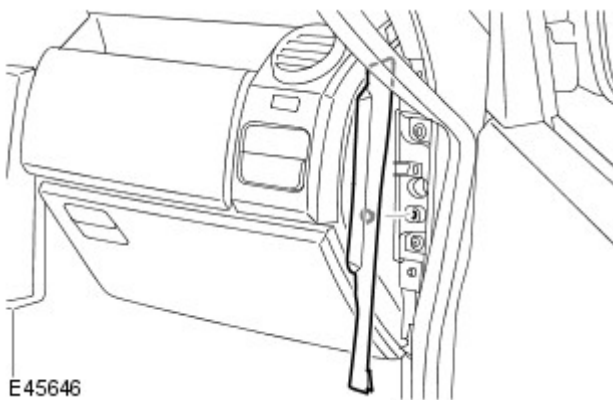
Removal and Installation

Removal

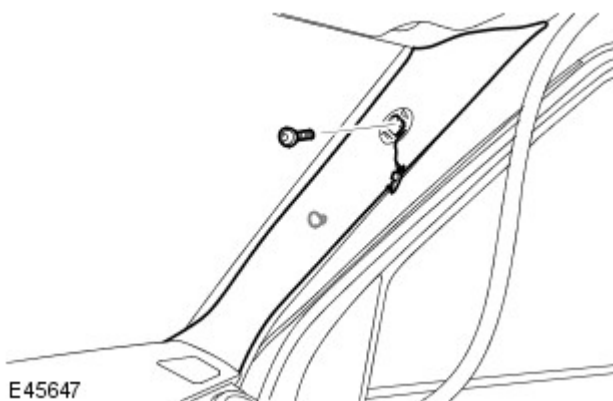
1. Release the door weatherstrip to access the A-pillar upper trim panel and instrument panel end panel.




2. Remove the instrument panel end panel.
 - Release the clip.

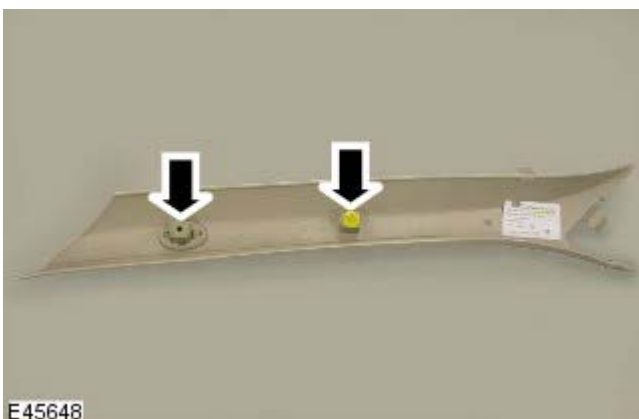


3. Remove the A-pillar upper trim panel.
 - Release the screw cover.
 - Remove and discard the Torx screw.
 - Release the clip.



4.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the screw retainer and clip from the A-pillar upper trim panel.



Installation

1. Install the screw retainer and clip to the A-pillar upper trim

panel.

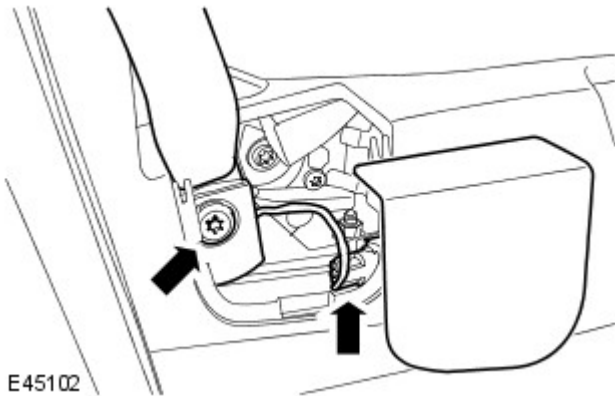
2. Install the A-pillar upper trim panel.
 - Secure with the clip.
 - Install a new Torx screw and tighten to 3 Nm (2 lb.ft).
 - Install the screw cover.
3. Install the instrument panel end panel.
 - Secure with the clip.
4. Attach the door weatherstrip.

Interior Trim and Ornamentation - B-Pillar Upper Trim Panel

Removal and Installation

Removal


1. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
2. Remove the B-pillar lower trim panel.
For additional information, refer to: B-Pillar Lower Trim Panel (501-05, Removal and Installation).
3. Release the safety belt lower anchor from the seat.
 - Remove the bolt cover.
 - Passenger side, disconnect the electrical connector.
 - Remove the Torx bolt.



E45102



E45728

4.  **NOTE:** Make sure the seat belt height adjuster is at its lowest point prior to removal of the B-pillar upper trim panel.

Remove the B-pillar upper trim panel.

- Release the front and rear door weatherstrips for access.
- Release the 2 lower clips, then the remaining upper clip.
- Release the safety belt.

Installation

1. Install the B-pillar upper trim panel.
 - Secure with the clips.
 - Attach the safety belt.
 - Attach the door weatherstrips.
2. Attach the safety belt lower anchor to the seat.
 - Tighten the Torx bolt to 40 Nm (30 lb.ft).
 - Passenger side, connect the electrical connector.
 - Install the bolt cover.
3. Install the B-pillar lower trim panel.
For additional information, refer to: B-Pillar Lower Trim Panel (501-05, Removal and Installation).

Interior Trim and Ornamentation - B-Pillar Lower Trim Panel

Removal and Installation

Removal


1. Remove the B-pillar lower trim panel.
 - Release weatherstrip from both sides of the B-pillar lower trim panel.
 - Release the 4 clips.



E43145



E43146

2.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove 4 clips from the B-pillar lower trim panel.

Installation

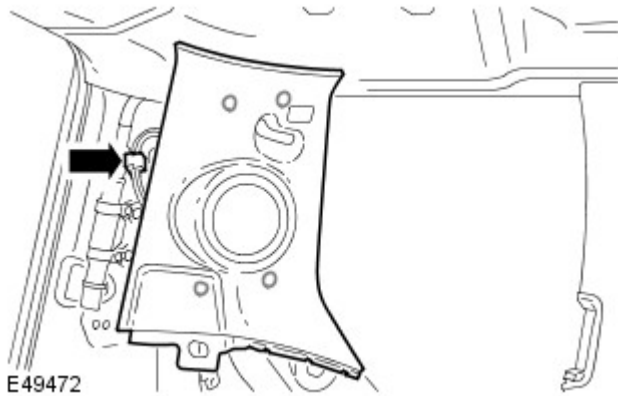
1. To install, reverse the removal procedure.


Interior Trim and Ornamentation - D-Pillar Trim Panel

Removal and Installation

Removal

1. Remove the C-pillar lower trim panel.
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).
2. Vehicles fitted with 7 seats: Release the seat belt.
 - Remove and discard the bolt.
3. Remove the D-pillar upper trim panel.
 - Release the 4 clips.
 - Disconnect the electrical connector.



4.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the speaker.

- Remove the 3 screws.

Installation

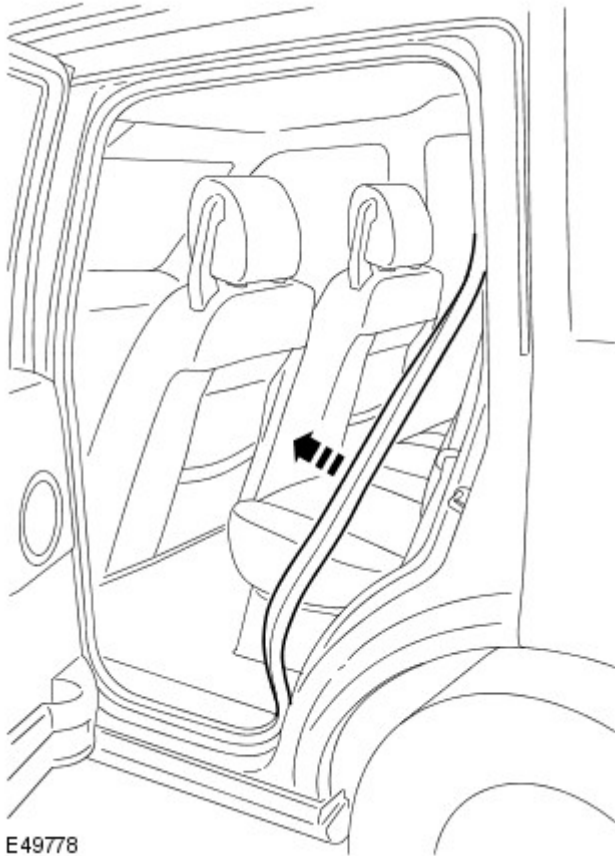
1. To install, reverse the removal procedure.
 - Tighten the new Torx bolt to 40 Nm (30 lb.ft).

Interior Trim and Ornamentation - C-Pillar Lower Trim Panel

Removal and Installation

Removal

1. Fold down the rear seat backrest.
2. Remove the loadspace trim panel RH. For additional information, refer to: Loadspace Trim Panel RH (501-05, Removal and Installation).
3. Release the door aperture weatherstrip.



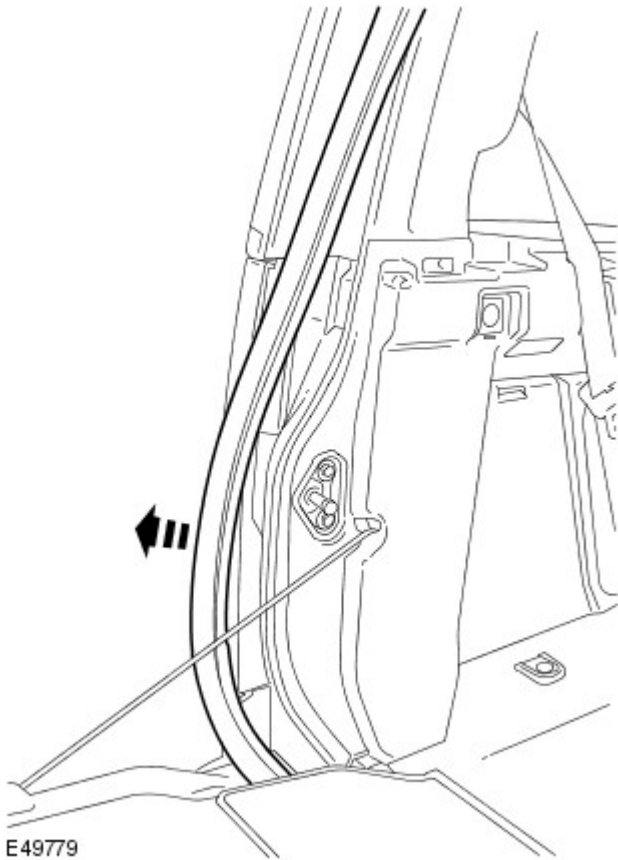
E49778



E49594

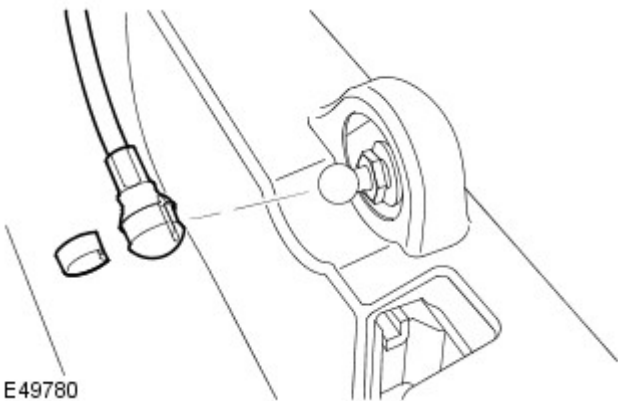
4. Release the safety belt anchor.
 - Remove and discard the bolt.

5. Release the tailgate aperture seal.



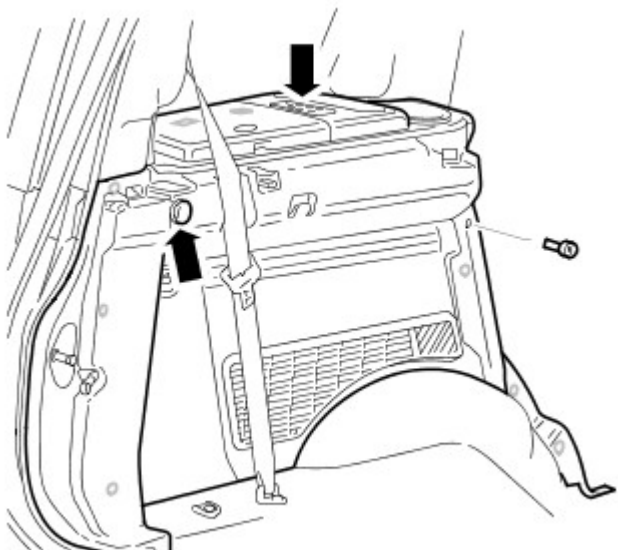
E49779

6. Remove the support spigot from the tailgate.
 - Release the clip.



E49780

7. Remove the C-pillar lower trim panel.
 - Remove the screw.
 - Release the 8 clips.
 - Disconnect the 2 electrical connectors.



E49781

8.  NOTE: Do not disassemble further if the component is

removed for access only.

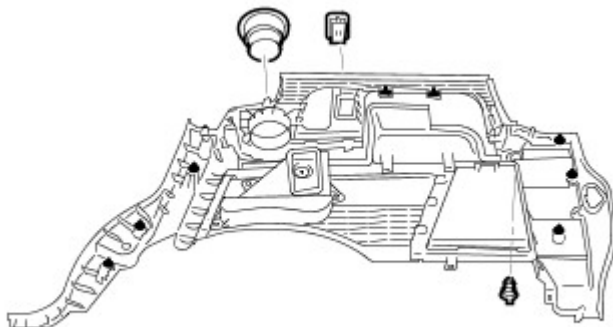
Remove the stowage tray.

- Release the cover.

9. Remove the audio control switch.

- Release the 2 clips.

10. Remove the accessory socket.



E49782

Installation

1. Install the accessory socket.

2. Install the audio control switch.

- Secure the clips.

3. Install the stowage tray.

- Install the cover.

4. Install the C-pillar lower trim panel.

- Install the clips.
- Tighten the screw to 8 Nm (6 lb.ft).
- Connect the electrical connector.

5. Install the support spigot to the tailgate.

- Install the clip.

6. Install the tailgate aperture seal.

7. Install the safety belt anchor.

- Tighten the Torx bolt to 45 Nm (33 lb.ft).

8. Install the door aperture weatherstrip.

9. Remove the loadspace trim panel RH. For additional information, refer to: Loadspace Trim Panel RH (501-05, Removal and Installation).

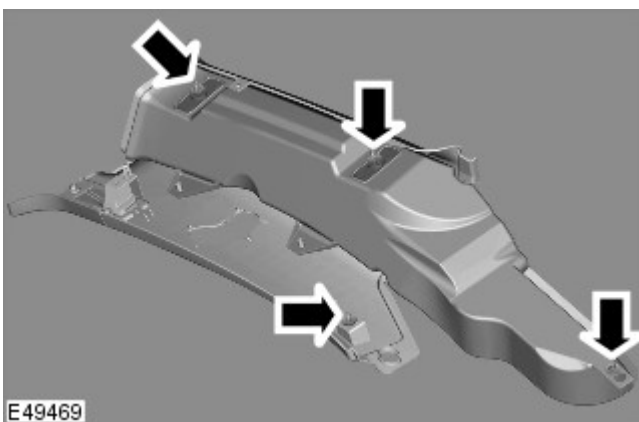
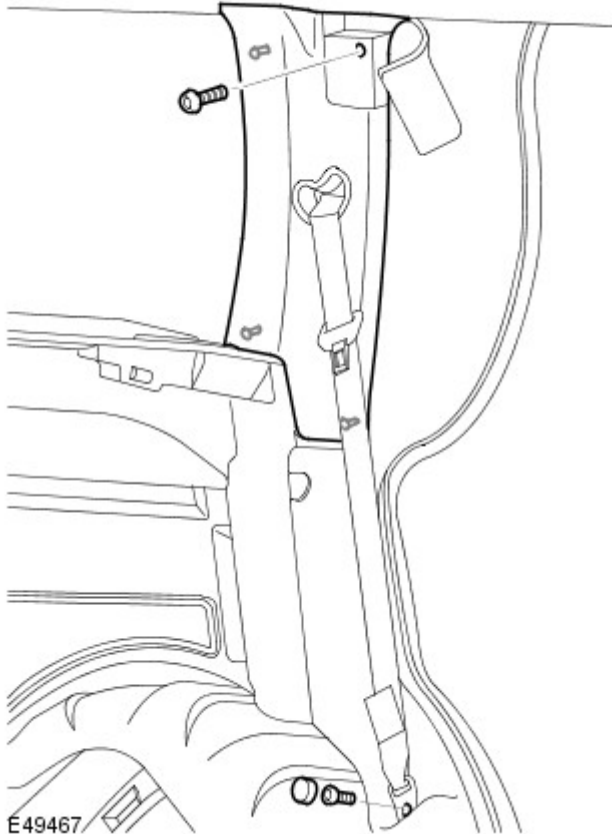
10. Return the seat backrest to the upright position.


Interior Trim and Ornamentation - C-Pillar Upper Trim Panel

Removal and Installation

Removal

1. Fold down the rear seat backrest.
2. Release the door aperture weatherstrip.
3. Release the safety belt lower anchor.
 - Remove and discard the Torx bolt.
4. Release the upper trim access cover.
5. Remove the C-pillar upper trim panel.
 - Remove and discard the Torx screw.
 - Release the 4 clips.
 - Release the safety belt from the seat.



6.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the 4 clips from the C-pillar upper trim panel.

Installation

1. Install the clips to the C-pillar upper trim panel.
2. Install the C-pillar upper trim panel.
 - Attach the safety belt.
 - Secure with the clips.
 - Install a new Torx screw and tighten to 3 Nm (2 lb.ft).

3. Install the upper trim access cover.
4. Install the safety belt lower anchor.
 - Tighten the new Torx bolt to 40 Nm (30 lb.ft).
5. Install the door aperture weatherstrip.
6. Return the seat backrest to the upright position.

Interior Trim and Ornamentation - Front Door Trim Panel

Removal and Installation

Removal

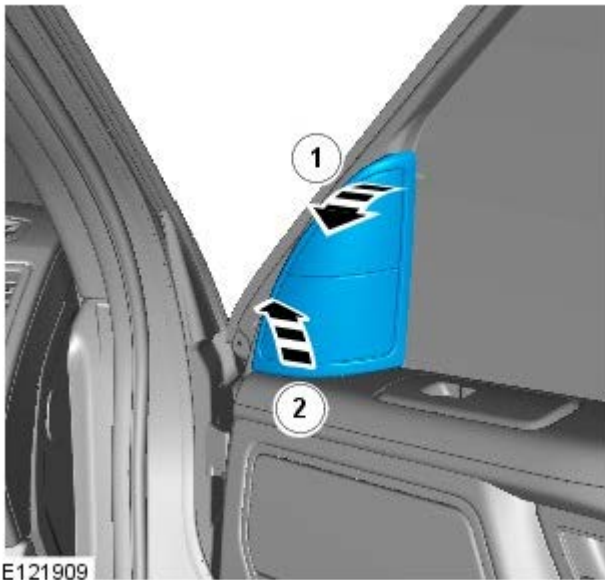
NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.



1. CAUTIONS:

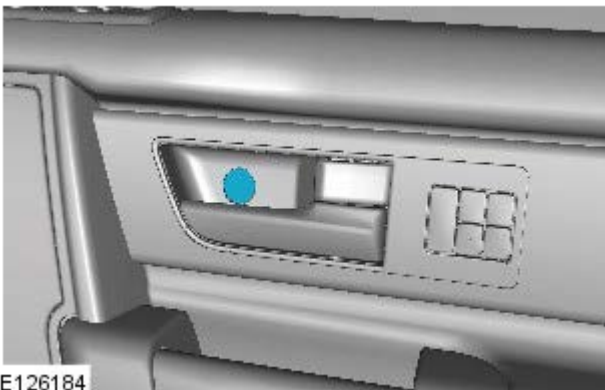


Take extra care not to damage the component.



Make sure that the clips are correctly located.

Disconnect the tweeter speaker electrical connector.



2.

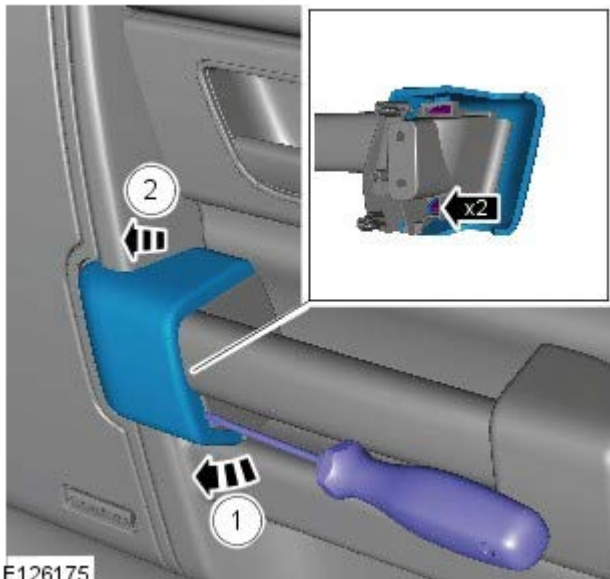


3.

4. CAUTIONS:





Take extra care not to damage the

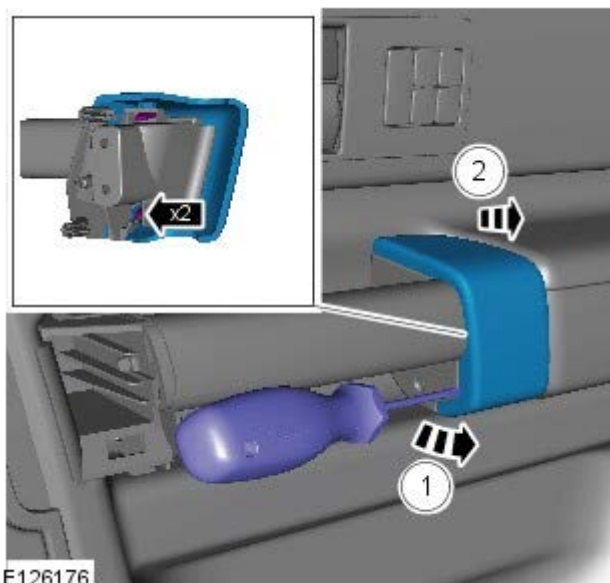


E126175

component. Apply masking tape to the end of the screwdriver.


 When removing the chrome finisher from the trim panel, make sure the components are not damaged. If necessary protect the surrounding areas using masking tape.


 Make sure that the clips are correctly located.




E126176

5. CAUTIONS:

 Take extra care not to damage the component. Apply masking tape to the end of the screwdriver.

 When removing the chrome finisher from the trim panel, make sure the components are not damaged. If necessary protect the surrounding areas using masking tape.

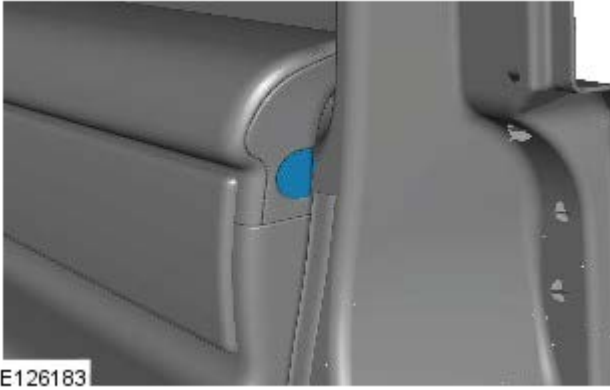
 Make sure that the clips are correctly located.



E126173

6.

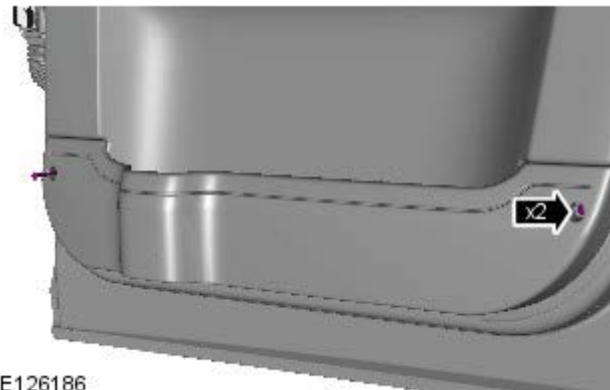
7.



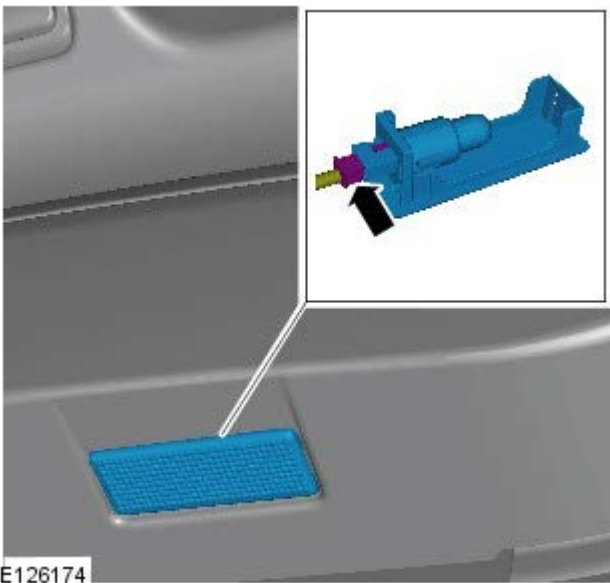
8.




9.



10.



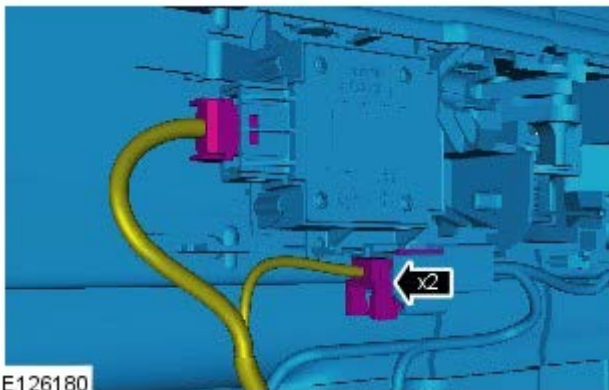
11.  CAUTION: Take extra care not to damage the wiring harnesses.



Detach the front door trim panel.

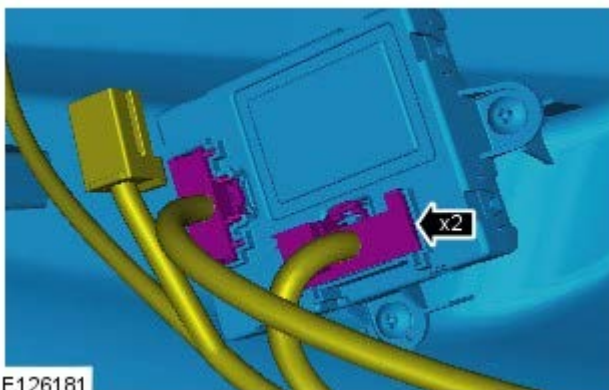
E126177

12.



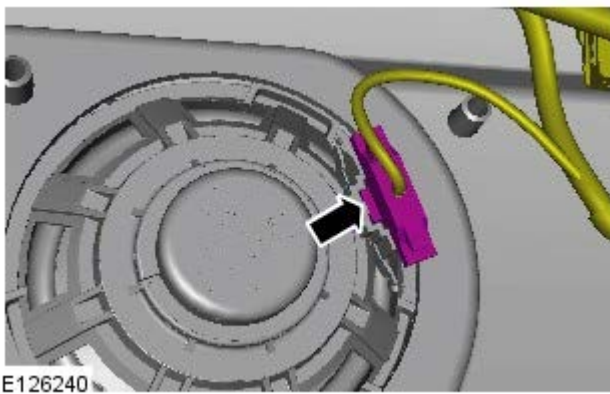
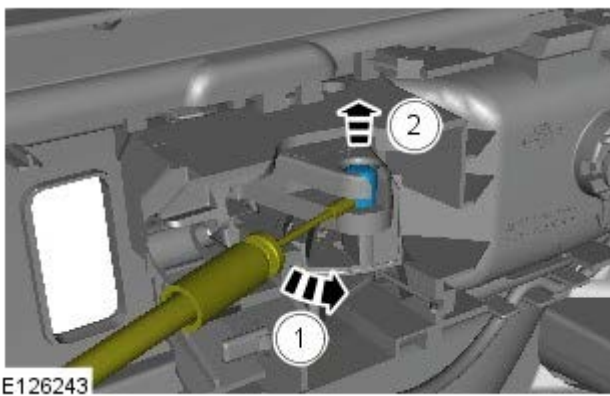
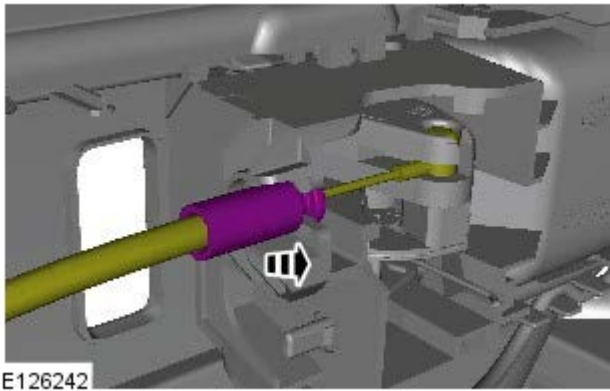
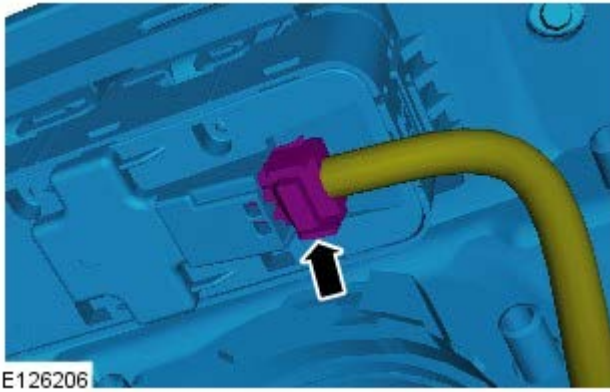
E126180


13.



E126181

14.



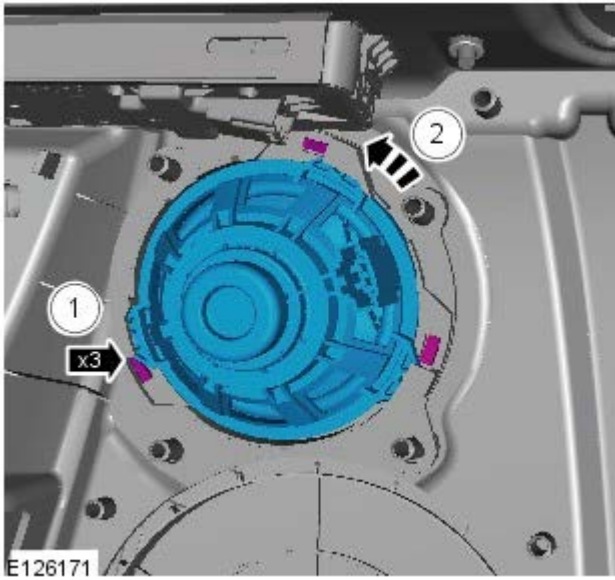
15.  CAUTION: Make sure that the release cable is removed from the door trim panel using the plastic fixing and not using the cable.

16.

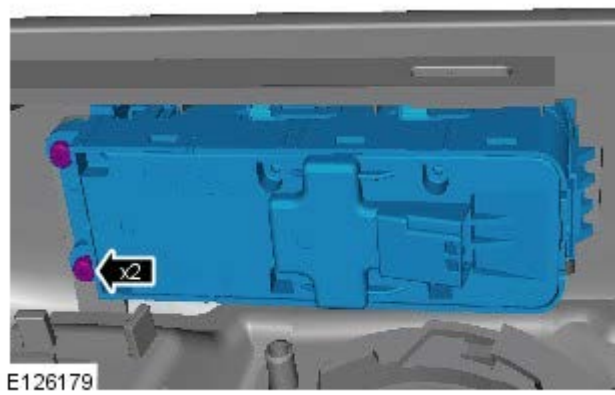
17. Remove the front door trim panel.

18.  NOTE: Do not disassemble further if the component is removed for access only.

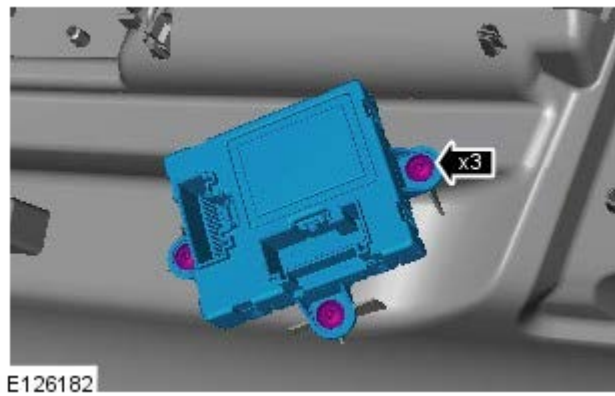
19.



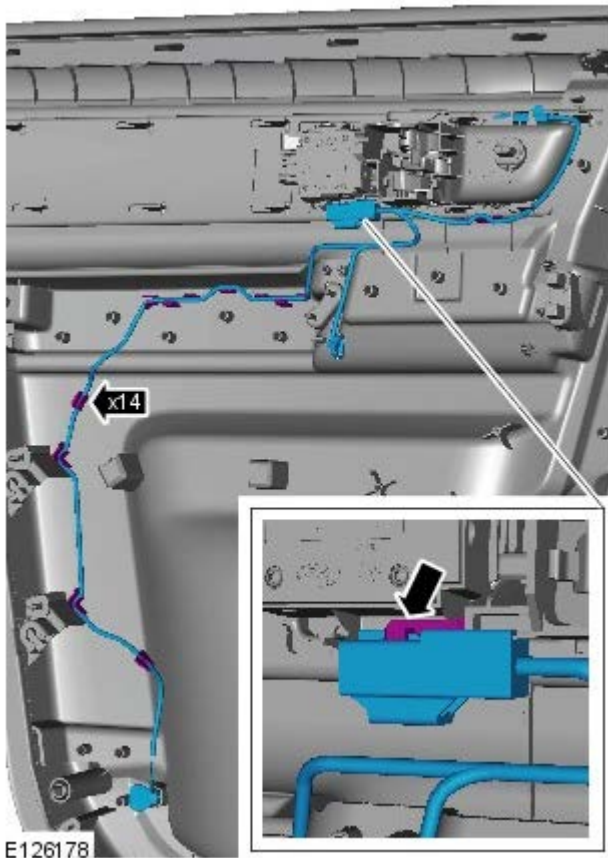
20.



21.

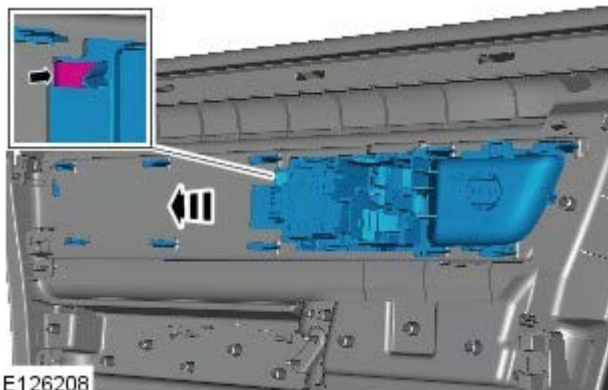


22.



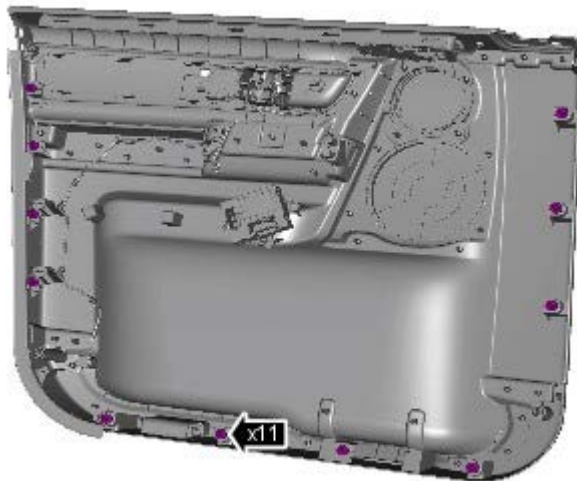
E126178

23. Release the retaining tang.



E126208

24.



E126172

Installation

1. To install, reverse the removal procedure.

Interior Trim and Ornamentation - Rear Door Trim Panel

Removal and Installation

Removal

NOTES:

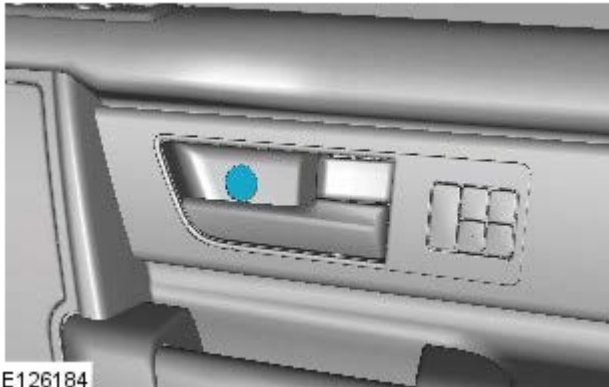


Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1.



E126184

2.



E126207

3. CAUTIONS:



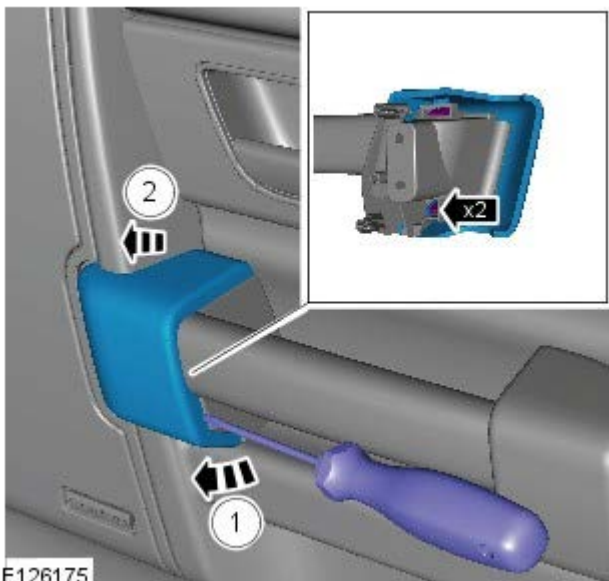
Take extra care not to damage the component. Apply masking tape to the end of the screwdriver.



When removing the chrome finisher from the trim panel, make sure the components are not damaged. If necessary protect the surrounding areas using masking tape.



Make sure that the clips are correctly located.

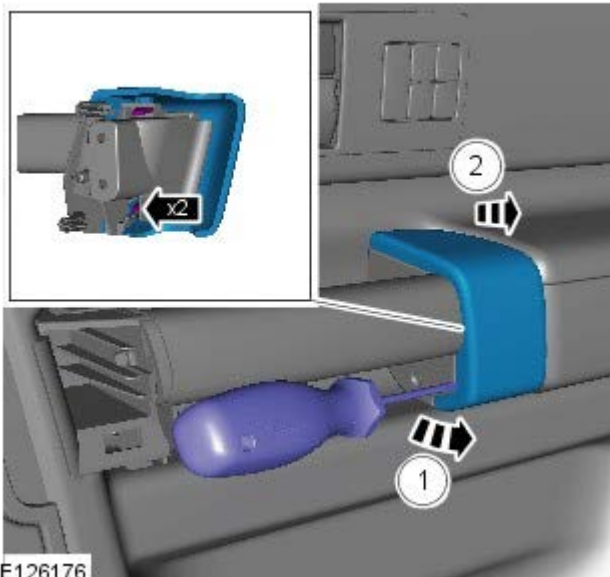


E126175

4. CAUTIONS:





Take extra care not to damage the



E126176

component. Apply masking tape to the end of the screwdriver.

 When removing the chrome finisher from the trim panel, make sure the components are not damaged. If necessary protect the surrounding areas using masking tape.

 Make sure that the clips are correctly located.

5.



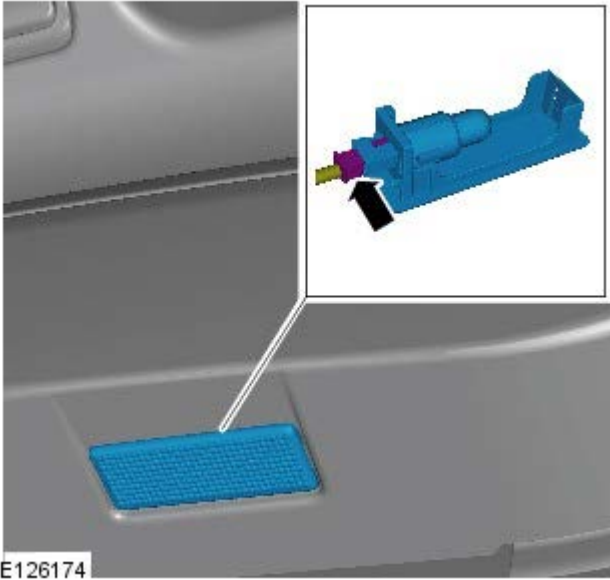
E126173


6.



E126225

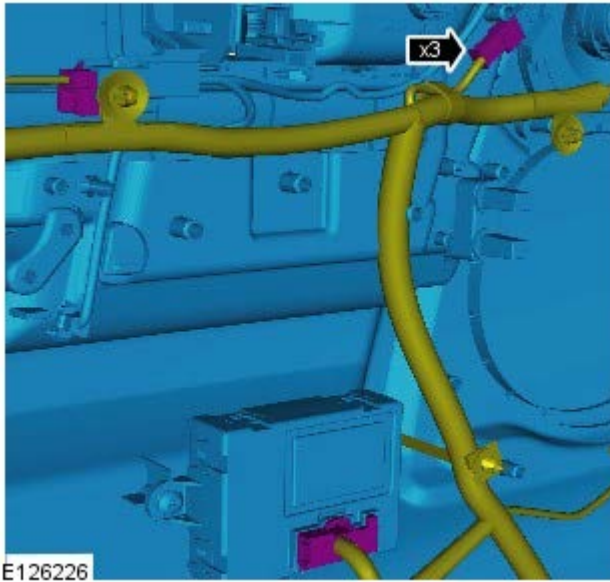
7.



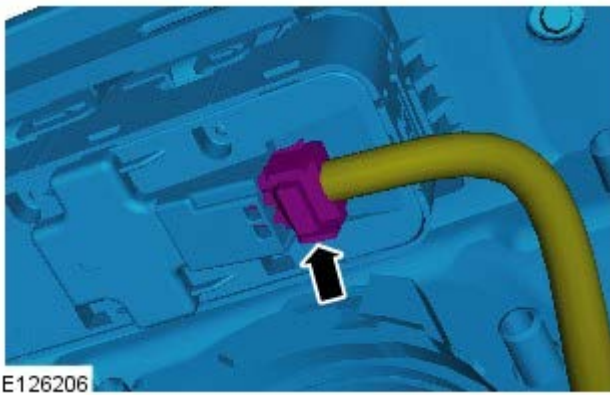
8.  CAUTION: Take extra care not to damage the wiring harnesses.


Detach the rear door trim panel.

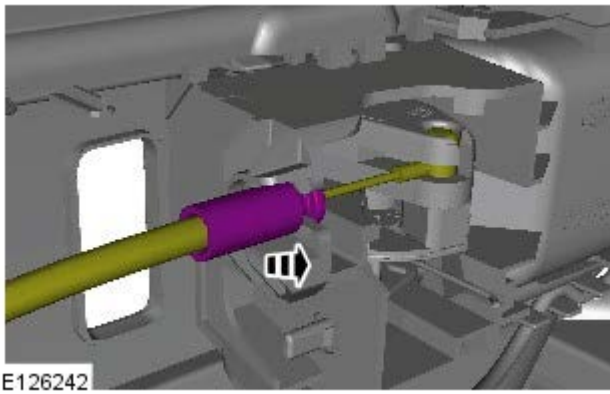
9.



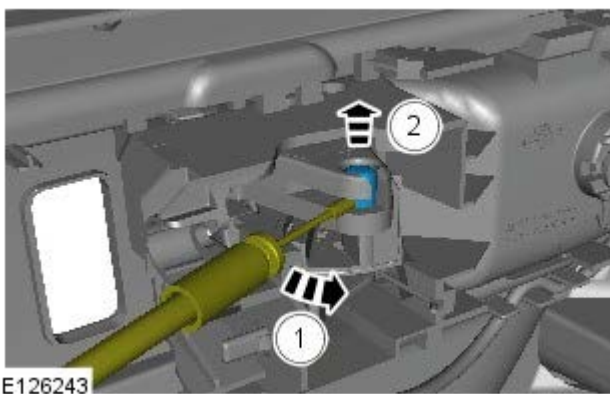
10.



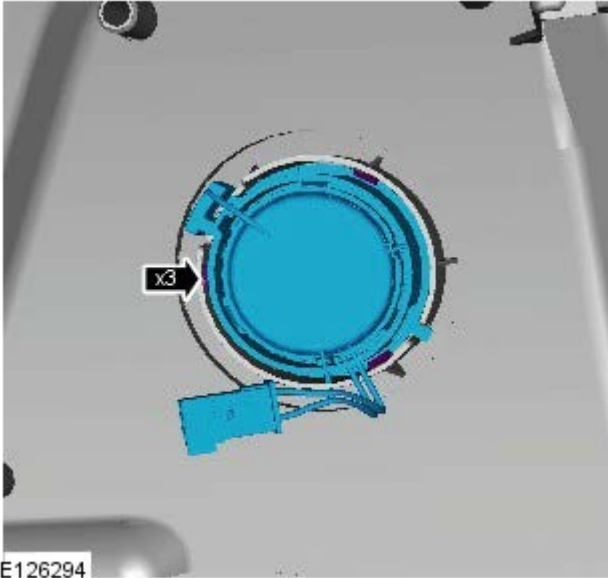
11.  CAUTION: Make sure that the release cable is removed from the door trim panel using the plastic fixing and not using the cable.




12.

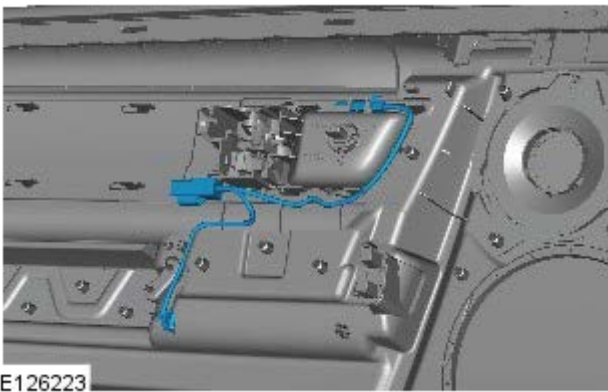


13. Remove the rear door trim panel.



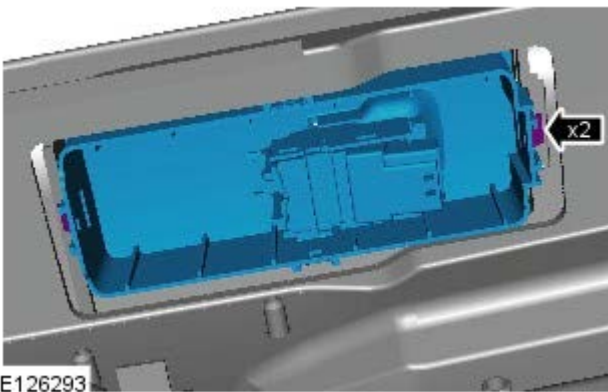
E126294

14.  NOTE: Do not disassemble further if the component is removed for access only.



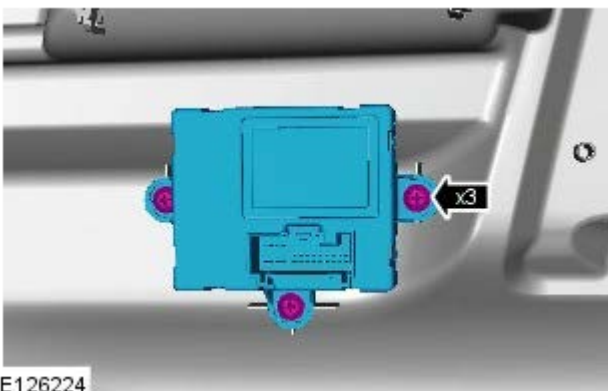
E126223

- 15.



E126293

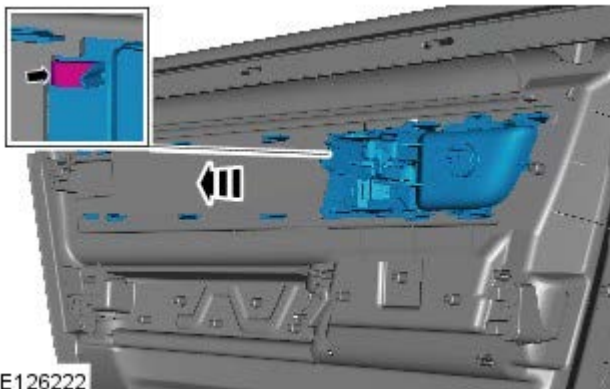
- 16.



E126224

- 17.

18. Release the retaining tang.



19.



E126227

Installation

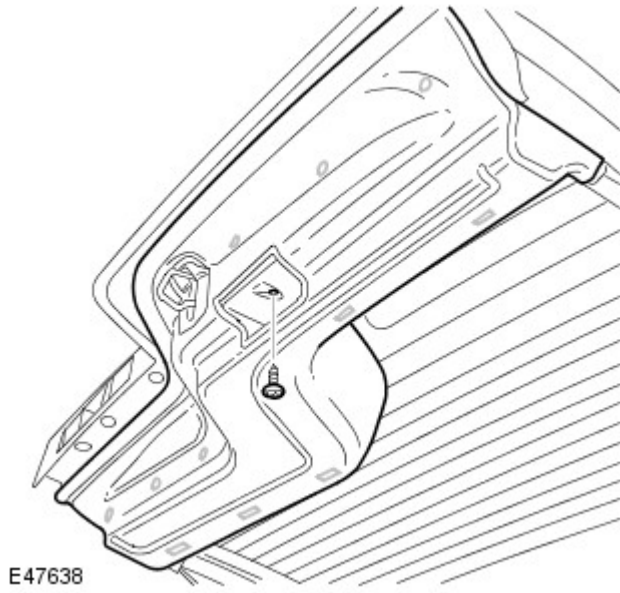
1. To install, reverse the removal procedure.

Interior Trim and Ornamentation - Liftgate Trim Panel


Removal and Installation

Removal

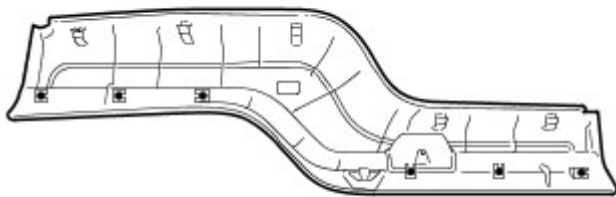
1. Remove the liftgate trim panel.
 - Remove the screw.
 - Release the 11 clips.



2. Remove the liftgate striker trim panel.

3.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove 6 clips from the liftgate trim panel.



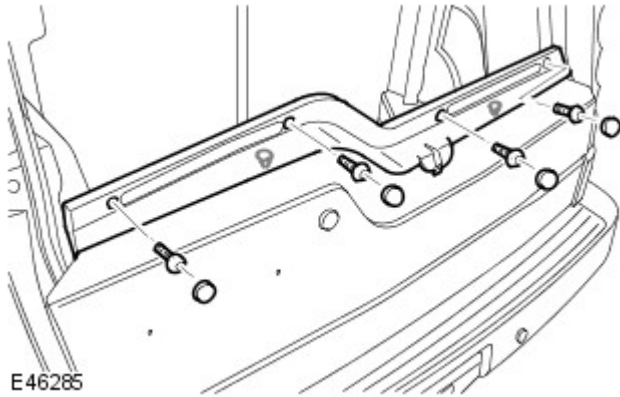
Installation

1. To install, reverse the removal procedure.

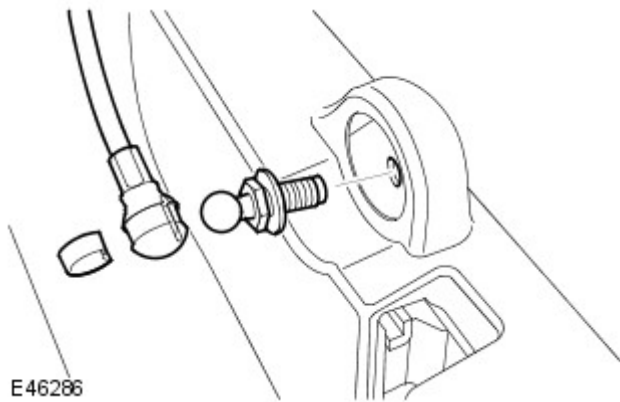
Interior Trim and Ornamentation - Tailgate Trim Panel

Removal and Installation

Removal



1. Remove the tailgate upper trim panel.
 - Remove the 4 screw covers.
 - Remove the 4 screws.
 - Release the 2 clips.



2.  **CAUTION:** To protect the paintwork, the tailgate must be supported at all times.

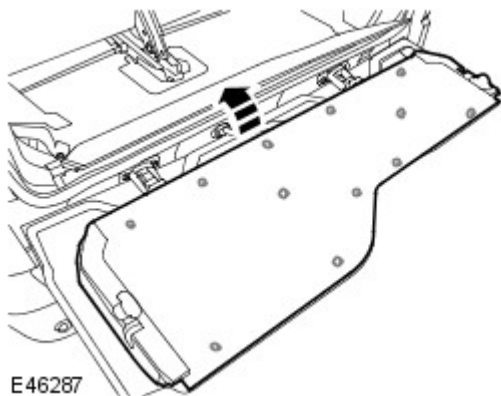
Release the 2 support cables from the tailgate.


- Release the 2 clips.

3. Remove the 2 support cable spigots from the tailgate.

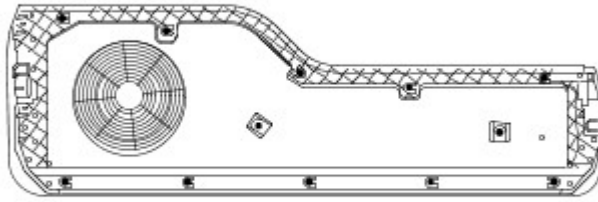
4. Lift the tailgate hinge cover for access.

5. Remove the tailgate trim panel.
 - Release from the 12 clips.



6.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the 12 clips from the tailgate trim panel.



E46288

Installation

1. Install the tailgate trim panel.
 - Install the clips.
2. Lower the tailgate hinge cover.
3. Tighten the support strut spigot to 25 Nm (18 lb.ft).
4. Position the support cables to the tailgate and secure with the clips.
5. Install the tailgate upper trim panel.
 - Secure with the clips.
 - Install the screws.
 - Install the screw covers.

Interior Trim and Ornamentation - Scuff Plate Trim Panel

Removal and Installation

Removal

NOTES:



Some components shown removed for clarity.




Some variation in the illustrations may occur, but the essential information is always correct.

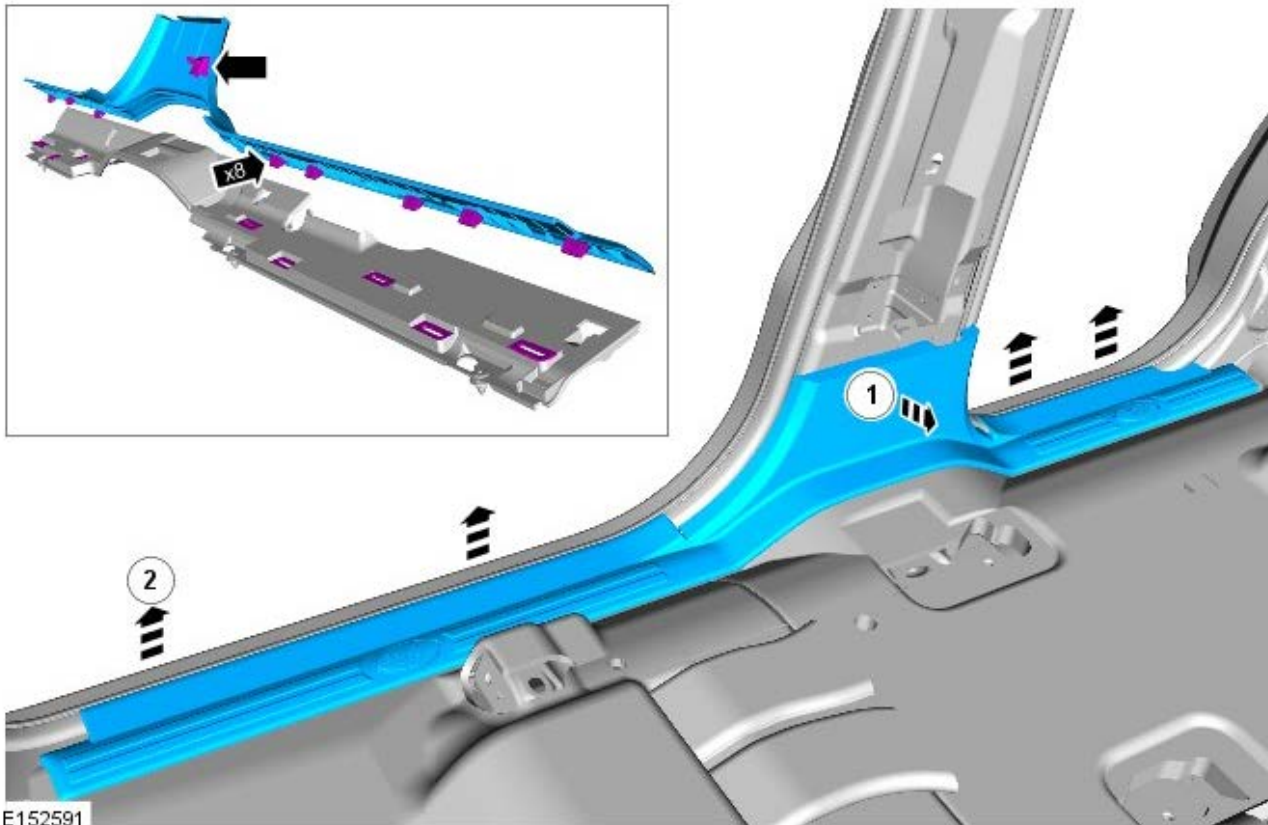


Removal steps in this procedure may contain installation details.



RH shown, LH similar.

1. Remove the B-pillar lower trim panel.
For additional information, refer to: B-Pillar Lower Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
2.  **CAUTION:** Care must be taken when releasing the trim panel from the retaining clips.



E152591

Installation

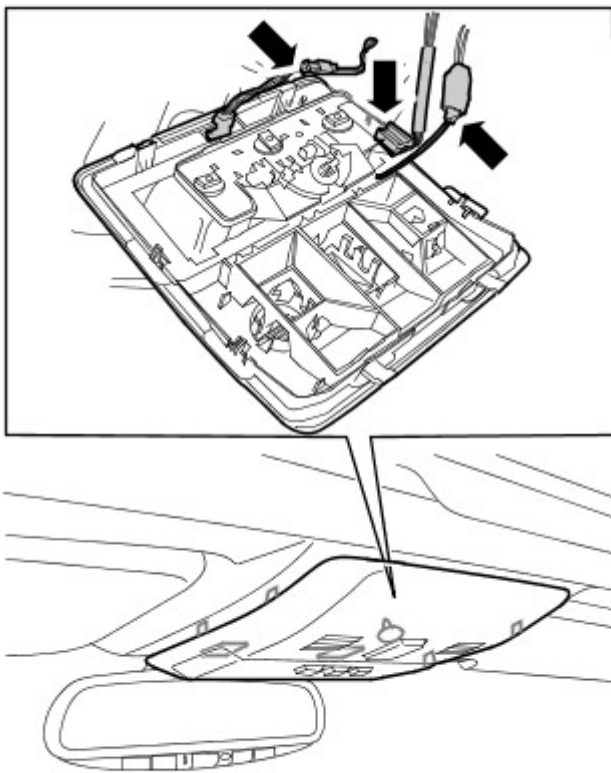
1. To install, reverse the removal procedure.

Interior Trim and Ornamentation - Headliner

Removal and Installation

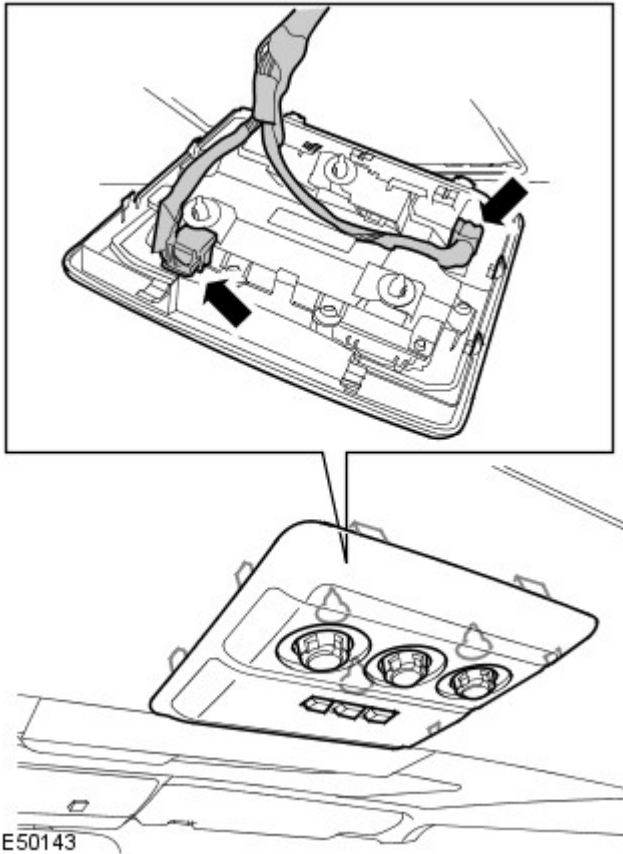
Removal

1. Remove both A-pillar upper trim panels.
For additional information, refer to: A-Pillar Trim Panel (501-05, Removal and Installation).
2. Remove both B-pillar upper trim panels.
For additional information, refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).
3. Remove both C-pillar upper trim panels.
For additional information, refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).
4. Remove both D-pillar upper trim panels.
For additional information, refer to: D-Pillar Trim Panel (501-05, Removal and Installation).
5. Remove the front overhead console.
 - Carefully release the 7 clips.
 - Disconnect the 3 electrical connectors.

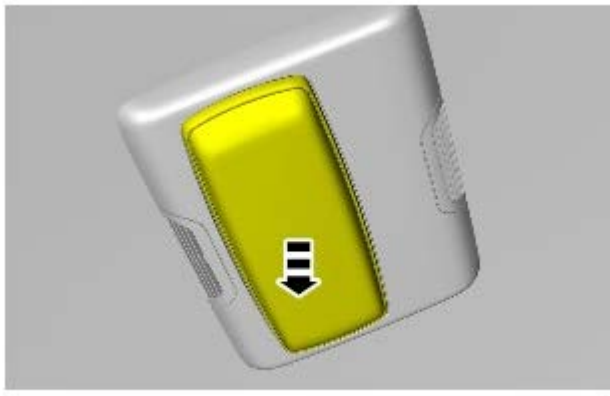


E50142

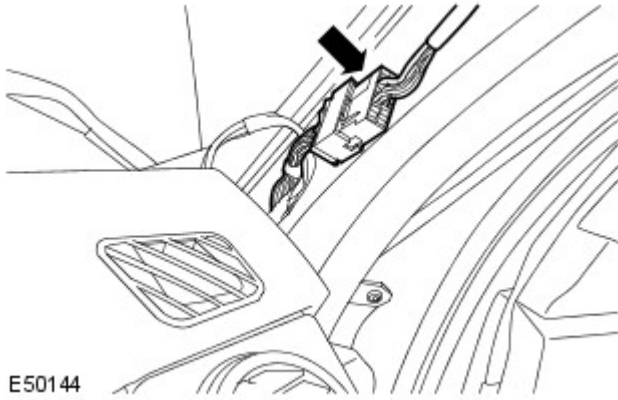
6. Remove the rear overhead console.
 - Carefully release the 9 clips.
 - Disconnect the 2 electrical connectors.



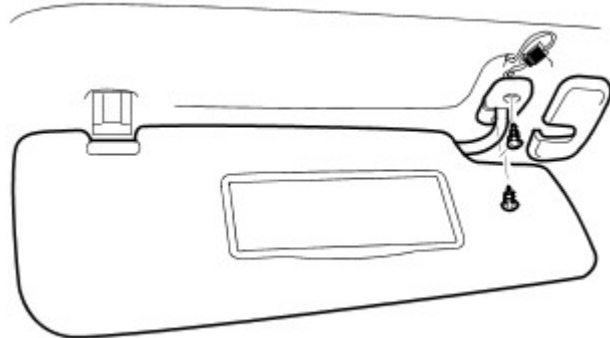
7. Remove the Bluetooth module.



8. Disconnect the RH A-pillar electrical connector.



E50144



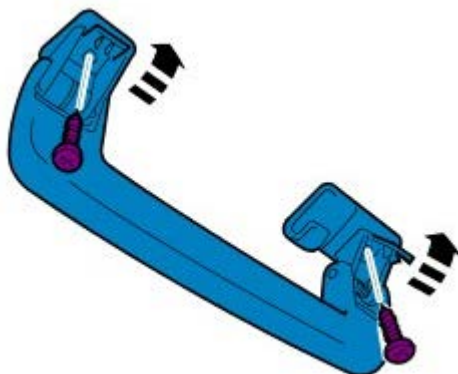
E49687

9. Remove the sun visor.
 - Remove the cover.
 - Remove the 2 screws.
 - Release from the clip.
 - Disconnect the electrical connector.
 - Repeat the above procedure for the other side.



E49688

10. Remove the sun visor retaining clip.
 - Release the screw cover.
 - Remove the screw.
 - Repeat the above procedure for the other side.



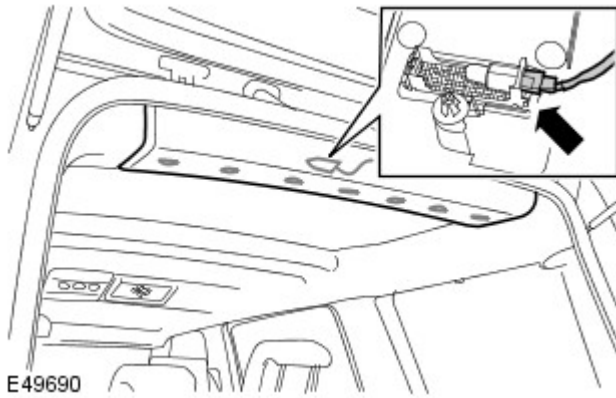
E49689

11. Remove the passenger assist handle.
 - Release the 2 screw covers.
 - Remove the 2 screws.
 - Repeat the above procedure for the remaining 5 handles.

12. Position the front seats fully forward.

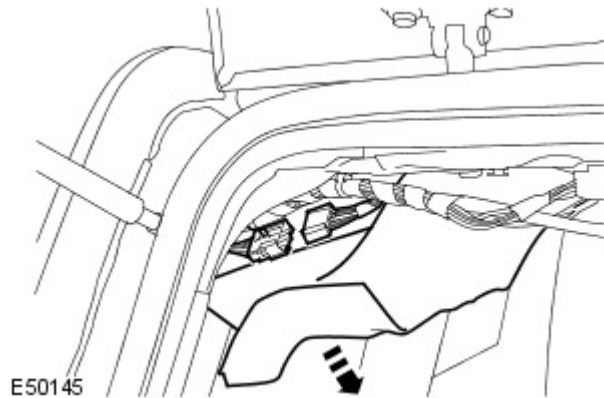
13. Position the rear seats fully forward.

14. Remove the rear headliner trim panel.
 - Release the 7 clips.
 - Disconnect the electrical connector.



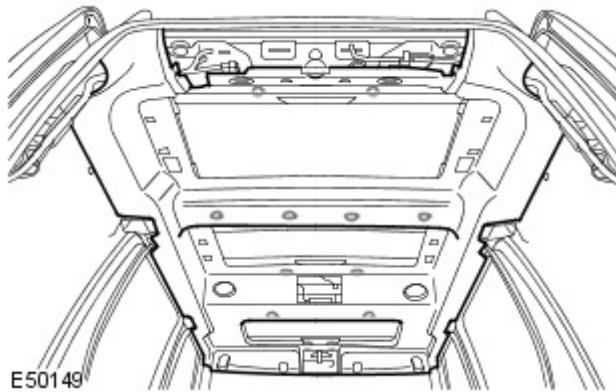
E49690

15. Disconnect the headliner wiring harness rear electrical connector.




E50145

16. With assistance, carefully remove the headliner.
 - Release the 14 clips.

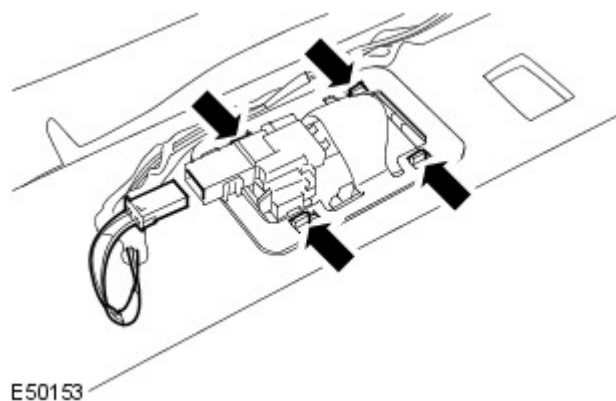


E50149

17.  **NOTE:** Do not disassemble further if the component is removed for access only.

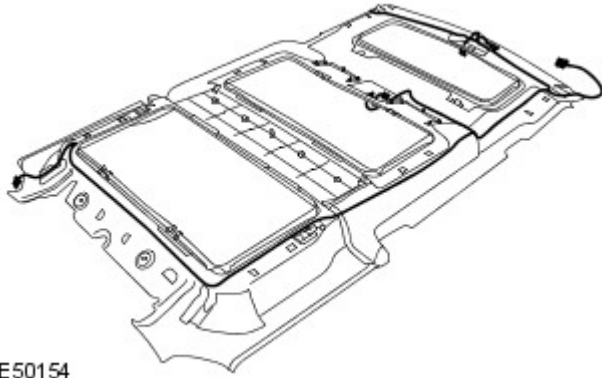
Remove the rear interior lamp.

- Release the clip.
- Disconnect the electrical connector.
- Repeat the above procedure for the other side.



E50153

18. Remove the headliner wiring harness.



E50154

Installation

1. Install the headliner wiring harness.
 - Secure the wiring harness to the headliner.
2. Install the interior lamp.
 - Secure with the clip.
 - Connect the electrical connector.
 - Repeat the above procedure for the other side.
3. With assistance, carefully install the headliner.
 - Secure with the clips.
4. Connect the headliner wiring harness rear electrical connector.
5. Install the rear headliner trim panel.
 - Secure the clips.
6. Reposition the rear seats.
7. Reposition the front seats.
8. Install the passenger assist handles.
 - Install the screws.
 - Secure the screw covers.
9. Install the sun visors.
 - Install the clips.
 - Install the screws.
 - Install the screw covers.
 - Connect the electrical connectors.
10. Connect the RH A-pillar electrical connector.
11. Install the Bluetooth module.
12. Install the rear overhead console.
 - Connect the electrical connectors.
 - Carefully secure the clips.
13. Install the front overhead console.
 - Connect the electrical connectors.
 - Carefully secure the clips.
14. Install both D-pillar upper trim panels.
For additional information, refer to: D-Pillar Trim Panel (501-05, Removal and Installation).
15. Install both C-pillar upper trim panels.
For additional information, refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).
16. Install both B-pillar upper trim panels.
For additional information, refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).
17. Install both A-pillar upper trim panels.

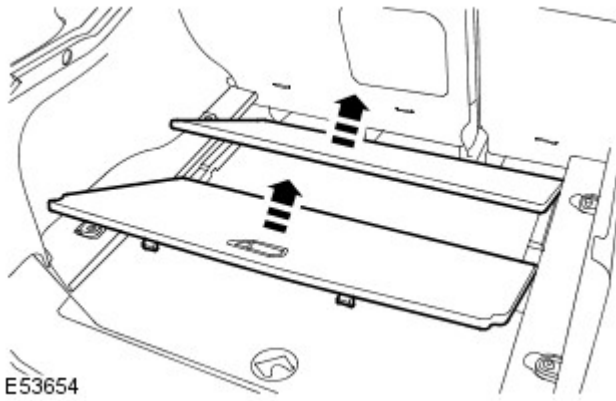
For additional information, refer to: A-Pillar Trim Panel
(501-05, Removal and Installation).

Interior Trim and Ornamentation - Loadspace Trim Panel RH

Removal and Installation

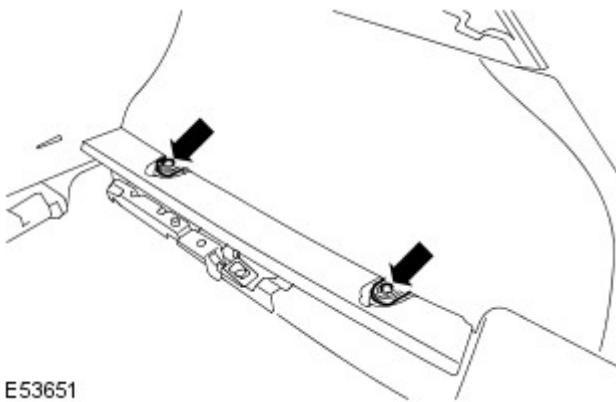
Removal

1. Remove the loadspace floor panels.
 - Lift and remove the front panel.
 - Lift and remove the rear panel.



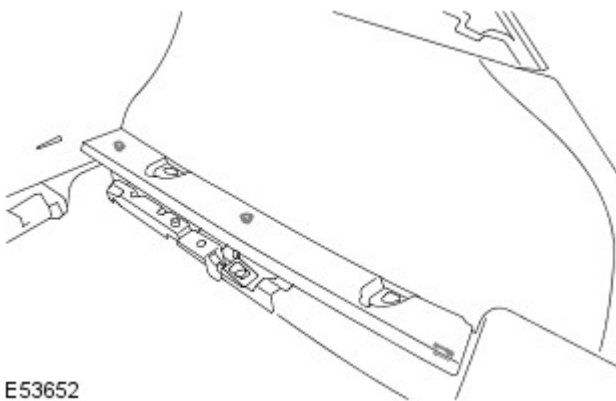
E53654

2. Remove the loadspace compartment anchors.
 - Remove the bolt.
 - Repeat the above procedure for the other anchor.




E53651

3. Remove the loadspace trim panel.
 - Release the 3 clips.



E53652

4.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the 2 clips.



E53653

Installation

1. Install the clips.

2. Install the loadspace trim panel.
 - Secure the clips.
 - Position the locating pegs.
3. Install the loadspace compartment anchors.
 - Position the locating peg.
 - Tighten the bolt to 25 Nm (18 lb.ft).
 - Repeat the above procedure for the other anchor.
4. Install the loadspace floor panels.

Interior Trim and Ornamentation - Front Door Trim Veneer

Removal and Installation

Removal

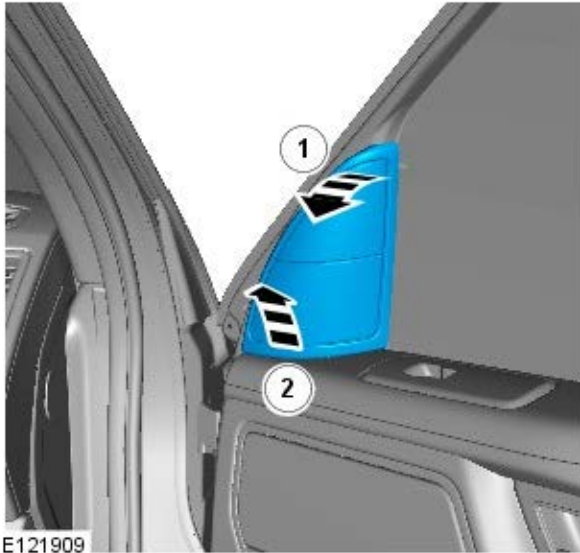
NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.



1. CAUTIONS:

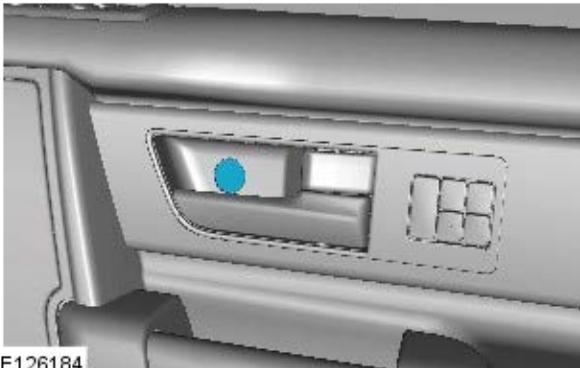


Take extra care not to damage the component.

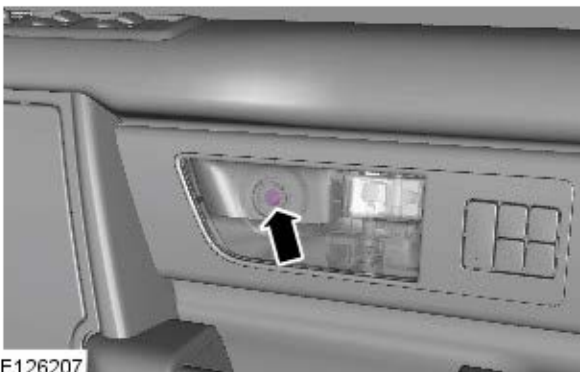


Make sure that the clips are correctly located.

Disconnect the tweeter speaker electrical connector.



2.

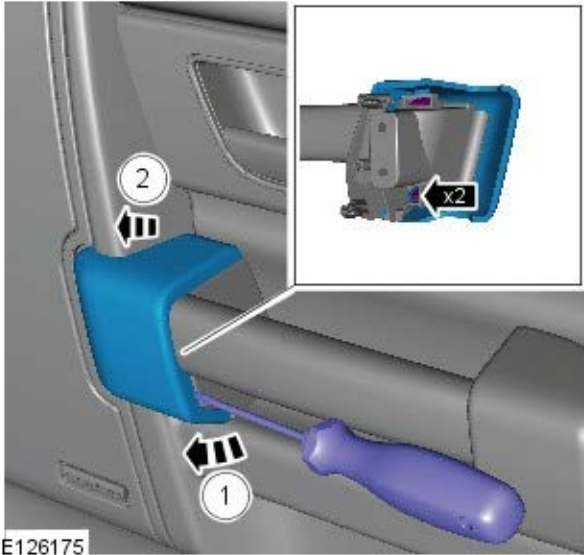


3.

4. CAUTIONS:



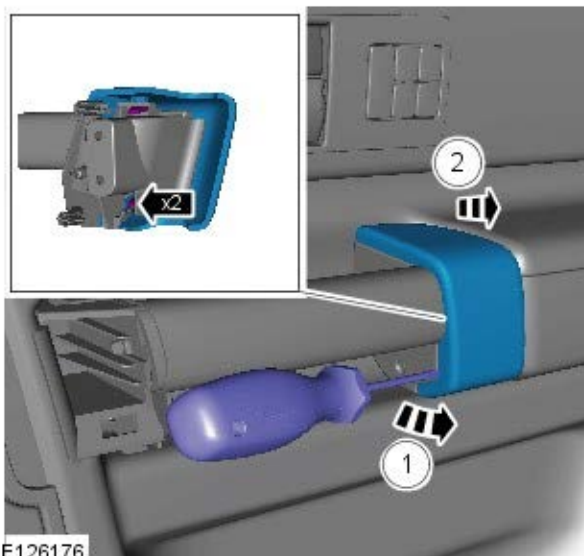
Take extra care not to damage the component.
Apply masking tape to the end of the screwdriver.



E126175

⚠ When removing the chrome finisher from the trim panel, make sure the components are not damaged. If necessary protect the surrounding areas using masking tape.

⚠ Make sure that the clips are correctly located.



E126176

5. CAUTIONS:

⚠ Take extra care not to damage the component. Apply masking tape to the end of the screwdriver.

⚠ When removing the chrome finisher from the trim panel, make sure the components are not damaged. If necessary protect the surrounding areas using masking tape.

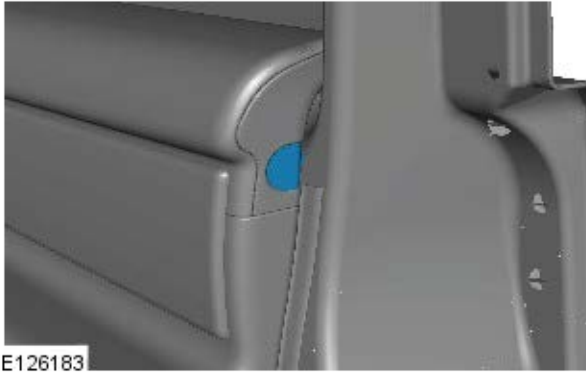
⚠ Make sure that the clips are correctly located.



E126173

6.

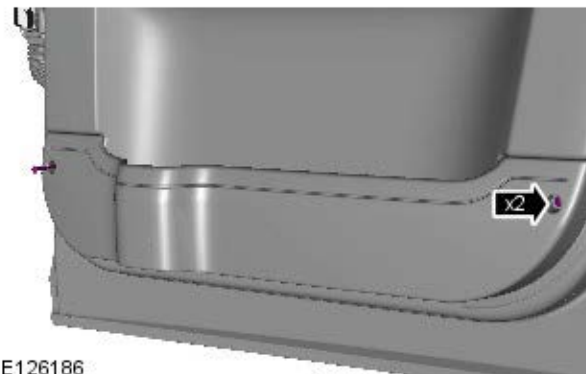
7.



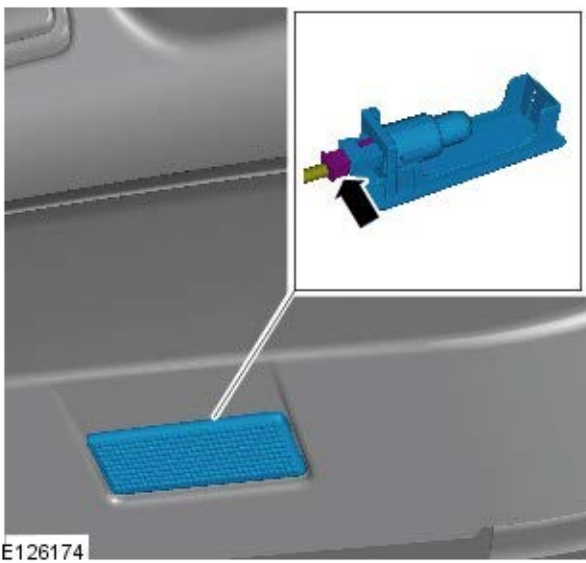
8.



9.



10.



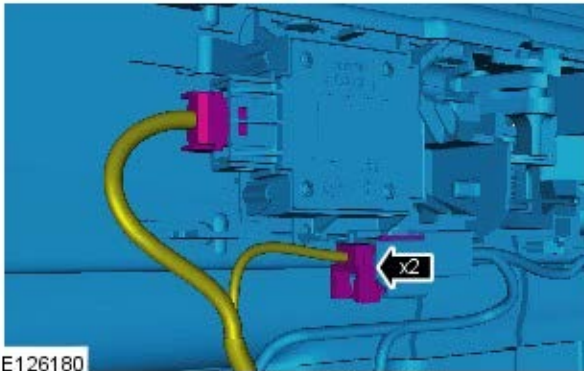
11.  CAUTION: Take extra care not to damage the wiring harnesses.

Detach the front door trim panel.



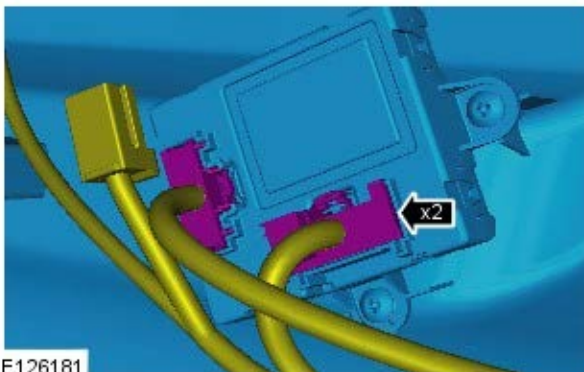
E126177

12.



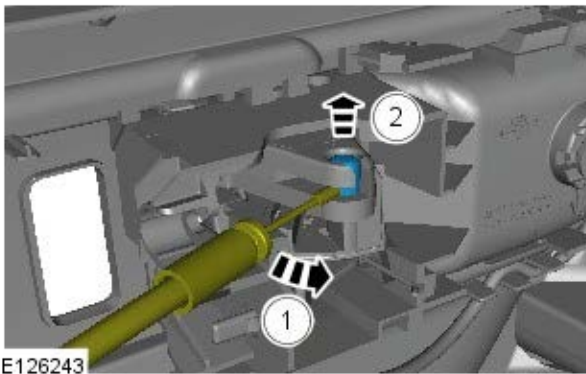
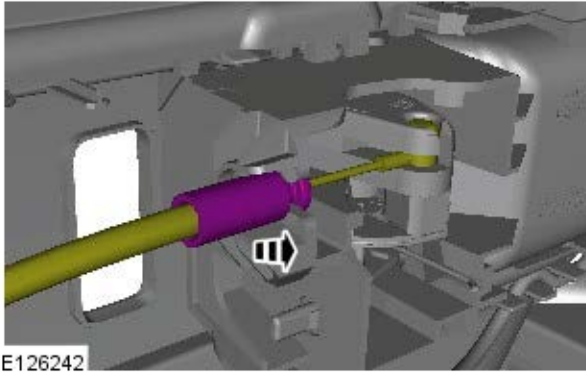
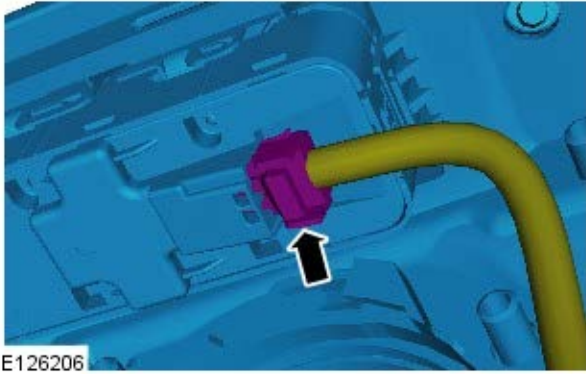
E126180


13.



E126181

14.

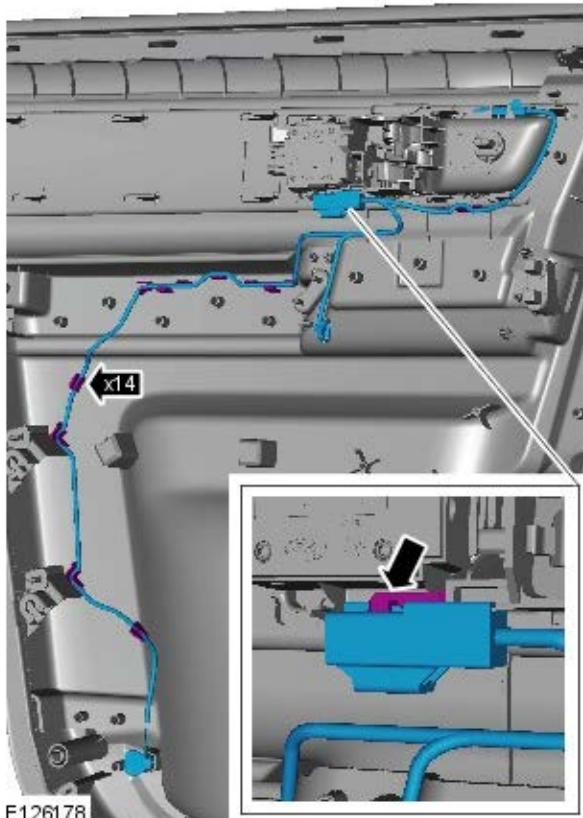


15.  CAUTION: Make sure that the release cable is removed from the door trim panel using the plastic fixing and not using the cable.

16.

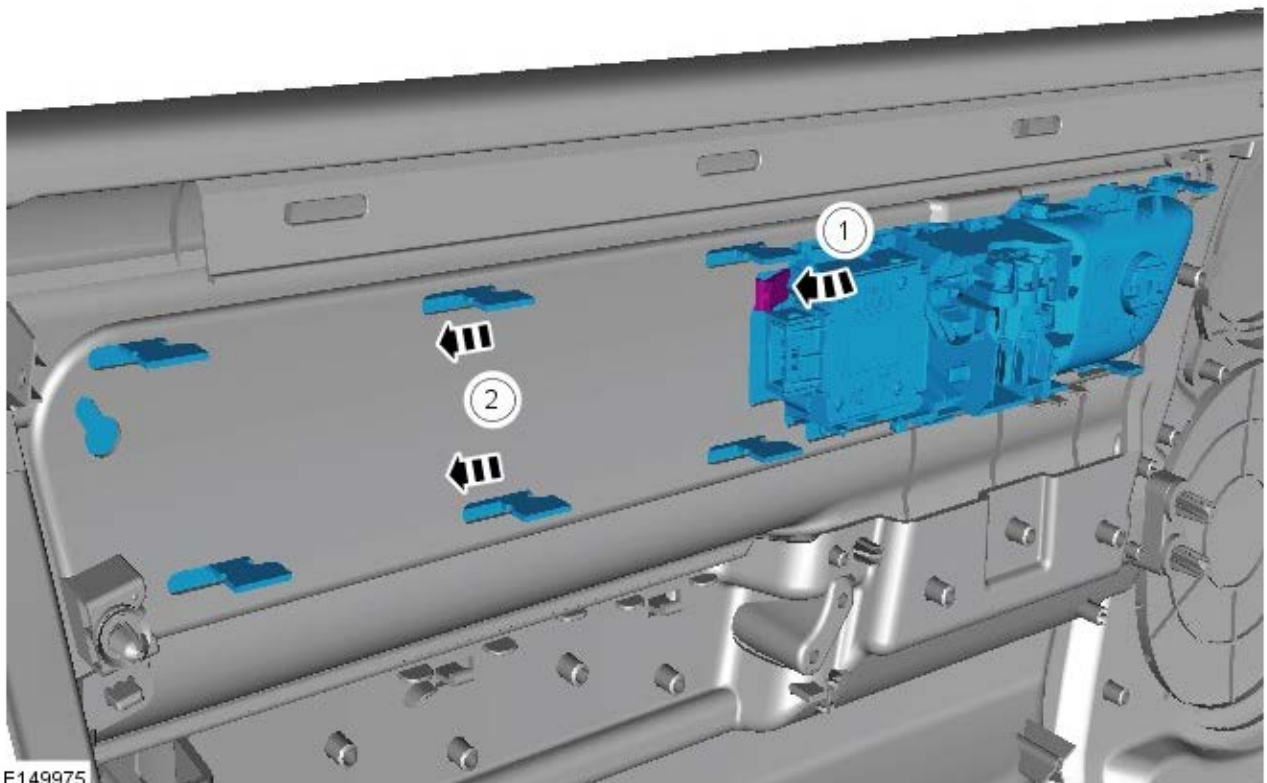
17. Remove the front door trim panel.

18.



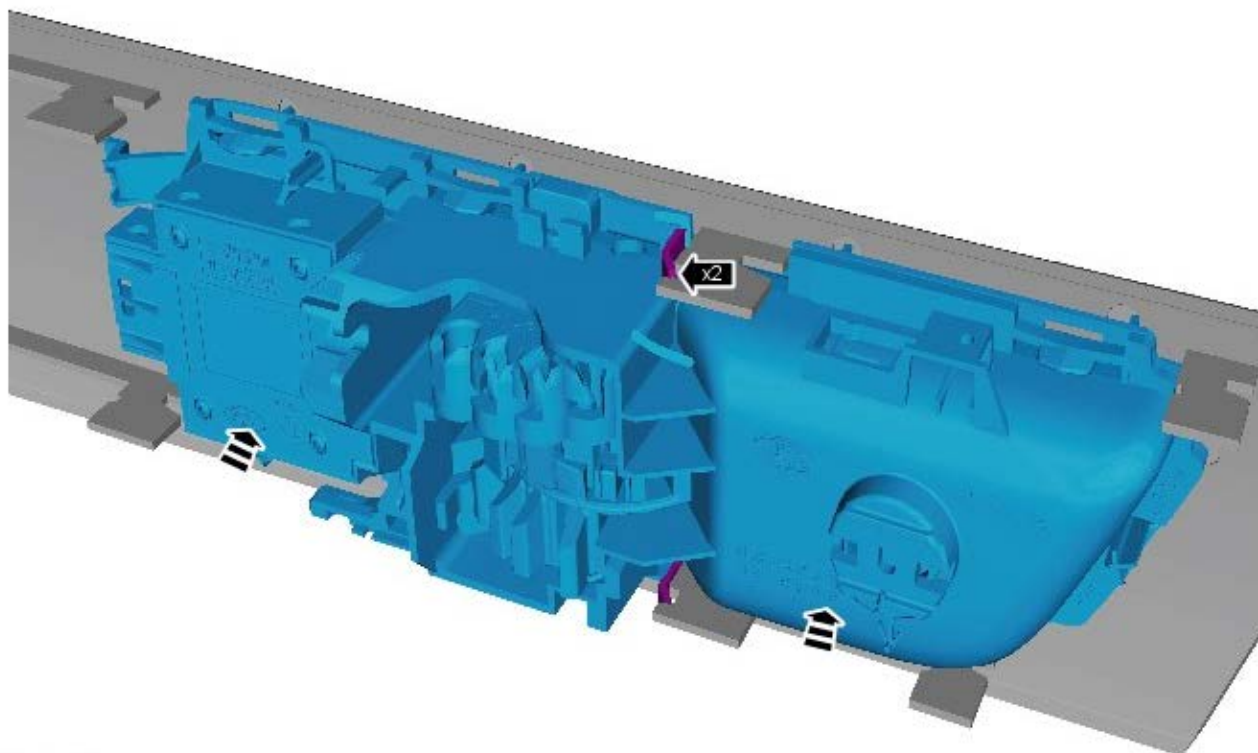
E126178

19. Release the retaining tang and remove the veneer.



E149975

20. Release the retaining tangs.



E149976

Installation

1. To install, reverse the removal procedure.

Interior Trim and Ornamentation - Rear Door Trim Veneer

Removal and Installation

Removal

NOTES:

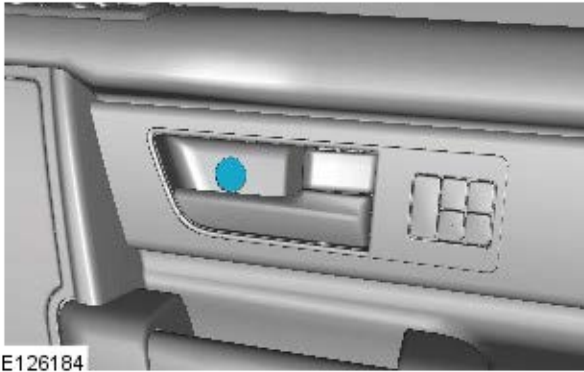


Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1.



2.



3. CAUTIONS:



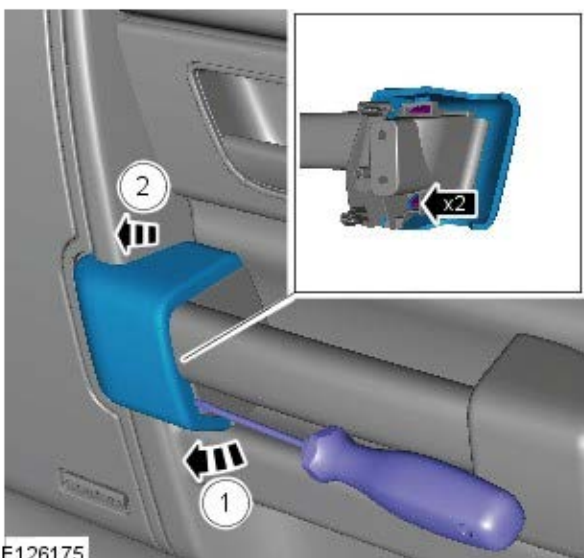
Take extra care not to damage the component. Apply masking tape to the end of the screwdriver.



When removing the chrome finisher from the trim panel, make sure the components are not damaged. If necessary protect the surrounding areas using masking tape.



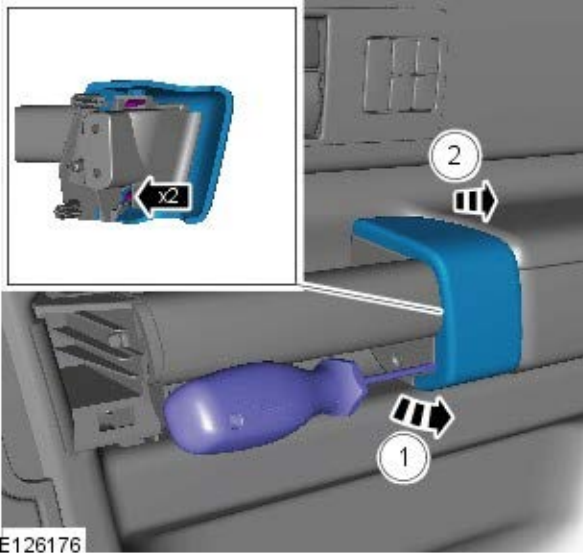
Make sure that the clips are correctly located.




4. CAUTIONS:



Take extra care not to damage the component. Apply masking tape to the end of the screwdriver.



E126176

 When removing the chrome finisher from the trim panel, make sure the components are not damaged. If necessary protect the surrounding areas using masking tape.

 Make sure that the clips are correctly located.

5.



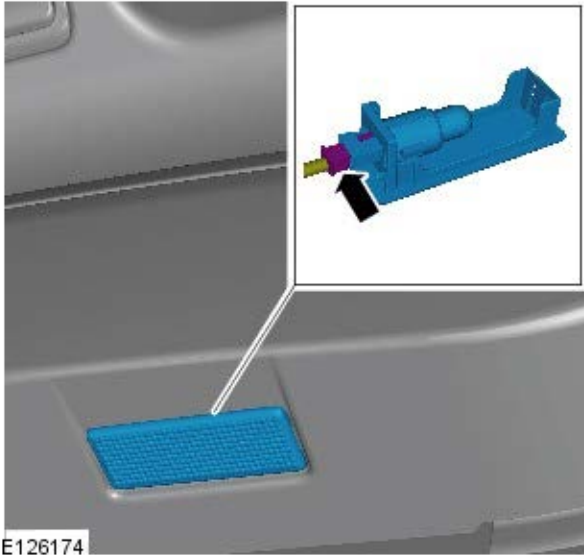
E126173

6.



E126225

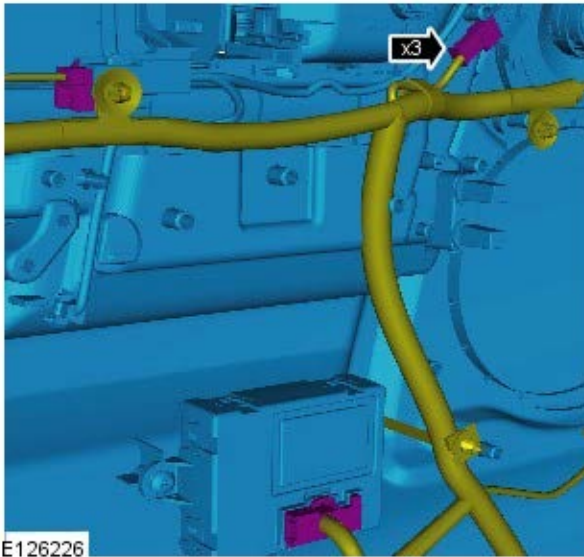
7.



8.  CAUTION: Take extra care not to damage the wiring harnesses.

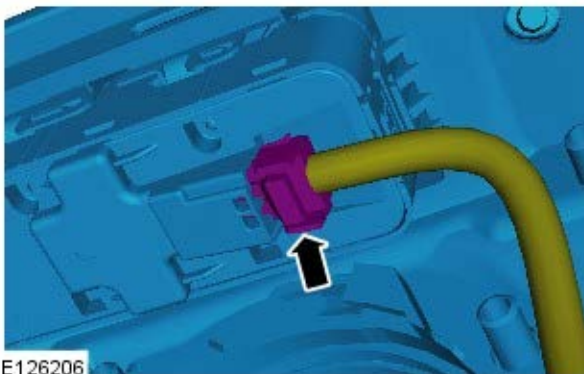
Detach the rear door trim panel.

- 9.




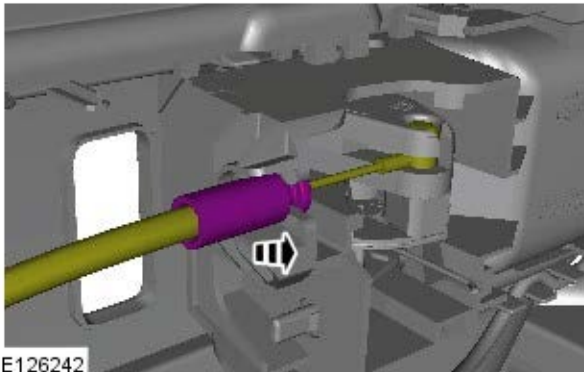
E126226

10.



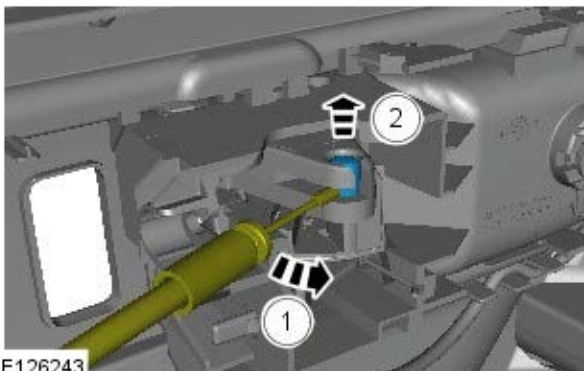
E126206

11.  CAUTION: Make sure that the release cable is removed from the door trim panel using the plastic fixing and not using the cable.



E126242

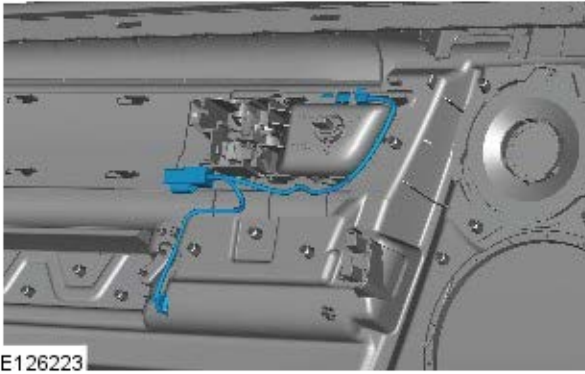
12.




E126243

13. Remove the rear door trim panel.

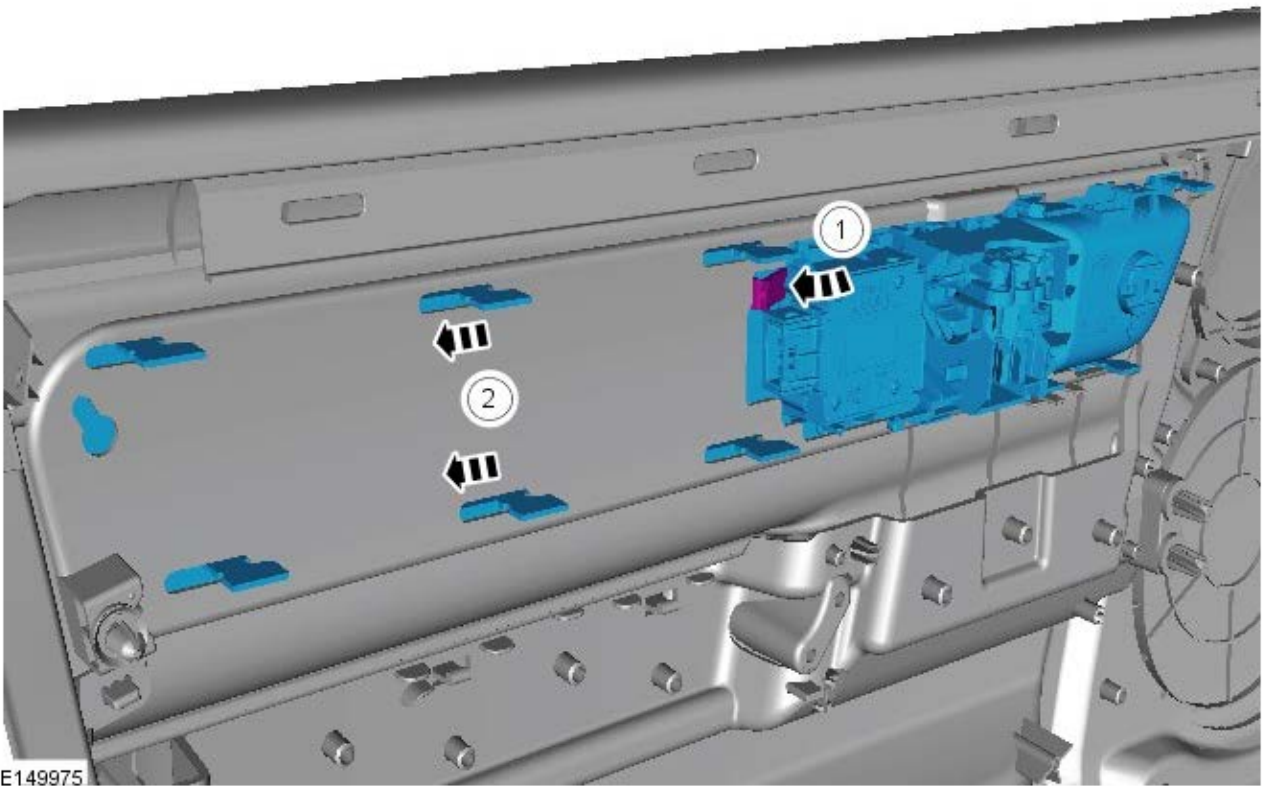
14.




E126223

15.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

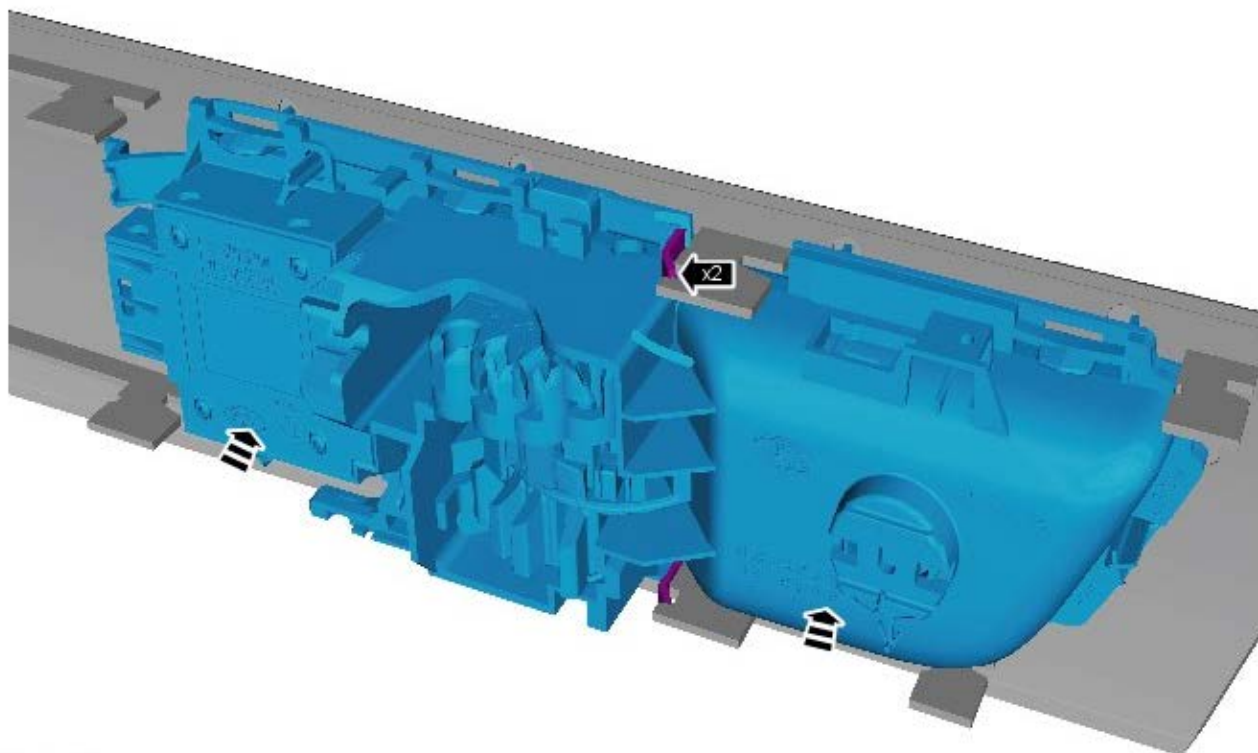
Release the retaining tang and remove the veneer.



E149975

16.  NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

Release the retaining tangs.



E149976

Installation

1. To install, reverse the removal procedure.

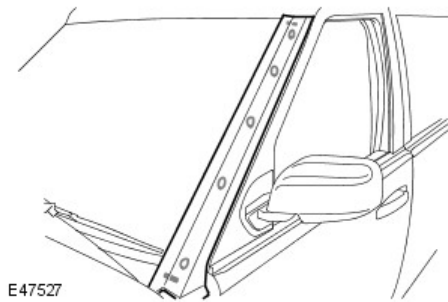
Exterior Trim and Ornamentation - A-Pillar Moulding LH

Removal and Installation

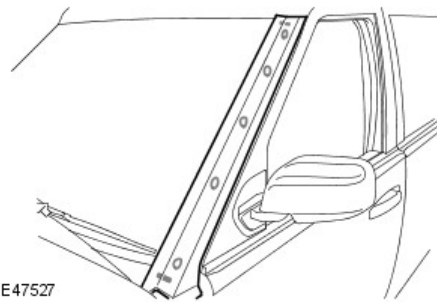
Removal



NOTE: This procedure is also applicable for the RH moulding.



1. Open the bonnet.



2. Remove the A-pillar moulding.
 - Release and discard the 5 clips.

Installation



1. NOTE: The lower clip is unique to the others and must only be installed to the lowest position on the moulding.

To install, reverse the removal procedure.


1. New clips must be used.

Exterior Trim and Ornamentation - Front Fender Moulding

Removal and Installation

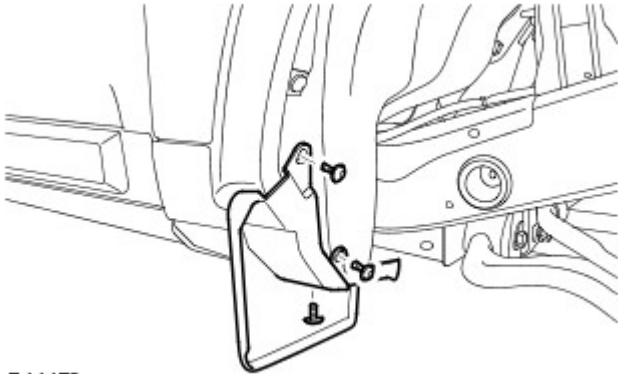
Removal

1. Remove the headlamp assembly.
For additional information, refer to: Headlamp Assembly (417-01, Removal and Installation).

2.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

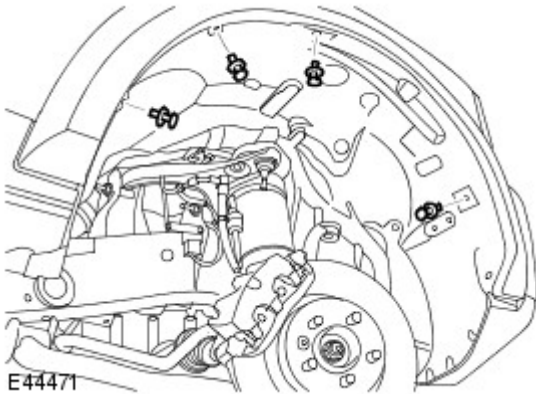
Raise and support the vehicle.

3. Remove the mud flap.
 - Remove the 3 retaining screws.



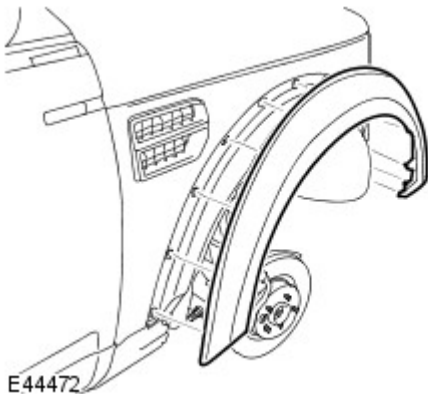
E44470

4. Remove the 4 retainers.




E44471

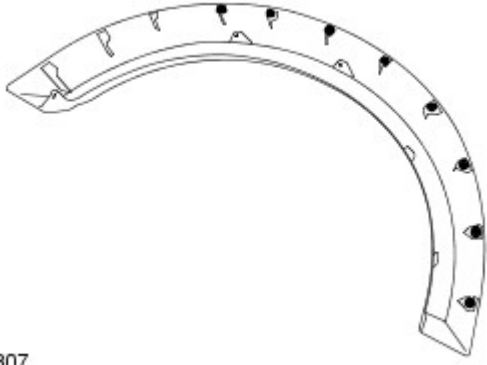
5. Remove the fender moulding.
 - Remove the 2 screws.
 - Carefully release the 10 clips.



E44472

6.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the clips from the moulding.



E53307

Installation

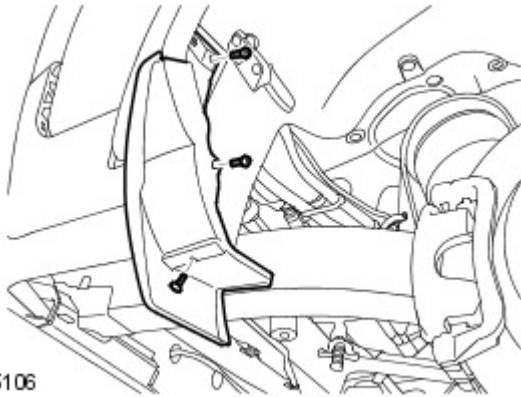
1. To install, reverse the removal procedure.
2. Install the headlamp assembly.
For additional information, refer to: Headlamp Assembly (417-01, Removal and Installation).

Exterior Trim and Ornamentation - Rear Quarter Panel Moulding

Removal and Installation

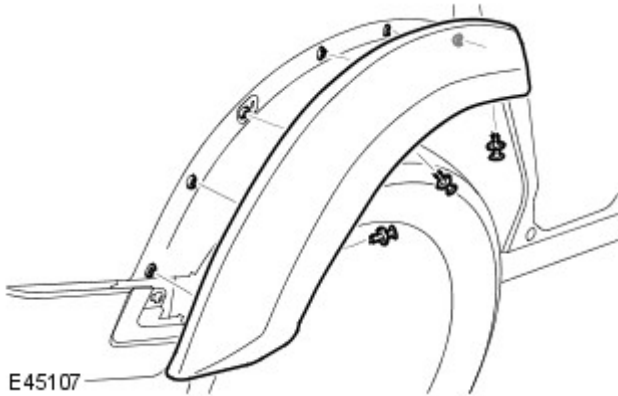
Removal

1. Remove the mud flap.
 - Remove the 3 screws.




E45106

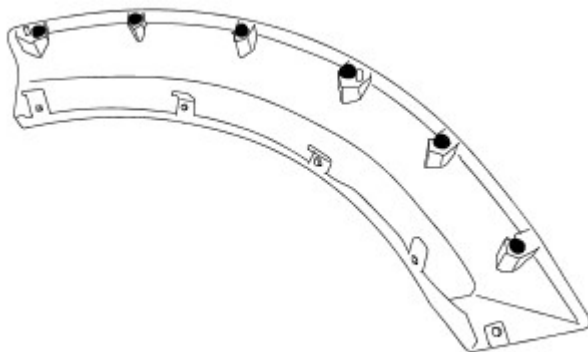
2. Remove the rear quarter panel moulding.
 - Remove the 3 clips from the underside of the moulding.
 - Release the 6 clips from the rear quarter panel.



E45107

3.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the clips from the moulding.



E45108

Installation

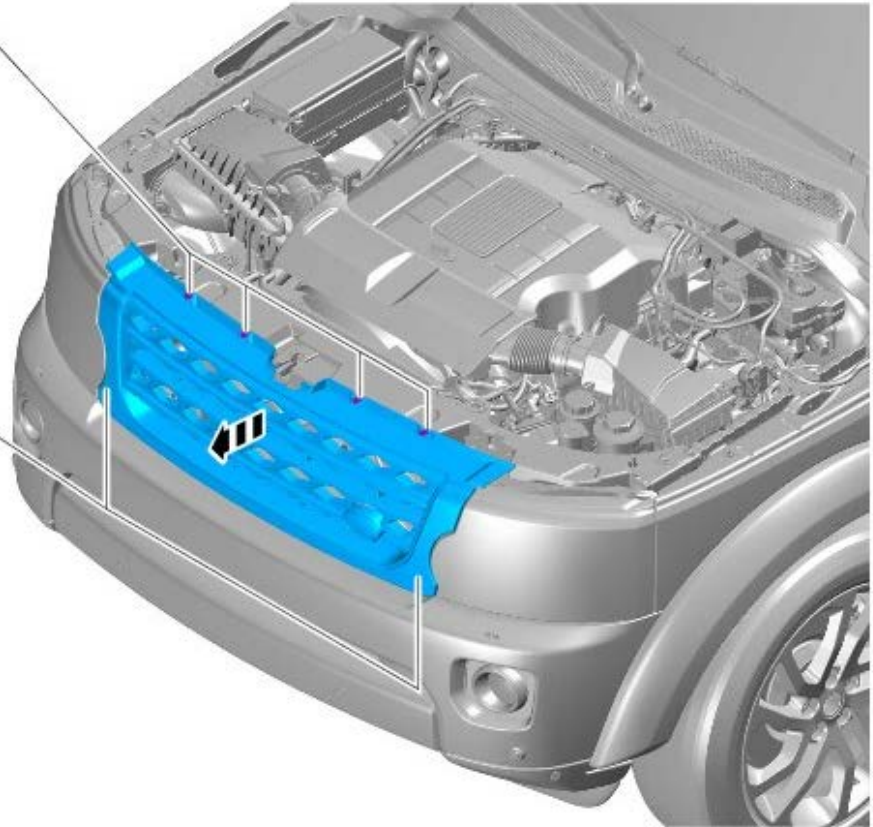
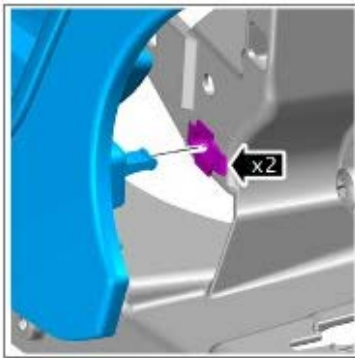
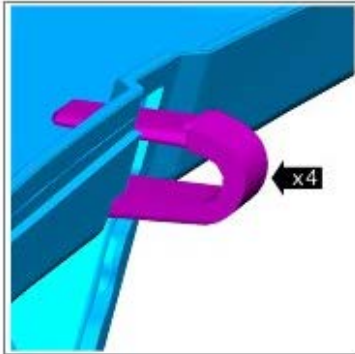
1. To install, reverse the removal procedure.

Exterior Trim and Ornamentation - Radiator Grille

Removal and Installation

Removal

1.
 - Open the hood.
 - Release the 6 clips.



E161439

Installation

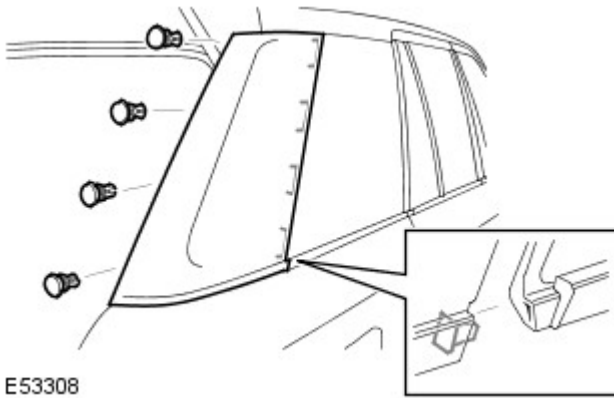
1. To install, reverse the removal procedure.

Exterior Trim and Ornamentation - Rear Quarter Window Moulding

Removal and Installation

Removal

1. Open the liftgate.
2. Remove the rear quarter window moulding.
 - Remove the 4 clips.
 - Release the locating peg.



E53308

Installation

1. Install the rear quarter window moulding.
 - Position the locating peg.
 - Secure the clips.

Rear View Mirrors -

Torque Specifications

Description	Nm	lb-ft
Exterior mirror bolts	6	4

This section contains no data

Rear View Mirrors - Rear View Mirrors

Diagnosis and Testing

Principle of Operation

For a detailed description of the rear view mirror systems and operation, refer to the relevant Description and Operation section of the workshop manual.

REFER to: Rear View Mirrors (501-09, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Door mirror switch condition and installation • Door mirror condition and installation 	<ul style="list-style-type: none"> • Battery condition and state of charge • Fuses • Harnesses and connectors • Washer jet and mirror heater relay • Memory control module(s) • Door mirror switch(s) • Door mirror motor(s) • Ignition switch • Battery Junction Box (BJB) • Central Junction Box (CJB) • Automatic Temperature Control Module (ATC) • Driver/Passenger Door Module (DDM/PDM) • Local Interconnect Network (LIN) circuit

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Mirrors do not defrost / washer jets freeze	<ul style="list-style-type: none"> • Fuse fault • Heated washer jets / heated mirrors circuit short circuit to ground, open circuit, high resistance • Automatic Temperature Control Module (ATC) fault 	<ul style="list-style-type: none"> • Check the fuses • Refer to the electrical circuit diagrams and test the heated washer jets / heated mirrors circuit for short circuit to ground, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Automatic Temperature Control Module (ATC) for related DTCs and refer to the relevant DTC index
Mirrors inoperative in one or more directions	<ul style="list-style-type: none"> • Door mirror mechanical failure • Door mirror circuit short circuit to ground, short circuit to power, open circuit, high resistance • Driver/Passenger Door Module (DDM/PDM) fault 	<ul style="list-style-type: none"> • Operate the mirror switch and listen for the motor(s). If each motor operation is audible, check the mechanical condition of the mirror and linkages • Refer to the electrical circuit diagrams and test the door mirror circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Driver/Passenger Door Module (DDM/PDM) for related DTCs and refer to the relevant DTC index
Memorized mirror position is not resumed	<ul style="list-style-type: none"> • Battery voltage below 10.5V • Position not stored • Switch operated during "one-touch" memory recall 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual and test the battery • Make sure that the desired position is correctly stored • Make sure that the memory store/recall procedure is being followed
'Lazy entry' function	<ul style="list-style-type: none"> • Remote transmitter fault (battery, transmitter) 	<ul style="list-style-type: none"> • Check that the remote transmitter operates the central locking

inoperative	programming, etc) • Battery voltage below 10.5V • Position not stored • Switch operated during "one-touch" memory recall	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual and test the battery • Make sure that the desired position is correctly stored • Make sure that the memory store/recall procedure is being followed
-------------	--	--

DTC Index

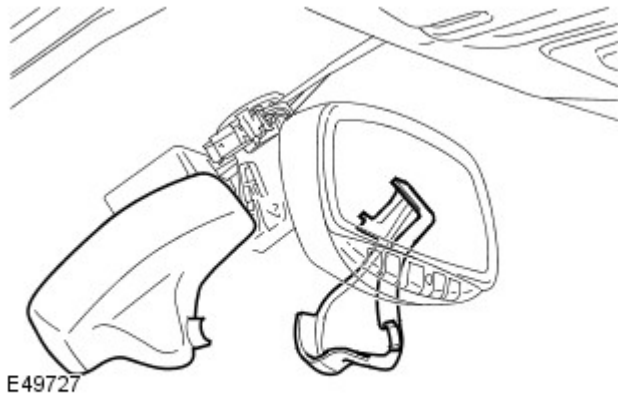
For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00. REFER to: (100-00)

Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (Description and Operation),
 Diagnostic Trouble Code (DTC) Index - DTC: Driver/Passenger Door Control Module (DDM/PDM)
 (Description and Operation).

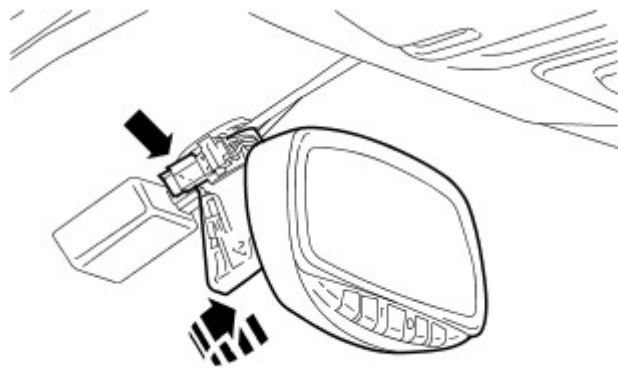
Rear View Mirrors - Interior Mirror

Removal and Installation

Removal



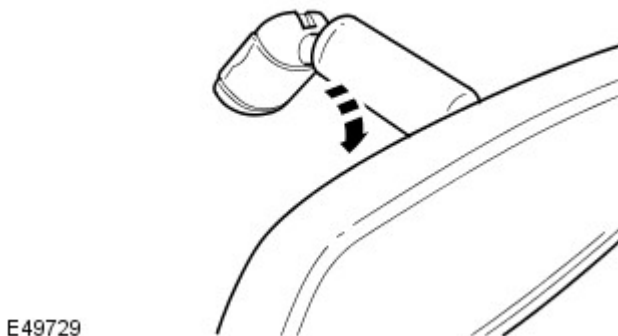
1. If installed, remove the interior mirror upper and lower covers.
 - Release the 2 clips.



2. Vehicles with an auto-dimming interior mirror, remove the interior mirror.
 - Disconnect the electrical connector.
 - Rotate the mirror stem at its base to release from the windshield.

E49728

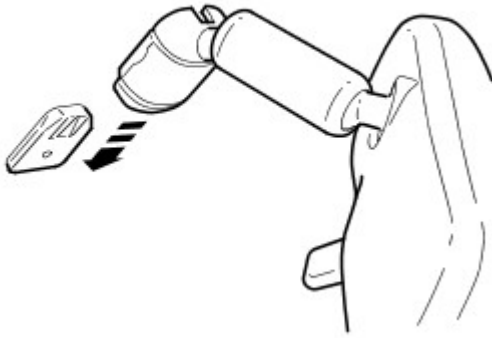
3. Vehicles without an auto-dimming interior mirror, remove the interior mirror.
 - Pull the mirror away from the windshield to release the clip.



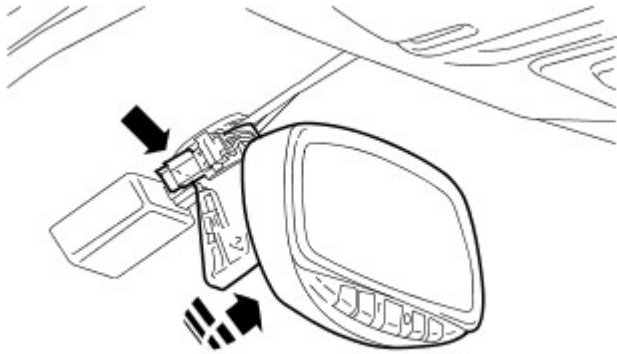
E49729

Installation

1. Vehicles without an auto-dimming interior mirror, install the interior mirror.
 - Slide the mirror onto the boss from above to engage the clip.



E49730



E49731

2. Vehicles with an auto-dimming interior mirror, install the interior mirror.
 - Rotate the mirror stem at its base to secure to the windshield.
 - Connect the electrical connector.

3. Install the interior mirror covers.
 - Secure with the clips.

Rear View Mirrors - Exterior Mirror Vehicles With: Parking Aid Camera

Removal and Installation

Removal

CAUTIONS:



Take extra care not to damage the component.



LH illustration shown, RH is similar.

NOTES:

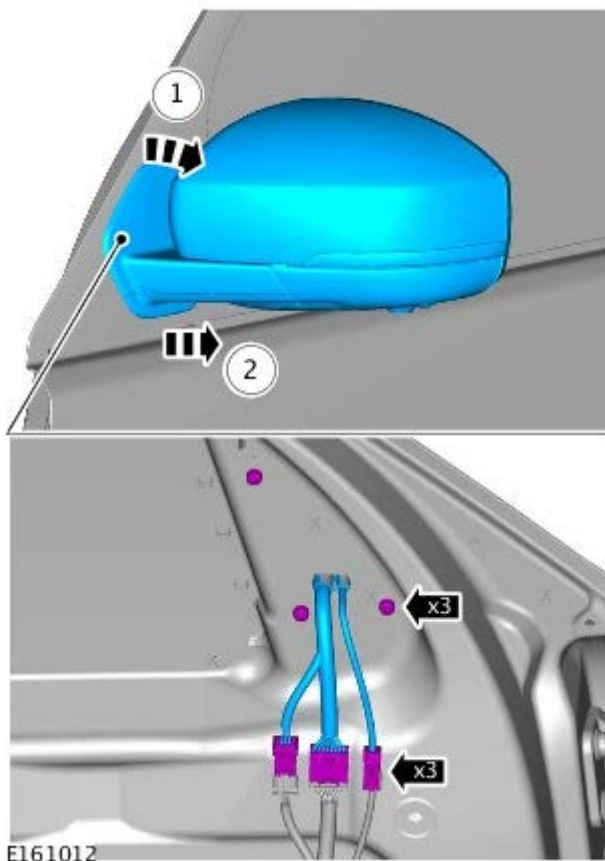


Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: [Front Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).



2. CAUTION: Make the components are aligned as shown.

Torque: 9 Nm

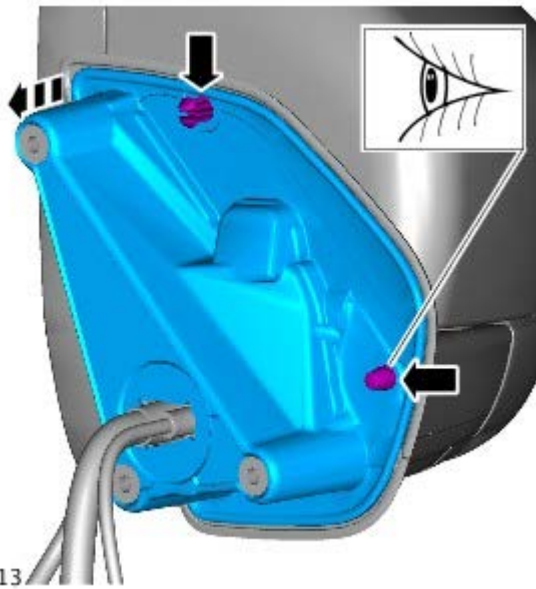
3. CAUTIONS:



Discard the seal.



Make sure that the component is aligned and attached as shown.



E161013

Installation

1. To install reverse the removal procedure.

Rear View Mirrors - Exterior Mirror Vehicles Without: Parking Aid Camera

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



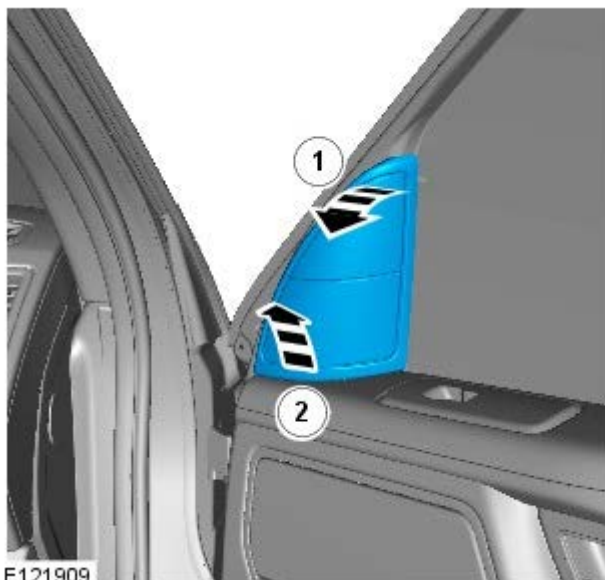
RH illustration shown, LH is similar.



The ignition must be switched off.



Some variation in the illustrations may occur, but the essential information is always correct.



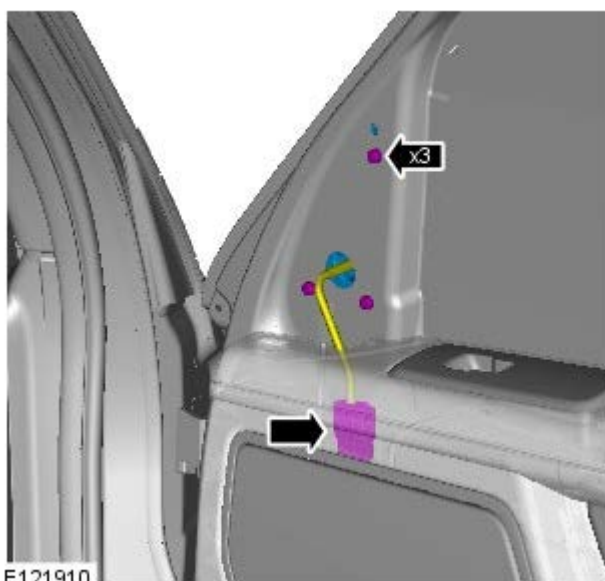
1. CAUTIONS:



Take extra care not to damage the component.



Make sure that the clips are correctly located.



2. CAUTIONS:



Take extra care not to damage the wiring harnesses.



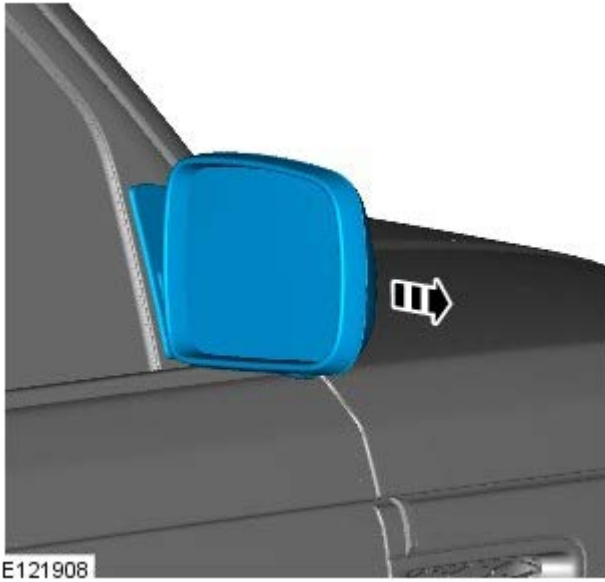
Make sure the electrical connector is securely in the service position, before disconnection. If the connector springs back after disconnection the internal door trim panel will have to be removed for access.



NOTE: Support as necessary.

Torque: 6 Nm

3.



Installation

1. To install, reverse the removal procedure.

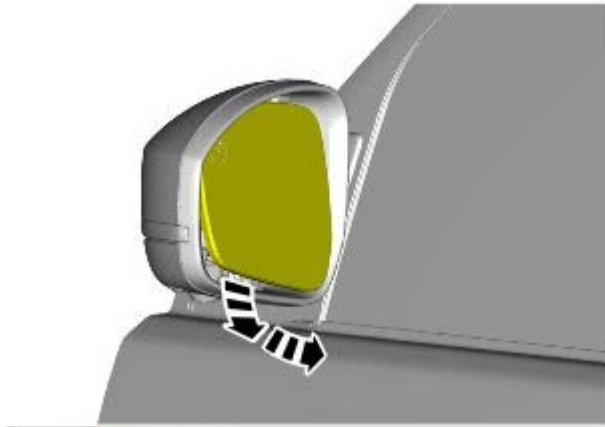
Rear View Mirrors - Exterior Mirror Glass

Removal and Installation

Removal

 CAUTION: LH illustration shown, RH is similar.

 NOTE: Removal steps in this procedure may contain installation details.



1. CAUTIONS:

 Take extra care not to damage the component.

 Do not use tools during this operation, removal of the component(s) must be carried out by hand.



E161007

2.



E161006

Installation

1. To install reverse the removal procedure.

Rear View Mirrors - Exterior Mirror Cover

Removal and Installation

Removal



CAUTION: Take extra care not to damage the edges of the component.

NOTES:



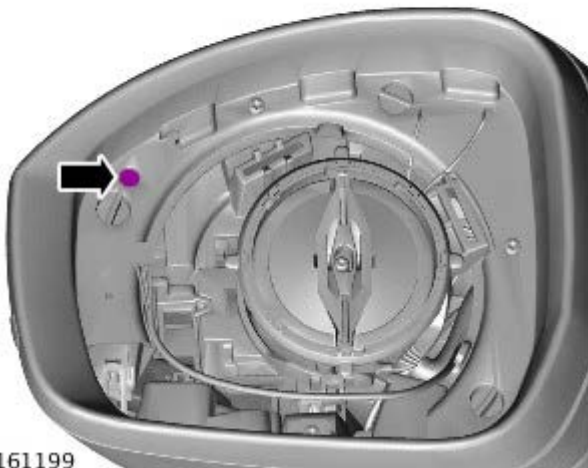
Removal steps in this procedure may contain installation details.



LH illustration shown, RH is similar.

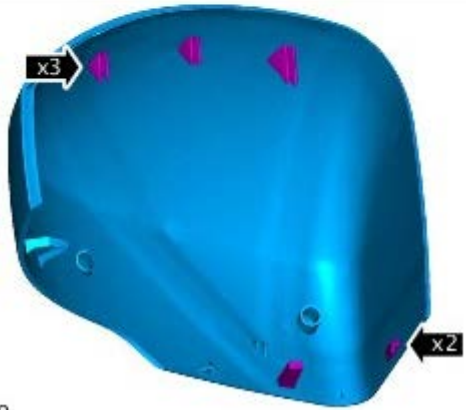
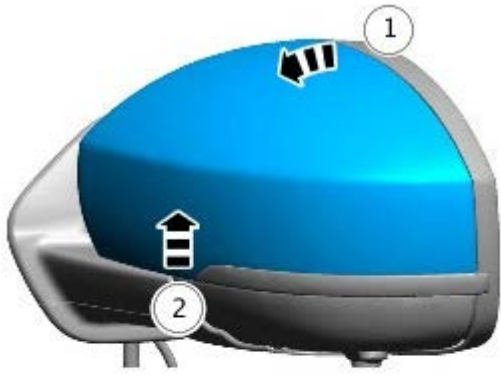
1. Refer to: [Exterior Mirror Glass](#) (501-09 Rear View Mirrors, Removal and Installation).

2.



E161199

3.



E161010

Installation

1. To install reverse the removal procedure.

Rear View Mirrors - Exterior Mirror Motor

Removal and Installation

Removal



CAUTION: LH illustration shown, RH is similar.

NOTES:



Removal steps in this procedure may contain installation details.



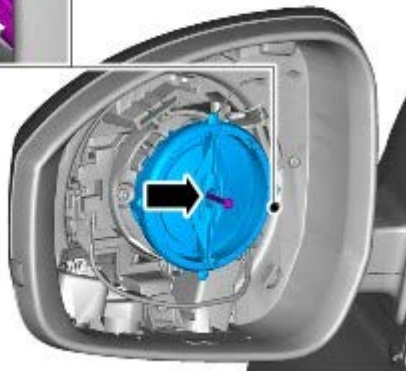
Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: [Exterior Mirror Glass](#) (501-09 Rear View Mirrors, Removal and Installation).



2. CAUTION: Take extra care not to damage the component.

Torque: 1.2 Nm



E161011

Installation

1. To install reverse the removal procedure.

Seating -

Torque Specifications

Description	Nm	lb-ft
Seat belt lower anchorage to seat Torx bolt	40	30
Front seat belt buckle to front seat Torx bolt	40	30
Front seat Torx bolts	40	30
Front seat armrest Torx bolt	10	7
Front seat grab handle Torx bolts	25	18
Front seat height adjustment motor nuts	25	18
Front seat position sensor nuts	4	3
Front seat tilt motor Torx bolts	10	7
Front seat backrest assembly Torx bolts	25	18
Front seat recliner motor Torx bolt	10	7
Seat module bracket Torx bolts	10	7
Front seat track motor nuts	25	18
Front seat base nuts	25	18
Front seat cushion Torx bolts	25	18
Third row seat Torx bolts	40	30
Third row seat cushion frame Allen bolts	25	18
Loadspace compartment anchor bolts	25	18
Rear seat Torx bolts	40	30
Rear seat backrest assembly Torx bolts	45	33

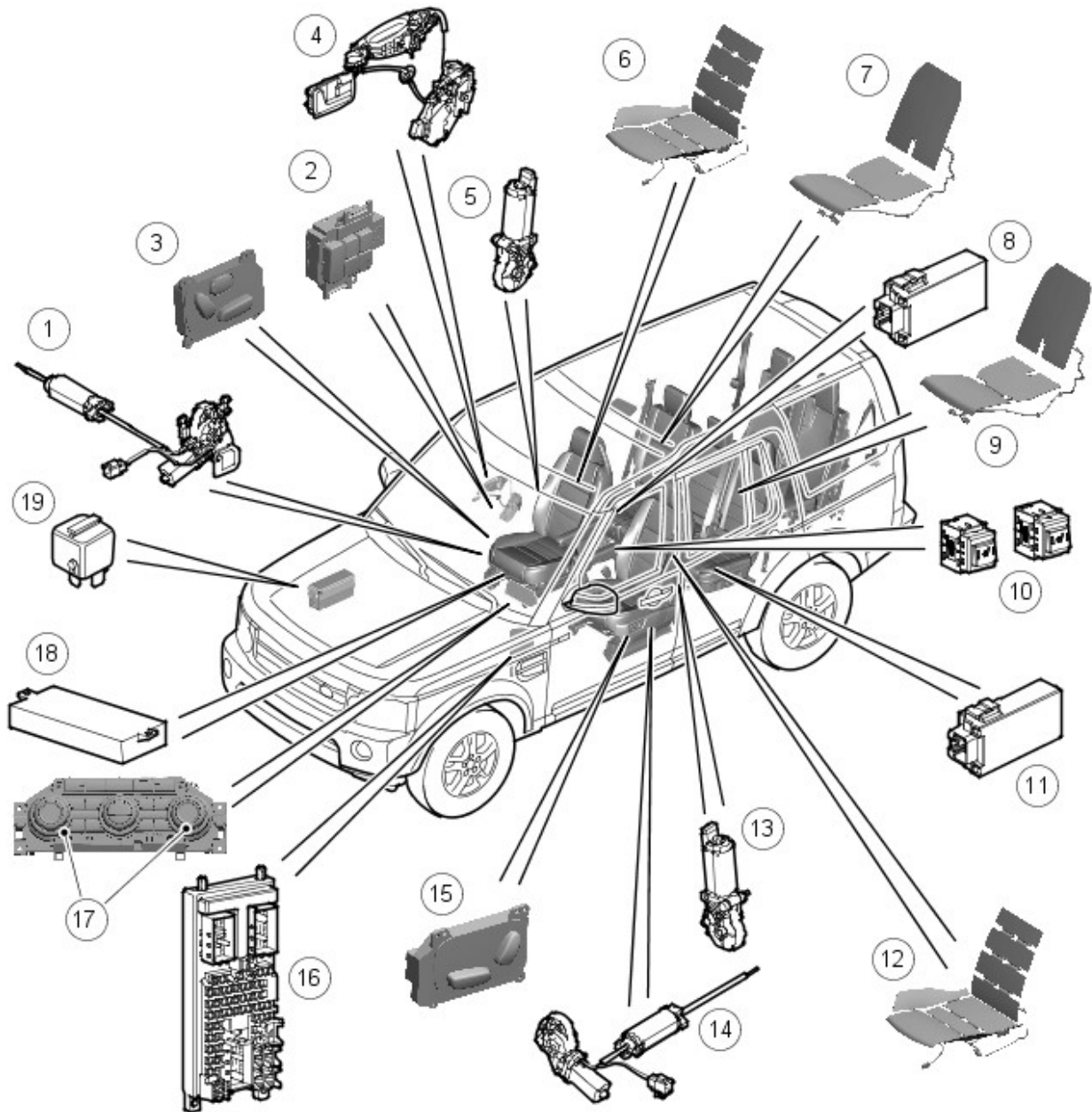
Seating - Seats

Description and Operation

Component Location



NOTE: RH drive shown, LH drive similar



E137099

Item	Part Number	Description
1	-	Driver's seat cushion adjustment motor assembly
2	-	Driver's seat memory switch pack
3	-	Driver's seat non-memory switch pack
4	-	Driver's door ajar switch
5	-	Driver's seat squab motor
6	-	Driver's seat heating element
7	-	Second row RH (right-hand) seat heating element
8	-	Second row RH seat heating module
9	-	Second row LH (left-hand) seat heating element
10	-	Second row heated seat switches (vehicles without rear air conditioning)
11	-	Second row LH seat heating module
12	-	Front passenger seat heating element
13	-	Front passenger seat squab motor
14	-	Front passenger seat cushion adjustment motor assembly

15	-	Front passenger seat switch pack
16	-	CJB (central junction box)
17	-	Front heated seat switch pack (climate control system)
18	-	Memory control module
19	-	Front passenger seat power relay

OVERVIEW

LEATHER SEAT COVERS

Leather is a natural product, therefore it bears natural characteristics, such as grain variations, growth & bush marks. These non-weakening marks show the true nature of the hide and are the hallmarks of Leather. In order to maintain the beauty of the vehicles natural Leather upholstery it requires regular cleaning, which if neglected, may cause deterioration. Where dust and dirt are allowed to accumulate and become ingrained in the surface of the Leather, the upholstery may become permanently damaged.

Light coloured upholstery can be particularly susceptible to soiling and staining and care should be taken to ensure that where there is evidence of any soiling or staining on the upholstery then this should be cleaned immediately using the Jaguar/Land Rover approved products, failure to do this could lead to the stain becoming permanent, this applies to all leather upholstery and is not colour specific.

Leather trimmed seats will naturally exhibit areas of creasing and wrinkling over a period of time and is a normal characteristic as the Leather ages.

Particular care should be taken where there is evidence of soiling or staining on the leather, this should be cleaned immediately. Failure to do this could lead to the stain becoming permanent.

Particular care should be taken to prevent damage from studs, zips and buckles.

NOTES:



[Please refer to Leather care label attached to seats for more information.](#)



[Creasing and wrinkling does not represent a manufacturing defect.](#)

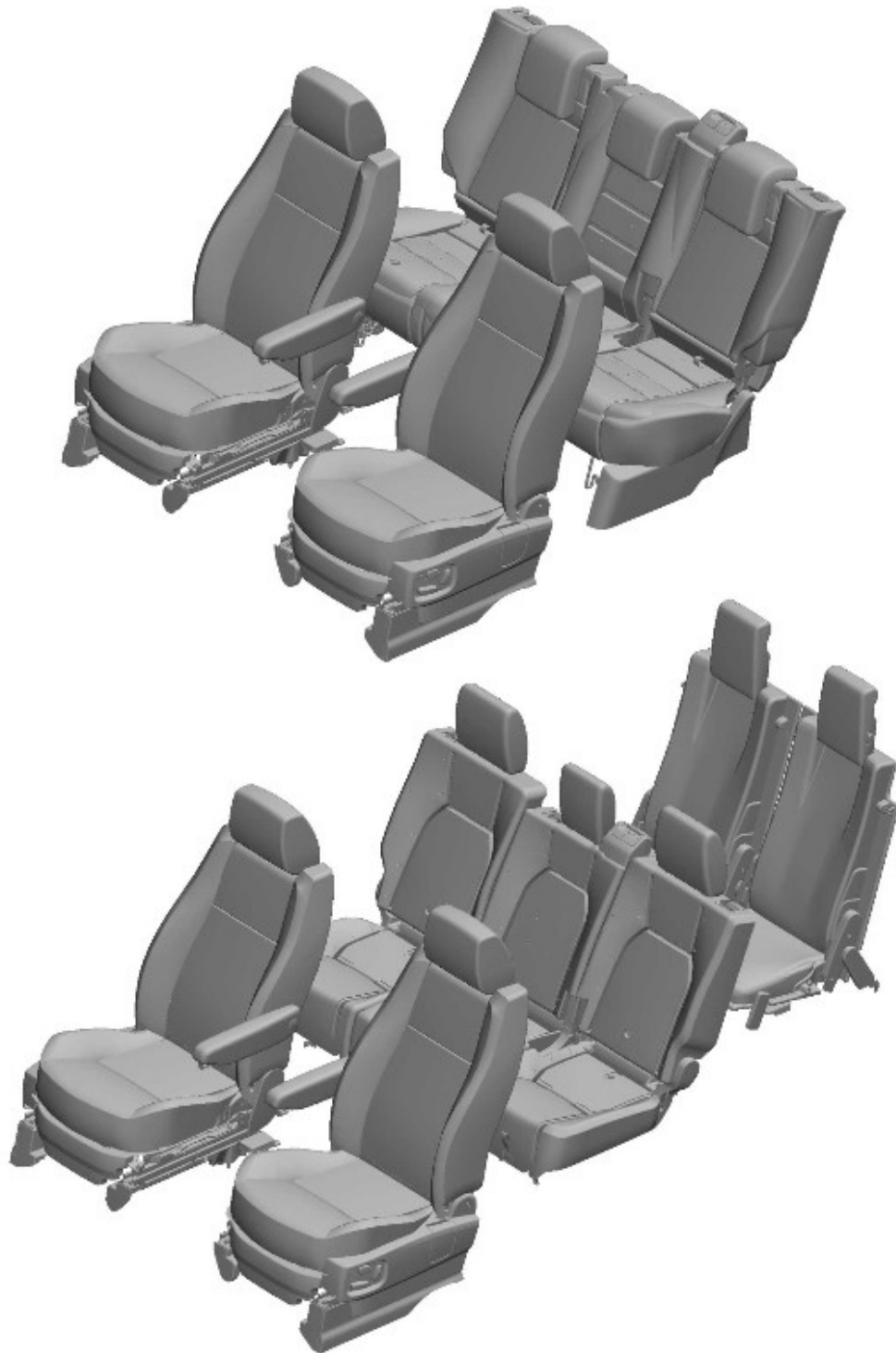


[Damage from studs, zips and buckles do not represent manufacturing defects.](#)



[Use only Jaguar/Land Rover approved products in accordance with the instructions for use.](#)

SEAT CONFIGURATION



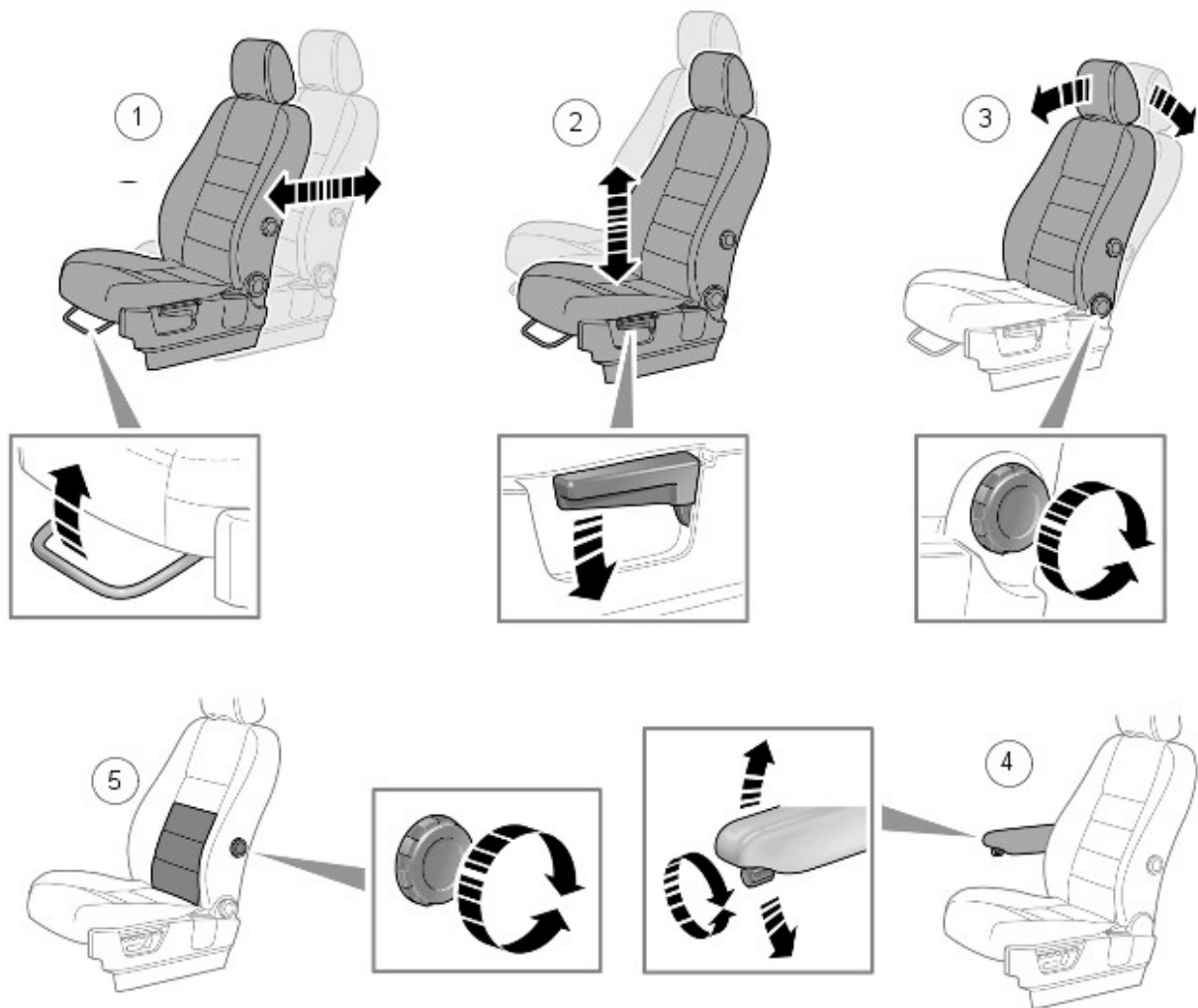
E 138147

Discovery is available in a 5 or 7 seat configuration. The driver's seat has the option of an 8-way power adjustment, with or without memory functionality, or a 6-way manual adjustment. The front passenger seat has the option of a 6 way power adjustment or a 4-way, non-height, manual adjustment. On vehicles from 2008MY, the front passenger seat can be fitted with an 8-way power adjustment.

The type of second row seats depends upon whether the 7-seat option is fitted. If the vehicle supports 5 seats, the 2nd row is designed as a 60/40 split, flip and fold configuration, whereas a vehicle that supports the 7 seat option is designed as a 35/30/35 split with the 2 outer seats having the ability to 'jack-knife', allowing access to the 3rd row of seats.

All seats are available in a fabric, duragrain or leather finish depending on model specification.

MANUAL FRONT SEATS



E137621

Item	Part Number	Description
1	-	Fore and aft adjustment
2	-	Height adjustment
3	-	Backrest adjustment
4	-	Lumbar support adjustment
5	-	Armrest height adjustment

Height adjustment (driver's seat only)

Pumping the handle controls seat height. Pumping the lever upwards raises the seat; downwards lowers the seat.

Recline adjustment

The angle of the backrest is adjusted by turning the rotary wheel either clockwise or anticlockwise.

Forward/backward adjustment

Lifting the tomel bar at the front of the seat and sliding the seat to the desired position achieves the forwards/backwards adjustment.

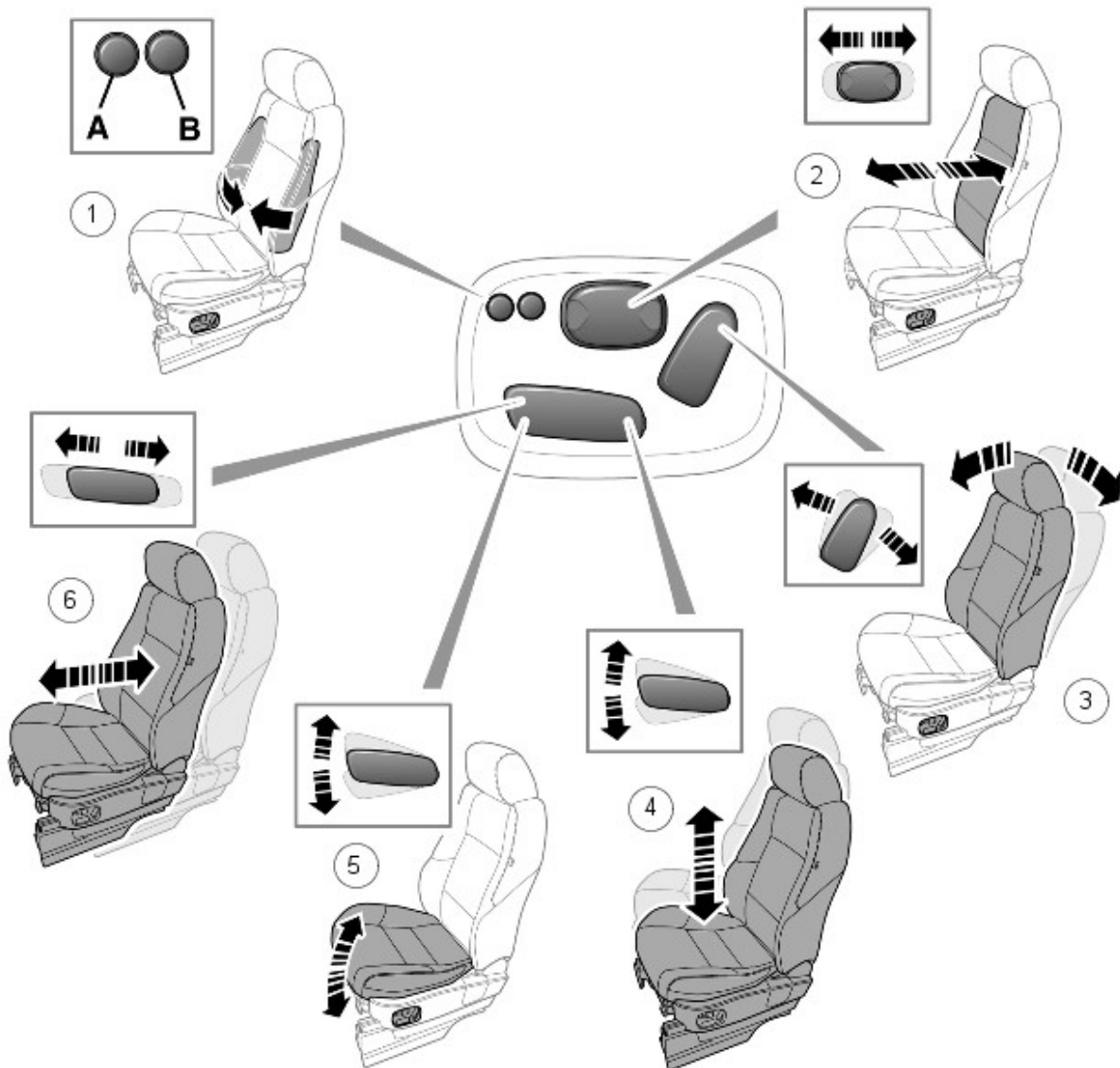
Lumbar support adjustment

A hand wheel in the side of the seat provides for adjustment of lumbar support.

Folding armrest adjustment (if fitted)

Some vehicles are fitted with adjustable front seat armrests. These are used in the horizontal position or can be stowed vertically alongside the seat back rest. The horizontal position can be adjusted for height by turning the knob set into the end of the armrest.

POWER OPERATED FRONT SEATS (NON-MEMORY)



E137620

Item	Part Number	Description
1	-	Bolster adjustment: A - Bolster inflate; B - Bolster deflate
2	-	Lumbar support adjustment
3	-	Backrest adjustment
4	-	Height adjustment
5	-	Cushion tilt adjustment
6	-	Fore and aft adjustment

Forward/Backward adjustment

Push and hold the switch forwards or backwards to move the seat to the desired position.

Seat back adjustment

Twist the switch forwards or backwards until the desired seat back angle is achieved.

Seat cushion height adjustment

Push the switch up or down to raise or lower the cushion.

Front Seat Motors



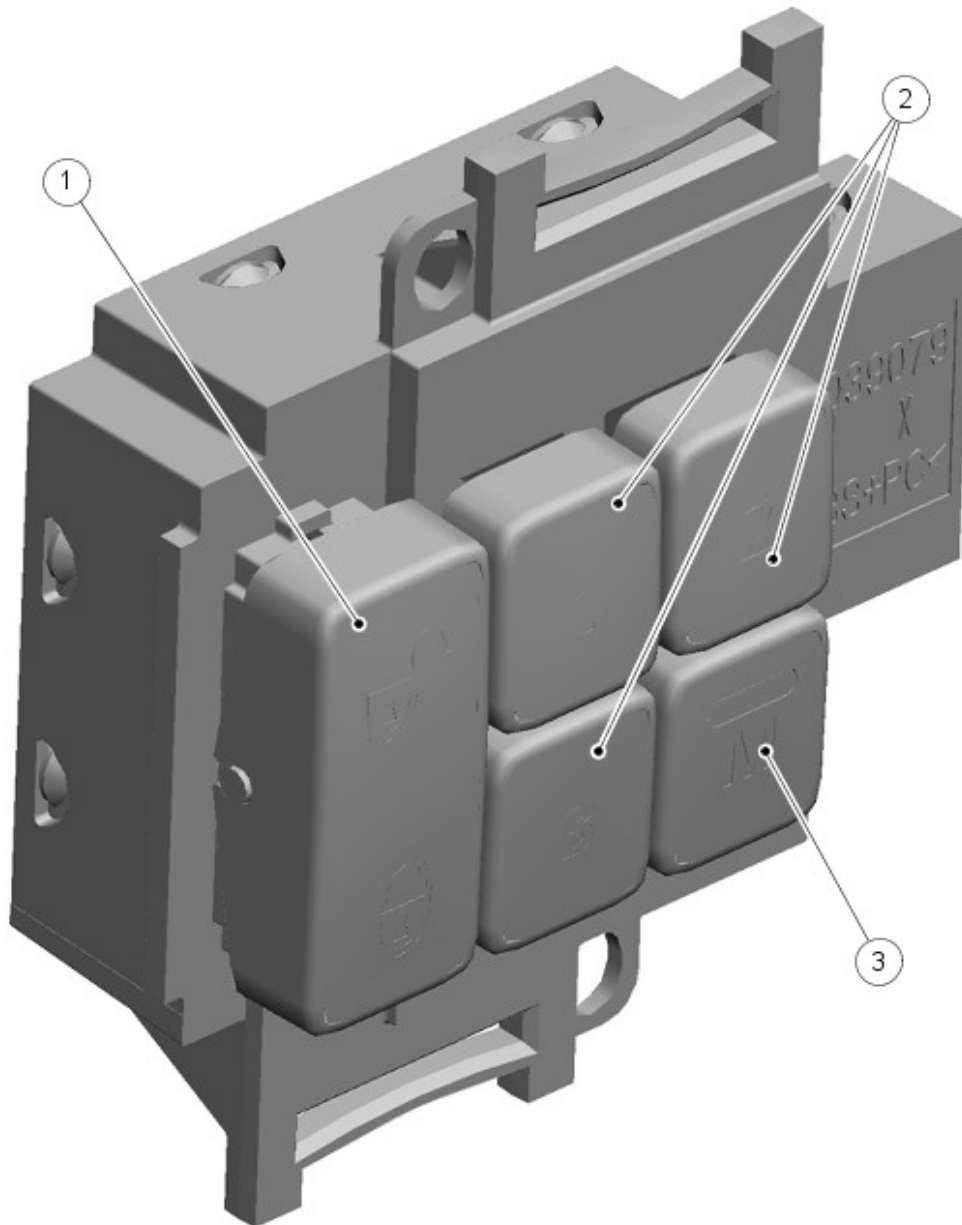
E 138148



NOTE: On vehicles from 2008MY, the passenger seat can also be fitted with 8-way electrical adjustment.

The seat motors are a permanent magnet motor type coupled to a rack and pinion assembly. Should the motor seize or stick an internal thermal cut-out switch will trip to remove voltage from the motor. Two pins within each of the seat switch packs control the seat motors. Both pins are normally earthed. Operating the switch applies voltage to one of the pins while the other pin remains earthed. Operating the switch in the opposite direction reverses power and earth to the motor allowing the motor to run in the opposite direction.

DRIVER'S MEMORY SEAT



E137100

Item	Part Number	Description
1	-	Lock/unlock button
2	-	Memory preset buttons
3	-	Memory store button

Once the power operated driver's seat, steering column and exterior mirrors are adjusted, the vehicle can memorize these settings for future use.

1. Press the memory store (M) button to activate the memory function. The switch indicator will illuminate.
2. Press one of the preset buttons within 5 seconds to memorize the current settings. MEMORY (1, 2 or 3) SETTINGS SAVED will be displayed on the message center, accompanied by an audible chime to confirm the settings have been memorized.
3. To recall a stored position press the relevant preset button. MEMORY (1, 2 OR 3) RECALLED will be displayed in the message center.

NOTES:



A seat position will only be memorized during the 5 second active period. Any existing settings will be overwritten when programming a memory position.



If the driver's seat or steering column are adjusted during entry or exit operation, automatic movement will stop.

Memory Recall

Memory recall has three memory positions stored for the seats, exterior mirrors and electric steering column (where

fitted). The switches for this function are located on driver's seat outer side trim panel. Pressing the appropriate numbered memory switch allows the seat to start moving to the position appropriate to that memory.

When a memory recall is initiated, to limit the overall current consumption, only two-seat axis will move towards their intended position at any one time. To minimize current load as the motors start, the initiation of each axis is phased with a 10ms delay between each motor starting.

The following procedure will store a memory position:

- Ensure reverse gear is not engaged
- Manually adjust the seat to the desired position, using the seat switches
- Press and release the 'memory store' switch
- Press and release the desired numbered memory switch within 5 seconds

If any of the seat adjustment or memory switches are activated during a 'one touch' memory recall, the recall will be overridden and the seat will begin to move in the direction corresponding to the switch that has been pressed.

Both mirrors move simultaneously about the vertical axis first (left/right), and then, once all vertical axis movements are complete, about the horizontal axis (up/down). To minimize the number of mirror motor's required, a method of sharing is implemented, which dictates that all movement about one axis is complete before movement about the other axis commences.

Mirror movement coincides with the following table:

Action	Control Module Pin 14	Control Module Pin 7	Control Module Pin 13	Control Module Pin 8
Driver Mirror Up	Battery	-	-	-
Driver Mirror Down	Ground	-	-	-
Driver Mirror Left	-	Ground	-	-
Driver Mirror Right	-	Battery	-	-
Passenger Mirror Up	-	-	Battery	-
Passenger Mirror Down	-	-	Ground	-
Passenger Mirror Left	-	-	-	Ground
Passenger Mirror Right	-	-	-	Battery

Lazy Entry

Pressing the unlock button on the remote transmitter will initiate a memory recall. This feature is known as 'lazy entry'. If the seat movement, memory switch or the lock button on the remote transmitter is pressed, then the 'lazy entry' feature will stop immediately.

The memory settings are stored within **EEPROM (electrically erasable programmable read only memory)** of the memory control module each time the ignition switch is cycled from position II to position I. These are the positional values that a lazy entry request uses when the remote unlock button for that particular key is next pressed.

The lazy entry feature can be activated or deactivated via the customer personalization feature of the high line instrument cluster. This provides the driver with the option to enable or disable lazy entry as required. For additional information, refer to: Information and Message Center (413-08, Description and Operation).

Immediate Adjustment

Pressing one of the manual adjustment switches will initiate the corresponding motor for that axis until the switch is released.

Only two seat motors can be driven at any one time. However, due to the sharing of relays, there are certain combinations of motors that cannot be driven together. The following table indicates which axis can and cannot be operated at the same time:

	Recline Up	Recline Down	Tilt Up	Tilt Down	Height Up	Height Down	Slide Forward	Slide Backward
Recline Up	-	No	Yes	Yes	Yes	Yes	Yes	Yes
Recline Down	No	-	Yes	Yes	Yes	Yes	Yes	Yes
Tilt Up	Yes	Yes	-	No	Yes	Yes	No*	No*
Tilt Down	Yes	Yes	No	-	Yes	Yes	No*	No*
Height Up	Yes	Yes	Yes	Yes	-	No	No*	No*
Height Down	Yes	Yes	Yes	Yes	No	-	No*	No*
Slide Forward	Yes	Yes	No*	No*	No*	No*	-	No
Slide Backward	Yes	Yes	No*	No*	No*	No*	No	-

Key

- - = Not applicable
- Yes = Can be activated together
- No = Cannot be activated together (Physically impossible)
- No* = Cannot be activated together (Relay sharing restriction)

If two axis are being driven and a third axis is requested to move, the third switch request is ignored until either of the two axis switches, already active, are released. The third axis movement may only be initiated providing the switch has been released and re-selected.

Seat adjustment can be initiated simultaneously with any mirror movement.

REVERSE GEAR MIRROR POSITION

To give the driver a clear view of the kerbs when reversing, the exterior door mirrors can be dipped when reverse gear is selected. The level of mirror dipping is set to a predetermined amount when the vehicle leaves the factory but has the ability to be customer programmed.

The following procedure will store a reverse gear mirror position:

- Perform a memory recall procedure
- Ensure reverse gear is engaged
- Manually adjust the mirrors to the desired position
- Press and release the 'memory store' switch
- Press and release the desired numbered memory switch
- Reverse gear mirror dip setting will be stored for that particular memory setting.

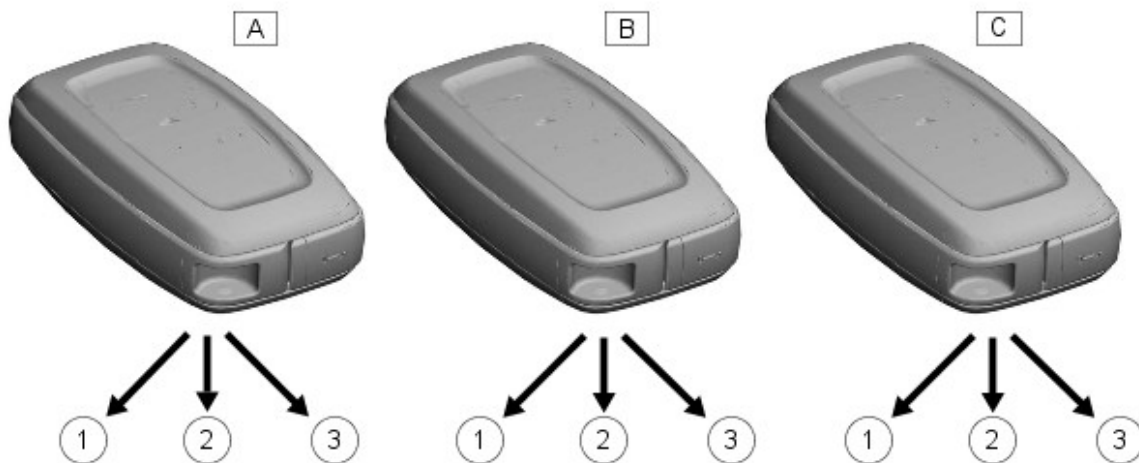
A single chime will be emitted from the instrument cluster to indicate that the store operation has been successful and 'Mirror Dip Stored' message will be displayed in the message center.

Once this sequence has been completed, the stored mirror position will be the position that the mirrors move to when reverse gear is next selected.

Storing a memory position with reverse gear selected only affects reverse gear mirror positions, the remainder of the memory positions remain unchanged.

To protect against an accidental setting, the mirror position will only be stored if a mirror adjustment has been made since reverse gear was selected. If there is no reverse gear mirror position stored, then a default setting, stored in the memory control module, is adopted.

There are three customer personalization memory settings per key. For each of these settings there are 3 possible reverse gear mirror position stores. This equates to a possible nine reverse gear mirror position settings. personalization memory setting relates to the 3 most recent ignition keys.



E137622

Item	Part Number	Description
A	-	Most recent ignition key
B	-	Second most recent ignition key
C	-	Third most recent ignition key
1	-	First reverse gear mirror position store
2	-	Second reverse gear mirror position store
3	-	Third reverse gear mirror position store

The reverse gear mirror position feature can be activated or deactivated via the customer personalization feature of the high line instrument cluster. This provides the driver with the option to enable or disable reverse gear mirror position as required.

For additional information, refer to: Information and Message Center (413-08, Description and Operation).

Information regarding the reverse gear mirror status, for both manual and automatic transmissions, is transmitted as a message on the LIN (local interconnect network) bus.

When the reverse gear mirror position feature is toggled 'OFF', all 3 memory settings associated with that personalization memory will return to the default reverse gear mirror settings.



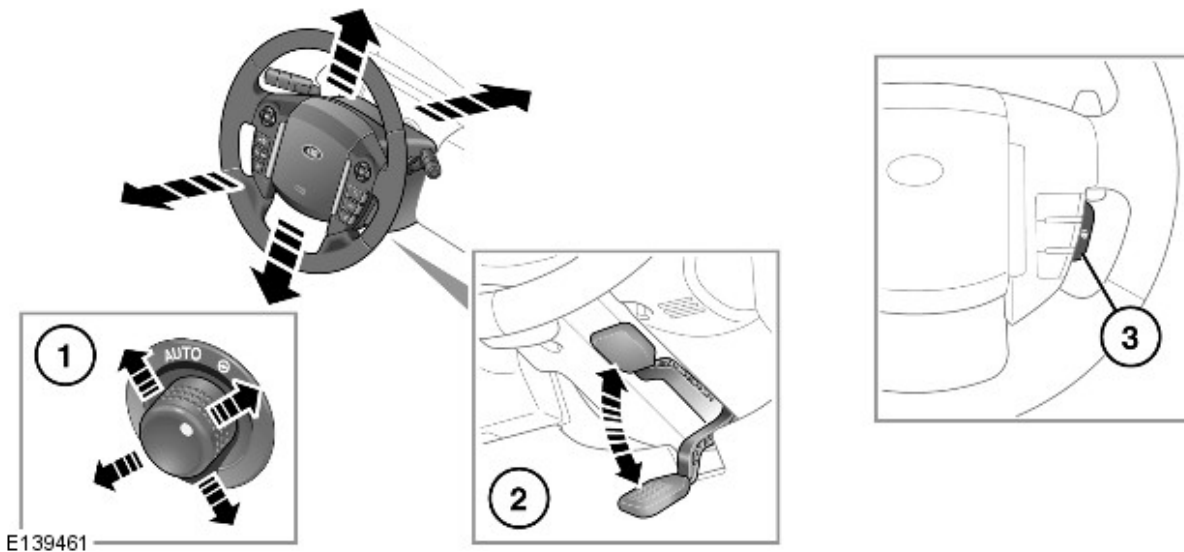
NOTE: Reverse gear status is only available with the ignition in position II.

When reverse gear is de-selected, the mirror position immediately prior to reverse selection will be resumed, unless a memory recall has been requested whilst reverse has been selected, in which case the mirrors will move to the requested memory position when reverse is de-selected.

On vehicles fitted with the ZF automatic transmission there is a delay of 0.5 second following the selection of reverse gear, prior to the reverse mirror position being recalled. This is to prevent any movement of the mirrors as the gear selector is moved through the reverse position on the way to, and from, the park position.

STEERING COLUMN ADJUST (where fitted)

The memory control module controls the electric adjustable steering column in a rake (up and down) and reach (in and out). The steering column can be adjusted for rake and reach by operating the rotary joystick control switch on the LH side of the steering column.



Item	Part Number	Description
1	-	Electric adjustment
2	-	Manual adjustment
3	-	Heated steering wheel

Entry/Exit Mode

Entry/Exit mode provides automatic movement of the steering column and driver's seat to allow easier entry to or exit from the vehicle.

Entry/Exit mode is selected by setting the steering column adjustment switch to the 'AUTO' position.

NOTES:



If the adjustment switch is moved away from 'AUTO' whilst the steering column is tilted away, the steering column will move back to its memorized position. Entry/Exit mode will then be cancelled.



If the adjustment switch is moved during entry/exit operation, steering column movement will stop.

Exit

When the ignition key is removed, the steering column will move to the uppermost rake and innermost reach positions and the driver's seat will move slightly rearwards and lower.

Entry

When the key is inserted in the ignition the steering column and seat will return to their previous positions. If, however, the memorised driver position has been changed (using the seat memory switches or another key transmitter), the steering wheel and seat will move to the new position.

Steering Column Control

Adjustment of the steering column is achieved by a single DC (direct current) motor. Each adjustment movement is transmitted through a solenoid actuated clutch; one clutch for reach movement and one for rake movement.

When engaged, a clutch can be released only if the system is unstressed. As the clutches are mounted on the same motor spindle, the sequence for position adjustment is as follows:

- Engage the selected clutch by powering the appropriate solenoid
- After a time period (approximately 0.1 of a second), the motor is powered in the desired direction
- When the motor reaches the stop position the solenoid and motor is released/unpowered. The clutch remains engaged under stress
- After a time period (approximately 0.1 of a second), the motor is powered in the opposite direction to enable the clutch to disengage when the stress is released.

Motor Rotation Direction	Clockwise	Counter Clockwise

Reach movement	IN	OUT
Rake movement	UP	DOWN

Simultaneous rake and reach movements are not possible since the motor must reverse direction as soon as the first axis has reached its required position.

Steering column rake and reach is controlled via potentiometer feedback.

AUDIBLE AND VISUAL CONFIRMATIONS

An audible confirmation is generated by the instrument cluster to provide confirmation to the driver that the requested operation has been successfully completed. The following operations support an audible confirmation:

Operation	Audible Confirmation	Conditions
Memory Store	Single Chime	Successful store operation completed
Memory Recall	Double Chime	Only issued if all axis of movement successfully reach the intended position
Reverse Gear Mirror Position Store	Single Chime	Successful store operation for reverse mirror position completed

In addition to audible confirmation there is also a visual confirmation via the instrument cluster message center. For additional information, refer to: Information and Message Center (413-08, Description and Operation).

MEMORY CONTROL MODULE



E 138149

Memory Control Module Location (LHD shown, RHD similar)

Item	Part Number	Description
1	-	Memory control module

The memory control module, located under the driver's seat, relies upon a number of inputs and controls a number of outputs. As with all electronic control modules, the unit needs information regarding the current operating conditions of the engine and other related systems before it can make calculations, which determine the appropriate outputs.

All memory values are stored in the non-volatile memory, [EEPROM](#). The current motor positions, which are monitored by the control modules integral Hall sensors, are stored in the [EEPROM](#). If a loss of power occurs, upon power reconnection the current motor position are recalled from memory and adopted as the current positions. This will allow the relative memory positions to be retained without any need to re-calibrate. The memory control module

checks the integrity of all data stored in the [EEPROM](#) each time it exits stand-by mode. In the event that the data is corrupt, the control module adopts the default values for all of the programming options. All memory positions are deemed as invalid and the software will perform as if there are no memory positions stored. Memory store operations will reset the relevant memory and allow full functionality.

Stall Detection

Seat, steering column (where fitted) and mirror motors are deemed to have stalled if there is no change in the inputs that are received from the corresponding feedback sensors for 200ms (seat), 1000ms (mirror & steering column) while that axis is being driven.

If a stall condition is detected then the drive to that axis is cancelled for the remainder of that memory operation (memory recall) or until the switch is re-selected (manual movement).

If the motor movement has stopped due to loss of sensor feedback, either stall or sensor failure, then that axis may be activated again, to move past the stall position, by re-selecting the appropriate switch. This allows control of the motor to be maintained if sensor feedback is lost.

Upon re-selection of movement, if sensor pulses are detected then the motor will continue to be driven until the switch is released or another stall condition is detected. If sensor feedback is not detected then the motor is only driven for 0.5 second and then stops until the switch is released and then pressed again, when a further 0.5 second of activation is permitted, and so on.

For all seat motor and steering column manual movements, whenever a motor is driven and a stall occurs, the memory control module records the position at which the stall occurred. If movement occurs beyond a stall position, then that position is erased from the control modules memory. This will always allow movement past a previously recorded stall position once movement has been registered beyond that position. This is the case for both manual and memory movement.

Initialization

When a replacement memory control module is fitted to a seat it should be initialized so that the control module can learn the seats and steering column maximum and minimum adjustment values. This is achieved by:

- adjusting all seat movement axis from one end of travel to the other; slide, recline, height and tilt
- adjusting all steering column movement from one end of travel to the other; rake and reach.

Battery Monitor

If the battery voltage drops below 10.5 Volts, then the memory control module ignores all requests for a memory recall, including lazy entry, or easy entry/exit until the battery voltage has reached 11.5 Volts. This will conserve as much power in the vehicle battery as possible to enable engine cranking.

Stand-by Mode

The memory control module supports a stand-by mode to keep power consumption to a minimum.

The control module will enter stand-by mode upon receipt of a [LIN](#) bus 'SLEEP' message from the [CJB](#). Alternatively, a time period of 3 seconds after the [LIN](#) bus network has remained quiet provided there are no motors being driven at that time and there are no valid switch requests.

If there is a failure with the [LIN](#) bus network then the seat will be operational in 'inch mode' only.

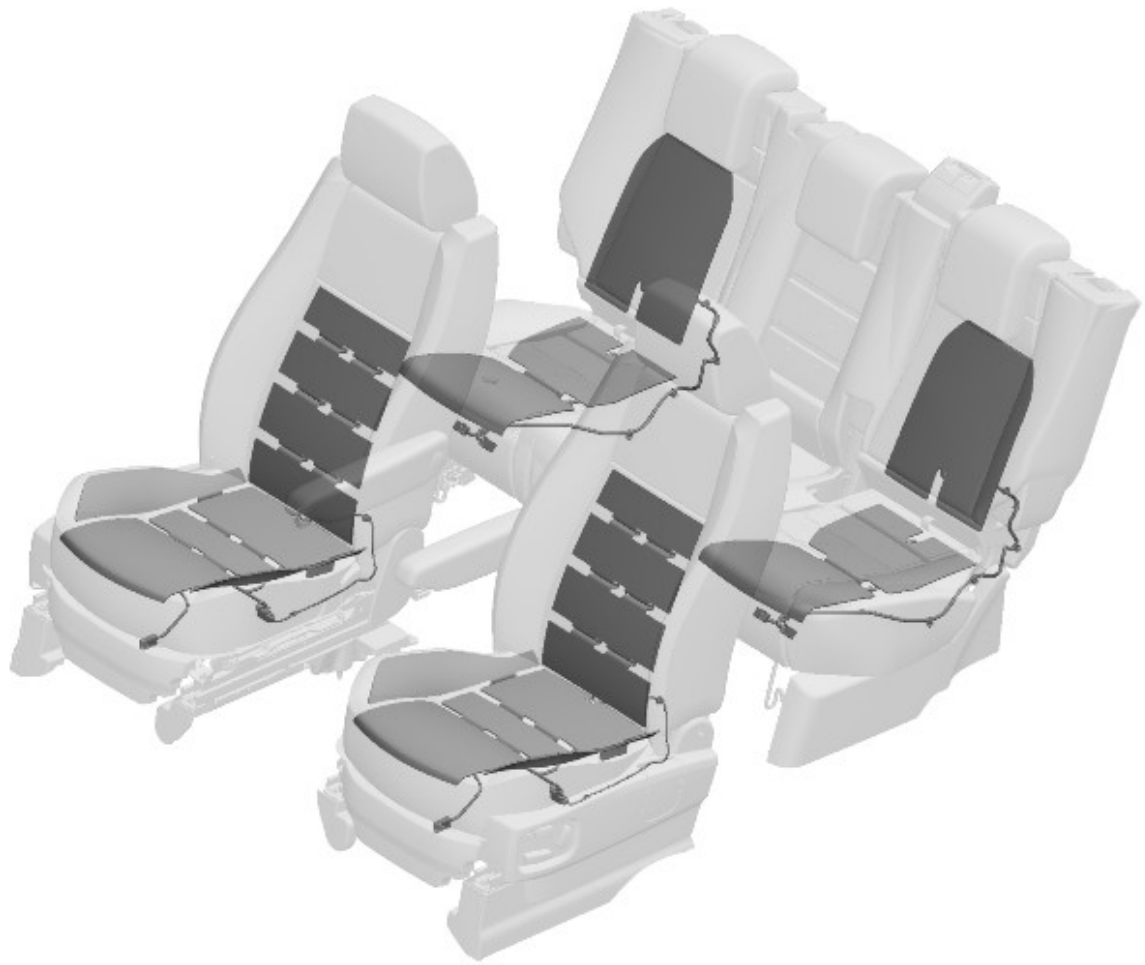
If the control module is being prevented from entering stand-by mode due to motor movement, memory recall or switch operation, then it will enter stand-by mode when the current function has terminated.



NOTE: In the case of a memory recall, all memory recall operations should be carried out before entering stand-by mode, not just the current motor movement.

The control module will exit stand-by mode if there is any [LIN](#) bus activity. When the control module exits stand-by mode it must verify the 'System Enable Status' in order to recognize when it should respond to a switch request.

SEAT HEATING



E138150

Front Seats

Front Seat Heater Switches



E138151

Item	Part Number	Description
1	-	LH front seat heater switch
2	-	RH front seat heater switch

The heated front seat system is available on both manual and electric seats and is controlled by the Automatic Temperature Control Module (ATCM).

When the front seat heater switch is operated, power is supplied to the heater elements in the seat, causing the seat to heat up. The ATCM senses seat temperature via the sensor in the cushion and regulates voltage to the seat heater elements to maintain a constant temperature.

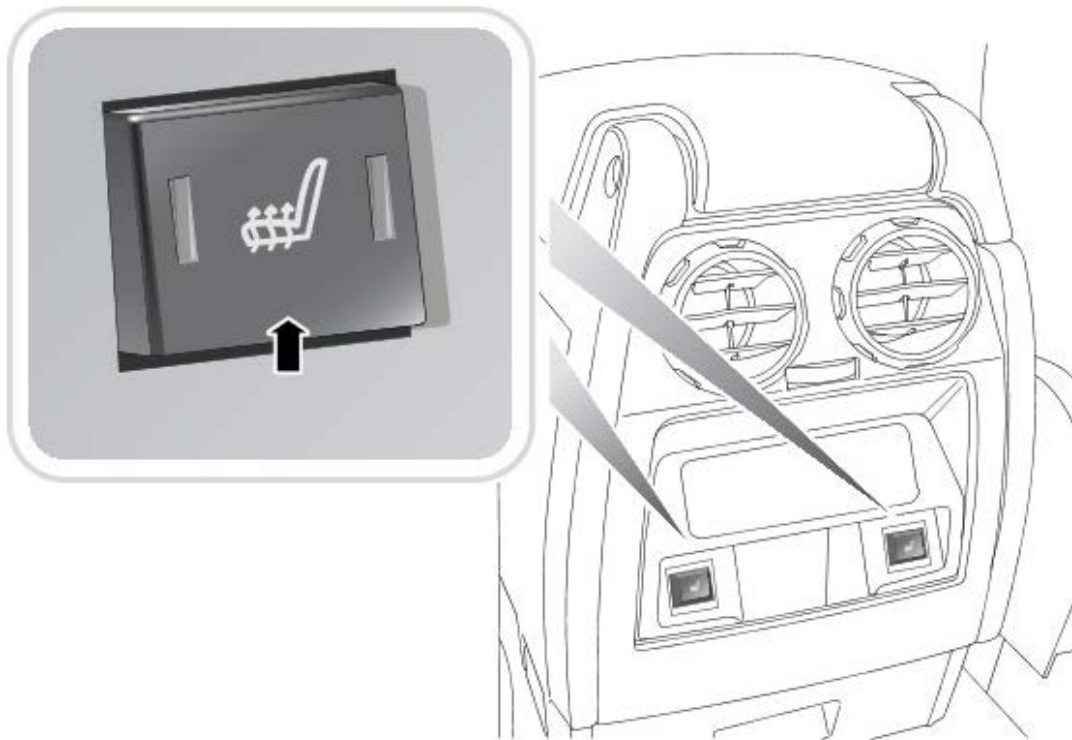
For additional information, refer to: [Control Components](#) (412-04 Control Components, Description and Operation).

Rear Seat Heaters

Rear Seat Heater Switches



NOTE: Rear air conditioning variant shown



E138152

The **RH** and **LH** rear seats support three integral heating elements, squab, back rest and bolster. The optional rear child booster seat also supports an integral seat-heating element.



NOTE: The rear center seat is not available with seat heating.

The rear seat heaters are enabled when the ignition switch is position II, and operate at one of two temperature settings. With the first press of a rear seat heater switch the relative rear seat heat control module (**RH** or **LH**) adopts the higher temperature setting, supplies a power feed to the related rear seat heater elements and illuminates two amber **LED (light emitting diode)**'s in the switch. At the second press of the switch the control module adopts the lower temperature setting and extinguishes one of the **LED**'s. At the third press of the switch the control module de-energizes the heater elements and extinguishes the second **LED**. The seat heaters remain on until selected off or the ignition is turned off.

The rear seat heat control modules receive an input from a temperature sensor in **RH** and **LH** rear seats, and regulate the power feed of the heater elements to control the seat temperature at the appropriate temperature setting between 35 and 45 °C (95 and 113 °F). The actual temperature settings vary with the type of seat covering, to allow for the different heat conduction properties of the different seat covering materials.

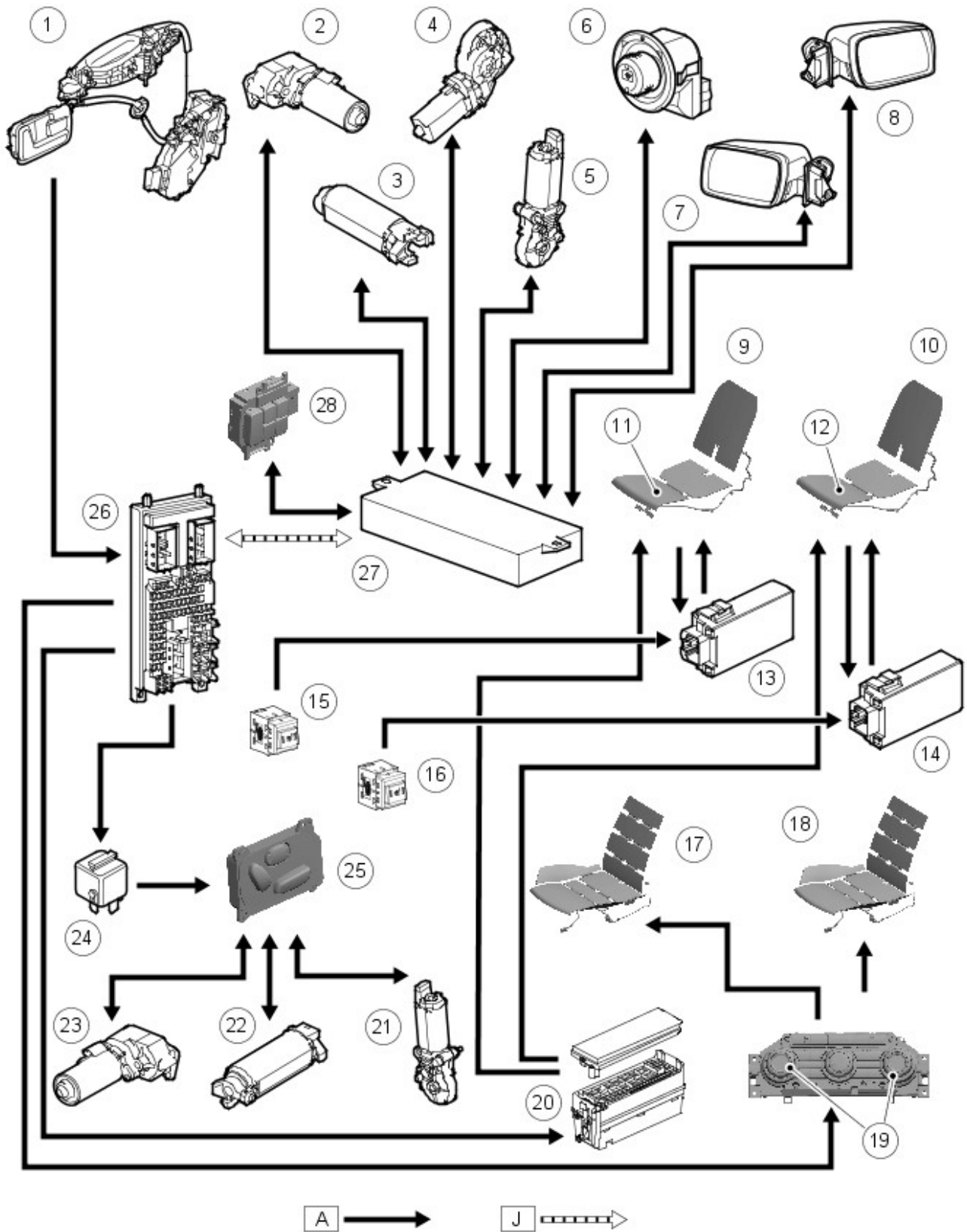
DIAGNOSTICS

The exchange of information between the diagnostic unit and the memory control module is via the **CJB**, which are interconnected via the hi-speed **CAN (controller area network)** bus and **LIN** bus. There is a non-volatile memory (**EEPROM**) for saving detected errors. Its contents are not lost when the power supply is disconnected. Only a Land Rover approved diagnostic system can erase the error memory.

CONTROL DIAGRAM



NOTE: A = Hardwired; J = CAN bus



E 137101

Item	Part Number	Description
1	-	Driver's door ajar switch
2	-	Driver's seat height motor
3	-	Driver's seat slide motor
4	-	Driver's seat tilt motor
5	-	Driver's seat recline motor
6	-	Mirror adjustment switch
7	-	LH mirror motor
8	-	RH mirror motor
9	-	LH rear seat heater

10	-	RH rear seat heater
11	-	LH rear seat heater cut-off switch
12	-	RH rear seat heater cut-off switch
13	-	LH rear seat heater control module
14	-	RH rear seat heater control module
15	-	LH rear seat heater switch
16	-	RH rear seat heater switch
17	-	Driver's seat heater
18	-	Front passenger seat heater
19	-	Front seat heater switches
20	-	BJB (battery junction box)
21	-	Front passenger seat recline motor
22	-	Front passenger seat slide motor
23	-	Front passenger seat height motor
24	-	Front passenger seat power relay
25	-	Front passenger seat switch pack
26	-	CJB
27	-	Memory control module
28	-	Driver's seat memory switch pack

Seating - Seats

Diagnosis and Testing

Principle of Operation

For a detailed description of the seating systems and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Seats (501-10 Seating, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Seat runners • Seat frames • Seat movement switch condition and installation • Seat heater switch condition and installation • Seat motor(s) condition and installation • Steering column switch condition and installation • Steering column condition and installation • Door mirror switch condition and installation • Door mirror condition and installation 	<ul style="list-style-type: none"> • Battery condition and state of charge • Fuses • Harnesses and connectors • Seat movement switch(s) • Seat heater switch(s) • Seat heater elements • Seat motor(s) • Seat module(s) • Memory control module(s) • Steering column switch • Steering column motor • Door mirror switch(s) • Door mirror motor(s) • Ignition switch • Battery Junction Box (BJB) • Central Junction Box (CJB) • Local Interconnect Network (LIN) circuit

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Seat does not move when the switch is operated (forward, backward, tilt, etc)	<ul style="list-style-type: none"> • Runner or mechanism jammed • Seat circuit short circuit to ground, short circuit to power, open circuit, high resistance • Thermal cut-out engaged • Driver/Passenger Seat Module (DSM/PSM) fault 	<ul style="list-style-type: none"> • Check for obstructions at the seat runners or mechanisms • Refer to the electrical circuit diagrams and test the relevant seat circuit for short circuit to ground, short circuit to power, open circuit, high resistance • The thermal cut-out may engage if there is a motor or mechanism fault • Using the manufacturer approved diagnostic system, check the Driver/Passenger Seat Module (DSM/PSM) for related DTCs and refer to the relevant DTC index
Steering column does not move when the switch is operated	<ul style="list-style-type: none"> • Steering column adjustment circuit short circuit to ground, short circuit to power, open circuit, high resistance • Central Junction Box (CJB) fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the steering column adjustment circuit for short circuit to ground, short circuit to power, open circuit, high resistance • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Mirrors do not move when the switch is operated	<ul style="list-style-type: none"> • Door mirror internal failure • Door mirror circuit short circuit to ground, short circuit to power, open 	<ul style="list-style-type: none"> • For door mirror tests, refer to the relevant section of the workshop manual • Refer to the electrical circuit diagrams and test the door mirror circuits for short circuit to ground, short circuit to power, open circuit, high resistance

	circuit, high resistance	
Memorized seat / steering column / mirror position is not resumed	<ul style="list-style-type: none"> Battery voltage below 10.5V Position not stored Switch operated during "one-touch" memory recall 	<ul style="list-style-type: none"> Refer to the relevant section of the workshop manual and test the battery Make sure that the desired position is correctly stored Make sure that the memory store/recall procedure is being followed
"Lazy entry" function inoperative	<ul style="list-style-type: none"> Remote transmitter fault (battery, transmitter programming, etc) Battery voltage below 10.5V Position not stored Switch operated during "one-touch" memory recall 	<ul style="list-style-type: none"> Check that the remote transmitter operates the central locking Refer to the relevant section of the workshop manual and test the battery Make sure that the desired position is correctly stored Make sure that the memory store/recall procedure is being followed
Entry/exit mode inoperative	<ul style="list-style-type: none"> Switch not in AUTO mode Driver/Passenger Seat Module (DSM/PSM) fault 	<ul style="list-style-type: none"> Make sure the function is enabled and that the switch is correctly set Using the manufacturer approved diagnostic system, check the Driver/Passenger Seat Module (DSM/PSM) for related DTCs and refer to the relevant DTC index
Seat does not get warm	<ul style="list-style-type: none"> Switch fault Heated seat circuit short circuit to ground, short circuit to power, open circuit, high resistance Temperature sensor Battery voltage is greater than 16.5 volts 	<ul style="list-style-type: none"> Check the LEDs at the switches as a quick check of the switch function. If the LEDs illuminate when the switches are operated, there is power to the switches and the switches are operating at least one level Refer to the electrical circuit diagrams and test the heated seat circuit for short circuit to ground, short circuit to power, open circuit, high resistance Test the operation of the temperature sensor If the battery voltage is higher than 16.5 volts for more than 5 seconds, seat heating is suspended
Part of the seat does not get warm	<ul style="list-style-type: none"> Heated seat element fault 	<ul style="list-style-type: none"> Refer to the electrical circuit diagrams and test the heated seat circuit for short circuit to ground, short circuit to power, open circuit, high resistance

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Driver/Passenger Seat Module (DSM/PSM) (100-00, Description and Operation).

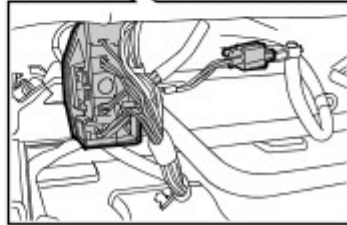
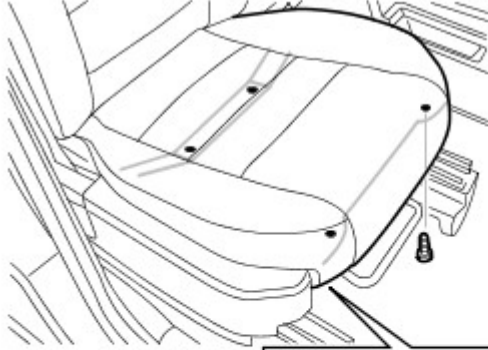
Seating - Front Seat Cushion

Removal and Installation

Removal



NOTE: In this procedure the cushion is removed as an assembly. There is a separate procedure showing removal of the cushion cover.



E55647

1. Remove the front seat cushion assembly.
 - Release and disconnect the 2 electrical connectors.
 - Remove the 4 Torx bolts.

Installation

1. Install the front seat cushion assembly.
 - Tighten the Torx bolts to 25 Nm (18 lb.ft).
 - Connect and secure the electrical connectors.

Seating - Front Seat

Removal and Installation

Removal

WARNINGS:

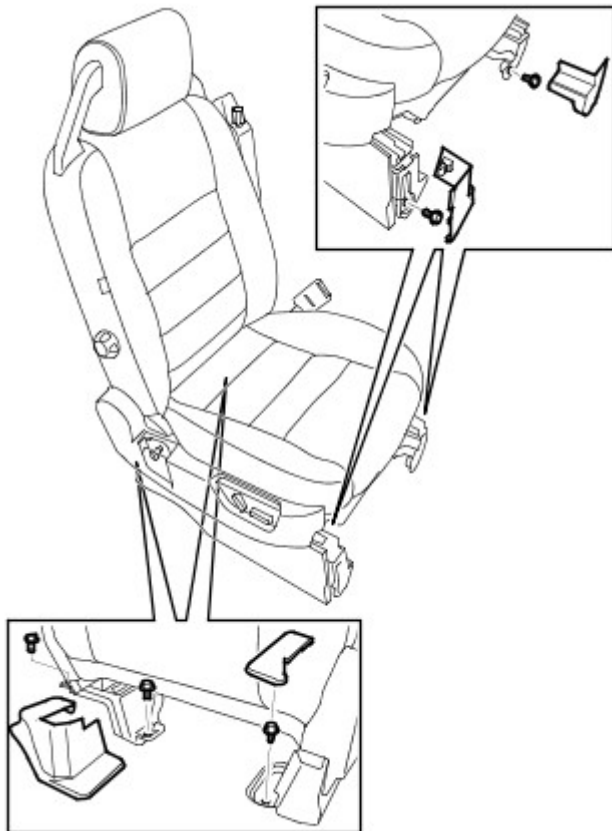


It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.



Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.

1. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).

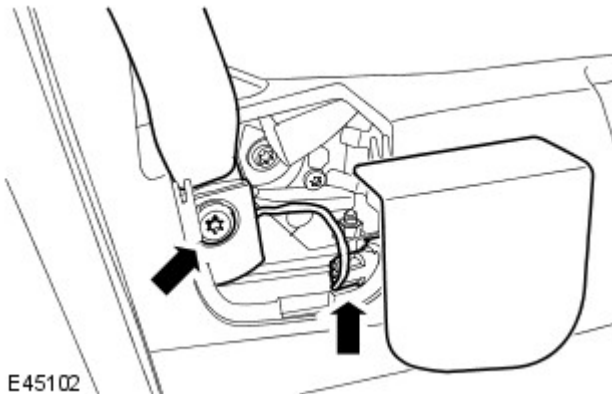


E45101

2.  **NOTE:** Torx bolts may be re-used.

Release the front seat.

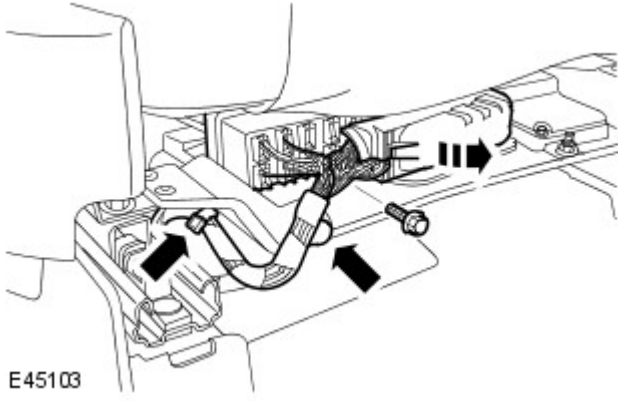
- Remove the bolt covers.
- Remove and the 5 Torx bolts.



E45102

3. Release the safety belt lower anchor from the seat.
 - Remove the bolt cover.
 - Passenger side, disconnect the electrical connector.
 - Remove and discard the Torx bolt.

4. With assistance, remove the front seat.
 - Protect the rocker panel.
 - Remove the bolt.
 - Disconnect the 2 electrical connectors.
 - Release the 2 wiring harness clips.



E45103

Installation

1. With assistance, install the front seat.
 - Connect the electrical connectors.
 - Secure the wiring harness clips.
2. Attach the safety belt lower anchor to the seat.
 - Tighten the new Torx bolt to 40 Nm (30 lb.ft).
 - Passenger side, connect the electrical connector.
 - Install the bolt cover.
3. Secure the front seat.
 - Tighten the Torx bolts to 40 Nm (30 lb.ft).
 - Install the bolt covers.
4. Connect the battery ground cable.

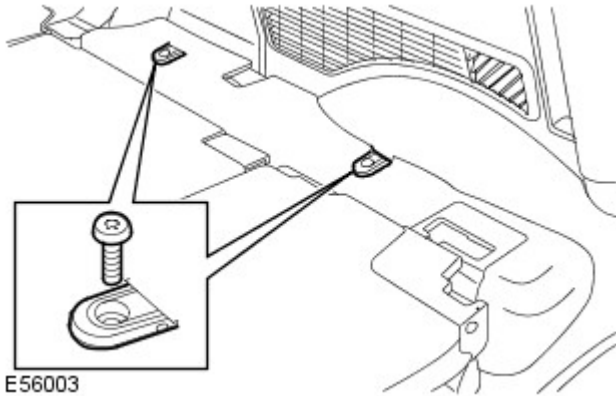
Seating - Third Row Seat

Removal and Installation

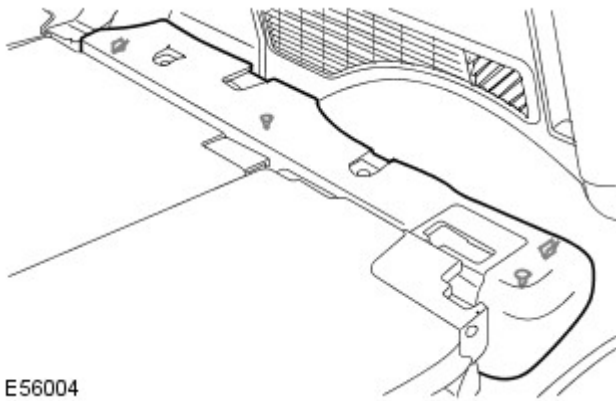
Removal



NOTE: Third row seats must be removed as a pair.



1. Remove the loadspace compartment anchors.
 - Remove the 4 Torx bolts.



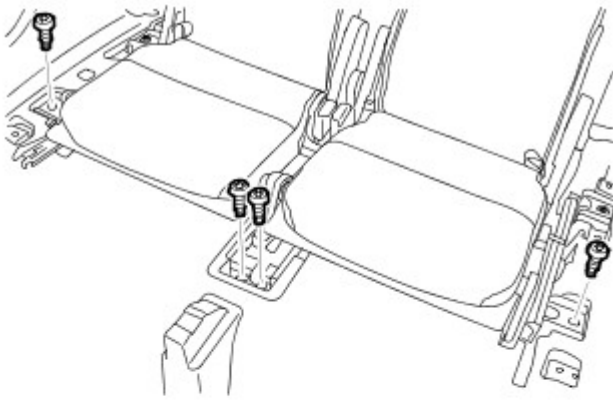
2. Remove the loadspace trim panels.
 - Release from the 4 clips.



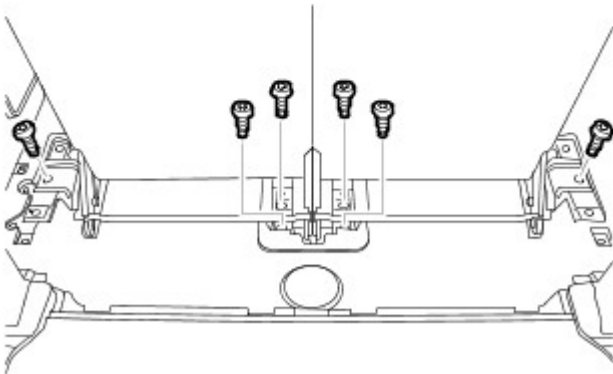
3. **NOTE:** Torx bolts may be re-used.

Remove the third row seats.


- Release the trim cover.
- Remove the 10 Torx bolts.



E 56005



E56006

4.  **NOTE:** Do not disassemble further if the component is removed for access only.

Separate the third row seats.

- Remove the seat frame finisher.
- Drill out the 6 rivets.
- Remove the 2 brackets.

Installation

1. Attach the third row seats.
 - Install the brackets.
 - Install the rivets.
2. Install the third row seats.
 - Tighten the Torx bolts to 40 Nm (30 lb.ft).
 - Secure the trim cover.
3. Install the loadspace trim panels.
 - Secure in the clips.
4. Install the loadspace compartment anchors.
 - Tighten the Torx bolts to 25 Nm (18 lb.ft).

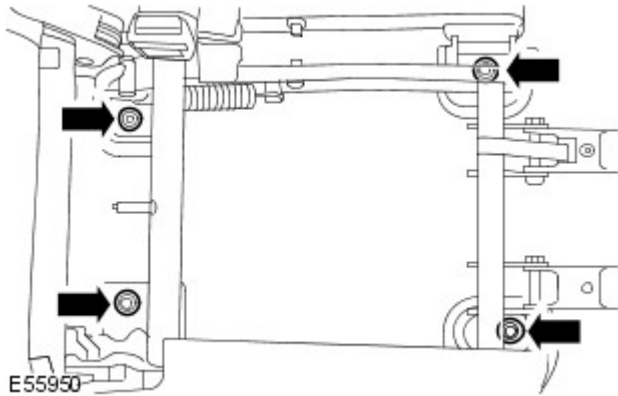
Seating - Rear Seat Vehicles With: 60/40 Split Seat

Removal and Installation

Removal



NOTE: This procedure shows the removal and installation of both the LH and the RH seats.

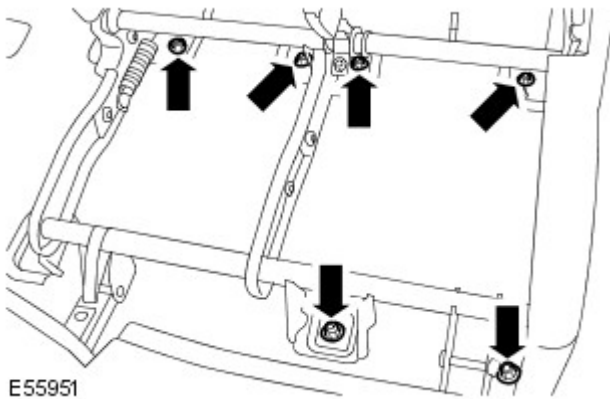


1. **NOTE:** The Torx bolts can be re-used.

Release the RH rear seat.

- Fold the LH seat cushion forward.
- Remove the 4 Torx bolts.
- Fold down the rear seat backrest.

2. Remove the RH rear seat.



3. **NOTE:** The Torx bolts can be re-used.

Release the LH rear seat.

- Fold the LH seat cushion forward.
- Remove the 6 Torx bolts.
- Fold down the rear seat backrest.

4. With assistance, remove the LH rear seat assembly.

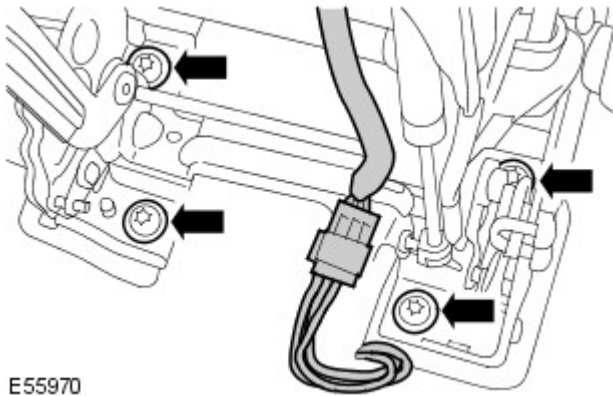
Installation

1. With assistance, install the LH rear seat assembly.
 - Position the seat on the dowels.
2. Secure the LH rear seat.
 - Return the seat backrest to the upright position.
 - Tighten the Torx bolts to 40 Nm (30 lb.ft).
 - Fold the seat cushion rearwards.
3. Install the RH rear seat.
 - Position the seat on the dowels.
4. Secure the RH rear seat.
 - Return the seat backrest to the upright position.
 - Tighten the Torx bolts to 40 Nm (30 lb.ft).
 - Fold the seat cushion rearwards.

Seating - Rear Seat Vehicles With: 40/20/40 Split Seat

Removal and Installation

Removal



E55970

1.  **NOTE:** The Torx bolts can be re-used.

Release the rear seat.

- Remove the front 2 Torx bolts.
- Fold the seat assembly forwards.
- Disconnect the electrical connector.
- Remove the rear 2 Torx bolts.

2. Remove the rear seat assembly.

Installation

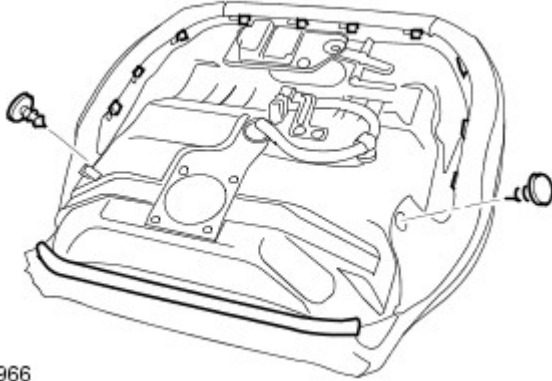
1. Install the rear seat assembly.
2. Secure the rear seat.
 - Connect the electrical connector.
 - Tighten the rear Torx bolts to 45 Nm (33 lb.ft).
 - Fold seat assembly rearwards.
 - Tighten the front Torx bolts to 45 Nm (33 lb.ft).

Seating - Front Seat Cushion Cover

Removal and Installation

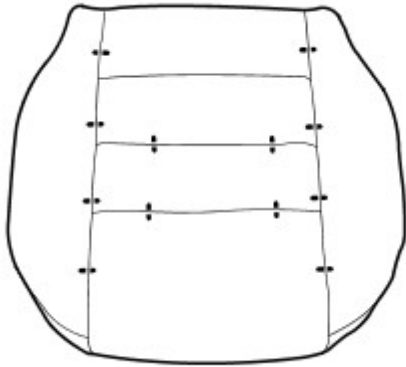
Removal

1. Remove the front seat cushion assembly.
For additional information, refer to: Front Seat Cushion (501-10, Removal and Installation).
2. Release the front seat cushion cover.
 - Release the 13 clips.



E55966

3. Remove the front seat cushion cover.
 - Remove the 12 hog rings.



E56020

Installation

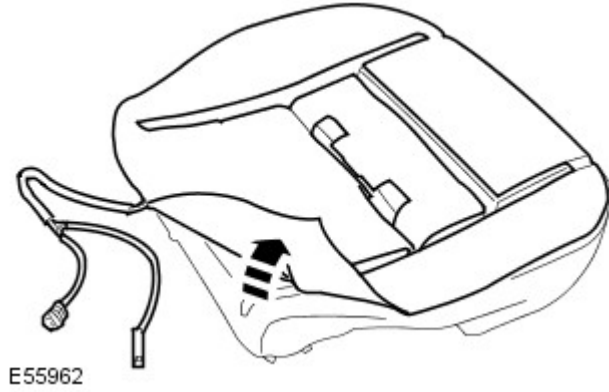
1. Install the front seat cushion cover.
 - Install the hog rings.
 - Attach the cover and secure with the clips.
2. Install the front seat cushion assembly.
For additional information, refer to: Front Seat Cushion (501-10, Removal and Installation).

Seating - Front Seat Cushion Heater Mat

Removal and Installation

Removal

1. Remove the front seat cushion cover.
For additional information, refer to: Front Seat Cushion Cover (501-10, Removal and Installation).
2. Remove the front seat cushion heater mat.



Installation

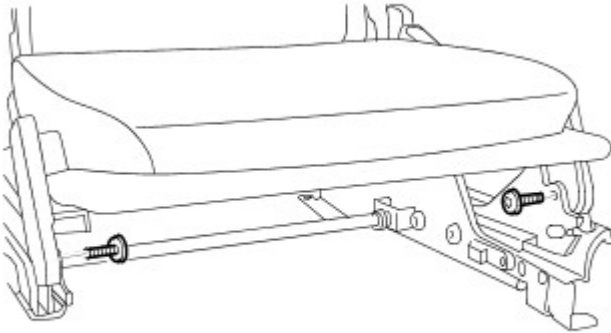
1. Install the front seat cushion heater mat.
2. Install the front seat cushion cover.
For additional information, refer to: Front Seat Cushion Cover (501-10, Removal and Installation).

Seating - Third Row Seat Cushion Cover

Removal and Installation

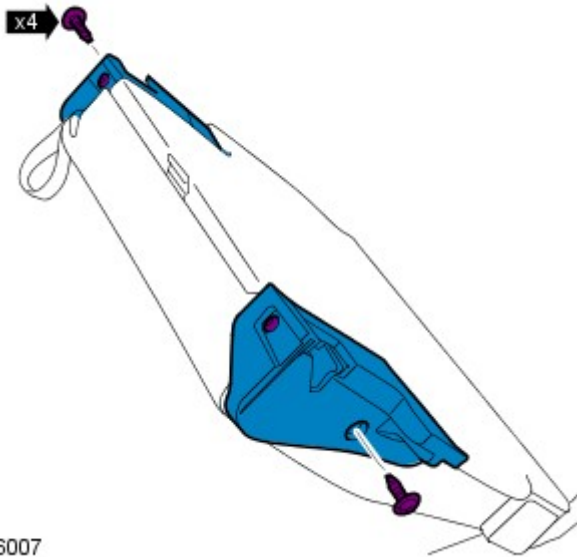
Removal

1. Remove the occasional seat cushion assembly.
 - Remove the 2 Torx bolts.




E56012

2. Remove the third row seat cushion latch covers.
 - Remove the 4 screws.

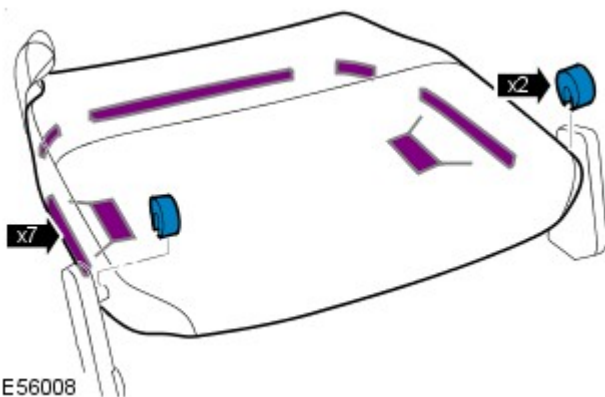


E56007

3.  **NOTE:** Note the fitted position.

Remove the third row seat cushion cover.

- Remove the 2 spacers.
- Release the 7 clips.



E56008

Installation

1. To install, reverse the removal procedure.
 - Tighten the Torx bolt to 25 Nm (18 lb.ft).

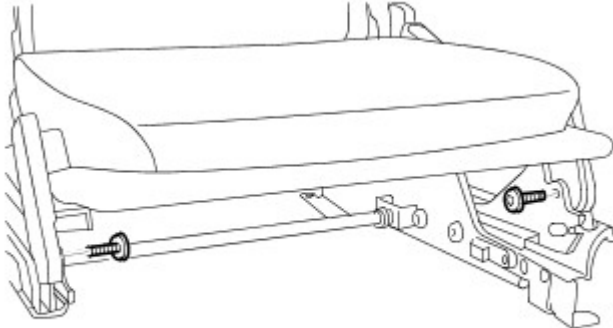
Seating - Third Row Seat Cushion

Removal and Installation

Removal



NOTE: In this procedure the cushion is removed as an assembly. There is a separate procedure for removing and installing the cushion cover.



E56012

1. Remove the third row seat cushion.
 - Remove the 2 Allen bolts.
 - Release the cushion from the seat frame.

Installation



1. **NOTE:** Ensure seat cushion return springs are correctly located.

Install the third row seat cushion.

- Attach the cushion to the seat frame.
- Tighten the Allen bolts to 25 Nm (18 lb.ft).

Seating - Rear Seat Cushion Cover Vehicles With: 60/40 Split Seat

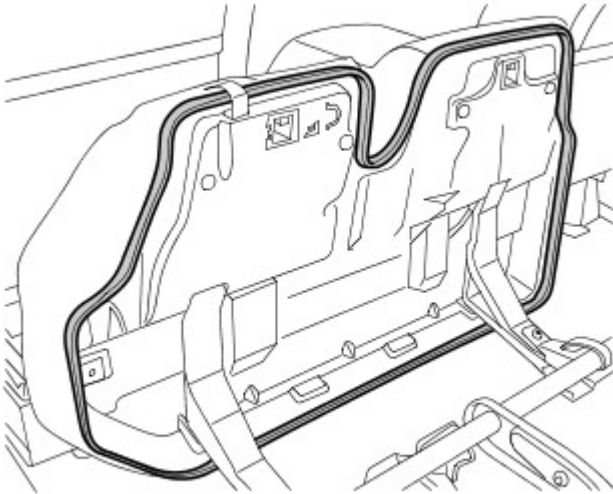
Removal and Installation

Removal



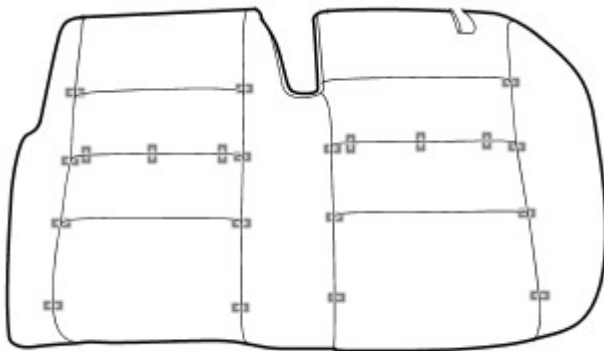
NOTE: This procedure shows the removal and installation of both the LH and the RH covers.

1. Fold the seat cushion forward.
2. Release the rear LH seat cushion cover.
 - Release the clip.



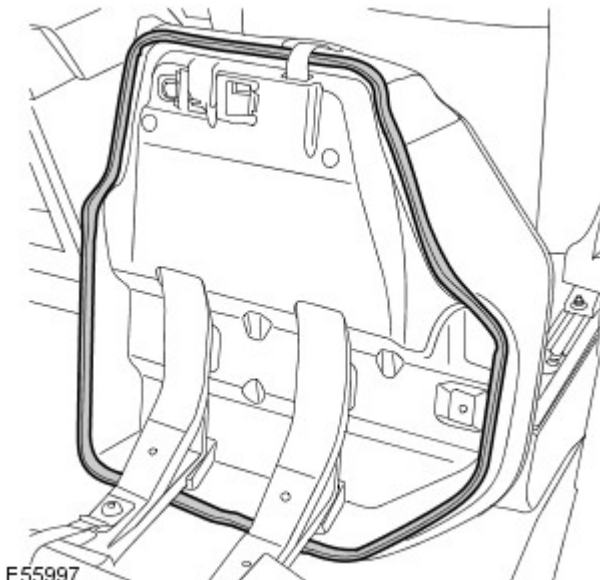
E55996

3. Remove the rear LH seat cushion cover.
 - Remove the 21 hog rings.



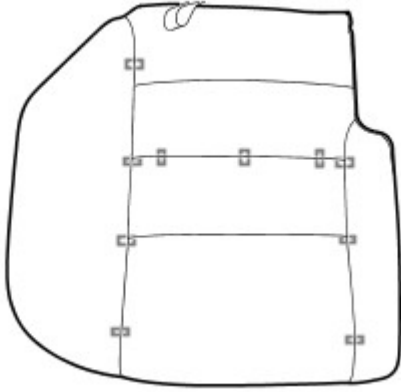
E56015

4. Release the rear RH seat cushion cover.
 - Release the clip.



E55997

5. Remove the rear RH seat cushion cover.
 - Remove the 10 hog rings.



E56016

Installation

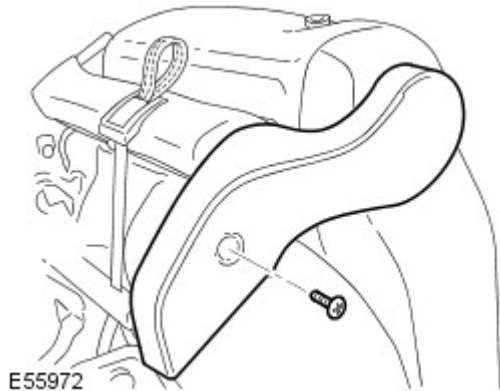
1. Install the rear seat cushion cover.
 - Install the hog rings.
 - Attach the retaining clip.
2. Fold the seat cushion rearwards.

Seating - Rear Seat Cushion Cover Vehicles With: 40/20/40 Split Seat

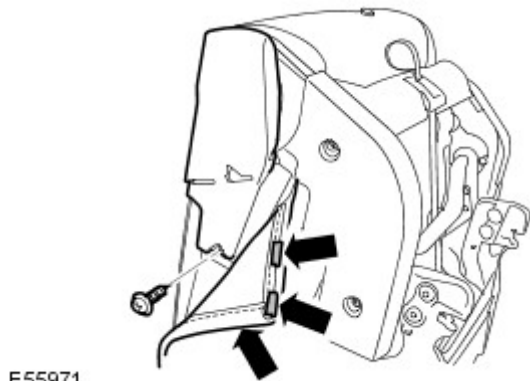
Removal and Installation

Removal

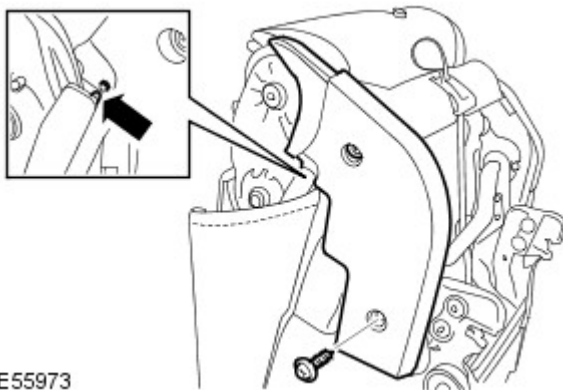
1. Remove the outer backrest hinge cover.
 - Fold the seat assembly forwards.
 - Remove the screw.



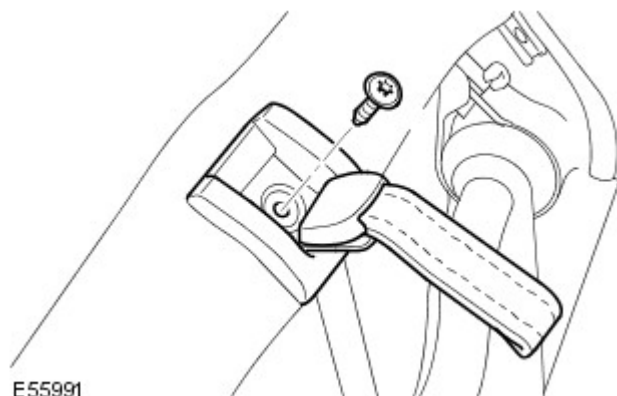
2. Remove the inner backrest hinge cover.
 - Release the backrest cover side clip.
 - Release the 2 clips.
 - Remove the screw.



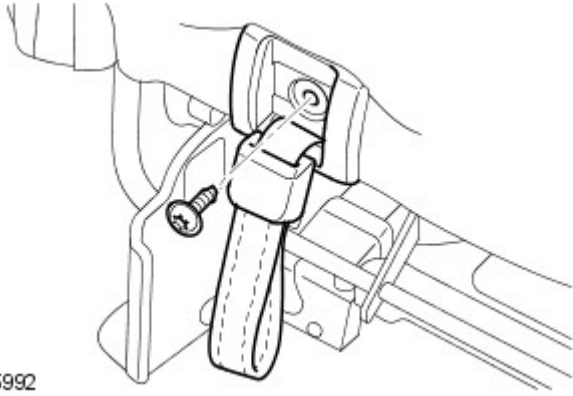
3. Remove the rear seat cushion side finisher.
 - Remove the 2 screws.



4. Remove the seat rear release strap finisher.
 - Remove the screw.

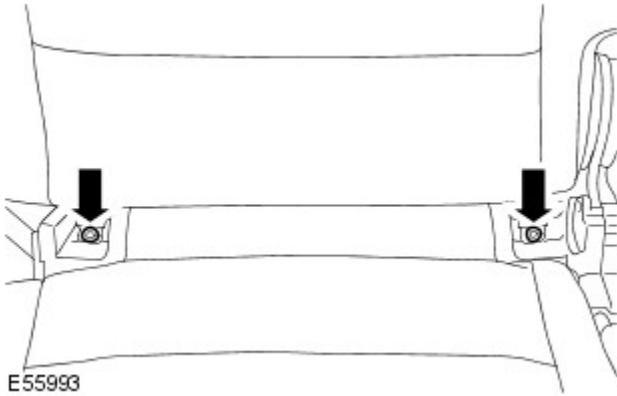


5. Remove the seat front release strap finisher.
 - Remove the screw.



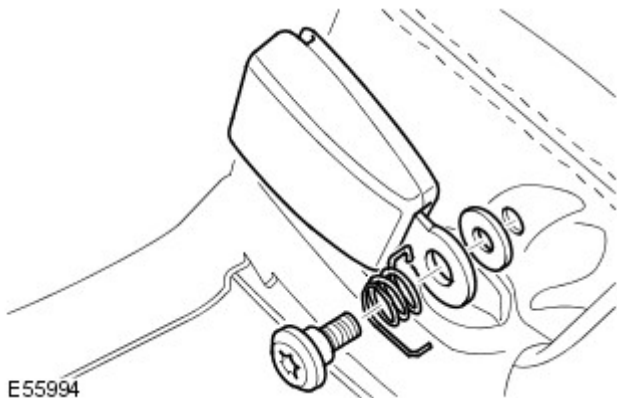
E55992

6. Remove the seat cushion finishers.
 - Remove the 2 screws.



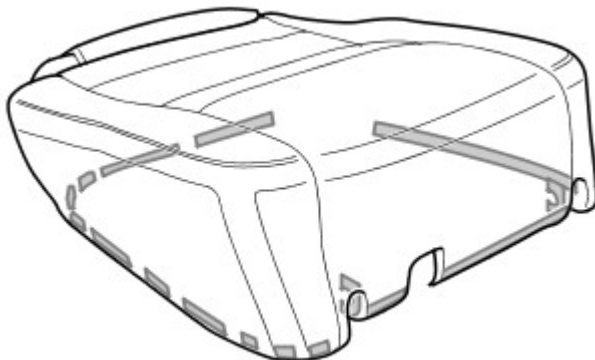
E55993

7. Remove the rear safety belt buckle.
 - Remove the Torx bolt.
 - Release the spring.



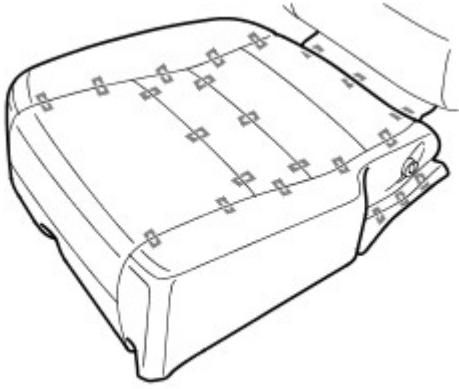
E55994

8. Release the rear seat cushion cover.
 - Release the 15 clips.



E55995

9. Remove the rear seat cushion cover.
 - Remove the 22 hog rings.



E56017

Installation

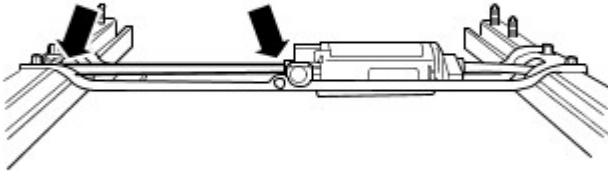
1. Install the rear seat cushion cover.
 - Install the hog rings.
 - Install the clips.
2. Install the rear safety belt buckle.
 - Attach the spring.
 - Tighten the Torx bolt to 45 Nm (33 lb.ft).
3. Install the seat cushion finishers.
 - Tighten the screws.
4. Install the seat front release strap finisher.
 - Remove the screw.
 - Tighten the screw.
5. Install the seat rear release strap finisher.
 - Tighten the screw.
6. Install the inner backrest hinge cover.
 - Attach the clips.
 - Tighten the screw.
7. Install the outer backrest hinge cover.
 - Tighten the screw.
 - Fold seat assembly rearwards.
8. Install the rear seat cushion side finisher.
 - Tighten the screws.

Seating - Front Seat Track Motor

Removal and Installation

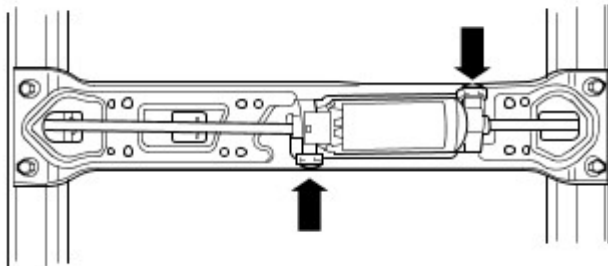
Removal

1. Raise the seat base for access.
2. Remove the drive cable.
 - Disconnect the seat motor electrical connector.



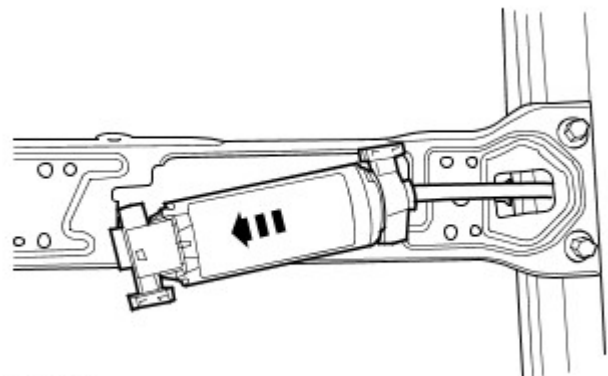
E131397

3. Remove the 2 clips.



E131398

4. Remove the front seat track motor.



E131399

Installation

1. Install the front seat track motor.
 - Install the drive cable.
 - Install the 2 clips.
2. Install the drive cable.
 - Connect the seat motor electrical connector.

Seating - Front Seat Height Adjustment Motor

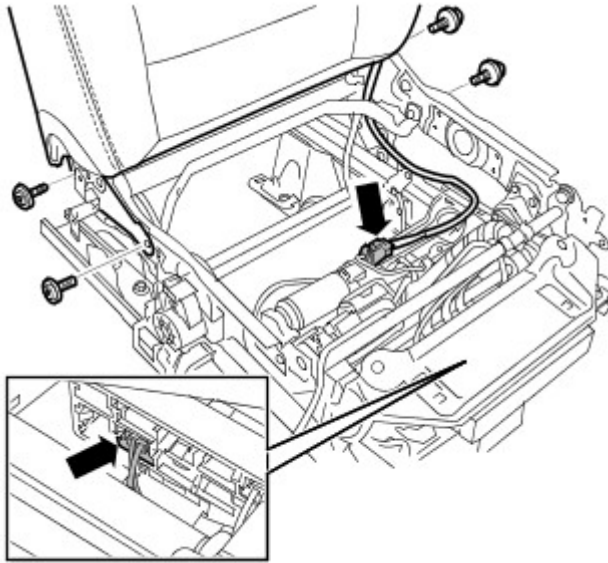
Removal and Installation

Removal



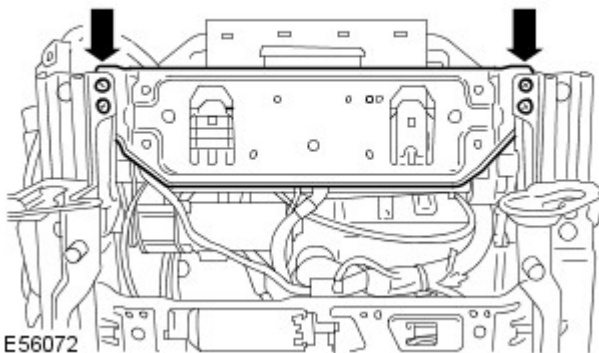
NOTE: Front seat height adjustment motor is supplied as part of the front seat frame assembly.

1. Remove the front safety belt buckle.
For additional information, refer to: Front Safety Belt Buckle (501-20A, Removal and Installation).
2. Remove the front seat cushion assembly.
For additional information, refer to: Front Seat Cushion (501-10, Removal and Installation).



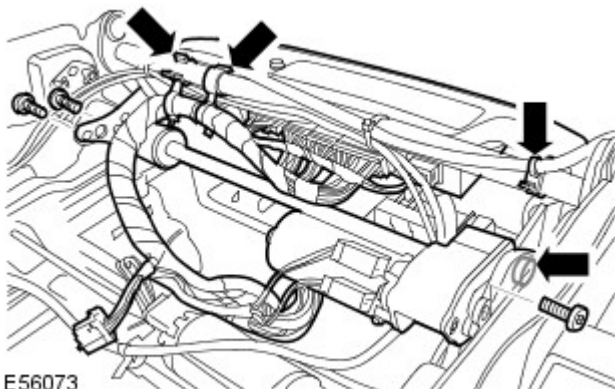
E56071

3. Remove the front seat backrest assembly.
 - Release and disconnect the 2 electrical connectors.
 - Remove the 4 Torx bolts.



E56072

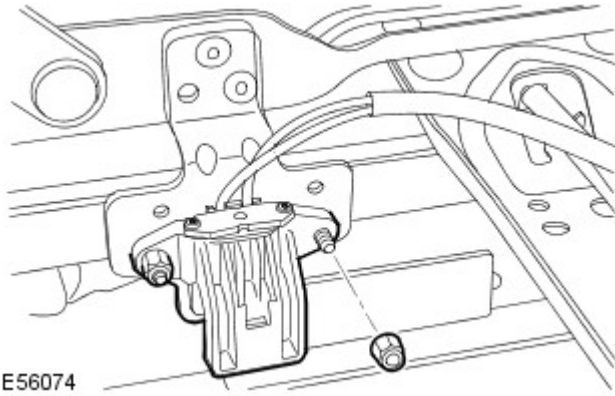
4. Remove the front seat electrical connector bracket.
 - Remove the 4 screws.



E56073

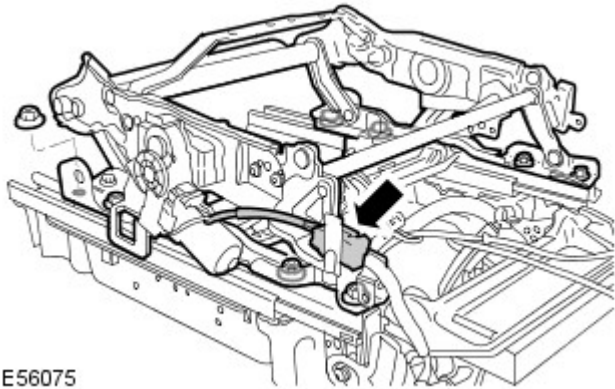
5. Remove the front seat tilt motor.
 - Release the 3 wiring harness clips.
 - Remove the 4 Torx bolts.

6. Remove the front seat position sensor.



E56074

- Remove the 2 nuts.



E56075

7. Remove the front seat height adjustment motor.
 - Disconnect the electrical connector.
 - Remove the 8 nuts.

Installation

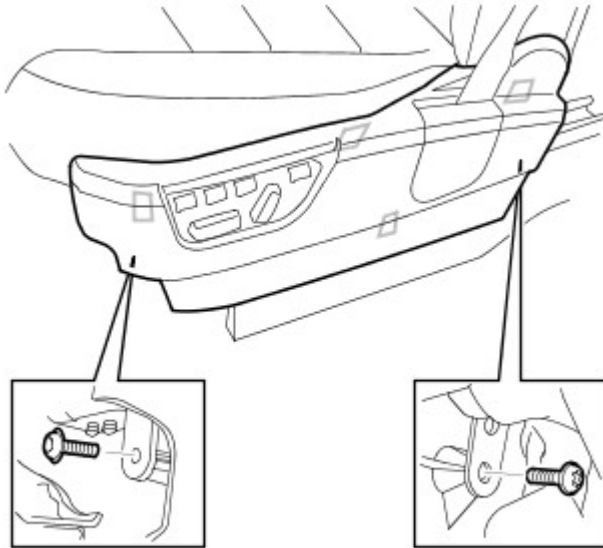
1. Install the front seat height adjustment motor.
 - Tighten the nuts to 25 Nm (18 lb.ft).
 - Connect the electrical connector.
2. Install the front seat position sensor.
 - Tighten the nuts to 4 Nm (3 lb.ft).
3. Install the front seat tilt motor.
 - Tighten the Torx bolts to 10 Nm (7 lb.ft).
 - Attach the wiring harness.
4. Install the front seat electrical connector bracket.
 - Tighten the screws.
5. Install the front seat backrest assembly.
 - Tighten the Torx bolts to 25 Nm (18 lb.ft).
 - Connect and secure the electrical connectors.
6. Install the front seat cushion assembly.
 For additional information, refer to: Front Seat Cushion (501-10, Removal and Installation).
7. Install the front safety belt buckle.
 For additional information, refer to: Front Safety Belt Buckle (501-20A, Removal and Installation).

Seating - Front Seat Tilt Motor

Removal and Installation

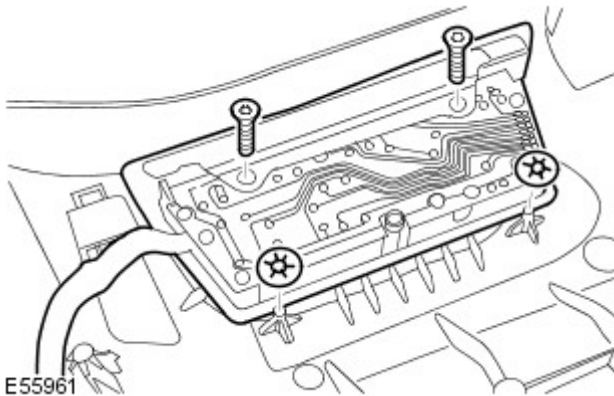
Removal

1. Remove the front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).



E56089

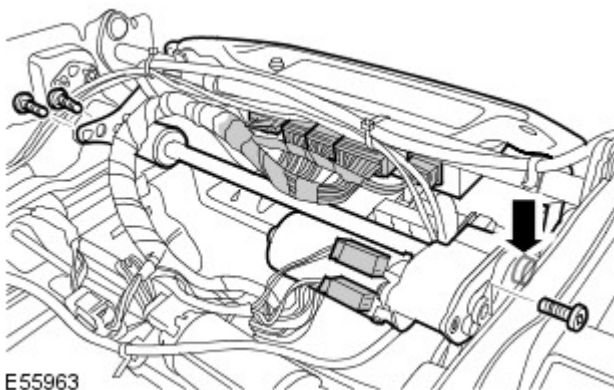
2. Remove the front seat cushion side finisher.
 - Remove the 2 Torx screws.
 - Release from the 3 clips.



E55961


3. Release the front seat control switch.
 - Remove the 2 screws.
 - Remove the 2 clips.

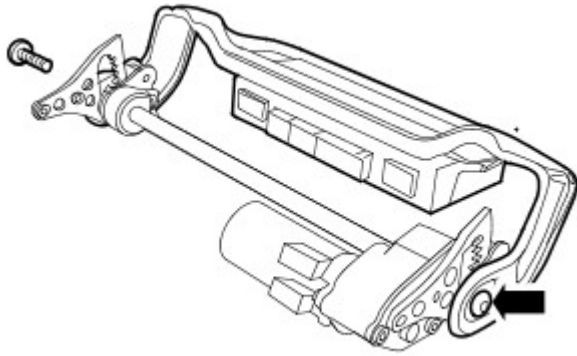
4. Remove the front seat cushion assembly.
For additional information, refer to: Front Seat Cushion (501-10, Removal and Installation).



E55963

5. Remove the front seat tilt motor assembly.
 - Remove the 4 Torx bolts.
 - Disconnect the 7 electrical connectors.

6.  **NOTE:** Do not disassemble further if the component is removed for access only.



E55964

- Remove the seat module bracket.
- Remove the 2 Torx bolts.

Installation

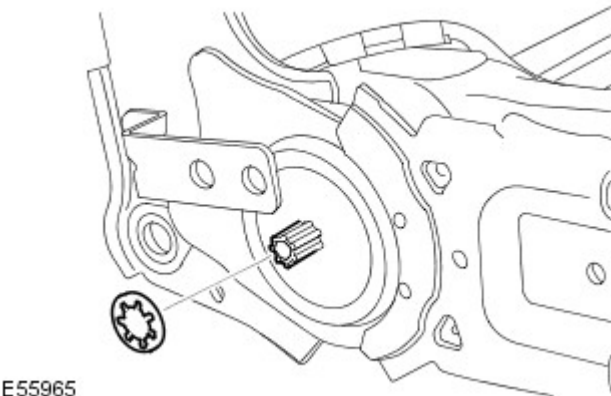
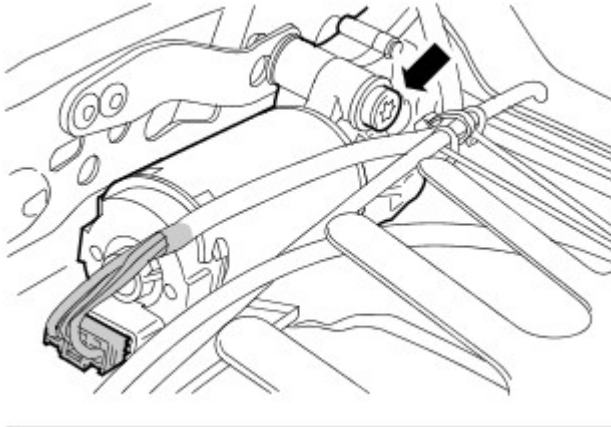
1. Install the seat module bracket.
 - Tighten the Torx bolts to 10 Nm (7 lb.ft).
2. Install the front seat tilt motor assembly.
 - Tighten the 4 Torx bolts to 10 Nm (7 lb.ft).
 - Connect the electrical connectors.
3. Install the front seat cushion assembly.
For additional information, refer to: Front Seat Cushion (501-10, Removal and Installation).
4. Install the front seat cushion side finisher.
 - Secure in the clips.
 - Tighten the screws.
5. Install the front seat control switch.
 - Secure in the clips.
 - Tighten the screws.
6. Install the front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).

Seating - Front Seat Recliner Motor

Removal and Installation

Removal

1. Remove the front seat backrest cover.
For additional information, refer to: Front Seat Backrest Cover (501-10, Removal and Installation).
2. Remove the front seat backrest pad.
3. Remove the front seat recliner motor.
 - Disconnect the electrical connector.
 - Remove the Torx bolt.
 - Remove the front seat backrest shaft clip.
 - Remove the front seat backrest shaft.



E55965

Installation

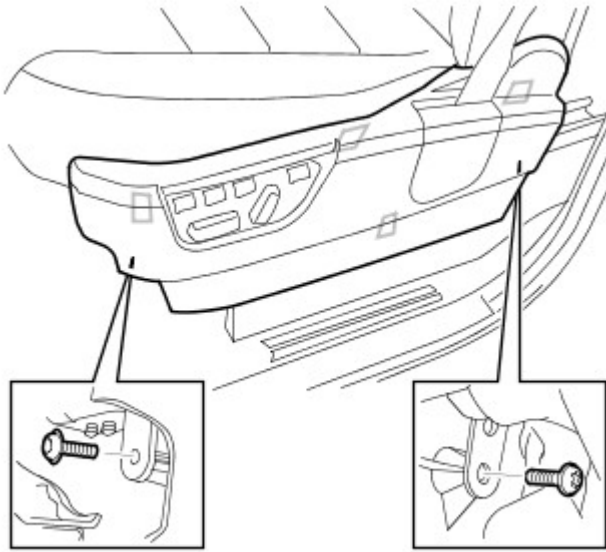
1. Install the front seat recliner motor.
 - Install the front seat backrest shaft.
 - Install the front seat backrest shaft clip.
 - Tighten the Torx bolt to 10 Nm (7 lb.ft).
 - Connect the electrical connector.
2. Install the front seat backrest pad.
3. Install the front seat backrest cover.
For additional information, refer to: Front Seat Backrest Cover (501-10, Removal and Installation).

Seating - Front Seat Control Switch

Removal and Installation

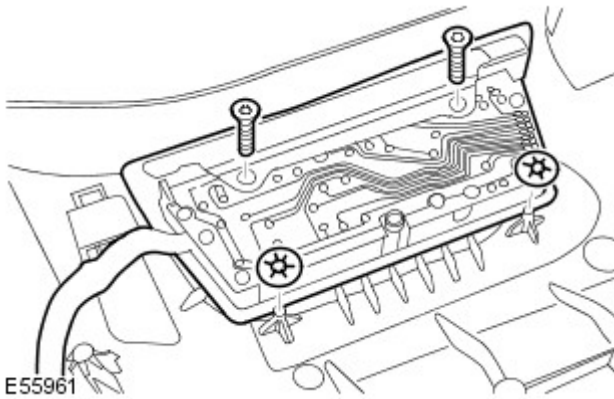
Removal

1. Remove the front seat cushion side finisher.
 - Remove the 2 screws.
 - Release from the 3 clips.



E55954

2. Remove the front seat control switch.
 - Disconnect the electrical connector.
 - Release the front seat control switch harness.
 - Remove the 2 screws.
 - Remove the 2 clips.



E55961

Installation

1. Install the front seat cushion side finisher.
 - Secure in the clips.
 - Tighten the screws.
2. Install the front seat control switch.
 - Secure in the clips.
 - Tighten the screws.
 - Connect the electrical connector.
 - Attach the wiring harness.

Seating - Front Seat Backrest Cover

Removal and Installation

Removal

WARNINGS:



To avoid accidental deployment, the restraints control module backup power supply must be depleted. Wait at least one minute after disconnecting the battery ground cable(s) before commencing any repair or adjustment to the supplemental restraint system (SRS), or any component(s) adjacent to the SRS sensors. Failure to follow these instructions may result in personal injury.



Always wear safety glasses when working on an air bag equipped vehicle and when handling an air bag module. Failure to follow this instruction may result in personal injury.



To minimize the possibility of premature deployment, do not use radio key code savers when working on the supplemental restraint system. Failure to follow this instruction may result in personal injury.



To minimize the possibility of injury in the event of premature deployment, always carry a live air bag module with the bag and trim cover pointed away from the body. Failure to follow this instruction may result in personal injury.



To minimize the possibility of premature deployment, live air bag modules must only be placed on work benches which have been ground bonded and with the trim cover facing up. Failure to follow these instructions may result in personal injury.



Never probe the electrical connectors of air bag modules or any other supplemental restraint system component. Failure to follow this instruction may result in personal injury.

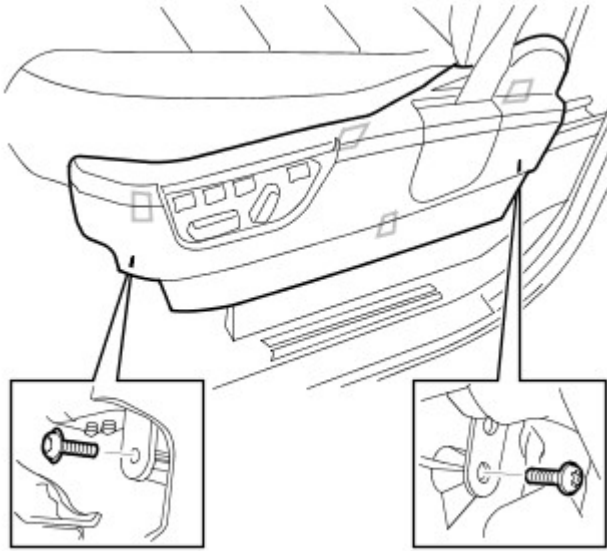


Painting over the driver air bag module trim cover or instrument panel could lead to deterioration of the trim cover and air bags. Do not for any reason attempt to paint discolored or damaged air bag module trim covers or instrument panel. Install a new component. Failure to follow this instruction may result in personal injury.



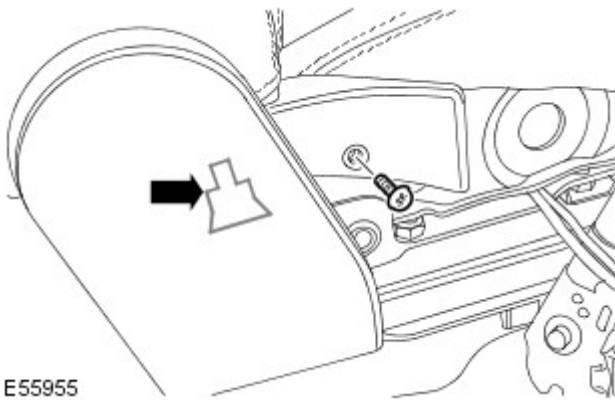
Make sure that sufficient time has elapsed after disconnecting the battery ground cable(s), before commencing work on the supplemental restraint system (SRS). Failure to follow these instructions may result in personal injury.

1. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
2. Remove the front safety belt buckle.
For additional information, refer to: Front Safety Belt Buckle (501-20, Removal and Installation).
3. Remove the front seat cushion side trim.
 - Remove the 2 screws.
 - Release from the 3 clips.



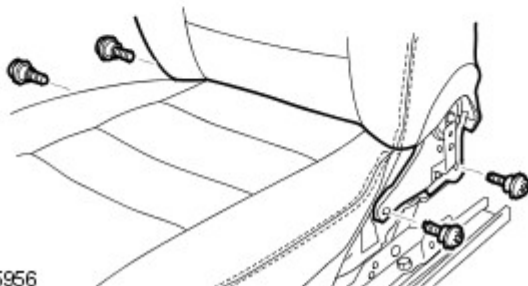
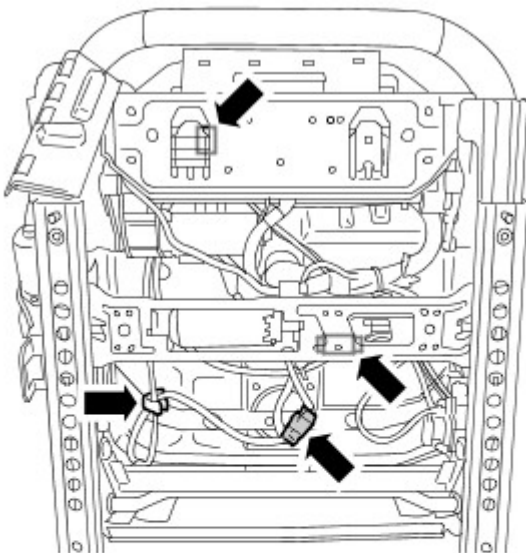
E55954

4. Remove the front seat backrest hinge cover.
 - Remove the 2 screws.
 - Release from the clip.



E55955

5. Remove the front seat backrest assembly.
 - Release the retaining clips and disconnect the three electrical connectors.
 - Remove the 4 Torx bolts.



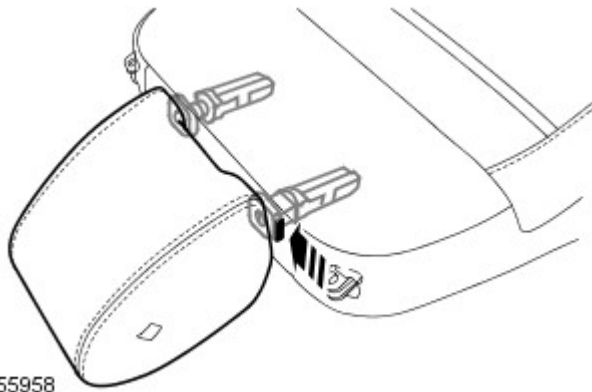
E55956

6. Remove the front seat grab handles.
 - Remove the bolt covers.



E55957

- Remove the 2 bolts.



E55958

7.  **NOTE:** Head restraint release latch is underneath backrest cover.

Remove the front seat head restraint.

- Release the front seat head restraint latch.

8. Remove the seat armrest.
For additional information, refer to: Front Seat Armrest (501-10, Removal and Installation).

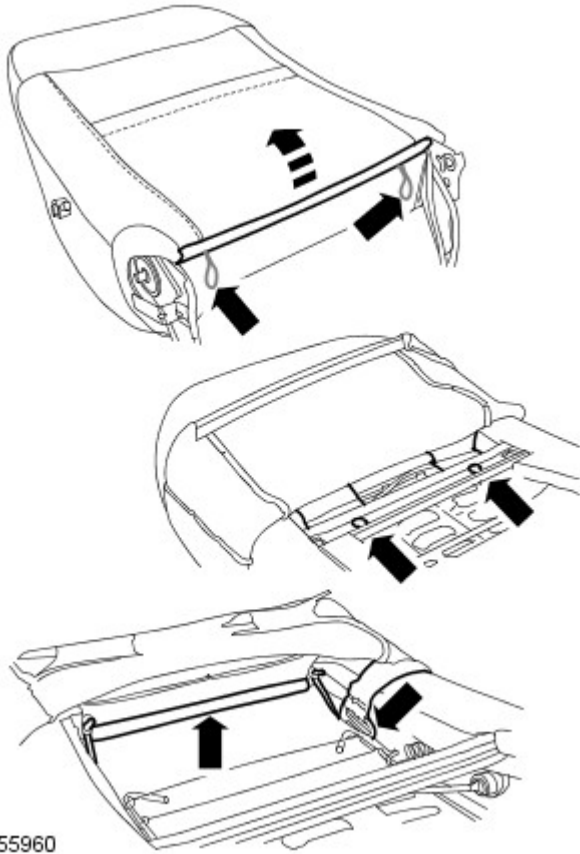
9. Remove the front seat lumbar adjustment knob.

- Pull sharply to release from lumbar mechanism.

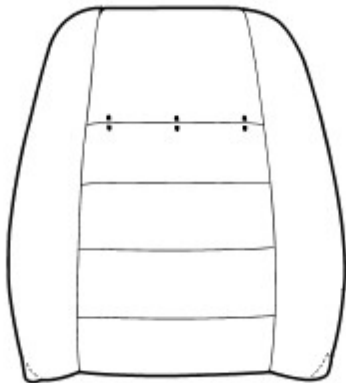


E67102

10. Release the front seat backrest cover.
- Release the 5 clips.
 - Release the tension straps.



E55960



E56021

11. Remove the front seat backrest cushion and cover from the front seat frame.
 - Remove the 3 hog rings.

Installation

1. Install the front seat backrest cover.
 - Install the hog rings.
 - Install the clips.
 - Attach the tension straps.
2. Install the front seat lumbar adjustment knob.
 - Push firmly to secure to the lumbar mechanism.
3. Install the seat armrest.

For additional information, refer to: Front Seat Armrest (501-10, Removal and Installation).
4. Install the front seat head restraint.
5. Install the front seat grab handles.
 - Tighten the bolts to 25 Nm (18 lb.ft).
 - Install the bolt covers.
6. Install the front seat backrest assembly.
 - Tighten the Torx bolts to 25 Nm (18 lb.ft).
 - Connect and secure the electrical connectors.
7. Install the front seat backrest hinge cover.

Tighten the screws.

- Fit the clip.

8. Install the front seat cushion side trim.

- Position and secure in the clips.
- Install the screws.

9. Install the front safety belt buckle.

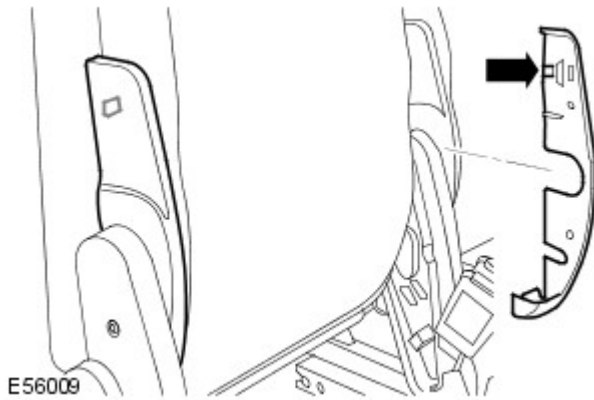
For additional information, refer to: Front Safety Belt Buckle (501-20, Removal and Installation).

Seating - Third Row Seat Backrest Cover

Removal and Installation

Removal

1. Fold the seat cushion assembly forwards.
2. Remove the seat backrest hinge inner covers.
 - Release the clip.



3. Remove the seat backrest latch covers.
 - Remove the 2 screws.



4. Remove the seat backrest cover.
 - Fold the seat cushion forward.
 - Release the 14 clips.



Installation


1. To install, reverse the removal procedure.

Seating - Front Seat Backrest Heater Mat

Removal and Installation

Removal

1. Remove the front seat backrest cover.
For additional information, refer to: Front Seat Backrest Cover (501-10, Removal and Installation).

2.  **NOTE:** Front seat cushion heater mat shown in illustration. Removal of backrest heater mat is the same.

Remove the front seat backrest heater mat.



E55962

Installation

1. Install the front seat backrest heater mat.
2. Install the front seat backrest cover.
For additional information, refer to: Front Seat Backrest Cover (501-10, Removal and Installation).

Seating - Rear Seat Backrest Cover Vehicles With: 60/40 Split Seat

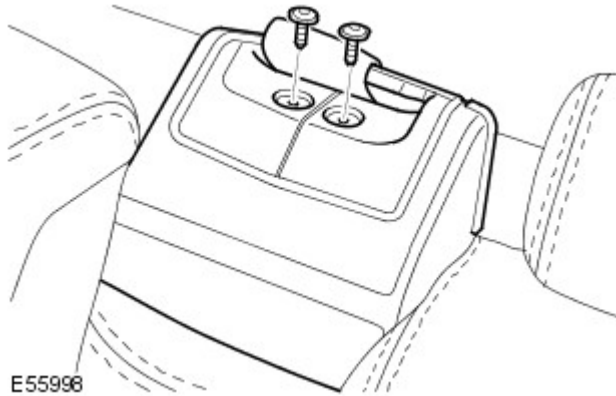
Removal and Installation

Removal



NOTE: This procedure shows the removal of both the LH and RH covers.

1. LH seat only: Remove the safety belt retractor cover and guide.
 - Remove the 2 screws.



E55998

2. Remove the rear seat release handle.



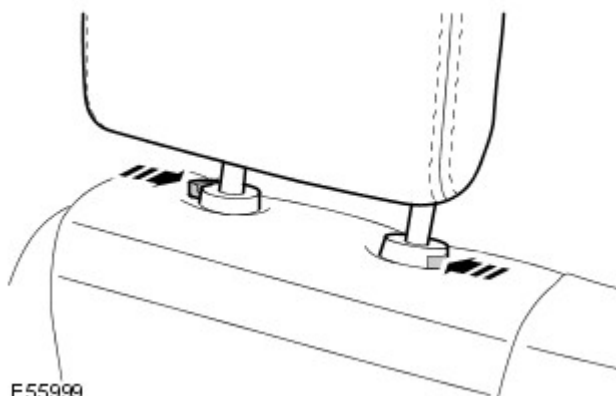
E55977

3. Remove the rear seat release handle finisher.
 - Remove the screw.



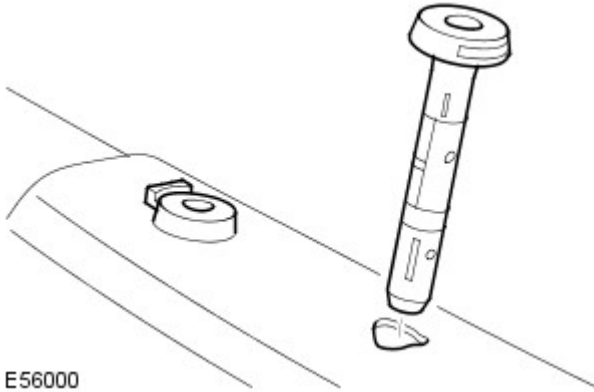
E55978

4. Remove the rear seat head restraint.
 - Depress the 2 retaining clips.



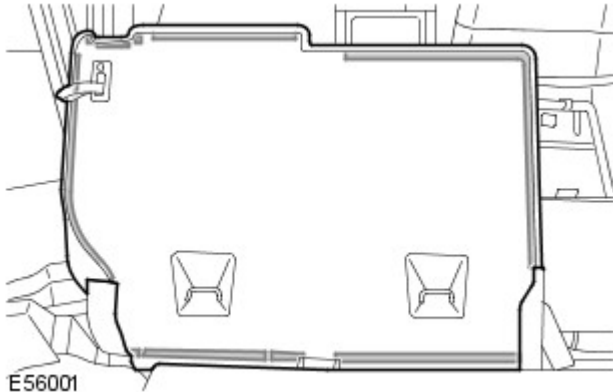
E55999

5. Remove the rear seat head restraint retaining clips.



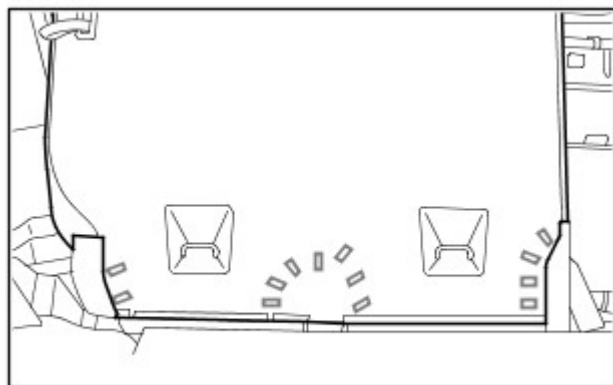
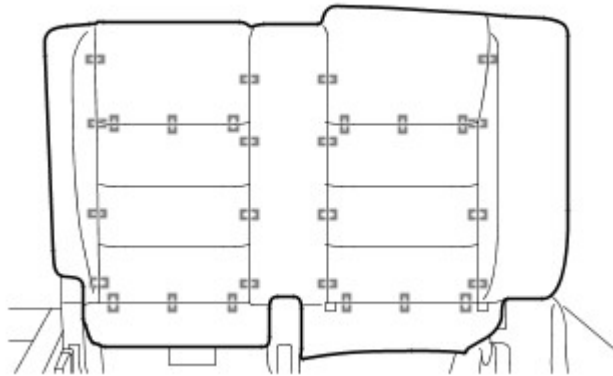
E56000

6. Release the rear LH seat backrest cover.
• Release the 10 clips.



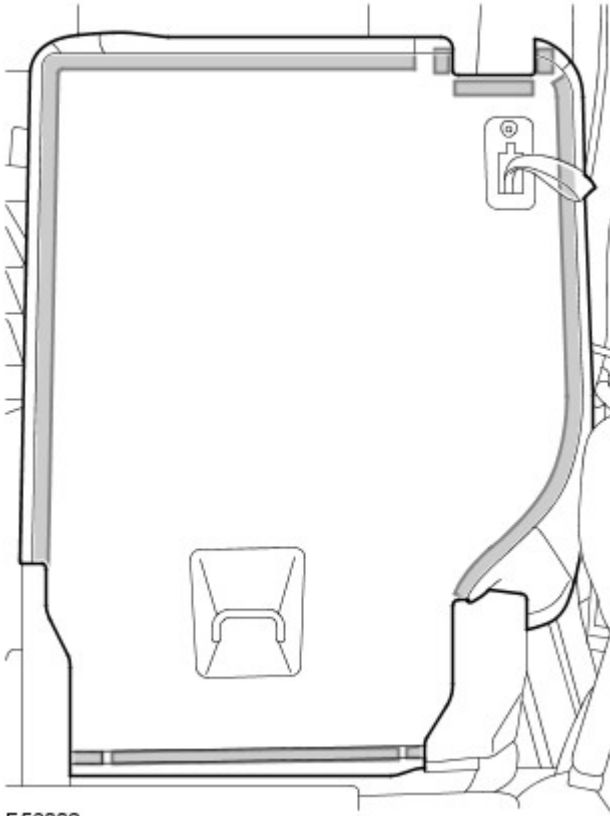
E56001

7. Remove the rear LH seat backrest cover.
• Remove the 41 hog rings.



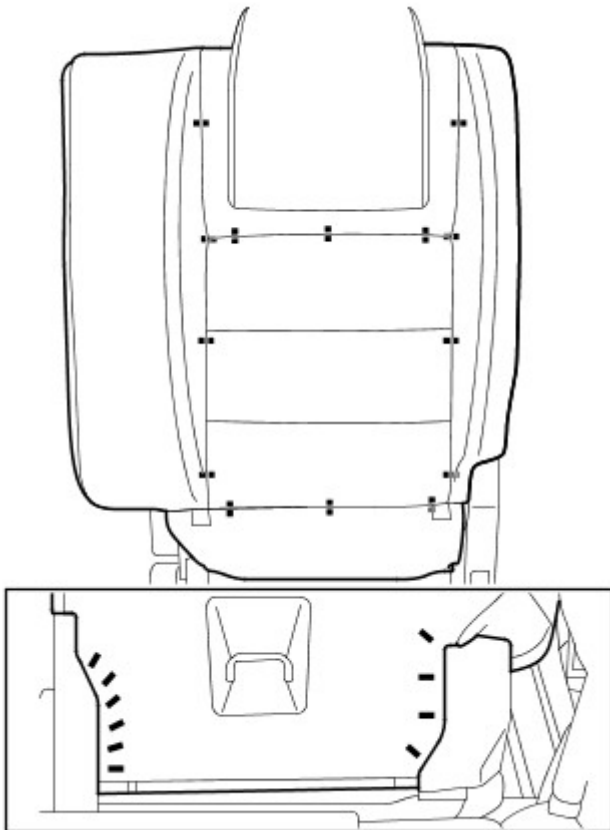
E56013

8. Release the rear RH seat backrest cover.
• Release the 9 clips.



E56002

9. Remove the rear RH seat backrest cover.
 - Remove the 24 hog rings.



E56014

Installation

1. Install the rear seat backrest cover.
 - Install the hog rings.
 - Attach the clips.
2. Install the rear seat head restraint retaining clips.

3. Install the rear seat head restraint.
4. Install the rear seat release handle finisher.
 - Tighten the screw.
5. Install the rear seat release handle.
6. Install the safety belt guide and retractor cover.
 - Attach the safety belt guide and retractor cover.
 - Tighten the screws.

Seating - Rear Seat Backrest Cover Vehicles With: 40/20/40 Split Seat Removal and Installation

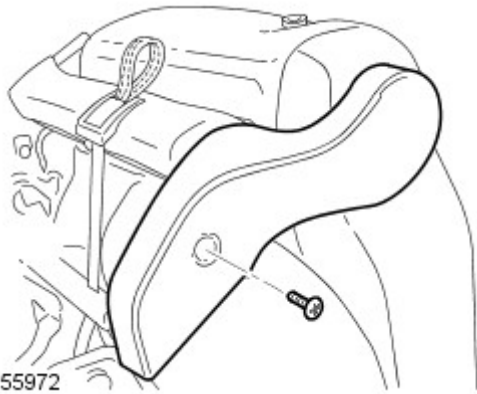
Removal

1. Remove the inner backrest hinge cover.
 - Release the backrest cover side clip.
 - Remove the screw.
 - Release the 2 clips.



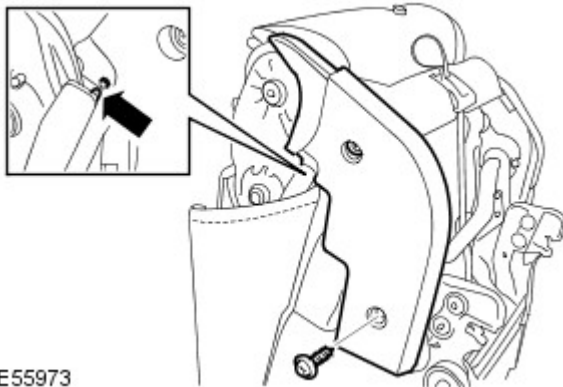
E55971

2. Remove the outer backrest hinge cover.
 - Remove the screw.



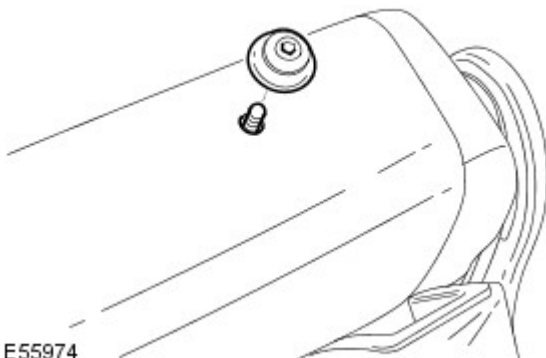
E55972

3. Remove the rear seat cushion side finisher.
 - Remove the 2 screws.



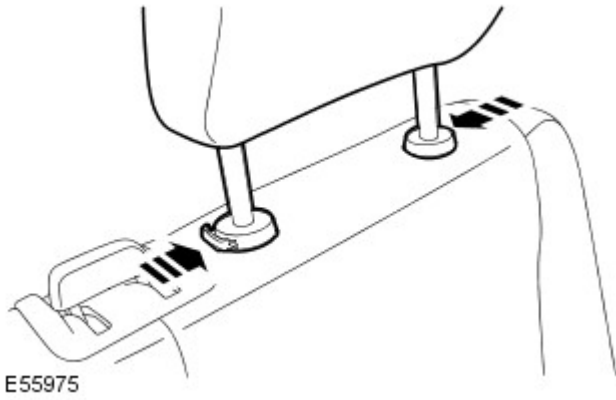
E55973

4. Remove the luggage strap tether.
 - Remove the Allen bolt.

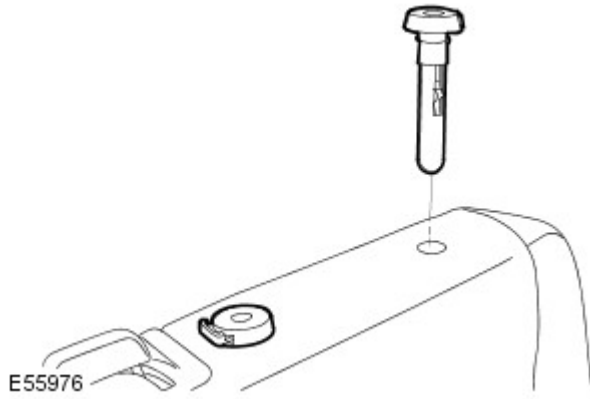


E55974

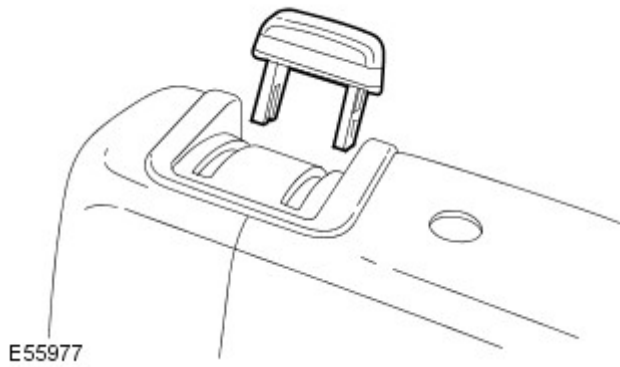
5. Remove the rear seat head restraint.
 - Depress the 2 retaining clips.



6. Remove the rear seat head restraint retaining clips.



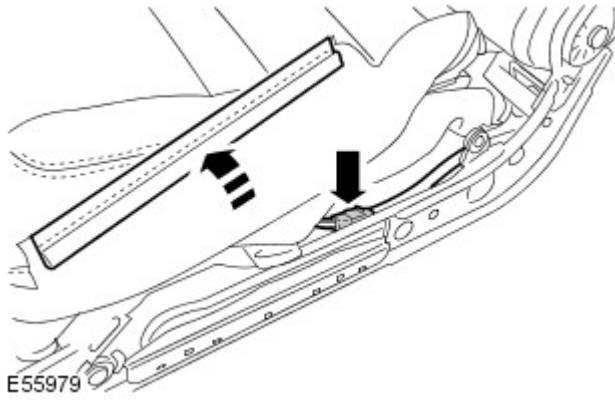
7. Remove the rear seat release handle.



8. Remove the rear seat release handle finisher.
 - Remove the screw.

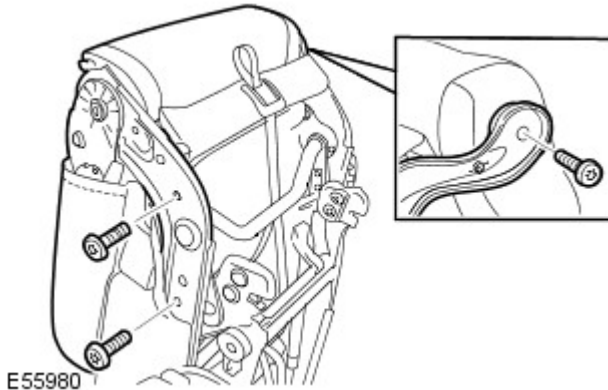


9. Disconnect the backrest heater mat electrical connector.
 - Release the rear seat cushion side clip.



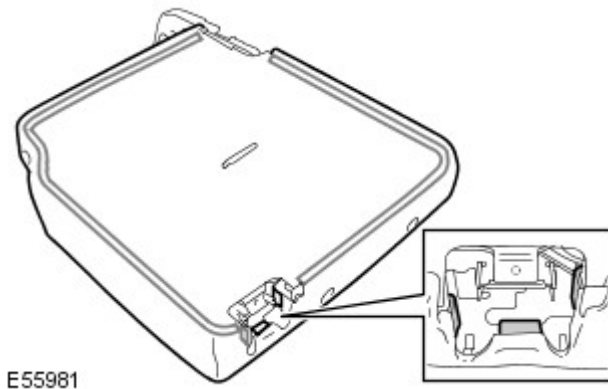
E55979

10. Remove the rear seat backrest assembly.
 - Remove the 3 Torx bolts.



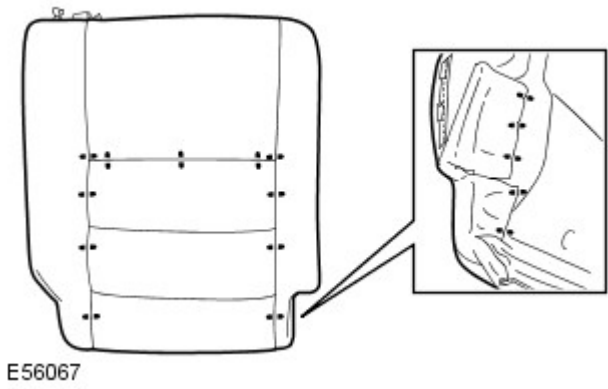
E55980

11. Release the rear seat backrest cover.
 - Release the 5 clips.



E55981

12. Remove the rear seat backrest cover.
 - Remove the 16 hog rings.



E56067

Installation

1. Install the rear seat backrest cover.
 - Install the 16 hog rings.
 - Attach the 4 clips.
2. Install the rear seat backrest assembly.
 - Tighten the Torx bolts to 45 Nm (33 lb.ft).

3. Connect the backrest heater mat electrical connector.
 - Attach the rear seat cushion side clip.
4. Install the rear seat release handle finisher.
 - Tighten the screw.
5. Install the rear seat release handle.
6. Install the rear seat head restraint retaining clips.
7. Install the rear seat head restraint.
8. Install the luggage strap tether.
9. Install the rear seat cushion side finisher.
 - Tighten the screws.
10. Install the outer backrest hinge cover.
 - Tighten the screws.
 - Tighten the screw.
11. Install the inner backrest hinge cover.
 - Attach the clips.
 - Tighten the screw.
 - Attach the backrest cover side clip.

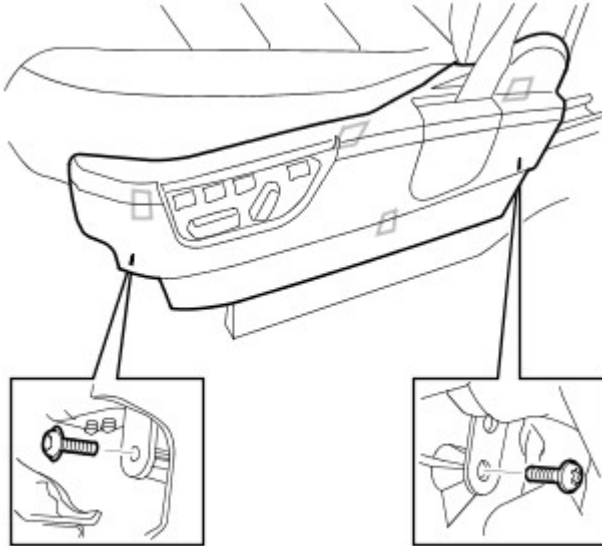
Seating - Seat Track Vehicles Without: Power Seats

Removal and Installation

Removal

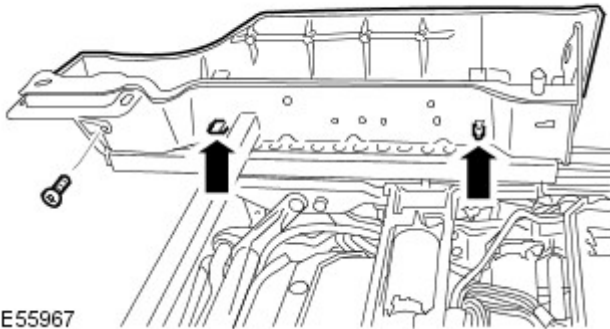
1. Remove the front safety belt buckle.
For additional information, refer to: Front Safety Belt Buckle (501-20, Removal and Installation).

2. Remove the front seat cushion side trim.
 - Remove the 2 Torx screws.
 - Release from the 4 clips.



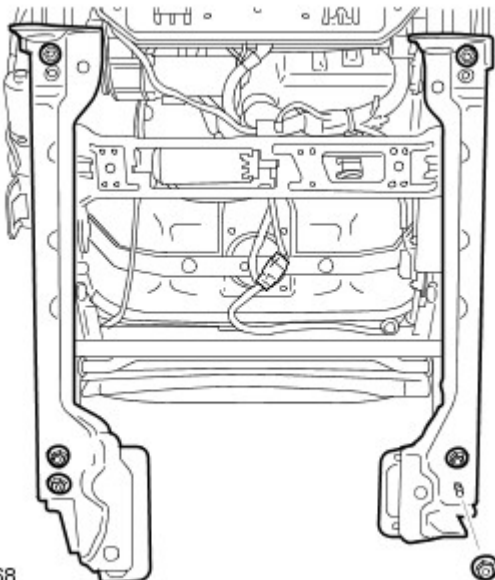
E56089

3. Remove the front seat base trim.
 - Remove the screw.
 - Release the 2 clips.



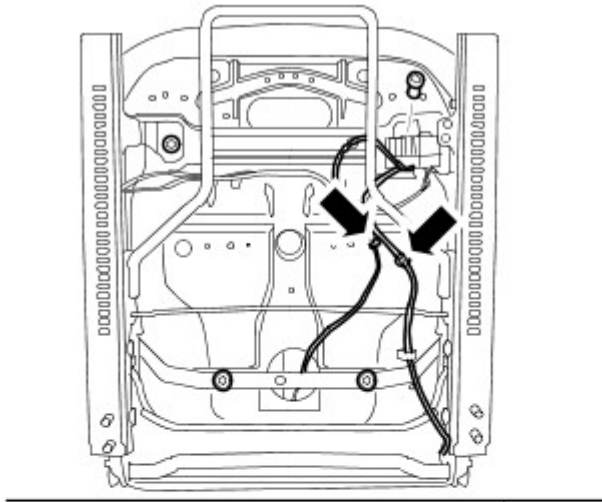
E55967

4. Remove the front seat base.
 - Remove the 6 nuts.

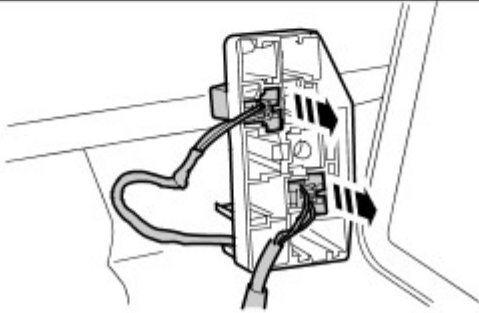


E55968

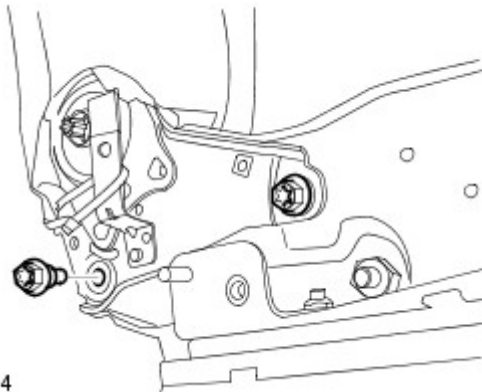
5. Remove the front seat cushion assembly.



- Release and disconnect the 2 electrical connectors.
- Remove the 4 Torx bolts.



E59785



6. Remove the seat track assembly.
 - Remove the 4 Torx bolts.

E59784

Installation

1. Install the seat track assembly.
 - Tighten the Torx bolts to 25 Nm (18 lb.ft).
2. Install the front seat cushion assembly.
 - Tighten the Torx bolts to 25 Nm (18 lb.ft).
 - Connect and secure the electrical connectors.
3. Install the front seat base.
 - Tighten the nuts to 25 Nm (18 lb.ft).
4. Install the front seat base trim.
 - Secure in the clips.
 - Tighten the screw.
5. Install the front seat cushion side trim.
 - Secure in the clips.
 - Tighten the screws.
6. Install the front safety belt buckle.
For additional information, refer to: Front Safety Belt Buckle (501-20, Removal and Installation).

Seating - Seat Track Vehicles With: Power Seats

Removal and Installation

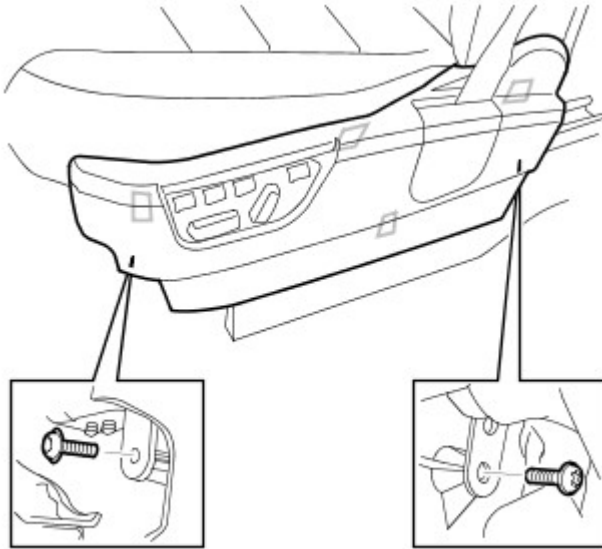
Removal



NOTE: The front seat track motor is supplied as part of the front seat lower frame assembly.

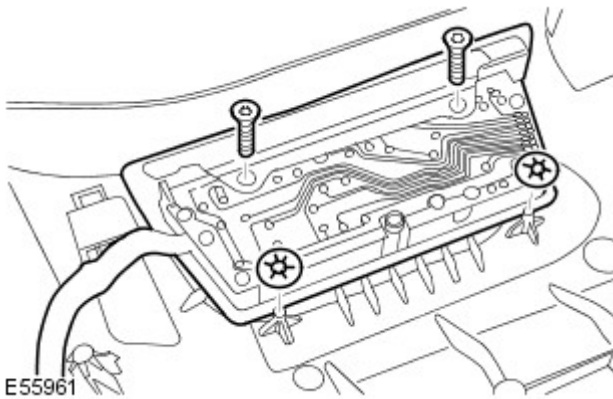
1. Remove the front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).

2. Remove the front seat cushion side trim.
 - Remove the 2 Torx screws.
 - Release from the 4 clips.



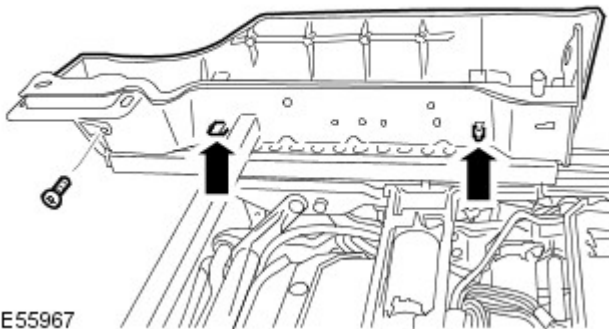
E56089

3. Release the seat control switch.
 - Remove the 2 screws.
 - Remove the 2 clips.



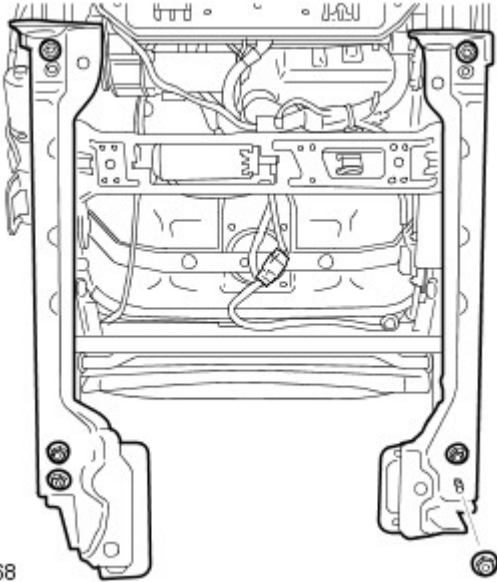
E55961

4. Remove the front seat base trim.
 - Remove the screw.
 - Release the 2 clips.

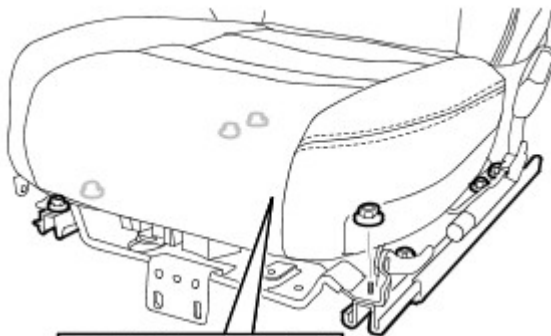


E55967

5. Remove the front seat base.
 - Remove the 6 nuts.



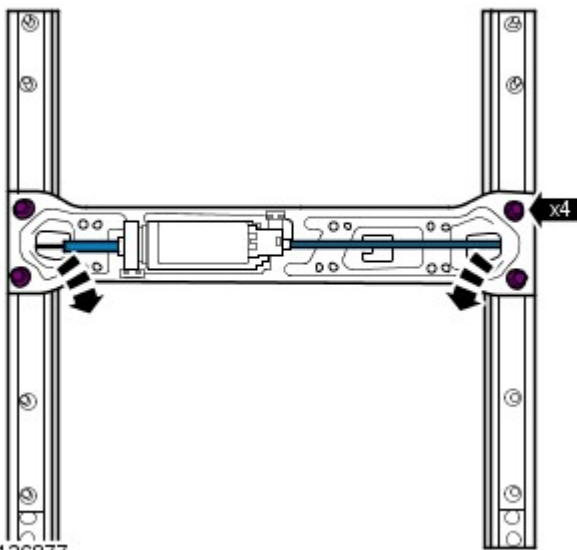
E55968



E55969



6. Remove the front seat track motor.
 - Disconnect the electrical connector.
 - Release the electrical connector.
 - Remove the 8 nuts.

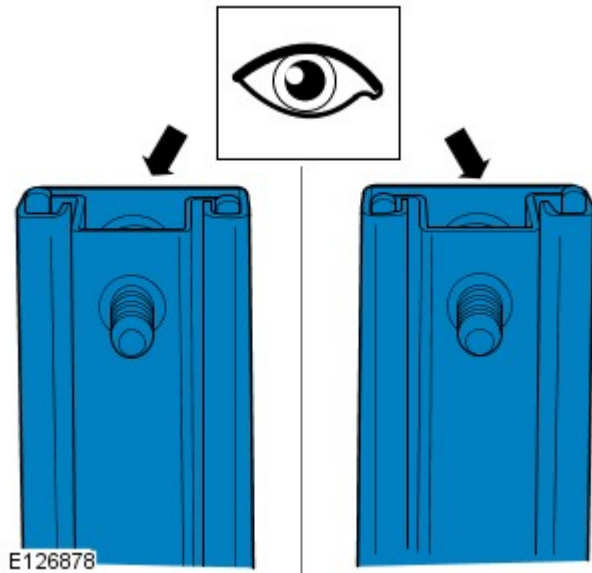


E126877

7. Remove the front seat track motor assembly from the seat rails.
 - Remove the 4 bolts.
 - Release the flexi drive from the seat rails.

Installation

1. Make sure the seat rails are installed as a matched pair as supplied.
 - Make sure the seat rails are correctly



aligned.

2. Install the front seat track motor assembly to the seat rails.
 - Install the 4 bolts.
 - Tighten the nuts to 10 Nm (7 lb.ft).
3. Install the front seat track motor.
 - Tighten the nuts to 22 Nm (16 lb.ft).
 - Connect the electrical connector.
 - Secure the electrical connector.
4. Install the front seat base.
 - Tighten the nuts to 22 Nm (16 lb.ft).
5. Install the front seat base trim.
 - Secure in the clips.
 - Tighten the screw.
6. Install the front seat cushion side trim.
 - Secure in the clips.
 - Tighten the screws.
7. Install the seat control switch.
 - Secure in the clips.
 - Tighten the screws.
8. Install the front seat.

For additional information, refer to: Front Seat (501-10, Removal and Installation).

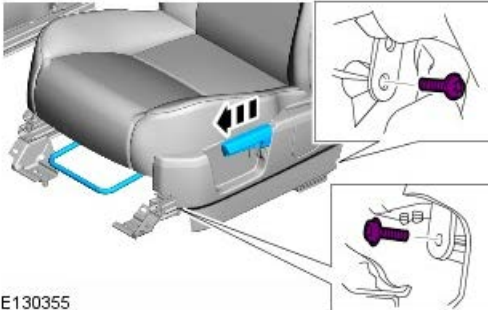
Seating - Front Seat Manual Height Adjustment Lever

Removal and Installation

Removal

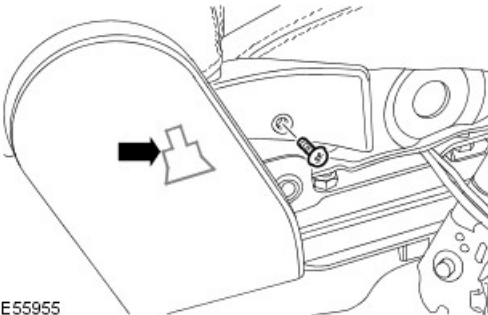
1. Remove the drivers side seat slides.
For additional information, refer to: Seat Track - Vehicles With: Power Seats (501-10, Removal and Installation).
2. Remove the front seat cushion base.
For additional information, refer to: Front Seat Cushion (501-10, Removal and Installation).

3.



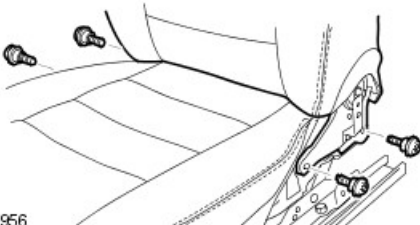
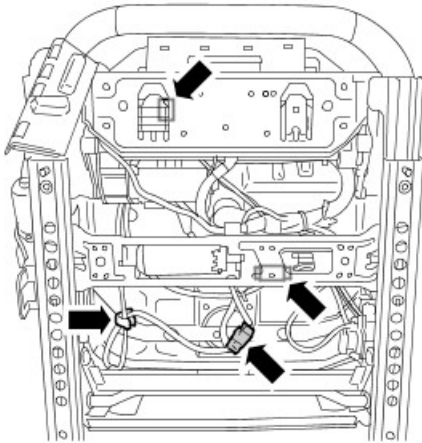
E130355

4.



E55955

5. TORQUE: 25 Nm

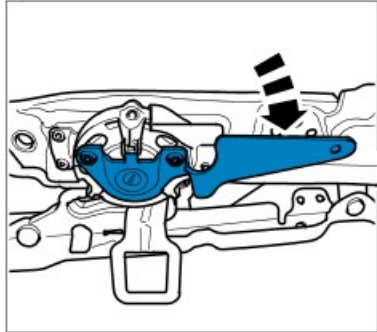


E55956

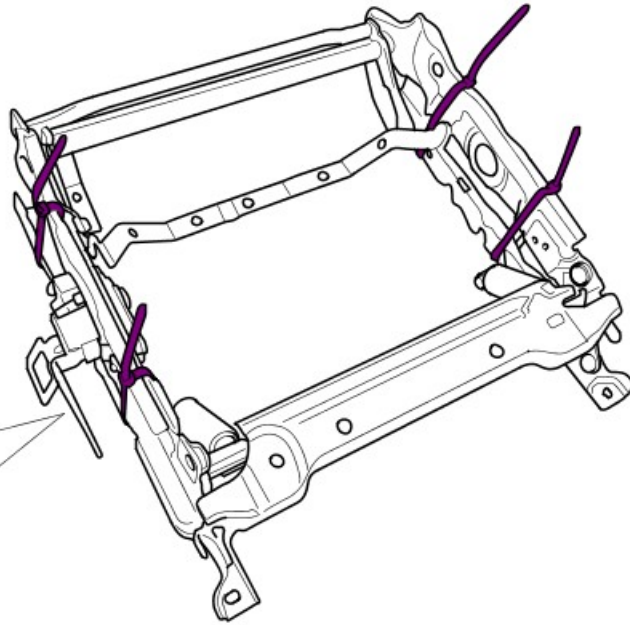
6. CAUTIONS:

 Tie straps must be fitted, failure to follow this instruction may result in personal injury.

 Failure to follow this



E130243

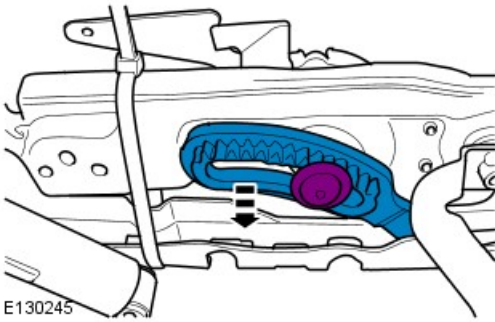


instruction may cause damage to the vehicle.

Secure the seat base using the 4 tie straps supplied, as shown.

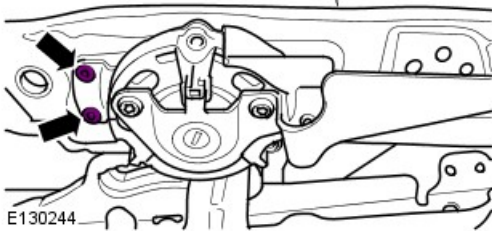
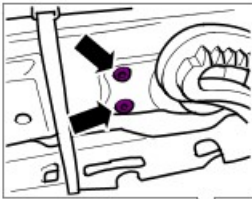
- Using the seat height adjuster, lower the seat base to its lowest position.

7. Release the arm from the height adjuster.
 - Remove the Torx bolt.



E130245

8. Drill out the 4 rivets.



E130244

Installation

1. To install, reverse the removal procedure.

Glass, Frames and Mechanisms -**Sealants**

Application	Land Rover Sealant kit Part No.
Windshield	CES 500020
Liftgate glass	CES 500020
Glass roof panel	CES 500020
Rear quarter window glass	CES 500020

Torque Specifications

Description	Nm	lb-ft
Rear door window fixed glass Torx screw	10	7
Rear door window motor and regulator to door nuts and bolts	10	7
Front door window regulator and motor nuts and bolts	10	7
Front door window glass guide channel bolt	10	7
Liftgate glass retaining nuts	25	18

Glass, Frames and Mechanisms - Glass, Frames and Mechanisms

Description and Operation



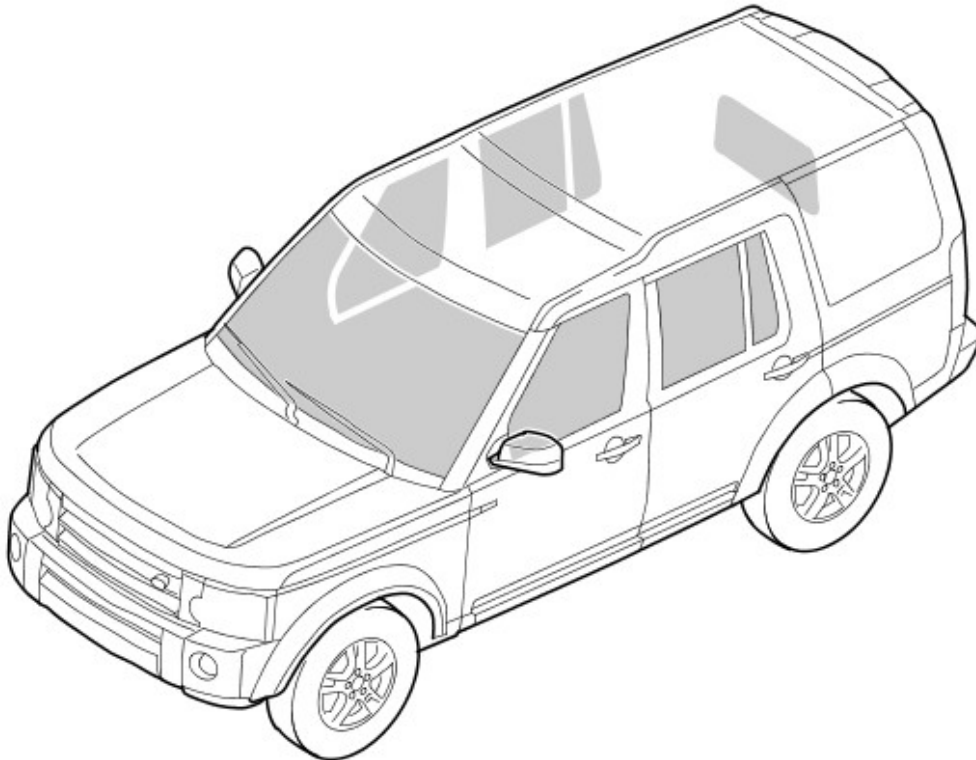
WARNING: The weight of the armoured components fitted to the vehicle are far in excess of those fitted to the standard vehicle, for an example, the windshield weighs approximately 100 Kg (220 lb). Repairs to all the armoured glass panes must be carried out by qualified personnel using appropriate lifting equipment.

The armoured glass varies with individual specification and has a minimum thickness of 21 mm (0.82 in). The glass is of multiple layer construction and offers ballistic protection to the vehicle's occupants.



CAUTION: The interior surface of the glass is susceptible to scratching; take care when cleaning the glass. Refer to Owner's Handbook for details.

Armoured windows



E102332

Windshield

The windshield fitted to armoured vehicles offers ballistic protection whilst retaining the optical quality of the standard windshield. The windshield is bonded to the window frame and features the same heating elements as the standard windshield.

Rear Window Glass

Rear armoured window of the armoured cell



E102480

The rear window fitted to the standard upper tailgate is a standard fit and offers no ballistic protection. Ballistic protection is provided by the rear window bonded into the rear hatch of the vehicle's armoured cell.

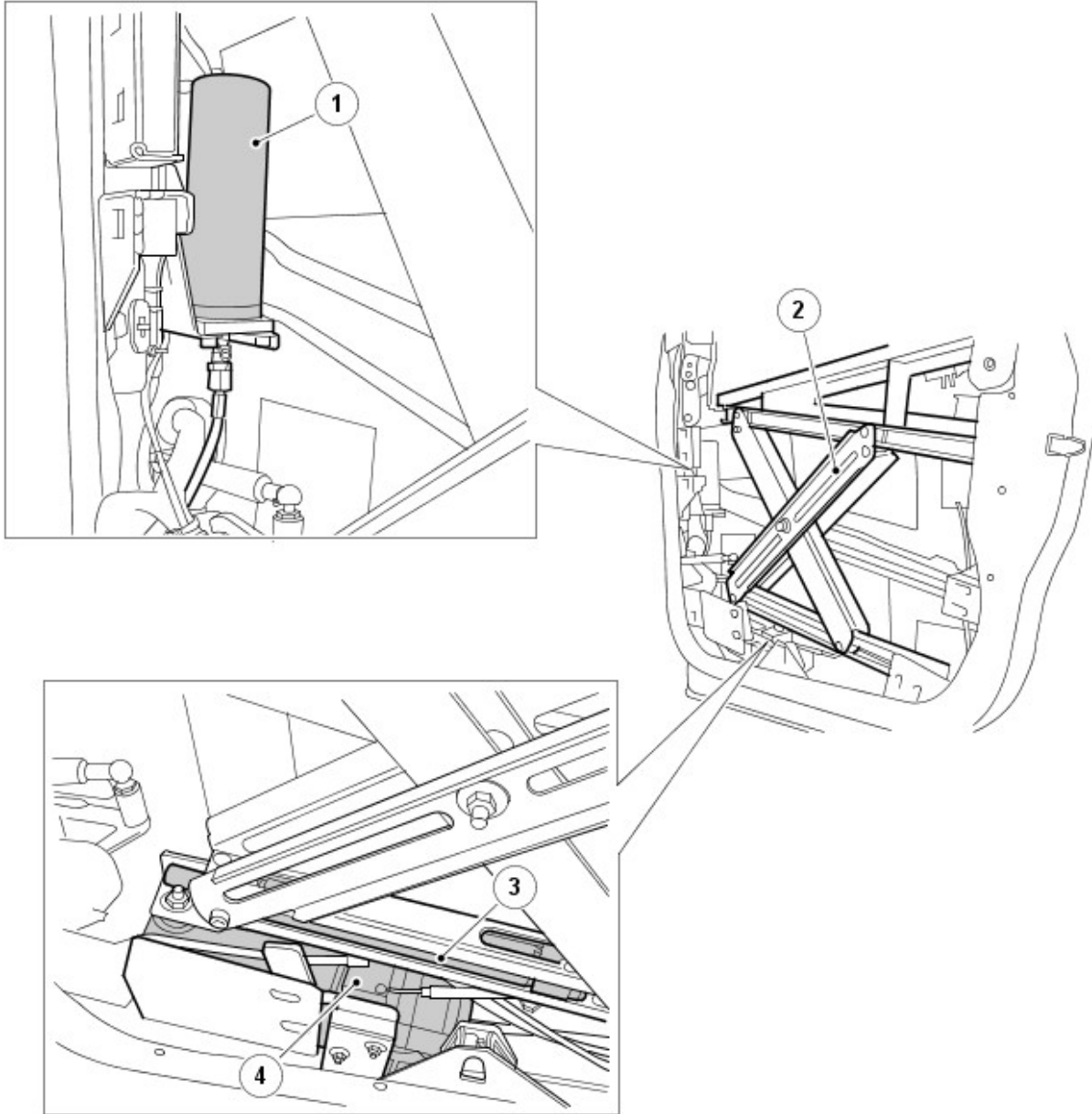
For additional information, refer to: Body Closures (501-03, Description and Operation).

The armoured window contains a heating element that functions in conjunction with the heating element incorporated in the tailgate's standard rear window.

Door Window Glass

Each door window glass offers ballistic protection to the vehicle's occupants. The door windows are permanently fixed in the closed position, with the exception of the driver's window which can be partially opened. A heavy-duty window regulator mechanism which is hydraulically operated has been installed to cope with the additional weight of the driver's window glass.

Driver's door window mechanism



E103000

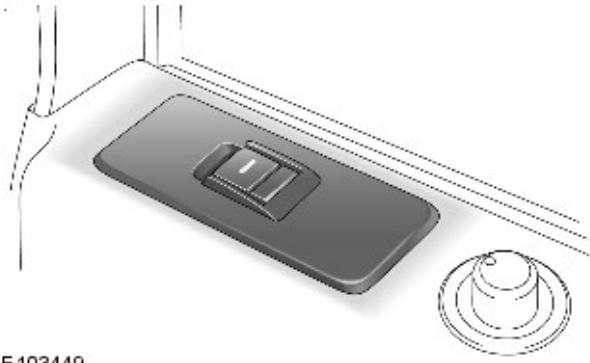
Item	Part Number	Description
1	-	Hydraulic fluid reservoir
2	-	Window regulator mechanism
3	-	Hydraulic ram
4	-	Hydraulic pump and motor

Operating the Drivers Window

⚠️ WARNING: One touch window operation and anti-trap are not available on this vehicle. Before closing the driver's window care must be taken to ensure no persons could become trapped.

The window can be operated when the ignition switch is in the 'ON' position, and for up to 40 seconds after the ignition switch is turned to position '0', providing a front door is not opened.

Driver's door window switch



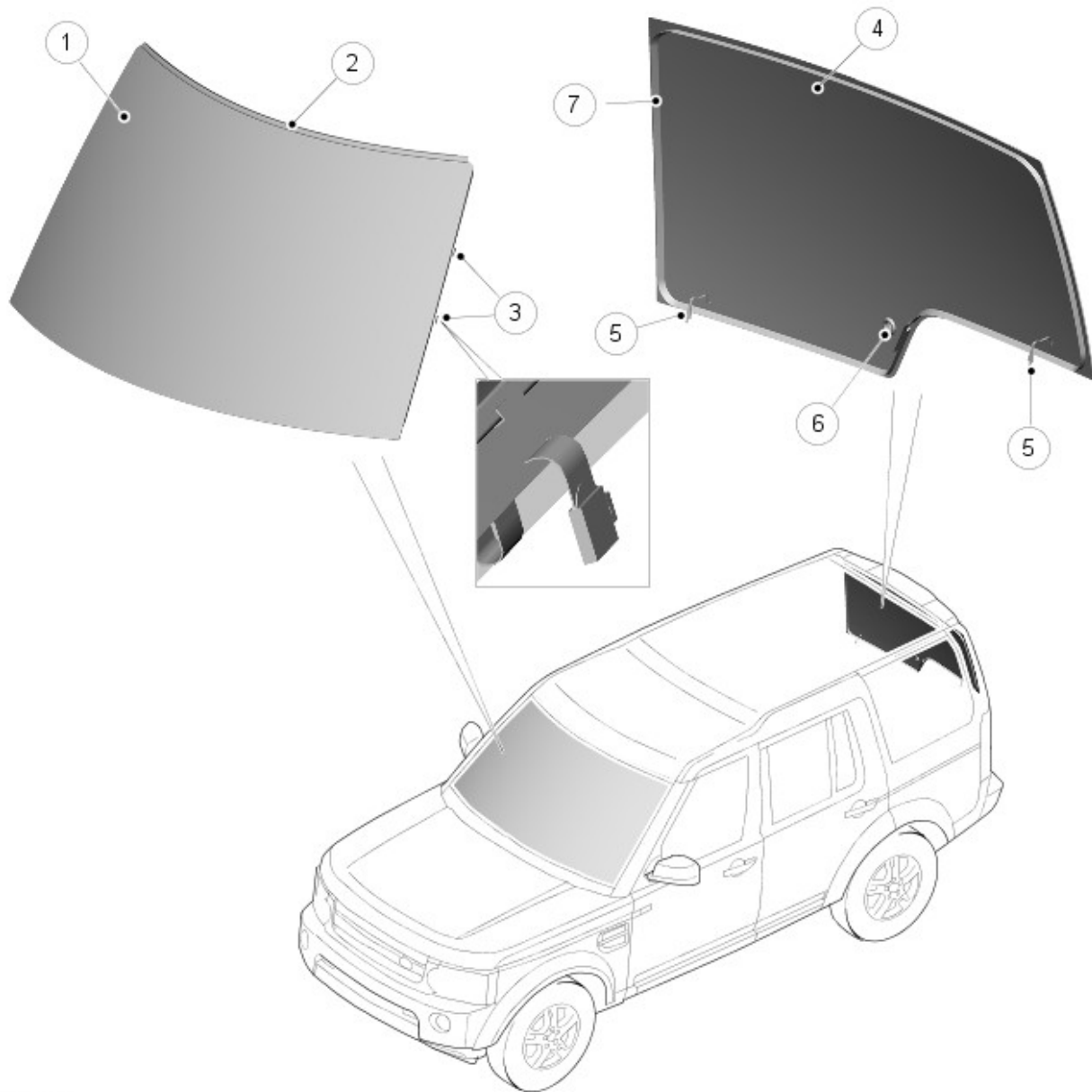
E 103449

Press and hold the front of the switch to lower the window. The window has restricted movement and will not fully lower. Lift and hold the front of the switch to close the window. The window will stop moving as soon as the switch is released.

Glass, Frames and Mechanisms - Glass, Frames and Mechanisms

Description and Operation

COMPONENT LOCATION - SHEET 1 OF 2



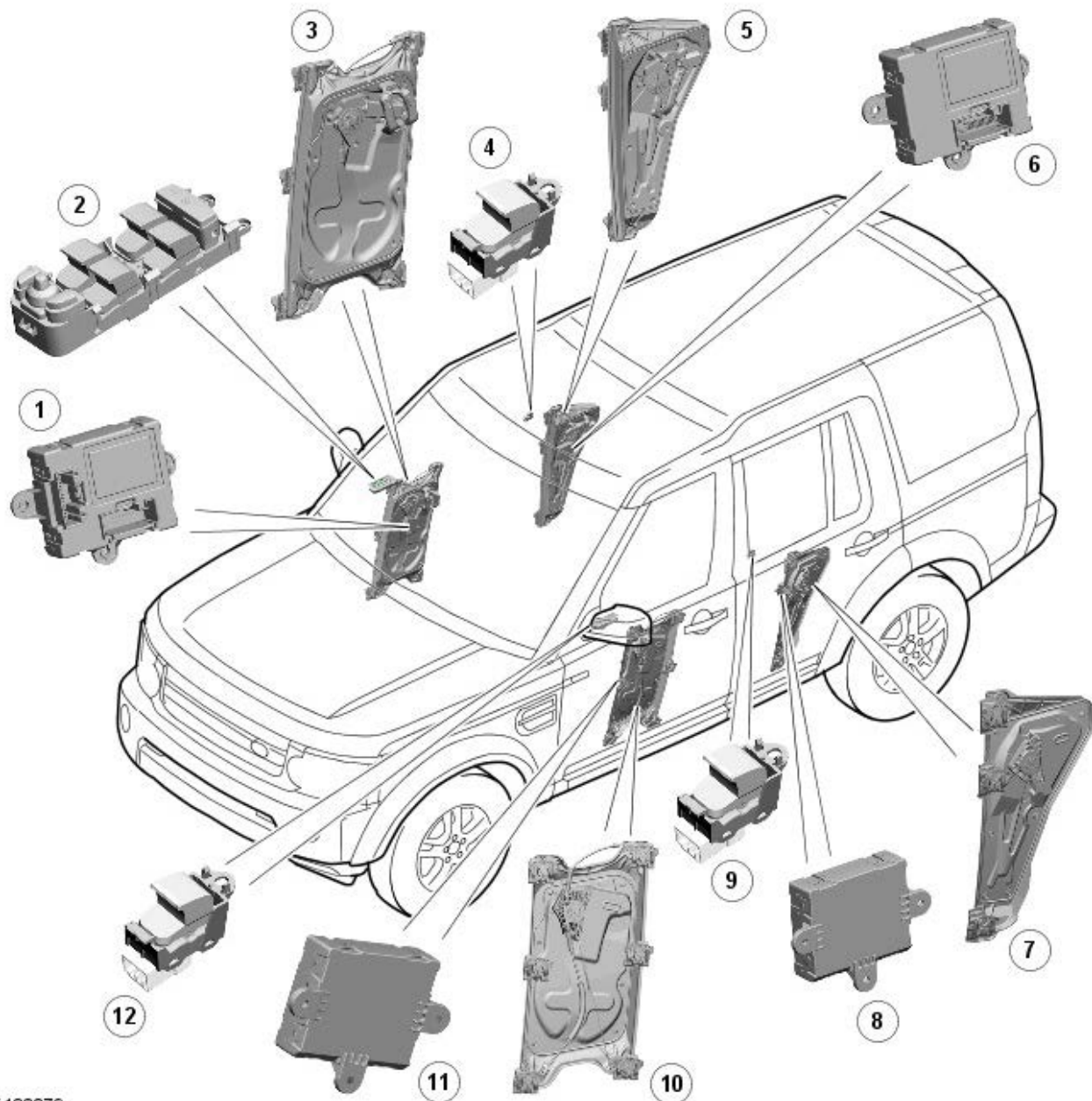
E142902

Item	Part Number	Description
1	-	Windshield
2	-	Finisher
3	-	Heated windshield connectors
4	-	Rear window
5	-	Heated rear window connectors
6	-	Rear wiper motor aperture
7	-	Sealant

COMPONENT LOCATION - SHEET 2 OF 2



NOTE: RHD (right-hand drive) shown, LHD (left-hand drive) similar.



E132379

Item	Part Number	Description
1	-	DDM (driver door module)
2	-	Driver window switches
3	-	Driver window regulator
4	-	RH (right-hand) rear window switch
5	-	RH rear window regulator
6	-	RHRDM (rear door module)
7	-	LH (left-hand) rear window regulator
8	-	LHRDM
9	-	LH rear window switch
10	-	Front passenger window regulator
11	-	PDM (passenger door module)
12	-	Front passenger window switch

GENERAL

Windshield

The laminated windshield is bonded and sealed to the body aperture using PU sealant. Heat bonded to the inner surface of the screen is the optical unit for the rain sensor and the interior mirror mounting boss.

Vertical fine-wire multi-strand elements are fitted between the glass laminations to de-ice and demist the screen. At the bottom of the screen six horizontal heating elements bonded to the interior glass surface prevent the wiper blades freezing to the screen during adverse weather conditions.

The screen is supplied with the heating element flat foil connectors fitted to a sealed terminal block. This terminal

block is wired to a connector for connecting to the vehicle harness.

Rear Window

The tempered glass tinted green rear window is bonded to the upper tail doorframe using PU sealant. Fitted to the inner surface of the rear window are the heating elements and antennas.

The heating element is connected by two Lucar terminals while the antenna is connected to the vehicle by a twin and single stud connector at the top of the screen.

Electric Windows

Electric windows are installed in all four doors. All of the electric windows incorporate one-shot up, one-shot down and anti-trap features.

In each door, the window is operated by a regulator, which is controlled by the related door module in response to inputs from window switches. The door modules also operate the windows in response to inputs from the [CJB \(central junction box\)](#) for global opening and closing.

WINDOW SWITCHES

Driver Window Switches



E 132380

Passenger Window Switch



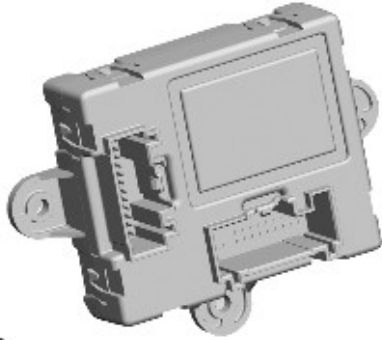
E 132381

Individual window switches are installed in each of the three passenger doors. Window switches for all of the windows and a rear window isolation switch are installed in the driver door switchpack in the top surface of the door trim.

All window switches are of the non-latching rocker type. The switches have two switching positions in each direction, inch up/down and one-shot up/down. Operating the switch to the second detent position will activate the one-shot feature.

The driver door switchpack is powered by a permanent battery feed from the [CJB](#). When the switches in the driver door switchpack are used, the switchpack translates the switch movement into a [LIN \(local interconnect network\)](#) bus message. A [LIN](#) bus connects the driver door switchpack to the driver door module and the driver side [RDM](#). Each passenger window switch is hardwired into circuits with the related door module.

DOOR MODULES



E 132128

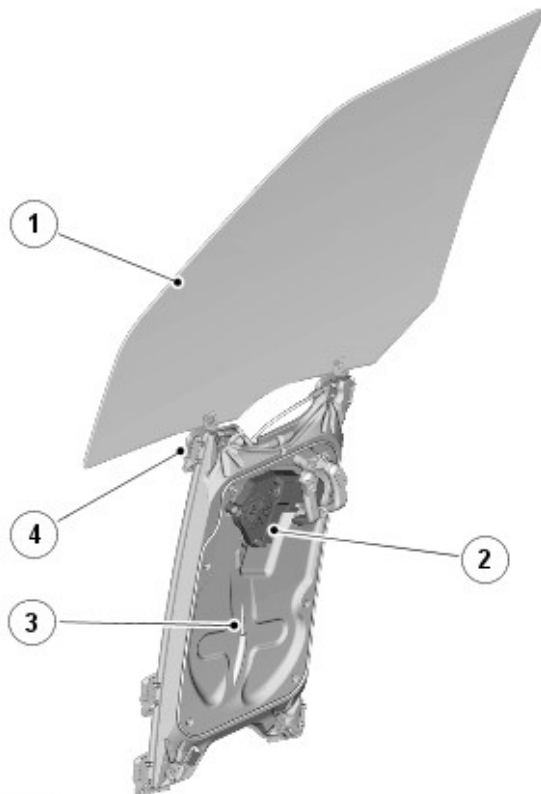
Each door module is attached to the inside of the related door casing and connected to the door harness.

The door modules interpret the window operation requests into appropriate outputs for the motor in the related window regulators. Each door module is powered by a permanent battery feed from the [CJB](#).

A [LIN](#) bus connects the two door modules on the driver side of the vehicle to the driver door switchpack. The two door modules on the front passenger side of the vehicle are connected together by a second [LIN](#) bus. The [DDM](#) and the [PDM](#) are also connected to the medium speed [CAN \(controller area network\)](#) bus.

WINDOW REGULATORS

Front Window Regulators



E133133

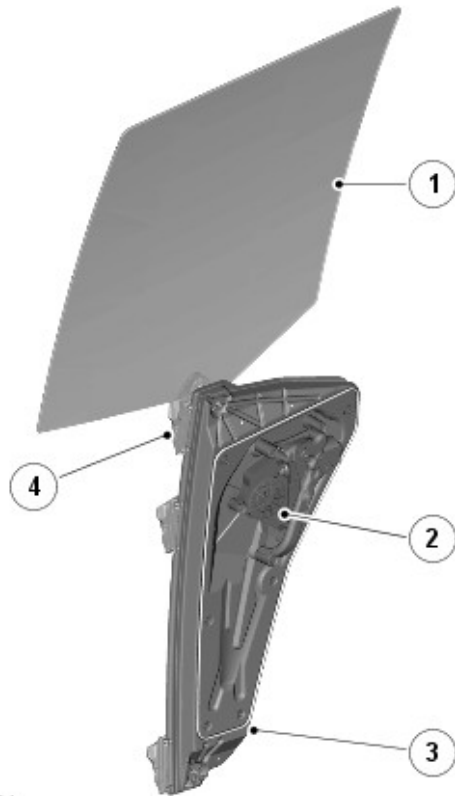
Item	Part Number	Description
1	-	Window Glass
2	-	Window motor
3	-	Mounting frame
4	-	Glass carrier

The front window regulator and motor is supplied as an assembly and is handed. Each assembly comprises a front and rear runner, a continuous cable and a motor.

The runners are secured in the door frame with four screws. The door glass is located in two carriers, which are located in tracks in the runners. The glass is retained in friction pads in each carrier and secured with clamp screws.

Each carrier is attached to the cable which, in turn, is attached to a drum driven by the motor. When the motor is operated the drum pulls the cable in the required direction to raise or lower the glass.

Rear Window Regulators



E133134

Item	Part Number	Description
1	-	Window Glass
2	-	Window motor
3	-	Mounting frame
4	-	Glass carrier

The rear window regulator and motor is supplied as an assembly and is handed. Each assembly comprises a runner, a continuous cable and a motor.

The runner is secured in the door frame with four bolts. The door glass is located in a carrier located in a track in the runner. The glass is retained in friction pads in the carrier and secured with a clamp screw.

The carrier is attached to the cable which, in turn, is attached to a drum driven by the motor. When the motor is operated, the drum pulls the cable in the required direction to raise or lower the glass.

OPERATION

The electric windows will operate in power modes 6 (ignition on) and 7 (engine running), and for five minutes after the ignition is switched off provided none of the doors are opened.

When a window open or closed selection is made, the related door module supplies power to the window motor to drive it in the appropriate direction. In the inch mode, the motor stops when the switch is released or the window reaches the end of its travel. In the one-shot mode, the motor stops when if the switch is operated again (either up or down) or the window reaches the end of its travel.

When the passenger window switches are used, they produce an open or close request by completing a circuit with the related door module.

When the driver window switches are used, the driver door switchpack outputs a request message for the appropriate door module on the LIN bus. If the message is for a door module on the opposite side of the vehicle to the driver, the DDM relays the message to the PDM on the medium speed CAN bus. If necessary, the PDM then sends a LIN bus message to the RDM on its side of the vehicle.

If any of the passenger windows have opposing up and down requests from two separate switches, for example, a passenger window switch and the related window switch on the driver door switchpack, then the operation of that window will cease, until one or both of the switches are released.

While the isolator switch engaged, the switch tell-tale is illuminated and the rear door modules ignore requests from their related passenger window switches.

Global opening and closing requests are output from the CJB on the medium speed CAN bus. The DDM and the PDM then relay the request to their respective RDM.

One-shot Window Operation Reset

If the battery is disconnected or discharged, or the power supply to a door module is interrupted, one-shot window operation is disabled until the window position is re-established by the affected door module(s). To reset one-shot window operation:

1. Close the window fully.
2. Release the switch, then pull up and hold the switch for one second.
3. If necessary, repeat the procedure for the other windows.

Anti-trap Protection

The anti-trap feature is incorporated for all of the door windows in both the inching and one-shot modes. If the anti-trap function is activated while a window is closing, the window motor reverses for 0.5 second.

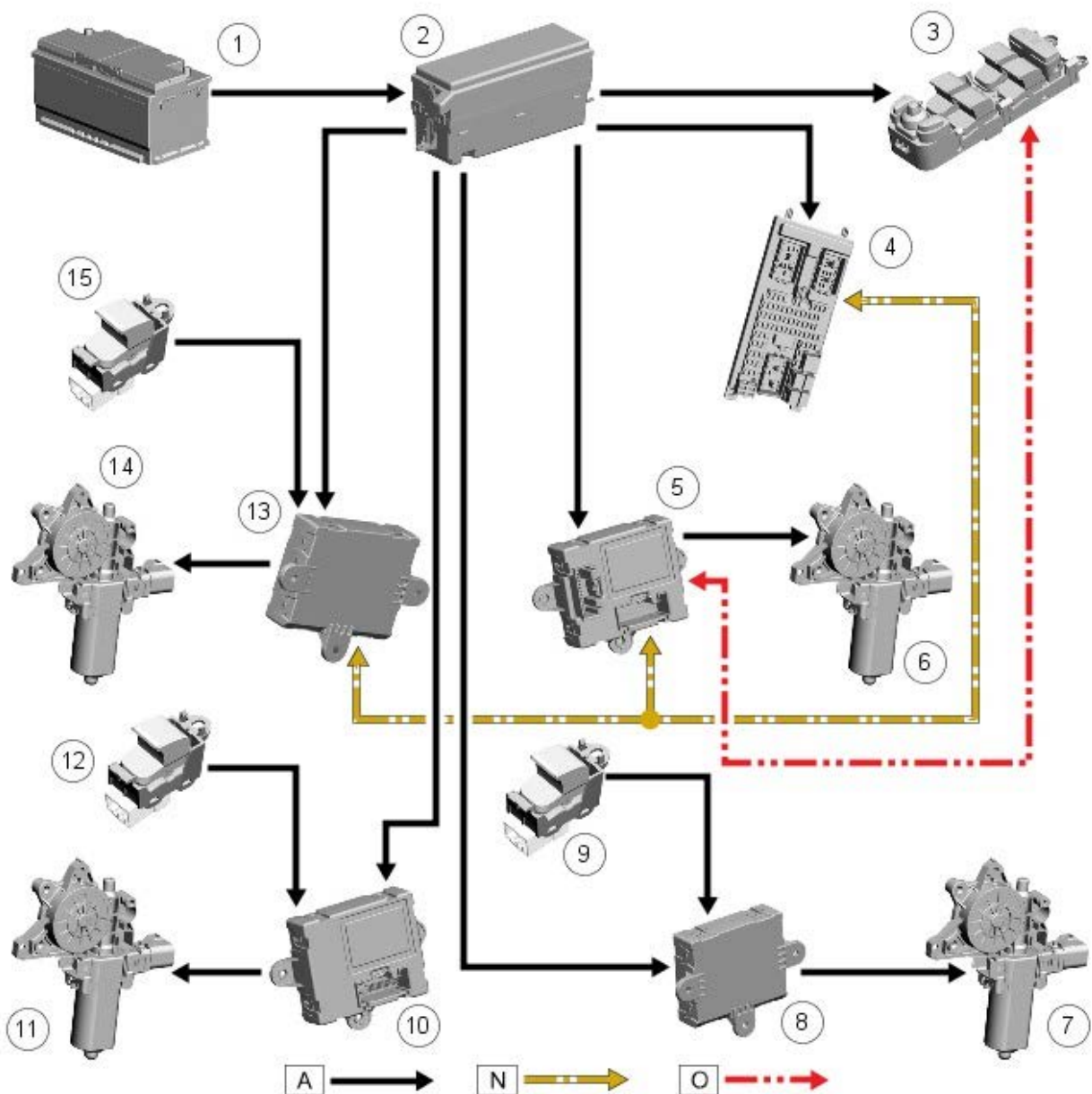
Each window motor has a Hall sensor to enable the related door module to monitor the motor speed. If the motor speed decreases below a set threshold, indicating an obstruction, the power feed to the motor is reversed so the window goes back down.

If it is still necessary to raise the window, the anti-trap protection can be overridden by attempting to close the window at intervals of less than 10 seconds. On the third attempt the window will move up with increased force to try and overcome the obstruction. If the obstruction cannot be overcome, one-shot operation is disabled.

WINDOW CONTROL DIAGRAM



NOTE: **A** = Hardwired, **N** = Medium speed CAN bus; **O** = LIN bus.



E142901

Item	Part Number	Description
1	-	Battery
2	-	EJB (engine junction box)
3	-	Driver window switches
4	-	CJB
5	-	DDM

- 6 - Driver window motor
- 7 - Driver side rear window motor
- 8 - Driver side RDM
- 9 - Driver side rear window switch
- 10 - Passenger side RDM
- 11 - Passenger side rear window motor
- 12 - Passenger side rear window switch
- 13 - PDM
- 14 - Passenger window motor
- 15 - Passenger window switch

Glass, Frames and Mechanisms - Glass, Frames and Mechanisms

Diagnosis and Testing

Principle of Operation

For a detailed description of the glass, frames and mechanisms and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: (501-11)

Glass, Frames and Mechanisms (Description and Operation),
Glass, Frames and Mechanisms (Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.



Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Window control switches condition and installation • Window motors/regulators • Window channels/runners • Window cables • Door window glass retaining brackets 	<ul style="list-style-type: none"> • Fuses • Harnesses and connectors • Window lift relay • Window control switches • Window motors

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Window(s) inoperative	<ul style="list-style-type: none"> • Fuse(s) • Switch fault • Front switch isolator fault • Motor/regulator fault • Channel/runner fault • Cable fault • Window circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Check the fuses • Check the suspect window operation from the individual door switch and from the driver door master switch (it is unlikely that both switches would fail at the same time, so if the window is inoperative from either switch, suspect a fault other than a switch) • If the inoperative window is a rear unit, check the function of the isolator at the master switch. • If the concern persists and a noise cannot be heard when operating the door window glass, GO to Pinpoint Test B. • Refer to the electrical circuit diagrams and test the window circuit for short circuit to ground, short circuit to power, open circuit, high resistance
Window(s) 'one-shot' function inoperative	<ul style="list-style-type: none"> • Window motor initialization required 	<p>NOTE: Do not install a new door window regulator motor for this concern.</p> <ul style="list-style-type: none"> • If the battery has been disconnected, carry out the initialization procedure
Heated rear window does not defrost	<ul style="list-style-type: none"> • Heated rear window circuit short circuit to ground, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams and test the heated rear window circuit for short circuit to ground, open circuit, high resistance
Window(s) noisy during operation	<ul style="list-style-type: none"> • Channel/runner fault • Cable fault • Motor/regulator 	<p>NOTE: Door window glass retaining bracket adjustment procedure</p> <ul style="list-style-type: none"> • GO to Pinpoint Test A.

	fault	
Slow or partial window operation	<ul style="list-style-type: none"> • Fuse • Switch fault • Relay fault • Element fault • Circuit fault 	<ul style="list-style-type: none"> • GO to Pinpoint Test C.
Rear door window glass bounce back	<ul style="list-style-type: none"> • Window motor initialization required (using the manufacturers approve diagnostic system) 	 NOTE: Do not install a new door window regulator motor for this concern. <ul style="list-style-type: none"> • Using the manufacturer approved diagnostic system, perform the window initialization routine
Front door window glass bounce back	<ul style="list-style-type: none"> • Window motor initialization required • Channel/runner fault 	 NOTE: Do not install a new door window regulator motor for this concern. <ul style="list-style-type: none"> • GO to Pinpoint Test D.

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Driver/Passenger Door Control Module (DDM/PDM) (100-00 General Information, Description and Operation).

Pinpoint Test

PINPOINT TEST A : WINDOW(S) NOISY DURING OPERATION	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE DOOR WINDOW GLASS IS SECURE	
	1 Remove the door window glass outer waist seal.
	2 Check if the door glass installed correctly and secured to the door window regulator.
	Is the door window glass correctly installed and secure? Yes GO to A2. No Install a new door window glass as necessary. REFER to: Front Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation) / Rear Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
A2: CHECK THE OPERATION OF THE DOOR WINDOW REGULATOR MOTOR	
	1 Remove the door window glass as necessary. REFER to: Front Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation) / Rear Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
	2 Operate the door window regulator four times.
	Does the door window regulator operate correctly (without noise)? Yes Ensure that an anti-rattle pad (available from the parts department) is installed to the door window glass retaining bracket and installed correctly. REFER to: Front Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation). Test the system for normal operation. If the concern persists, GO to A3 . No Install a new door window regulator motor as necessary. REFER to: Front Door Window Regulator and Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation) / Rear Door Window Regulator and Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).
A3: CHECK THAT THE DOOR WINDOW GLASS SEAL IS FREE FROM FOREIGN MATERIAL	
	1 Check for any foreign material or obstruction in the door window glass seal.
	Is the door window glass seal free from foreign material? Yes GO to A4. No Remove any foreign material from door window glass seal and lubricate the seal. Test the system for normal operation.
A4: CHECK THAT THE DOOR WINDOW GLASS SEAL IS INSTALLED CORRECTLY	
	1 Check that the door window glass seal is installed correctly.
	Is the door window glass seal installed correctly? Yes GO to A5.

	No Install the door window glass seal correctly. Test the system for normal operation.
A5: CHECK THAT THE DOOR WINDOW GLASS SEAL IS NOT WORN IN THE CHANNELS	
	1 Visually check that the door window glass seal is not worn in the door channels.
	Is the door window glass seal worn in the channels? Yes Install a new door window glass seal as necessary. Test the system for normal operation. No Install the door window glass and adjust the door window glass. Test the system for normal operation.

PINPOINT TEST B : WINDOW(S) INOPERATIVE (MOTOR NOISE CANNOT BE HEARD)

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

B1: CHECK FOR DOOR WINDOW REGULATOR MOTOR NOISE

	1 Operate the door window regulator motor as necessary.
	Is there a noise from the door window regulator motor when operated? Yes GO to B2. No Install a new door window regulator motor as necessary. REFER to: Front Door Window Regulator and Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation) / Rear Door Window Regulator and Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).

B2: CHECK THAT THE DOOR WINDOW GLASS SEAL IS FREE FROM FOREIGN MATERIAL

	1 Check for any foreign material or obstruction in the door window glass seal.
	Is the door window glass seal free from foreign material? Yes GO to B3. No Remove any foreign material from door window glass seal and lubricate the seal. Test the system for normal operation.

B3: CHECK THAT THE DOOR WINDOW GLASS SEAL IS INSTALLED CORRECTLY

	1 Check that the door window glass seal is installed correctly.
	Is the door window glass seal installed correctly? Yes GO to B4. No Install the door window glass seal correctly. Test the system for normal operation.

B4: CHECK THAT THE DOOR WINDOW GLASS SEAL IS NOT WORN IN THE CHANNELS

	1 Visually check that the door window glass seal is not worn in the door channels.
	Is the door window glass seal worn in the channels? Yes Install a new door window glass seal as necessary. Test the system for normal operation. No Install the door window glass. Adjust the door window glass referring to the door window glass retaining bracket procedure at the end of this section (see below). Test the system for normal operation. If the concern persists, Test the system for normal operation.

PINPOINT TEST C : SLOW OR PARTIAL WINDOW OPERATION

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

C1: CHECK THE OPERATION OF THE DOOR WINDOW REGULATOR MOTOR


	1 Remove the door window glass as necessary. REFER to: Front Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation) / Rear Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
	2 Operate the door window regulator as necessary.
	Does the door window regulator operate correctly? Yes GO to C2. No GO to C5.

C2: CHECK THAT THE DOOR WINDOW GLASS SEAL IS FREE FROM FOREIGN MATERIAL

	1 Check for any foreign material or obstruction in the door window glass seal.
	Is the door window glass seal free from foreign material? Yes GO to C3. No Remove any foreign material from door window glass seal and lubricate the seal. Test the system for normal operation.

C3: CHECK THAT THE DOOR WINDOW GLASS SEAL IS INSTALLED CORRECTLY

	1 Check that the door window glass seal is installed correctly.
--	--

	Is the door window glass seal installed correctly? Yes GO to C4. No Install the door window glass seal correctly. Test the system for normal operation.
C4: CHECK THAT THE DOOR WINDOW GLASS SEAL IS NOT WORN IN THE CHANNELS	
	1 Visually check that the door window glass seal is not worn in the door channels.
	Is the door window glass seal worn in the channels? Yes Install a new door window glass seal as necessary. Test the system for normal operation. No Adjust the door window glass referring to the door window glass retaining bracket procedure at the end of this section (see below). Test the system for normal operation.
C5: CHECK THE VOLTAGE TO THE DOOR WINDOW REGULATOR MOTOR	
 NOTE: The door window regulator motor can be removed from the regulator. Install a new door window regulator motor not the complete assembly for this concern.	
	1 Using a multimeter, check the voltage to the door window regulator motor.
	Is the voltage greater than 10 volts? Yes Install a new door window regulator motor as necessary. No Repair the wiring harness. Test the system for normal operation. If the concern continues, install a new door window regulator motor as necessary.

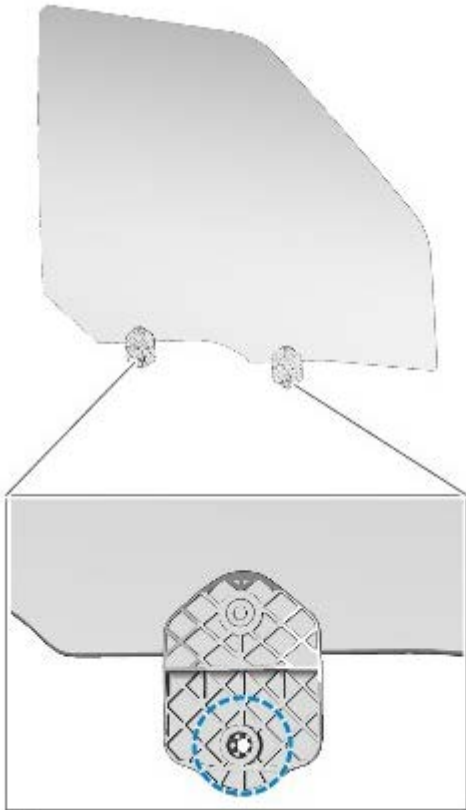
PINPOINT TEST D : FRONT DOOR WINDOW GLASS BOUNCE BACK	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: CHECK WINDOW MOTOR INITIALIZATION	
	1 Initialize the door window motor. REFER to: Door Window Motor Initialization (501-11 Glass, Frames and Mechanisms, General Procedures).
	Did the initialization work? Yes Test the system for normal operation. No GO to D2.
D2: CHECK THAT THE DOOR WINDOW GLASS SEAL IS FREE FROM FOREIGN MATERIAL	
	1 Check for any foreign material or obstruction in the door window glass seal.
	Is the door window glass seal free from foreign material? Yes GO to D3. No Remove any foreign material from door window glass seal and lubricate the seal. Test the system for normal operation.
D3: CHECK THAT THE DOOR WINDOW GLASS SEAL IS INSTALLED CORRECTLY	
	1 Check that the door window glass seal is installed correctly.
	Is the door window glass seal installed correctly? Yes GO to D4. No Install the door window glass seal correctly. Test the system for normal operation.
D4: CHECK THAT THE DOOR WINDOW GLASS SEAL IS NOT WORN IN THE CHANNELS	
	1 Visually check that the door window glass seal is not worn in the door channels.
	Is the door window glass seal worn in the channels? Yes Install a new door window glass seal as necessary. Test the system for normal operation. No GO to D5.
D5: CHECK THE DOOR WINDOW GLASS IS SECURE	
	1 Remove the door window glass outer waist seal.
	2 Check if the door glass installed correctly and secured to the door window regulator.
	Is the door window glass correctly installed and secure? Yes Test the system for normal operation. No Adjust the door window glass referring to the door window glass retaining bracket procedure in this procedure. Test the system for normal operation. If the concern persists, install a new door window regulator motor as necessary. REFER to: Front Door Window Regulator and Motor (501-11 Glass, Frames and Mechanisms, Removal and Installation).

Door window glass retaining bracket adjustment procedure

1. Remove the door window glass as necessary.

REFER to: Front Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation) / Rear Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).

2. Check for any foreign material or obstruction in the door window glass seal and channels. Clean all areas prior to adjustment to allow correct alignment.
3. Release but do not remove the door window glass retaining bracket(s) bolt(s).
4. Push the door window glass retaining bracket(s) to the edge of the door window glass to achieve minimum parallel gap.
5. Tighten the door window glass retaining bracket(s) bolt(s).
 - Tighten the retaining bolt(s) to 6Nm.

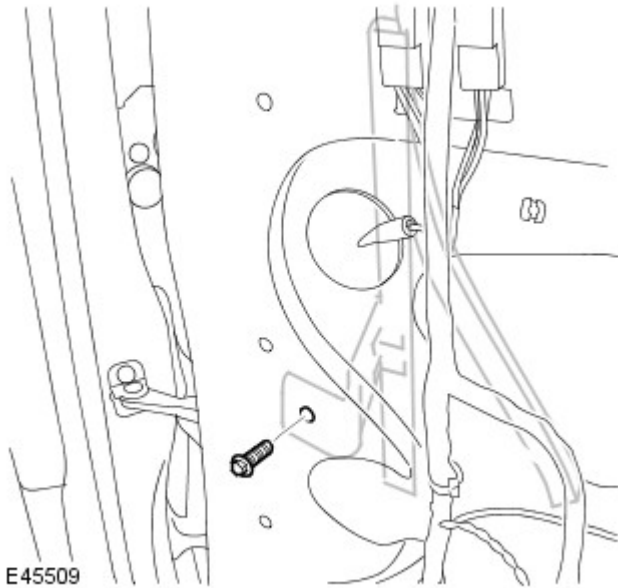



E136430

6. Apply lubricate (RYL500010) to the lower part of the door window glass retaining brackets prior to installation of the door window glass.
7. Install the door window glass as necessary.
REFER to: Front Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation) / Rear Door Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
8. Check the system for normal operation.

Door glass channel setting procedure

1. Remove the door trim panel as necessary.
REFER to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation) / Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).



2.  **NOTE:** Do not remove the door window glass channel.
Release the door window glass channel retaining bolt.
3. Lower the door window glass.
4. Tighten the door window glass channel retaining bolt.
5. Check the system for normal operation.

Glass, Frames and Mechanisms - Fixed Window Glass

Diagnosis and Testing

Principles of Operation

For a detailed description of the Glass, Frames and Mechanisms and operation, refer to the relevant Description and Operation section of the workshop manual.

Inspection and Verification

NOTES:



Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.



Refer to Section 100-00 General Information for window glass health and safety precautions.

1. Verify the customer concern.
2. Visually inspect for obvious mechanical faults.

Visual Inspection

Mechanical
Physical damage to the windshield

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart.

Warranty Repairs

NOTES:



The warranty period for the windshield is twelve months with the exception of delamination and electrical faults.



Warranty repairs should be completed using genuine parts, in accordance with the Warranty Policy and Procedures Manual.

1. Draw a line around the windshield damage using a marker pen.
2. Photograph the entire windshield. If the damage extends behind any trim, remove the trim and take further photographs.
3. Photograph the trademark logo and code to validate the windshield as factory fitment.


Symptom Chart


Symptom	Possible Cause	Action
Scratches	<ul style="list-style-type: none"> • Debris trapped under a wiper blade • Foreign object damage • Fouling by trim 	GO to Pinpoint Test A.
Chips	<ul style="list-style-type: none"> • Foreign object damage 	GO to Pinpoint Test B.
Cracks	<ul style="list-style-type: none"> • Foreign object damage • Impact damage during assembly 	GO to Pinpoint Test C.
Delamination	<ul style="list-style-type: none"> • Manufacturing defect 	GO to Pinpoint Test D.


PINPOINT TEST A : SCRATCH TEST


TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: IDENTIFY SCRATCH	
<p>NOTE: A scratch will usually be regular in shape, following the line of the object that caused it.</p>	
	<p>1 Probe using the tip of a pencil to identify a groove in the windshield surface.</p> <p>Is there a groove?</p> <p>Yes Windshield scratched. GO to A2.</p> <p>No Defect not valid.</p>

A2: CAUSE OF SCRATCH	
	1 Check for trim, body panels, or foreign objects that may have caused the scratch.
	Was the scratch caused by a foreign object? Yes The damage is not due to a defect or an assembly error. No Rectify as appropriate.

PINPOINT TEST B : CHIP TEST	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: CHIP TEST	
	 NOTE: Impact damage may cause a crack to form.
	1 Assess the damage by probing with the tip of a pencil.
	Is the damaged area rough (indicating a breach of the windshield surface)? Yes Damage caused by the impact of a foreign object. Not a manufacturing defect. No Install a new windshield.

PINPOINT TEST C : CRACK TEST	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: IDENTIFY CRACK	
	 NOTE: A crack will be detectable as a step in the glass.
	1 Confirm the presence of a crack by probing with the tip of a pencil.
	Is the windshield cracked? Yes Windshield cracked. GO to C2. No Windshield not cracked. GO to Pinpoint Test A.

C2: CAUSE OF CRACK	
	 NOTE: Multiple cracks will radiate out from the source.
	1 Assess the source of the crack by probing with the tip of a pencil.
	Is there evidence of impact damage being the source of the crack? Yes GO to Pinpoint Test B. No Install a new windshield.

PINPOINT TEST D : DELAMINATION TEST	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: DELAMINATION TEST	
	1 Visually assess the windshield for delamination.
	Have the glass laminates separated? Yes Install a new windshield. No No further action.

DTC Index

For a complete list of all Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

Glass, Frames and Mechanisms - Door Window Motor Initialization

General Procedures

1. NOTES:



After the battery has been disconnected it is necessary to initialize each door window motor separately to operate the "one-touch" up function.



Make sure a minimum of 2 minutes from initial disconnect of battery has elapsed prior to reconnecting the battery. The initialising of the window glass motor must be conducted with the engine running.

Operate the window control switch until the door window glass is in the fully closed position, continue to operate the window control switch for a further two seconds.

2. Release the window control switch.

3. Operate the window control switch in the closed position and continue to operate the window control switch for a further two seconds.

4. Operate the window control switch until the door window glass is in the fully open position ("one-touch" down).

5. NOTES:



If the door window motor initialization has been completed correctly, when the window control switch is operated, the door window glass should move to the fully closed position ("one-touch" up) automatically.



If the door window glass does not fully close automatically ("one-touch" up), repeat the complete procedure.


Operate the window control switch once to the close position.

6. Repeat the door window motor initialization for each door window motor.

Glass, Frames and Mechanisms - Front Door Window Glass

Removal and Installation

Special Tool(s)

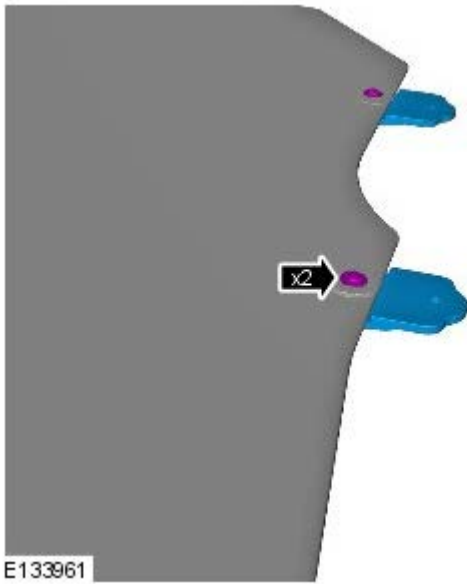
 <p>501-114</p> <p>E54200</p>	<p>501-114 Release Lever, Door Glass</p>
--	--

Removal

1. *Special Tool(s):* [501-114](#)

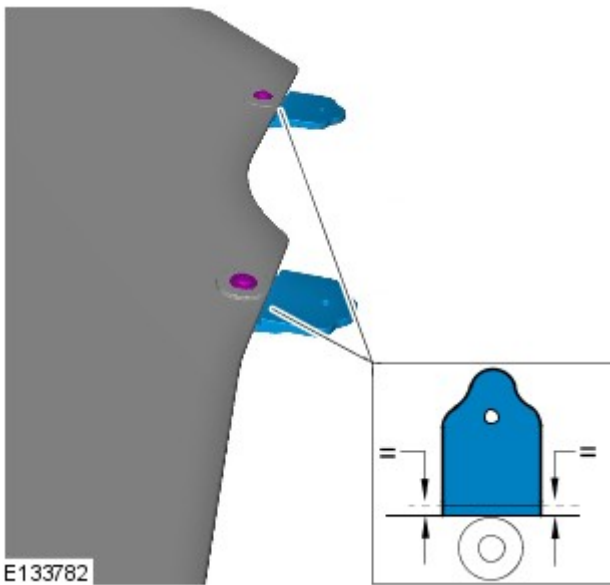


- 2.





E133961

Installation




E133782


- 
CAUTION: Make sure that the door glass retaining brackets are pushed to the edge of the door window glass to achieve minimum parallel gap.



NOTE: This operation must be done for both retaining brackets.

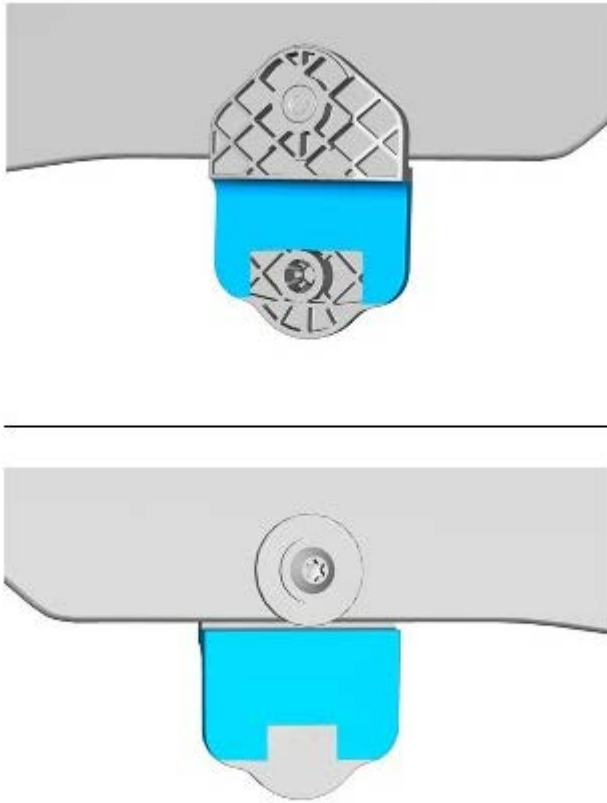
Torque: 6 Nm

- CAUTIONS:**


 Make sure that any grease or lubricant is removed from the retaining brackets prior to installation of the anti-rattle pads.


 Make sure that the anti-rattle pad is installed in the orientation illustrated.


NOTE: This operation must be done for both retaining brackets.



E140674

3. To install, reverse the removal procedure.

Glass, Frames and Mechanisms - Rear Door Window Glass

Removal and Installation

Removal

NOTES:

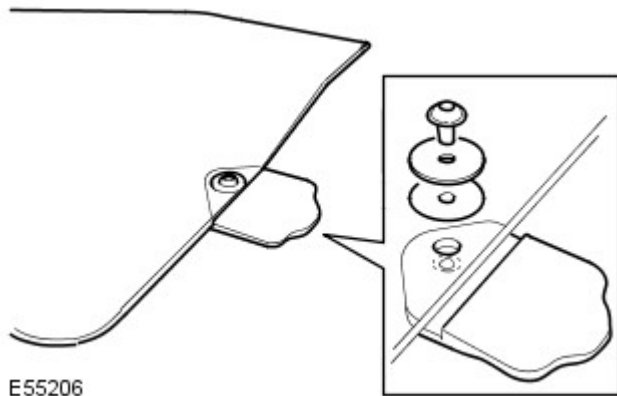


Once the rear door window fixed glass has been removed the rear door glass can be simply lifted and removed from the door.



The door glass should be lowered by approximately one third.

1. Remove the rear door window fixed glass.
For additional information, refer to: Rear Door Fixed Window Glass (501-11, Removal and Installation).
2. Remove the rear door window glass.



3. NOTES:



Do not disassemble further if the component is removed for access only.



Note the fitted position.

Remove the glass retaining clip.

- Remove the Torx bolt.
- Remove the spacer washer.
- Remove the flat washer.

Installation

1. Install the glass retaining clip.
 - Install the spacer.
 - Install the washer.
 - Tighten the Torx screws to 8 Nm (6 lb.ft).
2. Install the rear door window glass.
3. Install the rear door window fixed glass.
For additional information, refer to: Rear Door Fixed Window Glass (501-11, Removal and Installation).

Glass, Frames and Mechanisms - Liftgate Window Glass

Removal and Installation

Removal

CAUTIONS:



Always protect paintwork and glass when removing exterior components.



Always protect the interior components when removing body glass.

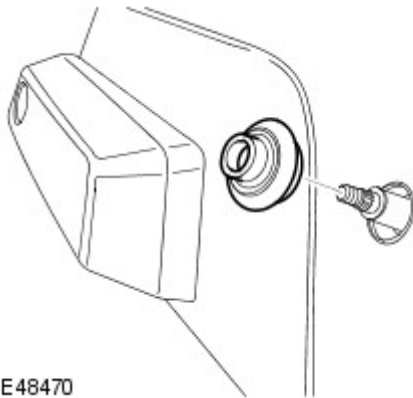


Lay the glass on felt covered supports. Do not stand on edge as this can cause chips which subsequently develop into cracks.



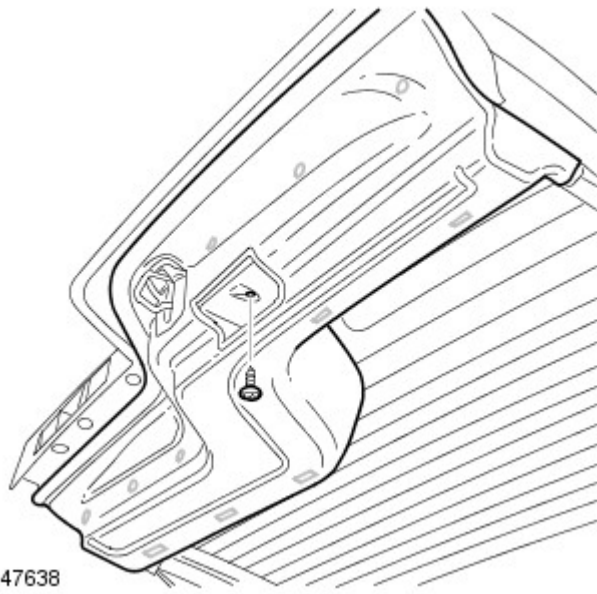
NOTE: The following equipment is required: | Cutting wire and handles | Kent knife | Glazing knife | Glass replacement kit | Sealant applicator gun | Suction cups | A felt covered table or stand to support glass

1. Remove the rear wiper arm.
For additional information, refer to: [Rear Wiper Pivot Arm](#) (501-16 Wipers and Washers, Removal and Installation).
2. Remove the rear wiper drive spindle seal.



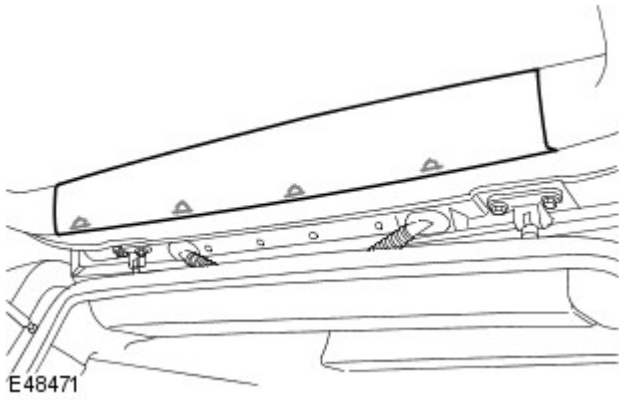
E48470

3. Remove the liftgate lower trim panel.
For additional information, refer to: [Liftgate Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

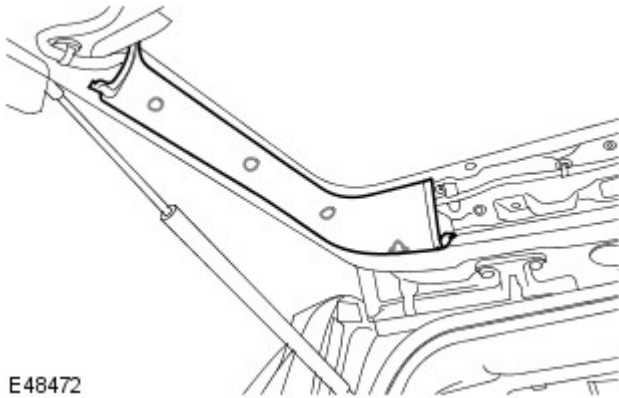


E47638

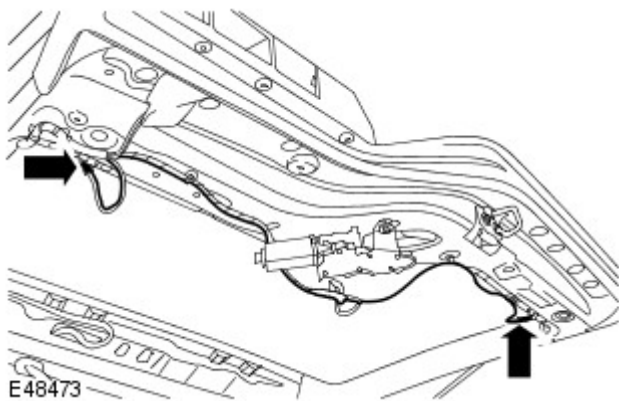
4. Remove the liftgate upper trim panel.
 - Release the 4 clips.



5. Remove the liftgate side trim panel.
 - Release the 4 clips.
 - Repeat the above procedure for the other side.



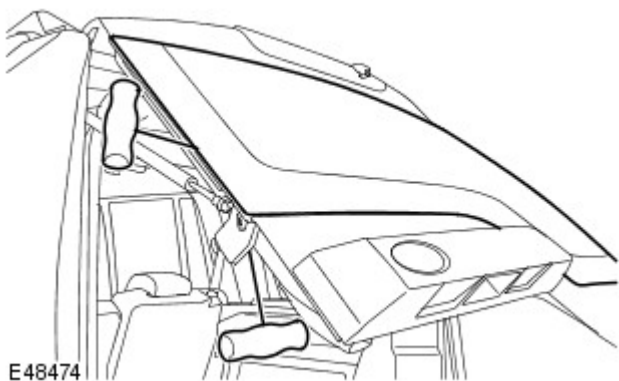
6. Disconnect both heated rear window electrical connectors.



7.  **WARNING:** Eye protection must be worn.

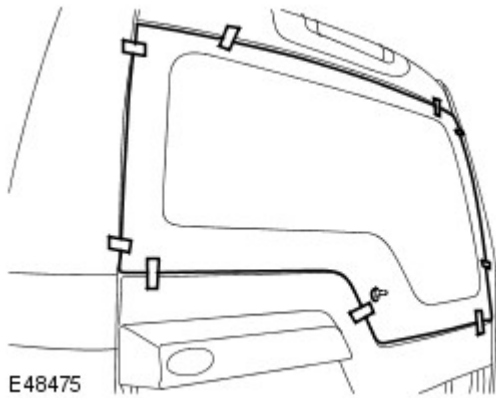
With assistance, remove the liftgate window glass.


- Carefully cut through the sealant using a glazing knife or cutting wire.
- Attach the suction cups.
- Noting fitted position, remove the 5 spacers.

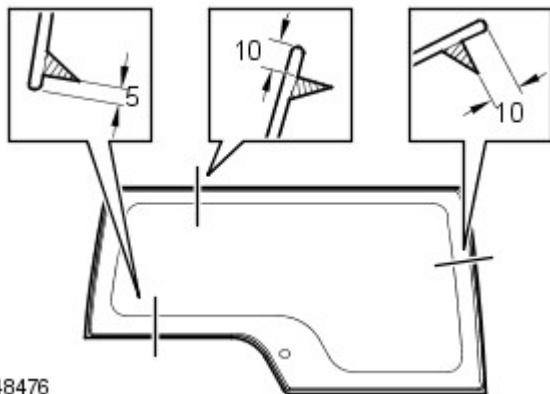


Installation

1. Carefully remove the sealant from the body to leave a smooth surface.
2. Install the liftgate window glass.
 - Install the spacers equally as shown.
 - Use masking tape to establish reference marks as an alignment aid.



3. Remove the liftgate window glass.
 - Clean the component mating faces.
4. Apply etch primer to any bare metal.
5.  **CAUTION:** Correct preparation of body apertures "post painting" to ensure satisfactory glass adhesion, must be carried out in line with industry practise.
 - Apply primer over the etch primer.
6. Apply glass primer to the sealant face on the liftgate window glass and allow to cure.
7. Apply activator over the old sealant on the liftgate and allow to cure.
8. Fit a pre-cut nozzle to the sealer cartridge, remove the lid, shake out the crystals and fit the cartridge to the applicator gun.
 - Modify the nozzle to achieve a bead section in the shape of a right angle triangle with a base of 8 mm and a vertical height of 12 mm.
9. Apply a continuous bead of sealant to the liftgate window glass as shown.



10. With assistance, install and align the liftgate window glass.
 - Lightly press the window glass to seat the sealer.
11. Test the sealer for leaks, apply additional sealer if necessary. If water is used, allow sealer to dry before testing. Spray water around the glass and check for leaks. Mark any area that leaks. Dry the glass and sealer then apply additional sealer.
12. Connect the heated rear window electrical connectors.
13. Install the liftgate side trim panel.
 - Secure with the clips.
 - Repeat the above procedure for the other side.
14. Install the liftgate upper trim panel.
 - Secure with the clips.

15. Install the liftgate lower trim panel.
For additional information, refer to: [Liftgate Trim Panel](#)
(501-05 Interior Trim and Ornamentation, Removal and Installation).
16. Install the rear wiper drive spindle seal.
17. Install the rear wiper arm.
For additional information, refer to: [Rear Wiper Pivot Arm](#)
(501-16 Wipers and Washers, Removal and Installation).

Glass, Frames and Mechanisms - Rear Door Fixed Window Glass

Removal and Installation

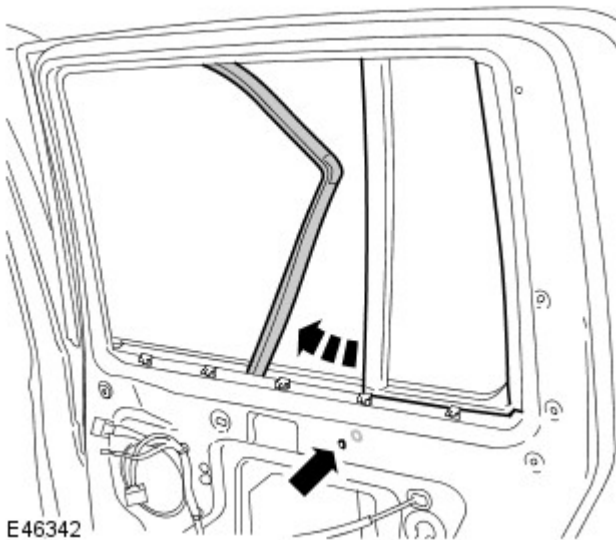
Removal

1. Remove the rear door window motor and regulator assembly.
For additional information, refer to: Rear Door Window Regulator and Motor (501-11, Removal and Installation).
2. Lower the rear door glass to the bottom of the door.
 - Remove the wedge.
3. Remove the rear door frame trim.
 - Release the 2 clips.
 - Carefully release the door trim.
4. Carefully remove the inner waist seal.



E46341

5. Release the lining from the glass rear channel.
6. Remove the rear door window fixed glass.
 - Remove the grommet.
 - Loosen the Torx screw, but do not remove it completely at this stage.
 - Pull the lower edge of the glass forward to release it from the door frame.



E46342

Installation

1. Install the rear door window fixed glass.
 - Make sure the locating peg on the fixed glass has engaged with the door frame.
 - Tighten the Torx screw to 10 Nm (7 lb.ft).
2. Install the channel lining.
3. Install the inner waist seal.
4. Install the door frame trim.
 - Clean the component mating faces.
 - Remove backing tape from adhesive strip.

- Secure the clips.

5.  NOTE: Wedge the glass in this position.

Raise the rear door glass fully.

- Engage the door glass with the channel.

6. Install the rear door window motor and regulator assembly.
For additional information, refer to: Rear Door Window Regulator and Motor (501-11, Removal and Installation).

Glass, Frames and Mechanisms - Windshield Glass

Removal and Installation

Removal

CAUTIONS:



Always protect paintwork and glass when removing exterior components.



Always protect the interior components when removing body glass.

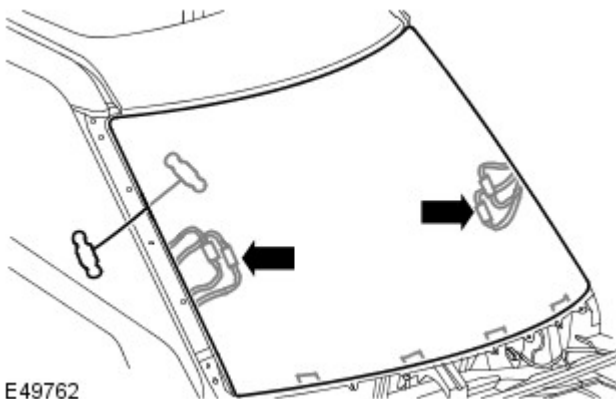
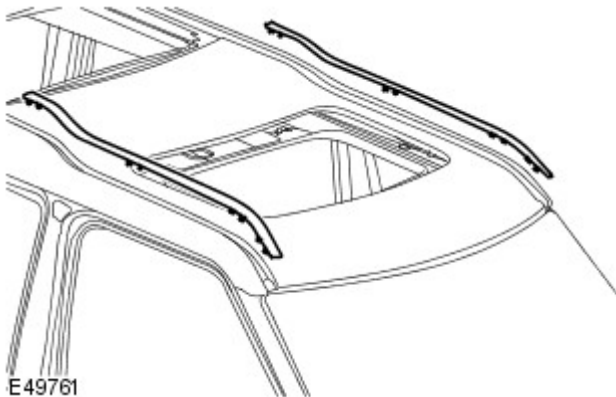


Lay the glass on felt covered supports. Do not stand on edge as this can cause chips which subsequently develop into cracks.



NOTE: The following equipment is required: Cutting wire and handles | Kent knife | Glazing knife | Windshield replacement kit | Sealant applicator gun | Suction cups | A felt covered table or stand to support glass

1. Remove the plenum chamber panel.
For additional information, refer to: [Plenum Chamber](#) (412-01 Air Distribution and Filtering, Removal and Installation).
2. Remove both A-pillar upper trim panels.
For additional information, refer to: [A-Pillar Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Remove the rain sensor.
For additional information, refer to: [Rain Sensor](#) (501-16 Wipers and Washers, Removal and Installation).
4. Remove the roof moulding.
 - Release the 6 clips.
 - Repeat the above procedure for the other side.



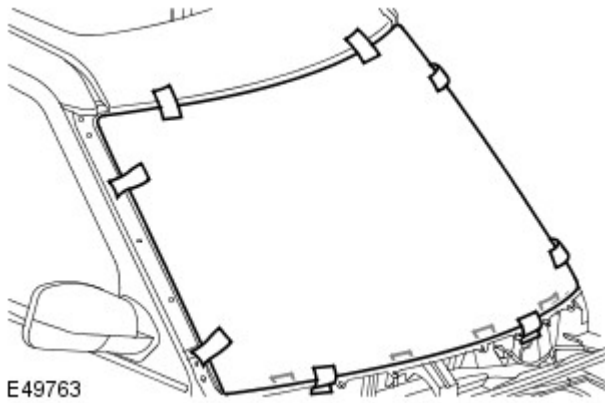
5.  **WARNING:** Eye protection must be worn.

With assistance, remove the windshield glass.

- If installed, disconnect the 4 electrical connectors.
- Carefully cut through the sealant using a glazing knife or cutting wire.
- Attach the suction cups.
- Noting fitted position, remove the 4 spacers.


Installation

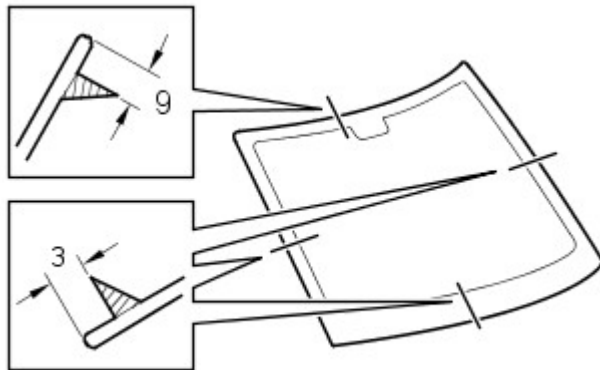
1. Carefully remove the sealant from the body to leave a smooth surface.
2. Install the windshield glass.
 - Install the spacers equally as shown.



E49763

Use masking tape to establish reference marks as an alignment aid.

3. Remove the windshield glass.
 - Clean the component mating faces.
4.  **CAUTION:** Correct preparation of body apertures "post painting" to ensure satisfactory glass adhesion, must be carried out in line with industry practise.
 - Apply etch primer to any bare metal.
5. Apply primer over the etch primer.
6. Apply glass primer to the sealant face on the windshield glass and allow to cure.
7. Apply activator over the old sealant on the windshield glass and allow to cure.
8. Fit a pre-cut nozzle to the sealer cartridge, remove the lid, shake out the crystals and fit the cartridge to the applicator gun.
 - Modify the nozzle to achieve a bead section in the shape of a right angle triangle with a base of 8 mm and a vertical height of 12 mm.
9. Apply a continuous bead of sealant to the windshield glass as shown.



E49764

10. With assistance, install the window glass.
 - Lightly press the window glass to seat the sealer.
 - Connect the electrical connectors.
11. Test the sealer for leaks, apply additional sealer if necessary. If water is used, allow sealer to dry before testing. Spray water around the glass and check for leaks. Mark any area that leaks. Dry the glass and sealer then apply additional sealer.
12. Install the roof mouldings.
 - Secure with the clips.
13. Install the rain sensor.

For additional information, refer to: [Rain Sensor](#) (501-16 Wipers and Washers, Removal and Installation).
14. Install both A-pillar upper trim panels.

For additional information, refer to: [A-Pillar Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

15. Install the plenum chamber panel.
For additional information, refer to: [Plenum Chamber](#) (412-01 Air Distribution and Filtering, Removal and Installation).

Glass, Frames and Mechanisms - Glass Roof Panel

Removal and Installation

Removal

CAUTIONS:



Always protect paintwork and glass when removing exterior components.



Always protect the interior components when removing body glass.



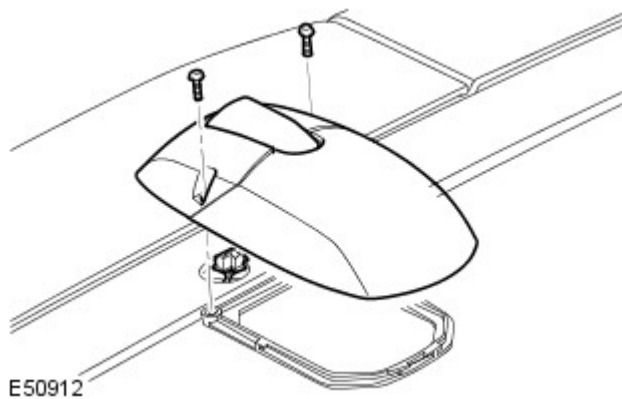
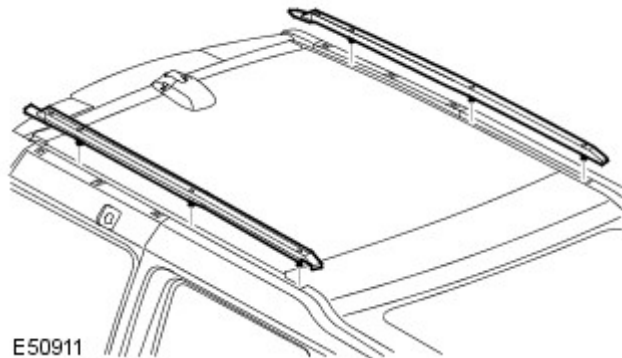
Lay the glass on felt covered supports. Do not stand on edge as this can cause chips which subsequently develop into cracks.



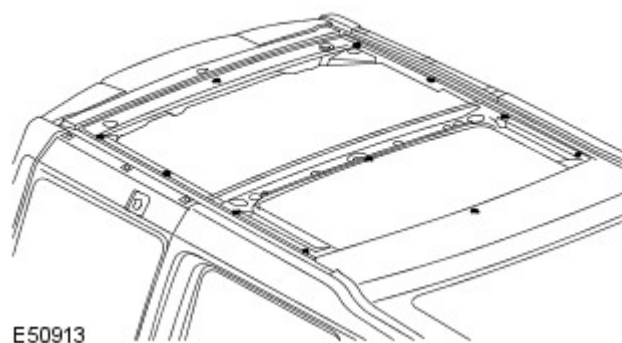
NOTE: The following equipment is required: I Cutting wire and handles I Kent knife I Glazing knife I Glass replacement kit I Sealant applicator gun I Suction cups I A felt covered table or stand to support glass

1. Remove the headliner.
For additional information, refer to: [Headliner](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

2. Remove the roof moulding.
 - Release the 3 clips.
 - Repeat the above procedure for the other side.



3. Remove the antenna.
 - Disconnect the cable.
 - Remove the 2 screws.



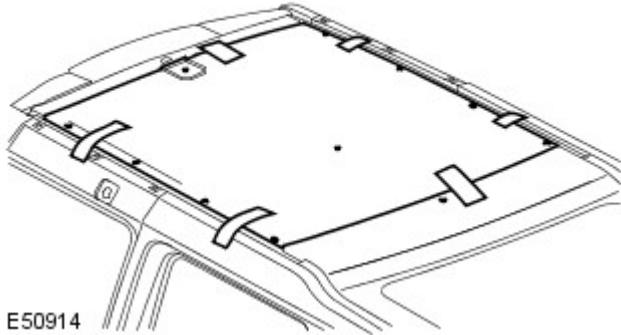
4.  **WARNING:** Eye protection must be worn.


With assistance, remove the roof panel fixed glass.

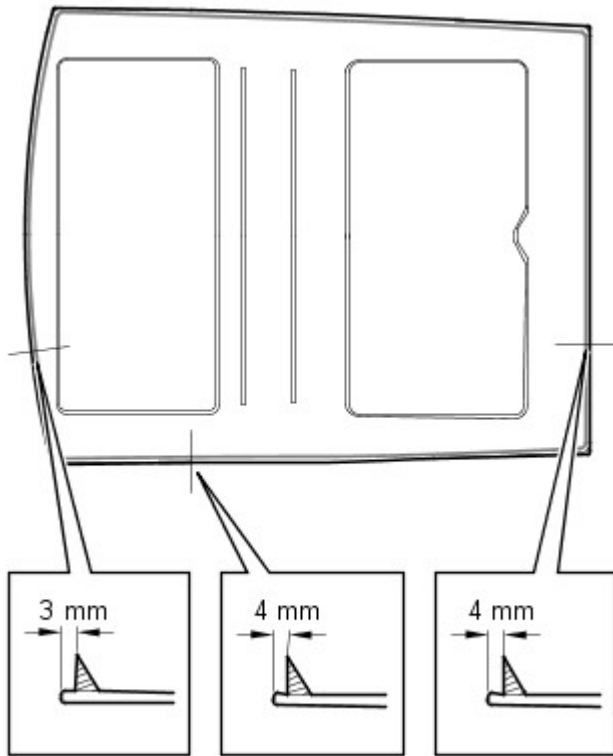
- Carefully cut through the sealant using a glazing knife or cutting wire.
- Attach the suction cups.
- Noting fitted position, remove the 11 spacers.

Installation

1. Carefully remove the sealant from the body to leave a smooth surface.
2. Install the roof panel fixed glass.
 - Install the spacers equally as shown.
 - Use masking tape to establish reference marks as an alignment aid.



3. With assistance, remove the roof panel fixed glass.
 - Clean the component mating faces.
4.  **CAUTION:** Correct preparation of body apertures “post painting” to ensure satisfactory glass adhesion, must be carried out in line with industry practise.
Apply etch primer to any bare metal.
5. Apply primer over the etch primer.
6. Apply glass primer to the sealant face on the roof panel fixed glass and allow to cure.
7. Apply activator over the old sealant on the roof panel and allow to cure.
8. Fit a pre-cut nozzle to the sealer cartridge, remove the lid, shake out the crystals and fit the cartridge to the applicator gun.
 - Modify the nozzle to achieve a bead section in the shape of a right angle triangle with a base of 8 mm and a vertical height of 12 mm.
9. Apply a continuous bead of sealant to the roof panel fixed glass as shown.



E50915

10. With assistance, install and align the roof panel fixed glass.
 - Lightly press the roof panel fixed glass to seat the sealer.
11. Test the sealer for leaks, apply additional sealer if necessary. If water is used, allow sealer to dry before testing. Spray water around the glass and check for leaks. Mark any area that leaks. Dry the glass and sealer then apply additional sealer.
12. Install the antenna.
 - Tighten the screws.
 - Connect the cable.
13. Install the roof mouldings.
 - Secure with the clips.
14. Install the headliner.

For additional information, refer to: [Headliner](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

Glass, Frames and Mechanisms - Rear Quarter Window Glass

Removal and Installation

Removal

CAUTIONS:



Always protect paintwork and glass when removing exterior components.



Always protect the interior components when removing body glass.



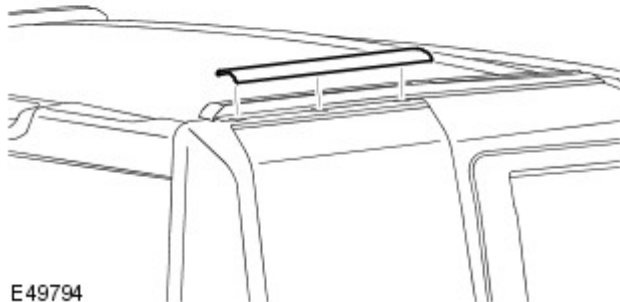
Lay the glass on felt covered supports. Do not stand on edge as this can cause chips which subsequently develop into cracks.



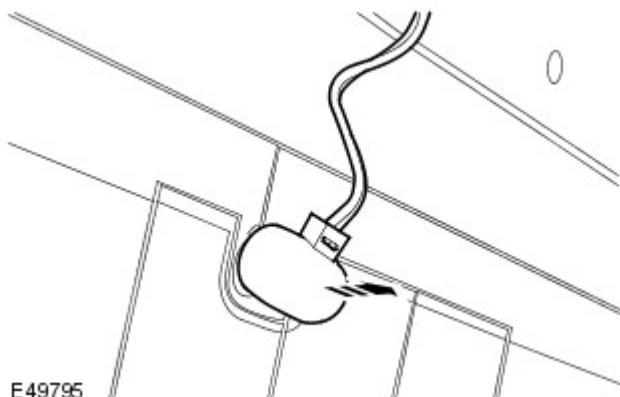
NOTE: The following equipment is required:

- Cutting wire and handles
- Kent knife
- Glazing knife
- Glass replacement kit
- Sealant applicator gun
- Suction cups
- A felt covered table or stand to support glass

1. Remove the D-pillar upper trim panel.
For additional information, refer to: [D-Pillar Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Remove the rear quarter window glass panel.
 - Release the 3 clips.



E49794



E49795

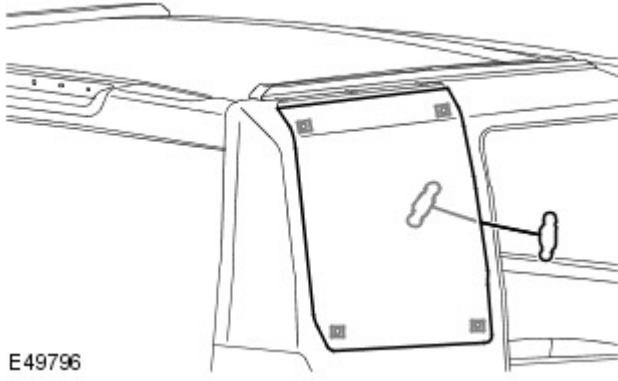
3. Disconnect the rear quarter window glass antenna connector.

4.  **WARNING:** Eye protection must be worn.



CAUTION: Care must be taken not to damage the air bag curtain module when cutting through the sealant.


With assistance, remove the rear quarter window glass.

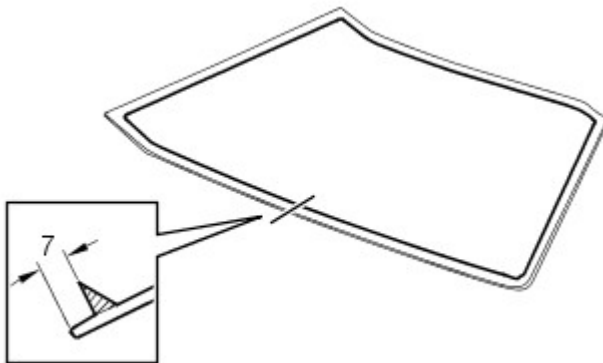


E49796

- Carefully cut through the sealant using a glazing knife or cutting wire.
- Attach the suction cups.
- Noting fitted position, remove the 4 spacers.

Installation

1. Carefully remove the sealant from the body to leave a smooth surface.
2. Apply etch primer to any bare metal.
3.  **CAUTION:** Correct preparation of body apertures "post painting" to ensure satisfactory glass adhesion, must be carried out in line with industry practise.
Apply primer over the etch primer.
4. Apply glass primer to the sealant face on the rear quarter window glass and allow to cure.
5. Apply activator over the old sealant on the rear quarter window glass and allow to cure.
6. Fit a pre-cut nozzle to the sealer cartridge, remove the lid, shake out the crystals and fit the cartridge to the applicator gun.
 - Modify the nozzle to achieve a bead section in the shape of a right angle triangle with a base of 8 mm and a vertical height of 12 mm.
7. Apply a continuous bead of sealant to the rear quarter window glass as shown.



E49797

8. With assistance, install and align the rear quarter window glass.
 - Install the spacers equally as shown.
 - Lightly press the window glass to seat the sealer.
9. Test the sealer for leaks, apply additional sealer if necessary. If water is used, allow sealer to dry before testing. Spray water around the glass and check for leaks. Mark any area that leaks. Dry the glass and sealer then apply additional sealer.
10. Connect the rear quarter window glass antenna connector.
 - Clean the component mating faces.
11. Install the rear quarter window glass panel.
 - Secure with the clips.

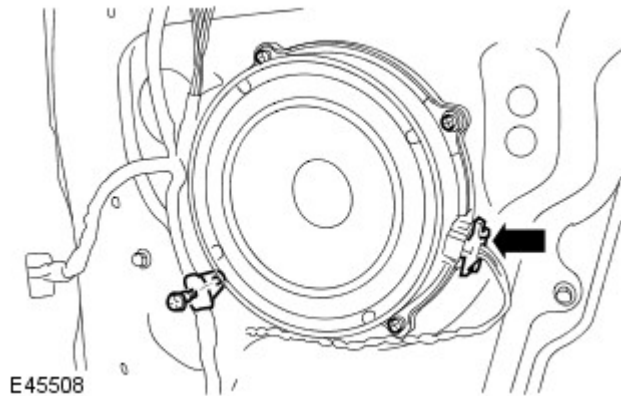
12. Install the D-pillar upper trim panel.
For additional information, refer to: [D-Pillar Trim Panel](#)
(501-05 Interior Trim and Ornamentation, Removal and Installation).

Glass, Frames and Mechanisms - Front Door Window Regulator and Motor

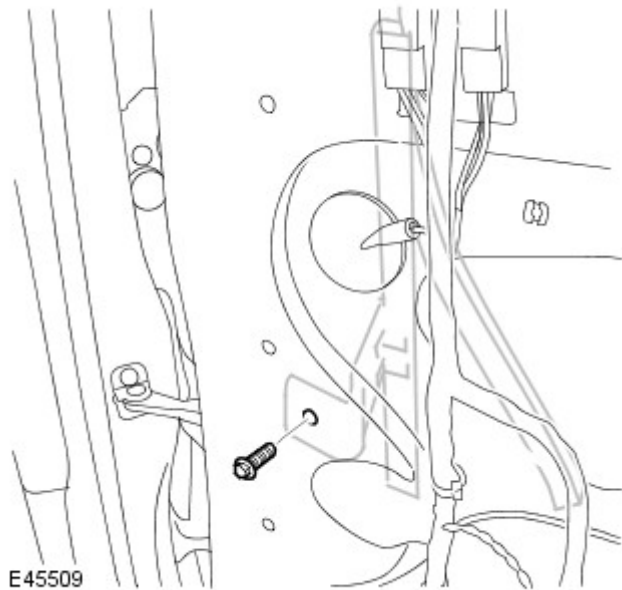
Removal and Installation


Removal

1. Remove the front door trim panel.
For additional information, refer to: Front Door Trim Panel (501-05, Removal and Installation).
2. Remove the front door window glass.
For additional information, refer to: Front Door Window Glass (501-11, Removal and Installation).
3. Remove the speaker.
 - Disconnect the electrical connector.
 - Remove the 4 screws.



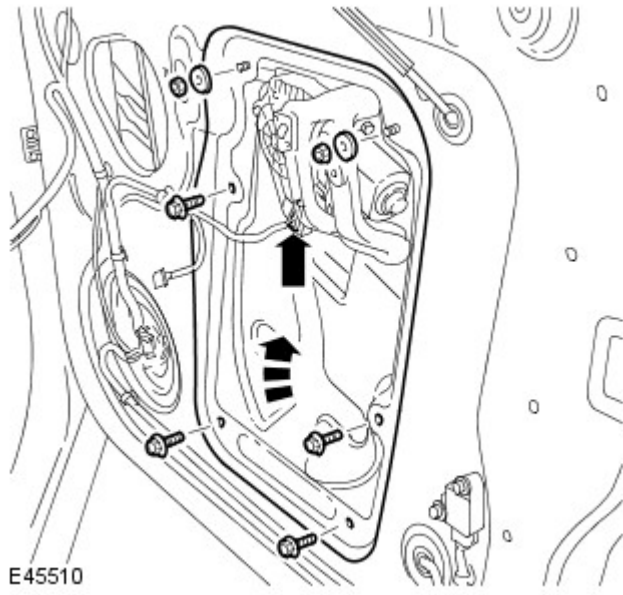
4. Remove the glass guide channel.
 - Release the channel lining.
 - Remove the bolt.



5.  **NOTE:** Rotate the assembly within the aperture through 90 degrees and release the upper edge from the rear side of the aperture first.

Remove the window motor and regulator assembly.

- Disconnect the electrical connector.
- Remove the 4 bolts.
- Remove the 2 nuts.



Installation

1. Install the window motor and regulator assembly.
 - Tighten the bolts and nuts to 10 Nm (7 lb.ft).
 - Connect the electrical connector.
2. Install the glass guide channel.
 - Tighten the bolt to 10 Nm (7 lb.ft).
 - Install the channel lining.
3. Install the speaker
 - Align the door wiring harness clip.
 - Tighten the screws.
 - Connect the electrical connector.
4. Install the front door window glass.
For additional information, refer to: Front Door Window Glass (501-11, Removal and Installation).
5. Install the front door trim panel.
For additional information, refer to: Front Door Trim Panel (501-05, Removal and Installation).

Glass, Frames and Mechanisms - Front Door Window Regulator and Motor

Removal and Installation

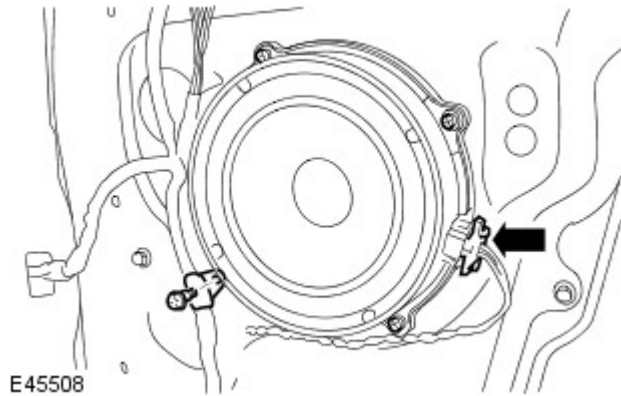
Removal



NOTE: Removal steps in this procedure may contain installation details.

1. Refer to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Refer to: Front Door Window Glass (501-11, Removal and Installation).

3.

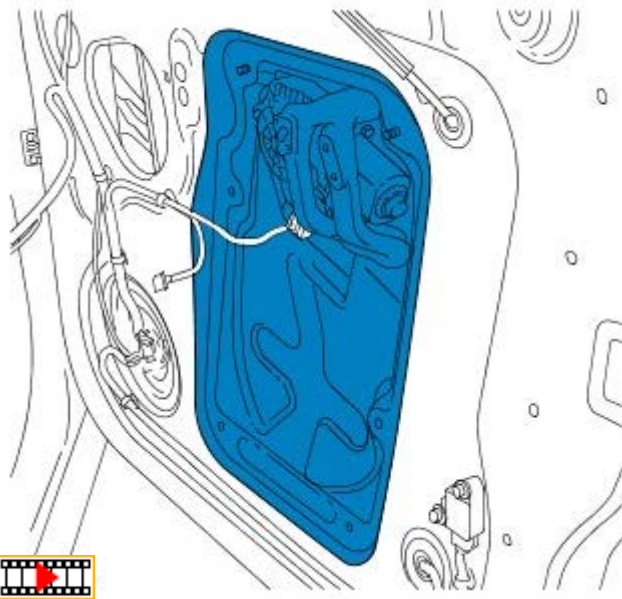


4. *Torque:*

Front door window regulator and motor retaining bolts 10 Nm

Front door window regulator and motor retaining nuts 10 Nm

Door window glass guide channel retaining bolt 10 Nm




Installation

1. To install, reverse the removal procedure.

Glass, Frames and Mechanisms - Rear Door Window Regulator and Motor

Removal and Installation

Special Tool(s)

 <p>501-114</p> <p>E54200</p>	<p>Door glass release lever</p> <p>501-114</p>
--	--

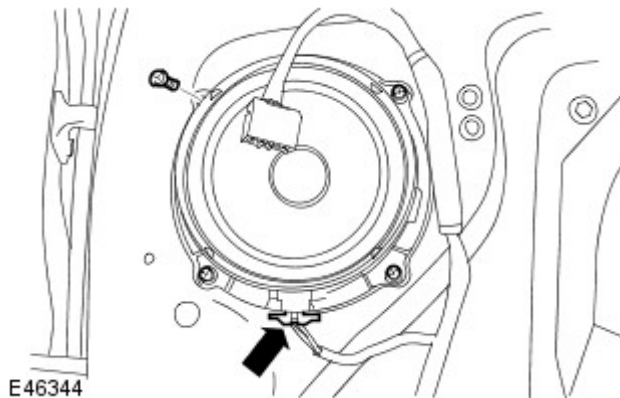
Removal



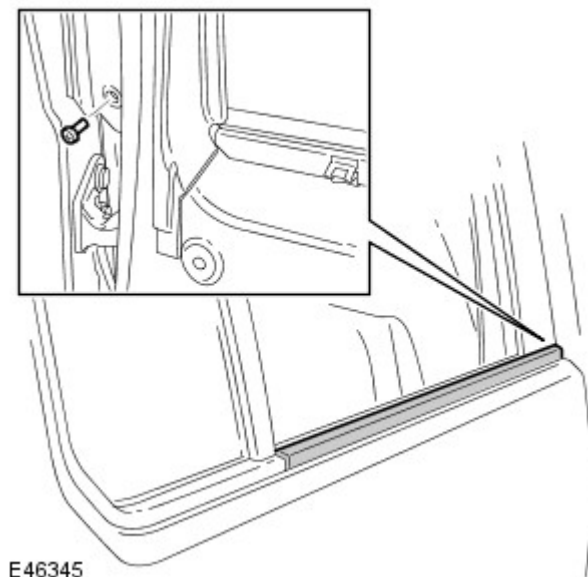
NOTE: The door glass should be lowered by approximately one third.

1. Remove the rear door trim panel.
For additional information, refer to: Rear Door Trim Panel (501-05, Removal and Installation).

2. Remove the speaker.
 - Disconnect the electrical connector.
 - Remove the 4 screws.

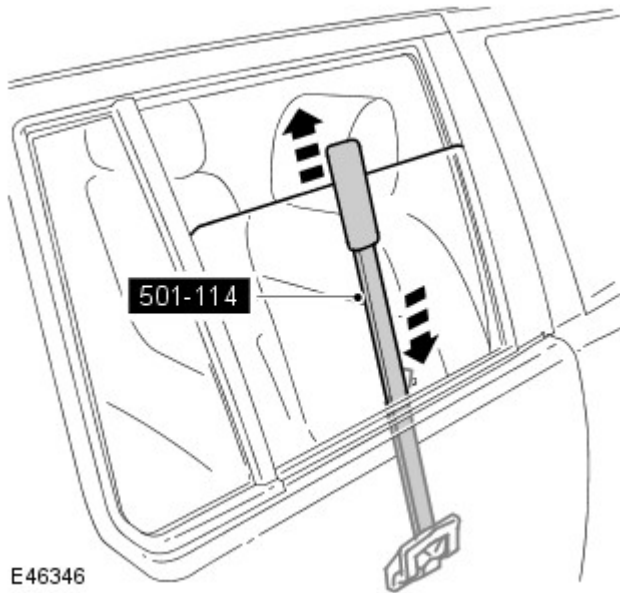


3. Carefully remove the outer waist seal.
 - Remove the screw.

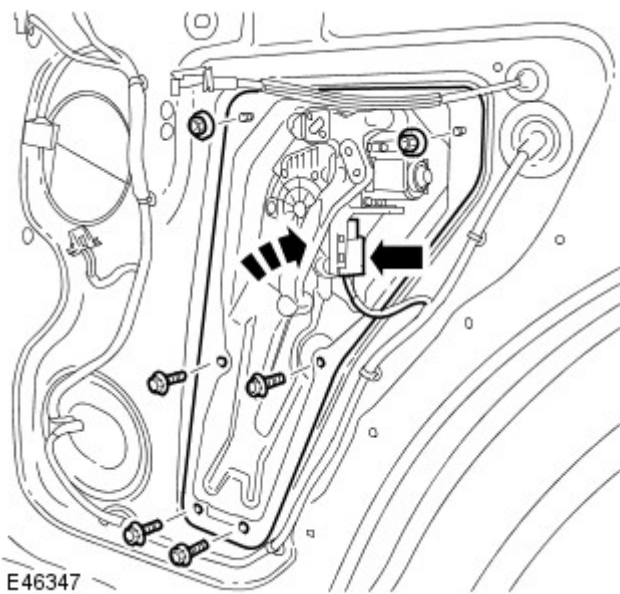


4.  **NOTE:** Wedge the glass in this position.

Using the special tool, release the clip and lift the glass to the top of the door frame.



E46346



E46347

5. Remove the window motor and regulator assembly.

- Disconnect the electrical connector.
- Remove the 4 bolts.
- Remove the 2 nuts.
- Rotate the assembly 90 degrees clockwise, to remove the upper part of the assembly from the rear side of the aperture first.

Installation

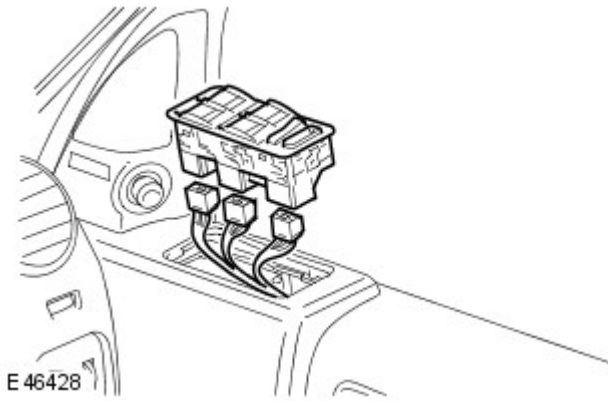
1. Install the window motor and regulator assembly.
 - Tighten the bolts and nuts to 10 Nm (7 lb.ft).
 - Connect the electrical connector.
2. Secure the glass to the glass regulator.
 - Remove the wedge.
 - Lower the glass.
3. Install the outer waist seal.
4. Install the speaker
 - Tighten the screws.
 - Connect the electrical connector.
5. Install the rear door trim panel.
 For additional information, refer to: Rear Door Trim Panel (501-05, Removal and Installation).

Glass, Frames and Mechanisms - Front Door Window Control Switch

Removal and Installation

Removal

1. Remove the window control switch.
 - Carefully release the switch.
 - Disconnect the 3 electrical connectors.



Installation

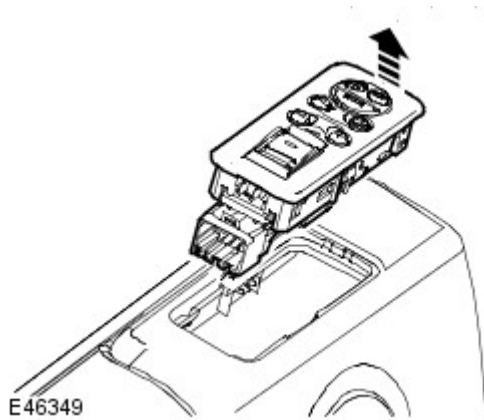
1. To install, reverse the removal procedure.

Glass, Frames and Mechanisms - Rear Door Window Control Switch

Removal and Installation

Removal

1. Remove the window control switch.
 - Carefully release the front of the switch.
 - Disconnect the electrical connector.



Installation

1. To install, reverse the removal procedure.

Instrument Panel and Console -

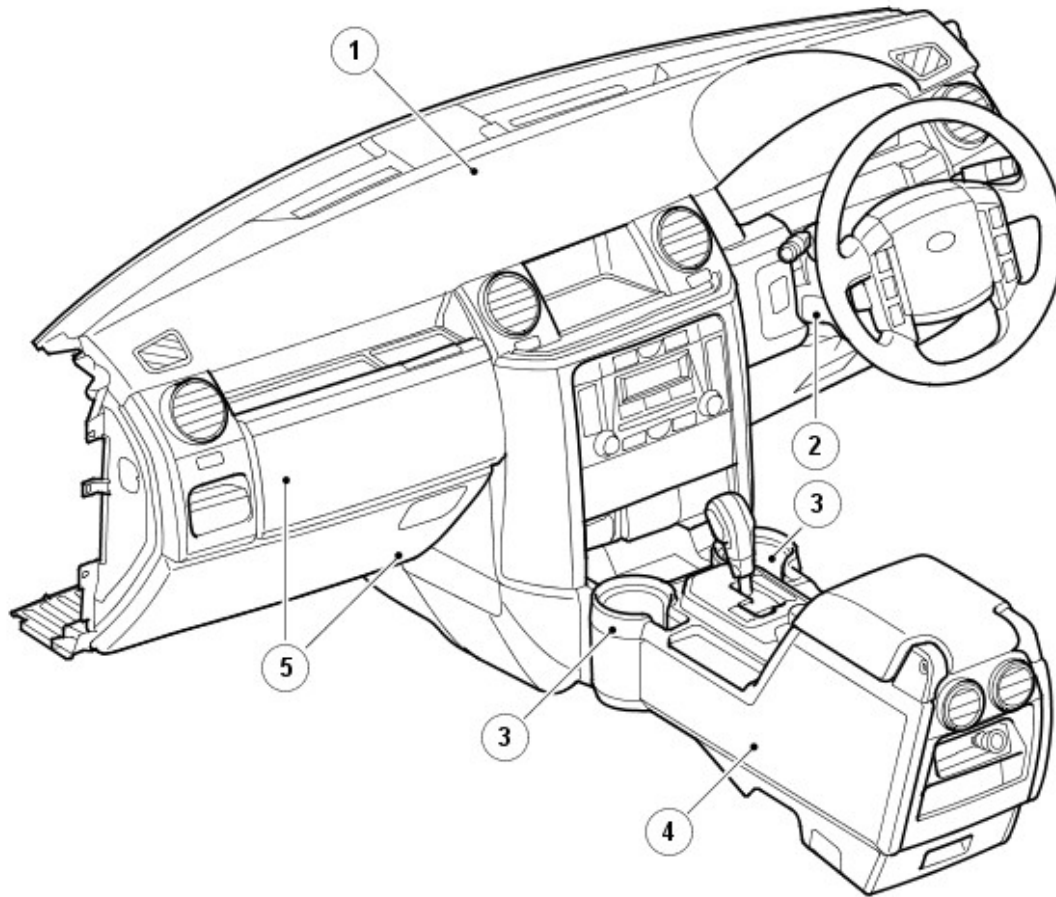
Torque Specifications

Description	Nm	lb-ft
Floor console lid Torx bolts	3	2
Floor console Torx bolts	10	7
Passenger air bag module nuts	10	7
Passenger air bag module bracket Torx screws	25	18
Instrument panel Torx bolts	25	18
Heater housing to bulkhead Torx bolts	6	4
Ground cables to passenger/driver side lower A-pillar nuts	10	7
Adaptor panel(s) nuts	10	7
A/C lines to bulkhead bolt	10	7
A/C lines to body nuts	10	7
EGR coolant crossover pipe bolts	10	7
Instrument panel carrier to bulkhead Torx bolt	25	18
Instrument panel upper section to body Torx bolt	10	7
Instrument panel center bracket Torx bolts	25	18
* Steering column intermediate shaft nut	22	16
Transmission selector lever bolts	10	7
Front door bolts	10	7
Door check strap to A-pillar bolts	10	7
Steering column switch assembly Torx bolts	3	2

* **New nut must be fitted**

Instrument Panel and Console - Instrument Panel

Description and Operation

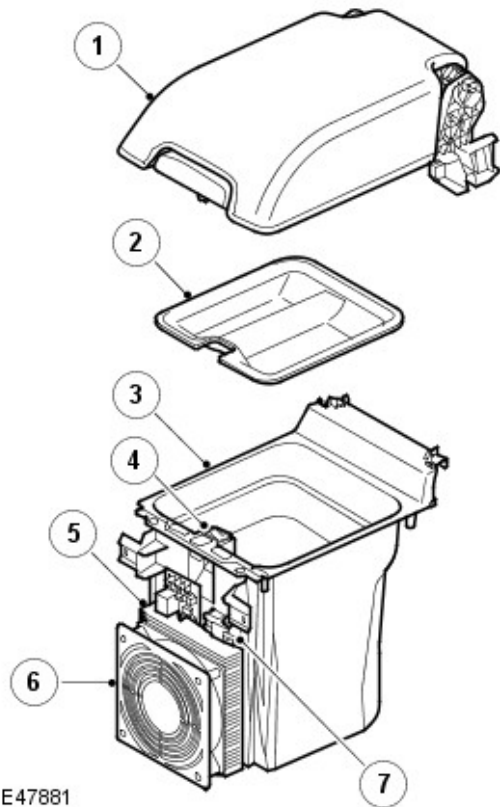


E51470

Item	Part Number	Description
1	-	Instrument Panel
2	-	Steering column cover
3	-	Cup holders
4	-	Centre console
5	-	Glovebox

COOL BOX

On some vehicles, a cool box is incorporated in the centre console between the two front seats.



E47881

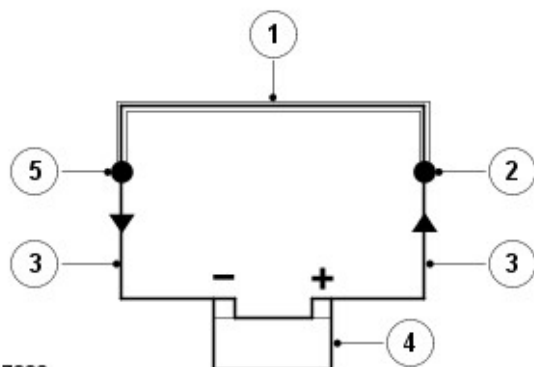
Item	Part Number	Description
1	-	Cubby box lid
2	-	Cubby box tray
3	-	Container
4	-	On/Off switch
5	-	Thermoelectric cooler heatsink
6	-	Fan
7	-	Electrical connector

The cool box is an open topped container with an aluminum liner and an insulating outer layer. A thermoelectric cooler is installed in the front of the container. The top of the container is covered by the cubby box tray and the cubby box lid. An electrical connector on the front of the cool box connects the cool box to the console harness.

Operation of the thermoelectric cooler is controlled by an on/off switch on the top front edge of the container. A permanent battery feed is supplied to the on/off switch from the central junction box (CJB). A light emitting diode (LED) in the on/off switch is illuminated while the cool box is selected on.

The thermoelectric cooler is a solid state heat pump that uses the Peltier Effect to cool the inside of the cool box. The Peltier Effect occurs when a direct current is passed through a circuit of two dissimilar conductors, which are connected together at two junctions; this causes one junction to become cold and one junction to become hot. The potential difference between the two conductors creates an electric field at each junction; when a current is then applied to the circuit the charge flows against the direction of the electric field at one junction, causing it to absorb heat, and with the direction of the electric field at the other junction, causing it to release heat. In thermoelectric coolers, a number of these circuits (known as couples) are connected together, in series, and sandwiched between ceramic plates, then connected to a heatsink and fan. On the cool box, the cold side of the thermoelectric cooler is attached to the aluminum liner and the heatsink and fan are installed on the insulating outer layer.

Peltier Effect Circuit

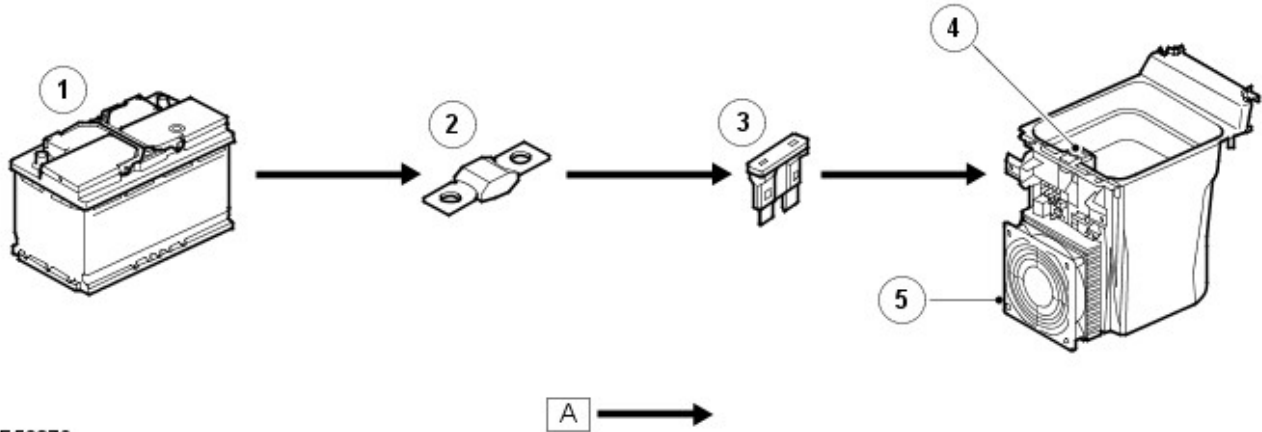


E47882

Item	Part Number	Description
1	-	Conductor material A
2	-	Hot junction
3	-	Conductor material B
4	-	Battery
5	-	Cold junction

When the on/off switch is selected on, the LED in the switch illuminates and power is supplied to the thermoelectric cooler. The couples in the thermoelectric cooler then transfer heat from the liner of the cool box to the heatsink, and the fan runs to cool the heatsink.

CONTROL DIAGRAM



E56376

Item	Part Number	Description
1	-	Battery
2	-	Fusible link 18E, battery junction box (BJB)
3	-	Fuse 59P, CJB
4	-	Cool box on/off switch
5	-	Thermoelectric cooler

Instrument Panel and Console - Floor Console

Description and Operation

For additional information, refer to: Instrument Panel (501-12 Instrument Panel and Console, Description and Operation).

Instrument Panel and Console - Overhead Console

Description and Operation

For additional information, refer to: Interior Lighting (417-02 Interior Lighting, Description and Operation).

Instrument Panel and Console - Floor Console

Removal and Installation

Removal

NOTES:

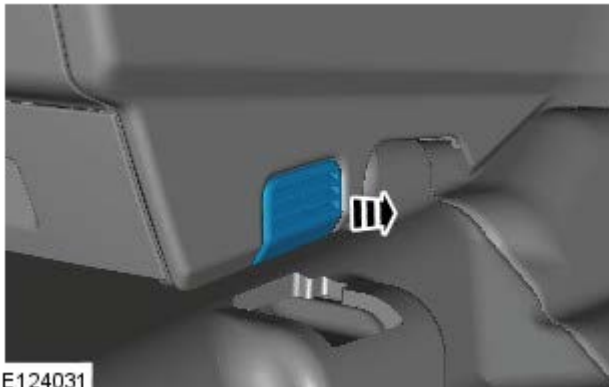


Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Floor Console Upper Section (501-12, Removal and Installation).



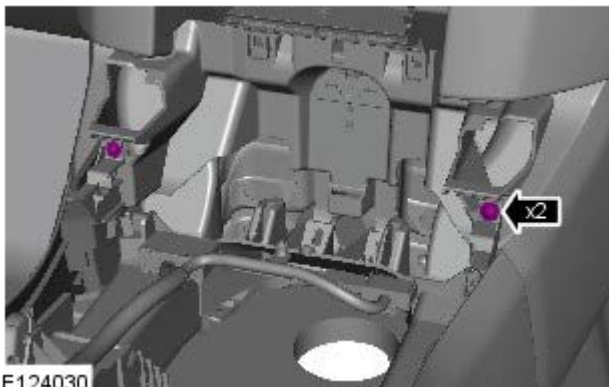
E124031

2.  NOTE: Right-hand shown, left-hand similar.



E124027

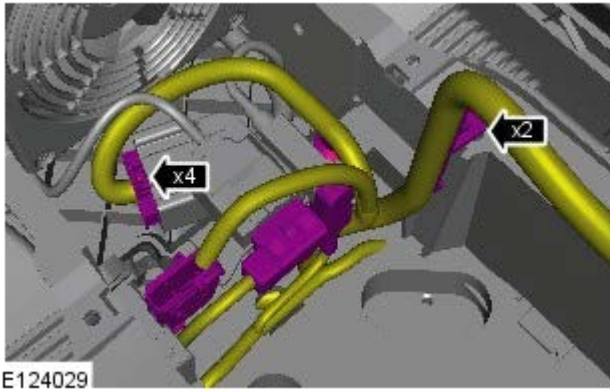
- 3.



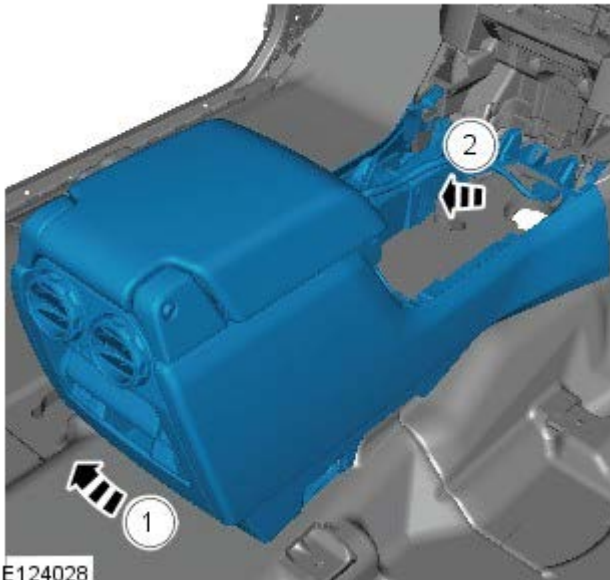
E124030

- 4.

- 5.



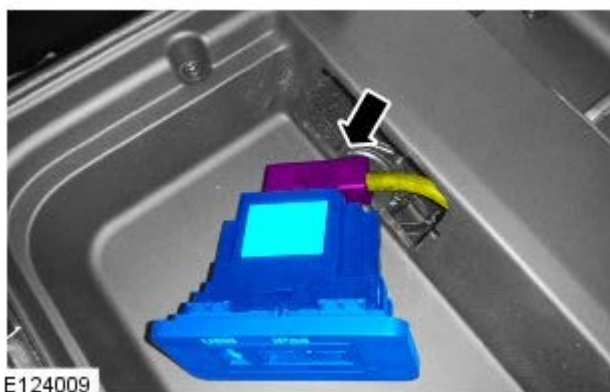
E124029



E124028




E124008



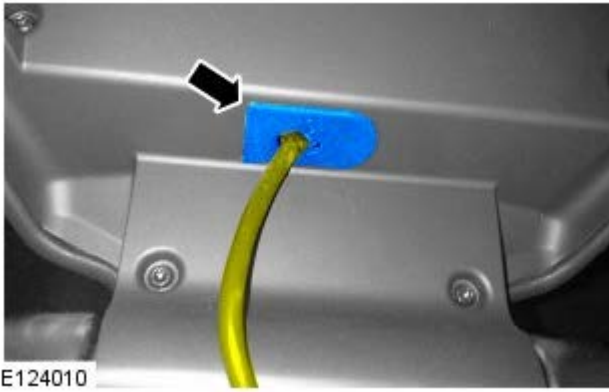
E124009

6.

7.  NOTE: Do not disassemble further if the component is removed for access only.

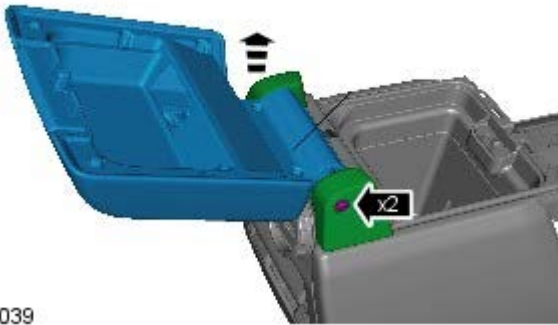
8.

9.



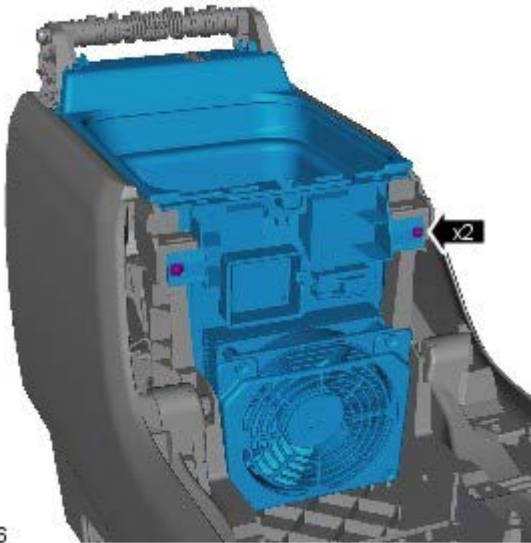
E124010

10.



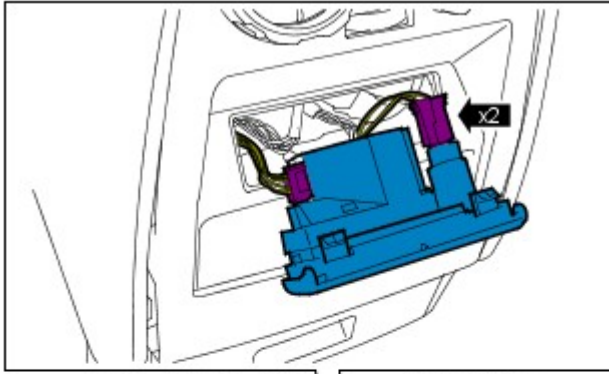
E124039

11.

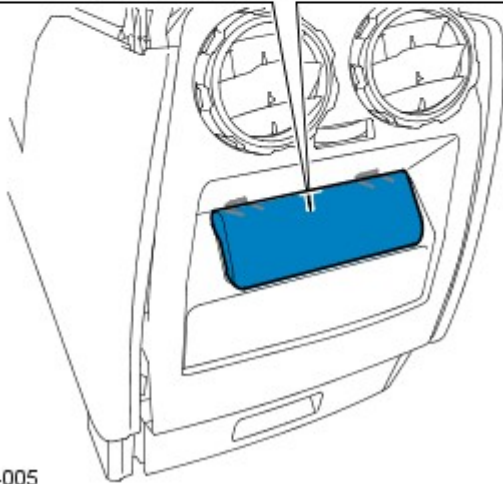


E124026

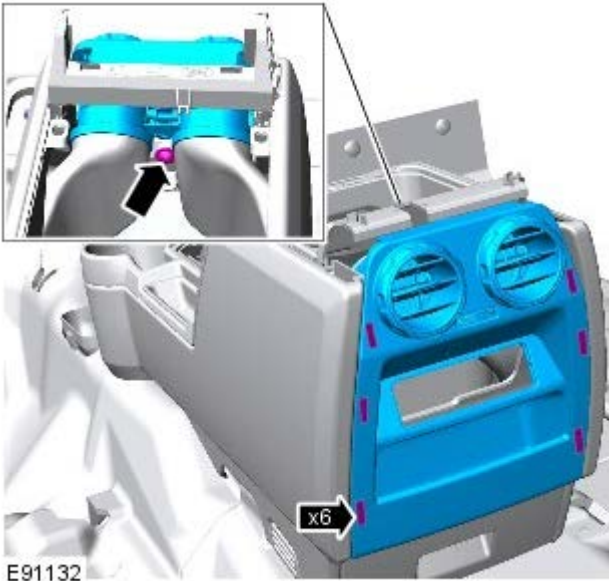
12.



E124005

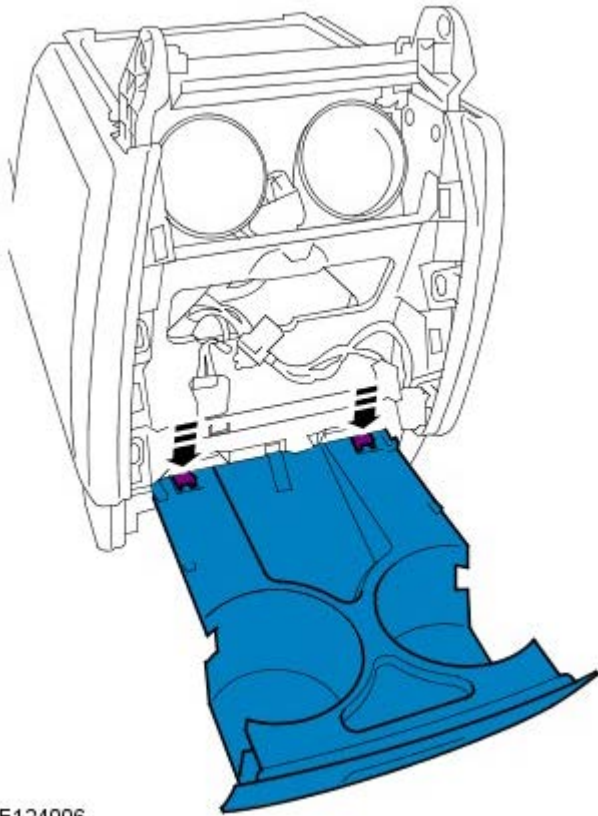


13.



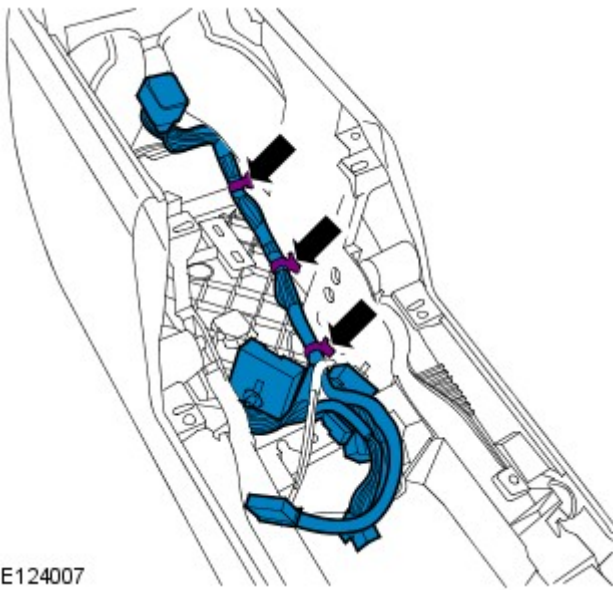
E91132

14.



E124006

15.



E124007

Installation

1. To install, reverse the removal procedure.

Instrument Panel and Console - Floor Console Upper Section

Removal and Installation

Removal

NOTES:



Removal steps in this procedure may contain installation details.



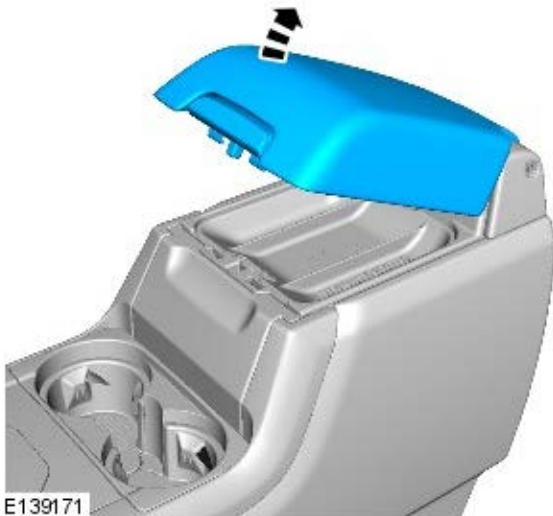
Some variation in the illustrations may occur, but the essential information is always correct.



Make sure that the gear selector lever is in position N before removing any components.

All vehicles

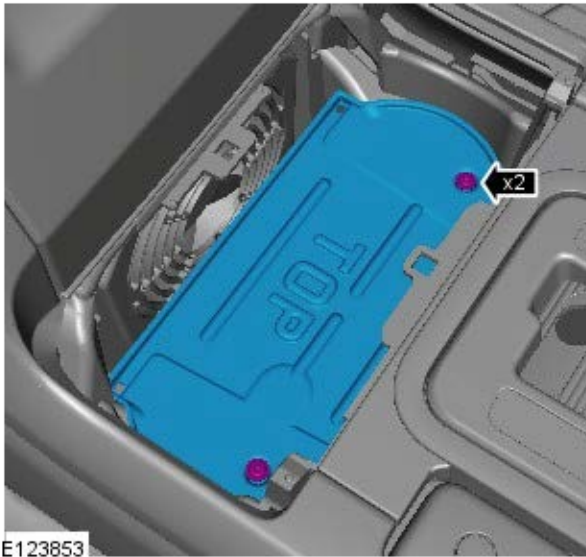
1.



2.



3.



E123853

Vehicles with 6 speed automatic transmission

4.



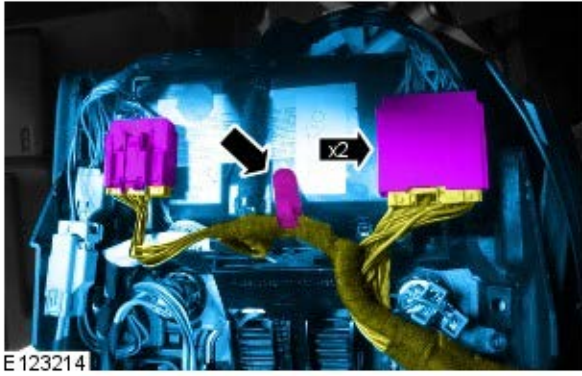
E123212

5.

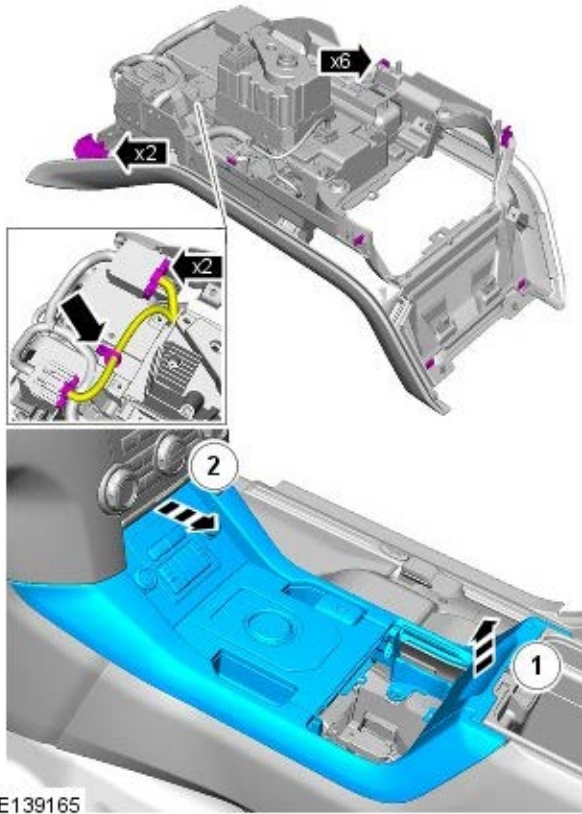


E123213

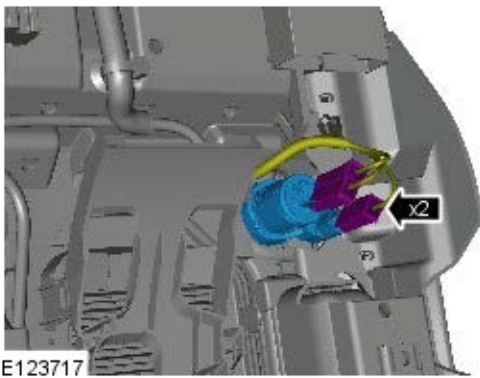
6.




Vehicles with 8 speed automatic transmission
7.

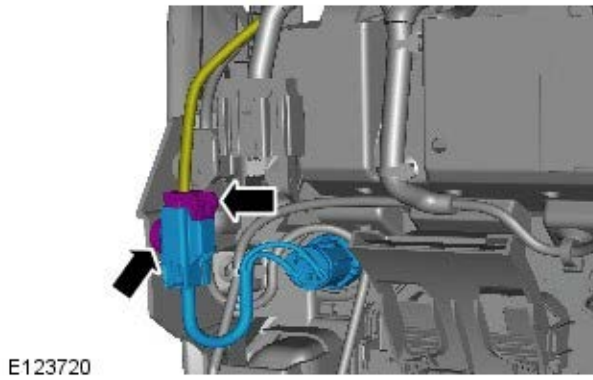


All vehicles

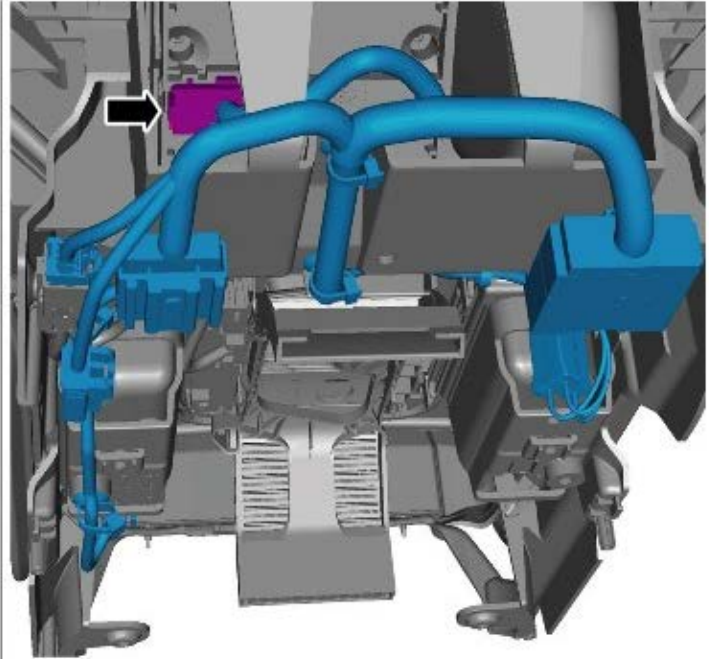
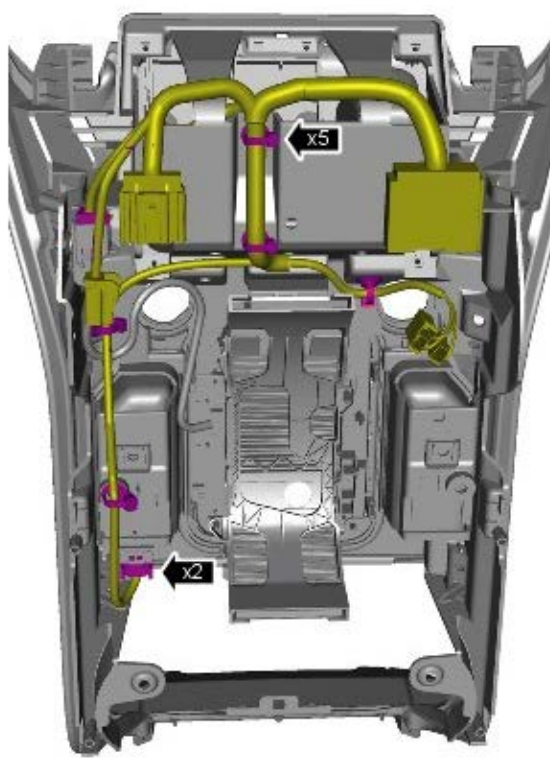


- 8.  NOTE: Do not disassemble further if the component is removed for access only.

9.

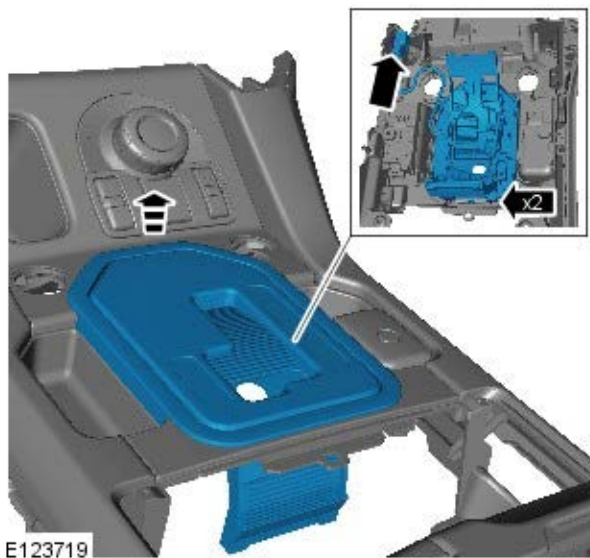


10.



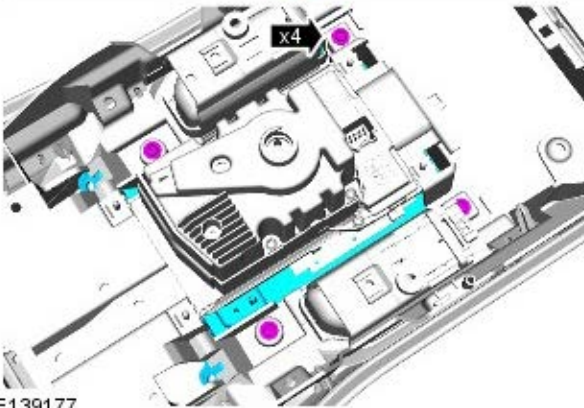
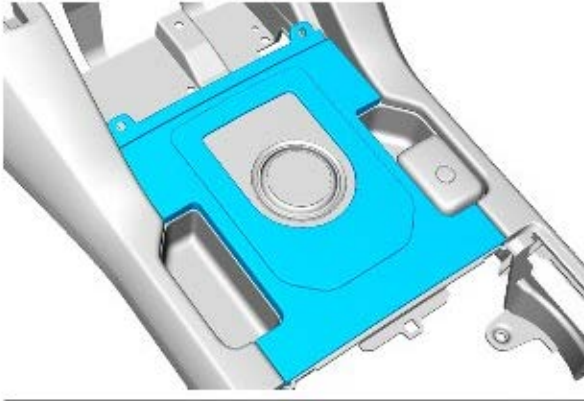
Vehicles with 6 speed automatic transmission

11.



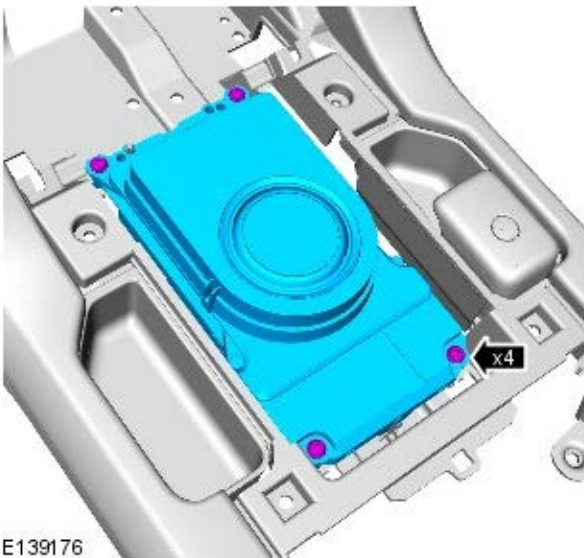
Vehicles with 8 speed automatic transmission

12.



E139177

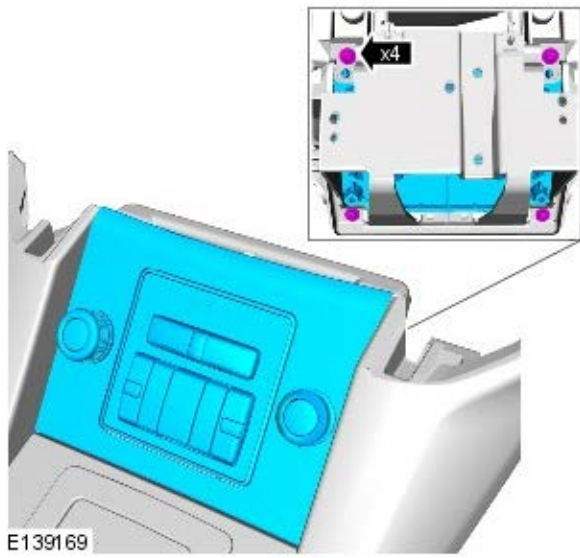
13.



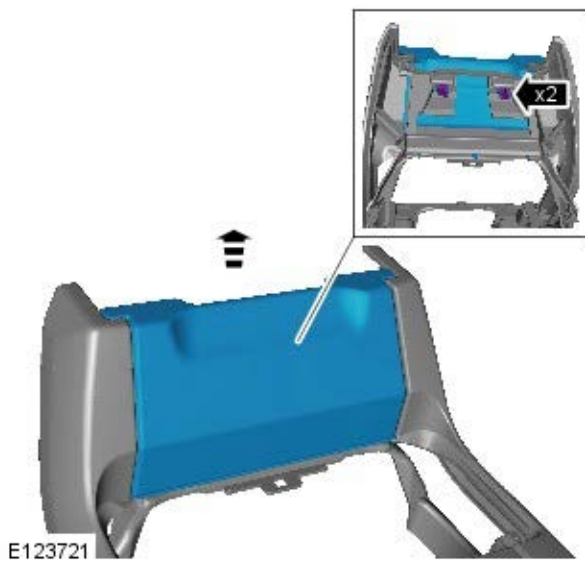
E139176

All vehicles

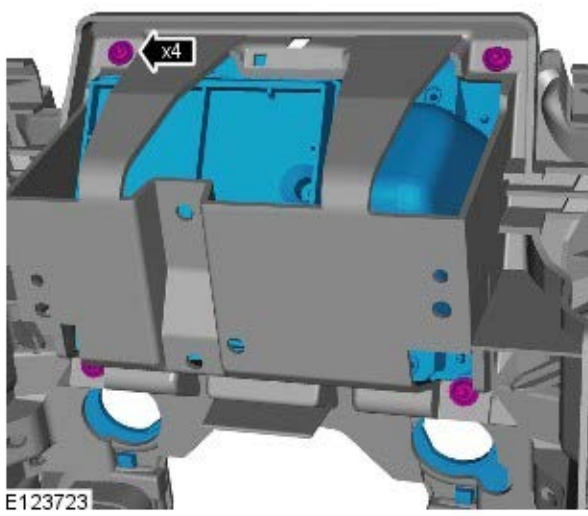
14.



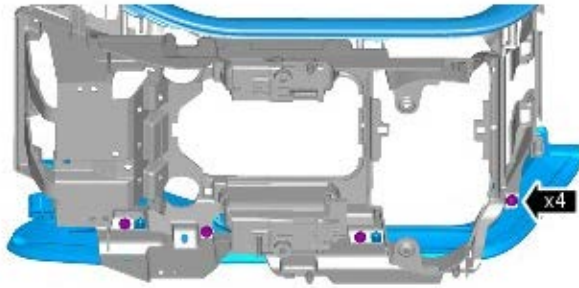
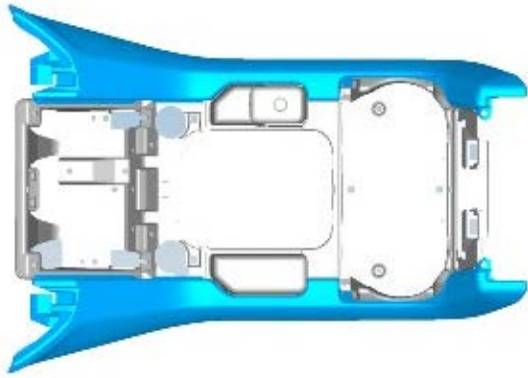
15.



16.

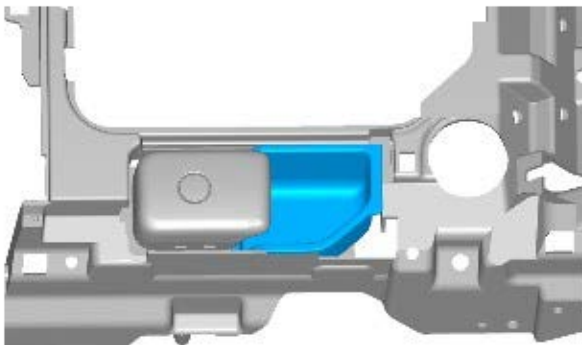


17.



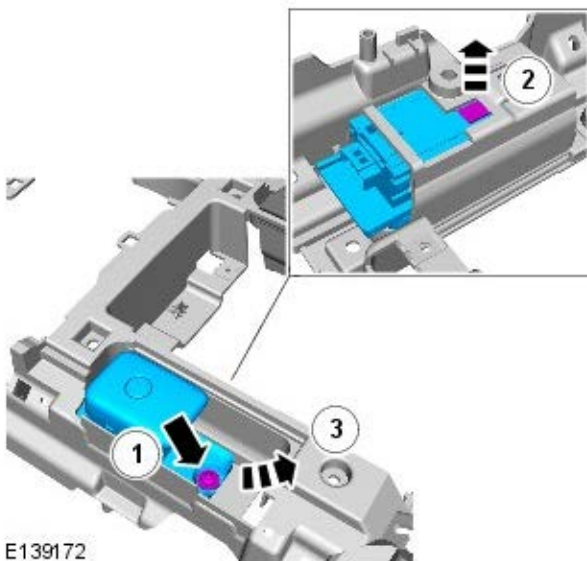
E129849

18.



E 129851

19.



E139172

Installation

1. To install, reverse the removal procedure.

Instrument Panel and Console - Instrument Panel Upper Section

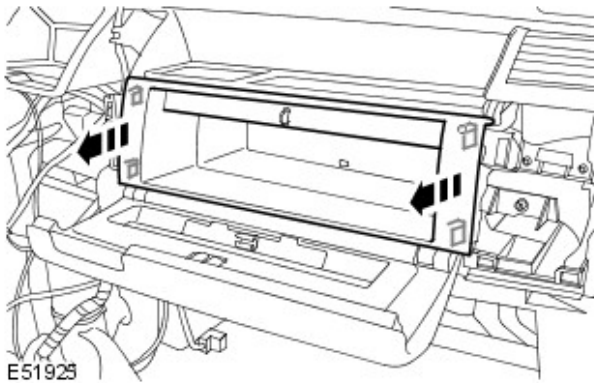
Removal and Installation

Removal



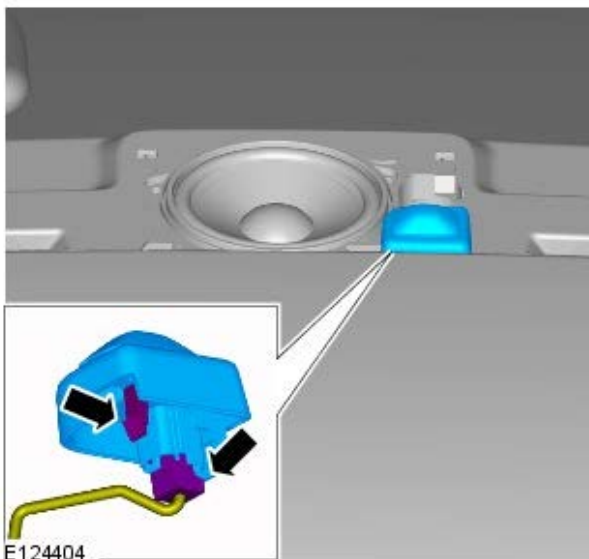
NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00 General Information, Description and Operation).
3. Remove the instrument panel driver side reinforcement.
For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).
4. Remove the passenger side register trim panel.
For additional information, refer to: Passenger Side Register Trim Panel (412-01, Removal and Installation).
5. Remove the stowage compartment tray.
 - Release the 4 clips.



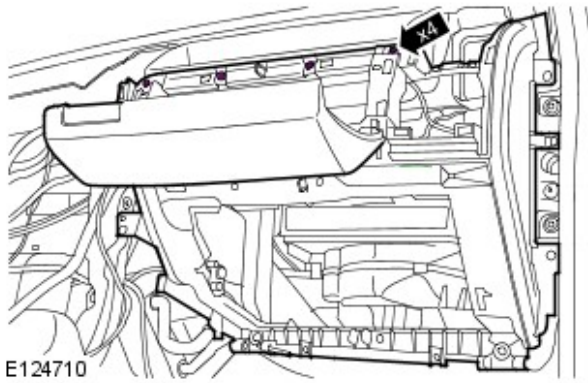
E51929

6. Remove the instrument panel speaker.
For additional information, refer to: Instrument Panel Speaker (415-03 Speakers, Removal and Installation).
7. Remove both A-pillar upper trim panels.
For additional information, refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
8. Remove the sunload sensor.
 - Release the clips.
 - Disconnect the electrical connector.

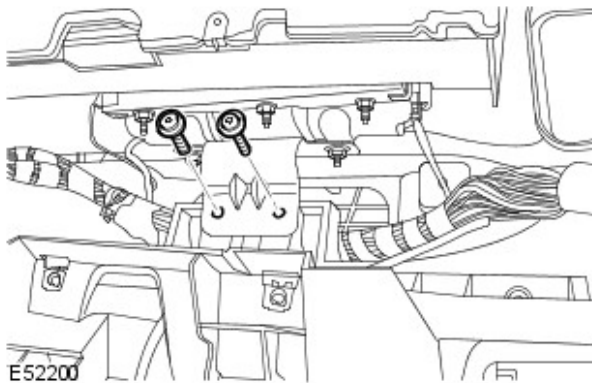


E124404

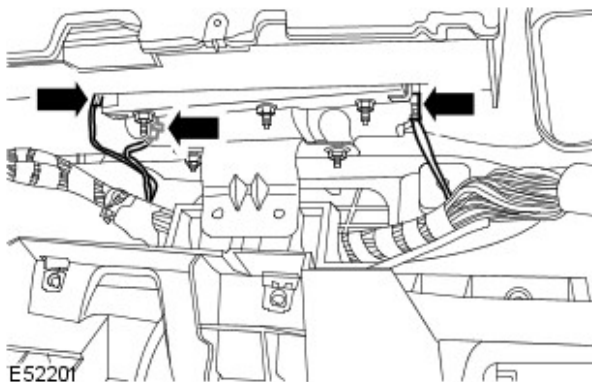
9. Remove the instrument panel passenger side reinforcement upper retaining screws.




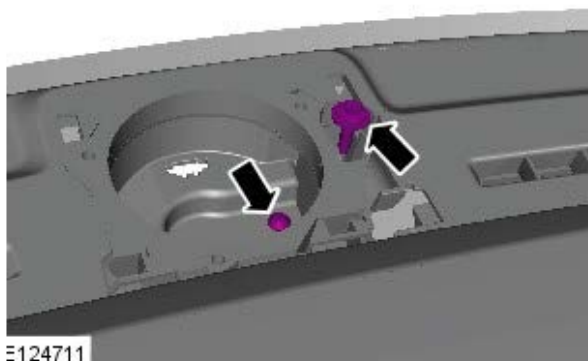
10. Release the passenger air bag module bracket.
 - Remove the 2 Torx screws.



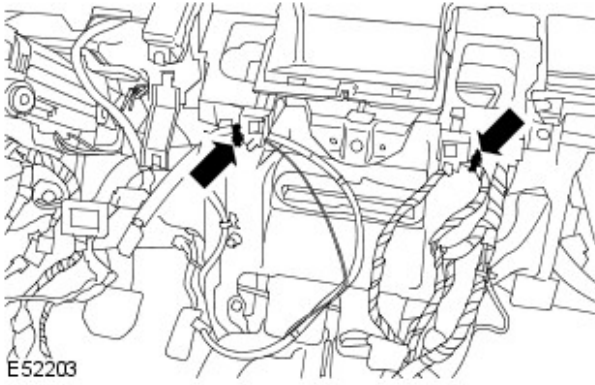
11. Disconnect the 3 electrical connectors from the passenger air bag module.
 - Disconnect the 3 electrical connectors from the passenger air bag module.



12.  **NOTE:** Avoid dropping the screw inside the instrument panel.
Remove 1 Torx screw and 1 bolt, from the instrument panel upper section speaker aperture.

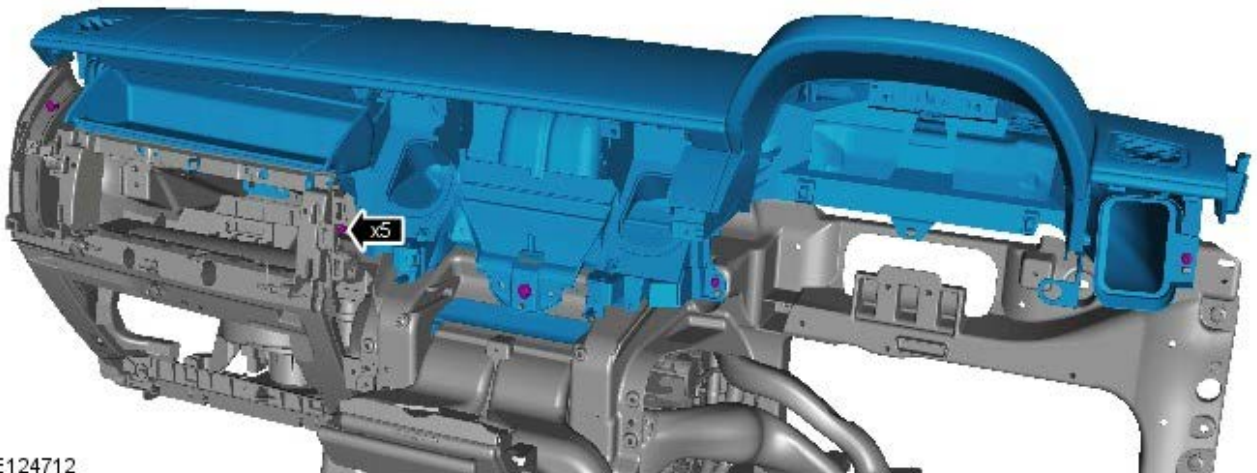


13. Release the instrument panel wiring harness.
 - Release the 2 clips.



E52203

14. With assistance, remove the instrument panel upper section.
 - Remove the 5 Torx screws.



E124712



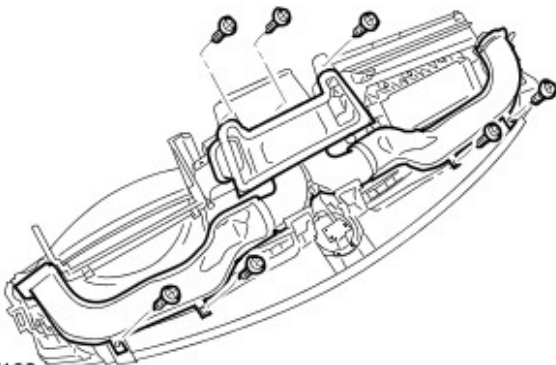
E47176

15.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the passenger air bag module.

- Remove the 4 nuts.

16. Remove the windshield defroster duct.
 - Remove the 7 screws.



E47193

Installation

1. Install the windshield defroster duct.
 - Tighten the screws.
2. Install the passenger air bag module.
 - Tighten the nuts to 10 Nm (7 lb.ft).
3. With assistance, install the instrument panel upper section.
 - Tighten the screws.
 - Attach the wiring harness.
4. Tighten the instrument panel upper section speaker aperture bolt to 10 Nm (7 lb.ft).
5. Secure the passenger air bag module bracket.
 - Tighten the Torx screws to 25 Nm (18 lb.ft).
6. Connect the passenger air bag module electrical connectors.
7. Install the instrument panel passenger side reinforcement upper retaining screws.
8. Install the sunload sensor.
 - Connect the electrical connector.
 - Secure with the clips.
9. Install the A-pillar trim panels.
For additional information, refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
10. Install the speaker
For additional information, refer to: Instrument Panel Speaker (415-03 Speakers, Removal and Installation).
11. Install the stowage compartment tray.
 - Secure the 4 clips.
12. Install the passenger side register trim panel.
For additional information, refer to: Passenger Side Register Trim Panel (412-01, Removal and Installation).
13. Install the instrument panel driver side reinforcement.
For additional information, refer to: Instrument Panel Driver Side Reinforcement (501-12, Removal and Installation).
14. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).


Instrument Panel and Console - Instrument Panel

Removal and Installation

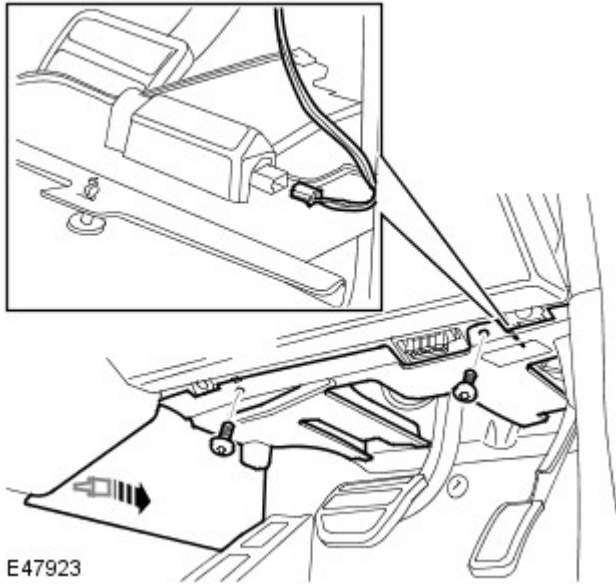
Removal



NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

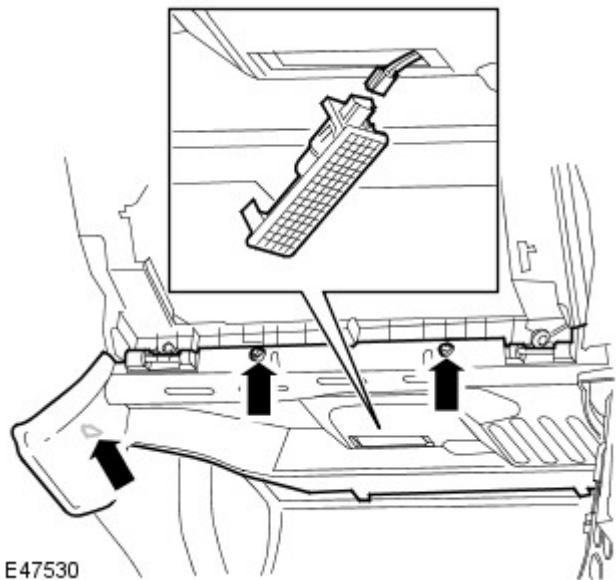
1. Remove the engine cover.
For additional information, refer to: Engine Cover - V6 4.0L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation) / Engine Cover - V8 5.0L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation) / Engine Cover - 2.7L V6 - TdV6 (501-05 Interior Trim and Ornamentation, Removal and Installation) / [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Evacuate the air conditioning (A/C) system.
For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
3.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.
4. Drain the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - TDV6 2.7L Diesel, General Procedures) / [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures) / Cooling System Draining, Filling and Bleeding (303-03C, General Procedures) / Cooling System Partial Draining, Filling and Bleeding (303-03B, General Procedures).
5. Remove the floor console.
For additional information, refer to: [Floor Console](#) (501-12 Instrument Panel and Console, Removal and Installation).
6. Remove both cowl side trim panels.
For additional information, refer to: [Cowl Side Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
7. Remove the driver side closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.



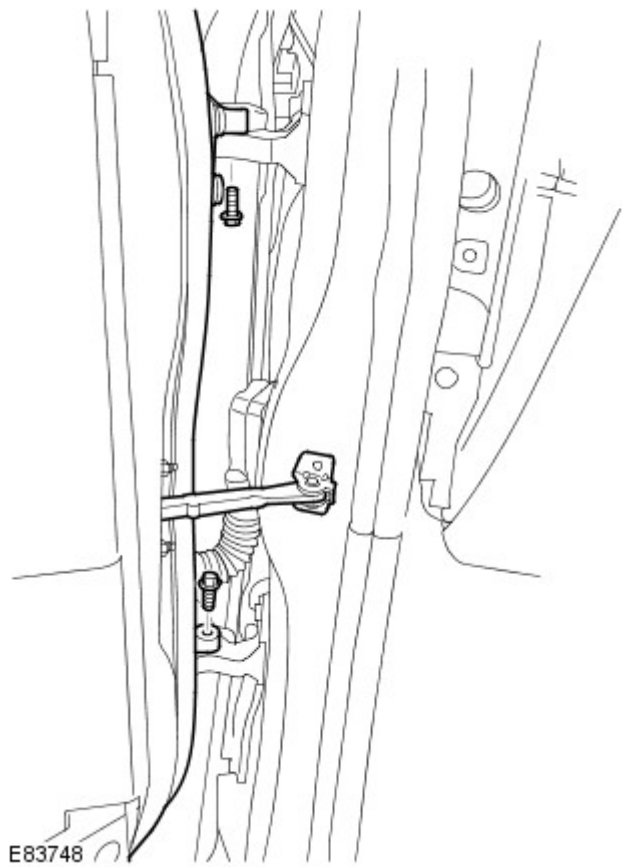
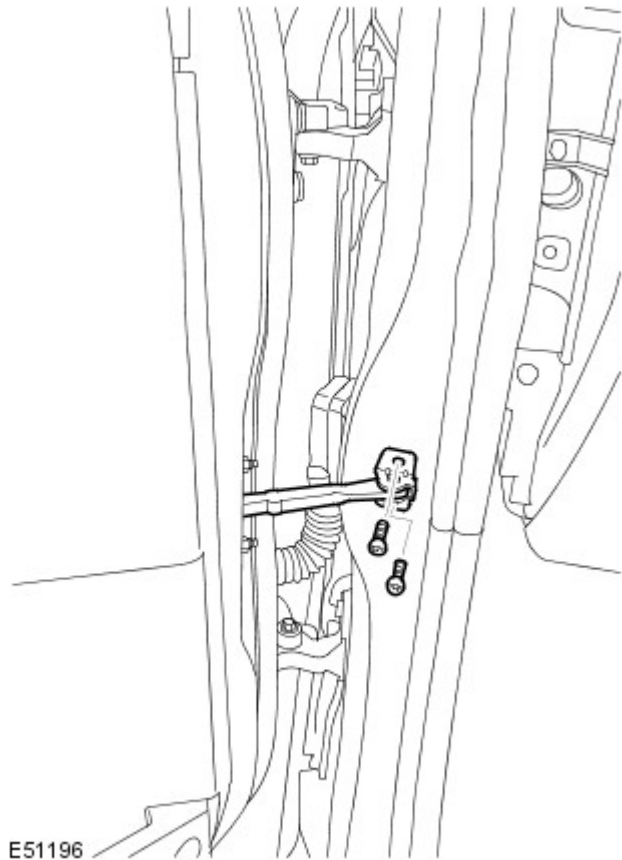
E47923


8. Remove the passenger side closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.



E47530

9. Release the door check strap from the A-pillar.
 - Remove the 2 Torx bolts.

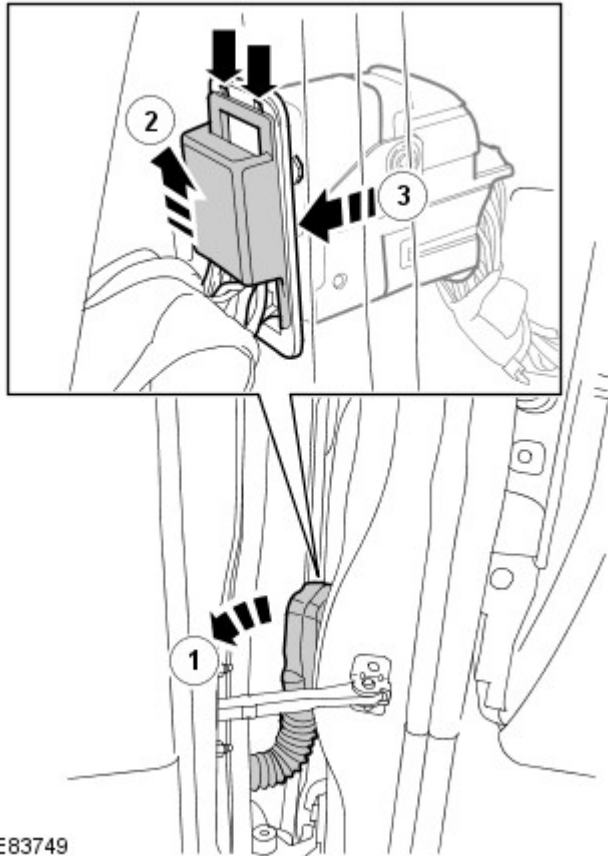


10.  NOTE: The door is still attached by its harness at this stage.

With assistance, release and support the door assembly.

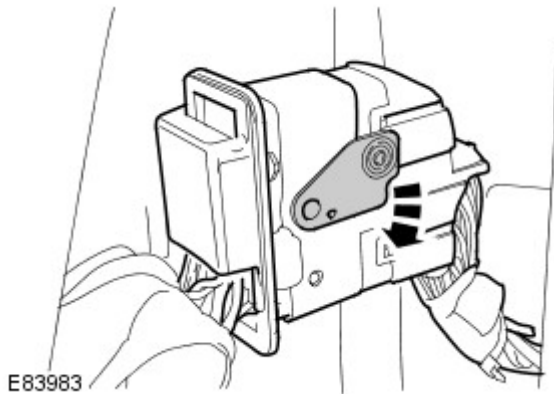
- Remove the 2 bolts.

11. Release the electrical connector from the A-Pillar.
- Release the grommet.
 - Carefully release, then slide the latch to locate in the indents, arrowed.



E83749

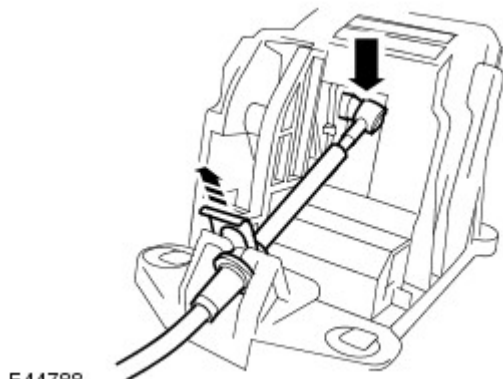
12. Remove the door.
 - Disconnect the electrical connector.



E83983

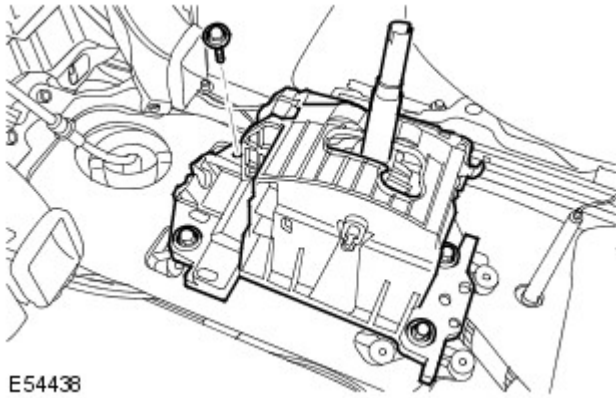
13. Remove the front seats.
For additional information, refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).

14. Release the transmission selector lever cable.
 - Remove the clip.
 - Release the cable.



E44788

15. Remove the transmission selector lever.
 - Remove the 4 bolts.



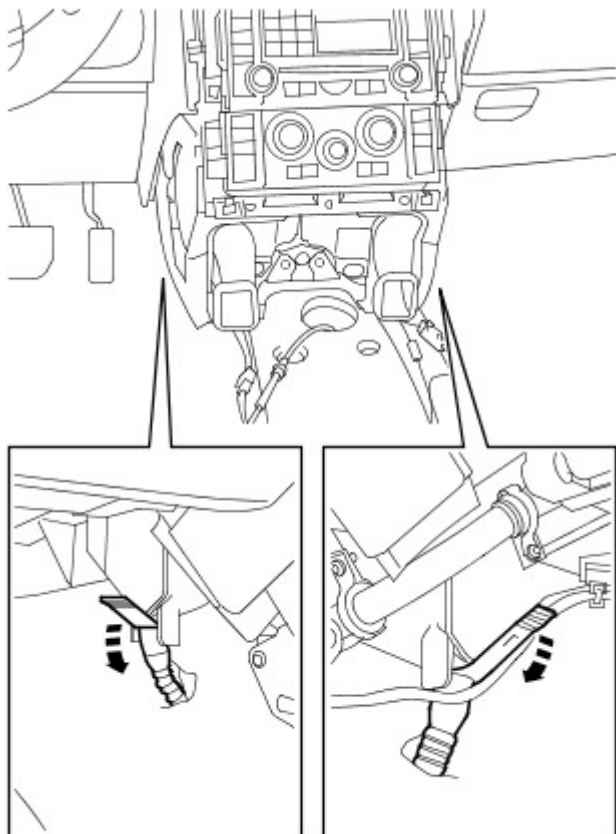
E54438

16. Disconnect the steering column intermediate shaft from the steering column.
 - Note the fitted position.
 - Remove the special bolt and discard the nut.



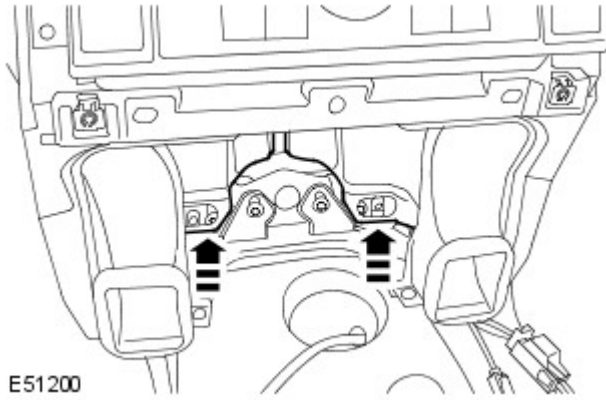
E49465

17. Disconnect 2 drain tubes from the heater housing.

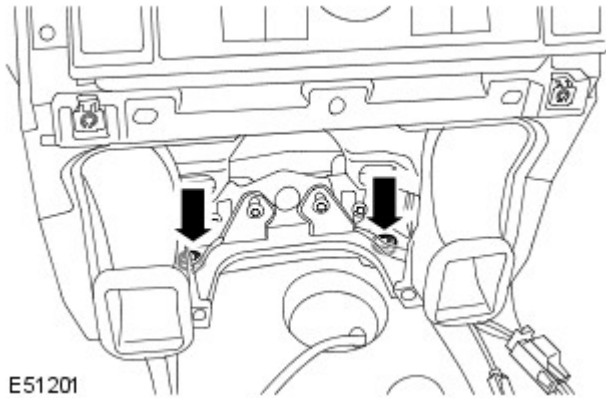


E51199

18. Position the heater housing center ducts aside for access.

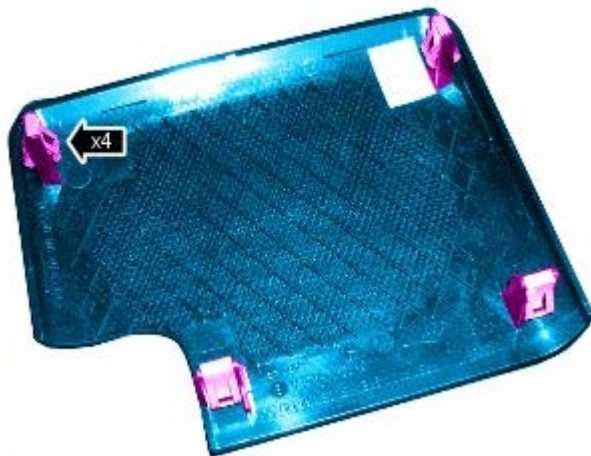


19. Remove 2 Torx bolts from the instrument panel center bracket.

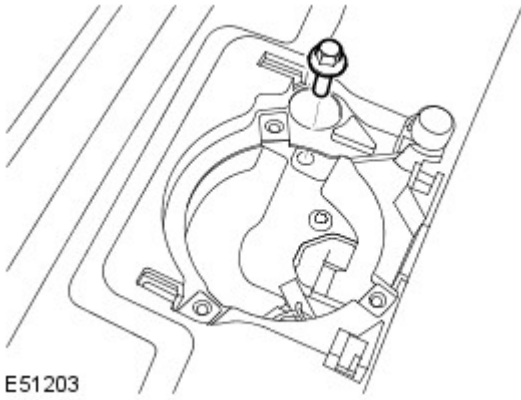


20. Remove the instrument panel center speaker grille.

- Release the 4 clips.



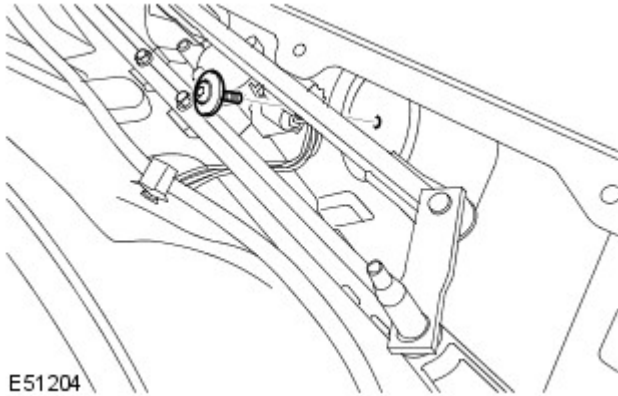
21. Remove the instrument panel upper section to body bolt.




E51203

22. Remove the plenum chamber panel.
For additional information, refer to: [Plenum Chamber](#) (412-01 Air Distribution and Filtering, Removal and Installation).

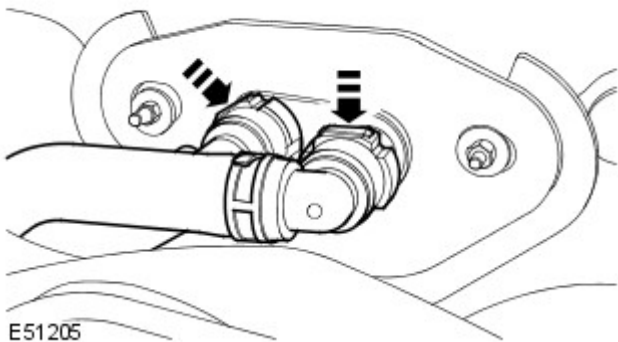
23. Remove the instrument panel carrier to bulkhead Torx bolt.



E51204

24.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

- Disconnect 2 heater hoses from the bulkhead.
- Release the 2 clips.

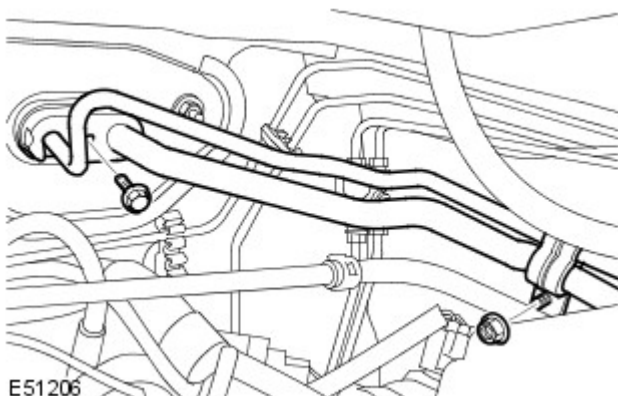


E51205

25. Release 2 A/C lines from the body.
 - Remove the nut.

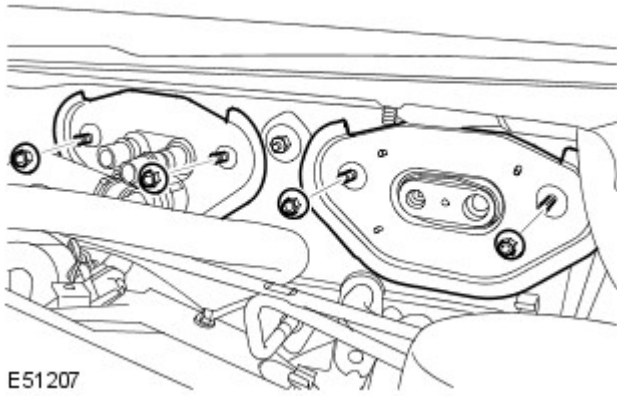
26.  **CAUTION:** Immediately cap all refrigerant lines to prevent ingress of dirt and moisture.

- Release 2 A/C lines from the bulkhead.
- Remove the bolt.
 - Remove and discard the O-ring seals.

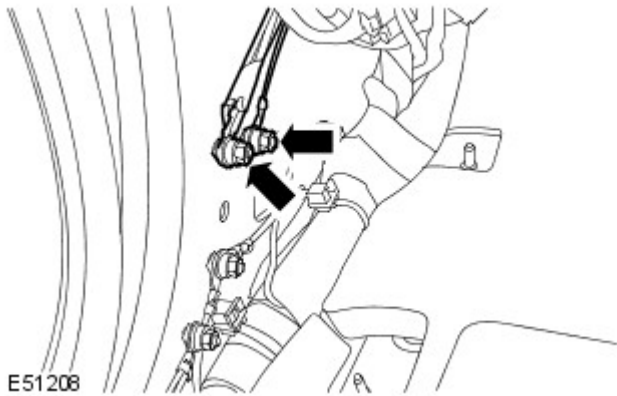


E51206

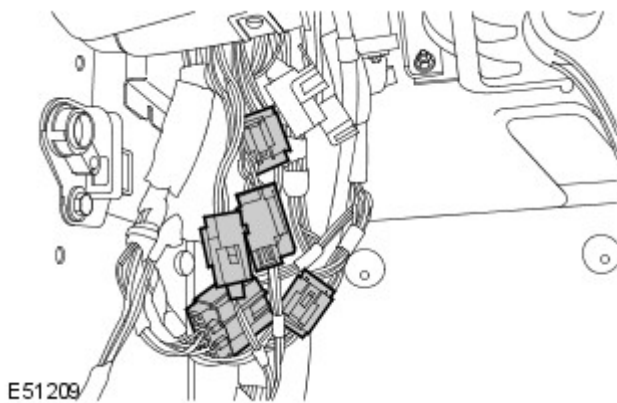
27. Remove the 2 adapter panels.
 - Remove the 4 nuts.



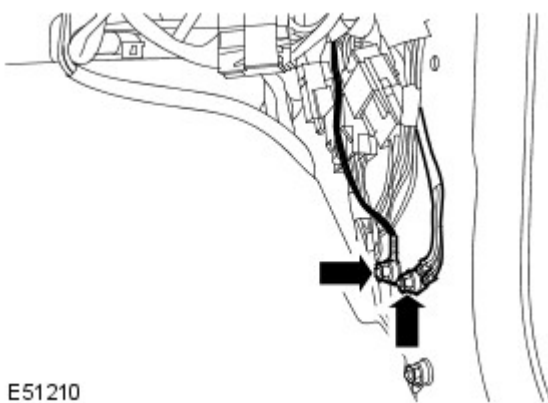
28. Release the 3 ground cables from the driver side lower A-pillar.
 - Remove the 2 nuts.



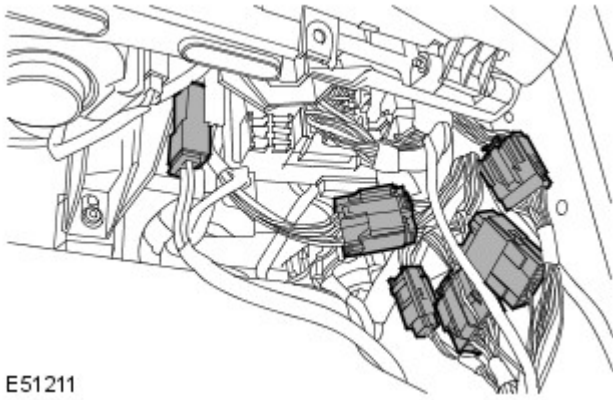
29. Disconnect the 5 electrical connectors from the driver side lower A-pillar.



30. Release the 3 ground cables from the passenger side lower A-pillar.
 - Remove the 2 nuts.

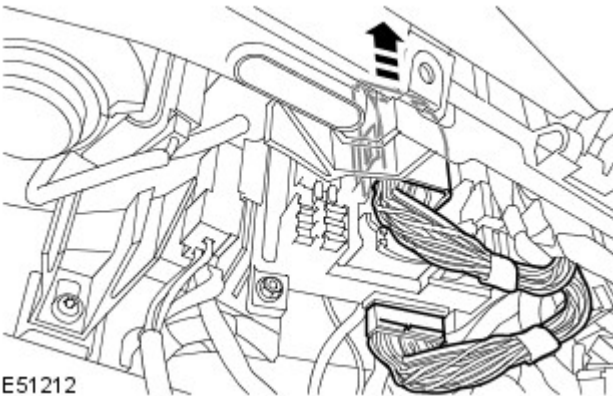


31. Disconnect the 5 electrical connectors from the passenger side lower A-pillar.
32. Disconnect the heater motor electrical connector.



E51211

33. Disconnect 2 central junction box (CJB) electrical connectors.



E51212

34. Disconnect 2 electrical connectors from the instrument panel center reinforcement.

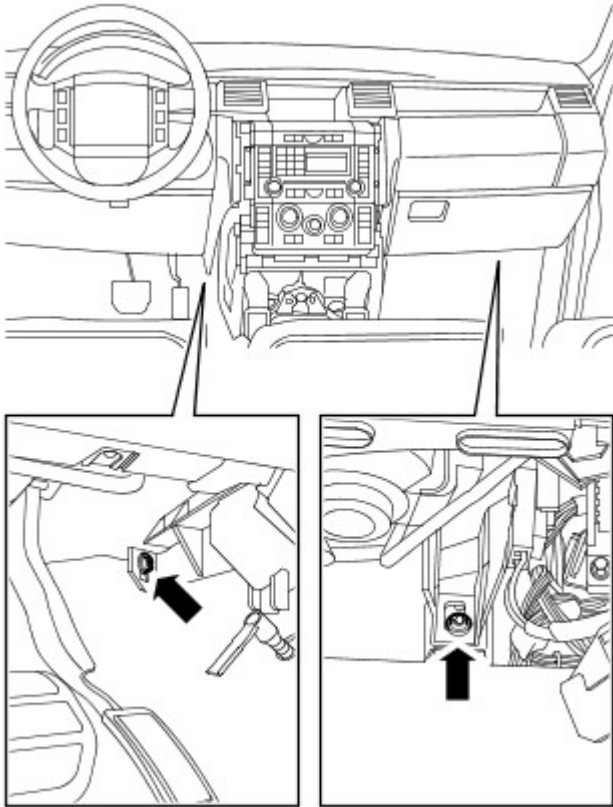
35. If installed, disconnect the instrument panel center reinforcement fibre optic cables.
 - Disconnect the electrical connector.



E51213

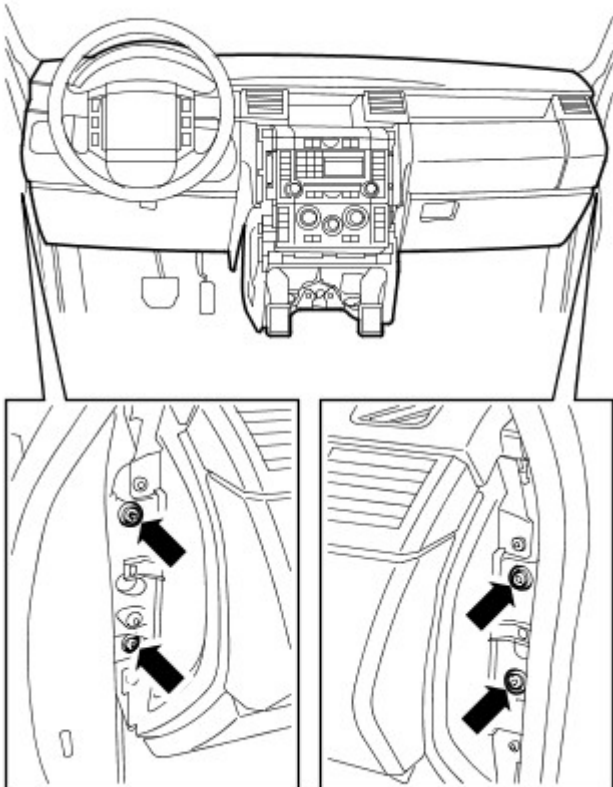
36. Driver side: Remove the heater housing to bulkhead Torx bolt.

37. Passenger side: Remove the heater housing to bulkhead Torx bolt.



E51214

38. With assistance, remove the instrument panel.
- Remove the 4 Torx bolts.



E51215

Installation

1. With assistance, install the instrument panel.
 - Tighten the Torx bolts to 25 Nm (18 lb.ft).
2. Passenger side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).

3. Driver side: Install the heater housing to bulkhead Torx bolt and tighten to 6 Nm (4 lb.ft).
4. Connect the instrument panel center reinforcement fibre optic cables.
5. Connect the instrument panel center reinforcement electrical connectors.
6. Connect the CJB electrical connectors.
7. Connect the heater motor electrical connector.
8. Connect the electrical connectors to the passenger side lower A-pillar.
9. Connect the ground cables to the passenger side lower A-pillar.
 - Tighten the nuts to 10 Nm (7 lb.ft).
10. Connect the electrical connectors to the driver side lower A-pillar.
11. Connect the ground cables to the driver side lower A-pillar.
 - Tighten the nuts to 10 Nm (7 lb.ft).
12. Install the adapter panels.
 - Tighten the nuts to 10 Nm (7 lb.ft).
13. Secure the A/C lines to the bulkhead.
 - Clean the components.
 - Install new O-ring seals.
 - Tighten the bolt to 10 Nm (7 lb.ft).
14. Secure the A/C lines to the body.
 - Tighten the nuts to 10 Nm (7 lb.ft).
15. Connect the bulkhead heater hoses.
16. Install the instrument panel carrier to bulkhead Torx bolt and tighten to 25 Nm (18 lb.ft).
17. Install the plenum chamber panel.
For additional information, refer to: [Plenum Chamber](#) (412-01 Air Distribution and Filtering, Removal and Installation).
18. Install the instrument panel upper section to body bolt and tighten to 10 Nm (7 lb.ft).
19. Install the speaker grille.
 - Secure with the clips.
20. Install the instrument panel center bracket Torx bolts and tighten to 25 Nm (18 lb.ft).
21. Attach the heater housing center ducts.
22. Connect the drain tubes to the heater housing.
23. Connect the steering column intermediate shaft.
 - Install the special bolt and tighten the new nut to 22 Nm (16 lb.ft).
24. Install the transmission selector lever.
 - Tighten the bolts to 10 Nm (7 lb.ft).
25. Attach the transmission selector lever cable.
 - Install the clip.
26. Install the front seats.
For additional information, refer to: [Front Seat](#) (501-10 Seating, Removal and Installation).

27. With assistance, install the door assembly.
 - Connect the electrical connector.
 - Secure the electrical connector.
 - Secure the grommet.
 - Tighten the bolts to 10 Nm (7 lb.ft).
28. Attach the door check strap to the A pillar.
 - Tighten the Torx bolts to 10 Nm (7 lb.ft).
29. Install the driver side closing trim panel.
 - Connect the electrical connector.
 - Secure the clip.
 - Tighten the screws.
30. Install the passenger side closing trim panel.
 - Connect the electrical connector.
 - Secure the clip.
 - Tighten the screws.
31. Install the cowl side trim panels.
For additional information, refer to: [Cowl Side Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).
32. Install the floor console.
For additional information, refer to: [Floor Console](#) (501-12 Instrument Panel and Console, Removal and Installation).
33. Refill the cooling system.
For additional information, refer to: Cooling System Draining, Filling and Bleeding (303-03 Engine Cooling - TDV6 2.7L Diesel, General Procedures) / [Cooling System Draining, Filling and Bleeding](#) (303-03A Engine Cooling - TDV6 3.0L Diesel, General Procedures) / Cooling System Draining, Filling and Bleeding (303-03C, General Procedures) / Cooling System Partial Draining, Filling and Bleeding (303-03B, General Procedures).
34. Recharge the A/C system.
For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
35. Install the engine cover.
For additional information, refer to: Engine Cover - V6 4.0L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation) / Engine Cover - V8 5.0L Petrol (501-05 Interior Trim and Ornamentation, Removal and Installation) / Engine Cover - 2.7L V6 - TdV6 (501-05 Interior Trim and Ornamentation, Removal and Installation) / [Engine Cover - TDV6 3.0L Diesel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).

Instrument Panel and Console - Instrument Panel Driver Side Reinforcement

Removal and Installation

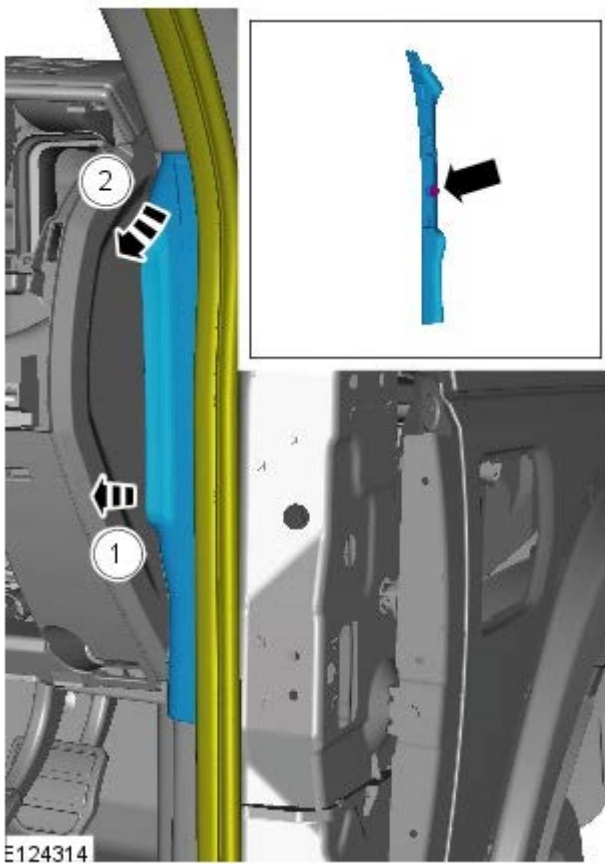
Removal



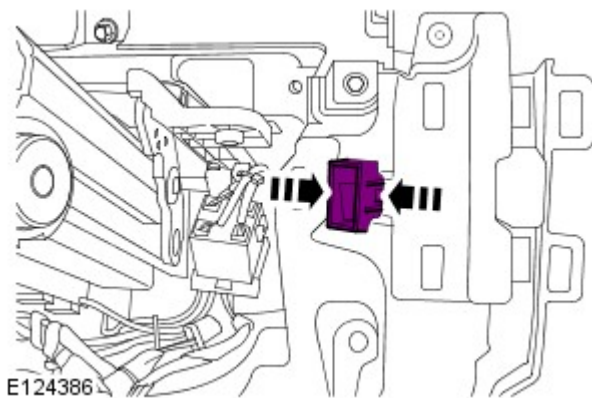
NOTE: Removal steps in this procedure may contain installation details.

1. Fully extend the steering column for access.
2. Refer to: Steering Wheel (211-04, Removal and Installation).
3. Refer to: Instrument Panel Center Reinforcement (501-12, Removal and Installation).
4. Refer to: Instrument Cluster (413-01, Removal and Installation).

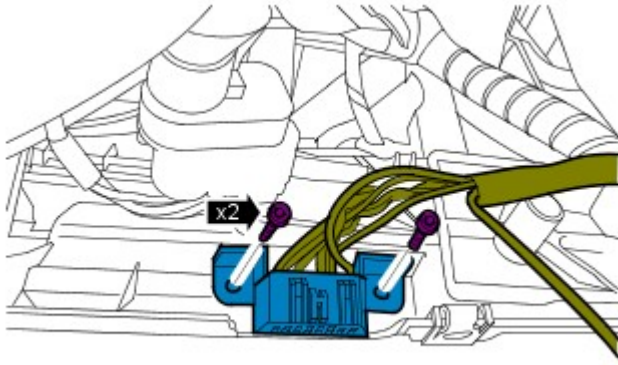
5.



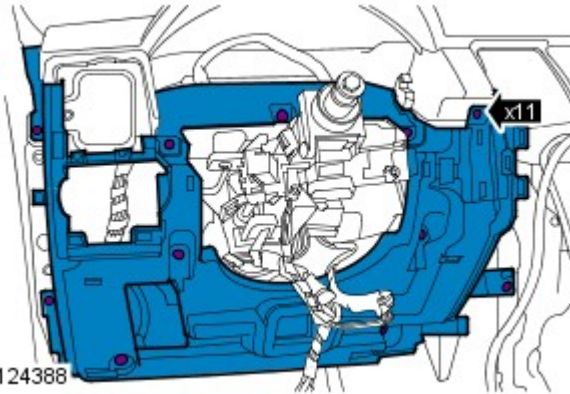
6.



7.



E124387



E124388

8.  NOTE: Left-hand drive shown, right-hand drive similar.

Installation

1. To install, reverse the removal procedure.

Instrument Panel and Console - Instrument Panel Passenger Side Reinforcement

Removal and Installation

Removal

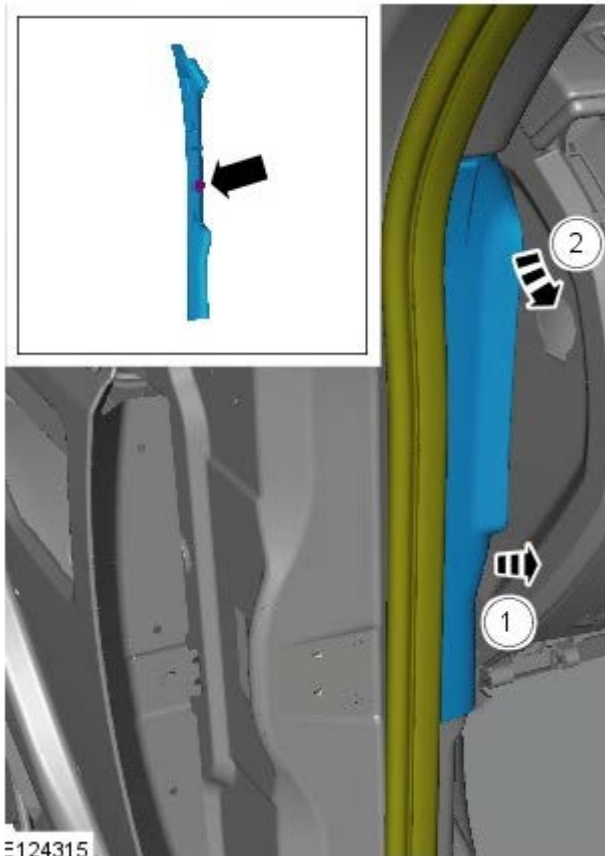


NOTE: Some variation in the illustrations may occur, but the essential information is always correct.

1. Remove the PAD switch.
For additional information, refer to: Passenger Air Bag Deactivation (PAD) Switch (501-20 Supplemental Restraint System, Removal and Installation).
2. Remove the instrument panel center reinforcement.
For additional information, refer to: Instrument Panel Center Reinforcement (501-12, Removal and Installation).
3. Remove the glove compartment.
For additional information, refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).

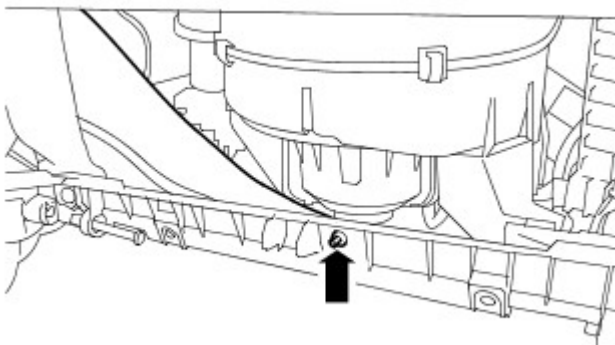
4. Detach the door weatherstrip and remove the side trim panel.

1. Release the trim panel retaining clip.
2. Remove the trim panel.

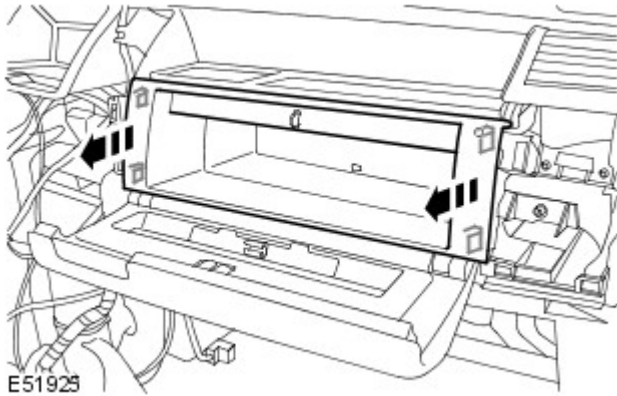


E124315

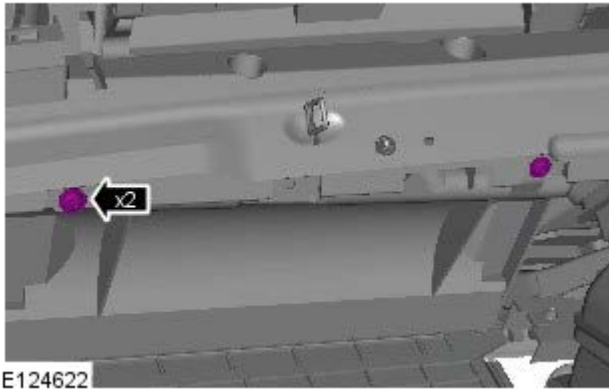
5. Remove the passenger side footwell duct.
 - Remove the clip.



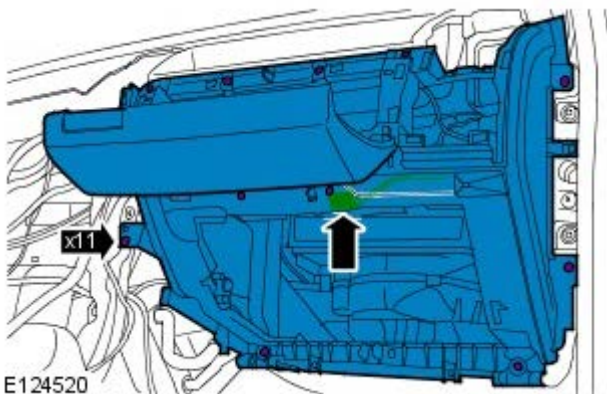
E51923



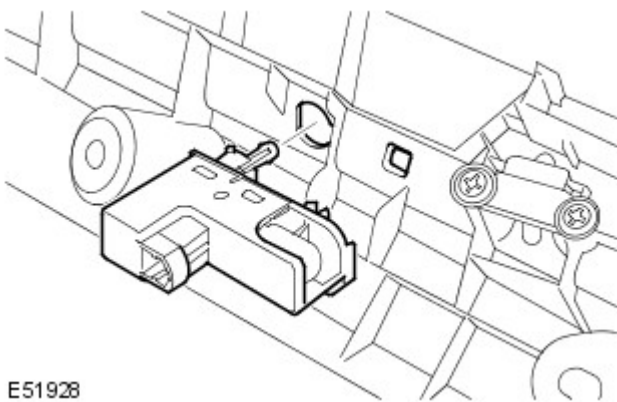
6. Remove the stowage compartment tray.
 - Release the 4 clips.



7. Remove the passenger side support bracket lower retaining screws.



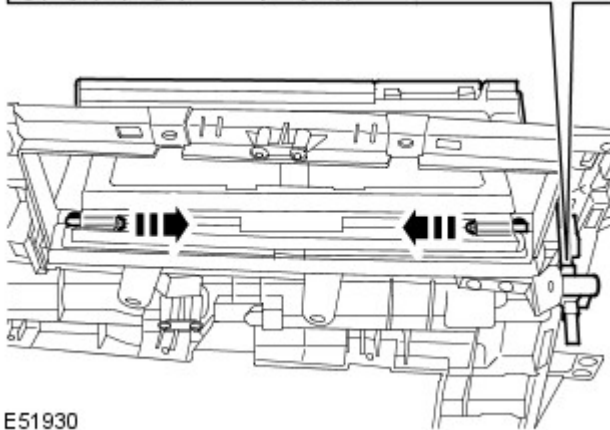
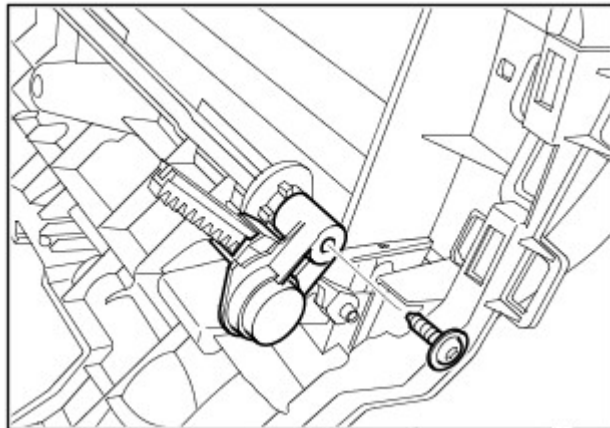
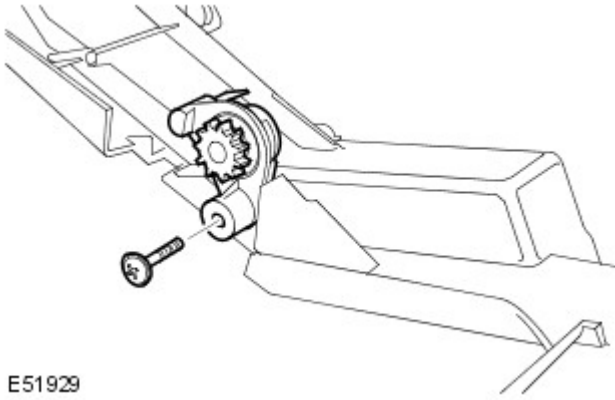
8. Remove the instrument panel passenger side reinforcement.
 - Remove the 11 Torx screws.
 - Disconnect the electrical connector.



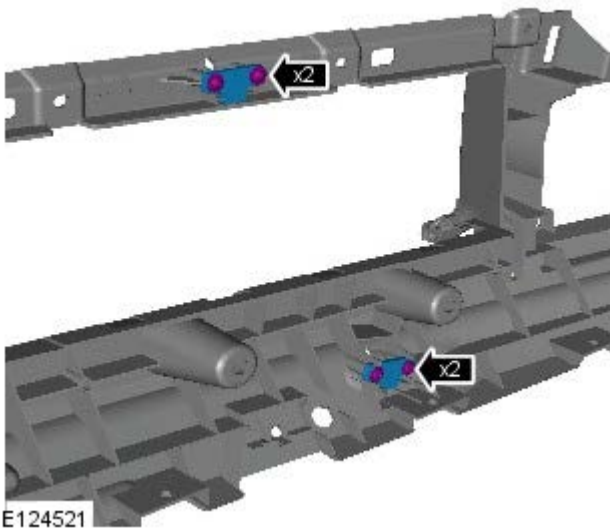
9.  **NOTE:** Do not disassemble further if the component is removed for access only.


Remove the glove compartment lamp.

10. Remove the glove compartment damper.
 - Remove the Torx screw.



E51930



11.  **NOTE:** Note the position of the hinge pin and spring prior to removal.

Remove the stowage compartment lid.

- Remove the 2 hinge pins.
- Release the 2 hinge springs.
- Remove the Torx screw and remove the damper.

12. Remove the glove and stowage compartment strikers.

- Remove the 4 Torx screws.

1. Install the glove compartment damper.
 - Tighten the Torx screw.
2. Install the stowage compartment lid.
 - Install the damper and tighten the Torx screw.
 - Attach the hinge springs.
 - Install the hinge springs.
3. Install the glove and stowage compartment strikers.
 - Tighten the screws.
4. Install the glove compartment lamp.
5. Install the instrument panel passenger side reinforcement.
 - Connect the electrical connector.
 - Tighten the Torx screws.
6. Install the passenger side support bracket lower retaining screws.
7. Install the passenger side footwell duct.
 - Install the clip.
8. Install the stowage compartment tray.
 - Secure the clips.
9. Install the side trim panel and attach the door weatherstrip.
10. Install the glove compartment.
For additional information, refer to: Glove Compartment (501-12 Instrument Panel and Console, Removal and Installation).
11. Install the instrument panel center reinforcement.
For additional information, refer to: Instrument Panel Center Reinforcement (501-12, Removal and Installation).
12. Install the PAD switch.
For additional information, refer to: Passenger Air Bag Deactivation (PAD) Switch (501-20 Supplemental Restraint System, Removal and Installation).

Instrument Panel and Console - Instrument Panel Center Reinforcement

Removal and Installation

Removal

NOTES:



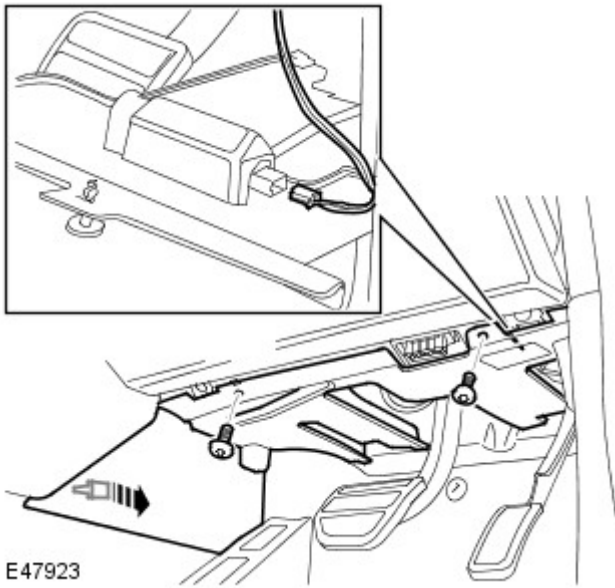
Removal steps in this procedure may contain installation details.



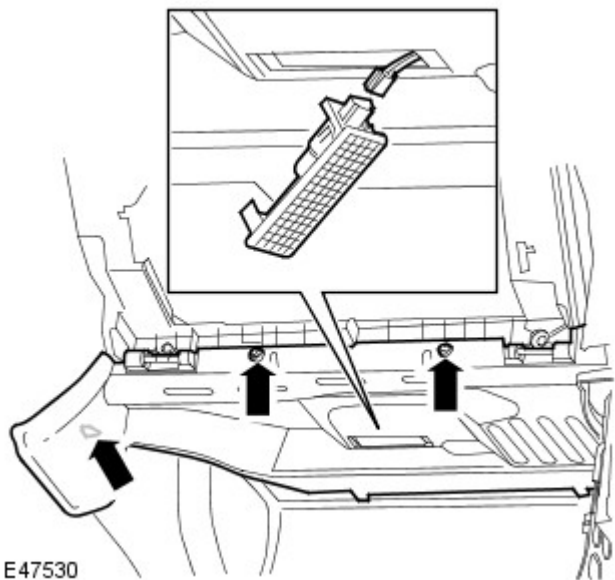
Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Floor Console (501-12, Removal and Installation).

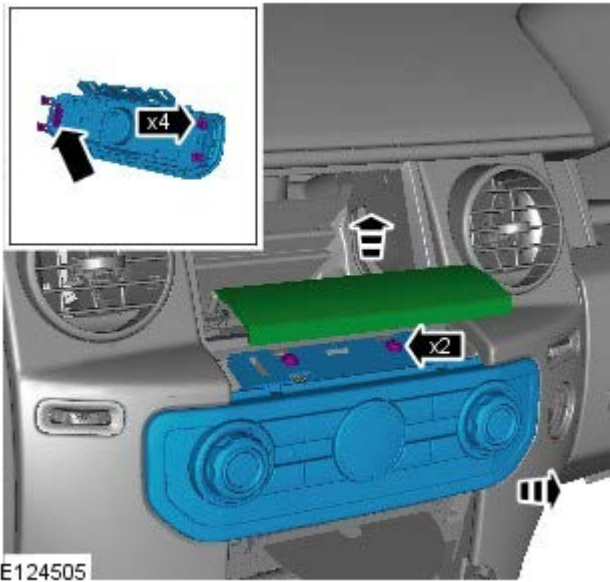
2.



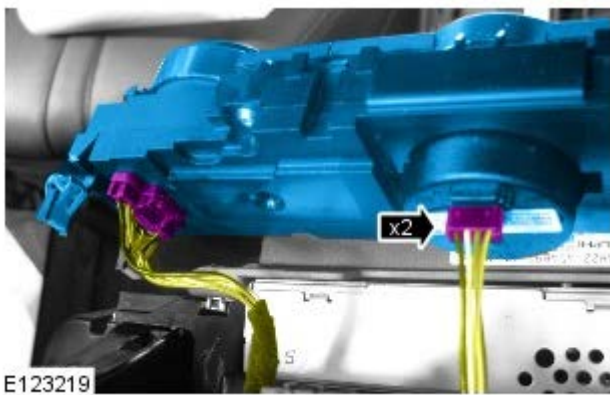
3.



4.



E124505




E123219

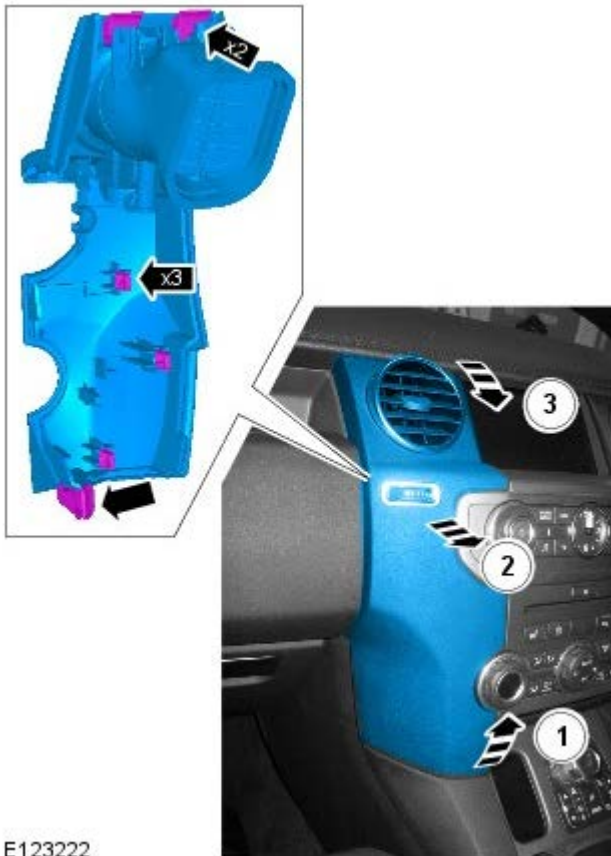


E122691

5.

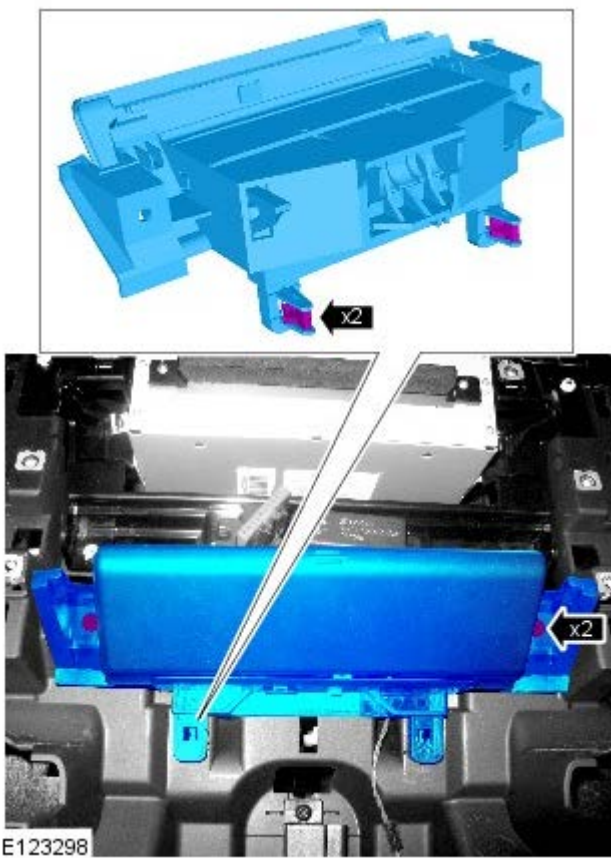
6.  NOTE: LHD shown, RHD similar.

7.  NOTE: RHD shown, LHD similar.



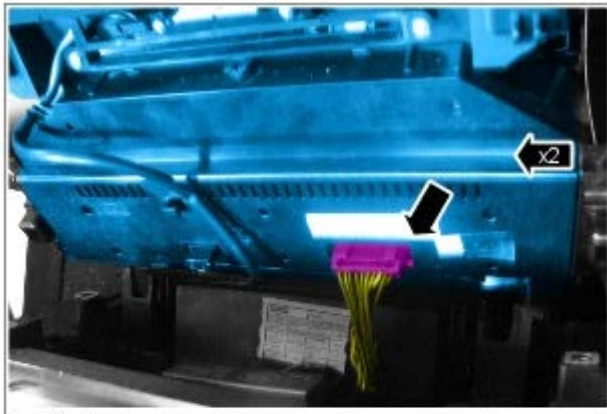
E123222

8.



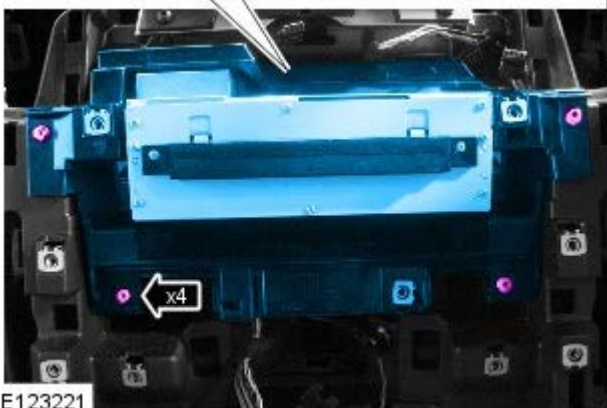
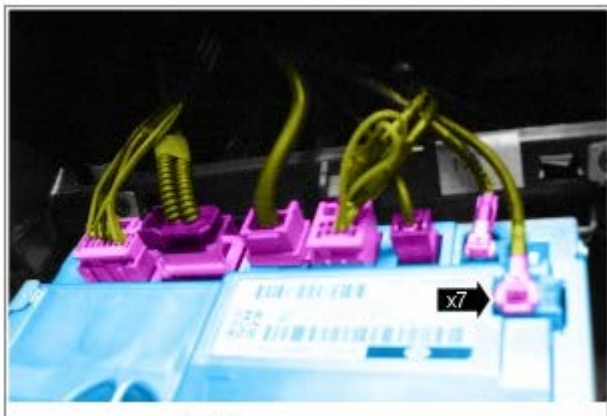
E123298

9.



E123220

10.



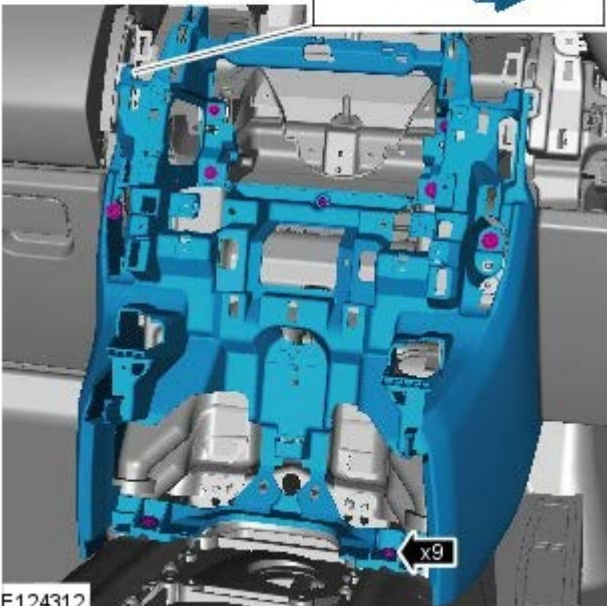
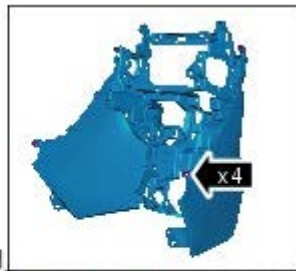
E123221

11.



E 122790

12.



E124312

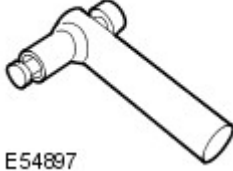
Installation

1. To install, reverse the removal procedure.

Instrument Panel and Console - Glove Compartment

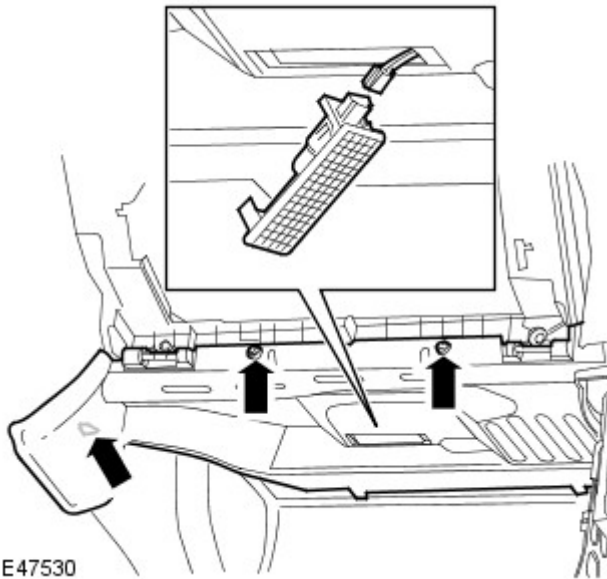
Removal and Installation

Special Tool(s)

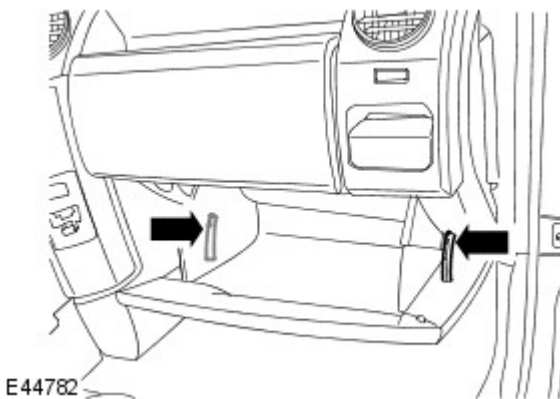
 <p>501-113</p> <p>E54897</p>	<p>Glove compartment hinge pin remover</p> <p>501-113</p>
--	---


Removal

1. Remove the closing trim panel.
 - Release the clip.
 - Remove the 2 screws.
 - Disconnect the electrical connector.



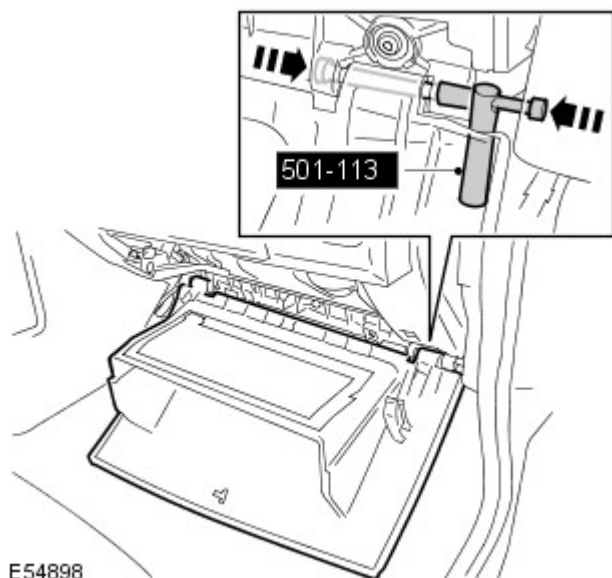
2. Open the glove compartment to the service condition.
 - Release the glove compartment latch stops.



3.  **CAUTION:** If the hinge pin will not release, rotate the pin through 90 degrees to aid removal.

Using the special tool, remove the glove compartment.

- Apply pressure to the head of the hinge pin and install the special tool. Remove the hinge pin.
- Repeat the above procedure for the remaining hinge pin.



Installation

1. Install the glove compartment.
 - Install the hinge pins.
2. Close the glove compartment.
 - Secure the latch stops.
3. Install the closing trim panel.
 - Connect the electrical connector.
 - Secure the clip.
 - Tighten the screws.

Instrument Panel and Console - Instrument Panel Console Switch Assembly

Removal and Installation

Removal

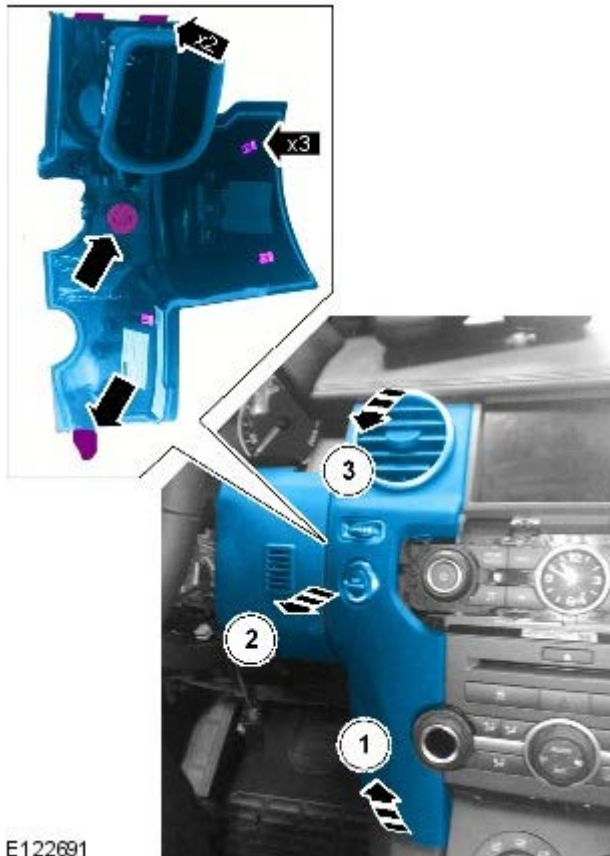
NOTES:



Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.



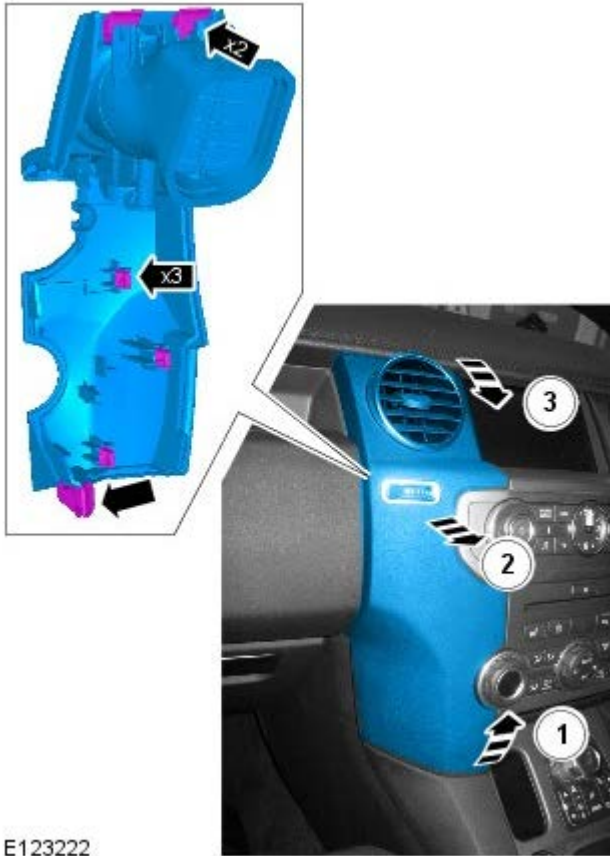
E122691



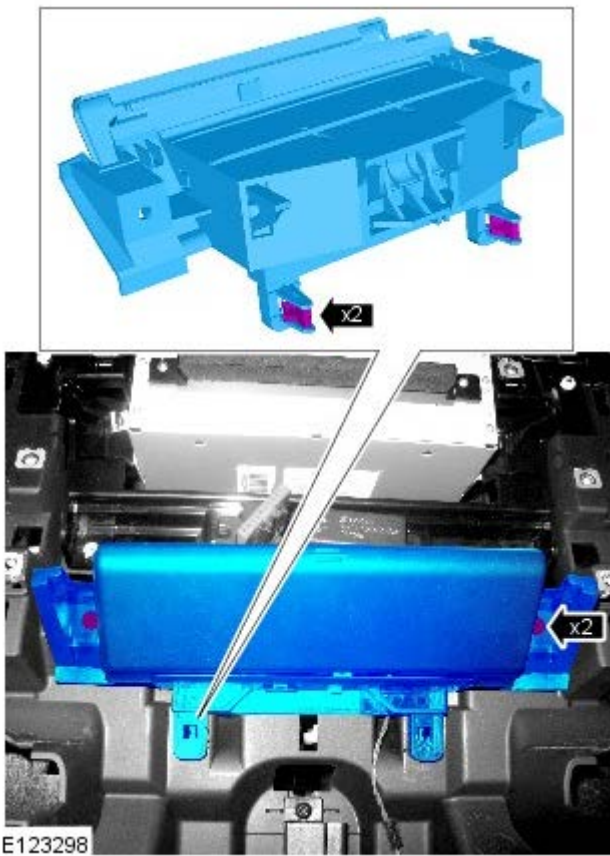
1. NOTE: LHD shown, RHD similar.



2. NOTE: RHD shown, LHD similar.



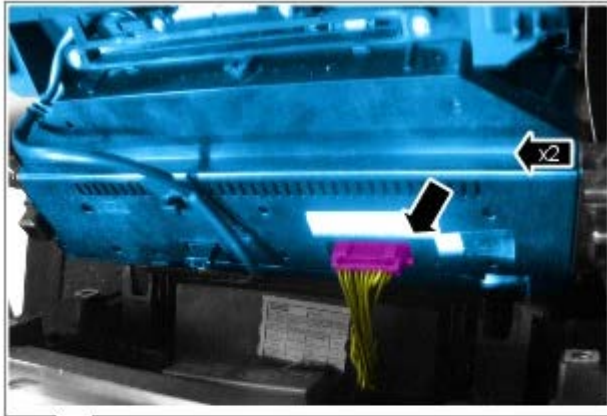
E123222



E123298

3.  NOTE: Floor console shown removed for clarity.

4.



E123220

Installation

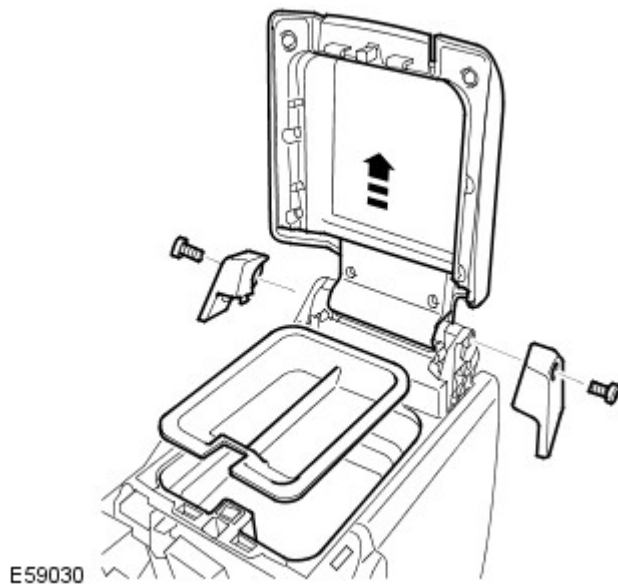
1. To install, reverse the removal procedure.

Instrument Panel and Console - Cool Box

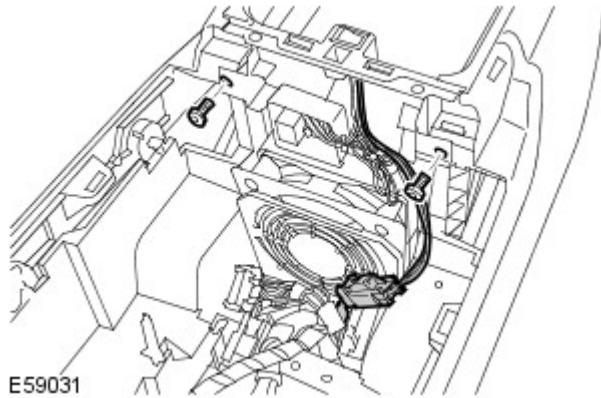
Removal and Installation

Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the floor console upper panel.
For additional information, refer to: Floor Console Upper Panel (501-12, Removal and Installation).
3. Remove the floor console lid.
 - Open the lid.
 - Remove the 2 Torx bolts.
 - Remove the 2 covers.



4. Remove the floor console cool box.
 - Remove the 2 Torx screws.
 - Disconnect the electrical connector.



Installation

1. Install the floor console cool box.
 - Connect the electrical connector.
 - Tighten the screws.
2. Install the floor console lid.
 - Install the covers.
 - Tighten the Torx bolts to 3 Nm (2 lb.ft).
3. Install the floor console upper panel.
For additional information, refer to: Floor Console Upper Panel (501-12, Removal and Installation).
4. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

Handles, Locks, Latches and Entry Systems -

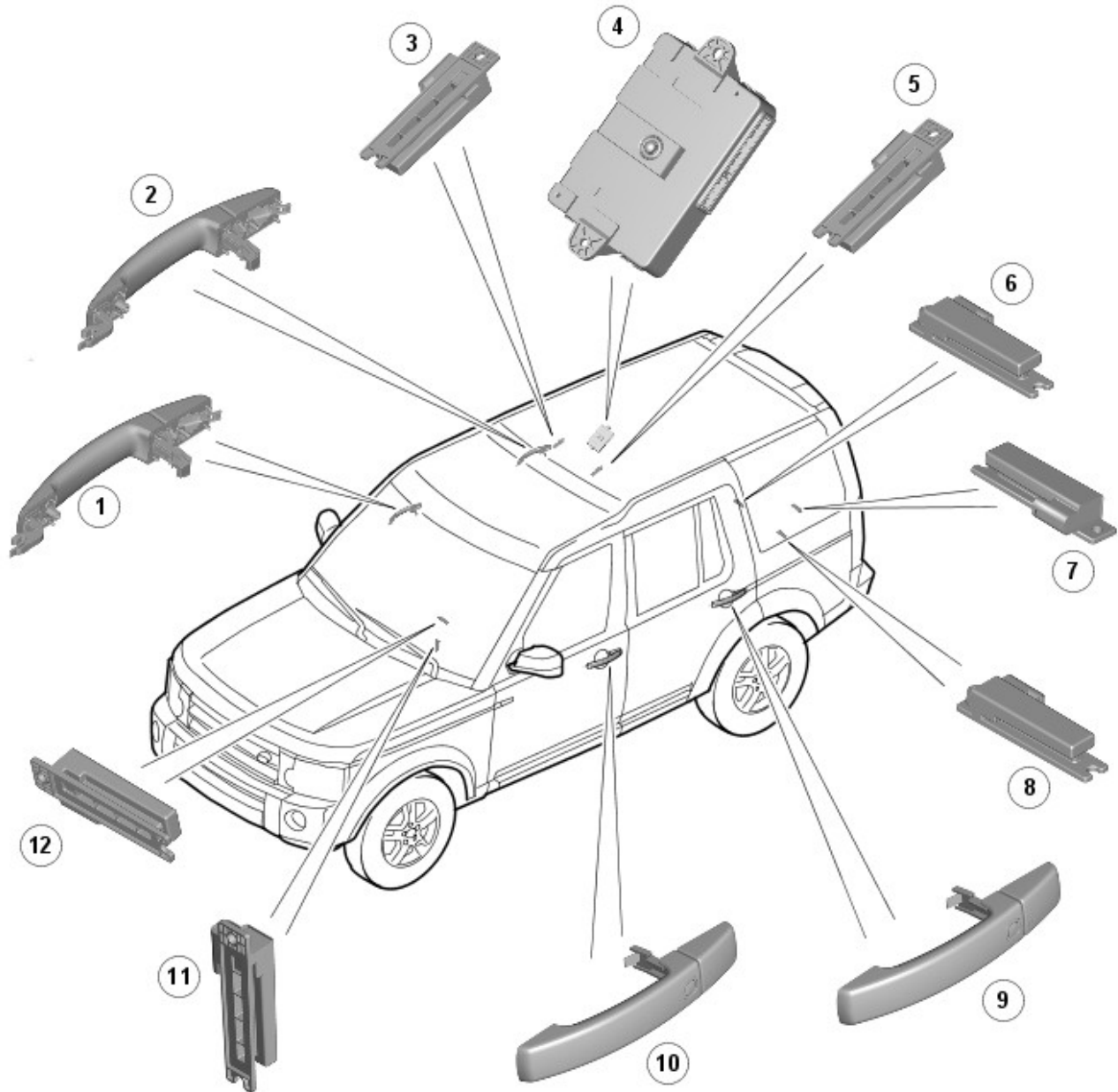
Torque Specifications

Description	Nm	lb-ft
Hood latch release handle bolt	5	3.7
Liftgate latch actuator bolts	10	7
Liftgate latch Torx screws	10	7
Liftgate striker bolts	25	18
Tailgate latch striker bolts	25	18
Tailgate latch Torx screws	25	18
Front door latch Torx screws	10	7
Rear door latch Torx screws	10	7

Handles, Locks, Latches and Entry Systems - Handles, Locks, Latches and Entry Systems

Description and Operation

Passive Entry - Antenna and Keyless Vehicle Module Location



E130381

Item	Part Number	Description
1	-	Door Antenna - right-hand-front
2	-	Door Antenna - right-hand-rear
3	-	Interior Antenna – roof lining
4	-	Keyless Vehicle Module
5	-	Interior Antenna – roof lining
6	-	Interior Antenna – luggage compartment
7	-	Bumper Antenna – rear bumper
8	-	Interior Antenna – luggage compartment
9	-	Door Antenna - left-hand-rear
10	-	Door Antenna - left-hand-front
11	-	Interior Antenna – front compartment (passive start only)
12	-	Interior Antenna – front compartment

OVERVIEW

The hinged panels are secured with latches and strikers. A remotely operated central locking system controls the

locking and unlocking of the door and luggage compartment latches.

A radio frequency Smart Key allows the vehicle to be locked and unlocked by pressing the appropriate handset buttons. Two levels of central locking system are available:

- Remote central locking, and an
- optional passive entry.

The passive entry and associated passive start system allows the driver to unlock and start the vehicle without using a vehicle key in a door-lock or ignition switch. The passive entry system is an optional fitment while the passive start system is a standard fitment on all vehicles. The passive start system is combined with the passive anti-theft immobilization system.

For additional information, refer to: Anti-Theft - Passive (419-01B, Description and Operation).

Emergency access to the vehicle is provided by a concealed key barrel located in the front left-hand door handle. The key barrel is concealed by a plastic cover which can be removed by inserting the blade of the emergency key into a slot in the cover. The removable emergency key blade is located in the Smart Key.

Operation of the key barrel unlocks the vehicle but does not disarm the alarm system. Locking and unlocking conditions using the emergency key in the door key barrel are:

- If the alarm is not armed the vehicle can be centrally unlocked.
- If the alarm is armed the door only can be opened and the alarm will be triggered.
- The vehicle cannot be double locked or the alarm system armed using the emergency key.

The vehicle can be centrally locked and unlocked from inside using the interior handle release levers on the front doors only. The driver can select locking options, single point entry or drive away locking for example, from a menu available on the touch screen.

Central Locking – Radio Frequency Remote System

The radio frequency central locking system provides locking and unlocking from inside the vehicle and outside within a 20 meter range. The system is operated using buttons on the Smart Key, which transmits radio frequency signals to the radio frequency receiver.

Additional buttons on the Smart Key provide for the convenience operation of the headlamp delay, panic alarm and tailgate release.

Depending on vehicle market, functions offered by the Smart Key include:

- Double locking the doors from outside the vehicle if the lock button on the Smart Key is pressed twice within 3 seconds.
- Drive-away locking - switched on or off by the customer using the vehicle security settings menu available on the touch screen.
- Single or two stage unlocking - single-stage unlocking unlocks all doors with a single press; two-stage unlocking unlocks the driver's door only with a single press and all other doors with a second press.

Changing the unlocking mode between single stage and two-stage also affects the unlocking mode for passive entry (see below). The single or two-stage unlocking function can be switched on or off, as can remote global open or close for the electric windows using the vehicle security settings menu available on the touch screen.

The fuel filler flap is locked by the global locking function. It is not locked by drive-away locking, or if doors are locked from inside the vehicle using the handles.

Actuated from the front door levers only, the doors can be locked from inside the vehicle by pressing the interior door release levers inwards and unlocked by pulling the levers. The touch-screen incorporates a valet mode feature which inhibits access to the glove box while also limiting the use of the touch-screen.

On leaving the vehicle with passive entry the user must press an external button on the door handle once to centrally lock the vehicle or twice within 3 seconds to double lock. The user has a further 3 seconds to pull the door handle to check the vehicle is locked without the Smart Key proximity function unlocking the door again. Pulling the handle after the 3 seconds has lapsed will unlock the door as normal.

If any aperture is not fully closed when the locking process is initiated, either passively or by the Smart Key transmitter, the locking function will be inhibited and an audible error indication will be given. If the ignition is left on an audible warning will be given if the user exits the vehicle, if the user attempts to lock the vehicle (ignition on), another audible indication will be given, and the locking function will be inhibited.

If the door is closed without locking and no key left in the car the ignition will be switched off immediately. If the ignition is left on at any time without starting the vehicle it will switch off automatically after 60 minutes.

If the door is opened by the mechanical key, the full alarm system will sound until the user enters the vehicle and presses either:

- the start/stop button, or
- Smart Key unlock button.



NOTE: If the KVM (keyless vehicle module) fails to locate the Smart Key, a message 'SMART KEY NOT FOUND REFER TO HANDBOOK' will appear in the instrument cluster message center and the keyless start back-up process will have to be used to mobilize and start the vehicle.

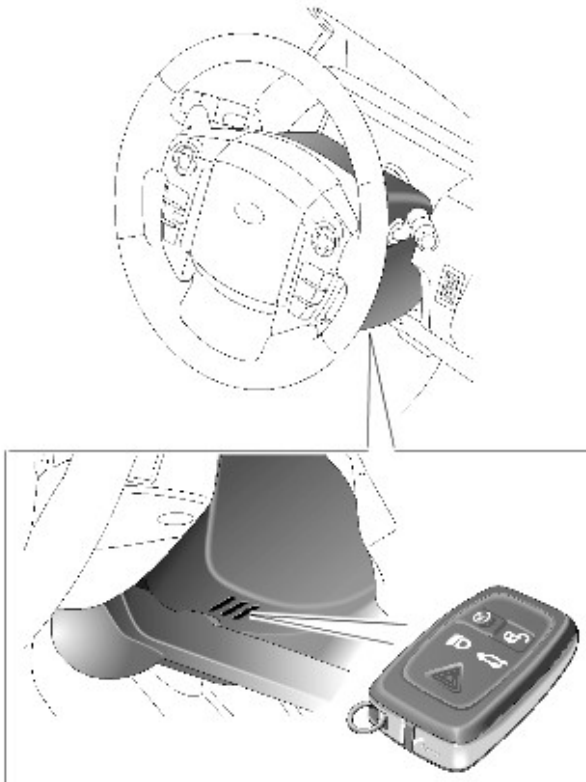
Keyless Start Backup

If the vehicle has been unlocked using the emergency key blade or the Smart Key is not detected by the vehicle, it will be necessary to use the keyless start backup to disarm the alarm and start the engine. The following process

must be followed in this event:

- Position the Smart Key against the underside of the fascia, on the outboard side of the steering column, with the buttons facing downwards. This is the location of the IAU (immobilizer antenna unit).
- Holding the Smart Key in position and the brake / clutch pedal depressed, press the start/stop button to start the engine.

Smart Key positioned next to immobilizer antenna unit



E129977

This process bypasses the data exchange between the KVM and the **CJB (central junction box)**; this is an inductive process and will operate if the battery in the Smart Key is discharged. A transponder within the Smart Key is detected by the IAU. The IAU confirms the code output from the transponder and communicates this code confirmation with the **CJB** via a LIN (local interconnect network) bus connection. The **CJB** then initiates the vehicle start process in the normal manner.

PASSIVE ENTRY SYSTEM

The passive entry system is controlled by the KVM and low frequency antennas in each door handle and one in the rear bumper; antennas are also strategically situated within the vehicle. When inside the vehicle, the antennas ensure the Smart Key is always within the active transmission zone of the antennas no matter where the Smart Key is placed inside the vehicle. For this reason the orientation and positioning of the antennas is critical to the correct functioning of the system.

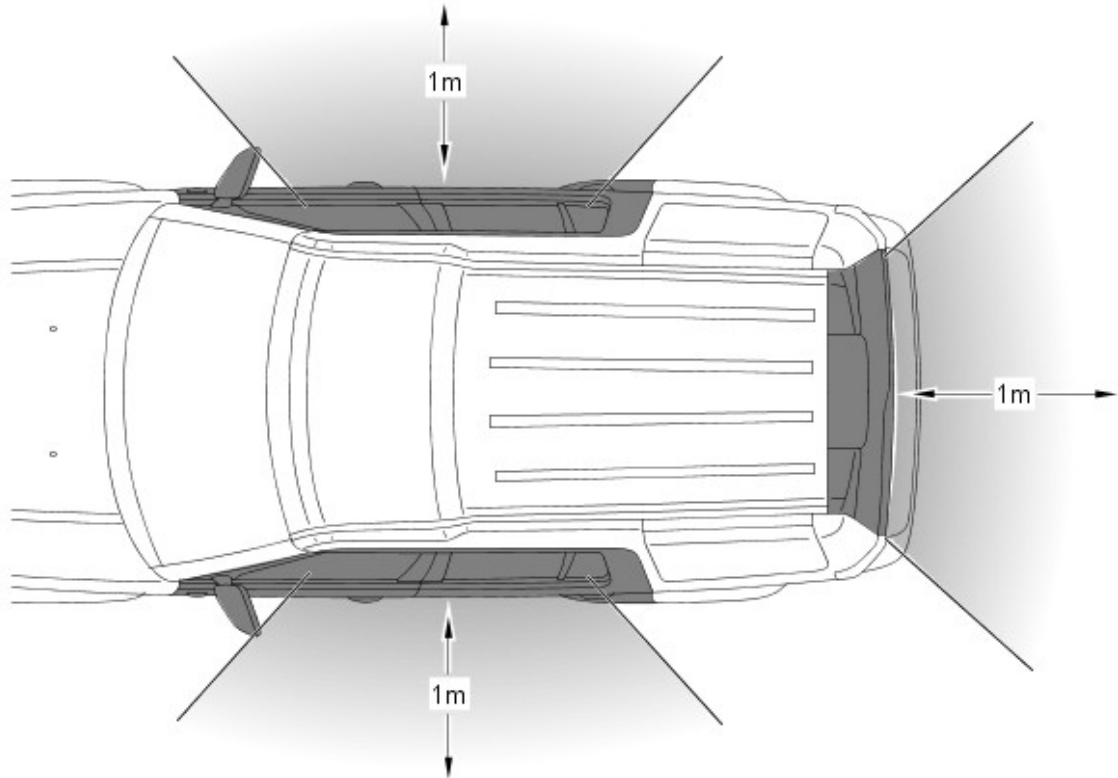
The vehicle can be unlocked without the use of a key-blade or buttons on the Smart Key.

When an external door handle is grasped and the Smart Key is within one meter (3.3ft.) of the handle; the Smart Key receives a low-frequency signal transmitted from the handle.

The Smart Key responds with a radio frequency transmission of its authorization code. The radio frequency signal is received by the Radio-Frequency receiver and passed to the keyless vehicle module which checks and approves the code as valid.

The KVM then drives the fast latch directly to allow the door to be opened. The keyless vehicle module also transmits an unlock request to the **CJB**. The **CJB** then passes an unlock request to the door modules.

Door-handle antenna operating area



E117707

Locking of the vehicle is performed by pressing one of the buttons located on each exterior door handle, with the Smart Key within a one meter range of the vehicle. When the door handle button is pressed, the KVM transmits a low-frequency signal via the handle antenna to the Smart Key. The Smart Key transmits a radio frequency signal which is verified by the KVM and allows the doors to be locked or double locked and the alarm system to be armed.

To double lock the vehicle, the button on the exterior door handle must be pressed twice within three seconds, with the Smart Key within one meter range of the vehicle. If a door, hood or the tailgate door is ajar when an attempt to lock the vehicle is made, an error tone is emitted and no locking action will occur. For additional information, refer to: Anti-Theft - Active (419-01A, Description and Operation).

When unlocking the vehicle using passive entry with single stage unlocking selected and a valid Smart key present, grasping the door handle will centrally unlock the vehicle. When the vehicle is configured for two stage unlocking and the drivers door handle is grasped with a valid Smart Key present only the drivers door will unlock, however if a passenger door handle is grasped with a valid Smart Key present the vehicle will centrally unlock.

NOTES:



Placing the key in a metallic container, a metal briefcase for example, may hinder its operation.



Passive locking will only activate if the key is outside the vehicle. If no key is present, two audible error warnings will sound.

To globally close the vehicle pressing and holding the button on the door handle locks the vehicle, arms the alarm and closes all open windows, not the sunroof. The windows will stop closing when the button is released.

Capacitive Door Handle

The new exterior door operates using the following principle. A capacitive plate is molded internally within the handle, the vehicle exterior body acts as a second capacitive plate; air between the two acts as an insulator. The control electronics within the door handle evaluate the capacitance of the circuit, when a hand interrupts the space between the electrical field is altered and thus the capacitance of the capacitor. This signal is used to trigger the KVM to initiate the unlock process. This signal is calibrated so as not to detect false activations, for example, rain water or soiling.

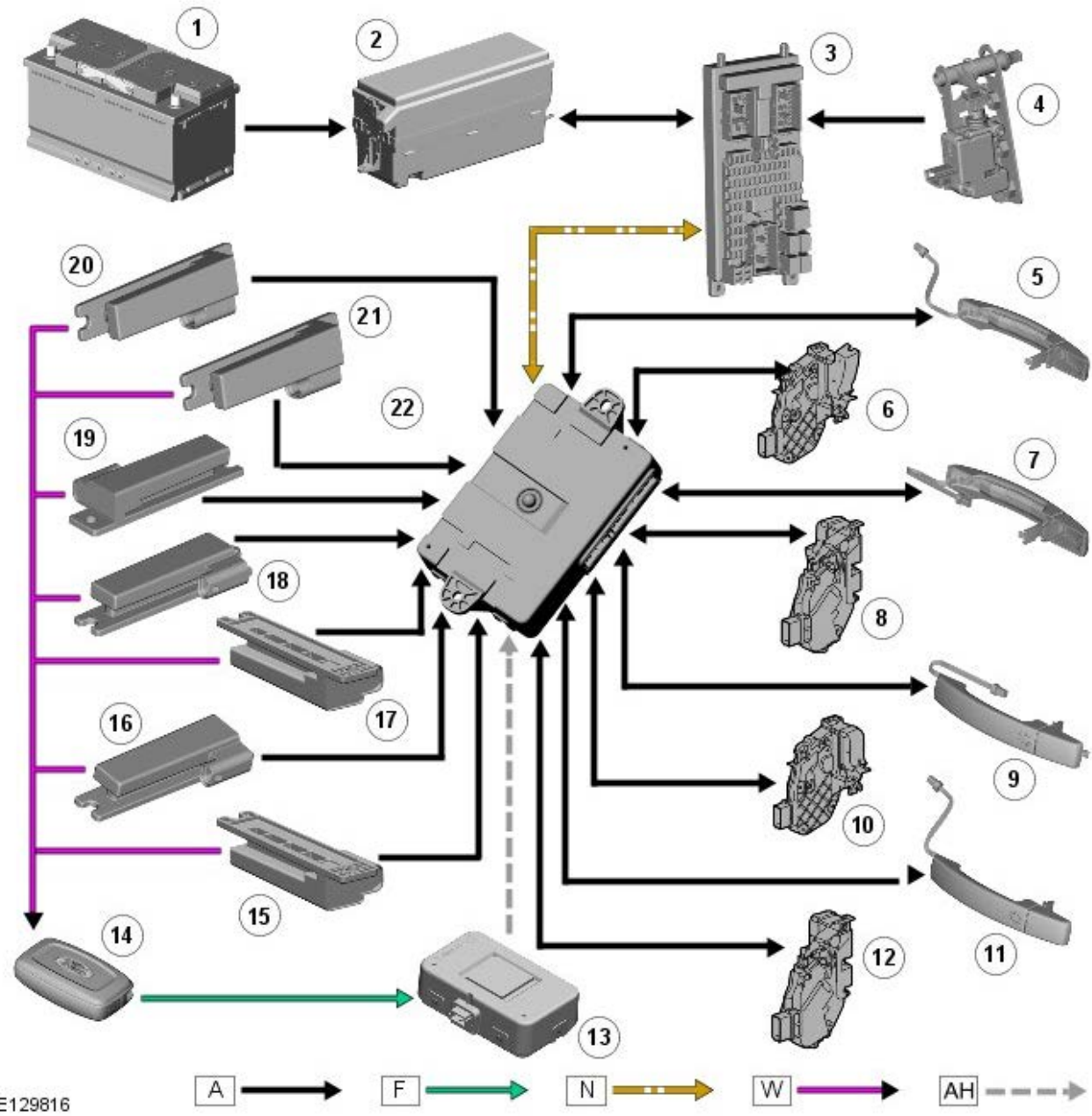


NOTE: Extreme water levels can trigger an unlock signal, for example, when washing a locked vehicle with a hose or high powered jet nozzle, providing the key is in the detection zone.

CONTROL DIAGRAM



NOTE: **A** = Hardwired; **F** = RF transmission; **N** = Medium Speed CAN; **W** = LF transmission; **AH** = Serial Communication Link



E129816



Item	Part Number	Description
1	-	Battery
2	-	EJB (engine junction box)
3	-	CJB
4	-	Tailgate release switch
5	-	Door handle, lock/unlock switch and antenna – right-hand-front
6	-	Door latch and fast latch - right-hand-front
7	-	Door handle, lock/unlock switch and antenna – left-hand-front
8	-	Door latch and fast latch - left-hand-front
9	-	Door handle, lock/unlock switch and antenna – right-hand-rear
10	-	Door latch and fast latch - right-hand-rear
11	-	Door handle, lock/unlock switch and antenna – left-hand-rear
12	-	Door latch and fast latch - left-hand-rear
13	-	Radio frequency receiver
14	-	Smart Key
15	-	Antenna
16	-	Antenna
17	-	Antenna
18	-	Antenna
19	-	Antenna
20	-	Antenna
21	-	Antenna

PRINCIPLES OF OPERATION

Passive Entry - Locking/Unlocking Process

The vehicle unlocking procedure is carried out in the following way.

With the key within one meter of the approached door and the handle grasped a signal is sent to the KVM which responds with the following simultaneous actions:

- The KVM energizes the low frequency antenna in the door handle which transmits a 125 KHz signal to the key.
- On receipt of the low frequency signal the Smart Key transmits a radio frequency signal '433.92 MHz Europe' '315 MHz NAS / ROW' containing its authorization code to the RF (radio frequency) receiver.
- The RF receiver relays the code, via a serial communication line, to the KVM which checks and approves the code as valid.
 - The KVM will only respond if the radio frequency signal produced is from a valid key for the vehicle.
- The KVM transmits the unlock request to the CJB via the medium-speed CAN (controller area network) bus.
- The CJB confirms and sends the request, via the medium speed CAN bus, to the front door modules.
- The front door modules respond with the following simultaneous actions:
 - Drive the motors to unlock the front doors.
 - Transmit the door unlock request via a LIN (local interconnect network) data signal to the rear door modules.
- The rear door modules drive the motors to unlock the rear doors.
- When the door handle reaches 80 percent of its travel the handle clutch switch is closed and grounded sending a hardwired switched signal to the KVM.
- The KVM drives the fast latch release motors in the door latch assemblies releasing the door latches as the approached door handle is pulled through its full travel, the door can be opened.

Handles, Locks, Latches and Entry Systems - Locks, Latches and Entry Systems

Diagnosis and Testing

Principle of Operation

For a detailed description of the locks, latches and entry systems and operation, refer to the relevant Description and Operation section of the workshop manual REFER to: [Handles, Locks, Latches and Entry Systems](#) (501-14 Handles, Locks, Latches and Entry Systems, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests

1. Verify the customer concern, to be sure the correct issue is investigated
2. Visually inspect for obvious signs of mechanical or electrical damage

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Incorrectly aligned door(s), hood or tailgate • Fuel filler door lock actuator • Hood release handle • Hood release cables • Hood latch(es) • Exterior door handle(s) • Interior door handle(s) • Cable(s) • Tailgate release switch • Rear window release switch 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Wiring connector(s) • Door lock actuator(s) • Remote transmitter (key-fob or smart key) • Central locking switches • Controller Area Network (CAN) circuits • Radio frequency (RF) receiver • Central junction box (CJB) • Loose or corroded connections

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index

Symptom Chart



NOTE: Complete the diagnostic steps below to confirm any concern prior to replacing any component

Symptom	Possible causes	Action
The message center indicates that the hood, the tailgate is open when it appears to be closed	<ul style="list-style-type: none"> • Incorrect striker alignment/adjustment • Ajar switch circuit short circuit to ground • Ajar switch failure 	<ul style="list-style-type: none"> • Check/adjust the strikers as necessary • Check for DTCs indicating an ajar switch fault. Refer to the DTC index
Vehicle indicates a miss-lock when the hood, tailgate appear to be closed		
Fuel flap does not lock/unlock	<ul style="list-style-type: none"> • Fuel flap cable detached from body • Fuel flap actuator detached from mounting bracket • Fuel flap actuator disconnected • Fuel flap actuator failure 	<ul style="list-style-type: none"> • Check the condition and installation of the fuel flap cable • Check the security of the fuel flap actuator and bracket • Check the security of the actuator electrical connector • Check for DTCs indicating a fuel flap actuator fault. Refer to the DTC index
Door(s) will not unlatch/open when using outside door handle	<ul style="list-style-type: none"> • Exterior door handle condition/installation • Exterior release cable disconnected from exterior door handle or door latch 	<ul style="list-style-type: none"> • Check the exterior door handle condition and installation • Check the condition and security of the exterior release cable • Single door will not open from the outside (but opens from the inside) GO to Pinpoint Test A.
Door(s) will not unlatch/open when	<ul style="list-style-type: none"> • Child lock(s) engaged 	<ul style="list-style-type: none"> • Check that the child locks are

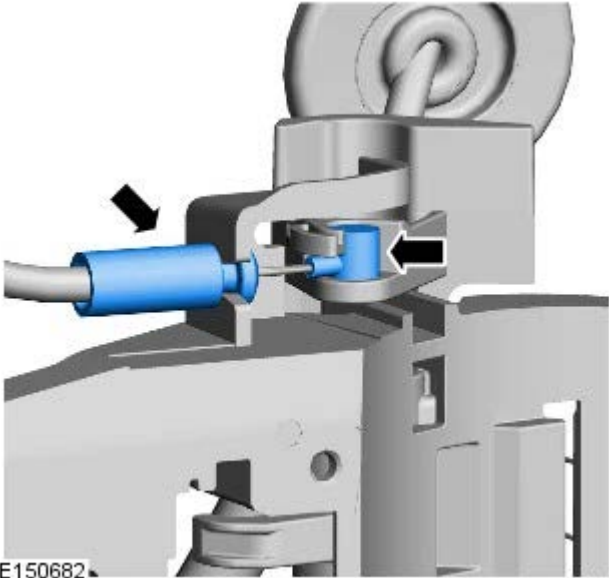
using inside door handle	<ul style="list-style-type: none"> Interior door handle condition/installation Interior release cable disconnected from interior door handle or door latch 	<ul style="list-style-type: none"> disengaged Check the interior door handle condition and installation Check the condition and security of the interior release cable Single Door Will Not Open From The Inside (but opens from the outside) GO to Pinpoint Test B.
Door(s) will not lock/unlock from key fob, key or internal lock switch	<ul style="list-style-type: none"> Wiring harness/connectors Central junction box (CJB) Door lock switch Cable fault 	<ul style="list-style-type: none"> Check for relevant stored DTCs Once any DTC related faults have been rectified continue with the diagnostic steps below No lock / unlock function from key-fob GO to Pinpoint Test C.
Door ajar or miss lock signal at message centre when door(s) are closed or alarm triggering	<ul style="list-style-type: none"> Wiring harness Instrument cluster Incorrect striker alignment/adjustment Ajar switch circuit short circuit to ground Ajar switch failure 	<ul style="list-style-type: none"> Latch Mounted Door Ajar Switch Test GO to Pinpoint Test D.

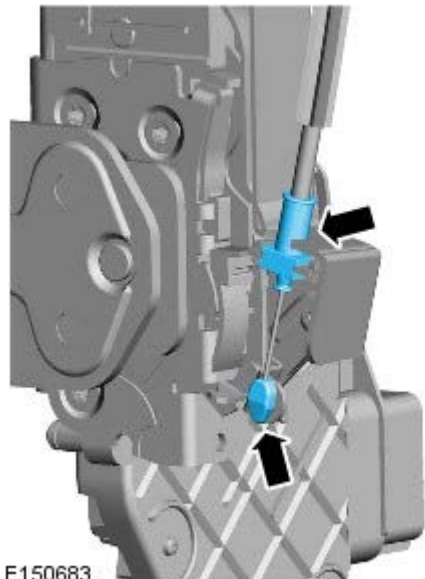
DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation) / [Diagnostic Trouble Code \(DTC\) Index - DTC: Driver/Passenger Door Control Module \(DDM/PDM\)](#) (100-00 General Information, Description and Operation).

Pinpoint Test

PINPOINT TEST A : SINGLE DOOR WILL NOT OPEN FROM THE OUTSIDE (BUT OPENS FROM THE INSIDE)	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: CHECK THE EXTERIOR DOOR RELEASE CABLE TO EXTERIOR DOOR HANDLE IS INSTALLED CORRECTLY	
	<ol style="list-style-type: none"> Remove the door trim panel as necessary REFER to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation) / Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
	<ol style="list-style-type: none"> Confirm the exterior door release cable is correctly installed to the exterior door handle
	<p>Is the cable correctly installed?</p> <p>Yes GO to A2.</p> <p>No Connect the door release cable correctly. If the cable is damaged, install a new door release cable. Test the system for normal operation</p>
A2: CHECK THE EXTERIOR DOOR HANDLE RELEASE CONNECTION TO THE DOOR LATCH	
	<ol style="list-style-type: none"> Confirm the exterior door handle release connection to the door latch is installed correctly



E150683

Is the exterior door handle release cable installed correctly?

Yes

GO to Pinpoint Test [C](#).

No

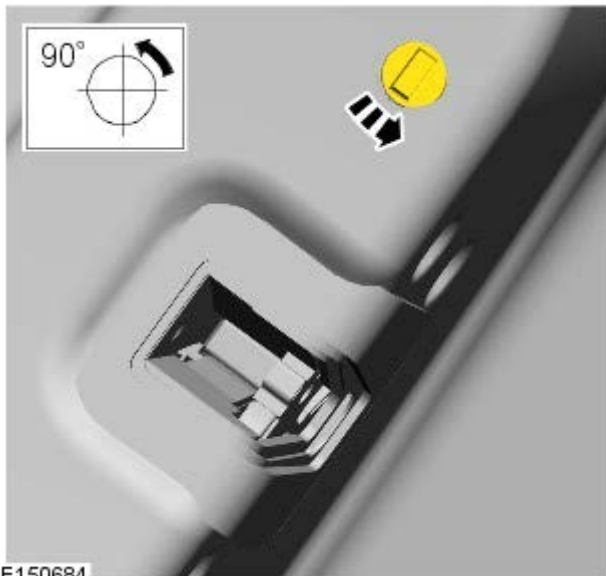
Connect the door release cable correctly. **If the cable is damaged, install a new door release cable.** Test the system for normal operation

PINPOINT TEST B : SINGLE DOOR WILL NOT OPEN FROM THE INSIDE (BUT OPENS FROM THE OUTSIDE)

TEST CONDITIONS

DETAILS/RESULTS/ACTIONS

B1: CHECK THE INTERIOR DOOR RELEASE CABLE TO INTERIOR DOOR HANDLE IS INSTALLED CORRECTLY



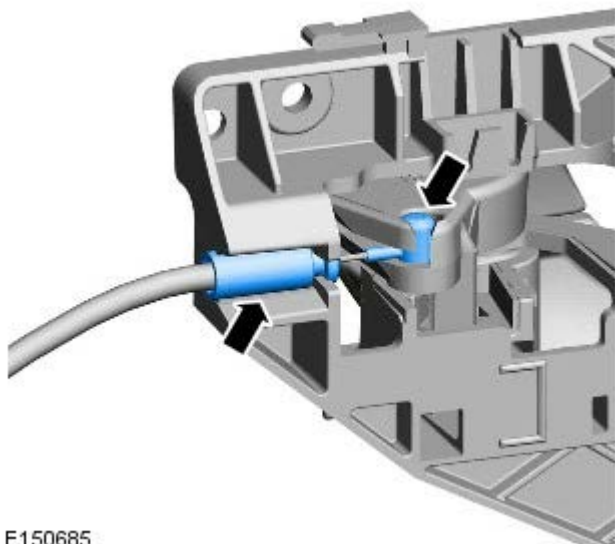
E150684



NOTE: Figure A - Child lock off position shown

- 1 Make sure the child lock is disengaged (rear door only)

- 2 Remove the door trim panel as necessary
REFER to: [Front Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation) / [Rear Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation).



E150685

3 Confirm the interior door release cable is correctly installed to the interior door handle

Is the cable correctly installed?

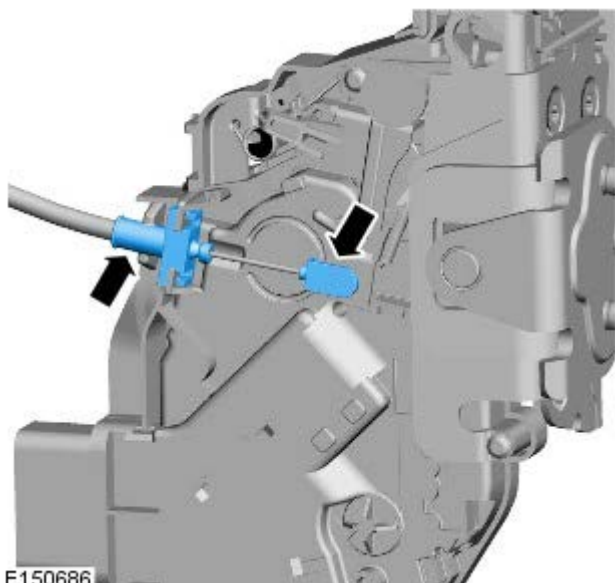
Yes

[GO to B2.](#)

No

Connect the door release cable correctly. **If the cable is damaged, install a new door release cable.** Test the system for normal operation

B2: CHECK THE INTERIOR DOOR HANDLE RELEASE CONNECTION TO THE DOOR LATCH



E150686

1 Confirm the interior door handle release connection to the door latch is installed correctly

Is the interior door handle release cable installed correctly?

Yes

GO to Pinpoint Test [C.](#)

No

Connect the door release cable correctly. **If the cable is damaged, install a new door release cable.** Test the system for normal operation

PINPOINT TEST C : DOOR LATCHING AND LOCKING FUNCTION TEST

TEST CONDITIONS

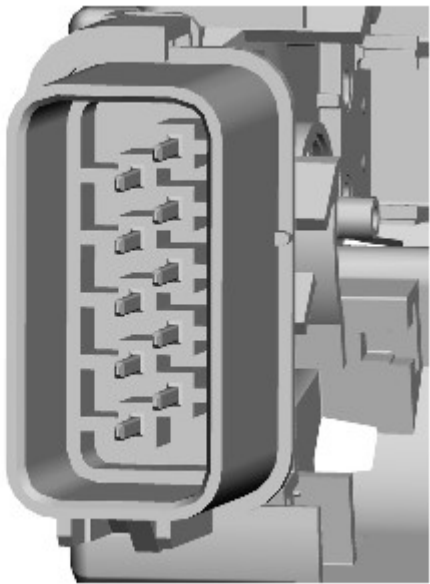
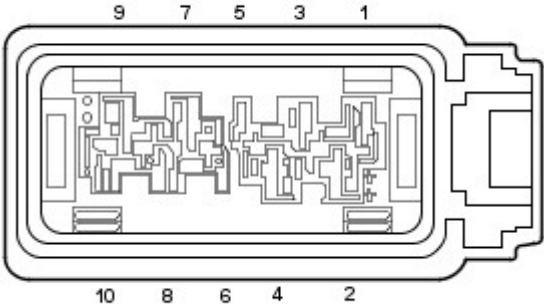
DETAILS/RESULTS/ACTIONS

C1: HARNESS CONNECTION



NOTE: Test as a single component to ensure that the door latch is not replaced unnecessarily, when another component may be at fault

1 Remove the door trim panel as necessary
REFER to: [Front Door Trim Panel](#) (501-05 Interior Trim and Ornamentation, Removal and Installation) / [Rear Door Trim Panel](#) (501-05 Interior Trim and

 <p>E150687</p>	<p>Ornamentation, Removal and Installation).</p> <p>2 Disconnect harness from latch, check for corrosion or damage to both connectors at socket points and pins. Re-connect harness ensuring robust assembly when all parts confirmed to be in good order. If harness or latch connectors are damaged, install new harness/latch as necessary. Test the system for normal operation</p>
	<p>Check for normal operation, does latch function correctly?</p> <p>Yes Re-assemble door trim and test for normal operation</p> <p>No GO to C2.</p>
<p>C2: LOCK COMMAND SIGNAL FROM VEHICLE HARNESS</p>	
 <p>E139357</p>	<p>1 Close all vehicle doors apart from door being investigated, please note which door, left side or right side is under investigation</p>
	<p>2 Disconnect harness from latch to enable access to socket points to carry-out conductivity testing as detailed</p>
	<p>3 Monitor the circuit for momentary power when locking the vehicle via the key-fob or smart key between terminals 1 and 10 left side or 8 and 10 right side</p>
	<p>Is there momentary power (for approx 8 seconds) between terminals 1 and 10 left side or 8 and 10 right side when locking the vehicle via the key-fob or smart key</p> <p>Yes The vehicle electrical system is locking correctly, providing the signal to the latch GO to C3.</p> <p>No Refer to the electrical circuit diagrams and investigate why vehicle electrical system is not providing signals to the latch. Using the manufacturer approved diagnostic system check for logged DTCs to localize the fault</p>
<p>C3: UNLOCK COMMAND SIGNAL FROM VEHICLE HARNESS</p>	
	<p>1 Monitor the circuit for momentary power when unlocking the vehicle via the key-fob or smart key between terminals 1 and 9 left side or 8 and 9 right side</p>
	<p>Is there momentary power (for approx 8 seconds) between terminals 1 and 9 left side and 8 and 9</p>

right side when unlocking the vehicle via the key-fob or smart key?
Yes
 The vehicle electrical system is unlocking correctly, providing the signal to the latch [GO to C4](#).
No
 Refer to the electrical circuit diagrams and investigate why vehicle electrical system is not providing signals to the latch. Using the manufacturer approved diagnostic system check for logged DTCs to localize the fault

C4: PHYSICAL TEST 1

1 Remove latch module from door
 REFER to: [Front Door Latch](#) (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation) / [Rear Door Latch](#) (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).

2 Inspect latch module for any visual damage

3 With the latch in hand, connect the electrical connector(s) to connect door latch to door harness

 **NOTE: THE LATCH IS NOW READY TO TEST**

4 Close all vehicle doors except the door being investigated

NOTES:

 Figure 1 - Unlatched position shown

 Figure 2 - First safety latched position shown

 Figure 3 - Fully latched position shown

 Test will not work if latch is only in first safety latch position

5 Rotate latch claw (using a small screw driver or similar), to the fully latched position (figure 3)

1



2



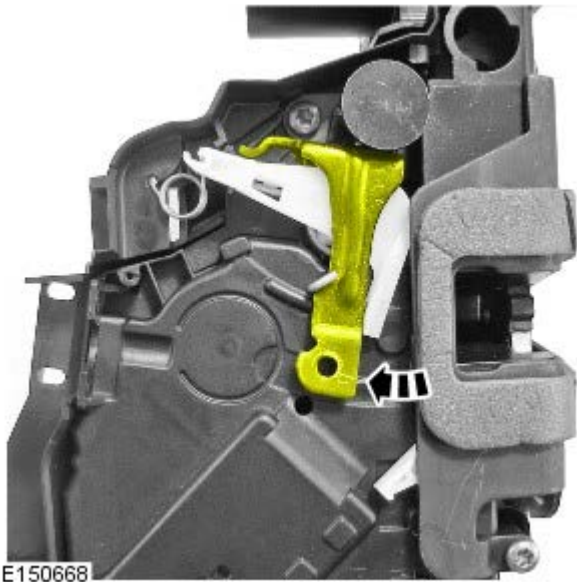
3



E139349

 **NOTE: Unlocked position shown**

6 Confirm that the latch interior release lever is in the unlocked position as shown



E150668



E150677



NOTE: Locked position shown

- 7 Press the **lock** button on the key-fob or smart key

Does the latch interior release lever move from the unlocked position to the locked position?

Yes

[GO to C5.](#)

No

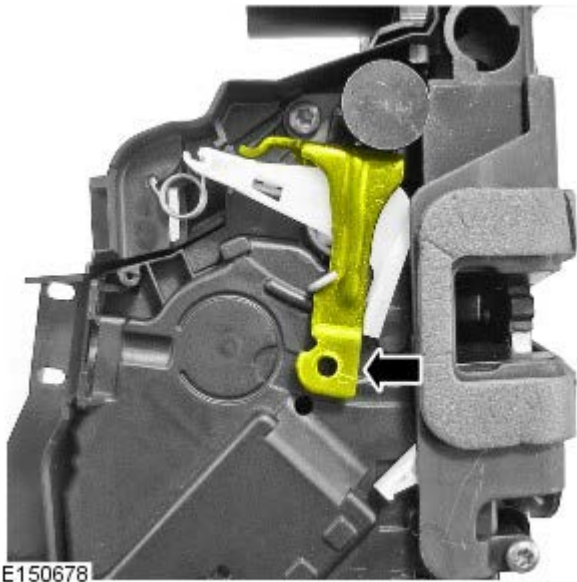
If this is a repeat test and the vehicle electrical test section has been completed and confirmed that vehicle is working correctly, then replace the door latch. If replacing latch as part of a warranty claim, please quote reference code **LKINOP** in the technician comments section of the warranty claim

C5: PHYSICAL TEST 2



NOTE: Unlocked position shown

- 1 With the latch in the locked state (i.e. the latch interior release lever is in the locked position), press the key-fob or smart key **unlock** button



E150678

Does the latch interior release lever move from the locked position to the unlocked position?

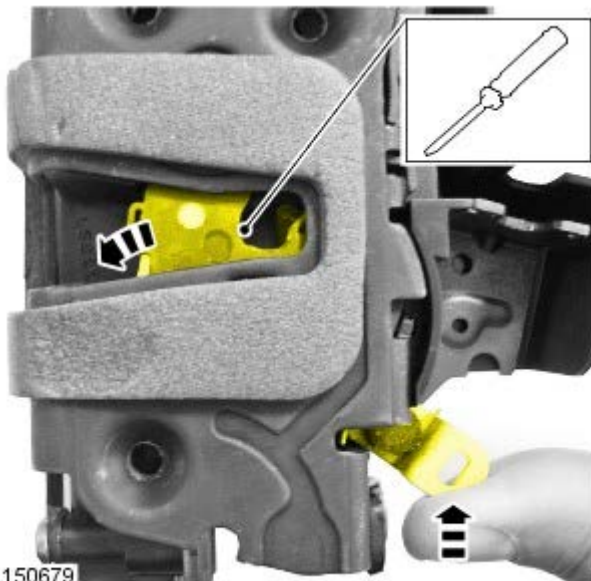
Yes

[GO to C6.](#)

No

If this is a repeat test and the vehicle electrical test section has been completed and confirmed that vehicle is working correctly, then replace the door latch. If replacing latch as part of a warranty claim, please quote reference code **LKINOP** in the technician comments section of the warranty claim

C6: PHYSICAL TEST 3



E150679



NOTE: Fully latched position shown

- 1 With the latch in its unlocked state, push the latch exterior release lever against its return spring, whilst simultaneously applying a light pressure to release the latch claw using a small screw driver or similar

Does the latch claw release?

Yes

[GO to C7.](#)

No

Repeat tests **C5** and **C6** to confirm the fault [GO to C5](#). If the repeat test has confirmed that the exterior release lever will not release the claw on an unlocked latch replace the door latch. If replacing latch as part of a warranty claim, please quote reference code **EXTINOP** in the technician comments section of the warranty claim

C7: PHYSICAL TEST 4



NOTE: Fully latched position shown

- 1 Using a small screw driver or similar, rotate latch claw to the second fully latched position



E150680

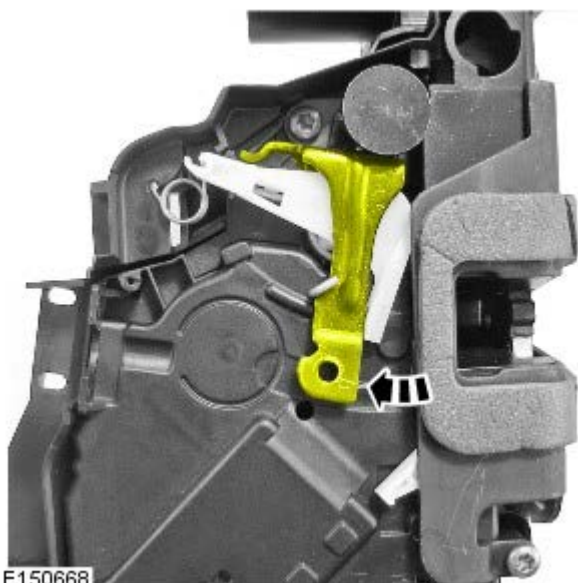


E139354



NOTE: Figure A - Child lock off position shown

- 2 If testing a rear door latch, ensure that the child lock is turned to the off position



E150668



NOTE: Unlocked position shown

- 3 Confirm that the latch interior release lever is in the unlocked position as shown

- 4 Whilst the latch is still in its unlocked state, push the latch interior release lever against its return spring, whilst simultaneously applying a light pressure to release the latch claw using a small screw driver or similar








Does the latch claw release?

Yes
Latch has passed all tests to confirm its correct function. **DO NOT REPLACE LATCH** as part of any attempts to resolve any locking functionality issues

No
Repeat test [GO to C7](#). If repeat test has confirmed that the interior release lever will not release the claw when the latch is in the unlocked state, then replace the latch. If replacing latch as part of a warranty claim, please quote reference code **INTINOP** in the technician comments section of the warranty claim

PINPOINT TEST D : LATCH MOUNTED DOOR AJAR SWITCH TEST

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: TEST 4 DOOR LATCH	
NOTES:	
<p> If a customer is complaining of issues relating to a door ajar signal e.g. door latch won't lock, or alarm system triggering (indicated via DTC's), there may be several components that generate the fault, including</p> <ul style="list-style-type: none"> • Body wiring harness / connectors • Door wiring harness / connectors • Alarm control module • Central junction box (CJB) • Door Latch ajar switch 	
<p> To investigate the functioning of the door ajar switch contained within the door latch, to prove or eliminate the door latch mounted door ajar switch as the root cause, follow the process below. This will prevent the unnecessary replacement of a correctly functioning door latch</p>	
	<p>1 Remove door trim from door REFER to: Front Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation) / Rear Door Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).</p>
	<p>2 Disconnect door harness from latch for access to connector pins for latch electrical testing</p>
	<p>3 Inspect latch module for any visual damage</p>
NOTES:	
<p> Figure 1 - Unlatched position shown</p>	
<p> Figure 2 - First safety latched position shown</p>	
<p> Figure 3 - Fully latched position shown</p>	

1



2



3

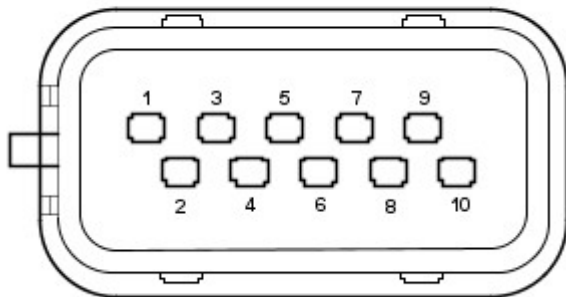


E139349



Test will not work if latch is only in first safety latch position

- 4 Using a small screw driver or similar, rotate latch claw to the second fully latched position (figure 3)



E139356

- 5 Carry out continuity test between terminals **1 and 4 (left side)** or **8 and 4 (right side)** with claw closed

Does the continuity test pass?

Yes

The latch ajar switch is working correctly. **Do not replace latch.** Investigate for fault elsewhere in vehicle system

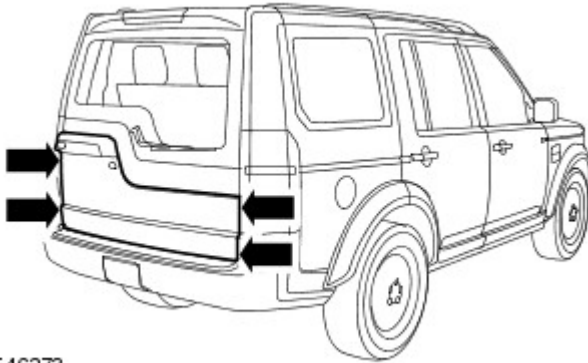
No

Release latch claw and repeat test from step 4 to confirm result. If this is a repeat test and you are sure that the ajar switch does not provide continuity when fully latched. Replace the latch. If replacing latch as part of a warranty claim, please quote reference code **AJARINOP** in the technician comments section of the warranty claim

Handles, Locks, Latches and Entry Systems - Tailgate Striker Adjustment

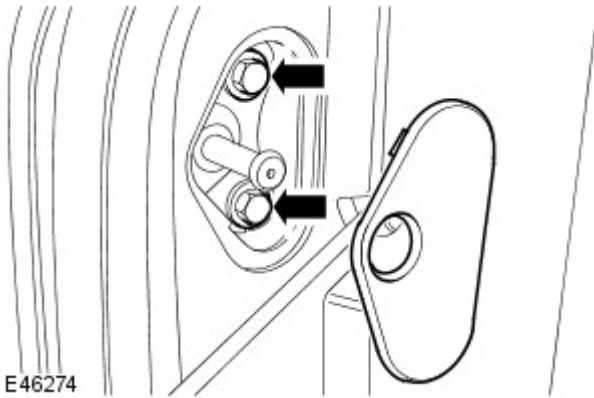
General Procedures

1. Check for an equal gap and alignment to the adjacent panels. If incorrect, follow the adjust procedure below.



E46273

2. Remove the tailgate striker trim panel.
3. Loosen the 2 tailgate striker bolts.



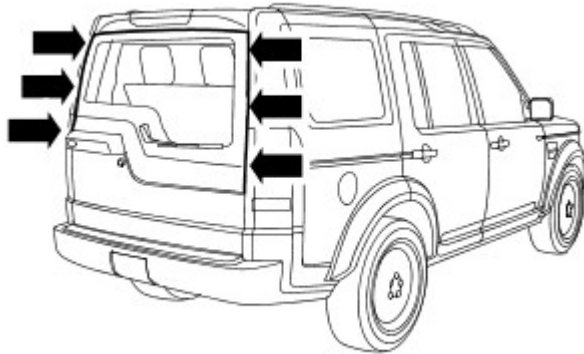
E46274

4. Close the tailgate and check for an equal gap and alignment to the adjacent panels.
5. Open the tailgate and tighten the tailgate striker bolts to 25 Nm (18 lb.ft).
6. Install the tailgate striker trim panel.

Handles, Locks, Latches and Entry Systems - Liftgate Striker Adjustment

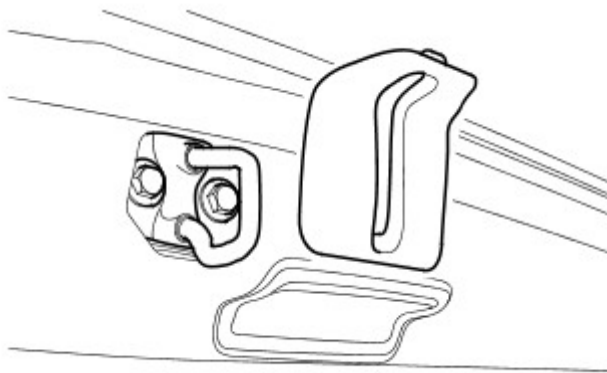
General Procedures

1. Check for an equal gap and alignment to the adjacent panels. If incorrect, follow the adjust procedure below.



E45607

2. Remove the liftgate striker trim panel.



E45600

3. Loosen the 2 liftgate striker bolts.
4. Close the liftgate and check for an equal gap and alignment to the adjacent panels.
5. Open the liftgate and tighten the liftgate striker bolts to 25 Nm (18 lb.ft).
6. Install the liftgate striker trim panel.

Handles, Locks, Latches and Entry Systems - Ignition Lock Cylinder

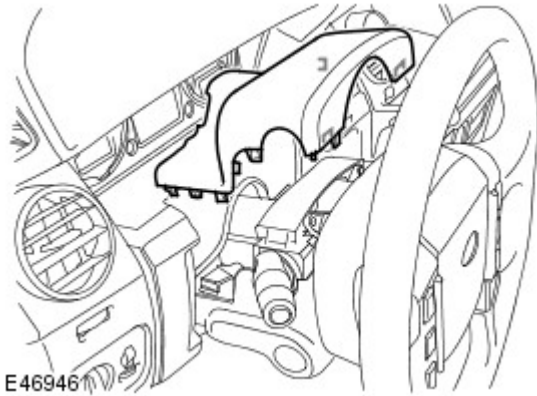
Removal and Installation

Removal



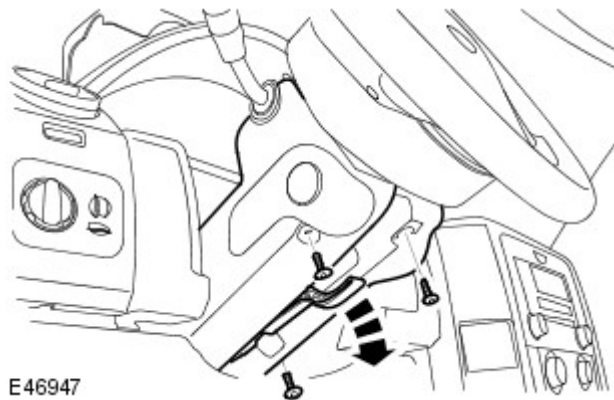
NOTE: This procedure is for removal and installation of the ignition lock cylinder. The ignition lock and door lock cylinders are replaced in sets.

1. Fully extend the steering column for access.
2. Remove the steering column upper shroud.
 - Release the 4 clips.



E46946

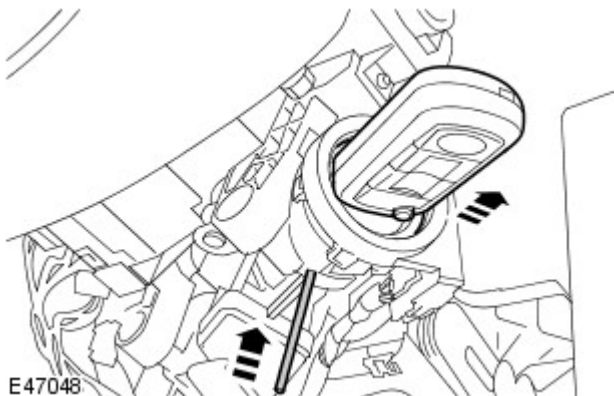
3. Remove the steering column lower shroud.
 - Remove the 3 Torx screws.
 - Release the steering column adjustment lever.



E46947

4. Remove the passive coil.
 - Disconnect the electrical connector.
 - Release the 2 clips.

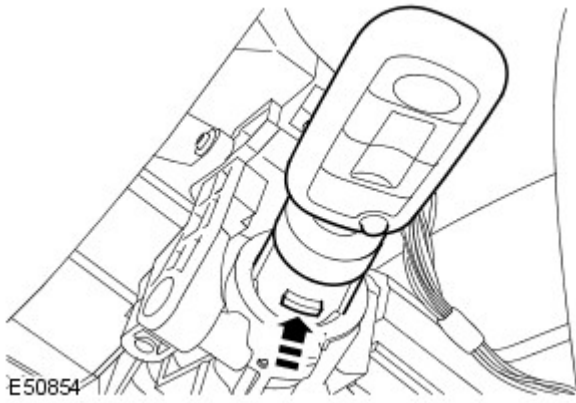
5. Remove the ignition lock cylinder.
 - Turn the ignition key to position 1.
 - Insert a pin, not exceeding 2 mm diameter, through the access hole in the ignition lock cylinder housing to depress the plunger, and release the ignition lock cylinder.



E47048

Installation

1. Install the ignition lock cylinder.
 - Turn the ignition key to position 1.
 - Locate into guides and depress the plunger.



2. Install the passive coil.
 - Secure the clips.
 - Connect the electrical connector.

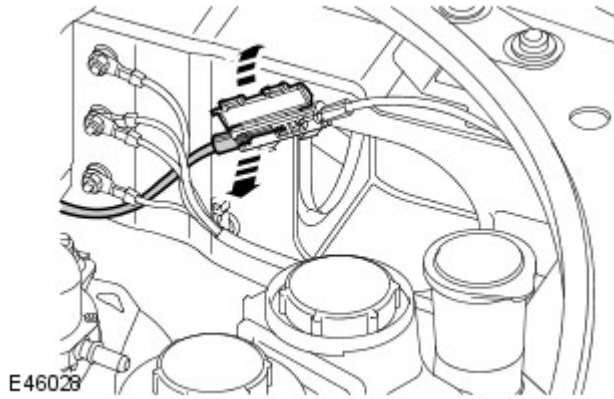
3. Install the steering column shrouds.
 - Tighten the Torx screws.
 - Secure the clips.
 - Secure the adjustment lever.

Handles, Locks, Latches and Entry Systems - Hood Latch Release Handle

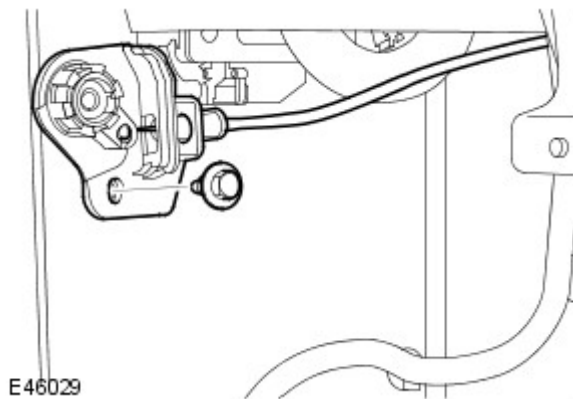
Removal and Installation

Removal

1. Remove the cowl side trim panel.
For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).



2. Disconnect the hood release cable from the connecting box.
 - Open the connecting box cover.



3. Remove the hood release lever housing.
 - Remove the bolt.
 - Disconnect the hood release cable.

Installation


1. Install the hood release lever housing.
 - Connect the hood release cable.
 - Tighten the bolt to 5 Nm (3.7 lb.ft).
2. Attach the hood release cable to the connecting box.
 - Close the connecting box cover.
3. Install the cowl side trim panel.
For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).

Handles, Locks, Latches and Entry Systems - Front Door Latch

Removal and Installation

Removal

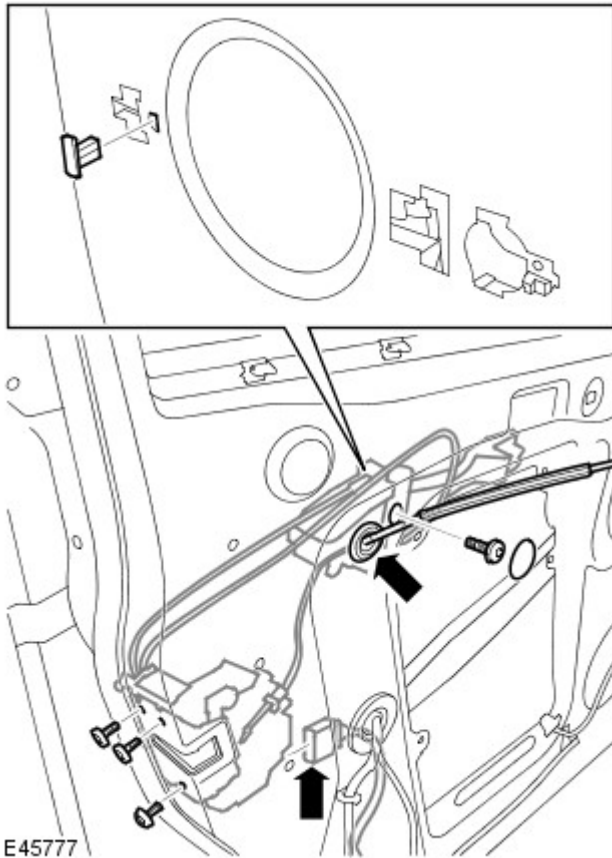
1. Remove the window motor and regulator assembly.
For additional information, refer to: Front Door Window Regulator and Motor (501-11, Removal and Installation).


2.  **CAUTION:** Release the exterior door handle and screw cover clips from inside the door.

Remove the front door exterior handle.

For additional information, refer to: Exterior Front Door Handle (501-14, Removal and Installation).

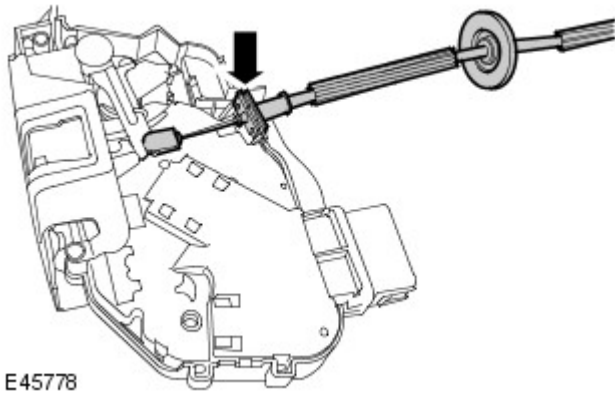
3. Release the remote control cable.
 - Release the grommet.
4. Release the door exterior handle mechanism.
 - Remove the adhesive tape from the access hole.
 - Remove the Torx screw.
 - Remove the locking pin.
5. Remove the front door latch assembly.
 - Disconnect the electrical connector.
 - Remove the 3 Torx screws.



6.  **NOTE:** Do not disassemble further if the component is removed for access only.

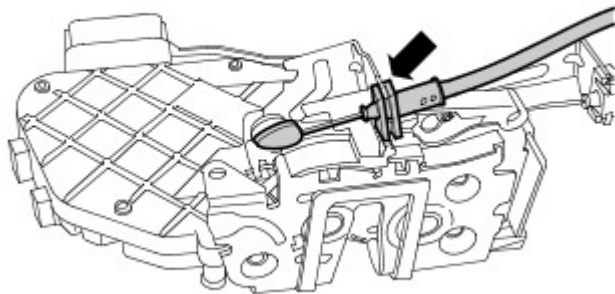
Remove the door latch remote control cable.

- Release the cable from the abutment bracket.
- Remove the cable from the lever.



E45778

7. Release the exterior door handle mechanism cable from the door latch.
 - Release the cable from the abutment bracket.
 - Remove the cable from the lever.



E45779

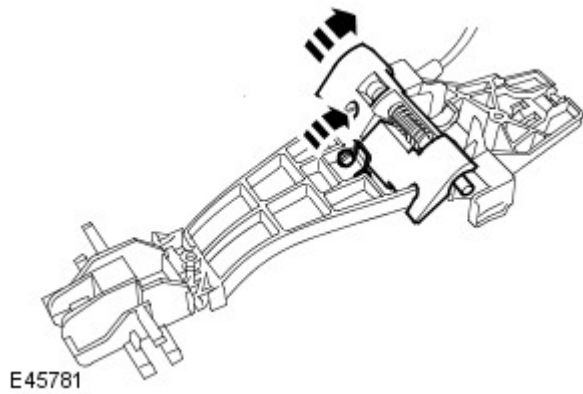
8. LH side: Release the door lock cylinder cable from the door latch.
 - Release the cable from the abutment bracket.
 - Remove the cable from the lever.



E45780

Installation

1. LH side: Connect the door lock cylinder cable to the door latch.
 - Connect the cable to the lever.
 - Secure the cable to the abutment bracket.
2. Connect the door exterior handle mechanism cable to the door latch.
 - Connect the cable to the lever.
 - Secure the cable to the abutment bracket.
3. Install the remote control cable to the door latch.
 - Connect the cable to the lever.
 - Secure the cable to the abutment bracket.
4. Set the exterior handle mechanism.
 - Rotate the lever.
 - Engage the retaining tang.



E45781


5. Install the front door latch assembly.
 - Tighten the Torx screws to 10 Nm (7 lb.ft).
 - Connect the electrical connector.
6. Install the door exterior handle mechanism.
 - Position the mechanism to the door.
 - Fit the locking pin.
 - Fit and tighten the Torx screw.
7. LH side: Position the control cables into the retainers.
8. Position the remote control cable to the door.
 - Install the grommet.
9. Install the front door exterior handle.
For additional information, refer to: Exterior Front Door Handle (501-14, Removal and Installation).
10. Install the window motor and regulator assembly.
For additional information, refer to: Front Door Window Regulator and Motor (501-11, Removal and Installation).

Handles, Locks, Latches and Entry Systems - Rear Door Latch

Removal and Installation

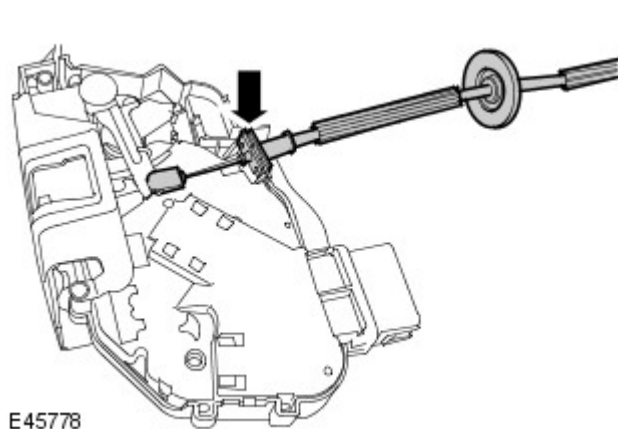
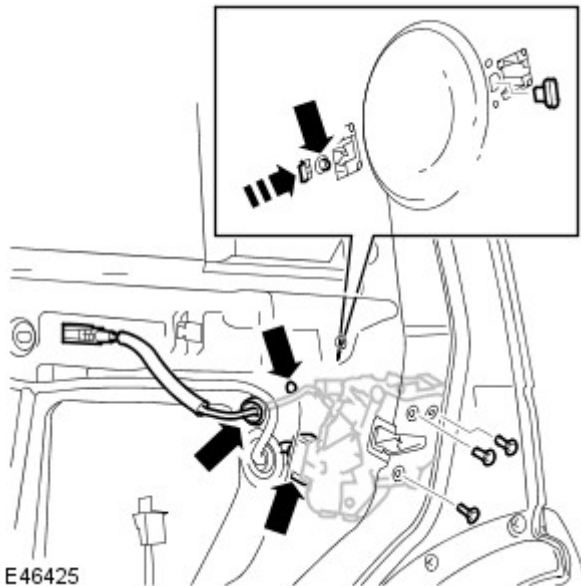
Removal


1. Remove the rear door window motor and regulator assembly.
For additional information, refer to: Rear Door Window Regulator and Motor (501-11, Removal and Installation).

2.  **CAUTION:** Release the exterior door handle and screw cover clips from inside the door.

Remove the rear door exterior handle.
For additional information, refer to: Exterior Rear Door Handle (501-14, Removal and Installation).

3. Release the remote control cable.
 - Release the grommet.
4. Release the door exterior handle mechanism.
 - Remove the 2 Torx screws.
 - Remove the locking pin.
5. Remove the rear door latch assembly.
 - Disconnect the electrical connector.
 - Remove the 3 Torx screws.

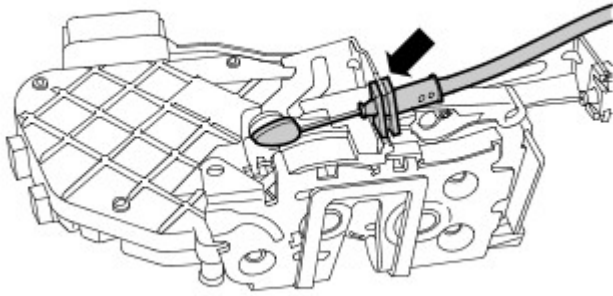


6.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the door latch remote control cable.

- Release the cable from the abutment bracket.
- Remove the cable from the lever.

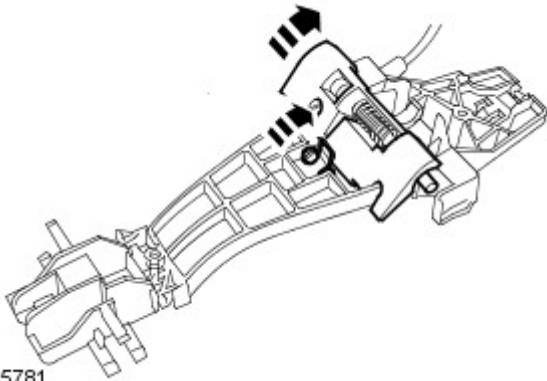
7. Release the exterior door handle mechanism cable from the door latch.
 - Release the cable from the abutment bracket.
 - Remove the cable from the lever.



E45779

Installation

1. Connect the door exterior handle mechanism cable to the door latch.
 - Connect the cable to the lever.
 - Secure the cable to the abutment bracket.
2. Install the remote control cable to the door latch.
 - Connect the cable to the lever.
 - Secure the cable to the abutment bracket.
3. Set the exterior handle mechanism.
 - Rotate the lever.
 - Engage the retaining tang.



E45781

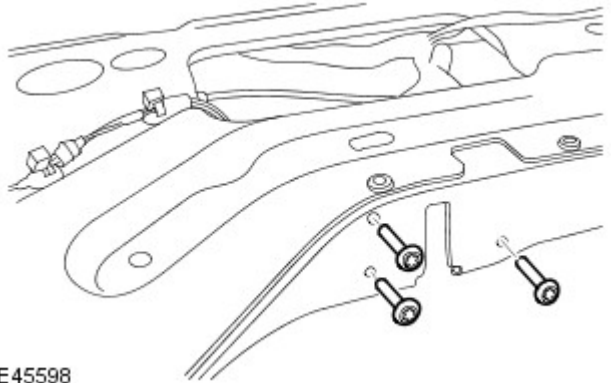
4. Install the rear door latch assembly.
 - Tighten the Torx screws to 10 Nm (7 lb.ft).
 - Connect the electrical connector.
5. Install the door exterior handle mechanism.
 - Position the mechanism to the door.
 - Fit the locking pin.
 - Install and tighten the Torx screws.
6. Position the remote control cable to the door.
 - Install the grommet.
7. Install the rear door exterior handle.
For additional information, refer to: Exterior Rear Door Handle (501-14, Removal and Installation).
8. Install the rear door window motor and regulator assembly.
For additional information, refer to: Rear Door Window Regulator and Motor (501-11, Removal and Installation).

Handles, Locks, Latches and Entry Systems - Liftgate Latch

Removal and Installation

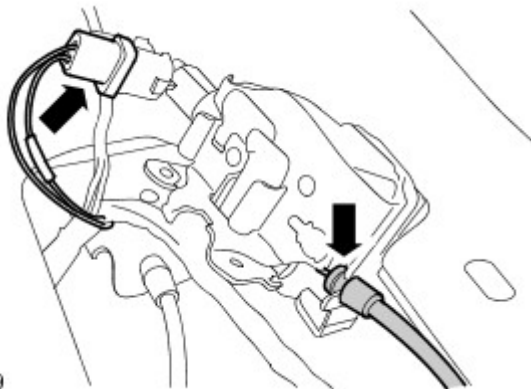
Removal

1. Remove the tailgate trim panel.
For additional information, refer to: Tailgate Trim Panel (501-05, Removal and Installation).
2. Remove the tailgate water shedder.
3. Release the liftgate latch.
 - Remove the 3 Torx screws.



E45598

4. Remove the liftgate latch.
 - Disconnect the electrical connector.
 - Release the liftgate latch to actuator cable.



E45599

Installation

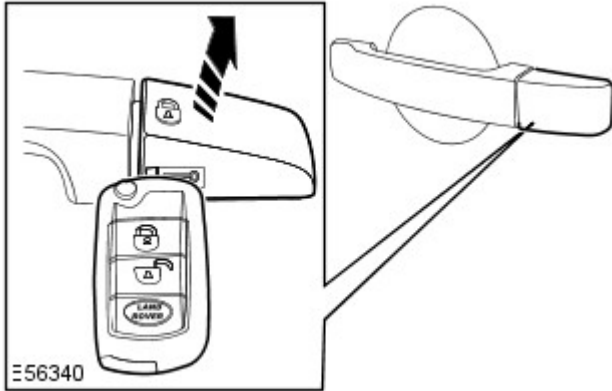
1. Install the liftgate latch.
 - Attach the liftgate latch to actuator cable.
 - Connect the electrical connector.
 - Tighten the Torx screws to 10 Nm (7 lb.ft).
2. Install the tailgate water shedder.
3. Install the tailgate trim panel.
For additional information, refer to: Tailgate Trim Panel (501-05, Removal and Installation).
4. Adjust the liftgate striker.
For additional information, refer to: Liftgate Striker Adjustment (501-14 Handles, Locks, Latches and Entry Systems, General Procedures).

Handles, Locks, Latches and Entry Systems - Door Lock Cylinder

Removal and Installation

Removal

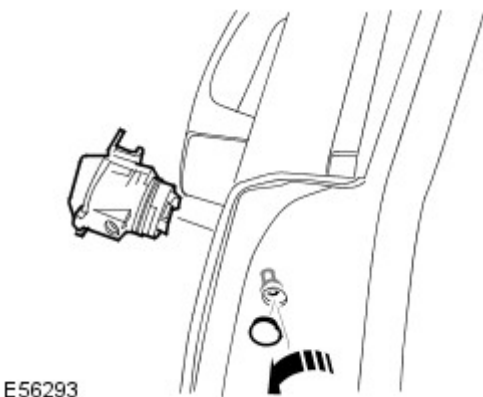
1. Remove the front door lock cylinder cover.
 - Use the ignition key.



2.  **NOTE:** The Torx screw remains in the door lock housing.

Remove the front door lock cylinder.

- Open the door.
- Remove the access plug.
- Loosen the Torx screw to release the lock.



Installation

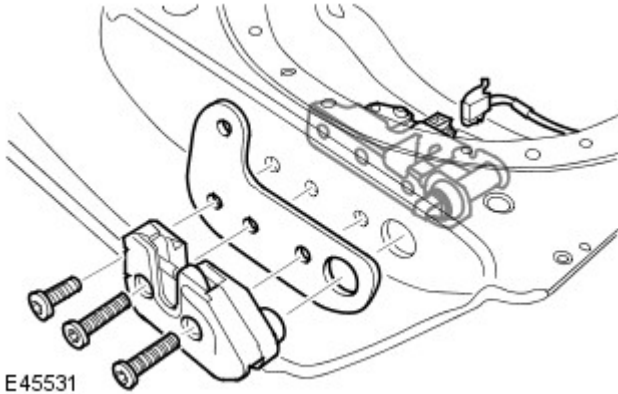
1. To install, reverse the removal procedure.

Handles, Locks, Latches and Entry Systems - Tailgate Latch

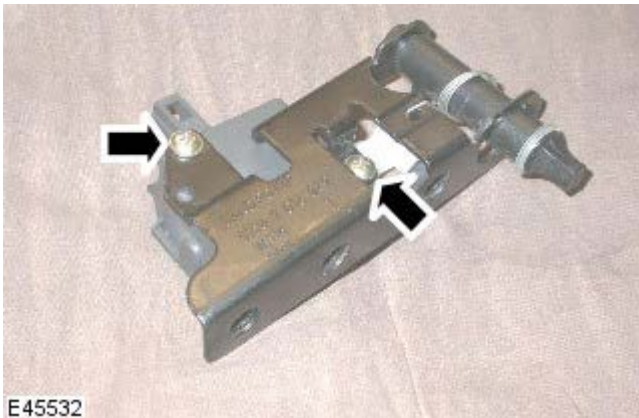
Removal and Installation


Removal

1. Remove the tailgate speaker assembly.
For additional information, refer to: Tailgate Speaker (415-03, Removal and Installation).



2. Remove the tailgate latch assembly.
 - Remove the 3 Torx bolts.
 - Disconnect the electrical connector.
 - Remove the latch.
 - Remove the latch plate.
 - Remove the latch actuator assembly.



3.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the latch actuator.

- Remove the 2 screws.

Installation

1. Install the latch actuator.
 - Tighten the screws.
2. Install the tailgate latch assembly.
 - Install the latch actuator assembly.
 - Install the latch plate.
 - Install the latch.
 - Tighten the Torx screws to 25 Nm (18 lb.ft).
 - Connect the electrical connector.
3. Install the tailgate speaker assembly.
For additional information, refer to: Tailgate Speaker (415-03, Removal and Installation).
4. Adjust both the tailgate strikers.
For additional information, refer to: Tailgate Striker Adjustment (501-14, General Procedures).

Handles, Locks, Latches and Entry Systems - Exterior Front Door Handle

Removal and Installation

Removal

NOTES:



This procedure details removal and installation of both the LH and RH exterior front door handles.

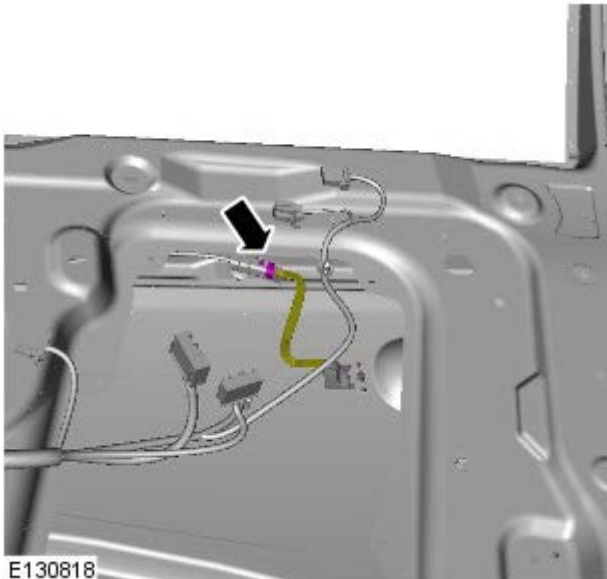


If the exterior handle is to be removed in conjunction with additional door internal items, then it is recommended that the exterior handle and screw cover be released from the inside of the door, after removal of the door trim pad, regulator and motor.

1. **NOTE:** Vehicles with passive entry system.

Remove the window regulator assembly.
For additional information, refer to: Front Door Window Regulator and Motor (501-11, Removal and Installation).

2. Disconnect the electrical connector.



3. **NOTE:** All vehicles.

LH side: Remove the private lock.
For additional information, refer to: Door Lock Cylinder (501-14, Removal and Installation).

4. **NOTES:**



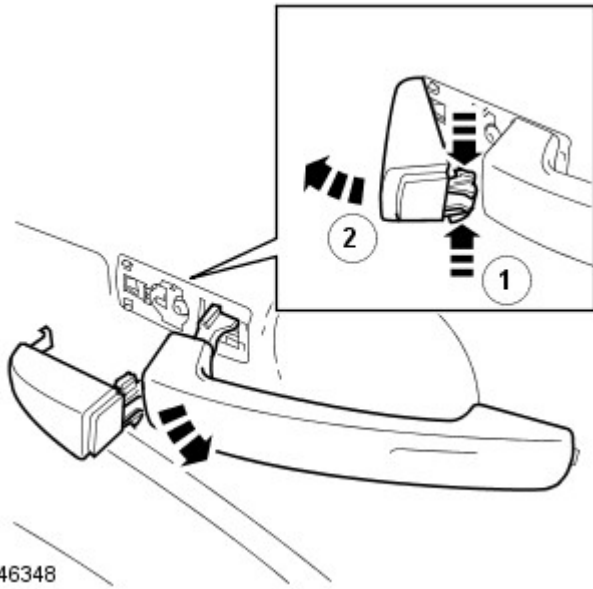
Removal of the screw cover may break the retaining clips.



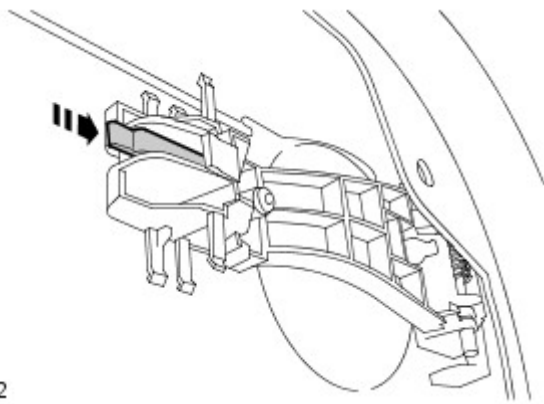
If the screw cover is to be removed in conjunction with additional door internal items, then it is recommended that the screw cover be released from the inside of the door, after removal of the door trim pad, regulator and motor.

RH side: Remove the screw cover.

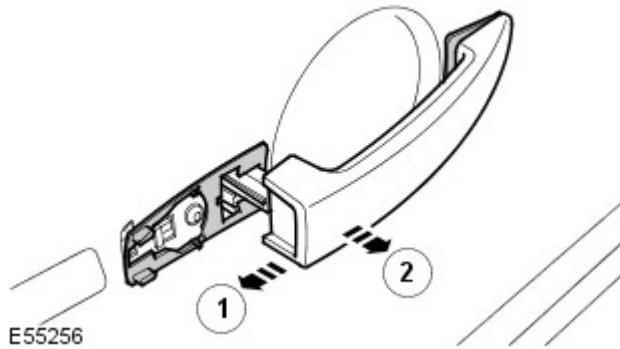
- Release the 2 clips.



E46348



E66202



E55256


5. To remove the exterior front door handle, after removal of the door trim pad and regulator.
 - Using a nylon mallet, carefully release the clip.
 - Remove the 2 gaskets.

6.  **NOTE:** Vehicles without passive entry system.

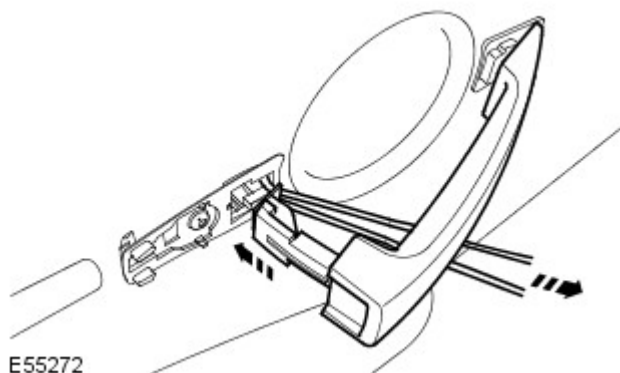
To remove the exterior front door handle, without removal of the door trim pad.

- Slide the handle firmly rearward, then pivot the handle away from the door to remove it.
- Remove the 2 gaskets.

Installation

1.  **NOTE:** Use a length of cord to hold the lock lever against spring pressure while engaging the outside handle.

To install, reverse the removal procedure.



E55272

Handles, Locks, Latches and Entry Systems - Exterior Rear Door Handle

Removal and Installation

Removal

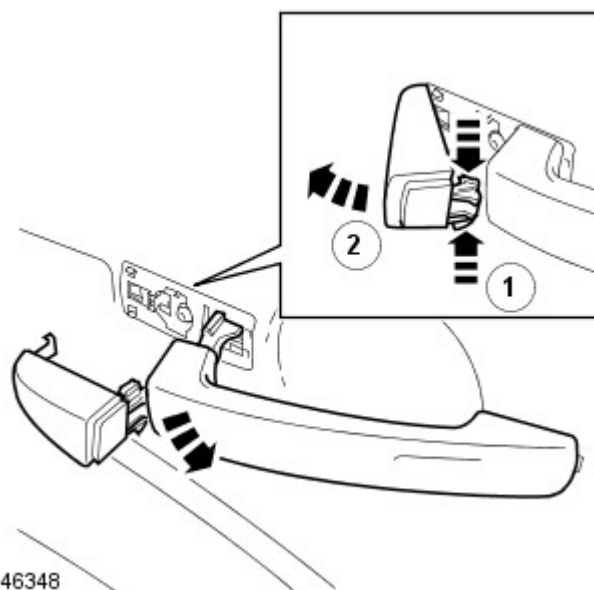
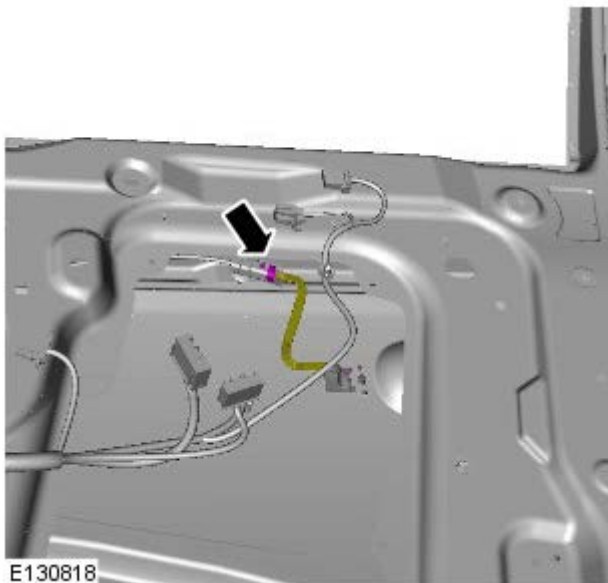


NOTE: If the exterior handle is to be removed in conjunction with additional door internal items, then it is recommended that the exterior handle and screw cover be released from the inside of the door, after removal of the door trim pad, regulator and motor.

1. **NOTE:** Vehicles with passive entry system.

For additional information, refer to: [Rear Door Window Regulator and Motor](#) (501-11 Glass, Frames and Mechanisms, Removal and Installation).

2. Disconnect the electrical connector.



3. **NOTES:**



All vehicles.



Removal of the screw cover may break the retaining clips.



If the screw cover is to be removed in conjunction with additional door internal items, then it is recommended that the screw cover be released from the inside of the door, after removal of the door trim pad, regulator and motor.

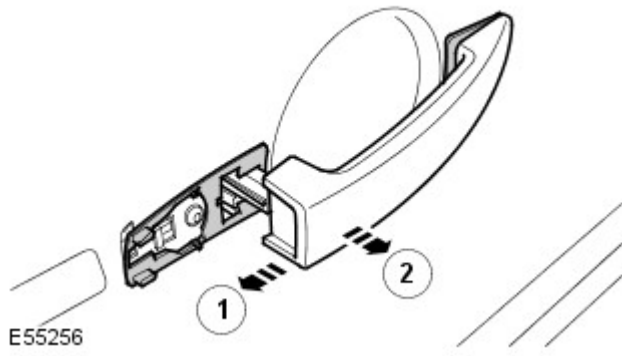
Remove the screw cover.

- Release the 2 clips.

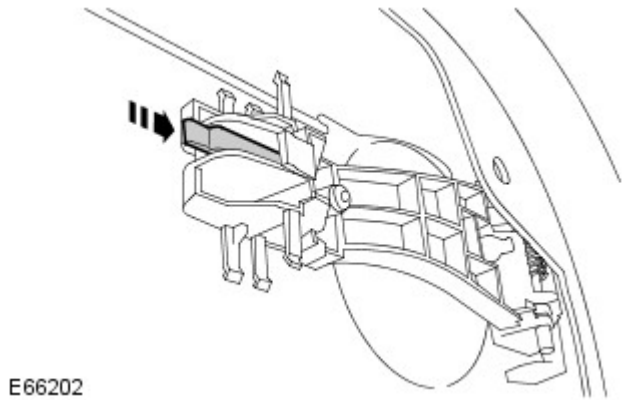
4. **NOTE:** Vehicles without passive entry system.

To remove the exterior rear door handle, without removal of the door trim pad.

- Slide the handle firmly rearward, then pivot the handle away from the door to remove it.

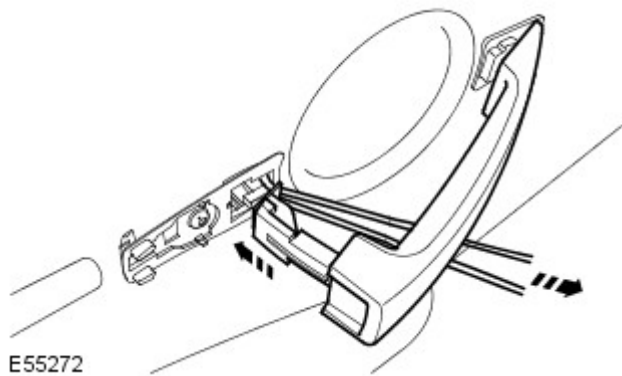



- Remove the 2 gaskets.



5. To remove the exterior rear door handle, after removal of the door trim pad and regulator.
 - Using a nylon mallet, carefully release the clip.
 - Remove the 2 gaskets.

Installation



1.  **NOTE:** Use a length of cord to hold the lock lever against spring pressure while engaging the outside handle.

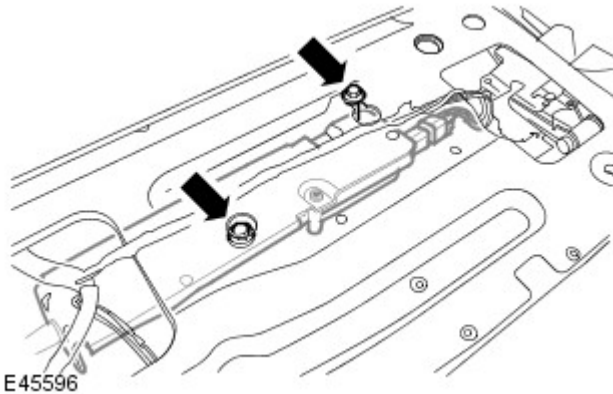
To install, reverse the removal procedure.

Handles, Locks, Latches and Entry Systems - Liftgate Latch Actuator

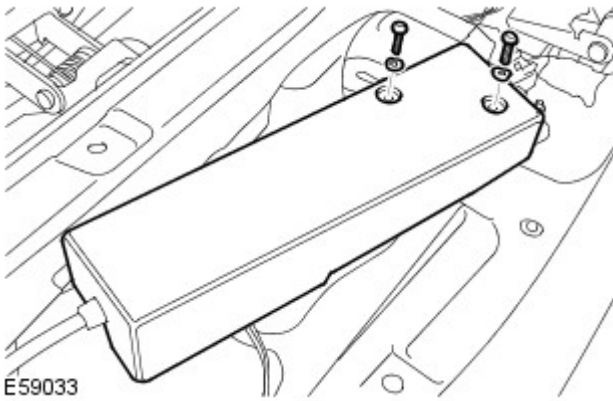
Removal and Installation

Removal

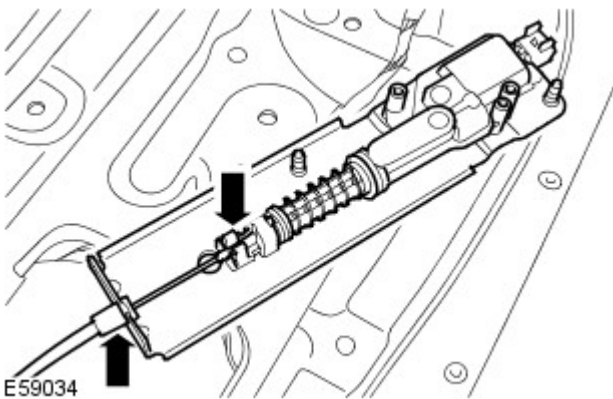
1. Remove the tailgate trim panel.
For additional information, refer to: Tailgate Trim Panel (501-05, Removal and Installation).



2. Release the liftgate actuator.
 - Loosen the 2 bolts.
 - Disconnect the electrical connector.




3. Remove the actuator cover.
 - Remove the 2 Torx screws.

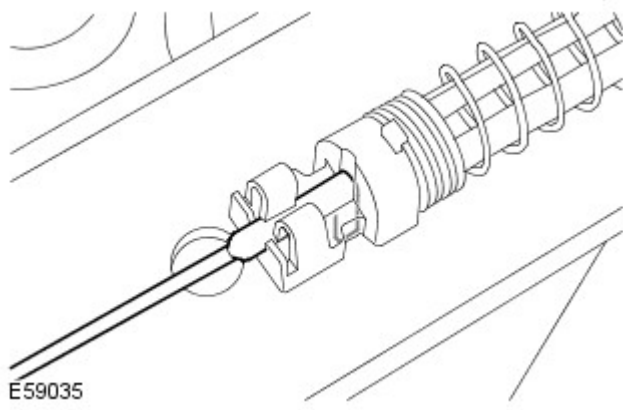


4. Remove the liftgate actuator.
 - Release the liftgate latch to actuator cable.

Installation

1.  **CAUTION:** It is possible to incorrectly install the cable, ensure the ferrule and clip are fully engaged.

Attach the actuator to the liftgate latch cable.



2. Install the cover.
 - Tighten the Torx screws.
3. Install the liftgate actuator.
 - Tighten the bolts to 10 Nm (7 lb.ft).
 - Connect and secure the electrical connector.
4. Install the tailgate trim panel.

For additional information, refer to: Tailgate Trim Panel (501-05, Removal and Installation).

Handles, Locks, Latches and Entry Systems - Remote Keyless Entry (RKE) Module

Removal and Installation

Removal

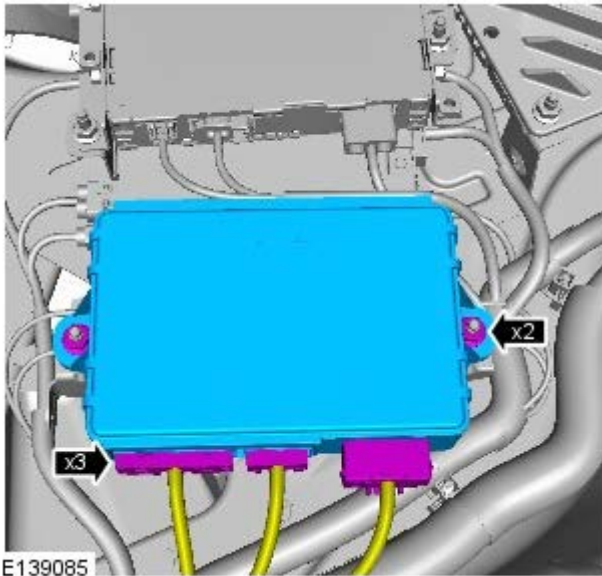


NOTE: Removal steps in this procedure may contain installation details.

1.  NOTE: RH side only.

Refer to: Rear Quarter Trim Panel (501-05, Removal and Installation).

2. Torque: 9 Nm



Installation

1. To install reverse the removal procedure.
2. Using the diagnostic tool, calibrate the component.

Wipers and Washers -

Capacities

Item	Description
Windscreen washer reservoir	6.3 litres (11.0 pints) (6.6 US quarts)

General Specifications

Item	Description
Front wiper motor make	Trico
Rear wiper motor make	Mitsuba
Windscreen washer pump make	MES
Power washer pump make	Textron

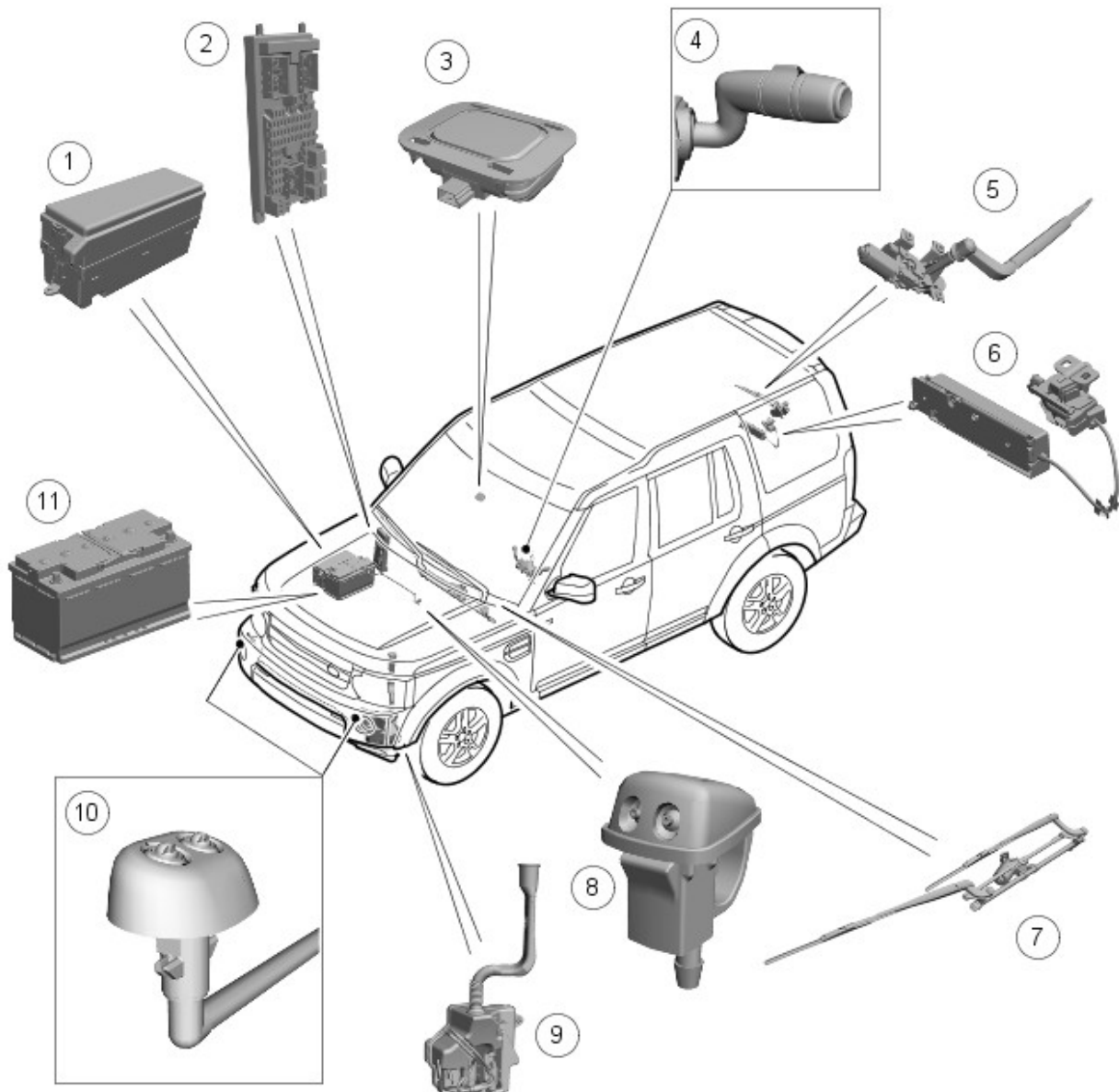
Torque Specifications

Description	Nm	lb-ft
Front wiper arms to linkage nut	18	13
Rear window wiper motor nuts	10	7
Rear wiper arm to motor nut	18	13
Wiper linkage to front wiper motor:		
Nut	25	18
Bolts	10	7
Wiper linkage to body bolts	6	4
Washer reservoir and pump assembly to body bolts	6	4
Washer reservoir and pump assembly to bumper armature bolts	22	16

Wipers and Washers - Wipers and Washers

Description and Operation

Wiper and Washer System Component Location



E139776

Item	Part Number	Description
1	-	BJB (battery junction box)
2	-	CJB (central junction box)
3	-	Rain/Light sensor
4	-	Wiper control switch
5	-	Rear wiper linkage and motor assembly
6	-	Tailgate latch assembly
7	-	Front wiper linkage and motor assembly, including wiper arms and blades
8	-	Front washer jets
9	-	Washer reservoir and pumps
10	-	Headlamp washer jets
11	-	Battery

GENERAL

The wiper and washer system is controlled by the CJB on receipt of requests made by the driver or the rain/light sensor unit (if fitted). All wiper functions for the front and rear wipers are controlled from a multi-function wash/wipe switch assembly located on the right hand side of the steering column.

The wiper and washer system comprises:

- Front and rear wiper motors
- A front wiper linkage
- Two front and one rear wiper arms and blades
- Two front washer jets and one rear washer jet
- A washer reservoir and pump
- A wash/wipe control column switch.

The following optional items can be added to enhance the wiper system:

- A rain/light sensor for automatic wiper control
- Heated front washer jets
- Headlamp washers
- Low fluid level sensor (fitted to vehicles with headlamp washers).

The wiper system can be optionally equipped with a rain/light sensor. The sensor, located below the interior rear view mirror, detects rain drops on the windscreen and automatically operates the wipers in the intermittent mode. The column stalk switch must be in the intermittent position for rain/light sensor controlled wiper operation.

The front wiper system has five stages of operation and six intermittent delay periods.

The five wiper stages are as follows:

1. Flick wipe
2. Off
3. Intermittent
4. Normal (slow) speed continuous
5. Fast speed continuous

Speed Control Intermittent Mode

The intermittent mode is affected by road speed, providing the speed control intermittent wipe mode has been configured. The intermittent wiper delay periods change with the road speed, with the delay decreasing as the road speed increases.

Speed Dependent Wipe Mode

When the speed dependent wipe mode has been configured, the normal continuous operation changes to intermittent operation when the vehicle is stationary. The fast speed operation changes to normal operation when the vehicle is stationary.

The wiper and washers operate with the ignition switch in position II. Wiper functions are suspended during engine cranking to reduce battery power consumption under high load conditions.

Diagnostic information for the wiper system is available and can be retrieved using T4.

CENTRAL JUNCTION BOX

The **CJB** is an integrated unit located behind the fascia on the passenger side of the bulkhead. The **CJB** contains fuses, relays and a number of microprocessors, which control the power supply and functionality of the wash/wipe system and other vehicle systems.

Inputs and Outputs

The **CJB** receives and sends the following wiper and washer system inputs and outputs:

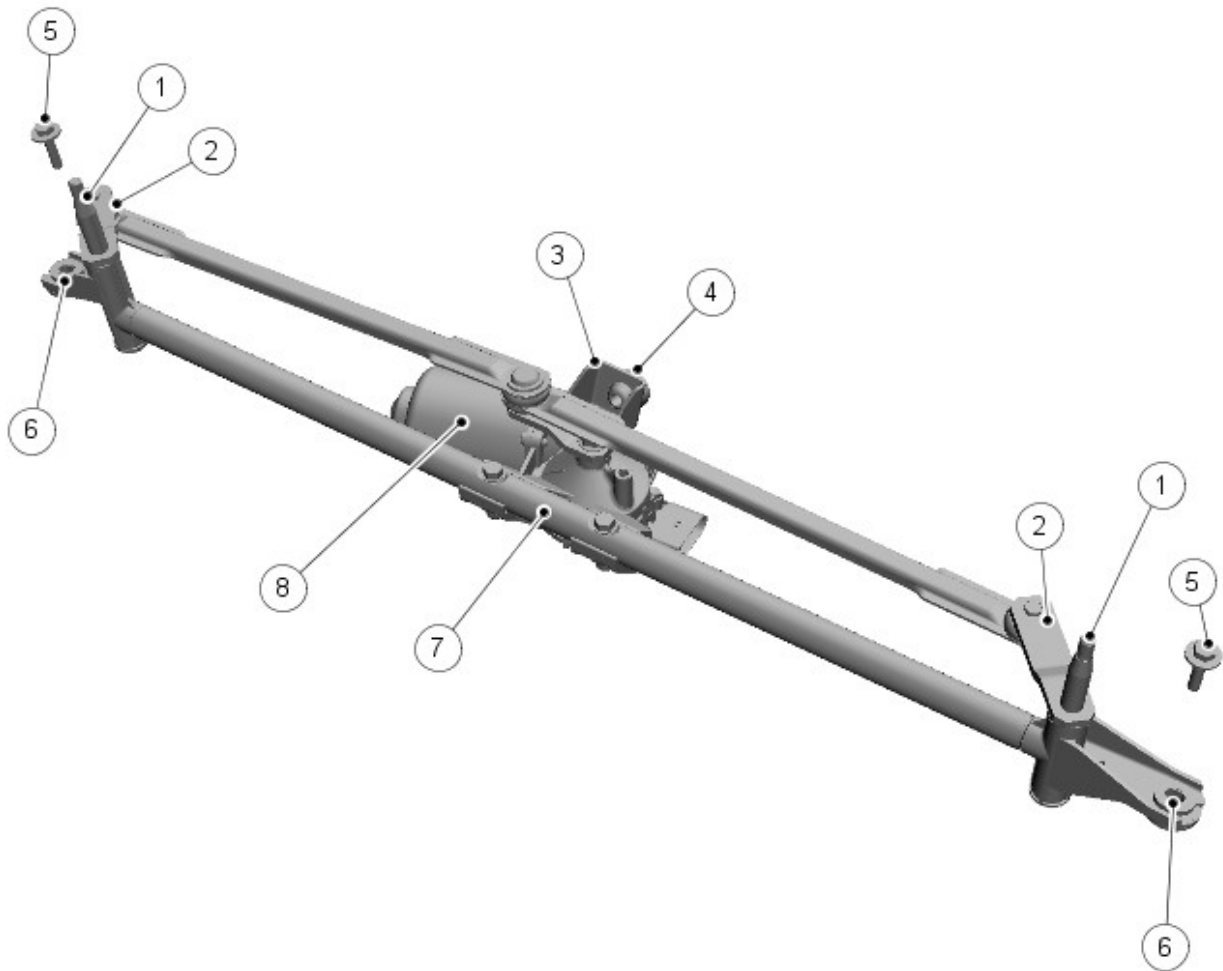
Inputs	Outputs
Intermittent front wipe switch	Front wiper motor (normal)
Rear wipe park switch	Front wiper motor (fast)
Rain/light sensor, if fitted	Washer motors
Normal (slow) speed continuous switch	Heated washer jets (if fitted)
Fast speed continuous switch	Rear wiper motor relay
Flick wipe switch	Headlamp power wash motor
Front screen wash switch	-
Rear screen wash switch	-
Ignition switch	-
Lighting switch	-
Low level reservoir status, via CAN	-
Vehicle speed, via CAN	-
Front wiper motor park switch	-
Reverse switch, via CAN	-
Tail gate open switch	-
Ambient temperature, via CAN	-

FRONT WIPER ASSEMBLY

The front wiper assembly comprises:

- Wiper motor and linkage assembly
- Wiper arms and blades
- Washer reservoir and pumps.

Wiper Linkage



E139777

Item	Part Number	Description
1	-	RH (right-hand) pivot housing assembly
2	-	Link rod
3	-	Bracket
4	-	Bush
5	-	Bolt
6	-	Bush
7	-	Link rod
8	-	Motor assembly

The wiper linkage and motor assembly are available as separate components. The wiper linkage and motor differs between LH (left-hand) and RH drive models.

The assembly is located below the plenum grill in the engine compartment and is secured with bushes, sleeves and bolts. The rubber bushes isolate the assembly from the body mountings.

The linkage assembly comprises a main tube, with a pivot housing at each end and the motor is attached directly to the tube. A motor crank is positively attached to the motor output shaft. Two link rods then attach to the motor crank which transfers power directly to each pivot crank.

The motor crank converts rotary motion from the motor output shaft into linear movement of the link rods. The cranks, connected between the each link rod and pivot housing, convert the linear motion to reciprocating motion at the pivot housing. This reciprocating motion is passed to the wiper arms and blades causing the blades to wipe an arc across the windscreen.

Wiper Motor

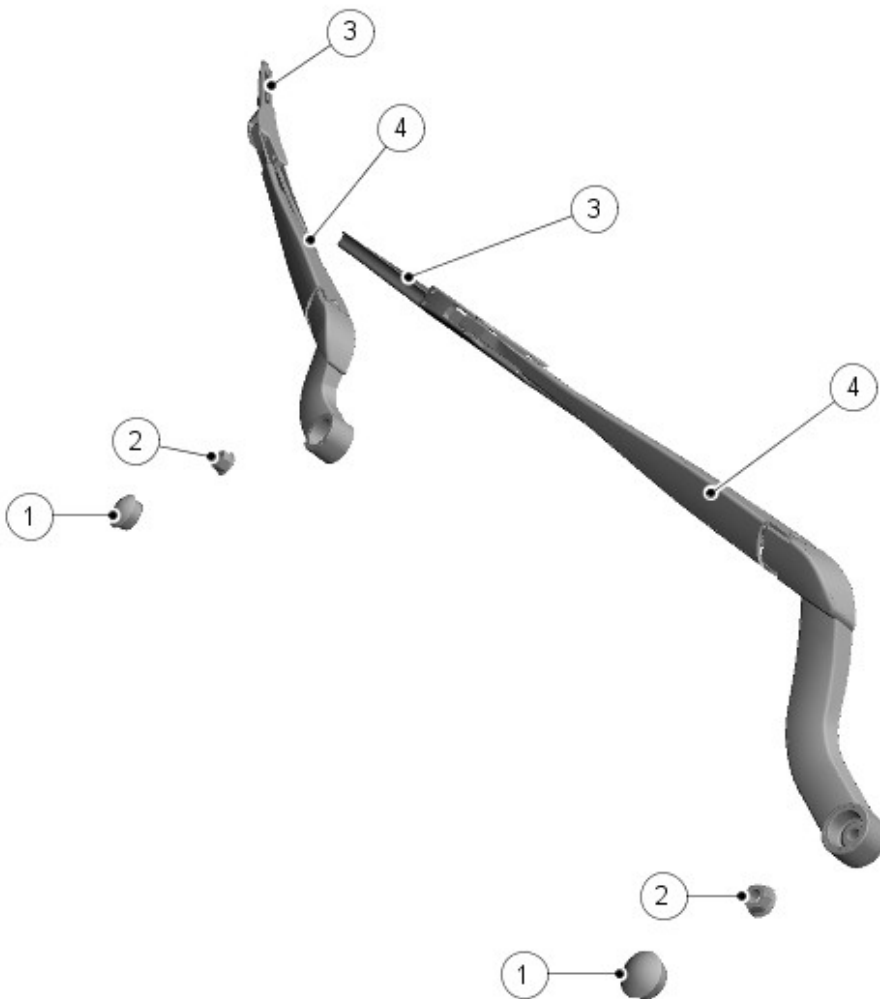
The motor assembly comprises a **DC (direct current)** motor, which drives a gear wheel via a worm drive attached to the motor spindle. The gear wheel has a central spigot, which provides the attachment point for the motor crank.

The motor is connected electrically by a five-pin connector. The connector supplies two battery voltage feeds to the motor (when switched). The motor has three sets of brushes with one brush connected to ground. One feed is direct to the motor brush opposite the ground brush and operates the motor at normal (slow) speed. The second feed is connected to a motor brush, which is offset from the ground brush and operates the motor at fast speed. With the power supplied through this brush, the current flows through fewer coil windings. This results in a lower resistance to the current flow to the ground brush and gives a higher motor rotational speed.

Output control of the wiper motor is through a double contact relay. The relay is located in the **BJB**.

The motor has an internal track switch, which signals the **CJB** when the wipers have reached the park position. The park signal is closed circuit when the wipers are in the park position. When the wipers are switched off and the **CJB** receives the park position signal from the motor, the **CJB** shorts the motor via a relay bridge circuit. This short circuit has the effect of applying a brake to the motor, giving precise positioning of the wiper blades in the park position.

Wiper Arms



E139778

Item	Part Number	Description
1	-	Spindle caps
2	-	Securing nuts
3	-	Wiper blades
4	-	Wiper arms

The wiper arms are positively located on tapered splines on the wiper linkage spindles.

The wiper arm has a pivot point, midway between the spindle attachment and the blade. A tension spring is

connected to the wiper arm on each side of the pivot point and applies pressure to maintain the wiper blade in contact with the windscreen.

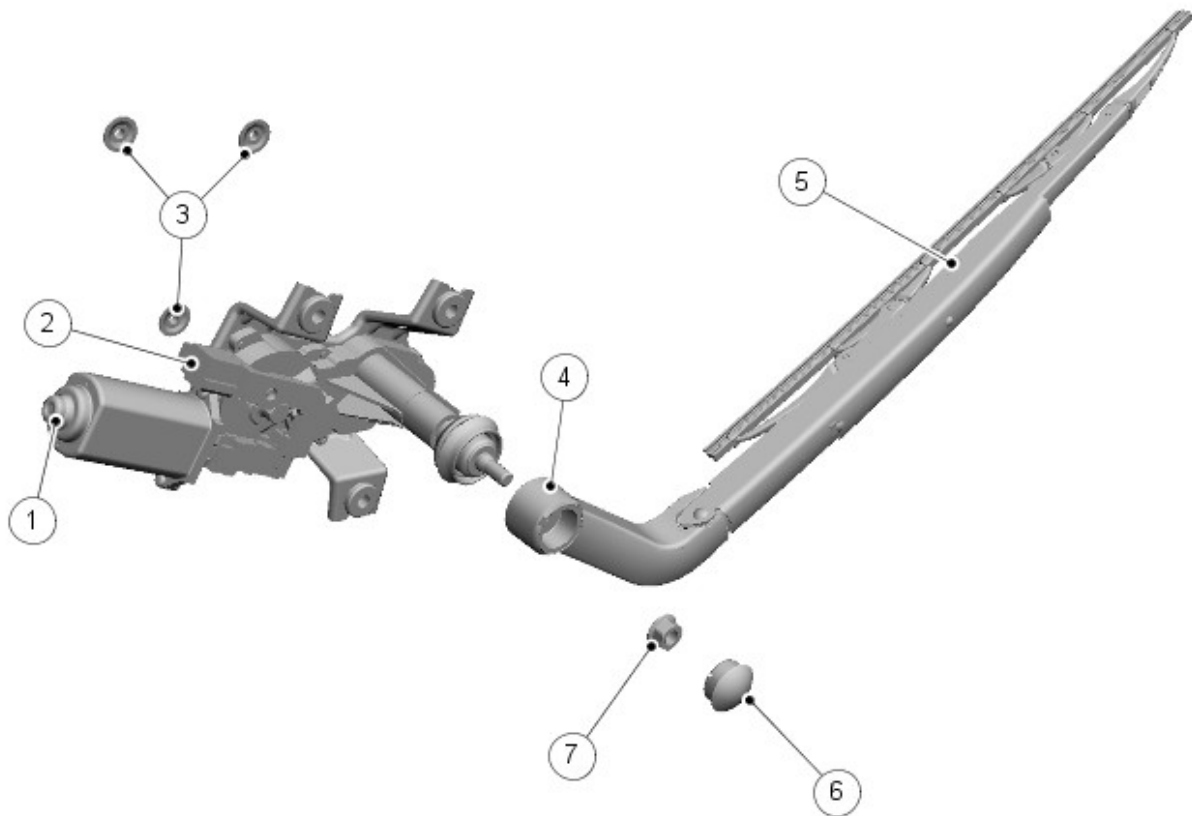
The wiper blades are attached to the wiper arms with clips that allow the blade to pivot. The wiper blades comprise of a sprung steel curved backbone which applies the pressure evenly to the windscreen, to which is applied the wiping lip to the bottom surface and an aero foil section to the top which presses the blades onto the windscreen at high vehicle speeds.

REAR WIPER ASSEMBLY

The rear wiper assembly comprises:

- Wiper motor
- Rear washer pump
- Rear washer jet
- Wiper arm and blade.

Wiper Motor



E139779

Item	Part Number	Description
1	-	Motor assembly
2	-	Harness connector
3	-	Washers and nuts
4	-	Pivot housing connection
5	-	Wiper arm
6	-	Spindle cap
7	-	Securing nut

The rear wiper and washers operation is controlled by the CJB, via the rear wiper relay, which is located in the LH rear 'D' post.

The rear wiper motor is located in the upper tail gate, behind a trim panel. The assembly is secured to the body of the upper tail gate with three M6 nuts. Bushes isolate the motor assembly from the body, which help reduce the transmission of motor operating noise to the tail gate.

The motor is located on a worm drive gearbox mechanism, which converts the rotary motion of the motor output spindle into the required arc for the rear wiper blade.

The feed hose, for the separate rear washer jet, is located at the rear of the motor spindle. The hose is connected to a 90 degrees connector allowing the washer fluid to flow through the center of the motor spindle. A Non-Return Valve (NRV) is located in the hose, near the motor, and prevents fluid returning to the reservoir.

The motor spindle is a conventional design with a taper spline location for the wiper arm and a threaded shank to secure the arm to the spindle.

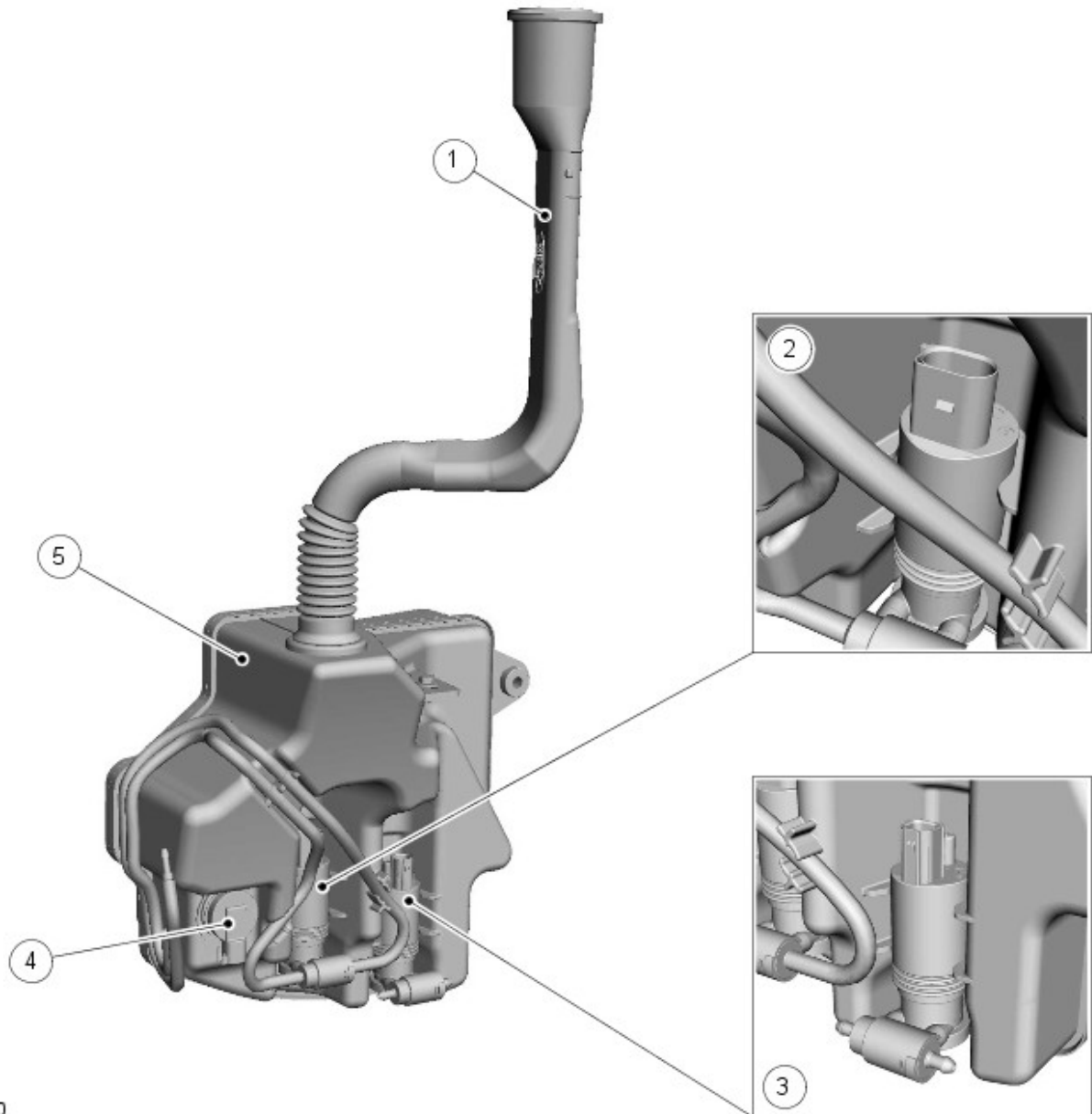
Wiper Arm

The wiper arm is similar in design to the front wiper arms. The arm attachment hole has tapered splines, which mate with the splines on the wiper spindle. The arm is secured to the wiper motor spindle with a nut. The wiper arm has a pivot point, close to the spindle attachment. A tension spring is connected to the wiper arm on each side of the pivot point and applies pressure to maintain the wiper blade in contact with the windscreen.

The wiper blade is attached to the wiper arm with a clip that allows the blade to pivot. The blade comprises a number of levers and yokes to, which the rubber wiper blade is attached. The levers and yokes ensure that the pressure applied by the arm tension spring is distributed evenly along the full length of the blade and also allow the blade to adjust to the curvature and contour of the windscreen.

A plastic cap located on the arm pivot point, covers the spindle attachment nut.

WASHER RESERVOIR AND PUMPS



E139780

Item	Part Number	Description
1	-	Filler tube and cap
2	-	Headlamp washer pump
3	-	Front and rear screen washer pump
4	-	Fluid level sensor
5	-	Reservoir

The windscreen washer system comprises:

Vehicles without headlamp washers:

- A reservoir
- A washer pump
- Two washer jets
- Hoses

Vehicles with headlamp washers:

- A reservoir
- Two washer pumps
- A level sensor
- Four washer jets - two windshield and two headlamp washers
- Hoses

The plastic, molded reservoir is located in the LH wheel arch, behind the liner and has a capacity of 11.08 pints (6.3 liters). It is secured to the body and front panel with bolts. A boss on the reservoir locates in a slot in the front panel and provides additional support.

The reservoir has two recessed holes on its rear face, which provide location for the combined front pump, rear pump and headlamp washer pumps. The pumps are push fitted into grommets, which seal the pumps in their

locations. A hole in the top of the reservoir allows for the fitment of a flexible filler tube. The front and rear wash hoses are integrated into the harness and so follow it's routing. The headlamp washer hose comes front the bumper around the bottle to attach to the headlamp washer pump.

A hole with a grommet in the side of the reservoir provides the location for the fluid level sensor.

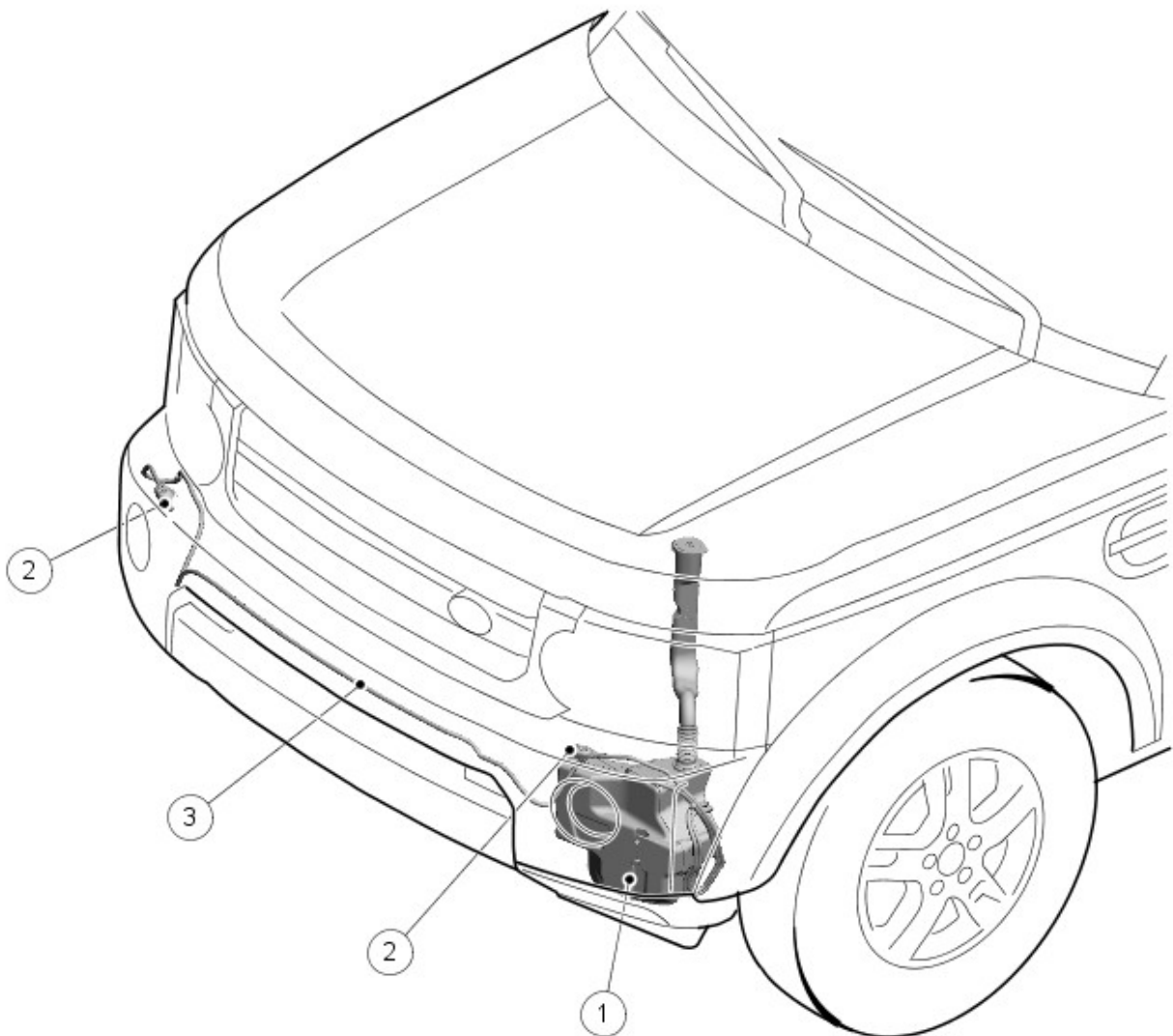
The low level sensor has a float, with integral magnet. The sensor has a contact, which is normally closed when the reservoir is full. When the fluid level reduces to approximately 1 liter, the magnetic float pivots down, which causes the switch contact to open. This open circuit is sensed by the **CJB** and transmits the low fluid level message on the **CAN (controller area network)** bus.

The sensor cannot determine the precise amount of fluid in the reservoir, but can detect when the fluid level has fallen below a certain point. When the fluid level is low, the magnetic float opens the sensor contacts, breaking a circuit through the sensor. This broken circuit is sensed by the **CJB** to which the sensor is directly connected.

The fluid level sensor is monitored continuously by the instrument cluster. The instrument cluster checks the fluid level sensor when the ignition is switched on to give the driver an early warning of the low fluid level. The instrument cluster then monitors the sensor value over a 25 second period when the ignition is on to prevent invalid messages due to fluid 'sloshing' in the reservoir.

When a low fluid level signal is transmitted to the high line instrument cluster, a 'WASHER FLUID LOW' message is displayed in the instrument cluster's message center. On the low line instrument cluster a low fluid level indicator is illuminated. The first display of this message, or illumination of the indicator, is accompanied by a 'chime' sound to alert the driver to the low fluid level.

HEADLAMP WASHERS



E139782

Item	Part Number	Description
1	-	Reservoir
2	-	Headlamp washer jets

The headlamp washer assembly is located below each headlamp.

The headlamp washer operation is controlled by the **CJB** via a headlamp washer relay. The relay is located in the **BJB**.

Head Lamp Wash Only (No Wipe Function)

The headlamp washers are only active when the headlamps and ignition are switched on. If the washer reservoir fluid level becomes low, the **CJB** sends a message via the **CAN** bus to the instrument cluster. The **CJB** then suspends headlamp wash operation to preserve washer fluid in the reservoir.

With the ignition and lights on, headlamp wash is activated on the first operation of the wiper column control switch in the wash/wipe position. The **CJB** then suspends headlamp wash activation for the next 10 minutes and four operations of the wash/wipe switch.

The **CJB** monitors the operation of the wash/wipe switch and maintains a counter to restrict headlamp washer operation to every fourth operation of the wash/wipe switch in conjunction with a 10 minute timer. The timer prevents a second operation of the headlamp washers within a 10 minute period. Should the washer switch be activated for more than four programmed wipe requests, during the 10 minute period, the headlamp washer will remain disabled. Only the next consecutive programmed wipe request, after the 10 timer has expired, will the headlamp washers be enabled. The counter and timer are reset when the ignition is switched off or lights have been switched back on from off.

When headlamp wash is active, the **CJB** energizes the washer pump twice per cycle. The headlamp washer pump is powered for a 0.5 second period.

RAIN/LIGHT SENSOR



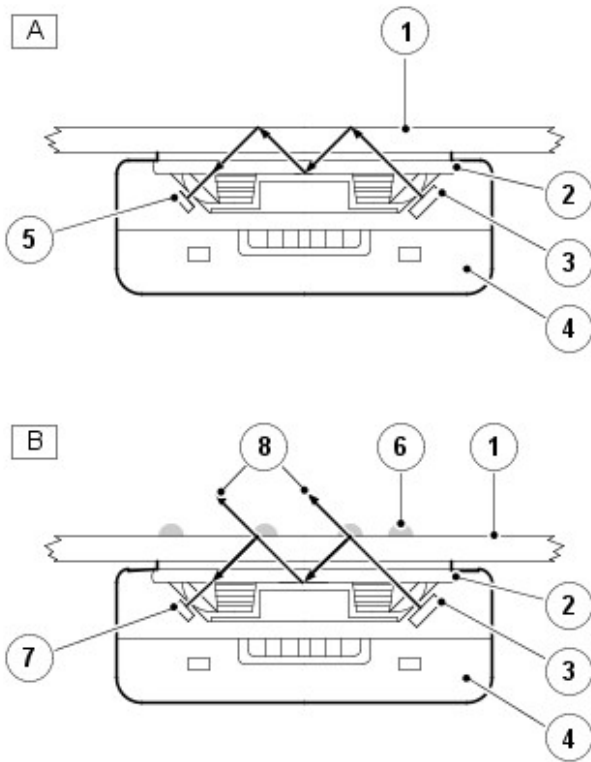
E133992

The rain/light sensor is located at the upper edge of the windscreen, behind the interior rear view mirror. The sensor is mounted on a mounting bracket, which is heat bonded to the inner surface of the windscreen during manufacture. Thus, if damage occurs to the optical unit, the windscreen will not have to be changed.

The rain sensor must be re-authorized to a new windscreen, if fitted, or if transferred to another vehicle, the new rain sensor assembly will automatically re-initialize when powered-up for the first time. In order for this to occur successfully, it must be fitted and connected to the windscreen bracket.

The sensor provides information to the **CJB** for the optimum wiper operation for the prevailing conditions to maintain the screen in a clear condition at all times. The rain/light sensor is an optical unit, which operates on an infrared waveband. The sensor uses the principle of the laws of reflection on interfacing surfaces between materials with differing refraction properties.

Rain Sensor Functionality



E43326

Item	Part Number	Description
A	-	Clean and dry windscreen
B	-	Wet and dirty windscreen
1	-	Windscreen - Outside surface
2	-	Optical unit
3	-	Transmitter diodes (100% light transmitted)
4	-	Rain/Light sensor unit
5	-	Receiver diodes (100% received)
6	-	Water droplets/film
7	-	Receiver diodes (less than 100% light received)
8	-	Lost light

The rain/light sensor contains transmitter and receiver diodes, which transmit and receive infrared light, which is directed onto the windscreen via an optical unit. The light is directed at an angle so that the light is reflected 100% on the outside surface of the screen and is transmitted back into the optical unit. To receive a 100% reflection, the outer screen surface must be clean and dry.

The rain/light sensor is active when the wiper column control switch is in the intermittent position. The rain/light sensor suspends wiper operation when the area of the windscreen for the rain/light sensor is dry and operates the wipers continuously when the windscreen is subject to heavy rainfall.

The sensitivity of the rain/light sensor can be adjusted by the driver using the intermittent rotary switch on the wiper stalk. Six sensitivity levels of the sensor can be selected, which has the effect of increasing or decreasing the wiper delay period, allow driver adjustment for the prevailing conditions. When several continuous wipe cycles have taken place, the sensor will maintain the continuous operation to avoid switching back to intermittent from a continuous wipe and back again.

The rain/light sensor receives vehicle speed information from the [ABS \(anti-lock brake system\)](#) module on the [LIN \(local interconnect network\)](#) bus via the [CJB](#). The speed information is used only for automatic headlamp operation.

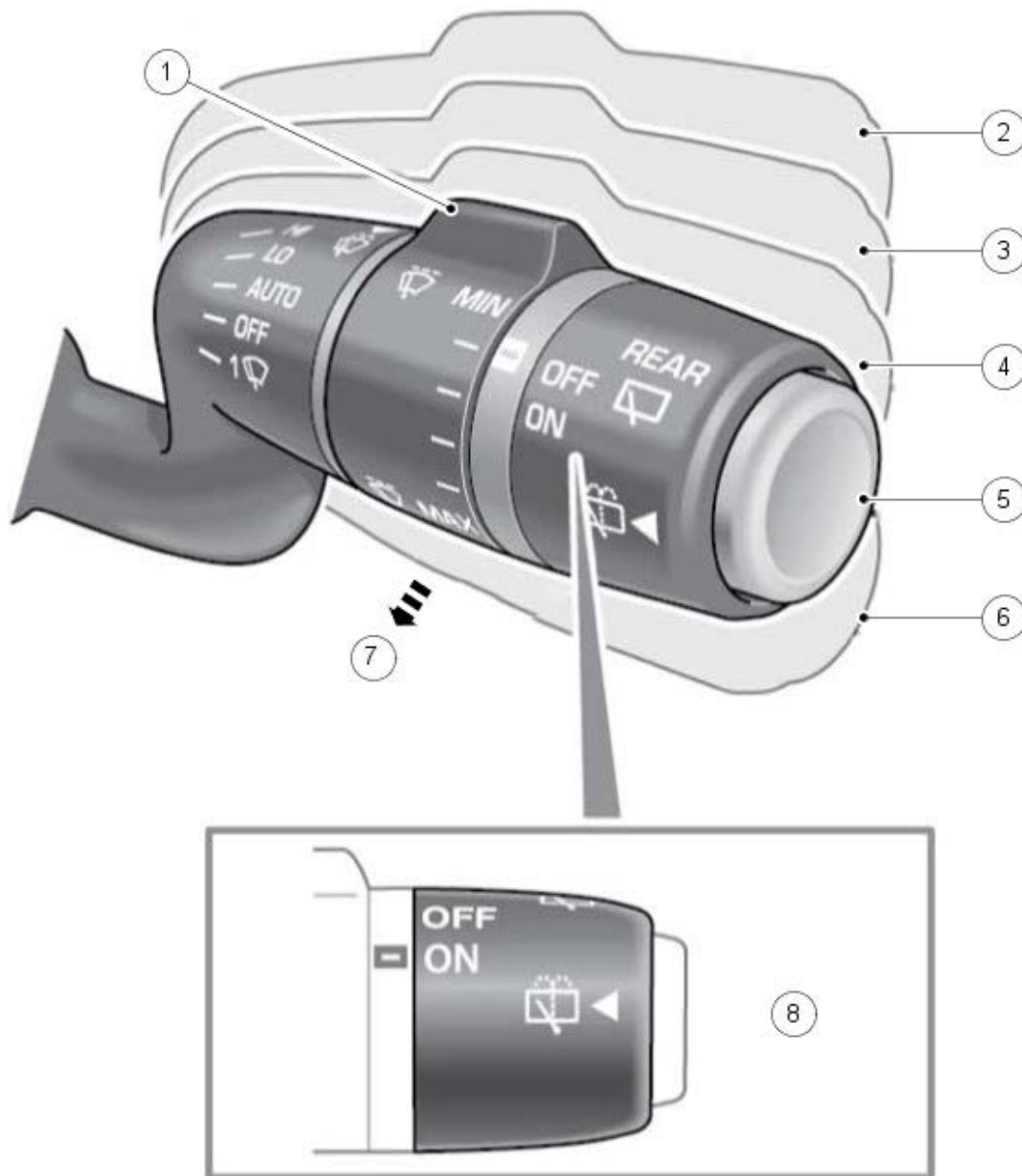
Automatic Headlamp Operation

A light sensor is incorporated in the housing of the rain/light sensor to control the operation of the automatic headlamps.

The automatic headlamps will function when the lighting control switch is in the 'AUTO' position and the [CJB](#) receives a lights on signal from the rain/light sensor.

For additional information, refer to: Exterior Lighting (417-01, Description and Operation).

WIPER CONTROL COLUMN SWITCH



E139781

Item	Part Number	Description
1	-	Intermittent wipe delay
2	-	High speed wipe
3	-	Low speed wipe
4	-	AUTO or intermittent wipe
5	-	Rear window wash/wipe
6	-	Single wipe of windscreen
7	-	Windscreen wash/wipe
8	-	Rear wiper

The wiper control column switch is located on the right hand side of the steering column and controls all front and rear wiper functions.

The switch comprises 6 switch positions and the intermittent rotary control. The switch positions each complete a combination of earth paths to connections on the [CJB](#). The [CJB](#) interprets the selected combination of switches and operates the respective function accordingly.

Flick Wipe

Moving the switch down selects the front wiper flick wipe function. The front wipers will operate at fast speed for as long as the flick wipe switch position is operated. Once the switch is released, the front wiper motor will revert to a normal (slow) speed operation until a park position has been detected.

Intermittent

Moving the switch up one position from 'OFF', selects intermittent front wiper operation. The rotary potentiometer on the stalk selects one of six delay periods. The delay period is also influenced by vehicle speed (should speed control intermittent wipe mode be configured), using a signal value derived from the [ABS](#) control module. The selected delay

period decreases with an increase in road speed. When a rain/light sensor is incorporated into the system, the intermittent position also initiates wiper operation controlled by the rain/light sensor. The sensitivity of the rain/light sensor is also adjusted by rotating the rotary switch to one of the six positions.

The rotary switch selects differing output values for each position. The switch is wired to three data input terminals of the [CJB](#).

Rotary Switch Position	Output Data 1	Output Data 2	Output Data 3
1	Yes	-	-
2	Yes	Yes	-
3	-	Yes	-
4	-	Yes	Yes
5	Yes	Yes	Yes
6	Yes	-	Yes

The time delay periods for the vehicle stationary and when moving at different speeds are shown in seconds (by speed CLASS) in the following tables:

Class	Speed Increase - MPH (KPH)	Speed Decrease - MPH (KPH)
0	Vehicle speed <5 (8), remain in class 0 Vehicle speed >5 (8), increment to class 1	-
1	Vehicle speed >5 (8) and <20 (32), remain in class 1 Vehicle speed >20 (32), increment to class 2	Vehicle speed = 0, Revert to class 0 Vehicle speed > 0 and <20 (32), remain in class 1
2	Vehicle speed >20 (32) and <40 (64), remain in class 2 Vehicle speed >40 (64), increment to class 3	Vehicle speed <10 (16), revert to class 1 Vehicle speed >10 (16) and <40 (64), remain in class 2
3	Vehicle speed >40 (64) and <60 (96), remain in class 3 Vehicle speed >60 (96), increment to class 4	Vehicle speed <30 (48), revert to class 2 Vehicle speed >30 (48) and 60< (96), remain in class 3
4	Vehicle speed >60 (96) and <80 (128), remain in class 4 Vehicle speed >80 (128), increment to class 5	Vehicle speed <50 (80), revert to class 3 Vehicle speed >50 (80) and <80 (128), remain in class 4
5	Vehicle speed >80 (128), remain in class 5 -	Vehicle speed <70 (112), revert to class 4 -

Key:

- < = Less than
- > = Greater than.

Rear Wiper Speed Class Matrix

Rotary Position	Speed Class					
	0	1	2	3	4	5
Position 1	6	5	4	3	2	0
Position 2	10	8	6	4	2	1
Position 3	14	11	8	5	3	1
Position 4	18	15	11	8	5	2
Position 5	22	18	13	9	6	3
Position 6	26	21	16	11	7	4

Front Wiper Speed Class Matrix

Rotary Position	Speed Class					
	0	1	2	3	4	5
Position 1	3.5	3	2.5	2	1.5	1
Position 2	5	4	3.5	3	2.5	2
Position 3	7	6.5	6	5	4	3
Position 4	9	8	7	6	5	4
Position 5	11	9.5	8	7	6	5
Position 6	13	11	9	8	7	6

The rotary switch positions also influence the operation of the rain/light sensor (when fitted) by adjusting its sensitivity. Refer to the Rain/Light Sensor section for details.

Normal (Slow) Speed

The normal (slow) speed continuous wiper operation is selected by moving the switch vertically to the second detente position from 'OFF'. The wipers will operate continuously when the vehicle is moving. When the vehicle is stationary, or less than 5 mph (8 km/h), the [CJB](#) operates the wipers in the intermittent mode (if speed dependent wipe mode is configured), using a 3 second intermittent delay period.

Fast Speed

The fast speed continuous wiper operation is selected by moving the switch vertically to the third detente position. The wipers will operate continuously at fast speed when the vehicle is moving. When the vehicle is stationary, or less than 5 mph (8 km/h), the [CJB](#) operates the wipers in normal (slow) speed mode (if speed dependent wipe mode is configured).

Wash/Wipe

When the non-latching wiper stalk button is pushed the front screen washer is operated. If the wipers are off and the button is pressed for less than 0.5 seconds, only the washer will operate. If the button is pressed for more than 0.5

seconds, the wipers will come on and perform two wipes. If the switch is operated for more than 10 seconds, the pump will be disabled. When headlamp washers are fitted, the headlamp washers will operate if the front windscreen washer is operated and the headlamps are on – refer to headlamp wash section for detail of operation. The **CJB** monitors the wash/wipe switch operation and after the switch is released, if a programmed wipe is enabled, the **CJB** allows two further wipe cycles to be completed.

Rear Wash/wipe

Moving the switch rearwards, towards the driver, selects the intermittent rear wash/wipe function. The intermittent delay period will vary according to the sensitivity settings and vehicle speed.

When the switch is moved rearwards to the second position and held, the washer pump will operate. If the switch is operated for more than 10 seconds, the pump will be disabled. When the switch is released, the rear wiper will complete a further two full wipe cycles and then operate on an intermittent function until selected off.

The intermittent delay period (below) depends on speed dependent wipe mode being enabled or disabled.

WINDSCREEN WASHER JETS

Two windscreen washer jets are located in the rear trim panel on the bonnet outer surface. The washer fluid feed hose from the front screen pump is connected to a 'Y' piece connector located between the two jets. Two short lengths of hose connect the jets to the 'Y' piece. Each jet contains a NRV to prevent washer fluid draining back to the reservoir and also to limit the amount of washer fluid, which can be forced by gravity from the jet during cornering.

Each washer jet has two ball nozzles, which can rotate in their housing's to obtain the optimum fluid application onto the windscreen.

REVERSE GEAR INPUT

The rear wiper also operates if reverse gear is selected and the front wipers are on. If the front wipers are operating continuously when reverse is selected, the rear wiper will also operate continuously as long as reverse gear is engaged. If the front wipers are operating intermittently when reverse is engaged, the rear wiper will complete one wipe cycle then wipe intermittently.

On vehicles fitted with rain/light sensor, when reverse gear is selected while the front wipers are in intermittent mode but the rain/light sensor indicates that the front wipers are off, the rear wiper will not operate. If the rain/light sensor subsequently calls for a single wipe, the rear wiper will operate a single wipe cycle. If the rain/light sensor calls for a slow or fast wipe, the rear wiper will operate continuously.

The **CJB** will operate the rear wiper (providing the front wipers are on) upon receipt of a reverse gear signal from the **TCM (transmission control module)** on the **CAN** bus, via the instrument cluster. On vehicles with manual transmission, the gear position signal is transmitted directly from the transfer box control module and picked by the **CJB** as a **CAN** bus message, via the instrument cluster.

'TAIL GATE OPEN' DISABLE

If the rear wiper is switched on or is already running and the tail gate is opened, the rear wiper should not start to run, or should immediately become disabled during a wipe cycle. If the tail gate is subsequently closed, the wiper will resume its normal operation after a delay of three seconds. Should the vehicle speed input be more than 4 mph (6km/h), then the tail gate switch will be deemed as closed.

The **CJB** receives the 'tail gate open' signal directly from the upper tail gate central locking motor.

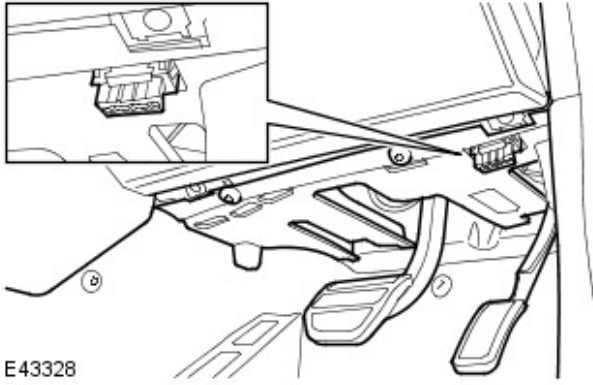
FRONT AND REAR WIPER MOTOR BLOCKING PROTECTION

The wiper park signal is also used by the **CJB** for blocking protection of the front wiper motor. This feature protects the motor in the event of the wiper operation being obstructed.

If the **CJB** does not receive a wiper park signal status change for a period of 6 seconds, when the wiper motor is active, the **CJB** removes the power supply to the motor. The motor will remain disabled until either an alternative motor mode has been selected, or the ignition has been moved to position 0 and back to position II. Should a stall condition be achieved 3 times during a single ignition position II status, then the wiper relay will remain disabled, regardless of wiper switch positions, for 180 seconds. The **CJB** will not automatically switch the motor on, to prevent the risk of injury. The wiper switch must be moved off and then on to reactivate the wiper motor. The blocking protection is active in all wiper switch positions and can only be reset by turning the ignition off.

The rear wiper algorithm contains the same logic as mentioned above.

DIAGNOSTICS



The diagnostic socket allows the transfer of information between the **CJB**, the rain/light sensor and T4. The diagnostic socket is located in the lower fascia closing panel, on the driver's side, below the steering column.

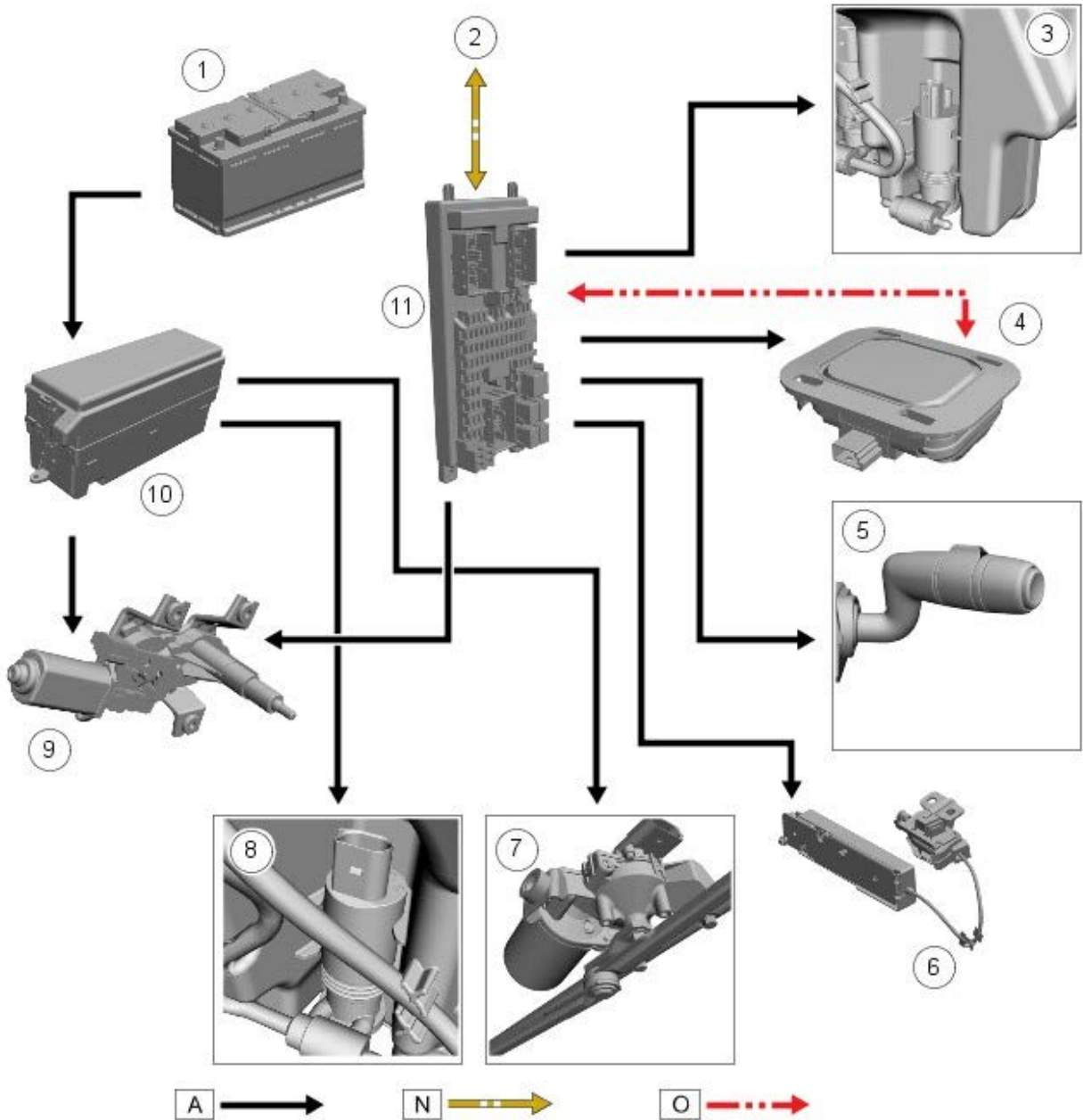
The rain/light sensor performs an internal self-test in the first 50ms from the ignition being switched to position I and can store fault codes, which can be used to diagnose, faults or non-function of the rain/light sensor. The faults are stored in a non-volatile memory which retains the logged fault codes even when the power supply is disconnected. If a rain/light sensor fault prevents the sensor from operating, the **CJB** will control wiper operation as if a rain/light sensor is not installed in the system.

The **CJB** monitors all inputs and outputs relative to the wiper system and other **CJB** controlled functions on the **LIN** bus. If a fault is detected, a code applicable to that fault is stored in a fault log. Two fault logs are provided within the **CJB** for internal and external faults.

CONTROL DIAGRAM



NOTE: **A** = Hardwired; **N** = Medium speed CAN; **O** = LIN bus.



E139783

Item	Part Number	Description
1	-	Battery
2	-	CAN connection to other systems
3	-	Front and rear screen washer pump
4	-	Rain/Light sensor
5	-	Wiper control switch
6	-	Tailgate latch assembly
7	-	Front wiper motor assembly
8	-	Headlamp washer pump
9	-	Rear wiper motor assembly
10	-	BJB
11	-	CJB

Wipers and Washers - Wipers and Washers

Diagnosis and Testing

Principle of Operation

For a detailed description of the wipers and washers systems and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Wipers and Washers (501-16 Wipers and Washers, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Windshield and rear window for damage or contamination e.g. road film or general residue deposits • Wiper blades, arms and linkage for wear, security, damage and freedom of movement • Windshield / rear window / headlamp washer fluid level • Washer hoses and jets for leaks, restrictions and damage 	<ul style="list-style-type: none"> • Battery condition and state of charge • Fusible links • Fuses • Relays • Electrical connections • Front and rear wiper motors • Wiper switch • Washer pumps • Rain/light sensor • Heated front washer jets • Light switch • Ambient air temperature sensor • Central Junction Box (CJB) • Battery Junction Box (BJB) • Anti-lock Brake System (ABS) control module • Automatic Temperature Control Module (ATC) • Instrument Cluster (IC) module • Controller Area Network (CAN) circuits

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible Causes	Action
Wiper blade(s) drag/judder across the windshield / rear window	<ul style="list-style-type: none"> • Contamination of the windshield / rear window • Wiper arm(s) incorrectly installed • Wiper arm(s) incorrectly aligned to the screen • Wiper arm(s) spring tension inadequate 	<ul style="list-style-type: none"> • Clean the windshield / rear window • Check the wiper arm installation • Check the wiper arm alignment • Check the wiper arm tension
Very slow operation of the wiper(s) across the windshield / rear window Wiper(s) inoperative	<ul style="list-style-type: none"> • Low battery voltage • Front wiper linkage seized or fouling • Wiper circuit short circuit to ground, short circuit to power, open circuit, high resistance 	<ul style="list-style-type: none"> • Refer to the relevant section of the workshop manual and test the battery • Check the wiper linkage for seizure and fouling • Refer to the electrical circuit diagrams and test the wiper circuit for short circuit to ground, short circuit to power, open circuit, high resistance

Noisy operation of wiper(s)	<ul style="list-style-type: none"> • Wiper motor/linkage fault 	<ul style="list-style-type: none"> • Lift the wiper arm(s) from the windshield / rear window and recheck the noise level during the wiper sweep operation
Noisy operation of washers	<ul style="list-style-type: none"> • Washer motor(s) faulty • Washer system blocked or partially blocked 	<ul style="list-style-type: none"> • Listen for washer motor operation. Check and top up washer fluid level. Check and rectify blocked washer circuit • Using the manufacturer approved diagnostic system, check the Central Junction Box (CJB) for related DTCs and refer to the relevant DTC index
Washers do not operate	<ul style="list-style-type: none"> • Fluid level low • Washer circuit blocked • Washer circuit faulty 	

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00, Description and Operation).

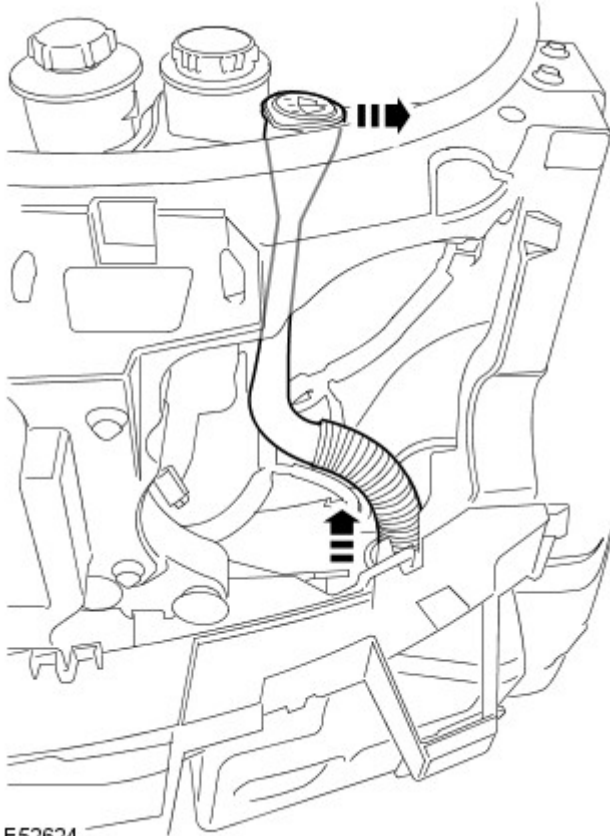
Wipers and Washers - Windshield Washer Reservoir


Removal and Installation

Removal

1. Remove the front bumper cover.
For additional information, refer to: Front Bumper Cover (501-19, Removal and Installation).

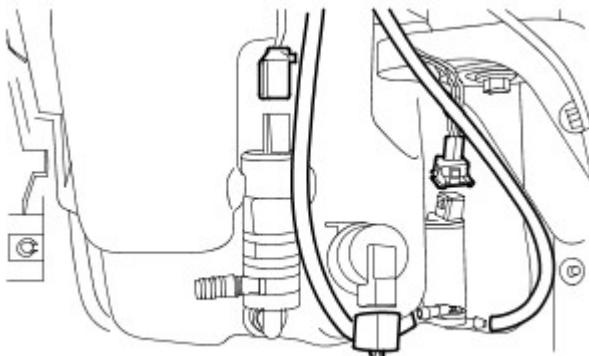
2. Remove the windshield washer reservoir filler neck.
 - Release the windshield washer reservoir filler neck from the coolant expansion tank.
 - Remove and if necessary, discard the seal.



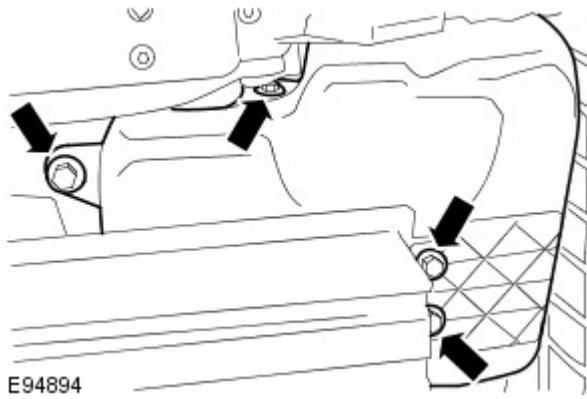
3.  **NOTE:** Some fluid spillage is inevitable during this operation.

Disconnect the 2 hoses from the windshield washer reservoir pumps.


- Drain the washer reservoir fluid.
- Disconnect the 3 electrical connectors.



4. Remove the windshield washer reservoir.
 - Remove the 4 bolts.



E94894

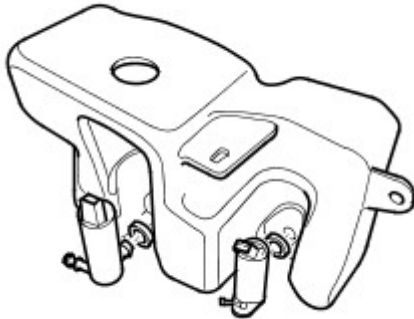
5.  NOTE: Do not disassemble further if the component is removed for access only.

Remove the windshield washer pump.

- Remove and if necessary, discard the seal.

6. Remove the headlamp washer pump.

- Remove and if necessary, discard the seal.



E47738


Installation

1. Install the windshield washer pump.
 - If necessary, install a new seal.
2. Install the headlamp washer pump.
 - If necessary, install a new seal.
3. Install the windshield washer reservoir.
 - Tighten the M6 bolts to 6 Nm (4 lb.ft).
 - Tighten the M8 bolt to 25 Nm (18 lb.ft).
4. Connect the 2 hoses to the windshield washer reservoir pumps.
 - Connect the electrical connectors.
5. Install the windshield washer reservoir filler neck.
 - If necessary, install a new seal.
 - Lubricate the seal.
 - Secure in the clip.
6. Install the front bumper cover.
 For additional information, refer to: Front Bumper Cover (501-19, Removal and Installation).

Wipers and Washers - Windshield Washer Pump

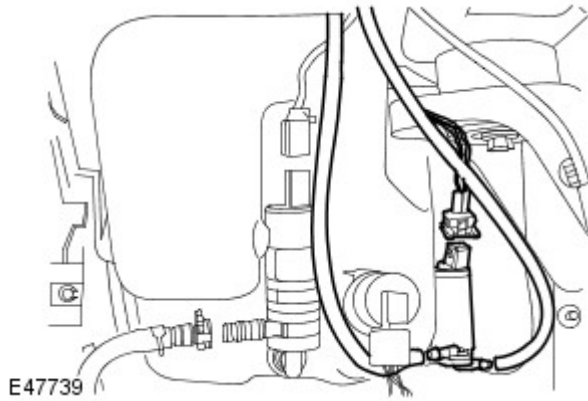
Removal and Installation

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

2. Remove the LH fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).
3. Release the windshield washer pump hoses.
 - Drain the washer reservoir fluid.
4. Disconnect the windshield washer pump electrical connector.
5. Remove the windshield washer pump.
 - Discard the O-ring seal.



Installation

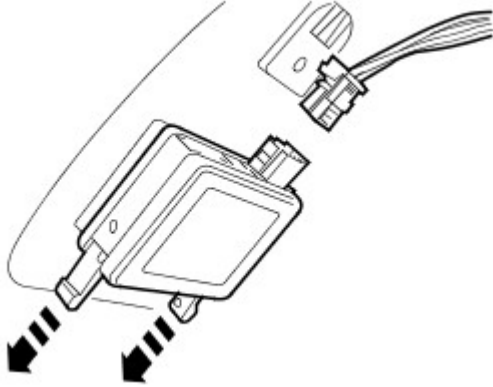
1. Install the windshield washer pump.
 - Install a new O-ring seal.
2. Connect the windshield washer pump electrical connector.
3. Connect the windshield washer pump hoses.
4. Install the fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).
5. Lower the vehicle.
6. Top-up the windshield washer reservoir.

Wipers and Washers - Rain Sensor

Removal and Installation

Removal

1. Remove the interior mirror.
For additional information, refer to: Interior Mirror (501-09 Rear View Mirrors, Removal and Installation).
2. Remove the rain sensor.
 - Release the 2 clips.
 - Disconnect the electrical connector.



E49707

Installation

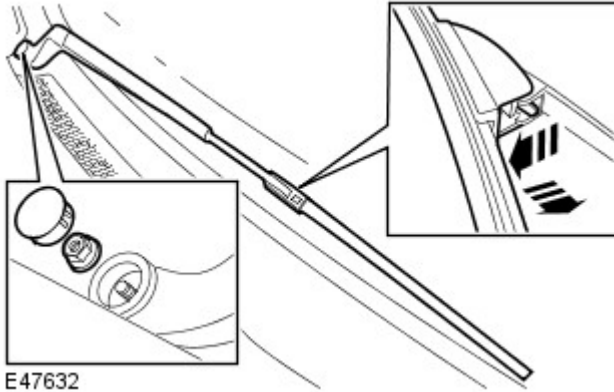
1. To install, reverse the removal procedure.


Wipers and Washers - Front Wiper Pivot Arm

Removal and Installation

Removal

1. Noting the fitted position, remove the front wiper pivot arm.
 - Remove the nut cover.
 - Remove the nut.



2.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the wiper blade.

- Release the clip.

Installation

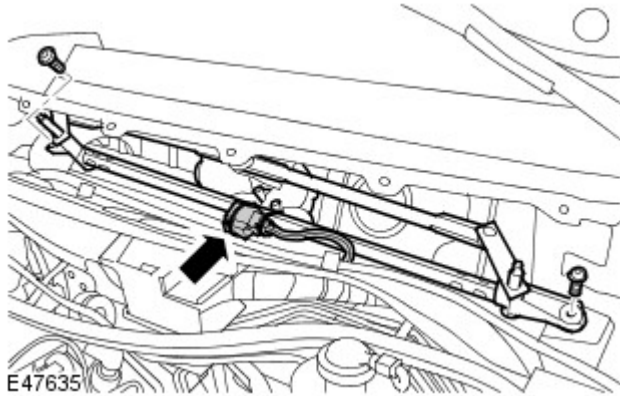
1. To install, reverse the removal procedure.
 - Tighten the nut to 24 Nm (18 lb.ft).

Wipers and Washers - Windshield Wiper Motor

Removal and Installation


Removal

1. Remove the plenum chamber panel.
For additional information, refer to: Plenum Chamber (412-01, Removal and Installation).



2. Remove the windshield wiper motor and linkage.
 - Remove the 2 bolts.
 - Remove the 2 clips.
 - Disconnect the electrical connector.




3.  **NOTE:** Do not disassemble further if the component is removed for access only.

Noting the fitted position, remove the wiper linkage.

- Remove the 2 bolts.
- Remove the nut.

Installation

1. Install the wiper linkage.
 - Tighten the bolts to 10 Nm (7 lb.ft).
 - Tighten the nut to 25 Nm (18 lb.ft).

2.  **CAUTION:** Make sure the windshield wiper motor is located on its stud prior to installing the bolts.

Install the windshield wiper motor and linkage.

- Tighten the bolts to 6 Nm (4 lb.ft).
- Connect the electrical connector.
- Install the clips.

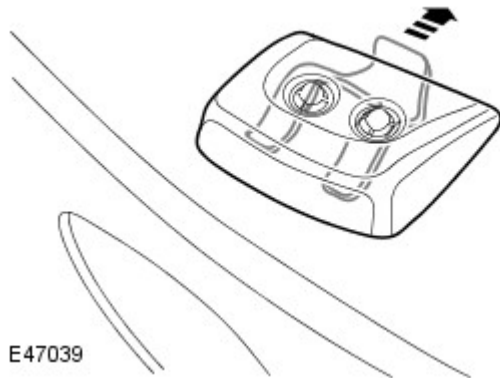
3. Install the plenum chamber panel.
For additional information, refer to: Plenum Chamber (412-01, Removal and Installation).

Wipers and Washers - Headlamp Washer Jet

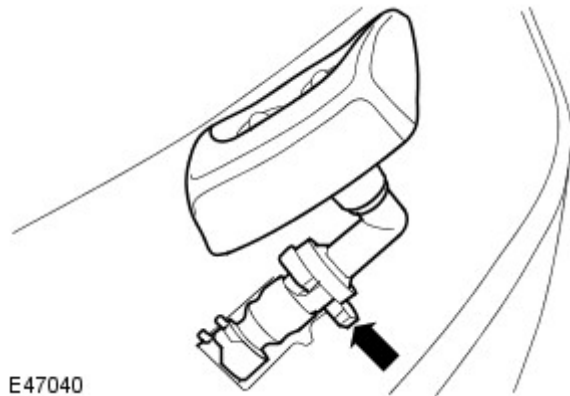
Removal and Installation

Removal

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the front fog lamp.
For additional information, refer to: Front Fog Lamp (417-01, Description and Operation).
3. Release the washer jet assembly.
 - Release the clip.



E47039



E47040

4. Remove the washer jet.
 - Release the hose clip and disconnect the hose.


Installation

1. To install, reverse the removal procedure.

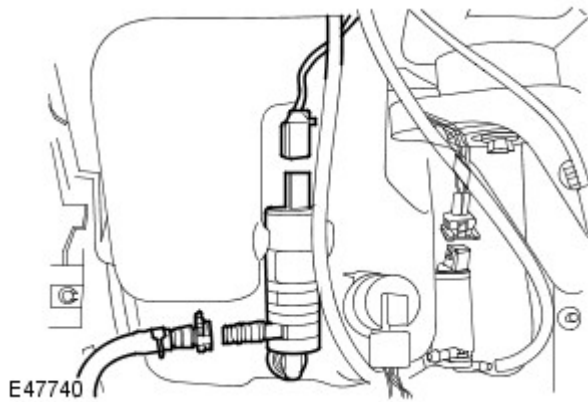
Wipers and Washers - Headlamp Washer Pump

Removal and Installation

Removal

1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.
2. Remove the LH fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).
3. Release the headlamp washer pump hose.
 - Drain the washer reservoir fluid.
4. Disconnect the headlamp washer pump electrical connector.
5. Remove the headlamp washer pump.
 - Discard the O-ring seal.




Installation

1. Install the headlamp washer pump.
 - Install a new O-ring seal.
2. Connect the headlamp washer pump electrical connector.
3. Connect the headlamp washer pump hose.
4. Install the fender splash shield.
For additional information, refer to: Fender Splash Shield (501-02, Removal and Installation).
5. Lower the vehicle.
6. Top-up the windshield washer reservoir.

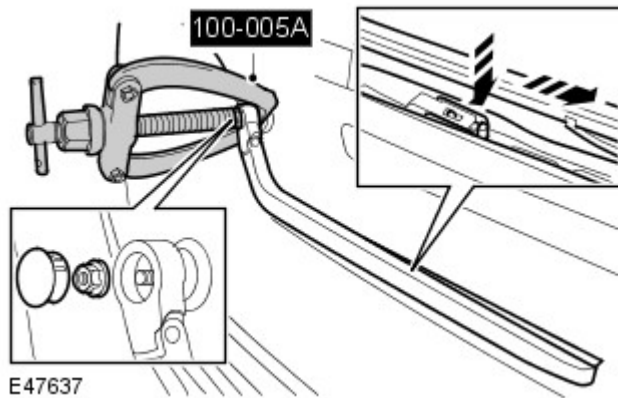
Wipers and Washers - Rear Wiper Pivot Arm

Removal and Installation


Special Tool(s)

 <p>100-005A E49451</p>	<p>General purpose puller 100-005A (LRT-99-500A)</p>
--	--

Removal



1. Noting the fitted position and using the special tool, remove the rear wiper pivot arm.
 - Remove the nut cover.
 - Remove the nut.

2.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the wiper blade.

- Release the clip.

Installation

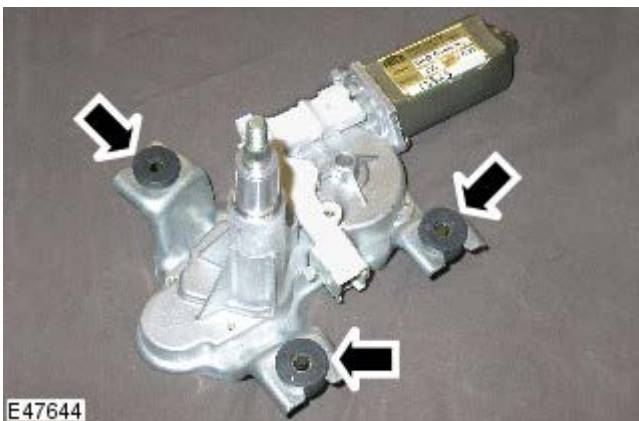
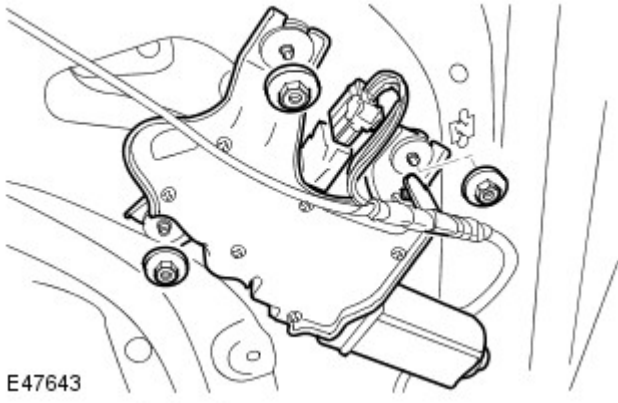
1. To install, reverse the removal procedure.
 - Tighten the nut to 15 Nm (11 lb.ft).


Wipers and Washers - Rear Window Wiper Motor

Removal and Installation

Removal

1. Remove the liftgate trim panel.
For additional information, refer to: Liftgate Trim Panel (501-05, Removal and Installation).
2. Remove the rear window wiper arm.
For additional information, refer to: Rear Wiper Pivot Arm (501-16, Removal and Installation).
3. Remove the rear window wiper motor.
 - Disconnect the electrical connector.
 - Release the clip.
 - Remove the 3 nuts.



4.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the 3 rubber insulators.

- Remove the metal inserts.

Installation

1. To install, reverse the removal procedure.
 - Tighten the nuts to 10 Nm (7 lb.ft).

Roof Opening Panel -

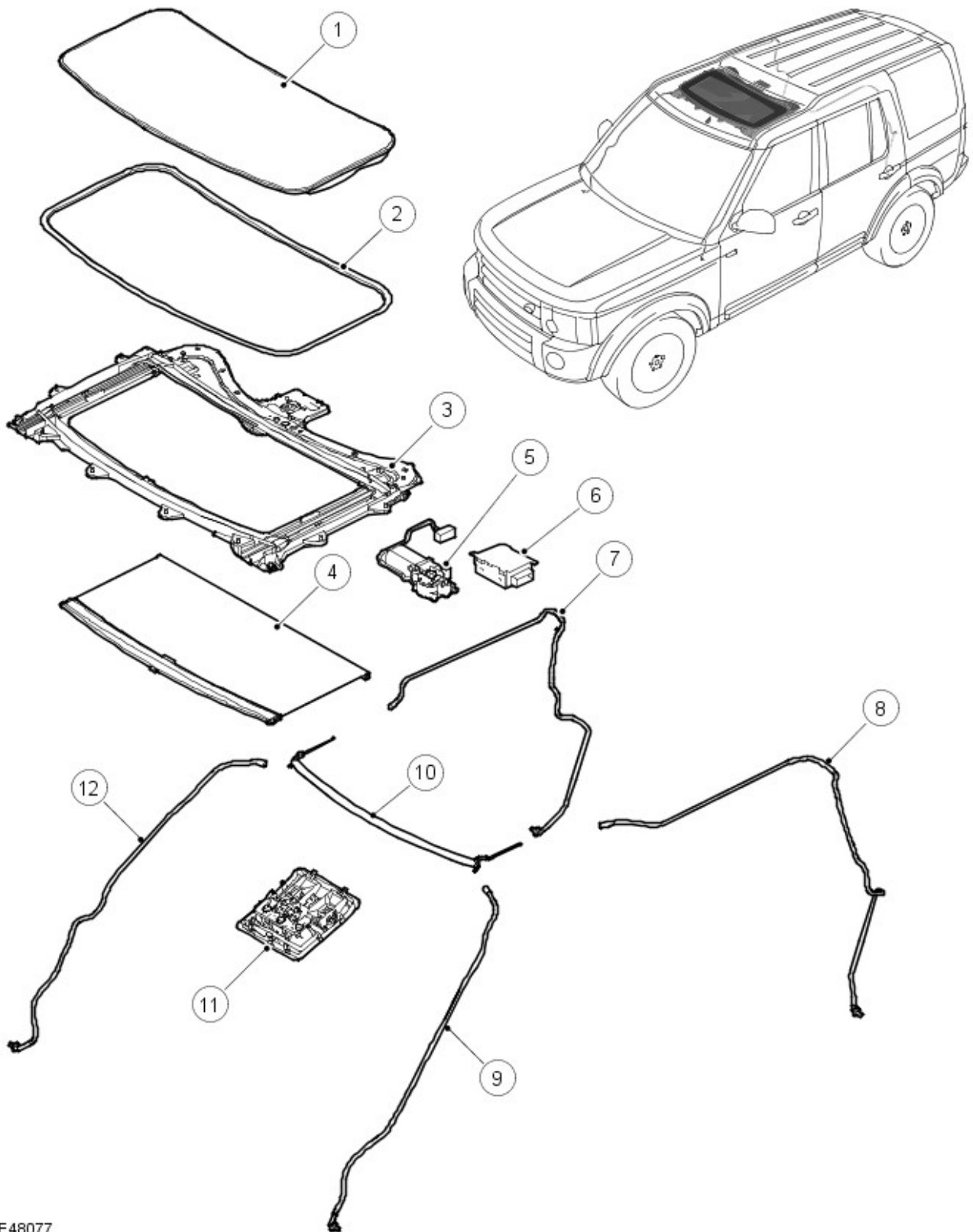
Torque Specifications

Description	Nm	lb-ft
Roof opening panel motor Torx screws	4	3
Roof opening panel bolts	10	7
Roof opening panel alignment Torx screws	6	4

Roof Opening Panel - Roof Opening Panel

Description and Operation

Roof Opening Panel Components

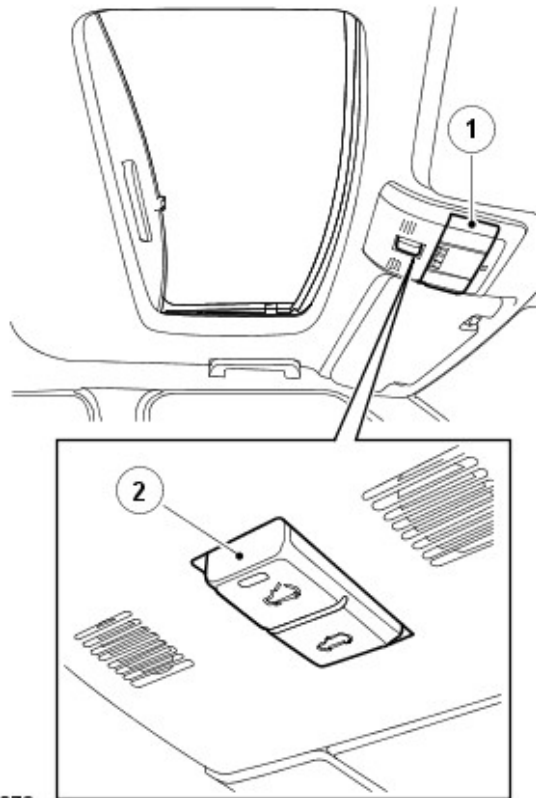


E48077

Item	Part Number	Description
1	-	Glass panel assembly
2	-	Glass panel seal
3	-	Frame assembly
4	-	Sunblind
5	-	Motor
6	-	Control module

- 7 - RH rear drain tube
- 8 - LH rear drain tube
- 9 - LH front drain tube
- 10 - Deflector
- 11 - Access panel
- 12 - RH front drain tube

GENERAL



E48078

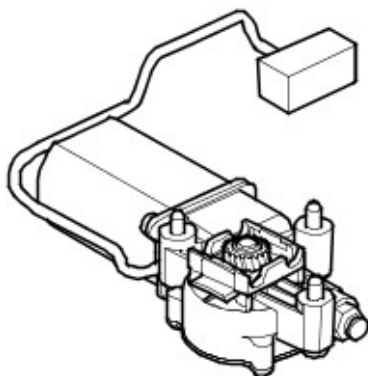
Item	Part Number	Description
1	-	Access panel
2	-	Switch

The sunroof is electrically operated through a two-way rocker switch located on the roof mounted centre console. An electric motor, attached to the sunroof frame, drives the glass sunroof panel to the tilt or open positions. The glass panel is operated by two cables, which are driven by the motor.

The sunroof frame is bolted to eleven mounting points on the roof panel. The frame is a large injection moulding and supports all of the sunroof components. Two aluminium guides held in the frame, on each side. The sunroof motor attaches to the rear of this frame. The motor is supported on the frame with three screws.

The sunroof glass panel is attached to the guide at the extreme front and rear. The tilt and slide positions are achieved by driving the attachment points on the panel over two fixed curves, one in the guide and one fixed to the panel.

Sunroof Motor



E48079

The sunroof motor has a worm drive, which drives a gear in a cast housing attached to the end of the motor. The gear has a small pinion gear attached to the outer part of its spindle. The pinion engages with the helixed cables to form a rack and pinion drive. Rotation of the motor turns the pinion, which in turn drives the cables in the required

direction.

Sunroof Motor Pin Out Information

Pin	Description	Input/Output
1	Hall sensor Ground	-
2	Hall sensor Supply	Input
3	Hall sensor Speed	Output
4	Hall sensor Direction	Output
5	Motor A	Input
6	Motor B	Input

The two cables are attached either side of the pinion. One end of each cable is attached to the guide. The opposite end is trapped in its position on the pinion by a metal insert in the frame. The cables run in channels in the frame to the guides. As the sunroof panel is closed, the cables are pushed through channels in the rear of the frame. The displaced cable is guided into a further two channels in the frame, which protect the cable and prevent the cable snagging creating noise. The cables are made from rigid spring steel and therefore can pull as well as push the sunroof along the guides.

A sun blind is also located in the guides integrated into the frame. The sunblind is operated manually, independently of the glass panels position. To move to the closed position the sunblind handle is pushed forward until it latches into the frame. To move the sunblind to the open position the sunblind handle is pushed up, to unlatch and either released or retracted to the open position. The sunblind can only be in either the fully open or fully closed positions.

Drain hoses are connected to the front and rear corners of the frame. The drain hoses are located inside of the cabin on the 'A' and 'C' post pillars to allow water, which has collected in the frame to escape. A one-way valve is fitted to the end of each drain hose to prevent the ingress of dirt and moisture.

SUNROOF CONTROL MODULE

The sunroof control module is mounted on the rear of the frame, and is connected to the motor at one end as described above, and to the vehicle electrical system at the other. It takes the inputs from the vehicle, such as LIN (Local Interconnect Network) bus signals and switch signals, and controls motor movement appropriately. It also contains the algorithm for the anti-trap system.

Sunroof Control Module Pin Out Information

Pin	Description	Input/Output
1	Switch Ground	-
2	Switch Open	Input
3	Switch Close	Input
4	Not used	-
5	Not used	-
6	Emergency (see note below)	Input
7	ECU Ground	-
8	Battery	Input
9	Not used	-
10	Not used	-
11	Not used	-
12	LIN	Input

NOTES:



Pin 6 is for use in an emergency only in the event of the vehicle LIN bus not being functional. It is not connected on the vehicle harness or in the connector.



Putting pin 6 to ground will enable the sunroof control module but without one touch operation or anti trap. The sunroof will not require re-calibrating unless the battery has been disconnected.



The sunroof control module will remain awake and enabled until pin 6 is disconnected again. Under no circumstances is this pin to be left grounded for long periods.



There is no emergency key access in the headlining for manual sunroof operation should the motor fail for any reason.

OPERATION

The sunroof can be operated with the ignition in power modes 4 accessory or 6 on. The sunroof can also be operated for up to 40 seconds after the ignition power mode 0 'off' provided the driver's or passenger's door is not opened. During the 40 second period the one touch function is inoperative.

The motor contains a micro-switch and a Hall effect sensor. Two gears, driven by the motor at one end of the pinion drive spindle, trip the micro-switch every thirteen revolutions of the spindle. When the micro-switch is tripped, the sunroof control module senses an open circuit signal. The sunroof control module, to calculate the exact position of the sunroof, uses the signal from the micro-switch combined with signals received from the Hall effect sensor. The Hall effect sensor is also responsible for the operation of the anti-trap function.

If the anti-trap feature is activated while the sunroof is closing, the roof panel is reversed for 200mm or as far as possible. The Hall sensor, located in the sunroof motor, monitors the speed of the motor and if the speed decreases below a set threshold, indicating an obstruction, the power feed to the motor is reversed so the sunroof goes back. In

an emergency the anti-trap function can be overridden by holding the sunroof switch in the closed position.

Tilt

With the sunroof panel closed, pushing the upper part of the rocker switch operates the sunroof motor to 'tilt' the rear of the sunroof upwards. The motor operates for as long as the switch is operated until the glass is tilted to its full extent. If the switch is released before the full tilt position is reached, the sunroof panel stops at the chosen position. A single press (between 0.5 and 1 second) of the switch operates the motor so that the panel automatically retracts to the fully tilted position.

When the tilt function is requested, the cables pull the guide rearward, forcing the panel attachment up a curve, which raises the sunroof panel to the tilt position.

With the sunroof panel in the tilted position, pushing the lower part of the rocker switch operates the sunroof motor to lower the sunroof panel. The motor operates to lower the panel for as long as the switch is operated until the panel is fully lowered. If the switch is released before the fully lowered position is reached, the sunroof panel stops at the chosen position.

Open (slide)

With the sunroof panel tilted, pushing the upper part of the rocker switch operates the sunroof motor to raise the sunroof panel and retract it backwards. A single press (between 0.5 and 1 second) of the switch operates the motor so that the panel automatically retracts to the fully open position. When the panel retracts, a wind deflector automatically raises at the front of the sunroof aperture, which serves to reduce wind noise.

When the open function is requested, the cables pull in a rearward direction, driving the glass panel attachments to slide the panel over the exterior roof skin.

With the sunroof panel half or fully open, pushing the lower part of the switch operates the motor to close the sunroof panel. A single press (between 0.5 and 1 second) of the switch operates the motor so that the panel automatically closes to the fully tilted position.

If only partial opening or closing is desired, pressing the switch momentarily (less than 0.5 seconds) in either direction will stop the sunroof panel movement. When movement is desired in either direction, pressing the switch will operate the motor to move the panel.

The sunroof has an 'anti-trap' function which prevents the sunroof panel from closing if an obstruction is sensed. When an obstruction is sensed, the motor will automatically retract the panel by 200mm or as far as possible. When the obstruction is removed, the panel can be closed by the normal method.

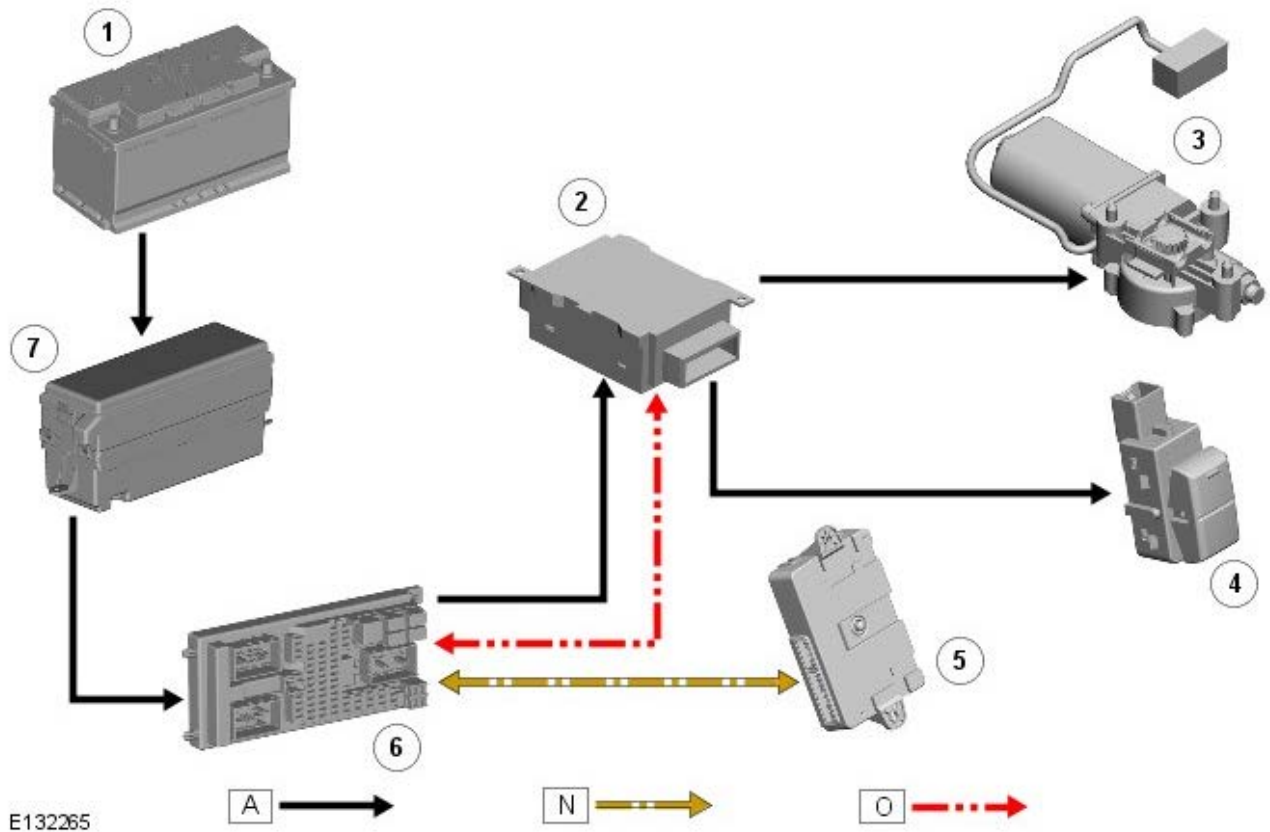
Battery Disconnection

If the battery has been disconnected, the one touch and anti-trap function will become inoperative. Pressing the lower part of the sunroof switch for 60 seconds will start the sunroof's calibration routine. The sunroof will complete a full cycle in order to re-learn the parameters required for one-touch open and close and the anti-trap function. The sunroof will still have manual movement available until the sunroof is re-calibrated.

SUNROOF CONTROL DIAGRAM



NOTE: **A** = Hardwired; **N** = Medium speed CAN bus; **P** = Local Interconnect Network (LIN) bus



E132265

Item	Part Number	Description
1	-	Battery
2	-	Sunroof control module
3	-	Sunroof motor
4	-	Sunroof switch
5	-	Keyless Vehicle Module (KVM)
6	-	Central Junction Box (CJB)
7	-	Engine Junction Box (EJB)

Roof Opening Panel - Roof Opening Panel

Diagnosis and Testing

Principle of Operation

For a detailed description of the roof opening panel system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Roof Opening Panel (501-17 Roof Opening Panel, Description and Operation).

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Glass panel assembly • Glass panel seal • Frame assembly • Sunblind • Deflector • Access panel • Roof opening panel cables • Drain tube(s) 	<ul style="list-style-type: none"> • Fuses • Battery Junction Box (BJB) • Central Junction Box (CJB) • Wiring harness • Loose or corroded connector(s) • Roof opening panel motor and control module • Roof opening panel switch

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, verify the symptom and refer to the Symptom Chart, alternatively check for Diagnostic Trouble Codes (DTCs) and refer to the DTC Index.

Symptom Chart

Symptom	Possible causes	Action
Roof opening panel inoperative	<ul style="list-style-type: none"> • Fuse(s) blown • Circuit fault • Switch fault • Motor fault • Module fault 	<ul style="list-style-type: none"> • Refer to the electrical circuit diagrams • Check the fuse(s) (see visual inspection) • Check the roof opening panel circuits • Check the switch and motor function • One touch switch inoperative GO to Pinpoint Test A. • Roof opening panel inoperative GO to Pinpoint Test B.
Roof opening panel sticking/jamming	<ul style="list-style-type: none"> • Debris in the channels/guides • Cable(s) sticking/damaged • Roof opening panel not correctly aligned • Switch fault • Motor fault 	<ul style="list-style-type: none"> • Check for general debris • Inspect, clean and lubricate the cable(s) and guides • Check the roof opening panel alignment REFER to: Roof Opening Panel Alignment (501-17 Roof Opening Panel, General Procedures). • Refer to the electrical circuit diagrams • Check the switch and motor function • GO to Pinpoint Test E.
Roof opening panel juddering	<ul style="list-style-type: none"> • Debris in the channels/guides • Cable(s) sticking/damaged • Roof opening panel not correctly aligned • Motor fault 	<ul style="list-style-type: none"> • Check for general debris • Inspect, clean and lubricate the cable(s) and guides • Check the roof opening panel alignment REFER to: Roof Opening Panel Alignment (501-17 Roof Opening Panel, General Procedures). • Check the motor function • GO to Pinpoint Test E.
Water ingress from roof opening panel	<ul style="list-style-type: none"> • Debris in the channels/guides • Drain tube(s) blocked • Damage to the glass panel seal • Roof opening panel not correctly aligned 	<ul style="list-style-type: none"> • Check for general debris • Check for blocked drain tube(s) • Inspect, clean and lubricate the cable(s) and guides • Check the glass panel seal • Check the roof opening panel alignment REFER to: Roof Opening Panel Alignment (501-17 Roof Opening Panel, General Procedures). • Water ingress GO to Pinpoint Test H.

Noise	<ul style="list-style-type: none"> • Damage to the glass panel seal • Cable(s) sticking/damaged • Roof opening panel not correctly aligned 	<ul style="list-style-type: none"> • Check the glass panel seal • Inspect, clean and lubricate the cable(s) and guides • Check the roof opening panel alignment REFER to: Roof Opening Panel Alignment (501-17 Roof Opening Panel, General Procedures). • Noise during operation GO to Pinpoint Test C. • Noise in open or tilt position GO to Pinpoint Test D. • Wind noise GO to Pinpoint Test L.
-------	---	---

DTC Index

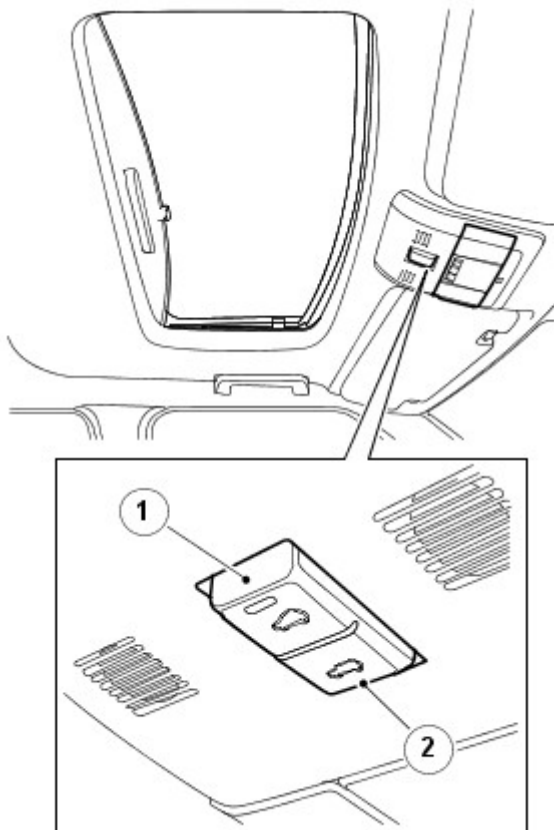
For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Central Junction Box (CJB) (100-00 General Information, Description and Operation).

PINPOINT TEST A : ROOF OPENING PANEL - ONE TOUCH SWITCH OPERATION INOPERATIVE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

A1: ONE TOUCH SWITCH OPERATION INOPERATIVE



E141874

- 1 Operate the roof opening panel through all possible positions using the roof mounted switch (1) (slide open / slide close / tilt open / tilt close) without using one touch operation
 - Set the ignition to the ON position
 - Ensure that the glass is in the closed position using the 'close' switch on the overhead console
 - Press and hold the open switch (1), the opening panel moves to tilt position, and then to open
 - Press and hold the close switch (2), the panel moves forward into the tilt position, then closed position

Does the roof opening panel operate through all possible positions correctly?
Yes
 Perform the manual roof opening panel initialization procedure
 REFER to: Power Roof Opening Panel Initialization (501-17 Roof Opening Panel, General Procedures).
 Check for correct roof opening panel operation [GO to A2.](#)
No
 GO to Pinpoint Test [B.](#)

A2: ONE TOUCH SWITCH - OPERATION

	1 Operate one touch function the roof opening panel using the roof mounted switch
	2 Set the ignition to the ON position
	3 Press once and release the open switch on the roof console <ul style="list-style-type: none"> • Panel should move to tilt position
	4 Press once and release the open switch on the roof console <ul style="list-style-type: none"> • Panel should move from tilt position to full open

	position
	5 Press once and release the close switch on the roof console <ul style="list-style-type: none"> Panel should move from full open position to tilt position
	6 Press once and release the close switch on the roof console <ul style="list-style-type: none"> Panel should move from tilt position to closed position
	Does the one touch function of the roof opening panel switch operate correctly? Yes No further action required No GO to A3.


A3: ONE TOUCH SWITCH - OPERATION

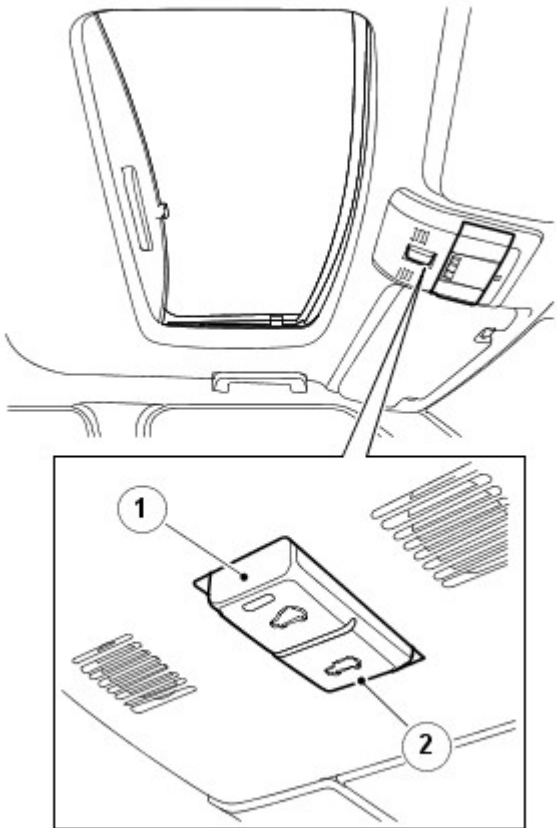
	1 Perform the manual roof opening panel initialization procedure using the manufacturers approve diagnostic system. Check for correct roof opening panel operation
	Does the one touch function of the roof opening panel switch operate correctly? Yes No further action required No GO to Pinpoint Test B.

PINPOINT TEST B : ROOF OPENING PANEL - INOPERATIVE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

B1: INOPERATIVE

 **NOTE:** These tests are to be carried out to determine the cause of the loss of roof opening panel functionality

 <p>E141874</p>	1 Perform the manual roof opening panel initialization procedure REFER to: Power Roof Opening Panel Initialization (501-17 Roof Opening Panel, General Procedures). Check for correct roof opening panel operation
--	---

	Does the roof opening panel operate correctly? Yes No further action required No GO to B2.
--	--

B2: FUSE

NOTE: These tests are to be carried out to determine the cause of the loss of roof opening panel functionality

	1 Refer to the electrical circuit diagrams and check the fused link to the roof opening panel motor
	Is the fused link (VBATT) circuit to the roof opening panel motor intact? Yes GO to B3. No The fused link to the roof opening panel motor has failed. Refer to the electrical circuit diagrams and check the circuit - VBATT - between the fused link and the roof opening panel motor for short circuit to ground. Replace the fused link or repair the circuit as required. Perform the manual roof opening panel initialization procedure REFER to: Power Roof Opening Panel Initialization (501-17 Roof Opening Panel, General Procedures). Check for correct operation, If correct no further action required

B3: SWITCH CONNECTOR

	1 Access to the connector for the front overhead console REFER to: Overhead Console (501-12 Instrument Panel and Console, Removal and Installation).
	2 Refer to the electrical circuit diagrams and check the roof opening panel switch terminals and housing for location and condition
	Are the roof opening panel switch terminals and housing located correctly and in good condition? Yes GO to B4. No Correctly relocate or replace any roof opening panel switch connector terminals as required. Perform the manual roof opening panel initialization procedure REFER to: Power Roof Opening Panel Initialization (501-17 Roof Opening Panel, General Procedures). Check for correct operation, If correct no further action required



B4: MOTOR CONNECTOR

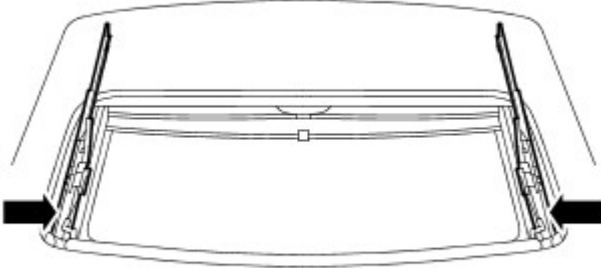
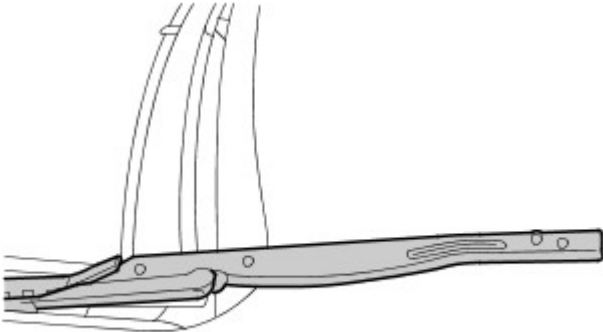
	1 Access the roof opening panel motor REFER to: Roof Opening Panel Motor (501-17 Roof Opening Panel, Removal and Installation).
	2 Refer to the electrical circuit diagrams and check the roof opening panel motor terminals and housing for location and condition
	Are the roof opening panel motor connector terminals and housing located correctly and in good condition? Yes GO to B5. No Correctly relocate or replace any roof opening panel motor connector terminals as required. Check for correct roof opening panel operation. Perform the manual roof opening panel initialization procedure REFER to: Power Roof Opening Panel Initialization (501-17 Roof Opening Panel, General Procedures). Check for correct operation, If correct no further action required

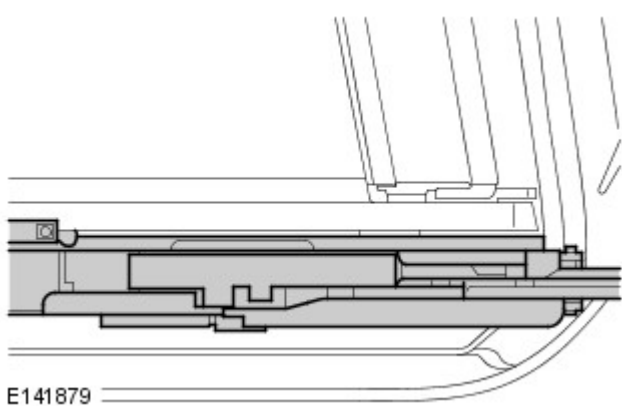
B5: SWITCH - CIRCUIT CHECK

NOTE: The roof opening panel motor gives a voltage out on the open and close circuits which is grounded when the switch is operated, this voltage should be greater than 7volts (switch inactive) and less than 1volt (switch active) with the ignition state switched to on

	1 Refer to the electrical circuit diagrams and locate the open and close circuits between the roof opening panel motor and the roof opening panel switch, monitor the voltage on each circuit as the switch is operated
	Do both open and close switch circuit voltages change from greater than 7 volts to less than 1 volt

	<p>when the roof opening panel open or close switches are pressed?</p> <p>Yes GO to B8.</p> <p>No GO to B6.</p>
B6: SWITCH - CIRCUIT CHECK 2	
NOTES:	
	During the previous check, if the voltage remained high (greater than 7 volts), refer to the electrical circuit diagrams and check the switch circuit for fault
	During the previous check, if the voltage remained low (less than 1 volt), refer to the electrical circuit diagrams and check the roof opening panel motor circuit for fault
	<p>1 Refer to notes above</p> <p>Did the voltage remain low (less than 1 volt)?</p> <p>Yes GO to B7.</p> <p>No The voltage remained high (greater than 7 volts) refer to the electrical circuit diagrams and check the roof opening panel switch circuit for fault. Repair as required. Perform the manual roof opening panel initialization procedure REFER to: Power Roof Opening Panel Initialization (501-17 Roof Opening Panel, General Procedures). Check for correct operation, If correct no further action required</p>
B7: MOTOR SUPPLY	
	<p>1 Refer to the electrical circuit diagrams and check the voltage between the power (VBATT) and ground (GND) circuits to the roof opening panel motor for battery supply voltage (approx. 12 volts)</p>
	<p>Is the supply voltage to the (VBATT) and (GND) circuits correct ?</p> <p>Yes GO to B8.</p> <p>No Check the (VBATT) and (GND) circuits to the roof opening panel motor for fault. Repair as required. Perform the manual roof opening panel initialization procedure REFER to: Power Roof Opening Panel Initialization (501-17 Roof Opening Panel, General Procedures). Check for correct operation, If correct no further action required</p>
B8: MOTOR - FAILURE	
	<p>1 Uninstall the motor from the roof opening panel REFER to: Roof Opening Panel Motor (501-17 Roof Opening Panel, Removal and Installation).</p>
	<p>2 Operate the roof opening panel using the roof mounted switch</p>
	<p>When operating the switch, does the motor operate?</p> <p>Yes GO to B9.</p> <p>No Replace the roof opening panel motor REFER to: Roof Opening Panel Motor (501-17 Roof Opening Panel, Removal and Installation). Check for correct operation, If correct no further action required</p>
B9: MANUAL - ROOF OPERATION	
	<p>1 Reinstall the roof opening panel motor to the roof opening panel frame REFER to: Roof Opening Panel Motor (501-17 Roof Opening Panel, Removal and Installation).</p>
	<p>2 Using a large flathead screwdriver applied to the motor, operate the roof opening panel through all possible positions (slide open / slide close / tilt open / tilt close)</p>
	<p>Can the roof opening panel be manually operated through all possible positions?</p> <p>Yes Install a new roof opening panel module</p>

	<p>REFER to: Roof Opening Panel Module (501-17 Roof Opening Panel, Removal and Installation). Check for correct operation, If correct no further action required</p> <p>No GO to B10.</p>
B10: GLASS PANEL – REMOVAL	
	<p>1 Remove the glass panel from the roof opening panel REFER to: Roof Opening Panel Glass (501-17 Roof Opening Panel, Removal and Installation).</p>
	<p>Can the glass panel be removed? Yes GO to B11. No Contact dealer technical support</p>
B11: GLASS PANEL REMOVED	
 <p>E141877</p>	<p>1 Carry out visual and manual inspection of the rail(s) for debris</p>
	<p>Are the rail(s) free from debris? Yes GO to B12. No Clear any obstructions from the rails. Apply grease (KP 1N-30 or ISO-L-X-CDBE1) to the areas shown. Then, GO to B12.</p>
B12: LIFTER ARMS - CONDITION	
 <p>E141878</p>	<p>1 Carry out visual inspection of the lifter arms for cracks or damage (pieces broken)</p>
	<p>Are the lifter arms cracked or damaged? Yes Replace the lifter arms. Perform the manual roof opening panel initialization procedure REFER to: Power Roof Opening Panel Initialization (501-17 Roof Opening Panel, General Procedures). Check for correct operation, If correct no further action required No GO to B13.</p>
B13: REAR MECHANISM - CONDITION	
	<p>1 Carry out visual inspection of the rear mechanism</p>



E141879

Are the rear mechanisms free from cracking and damage?

Yes

[GO to B14.](#)

No

Install a new roof opening panel
 REFER to: Roof Opening Panel (501-17 Roof Opening Panel, Removal and Installation).
 Check for correct operation, If correct no further action required

B14: GLASS PANEL - RE-ASSEMBLY

1 Re-assemble the glass panel onto the roof opening panel
 REFER to: Roof Opening Panel Glass (501-17 Roof Opening Panel, Removal and Installation).

2 Perform the manual roof opening panel initialization procedure
 REFER to: Power Roof Opening Panel Initialization (501-17 Roof Opening Panel, General Procedures).

3 Check for correct roof opening panel operation

Does the roof opening panel operate correctly?

Yes

No further action required

No

Contact dealer technical support

PINPOINT TEST C : ROOF OPENING PANEL - DURING OPERATION

TEST CONDITIONS

DETAILS/RESULTS/ACTIONS

C1: NOISE

NOTES:



These tests are to be carried out to determine the cause of the noise in relation to the roof opening panel



If the customer concern is related wind noise, refer to the symptom chart above

1 Confirm customer complaint, locate the noise, by operating the roof opening panel through all possible positions (slide open / slide close / tilt open / tilt close) using the roof mounted switch

2 Determine the cause of the noise

Is the noise evident **only** during operation of the roof opening panel?

Yes

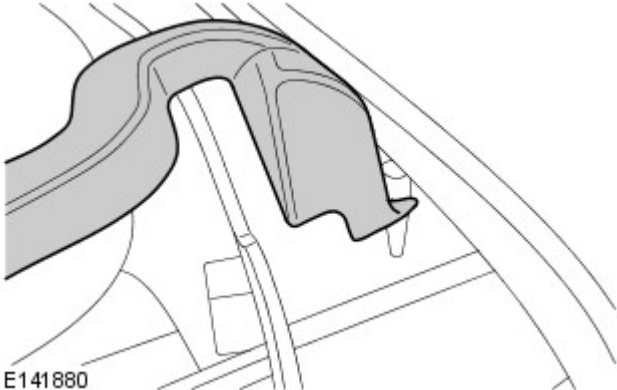
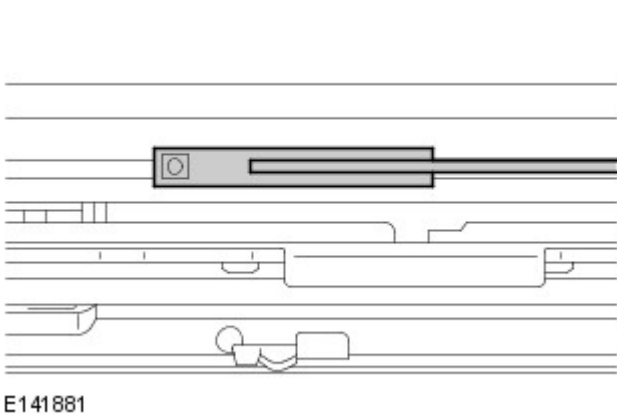
The noise is evident during (slide open / slide close / tilt open / tilt close) operation GO to Pinpoint Test [D](#).



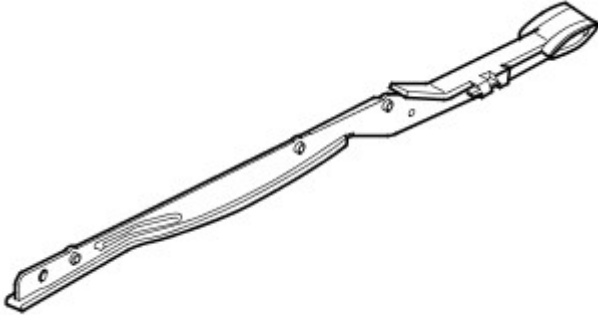
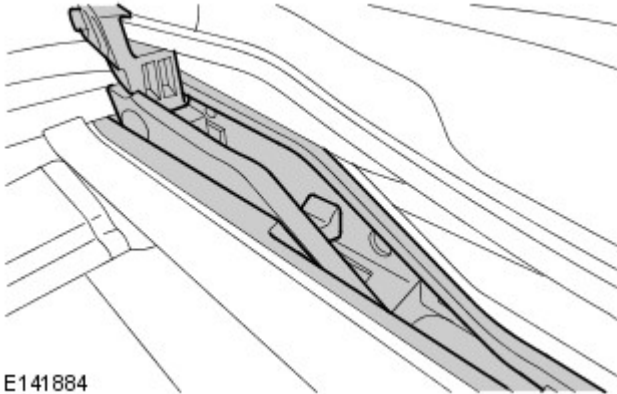
No

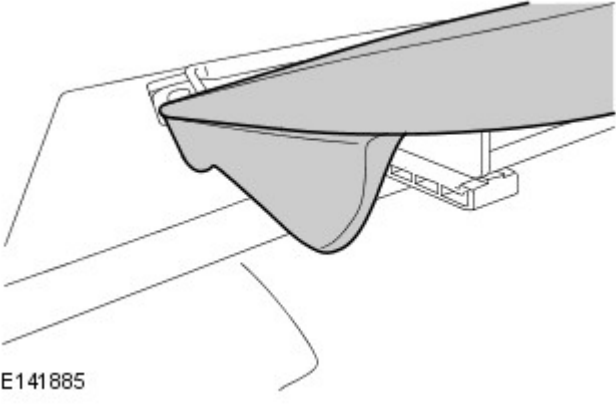


(1) The noise is evident during inputs from the vehicle [GO to C2](#). Or, (2) the customer symptom is not evident. No further action required

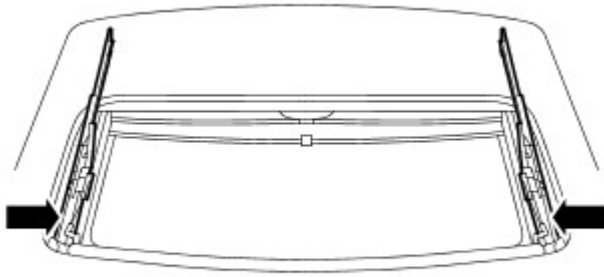
C2: AIR DEFLECTOR – ALIGNMENT AND NOISE

1 Carry out visual inspection of the wind deflector, confirm the position is correct, the left / right buffers are present and the springs are in good condition

 <p>E141880</p>	
 <p>E141881</p>	<p>2</p>
	<p>Is the position of the wind deflector correct, with the left / right buffers present and the springs are in good condition?</p> <p>Yes GO to C3.</p> <p>No Correctly reinstall or replace the wind deflector (buffers or springs) as required. Check for correct operation, If correct no further action required. If customer concern is still evident GO to C3.</p>
<p>C3: MOTOR FIXING - SECURITY, LOCATION AND TORQUE</p>	
	<p>1 Carry out visual inspection of the roof opening panel motor for location and security of fixings</p>
	<p>Is the roof opening panel motor correctly located and securely installed?</p> <p>Yes GO to C4.</p> <p>No Re-torque the fixings, TORQUE 3NM ± 0.25 if this is not possible replace the roof opening panel REFER to: Roof Opening Panel (501-17 Roof Opening Panel, Removal and Installation).</p>
<p>C4: ROLLO BLIND NOISE</p>	
	<p>1 Operate the rollo blind</p>
	<p>Does the rollo blind retract correctly without noise?</p> <p>Yes GO to C5.</p> <p>No GO to Pinpoint Test E.</p>
<p>C5: MOTOR NOISE</p>	
	<p>1 Operate the roof opening panel</p>
	<p>During operation is the motor noise acceptable? (compare to other vehicles)</p> <p>Yes If customer concern is still evident contact dealer technical support</p> <p>No Install a new roof opening panel motor REFER to: Roof Opening Panel Motor (501-17 Roof Opening Panel, Removal and Installation). Check for correct operation, If correct no further action required</p>
<p>PINPOINT TEST D : ROOF OPENING PANEL - NOISE IN OPEN / TILT POSITION</p>	

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: OPEN / TILT POSITION MECHANISM NOISE	
NOTES:	
 These tests are to be carried out to determine the cause of the noise in relation to the roof opening panel	
 If the customer concern is related wind noise or noise during movement, refer to the symptom chart above	
	1 Confirm customer complaint, locate the noise, by operating the roof opening panel through all possible positions (slide open / slide close / tilt open / tilt close) using the roof mounted switch
	2 Roof panel fully open position
	3 Check for movement in the roof opening panel mechanism by manually moving the glass panel upwards / downwards
	Is there up and down movement? Yes GO to D2. No Contact dealer technical support
D2: DAMAGED LIFTER ARMS	
	1 Remove the glass panel REFER to: Roof Opening Panel Glass (501-17 Roof Opening Panel, Removal and Installation).
 E141883	2 Carry out visual inspection of the lifter arms for cracks or damage (pieces broken)
	Are the lifter arms cracked or damaged? Yes Replace the lifter arms, reinstall the glass panel. Check for correct operation. (1) If correct no further action required. (2) If customer concern is still evident GO to D3. No GO to D3.
D3: REAR SLIDER MECHANISM	
 E141884	1 Carry out a visual inspection of the rear slider mechanisms
	Are the rear slider mechanisms damaged or bent? Yes Install a new roof opening panel REFER to: Roof Opening Panel (501-17 Roof Opening Panel, Removal and Installation). Check for correct operation, If correct no further action required. If customer concern is still evident contact dealer technical support GO to D4.

	No GO to D4.
D4: SLIDE PADS AND SIDE COVERS	
 <p>E141885</p>	1 Carry out a visual inspection of the slide pads and the side covers
	Are the slide pads and the side covers damaged or bent? Yes Replace the glass panel assembly REFER to: Roof Opening Panel Glass (501-17 Roof Opening Panel, Removal and Installation). No GO to D5.
D5: ROOF OPERATION	
	1 Reinstall the glass panel as required 2 Check for correct operation
	Is the customer concern is still evident? Yes If customer concern is still evident contact dealer technical support No No further action required
PINPOINT TEST E : ROOF OPENING PANEL - BOUNCE BACK	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: INITIALIZATION	
 NOTE: These tests are to be carried out to determine the cause of the unnecessary roof opening panel bounce back	
	1 Perform the manual roof opening panel initialization procedure REFER to: Power Roof Opening Panel Initialization (501-17 Roof Opening Panel, General Procedures). Check for correct roof opening panel operation
	2 Operate the roof opening panel through all possible positions (slide open / slide close / tilt open / tilt close) using the roof mounted switch
	3 Operate the roof opening panel one touch function five times in succession using the roof mounted switch
	Does the roof opening panel operate correctly five times in succession? Yes No further action required No GO to E2.
E2: GUIDES - INSPECTION	
	 NOTE: Image shows glass panel removed for clarity. Do not remove the glass panel at this time 1 Carry out visual inspection of the guides



E141877

Are the guides free from debris and obstruction?

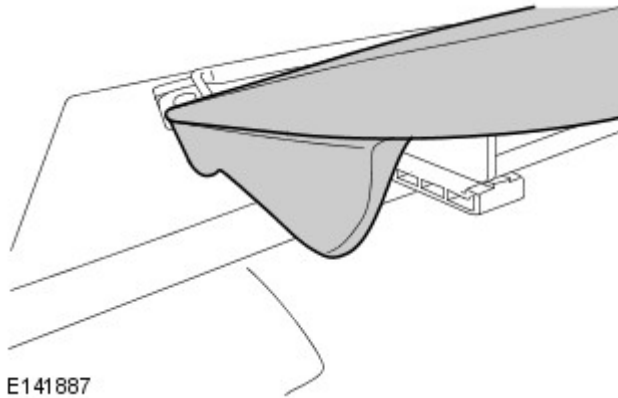
Yes

[GO to E3.](#)

No

Remove any debris or obstruction. Check for correct operation. **(1)** If correct no further action required. **(2)** If customer concern is still evident [GO to E3.](#)

E3: SIDE COVERS



E141887

1 Carry out visual inspection of the side covers attached to the glass panel

Are the side covers bent or damaged?

Yes

Replace the glass panel

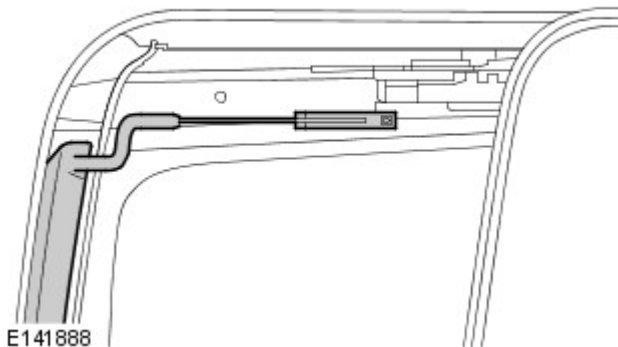
REFER to: Roof Opening Panel Glass (501-17 Roof Opening Panel, Removal and Installation).

Check for correct operation. **(1)** If correct no further action required. **(2)** If customer concern is still evident [GO to E4.](#)

No

[GO to E4.](#)

E4: WIND DEFLECTOR



E141888

1 Carry out visual inspection of the wind deflector

Is the wind deflector damaged or incorrectly located?

Yes

Re-install or replace the wind deflector as required. Check for correct operation. Check for correct operation. **(1)** If correct no further action required. **(2)** If customer concern is still evident contact dealer technical support

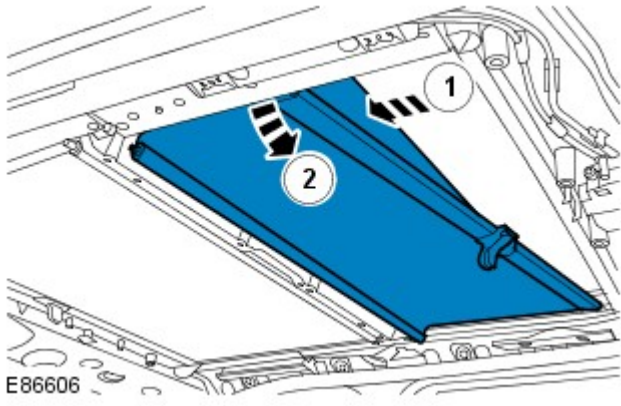
No

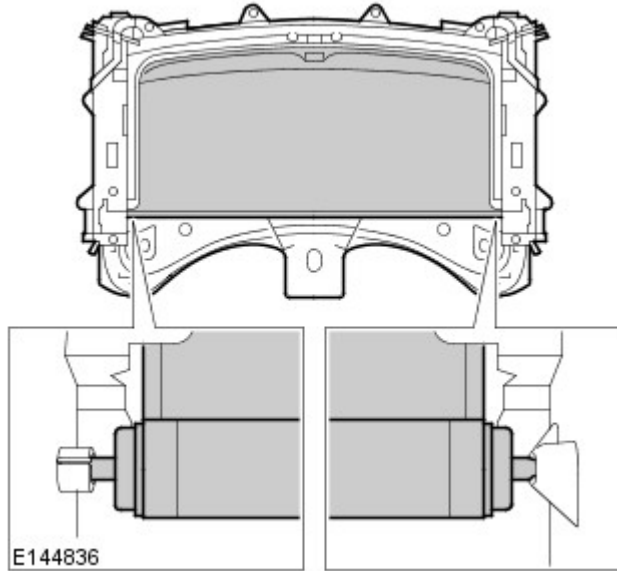
If concern still evident contact dealer technical support

PINPOINT TEST F : ROOF OPENING PANEL BLIND - OPERATION

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: OPERATION	
	1 Operate the roof opening panel blind through all movements and latch to the frame
	Does the roof opening panel blind operate through all movements and retract correctly? Yes If concern still evident contact dealer technical support
	No Disassemble rolo blind from roof REFER to: Roof Opening Panel Blind (501-17 Roof Opening Panel, Removal and Installation). Use following procedure to rewind the rolo blind REFER to: Roof Opening Panel Blind Rewind Procedure (501-17 Roof Opening Panel, General Procedures). Then GO to F2.
F2: ROLLO BLIND MECHANISM	
	1 Once the rolo blind rewind procedure has been attempted
	Could the rewind procedure be completed successfully? Yes Re-install the rolo into the roof. Check for correct operation. (1) If correct no further action required. (2) If customer concern is still evident contact dealer technical support
	No Install a new rolo blind. Check for correct operation, If correct no further action required


PINPOINT TEST G : ROOF OPENING PANEL BLIND - NOISE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: GUIDES - INSPECTION	
	1 Carry out visual inspection of the guides
	Are the guides free from debris and obstruction? Yes GO to G2.
	No Remove any debris or obstruction. Check for correct operation. (1) If correct no further action required. (2) If customer concern is still evident GO to G2.
G2: SLIDESHOES	
 <p>E86606</p>	1 Remove the slide shoes from the guide
	2 Carry out visual inspection of the slide shoes
	Are the slide shoes broken / damaged or is the felt on the slide shoes missing or damaged? Yes If the felt on the slide shoe is adrift then it may be possible to secure the felt using a small amount of glue. Replace the rolo blind as required. Check for correct operation. (1) If correct no further action required. (2) If customer concern is still evident GO to G3.
	No GO to G3.
G3: MOUNTING PINS	
	1 Lower the headliner to gain access to see the ends of the blind assembly mounted into the roof REFER to: Headliner (501-05 Interior Trim and Ornamentation, Removal and Installation). (remove grab handle, remove headliner clips to roof opening panel)



	2 Carry out visual inspection of the mounting pins of the rolo blind
	Are the rolo pins correctly mounted? Yes If customer concern is still evident contact dealer technical support No Remove the rolo blind. Carry out blind rewind procedure. REFER to: Roof Opening Panel Blind Rewind Procedure (501-17, General Procedures). Re-install the rolo blind. Check for correct operation. (1) If correct no further action required. (2) If customer concern is still evident contact dealer technical support

PINPOINT TEST H : WATER INGRESS

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: GLASS PANEL	
 NOTE: These tests are to be carried out to determine the cause of the water ingress around the roof opening panel	
	1 Carry out visual inspection of the glass panel alignment to the roof aperture REFER to: Roof Opening Panel Alignment (501-17 Roof Opening Panel, General Procedures). Correctly relocate the glass panel as required
	2 Perform the manual roof opening panel initialization procedure REFER to: Power Roof Opening Panel Initialization (501-17 Roof Opening Panel, General Procedures).
	Is the alignment correct? Yes GO to H2. No Contact dealer technical support
H2: SEAL - LOCATION	
	1 Carry out visual inspection of the seal on the glass panel for location and damage
	Is the glass panel seal correctly located and intact? Yes GO to H3. No Install new glass panel. REFER to: Roof Opening Panel Glass (501-17 Roof Opening Panel, Removal and Installation). Conduct a water leak test REFER to: Water Leaks (501-25 Body Repairs - Water Leaks, Description and Operation). (1) If correct no further action required. (2) If leak still evident GO to H3.
H3: DRAIN TUBES – FREE FROM DEBRIS	
	1 Carry out inspection of the drain tubes REFER to: (501-17) Driver Side Roof Opening Panel Front Drain Hose (Removal and Installation), Passenger Side Roof Opening Panel Front Drain Hose (Removal and Installation).
	Are the drain tubes free from debris? Yes

	<p>GO to H4.</p> <p>No Remove the obstruction to ensure flow through the drain tubes and conduct water leak test REFER to: Water Leaks (501-25 Body Repairs - Water Leaks, Description and Operation). (1) If correct no further action required. (2) If leak still evident GO to H4.</p>
H4: ASSEMBLY FRAME	
	1 Carry out visual inspection of the frame for cracks and damage
	Is the frame damaged (allowing water ingress)? Yes Install a new roof opening panel REFER to: Roof Opening Panel (501-17 Roof Opening Panel, Removal and Installation). No If concern still evident contact dealer technical support

PINPOINT TEST I : ROOF OPENING PANEL - WIND NOISE

TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
-----------------	-------------------------

I1: VERIFY CUSTOMER CONCERN

 **NOTE:** These tests are to be carried out to determine the cause of the wind noise around the roof opening panel area

	1 Perform the manual roof opening panel initialization procedure REFER to: Power Roof Opening Panel Initialization (501-17 Roof Opening Panel, General Procedures).
	2 Carry out a road test to verify the customer complaint, drive at the speed indicated by the customer
	Can the noise be confirmed? Yes If the customer concern is still evident GO to I2. No No further action required

I2: OPERATION

	1 Operate the roof opening panel through all possible positions (slide open / slide close / tilt open / tilt close) using the roof mounted switch
	Does the roof opening panel operate correctly? Yes GO to I3. No GO to Pinpoint Test B.

I3: GLASS PANEL ALIGNMENT

	1 Correctly relocate the glass panel as required. REFER to: Roof Opening Panel Alignment (501-17 Roof Opening Panel, General Procedures).
	2 Carry out visual inspection of the glass panel alignment to the roof aperture
	Is the alignment correct? Yes GO to I4. No Contact dealer technical support

I4: GLASS SEAL

	1 Carry out visual inspection of the glass panel seal
	Is the glass panel seal correctly installed? Yes GO to I5. No Install a new roof opening panel glass REFER to: Roof Opening Panel Glass (501-17 Roof Opening Panel, Removal and Installation).

I5: WIND NOISE

	1 Carry out a road test, drive at the speed indicated by the customer
	Is the wind noise still evident? Yes Contact dealer technical support No No further action required

Roof Opening Panel - Roof Opening Panel Blind Rewind Procedure

General Procedures

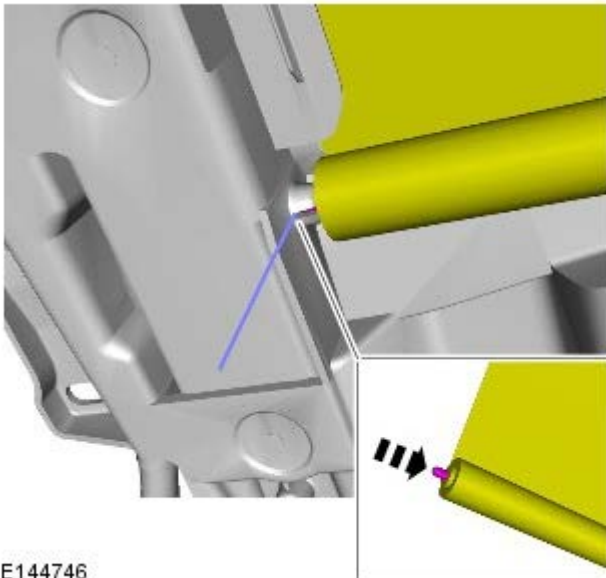
Inspection

1. Refer to: Headliner (501-05, Removal and Installation).
2. Close the roof opening panel blind (but do not latch the handle to the frame).



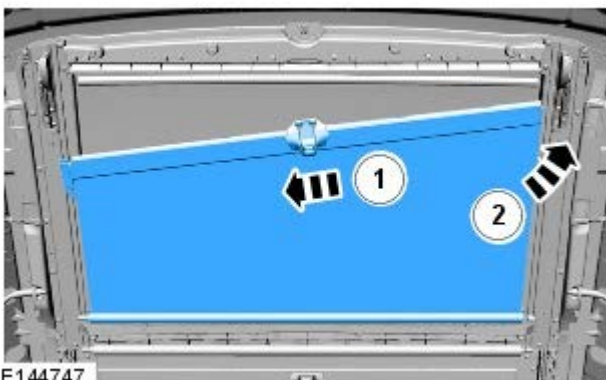
E131223

3. Using a suitable tool, release the roof opening panel blind locking tang on the right.



E144746

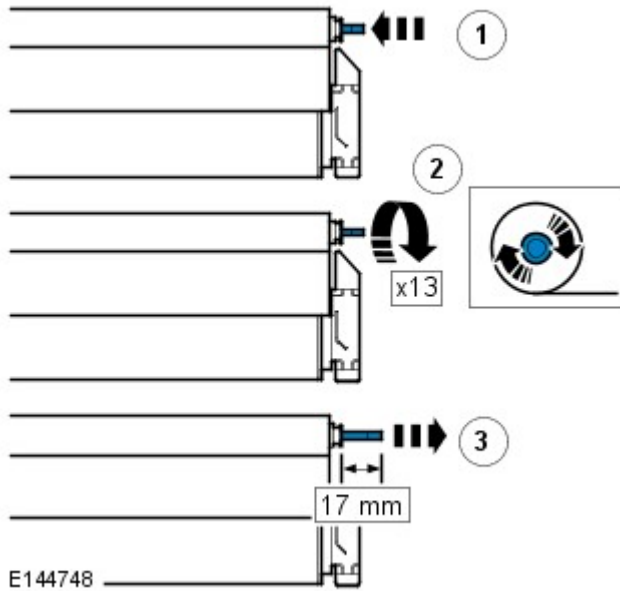
4.
 - **Release the roof opening panel blind from the mounting bracket and remove the roof opening panel blind from the vehicle.**
 - 1. Push the roof opening panel blind to the right.
 - 2. Rotate the roof opening panel blind counter clockwise.



E144747

5. Remove the roof opening panel blind.

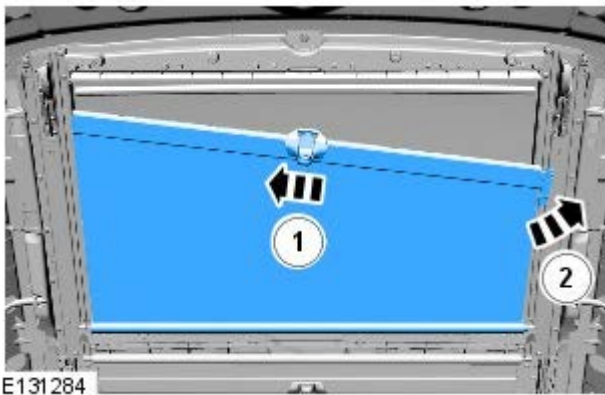
6.
 - **Rewind the roof opening panel.**
 - 1. Push the spring axle into the roof opening panel blind.
 - 2. Using a suitable tool, hold and rotate the spring axle 13 turns (360°).
 - 3. Release the spring axle 17 mm from the roof opening panel blind once the 13



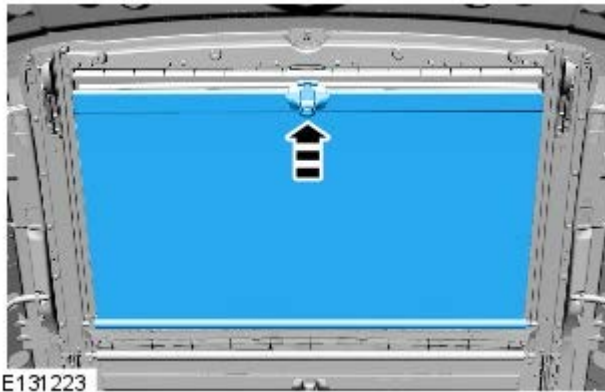
rotations have been completed.


7.

- **Install the roof opening panel blind sliders to the runners.**
- 1. Push the roof opening panel blind right slider in to the runner
- 2. Install the left slider clockwise to the runner.



8. Close the roof opening panel blind.



9.  **NOTE:** Make sure that the spring axle is correctly located into the roof opening panel.

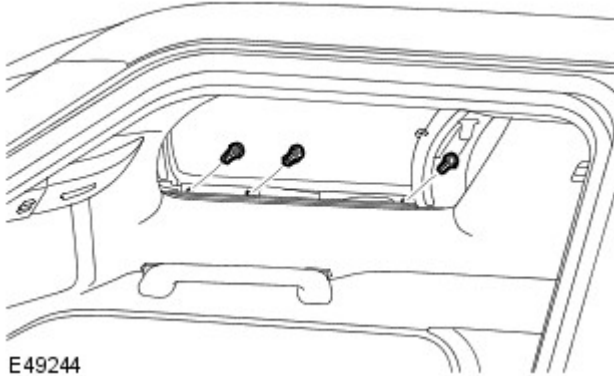
- Open the roof opening panel blind and check for correct operation.

10. Refer to: Headliner (501-05, Removal and Installation).

Roof Opening Panel - Roof Opening Panel Alignment

General Procedures

1. With the roof opening panel closed, check the alignment of the glass to the roof panel. The glass should be central in its aperture. Profile of sunroof to body:
 1. Front edge, set flush or up to 1.0 mm (0.040") low.
 1. Rear edge, set flush or up to 1.0 mm (0.040") high.
2. Open the roof opening panel blind.
3. Loosen the 6 roof opening panel Torx bolts.



4. Align the roof opening panel.
 - Tighten the Torx screws to 6 Nm (4 lb.ft).
5. Close the roof opening panel blind.

Roof Opening Panel - Power Roof Opening Panel Initialization

General Procedures

Initialization

NOTES:



Make sure that the battery voltage is between 11-14 Volts. Connect a suitable approved battery charger to the vehicle battery if required.



The vehicle needs to be inside the workshop for a minimum of 1 hour, with the temperature between 5 - 30 degrees.

1. Switch the ignition ON.

2. NOTES:



Do not release the roof opening panel switch during the initialization.



If the roof opening panel does not operate after 60 seconds. Connect the approved diagnostic tool and read the diagnostic troubles code(s) (DTC(s)), then clear the DTC(s).

Press and hold the front of the roof opening panel switch.

3. NOTES:



A time delay may occur during the initialization of the roof opening panel.



The cycle time will depend on the glass panel position.

- **The initialization process:**

- The roof opening panel will close.
- The roof opening panel will open to the tilt position.
- The roof opening panel will fully open.
- The roof opening panel will fully close.

4. Release the roof opening panel switch once the roof opening panel has fully closed.

5. Check the roof opening panel for correct operation.

6. Switch the ignition OFF.

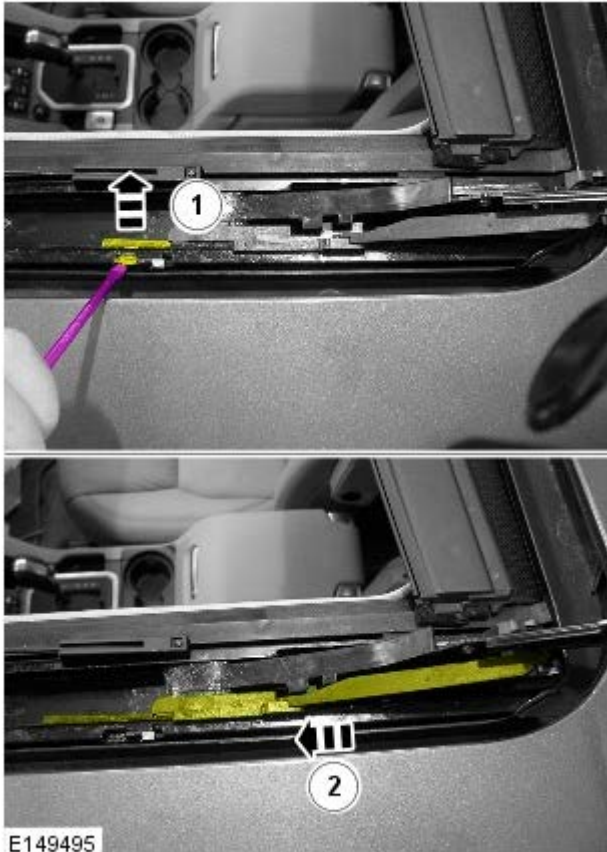
7. If installed, disconnect and remove the suitable battery charger and diagnostic tool.


Roof Opening Panel - Lifter Arms

Removal and Installation

Removal

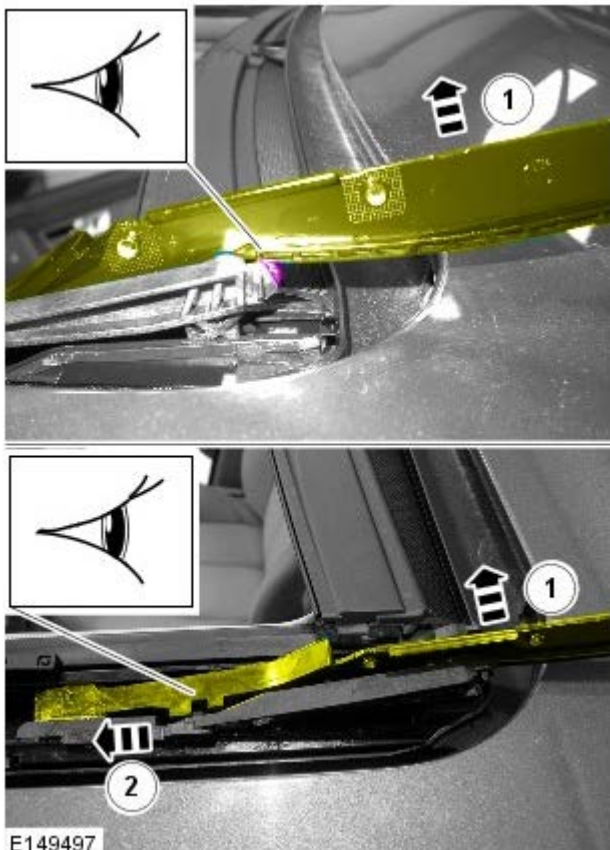
1. Refer to: Roof Opening Panel Glass (501-17, Removal and Installation).
2. Set the roof opening panel motor to the fully open position.



3.  **CAUTION:** Care must be taken during this step.

1. Using a suitable tool, release the locking tang.
2. Slide the driving wedge forward until the lifter arm becomes free.

4.
 1. Raise the rear of the lifter arm to release the lifter arm from the guides and the tangs.
 2. Push the lifter arm forward.



E149497



E149496

Installation



E149499

5.

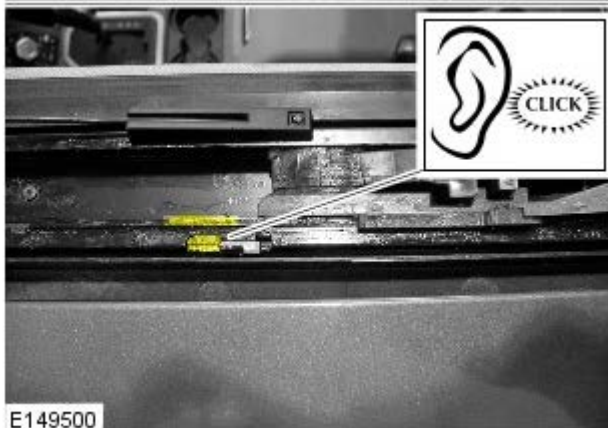
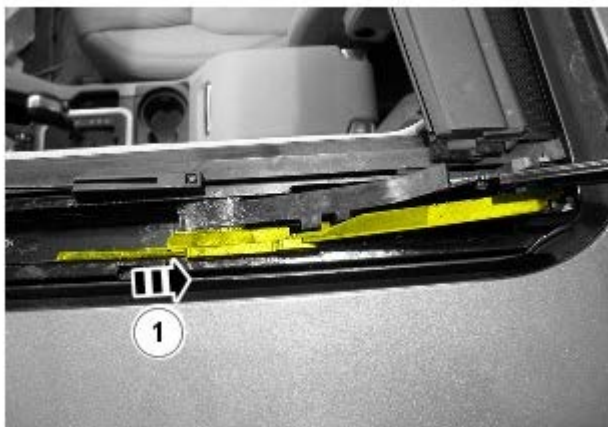
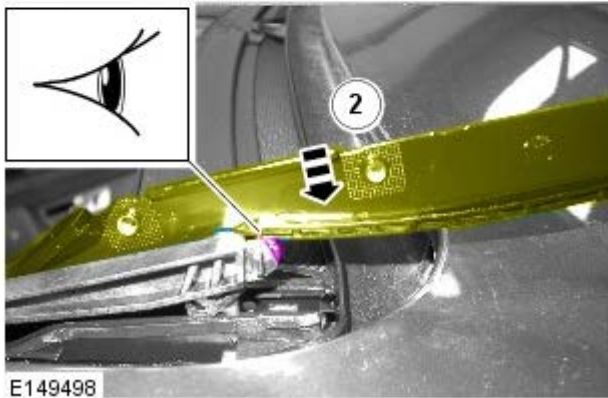
1. Push the lifter arm fully forward.
2. Remove the lifter arm.

1.

1. Install the lifter arm.
2. Slide the lifter arm rearwards.

2.

1. Push the lifter arm rearwards and locate in the tangs.
2. Push the lifter arm downwards and locate in the guides.



3.

- Slide the driving wedge rearward until the locking tab is fully located.

4. Repeat the procedure to the other side.

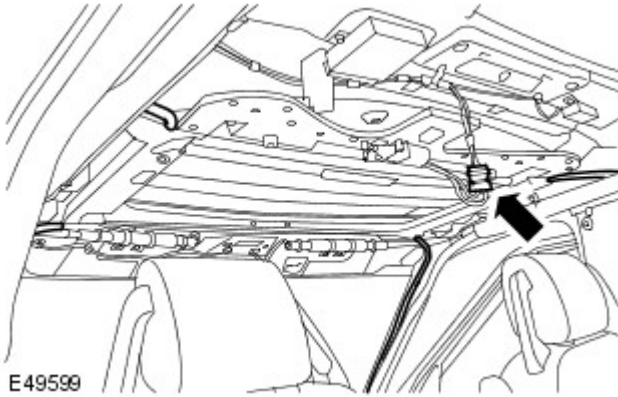
5. Refer to: Roof Opening Panel Glass (501-17, Removal and Installation).

Roof Opening Panel - Roof Opening Panel

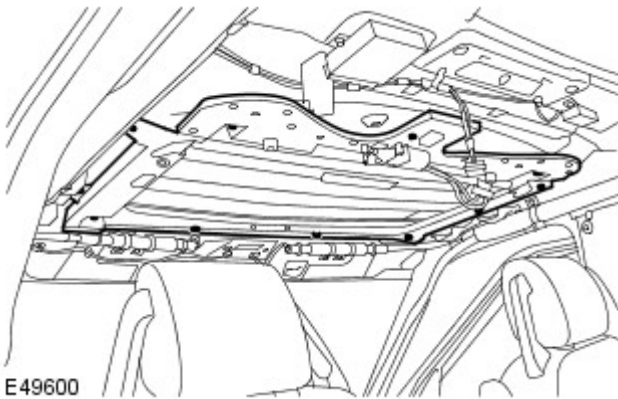
Removal and Installation


Removal

1. Remove the headliner.
For additional information, refer to: Headliner (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Release the 4 drain hoses from the roof opening panel.
3. Disconnect the roof opening panel motor electrical connector.



4. With assistance, remove the roof opening panel assembly.
 - Remove the 11 bolts.



5.  **CAUTION:** Do not depress the RH plunger to remove the blind.

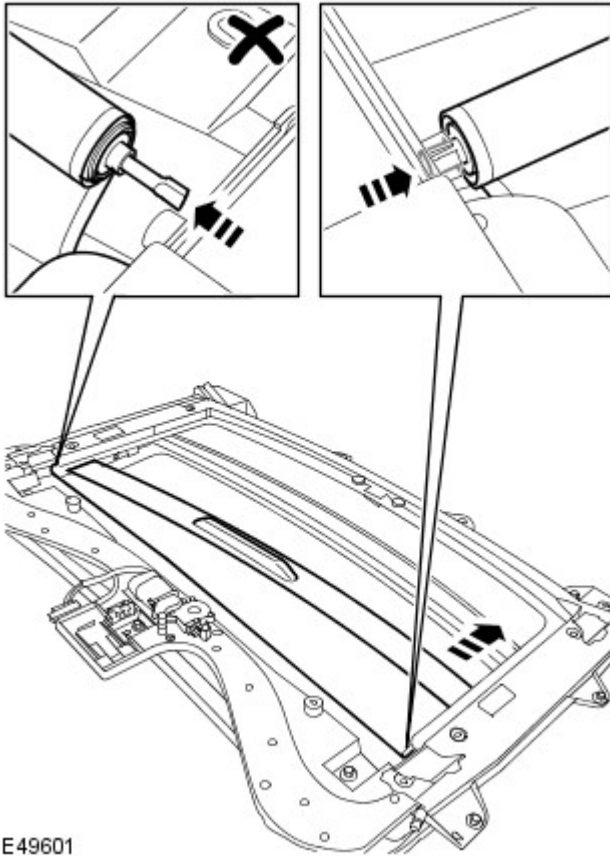
NOTES:

 Do not disassemble further if the component is removed for access only.

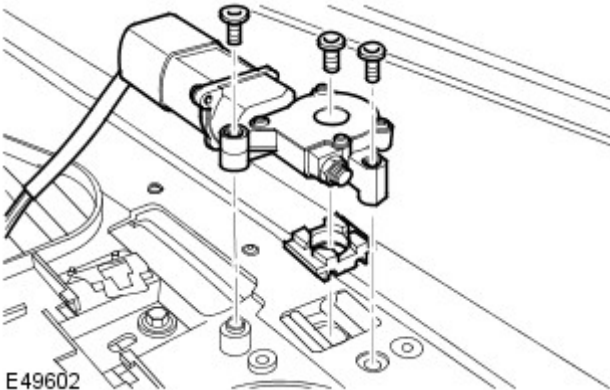
 Note the fitted position.

Remove the roof opening panel blind.

- Twist to release the handle.
- Depress the LH plunger.




E49601



E49602

6. Remove the roof opening panel motor.
 - Remove the 3 Torx screws.
 - Remove the spacer.

Installation

1. Install the roof opening panel motor.
 - Install the spacer.
 - Tighten the Torx screws to 4 Nm (3 lb.ft).
2.  **NOTE:** Align to the position noted on removal.
 - Install the roof opening panel blind.
 - Secure in the guides.
 - Locate the tensioner peg.
 - Depress the LH plunger.
3. With assistance, install the roof opening panel assembly.
 - Clean the component mating faces.
 - Tighten the bolts to 10 Nm (7 lb.ft).
4. Connect the roof opening panel motor electrical connector.
5. Connect the drain hoses.
 - Make sure the drain hoses are clear prior to connection.
6. Install the headliner.

For additional information, refer to: Headliner (501-05 Interior Trim and Ornamentation, Removal and Installation).

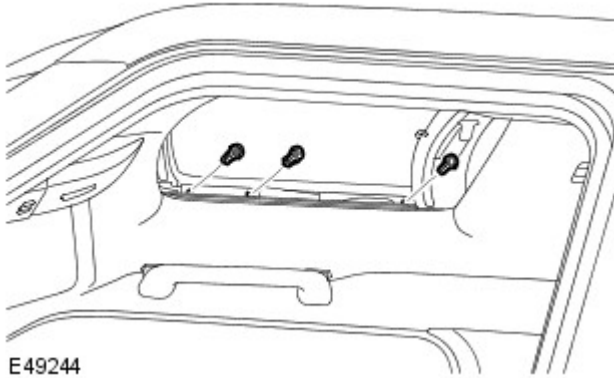
7. Using T4, configure a new roof opening panel.
8. If the battery has been disconnected, the one touch and anti-trap function will become inoperative. Close the roof opening panel and continue to hold the switch for a further 20 seconds to allow the sunroof to complete a full cycle. This will complete the roof opening panels calibration routine and reset these functions.

Roof Opening Panel - Roof Opening Panel Glass

Removal and Installation

Removal

1. Open the roof opening panel blind.
2. Open the roof opening panel to the tilt position.
3. Remove the roof opening panel glass.
 - Remove the 3 Torx screws.
 - Repeat the above procedure for the other side.



E49244

Installation

1. Install the roof opening panel glass.
 - Install the Torx bolts, but do not tighten fully at this stage.
2. Align the roof opening panel glass.

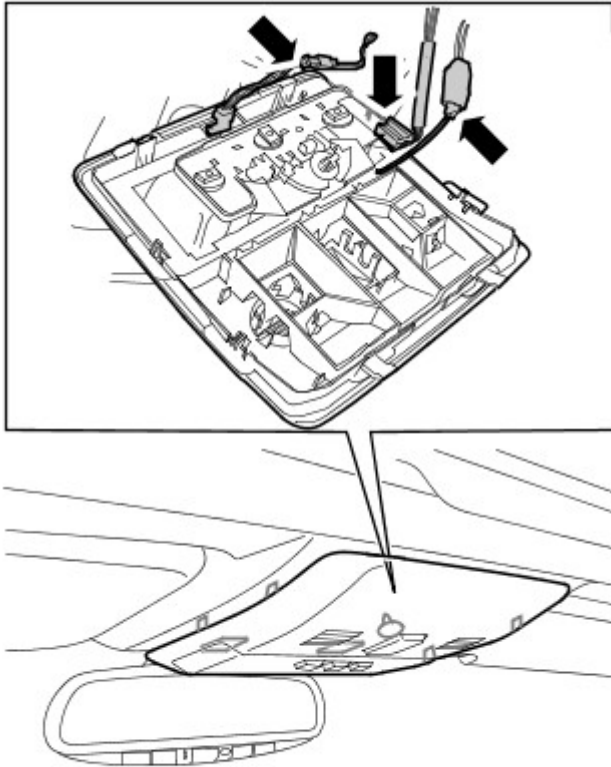
For additional information, refer to: Roof Opening Panel Alignment (501-17, General Procedures).

Roof Opening Panel - Roof Opening Panel Motor

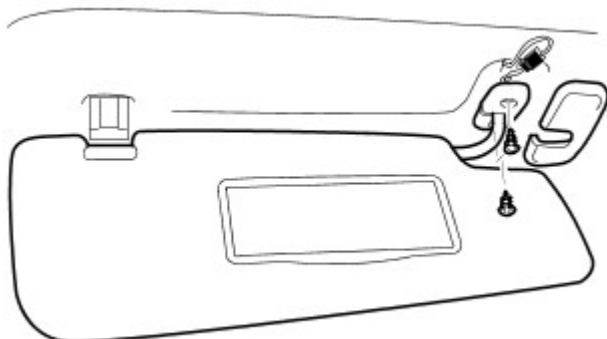
Removal and Installation

Removal

1. Remove both A-pillar upper trim panels.
For additional information, refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
2. Remove both B-pillar upper trim panels.
For additional information, refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
3. Remove the front overhead console.
 - Carefully release the 7 clips.
 - Disconnect the electrical connector.

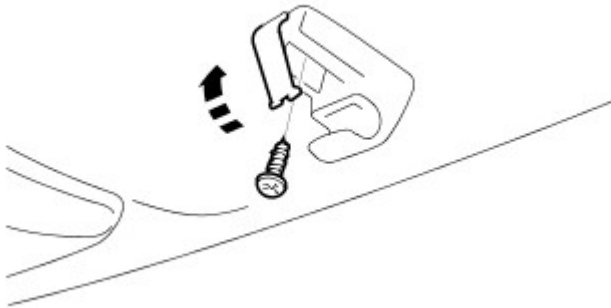


E50142

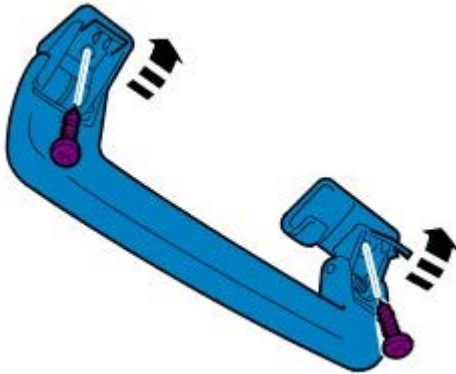


E49687

4. Remove the sun visor.
 - Remove the cover.
 - Remove the 2 screws.
 - Release from the clip.
 - Disconnect the electrical connector.
 - Repeat the above procedure for the other side.
5. Remove the sun visor retaining clip.
 - Release the screw cover.
 - Remove the screw.
 - Repeat the above procedure for the other side.

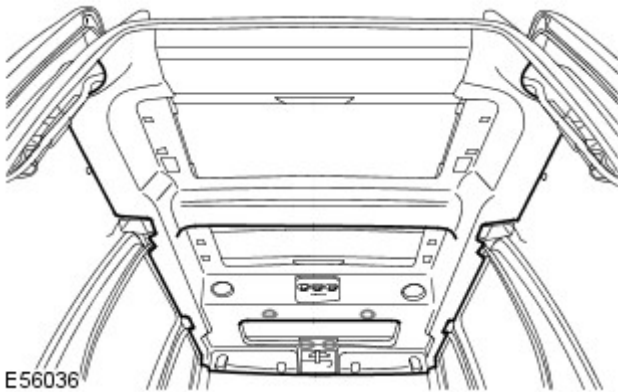


E49688



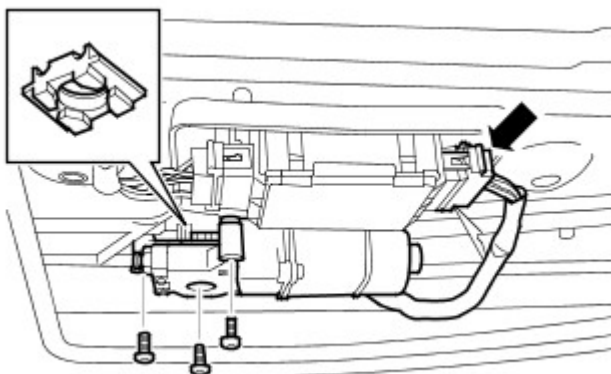
E49689

6. Remove the passenger assist handle.
 - Release the 2 screw covers.
 - Remove the 2 screws.
 - Repeat the above procedure for the other side.



E56036

7. Lower the headliner for access.
 - Release the 4 clips.



E55446

8. Remove the roof opening panel motor.
 - Disconnect the electrical connector.
 - Remove the 3 Torx screws.
 - Remove the spacer.

Installation

1. Install the roof opening panel motor.
 - Install the spacer.
 - Tighten the Torx screws to 4 Nm (3 lb.ft).
 - Connect the electrical connector.
2. Position the headliner.
 - Secure with the clips.

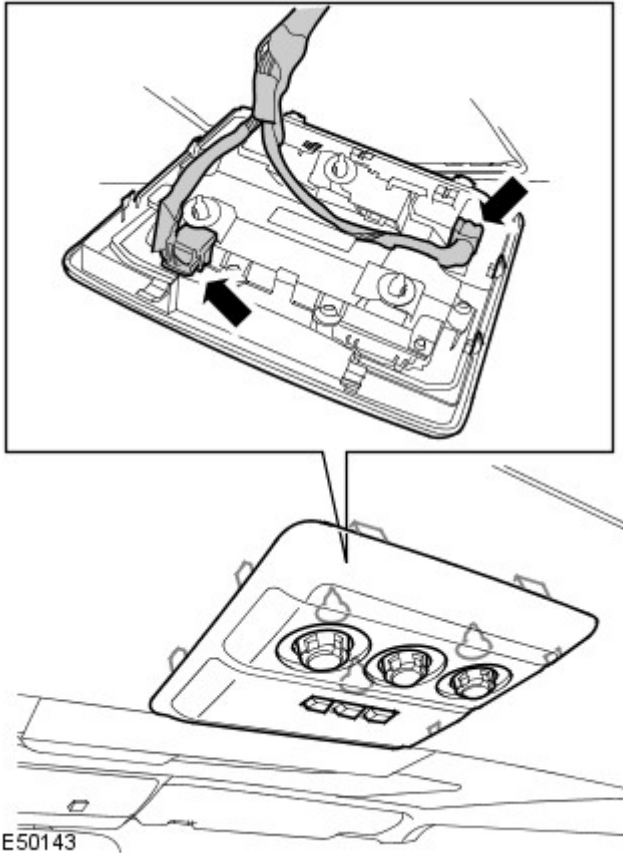
3. Install the passenger assist handles.
 - Install the screws.
 - Secure the screw covers.
4. Install the sun visors.
 - Install the clips.
 - Install the screws.
 - Install the screw covers.
 - Connect the electrical connectors.
5. Install the front overhead console.
 - Connect the electrical connector.
 - Carefully secure the clips.
6. Install both B-pillar upper trim panels.
For additional information, refer to: B-Pillar Upper Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
7. Install both A-pillar upper trim panels.
For additional information, refer to: A-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
8. Using T4, configure a new roof opening panel motor.
9. If the battery has been disconnected, the one touch and anti-trap function will become inoperative. Close the roof opening panel and continue to hold the switch for a further 20 seconds to allow the sunroof to complete a full cycle. This will complete the roof opening panel calibration routine and reset these functions.

Roof Opening Panel - Roof Opening Panel Module

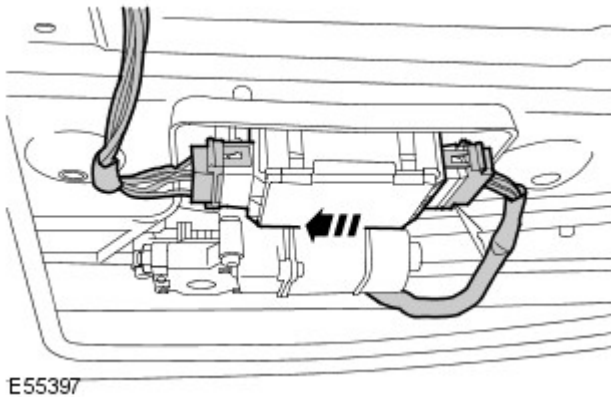
Removal and Installation

Removal

1. Remove the rear overhead console.
 - Carefully release the 9 clips.
 - Disconnect the 2 electrical connectors.



2. Remove the roof opening panel module.
 - Slide the module to the LH side to release it from the bracket.
 - Disconnect the 2 electrical connectors.




Installation

1. Install the roof opening panel module.
 - Connect the electrical connectors.
 - Secure the module to the bracket.
2. Install the rear overhead console.
 - Connect the electrical connectors.
 - Carefully secure the clips.
3. Using T4, configure a new roof opening panel module.
4. If the battery has been disconnected, the one touch and anti-trap function will become inoperative. Close the roof opening panel and continue to hold the switch for a further 20 seconds to allow the sunroof to complete a full cycle. This will complete the roof opening panels calibration routine and reset these functions.

Roof Opening Panel - Roof Opening Panel Blind

Removal and Installation

Removal

1.  NOTE: Repeat the procedure for both sides.

Refer to: A-Pillar Trim Panel (501-05, Removal and Installation).

2.  NOTE: Repeat the procedure for both sides.

Refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).

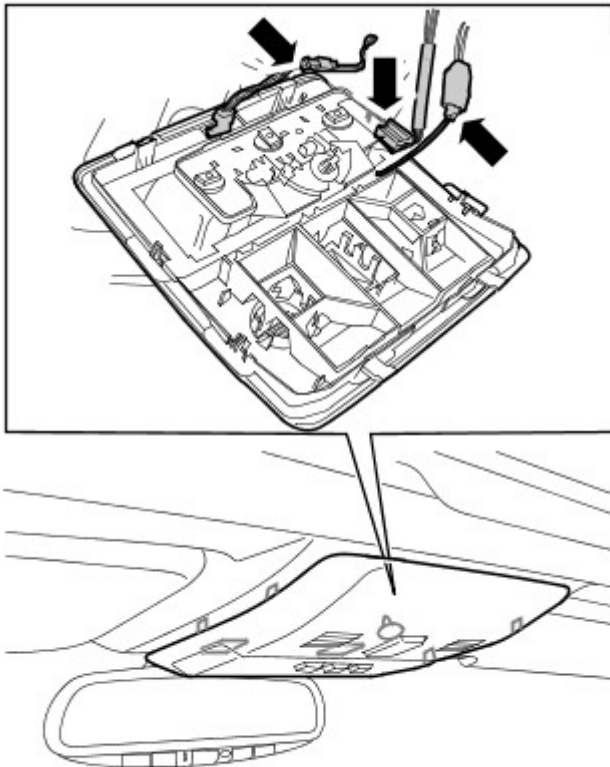
3.  NOTE: Repeat the procedure for both sides.

Refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).


4.  NOTE: Repeat the procedure for both sides.

Refer to: D-Pillar Trim Panel (501-05, Removal and Installation).

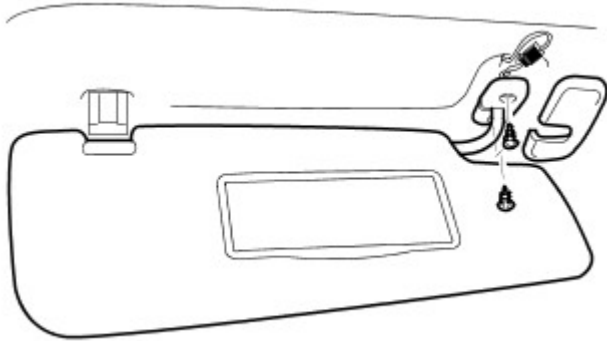
5.
 - Remove the overhead console.



E50142

6.  NOTE: Repeat the procedure for both sides.

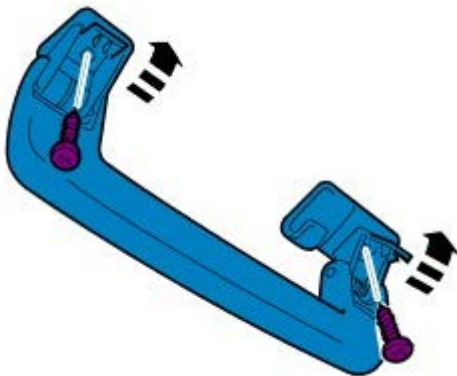
- Remove the sun visor.



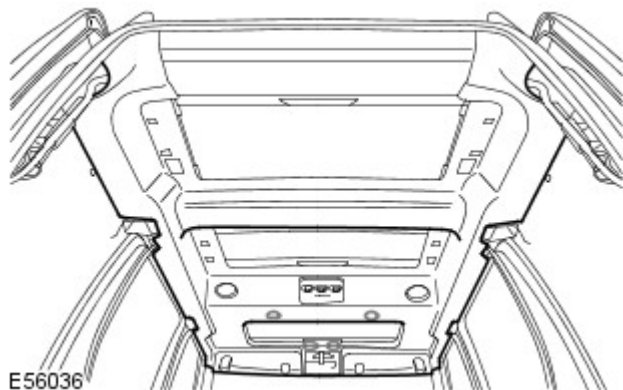
E49687



E49688




E49689



E56036

7.  NOTE: Repeat the procedure for both sides.

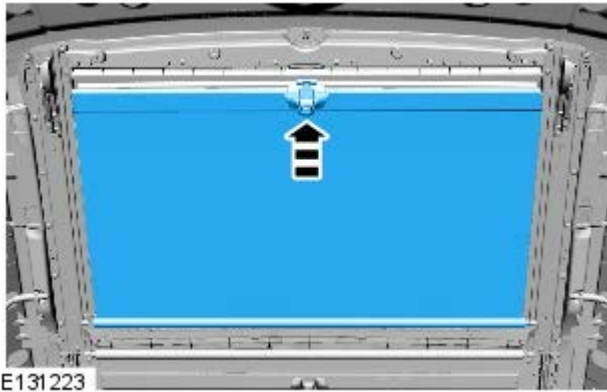
- Remove the sun visor retaining clip.

8.  NOTE: Repeat the procedure for both sides.

- Remove the passenger assist handle.

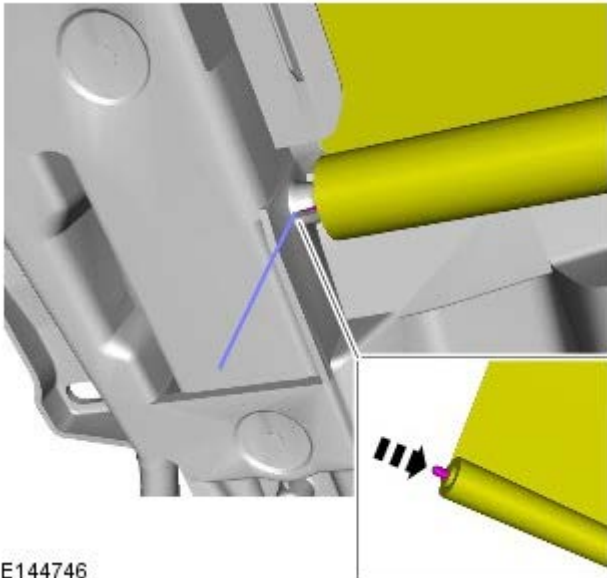
9.
 - Lower the headliner for access.

10. Close the roof opening panel blind (but do not latch the handle to the frame).



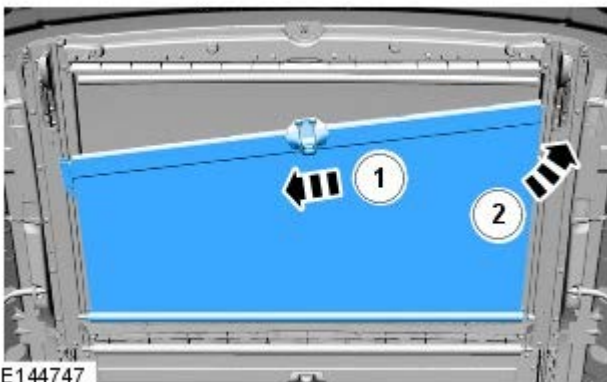
E131223

11. Using a suitable tool, release the roof opening panel blind locking tang on the right.



E144746

12.
 - Release the roof opening panel blind from the mounting bracket and remove the roof opening panel blind from the vehicle.
 - 1. Push the roof opening panel blind to the right.
 - 2. Rotate the roof opening panel blind counter clockwise.




E144747

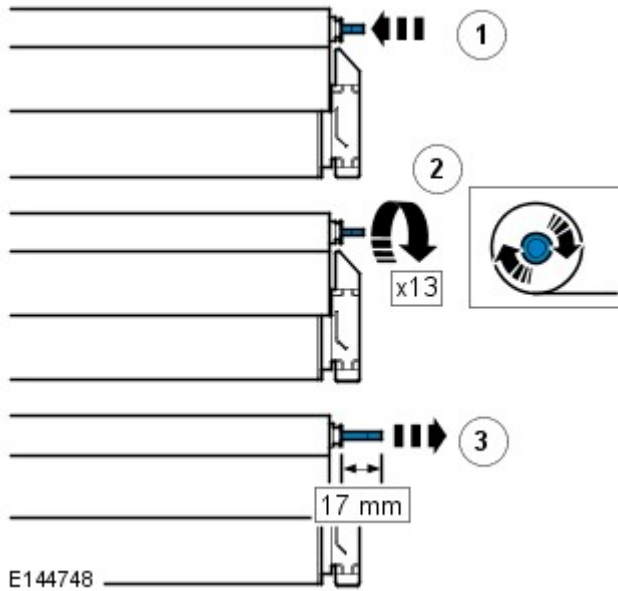
13. Remove the roof opening panel blind.

Installation

1.  **NOTE:** This step must be followed if the roof opening panel blind tension has been lost.

- Rewind the roof opening panel.
-  **CAUTION:** Make sure that all tension is removed from the roof opening panel blind. Push the spring axle 3-4 times until all tension is removed, then follow the steps below.

1. Push the spring axle into the roof



opening panel blind.

- 2. Using a suitable tool, hold and rotate the spring axle 13 turns (360°).

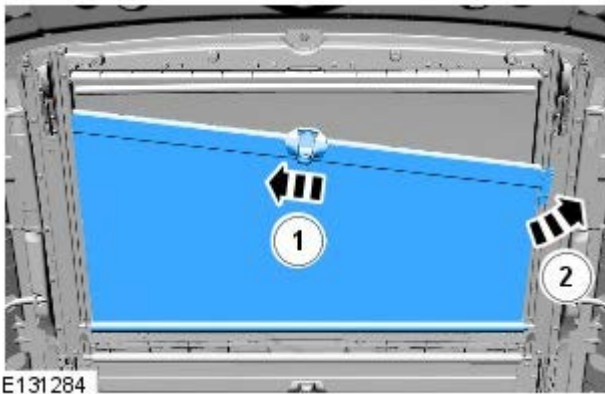
⚠ **NOTE:** This step is to lock the tension to the roof opening panel blind prior to installation.

3. Pull the spring axle 17 mm from the roof opening panel blind once the 13 rotations have been completed.

2.

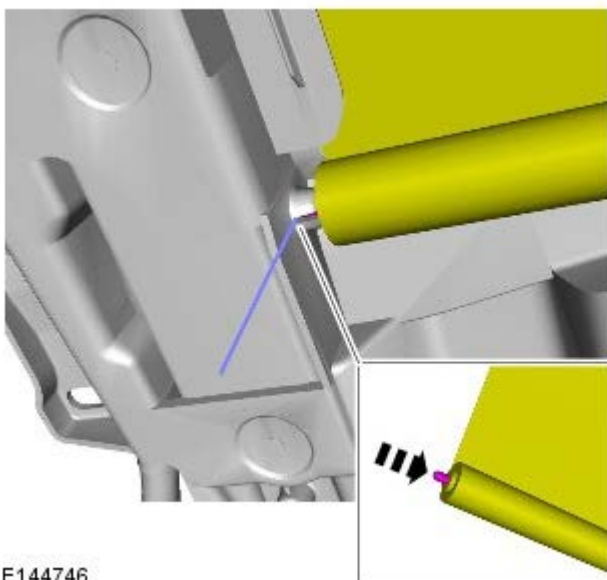
- **Install the roof opening panel blind sliders to the runners.**

- 1. Push the roof opening panel blind right slider in to the runner.
- 2. Install the left slider clockwise to the runner.

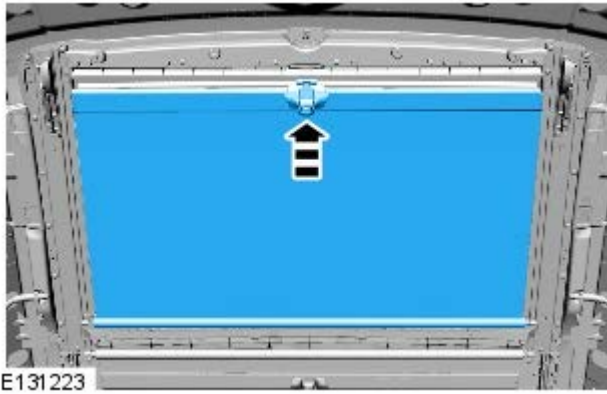


3. ⚠ **CAUTION:** Make sure that the roof opening panel blind tension remains during installation.





- **Install the roof opening panel blind to the mounting brackets.**
- Carefully locate the roof opening panel blind tube to the left-hand mounting bracket.
- Using a suitable tool, push the roof opening panel blind locking tang inwards of the blind and install the blind to the mounting bracket (as illustrated).





4. Close the roof opening panel blind.




E131223

5.  **CAUTION: Make sure that the spring axle is correctly located into the roof opening panel.**
 - Open the roof opening panel blind and check for correct operation.
6.
 - Install the headliner.
7.
 - Install the passenger assist handle.
8.  **NOTE: Repeat the procedure for both sides.**
 - Install the sun visor retaining clip.
9.  **NOTE: Repeat the procedure for both sides.**
 - Install the sun visor.
10.
 - Install the overhead console.
11.  **NOTE: Repeat the procedure for both sides.**

Refer to: D-Pillar Trim Panel (501-05, Removal and Installation).
12.  **NOTE: Repeat the procedure for both sides.**

Refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).
13.  **NOTE: Repeat the procedure for both sides.**

Refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).
14.  **NOTE: Repeat the procedure for both sides.**

Refer to: A-Pillar Trim Panel (501-05, Removal and Installation).

Roof Opening Panel - Driver Side Roof Opening Panel Front Drain Hose

Removal and Installation

Removal

NOTES:

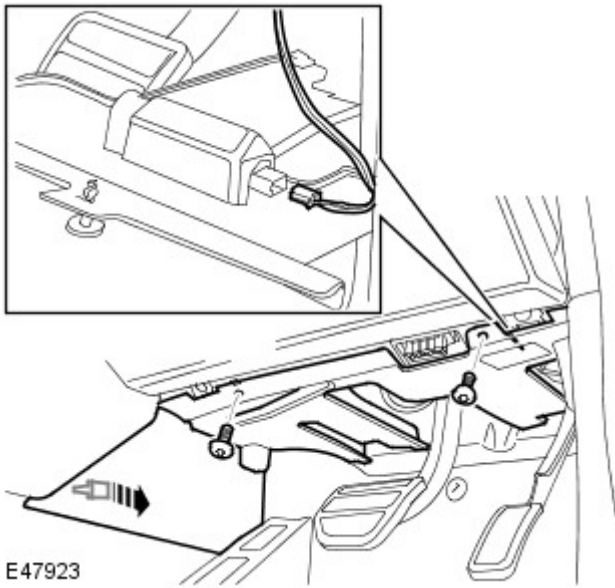


Removal steps in this procedure may contain installation details.

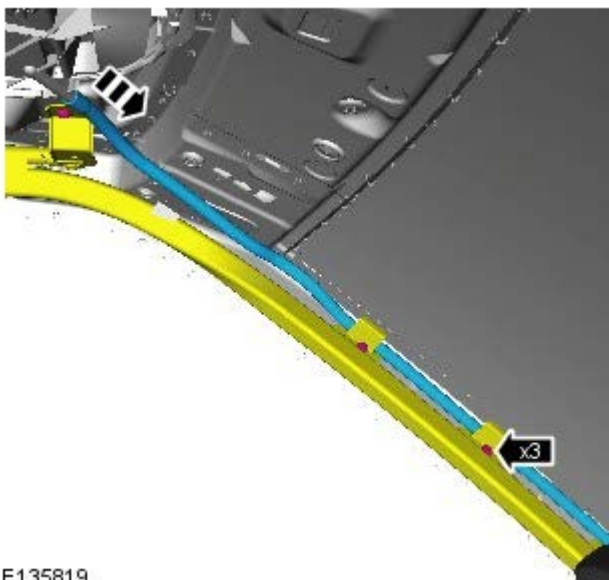


Some variation in the illustrations may occur, but the essential information is always correct.

1. Refer to: Headliner (501-05, Removal and Installation).
2. Remove the driver side closing trim panel.



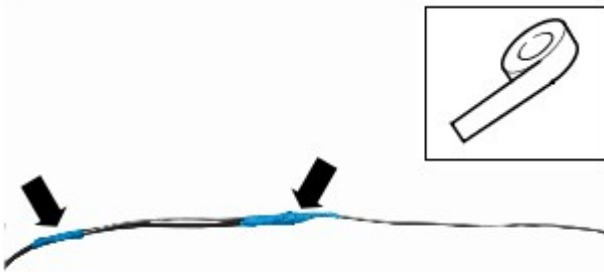
3. Release the side air bag curtain and detach the drain hose from the opening roof panel.



4. Detach the drain hose from the body panel.



E118136



E134896



E135820

Installation

1. To install, reverse the removal procedure.

5. Using suitable tape, secure the drain hose to a suitable rod to aid removal from the A-pillar area.

6. Remove the drain hose.

Roof Opening Panel - Passenger Side Roof Opening Panel Front Drain Hose

Removal and Installation

Removal

NOTES:

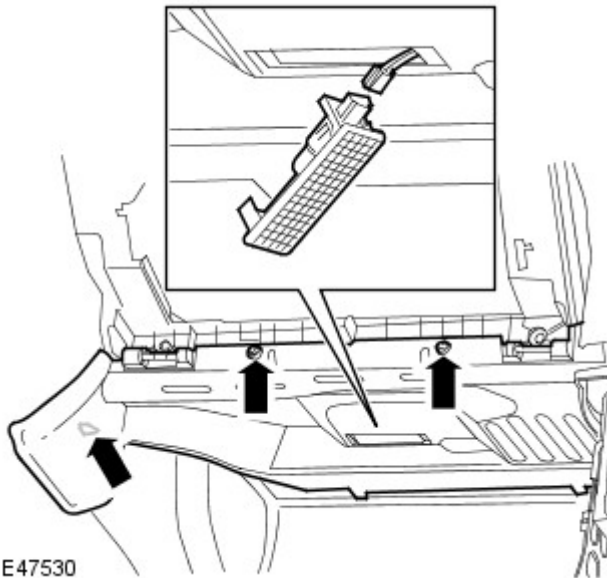


Removal steps in this procedure may contain installation details.



Some variation in the illustrations may occur, but the essential information is always correct.

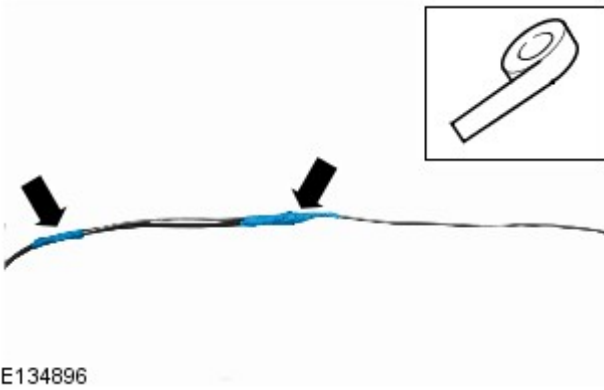
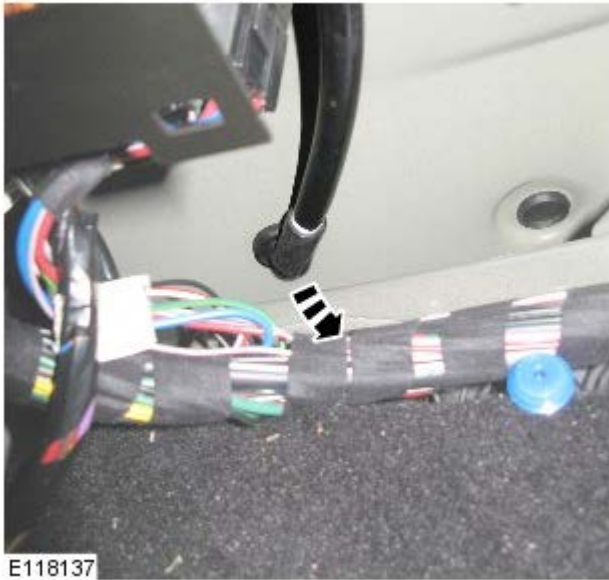
1. Refer to: Headliner (501-05, Removal and Installation).
2. Remove the passenger side closing trim panel.



3. Release the side air bag curtain and detach the drain hose from the opening roof panel.



4. Detach the drain hose from the body panel.



Installation

1. To install, reverse the removal procedure.

5. Using suitable tape, secure the drain hose to a suitable rod to aid removal from the A-pillar area.

6. Remove the drain hose.

Bumpers -

Description	Nm	lb-ft
Front bumper bolts	25	18
Windshield washer reservoir bolts	5	3.5
Front bumper cover bolts	5	3.5

Bumpers - Front Bumper

Removal and Installation

Removal

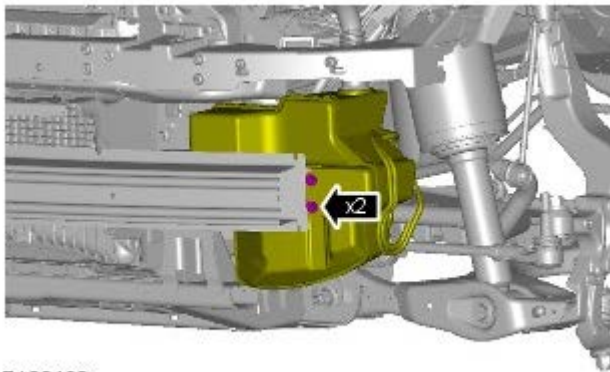


NOTE: Removal steps in this procedure may contain installation details.

1. Disconnect the battery ground cable.

Refer to: Specifications (414-00, Specifications).

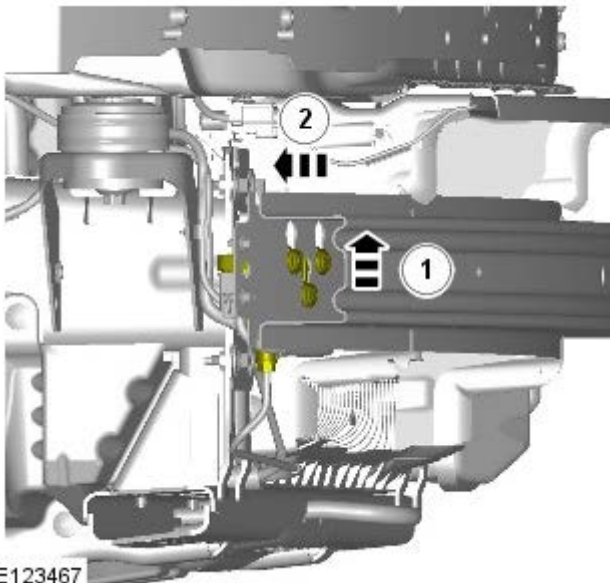
2. Refer to: Front Bumper Cover (501-19, Removal and Installation).



E123468

3. NOTE: Support as necessary.

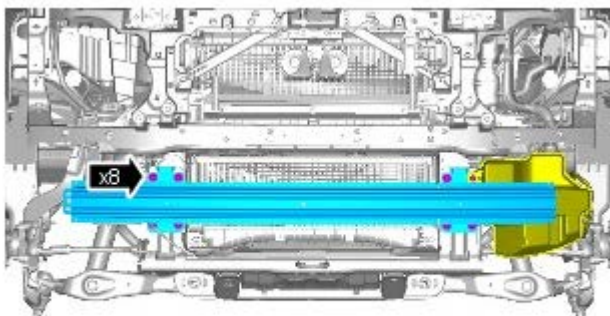
Torque: 10 Nm



E123467

4. CAUTION: Take extra care not to damage the component.

NOTE: Support as necessary.



E123469

5. NOTE: With assistance remove the component.

Torque: 25 Nm

Installation

1. To install, reverse the removal procedure.


Bumpers - Front Bumper Cover

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

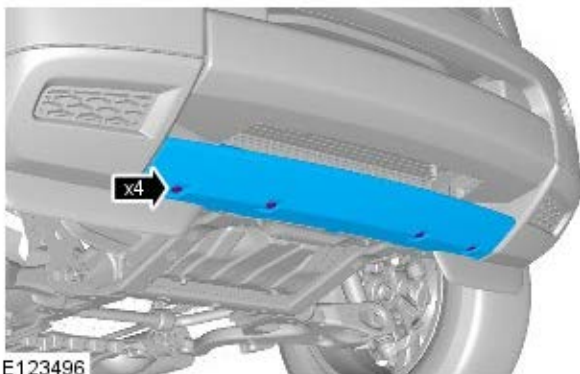
1.  **WARNING:** Make sure to support the vehicle with axle stands.


Raise and support the vehicle.

2.  NOTE: Repeat the procedure for the other side.

Refer to: [Front Fender Moulding](#) (501-08 Exterior Trim and Ornamentation, Removal and Installation).

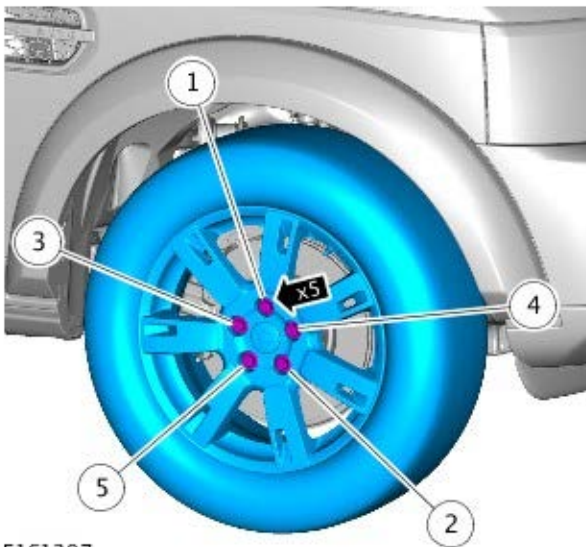
3.




4.  NOTE: Repeat the step for the other side.

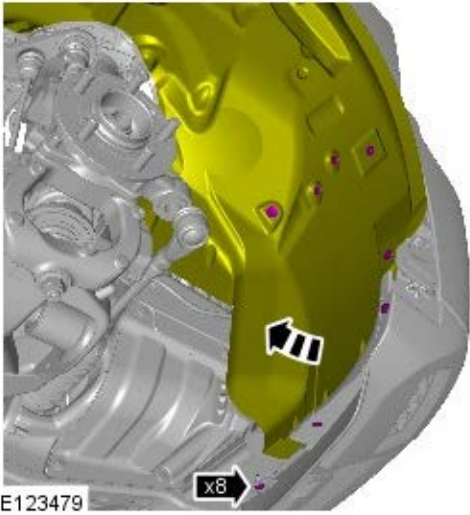
Torque:

Stage 1: 4 Nm
Stage 2: 70 Nm
Stage 3: 140 Nm

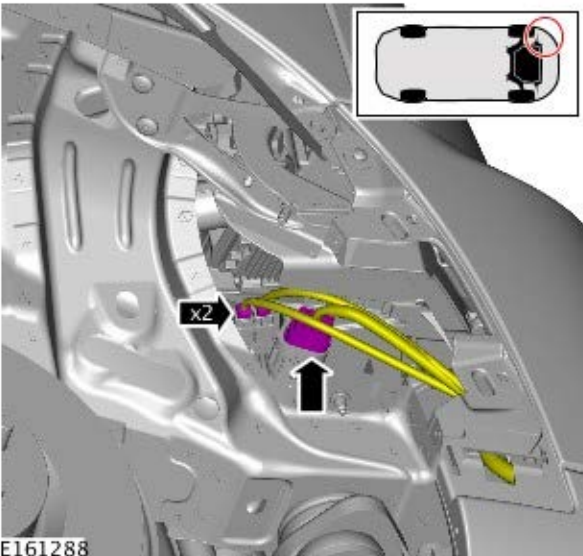


5.  NOTE: Repeat the step for the other side.

Torque: 1 Nm



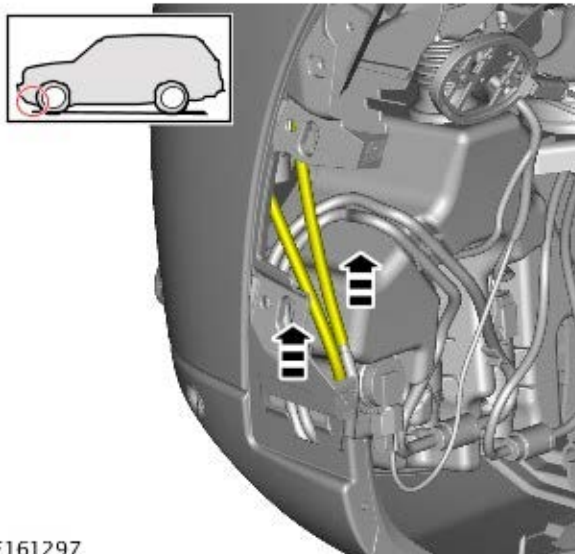
E123479



E161288

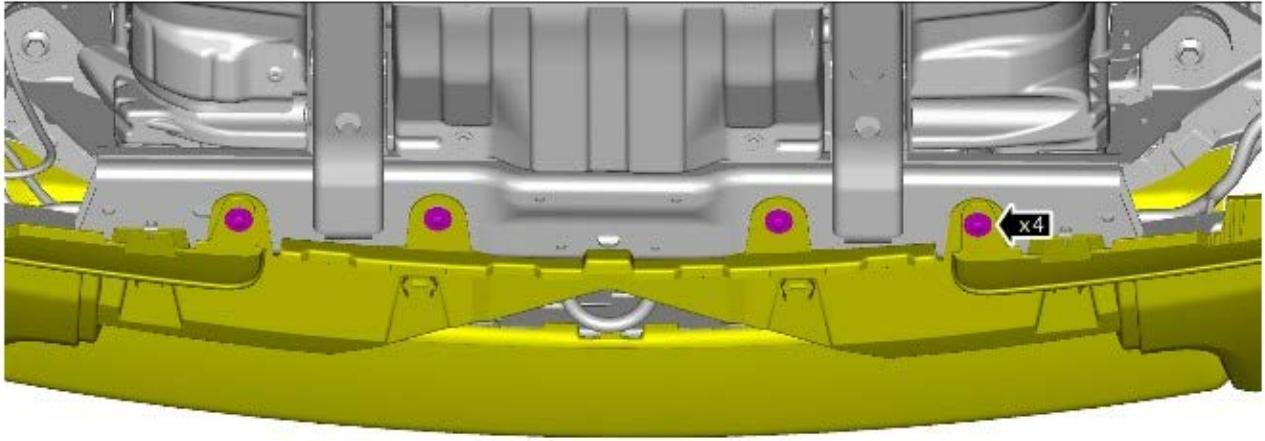
6.  CAUTION: Take extra care not to damage the wiring harnesses.

7.

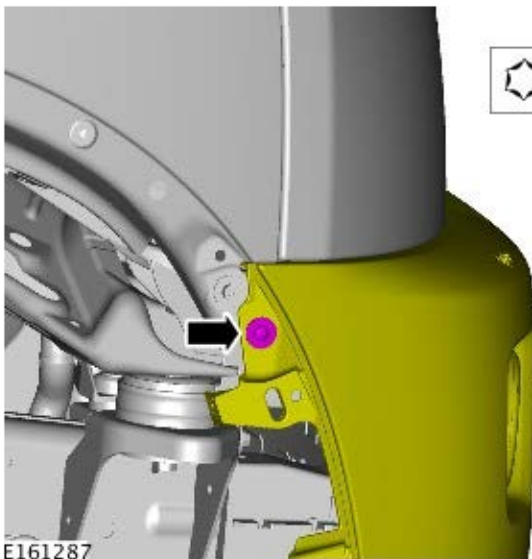


E161297


8. Torque: 5 Nm



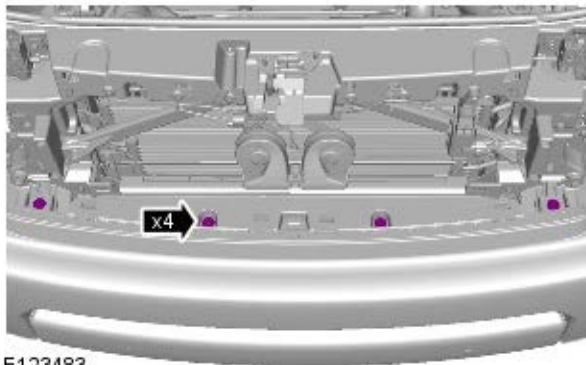
E161285



E161287

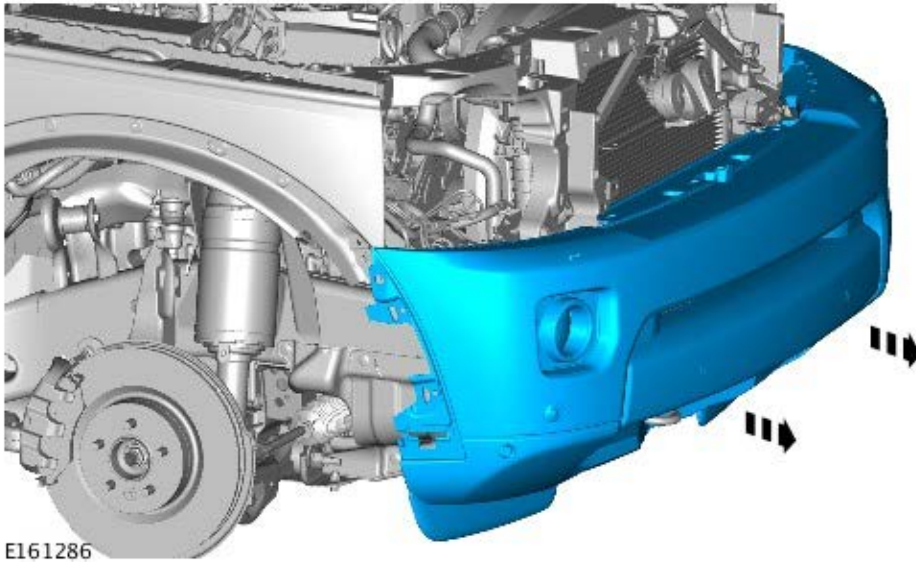
9.  NOTE: Repeat the step for the other side.
Torque: 5 Nm

10. Torque: 5 Nm




E123483

11.  CAUTION: Make sure to protect the paintwork.

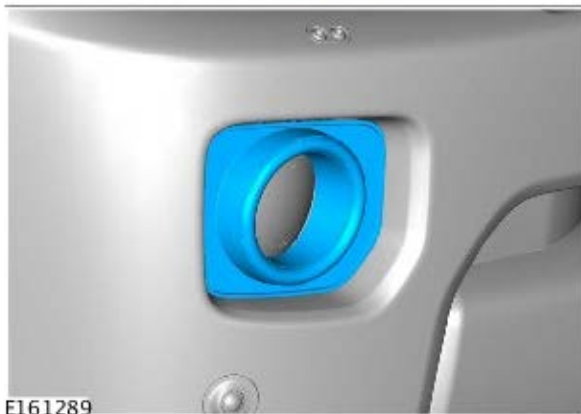
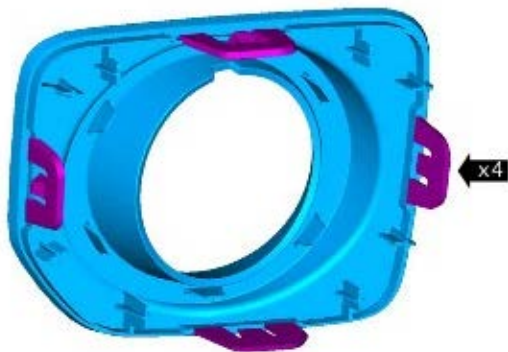


E161286


12. NOTES:

 Do not disassemble further if the component is removed for access only.

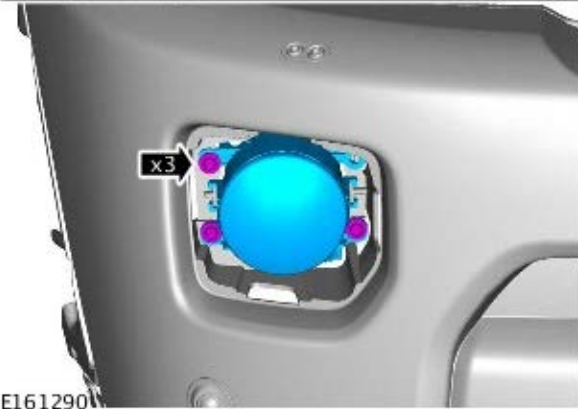
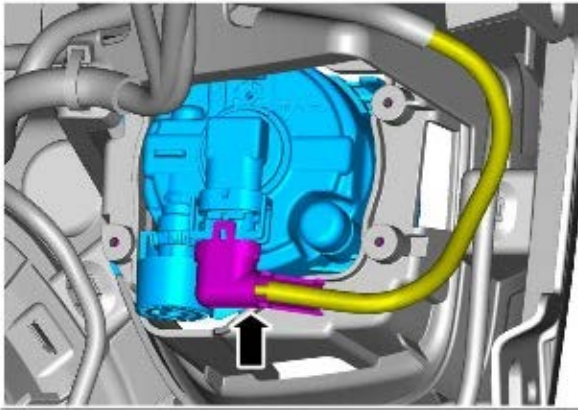
 Repeat the step for the other side.



E161289

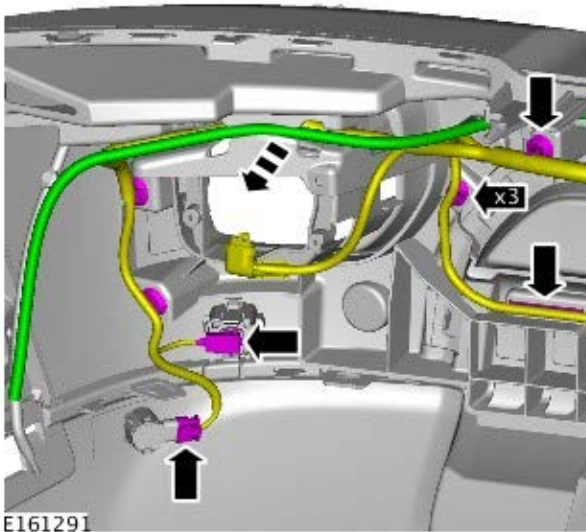
13.  NOTE: Repeat the step for the other side.

Torque: 1.5 Nm



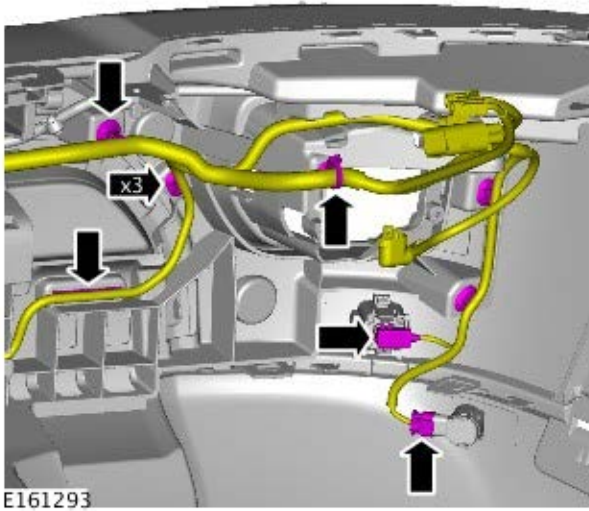
E161290

14.

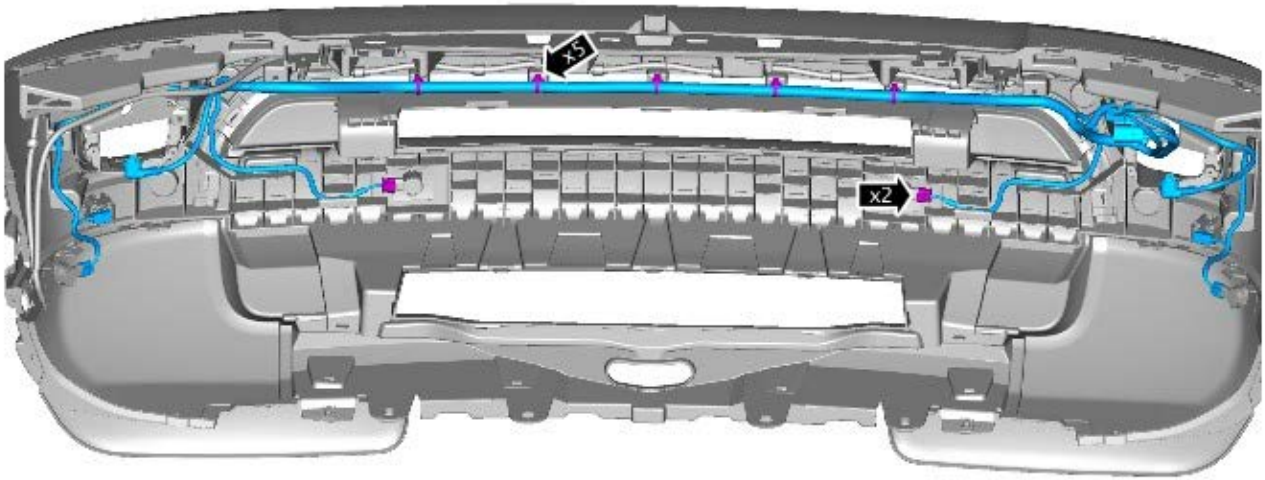


E161291

15.

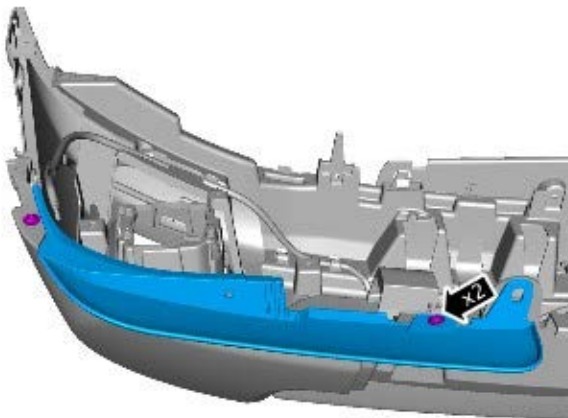


16.



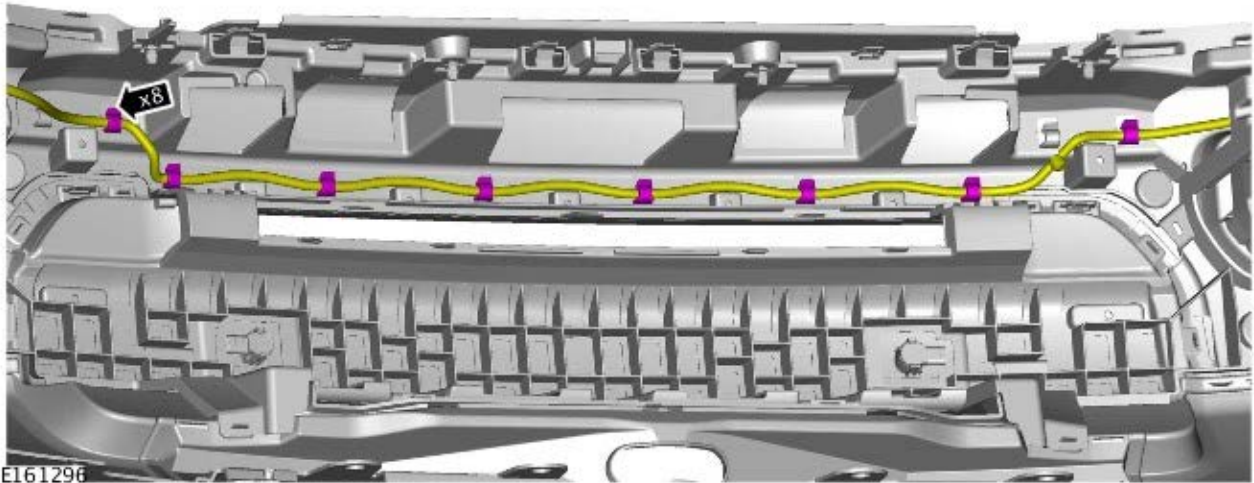
E161292

17. Torque: 1 Nm




E123488

18.



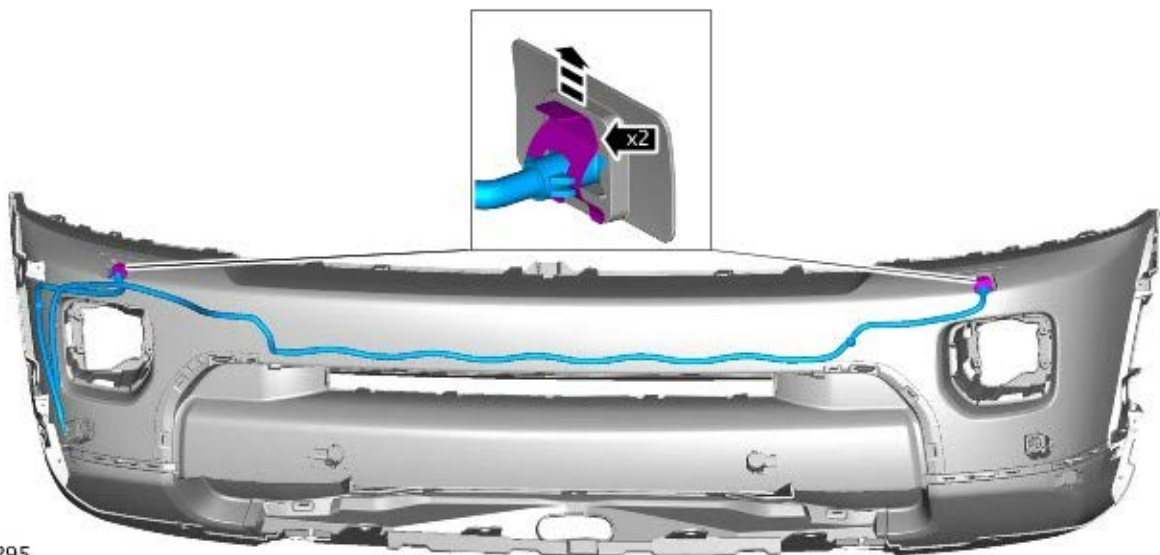
E161296

19.  CAUTION: Make sure the locating tangs are aligned. Failure to follow this instruction may result in damage to the vehicle.



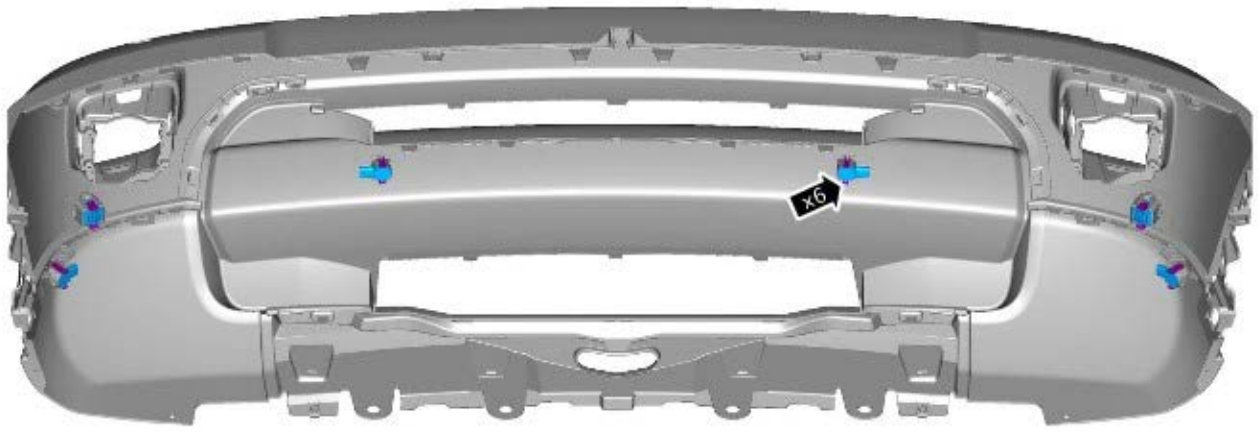
E123489

20.



E161295

21.



E161294

Installation

1. To install, reverse the removal procedure.

Bumpers - Front Bumper Lower Cover

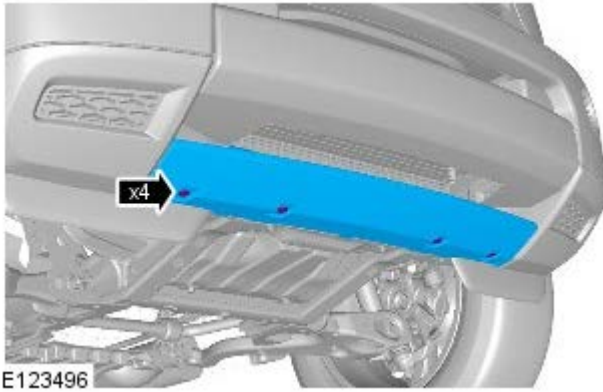
Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1.



Installation

1. To install, reverse the removal procedure.

Bumpers - Rear Bumper Cover

Removal and Installation

Removal



NOTE: Removal steps in this procedure may contain installation details.

1.  **WARNING:** Make sure to support the vehicle with axle stands.

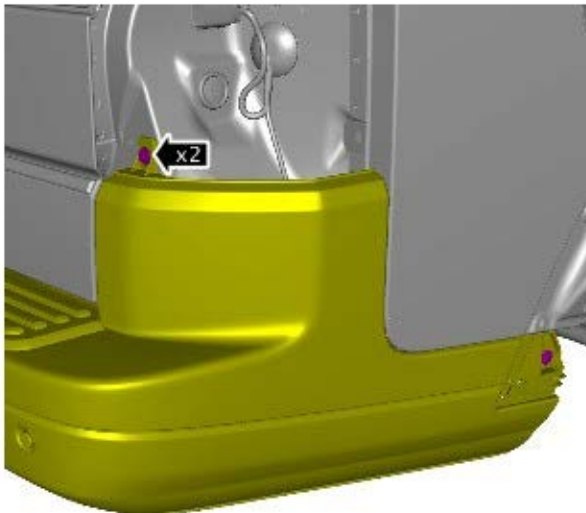
Raise and support the vehicle.

2.  NOTE: Repeat the procedure for the other side.

Refer to: [Rear Lamp Assembly](#) (417-01 Exterior Lighting, Removal and Installation).

3.  NOTE: Repeat the procedure for the other side.

Refer to: [Rear Quarter Panel Moulding](#) (501-08 Exterior Trim and Ornamentation, Removal and Installation).

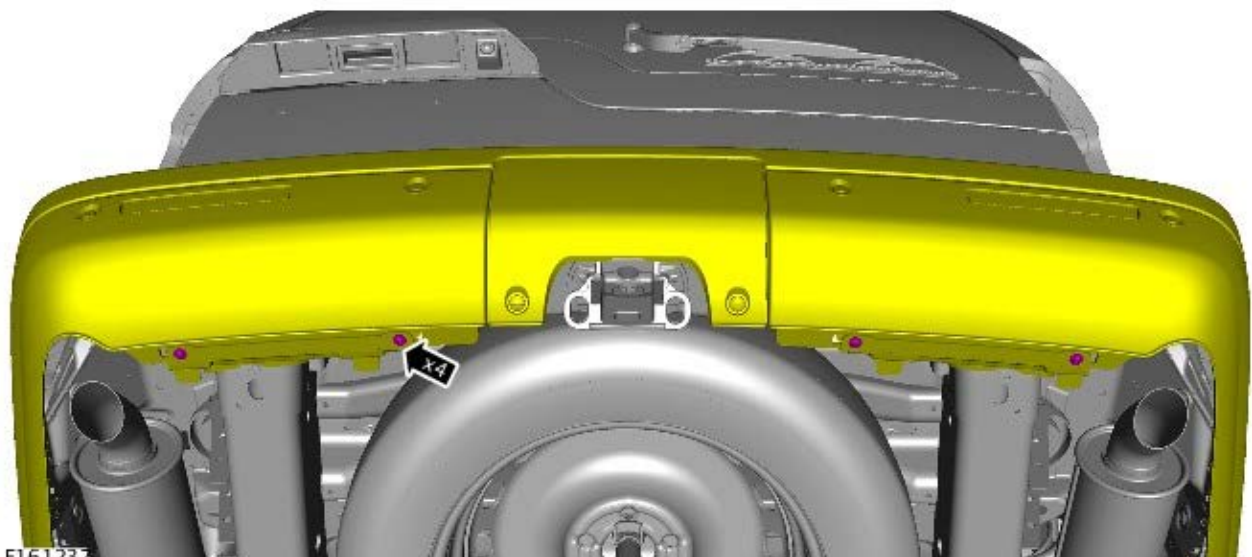


E161240

4.  NOTE: Repeat the step for the other side.

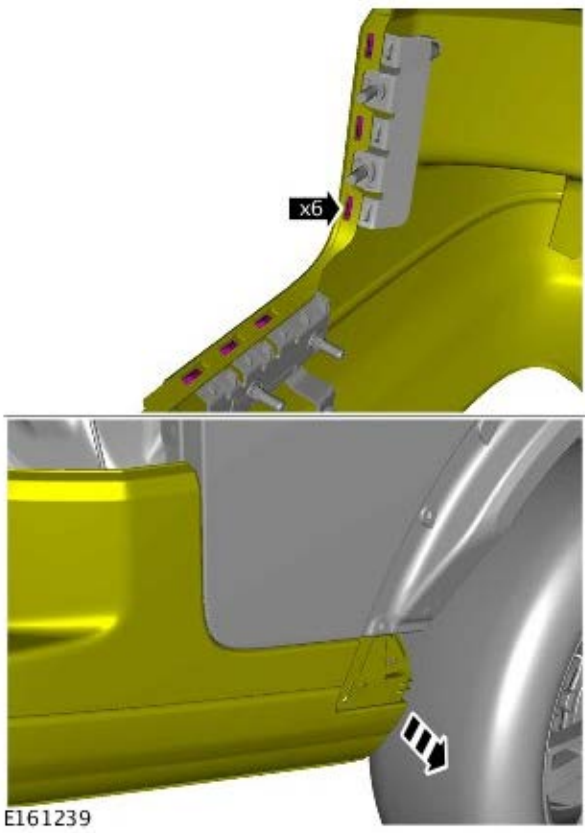
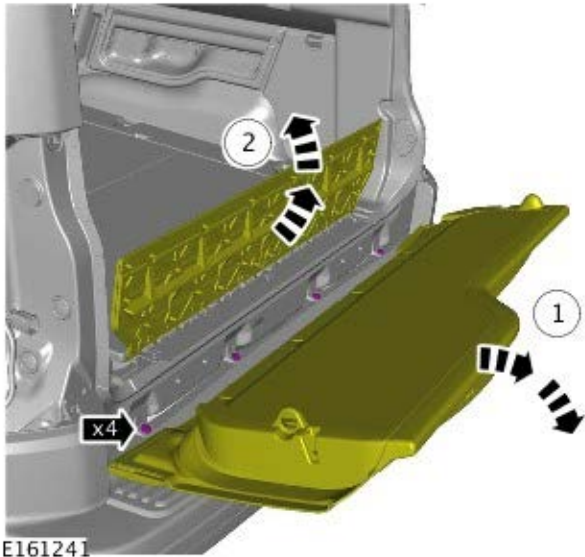
Torque: 10 Nm

5. Torque: 10 Nm




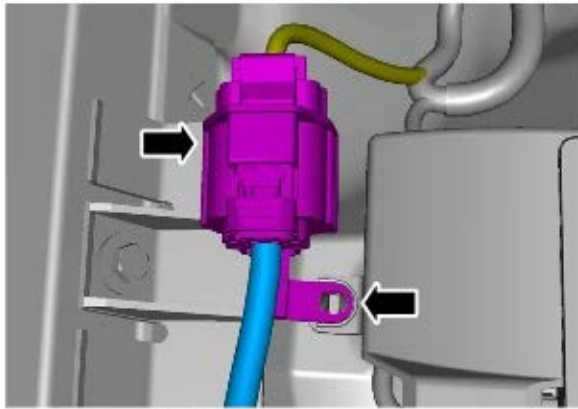
E161237

- 6.

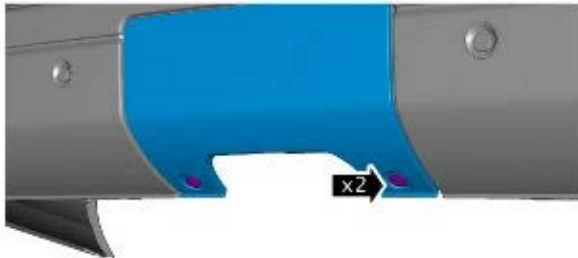
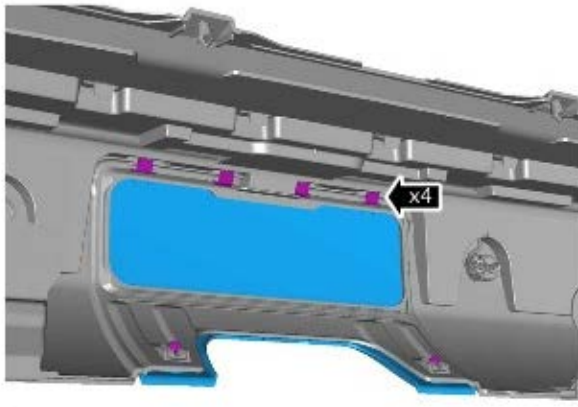


7.  NOTE: Repeat the step for the other side.


8.  CAUTION: Make sure to protect the paintwork.



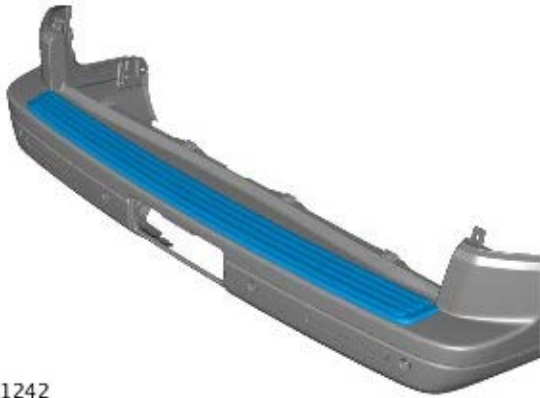
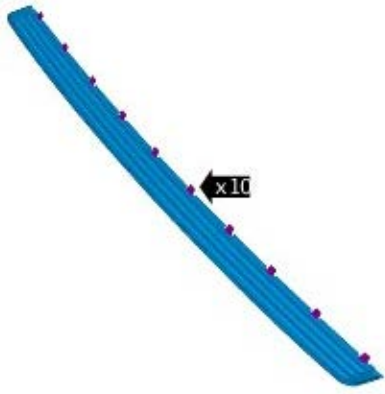
E161238



E161246

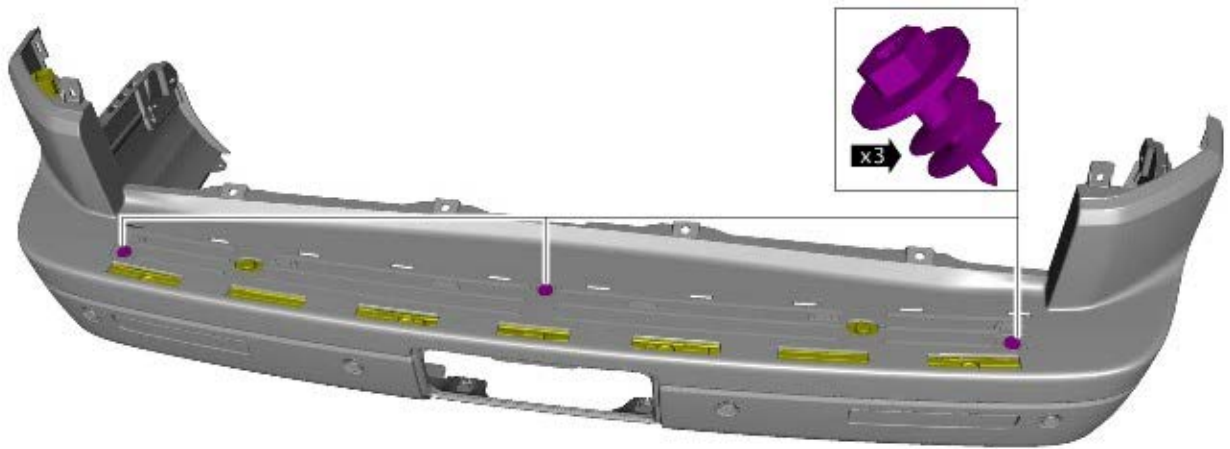
9.  NOTE: Do not disassemble further if the component is removed for access only.

10.



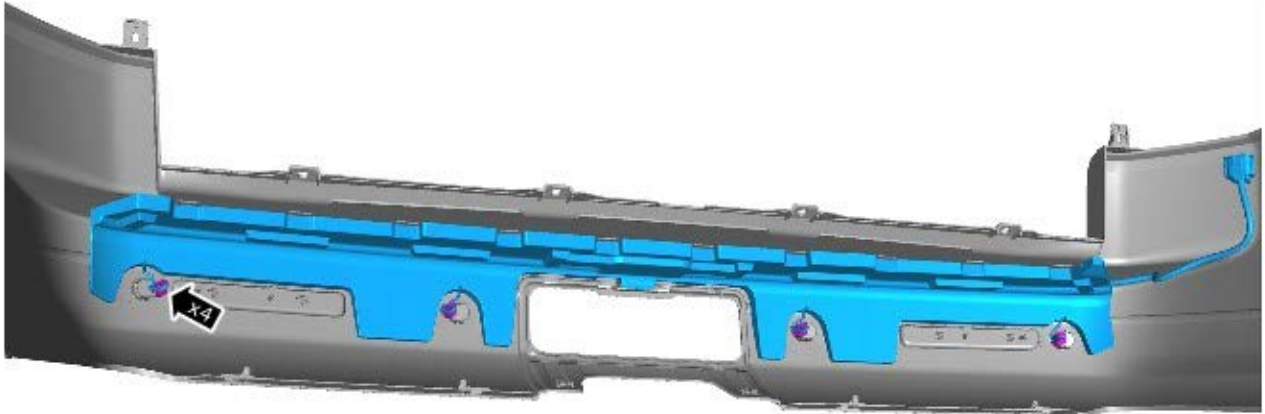
E161242

11.



E161244

12.



E161243

13.



E161245

Installation

1. To install, reverse the removal procedure.

Safety Belt System -

Torque Specifications

Description	Nm	lb-ft
Front safety belt retractor Torx bolt	40	30
Front safety belt buckle Torx bolt	40	30
+ Front safety belt upper anchor Torx bolt	40	30
Second row safety belt retractor Torx bolt	40	30
+ Second row safety belt upper anchor Torx bolt	40	30
Third row safety belt retractor Torx bolt	40	30
+ Third row safety belt upper anchor Torx bolt	40	30
Luggage compartment Torx bolts	25	18
Rear safety belt buckle Torx bolt	25	18
Rear safety belt buckle - RH - Torx bolt	40	30
Rear safety belt buckle - LH - Torx bolt - 60-40 split	25	18
Rear center safety belt buckle Torx bolt - 40-20-40 split	40	30
Rear safety belt buckle Torx bolt - 40-20-40 split	25	18
+ Rear seat Torx bolts	40	30

+ New Torx bolt must be fitted

Safety Belt System - Safety Belt System

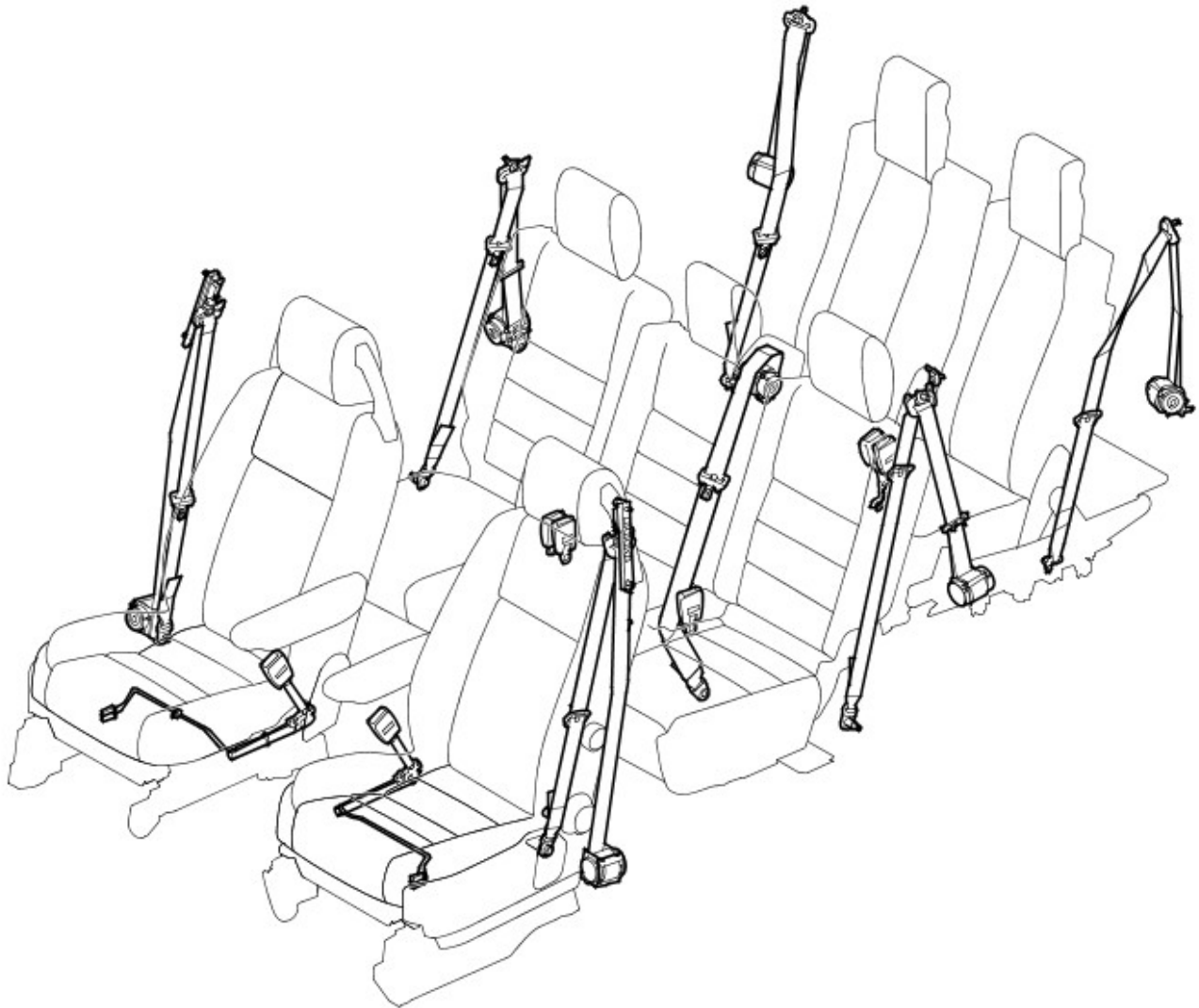
Description and Operation

COMPONENT LOCATIONS (FIVE SEAT VEHICLES)



E44815

COMPONENT LOCATIONS (SEVEN SEAT VEHICLES)



E44835

GENERAL

A three point safety belt is installed at each seat position. Except in North American Specification (NAS) markets, all of the safety belts have Emergency Locking Retractors (ELR). In NAS markets, only the driver seat is fitted with an ELR; all of the passenger safety belts have Automatic Locking Retractors (ALR).

Both types of retractor incorporate a liftshaft locking system with webbing sensor and car sensor activating mechanisms. The webbing sensor activates the locking system if the webbing is subjected to a sharp pull. The car sensor activates the locking system if the vehicle is subjected to sudden deceleration or a severe tilt angle.

The ALR has a mode of operation where the retractor will take up slack in the webbing, but not allow any slack to be paid out. This mode of operation can be used to secure a child seat.

- **To engage the ALR child seat mode of operation:** Pull the webbing out of the retractor to its full extent.
- **To cancel the ALR child seat mode of operation:** Allow the retractor to fully rewind the webbing.

A safety belt warning indicator is installed in the instrument cluster to remind the front seat occupants to fasten their safety belts. On NAS vehicles, when the ignition switch is turned to position II, the warning indicator illuminates if the safety belt of an occupied front seat is not fastened. The warning indicator remains illuminated until the safety belt of each occupied front seat is fastened, or the ignition is switched off. In all markets except NAS, a belt minder function provides a more intrusive reminder to fasten the front safety belts.

FRONT SAFETY BELTS

The retractor of each front safety belt is attached to the related B pillar. The webbing runs from the retractor through an upper mounting, attached to a shoulder height adjuster on the B pillar, to an anchor point on the front seat.

On NAS vehicles, a tension sensor is integrated into the anchor point of the passenger front safety belt. The tension sensor is part of the occupant classification system.

For additional information, refer to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-

20B, Description and Operation).

The retractor for each front safety belt incorporates a load limiter that allows the retractor reel to partially unwind when the load on the webbing exceeds a predetermined limit.

The buckle for each front safety belt is attached to a pretensioner secured to the inboard side of the related front seat frame. Each buckle incorporates a safety belt buckle sensor that provides a status input to the restraints control module, which uses the input to determine the air bag and pretensioner activation strategies. The restraints control module also relays the status of the safety belts to the instrument cluster on the high speed CAN bus.

Belt Minder Function (Where Fitted)

The belt minder function provides warnings to the driver if the appropriate front safety belts are not fastened when driving. The belt minder function is controlled by the instrument cluster using medium speed CAN bus messages, from the restraints control module, to monitor the status of the front safety belts.

When the ignition switch is turned to position II, the instrument cluster illuminates the safety belt warning indicator until one of the front safety belts is fastened or the belt minder function is triggered. The belt minder function is triggered when the ignition switch is in position II and the following conditions coexist:

- The belt minder function is enabled.
- Vehicle speed is 8 km/h (5 mph) or more.
- The vehicle is not in reverse.
- The driver safety belt or, if the front passenger seat is occupied, the front passenger safety belt, is unfastened.

When the belt minder is triggered, the instrument cluster generates the following warnings for 10 seconds.

- Flashes the safety belt warning indicator at 2 Hz.
- Sounds a repeating chime in sequence with the flashing safety belt warning indicator.

After 10 seconds, the repeating chime is discontinued and the safety belt warning indicator changes from flashing to continuously illuminated. While the trigger conditions still coexist, the warnings are repeated every 30 seconds until one of the following occurs:

- 5 minutes has elapsed from when the warnings were first triggered.
- The safety belt of each occupied front seat is fastened.
- The ignition switch is turned to position 0.
- The vehicle speed decreases to 5 km/h (3 mph).

The belt minder function can be enabled and disabled using the driver safety belt switch. The instrument cluster changes the state of the belt minder function if, within 60 seconds of first turning the ignition switch to position II, the driver safety belt is fastened and unfastened nine times. Successful completion of the change is indicated by a single chime and the safety belt warning indicator flashing five times, at 2 Hz. The belt minder function can also be enabled and disabled using T4.

Safety Belt Warning Indicator



E 132235

SECOND ROW SAFETY BELTS

The retractor of each outboard second row safety belt is attached to the body immediately behind the D pillar. The webbing runs from the retractor, through an upper mounting on the D pillar, to an anchor point at the front of the related wheel arch.

The retractor for the center second row safety belt is installed in the top of the seat back. The webbing runs from the retractor, over the top of the seat, to an anchor point at the base of the seat frame.

The buckles for the second row safety belts are attached to the related seat frame.

THIRD ROW SAFETY BELTS (WHERE FITTED)

The retractor of each third row safety belt is attached to the E pillar. The webbing runs from the retractor, through a mounting on the E pillar to an anchor point on the floor.

The buckles for the third row safety belts are attached to the related seat frame.

Safety Belt System - Safety Belt System

Diagnosis and Testing

Principle of Operation

For a detailed description of the seatbelt system and operation, refer to the relevant description and operation section of the workshop manual REFER to: Safety Belt System (501-20 Safety Belt System, Description and Operation).

Safety Information

WARNINGS:



To avoid accidental deployment the back-up power supply must be depleted before beginning any work on the SRS system or its components. Failure to follow this instruction may result in personal injury



Do not use a multimeter to probe an SRS module. It is possible for the power from the multimeter battery to trigger the activation of the module. Failure to follow this instruction may result in personal injury



NOTE: Do not to use a cellular phone or to have a cellular phone in close proximity when working on the SRS system or components

Power supply depletion

Before beginning any work on the SRS system or related components:

1. Remove the ignition key
2. Disconnect the battery leads, ground first
3. Wait 2 minutes for the power circuit to discharge

There are comprehensive instructions on the correct procedures for SRS system repairs, refer to the relevant section of the workshop manual

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle



NOTE: Check and rectify basic faults before beginning diagnostic routines including pinpoint tests

1. Verify the customer concern by operating the seatbelt
2. Visually inspect for obvious signs of mechanical or electrical damage

Visual Inspection



Mechanical	Electrical
<ul style="list-style-type: none"> • Check for the installation of non-standard accessories which may affect or obstruct the function of the seatbelt system • Frayed or damaged webbing • Missing or damaged button stop • Pretensioner(s) Buckles/Stalks 	<ul style="list-style-type: none"> • Fuses • Wiring harness fault • Correct engagement of electrical connectors • Loose or corroded connections • Warning lamp bulb(s) • Impact sensor(s) • Buckle sensor(s) • Pretensioner(s) • Belt tension sensor(s) • Restraints control module

3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step
4. If the cause is not visually evident, carry out the test methods described below, alternatively check for diagnostic trouble codes and refer to the relevant diagnostic trouble code index

For a complete list of all diagnostic trouble codes that could be logged on this vehicle, please refer to section 100-00.

REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Restraints Control Module (100-00 General Information, Description and Operation).

Symptom Chart for Seatbelt Rows 1, 2 and 3

Symptom	Possible Causes	Action
Seatbelt jammed - Webbing tight	<ul style="list-style-type: none"> • Backlock effect-in action (webbing retracted quickly and came to sudden stop) • Seatbelt retractor not installed correctly • Rear centre seatbelt only. Mini-button (webbing travel limit stop) missing and seat squab has been moved causing tight fit • Automatic locking retractor activated (clicking – during retraction only) 	<ul style="list-style-type: none"> • GO to Pinpoint Test A. • GO to Pinpoint Test E. • GO to Pinpoint Test H. • See the automatic locking retractor description below
Seat squab will not fold/jammed	 NOTE: Rear centre seatbelt only <ul style="list-style-type: none"> • Mini-button (webbing travel limit stop) missing and seat squab has been moved causing excessive tension 	<ul style="list-style-type: none"> • GO to Pinpoint Test H.
Seatbelt jammed - Webbing loose	<ul style="list-style-type: none"> • Seatbelt webbing trapped in seat • Seatbelt retractor webbing guide loose • Twist in webbing • Interference in webbing routing • D-loop not rotating correctly 	<ul style="list-style-type: none"> • GO to Pinpoint Test B. • GO to Pinpoint Test C. • GO to Pinpoint Test D. • GO to Pinpoint Test E. • GO to Pinpoint Test G.
Seatbelt - Intermittent jamming	<ul style="list-style-type: none"> • Seatbelt retractor not installed correctly 	<ul style="list-style-type: none"> • GO to Pinpoint Test E.
Seatbelt - Slow retraction	<ul style="list-style-type: none"> • Seatbelt retractor webbing guide loose • Twist in seatbelt webbing • Interference in webbing routing • Seatbelt retractor not installed correctly • D-loop not rotating correctly • Foreign object/debris 	<ul style="list-style-type: none"> • GO to Pinpoint Test C. • GO to Pinpoint Test D. • GO to Pinpoint Test E. • GO to Pinpoint Test F. • GO to Pinpoint Test G. • GO to Pinpoint Test E.
Seatbelt - Not retracting	<ul style="list-style-type: none"> • Seatbelt retractor webbing guide loose • Twist in seatbelt webbing • D-loop not rotating correctly • Interference in webbing routing • Foreign object/debris 	<ul style="list-style-type: none"> • GO to Pinpoint Test C. • GO to Pinpoint Test D. • GO to Pinpoint Test G. • GO to Pinpoint Test E. • GO to Pinpoint Test E.
Seatbelt - Not extracting	<ul style="list-style-type: none"> • Backlock effect-in action (webbing retracted quickly and came to sudden stop) • Seatbelt retractor not installed correctly • Seatbelt retractor webbing guide loose • Twist in seatbelt webbing • D-loop not rotating correctly • Interference in webbing routing • Foreign object/debris • Automatic locking retractor activated (clicking – during retraction only) 	<ul style="list-style-type: none"> • GO to Pinpoint Test A. • GO to Pinpoint Test E. • GO to Pinpoint Test C. • GO to Pinpoint Test D. • GO to Pinpoint Test G. • GO to Pinpoint Test E. • GO to Pinpoint Test E. • See the automatic locking retractor description below
Seatbelt - Noisy during operation	<ul style="list-style-type: none"> • Automatic locking retractor activated (clicking–during retraction only) • Interference in webbing routing (rubbing) 	<ul style="list-style-type: none"> • GO to Pinpoint Test B. • GO to Pinpoint Test E.
Seatbelt buckle - Not latching / jammed	<ul style="list-style-type: none"> • Foreign object/debris 	 CAUTION: Do not insert any objects or tools into the buckle head <ul style="list-style-type: none"> • GO to Pinpoint Test L.

Inertia Reel Seatbelts

The vehicle is equipped with (two row one), (three row two), and (two row three (seven seat versions only)) inertia reel seatbelts


These seatbelts are "**dual sensitive**" which means that they have:

- **Car sense system - A vehicle motion sensor, which locks the seatbelt webbing under braking, cornering, on steep hills and in adverse camber conditions, when parked on a steep incline or driveway or two wheels on a high curb**
- **Webb sense system - A webbing motion sensor, which locks when the seatbelt webbing is extracted suddenly**

The seatbelts in the following positions are equipped with an automatic locking retractor function:

Carline	Market	Seat position	Automatic Locking Retractor Installed	From Model Year
Defender (L316)	All	All	No	2007
Discovery / Range Rover Sport (L319/L320)	All	Driver	No	2008
Discovery / Range Rover Sport (L319/L320)	US	Passenger	Yes	2005
Discovery / Range Rover Sport (L319/L320)	All	Driver	No	2005
Discovery / Range Rover Sport (L319/L320)	ROW	Passenger	No	2005
Discovery (L319)	All	Row 2	Yes	2005
Discovery (L319)	All	Row 3	Yes	2005
Range Rover Sport (L320)	All	Row 2	Yes	2006
Freelander (L359)	All	Driver	No	2007
Freelander (L359)	ROW	Passenger	No	2007
Freelander (L359)	US	Passenger	Yes	2007
Freelander (L359)	ROW	Row 2	No	2007
Freelander (L359)	US	Row 2	Yes	2007
Range Rover Evoque (L538)	All	Driver	No	2011
Range Rover Evoque (L538)	ROW	Passenger	No	2011
Range Rover Evoque (L538)	US	Passenger	Yes	2011
Range Rover Evoque (L538)	ROW	Row 2	No	2011
Range Rover Evoque (L538)	US	Row 2	Yes	2011
Range Rover (L322)	All	Driver	No	2003
Range Rover (L322)	ROW	Passenger	No	2003
Range Rover (L322)	US	Passenger	Yes	2003
Range Rover (L322)	ROW	Row 2	No	2003
Range Rover (L322)	US	Row 2	Yes	2003

The **automatic locking retractor function** is a feature to secure a child seat or heavy load to the seat

Activation	Deactivation
 <p>NOTE: When automatic locking retractor is activated, no further webbing can be drawn from the seatbelt retractor, prior to disengagement of the automatic locking. This can be mistaken as a jammed seatbelt retractor</p> <p>Activated by total extraction of the webbing</p> <p>When activated the automatic locking retractor is identified by a clicking noise during webbing retraction</p>	<p>Automatic locking retractor is deactivated by allowing the webbing to retract until the clicking stops (close to park position)</p> <p>When deactivated the automatic locking retractor seatbelt changes state, from a static seatbelt to an automatic seatbelt</p>

Seatbelt Locking Test

With the vehicle stationary and on level ground take firm hold of the seatbelt webbing (on the tongue side of the upper seatbelt anchor) and withdraw sharply, **the retractor should lock**. Preventing further webbing release (**repeat this test 3 times**). Any seatbelt retractor which fails to lock **must not be used** and a **new seatbelt must be installed**.

DTC Index

For a list of diagnostic trouble codes that could be logged on this vehicle, please refer to Section 100-00 or for removal and installation/description and operation see Section 501-20

Diagnostic Guide Inertia Reel Seatbelts

PINPOINT TEST A : BACKLOCK	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: BACKLOCK	
1	Visually inspect the condition of the suspect seatbelt
2	Draw a maximum of 20mm of the webbing from the seatbelt retractor with moderate force. Then release the webbing
3	Check for correct operation twice
	Does the webbing move freely then retract correctly?
Yes	No further action required
No	For first row seatbelt GO to Pinpoint Test C. For second and third row seatbelts GO to Pinpoint Test B.

PINPOINT TEST B : WEBBING - TRAPPED IN SEAT	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: WEBBING - TRAPPED IN SEAT	
	1 Visually inspect the condition of the suspect seatbelt
	2 Lift the seat base or release the seat backrest as required
	3 Free the trapped webbing, allow the webbing to retract Note: If the automatic locking retractor is activated, allow the webbing to retract until the clicking stops
	4 Check for correct operation twice
	Does the webbing move freely then retract correctly? Yes No further action required No GO to Pinpoint Test C.


PINPOINT TEST C : SEATBELT RETRACTOR - WEBBING GUIDE LOOSE	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: SEATBELT RETRACTOR - WEBBING GUIDE LOOSE	
	1 Refer to 501-20 removal and installation section of the workshop manual, remove any trim panels required to expose the D loop (anchor point) and seatbelt retractor
	2 Check the webbing is not trapped or twisted and is centrally located on the seatbelt retractor spindle
	3 Attempt to withdraw the webbing from the seatbelt retractor NOTE: If the seatbelt webbing is jammed, the automatic locking retractor could be engaged
	4 To release the automatic locking retractor, manually wind the webbing onto the spindle until the automatic locking retractor deactivates (clicking stops)
	5 Fully extract webbing
	6 Confirm webbing guide location is correct , Confirm the fixing lugs are correctly located in the retractor frame
	7 Allow webbing to retract
	8 Check for correct operation twice
	Does the webbing move freely then retract correctly? Yes Refer to the 501-20 removal and installation section of the workshop manual, reinstall any trim panels, ensure there are no obstructions and the webbing does not catch or rub. No further action required No GO to Pinpoint Test D.


PINPOINT TEST D : TWIST IN WEBBING	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
D1: TWIST IN WEBBING	
	1 Refer to section 501-20 removal and installation section of the workshop manual, remove any trim panels required to expose the D loop (anchor point)
	2 Twist the webbing back the correct way in the loop
	3 Pass the twist through the pillar loop or escutcheon as required
	4 Check for correct operation twice
	Does the webbing move freely then retract correctly? Yes Refer to the 501-20 removal and installation section of the workshop manual, reinstall any trim panels, ensure there are no obstructions and the webbing does not catch or rub. No further action required No GO to Pinpoint Test E.

PINPOINT TEST E : INTERFERENCE - WEBBING ROUTING	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
E1: INTERFERENCE - WEBBING ROUTING	
	1 Refer to the 501-20 removal and installation section of the workshop manual, remove any trim panels required to expose the D loop (anchor point)
	2 Remove obstructions and foreign objects ensure the webbing does not catch or rub
	3 Confirm the seatbelt does not contact the wiring harness
	4 Check for correct operation twice
	Does the webbing move freely then retract correctly? Yes Refer to the 501-20 removal and installation section of the workshop manual, reinstall any trim panels, ensure there are no obstructions and the webbing does not catch or rub. No further action required No GO to Pinpoint Test E.

PINPOINT TEST F : SEATBELT RETRACTOR - INCORRECT INSTALLATION	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
F1: SEATBELT RETRACTOR - INCORRECT INSTALLATION	
	1 Refer to the 501-20 removal and installation section of the workshop manual, remove any trim panels required to expose the D loop (anchor point) and the seatbelt retractor
	2 Refer to the 501-20 removal and installation section of the workshop manual, correctly reinstall the seatbelt retractor ensure that the locating "T bar" and "anti rotation pins" are correctly located
	3 Check for correct operation twice
	Does the webbing move freely then retract correctly? Yes Refer to the 501-20 removal and installation section of the workshop manual, reinstall any trim panels, ensure there are no obstructions and the webbing does not catch or rub. No further action required No Replace as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component

PINPOINT TEST G : D-LOOP NOT ROTATING CORRECTLY	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
G1: D-LOOP NOT ROTATING CORRECTLY	
	1 Refer to the 501-20 removal and installation section of the workshop manual, remove any trim panels required to expose the D loop (anchor point) and the seatbelt retractor
	2 Ensure there are no obstructions and the webbing does not catch or rub, the D loop (anchor point) rotates correctly and if installed the confirm the height adjuster operates correctly
	3 Check for correct operation twice
	Does the webbing move freely then retract correctly? Yes Refer to the 501-20 removal and installation section of the workshop manual, reinstall any trim panels, ensure there are no obstructions and the webbing does not catch or rub. No further action required No Replace as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component

PINPOINT TEST H : MINI BUTTON - MISSING/DAMAGED	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
H1: MINI BUTTON - MISSING/DAMAGED	
 NOTE: This test applies to the rear centre seatbelt retractor installed in the seat back	
	1 Refer to the 501-20 removal and installation section of the workshop manual, remove the seat cushion and the plastic escutcheon at the top of the seat back (where the webbing exits to expose the lower anchor fixing point of the center seatbelt)
	2 Remove the lower anchorage of the seatbelt
	3 With the seat back correctly latched, allow up to 20mm webbing to retract, then extract the webbing
	Is the mini-button (webbing travel limit stop) correctly installed to the webbing and in good condition? Yes Feed the mini-button back through the plastic escutcheon if required. Correctly reinstall the escutcheon to the seat back, extract the webbing then allow to retract, ensure the mini-button comes to rest outside the escutcheon stop No Replace as required. Refer to the warranty policy and procedures manual, or determine if any prior approval programme is in operation, prior to the installation of a new module/component

PINPOINT TEST I : SEATBELT BUCKLE - NOT LATCHING/JAMMED	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
I1: SEATBELT BUCKLE - NOT LATCHING/JAMMED	
 CAUTION: Do not insert any objects or tools into the buckle head	
	1 Visually inspect the buckle head for evidence of damage. If damaged replace as required
	2 Depress the buckle release (red button) and (Using a torch) carry out visual inspection for any evidence of debris/material or foreign objects in the buckle head
	3 If required remove the pretensioner from the vehicle. Remove the seat. Remove the pretensioner from the seat frame
	4 Do not insert any objects or tools buckle head With the buckle removed invert and

	attempt to shake out any debris
	5 Attempt to latch the tongue in the buckle
	Does the seatbelt buckle operate correctly
	Yes Reinstall any components, no further action required
	No Replace the pretensioner, Refer to section 501 20

Safety Belt System - Front Safety Belt Retractor

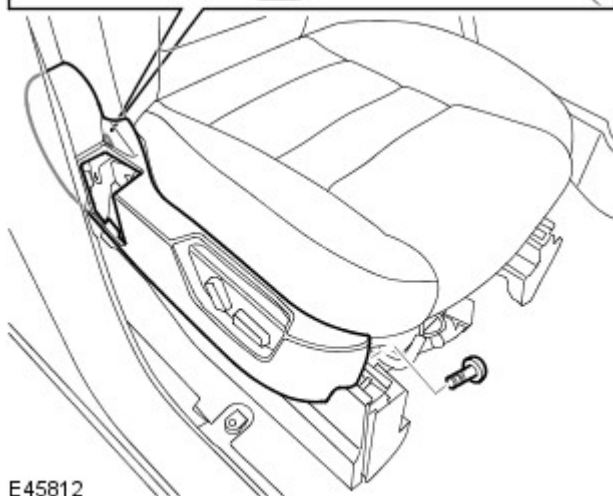
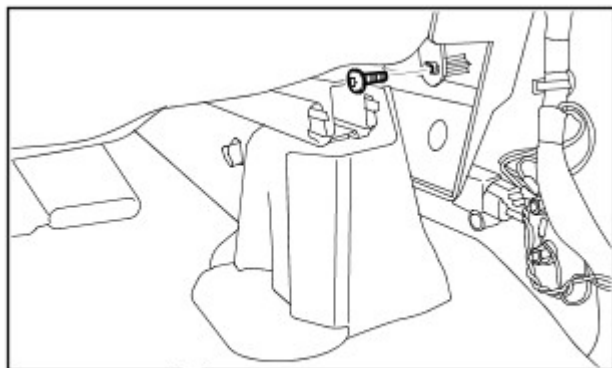
Removal and Installation

Removal

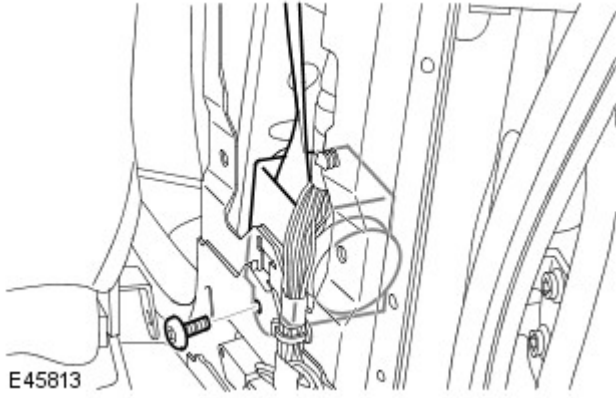
1. Position the front seat fully forwards.
2. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
3. Remove the B-pillar upper trim panel.
For additional information, refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).
4. Release the safety belt upper anchor from the B-pillar.
 - Remove and discard the Torx bolt.



5. Release the front seat switch pack trim panel for access.
 - Remove the 2 screws.



6. Remove the front safety belt retractor.
 - Remove and discard the Torx bolt.



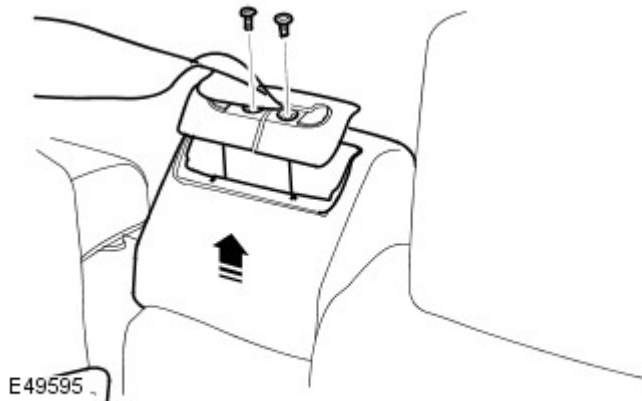
Installation

1. Install the front safety belt retractor.
 - Tighten the Torx bolt to 40 Nm (30 lb.ft).
2. Install the front seat switch pack trim panel.
 - Tighten the screws.
3. Attach the safety belt upper anchor.
 - Tighten the Torx bolt to 40 Nm (30 lb.ft).
4. Install the B-pillar upper trim panel.
For additional information, refer to: B-Pillar Upper Trim Panel (501-05, Removal and Installation).

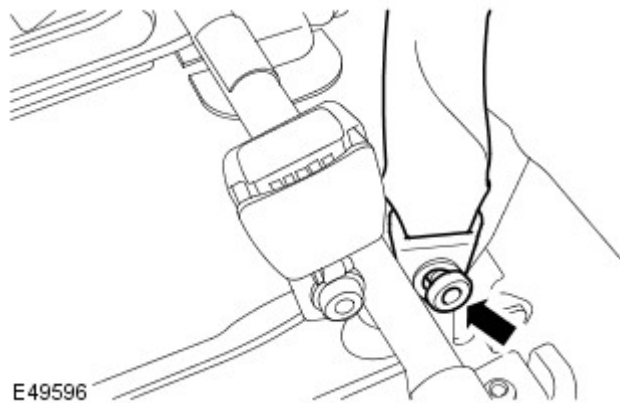
Safety Belt System - Second Row Center Safety Belt Retractor Vehicles With: 60/40 Split Seat

Removal and Installation

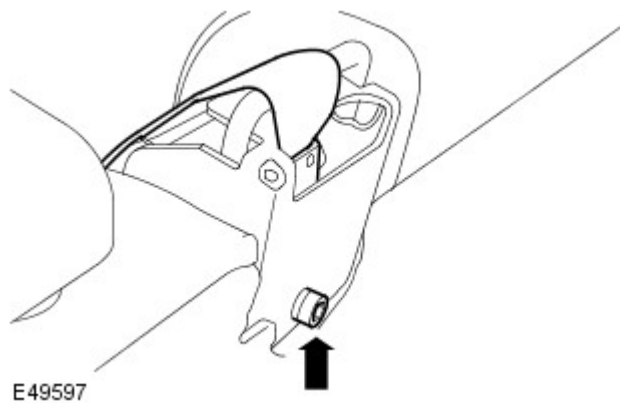
Removal



1. Release the safety belt retractor cover and guide
 - Remove the 2 screws.
 - Remove the safety belt guide.
 - Remove the retractor cover.



2. Remove the safety belt lower anchor.
 - Raise the seat cushion.
 - Remove and discard the nut.



3. Remove the safety belt retractor assembly.
 - Remove and discard the Torx bolt.

Installation

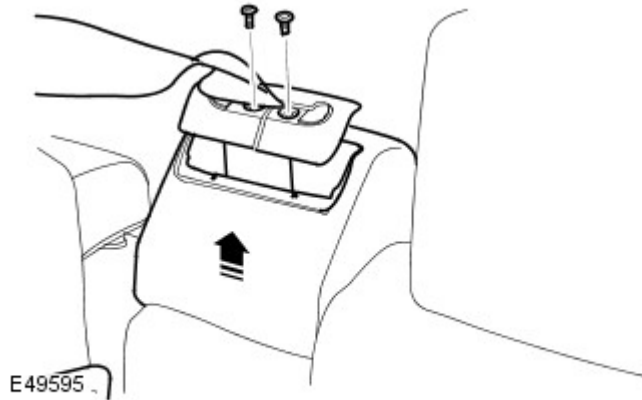
1. Install the safety belt retractor assembly.
 - Tighten the new Torx bolt to 40 Nm (30 lb.ft).
2. Install the safety belt guide and retractor cover.
 - Attach the safety belt guide and retractor cover.
 - Tighten the screws.
3. Install the safety belt lower anchor.
 - Tighten the new nut to 40 Nm (30 lb.ft).
 - Lower the seat cushion.

Safety Belt System - Second Row Center Safety Belt Retractor Vehicles With: 40/20/40 Split Seat

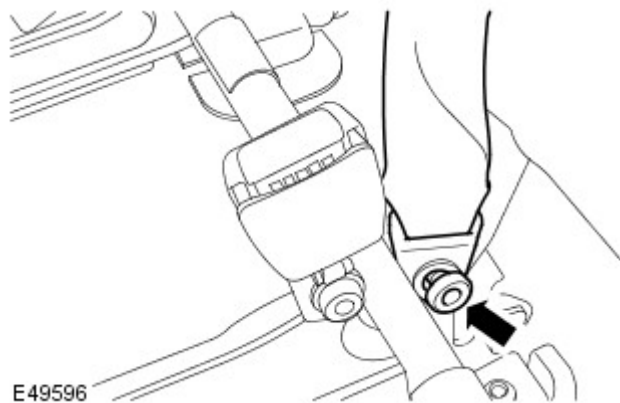
Removal and Installation

Removal

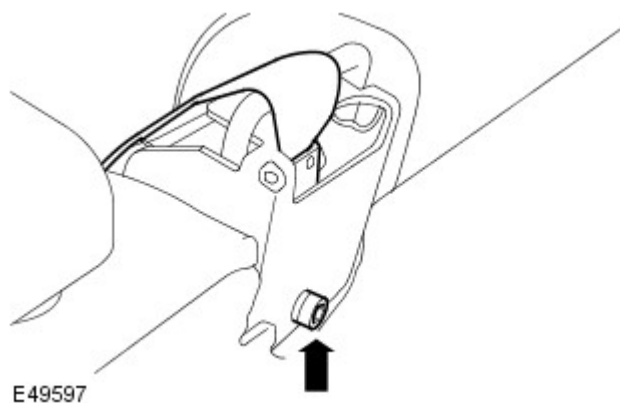
1. Remove the center seat.
For additional information, refer to: Rear Seat - Vehicles With: 40/20/40 Split Seat (501-10, Removal and Installation).



2. Release the safety belt retractor cover and guide
 - Remove the 2 screws.
 - Remove the safety belt guide.
 - Remove the retractor cover.



3. Remove the safety belt lower anchor.
 - Fold the LH outer seat assembly forwards.
 - Remove and discard the Torx bolt.



4. Remove the safety belt retractor assembly.
 - Remove and discard the Torx bolt.

Installation

1. Install the safety belt retractor assembly.
 - Tighten the new Torx bolt to 40 Nm (30 lb.ft).
2. Install the safety belt guide and retractor cover.
 - Attach the safety belt guide and retractor cover.
 - Tighten the screws.

3. Install the safety belt lower anchor.
 - Tighten the new nut to 40 Nm (30 lb.ft).
 - Lower the seat cushion.

4. Install the center seat.

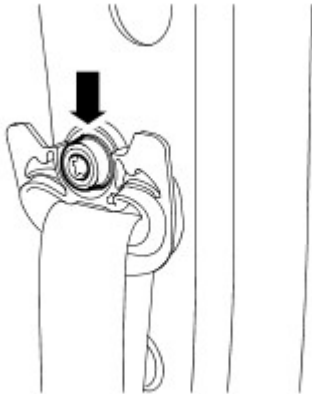
For additional information, refer to: Rear Seat - Vehicles With: 40/20/40 Split Seat (501-10, Removal and Installation).

Safety Belt System - Second Row Safety Belt Retractor

Removal and Installation

Removal

1. Remove the C-pillar upper trim panel.
For additional information, refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).
2. Remove the C-pillar lower trim panel.
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).
3. Release the safety belt upper anchor.
 - Remove and discard the Torx bolt.



E49593



E49594

4. Remove the second row safety belt retractor.
 - Remove and discard the Torx bolt.

Installation

1. Install the second row safety belt retractor.
 - Tighten the Torx bolt to 40 Nm (30 lb.ft).
2. Install the safety belt upper anchor.
 - Tighten the Torx bolt to 40 Nm (30 lb.ft).
3. Install the C-pillar lower trim panel.
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).
4. Install the C-pillar upper trim panel.
For additional information, refer to: C-Pillar Upper Trim Panel (501-05, Removal and Installation).

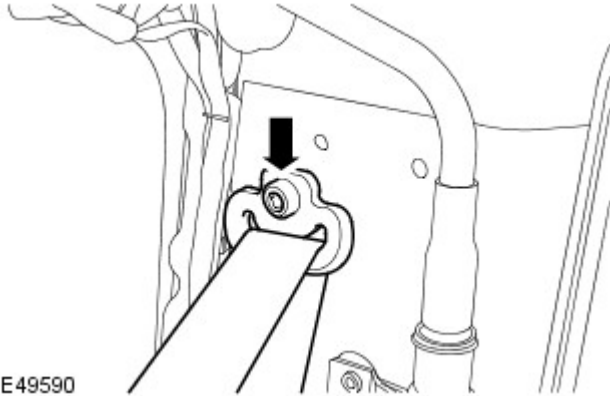
Safety Belt System - Third Row Safety Belt Retractor

Removal and Installation

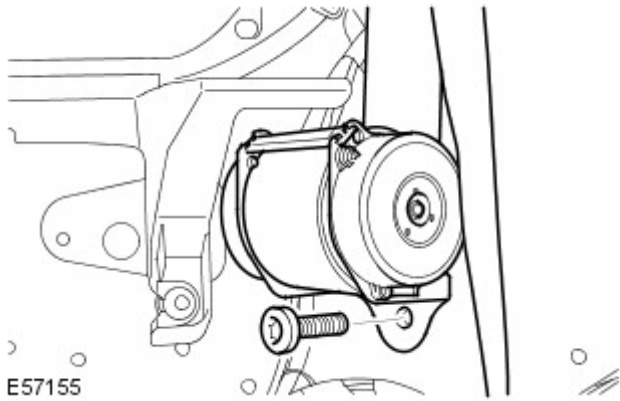
Removal

1. Remove the D-pillar upper trim panel.
For additional information, refer to: D-Pillar Trim Panel (501-05, Removal and Installation).

2. Release the safety belt upper anchor.
 - Remove and discard the Torx bolt.



3. Remove the third row safety belt retractor.
 - Remove and discard the Torx bolt.



Installation

1. Install the third row safety belt retractor.
 - Tighten the Torx bolt to 40 Nm (30 lb.ft).
2. Install the safety belt upper anchor.
 - Tighten the Torx bolt to 40 Nm (30 lb.ft).
3. Install the D-pillar upper trim panel.
For additional information, refer to: D-Pillar Trim Panel (501-05, Removal and Installation).

Safety Belt System - Front Safety Belt Buckle

Removal and Installation

Removal

WARNINGS:

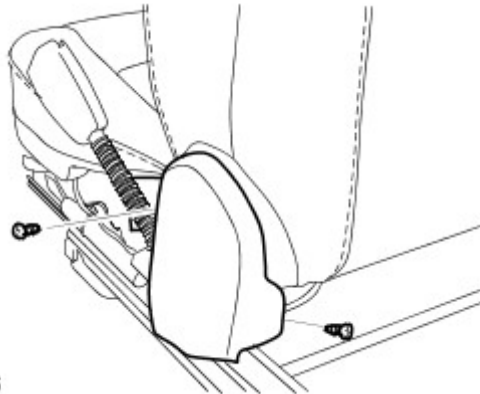


It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.



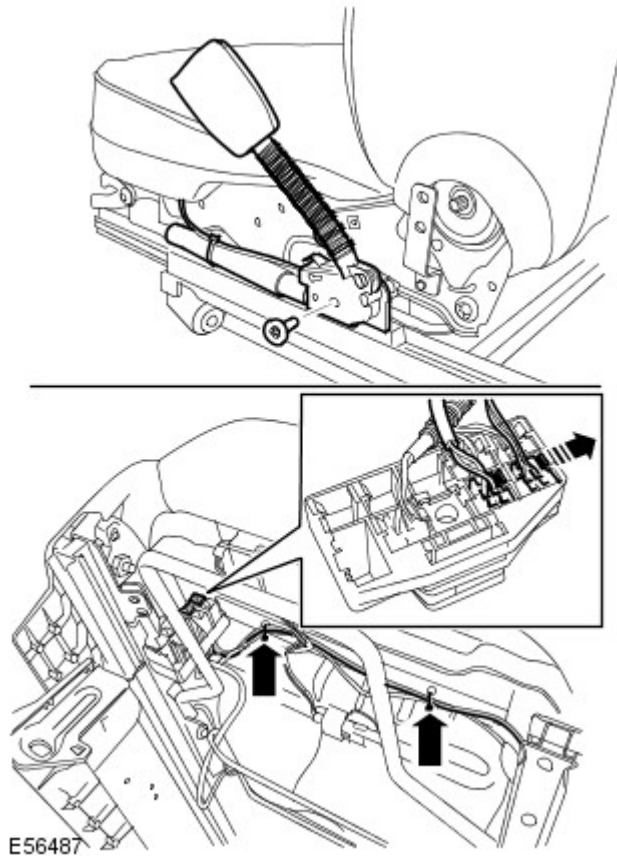
Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
3. Remove the front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).
4. Remove the seat backrest hinge cover.
 - Remove the 2 screws.



E56486

5. Remove the front safety belt buckle.
 - Remove the Torx bolt.
 - Disconnect the 2 electrical connectors.
 - Release the wiring harness.



Installation

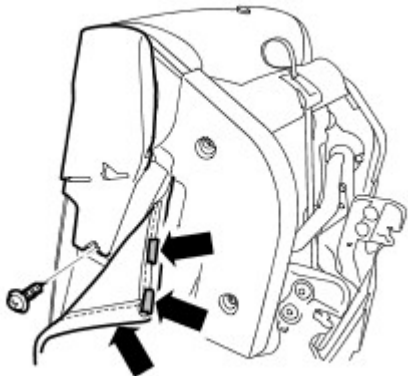
1. Install the front safety belt buckle.
 - Tighten the Torx bolt to 40 Nm (30 lb.ft).
 - Connect the electrical connectors.
 - Attach the wiring harness.
2. Install the seat backrest hinge cover.
 - Tighten the screws.
3. Install the front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).
4. Connect the battery ground cable.

Safety Belt System - Rear Safety Belt Buckle Vehicles With: 40/20/40 Split Seat

Removal and Installation

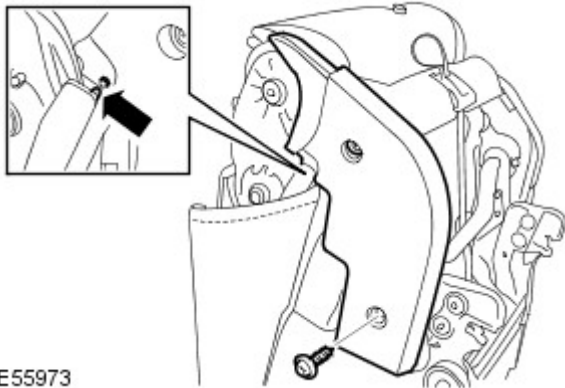
Removal

1. Remove the inner backrest hinge cover.
 - Release the backrest cover side clip.
 - Remove the screw.
 - Release the 2 clips.



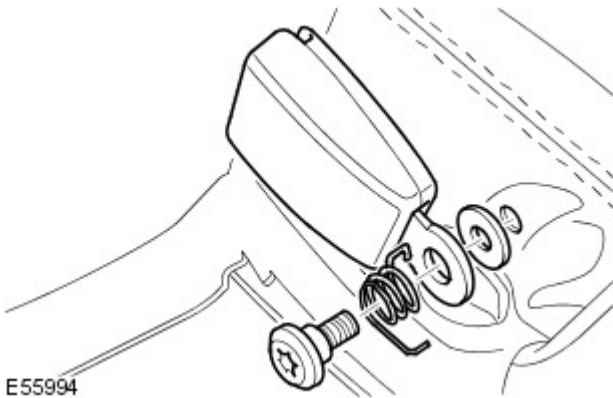
E55971

2. Remove the rear seat cushion side finisher.
 - Remove the 2 screws.
 - Release the tension strap.



E55973

3. Remove the safety belt buckle.
 - Fold the seat assembly forwards.
 - Remove the Torx bolt.
 - Release the tension spring.



E55994

Installation

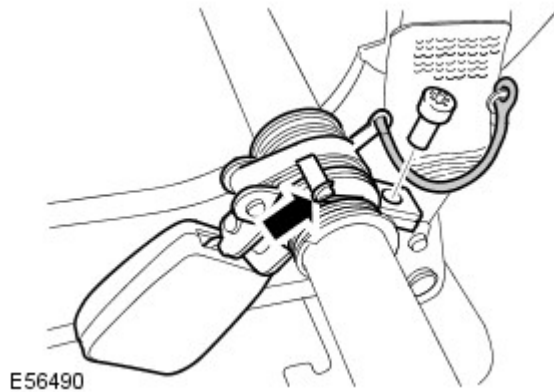
1. Install the safety belt buckle.
 - Attach the tension spring.
 - Tighten the Torx bolt to 25 Nm (18 lb.ft).
 - Fold seat assembly rearwards.
2. Install the rear seat cushion side finisher.
 - Attach the tension strap.
 - Tighten the screws.
3. Install the inner backrest hinge cover.
 - Attach the clips.
 - Tighten the screw.
 - Attach the backrest cover side clip.

Safety Belt System - Rear Safety Belt Buckle LH Vehicles With: 60/40 Split Seat

Removal and Installation

Removal

1. Remove the safety belt buckle.
 - Raise the seat cushion.
 - Release the retaining strap.
 - Remove the Torx bolt.
 - Release the tension spring.



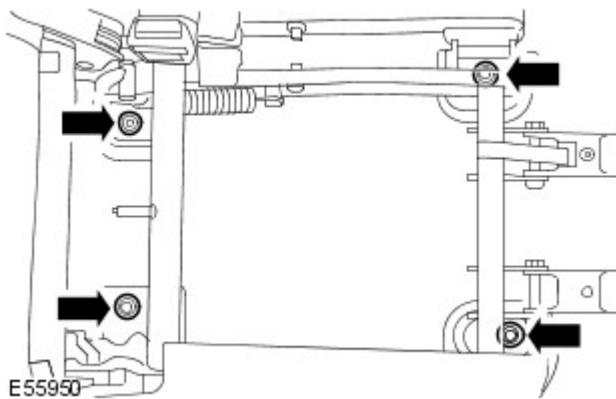
Installation

1. Install the safety belt buckle.
 - Attach the tension spring.
 - Tighten the Torx bolt to 25 Nm (18 lb.ft).
 - Attach the retaining strap.
 - Lower the seat cushion.

Safety Belt System - Rear Safety Belt Buckle RH Vehicles With: 60/40 Split Seat

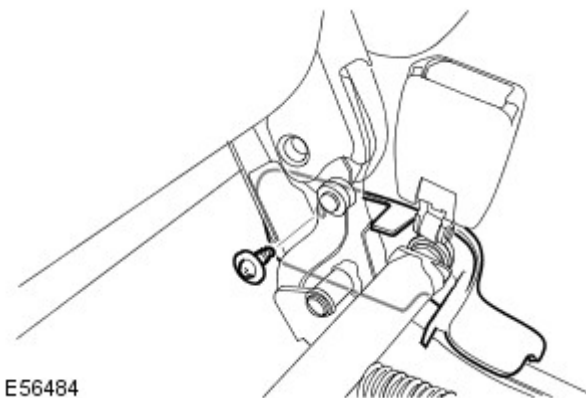
Removal and Installation

Removal

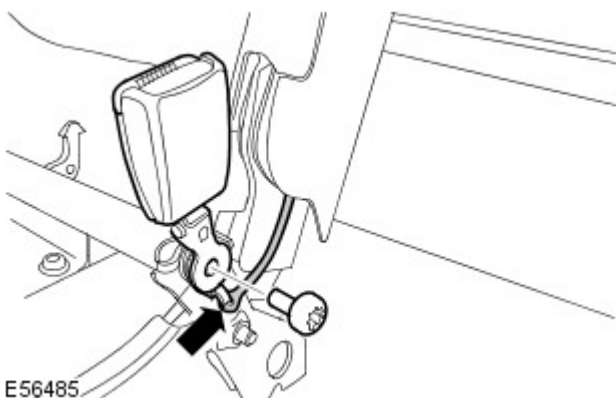


1. Release the RH rear seat.
 - Fold the seat cushion forward.
 - Remove and discard the 4 Torx bolts.
 - Fold down the rear seat backrest.

2. Remove the RH rear seat.



3. Remove the rear seat cushion side finisher.
 - Remove the screw.



4. Remove the safety belt buckle.
 - Raise the seat cushion.
 - Release the retaining strap.
 - Remove and discard the bolt.

Installation

1. Install the safety belt buckle.
 - Tighten the Torx bolt to 40 Nm (30 lb.ft).
 - Attach the retaining strap.
 - Lower the seat cushion.
2. Install the rear seat cushion side finisher.
 - Tighten the screw.
3. Install the RH rear seat.
 - Position the seat on the dowels.
4. Secure the RH rear seat.
 - Return the seat backrest to the upright position.

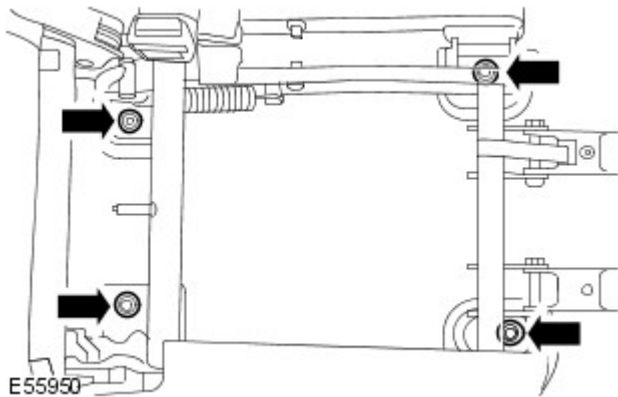
Tighten the new bolts to 40 Nm (30 lb.ft).

- Fold the seat cushion rearwards.

Safety Belt System - Rear Center Safety Belt Buckle Vehicles With: 60/40 Split Seat

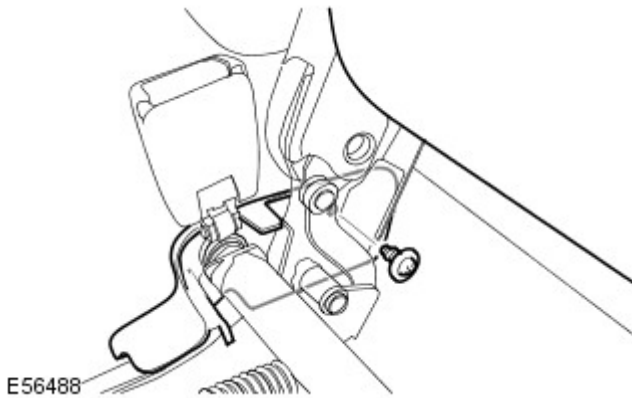
Removal and Installation

Removal

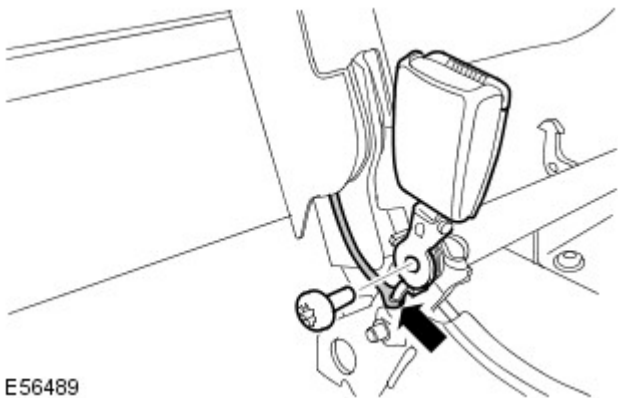


1. Release the RH rear seat.
 - Fold the seat cushion forward.
 - Remove and discard the 4 Torx bolts.
 - Fold down the rear seat backrest.

2. Remove the RH rear seat.



3. Remove the rear seat cushion side finisher.
 - Raise the seat cushion.
 - Remove the screw.



4. Remove the safety belt buckle.
 - Release the retaining strap.
 - Remove and discard the bolt.

Installation

1. Install the safety belt buckle.
 - Tighten the Torx bolt to 40 Nm (30 lb.ft).
 - Attach the retaining strap.
 - Lower the seat cushion.
2. Install the rear seat cushion side finisher.
 - Tighten the screw.
3. Install the RH rear seat.
 - Position the seat on the dowels.
4. Secure the RH rear seat.
 - Return the seat backrest to the upright position.

Tighten the new bolts to 40 Nm (30 lb.ft).

- Fold the seat cushion rearwards.

Supplemental Restraint System -

Torque Specifications

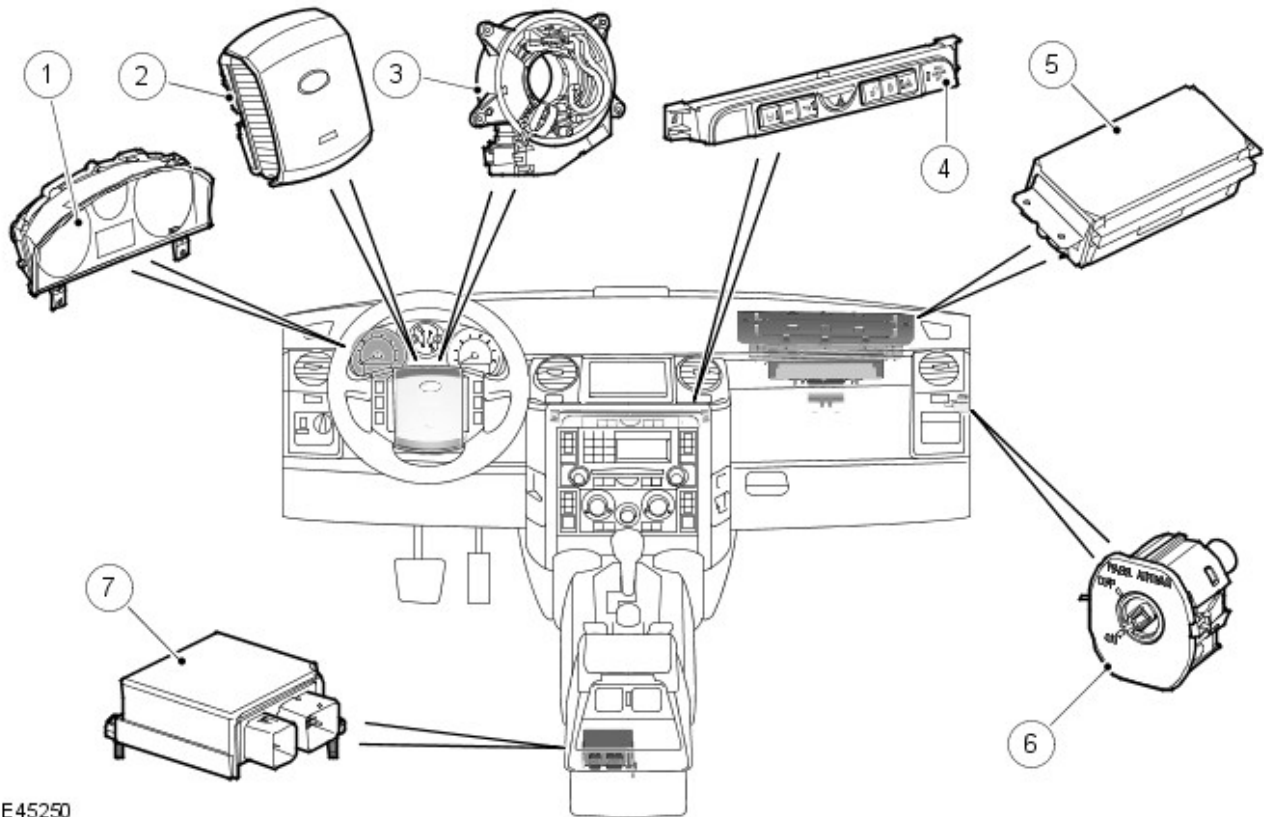
Description	Nm	lb-ft
Passenger air bag module bracket nuts	10	7
Passenger air bag module nuts	10	7
Rear side air curtain module Torx screws	10	7
C-pillar side impact sensor Torx bolts	8	6
Side air curtain module Torx screws	10	7
B-pillar side impact sensor Torx screws	8	6
Restraints control module (RCM) Torx screws	10	7
Front door side impact sensor Torx bolts	8	6
Side air bag module nuts	10	7
Front impact sensor Torx bolts	8	6

Supplemental Restraint System - Air Bag and Safety Belt Pretensioner

Supplemental Restraint System (SRS)

Description and Operation

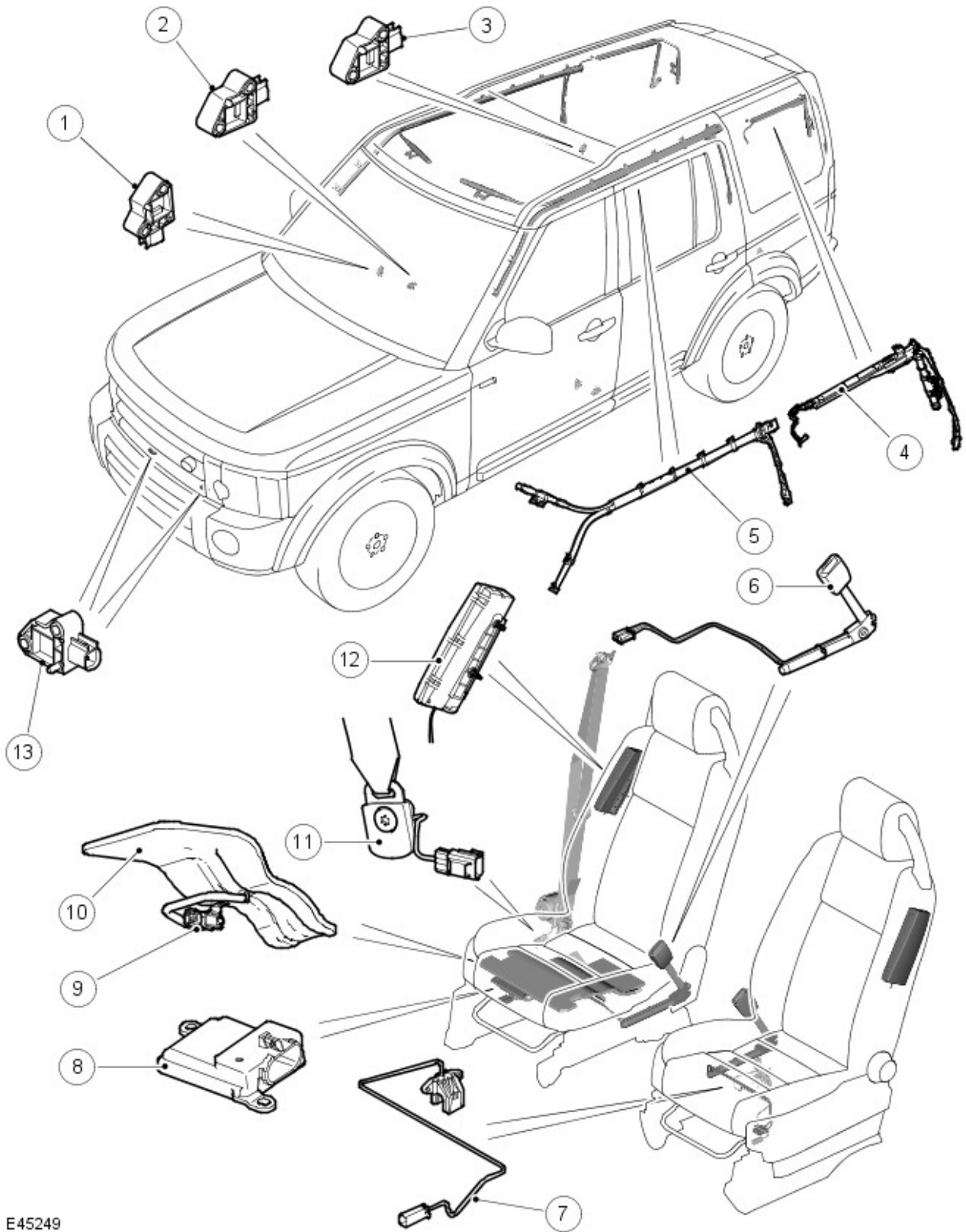
COMPONENT LOCATION - SHEET 1 OF 2



E45250

Item	Part Number	Description
1	-	supplemental restraint system (SRS) warning indicator
2	-	Driver air bag
3	-	Clockspring
4	-	Passenger air bag deactivation indicator
5	-	Passenger air bag
6	-	Passenger air bag deactivation switch (all except NAS (north American specification) and Australia)
7	-	restraints control module (RCM)

COMPONENT LOCATION - SHEET 2 OF 2



E45249

Item	Part Number	Description
1	-	Door side impact sensor
2	-	B pillar side impact sensor
3	-	Rear quarter side impact sensor
4	-	Third row side air curtain
5	-	First and second row side air curtain
6	-	Safety belt pretensioner and buckle switch
7	-	Seat position sensor
8	-	Occupant classification module (NAS only)
9	-	Seat cushion pressure sensor (NAS only)
10	-	Seat cushion pressure pad (NAS only)
11	-	Safety belt tension sensor (NAS only)

- 12 - Side air bag
- 13 - Front impact sensors

GENERAL

The SRS provides additional protection for occupants in certain vehicle accident conditions. The SRS consists of:

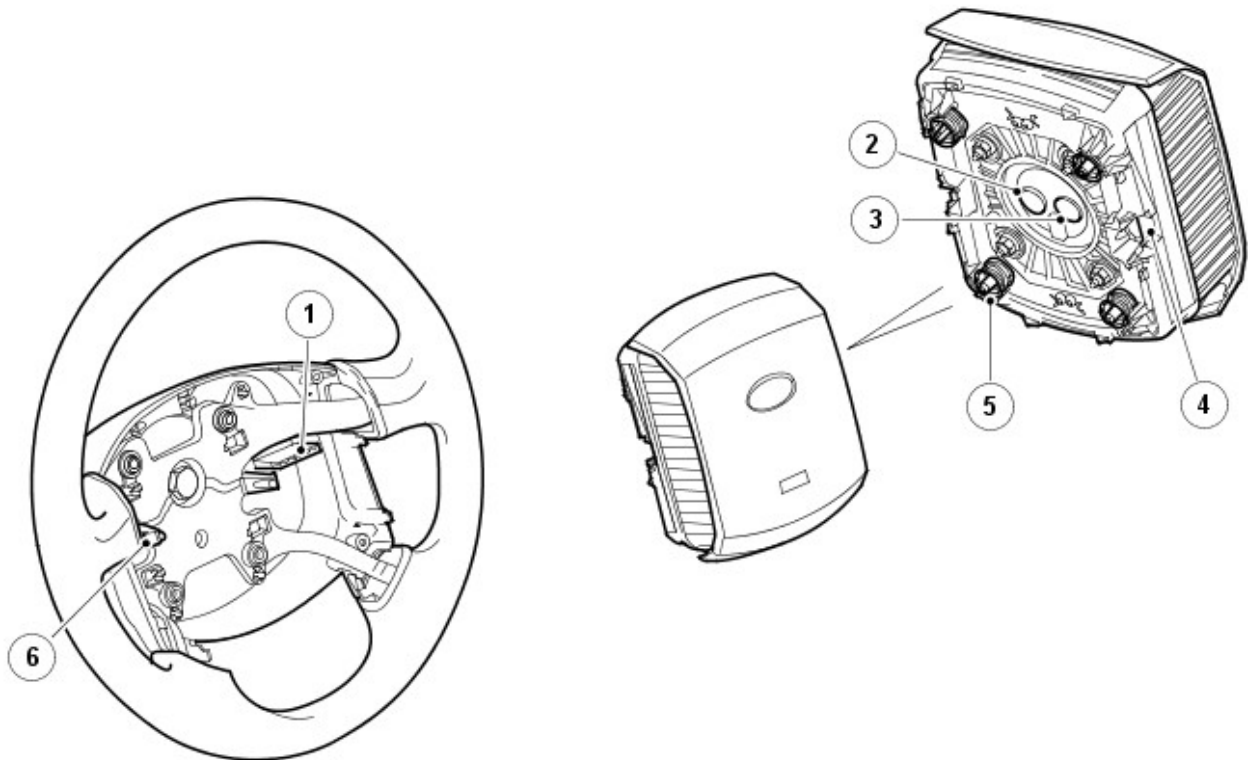
- A driver air bag
- A passenger air bag
- A side air bag on each front seat
- Side air curtains for first and second row seats
- Side air curtains for third row seats (where fitted)
- A pretensioner for each front safety belt
- A buckle sensor for each front safety belt
- Front and side impact sensors
- A passenger air bag deactivation indicator
- A passenger air bag deactivation switch (all except NAS and Australia)
- An occupant monitoring system for the front passenger seat
- A position sensor for the driver seat
- A SRS warning indicator
- A clockspring
- A RCM.



WARNING: All pyrotechnic devices are dangerous. Before performing any procedures on any pyrotechnic device, read all information contained within the Standard Workshop Practices section of this manual. For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).

The SRS features selective activation of the air bags and pretensioners, and two stage driver and passenger air bags. The RCM monitors internal and external sensors and activates the required safety belt pretensioners and air bags if the sensors detect an impact or roll-over above preset limits.

DRIVER AIR BAG



E45251

Item	Part Number	Description
1	-	Release tool slot and guide channel
2	-	Inflator stage 1 connector
3	-	Inflator stage 2 connector
4	-	Latch spring
5	-	Locating pin and spring
6	-	Latch hook

The driver air bag forms the center pad of the steering wheel. Four pins and two latches locate and secure the driver air bag to the steering wheel. The latches consist of wire springs on each side of the driver air bag which engage with hooks in the steering wheel. The driver air bag is released from the steering wheel by pulling on the wire springs with a special tool inserted through a slot on each side of the steering wheel hub. Springs on the locating pins then

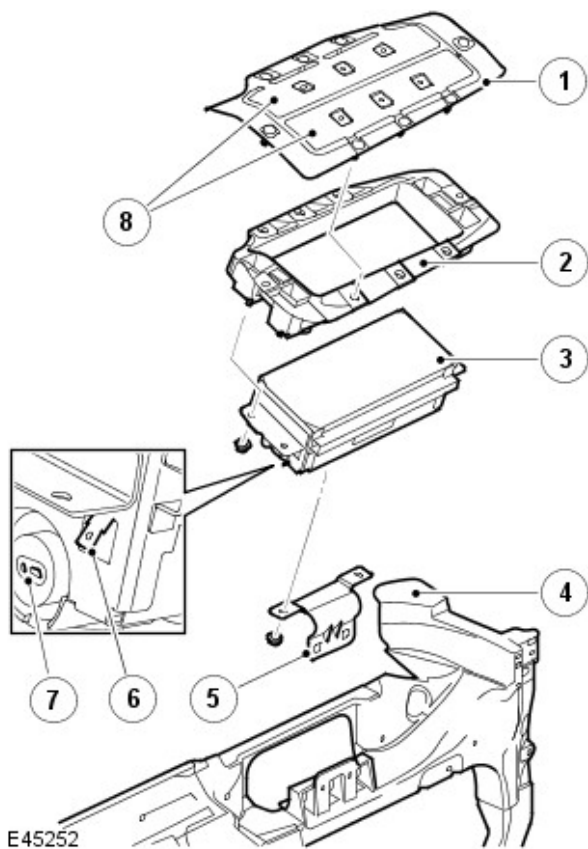
push the driver air bag away from the steering wheel.

A Lucar connector attaches a ground to the driver air bag.

The driver air bag has a two stage inflator, with separate electrical connectors for each stage. The inflator contains a non-azide propellant as the gas generator.

Lines moulded into the inner surface of the driver air bag cover provide weak points that split open in a controlled manner when the driver air bag deploys. The inflated volume of the air bag is 57 liters (2.01 ft³).

PASSENGER AIR BAG



Item	Part Number	Description
1	-	Reinforcement lid
2	-	Chute
3	-	Passenger air bag
4	-	In-vehicle crossbeam
5	-	Mounting bracket
6	-	Lucar connector
7	-	Inflator connector
8	-	Deployment doors

The passenger air bag is located in the instrument panel, behind the upper glove compartment. The bottom of the passenger air bag is attached to a mounting bracket on the in-vehicle crossbeam. The top of the passenger air bag is attached to a chute, which, in turn, is attached to a reinforcement lid in the top of the instrument panel. When the air bag deploys, the chute guides the air bag to the underside of the reinforcement lid. The reinforcement lid incorporates two deployment doors that are forced open, splitting the instrument panel covering, when the air bag deploys.

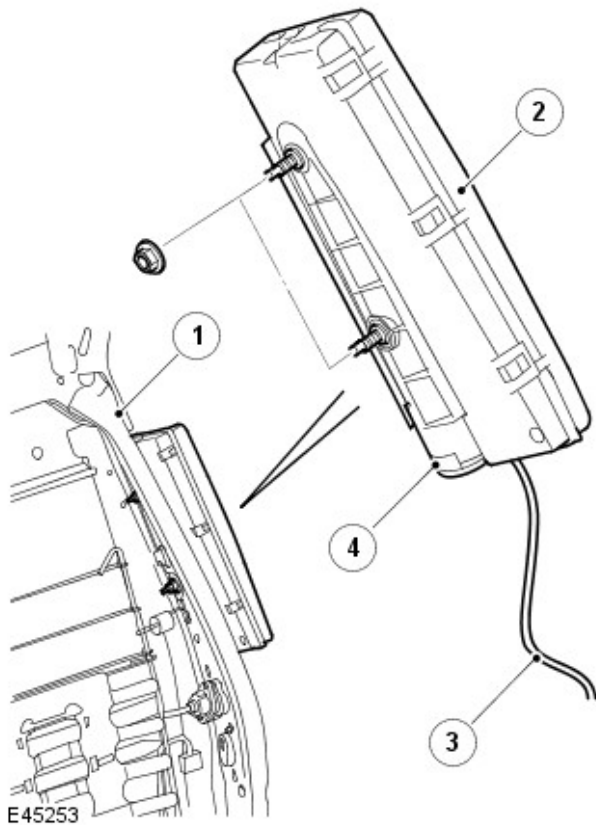
A Lucar connector attaches a ground to the passenger air bag.

The passenger air bag has a two stage inflator, with separate electrical connectors for each stage. The inflator contains a non-azide propellant as the gas generator. The inflator uses a high pressure mix of air and hydrogen gas as the inflation medium. The inflated volume of the air bag is 130 liters (4.59 ft³).

SIDE AIR BAGS



NOTE: Left side air bag shown, right side air bag is mirror image



E45253

Item	Part Number	Description
1	-	Seat backrest frame
2	-	Side air bag
3	-	Cable
4	-	Inflator

A side air bag is attached to the outside of each front seat backrest frame, under the backrest cover.

The side air bags are handed, and each consist of a moulded plastic case which contains the folded air bag and the inflator. A cable connects the igniter of the inflator to a connector in the main seat harness connector block located under the front edge of the seat cushion.

When the air bag deploys it forces the front edge of the moulded plastic case apart and splits open the backrest cover.

The side air bags use compressed argon as the inflation medium. The inflated volume of each side air bag is 12 liters (0.42 ft³).

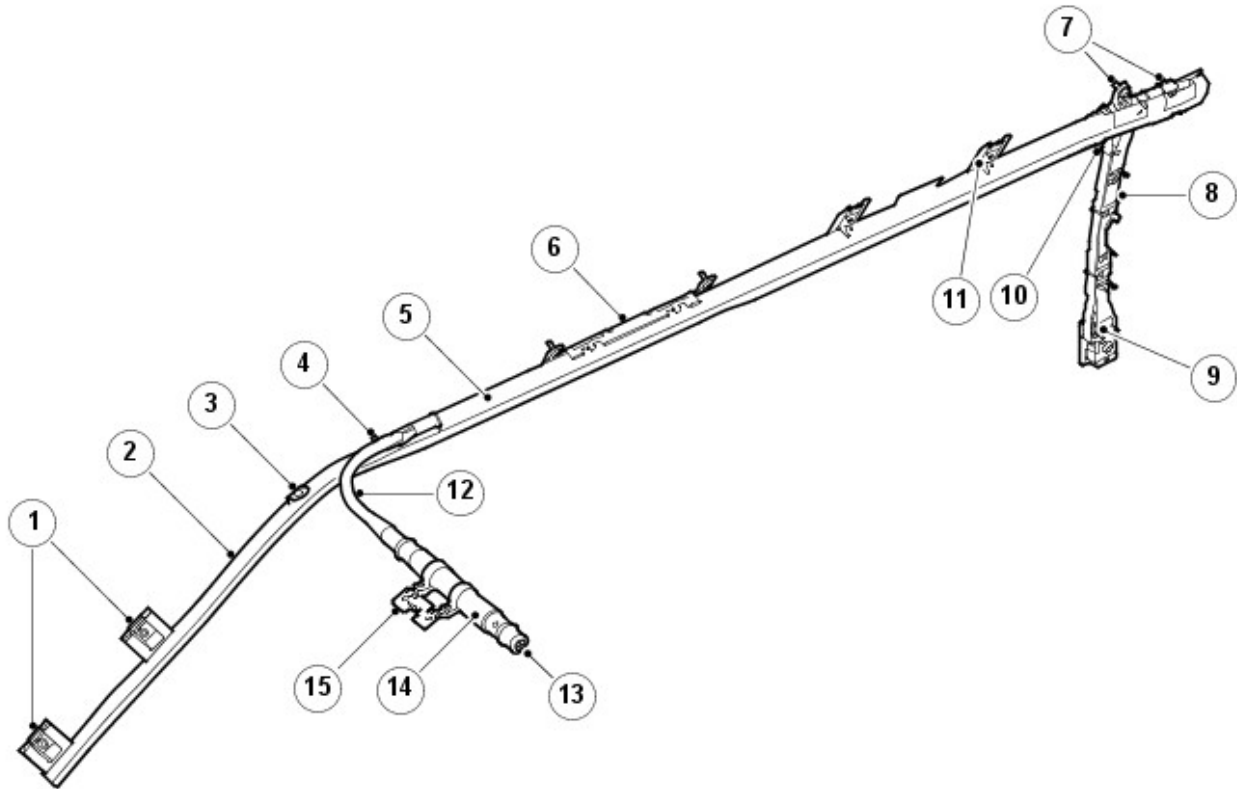
SIDE AIR CURTAINS

The side air curtains are designed to protect the head and upper body in side impact and roll-over situations. The first and second row side air curtains are a standard fit on all vehicles. The third row side air curtains are fitted on seven seat vehicles only. The side air curtains use compressed argon as the inflation medium.

First and Second Row Side Air Curtain



NOTE: Right side air curtain shown, left side air curtain is mirror image



E45254

Item	Part Number	Description
1	-	Air curtain anchorage points
2	-	Non inflatable section of air curtain
3	-	Air curtain clip (manufacturing aid)
4	-	Front gas guide attachment
5	-	Inflatable section of air curtain
6	-	B pillar ramp
7	-	Securing screws
8	-	Active tether device
9	-	Rear tether anchor
10	-	Rear tether
11	-	Cant rail clip
12	-	Gas guide pipe
13	-	Inflator electrical connector
14	-	Inflator
15	-	Inflator mounting bracket

The first and second row side air curtains are installed on the cant rails above the front and rear doors, behind the headliner.

Each side air curtain has an inflator, which is attached to the header rail by a mounting bracket and two screws. The inflator is connected to the air curtain by a gas guide pipe.

The gas guide pipe and air curtain are secured along the cant rail by a fixing at the front of the gas guide pipe, two fixings at the B pillar ramp, two clips and two screws, and two fixings at the end of the gas guide pipe and C pillar ramp.

At the rear of the air curtain, an active tether device is clipped in two positions down the C pillar. At the bottom of the active tether device is a fixing anchorage.

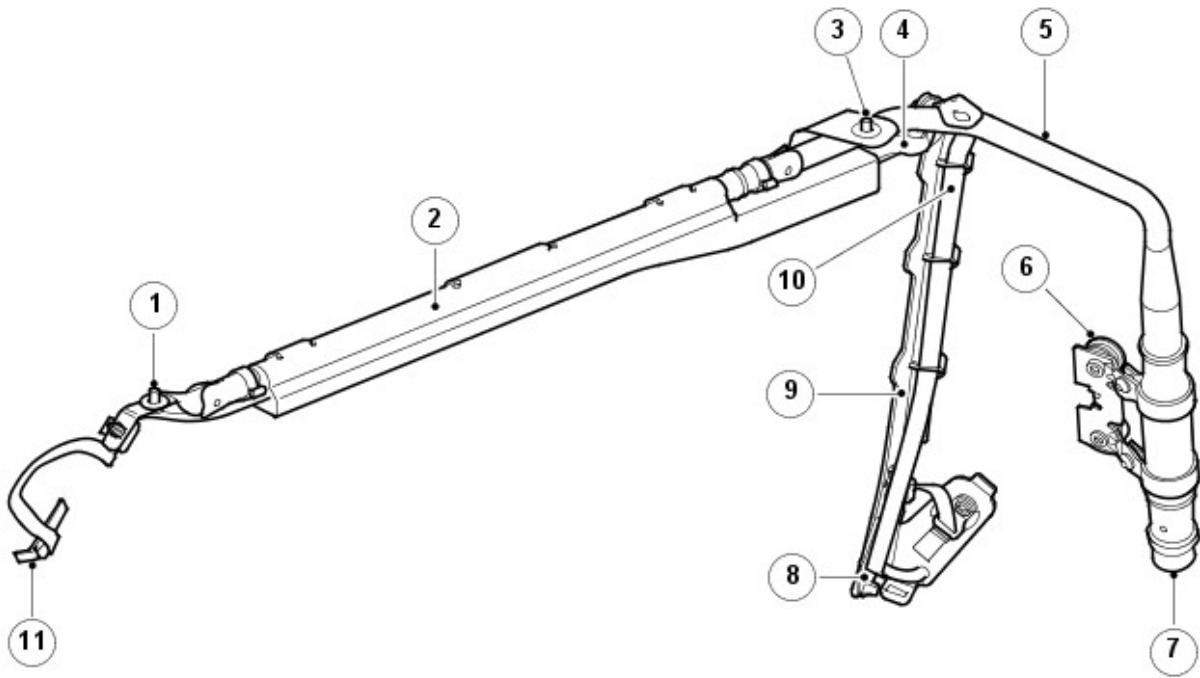
The front of the air curtain is secured to the A pillar by two fixings.

When the side air curtain deploys, it breaks out of the B pillar ramp and the clips on the cant rail and extends downwards from behind the headliner. The deploying air curtain is tensioned between the anchorage points on the A pillar and the active tether device on the C pillar. This retains the air curtain in position against the upper part of the doors and the B pillar.

Third Row Side Air Curtain



NOTE: Right side air curtain shown, left side air curtain is mirror image



E45255

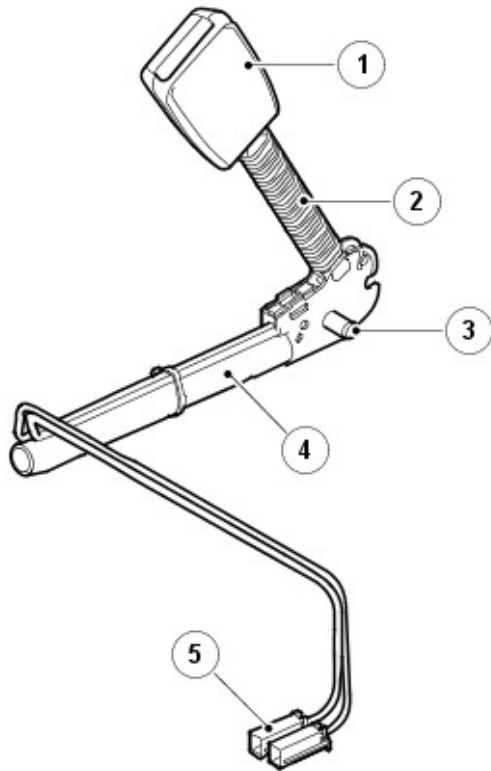
Item	Part Number	Description
1	-	Securing screw
2	-	Air curtain
3	-	Securing screw
4	-	Rear tether
5	-	Gas guide pipe
6	-	Inflator mounting bracket
7	-	Inflator
8	-	Rear tether anchor
9	-	Tether housing
10	-	Rear tether
11	-	Front tether anchor

The third row side air curtains are installed on the cant rails above the rear quarter windows, behind the headliner.

Each side air curtain has an inflator, which is attached to the D pillar by a mounting bracket and two screws. The inflator is connected to the air curtain by a gas guide pipe. The gas guide pipe and air curtain are secured to the cant rail by two screws. Tethers are attached to the front and rear of the air curtain. The front tether is anchored to the C pillar. The rear tether is anchored to the D pillar and held in position by a tether housing.

When a third row side air curtain deploys, it extends downwards from behind the headliner. The expanding air curtain tightens the tethers, which retain the air curtain in position against the rear quarter window.

PRETENSIONERS



E45256

Item	Part Number	Description
1	-	Safety belt buckle
2	-	Boot
3	-	Anchor bolt
4	-	Piston and tube
5	-	Electrical connectors for inflator and buckle switch

The pretensioners are used to tighten the front safety belts during a collision to ensure the occupants are securely held in their seats. A pretensioner is integrated into each front safety belt buckle.

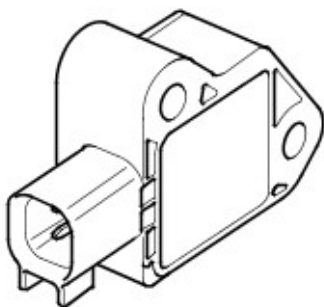
Each pretensioner has a tube containing an inflator and a piston. The inflator is connected to the RCM. The piston is attached to a steel cable, the opposite end of which is attached to the safety belt buckle.

On receipt of a fire signal from the RCM, the inflator generates nitrogen gas that rapidly expands to drive the piston along the tube, pulling the cable and drawing the safety belt buckle downwards.

SAFETY BELT SENSORS

The buckle of each front safety belt incorporates a Hall effect sensor that provides a safety belt status signal to the RCM. The RCM broadcasts the status of the two front safety belts on the high speed controller area network (CAN) bus for use by the instrument cluster.

IMPACT SENSORS



E45257

Impact sensors are installed in the front and both sides of the vehicle. The use of multiple impact sensors provides shorter air bag trigger times, through faster detection of lateral and longitudinal acceleration, and improves detection accuracy.

There are two front impact sensors attached to brackets on the body front support frame, just above each front longitudinal.

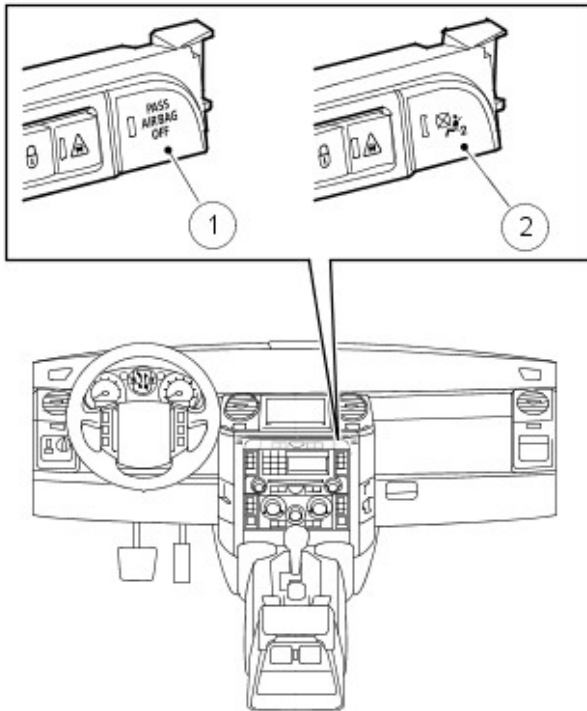
There are six side impact sensors located in the passenger compartment, as follows:

- One attached to each front door.
- One attached to the base of each B pillar.
- One installed in each rear quarter, above the rear wheelarch.

Each impact sensor incorporates an accelerometer and a microcontroller powered by a feed from the RCM. The power feed also provides the interface connection through which the impact sensor communicates with the RCM using serial data messages. Acceleration is evaluated by the microcontroller and transmitted to the RCM, which then makes the decision on whether or not to activate the air bags and pretensioners.

When the ignition is switched on the RCM supplies power to the impact sensors, which perform a self test. After satisfactory self tests the impact sensors continually output 'sensor active' messages to the RCM. If a fault is detected the relevant impact sensor sends a fault message, instead of the sensor active message, to the RCM. The RCM then stores a related fault code and illuminates the SRS warning indicator.

PASSENGER AIR BAG DEACTIVATION INDICATOR



E45258

Item	Part Number	Description
1	-	Deactivation indicator (NAS and Japan)
2	-	Deactivation indicator (all except NAS and Japan)

The passenger air bag deactivation indicator is installed on the center switch pack of the instrument panel. When appropriate, the indicator illuminates to advise front seat occupants that the passenger air bag is disabled. Operation of the indicator is controlled by the RCM based on seat occupancy status derived from the occupant classification system (NAS vehicles) or the passenger air bag deactivation switch (all except NAS and Australian specification vehicles).

The RCM illuminates the indicator when:

- The passenger air bag is deactivated with the passenger air bag deactivation switch (where fitted). OR
- Required by passenger seat occupant monitoring (NAS vehicles only).

PASSENGER AIR BAG DEACTIVATION SWITCH



E45259

The passenger air bag deactivation switch provides a method of manually disabling the passenger air bag on all vehicles except Australian specification and those fitted with the occupant classification system. The switch is installed in the front passenger end of the instrument panel and is operated by the ignition key.

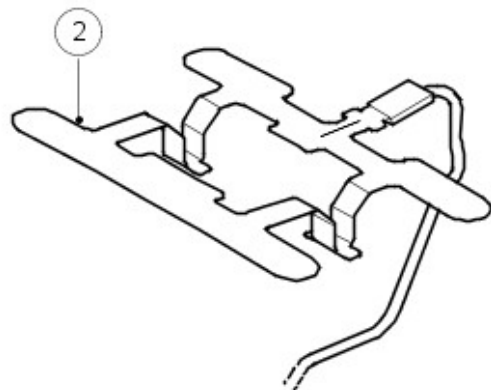
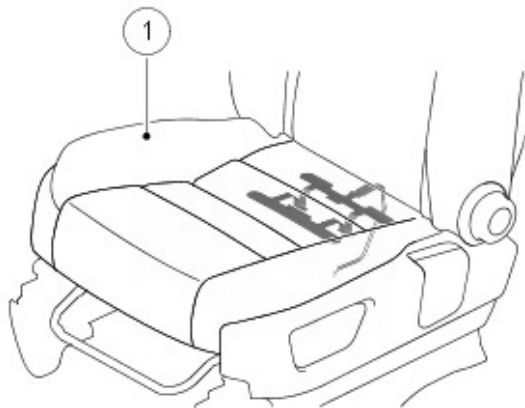
When the passenger air bag deactivation switch is operated, it changes a ground connection between two pins in the connectors of the RCM. When the passenger air bag deactivation switch is selected to OFF, the RCM disables the passenger air bag and, if the front passenger seat is occupied, illuminates the passenger air bag deactivation indicator.

OCCUPANT SENSING

There are 2 types of occupant sensing:

- In all markets except North America, vehicles have an occupant detection system to activate the seat belt minder
- On NAS vehicles, an occupant classification system provides signals to the RCM to allow the correct arming of the passenger air bag and corresponding indicator.

Occupant Detection System



E46657

Item	Part Number	Description
1	-	Seat cushion
2	-	Pressure switch

The occupant detection system can only determine if the front passenger seat is occupied or unoccupied. The occupant detection system consists of a pressure switch installed between the foam padding and the cover of the front passenger seat cushion.

The pressure switch incorporates a number of load cells connected in series and embedded in a plastic film. Weight on the pressure sensor increases the resistance of the circuit.

The instrument cluster supplies a reference voltage to the pressure switch and measures the current draw to determine the occupancy status. From the occupancy status, and the status of the front passenger safety belt (received from the RCM on the high speed CAN bus), the instrument cluster determines the belt minder status.

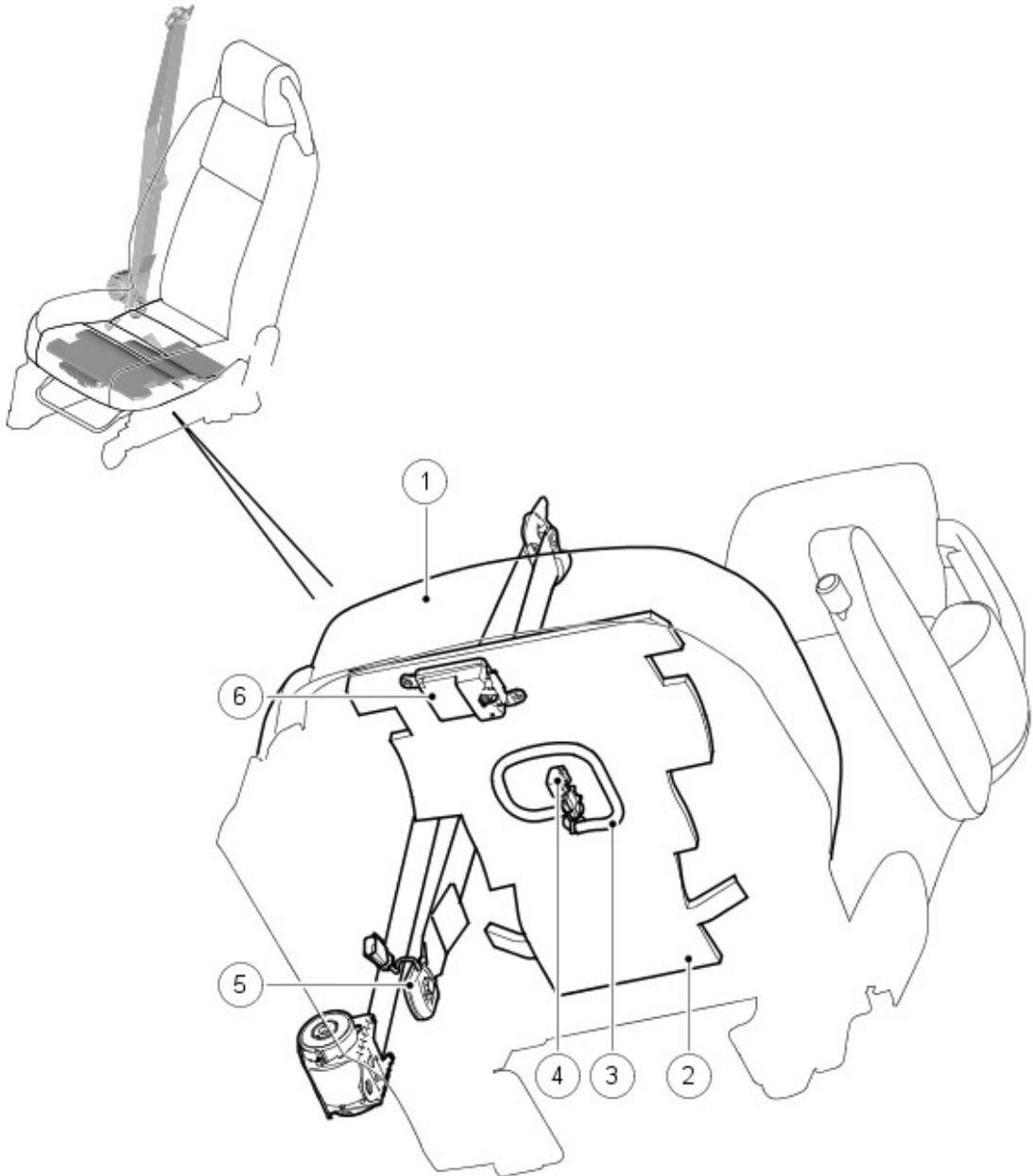
Occupant Classification System



WARNING: All Land Rover vehicles, with the exception of Defender, are equipped with passenger air bags. Passenger air bags offer well documented benefits in crash protection for adult front passenger seat occupants but their deployment can be harmful to children and infants sat in the front passenger seat of the vehicle. Land Rover recommends that children and infants are placed in the rear seats of the vehicle.



NOTE: All new Land Rover vehicles sold in North America comply with the FMVSS208 legislation due to the fitment of the occupant classifications system.



E45261

Item	Part Number	Description
1	-	Seat cushion
2	-	Pressure pad
3	-	Pressure tube
4	-	Pressure sensor
5	-	Safety belt tension sensor
6	-	Occupant classification module

Occupant classification system comprises an ECU, attached to the underside of the seat, a silicon filled bladder with a pressure sensor fitted between the cushion foam and the seat pan and a seat belt tension sensor. When an occupant sits on the seat a pressure is created in the bladder and the occupant weight is determined from the pressure generated. The weight is compared against 4 classification thresholds. These are:

- Empty
- Occupied inhibit status (6 year old child, 3 year old child, rear facing/forward facing 12 month infant seats and booster seats)
- Occupied allow status (weight greater than 5th percentile female) and the airbag enabled/disabled as appropriate
- Indeterminate state.

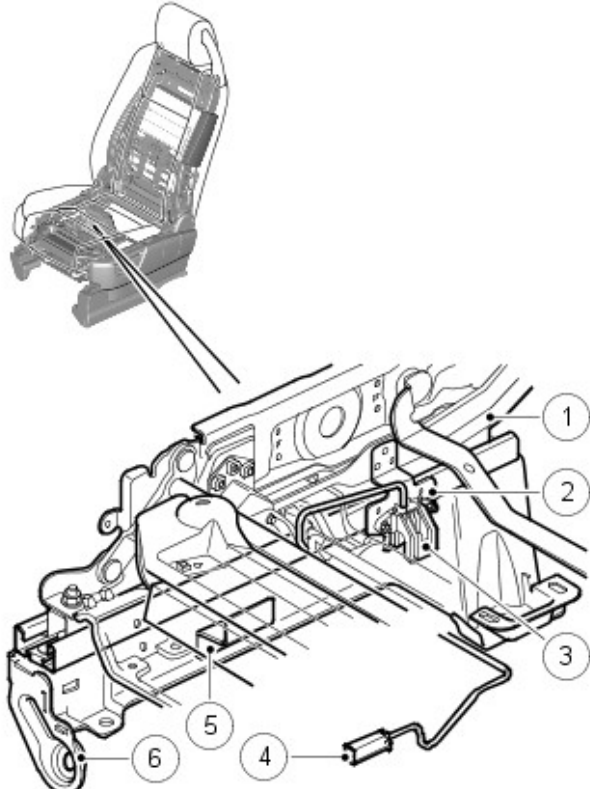
Classification	Deactivation Indicator	SRS Warning Indicator
Seat unoccupied	OFF	OFF
Occupied inhibit	ON	OFF

Occupied allow	OFF	OFF
Indeterminate state	OFF	ON

OCS module contains accelerometers and algorithms to compensate for the effects of longitudinal, lateral and vertical forces acting on the vehicle whilst being driven. The belt tension sensor is used to offset loads forced into the seat by 'cinched' child seats (where a child seat load on the seat is increased by a highly tensioned seat belt) and also dynamic belt loading (Off-road/aggressive driving styles).

The belt minder system on cars equipped with the occupant classification system uses the RCM to detect seat occupancy status based on calculations within the RCM, with the instrument cluster then determining whether a seat belt reminder should be activated based on the status of the seat belt buckle switches and vehicle speed.

SEAT POSITION SENSOR



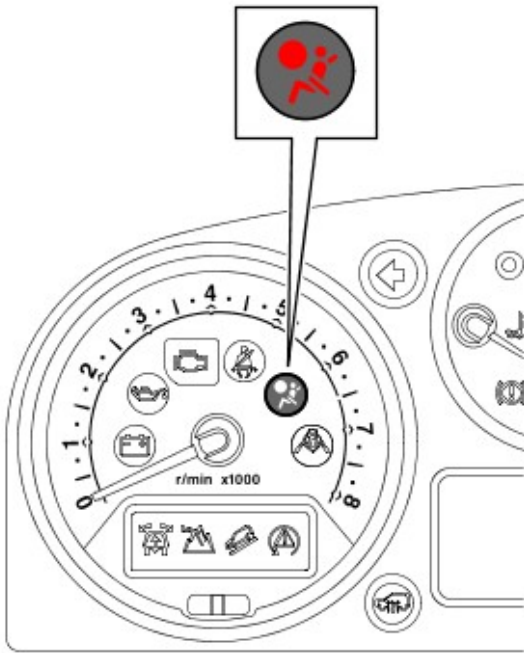
E45262

Item	Part Number	Description
1	-	Seat frame
2	-	Mounting plate
3	-	Seat position sensor
4	-	Electrical connector
5	-	Target plate
6	-	Seat base

The seat position sensor allows the RCM to detect when the driver seat is forward of a given point on the seat track. The seat position sensor consists of a Hall effect sensor attached to the driver seat frame and a target plate on the seat base. While the ignition is on, the RCM supplies the sensor with a power supply of 12V nominal, and monitors the return voltage. When the seat frame moves forwards, the sensor moves over the target plate, which changes the reluctance of the sensor. The change of voltage is detected by the RCM and used as a switching point. The switching point is when the center of the sensor is 3 ± 4 mm from the leading edge of the target plate.

When the driver seat is forward of the switching point, the RCM increases the time delay between firing the two stages of the inflator in the driver air bag. When the driver seat is rearward of the switching point, the RCM uses the normal time delay between firing the two stages.

SRS WARNING INDICATOR

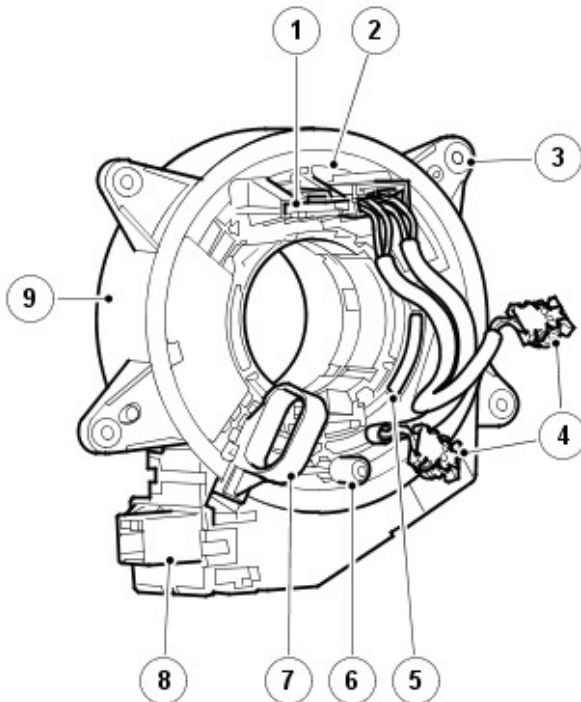


E45263

The SRS warning indicator consists of a red light emitting diode (LED) behind a SRS graphic in the tachometer of the instrument cluster.

Operation of the SRS warning indicator is controlled by a high speed CAN bus message from the RCM to the instrument cluster. The RCM illuminates the SRS warning indicator if a fault is detected, and for approximately 6 seconds during the bulb check at the beginning of each ignition cycle.

CLOCKSPRING



E45264

Item	Part Number	Description
1	-	Electrical connector for steering wheel switch packs and horn
2	-	Inner rotor

3	-	Outer housing securing lug
4	-	Driver air bag link leads
5	-	Viewing window
6	-	Drive peg
7	-	Stopper
8	-	Electrical connector for steering column harness
9	-	Outer cover

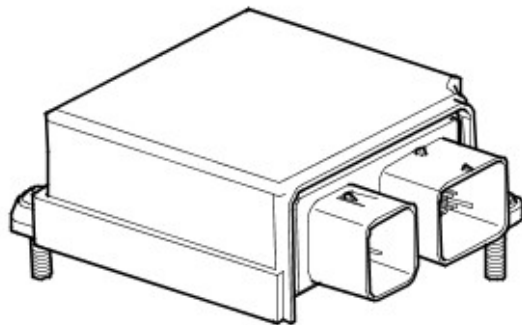
The clockspring is installed on the steering column to provide the electrical interface between the fixed wiring harness of the steering column and the components that rotate with the steering wheel, i.e. the driver air bag, the horn and the steering wheel switch packs.

The clockspring consists of a plastic cassette which incorporates an outer cover fixed to the steering column and an inner rotor which turns with the steering wheel. Four securing lugs attach the cover to the multifunction switch on the steering column. The rotor is keyed to the steering wheel by a drive peg. A lug on the underside of the rotor operates the self-cancelling feature of the turn signal indicator switch. A ribbon lead, threaded on rollers in the rotor, links two connectors on the cover to two connectors on the rotor. Link leads for the driver air bag are installed in one of the connectors on the rotor.

To prevent damage to the ribbon lead, both the steering and the clockspring must be centralized when removing and installing the clockspring or the steering wheel. The clockspring is centralized when the drive peg is at six o'clock and 50 - 100% of a yellow wheel is visible in the viewing window.

Replacement clocksprings are fitted with a stopper, which locks the cover to the rotor, in the central position. The stopper must be broken off when the replacement clockspring is installed.

RCM



E45265

The RCM is installed on the top of the transmission tunnel, in line with the B pillars, and controls operation of the SRS. The main functions of the RCM include:

- Crash detection and recording.
- Air bag and pretensioner firing.
- Self test and system monitoring, with status indication via the SRS warning lamp and non volatile storage of fault information.

A safing sensor in the RCM provides confirmation of an impact to verify if air bag and pretensioner activation is necessary. A roll-over sensor monitors the lateral attitude of the vehicle. Various firing strategies are employed by the RCM to ensure that during an accident only the appropriate air bags and pretensioners are fired. The firing strategy used also depends on the inputs from the safety belt switches and the occupant monitoring system.

An energy reserve in the RCM ensures there is always a minimum of 150 milliseconds of stored energy available if the power supply from the ignition switch is disrupted during a crash. The stored energy is sufficient to produce firing signals for the driver air bag, the passenger air bag and the safety belt pretensioners.

When the ignition is switched on the RCM performs a self test and then performs cyclical monitoring of the system. If a fault is detected the RCM stores a related fault code and illuminates the SRS warning indicator. The faults can be retrieved by the Land Rover approved diagnostic system on a dedicated link between the RCM and the diagnostic socket. If a fault that could cause a false fire signal is detected, the RCM disables the respective firing circuit, and keeps it disabled during a crash event.

SRS OPERATION

General

In a collision, the sudden deceleration or acceleration is measured by the safing sensor in the RCM and by the impact sensors. The RCM evaluates the readings to determine the impact point on the vehicle and whether the deceleration/acceleration readings exceed the limits for firing any of the air bags or pretensioners. During a collision, the RCM only fires the air bags and pretensioners if the safing sensor confirms that the data from the remote sensor(s) indicates an impact limit has been exceeded. The RCM also monitors the vehicle for a roll-over accident using the internal roll-over sensor and high speed CAN bus messages from the anti-lock brake system (ABS) module and the steering angle sensor.

The RCM incorporates the following impact thresholds to cater for different accident scenarios:

- Front impact, pretensioners.

- Front impact, driver and passenger air bags stage 1, belt unfastened.
- Front impact, driver and passenger air bags stage 2, belt unfastened.
- Front impact, driver and passenger air bags stage 1, belt fastened.
- Front impact, driver and passenger air bags stage 2, belt fastened.
- Rear impact.
- LH side impact.
- RH side impact.
- Roll-over.

The front impact thresholds increase in severity from pretensioners, through to driver and passenger air bag stage 2, belt fastened.

Firing Strategies

The seat belt pretensioners are fired when either the pretensioner impact limit or the roll-over limit is exceeded. The RCM only fires the pretensioners if the related safety belt is fastened. For the front passenger pretensioner to fire, the seat must also be occupied by a large person, i.e. someone over a given weight (NAS only).

The driver and passenger air bags are only fired in a frontal impact that exceeds the stage 1 threshold. Both stages of the inflator in the driver and passenger air bags are fired. At impacts between the stage 1 and 2 thresholds, the delay between the firing of the two stages varies with the severity of the impact; the more severe the impact the shorter the delay. At stage 2 impact thresholds and above, the two stages of the inflator are fired almost simultaneously. The passenger air bag is disabled unless the front passenger seat is occupied by a large person (NAS only), or the passenger air bag deactivation switch is on (all except NAS). The time delay between firing the two stages of the inflator in the driver air bag is increased if the driver seat is forward of the seat position sensor switching point.

If there is a fault with a safety belt buckle sensor, the RCM assumes the related safety belt is fastened for the pretensioner firing strategy and unfastened for the driver and passenger air bag firing strategies. If there is a fault with the occupant detection system, or if there is a fault with the passenger air bag deactivation switch, the RCM increase the time delay between firing the two stages of the inflator in the passenger air bag.

If a side impact limit is exceeded, the RCM fires the side air bag and the side air curtain(s) on that side of the vehicle. If the side impact limit on the front passenger side of the vehicle is exceeded, the RCM also evaluates the input from the occupant classification system, and fires the side air bag only if the front passenger seat is occupied by a large person (NAS only).

The side air curtain(s) on both sides of the vehicle are fired if the roll-over limit is exceeded.

If multiple impacts occur during a crash event, after responding to the primary impact the RCM will output the appropriate fire signals in response to any further impacts if unfired units are available.

Crash Signal

When the RCM outputs any of the fire signals, it also outputs a hard wired crash signal to the Engine Control Module (ECM) and changes the high speed CAN bus output message from 'no crash' to 'crash condition'. The high speed CAN bus message is used by the central junction box (CJB) and the FFBH (fuel fired booster heater).

On receipt of the crash signals:

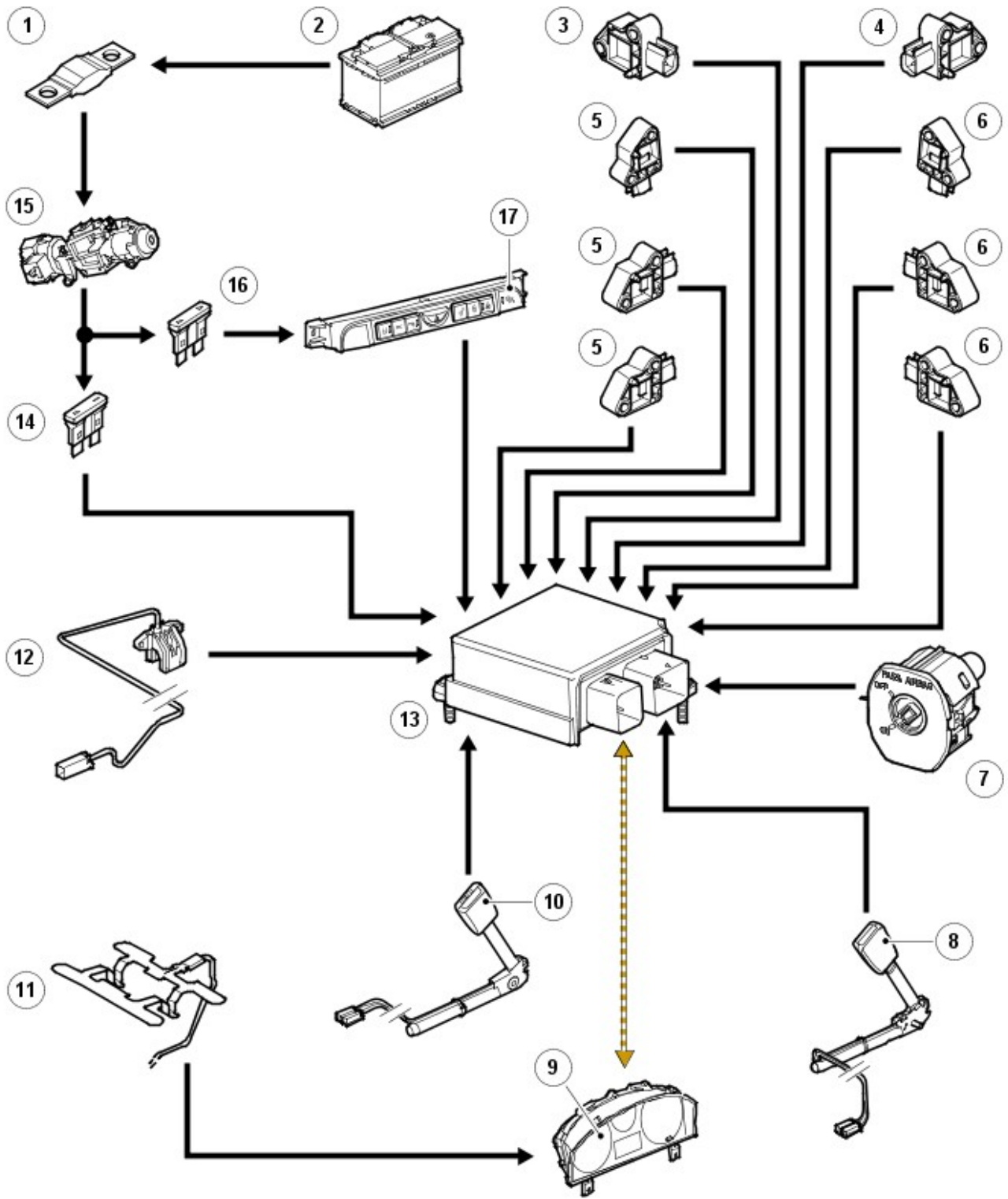
- The engine control module (ECM) disables the fuel pump.
- Operation of the FFBH is disabled.
- The CJB enters the crash mode and:
 - Activates all of the unlock signals of the vehicle locking system, even if the vehicle is already unlocked. After 3 seconds, the CJB activates the unlock signals again, in case a lock button is pressed during the crash, by flailing limbs for example.
 - Ignores all locking and superlocking inputs until the crash mode is cancelled, when it returns the locking system to normal operation.
 - Activates all of the courtesy lamps, except for the approach lamps. The activated courtesy lamps remain on until they are manually switched off at the lamp unit, or the CJB crash mode is cancelled, when they return to normal operation.
 - Activates the hazard warning lamps. The hazard warning lamps remain on until cancelled by turning the ignition switch from position II to position I or 0, or until the crash mode is cancelled.

The crash mode is cancelled by cycling the ignition switch.

CONTROL DIAGRAM - SHEET 1 OF 2 (ALL EXCEPT NAS)



NOTE: A = Hardwired connections; D = High speed CAN bus



E48032

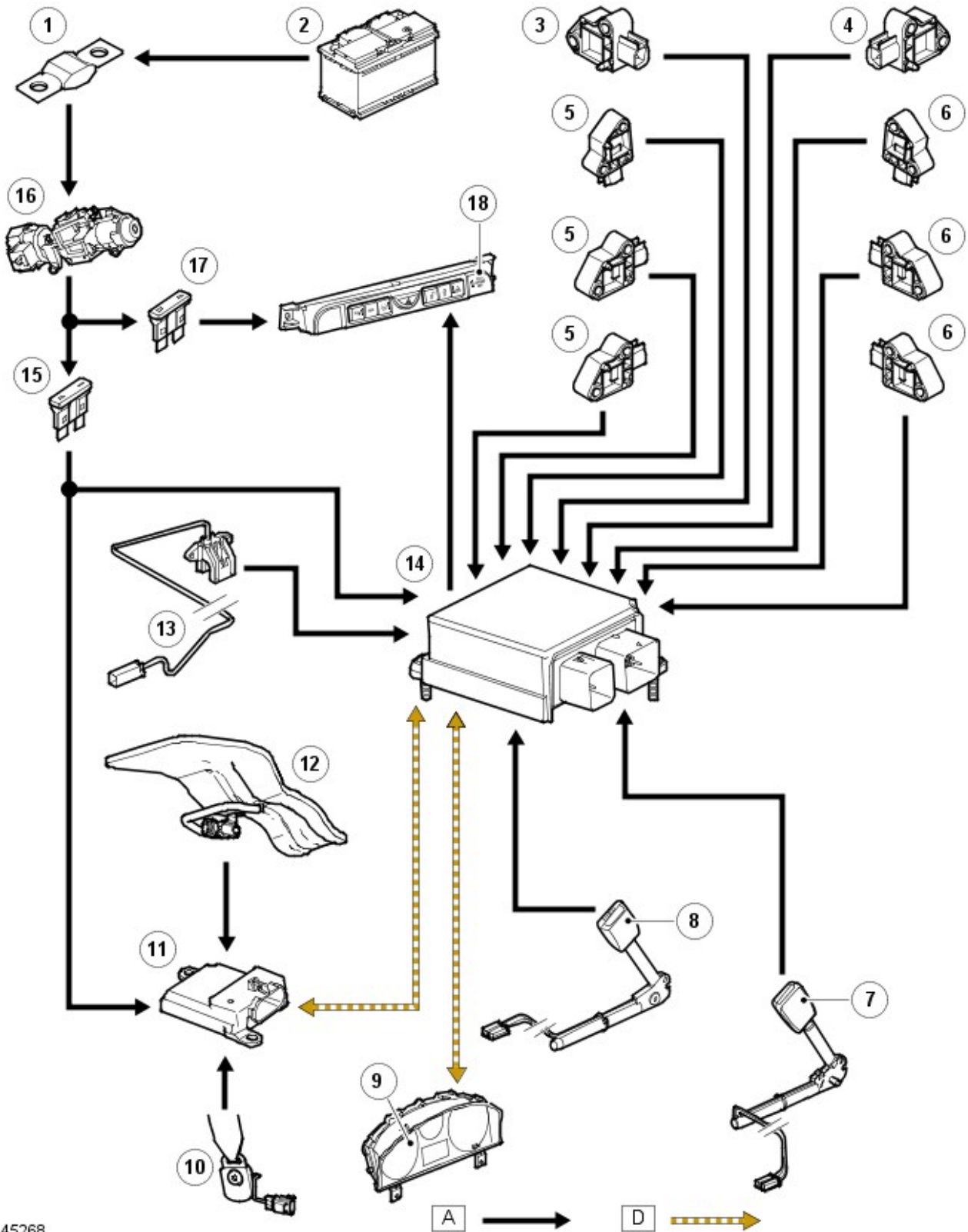


Item	Part Number	Description
1	-	Fusible link 11E, battery junction box (BJB)
2	-	Battery
3	-	Left front impact sensor
4	-	Right front impact sensor
5	-	Left side impact sensor
6	-	Right side impact sensor
7	-	Passenger air bag deactivation switch
8	-	Left safety belt buckle sensor
9	-	Instrument cluster
10	-	Right safety belt buckle sensor
11	-	Occupant detection pressure sensor

- 12 - Seat position sensor
- 13 - RCM
- 14 - Fuse 9P, CJB
- 15 - Ignition switch
- 16 - Fuse 68P, CJB
- 17 - Passenger air bag deactivation indicator

CONTROL DIAGRAM - SHEET 1 OF 2 (NAS ONLY)

 NOTE: A = Hardwired connections; D = High speed CAN bus



E45268

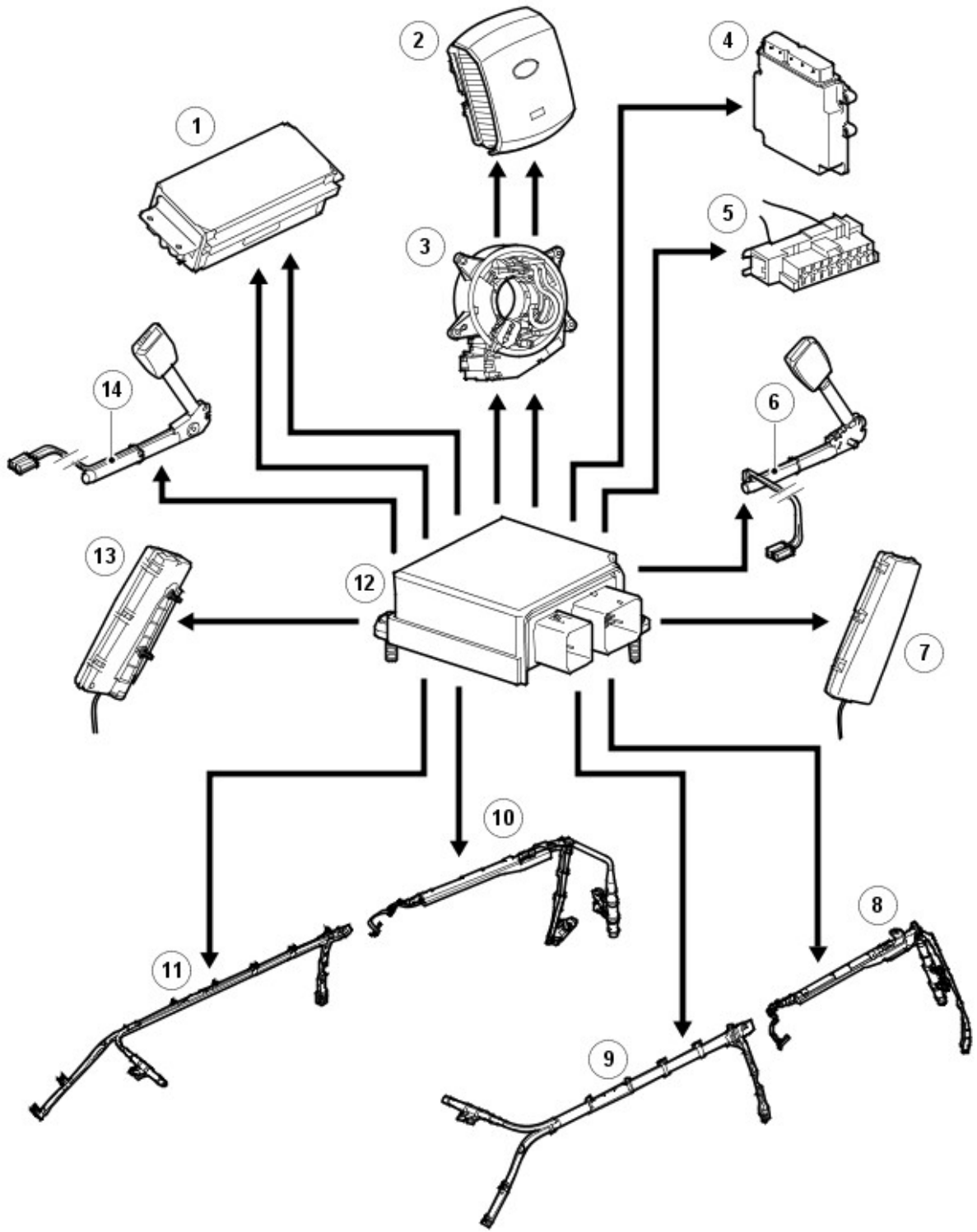
Item	Part Number	Description
1	-	Fusible link 11E, BJB

2	-	Battery
3	-	Left front impact sensor
4	-	Right front impact sensor
5	-	Left side impact sensor
6	-	Right side impact sensor
7	-	Left safety belt buckle switch
8	-	Right safety belt buckle switch
9	-	Instrument cluster
10	-	Safety belt tension sensor
11	-	Occupant classification module
12	-	Pressure pad and sensor
13	-	Seat position sensor
14	-	RCM
15	-	Fuse 9P, CJB
16	-	Ignition switch
17	-	Fuse 68P, CJB
18	-	Passenger air bag deactivation indicator

CONTROL DIAGRAM - SHEET 2 OF 2 (ALL MARKETS)



NOTE: A = Hardwired connections



A →

E47315

Item	Part Number	Description
1	-	Passenger air bag
2	-	Driver air bag
3	-	Clockspring
4	-	ECM
5	-	Diagnostic socket
6	-	Left pretensioner
7	-	Left side air bag
8	-	Left third row side air curtain
9	-	Left first and second row side air curtain
10	-	Right third row side air curtain
11	-	Right first and second row side air curtain

- 12 - RCM
- 13 - Right side air bag
- 14 - Right pretensioner

Supplemental Restraint System - Air Bag Supplemental Restraint System (SRS)

Description and Operation



WARNING: Do not fit a standard safety belt to an armoured vehicle. The armoured vehicle safety belts are the load-limiting type and are designed to be used without any supplementary restraint systems.

The SRS (supplemental restraint system) has been deactivated. This has been achieved by re-programming the RCM (restraints control module) to 'plant' mode. If a new RCM is required, the unit will need to be re-programmed using the Land Rover approved diagnostic system.



NOTE: The SRS warning indicator in the instrument cluster is permanently illuminated on the armoured vehicle, this does not indicate a fault with the system.

The change to the SRS has meant that although still fitted the safety belt pre-tensioners have been inhibited. All other SRS pyrotechnic devices have been removed from the armoured vehicle.

Supplemental Restraint System - Air Bag Supplemental Restraint System (SRS)

Diagnosis and Testing

Principle of Operation

For a detailed description of the air bag supplemental restraint system and operation, refer to the relevant Description and Operation section of the workshop manual. REFER to: Air Bag and Safety Belt Pretensioner Supplemental Restraint System (SRS) (501-20 Supplemental Restraint System, Description and Operation).

Safety Information

WARNINGS:



To avoid accidental deployment the back-up power supply must be depleted before beginning any work on the SRS system or its components. Failure to follow this instruction may result in personal injury.



Do not use a multimeter to probe an SRS actuator. It is possible for the power from the multimeter battery to trigger the activation of the actuator. Failure to follow this instruction may result in personal injury.

NOTES:



It is advisable not to use a cellular phone or to have a cellular phone in close proximity when working on the SRS system or components.



Given the legal implications of a restraints system failure, harness repairs to Air Bag module circuits are not acceptable. Where the text refers to "REPAIR the circuit", this will normally mean the replacement of a harness.

Power supply depletion

Before beginning any work on the SRS system or related components:

1. Remove the ignition key.
2. Disconnect the battery leads, ground first.
3. Wait 2 minutes for the power circuit to discharge.

There are comprehensive instructions on the correct procedures for SRS system repairs in the workshop manual. Refer to the relevant section of the workshop manual.

Inspection and Verification



CAUTION: Diagnosis by substitution from a donor vehicle is **NOT** acceptable. Substitution of control modules does not guarantee confirmation of a fault and may also cause additional faults in the vehicle being checked and/or the donor vehicle.



NOTE: Check and rectify basic faults before beginning diagnostic routines involving pinpoint tests.

1. Verify the customer concern.
 - Confirm the function of the warning lamp (if the warning lamp is inoperative, system faults will be signaled by an audible chime)
2. Visually inspect for obvious signs of mechanical or electrical damage.

Visual Inspection

Mechanical	Electrical
<ul style="list-style-type: none"> • Check for the installation of non-standard accessories which may affect or obstruct the function of the system • Check the condition of trim, etc at the SRS system components • Sensor(s) • Pretensioner(s) • Air bag module(s) • Occupant detection/classification sensors • Seat position sensor 	<ul style="list-style-type: none"> • Fuses • Wiring harness • Confirm all electrical connector(s) are engaged correctly on the air bag circuits • Confirm the restraints control module (RCM) is correctly installed • Warning lamp bulb(s) • Impact sensor(s) • Buckle sensor(s) • Pretensioner(s) • Air bag module(s) • Air bag deactivation switch • Air bag deactivation warning lamp • Occupant detection/classification sensors



- Seat position sensor
- Clockspring



3. If an obvious cause for an observed or reported concern is found, correct the cause (if possible) before proceeding to the next step.
4. If the cause is not visually evident, check for Diagnostic Trouble Codes (DTCs) and refer to the relevant DTC Index.

Seatbelt Buckle Pre Tensioner Diagnostics



This procedure should be used to aid diagnosis of the following supplementary restraints system (SRS) - buckle pre tensioner (PBP) fault codes

SRS Light Status	DTC
On	B1212-11
On	B1212-12
On	B1212-1A
On	B1212-1B
On	B1213-11
On	B1213-12
On	B1213-1A
On	B1213-1B

PINPOINT TEST A : BUCKLE PRE TENSIONER DIAGNOSTIC	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
A1: DIAGNOSTIC PROCEDURE	
WARNINGS:	
 Prior to any work on the SRS system the vehicle battery must be disconnected system the vehicle battery must be disconnected	
 Please wait for 120 seconds to allow the air bag deployment energy reserve to dissipate	
	1 Check location of harness fly-lead ensuring there is no risk snagging and sufficient strain relief during full seat travel
	2 Disconnect under-seat buckle pre tensioner connectors
	3 Check connector for water ingress or signs of corrosion (white/green residue)
	4 Check for debris in female connector and remove as required
	5 Check for debris in male harness end connector and remove
	6 Check that male connector pins are secure and in good condition
	7 Check that all connector terminals are clean secure and in good condition
	8 Reconnect the connector <ul style="list-style-type: none"> • An audible click should be heard confirming security
	9 Check actuator harness fly-lead is connected and correctly routed
	10 Reconnect the vehicle battery
	11 Clear the DTC, cycle the ignition state off / on wait 30 seconds and re-test
	12 To confirm repair. Whilst sitting in seat, retest as follows: <ul style="list-style-type: none"> • Seat fully up - move fully backwards and forwards • Seat fully down - move fully backwards and forwards
	Is the warning lamp illuminated? Yes GO to Pinpoint Test B . No No further action required

PINPOINT TEST B : BUCKLE PRE TENSIONER DIAGNOSTIC	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
B1: DIAGNOSTIC PROCEDURE	
WARNINGS:	
 Prior to any work on the SRS system the vehicle battery must be disconnected system the vehicle battery must be disconnected	
 Please wait for 120 seconds to allow the air bag deployment energy reserve to dissipate	
	1 Check routing and condition of harness along buckle pre tensioner tube

	<ul style="list-style-type: none"> • Pre 10 model year : x2 cable tie & tape • Post 10 model year : Cradle
	2 Ensure harness is in good condition with no damage
	3 Ensure harness is securely routed
	4 Reconnect the vehicle battery
	5 Clear the DTC, cycle the ignition state off / on wait 30 seconds and re-test
	6 To confirm repair. Whilst sitting in seat, retest as follows: <ul style="list-style-type: none"> • Seat fully up - move fully backwards and forwards • Seat fully down - move fully backwards and forwards
	Is the warning lamp illuminated? Yes GO to Pinpoint Test C . No No further action required

PINPOINT TEST C : BUCKLE PRE TENSIONER DIAGNOSTIC	
TEST CONDITIONS	DETAILS/RESULTS/ACTIONS
C1: DIAGNOSTIC PROCEDURE	
WARNINGS:	
 Prior to any work on the SRS system the vehicle battery must be disconnected system the vehicle battery must be disconnected	
 Please wait for 120 seconds to allow the air bag deployment energy reserve to dissipate	
	1 Remove seat and check routing and condition of under-seat harness
	2 Ensure harness is in good condition with no damage
	3 Ensure harness is securely routed
	4 Ensure all fir tree clips and cable ties are correctly installed
	5 Reinstall seat
	6 Ensure harness is securely routed
	7 Reconnect the vehicle battery
	8 Clear the DTC, cycle the ignition state off / on wait 30 seconds and re-test
	9 To confirm repair. Whilst sitting in seat, retest as follows: <ul style="list-style-type: none"> • Seat fully up - move fully backwards and forwards • Seat fully down - move fully backwards and forwards
	Is the warning lamp illuminated? Yes Install new component No No further action required

DTC Index

For a list of Diagnostic Trouble Codes (DTCs) that could be logged on this vehicle, please refer to Section 100-00.


REFER to: Diagnostic Trouble Code (DTC) Index - DTC: Restraints Control Module (RCM) (100-00 General Information, Description and Operation) /

Diagnostic Trouble Code (DTC) Index - DTC: Occupant Classification System (OCS) (100-00 General Information, Description and Operation).

Supplemental Restraint System - Driver Air Bag Module

Removal and Installation

Special Tool(s)

 <p>501-106</p> <p>E48291</p>	<p>Airbag module remover 501-106</p>
--	--

Removal

WARNINGS:



It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.

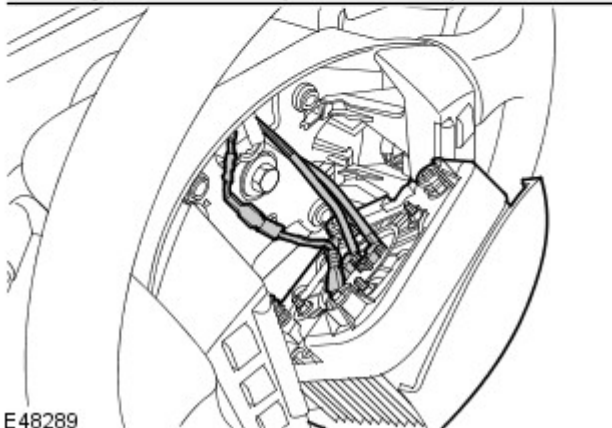
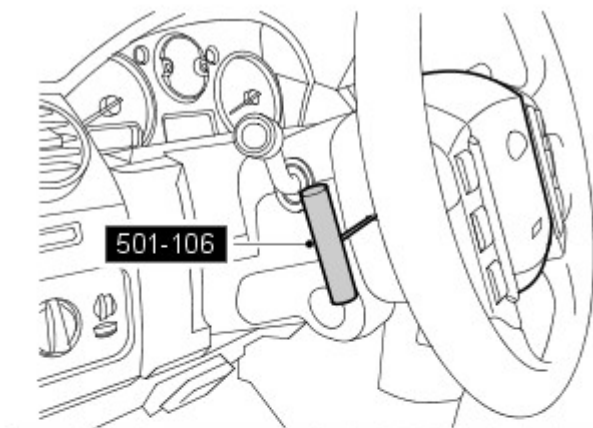


Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.



NOTE: If the SRS component is to be replaced, the bar code of the new unit must be recorded.


1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
3. Remove the driver air bag module.
 - Using the special tool, release the clip.
 - Repeat the above procedure for the other side.
 - Disconnect the ground cable.
 - Release the clips and disconnect the 2 electrical connectors.



E48289

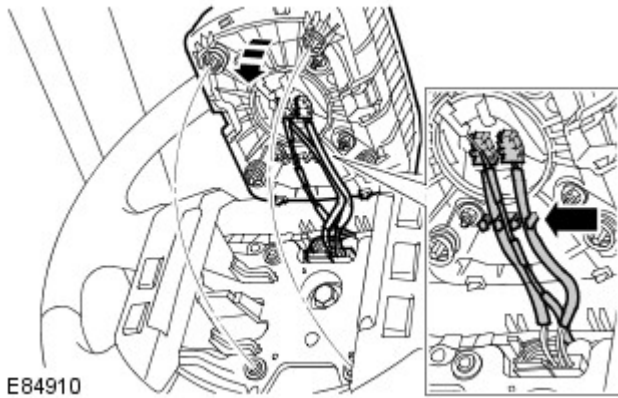
Installation


1.  **WARNING:** The SRS electrical connectors are unique. **DO NOT** force, or attempt to connect electrical connectors to the wrong sockets.

 **CAUTION:** Make sure the cables/harnesses are not twisted before connecting them to the airbag module. Once connected, do not rotate the air bag module as this will cause the wires to twist, which can lead to harness damage and SRS faults.

Attach the driver air bag module.

- Connect the ground cable.
- Connect the electrical connectors.



2.  **WARNING:** Driver air bag module installation can be confirmed by hearing 2 audible clicks, 1 for each spring. The module edges should also be flush with the steering wheel.

Install the driver air bag module.

- Install top edge of module, then hinge upwards and make sure wires are connected to clips.
- Make sure the wires are not trapped behind the module.
- Hold wires in place while hinging module closed.
- Align the locating pins and springs.

Supplemental Restraint System - Passenger Air Bag Module

Removal and Installation

Removal

WARNINGS:



It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.

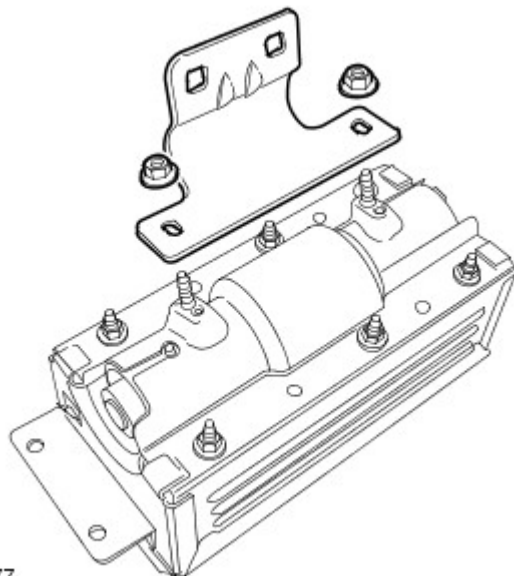



Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
3. Remove the instrument panel upper section.
For additional information, refer to: Instrument Panel Upper Section (501-12, Description and Operation).



4. Remove the passenger air bag module.
 - Remove the 4 nuts.



5.  **NOTE:** Do not disassemble further if the component is removed for access only.

Remove the passenger air bag module bracket.

- Remove the 2 nuts.

Installation

1. Install the passenger air bag module bracket.
 - Tighten the nuts to 10 Nm (7 lb.ft).
2. Install the passenger air bag module.
 - Tighten the nuts to 10 Nm (7 lb.ft).

3. Install the instrument panel upper section.
For additional information, refer to: Instrument Panel Upper Section (501-12, Description and Operation).

Supplemental Restraint System - Rear Side Air Curtain Module

Removal and Installation

Removal

WARNINGS:



It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.

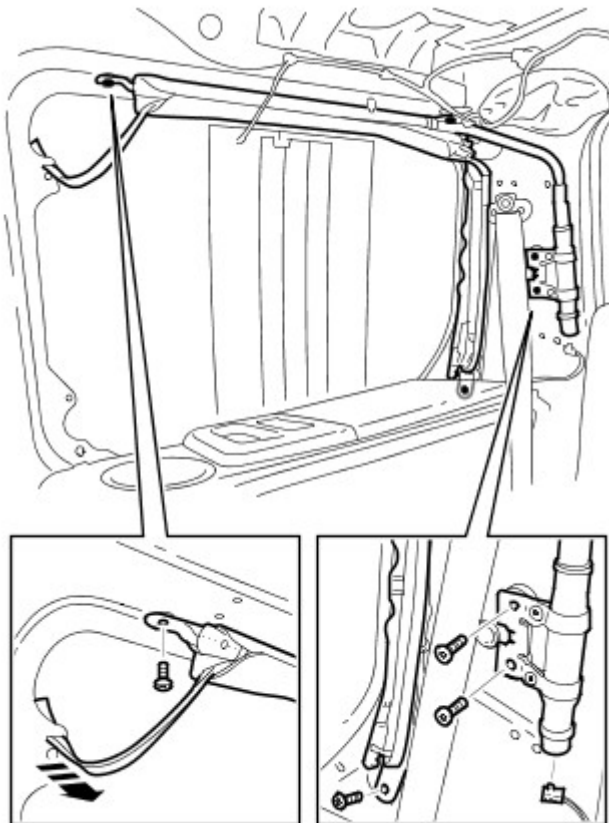


Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.



NOTE: If the SRS component is to be replaced, the bar code of the new unit must be recorded.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
3. Remove the headliner.
For additional information, refer to: Headliner (501-05, Removal and Installation).
4. Remove the side air curtain module.
 - Disconnect the electrical connector.
 - Remove the 5 Torx screws.
 - Release the retaining strap.



E 49973

Installation

1. Install the side air curtain module.
 - Tighten the Torx screws to 10 Nm (7 lb.ft).
 - Connect the electrical connector.
 - Secure the retaining strap.
2. Install the headliner.
For additional information, refer to: Headliner (501-05, Removal and Installation).

3. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

Supplemental Restraint System - Front Impact Severity Sensor

Removal and Installation

Removal

WARNINGS:



It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.



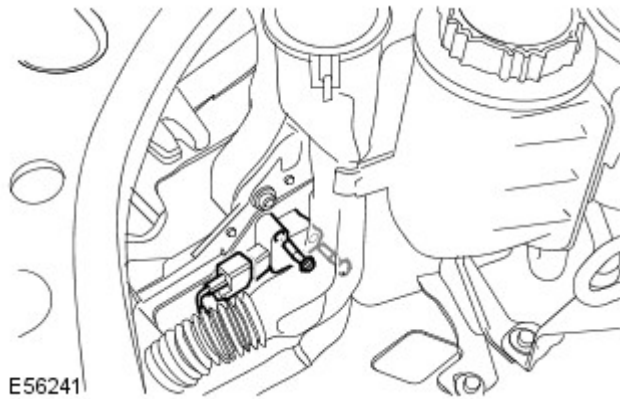
Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.



NOTE: If the SRS component is to be replaced, the bar code of the new unit must be recorded.

1. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
2. Remove the headlamp assembly.
For additional information, refer to: Headlamp Assembly (417-01, Removal and Installation).

3. Remove the front impact sensor.
 - Disconnect the electrical connector.
 - Remove the 2 Torx bolts.



Installation

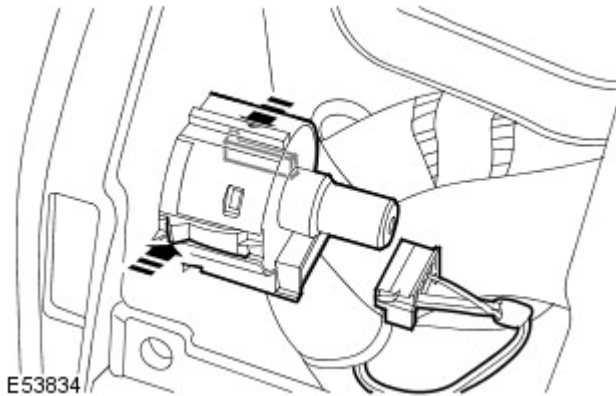
1. Install the front impact sensor.
 - Tighten the Torx bolts to 8 Nm (6 lb.ft).
 - Connect the electrical connector.
2. Install the headlamp assembly.
For additional information, refer to: Headlamp Assembly (417-01, Removal and Installation).

Supplemental Restraint System - Passenger Air Bag Deactivation (PAD) Switch

Removal and Installation

Removal

1. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
2. Remove the passenger side register trim panel.
For additional information, refer to: Passenger Side Register Trim Panel (412-01, Removal and Installation).
3. Remove the PAD switch.
 - Disconnect the electrical connector.
 - Release the 2 clips.



E53834

Installation

1. Install the PAD switch.
 - Connect the electrical connector.
 - Secure with the clips.
2. Install the passenger side register trim panel.
For additional information, refer to: Passenger Side Register Trim Panel (412-01, Removal and Installation).

Supplemental Restraint System - Clockspring

Removal and Installation

Removal

WARNINGS:



It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.



Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.

CAUTIONS:



Make sure the wheels are in the straight-ahead position. Failure to follow this instruction may result in damage to the components.



Correct clockspring alignment can be found by viewing a yellow marker through the window situated on the clockspring face. If the marker is not visible, carefully turn the clockspring. If the turning force increases before the marker is visible, reverse the direction to avoid component damage.

NOTES:

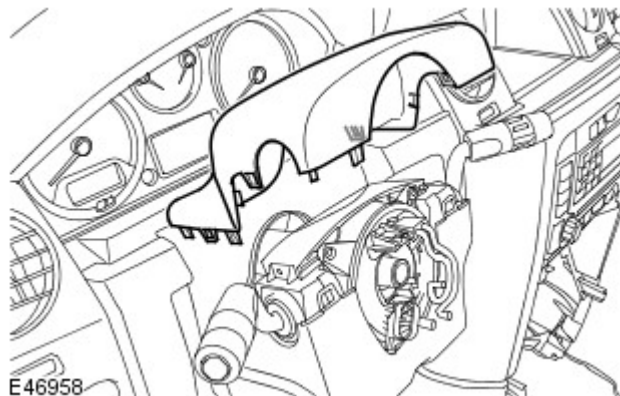


test piece

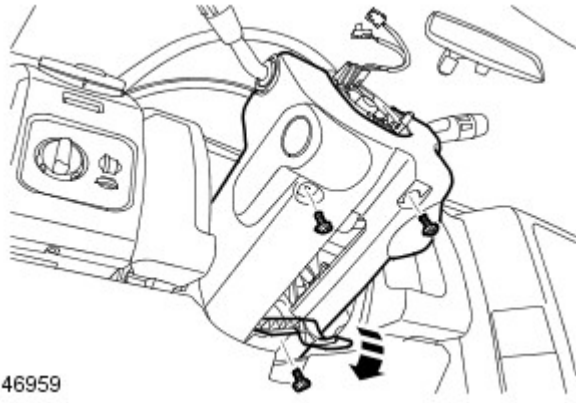


If the SRS component is to be replaced, the bar code of the new unit must be recorded.

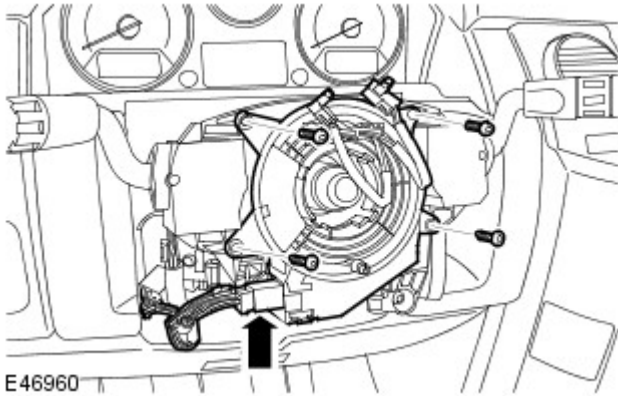
1. Fully extend the steering column for access.
2. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
3. Remove the steering wheel.
For additional information, refer to: Steering Wheel (211-04, Removal and Installation).
4. Remove the steering column upper shroud.
 - Release the 6 clips.




5. Remove the steering column lower shroud.
 - Remove the 3 Torx screws.
 - Release the steering column adjustment lever.



E46959




E46960

6.  CAUTION: Do not dismantle the clockspring, it has no servicable parts and must be replaced as a complete assembly.

Remove the clockspring.

- Disconnect the 2 electrical connectors.
- Remove the 4 screws.

Installation

1.  CAUTION: Correct clockspring alignment can be found by viewing a yellow marker through the window situated on the clockspring face. If the marker is not visible, carefully turn the clockspring. If the turning force increases before the marker is visible, reverse the direction to avoid component damage.

To install, reverse the removal procedure.

Supplemental Restraint System - B-Pillar Side Impact Sensor

Removal and Installation

Removal

WARNINGS:



It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.

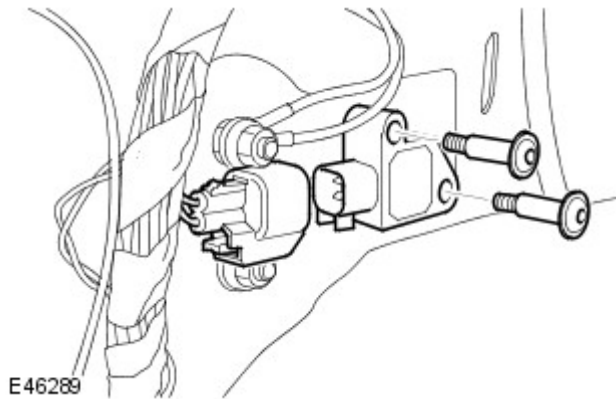


Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.



NOTE: If the SRS component is to be replaced, the bar code of the new unit must be recorded.

1. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
2. Remove the scuff plate trim panel.
For additional information, refer to: Scuff Plate Trim Panel (501-05, Removal and Installation).
3. Remove the side impact sensor.
 - Remove the 2 Torx bolts.
 - Disconnect the electrical connector.



Installation

1. Install the side impact sensor.
 - Connect the electrical connector.
 - Tighten the Torx bolts to 8 Nm (6 lb.ft).
2. Install the scuff plate trim panel.
For additional information, refer to: Scuff Plate Trim Panel (501-05, Removal and Installation).

Supplemental Restraint System - C-Pillar Side Impact Sensor

Removal and Installation

Removal

WARNINGS:



It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.

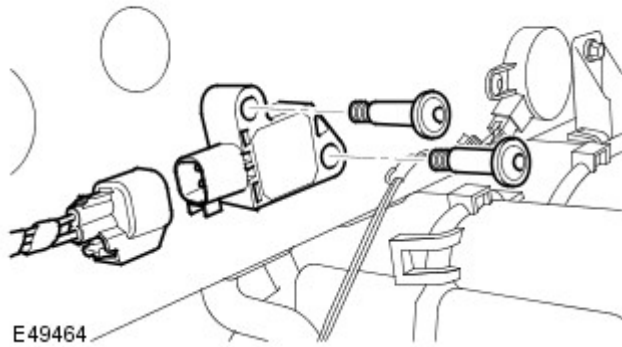


Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.



NOTE: If the SRS component is to be replaced, the bar code of the new unit must be recorded.

1. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
2. Remove the C-pillar lower trim panel.
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).
3. Remove the side impact sensor.
 - Remove the 2 Torx bolts.
 - Disconnect the electrical connector.



Installation

1. Install the side impact sensor.
 - Tighten the Torx bolts to 8 Nm (6 lb.ft).
 - Connect the electrical connector.
2. Install the C-pillar lower trim panel.
For additional information, refer to: C-Pillar Lower Trim Panel (501-05, Removal and Installation).

Supplemental Restraint System - Front Door Side Impact Sensor

Removal and Installation

Removal

WARNINGS:



It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.



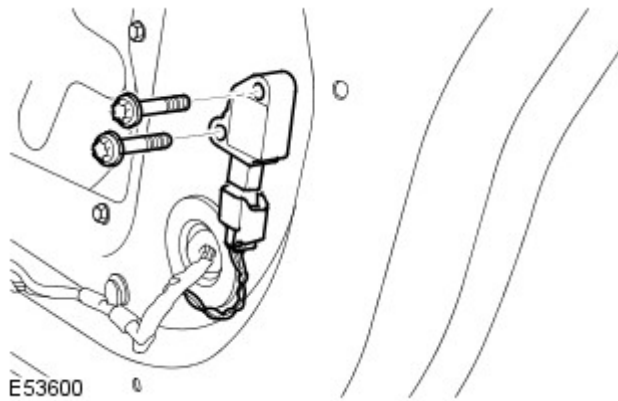
Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.



NOTE: If the SRS component is to be replaced, the bar code of the new unit must be recorded.

1. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
2. Remove the front door trim panel.
For additional information, refer to: Front Door Trim Panel (501-05, Removal and Installation).

3. Remove the front door side impact sensor.
 - Disconnect the electrical connector.
 - Remove the 2 Torx bolts.



Installation

1. Install the front door side impact sensor.
 - Tighten the Torx bolts to 8 Nm (6 lb.ft).
 - Connect the electrical connector.
2. Install the front door trim panel.
For additional information, refer to: Front Door Trim Panel (501-05, Removal and Installation).

Supplemental Restraint System - Side Air Bag Module

Removal and Installation

Removal

WARNINGS:

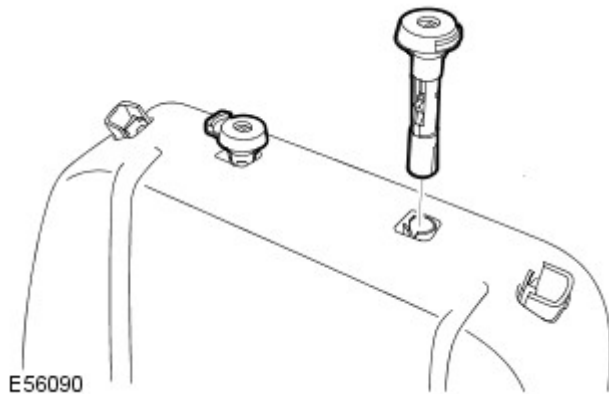


It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.

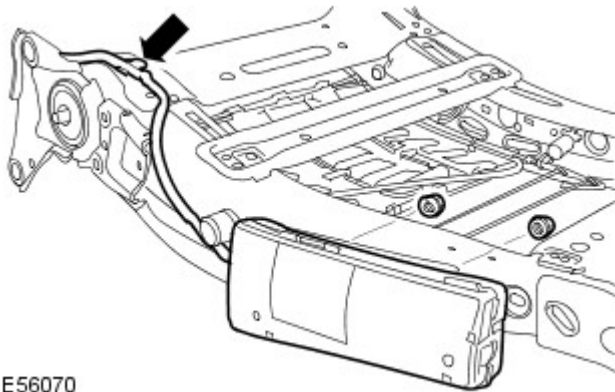


Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.


1. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
2. Remove the front seat backrest cover.
For additional information, refer to: Front Seat Backrest Cover (501-10, Removal and Installation).
3. Remove the front seat backrest pad.
 - Remove the front seat head restraint retaining clips.



E56090



E56070

4.  **NOTE:** If the SRS component is to be replaced, the bar code of the new unit must be recorded.

Remove the side air bag module.

- Release the side air bag module harness.
- Remove the 2 nuts.

Installation

1. Install the side air bag module.
 - Tighten the nuts to 10 Nm (7 lb.ft).
 - Attach the wiring harness.
2. Install the front seat backrest pad.
 - Install the front seat head restraint retaining clips.
3. Install the front seat backrest cover.
For additional information, refer to: Front Seat Backrest Cover (501-10, Removal and Installation).

Supplemental Restraint System - Side Air Curtain Module

Removal and Installation

Removal

WARNINGS:



It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.

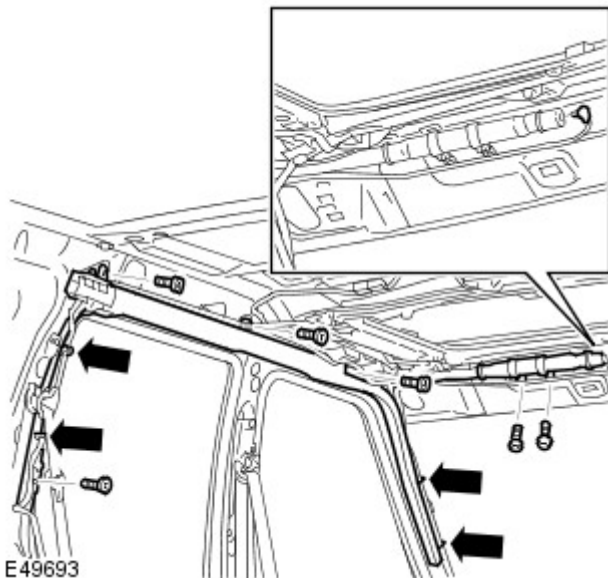


Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.



NOTE: If the SRS component is to be replaced, the bar code of the new unit must be recorded.

1. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
2. Remove the headliner.
For additional information, refer to: Headliner (501-05, Removal and Installation).
3. Release the roof opening panel drain tube from the securing clips.
4. Release the tire deflation wiring harness from securing clips.
5. Remove the side air curtain module.
 - Remove the 8 screws.
 - Remove the 5 Torx screws.
 - Disconnect the electrical connector.



Installation

1. Install the side air curtain module.
 - Tighten the Torx screws to 10 Nm (7 lb.ft).
 - Tighten the screws.
 - Connect the electrical connector.
2. Secure the tire deflation wiring harness into the clips.
3. Secure the roof opening panel drain tube into the clips.
4. Install the headliner.
For additional information, refer to: Headliner (501-05, Removal and Installation).

Supplemental Restraint System - Restraints Control Module (RCM)

Removal and Installation

Removal

WARNINGS:



It is imperative that before any work is undertaken on the SRS system, the appropriate information is read thoroughly.



Always disconnect both battery cables before beginning work on the SRS system. Disconnect the ground cable first. Never reverse connect the battery.

NOTES:

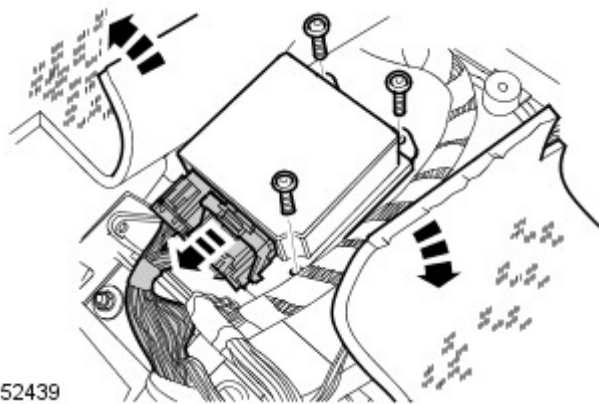


If the restraints control module (RCM) is to be replaced then T4 must be connected and the correct procedures adhered to, prior to battery disconnection.




If the SRS component is to be replaced, the bar code of the new unit must be recorded.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Make the SRS system safe.
For additional information, refer to: Standard Workshop Practices (100-00, Description and Operation).
3. Remove the floor console.
For additional information, refer to: Floor Console (501-12, Removal and Installation).



E52439

4.  **CAUTION:** Make sure the wiring harness is protected when cutting the carpet.

Remove the restraints control module (RCM).

- Cut the carpet for access.
- Disconnect the 2 electrical connectors.
- Remove the 3 Torx screws.

Installation

1. Install the RCM.
 - Tighten the Torx screws to 10 Nm (7 lb.ft).
 - Connect the electrical connectors.
 - Position the carpet.
2. Install the floor console.
For additional information, refer to: Floor Console (501-12, Removal and Installation).
3. Initiate a new RCM using T4.

Supplemental Restraint System - Occupant Classification Sensor

Removal and Installation

Removal



NOTE: The occupant classification sensor is part of the passenger seat cushion. The sensor is only fitted to NAS models.

1. Disconnect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the front seat cushion cover.
For additional information, refer to: Front Seat Cushion Cover (501-10, Removal and Installation).

Installation

1. Install the front seat cushion cover.
For additional information, refer to: Front Seat Cushion Cover (501-10, Removal and Installation).
2. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).
3. Using T4, configure a new occupant classification sensor.

Body Repairs - General Information - Body Repairs

Description and Operation

General Information

Introduction

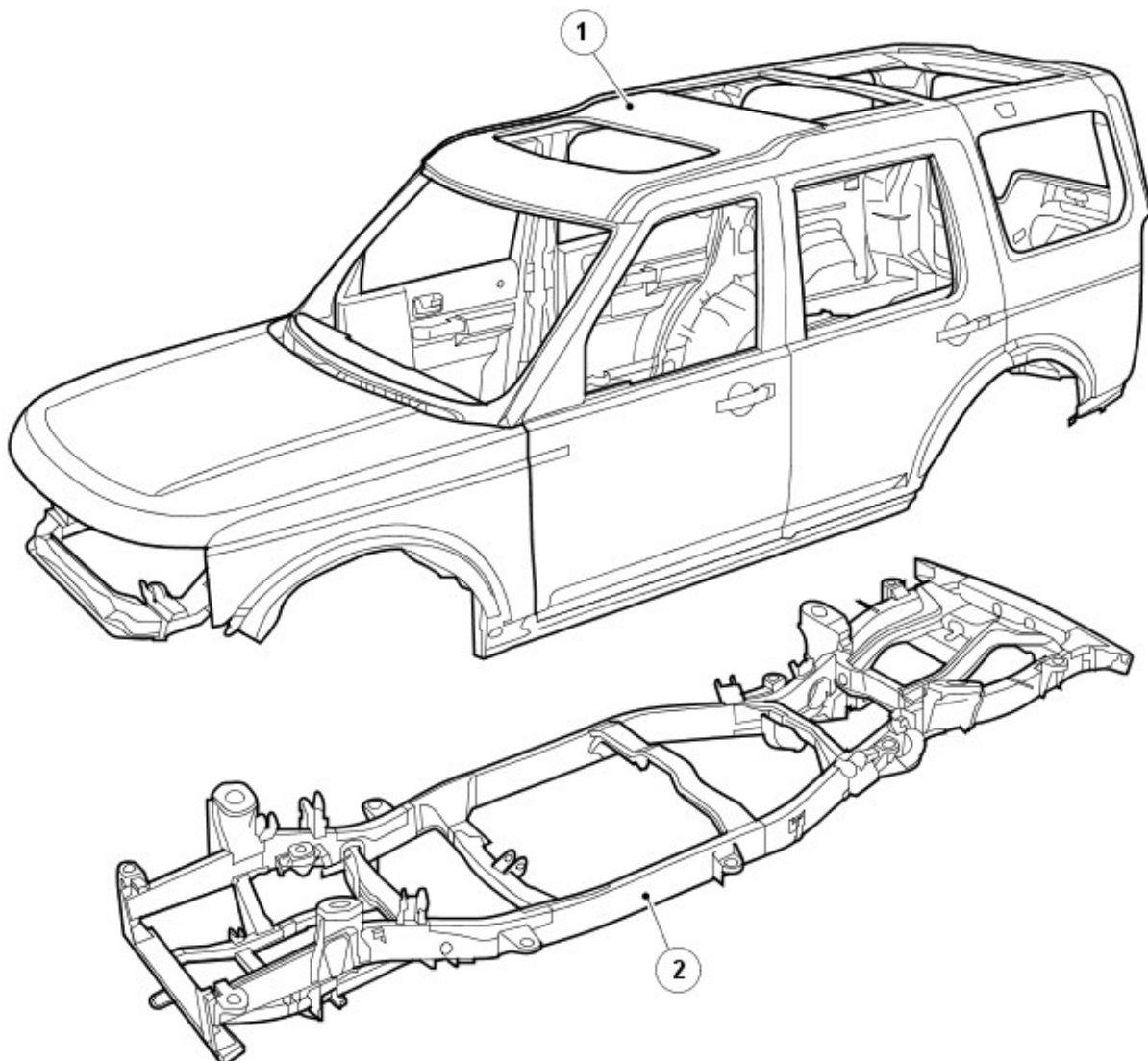
The body plays a significant role in the increasing trend of ever more rapidly changing model variants. The different customer groups are strongly influenced by the design and shape of the body. At the same time the stability of the body plays the most important part in ensuring passenger and driver safety. Lightweight construction, alternative materials, composite materials, plastics and appropriate joining processes are all design features that characterise modern Land Rover vehicle bodies.

In terms of manufacturing technology, modern safety cell bodies can be produced almost without any problems. Land Rover guarantee high quality standards by ensuring that mechanical strength properties are tried and tested in numerous computer simulations, crash tests, by testing materials and by employing sophisticated manufacturing technologies. In the event of repairs it is vital that the production quality standards are upheld. This requires a well-equipped workshop, and places particular emphasis on the qualifications of the workshop technicians. Up-to-date knowledge of current manufacturing technologies and continuous training on new repair methods and techniques are vital for high-quality body repairs. The model-specific repair manuals and the general repair techniques provide valuable support when undertaking body repairs.

Always follow the repair instructions published in this manual. Failure to observe this instruction can result in serious impairment of vehicle safety. All specified safety requirements must be met after the work has been carried out.

Vehicle design

Vehicle design



Item	Part Number	Description
1	-	Body
2	-	Integral body Frame

High Strength Steels

Land Rover vehicles are constructed from a number of different steels, partly to obtain an optimised body (collision, safety, rigidity, fuel economy, etc).

Steels are divided into several groups according to their tensile and yield strength, that is to say the force necessary to bring about plastic deformation of the material.

Yield Summary

Yield is the strength at which the metal changes from elastic to plastic in behaviour, the point of no return.

Tensile Summary

Tensile strength is the breaking strength of a material when subjected to a tensile (stretching) force, the point of no return.

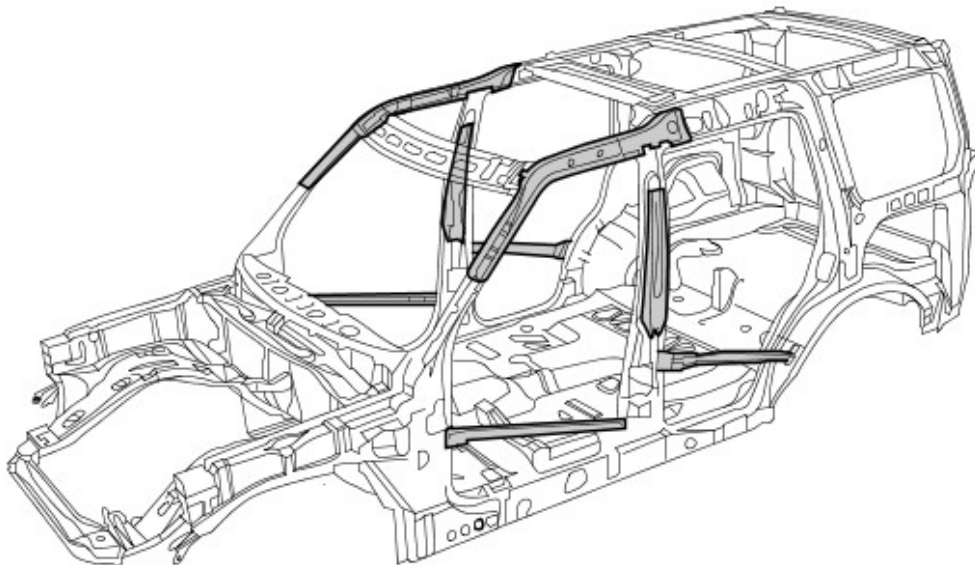
Abbreviation	Steel type	Yield Point
SS	Soft Steel	Maximum Yield point of 220 MPa
DP	Dual Phase Steel	Steel With a Yield Point up to 400 MPa
HS	High Strength Steel	Steel With a Yield Point 220 - 450 MPa
EHS	Extra High Strength Steel	Steel With a Yield Point 450 - 800 MPa
UHS	Ultra High Strength Steel	Steel With a Yield Point up to 1400 MPa

Ultra High Strength

The addition of ultra high strength steel in the A Pillar, B-Pillar and cantrail gives the body greater strength in a front or side impact.

No attempt should be made to straighten ultra high strength steel, due to its brittleness.

Ultra High Strength steel in body structure



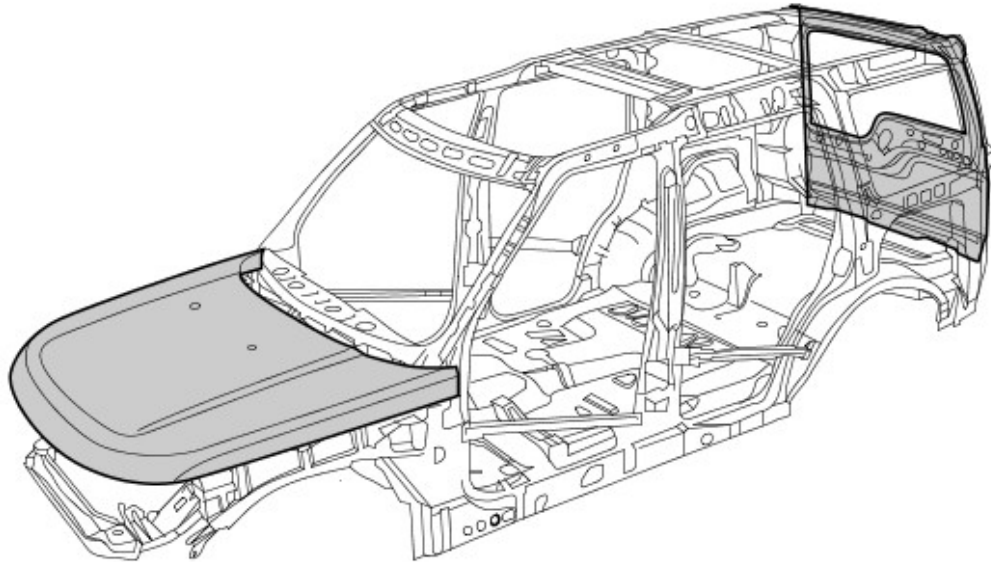
E55726

Aluminium

Aluminium 6000 series is used in the hood, tailgate and liftgate. It is made from magnesium/copper aluminium alloy and is heat treated during manufacturing/paint bake process resulting in a panel with increased strength and dent resistance.

When repairing aluminium you must use tools that have only been used on aluminium and never on steel panels, this is to prevent cross-contamination

Aluminium in body structure



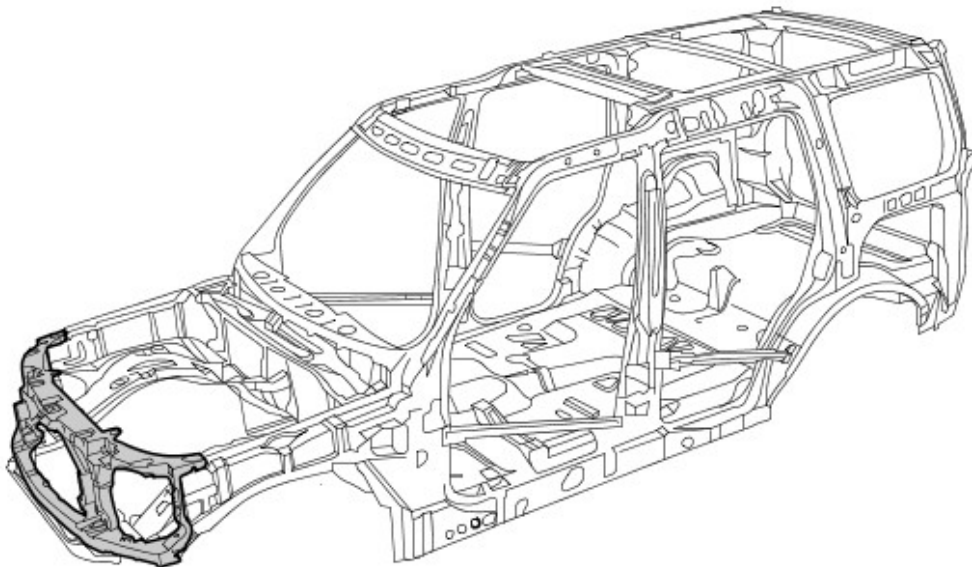
E55727

Magnesium

Magnesium AM60B is used to make the hood latch panel. It has good ductility and energy absorbing properties. It is also used on the instrument panel mounting beam.

No attempt should be made to weld or straighten the hood latch panel and it should be replaced in the event of an accident. If the corrosive coating is damaged it must be repaired using 'Land Rover Low Temperature Anti-Corrosion Coating', service part no VEP 501 840 PMA

Magnesium in body structure



E56195

Accident damage and diagnosis

General notes

Exact diagnosis of the extent of damage enables proper repair planning.

All body repairs must be carried out in accordance with the guidelines in this Body Repair Manual.

The stability and strength properties of the body must be taken into account during body repairs. The body has exactly defined deformation patterns that must not be affected by any repair work.

For instance, the crumple zones absorb the bulk of the impact energy. If any unprofessional repair techniques or methods are used in these areas then this can pose a fundamental threat to vehicle safety.

Hidden damage

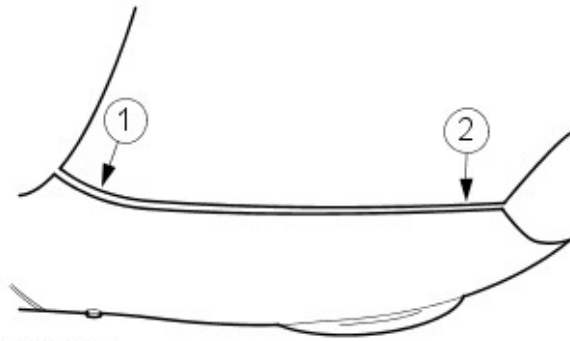
As well as looking at external indicators like flaked off paint, it is vital to check for hidden body damage or deformation that is not visible from the outside. Large attached parts like bumpers and inner fenders often need to be removed to allow accurate assessment of damage to underlying body parts.

Gap dimensions

For additional information, refer to: Body and Frame (501-26, Description and Operation).

Gap dimensions offer another alternative for diagnosis by visual inspection. If any changes or misaligned edges are apparent, then this usually indicates that the dimensions of the affected part are incorrect.

Changes in gap dimension



DEE0003919

Item	Part Number	Description
1	-	Gap too wide
2	-	Gap too small

Planning a repair

The following decisions have to be made before the repairs are started:

- Does the vehicle need to be put on a straightening jig, or can it be straightened by other means?
- Does the body need to be measured?
- Do aggregates like engine or axles need to be removed?



NOTE: It is preferable to repair body parts rather than to renew them, as this keeps the complete body-shell intact.

- Which body parts need to be renewed?
- Which body parts can be repaired?

Obtaining spare parts

The availability of spare parts often determines how easily the body repairs can be carried out. The following procedure is recommended:

- Obtain all the data for the vehicle, including type, vehicle identification number, trim code, engine identification letters, initial registration etc.
- Establish all of the metal parts that need to be renewed.
- Establish all of the attached parts that need to be renewed, including small parts like rivets, clips etc.

Straightening repairs

Straightening repairs are often required to restore the body to its original shape after an accident. This can be done with:

- Alignment jigs
- Universal straightening and measuring jigs

The following points must be followed to ensure that the repairs are carried out professionally and that all the dimensions are correct after the repairs have been carried out.

- Structure:
 - The repair sequence depends on the individual repair plan (taking any necessary disassembly work into account).
 - Clean the attachment areas.
 - Anchor the vehicle free of stress on the relevant system.
 - Support the aggregates to take strain off the body.
 - Decide on at least three measuring/mounting points that are undamaged and as far apart as possible (for basic adjustment).
 - Check the dimensions of the measuring/mounting points.
- Straightening:
 -



NOTE: Check dimensions and gaps continuously during straightening.

A body is always straightened in the opposite direction to that of the impact. Always carry out straightening repairs with the complete body shell assembled (do not cut out any parts beforehand). Carry out the straightening work in several stages. This prevents the risk of over stretching or of welded joints tearing out. During the individual straightening steps, relieve tension by striking with an aluminium hammer while the part is subjected to a tensile load (in the area of pre-determined folding points, dents, welded joints etc.).



CAUTION: Ultra High Strength steel in the A-Pillar, B-Pillar and cantrail cannot be straightened.

Panel Beating

Fundamentals of panel beating

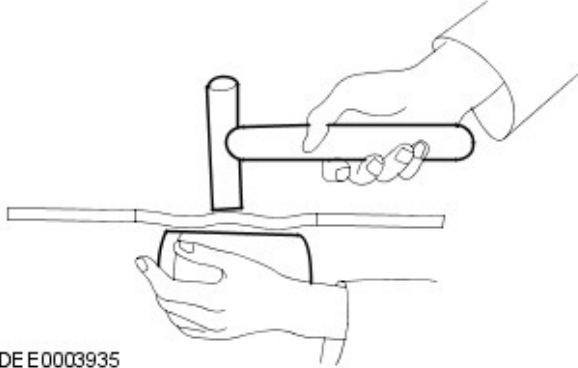
Before carrying out any sectional replacements or complete replacements of body panels, always check carefully whether the damaged panel(s) can be rectified by panel beating. Panel beating is usually the easiest and most economical method of repairing a damaged panel.

Examples of applications of different panel beating techniques:

Aluminium hammer and mallet

- Advantage: Low risk of overstretching the panel.
- Used for repairs of small dents on panels that are accessible from both sides.
- These two panel beating tools are usually used for "finishing repairs".

Fine straightening with an aluminium hammer and a universal dolly



DEE0003935

Sliding hammer

- If the damaged panel is only accessible from the outside, use a sliding hammer to pull it back into shape. The discs or studs needed to mount the sliding hammer are welded onto the bare surface. Dents in the panel can be flattened out using controlled application of the sliding hammer.

Cutting out body parts

Depending on how the parts are joined/connected, different tools are suitable for cutting/separating body parts.

NOTES:



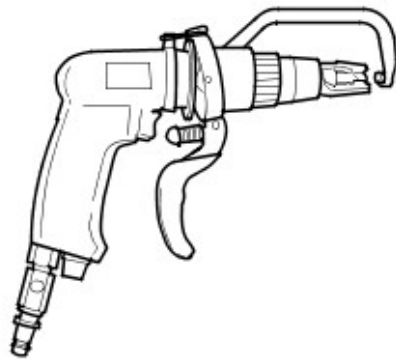
All other parts like interior equipment, window glass etc. must be protected against flying sparks.



Ensure that the milling depth is set correctly to prevent the remaining flange from being weakened.

Spot-weld mill

Spot-weld mill



DEE0003924

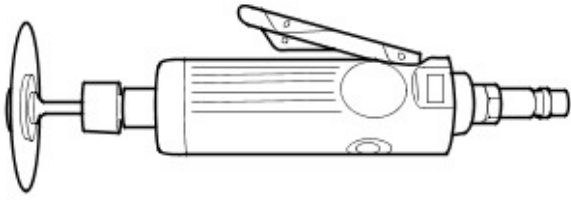
Rod sander



NOTE: Wear protective clothing. Protect any vulnerable body or glass areas against flying sparks. Remove explosive materials from the vicinity.

Any spot welds that are inaccessible for the spot-weld mill (diameter > 8 mm) should be ground out using a rod sander. The same applies to MIG spot welds or seams.

Rod sander



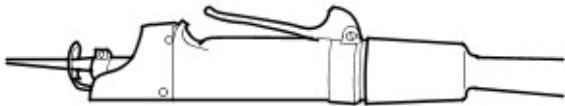
DEE0003925



NOTE: Underlying metal parts, wiring harnesses, hoses etc. must not be damaged - remove them beforehand if necessary.

Body saws are particularly versatile and are therefore very suitable for making severance cuts on body parts.

Short stroke saw

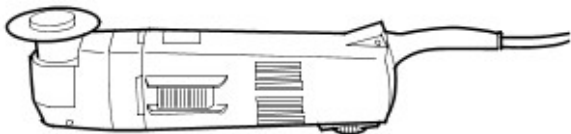


DEE0003926

Reciprocating saw

- In addition to the short stroke saw, the reciprocating saw can be used. With this, it is possible to make narrow and straight cuts to an exact depth.

Reciprocating saw



DEE0003927

Carrying out the repairs

Complete replacement

- In a complete replacement the entire damaged old part is removed at its original joins/connections, and a complete new part is then installed. The following illustration shows a replacement new back panel.

Replacement of a new back panel



E56124

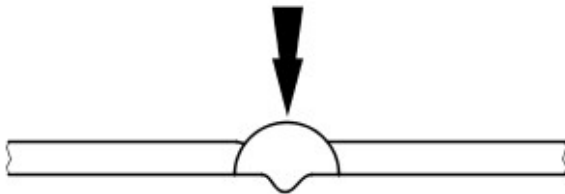
Sectional replacement

- In many cases it makes technical and economical sense to carry out a sectional replacement. The two main considerations are firstly, maintaining the original overall body shell structure and secondly, keeping the repair costs to a minimum.

The main method for sectional replacement:

- Butt joints
- New part and old part are joined with a continuous MIG weld seam.
- Butt joints are most commonly used for sectional replacements on members and pillars, or on short severance cuts.

Butt joint



DEE0003929



NOTE: The severance cut should always be kept as short as possible on sectional replacement. Only cut at the severance lines shown in the repair chapters.

Do not make any cuts near reinforcements or pre-determined folding lines.

- Prepare parts remaining on the vehicle / new parts.
 - Reshape the adjoining surface of any dented body parts that are to remain on the vehicle using a hammer and a counterhold (ensure that the old part matches the shape of the new part). Grind off left over spot welds or seams with a suitable tool.
 - Cut the new parts to shape.
 - If necessary punch or drill holes for mig plug welding.
 -



NOTE: Do not use a welding torch to remove paint residue (the heat could cause the metal to deform).

Prepare all joining flanges to a bright metal finish on both sides. Do not use an angle grinder for this purpose (this could weaken the metal and damage the zinc layer). Suitable tools: rotating wire brush, belt sander or plastic disc.

- Apply welding primer liberally to all weld flanges.
- The primer must be well stirred or shaken before use.



NOTE: When using aerosols, take care not to contaminate adjacent parts with spray mist.

fitting the new part.

It must be ensured that the new part fits exactly to the specified dimensions, to help this it is recommended to use such equipment as:

- Alignment jig
- Universal measuring system
- Jig system
- Ruler or tape measure

Any attached body parts that require accurate alignment and fitting must be incorporated in this step; for instance bumpers, seals, headlamps, rear lamps and lock assembly components. If this is not done carefully it may result in water leaks, wind noises and substantial follow-on work.

Ensure that edges line up with adjacent parts and check that gaps are consistent (compare left and right-hand sides). Make sure that the shape of the vehicle is retained.

Secure the new part



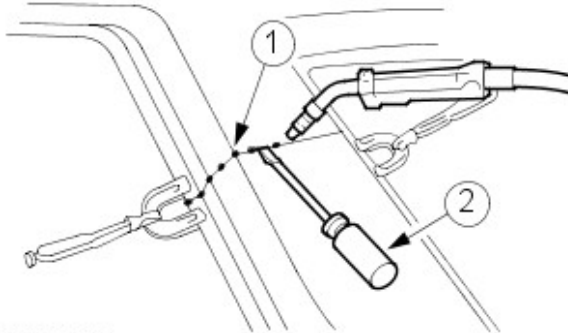
NOTE: The need for subsequent follow-on work can be significantly reduced if aligning and tack-welding are carried out with due care.

Depending on accessibility the following methods for securing are available:

- Grip pliers (set of)
- Screw clamp (set of)
- Self-tapping screws
- Tack welds

Using a suitable tool ensure that the edges of sectional replacements of profiled parts line up. The edge is then tack welded to ensure that it lines up.

Aligning and tack weld



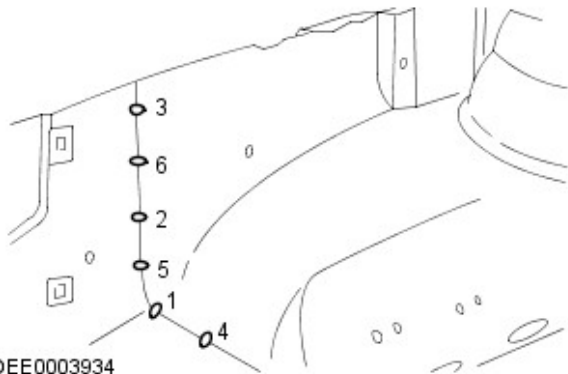
DEE 0003933

Item	Part Number	Description
1	-	Tack welds
2	-	Using a suitable tool to align

Longer joints are usually tack welded to prevent the panel from warping. It is important to carry out the tack welds in the correct sequence (see diagram).

Weld in the new part following the instructions in the repair manual.

Correct tack welding sequence



DEE0003934

Safety measures

The electronic control modules (ECM) fitted to vehicles make it advisable to follow suitable precautions prior to carrying out welding repair operations. Harsh conditions of heat and vibration may be generated during these operations which could cause damage to the modules. In particular, it is essential to follow the appropriate precautions when disconnecting or removing the airbag RCM.

For additional information, refer to: Specifications (501-20B, Specifications).

Do not allow electronic modules or lines to come into contact with the ground connection or the welding electrode.

Connect the ground connection of the electrical welder directly to the part that is to be welded. Ensure that there are no electrically insulating parts between the ground connection and the welding point.

Resistance spot welding

Where resistance spot welds have been used in production, they must be reproduced with new spot welds in replacement where possible. All such reproduction spot welds should be spaced 25 to 30mm apart.

Setting up the equipment and co-ordinating the welding parameters

Equipment:

- Follow the equipment manufacturer's instructions for the equipment settings.

- Select the correct electrode arms (as short as possible).
- Align the electrode arms and tips exactly.
- Electrode tips should be convex (rough shaping with a file, fine shaping with a sanding block).

Body:

- Ensure that the flanges to be joined lie perfectly flat to one another.
- Prepare a bare metal joint surface (inside and outside).

Notes on technique/method:

- Carry out a test weld on a sample piece of the material coated in welding paste.
- If any metal parts are located between the electrode arms then there will be a loss of induction and therefore power (adjust current setting).
- The power needs to be adjusted for high and ultra high-strength steel.
- Repeated welding on old welding points often leads to poor quality welds.
- Keep the electrode tips as near as possible to an angle of 90° to the contact surface.
- The electrodes work best if their shape is convex. Clean the contact surface of the electrodes regularly.

Resistance spot welding panels where the total thickness is 3 mm or more

For all repairs to modern Land Rover vehicles, spot-welding equipment should be suitable for reliable welding of zinc-plated, high-strength and high-tensile steels in three or more layers, up to 5 mm total thickness. If these requirements are not fulfilled, plug welding must be used for safety reasons. The electrical specifications (current, resistance, heat) of the spot-welding equipment have different validity, depending upon the type of equipment. Therefore, it is essential that the equipment manufacturer's instructions are observed with regard to the actual welding performance.

MIG / MAG welding

Setting up the equipment and co-ordinating the welding parameters

Any joins that are MIG/MAG welded in production must also be MIG/MAG welded during repairs. Also during repairs, some resistance spot welds need to be replaced by plug welds.

If access is difficult, or if a suitably powerful spot welder (see above) for total panel thicknesses of 3 mm or more is not available, resistance spot welding must be partially replaced by plug welding during repairs. In this case, the increased time needed and the correspondingly more demanding corrosion protection requirements, must be taken into account.

Welding repairs can only be carried out properly if the equipment is set up correctly and all the welding parameters are co-ordinated.

Equipment:

- Set up the equipment as directed by the manufacturer.
- The hoses must be untwisted.
- The core must be free of abraded rod particles.
- The gas and current nozzles must be free of slag and scale residue.
- Pay attention to the quality of the welding wire and the throughput of gas.

Body:

- Ensure that the joint surface is correct.
- Prepare a bare metal joint surface.
- Maintain the correct gaps (formation of roots).

Notes on technique/method:

-

NOTES:



The increased application of heat during MIG welding destroys the welding primer/zinc layer over a much larger area than during resistance spot welding, as a result of which much more care needs to be taken when applying anti-corrosion protection afterwards.

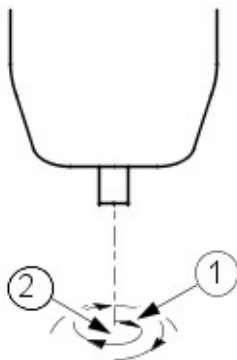


A test weld should always be carried out to ensure that the welded joint is not just a surface connection.

Attach the ground cable right next to the welding point (ensure that good contact is made).

- During plug welding start welding on the lower panel to ensure adequate penetration.

Plug welding



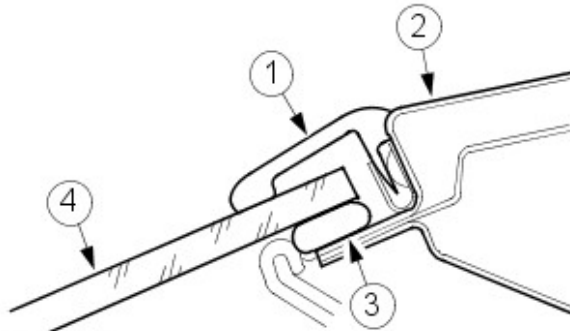
DEE0003936

Item	Part Number	Description
1	-	Welding direction: circular pattern working from the inside outwards

Bonded glazing

- The windscreen, side and rear windows are bonded directly onto the window frames on the body and liftgate.
- The windows are bonded primarily for reasons of adhesive strength. Bonded glazing provides additional torsional stiffness to the body.

Adhesive bonding of bonded windows



DEE0003938

Item	Part Number	Description
1	-	Rubber strip
2	-	Window frame
3	-	Adhesive
4	-	Window glass

Removing and installing bonded windows

Safety measures

The following safety measures must always be followed to prevent personal injury:

- Wear protective gloves.
- Wear protective goggles.

Preparations

Before cutting out a bonded window, undo and remove any attached parts in the cutting area that are at risk, e.g. trim panels and decorative strips, as well as all electrical connections.

Mask any painted areas that are adjacent to the window.

Cut off any surplus adhesive, as this makes it easier to cut out the window.

Secure vertical windows against dropping out.

Cutting out the window

Cut into the adhesive bead at easily accessible points using the cutting tool.

Carefully guide the cutting tool around the window, cutting through the adhesive bead.

Avoid touching the window frame and the body flange.

Use cup suction tools to lift the cut-out window out of the window aperture.

General preparations for bonding

Follow the manufacturer's instructions.

Cut back the remaining adhesive bead on the metal flange to a residual height of about 1mm. Do not touch or clean the cut surface afterwards.

Carefully rectify any paint damage (apply primer and top coat).

Renew the window stops as necessary.

Bonding the window glass

Apply an even bead of adhesive to the window or to the body flange.

Insert the window glass into the window aperture and centre it (2 technicians required).

Check the gaps.



NOTE: Open the windows and doors while the window is left to dry and do not move the vehicle (slamming doors creates excess pressure which could cause the window to become loose).

Use adhesive tape to prevent the window from falling out or slipping.

Finishing operations

Reconnect all electrical connections and check that the components operate correctly.

Install the attached parts and check that the fit is accurate and secure.

- Carry out a visual inspection to ensure that the gaps and joints are even.

Thoroughly clean the window glass.

Protective equipment and safety at work

Various safety measures and legal requirements must be met when carrying out repairs. All regulations

relating to health and safety at work must be followed.

Welding safety precautions

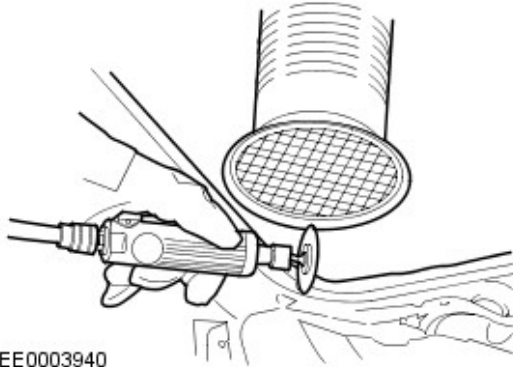
The following safety precautions must be observed to prevent the risk of personal injury:

- Safety hood (face protection)
- Welding shield
- Safety gloves
- Safety shoes
- Extraction unit for welding smoke

Welding should always be carried out in well ventilated areas. A fire extinguisher must also always be within reach.

General body repair safety measures

Extraction unit



DEE0003940

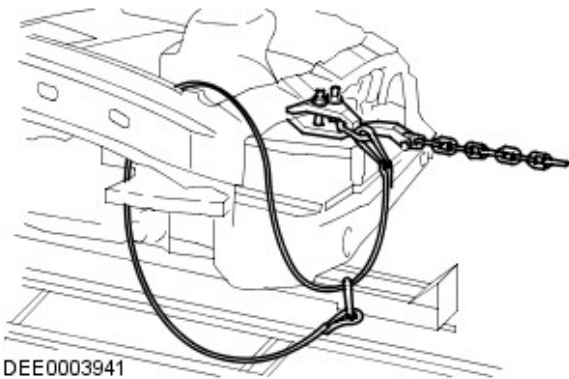
Sealing compound, underbody protection etc. must **not** be burned off with a naked flame. This would produce toxic gases. If for instance PVC is burned, then gases containing hydrochloric acid are produced. For this reason a suitable extraction unit should always be used when performing grinding, welding or soldering work. Always ensure good ventilation when working with materials that contain solvents, wear breathing equipment and use an extraction unit.

Ear defenders should always be worn when cutting, grinding or straightening metal, as the noise levels can reach or even exceed 85 - 90 dB(A).

When removing components from a vehicle mounted on a lifting ramp, watch out for a shift in its centre-of-gravity. When first placing the vehicle on the ramp, take into account that it may need to be secured against tipping over.

Chains and chain clamps must be secured with safety ropes during straightening work.

Safety rope



DEE0003941

Paint Preparation

Paint repairs

Before carrying out paintwork repairs, clean the vehicle thoroughly using either a steam cleaner or high pressure washer.

Wash locally repaired areas using a mild water-mixable detergent and wipe them clean with solvent, immediately before paint application.

Ensure damaged paintwork which has led to exposed metal is abraded until the metal is clean, extending beyond the area of the original damage. Treat the bare metal with an etch phosphate to remove all traces of rust and to provide a key for new paint coats. Re-treat the affected area using either a separate acid-etch primer and two pack surfacer or an integrated etch primer/filler, and follow with a two pack paint system. Treat those surfaces not receiving paint using an approved cavity wax, following paint operations

CAUTIONS:



When preparing bumpers for painting, ensure the PDC sensors are not damaged. Only remove the clear coat if

possible. When painting the PDC sensors, do not apply excessive layers of paint as this can hinder the performance of the sensors.



When heat curing paint repairs, the temperature must not exceed 65°C (149°F). Temperature above this figure will cause the reflective elements within the headlamps and tail lamps to distort and may damage other components.

Body Repairs - Corrosion Protection - Corrosion Protection

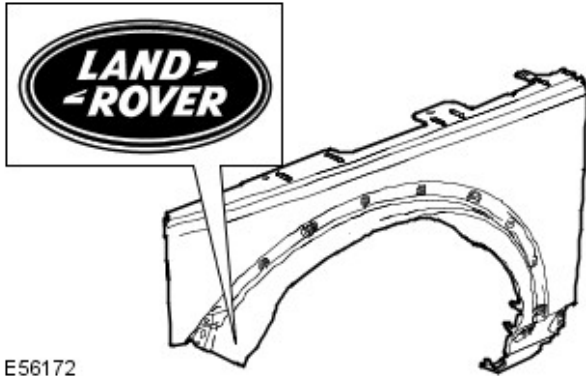
Description and Operation

General

The corrosion protection provided in production must be carefully maintained and/or reproduced during and after body repair work. It is only then that the long-term warranty against penetrative rust damage can be assured.

Only Land Rover original bodywork components and Land Rover approved repair materials (sealer, paint etc.), are to be used for bodywork repairs.

Land Rover original parts



E56172

All Land Rover bodywork components have a cathodic base coating. Individual bodywork components are zinc plated on one or both sides (in different areas depending on vehicle model).

Together with elastic paint coating, this guarantees an optimum, highly resistant protection against corrosion caused by the impact of small objects such as gravel.



NOTE: If possible, the individual protective layers (zinc, cathodic base coat) on Land Rover bodywork components must not be damaged or destroyed by sanding or other mechanical operations.

If hairline cracks at "bodywork connection areas" appear after reshaping work (e.g. at door hinges), it must be ensured that the corrosion protection provided in production is recreated. The complete paint covering must be re-created if necessary. The same applies to reshaping work on heavily profiled bodywork components (e.g. floor pan). Renew or touch-up the paint coating, sealing beads and underbody protection as necessary.

After repair, any interior surfaces which are no longer visible or accessible must be primed before cavity wax is applied. To be certain of an even coating on inner surfaces, careful application of spray (twice, with drying time in-between) must be carried out throughout the whole cavity.

If bodywork panels are strongly heated during repair work, this will invariably result in damage to or even destruction of the applied corrosion protection material. The effectiveness of the cavity protection material is reduced if heating occurs. Reworking of the affected areas is therefore vital.

Welded areas should be made good before corrosion protection is applied.

The corrosion protection measures to be taken when bodywork components are renewed are described on the following pages.

Corrosion protection of new components

All new components must be inspected for transport or storage damage such as scratches or dents. The following operations may be necessary, depending on the extent of damage:

Undamaged new component

- Do not grind the cathodic dip primer.
- Thoroughly clean with silicone remover and rob dry.

Slightly damaged new component

- Sand out scratches
- Finely sand the surrounding surface.
- Thoroughly clean with silicone remover and rub dry.
- Apply corrosion protection primer to bare areas.

Damaged new components (bumps and dents)

- Beat out the dented area sand down to bare metal.
- Apply polyester filler (only onto bare metal)
- Apply filler.
- Lightly sand the whole components.
- Thoroughly clean with silicone remover and rob dry.
- Apply corrosion protection primer to bare areas.

The clinched flanges on the hood, doors, tailgate and liftgate must be sealed with clinched flange sealer.

Weld Components

Use a rotating tress wire brush to remove the dip coat on the inside and outside of the area to be welded, taking care not to damage the zinc coating.

NOTES:



The area to be ground should be kept as small as possible, the corrosion protection applied in production (cathodic primer) should be retained as much as is possible.



The welding primer must be stirred well or shaken before application.

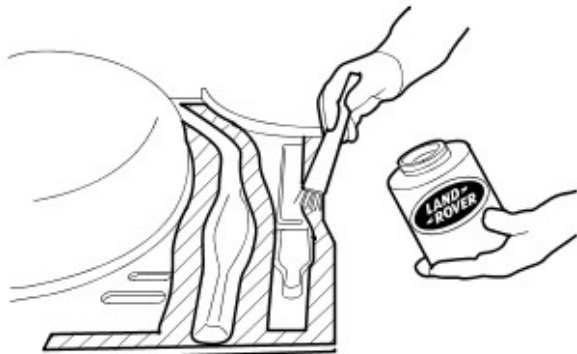
Clean the repair area thoroughly (silicone remover).

Apply welding primer evenly to all weld flanges (old and new components).



NOTE: The welding primer must be allowed to dry before welding is carried out.

Apply welding primer



E56116

All weld beads must be ground down after all welding is completed, taking care not to weaken the material.

Any unevenness at the joint must be made good.

If necessary, spot weld missing T-pins for trim strip clamps into position. The vehicle must be completely cleaned of sanding dust and metal swarf because of the danger of corrosion.

Clean and prime all internal areas and those to be sealed.



NOTE: The primer must be dry before sealing mastic or underbody protection is applied. Do not use thinners when applying sealing mastic (the mastic would not dry).

Partial renewal

The procedure to follow when partially renewing components is the same as described in the section "Welded components".

The main difference when components are partially, rather than completely renewed, concerns the preparation of butt or lap joints.

When bodywork components are cut through, attention must be paid to the adequate removal of the paint and zinc coatings on inner areas. This specially applies to areas which are difficult to access internally. It is important for the weld quality that the inner area is bare metal. Zinc and paint residues in the weld area burn and cause serious hole formation during welding. If the zinc layer and the paint coating are not removed, the zinc and paint will burn during welding. The soot produced prevents satisfactory cavity protection.

Procedure

The paint layer must be removed for a width of 30mm from the line of the weld using a rotating tress wire brush.

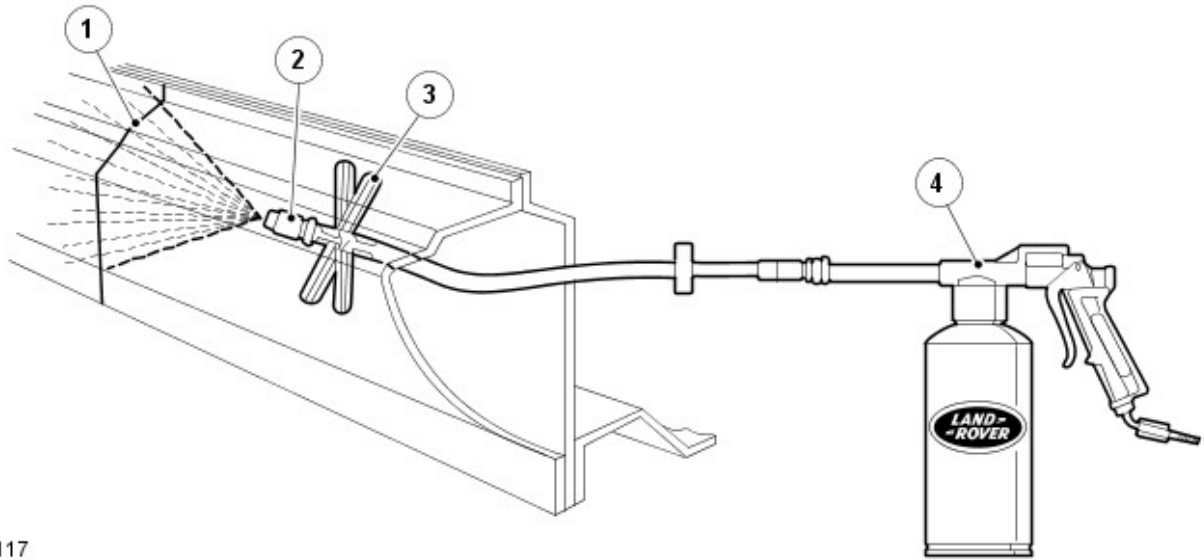
This operation must be carried out on both the new and the old parts of the bodywork.

Depending on the bodywork component, a 10mm width of the underlying zinc layer must also be removed along the weld line.



NOTE: A flat scraper or a wire brush can be used instead of the rotating brush if the cavity is small. Do not use an angle grinder, which would weaken the structure.

Application of cavity wax protection on a door rocker panel after partial repair



E56117

Item	Part Number	Description
1	-	Weld bead
2	-	Spray head
3	-	Distance maintainer
4	-	Spray gun

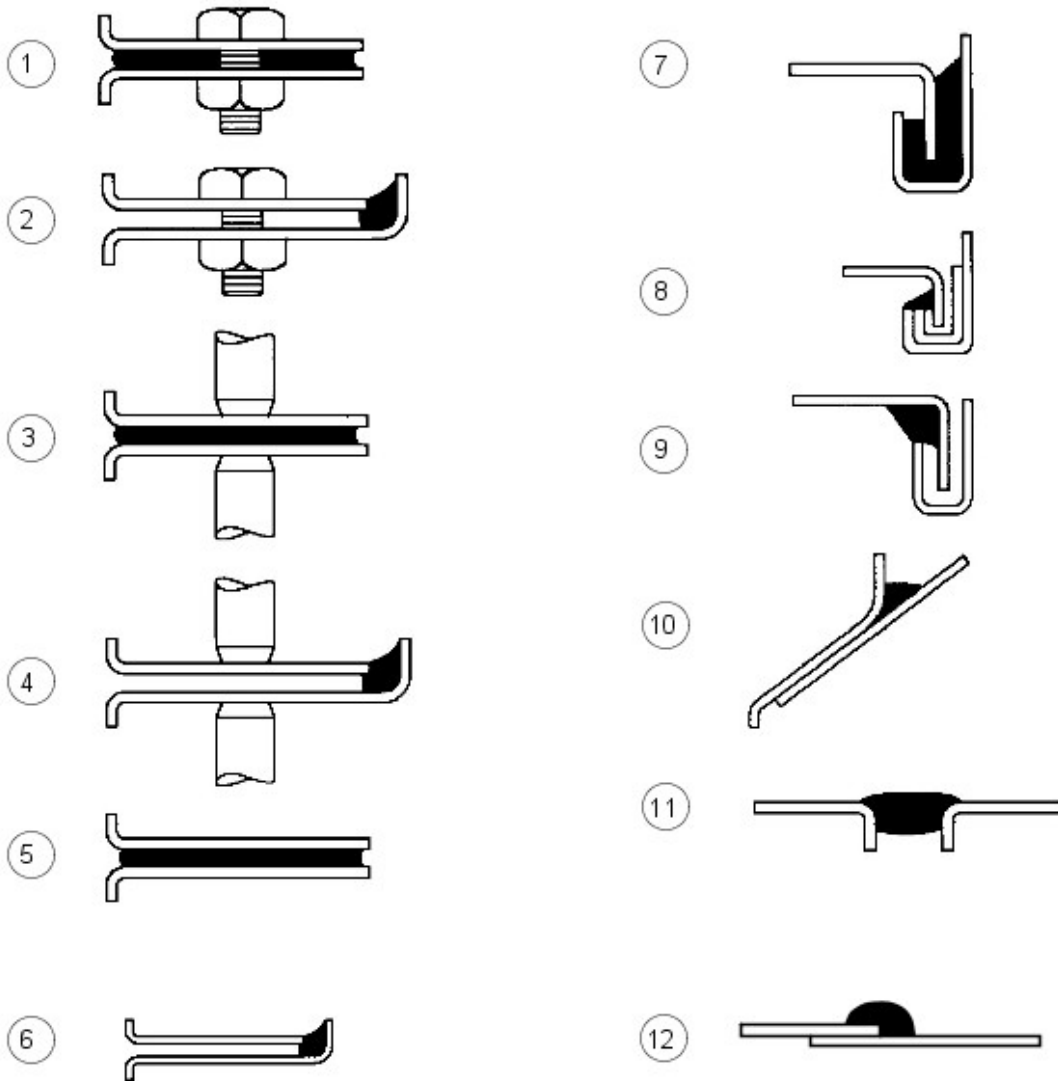
Classification of the different corrosion protection measures for dent removal

Corrosion protection method	Exterior surfaces	Accessible inner surfaces	Inaccessible inner surfaces
Painting	X	X	
Cavity protection			X

Classification of different corrosion protection measures for installation of new components

Corrosion protection method	Weld flanges before welding in place (contact surfaces)	All bare sanded areas	Weld flange area accessible	Weld flange area not accessible
Welding primer	X			
Painting		X	X	
Clinched flange protection			X	
Cavity protection				X

Body sealing materials



E56018

Item	Part Number	Description
1	-	Between Panels - Bolted
2	-	Panel Edge Bolted
3	-	Between Panels - spot welded
4	-	Panel edges - spot welded
5	-	Between panels - bonded
6	-	Panel edges - bonded
7	-	Clinch joints - type A
8	-	Clinch joints - type B
9	-	Clinch joints - type C
10	-	Gaps between panels - type A
11	-	Gaps between panels - type B
12	-	Lap joint

Description - Usage	Supplier	Part Number
Cavity - Wax	-	-
Inner Cavity Wax (Amber)	3M	0890/11/21
Inner Cavity Wax (Transparent)	3M	08909/19/29
Cavity Wax	Croda	PW57
Engine Bay Waxes/Lacquers		
Astrolan Engine Bay Wax and Cosmetic Wax	Astors	DA3243/1
Engine Bay and Cosmetic Wax/Lacquer	Croda	PW197
Engine Bay Cosmetic Lacquer	Dinol	4010

Miscellaneous Materials	-	-
Aerosol Auto Adhesive (Trim) - impact Adhesive for trim Parts	3M	08080
Flexible Parts Repair Material - rubber modified polypropylene parts	3M	05900
Acoustic Foam (sika baffle 278) - expanding foam block repair	Sika	LR Part No AZL 500021. Ford Part No 6H22-11840-AA
Flexible Foam (anti - flutter) - between panels	Duramix	4320
Water Shedder Repair (Aerosol)	Teroson	-
Low Temperature Anti-Corrosion Coating (Magnesium)	Land Rover	VEP 501 840 PMA
Seam Sealers		
Body Caulking - type (b) gaps between panels	3M	08568
Drip Chek Clear - bolted, spot welded and bonded panel edges; type (a) and (b) gaps between panels; type ©) clinch joints	3M	08401
Drip Chek Heavy - type (b) gaps between panels; type ©) clinch joints	3M	08531
Polyurethane Seam Sealer - bolted, spot welded and bonded panel edges; type (a) and (b) gaps between panels; type (b) clinch joints	3M	08684/89/94
Polyurethane Sealer (Sachet) - bolted panel edges; type (b) clinch joints	3M	08703/83/88
Sprayable Sealer - lap joints	3M	08800/23
Super Seam Sealer - lap joints; type (b) clinch joints	3M	08537
Weld Thru' Sealer - between spot welded panels	3M	08626
Betafill Clinch and Brushable Sealer - type (b) clinch joints	Gurit-Essex	10211/15/20
Clinch, Joint and Underbody Coating - lap joint	Gurit-Essex	10101/10707
Leak Chek Clear - between bolted panels; spot welded and bonded panel edges; type ©) clinch joints; type (a) gaps between panels	Kent Industries	10075
Putty - type (b) gaps between panels	Kent Industries	-
Polyurethane Seam Sealer - bolted, spot welded and bonded panel edges; between bonded panels; type (a) and (b) gaps between panels	PPG	6500
Polyurethane Seam Sealer - bolted, spot welded and bonded panel edges; between bonded panels; type (b) gaps between panels	Teroson	92
Terolan Light Seam Sealer - bolted, spot welded and bonded panel edges; between bonded panels; type (a) and (b) gaps between panels; between bonded panels; type ©) clinch joints	Teroson	-
Terolan Special Brushable Seam Sealer - lap joints	Teroson	-
Terostat Sprayable Seam Sealer - bolted, spot welded and bonded panel edges; between bonded panels; type (b) gaps between panels	Teroson	9320
Terostat 1K PU Seam Sealer (SE 20) - type (a) and (b) gaps between panels; spot welded and bonded panel edges	Teroson	-
Sealing Compound - bolted, spot welded and bonded panel edges; between bonded panels; type (b) gaps between panels	Wurths	8901001/-/6
Structural Adhesives		
Automotive Structural Adhesive - between bonded panels; type (a) clinch joints	3M	08115
Two Part structural Epoxy - between bonded and spot welded panels; type (a) clinch joints	Ciba-Geigy	XB5 106/7
Underbody Sealers		
Body-Schutz	3M	08861
Spray-Schutz	3M	08877
Crodapol Brushable Underbody sealer	Croda	PV75
Terotex Underseal (CP02)	Teroson	9320
Underbody Waxes		
Stone Chip Coating (smooth)	3M	08158/9
Underbody Wax	Croda	PW61
Underbody Wax	Dinol	Tectacote 205
Weld - through Primers		
Weld Thru' Coating	3M	05913
Zinc Spray	3M	09113
Zinc Rich Primer	ICI	p-565 634

Material Equipment/Suppliers

3M

- Automotive Trade Group
- 3M UK Plc
- 3M House
- PO Box 1
- Market Place
- Bracknell
- Berks.
- RG12 1JU
- Telephone (01344) 858611

Cooper Pegler

- Burgess Hill
- Sussex
- RH 15 9LA
- Telephone (014446) 42526

SATA Spray Equipment

- Minden Industrial equipment
- 16 Greyfriars Road
- Moreton Hall
- Bury St Edmunds
- Suffolk
- IP32 7DX
- Telephone (01284) 760791

Teroson

- Watchmead
- Welwyn Garden City
- Hertfordshire
- AL7 1JB
- Telephone 01707 358800

Underbody sealer

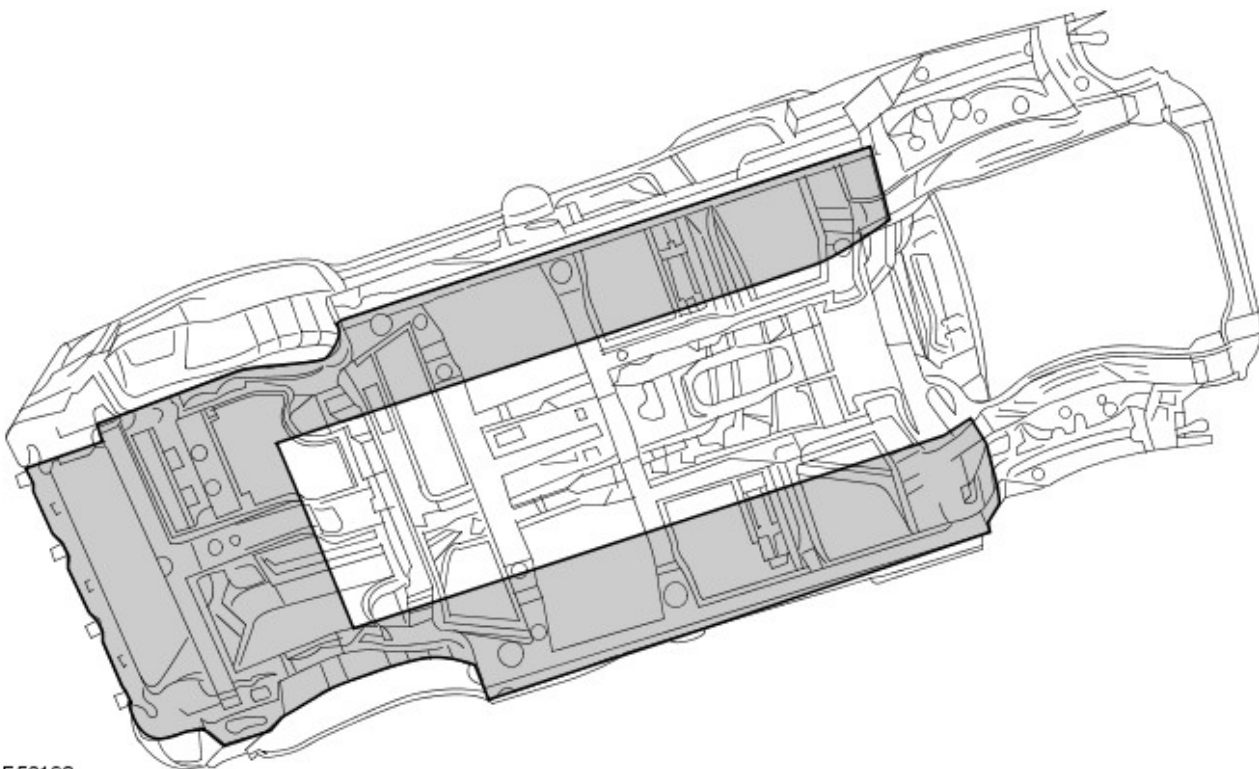
Under floor areas and rocker outer panels are treated with a plastisol PVC underbody sealer. This material is not suitable for re-treatment. When repairing areas of underbody sealer, strip the factory-applied underbody sealer back to a suitable break point. Ensure that a clean metal surface is exposed and that the edge of the existing adheres soundly to the panel.

Apply new underbody sealer between primer and surface paint operations. Apply seam sealer as necessary before application of underbody sealer. Ensure that blanking plugs and grommets in the floor pan (except those used for wax injection) are fitted before underbody sealer application. Refit any heat-fusible plugs which have been disturbed in repair with the aid of a hot air blower, or replace with rubber grommets



CAUTION: Ensure that suspension units, wheels, tires, power unit, drive shafts, exhaust and brakes (including all mounting points) are shielded prior to application of fresh underbody sealer.

Area of underbody sealer application



Precautions during body repairs and handling

Take care when handling the vehicle in the workshop. Underbody sealers, seam sealers, underbody wax and body panels may be damaged if the vehicle is carelessly lifted.

Proprietary anti-corrosion treatments

The application of proprietary anti corrosion treatments in addition to the factory-applied treatment could invalidate

the corrosion warranty and should be discouraged. This does not apply to approved, compatible, preservative waxes which may be applied on top of existing coatings.

Fitting approved accessories

When fitting accessories ensure that the vehicle corrosion protection is not affected, either by breaking the protective coating or by introducing a moisture trap.

Do not screw self-tapping screws directly into body panels. Fit suitable plastic inserts to the panel beforehand. Always ensure that the edges of holes drilled into panels, chassis members and other body parts are protected with a suitable zinc rich or acid etch primer, and follow with a protective wax coating brushed onto the surrounding area.

Do not attach painted metal surfaces of any accessory directly to the vehicle's bodywork unless suitably protected. Where metal surfaces are bolted together always interpose a suitable interface material such as weldable zinc rich primer, extruded strip, or zinc tape.

Steam Cleaning

Due to the high pressure/temperature generated by steam cleaning equipment, there is a risk that certain adhesives and corrosion prevention material may become softened or liquified.

Take care not to allow the steam jet to dwell on one area, and keep the nozzle at least 300mm from the panel surface.



CAUTION: Do not remove wax or lacquer from underbody areas during repairs.

Inspection during maintenance servicing

It is a requirement of the corrosion warranty that the vehicle is checked for corrosion by an authorised Land Rover Authorised Repairers at least once a year, to ensure that the factory-applied protection remains effective.

Rectify any bodywork damage or evidence of corrosion found during inspection as soon as is practicable, both to minimise the extent of the damage and to ensure the long term effectiveness of the factory-applied corrosion prevention treatment.

Underbody protection repairs

Whenever body repairs have been carried out, ensure that full sealing and corrosion protection treatments are reinstated. This applies both to the damaged areas and also to areas where protection has been indirectly impaired, as a result either of accident damage or repair operations.

Remove corrosion protection from the damaged areas before straightening or panel beating. This applies in particular to panels coated with wax, PVC underbody sealer, sound deadening pads etc.



CAUTION: Do not use oxy-acetylene to remove corrosion prevention material. Large volumes of fumes and gases are liberated by these materials when they burn.

The most common method of removal is by means of a hot air blower with an integral scraper. High temperatures can be generated with this equipment which may cause fumes. Take care during its use.

Structural Adhesive

Metal to metal adhesive is applied to critical joint areas during factory assembly. The material used is a high temperature, heat cured, nitrile phenolic which serves to bond two metal surfaces and also to seal the joint against ingress of dust, moisture and fumes. This material is not suitable for service use and, during repair, should be substituted by an approved structural adhesive.

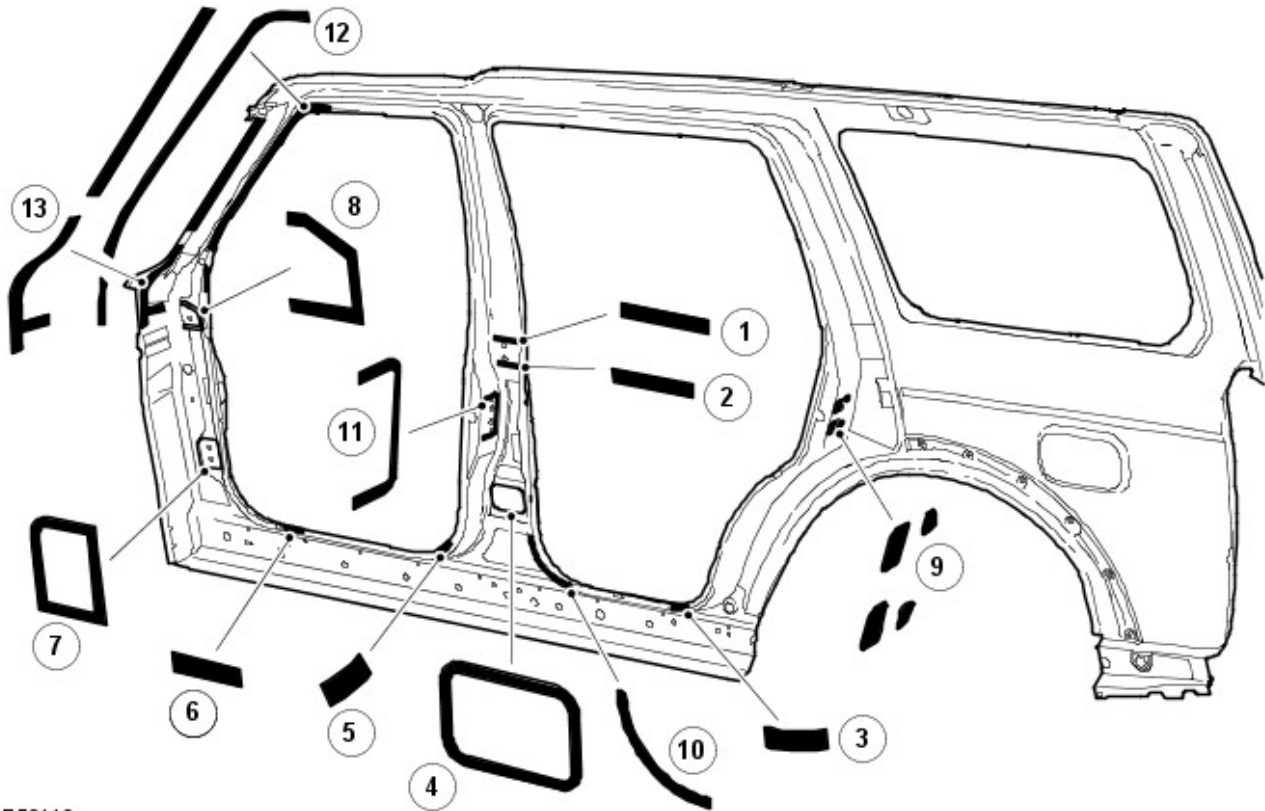


CAUTION: When separating a joint with metal to metal adhesive, it is important to avoid distortion. Heat gradually until the bond weakens sufficiently to permit panel separation.



NOTE: When spot welding through metal to metal adhesive, take particular care to adjust the equipment setting to ensure a suitable weld.

Areas of structural adhesive



E56119

Item	Application	Function
1	B-pillar upper hinge RH/LH	Structural
2	B-pillar upper hinge RH/LH	Structural
3	Rear rocker panel RH/LH	Structural
4	B-pillar lower hinge RH/LH	Structural
5	Front rocker panel RH/LH	Structural
6	Front rocker panel RH/LH	Structural
7	A-pillar lower hinge RH/LH	Structural
8	A-pillar upper hinge RH/LH	Structural
9	C-pillar striker reinforcement	Structural
10	B pillar rear door aperture	Structural
11	B-pillar latch face	Structural
12	A-pillar to front door aperture	Structural
13	A-pillar to W/shield aperture	Structural

Joints symmetrically opposite to those shown are also treated. Apply 3mm diameter beads to all joints shown. Leave rocker drain points free of adhesive.

Expanding Foam Acoustic Seals

Expanding foam acoustic seals are used in various closed-sections of the body to improve vehicle refinement. The seals are installed during the vehicle body manufacture and expand during the paint process up to ten times original size, thus locking them into position. They are located such that they prevent noise accentuation along a section and reflect air borne noise away from the cabin.

The seals have spilt functionality depending on location. The seals located at the base of the body pillars have a primary function of preventing water ingress when wading. Their secondary function is to prevent noise and dust ingress.

The seal around the fuel filler has a primary function of preventing both fuel and water ingress. With a secondary function of preventing noise and dust ingress.

The remaining seals primary function is to prevent noise accentuation along a section and reflect air borne noise away from the cabin.

Another advantage of the seals is that they marginally increase the overall stiffness of the body and its structural performance in case of a crash.

The seals are manufactured from an expandible polymer, 'Sika Baffle 250.'

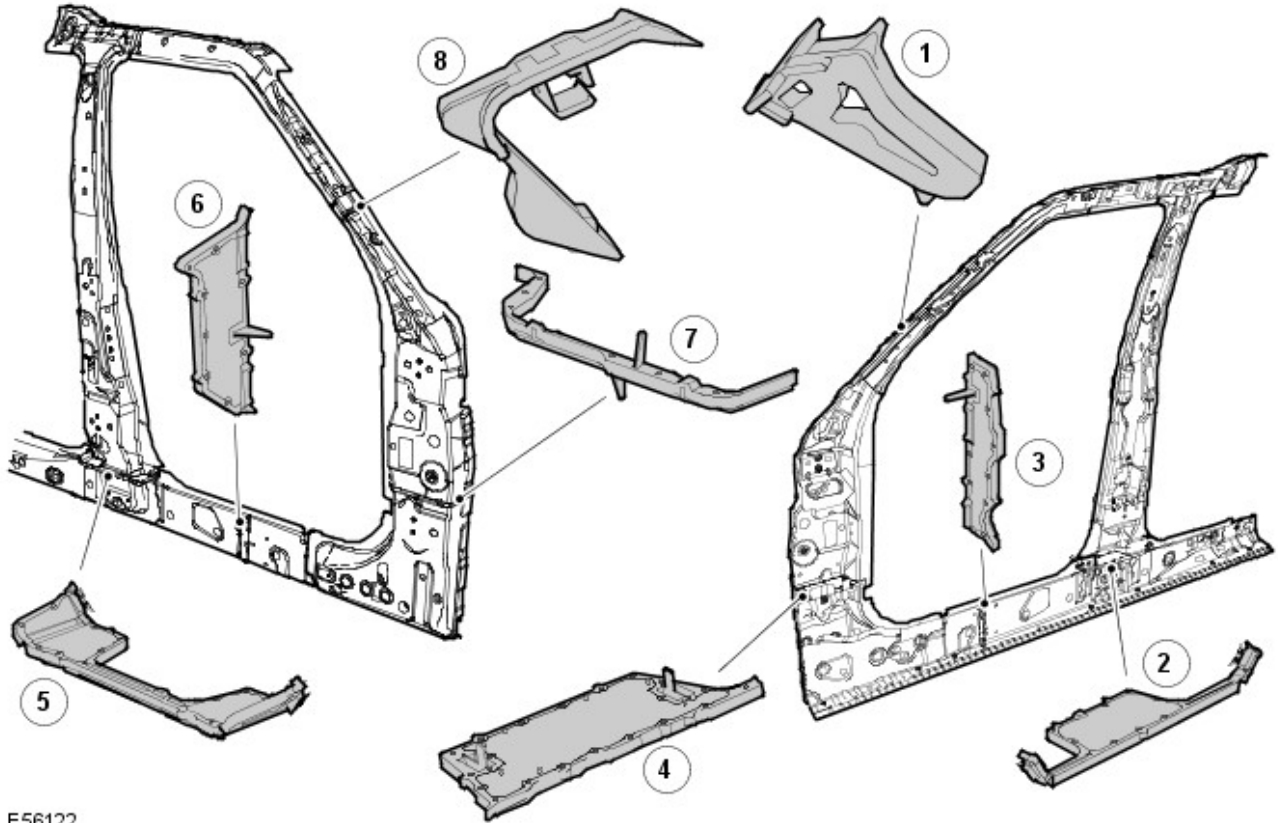
Replacing Foam Acoustic Seals

As paint oven temperatures used in a repair workshop are significantly lower than those that are used during manufacture of the vehicle, a different process is required to replace the seals.

After a repair that involves replacement of a section containing expanding foam acoustic seals, the new expanding foam acoustic seal is installed to the new section and injected with an approved acoustic foam. The acoustic foam

should be injected after paint refinishing, where possible. When injecting the foam, ensure the foam fills a complete cross section of the cavity and around the expanding foam acoustic seal.

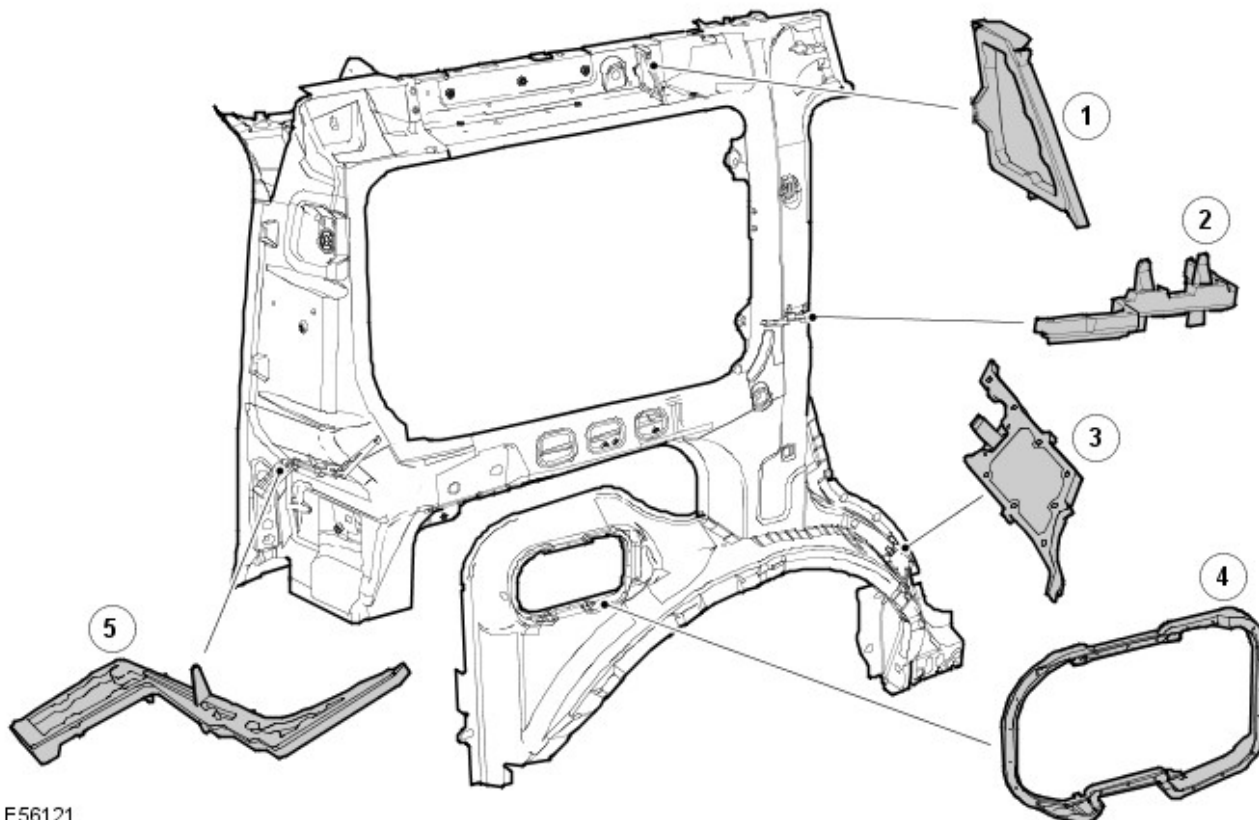
Position of acoustic seals, front reinforcement



E56122

Item	Description	Function	Service part No
1	A-pillar upper inner	Acoustic	EUH000520
2	B-pillar lower inner	Water Ingress/Acoustic	EUH000560
3	Rocker panel middle	Acoustic	EUH000670
4	A-pillar lower inner	Water Ingress/Acoustic	EUH000550
5	B-pillar lower outer	Water Ingress/Acoustic	EUH000570
6	Rocker panel outer	Acoustic	EUH000680
7	A-pillar lower inner	Water Ingress/Acoustic	EUH000540
8	A-pillar upper outer	Acoustic	EUH000530

Position of acoustic seals, rear quarter panel



E56121

Item	Description	Function	Service part No
1	Cantrail rear	Acoustic	EUH000650
2	C-pillar outer	Acoustic	EUH000610
3	Rear wheel arch outer	Water Ingress/Acoustic	EUH000590
4	Fuel filler aperture	Water/Fuel Ingress	ARY 780030
5	D-pillar outer	Acoustic	EUH000630

Seam Sealer

A heat cured, PVC based sealant is applied to specific joint seams during factory assembly. This material is not suitable for service use and during repair, should be substituted by an approved seam sealer.

Apply seam sealers after the application of primer and before the application of top coat. The sealer must form a continuous bead, with the profile of the bead dependent on the type of seam. If the seam sealer is applied with a brush take particular care to maintain the required coverage of the seam.

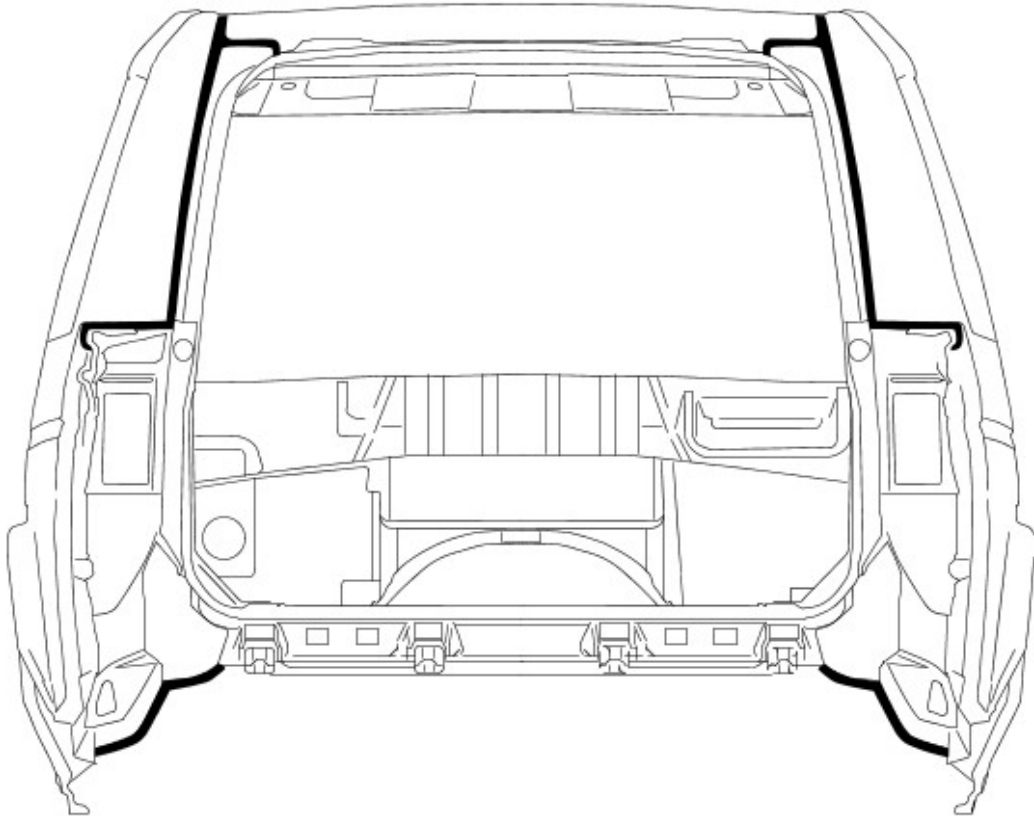
Ensure that all accessible repair seams are sealed following a repair. Damaged to a vehicle often flexes areas of the body remote from the impact. As a result the seam sealer in these areas may be disturbed by subsequent straightening and repair operations. Check all seams in the vicinity of the area undergoing repair for evidence of cracked seam sealer, then clean out as required and apply fresh seam sealer using the following procedure:

- Clean the affected seam and re-treat any exposed metal areas with a suitable etch phosphate primer.
- Treat affected area with an etch-acid primer.
- Apply appropriate seam sealer as necessary.
- apply appropriate colour coat (and under body sealer as applicable).

Where seams are inaccessible following the reassembly or fitting of components, ensure that a paste-type seam sealer is applied to such seams. Certain seams also become inaccessible after the completion of panel repairs. In such instances apply seam sealer and paint before final assembly

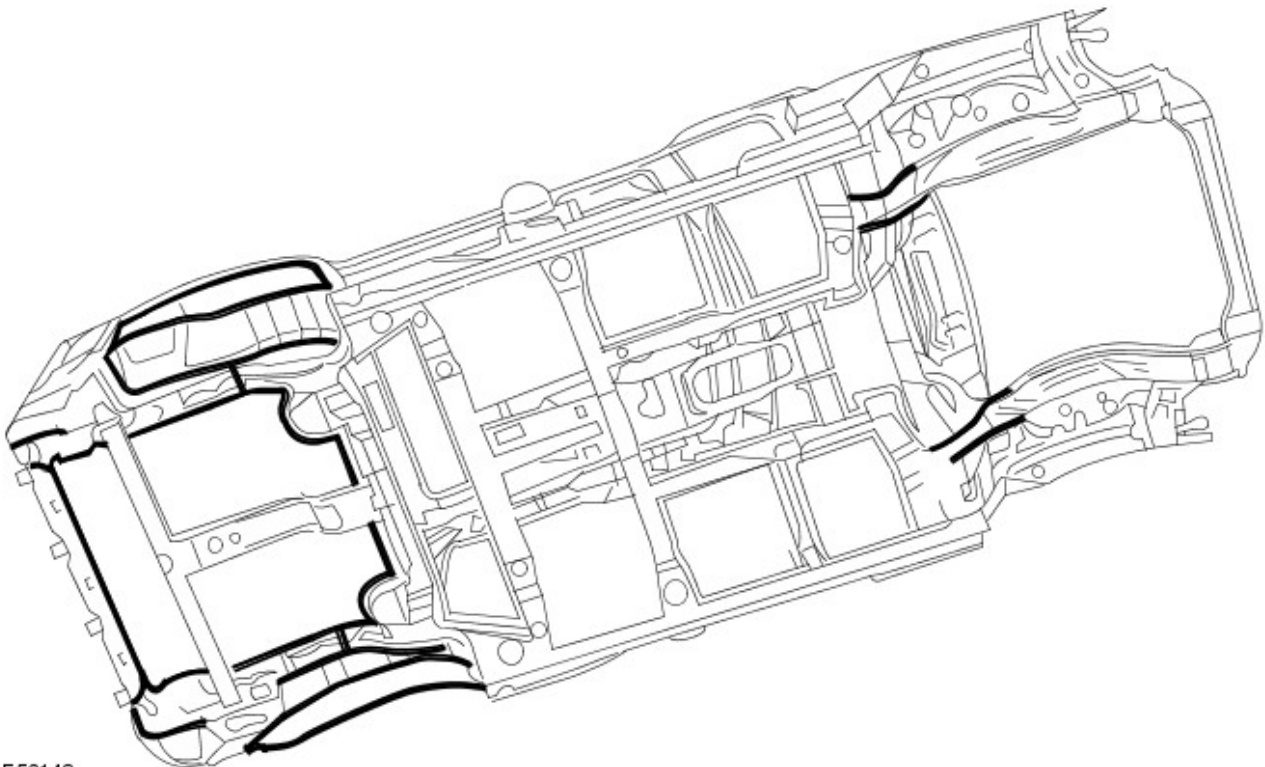
Provided access is adequate, apply seam sealer to both sides of a repair joint. Where access is limited to one side only (eg box section), treat the affected box member with cavity wax

Seam sealer on the rear end



E56146

Underbody seam sealer



E56148

Cavity Wax

After repairs, always re-treat these areas with an approved cavity wax. In addition, treat all interior surfaces which have been disturbed during repairs whether they have been treated in production or not. This includes all Box members, cavities and door interiors.

Before wax injection, ensure that the cavity to be treated is free from any contamination or foreign matter. Where necessary, clear out any debris.

Ensure that cavity wax is applied after the final paint process and before refitting any trim components.

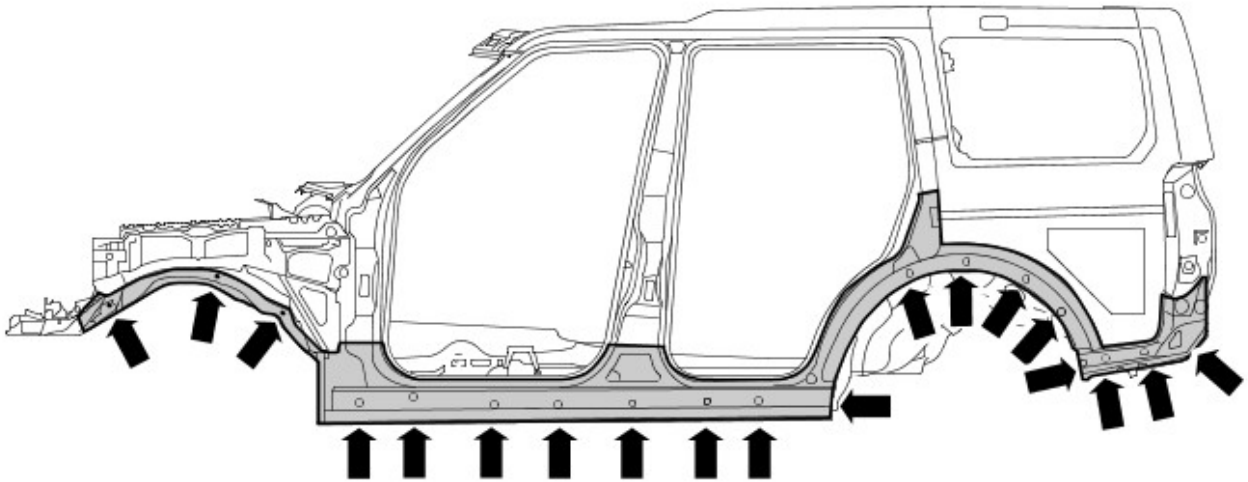
During application ensure that the wax covers all flanges and seam areas and that it is adequately applied to all repaired areas of both new and existing panels.

It should be noted that new panel assemblies and complete body shells are supplied without wax injection treatment. Ensure that such treatment is carried out after repairs.

Effective cavity wax protection is vital. Always observe the following points:

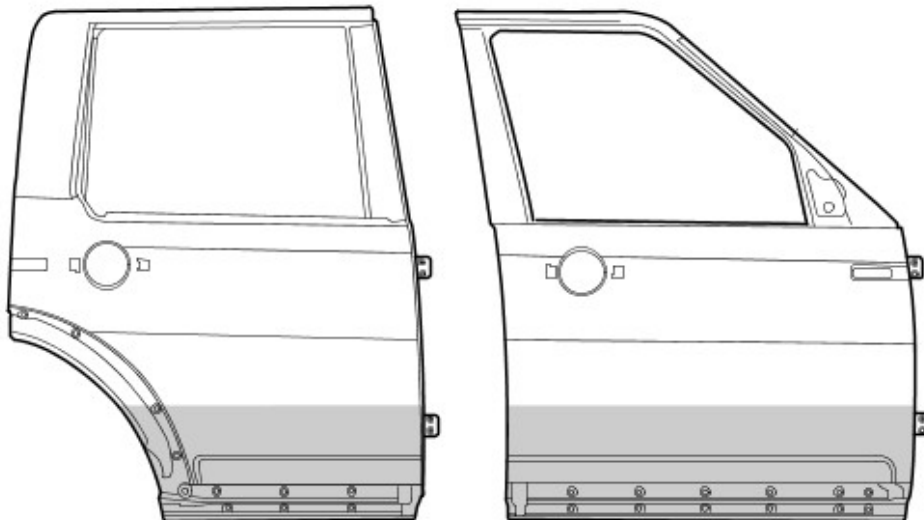
- Complete all paint refinish operations before wax application.
- Check the spray pattern of injection equipment.
- Mask all areas not to be waxed
- Remove body fixings, such as seat belt retractors, if contamination is at all likely.
- Move door glasses to fully closed position before treating door interiors.
- Treat body areas normally covered by trim before refitting items.
- Check that body and door drain holes are clear after the protective wax has dried.
- Keep all equipment clean, especially wax injection nozzles

Wax injection areas, body



E56192

Wax injection areas, doors



E56251

Body Repairs - Water Leaks - Water Leaks

Description and Operation

General

If water leaks occur after bodywork repairs, the cause can be established using the checks described below. A systematic and logical procedure is required to locate water leaks. Before beginning extensive checks, a thorough visual inspection must be carried out.

Visual Inspection

- The following characteristics may indicate existing leaks:
- Check the clearance and accurate fit of ancillary components such as the hood, tailgate, liftgate, doors, and so on.
- Check for correct fit and possible damage to sealing elements such as blanking plugs, rubber door seals, and so on.
- Check water drain holes for unhindered flow.

Various tests can be used to provide further information on possible leaks:

- Water test
- Washer test
- Road test
- Chalk (powder) test

Practical execution of tests and checks

Water test



NOTE: Never aim a jet of water directly at a rubber seal.

Carry out the water test with a second person present (passenger compartment).
Use variable washer nozzles (concentrated water jet to fine spray mist).
Start in the lower section and spray the whole area, working upwards in stages.

Washer test

Further tests can be carried out in the washer system.
Some leaks originate here, or only occur here.
The relevant passenger compartment should be checked using a torch during the wash procedure.

Road test

If no leaks are located during the tests above, road tests should be carried out on wet roads.
Road tests under various conditions:

- At various speeds.
- On various road surfaces (asphalt to cobbles).
- With loaded or unloaded vehicle.
- Driving through puddles (splash water).

Chalk test (powder test)

In this test, the clamping load and the bearing surface of the seal are checked.
Performing the test:

- Dust the door seal with powder or coat with chalk.
- Coat the bearing surface of the seal with a thin film of grease.
- Slowly close the door and open it again.
- Check the width and continuity of the imprint on the door seal.

Other test equipment

Other equipment such as stethoscopes, UV lamps, special mirrors or ultrasound measuring instruments can be used to locate leaks.

Rectifying the leak using recommended tools, auxiliary equipment and materials

Tools and auxiliary equipment:

- Dry, absorbent cloths
- Variable washer nozzle
- Torch, fluorescent tube
- Mirror
- Compressed air
- Seal lip installer
- Wet/dry vacuum cleaner
- Sealing compound compressor
- Remover for interior trim
- Cutter blade or pocket knife
- Wedge (wood or plastic)
- Hot air blower
- Special mirror for concealed leaks
- Air flow checker
- Sealing compound (tape and plastic compound)
- Multi-purpose sticker
- Clinched flange sealer
- Window sealing compound

- Water shield (PVC)
- Double-sided adhesive tape for water shield
- Methylated spirit (available from trade outlets)
- PU adhesive
- Silicone remover
- Tar remover

Water leaks according to mileage or running time

Increasing mileage has an effect on the problem of leaks in a vehicle. Possible influencing factors are:

 Servicing and maintenance of seals:

- No maintenance, lack of maintenance or incorrect maintenance
- Using an incorrect agent

 Damaged seals:

- As a result of aging, wear or incorrect handling/assembly.

 Heavy soiling of the vehicle:

- Heavy soiling of a vehicle can seriously impair the function of water drainage channels in particular, and also of rubber seals.

 Age-related factors:

- Environmental factors
- UV radiation
- Extreme climatic conditions

 Corrosion can have a serious impact on bodywork, in particular as a result of:

- Lightly or heavily rusted seal carriers
- Rusted body seal welds
- Perforation corrosion

Water leaks after body repairs

If a vehicle develops a leak after body repairs, the following points must be taken into consideration in particular:

 The correct seating of ancillary components and their seals must be checked.

 The correct alignment of doors/tailgate and liftgate must be checked. The associated seals must not be damaged and must be installed correctly.

 Check that welded seams are correctly sealed.

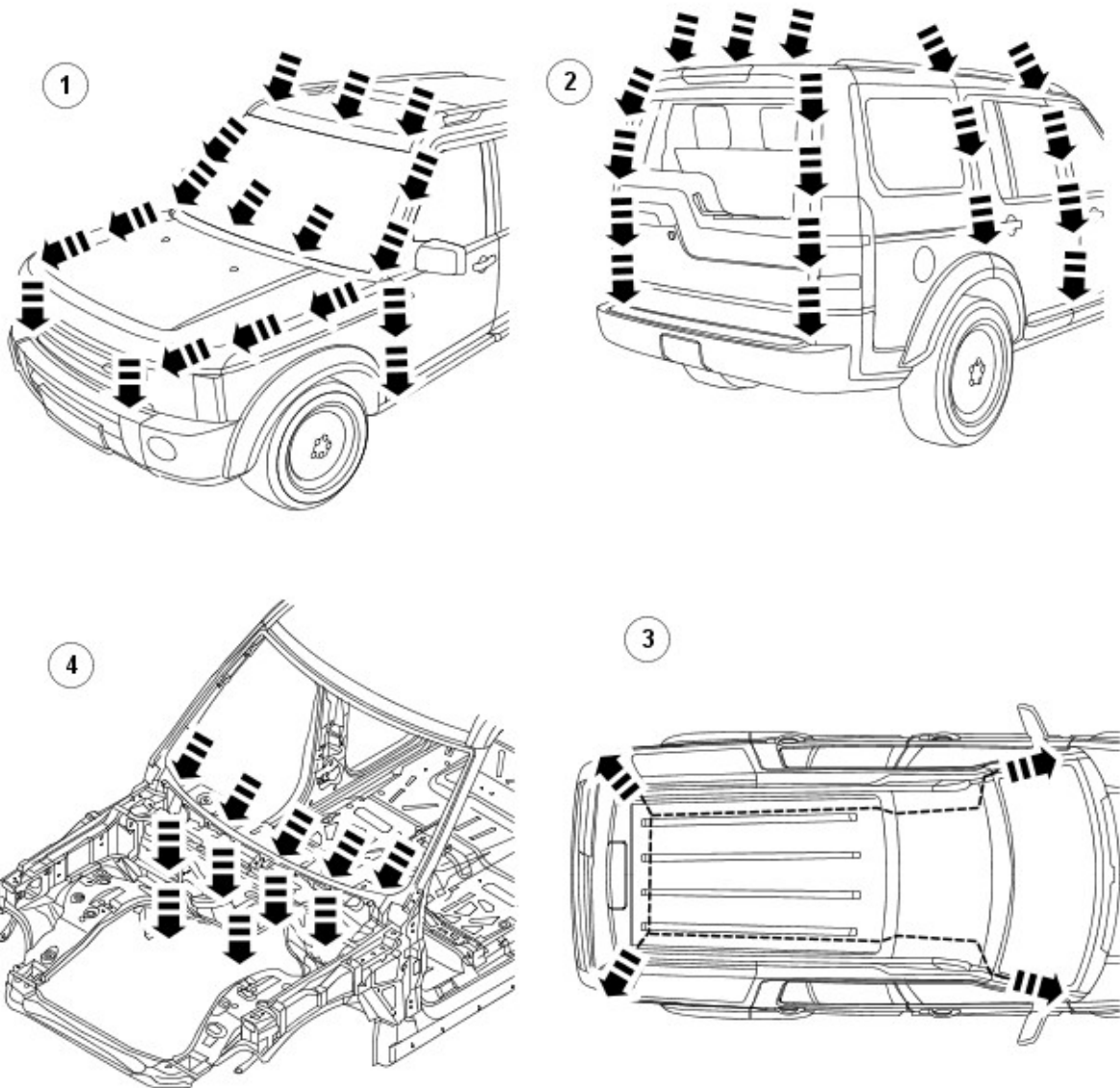
 The correct seating of rubber grommets must be checked.

 Directly-glazed windows must have correct and complete bonding.

Water drainage system

If a vehicle develops water leaks, then areas into which water is routed or drained should be checked first.

Water drainage system



E56126

Item	Part Number	Description
1	-	Water drainage, front
2	-	Water drainage, side and rear
3	-	Roof drainage
4	-	Engine compartment drainage

Water leaks, diagnosis and corrective action: Front passenger compartment

Windscreen

Diagnosis:

- Ingress of water into A-pillar area or instrument cluster area and rocker panel area.

Cause:

- Breaks in adhesive beads

Corrective action:

- The breaks in adhesive beads can be located from inside by using compressed air. The leak can be identified from outside by the escaping air.
- The second test method is by means of a water test. The outer trims must be raised carefully using a plastic wedge. The leak should be located from inside by a second assistant.

Side windows

In the case of side windows, the same problems can arise as for a windscreen. The same corrective actions must therefore be used.

Door seal

Diagnosis:

- Water ingress in the lower part of the interior door trim or in the rocker panel area.

Cause:

- The water shield fitted behind the interior door trim exists to drain off water that has entered the door via the drainage holes, either downwards or outwards. If the water shield seal is damaged or has been fitted incorrectly, then water can get into the passenger compartment.
- In addition to this, the drainage holes can become clogged with leaves, dirt or excess cavity protection agents. Water gathers in the door and ingresses into the passenger compartment.
- Check water shield for damage or correct fitting.
- If the water shield needs to be re-bonded, then approved seam sealer should be used.
- Before the water shield is installed, the drainage holes must be checked for unhindered flow.

Door seals

Diagnosis:

- Ingress of water into the rocker panel area

Cause:

- Insufficient clamping load between seal and door.

Corrective action:

- Check clamping load:
- The easiest way to check the clamping load of a seal to the respective bearing surface is by means of a paper strip test. This consists of trapping strips of paper at various points between the door and the seal, and fully closing the door. If it is possible to pull out the paper with no great resistance, then the clamping load is too low.
- Adjust the clamping load:



NOTE: When adjusting the clamping load, the profile alignment of the relevant components must always be taken into consideration.

The clamping load is normally adjusted using the striker. When doing so, the edge alignment from the door to the side panel, or from the front door to the rear door must be taken into account.

- Another setting method is to realign the panel flange for the seal mounting. The clamping load is increased by moving the flange towards the door.



NOTE: Do not realign the flange too far in the direction of the door, as this can reduce the bearing surface of the seal to the door.

Check the bearing surface:

- Apply chalk evenly to the surface of the seal. Evenly coat the bearing surface of the door with vaseline.
- Close the door fully, the lock must engage. Open the door. The imprint of the chalk (bearing surface) can be identified in the film of grease.
- The bearing surface should be at least 5mm across at all points.

Other causes:

- The door seal must completely seal the door where it meets the bodywork.
- Water can ingress directly or indirectly into the interior of the vehicle if the seal is damaged at any point.

Corrective action:

- A damaged or worn door seal must always be renewed in full.
- When renewing the seal, the following must be taken into account:
- Always fit the seal first in the area of the narrow radii (corner points).
- Next, secure the seal to the flange evenly by tapping lightly with a rubber hammer. The installed seal must not be kinked at any point.



NOTE: The prescribed length of a seal must not be shortened.

Other cause:

- The door seal is attached to the welded flange all the way round. If this welded flange is uneven or damaged at any point (usually in areas with narrow radii) then this point could be subject to leaks.
- A stretched seal carrier can also cause a leak.
- In both cases, water gets into the vehicle interior under the seal carrier.

Corrective action:

- Align the deformed welded flange using a hammer and anvil block, prevent and if necessary repair any paint damage.

Other cause:

- The door seal is attached to the welded flange all the way round. If this welded flange is uneven or damaged at any point (usually in areas with narrow radii) then this point could be subject to leaks.
- A stretched seal carrier can also cause a leak.
- In both cases, water gets into the vehicle interior under the seal carrier.

Sliding roof/tilting roof

Diagnosis:

- Ingress of water at sliding roof aperture

Cause:

- The sliding roof/tilting roof is installed in a water trap. The water drains off via the water trap, water drain holes and drain hoses. The drain hoses lead downwards on both sides via the A-pillar and C-pillar.
- The drain holes or drain hoses can become clogged with leaves, dirt, underbody protection and so on.

Corrective action:

-



NOTE: In the case of a sliding or tilting roof, the external rubber seal and the lock actuator or latch mechanism must be checked first of all.

Check the water trap for leaks.

- Check the drain hoses for leaks and for correct connection to the water trap.
- Check the drainage system for unhindered flow, and blow out with compressed air if necessary.
- Check the external seal and the correct adjustment of the sliding roof.

Tailgate and Liftgate

Diagnosis:

- Ingress of water into rear headlining area and luggage area.

Cause:

- The leak problems of the tailgate and liftgate correspond to those of the doors.
- In addition to this, the area to be sealed is much bigger. The routing holes for cables and hoses must also be sealed.
- The rubber grommets for the routing holes must be checked for damage and correct seating (fully unhooked).
- The mounting points of the tailgate and liftgate hinges may leak.

Corrective action:

- Check the rubber grommets and renew if necessary.
- Check the hinge mounting points, and re-seal with sealing compound if necessary.

Forced air extraction

Diagnosis:

- Ingress of water into side luggage compartment area

Cause:

- The forced air extraction for the vehicle interior is located in the D-pillar behind the rear lights.
- The rubber flap of the forced air extraction must be able to move freely.

Corrective action:

- Remove the forced air extraction.
- Check the seal area between the bodywork and housing, as well as the rubber flap.
- Renew seal if necessary.

Rear window and moon roof

Diagnosis:

- Ingress of water into the luggage compartment area

Cause:

- Rear window and moon roof leaking.
- Check for leak in the same way as for leaking windscreen.

Panel connections with seal welds

Diagnosis:

- Ingress of water into the luggage compartment area

Cause:

- Several panel connections must be fitted in production in the wheelhouse and luggage compartment areas. These connections are sealed with sealing compound.
- Uneven application of sealing compound can lead to a break in a seal weld.

Corrective action:

- Expose the seal weld.
- Locate the leak in the seal weld.
- Re-seal using sealing compound.

Body Repairs - Vehicle Specific Information and Tolerance Checks - Body and Frame

Description and Operation

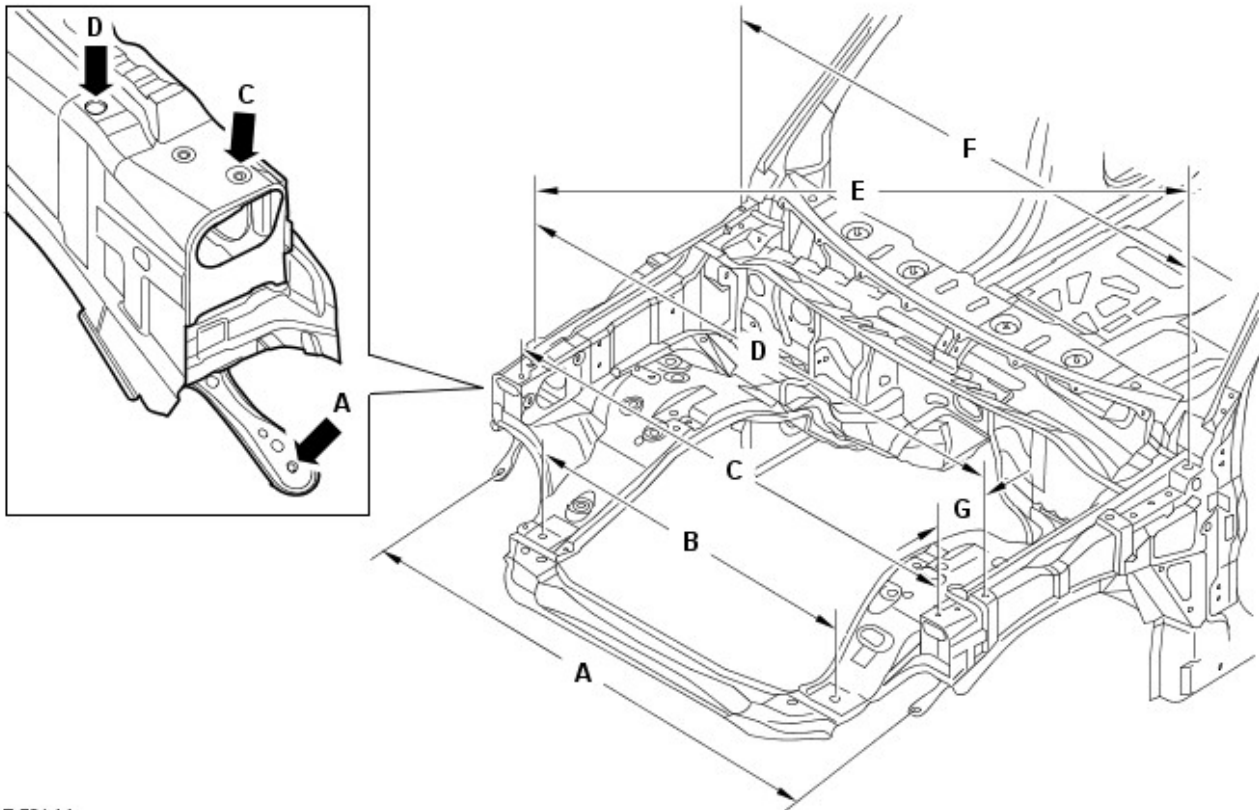
Body Repairs - Tolerance Checks

Measurements shown are in millimetres and inches. The measurements shown in brackets are in inches.

Point-to-Point Dimensional Information

Point-to-point measurements are actual distances between two points. These points can be holes or intersections points. Where holes are taken, the point of measurement is always from the hole centres.

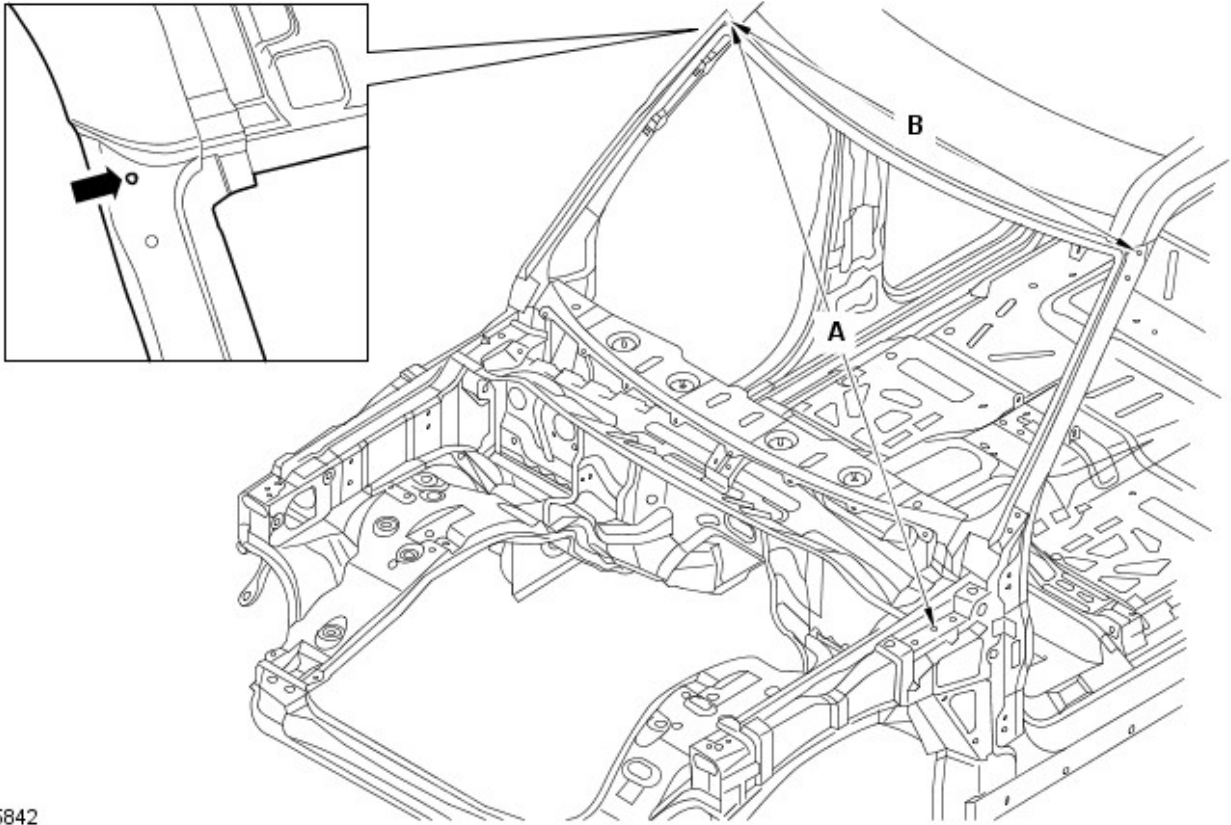
Front end dimensions



E 56144

Item	From	To	Length
A	Hood latch panel, lower LH outer fixing	Hood latch panel, lower RH outer fixing	1503.2 (59.18)
B	Hood latch panel, LH locator slot	Hood latch panel, RH locator slot	900 (35.43)
C	Hood latch panel, LH locator dowel	Hood latch panel, RH locator dowels	1540.4 (60.64)
D	Fender, front LH fixing	Fender, front RH fixing	1617.8 (63.69)
E	Fender, front RH fixing	Fender, rear LH fixing	1780.2 (70.08)
F	Fender, rear LH fixing	Fender, rear RH fixing	1620 (63.77)
G	Fender, front fixing	Hood latch panel, locator dowel	114.23 (4.49)

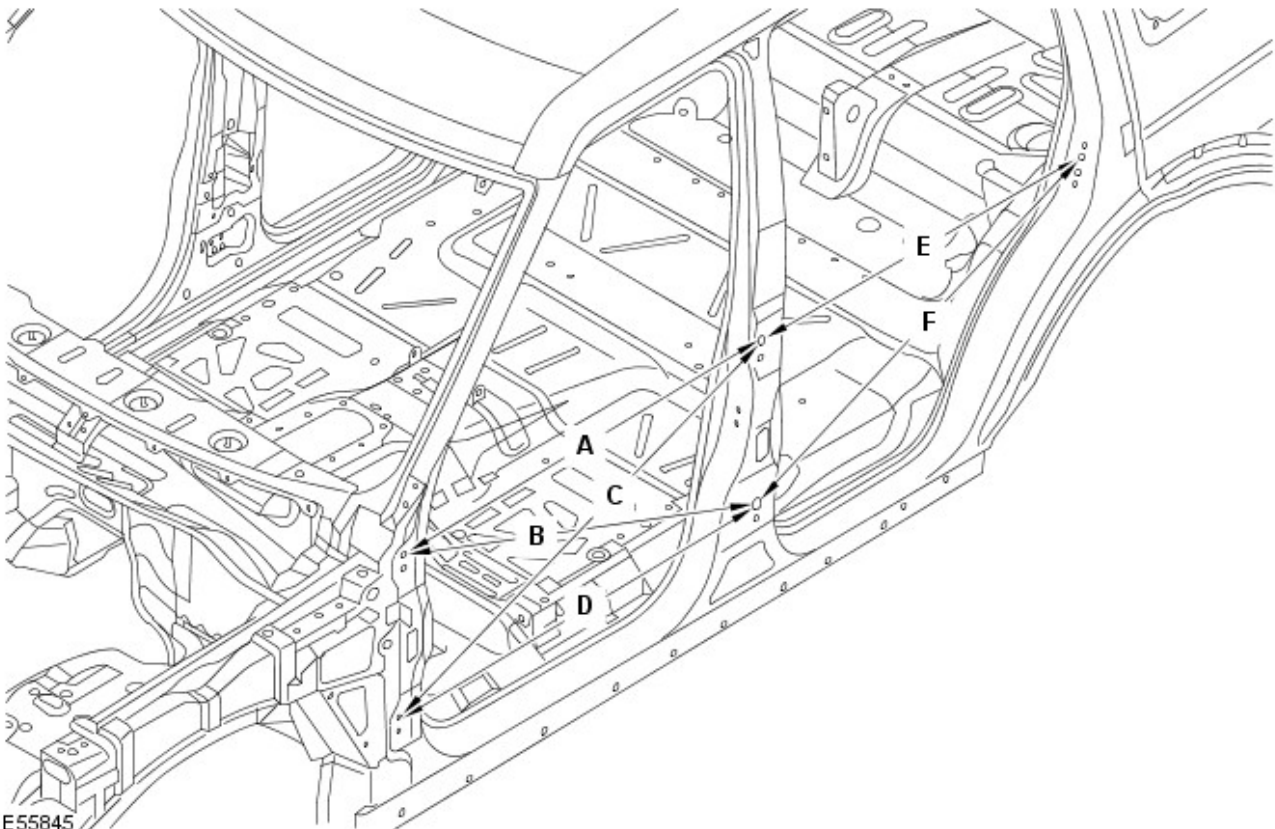
Front end dimensions



E55842

Item	From	To	Length
A	LH hood hinge, middle fixing hole	RH windshield side upper finisher, fixing hole	1827 (71.92)
B	LH windshield side upper finisher, fixing hole	RH windshield side upper finisher, fixing hole	1431.5 (56.35)

Side view dimensions

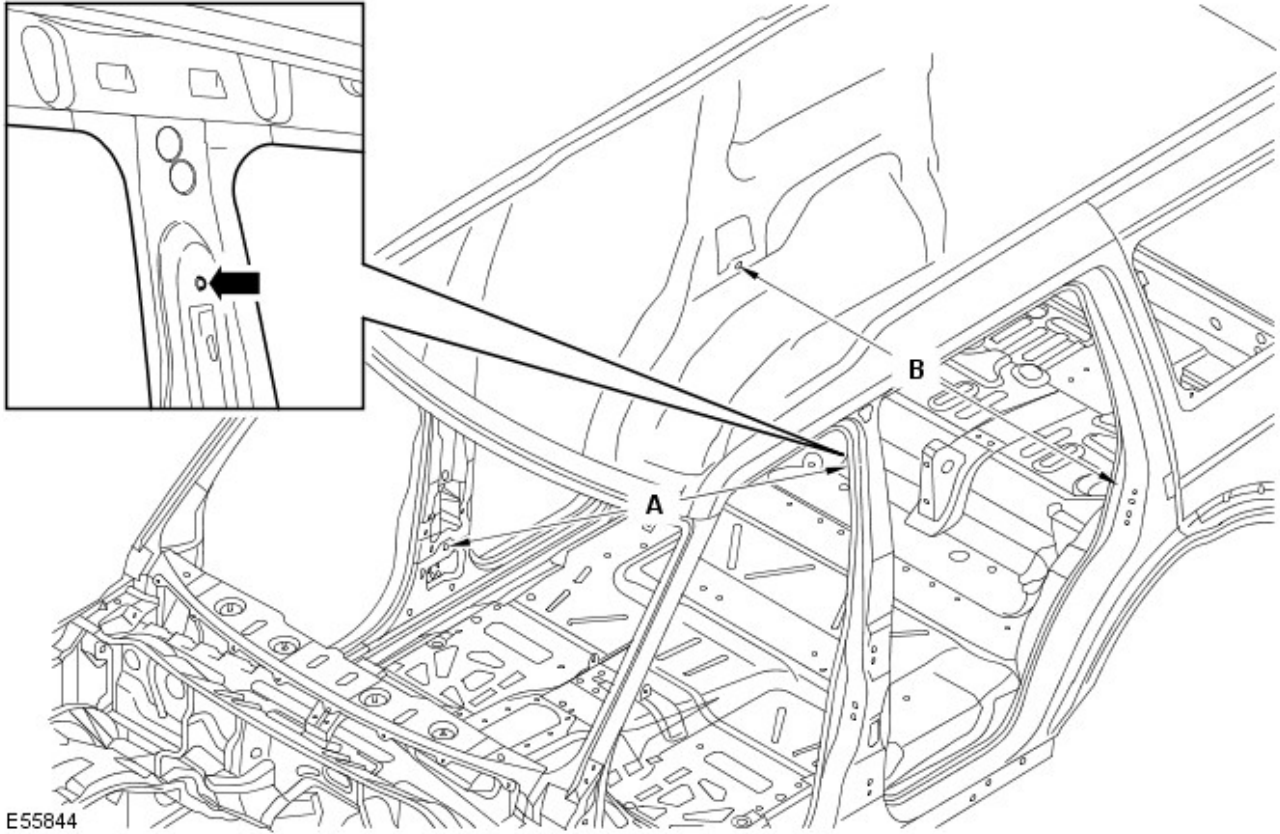


E55845

Item	From	To	Length
A	Front door top hinge, top fixing hole	Rear door top hinge, top fixing hole	1078.9 (42.47)
B	Front door top hinge, top fixing hole	Rear door bottom hinge, top fixing hole	1138.3 (44.81)
C	Front door bottom hinge, top fixing hole	Rear door top hinge, top fixing hole	1174.4 (46.23)
D	Front door bottom hinge, top fixing hole	Rear door bottom hinge, top fixing hole	1078.9 (42.47)

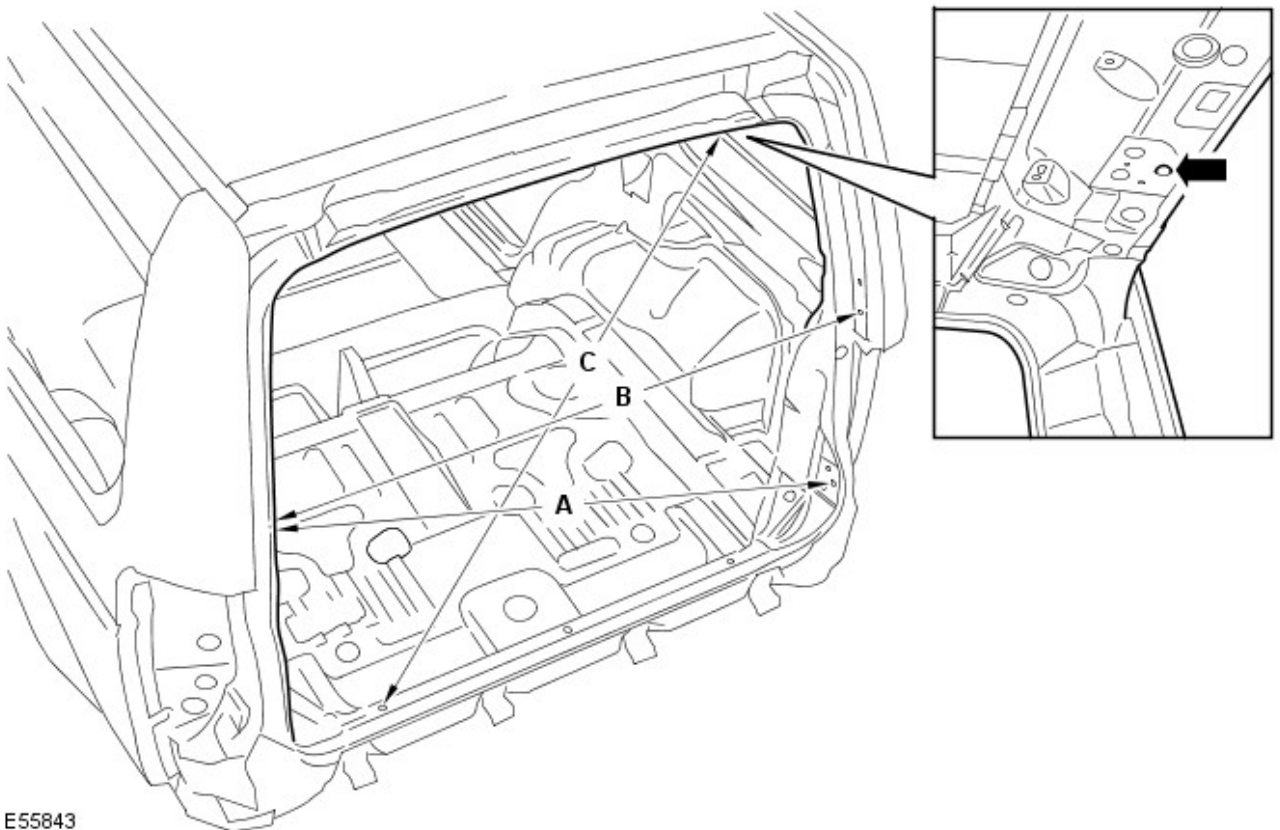
E	Rear door top hinge, top fixing hole	D pillar striker fixing hole	983.5 (38.72)
F	Rear door bottom hinge, top fixing hole	D pillar striker fixing hole	1069.9 (42.12)

Internal dimensions



Item	From	To	Length
A	LH safety belt anchorage, top fixing	RH safety belt retractor, lower fixing	1743.6 (68.64)
B	RH inner rear wheelarch, lower safety belt retractor fixing	LH inner rear wheelarch, lower safety belt retractor fixing	1518.2 (59.77)

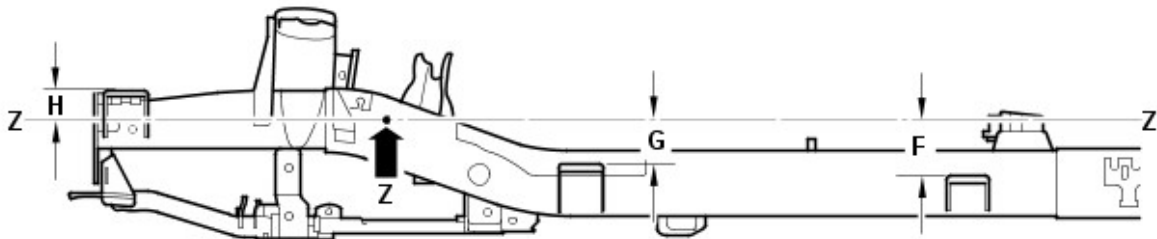
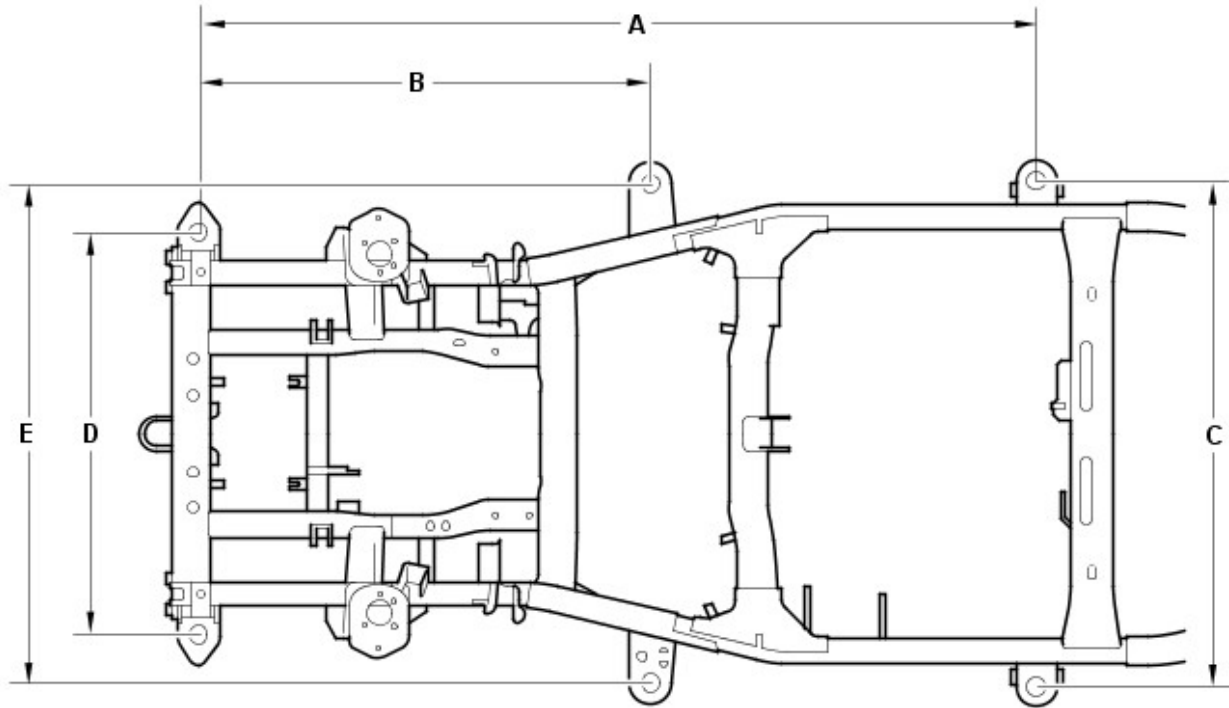
Rear view dimensions



Item	From	To	Length
A	Liftgate, RH alignment fixing	Tailgate, LH striker fixing	1222.1 (48.11)
B	Liftgate, RH alignment fixing	Liftgate, LH alignment fixing	1186.6 (46.71)
C	Tailgate, LH hinge cover, fixing hole	Rear header, RH location hole	1184.3 (46.62)

Underbody Dimensional Information

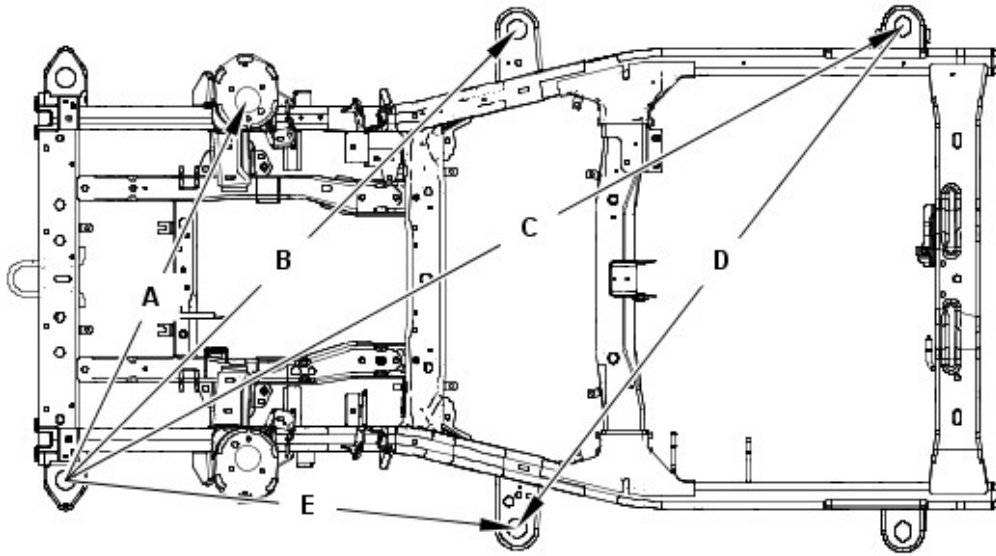
Front integral body frame dimensions



E55836

Item	From	To	Length
A	Body Mount 1 (front)	Body Mount 3	2113 (83.12)
B	Body Mount 1 (front)	Body Mount 2	1139 (44.84)
C	Body Mount 3 (LH)	Body Mount 3 (RH)	1275 (50.196)
D	Body Mount 1 (LH front)	Body Mount 1 (RH front)	1015 (39.96)
E	Body Mount 2 (LH)	Body Mount 2 (RH)	1258 (49.53)
F	Datum Line (Z)	Body Mount 3	136.5 (5.374)
G	Datum Line (Z)	Body Mount 2	105.5 (4.15)
H	Datum Line (Z)	Body Mount 1	78.8 (3.102)

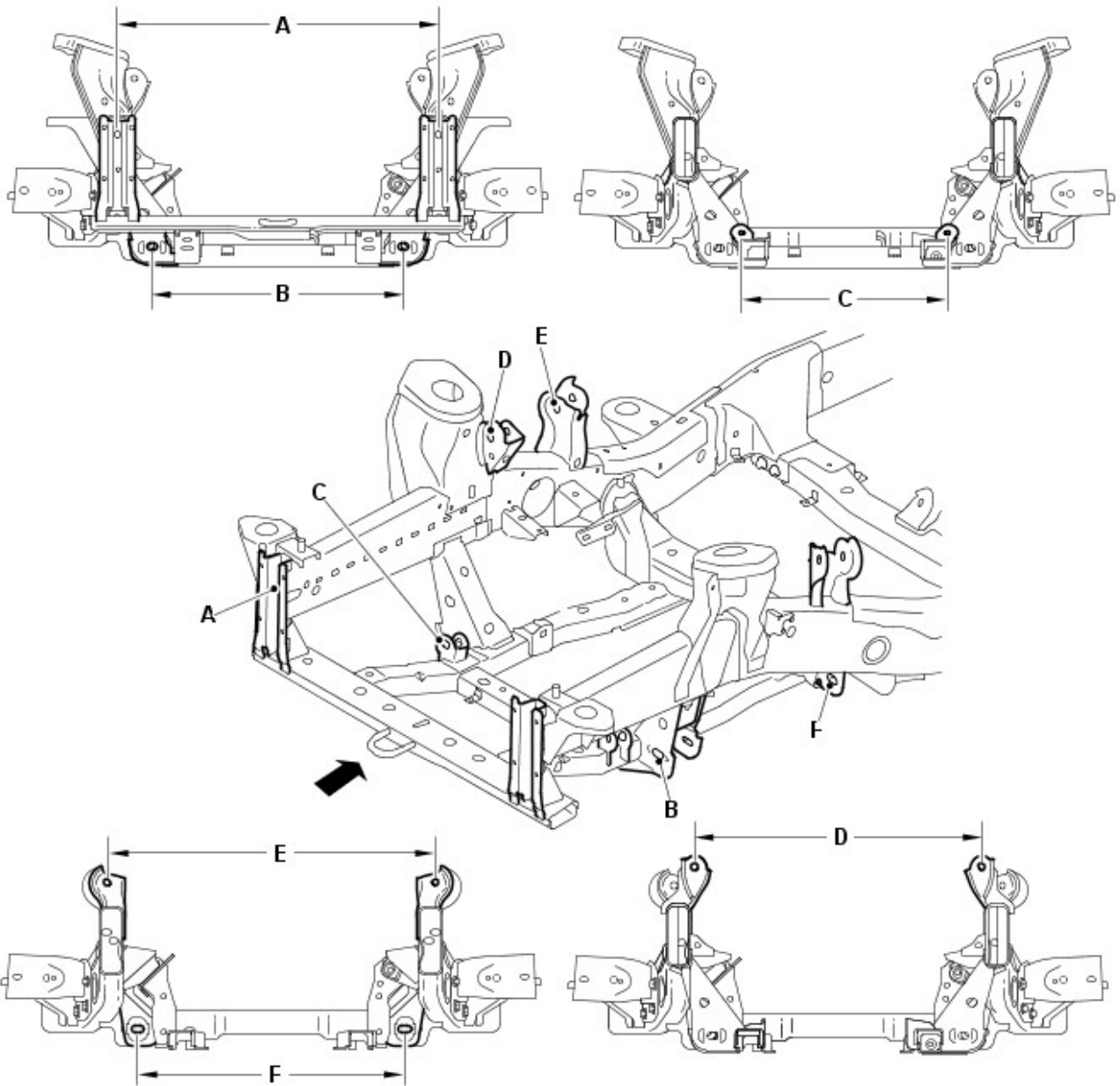
Front integral body frame dimensions



E55835

Item	From	To	Length
A	Body Mount 1 (LH front)	Damper Mounting (RH)	1063.1 (41.85)
B	Body Mount 1 (LH front)	Body Mount 2 (RH)	1609 (63.34)
C	Body Mount 1 (LH front)	Body Mount 3 (RH)	24.3.3 (94.61)
D	Body Mount 2 (LH front)	Body Mount 3 (RH)	1597.7 (62.90)
E	Body Mount 1 (LH front)	Body Mount 2 (LH)	1139 (44.84)

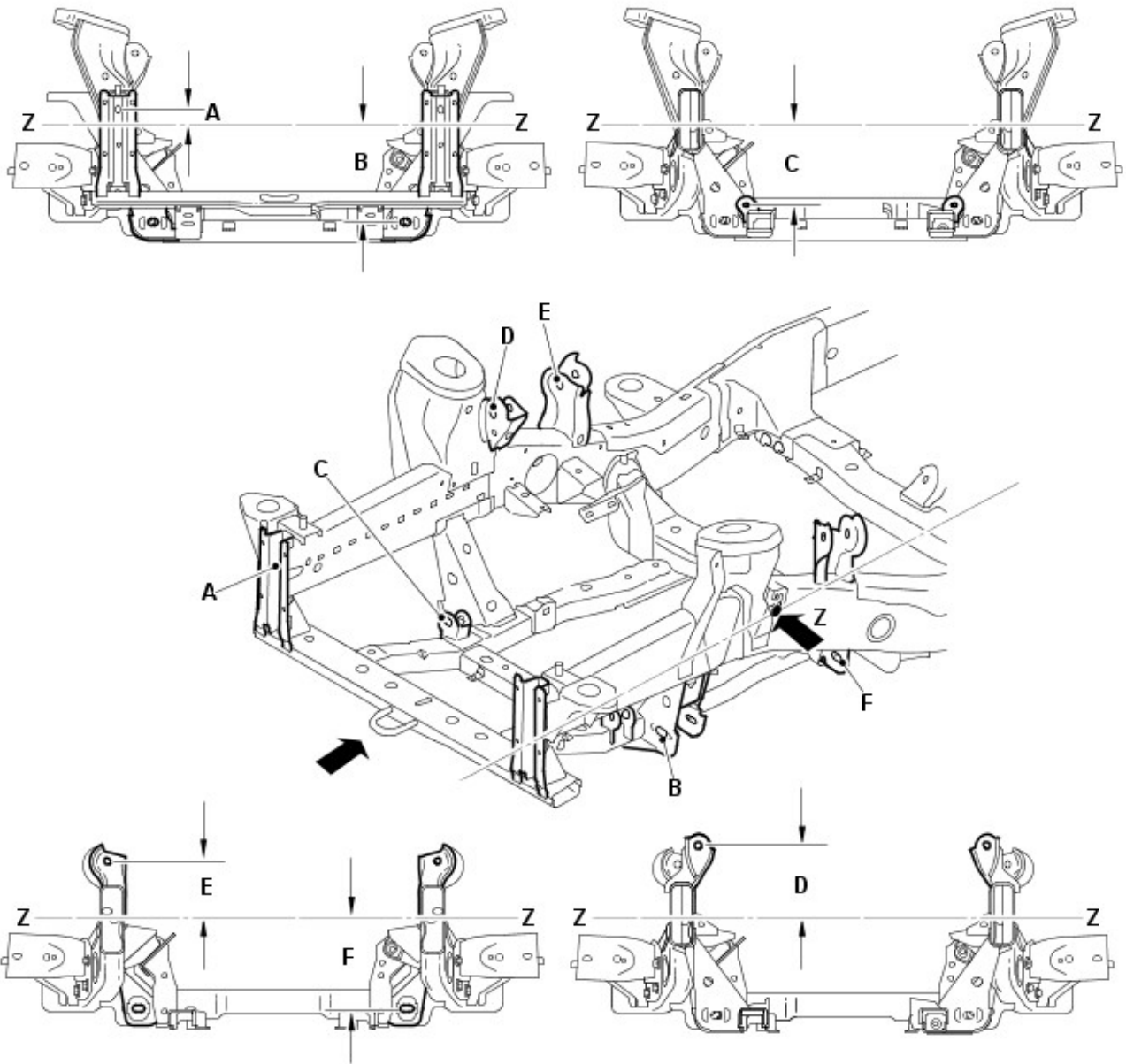
Front integral body frame dimensions



E57095

Item	From	To	Length
A	Front Bumper Mount (L/H)	Front Bumper Mount (R/H)	810 (31.8)
B	Lower Arm (L/H front)	Lower Arm (R/H front)	635.7 (25.02)
C	Steering Gear (L/H)	Steering Gear (R/H)	520 (20.4)
D	Upper Arm (L/H front)	Upper Arm R/H front)	748.7 (29.47)
E	Upper Arm (L/H rear)	Upper Arm (R/H rear)	836.8 (32.9)
F	Lower Arm ((L/H rear)	Lower Arm ((L/H rear)	678.6 (26.71)

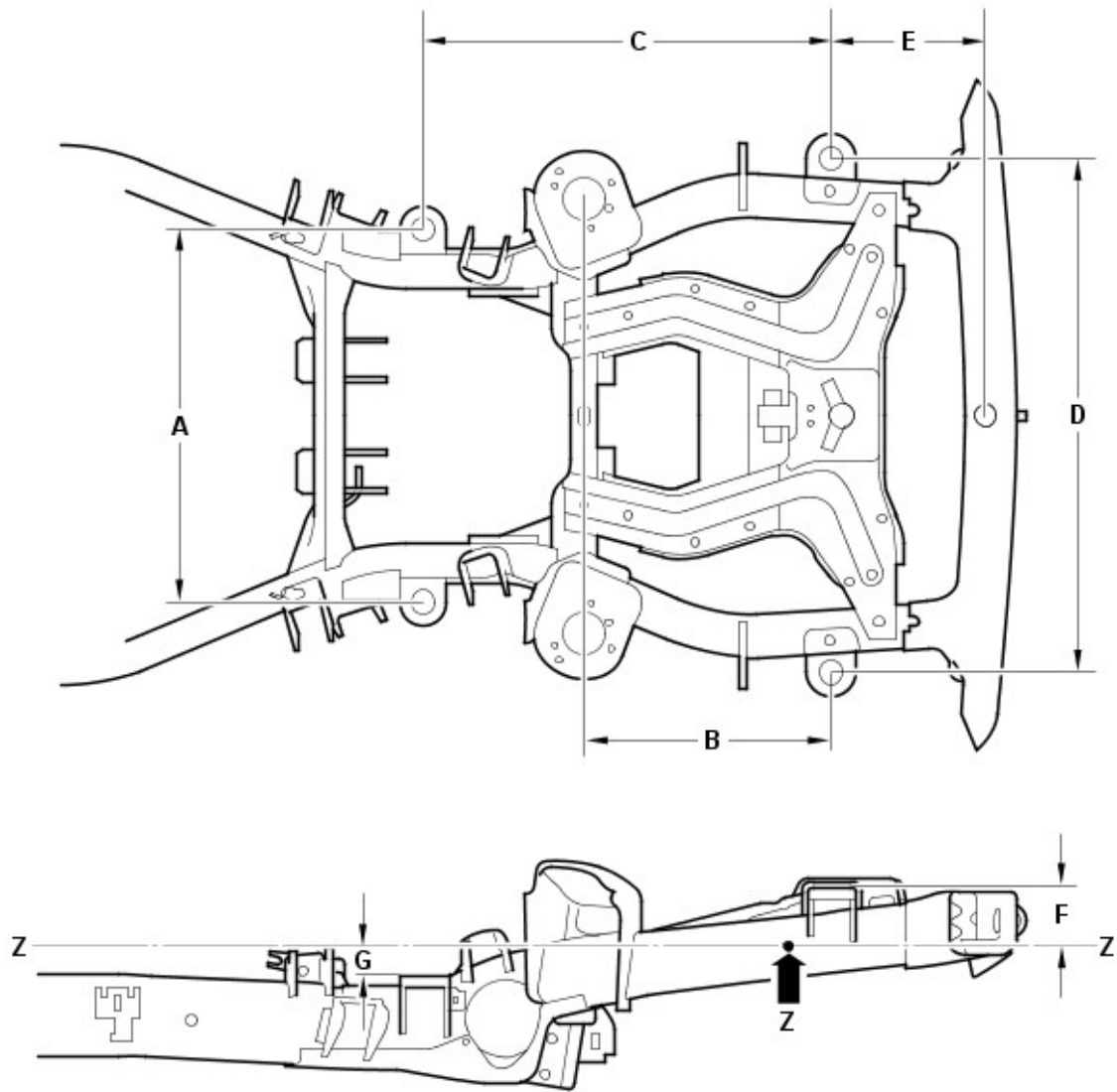
Front integral body frame dimensions



E57470

Item	From	To	Length
A	Datum Line (Z)	Front Bumper Mount	37.81 (1.488)
B	Datum Line (Z)	Lower Arm	249.22 (9.811)
C	Datum Line (Z)	Steering Gear	201.84 (7.946)
D	Datum Line (Z)	Upper Arm front	170.09 (6.696)
E	Datum Line (Z)	Upper Arm Rear	134.17 (5.282)
F	Datum Line (Z)	Lower Arm Rear	236.37 (5.282)

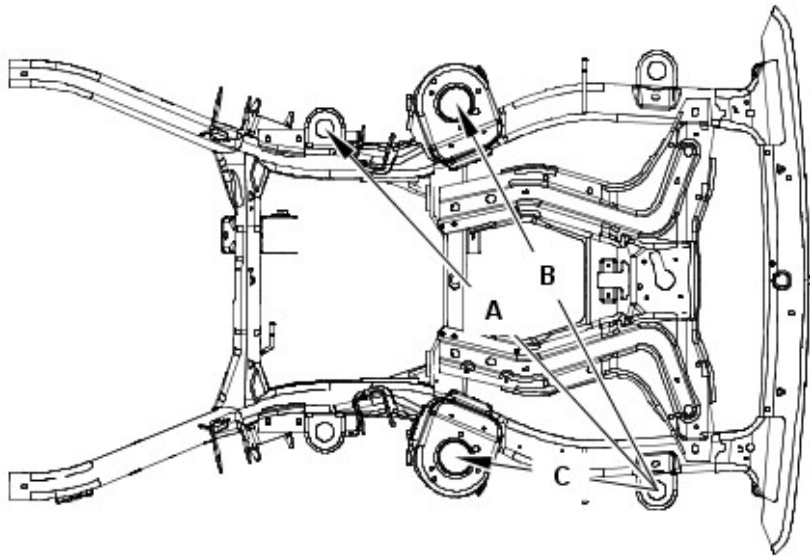
Rear integral body frame dimensions



E55834

Item	From	To	Length
A	Body Mount 4 (LH)	Body Mount 4 (RH)	806 (31.732)
B	Body Mount 5 (rear)	Damper Mounting	533.5 (21.00)
C	Body Mount 5 (rear)	Body Mount 4	882.8 (34.755)
D	Body Mount 5 (LH rear)	Body Mount 5 (RH rear)	1114 (43.858)
E	Body Mount 5 (rear)	Rear Crossmember	332 (13.07)
F	Datum Line (Z)	Body Mount 5 (rear)	127.5 (5.01)
G	Datum Line (Z)	Body Mount 4	61.2 (2.40)

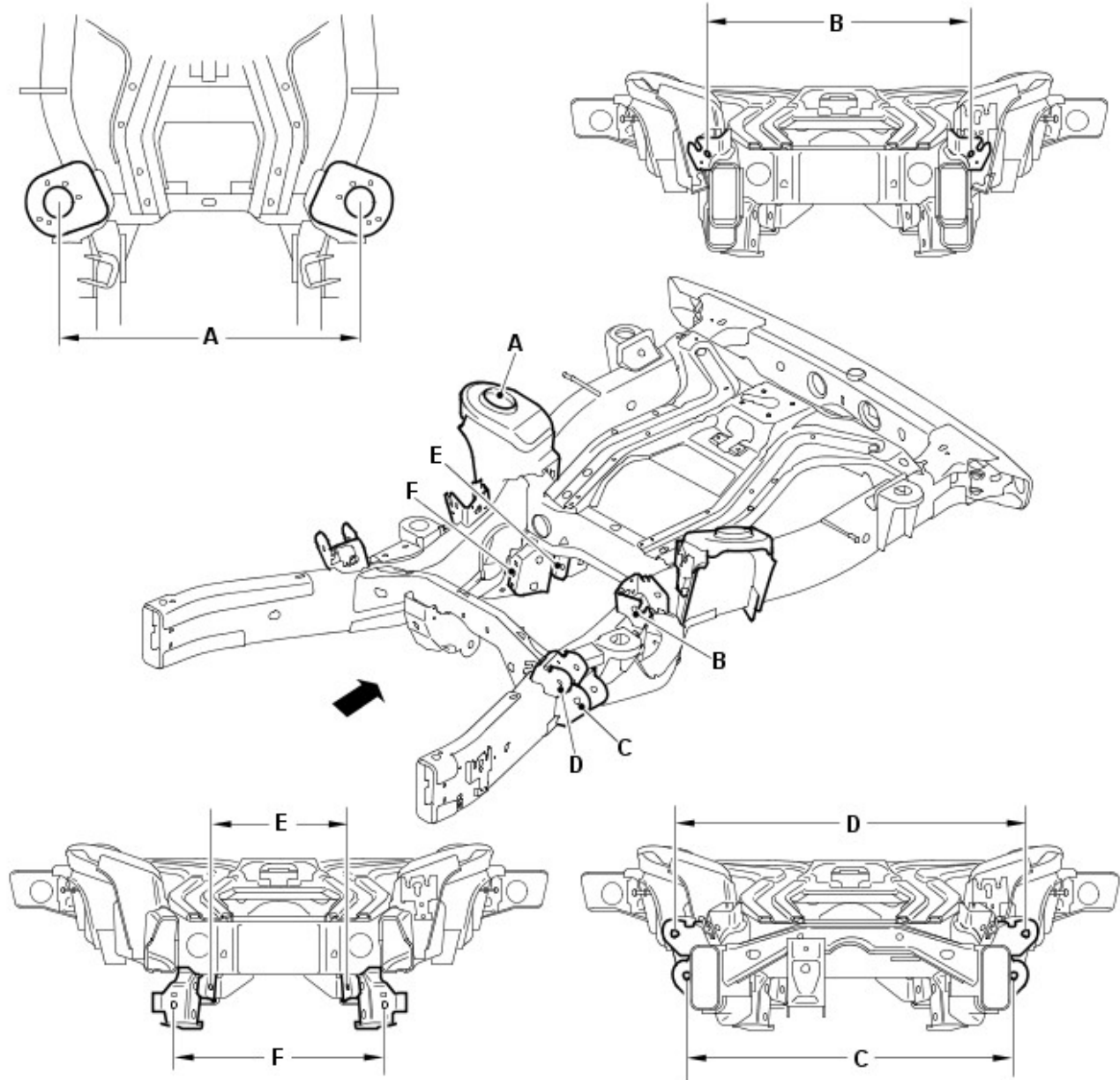
Rear integral body frame dimensions



E55833

Item	From	To	Length
A	Body Mount 5 (LH rear)	Body Mount 4 (RH)	1304.2 (51.34)
B	Body Mount 5 (LH rear)	Rear Damper Mounting (RH)	1156 (45.51)
C	Body Mount 5 (LH rear)	Rear Damper Mounting (LH)	533.5 (21.00)

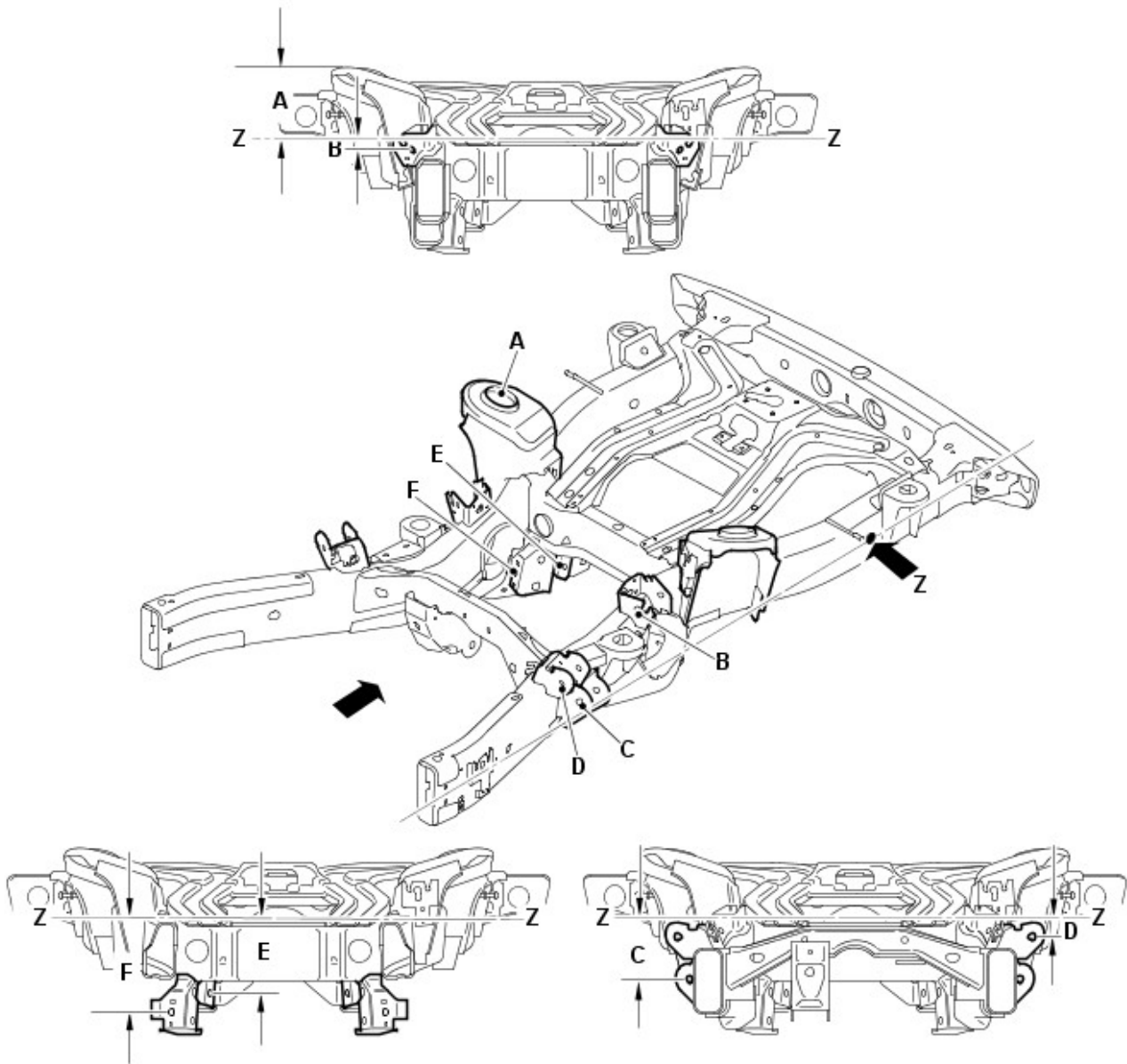
Rear integral body frame dimensions



E57096

Item	From	To	Length
A	Damper (L/H)	Damper (R/H)	937.1 (36.9)
B	Upper Arm (L/H rear)	Upper Arm (R/H rear)	757.4 (29.81)
C	Lower Arm (L/H front)	Lower Arm (R/H front)	818.4 (32.2)
D	Upper Arm (L/H front)	Upper Arm (R/H front)	946.5 (37.2)
E	Toe Link (L/H)	Toe Link (R/H)	439 (17.2)
F	Lower Arm (L/H rear)	Lower Arm (R/H rear)	508.4 (20.01)

Rear integral body frame dimensions



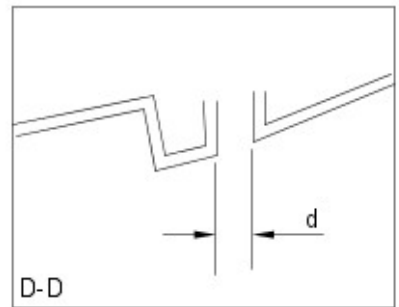
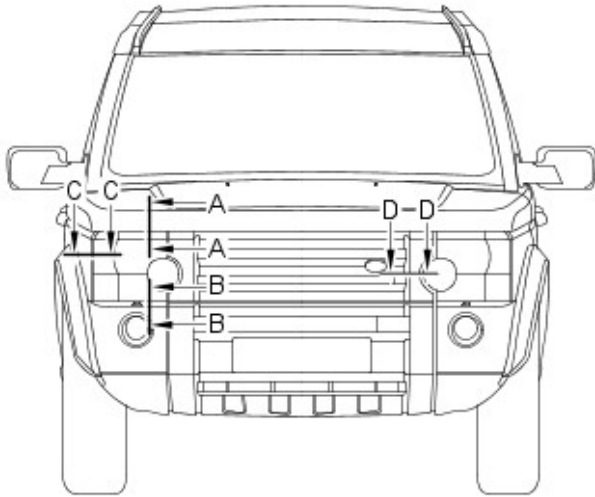
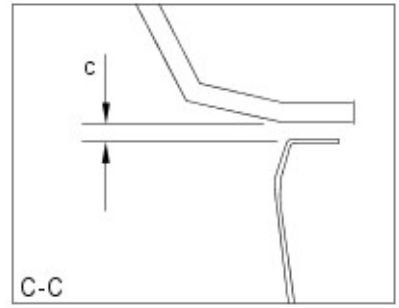
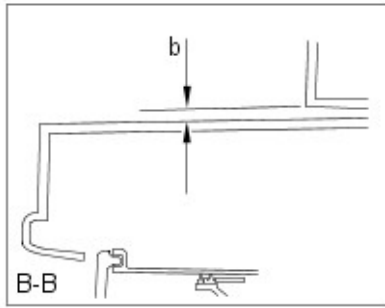
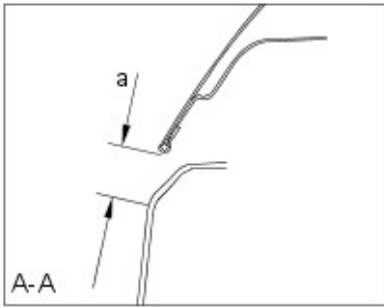
E57471

Item	From	To	Length
A	Datum Line (Z)	Damper	169.97 (6.691)
B	Datum Line (Z)	Upper Arm Rear	32.27 (1.270)
C	Datum Line (Z)	Lower Arm Front	161.04 (6.340)
D	Datum Line (Z)	Upper Arm Front	55.07 (2.168)
E	Datum Line (Z)	Toe Link	200.87 (7.908)
F	Datum Line (Z)	Lower Arm Rear	250.81 (9.874)

Gap and Profile Measurements

The following information is to be used as a guide to assist the technician in installing exterior body panels and trim items so as to achieve a correctly aligned and cosmetically acceptable vehicle.

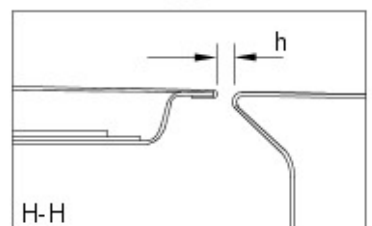
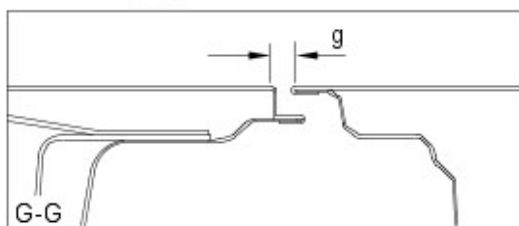
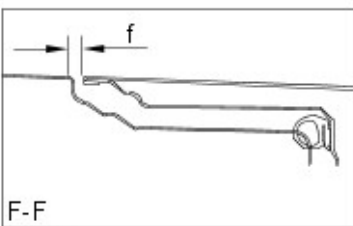
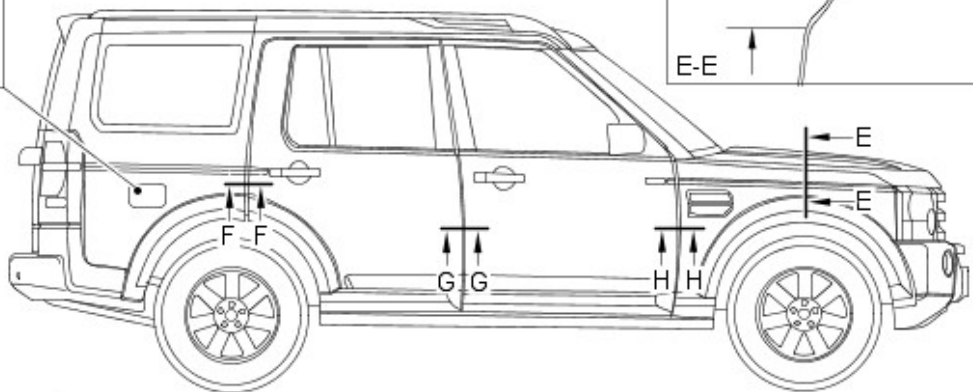
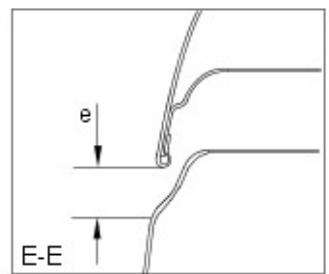
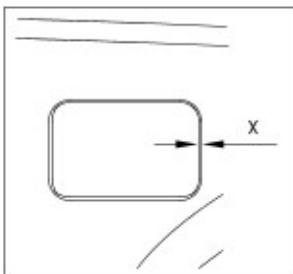
Front view dimensions



E55848

Section	Description	Gap	Profile
A-A	Headlamp to Hood	22.0 (0.866) ± 1.4 (0.055)	N/A
B-B	Headlamp to Bumper	6.0(0.236) ± 1.8 (0.070)	N/A
C-C	Headlamp to Fender	4.0(0.157) ± 1.2 (0.0472)	0.0 ± 1.2 (0.047)
D-D	Headlamp to Grille	4.0(0.157) ± 1.2 (0.0472)	0.0 ± 1.0 (0.039)

Side view dimensions

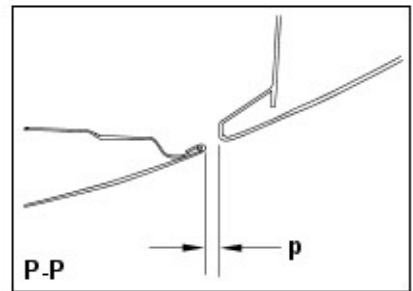
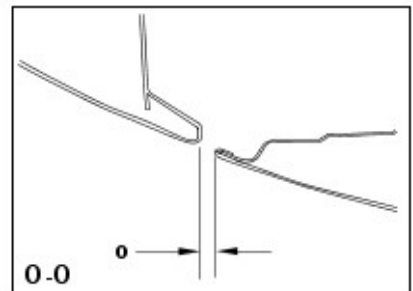
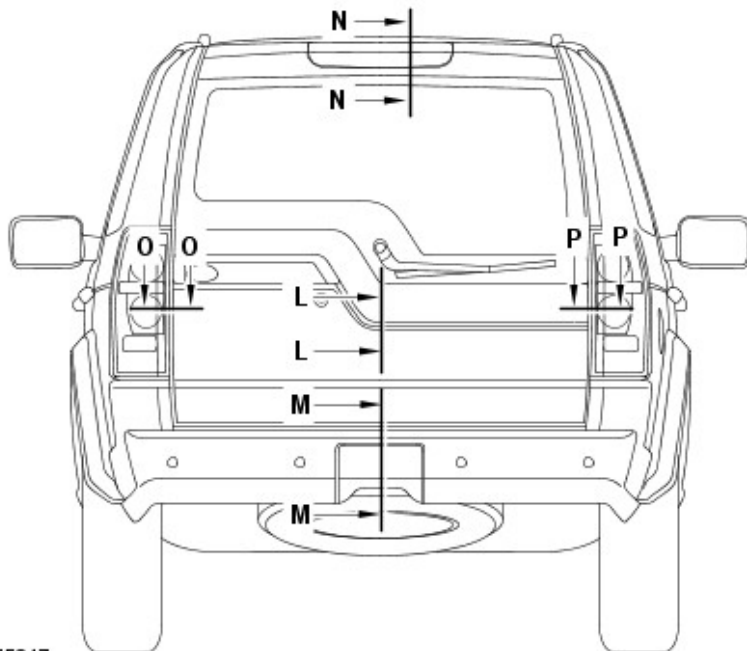
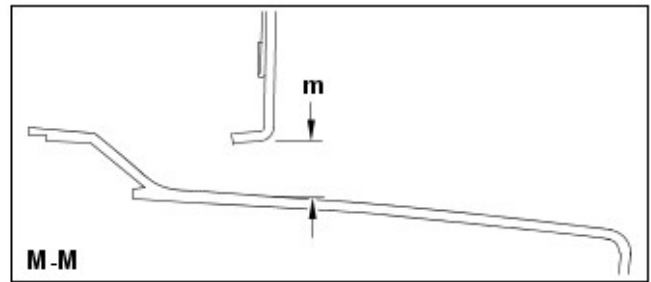
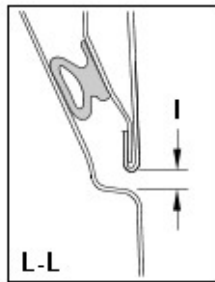
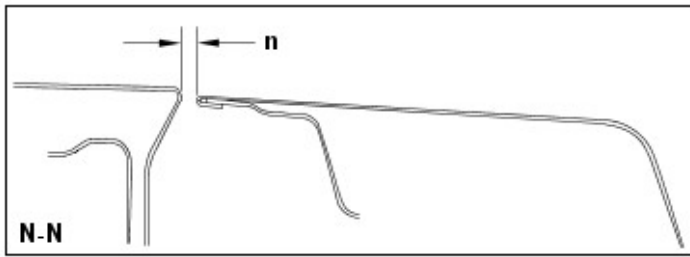


E55846

Section	Description	Gap	Profile
E-E	Hood to Fender	22.0 (0.866) ± 1.4(0.055)	+ 1.0 (0.039)
F-F	Rear Door to Bodyside	4.5 (0.177) ± 1.1 (0.043)	0.0 + 1.0 (0.039) - 0.0

G-G	Front Door to Rear Door	5.0 (0.196) ± 1.0 (0.039)	0.0 + 1.0 (0.039) - 0.0
H-H	Front Fender to Front Door	5.0 (0.196) ± 1.0 (0.039)	0.0 + 1.4 (0.055) - 0.0
X-X	Fuel Filler Flap to Bodyside	2.9 (0.114) ± 1.0 (0.039)	1.0 (0.039) ± 1.0 (0.039)

Rear view dimensions



E55847

Section	Description	Gap	Profile
L-L	Liftgate to Tailgate	6.0 (0.236) ± 1.0 (0.039)	0.0 ± 1.0 (0.039)
M-M	Tailgate to Bumper	12.8 (0.503) ± 2.1 (0.0826)	N/A
N-N	Liftgate to Roof	10 (0.393) ± 1.3 (0.0511)	-2.0 (0.078) ± 1.3 (0.0511)
O-O	Tailgate to Rear Lamp	5.0 (0.196) ± 1.6 (0.062)	5.0 (0.196) ± 1.3 (0.0511)
P-P	Liftgate to Rear Lamp	5.0 (0.196) ± 1.6 (0.062)	3.0 (0.118) ± 1.9 (0.074)

Front End Sheet Metal Repairs -

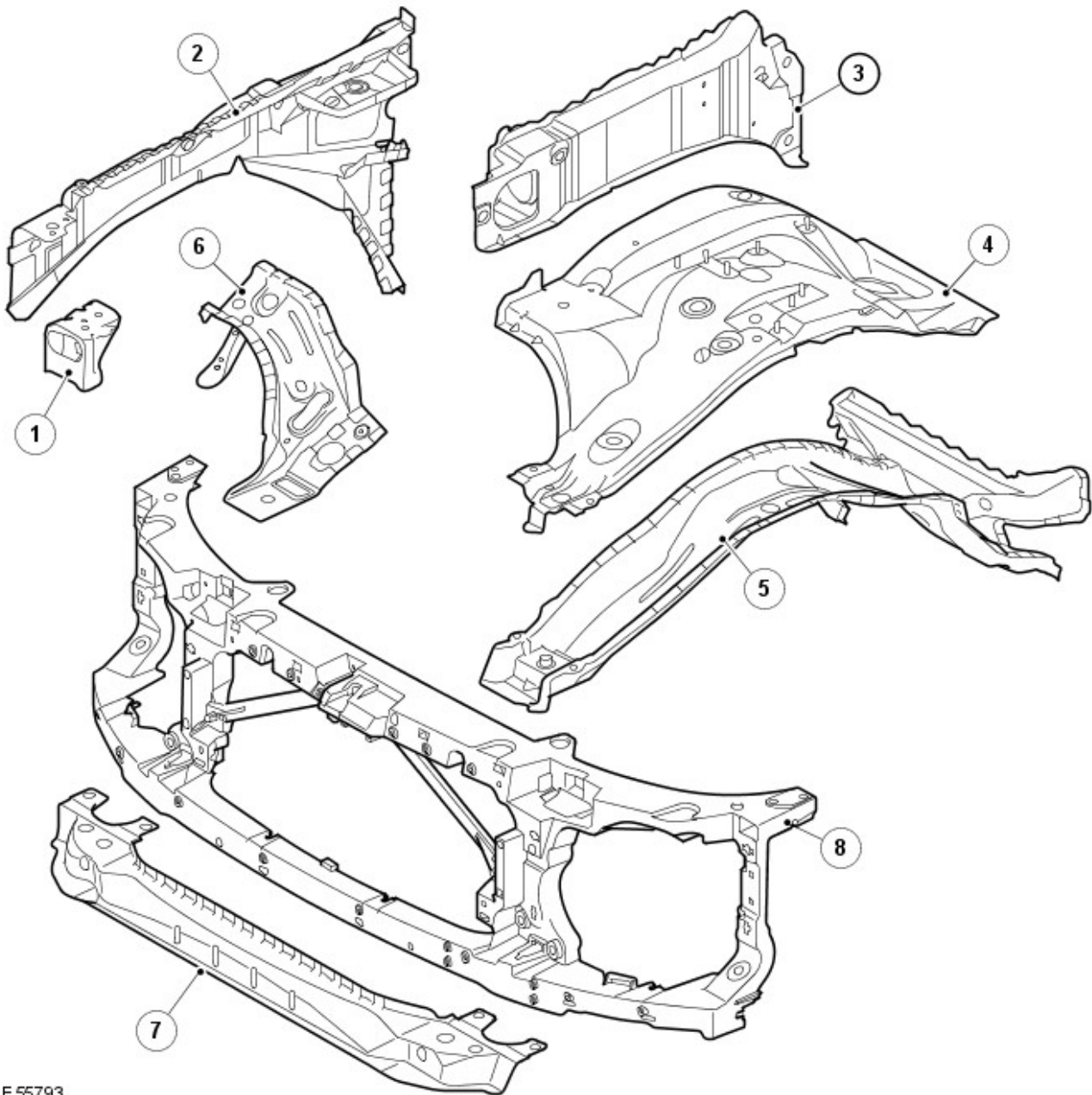
Torque Specifications

Description	Nm	lb-ft
Air deflector bolts	10	7
Hood latch Torx bolts	10	7
Hood panel bolts	25	18
Coolant expansion tank bolts	10	7

Front End Sheet Metal Repairs - Front End Sheet Metal

Description and Operation

Front end service panels



E 55793

Item	Description	Service part No
1	Fender apron panel closing.	R/H ABD780100 L/H ABD780110
2	Fender apron panel reinforcement.	R/H ABD780140 L/H ABD780150
3	Fender apron panel.	R/H ABD780220 L/H ABD780230
4	Front wheelhouse.	R/H ANJ780040 L/H ANJ780050
5	Front side member.	R/H AB1780040 L/H AB1780050
6	Front wheelhouse reinforcement.	R/H AWW780020 L/H AWW780030
7	Front crossmember.	ABC780060
8	Hood latch panel.	DIN500020

Time schedules, front end

The following information shows the total time taken to replace single panels and complete assemblies. This time includes removal of Mechanical, Electrical and Trim (MET) items, plus paint times based on Metallic Clear Over Base Paint.

The times shown were generated by Thatcham (the motor insurance repair and research centre) and are to be used as a guide only.

Single panel times

Panel Description	Petrol	Diesel
Hood	7.8	7.8
Hood latch panel	2.7	2.7
Front fender L/H	7.5	7.5
Front Fender R/H	7.5	7.5
Front Crossmember	6.0	6.0

Combination panel replacement times

The following panel combination times show the total time to remove/refit body panels, MET items and any paint process.

Combination panel times

Panel Description	Petrol	Diesel
Hood		
Front bumper		
Hood latch panel		
Front crossmember		
Front grille		
Front fender		
Total Time	17.6	17.6

Combination panel times

Panel Description	Petrol	Diesel
Hood		
Front bumper		
Hood latch panel		
Front crossmember		
Front grille		
Front fender L/H and R/H		
Total Time	18.1	18.1

Combination panel times

Panel Description	Petrol	Diesel
Body off integrated frame		
Hood		
Front bumper		
Hood latch panel		
Front side member		
Fender apron panel		
Fender apron panel reinforcement		
Front wheelhouse		
Front crossmember		
Front grille		
Front fender L/H and R/H		
Total Time	L/H 39.2 R/H 39.1	L/H 39.6 R/H 39.4

Combination panel times

Panel Description	Petrol	Diesel
Body off integrated frame		
Hood		
Front bumper		
Hood latch panel		
Front side member L/H and R/H		
Fender apron panel L/H and R/H		
Fender apron panel reinforcement L/H and R/H		
Front wheelhouse L/H and R/H		
Front crossmember		
Front grille		
Front fender L/H and R/H		
Total Time	48.8	49.2

Front End Sheet Metal Repairs - Hood Latch Panel

Removal and Installation

Removal

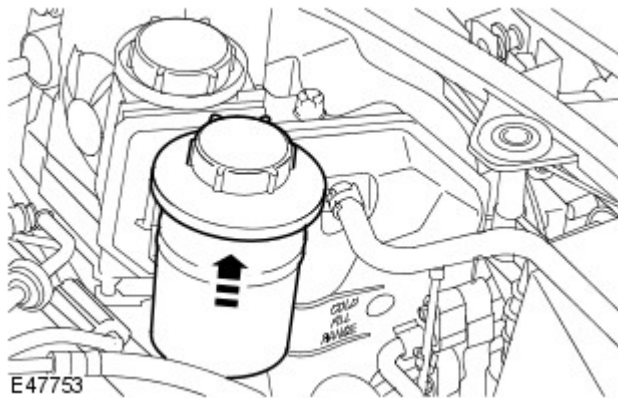


NOTE: If the hood latch panel coating is damaged or scratched, it must be repaired using the approved coating.

For additional information, refer to: [Specifications \(501-27, Specifications\)](#).

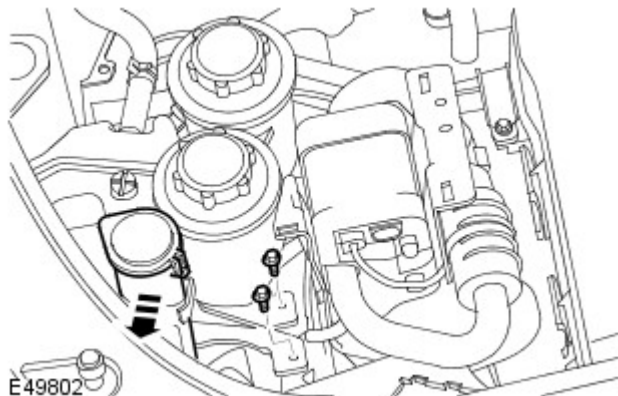
1. Disconnect the battery ground cable.
For additional information, refer to: [Specifications \(414-00, Specifications\)](#).
2. Remove the front bumper.
For additional information, refer to: [Front Bumper \(501-19, Removal and Installation\)](#).

3. Release the power steering fluid reservoir and position aside.
 - Release the clip.

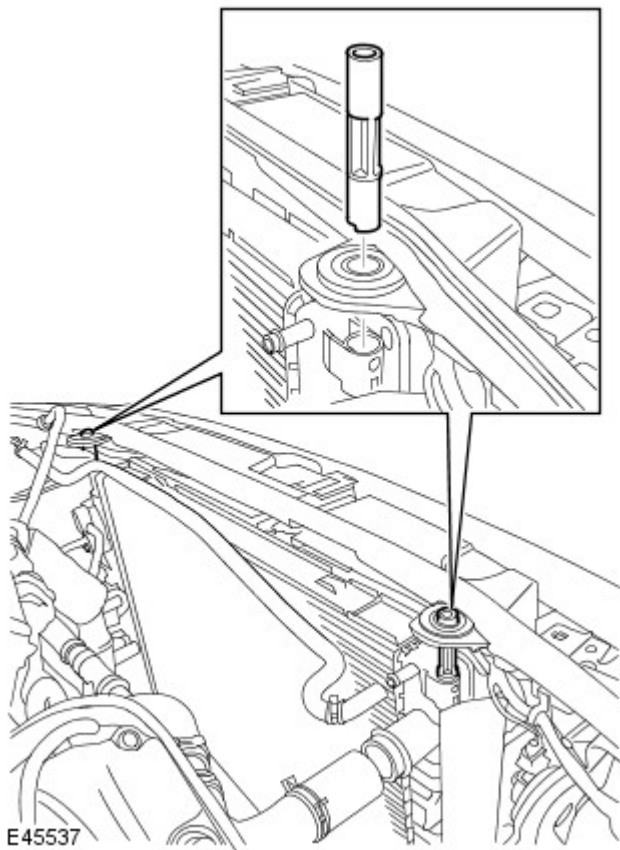


4. Release the washer reservoir filler neck from the coolant tank clip.
5. Remove the 2 coolant expansion tank mounting bolts.

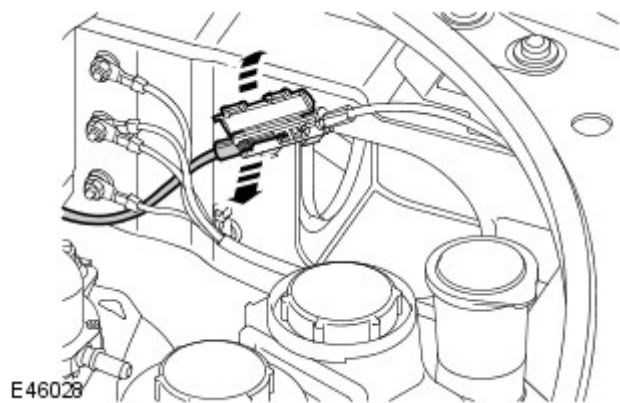
6. Release the coolant expansion tank.
 - Lift coolant expansion tank vertically.




7. Remove the radiator securing pegs.



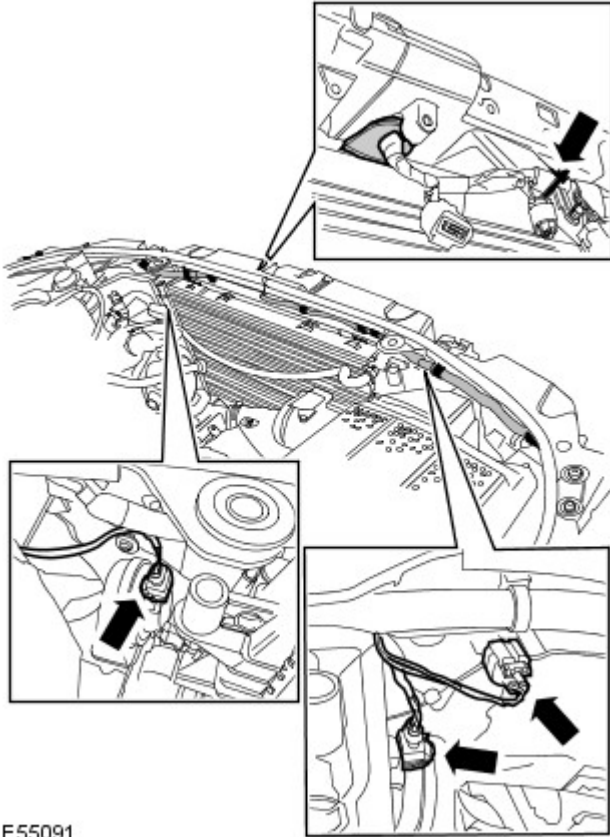
8. Disconnect the hood release cable from the connecting box.



9.  **NOTE:** Note the fitted position.

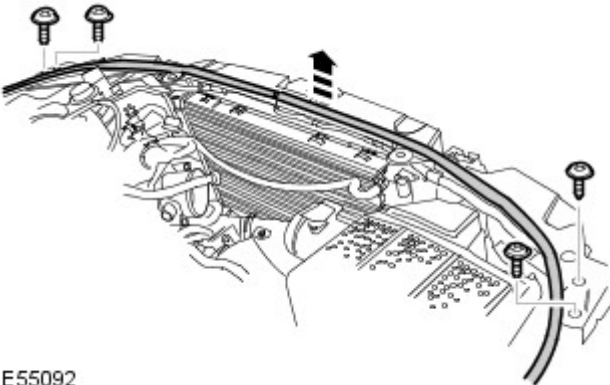
Release the wiring harness.

- Disconnect the 3 electrical connectors.
- Release the 9 clips.
- Release the grommet.
- Carefully tie the harness aside.



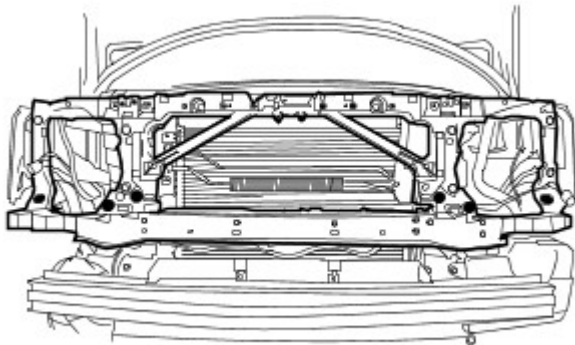
E55091

10. Remove the panel upper fixings.
 - Remove the 4 Torx bolts.



E55092

11. Remove the panel lower fixings.
 - Remove the 6 Torx bolts.

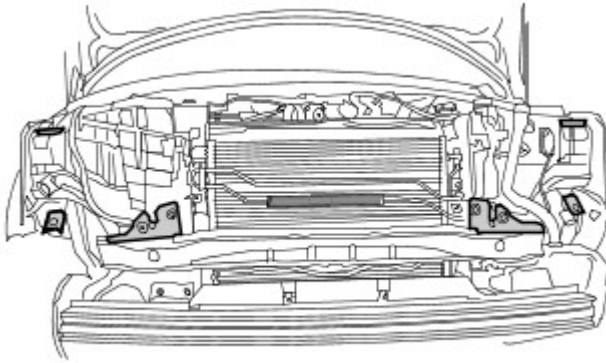


E55093

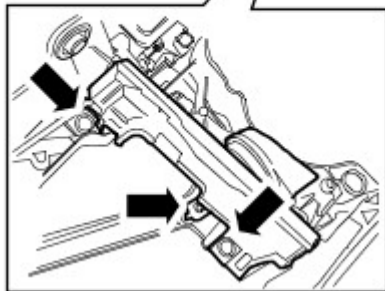
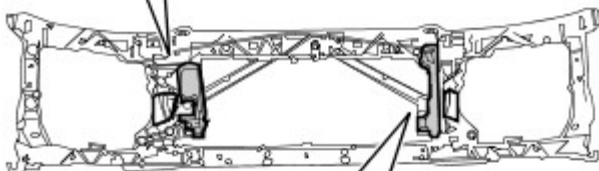
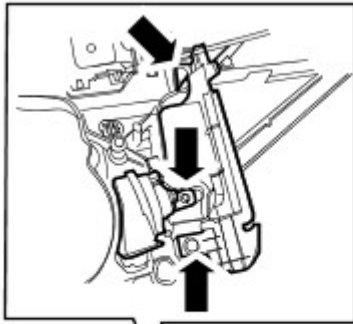
12.  **NOTE:** Note the fitted position.

With assistance, remove the hood latch panel.


13. Noting the fitted position, remove the 6 spacers.
 - Remove the 2 clips.



E55094



E55095

14.  NOTE: Do not disassemble further if the component is removed for access only.

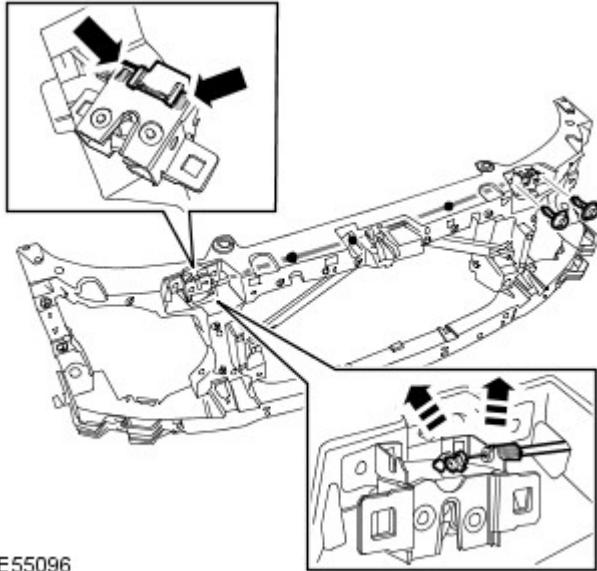
Remove the 2 horn assemblies.

- Remove the 2 air deflectors.
- Remove the 2 Torx bolts.

15. Remove the hood switch.
- Remove the 2 Torx bolts.
 - Release the 2 clips.



16. Remove the RH hood latch.
- Release and remove the cable.

17. Remove the LH hood latch.
- Remove the 2 Torx bolts.



E55096

Installation

1. Install the horn assemblies.
 - Install the air deflectors.
 - Install the bolts and tighten to 10 Nm (7 lb.ft).
2. Install the LH hood latch.
 - Tighten the Torx bolts to 10 Nm (7 lb.ft).
3. Install the RH hood latch.
 - Attach the hood release cable.
 - Install the hood switch.
 - Tighten the Torx bolts to 10 Nm (7 lb.ft).
4. Install the spacers.
 - Install the clips.
5.  **NOTE:** [Align to the position noted on removal.](#)
 With assistance, install the hood latch panel.
6. Install the panel fixings.
 - Install and tighten the bolts to 25 Nm (18 lb.ft).
7.  **NOTE:** [Align to the position noted on removal.](#)
 Install the wiring harness.
 - Connect and secure the electrical connector.
 - Carefully secure the clips.
8. Connect the hood release cable.
9. Install the radiator securing pegs.
10. Install the coolant expansion tank.
 - Position the coolant expansion tank, locate the spigot and lug.
 - Install the bolts and tighten to 10 Nm (7 lb.ft).
11. Install the windshield washer reservoir filler neck.
 - Locate in clip.
12. Install the power steering fluid reservoir.
 - Position and secure to mounting bracket.
13. Install the front bumper.
 For additional information, refer to: Front Bumper (501-19, Removal and Installation).

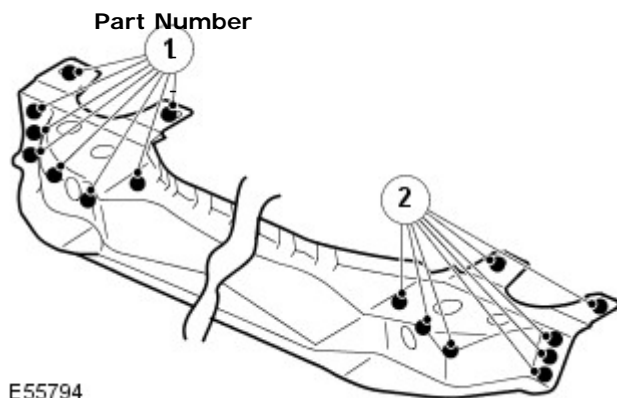
14. Open and close the hood to check the hood latch operation.
15. Adjust both of the hood latches.
 - Loosen the 4 hood latch Torx bolts.
 - Lower the hood and check for alignment.
 - Open the hood and tighten the Torx bolts to 10 Nm (7 lb.ft).
 - Check for the correct operation of the hood safety catch.
 - If necessary, repeat the above adjustment procedure.
16. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00, Specifications).

Front End Sheet Metal Repairs - Front Crossmember

Removal and Installation

Removal

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the hood latch panel.
For additional information, refer to: Hood Latch Panel (501-27 Front End Sheet Metal Repairs, Removal and Installation).
3. Remove the radiator.
For additional information, refer to: Radiator (303-03C Engine Cooling - 2.7L Diesel, Removal and Installation).
4. Remove both front impact sensors.
For additional information, refer to: Front Impact Severity Sensor (501-20B Supplemental Restraint System, Removal and Installation).
5. Release wiring harness from crossmember
6. Remove the fender moulding.
For additional information, refer to: Fender Moulding (501-08 Exterior Trim and Ornamentation, Removal and Installation).



E55794

7.

Item	Description
1	8 spot welds.
2	8 spot welds.

8. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Front End Sheet Metal Repairs - Front Side Member

Removal and Installation

Removal

NOTES:



This procedure requires the body to be removed from the integrated body frame.



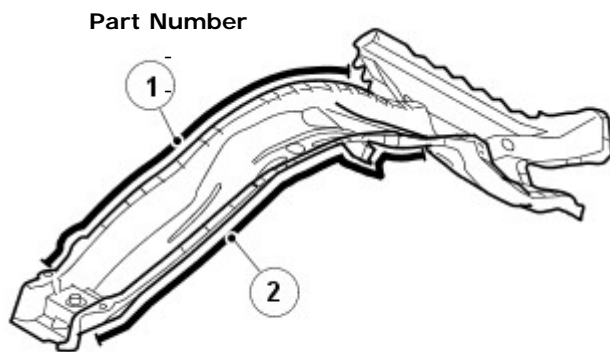
In this procedure the front side member is replaced in conjunction with hood latch panel, front wheelhouse and the front crossmember.

1. Load vehicle onto ramp.
2. Disconnect both the battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
3. L/H side: Remove the battery.
4. Remove the front fender.
For additional information, refer to: Fender (501-02 Front End Body Panels, Removal and Installation).
5. Remove the hood latch panel.
For additional information, refer to: Hood Latch Panel (501-27 Front End Sheet Metal Repairs, Removal and Installation).
6. Remove the front crossmember.
For additional information, refer to: Front Crossmember (501-27 Front End Sheet Metal Repairs, Removal and Installation).
7. Remove the front wheelhouse.
For additional information, refer to: Front Wheelhouse (501-27, Removal and Installation).
8. Remove the hood.
9. Remove both hood support struts.
10. Remove the hood wiring harness.
11. Remove the plenum chamber panel.
For additional information, refer to: Plenum Chamber (412-01 Air Distribution and Filtering, Removal and Installation).
12. Remove both wiper arms and blades.
13. L/H side: Remove the power steering fluid reservoir.
For additional information, refer to: Power Steering Fluid Reservoir - 2.7L Diesel (211-02 Power Steering, Removal and Installation).
14. Remove the instrument panel.
For additional information, refer to: Instrument Panel - 2.7L Diesel (501-12 Instrument Panel and Console, Removal and Installation).
15. Remove the insulation from outer and inner bulkhead.
16. R/H side: Release the ABS modulator.
17. R/H side: Remove the accelerator pedal.
For additional information, refer to: Accelerator Pedal (310-02C Acceleration Control - 2.7L Diesel, Removal and Installation).
18. L/H side: Remove the battery junction box.
For additional information, refer to: Battery Junction Box

(BJB) - 2.7L Diesel (418-00 Module Communications Network, Removal and Installation).

19. Release the wiring harness from bulkhead.
20. Release the wiring harness from fender apron panel reinforcement.
21. Release the wiring harness from the side member.
22. L/H side: Remove the fuel fired booster heater.
For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Heating, Removal and Installation).
23. Remove the scuff plate trim panel trim
For additional information, refer to: Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
24. Remove the footrest
25. Remove the cowl side trim panel.
For additional information, refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
26. Release the front carpet.

27.



E55830

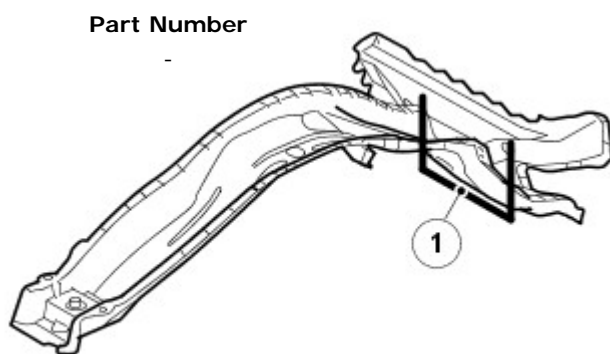
Item

- 1
- 2

Description

- 18 spot welds.
16 spot welds.

28.



E56906

Item

- 1

Description

- 6 plug welds and a butt weld.

29. For additional information:

- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
- Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Front End Sheet Metal Repairs - Front Side Member Section

Removal and Installation

Removal

NOTES:



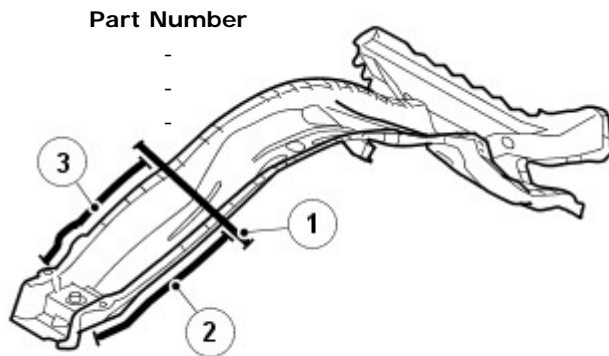
This procedure requires the body to be removed from the integrated body frame.



In this procedure the front side member section is replaced in conjunction with hood latch panel, front wheelhouse and the front crossmember.

1. Load vehicle onto ramp.
2. Disconnect both the battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
3. L/H side: Remove the battery.
4. Remove the front fender.
For additional information, refer to: Fender (501-02 Front End Body Panels, Removal and Installation).
5. Remove the hood latch panel.
For additional information, refer to: Hood Latch Panel (501-27 Front End Sheet Metal Repairs, Removal and Installation).
6. Remove the front wheelhouse.
For additional information, refer to: Front Wheelhouse (501-27, Removal and Installation).
7. Remove the front crossmember.
For additional information, refer to: Front Crossmember (501-27 Front End Sheet Metal Repairs, Removal and Installation).
8. Remove the hood.
9. Remove both hood support struts.
10. Remove the hood wiring harness.
11. Remove the plenum chamber panel.
For additional information, refer to: Plenum Chamber (412-01 Air Distribution and Filtering, Removal and Installation).
12. L/H side: Remove the power steering fluid reservoir.
For additional information, refer to: Power Steering Fluid Cooler - 2.7L Diesel (211-02 Power Steering, Removal and Installation).
13. Remove the instrument panel.
For additional information, refer to: Instrument Panel - 2.7L Diesel (501-12 Instrument Panel and Console, Removal and Installation).
14. Remove the insulation from outer and inner bulkhead.
15. R/H side: Release the ABS modulator.
16. R/H side: Remove the accelerator pedal.
For additional information, refer to: Accelerator Pedal (310-02C Acceleration Control - 2.7L Diesel, Removal and Installation).
17. L/H side: Remove the battery junction box.
For additional information, refer to: Battery Junction Box (BJB) - 2.7L Diesel (418-00 Module Communications Network, Removal and Installation).

18. Release the wiring Harness from bulkhead.
19. Release the wiring harness from fender apron panel reinforcement.
20. Release the wiring harness from the side member.
21. L/H side: Remove the fuel fired booster heater.
For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Heating, Removal and Installation).
22. Remove the scuff plate trim panel trim
For additional information, refer to: Scuff Plate Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
23. Remove the footrest
24. Remove the cowl side trim panel.
For additional information, refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
25. Release the front carpet.



E55831

Item	Description
1	Butt weld
2	7 spot welds.
3	8 spot welds.

- 26.
27. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Front End Sheet Metal Repairs - Fender Apron Panel Reinforcement

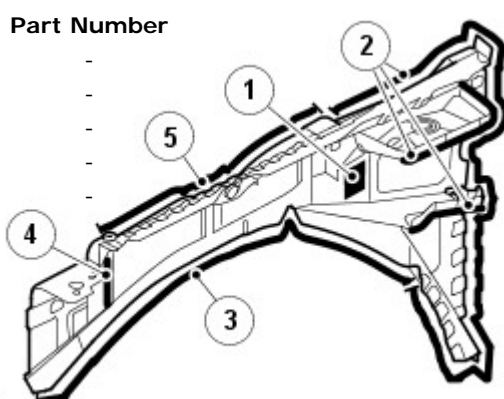
Removal and Installation

Removal



NOTE: In this procedure the fender apron panel reinforcement is replaced in conjunction with fender apron panel closing.

1. Disconnect both the battery cables.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the front fender.
For additional information, refer to: Fender (501-02, Removal and Installation).
3. Remove the hood latch panel.
For additional information, refer to: Hood Latch Panel (501-27, Removal and Installation).
4. L/H side: Remove the battery junction box.
For additional information, refer to: Battery Junction Box (BJB) - 2.7L Diesel (418-00 Module Communications Network, Removal and Installation).
5. L/H side: Remove the power steering fluid reservoir.
For additional information, refer to: Power Steering Fluid Reservoir - 2.7L Diesel (211-02, Removal and Installation).
6. L/H side: Remove the battery.
7. L/H side: Remove the fuel fired booster heater.
For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Heating, Removal and Installation).
8. L/H side: Remove fuel fired booster heater pipes.
9. R/H side: Remove the air cleaner.
For additional information, refer to: Air Cleaner (303-12C, Removal and Installation).
10. R/H side: Release the ABS modulator.
11. Remove the wiring harness.
12. Remove the plenum chamber panel.
For additional information, refer to: Plenum Chamber (412-01 Air Distribution and Filtering, Removal and Installation).
13. Remove the hood.
14. Remove both hood support struts.
15. Remove the hood wiring harness.



Part Number

-
-
-
-
-

16.

Item

1
2
3
4
5

Description

Acoustic seal.
34 plug welds.
13 spot welds.
3 spot welds.
14 spot welds.

17. For additional information:

- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
- Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Front End Sheet Metal Repairs - Fender Apron Panel

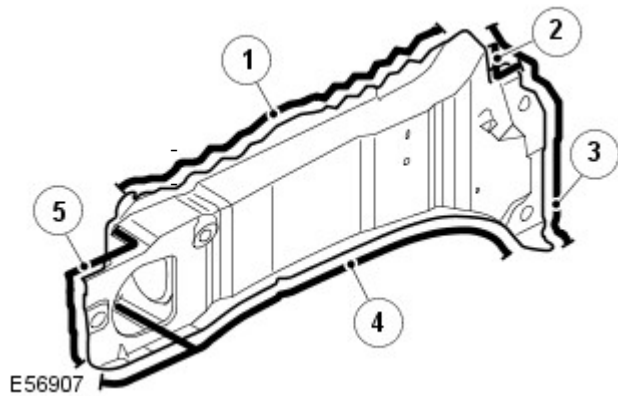
Removal and Installation

Removal

1. Disconnect both the battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the front fender.
For additional information, refer to: Fender (501-02 Front End Body Panels, Removal and Installation).
3. Remove the hood latch panel.
For additional information, refer to: Hood Latch Panel (501-27 Front End Sheet Metal Repairs, Removal and Installation).
4. Remove the radiator.
For additional information, refer to: Radiator (303-03C Engine Cooling - 2.7L Diesel, Removal and Installation).
5. Remove the radiator coolant expansion tank.
For additional information, refer to: Coolant Expansion Tank (303-03C Engine Cooling - 2.7L Diesel, Removal and Installation).
6. L/H side: Remove the power steering fluid reservoir.
For additional information, refer to: Power Steering Fluid Reservoir - 2.7L Diesel (211-02 Power Steering, Removal and Installation).
7. Remove the hood.
8. Remove both hood support struts.
9. Remove the hood wiring harness.
10. Remove both wiper arms and blades.
11. Remove the plenum chamber panel.
For additional information, refer to: Plenum Chamber (412-01 Air Distribution and Filtering, Removal and Installation).
12. L/H side: Remove the battery.
13. Remove the wiring harness
14. R/H side: Release the ABS modulator.
15. Remove the air cleaner.
For additional information, refer to: Air Cleaner (303-12A Intake Air Distribution and Filtering - 4.0L, Removal and Installation).
16. Remove the insulation from outer bulkhead.
17. L/H side: Remove the fuel fired booster heater.
For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Heating, Removal and Installation).
18. L/H side: Remove the battery junction box.
For additional information, refer to: Battery Junction Box (BJB) - 2.7L Diesel (418-00 Module Communications Network, Removal and Installation).

19.

Part Number	Item	Description
-	1	14 spot-welds.
-	2	2 mig welds.
-	3	11 mig-plug welds



E56907

4
5

19 mig-plug welds.
5 mig-plug welds.

20. For additional information:

- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
- Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

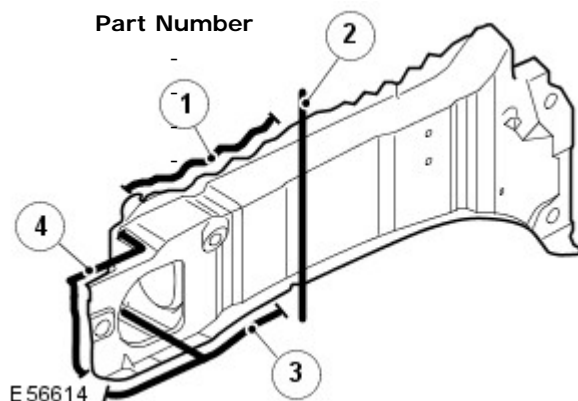
1. Install is the reversal of removal.

Front End Sheet Metal Repairs - Fender Apron Panel Section

Removal and Installation

Removal

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the front fender.
For additional information, refer to: Fender (501-02 Front End Body Panels, Removal and Installation).
3. Remove the hood latch panel.
For additional information, refer to: Hood Latch Panel (501-27 Front End Sheet Metal Repairs, Removal and Installation).
4. Remove the radiator coolant expansion tank.
For additional information, refer to: Coolant Expansion Tank (303-03C Engine Cooling - 2.7L Diesel, Removal and Installation).
5. L/H side: Remove the power steering fluid reservoir.
For additional information, refer to: Power Steering Fluid Reservoir - 2.7L Diesel (211-02 Power Steering, Removal and Installation).
6. Remove the air cleaner.
For additional information, refer to: Air Cleaner (303-12C Intake Air Distribution and Filtering - 2.7L Diesel, Removal and Installation).
7. Remove the hood.
8. Remove both hood support struts.
9. Remove the hood wiring harness.
10. L/H side: Remove the battery.
11. Remove the Wiring harness.
12. R/H side: Release the ABS modulator.
13. L/H side: Remove the fuel fired booster heater.
For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Heating, Removal and Installation).
14. L/H side: Remove the battery junction box.
For additional information, refer to: Battery Junction Box (BJB) - 2.7L Diesel (418-00 Module Communications Network, Removal and Installation).



15.

Item	Description
1	5 spot-welds
2	Butt weld
3	9 mig-plug welds.
4	5 mig-plug welds.

16. For additional information:
 - Welding.

For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).

- Corrosion protection.

For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).

- Tolerance checks.

For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Front End Sheet Metal Repairs - Front Wheelhouse

Removal and Installation

Removal

NOTES:

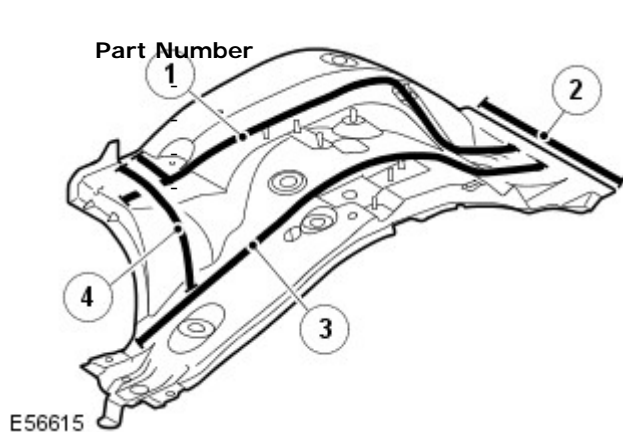


This procedure requires the body to be removed from the integrated body frame.

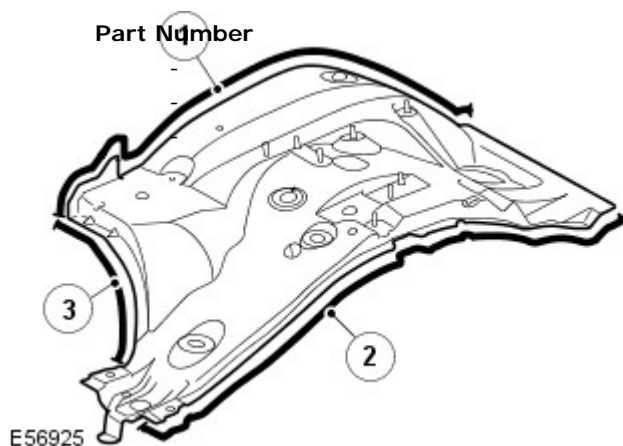


In this procedure the front wheelhouse is replaced in conjunction with the front side member, hood latch panel and front crossmember.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the front side member.
For additional information, refer to: Front Side Member (501-27, Removal and Installation).
3. Remove the crossmember.
For additional information, refer to: Front Crossmember (501-27, Removal and Installation).
4. Remove the hood latch panel.
For additional information, refer to: Hood Latch Panel (501-27, Removal and Installation).



5.	Item	Description
	1	19 plug welds.
	2	9 plug welds.
	3	18 spot welds.
	4	7 plug welds.



6.	Item	Description
	1	13 spot welds.
	2	16 spot welds.
	3	9 spot welds.

7. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.

For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Front End Sheet Metal Repairs - Front Wheelhouse Reinforcement

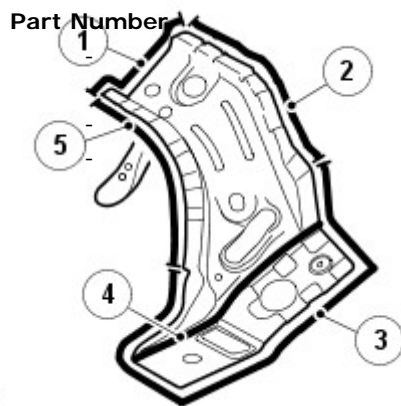
Removal and Installation

Removal



NOTE: In this procedure the front wheelhouse reinforcement is replaced in conjunction with the front side member and front wheelhouse.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the front side member.
For additional information, refer to: Front Side Member (501-27, Removal and Installation).
3. Remove the front wheelhouse.
For additional information, refer to: Front Wheelhouse (501-27, Removal and Installation).



E56616

4.

Item	Description
1	4 spot welds.
2	7 plug welds.
3, 4	20 plug welds.
5	9 spot welds.

5. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Front End Sheet Metal Repairs - Front Wheelhouse Section

Removal and Installation

Removal

NOTES:

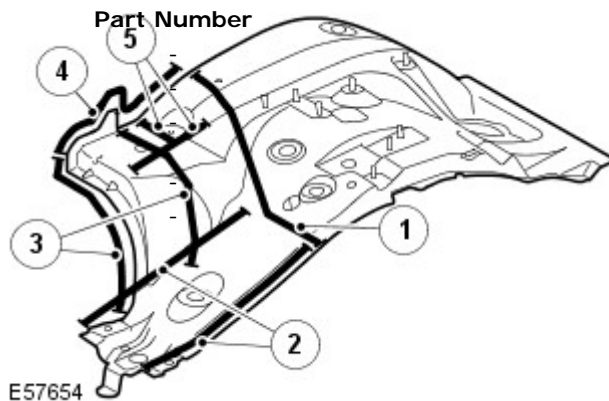


This procedure requires the body to be removed from the integrated body frame.



In this procedure the front wheelhouse section is replaced in conjunction with the front side member section, front wheelhouse reinforcement, hood latch panel and front crossmember.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the front side member section.
For additional information, refer to: Front Side Member Section (501-27, Removal and Installation).
3. Remove the front wheelhouse reinforcement.
For additional information, refer to: Front Wheelhouse Reinforcement (501-27, Removal and Installation).
4. Remove the crossmember.
For additional information, refer to: Front Crossmember (501-27, Removal and Installation).
5. Remove the hood latch panel.
For additional information, refer to: Hood Latch Panel (501-27, Removal and Installation).



Item	Description
1	Butt weld
2	15 spot welds.
3	7 plug welds, 9 spot welds.
4	20 spot welds.
5	9 plug welds.

- 6.
7. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Front End Sheet Metal Repairs - Fender Apron Panel Closing Panel

Removal and Installation

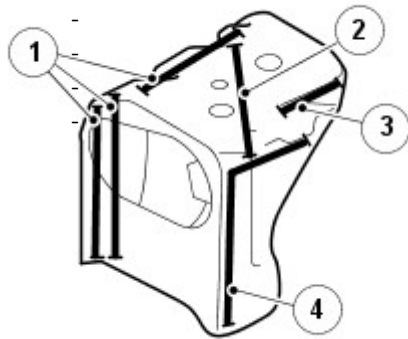
Removal



NOTE: In this procedure the fender apron closing panel is replaced in conjunction with the fender apron panel or the fender apron panel reinforcement.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the fender apron panel.
For additional information, refer to: Fender Apron Panel (501-27, Removal and Installation).
3. Remove the fender apron panel reinforcement.
For additional information, refer to: Fender Apron Panel Reinforcement (501-27, Removal and Installation).

Part Number



E56612

4.

Item	Description
1	7 plug welds.
2	2 spot welds.
3	2 spot welds.
4	5 plug welds.

5. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Front End Sheet Metal Repairs - Fender Apron Panel Reinforcement

Front Section

Removal and Installation

Removal

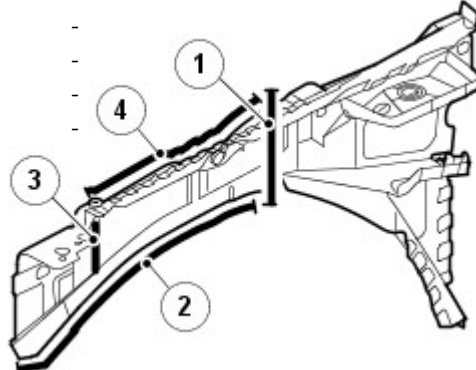


NOTE: In this procedure the fender apron panel reinforcement front section is replaced in conjunction with fender apron panel closing.

1. Disconnect both the battery cables.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the front fender.
For additional information, refer to: Fender (501-02, Removal and Installation).
3. Remove the hood latch panel.
For additional information, refer to: Hood Latch Panel (501-27, Removal and Installation).
4. L/H side: Remove the battery junction box.
For additional information, refer to: Battery Junction Box (BJB) - 2.7L Diesel (418-00 Module Communications Network, Removal and Installation).
5. L/H side: Remove the radiator coolant expansion tank.
For additional information, refer to: Coolant Expansion Tank (303-03A, Removal and Installation).
6. L/H side: Remove the power steering fluid reservoir.
For additional information, refer to: Power Steering Fluid Reservoir - 2.7L Diesel (211-02, Removal and Installation).
7. L/H side: Remove the battery.
8. L/H side: Remove the fuel fired booster heater.
For additional information, refer to: Fuel Fired Booster Heater (412-02B Auxiliary Heating, Removal and Installation).
9. L/H side: Remove fuel fired booster heater pipes.
10. R/H side: Release the ABS modulator.
11. Remove the wiring harness.
12. Remove the hood.
13. Remove both hood support struts.
14. Remove the hood wiring harness.

15.

Part Number



E56613

Item

- 1
- 2
- 3
- 4

Description

- Butt weld.
20 spot welds.
3 spot welds.
11 spot welds.

16. For additional information:
 - Welding.

For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).

- Corrosion protection.

For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).

- Tolerance checks.

For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Front End Sheet Metal Repairs - Fender Apron Panel Reinforcement Rear Section

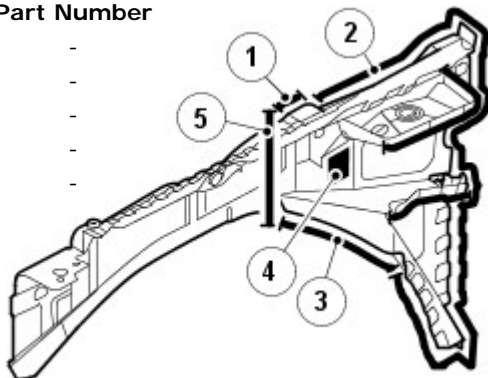
Removal and Installation

Removal

1. Disconnect both the battery cables.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the front fender.
For additional information, refer to: Fender (501-02, Removal and Installation).
3. L/H side: Remove the battery junction box.
For additional information, refer to: Battery Junction Box (BJB) - 2.7L Diesel (418-00 Module Communications Network, Removal and Installation).
4. L/H side: Remove the battery.
5. R/H side: Remove the air cleaner.
For additional information, refer to: Air Cleaner (303-12C, Removal and Installation).
6. R/H side: Release the ABS modulator.
7. Remove the wiring harness.
8. Remove the plenum chamber panel.
For additional information, refer to: Plenum Chamber (412-01 Air Distribution and Filtering, Removal and Installation).
9. Remove the hood.
10. Remove both hood support struts.
11. Remove the hood wiring harness.

Part Number

-
-
-
-
-



E56917

12.

Item

1
2
3
4
5

Description

3 spot welds.
34 plug welds.
7 spot welds.
Acoustic seal.
Butt weld.

13. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

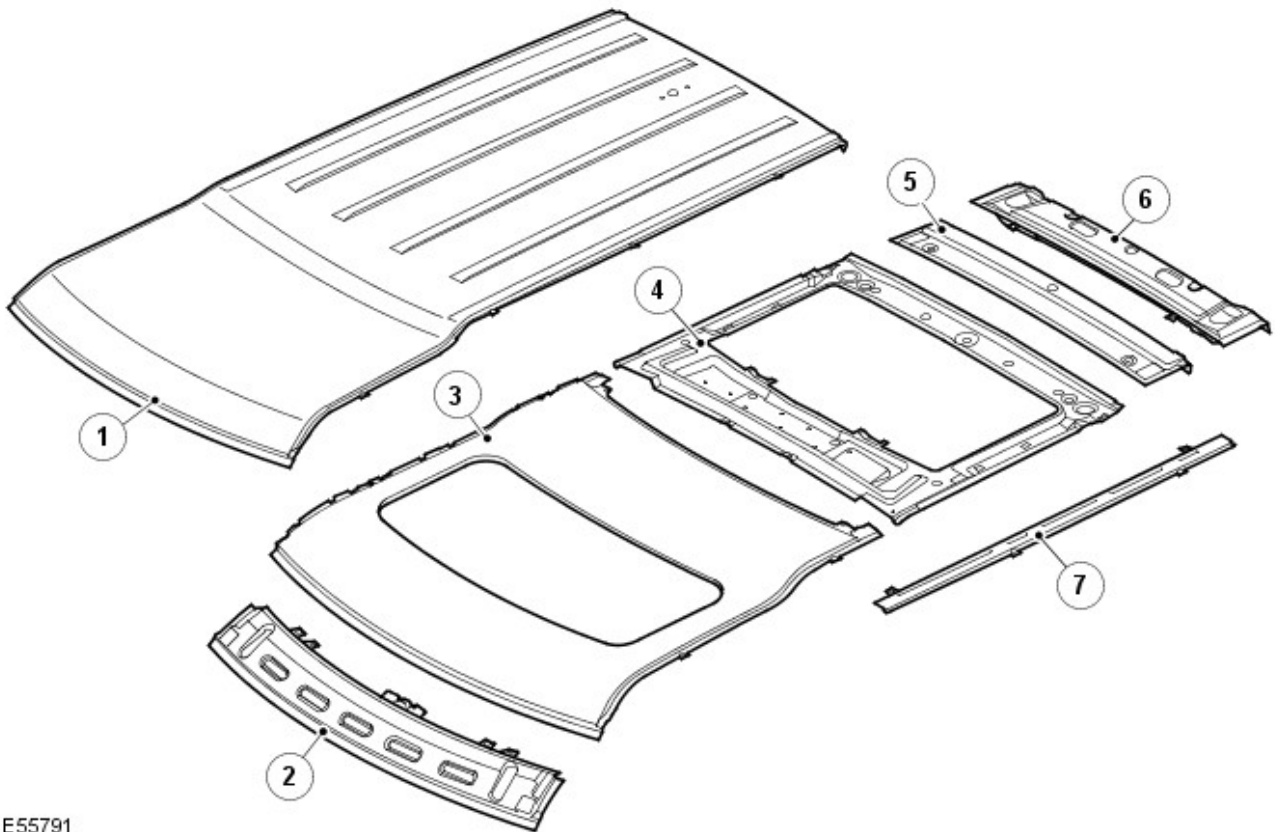
Installation

1. Install is the reversal of removal.

Roof Sheet Metal Repairs - Roof

Description and Operation

Roof service panels



E55791

Item	Description	Service part No
1	Roof panel	AKA780012
2	Header assembly	AKC780050
3	Roof panel (with roof opening panel)	AKB780040
4	Roof reinforcement	AKR780080
5	Roof reinforcement	AKB780031
6	Rear assembly	AKC780090
7	Rail assembly	R/H AK1780021 L/H AK1780031

paragraph

Time schedules, front end

The following information shows the total time taken to replace single panels and complete assemblies. This time includes removal of Mechanical, Electrical and Trim (MET) items, plus paint times based on Metallic Clear Over Base Paint.

The times shown were generated by Thatcham (the motor insurance repair and research centre) and are to be used as a guide only.

Single panel times

Panel Description	Petrol	Diesel
Roof panel	25.8	25.8
Roof glass support panel	1.1	1.1

Roof Sheet Metal Repairs - Roof Panel

Removal and Installation

Removal

NOTES:



The roof opening panel is supplied with the reinforcement roof aperture.

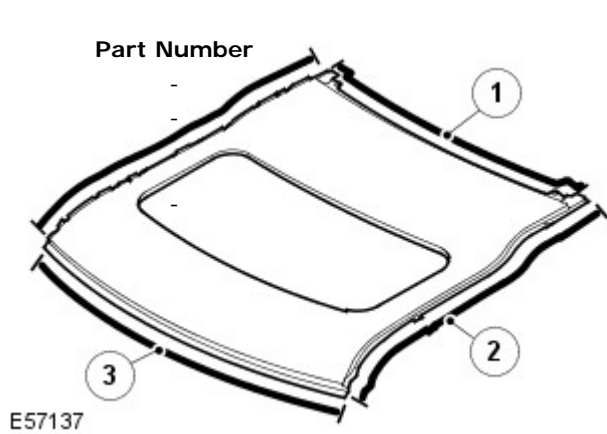


This procedure shows removal of the roof opening panel. For vehicles with a fixed roof, the procedure is similar.

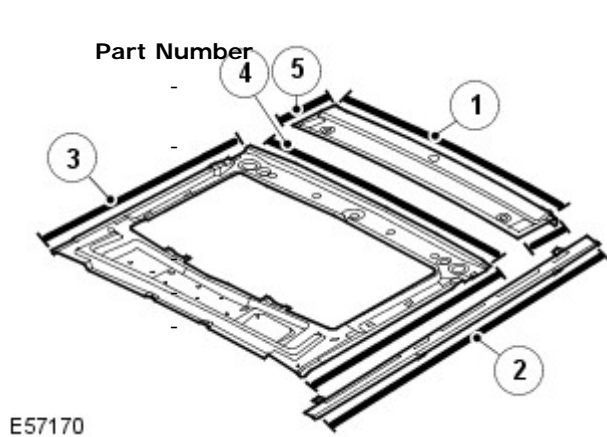
1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove both side air curtain modules.
For additional information, refer to: Side Air Curtain Module (501-20B Supplemental Restraint System, Removal and Installation).
3. Remove the windshield glass.
For additional information, refer to: Windshield Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
4. Remove both rear quarter window glass.
For additional information, refer to: Rear Quarter Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
5. If applicable, remove roof opening panel.
For additional information, refer to: Roof Opening Panel (501-17 Roof Opening Panel, Removal and Installation).
6. If applicable, remove glass roof panel.
For additional information, refer to: Glass Roof Panel (501-11 Glass, Frames and Mechanisms, Removal and Installation).
7. Remove both front seats.
For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).
8. Remove the rear seat.
For additional information, refer to: Rear Seat - Vehicles With: 60/40 Split Seat (501-10 Seating, Removal and Installation).
9. Release the wiring harness from both A-pillars.
10. Release the wiring harness from the roof.
11. Remove the liftgate.
12. Remove both front door and rear door aperture weatherstrip.
13. Remove the tailgate weatherstrip.
14. Remove both front safety belt retractors.
For additional information, refer to: Front Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).
15. Remove both second row safety belt retractors.
For additional information, refer to: Second Row Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).
16. If applicable, remove both third row safety belt retractors.
For additional information, refer to: Third Row Safety Belt

Retractor (501-20A Safety Belt System, Removal and Installation).

17. Release the carpet
18. Remove the load space trims.
19. Remove the load space carpets.



Item	Description
1	33 spot welds.
2	31 spot welds. (R/H is symmetrically opposite to L/H).
3	43 spot welds.



Item	Description
1	12 plug welds and 27 spot welds.
2	7 plug welds and 40 spot welds (R/H is symmetrically opposite to L/H).
3	23 spot welds.
4	32 spot welds.
5	4 plug welds. (R/H is symmetrically opposite to L/H).

22. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

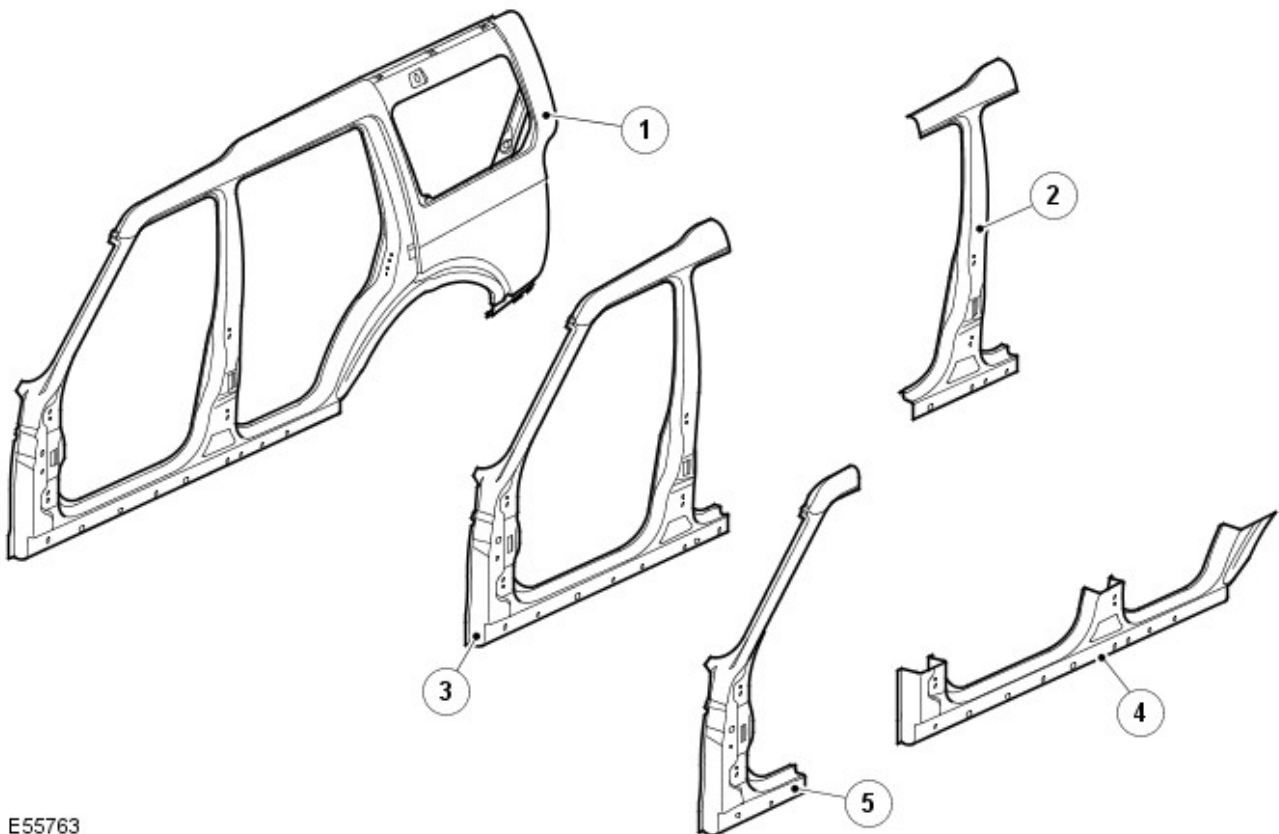
1. Install is the reversal of removal.

This section contains no data

Side Panel Sheet Metal Repairs - Side Panel Sheet Metal

Description and Operation

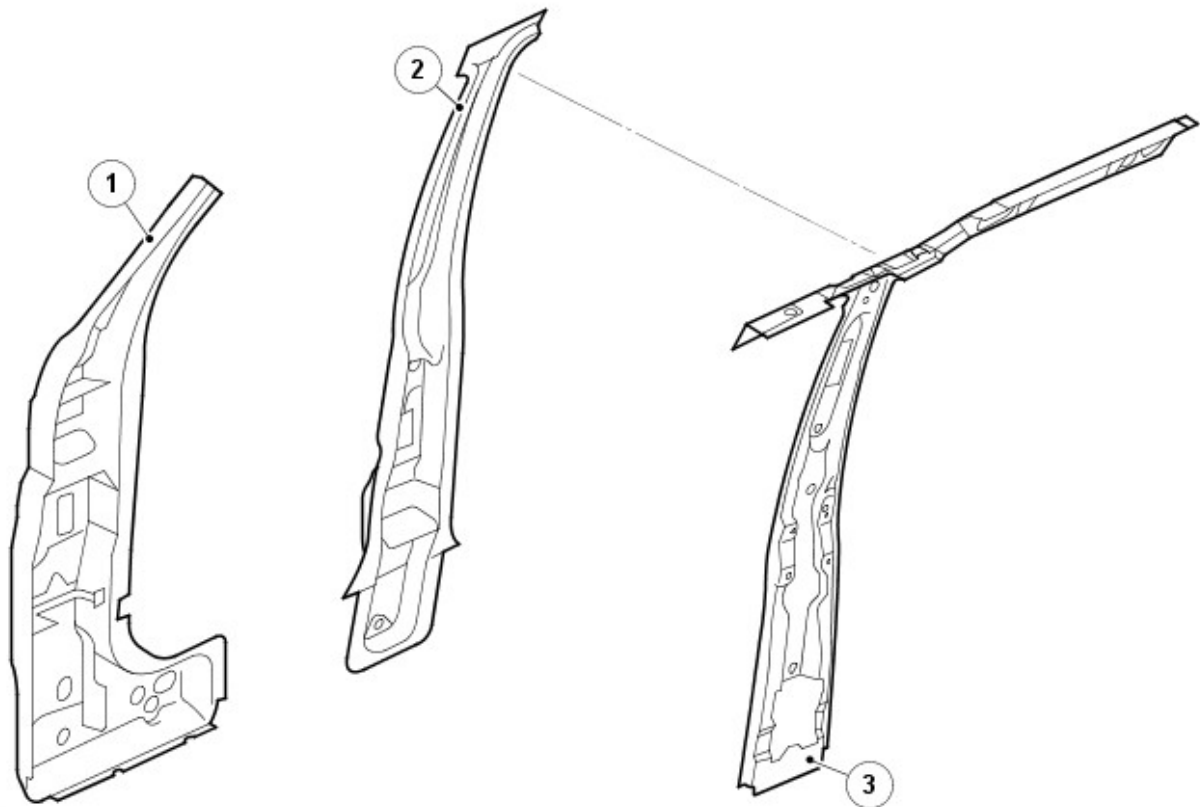
Outer bodyside service panels



E55763

Item	Description	Service part No
1	Side panel outer	R/H ALA80060 L/H ALA780070
2	B-Pillar outer	R/H ALA780140 L/H ALA780150
3	Side panel front section	R/H ALA780120 L/H ALA780130
4	Rocker panel outer	R/H ALA780200 L/H ALA780210
5	A-Pillar outer	R/H ALA780160 L/H ALA780170

Inner bodyside service panels



E55764

Item	Description	Service part No
1	A-Pillar inner	R/H ALR780520 L/H ALR780530
2	B-Pillar inner	R/H ALR780640 L/H ALR780650
3	B-Pillar closing	R/H AME780280 L/H AME780290

paragraph

Time schedules, front end

The following information shows the total time taken to replace single panels and complete assemblies. This time includes removal of Mechanical, Electrical and Trim (MET) items, plus paint times based on Metallic Clear Over Base Paint.

The times shown were generated by Thatcham (the motor insurance repair and research centre) and are to be used as a guide only.

Single panel times

Panel Description	Petrol	Diesel
Front door	9.4	9.4
Rear door	8.4	8.4
Rocker panel L/H	22.1	22.1
Rocker panel R/H	21.4	21.4

Combination panel replacement times

The following panel combination times show the total time to remove/refit body panels, MET items and any paint process.

Combination panel times

Panel Description	Petrol	Diesel
Front door		
Front fender		
Total Time	11.8	11.8

Combination panel times

Panel Description	Petrol	Diesel
Rear door		
Quarter panel		
Total Time	L/H 27.9 R/H 28.3	L/H 27.9 R/H 28.3

Combination panel times

Panel Description	Petrol	Diesel
B-Pillar		
Front door		

Rear door		
Total Time	L/H 29.2 R/H 28.7	L/H 29.2 R/H 28.7

Combination panel times

Panel Description	Petrol	Diesel
Front door		
front fender		
Rear door		
Quarter panel		
Total Time	L/H 34.0 R/H 34.4	L/H 34.0 R/H 34.4

Combination panel times

Panel Description	Petrol	Diesel
A-Pillar		
A-Pillar reinforcement		
Front door		
Windshield glass		
Front fender		
Fender apron panel reinforcement		
Total Time	L/H 35.6 R/H 36.4	L/H 35.6 R/H 36.4

Combination panel times

Panel Description	Petrol	Diesel
Rear bumper		
Rear door		
Rear wheelhouse outer		
Quarter panel		
Total Time	L/H 32.2 R/H 32.5	L/H 32.2 R/H 32.5

Combination panel times

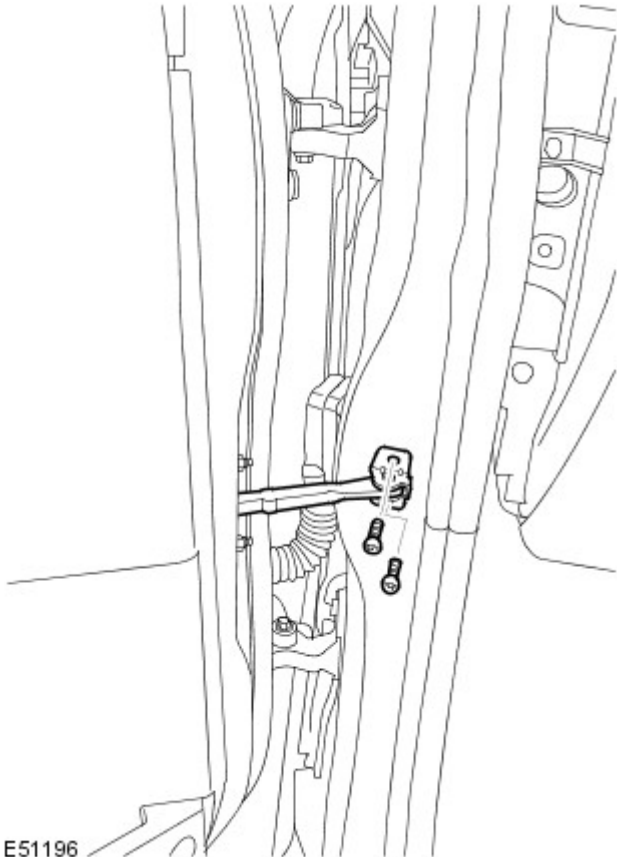
Panel Description	Petrol	Diesel
Bodyside		
Front door		
Rear door		
Windshield glass		
Front fender		
Fender apron panel reinforcement		
Total Time	L/H 59.0 R/H 60.1	L/H 59.0 R/H 60.2

Side Panel Sheet Metal Repairs - Rocker Panel

Removal and Installation

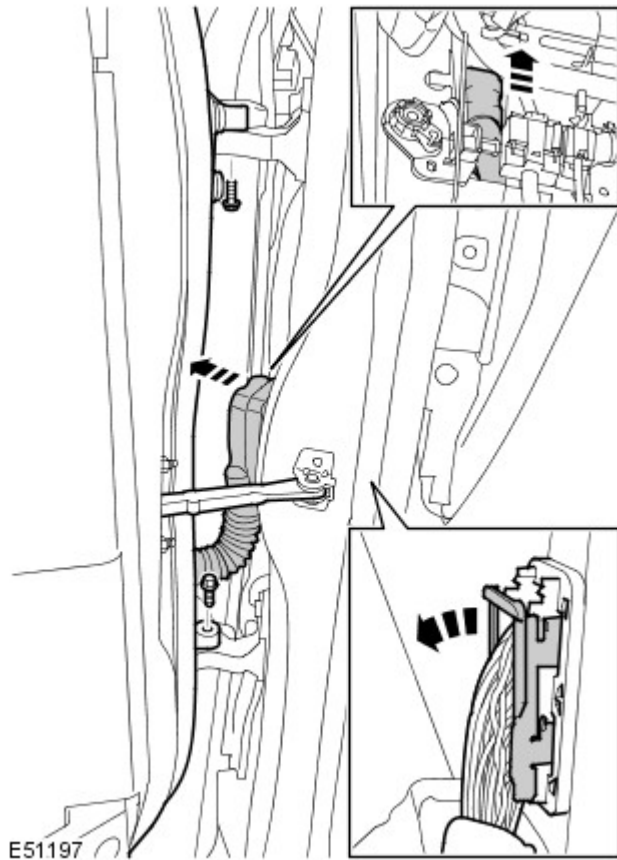
Removal

1. Load vehicle onto ramp.
2. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
3. Remove the rear wheel and tire.
4. Remove the rear fender splash shield.
5. Remove the front fender.
For additional information, refer to: Fender (501-02 Front End Body Panels, Removal and Installation).
6. Release the front door check strap from the A-pillar and release the rear door check strap from the B-pillar.
 - Remove the 2 Torx bolts.



E51196

7. Remove the front and rear door assemblies.
 - Disconnect the electrical connector
 - Release the wiring harness grommet
 - Release the wiring harness retaining clip
 - Remove the 2 bolts

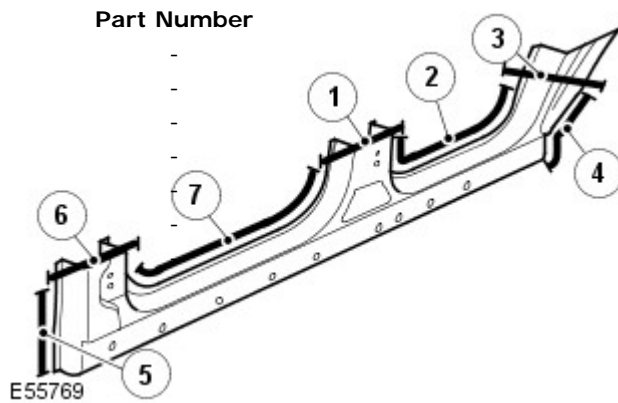


8. Remove the front and rear door weatherstrips.
9. Remove the front seat.
For additional information, refer to: Front Seat (501-10 Seating, Removal and Installation).
10. Remove the rear seat.
For additional information, refer to: Rear Seat - Vehicles With: 60/40 Split Seat (501-10 Seating, Removal and Installation).
11. Remove the cowl side trim panel.
For additional information, refer to: Cowl Side Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
12. Release the wiring harness from A-pillar.
13. Remove the front safety belt retractor.
For additional information, refer to: Front Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).
14. Remove the B-pillar side impact sensor.
For additional information, refer to: B-Pillar Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation).
15. Remove the second row safety belt retractor.
For additional information, refer to: Second Row Safety Belt Retractor (501-20A Safety Belt System, Removal and Installation).
16. Remove the C-pillar side impact sensor.
For additional information, refer to: C-Pillar Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation).
17. Release the rocker panel and B-pillar wiring harness.
18. Release the carpet away from the area of repair.

19. Release the wiring harness from rocker panel and B-pillar.

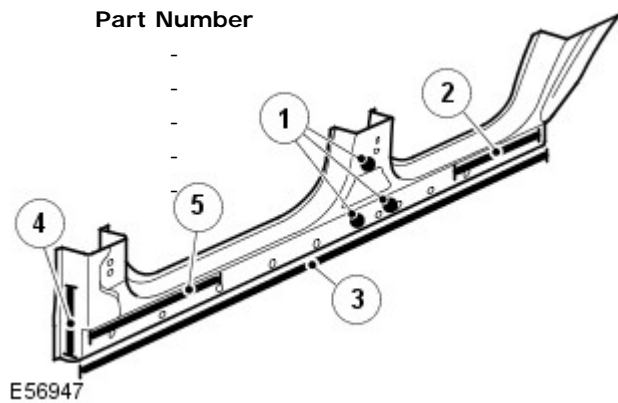
20. Remove the rocker panel finisher.

21.



Item	Description
1	Butt weld.
2	20 spot-welds.
3	Butt weld.
4	9 spot welds.
5	8 spot welds.
6	Butt weld.
7	35 spot welds.

22.



Item	Description
1	3 plug welds.
2	3 plug welds.
3	38 plug welds.
4	3 plug welds.
5	4 plug welds.

23. For additional information:

- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
- Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

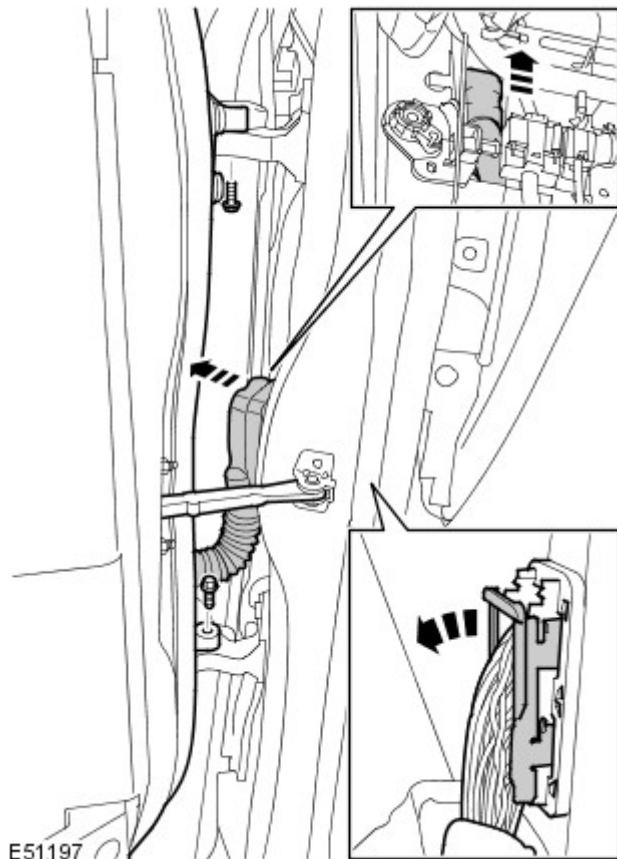
1. Install is the reversal of removal.

Side Panel Sheet Metal Repairs - A-Pillar Outer Panel

Removal and Installation

Removal

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the windshield glass.
For additional information, refer to: Windshield Glass (501-11, Removal and Installation).
3. Remove the front fender.
For additional information, refer to: Fender (501-02, Removal and Installation).
4. L/H side: Remove the battery junction box.
For additional information, refer to: Battery Junction Box (BJB) - 2.7L Diesel (418-00, Removal and Installation).
5. R/H side: Remove the ABS module.
For additional information, refer to: Anti-Lock Brake System (ABS) Module (206-09A, Removal and Installation).
6. R/H side: Remove the accelerator pedal.
For additional information, refer to: Accelerator Pedal (310-02C, Removal and Installation).
7. R/H side: Remove the brake booster.
For additional information, refer to: Brake Booster (206-07, Removal and Installation).
8. Remove the front door assembly.
 - Disconnect the electrical connector
 - Release the wiring harness grommet
 - Release the wiring harness retaining clip
 - Remove the 2 bolts

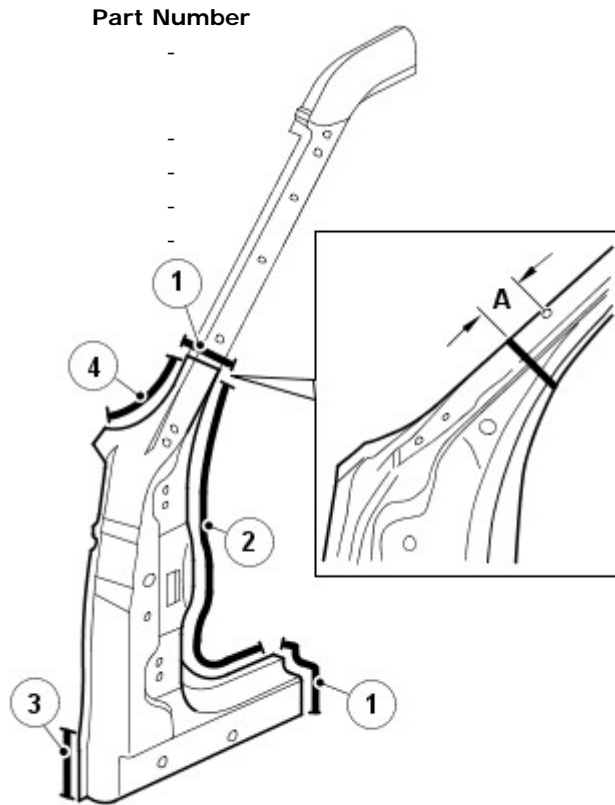


E51197

9. Remove the insulation from the outer and inner bulkhead.
10. Remove the front and rear door weatherstrip.
11. Remove the cowl side trim panel.
For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).

12. Release the A-Pillar wiring harness.
13. Remove the footrest.
14. Remove the front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).
15. Remove the front safety belt retractor.
For additional information, refer to: Front Safety Belt Retractor (501-20A, Removal and Installation).
16. Remove the rocker panel outer trim.
17. Release the front carpet.

18.



E55944

Item

Description

- | | |
|---|---|
| A | Cut line 55mm (2.165 inches) from A-Pillar trim hole. |
| 1 | Butt welds. |
| 2 | 30 spot welds. |
| 3 | 8 spot welds. |
| 4 | 15 spot welds. |

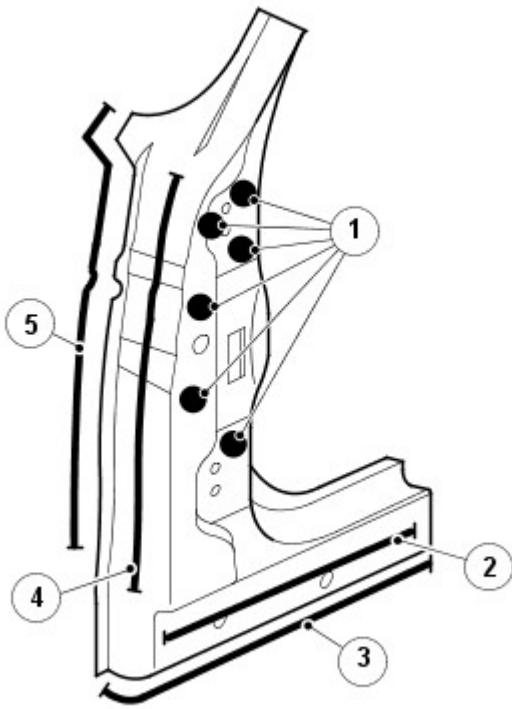
19.

Part Number

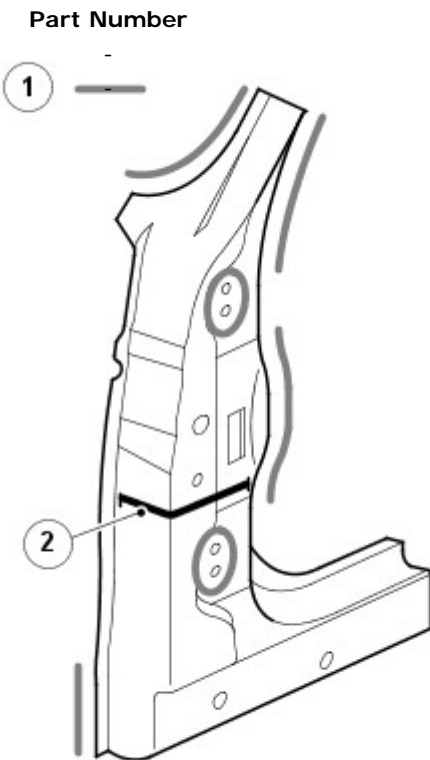
Item

Description

- | | | |
|---|---|----------------|
| - | 1 | 6 plug welds. |
| - | 2 | 4 plug welds. |
| - | 3 | 12 plug welds. |
| - | 4 | 10 plug welds. |
| - | 5 | 13 plug welds. |



E57675



E57676

21. For additional information:
- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).

- Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

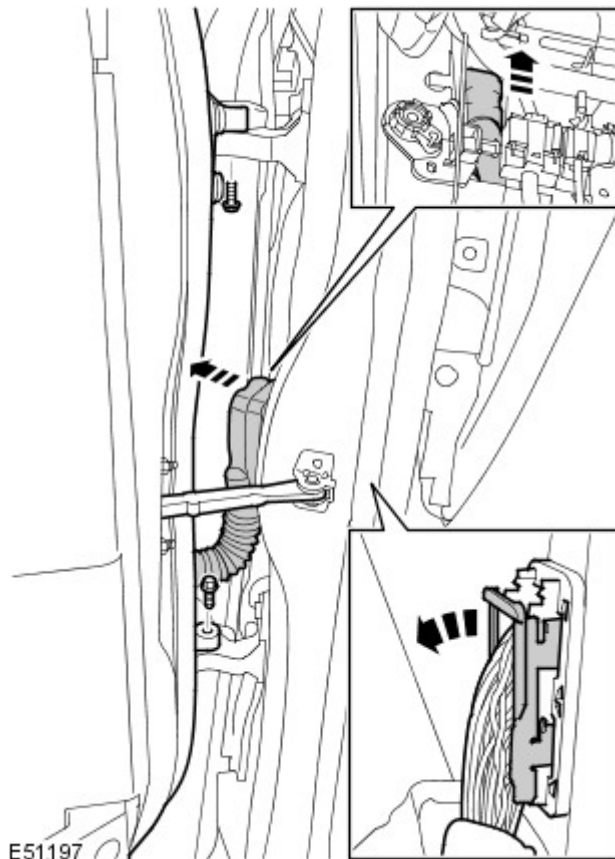
1. Install is the reversal of removal.

Side Panel Sheet Metal Repairs - Side Panel

Removal and Installation

Removal

1. Load vehicle onto ramp.
2. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00, Specifications).
3. Remove the windshield glass.
For additional information, refer to: Windshield Glass (501-11, Removal and Installation).
4. Remove the front fender.
For additional information, refer to: Fender (501-02, Removal and Installation).
5. Remove the front and rear door assemblies.
 - Disconnect the electrical connector
 - Release the wiring harness grommet
 - Release the wiring harness retaining clip
 - Remove the 2 bolts



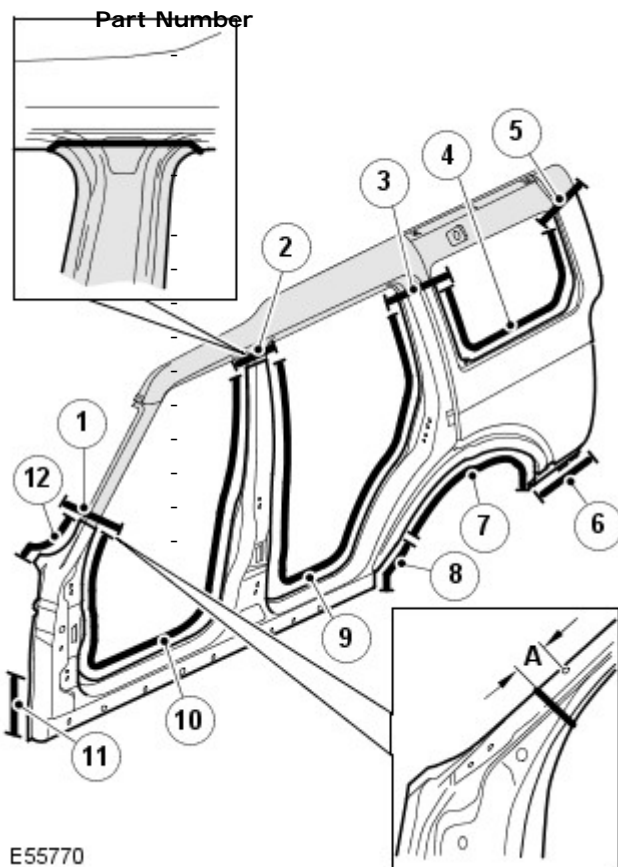
6. Remove front and rear door strikers.
7. Remove the insulation from the outer and inner bulkhead.
8. Remove the cowl side trim panel.
For additional information, refer to: Cowl Side Trim Panel (501-05, Removal and Installation).
9. Release the A-Pillar wiring harness.
10. L/H side: Remove the battery junction box.
For additional information, refer to: Battery Junction Box (BJB) - 2.7L Diesel (418-00, Removal and Installation).
11. R/H side: Remove the brake booster.
For additional information, refer to: Brake Booster (206-07, Removal and Installation).
12. R/H side: Remove the ABS module.
For additional information, refer to: Anti-Lock Brake System (ABS) Module (206-09A, Removal and Installation).

13. R/H side: Remove the accelerator pedal.
For additional information, refer to: Accelerator Pedal (310-02C, Removal and Installation).
14. Remove the footrest.
15. Remove the front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).
16. Remove the rear seat.
For additional information, refer to: Rear Seat - Vehicles With: 60/40 Split Seat (501-10, Removal and Installation).
17. Remove the front and rear door weatherstrip.
18. Remove the front safety belt retractor.
For additional information, refer to: Front Safety Belt Retractor (501-20A, Removal and Installation).
19. Remove the Second row safety belt retractor.
For additional information, refer to: Second Row Center Safety Belt Retractor - Vehicles With: 60/40 Split Seat (501-20A, Removal and Installation).
20. Remove the third row safety belt retractor.
For additional information, refer to: Third Row Safety Belt Retractor (501-20A, Removal and Installation).
21. Remove the B-Pillar side impact sensor.
For additional information, refer to: B-Pillar Side Impact Sensor (501-20B, Removal and Installation).
22. Remove the side air curtain module.
For additional information, refer to: Side Air Curtain Module (501-20B, Removal and Installation).
23. Remove the C-Pillar side impact sensor.
For additional information, refer to: C-Pillar Side Impact Sensor (501-20B, Removal and Installation).
24. Remove the wiring harness from the B-Pillar.
25. Release the wiring harness from the rocker panel.
26. Release wiring harness from roof panel.
27. Remove the rocker panel outer trim.
28. Release the front and back carpet.
29. Remove rear wheel and tire.
30. Remove rear bumper cover.
For additional information, refer to: Rear Bumper Cover (501-19, Removal and Installation).
31. Remove forced air extraction grille.
32. R/H side: Remove fuel tank.
For additional information, refer to: Fuel Tank (310-01C, Removal and Installation).
33. R/H side: Remove the fuel tank filler pipe.
For additional information, refer to: Fuel Tank Filler Pipe (310-01C, Removal and Installation).
34. R/H side: Remove the fuel filler interlock catch.
For additional information, refer to: Fuel Filler Interlock Catch (501-03, Removal and Installation).
35. Remove the rear quarter window glass.
For additional information, refer to: Rear Quarter Window

Glass (501-11, Removal and Installation).

36. Remove the exhaust heatshields.
37. Remove the tailgate latch.
For additional information, refer to: Liftgate Latch (501-14, Removal and Installation).
38. Remove tailgate weatherstrip.
39. With assistance remove the tailgate.
40. Remove the load space trims.
41. Remove the load space carpets.
42. Release wiring harness.

43.



E55770

Item

Description

- | | |
|----|--|
| A | Cut line is 55mm (2.165 inches) from A-Pillar trim hole. |
| 1 | Butt weld. |
| 2 | Cut line and butt weld. |
| 3 | Butt weld. |
| 4 | 50 spot welds. |
| 5 | Butt weld. |
| 6 | 5 spot welds. |
| 7 | 40 spot welds. |
| 8 | 9 spot welds. |
| 9 | 100 spot welds. |
| 10 | 98 spot welds. |
| 11 | 8 spot welds. |
| 12 | 15 spot welds. |

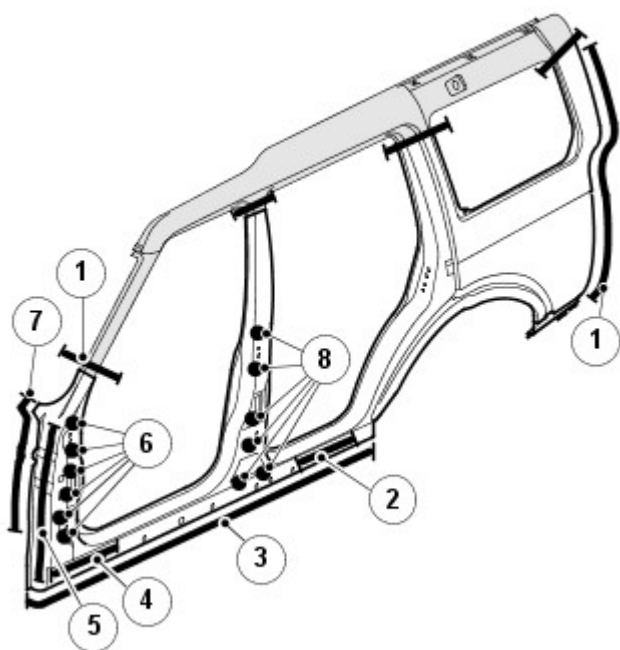
44.

Part Number

Item

Description

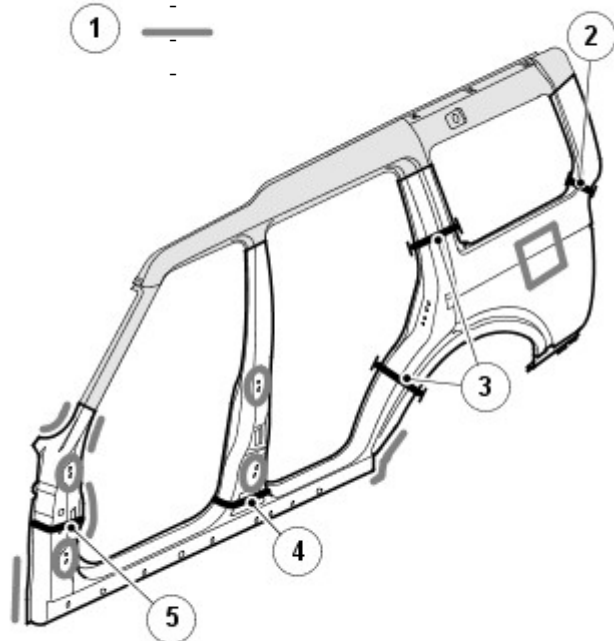
- | | | |
|---|---|----------------|
| - | 1 | 22 plug welds. |
| - | 2 | 3 plug welds. |
| - | 3 | 38 plug welds. |
| - | 4 | 4 plug welds. |
| - | 5 | 10 plug welds. |
| - | 6 | 6 plug welds. |
| - | 7 | 13 plug welds. |
| - | 8 | 6 plug welds. |



E57699

Part Number

-
-
-
1
-
-



E57700

45.

Item

- 1
- 2
- 3
- 4
- 5

Description

- Areas of adhesive.
- Acoustic seal.
- Acoustic seals.
- Acoustic seal.
- Acoustic seal.

46. For additional information:

- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B, Description and Operation).
- Tolerance checks.

For additional information, refer to: Body and Frame
(501-26, Description and Operation).

Installation

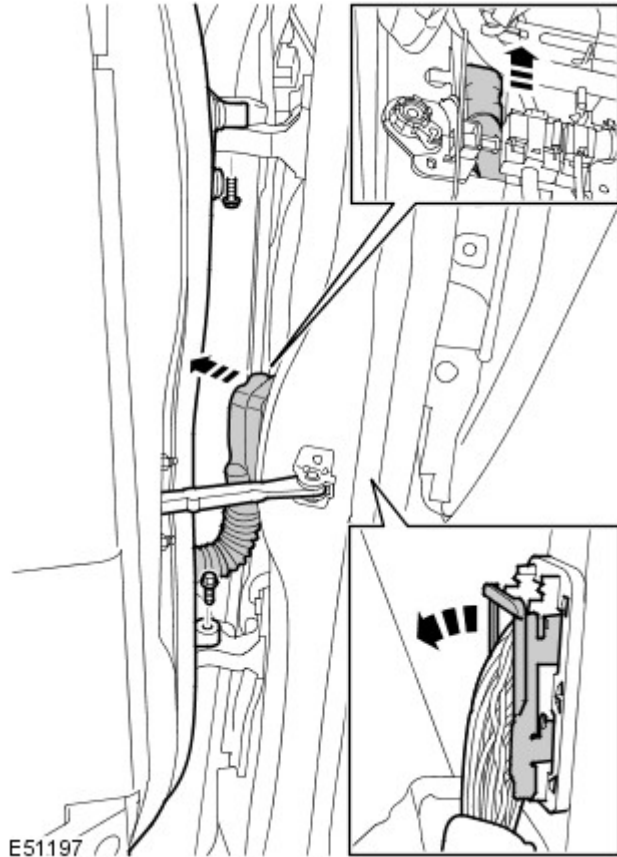
1. Install is the reversal of removal.

Side Panel Sheet Metal Repairs - B-Pillar Outer Panel

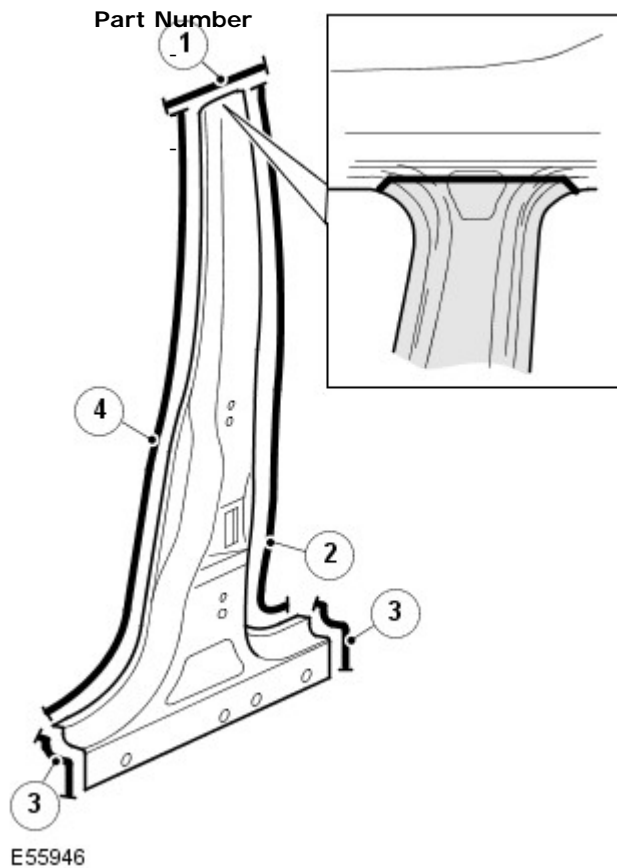
Removal and Installation

Removal

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the rear door assembly.
 - Disconnect the electrical connector
 - Release the wiring harness grommet
 - Release the wiring harness retaining clip
 - Remove the 2 bolts

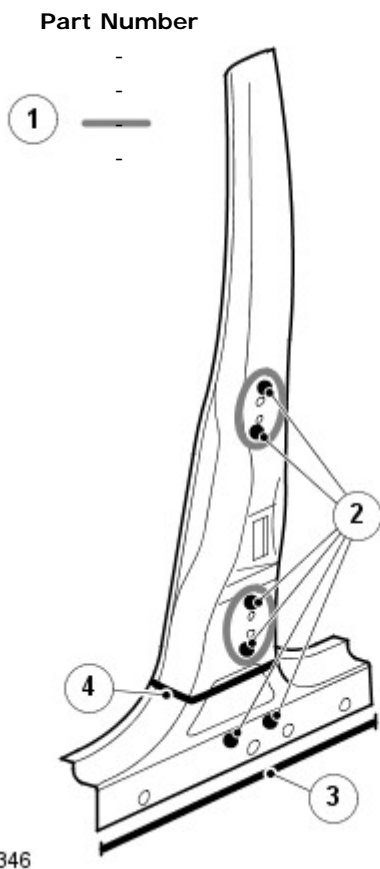


3. Remove front door striker.
4. Remove the front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).
5. Remove the rear seat.
For additional information, refer to: Rear Seat - Vehicles With: 60/40 Split Seat (501-10, Removal and Installation).
6. Remove the B-pillar side impact sensor.
For additional information, refer to: B-Pillar Side Impact Sensor (501-20B, Removal and Installation).
7. Remove the side air curtain module.
For additional information, refer to: Side Air Bag Module (501-20B, Removal and Installation).
8. Remove the wiring harness from the B-pillar.
9. Release the wiring harness from the rocker panel.
10. Remove the front safety belt retractor.
For additional information, refer to: Front Safety Belt Retractor (501-20A, Removal and Installation).
11. Remove the rocker panel outer trim.
12. Release the carpet.



13.

Item	Description
1	Cut line and butt weld.
2,4	81 spot welds.
3	Butt welds.



14.

Item	Description
1	Adhesive.
2	6 plug welds.
3	19 plug welds.
4	Acoustic seal.

15. For additional information:

- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion

Protection, Description and Operation).

- Tolerance checks.

For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Side Panel Sheet Metal Repairs - A-Pillar Reinforcement

Removal and Installation

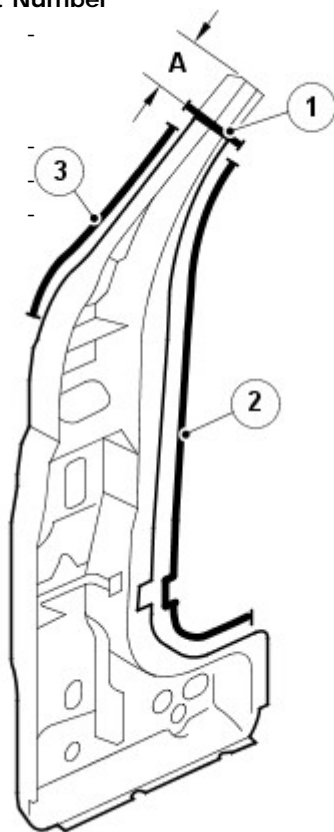
Removal



NOTE: In this procedure the A-Pillar reinforcement is replaced in conjunction with the A-Pillar outer panel.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the A-Pillar outer panel.
For additional information, refer to: A-Pillar Outer Panel (501-29, Removal and Installation).
3. Remove the instrument panel.
For additional information, refer to: Instrument Panel - 2.7L Diesel (501-12, Removal and Installation).

Part Number



E55945

4.

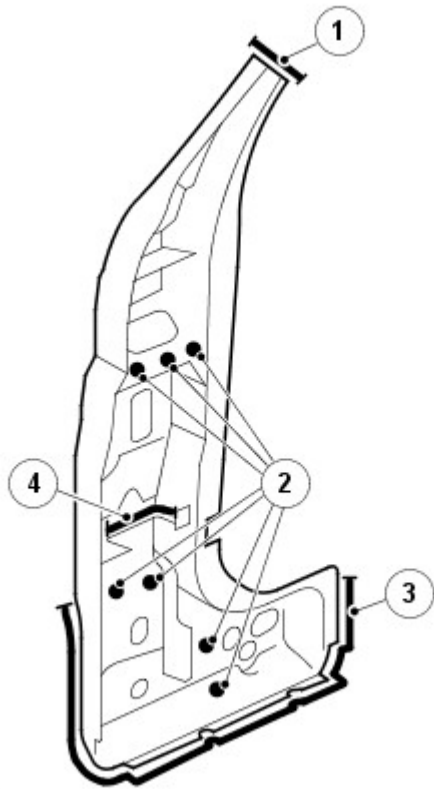
Item	Description
A	Cut line 80mm (3.149 inches) from edge of A Pillar reinforcement.
1	Butt weld.
2	30 spot welds.
3	17 spot welds.

5.

Part Number

-
-
-
-

Item	Description
1	Butt weld
2	7 Plug welds.
3	16 plug welds.
4	Acoustic seal.



E57677

6. For additional information:

- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
- Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Side Panel Sheet Metal Repairs - B-Pillar Reinforcement

Removal and Installation

Removal

NOTES:



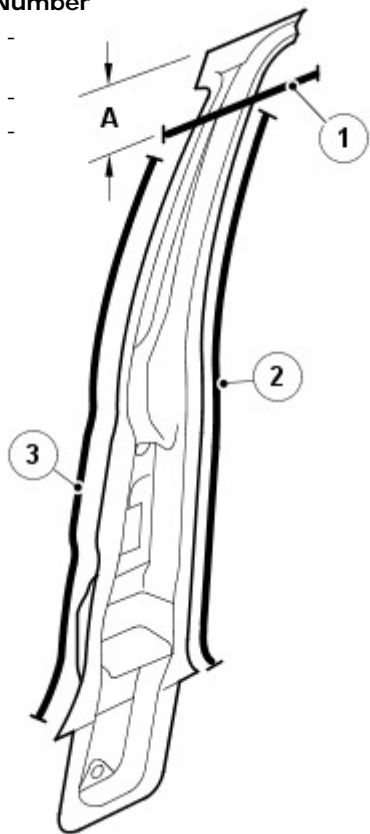
In this procedure the B-Pillar reinforcement is replaced in conjunction with the B-pillar outer panel.



The B-Pillar closing panel is fitted with the B-Pillar reinforcement.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the B-pillar outer panel.
For additional information, refer to: B-Pillar Outer Panel (501-29 Side Panel Sheet Metal Repairs, Removal and Installation).

Part Number



E55947

3.

Item

Description

- | | |
|-----|--|
| A | Cut line 140.0mm (5.51 inches) |
| 1 | Butt weld. |
| 2,3 | 81 spot welds. (including the B-Pillar closing panel.) |

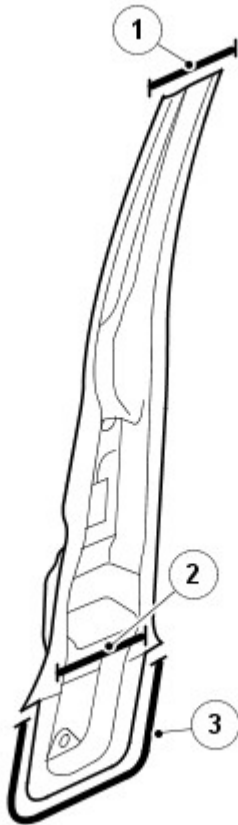
4.

Part Number

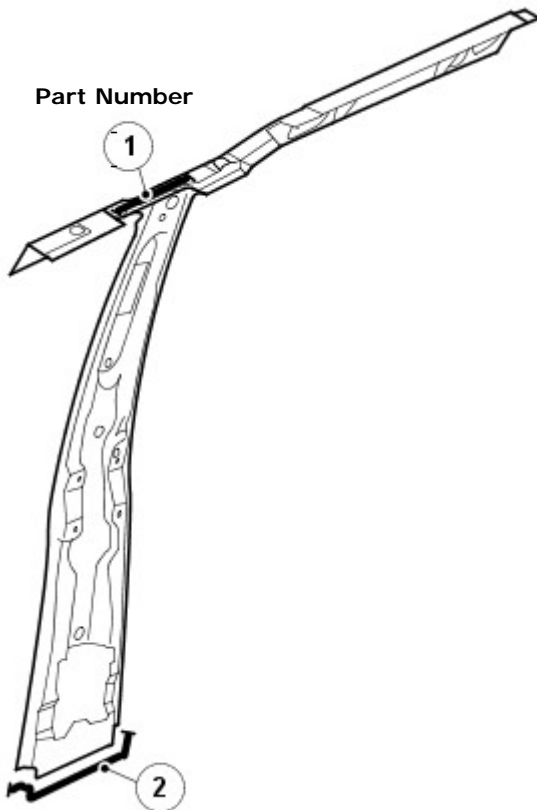
Item

Description

- | | | |
|---|---|----------------|
| - | 1 | Butt weld. |
| - | 2 | Acoustic seal. |
| - | 3 | 12 plug welds. |



E57347



E55948

5. The B-Pillar closing panel is supplied with the cantrail. Remove the B-Pillar closing panel from the cantrail and fit the B-pillar closing panel to the B-Pillar reinforcement, as shown in graphic E55948 and E55947.

Item	Description
1	9 plug welds.
2	4 spot welds.

6. For additional information:

- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).

- Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

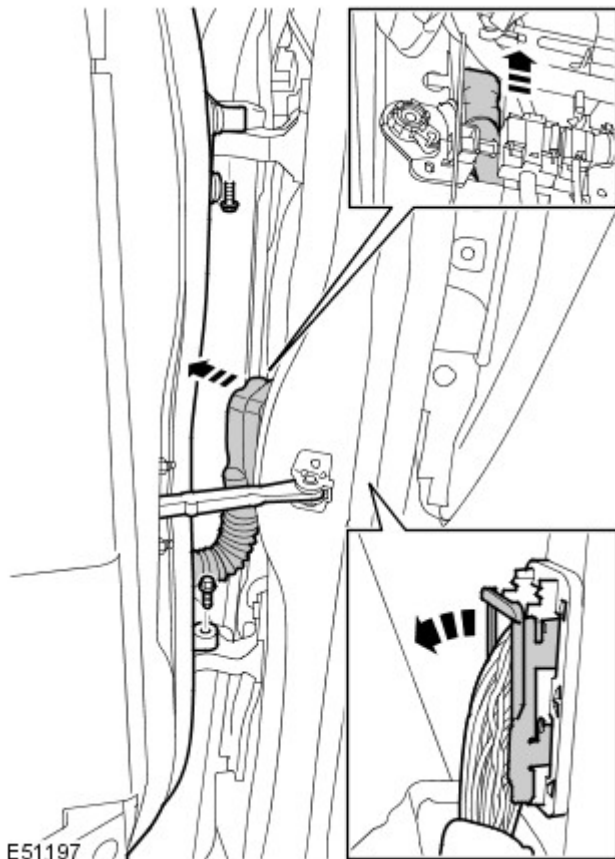
1. Install is the reversal of removal.

Side Panel Sheet Metal Repairs - Side Panel Front Section

Removal and Installation

Removal

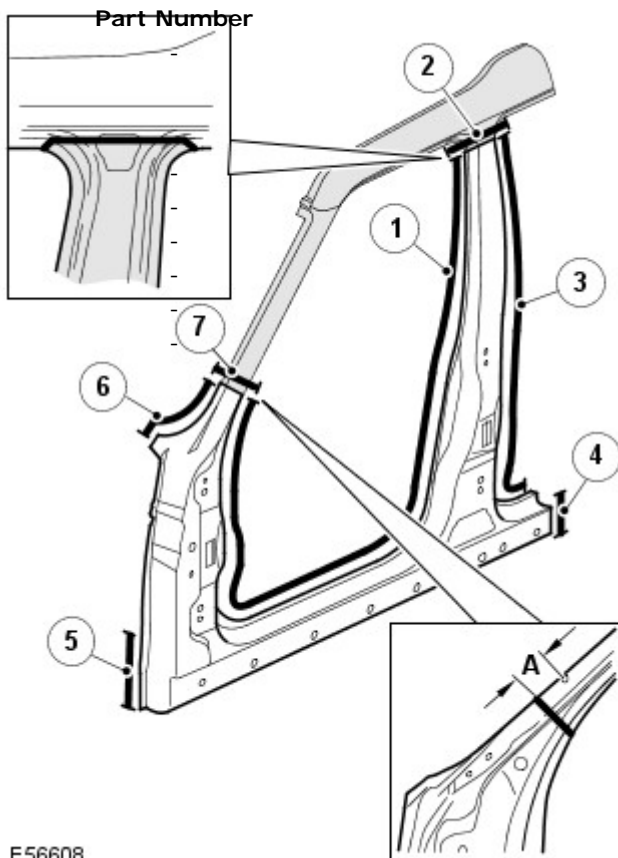
1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00, Specifications).
2. Remove the windshield glass.
For additional information, refer to: Windshield Glass (501-11, Removal and Installation).
3. Remove the front fender.
For additional information, refer to: Fender (501-02, Removal and Installation).
4. L/H side: Remove the battery junction box.
For additional information, refer to: Battery Junction Box (BJB) - 2.7L Diesel (418-00, Removal and Installation).
5. R/H side: Remove the brake booster.
For additional information, refer to: Brake Booster (206-07, Removal and Installation).
6. R/H side: Remove the ABS module.
For additional information, refer to: Anti-Lock Brake System (ABS) Module (206-09A, Removal and Installation).
7. R/H side: Remove the accelerator pedal.
For additional information, refer to: Accelerator Pedal (310-02C, Removal and Installation).
8. Remove the front and rear door assemblies.
 - Disconnect the electrical connector
 - Release the wiring harness grommet
 - Release the wiring harness retaining clip
 - Remove the 2 bolts



9. Remove front door striker.
10. Remove the insulation from the outer and inner bulkhead.
11. Remove the front and rear door weatherstrip.
12. Remove the footrest.

13. Release the A-Pillar wiring harness.
14. Remove the front safety belt retractor.
For additional information, refer to: Front Safety Belt Retractor (501-20A, Removal and Installation).
15. Remove the B-Pillar side impact sensor.
For additional information, refer to: B-Pillar Side Impact Sensor (501-20B, Removal and Installation).
16. Remove the side air curtain module.
For additional information, refer to: Side Air Bag Module (501-20B, Removal and Installation).
17. Remove the front seat.
For additional information, refer to: Front Seat (501-10, Removal and Installation).
18. Remove the rear seat.
For additional information, refer to: Rear Seat - Vehicles With: 60/40 Split Seat (501-10, Removal and Installation).
19. Remove the wiring harness from the B-Pillar.
20. Release the wiring harness from the rocker panel.
21. Release wiring harness from roof panel.
22. Remove the rocker panel outer trim.
23. Release the front and back carpet.

24.

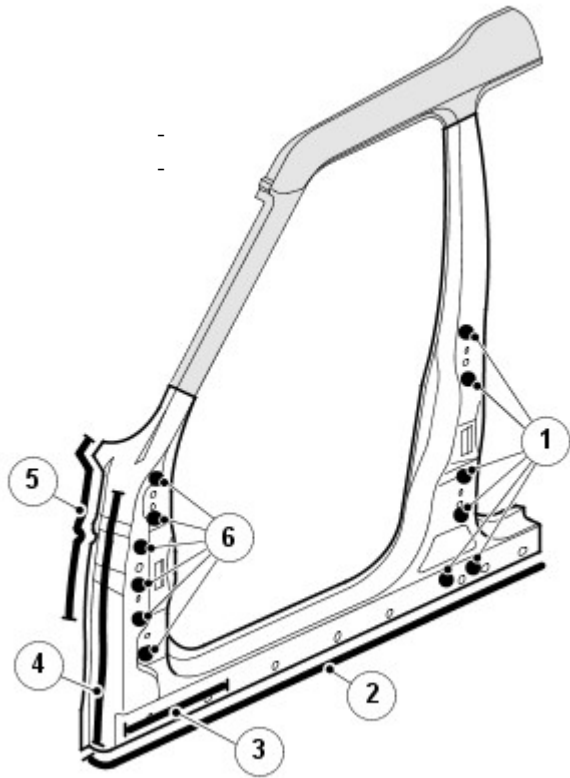


E56608

Item	Description
A	Cut line is 55 mm (2.165 inches) from A-Pillar trim hole.
1	98 spot welds.
2	Butt weld.
3	80 spot welds.
4	Butt weld.
5	8 spot welds.
6	15 spot welds.
7	Butt weld.

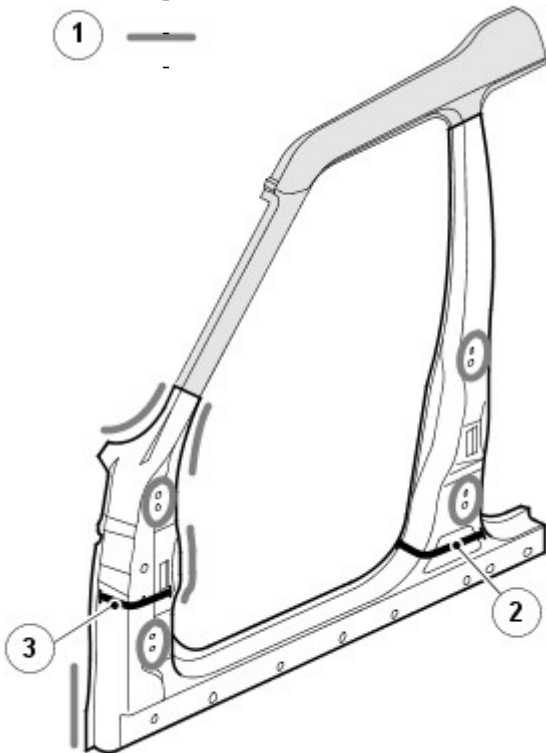
25.

Part Number	Item	Description
-	1	6 plug welds.
-	2	31 plug welds.
-	3	4 plug welds.
-	4	10 plug welds.



E57174

Part Number



E57175

- 5 13 plug welds.
- 6 6 plug welds.

26.

Item	Description
1	Areas of adhesive.
2	Acoustic seal.
3	Acoustic seal.

27. For additional information:

- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).

- Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

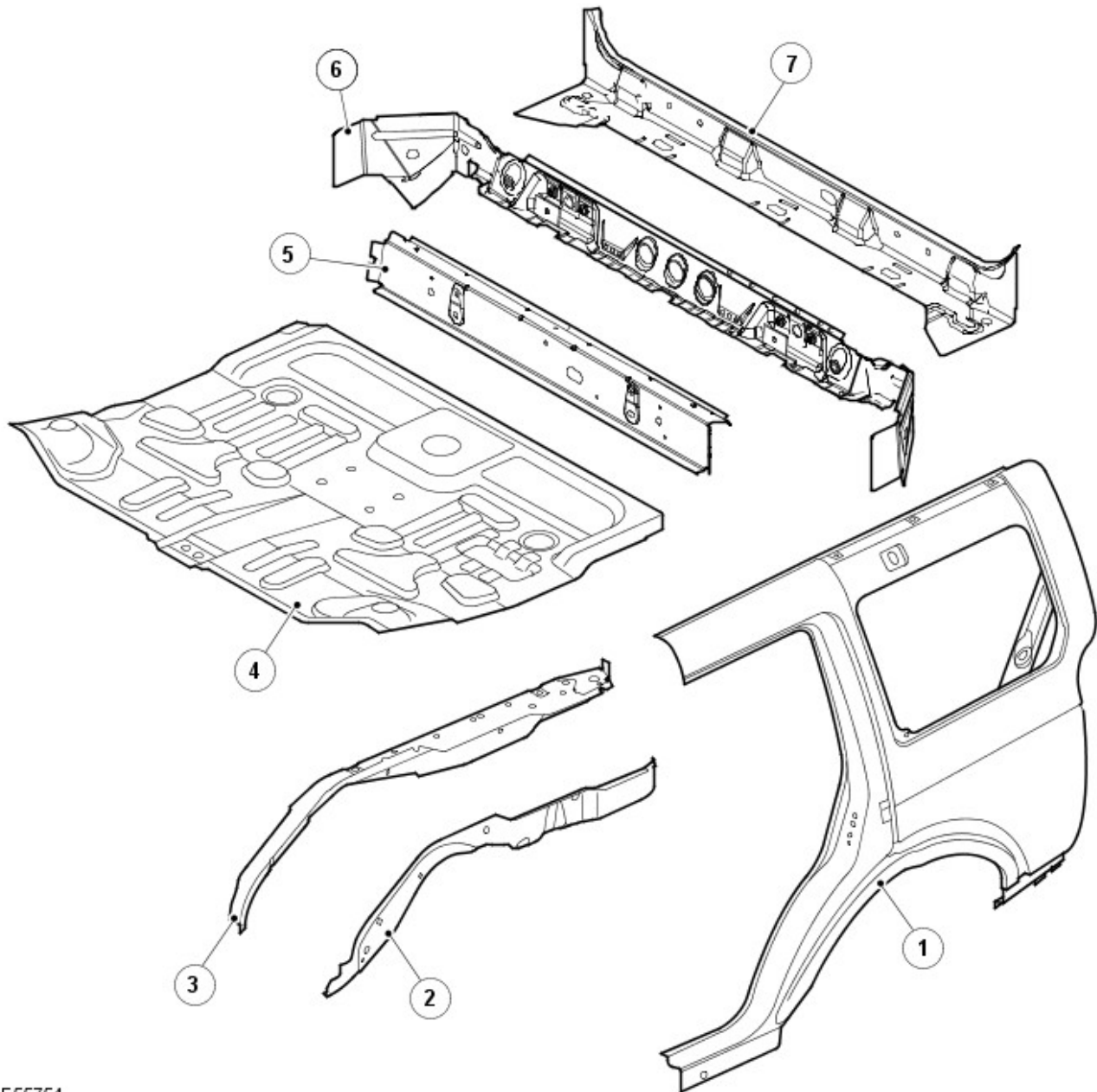
1. Install is the reversal of removal.

This section contains no data

Rear End Sheet Metal Repairs - Rear End Sheet Metal

Description and Operation

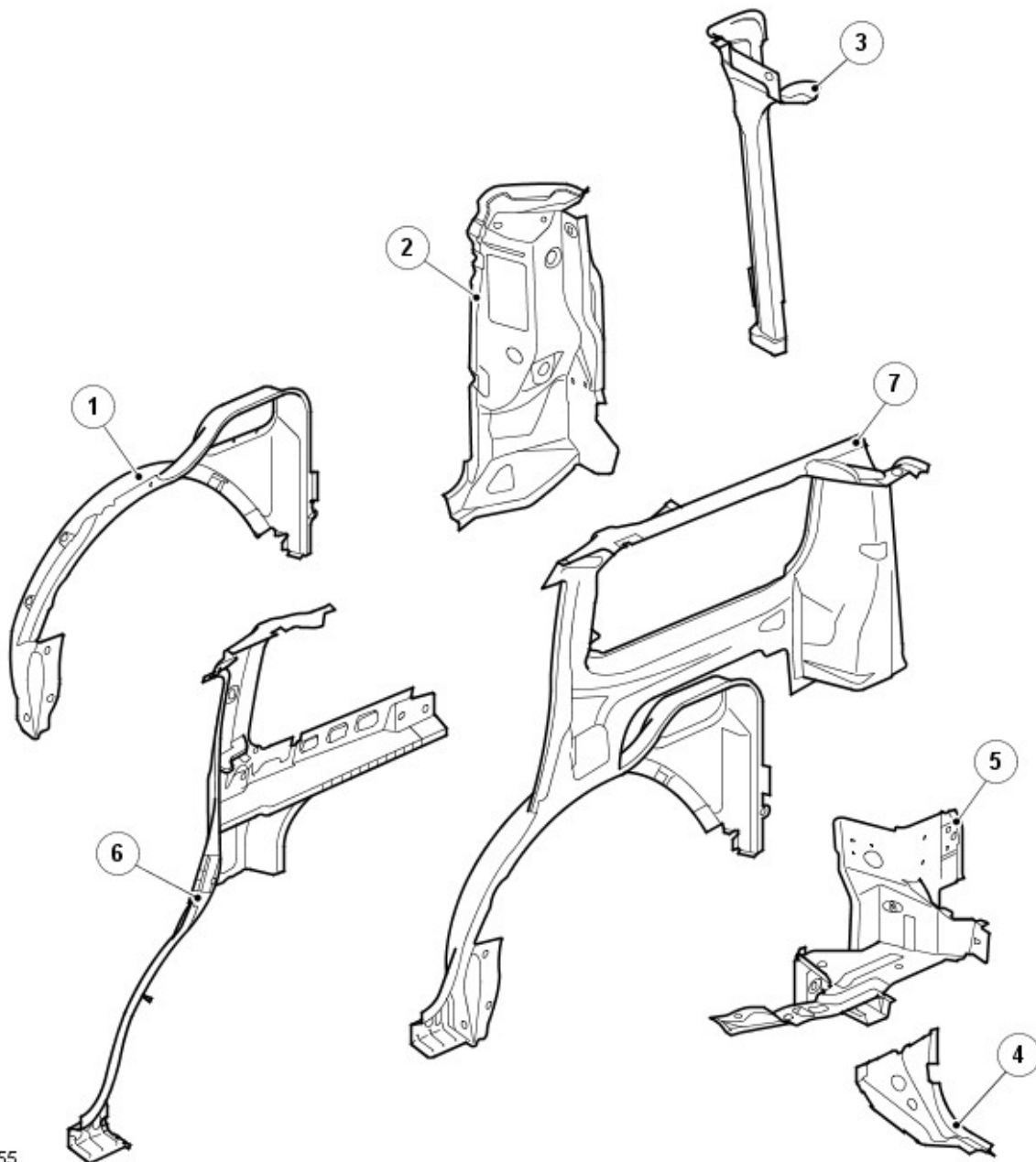
Rear end service panels



E55754

Item	Description	Service part No
1	Quarter panel outer	R/H ALA780100 L/H ALA780110
2	Rear side member	R/H AGA780021 L/H AGA780031
3	Rear side member	R/H AFD780080 L/H AFD780090
4	Rear floor panel	AFD780010
5	Rear crossmember	AQA780050
6	Rear panel reinforcement	AQR780080
7	Rear panel outer	AQA780030

Rear end service panels



E55755

Item	Description	Service part No
1	Rear wheelhouse outer	R/H ALK780100 L/H ALK780110
2	Rear lamp mounting panel	R/H AME780320 L/H AME780330
3	Water drain panel	R/H AME780300 L/H AME780310
4	D-pillar closing panel	R/H AFF780060 L/H AFF780070
5	D-pillar inner lower panel assembly	R/H AGY780060 L/H AGY780070
6	Inner quarter panel	R/H ALR780220 L/H ALR780230
7	Inner quarter panel/side panel rear section	R/H ALJ780120 L/H ALJ780130

Time schedules, front end

The following information shows the total time taken to replace single panels and complete assemblies. This time includes removal of Mechanical, Electrical and Trim (MET) items, plus paint times based on Metallic Clear Over Base Paint.

The times shown were generated by Thatcham (the motor insurance repair and research centre) and are to be used as a guide only.

Single panel times

Panel Description	Petrol	Diesel
Liftgate	9.0	9.0

Tailgate	6.7	6.7
Quarter panel L/H	23.4	23.4
Quarter panel R/H	23.7	23.7

Combination panel replacement times

The following panel combination times show the total time to remove/refit body panels, MET items and any paint process.

Combination panel times

Panel Description	Petrol	Diesel
Rear bumper		
D-Pillar closing panel L/H and R/H		
Rear lamp panel		
Rear crossmember		
Rear panel		
Quarter panel		
Tailgate		
Total Time	L/H 35.6 R/H 35.9	L/H 35.6 R/H 35.9

Combination panel times

Panel Description	Petrol	Diesel
Rear bumper		
D-Pillar closing panel L/H and R/H		
Rear lamp panel L/H and R/H		
Rear panel		
Rear crossmember		
Tailgate		
Quarter panel L/H and R/H		
Total Time	62.1	62.1

Combination panel times

Panel Description	Petrol	Diesel
Body off integraed frame		
Rear floor panel section		
Rear bumper		
Rear side member section		
D-Pillar closing panel		
D-Pillar inner lower panel assembly		
Rear lamp panel		
Rear panel		
Rear crossmember		
Tailgate		
Quarter panel		
Total Time	L/H 64.1 R/H 64.3	L/H 64.3 R/H 64.5

Combination panel times

Panel Description	Petrol	Diesel
Body off integraed frame		
Rear floor panel section		
Rear bumper		
Rear side member section L/H and R/H		
D-Pillar closing panel L/H and R/H		
D-Pillar inner lower panel assembly L/H and R/H		
Rear lamp panel L/H and R/H		
Rear panel		
Rear crossmember		
Tailgate		
Quarter panel L/H and R/H		
Total Time	87.4	87.6

Combination panel times

Panel Description	Petrol	Diesel
Rear bumper		
D-Pillar closing panel		
D-Pillar inner lower panel assembly		
Rear lamp panel		
Rear panel		
Rear crossmember		
Tailgate		
Quarter panel		
Total Time	48.7	48.7

Combination panel times

Panel Description	Petrol	Diesel
Rear bumper		

Rear lamp panel		
Rear panel		
Rear crossmember		
D Pillar closing panel L/H and R/H		
Tailgate		
Total Time	27.1	27.1

Rear End Sheet Metal Repairs - Quarter Panel

Removal and Installation

Removal

1. Load vehicle onto ramp.
2. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
3. Remove the rear wheel and tire.
4. Remove the rear bumper cover.
For additional information, refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).
5. Remove the forced air extraction grille.
6. R/H side: Remove fuel tank.
For additional information, refer to: Fuel Tank (310-01C Fuel Tank and Lines - 2.7L Diesel, Removal and Installation).
7. R/H side: Remove the fuel tank filler pipe.
For additional information, refer to: Fuel Tank Filler Pipe (310-01C Fuel Tank and Lines - 2.7L Diesel, Removal and Installation).
8. R/H side: Remove the fuel filler interlock catch.
For additional information, refer to: Fuel Filler Interlock Catch (501-03 Body Closures, Removal and Installation).
9. Remove the headliner.
For additional information, refer to: Headliner (501-05 Interior Trim and Ornamentation, Removal and Installation).
10. Remove the rear seat.
For additional information, refer to: Rear Seat - Vehicles With: 60/40 Split Seat (501-10 Seating, Removal and Installation).
11. Remove the C-pillar side impact sensor.
For additional information, refer to: C-Pillar Side Impact Sensor (501-20B Supplemental Restraint System, Removal and Installation).
12. Remove the side air curtain module.
For additional information, refer to: Side Air Curtain Module (501-20B Supplemental Restraint System, Removal and Installation).
13. Remove the rear quarter window glass.
For additional information, refer to: Rear Quarter Window Glass (501-11 Glass, Frames and Mechanisms, Removal and Installation).
14. Remove the rocker panel finisher.
15. Remove the exhaust heatshield.
16. Remove the tailgate latch.
For additional information, refer to: Tailgate Latch (501-14 Handles, Locks, Latches and Entry Systems, Removal and Installation).
17. Remove the tailgate weatherstrip.
18. With assistance remove the tailgate.
19. Remove the load space trims.
20. Remove the load space carpets.

- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
- Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Rear End Sheet Metal Repairs - Inner Quarter Panel

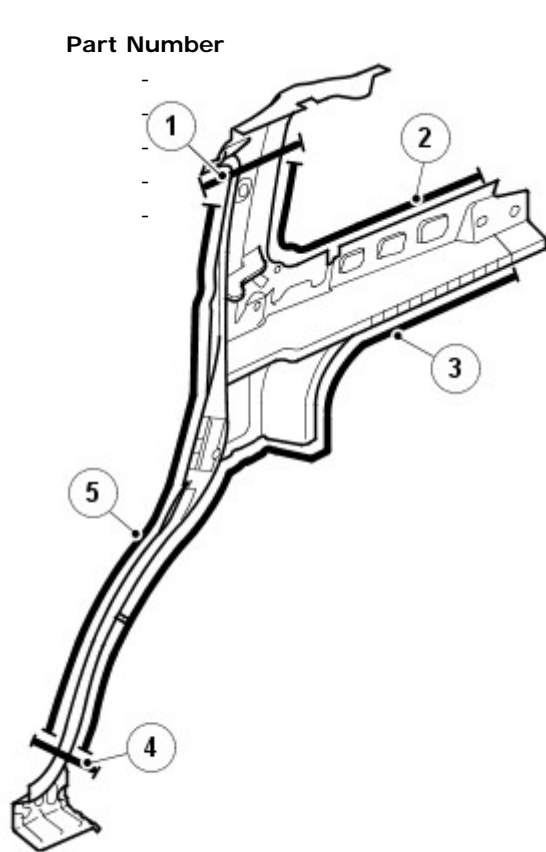
Removal and Installation

Removal



NOTE: In this procedure, the inner quarter panel is replaced in conjunction with the quarter panel.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the quarter panel.
For additional information, refer to: Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).

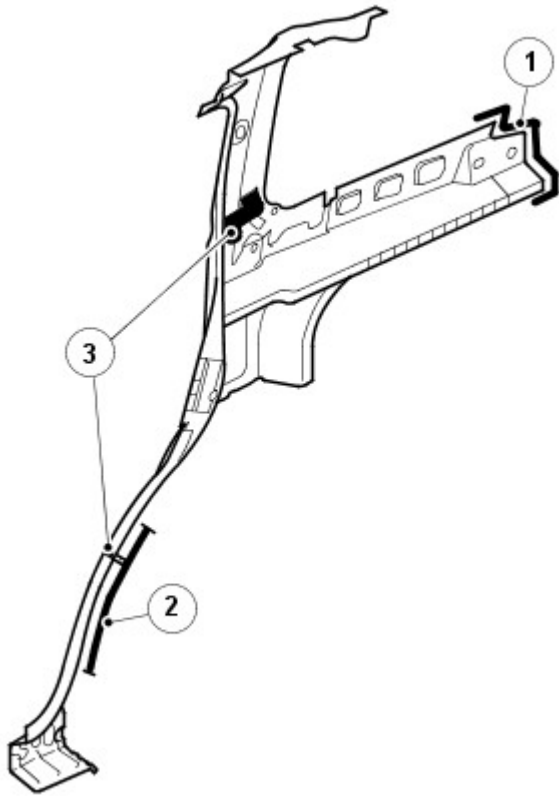


E55760

Item	Description
1	Butt weld.
2	24 spot welds.
3	11 spot welds.
4	Butt weld.
5	40 spot welds.

Part Number	Item	Description
-	1	5 plug welds.
-	2	8 plug welds.
-	3	Acoustic seals

4.



E57103

5. For additional information:

- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
- Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Rear End Sheet Metal Repairs - Water Drain Panel

Removal and Installation

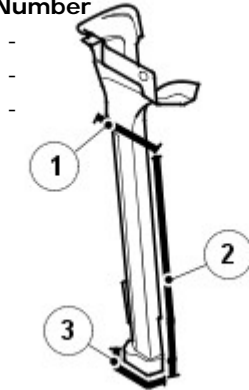
Removal



NOTE: In this procedure, the water drain panel is replaced in conjunction with the quarter panel.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the quarter panel.
For additional information, refer to: Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).

Part Number



E55934

3.

Item

Description

1	Butt weld.
2	12 spot-welds.
3	2 plug-welds.

4. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Rear End Sheet Metal Repairs - Rear Wheelhouse Outer

Removal and Installation

Removal



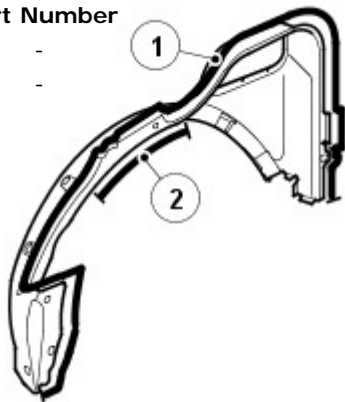
NOTE: In this procedure, the rear wheelhouse outer is replaced in conjunction with the quarter panel.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Disconnect the parking brake cables.
For additional information, refer to: Parking Brake Cable (206-05 Parking Brake and Actuation, Removal and Installation).
3. Remove the brake line.
4. Remove the rear suspension.
For additional information, refer to: Rear Suspension (204-02 Rear Suspension, Description and Operation).
5. Remove the quarter panel.
For additional information, refer to: Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).

Part Number

-

-



E55930

6.

Item

1

2

Description

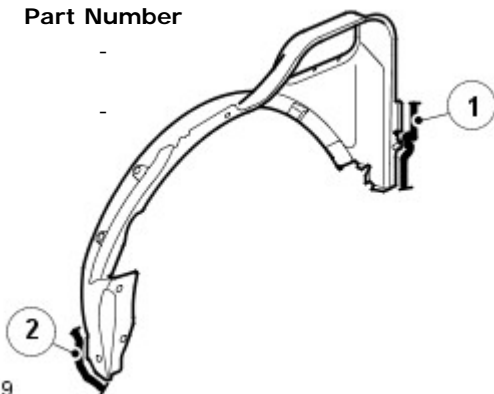
60 spot welds.

10 spot welds.

Part Number

-

-



E57119

7.

Item

1

2

Description

160mm (6.29) adhesive.

2 plug welds and 5 spot welds.

8. For additional information:

- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
- Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Rear End Sheet Metal Repairs - Rear Lamp Mounting Panel

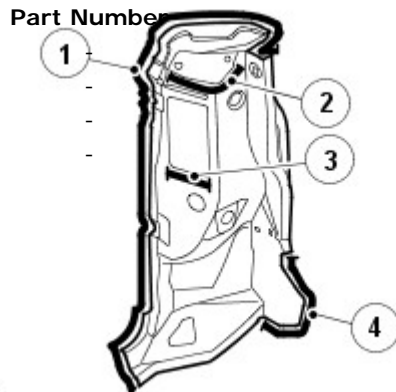
Removal and Installation

Removal



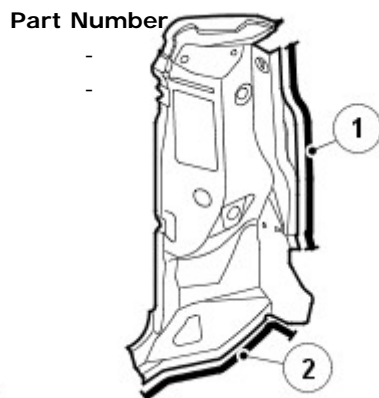
NOTE: In this procedure, the rear lamp mounting panel is replaced in conjunction with the quarter panel.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the quarter panel.
For additional information, refer to: Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).



E57102

Item	Description
1	18 plug welds.
2	Adhesive.
3	3 plug welds.
4	2 plug welds.



E55761

Item	Description
1	16 spot welds.
2	11 spot welds.

5. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Rear End Sheet Metal Repairs - Back Panel

Removal and Installation

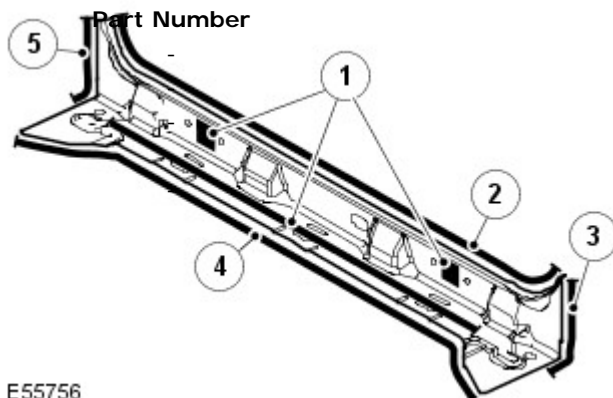
Removal



NOTE: When replacing the back panel it is necessary to remove a section of the rear lamp panel.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the rear bumper cover.
For additional information, refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).
3. Remove both D-pillar trim panels.
For additional information, refer to: D-Pillar Trim Panel (501-05 Interior Trim and Ornamentation, Removal and Installation).
4. Remove the tailgate hinge trim cover.
5. Remove the tailgate weather seal.
6. Remove the load space trims.
7. Remove the load space carpets.
8. With assistance remove the tailgate.
9. Remove the L/H exhaust heatshield tailpipe.
10. Remove the R/H exhaust heatshield tailpipe.
11. Remove the spare wheel and tire.
12. Release the back panel wiring harness.

13.



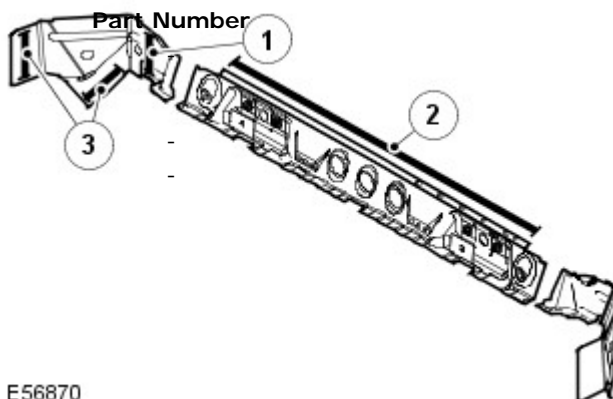
E55756

Item

Description

1	20 plug welds.
2	42 spot welds.
3	4 plug welds.
4	21 plug welds.
5	4 plug welds.

14.



E56870

Item

Description

1	2 plug welds. (R/H is symmetrically opposite to L/H)
2	30 spot welds.
3	7 spot welds. (R/H is symmetrically opposite to L/H)

15. For additional information:

- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
- Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Rear End Sheet Metal Repairs - Rear Floor Panel Section

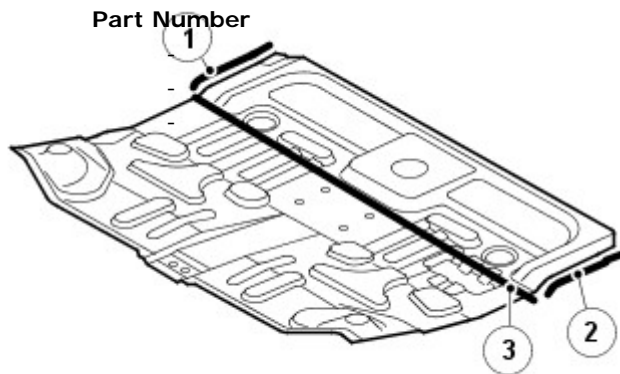
Removal and Installation

Removal



NOTE: In this procedure, the rear floor panel section is replaced in conjunction with the back panel and rear crossmember.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the back panel.
For additional information, refer to: Back Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
3. Remove the rear crossmember.
For additional information, refer to: Rear Crossmember (501-30 Rear End Sheet Metal Repairs, Removal and Installation).



E55762

Item	Description
1	Mig-weld.
2	Mig-weld.
3	Mig-welds and 18 plug-welds.

- 4.
5. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Rear End Sheet Metal Repairs - Rear Crossmember

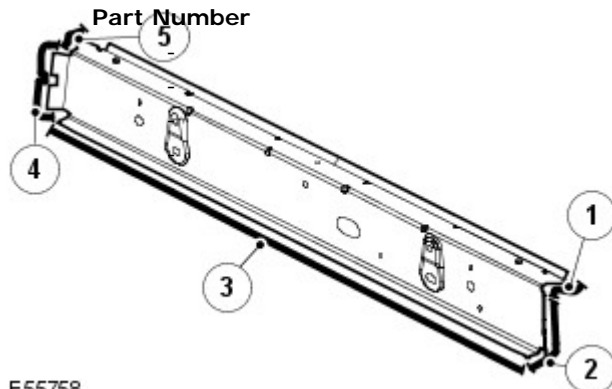
Removal and Installation

Removal



NOTE: In this procedure, the rear crossmember is replaced in conjunction with the back panel.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the back panel.
For additional information, refer to: Back Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).



E55758

3.

Item	Description
1	Mig weld.
2	3 spot welds.
3	12 plug welds.
4	3 spot welds.
5	Mig weld.

4. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

This section contains no data

Rear End Sheet Metal Repairs - Quarter/Side Panel Rear Section LH

Removal and Installation

Removal

NOTES:



The quarter / side panel rear section R/H is symmetrically opposite to the L/H.



In this procedure, quarter / side panel rear section is replaced in conjunction with the quarter panel.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the quarter panel.
For additional information, refer to: Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).

3.

Part Number	Item	Description
-	1	15 spot welds.
-	2	Butt weld.
-	3	Butt weld.
-	4	Acoustic seal.
-	5	3 plug welds.
-	6	8 plug welds.
-	7	Mig weld.
-	8	5 plug welds.
-	9	Butt weld.

E55933

4. For additional information:

- Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
- Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Rear End Sheet Metal Repairs - Rear Side Member Section

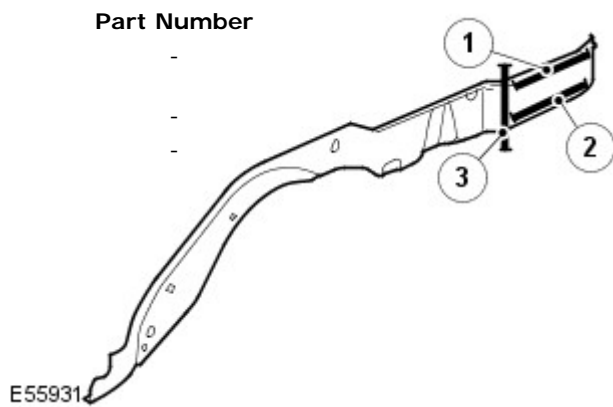
Removal and Installation

Removal



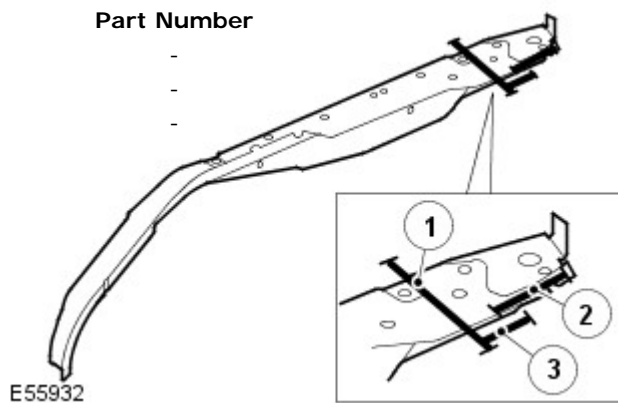
NOTE: In this procedure, the rear side member section is replaced in conjunction with the back panel and rear crossmember.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the back panel.
For additional information, refer to: Back Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).
3. Remove the rear crossmember.
For additional information, refer to: Rear Crossmember (501-30 Rear End Sheet Metal Repairs, Removal and Installation).



4.

Item	Description
1	2 plug welds. (also see graphic E55932)
2	2 plug welds.
3	Butt weld.



5.

Item	Description
1	Butt weld.
2	2 plug welds.
3	4 plug welds.

6. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Rear End Sheet Metal Repairs - D-Pillar Inner Lower Panel

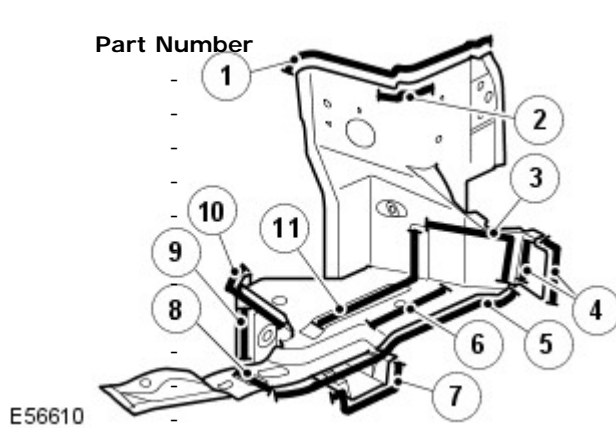
Removal and Installation

Removal



NOTE: In this procedure the D-Pillar inner lower panel is replaced in conjunction with the quarter panel.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the quarter panel.
For additional information, refer to: Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).



3.

Item	Description
1	8 plug welds.
2	3 plug welds.
3	4 plug welds.
4	Mig weld.
5	7 plug welds.
6	6 plug welds.
7	4 plug welds.
8	Butt weld.
9	Adhesive
10	4 plug welds.
11	6 plug welds.

4. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Rear End Sheet Metal Repairs - D-Pillar Closing Panel

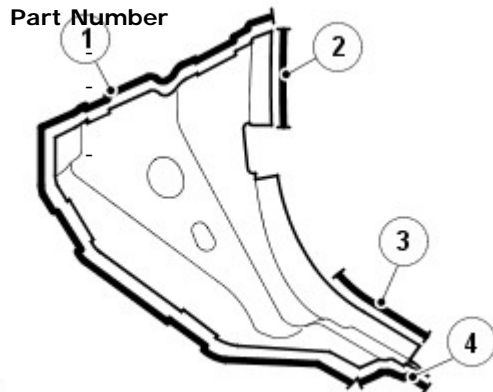
Removal and Installation

Removal



NOTE: In this procedure the D-Pillar closing panel is replaced in conjunction with the quarter panel.

1. Disconnect both battery cables.
For additional information, refer to: Specifications (414-00 Charging System - General Information, Specifications).
2. Remove the quarter panel.
For additional information, refer to: Quarter Panel (501-30 Rear End Sheet Metal Repairs, Removal and Installation).



E56611

3.

Item	Description
1	Mig weld.
2	2 plug welds.
3	1 plug weld.
4	4 plug welds.

4. For additional information:
 - Welding.
For additional information, refer to: Body Repairs (501-25A Body Repairs - General Information, Description and Operation).
 - Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25B Body Repairs - Corrosion Protection, Description and Operation).
 - Tolerance checks.
For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).

Installation

1. Install is the reversal of removal.

Full Frame and Body Mounting -

Torque Specifications

Description	Nm	lb-ft
HO2s harness bracket bolt	10	7
Transmission support crossmember nuts and bolts	90	66
Transmission support insulator through-bolt	175	129
Transmission undershield bolts	10	7
* Integrated-body frame to body bolts	133	98

* New bolts must be installed

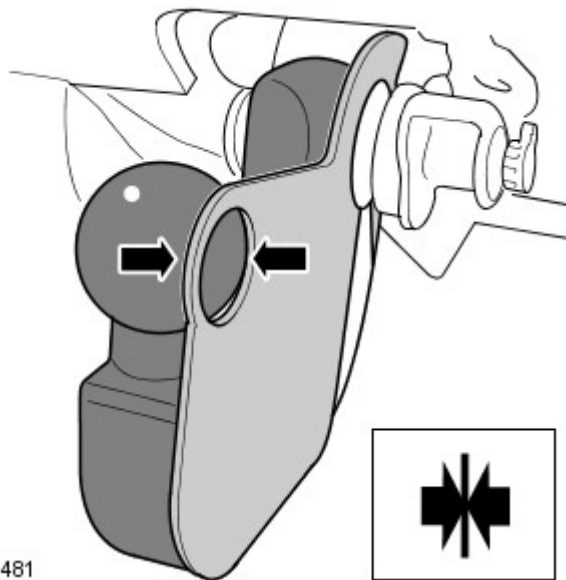
Full Frame and Body Mounting - Tow Bar Mounting Check


General Procedures

Special Tool(s)


 <p>E140509</p>	<p>Tow Bar Gauge JLR-501-201</p>
--	--------------------------------------


1. **Pre test:** Check the detachable tow bar locking pin is moving freely without sticking.
2. Insert the tow bar into the chassis following the owners handbook instruction.



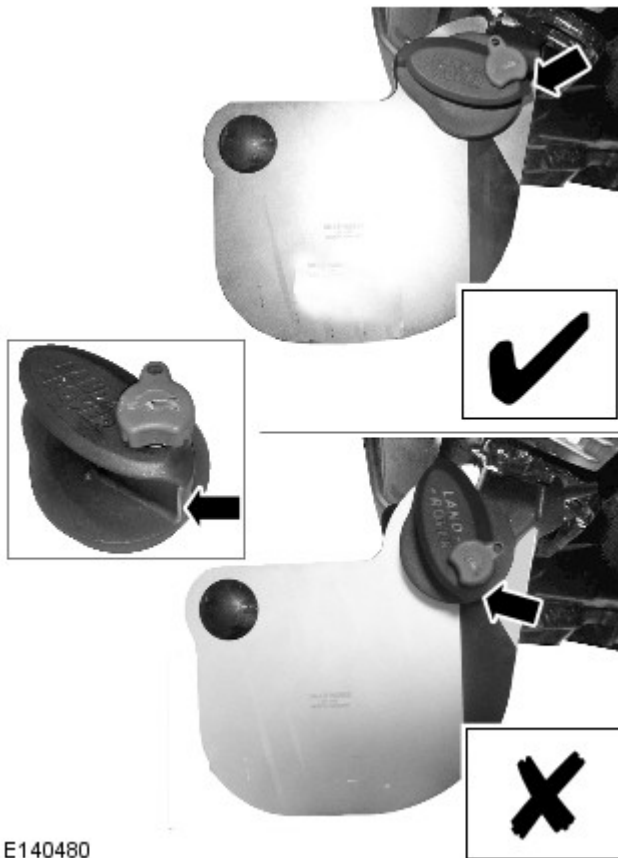
3.  **CAUTION:** The special tool must be flat against the tow bar ball before taking measurements.

Hold the special tool JLR-501-201 against the tow bar as shown, failure to follow this instruction may result in an incorrect measurement.

4.  **CAUTION:** Make sure the special tool is mounted flush to the tow ball.

 **NOTE:** Note the position of the tow bar release handle.

Install the special tool as shown.



E140480

5. Check the position of the tow bar release handle against the special tool, and observe the following:
 - If the tow bar release handle points to the red area of the special tool, go to Step 6.
 - If the tow bar release handle points outside of the red area of the special tool, then the tow bar mounting is correct and no further action is required.
6. Install a new tow bar and check the tow bar mounting following Steps 3 - 5.
 - If the tow bar release handle points to the red area of the special tool, install a new rear crossmember. For additional information, refer to: Rear Crossmember (502-02, Removal and Installation).

Full Frame and Body Mounting - Transmission Support Crossmember TDV6 3.0L Diesel

Removal and Installation

Removal


NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.

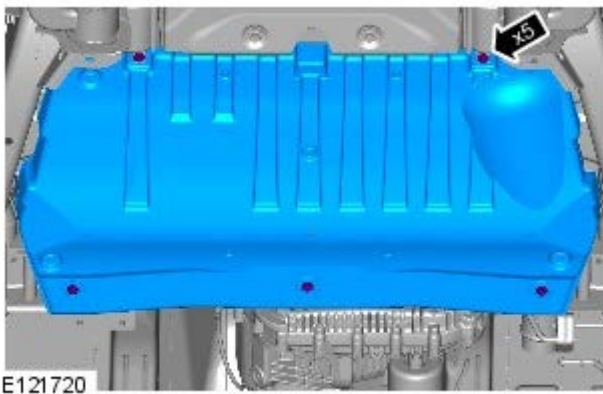


Removal steps in this procedure may contain installation details.

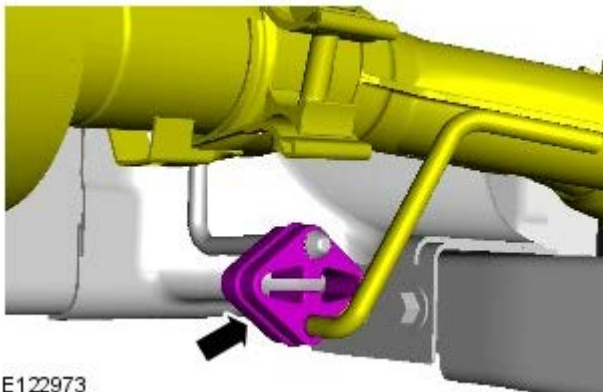
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

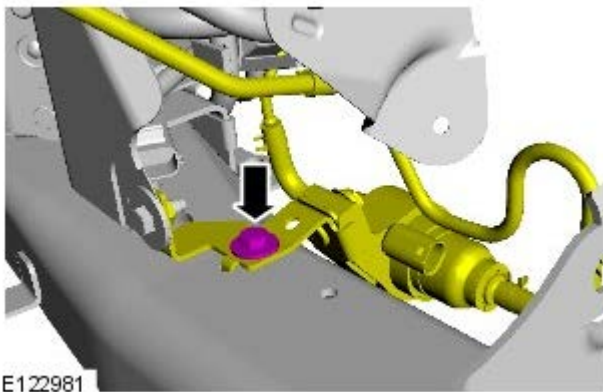
2.



3.

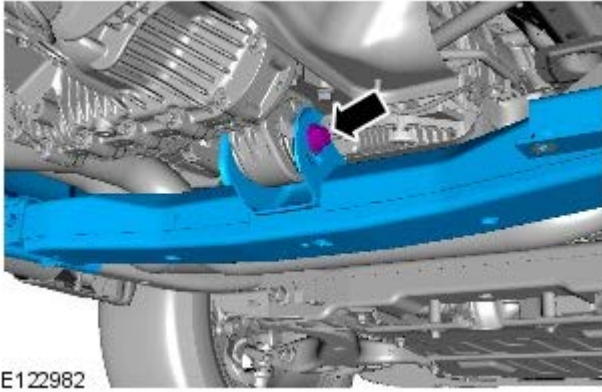


4.



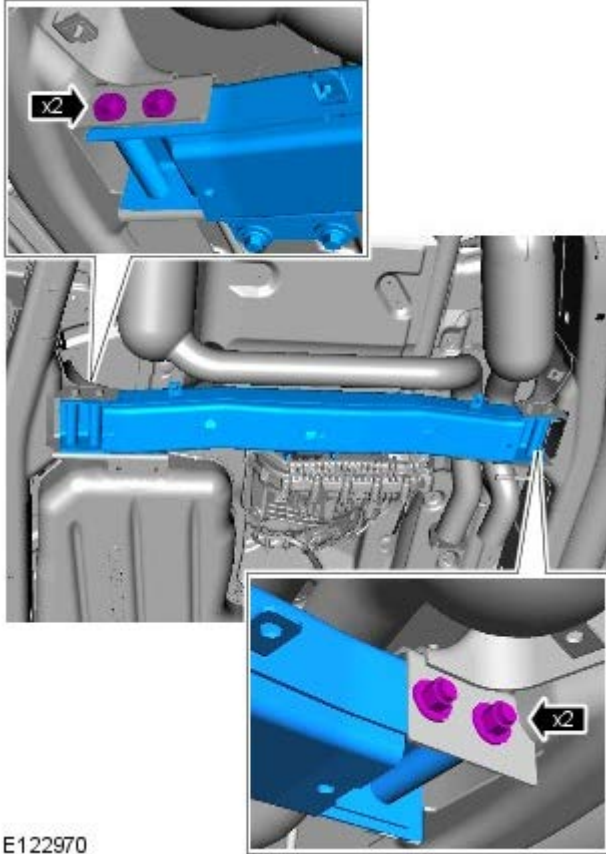
5.

- Support the transfer case.



E122982

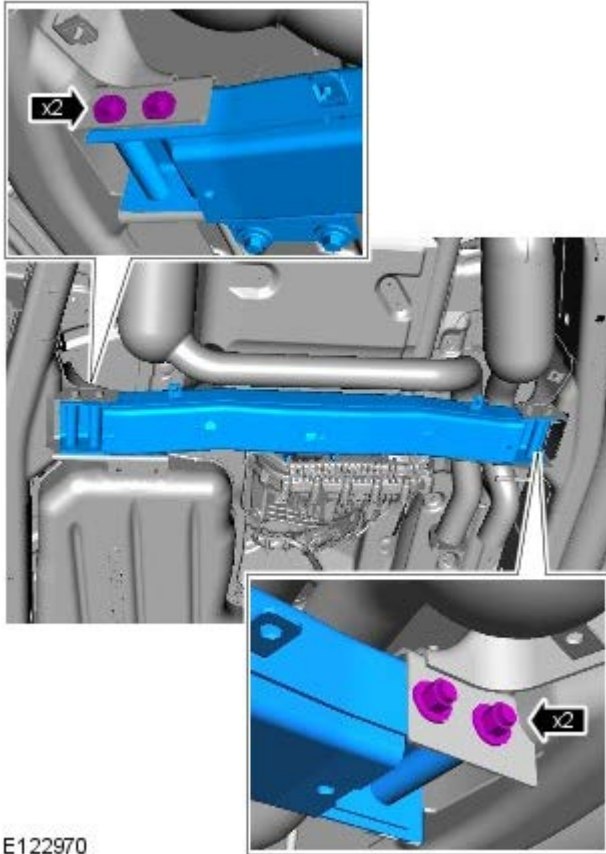
6.



E122970

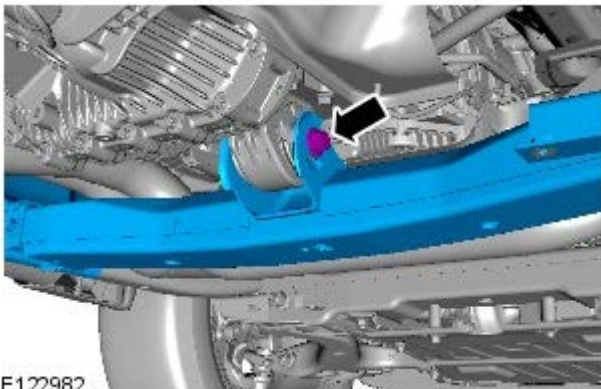
Installation

1. TORQUE: 115 Nm



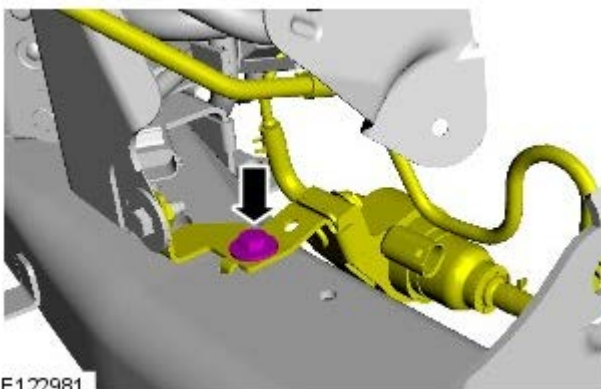
E122970

2. TORQUE: 175 Nm



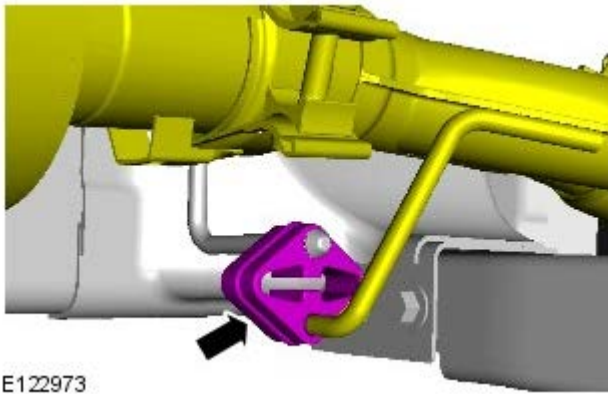
E122982

3. TORQUE: 10 Nm



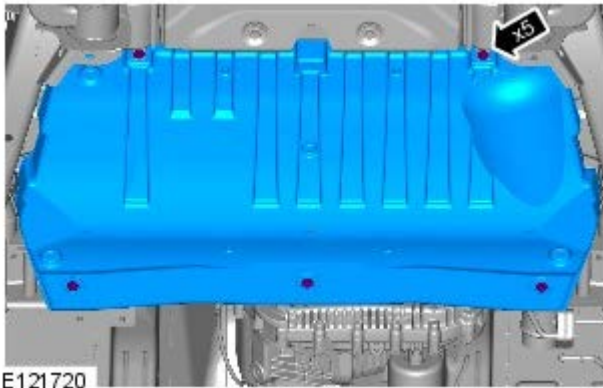
E122981

4.



E122973

5. TORQUE: 10 Nm



E121720

Full Frame and Body Mounting - Transmission Support Crossmember V6 S/C 3.0L Petrol

Removal and Installation

Removal


NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.

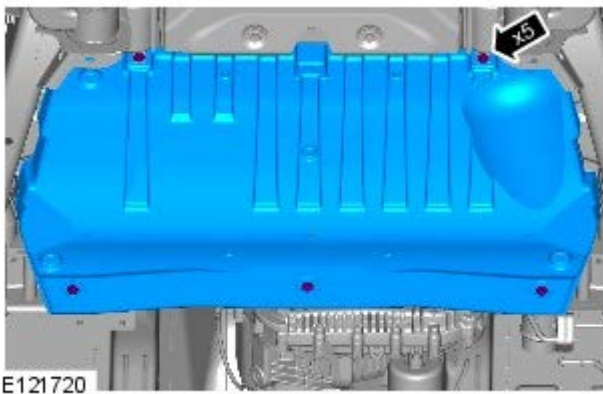


Removal steps in this procedure may contain installation details.

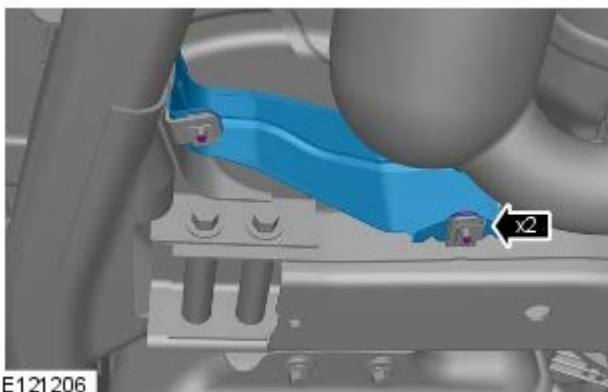
1.  **WARNING:** Do not work on or under a vehicle supported only by a jack. Always support the vehicle on safety stands.

Raise and support the vehicle.

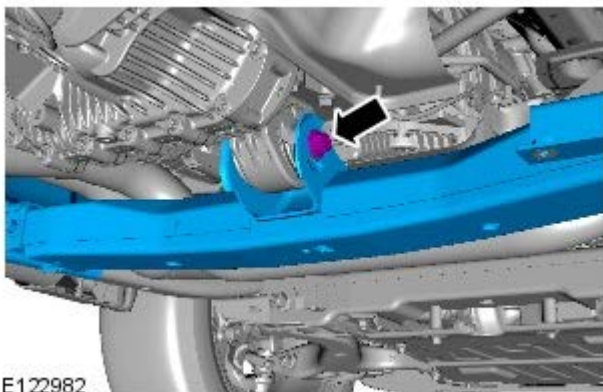
2.



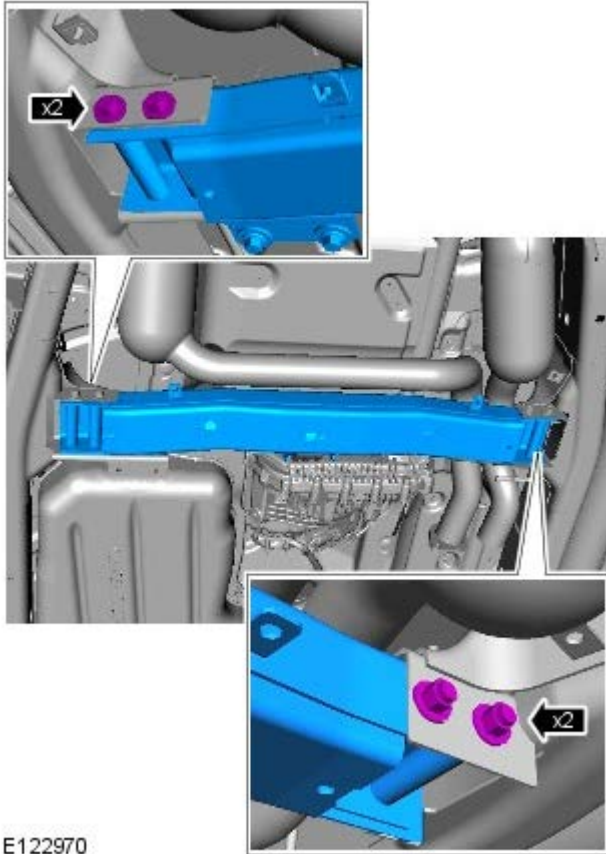
3.



4.



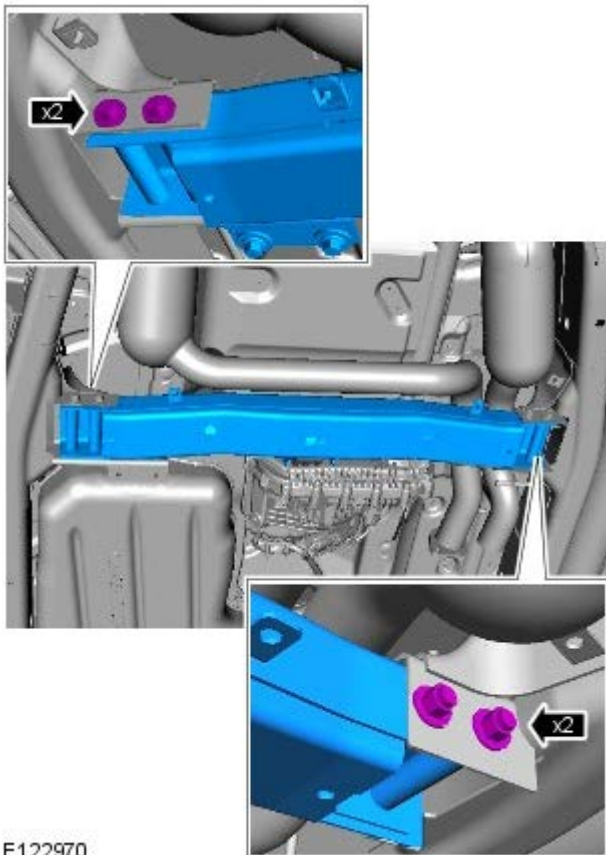
5.



E122970

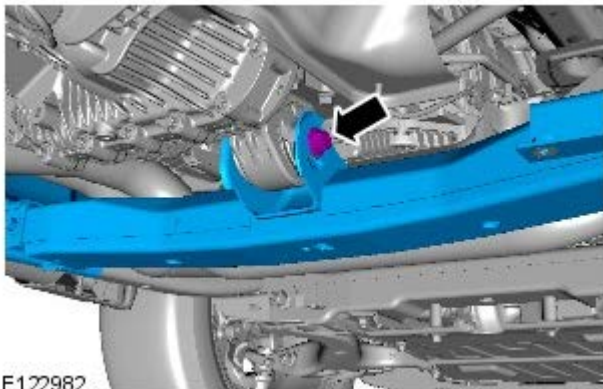
Installation

1. TORQUE: 115 Nm



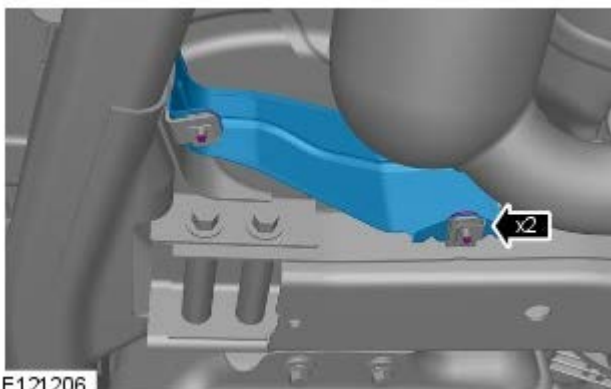
E122970

2. TORQUE: 175 Nm



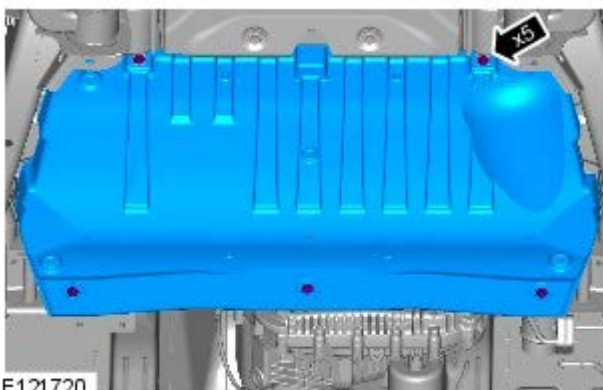
E122982

3. TORQUE: 10 Nm



E121206

4. TORQUE: 10 Nm



E121720

5. Lower the vehicle.


Full Frame and Body Mounting - Rear Crossmember

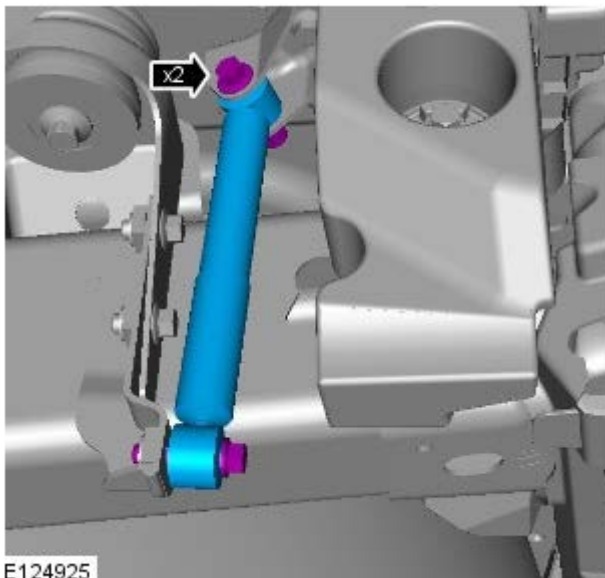
Removal and Installation

Removal



NOTE: Some illustrations may show the body removed for clarity.

1.  **WARNING:** Make sure to support the vehicle with axle stands.
Raise and support the vehicle.
2. Disconnect battery ground cable.
For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).
3. Disconnect the battery positive cable.
4. Remove the rear bumper cover.
For additional information, refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).
5. Remove the spare wheel and tire.



6. NOTES:



If equipped.

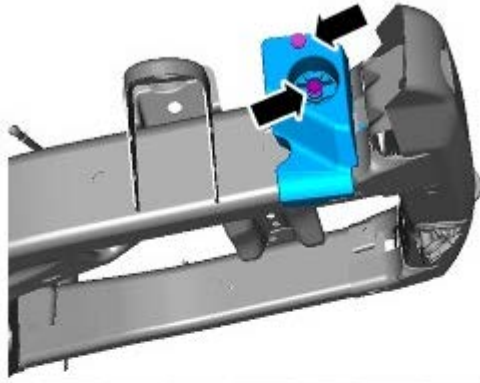


The procedure must be carried out on both sides.

Remove both rear body mount dampers.

7.  **NOTE:** The procedure must be carried out on both sides.

Remove both rear body mass dampers.

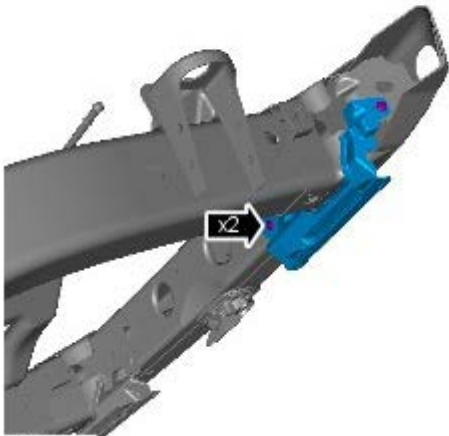


E145690

8.  NOTE: The procedure must be carried out on both sides.

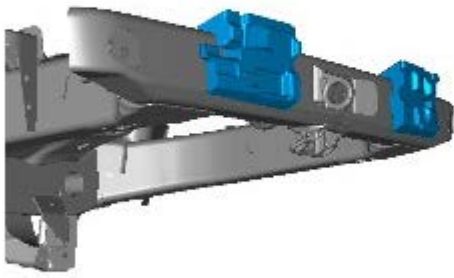
Remove the rear bumper cover lower brackets.

- Remove the 2 screws.



E145862

9. Remove the rear bumper foam pads.




E145863



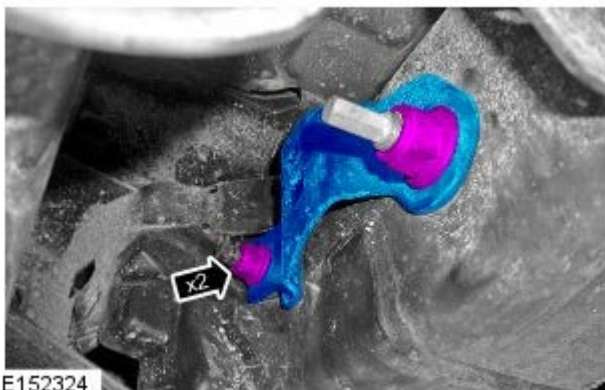
10. NOTES:

 Up to the end of 06MY.

 The procedure must be carried out on both sides.

Remove the bracket.


- Remove the 2 nuts.



E152324

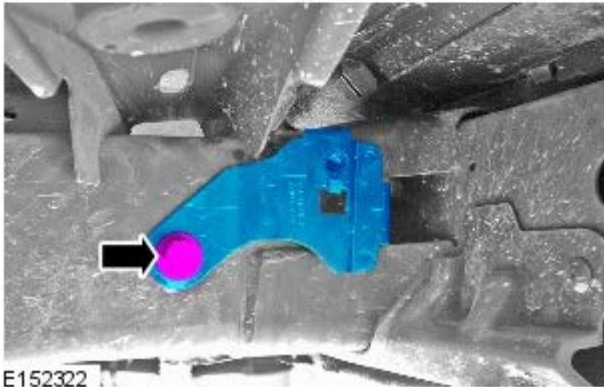
11. NOTES:

 Up to the end of 06MY.

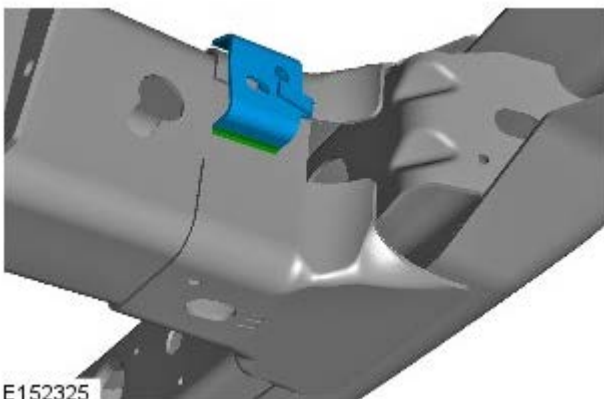
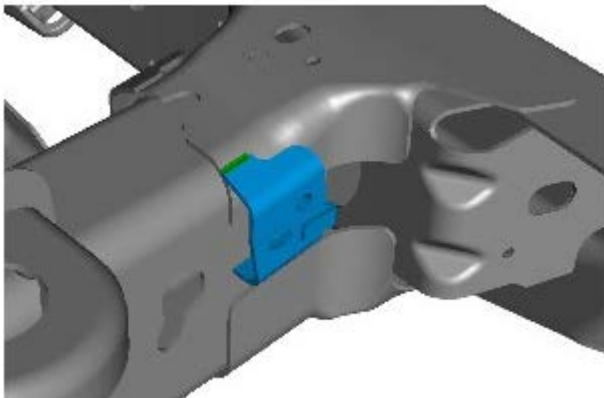
 The procedure must be carried out on both sides.

Remove the bracket.

- Remove the bolt.




E152322




E152325

12. NOTES:

 07MY onwards.

 Vehicles built from 07MY onwards have welded rear body mass damper brackets, these must be removed and replaced with the bolt-on style brackets.

 The procedure must be carried out on both sides.

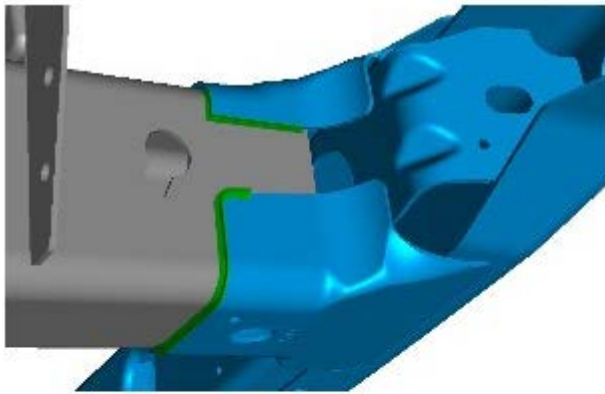
Using suitable tools, remove and discard the 4 rear body mass damper brackets.

Item	Description
-	Mig weld. (Right-hand is symmetrically opposite to left-hand).

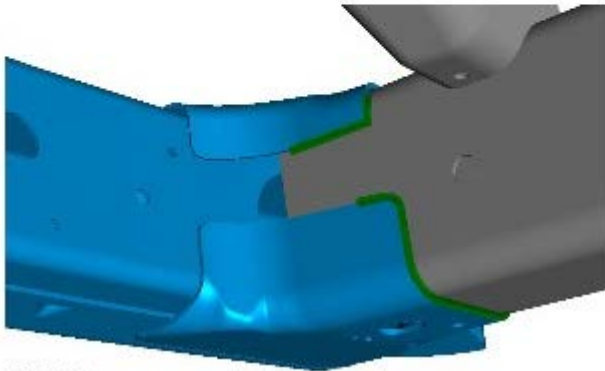
13.  NOTE: The procedure must be carried out on both sides.

Using suitable tools, remove and discard the rear crossmember.

Item	Description
------	-------------

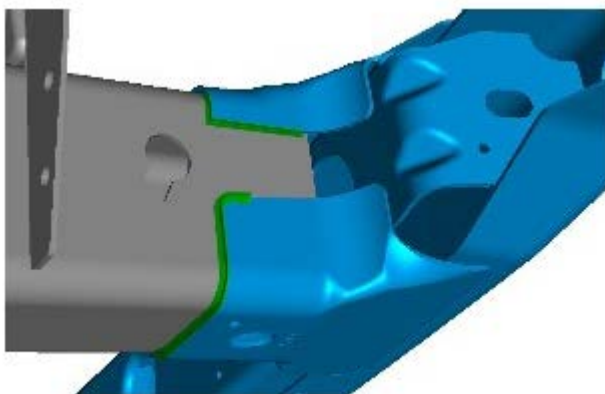


-	Mig weld. (Right-hand is symmetrically opposite to left-hand).



E152326

Installation

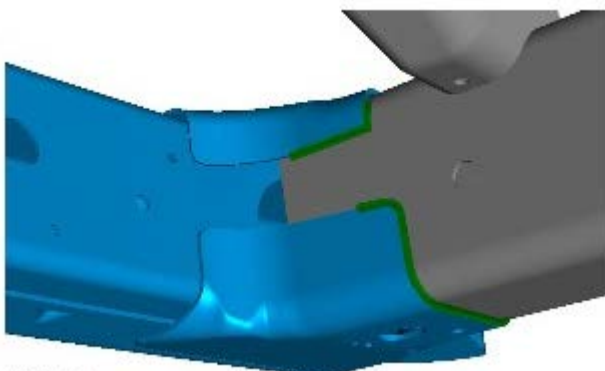


1.  **NOTE:** The procedure must be carried out on both sides.

Install the rear crossmember.

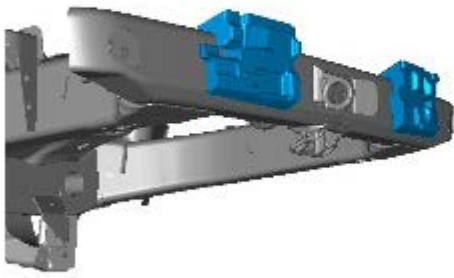
- For additional information:
- Welding.
For additional information, refer to: Body Repairs (501-25 Body Repairs - General Information, Description and Operation).
- Corrosion protection.
For additional information, refer to: Corrosion Protection (501-25 Body Repairs - Corrosion Protection, Description and Operation).
- Tolerance checks.

For additional information, refer to: Body and Frame (501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks, Description and Operation).



E152326

2. Install the rear bumper foam pads.

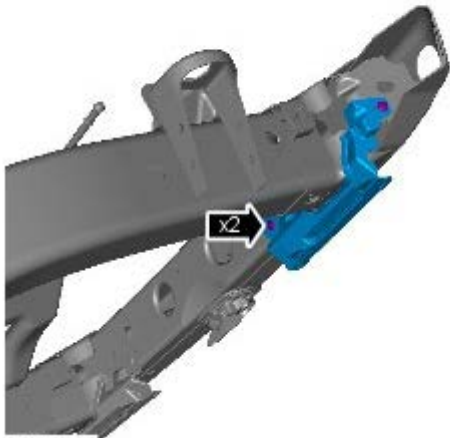


E145863

3.  NOTE: The procedure must be carried out on both sides.

Install the rear bumper cover lower brackets.


- Secure the 2 scrivets.



E145862

4. NOTES:

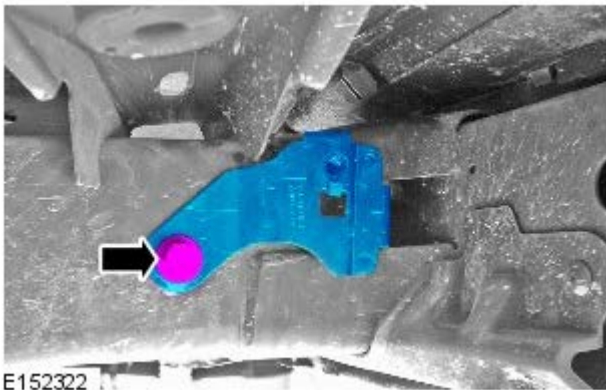
 07MY onwards.

 The procedure must be carried out on both sides.

Install the stiffener inside the chassis.




E152323



E152322

5. NOTES:

 All Vehicles.

 The procedure must be carried out on both sides.

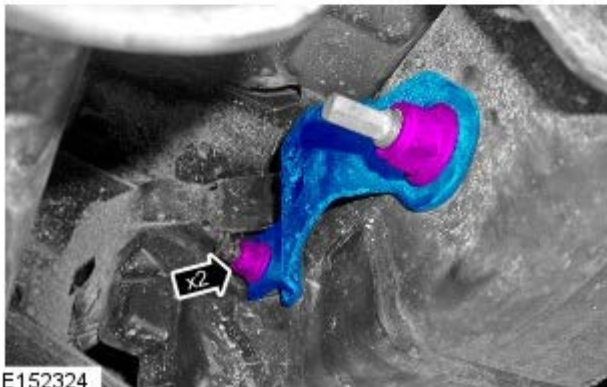
Install the bracket.

- Tighten the bolt to 175 Nm.

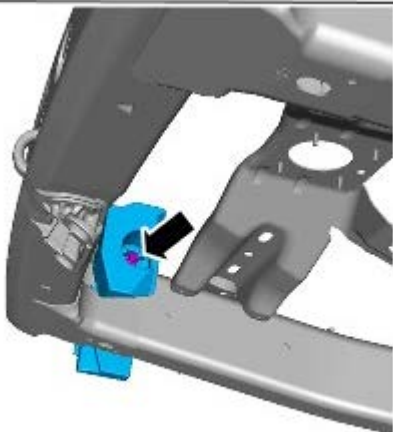
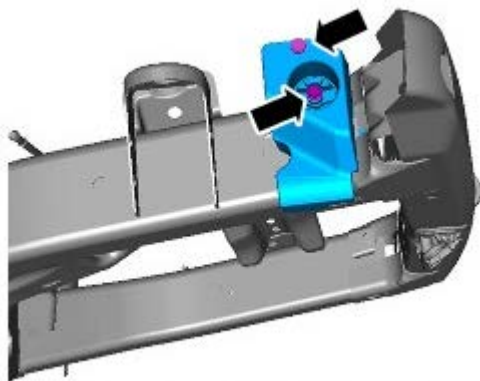
6.  NOTE: The procedure must be carried out on both sides.

Remove the bracket.

- Tighten the M14 nut to 175 Nm.
- Tighten the M10 nut to 45 Nm





E152324



E145690

7. NOTES:

 The procedure must be carried out on both sides.


 Left-hand shown, right-hand similar.

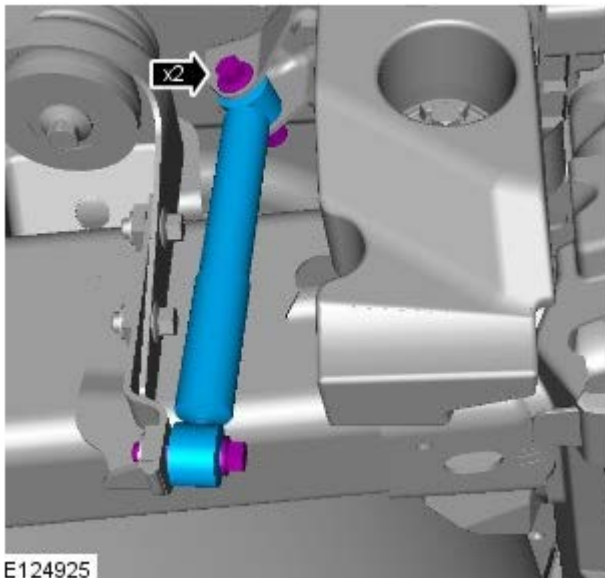
Install both rear body mass dampers.

- Tighten the M8 bolts to 25 Nm.
- Tighten the M10 bolts to 40 Nm

8. NOTES:

 If equipped.

 The procedure must be carried out on both sides.



Install both rear body mount dampers.

- Tighten the bolts to 45 Nm.

9. Install the spare wheel and tire.
10. Install the rear bumper cover.
For additional information, refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).
11. Connect the battery positive cable.
 - Tighten the battery terminal to 5 Nm.
12. Connect the battery ground cable.
For additional information, refer to: Specifications (414-00 Battery and Charging System - General Information, Specifications).

Full Frame and Body Mounting - Body V6 S/C 3.0L Petrol

Removal and Installation

Removal

NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.

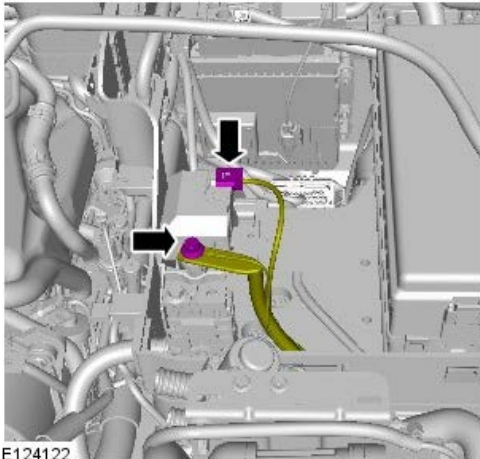


Some illustrations may show the engine removed for clarity.

All vehicles

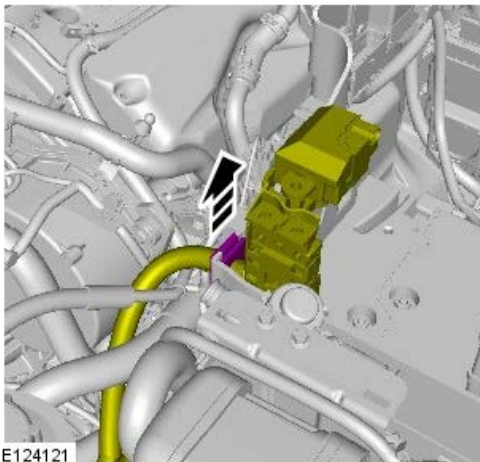
1. Remove the battery cover.
For additional information, refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

2.



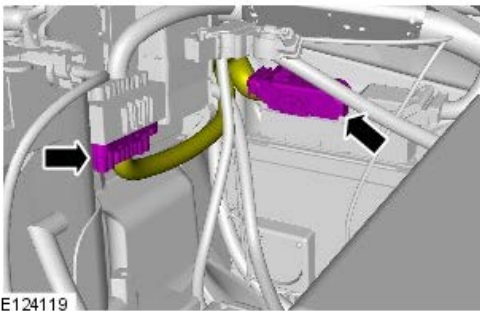
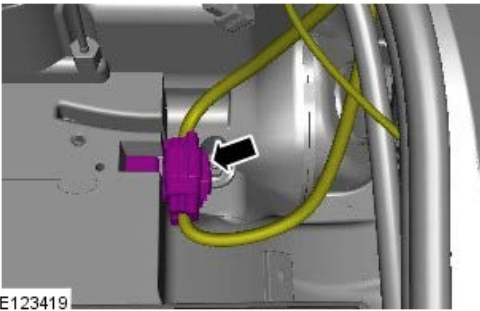
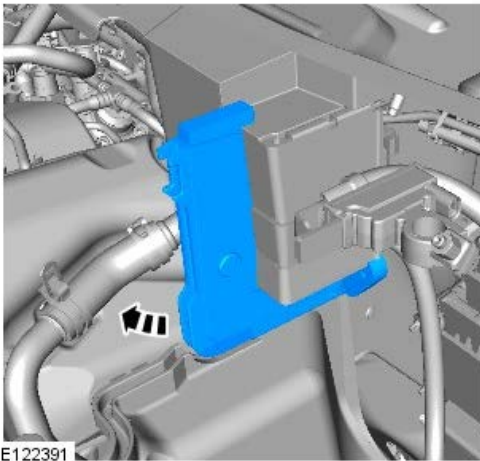
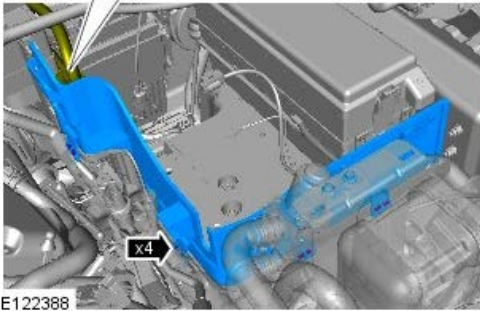
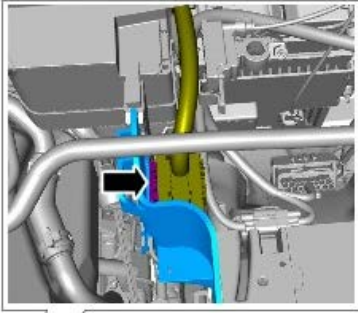
E124122

3.



E124121

4.  NOTE: RHD illustration shown, LHD is similar.



5.

6.

7.

8. For additional information, refer to: [Air Cleaner LH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

9. For additional information, refer to: [Air Cleaner RH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

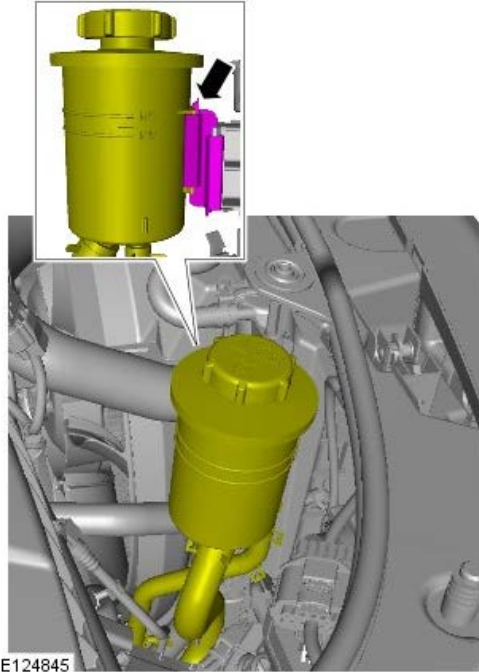
10. For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).

11.

12. For additional information, refer to: Rear Bumper Cover (501-19, Removal and Installation).

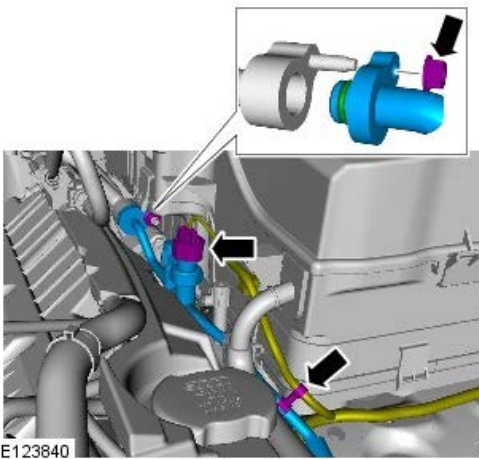
Vehicles with active damping

13.





E124845

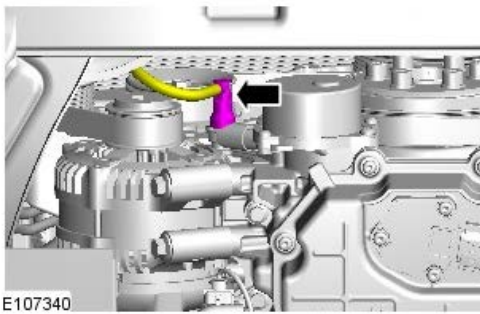
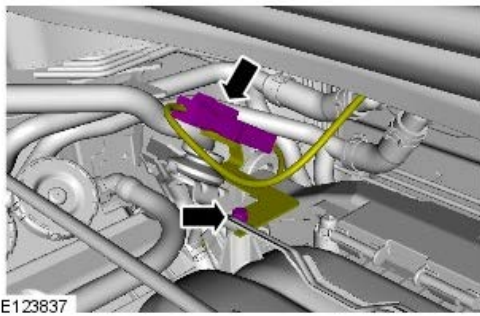
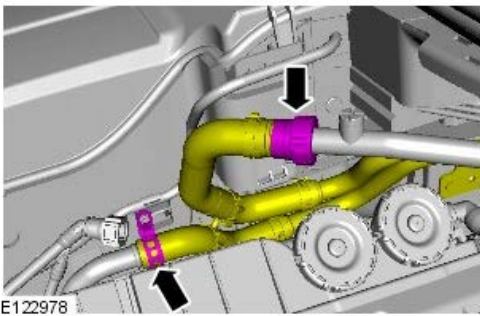
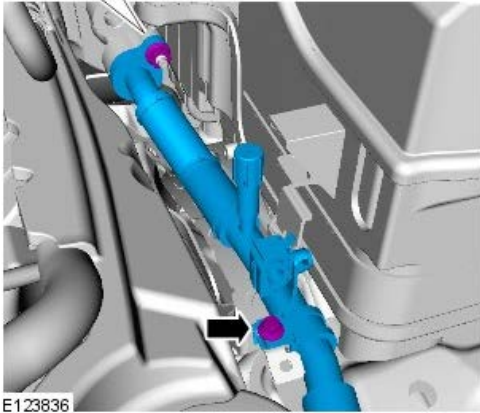
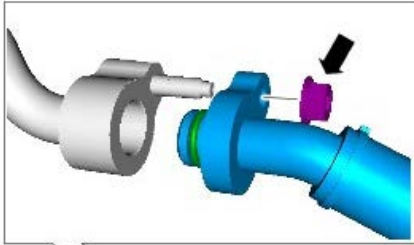
All vehicles



E123840

14.  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.
 - Discard the O-ring seal.

15.  **CAUTION:** Make sure that all openings are sealed. Use new blanking caps.
 - Discard the O-ring seal.

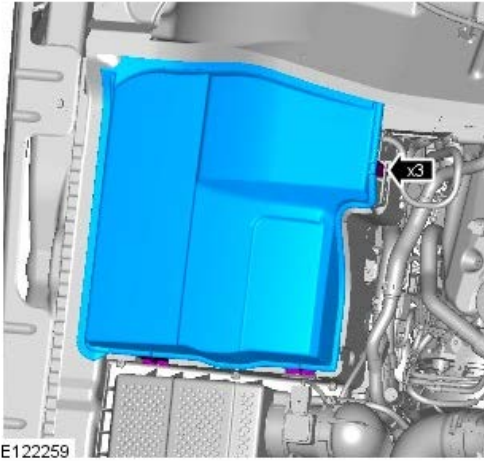


16.  **WARNING:** Be prepared to collect escaping fluid.

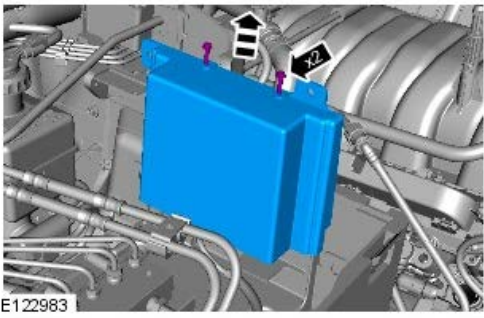
17.

18.

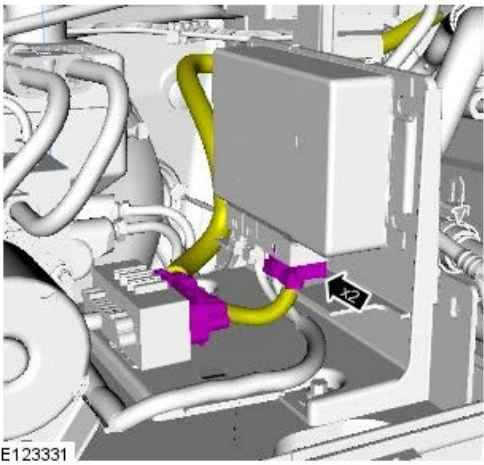
19. For additional information, refer to: [Auxiliary Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).



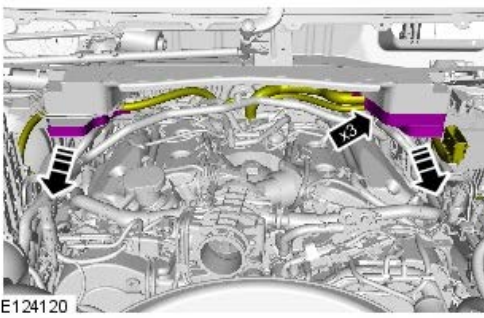
20.



21.

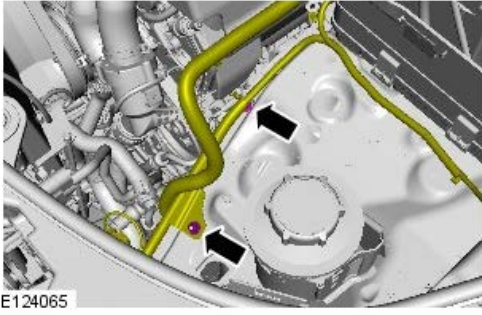


22.



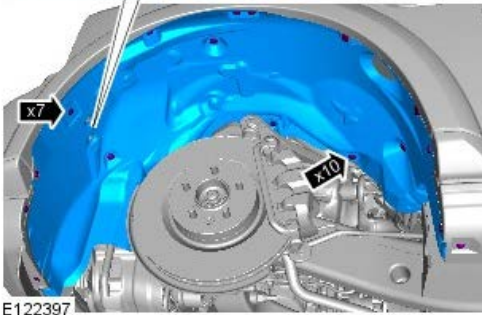
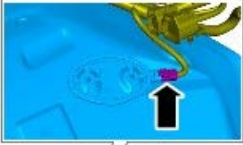
23.

24.



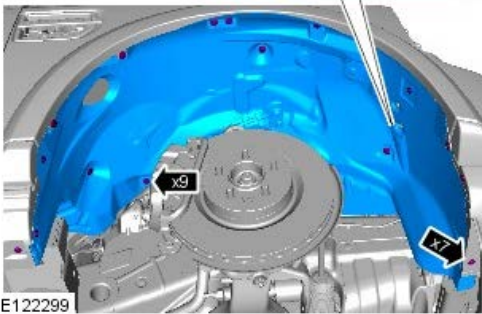
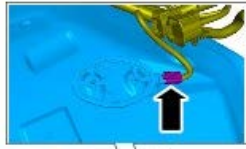
E124065

25.



E122397

26.



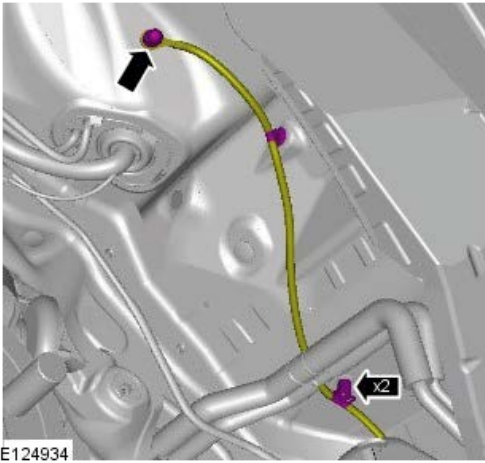
E122299

27.



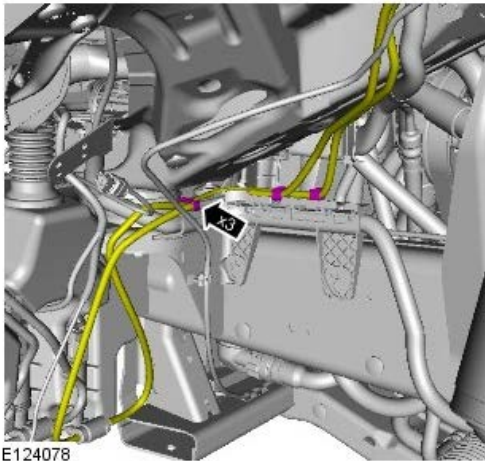
E124927

28.



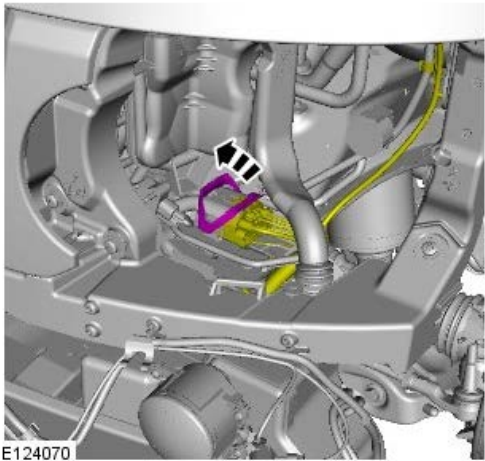
E124934

29.



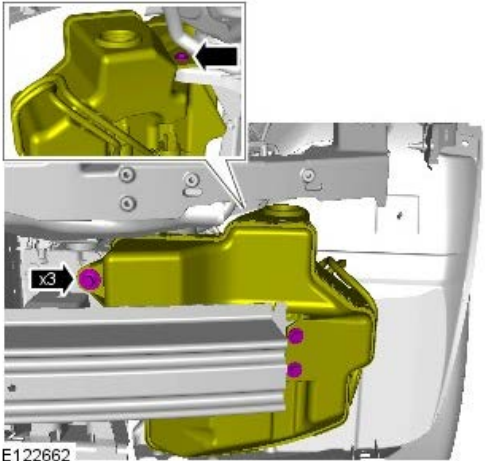
E124078

30.



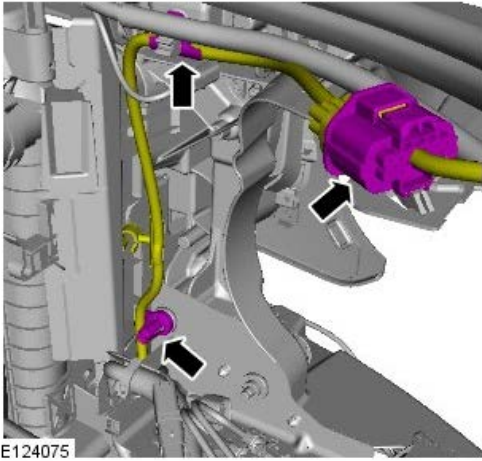
E124070

31.

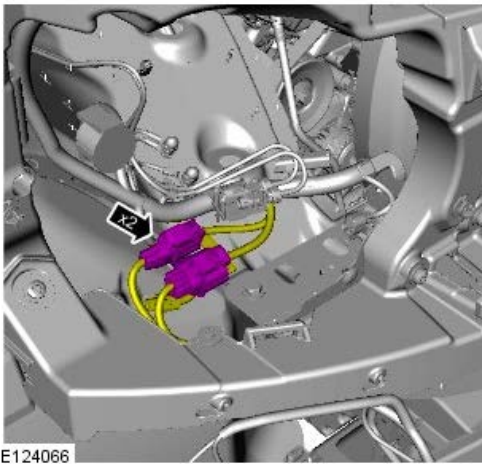


E122662

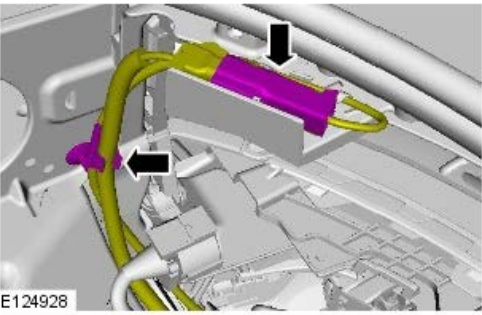
32.



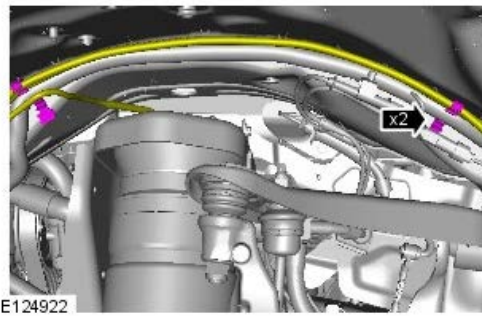
33.



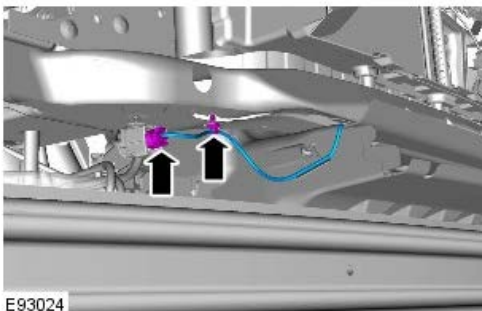
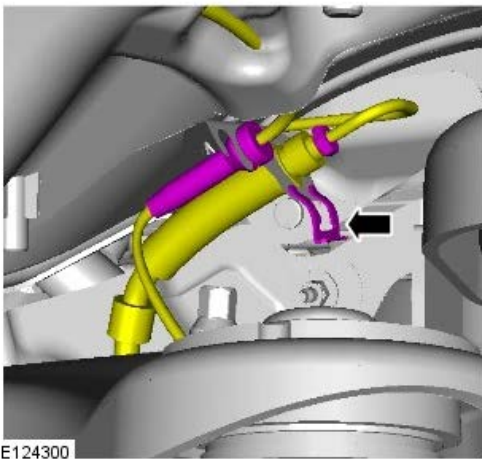
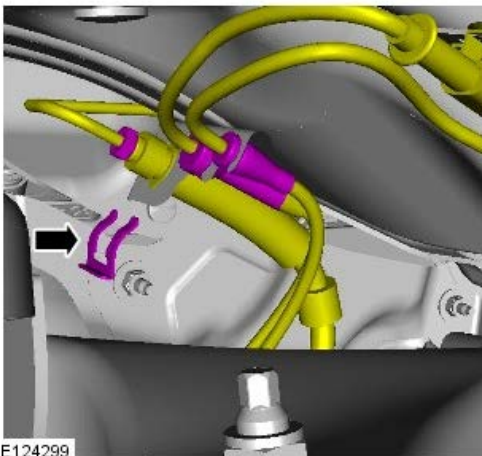
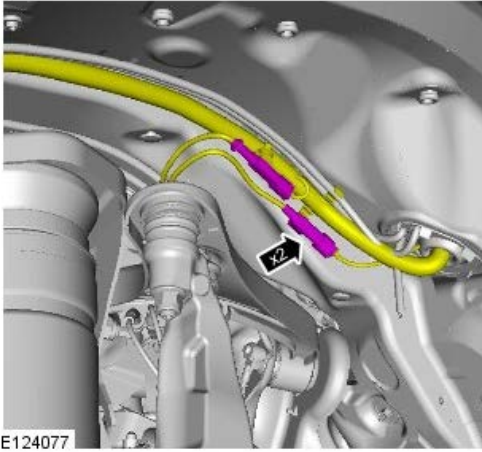
34.





35.



36.

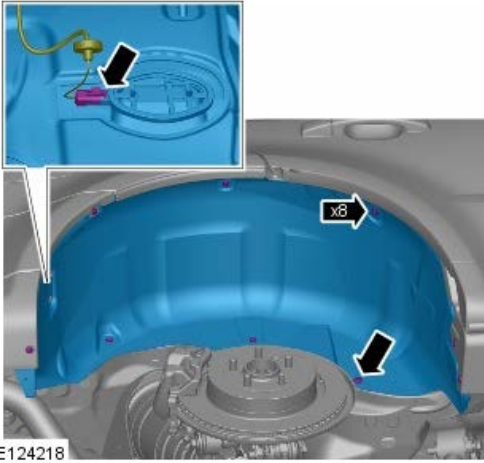


37.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.
- Position an absorbent cloth to collect fluid spillage.
 - Disconnect the line union.
 - Remove the clip.

38.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.
- Position an absorbent cloth to collect fluid spillage.
 - Disconnect the line union.
 - Remove the clip.

39.

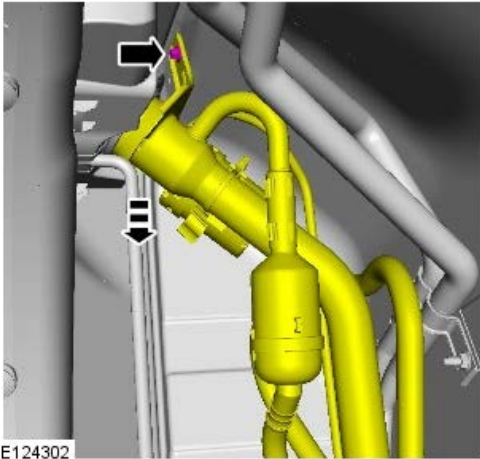
40. For additional information, refer to: [Fuel Filler Door Assembly](#) (501-03 Body Closures, Removal and Installation).



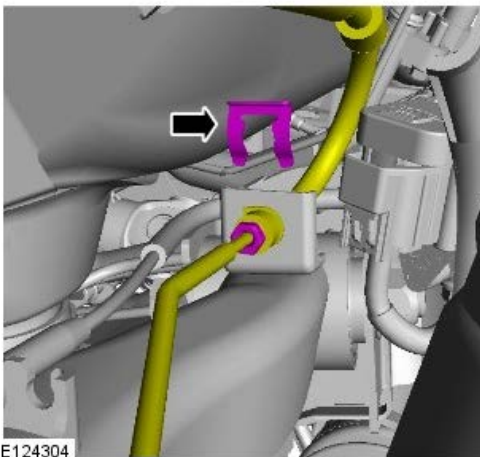
E124218

41. Remove the fuel filler cap.


42.




E124302



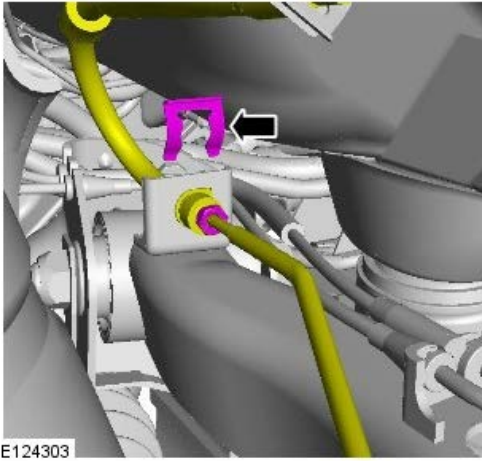
E124304

43.  CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

- Position an absorbent cloth to collect fluid spillage.
- Disconnect the line union.
- Remove the clip.

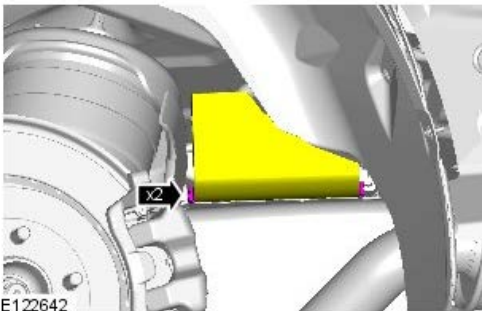
44.  CAUTION: Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

- Position an absorbent cloth to collect fluid spillage.
- Disconnect the line union.
- Remove the clip.



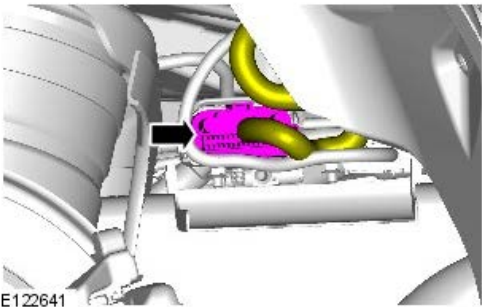
E124303

45.



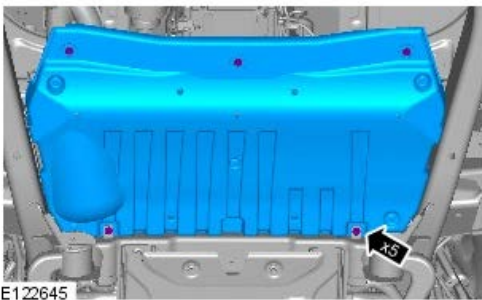
E122642

46.




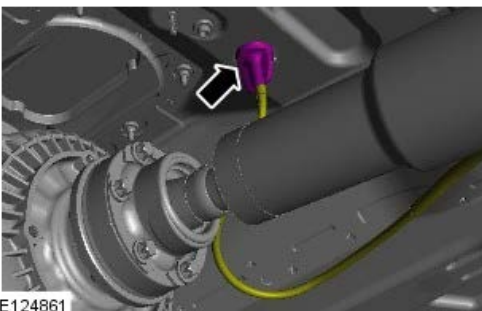
E122641

47.



E122645

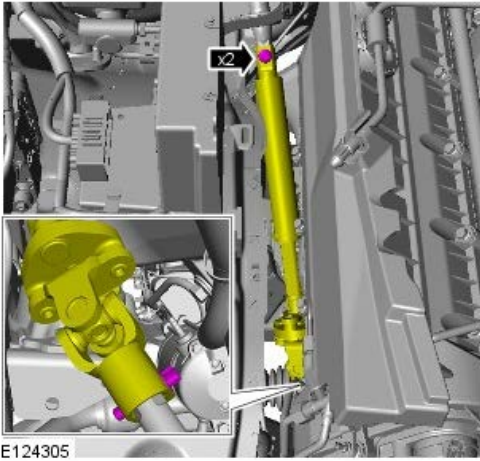
48.  CAUTION: Note the fitted position of the seal.



E124861

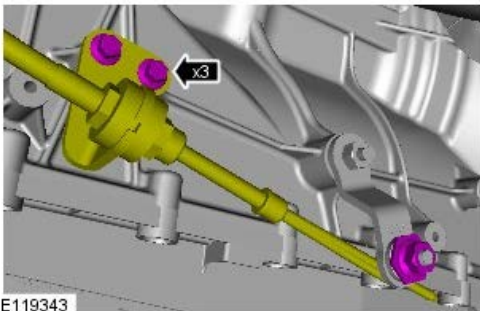
49.

- Remove and discard the bolt.



E124305

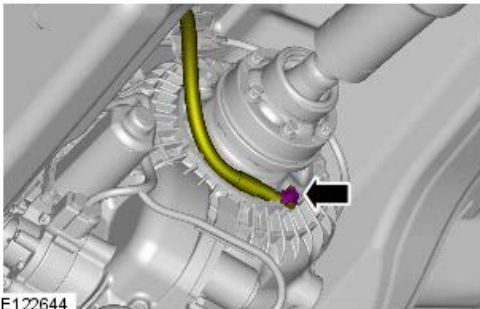
50.



E119343

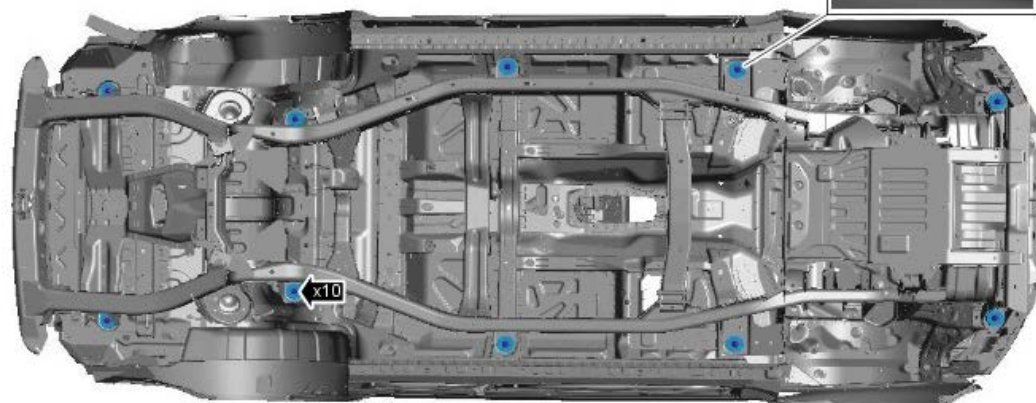
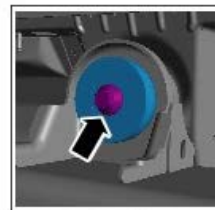
51. Lower the vehicle.

52.



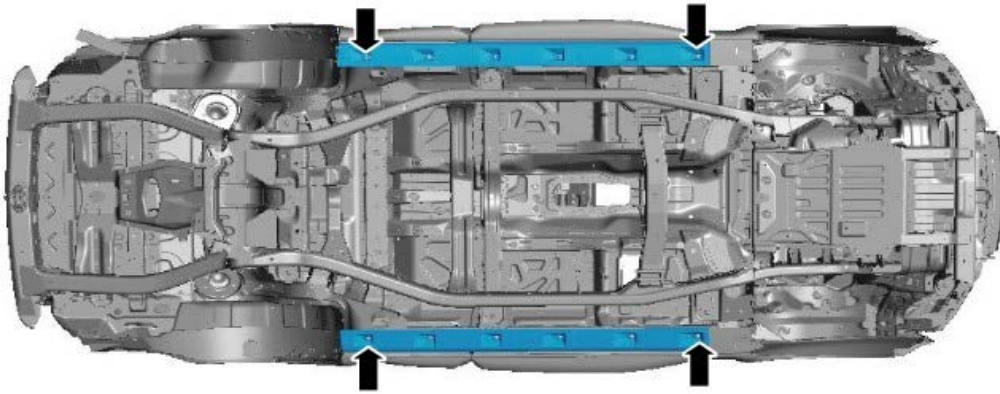
E122644

53. Remove and discard the 10 body mount bolts.
- Remove the 10 spacing washers.



E124859

54.  **CAUTION:**
To prevent the



E124860

body becoming unstable when raised from the integrated body frame, install the vehicle tie down straps.

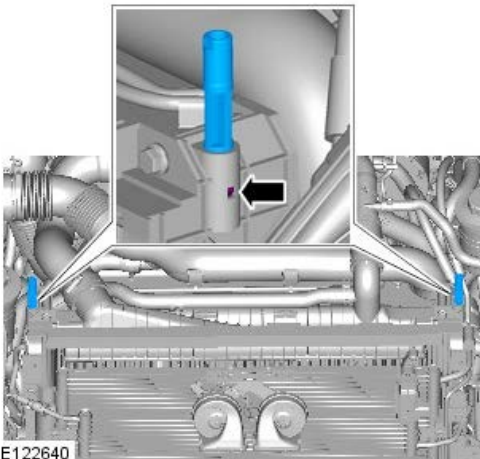


NOTE:
Note the fitted position of the body mounts.

Using an assistant raise and support the body.

- Remove the body mounts.

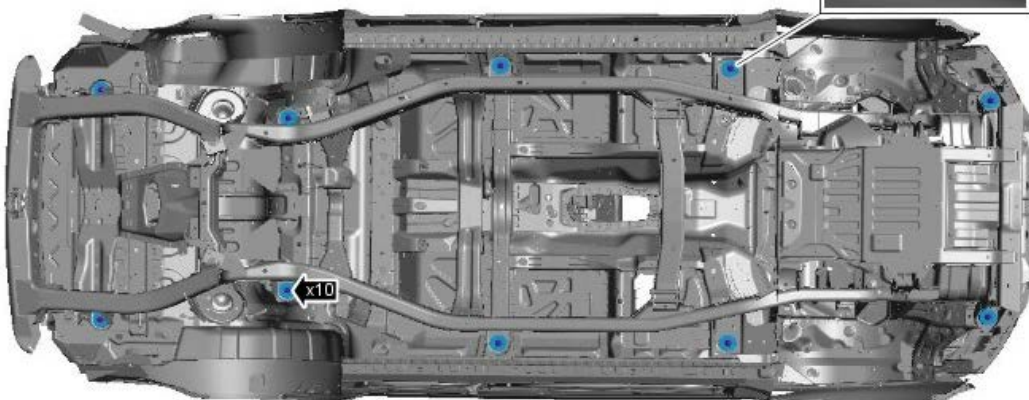
55.



E122640

Installation

All vehicles



E124859

1. CAUTIONS:



Make sure that new bolts are installed.



Make sure that all components are free and do not get caught up whilst lowering the body onto the integrated body frame.

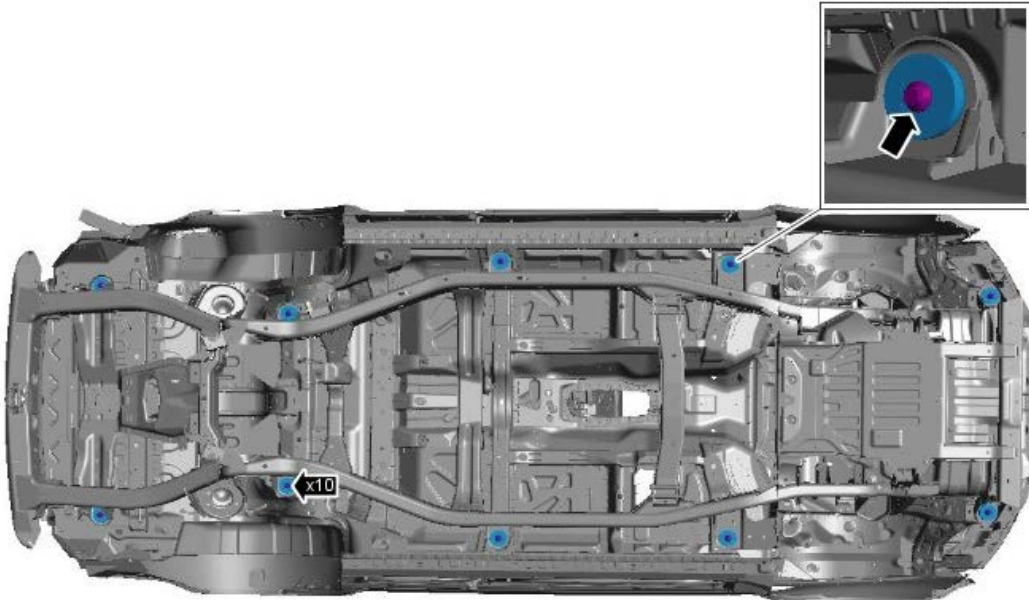
Using an assistant install the body to the integrated body frame.

- Install the body mounts.
- With assistance align the body and integrated body frame mounts.
- Install the bolts, but do not tighten fully at this stage.

2. Remove the tie down straps securing the body.

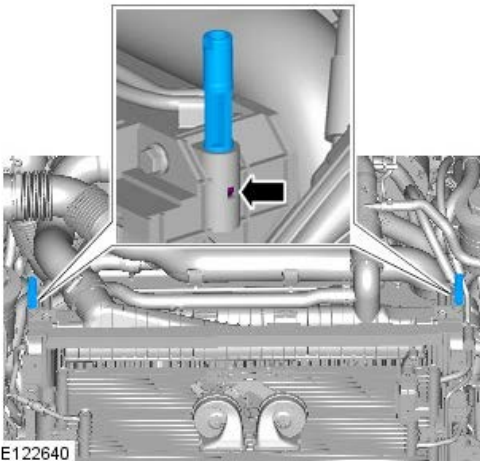
3. TORQUE: 133

Nm



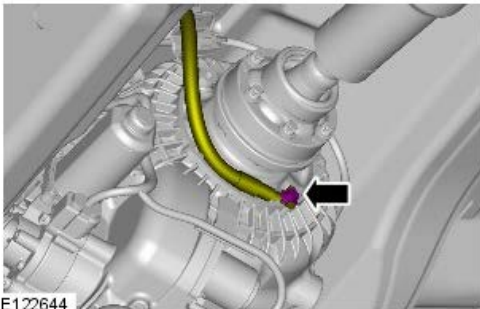
E124859

4.



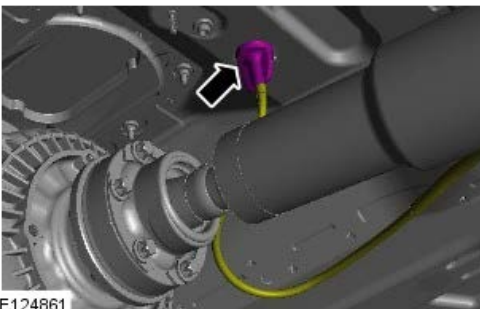
E122640

5. TORQUE: 25 Nm



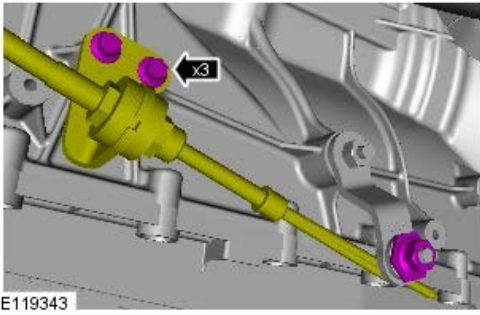
E122644

6.

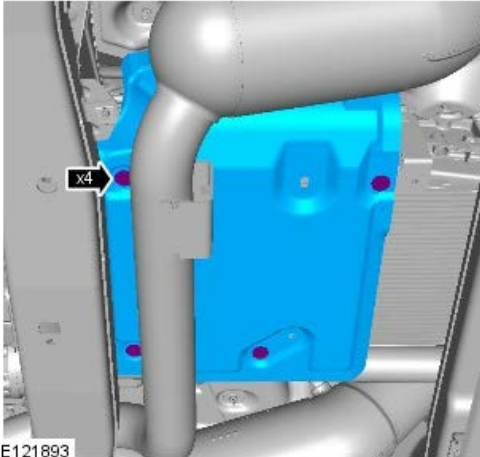


E124861

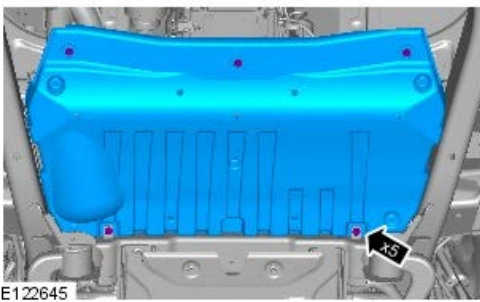
7.



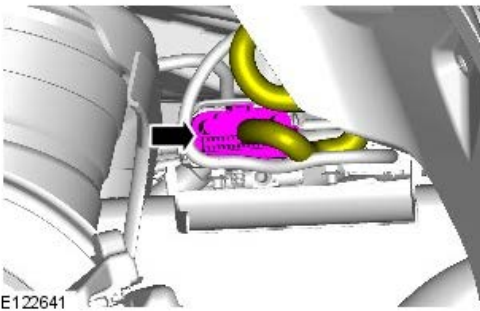
8. TORQUE: 12 Nm



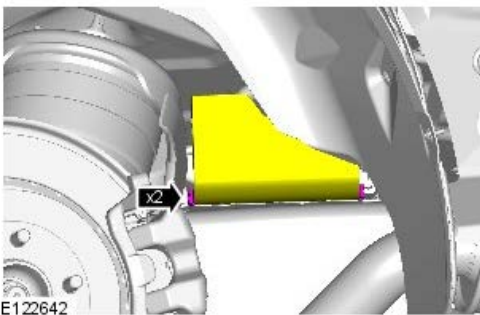
9. TORQUE: 12 Nm



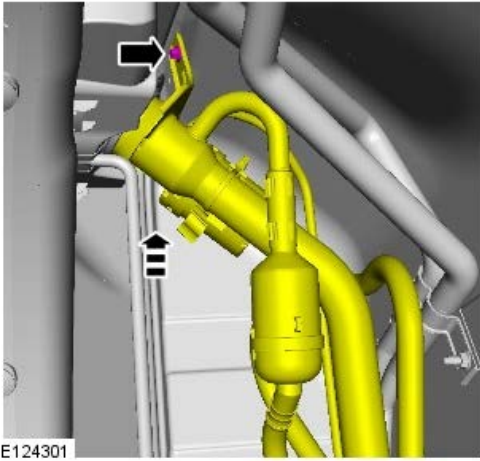
10.



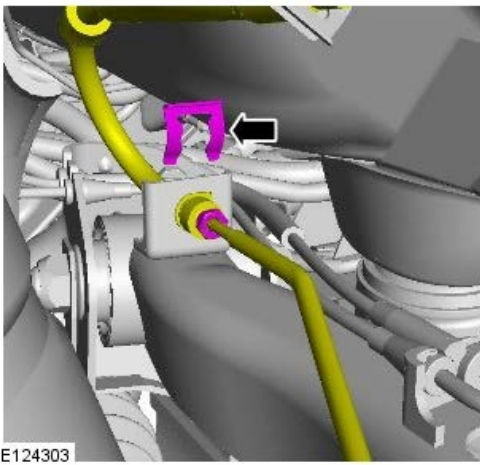
11.




12. TORQUE: 12 Nm



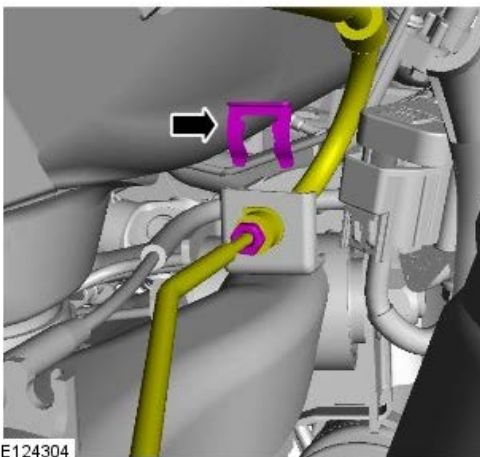
13. For additional information, refer to: [Fuel Filler Door Assembly](#) (501-03 Body Closures, Removal and Installation).



14.  **NOTE:** Remove and discard the blanking caps.

TORQUE: 16 Nm

- Clean the component mating faces.
- Secure the clip.



15.  **NOTE:** Remove and discard the blanking caps.

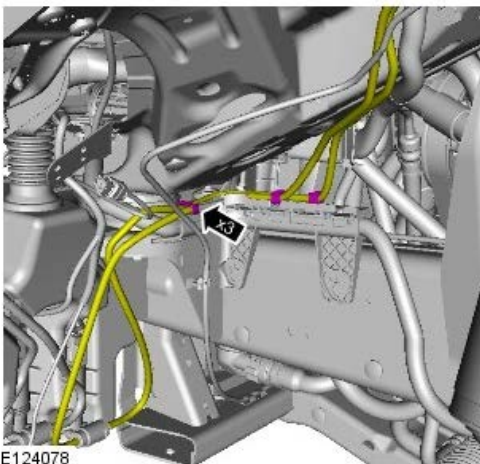
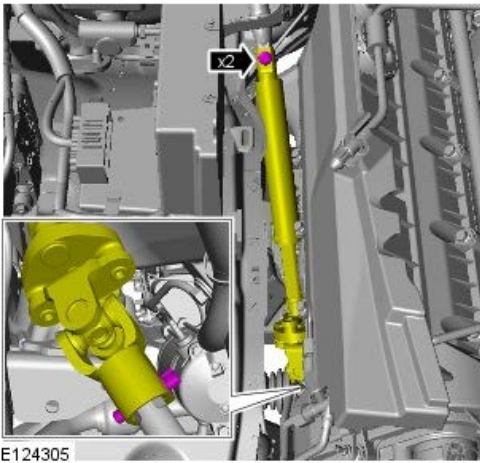
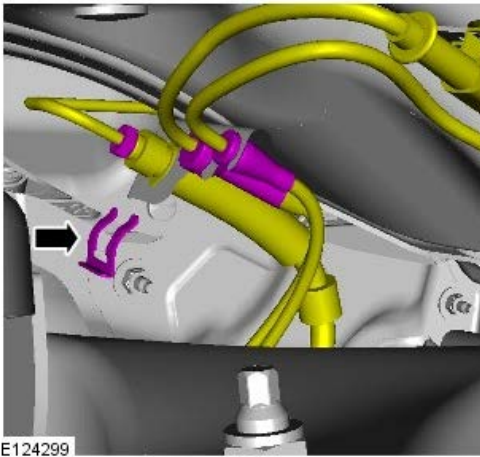
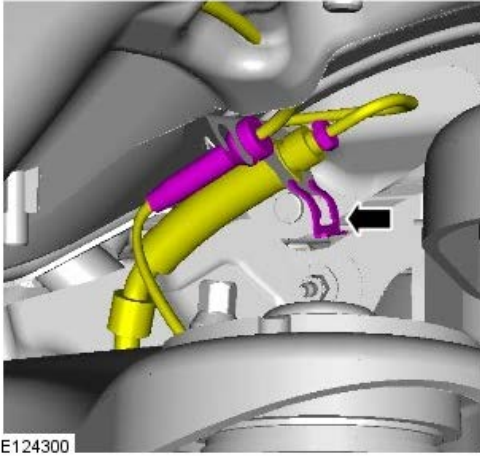
TORQUE: 16 Nm


- Clean the component mating faces.
- Secure the clip.

16.  **NOTE:** Remove and discard the blanking caps.

TORQUE: 16 Nm


- Clean the component mating faces.
- Secure the clip.



17.  **NOTE:** Remove and discard the blanking caps.

TORQUE: 16 Nm

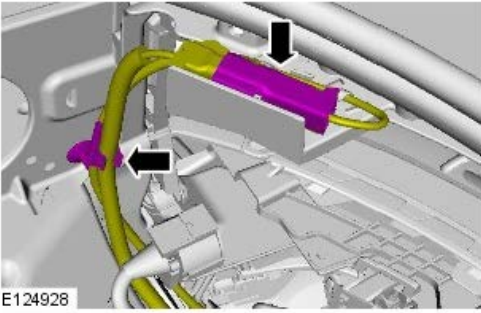
- Clean the component mating faces.
- Secure the clip.

18.  **WARNING:** Make sure that a new bolt is installed.

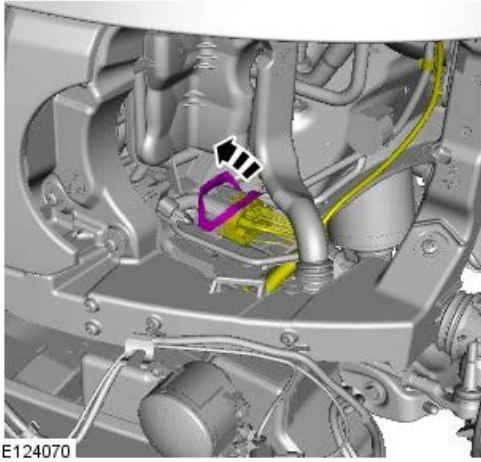
TORQUE: 25 Nm

19.

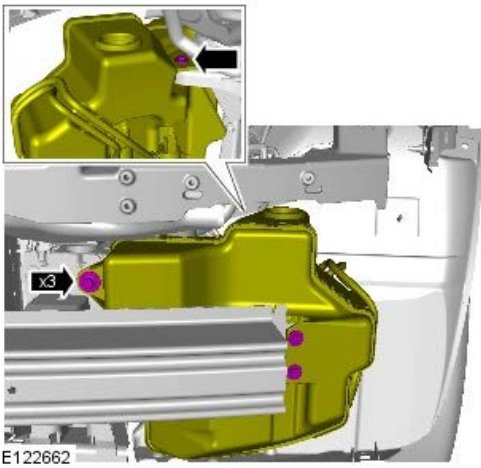
20.



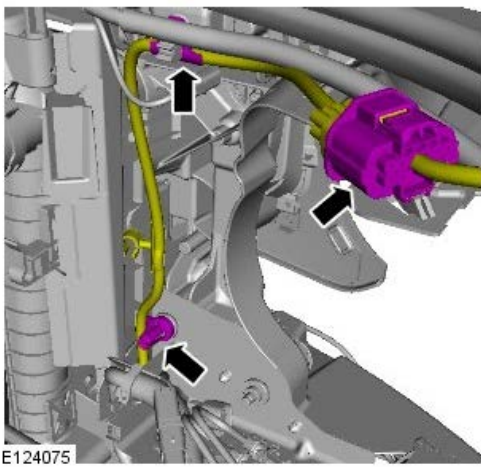
21.



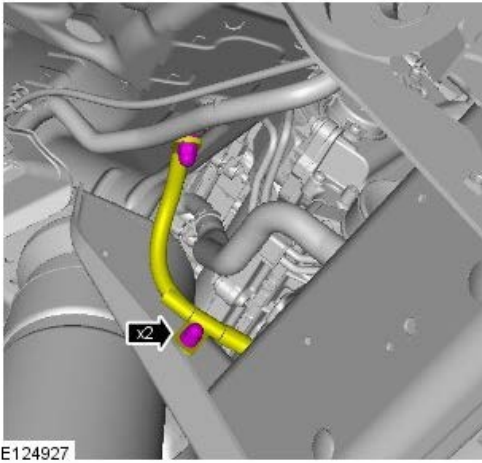
22. TORQUE: 12 Nm



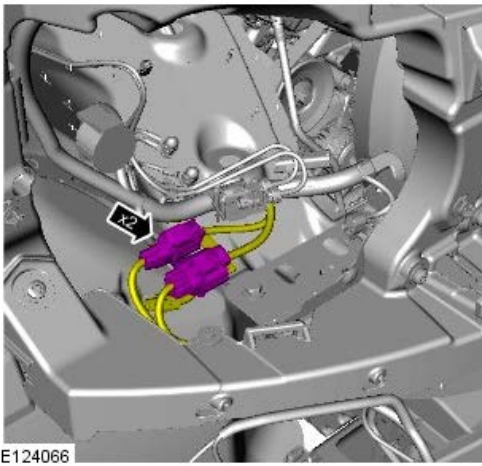
23.



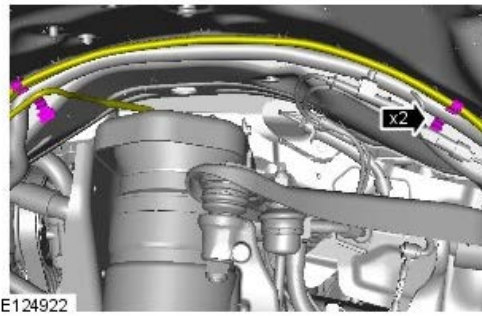
24. TORQUE: 20 Nm



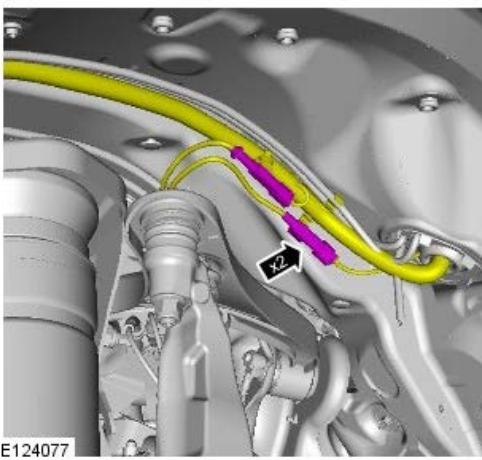
25.



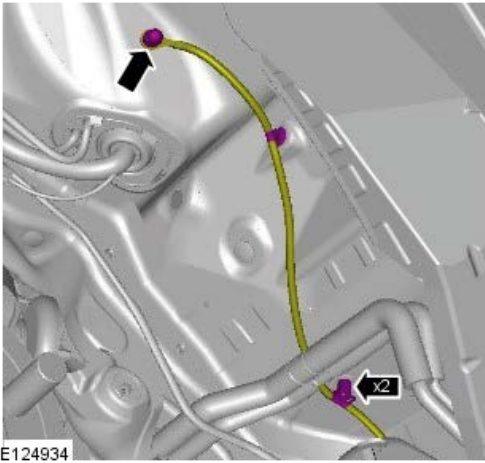
26.



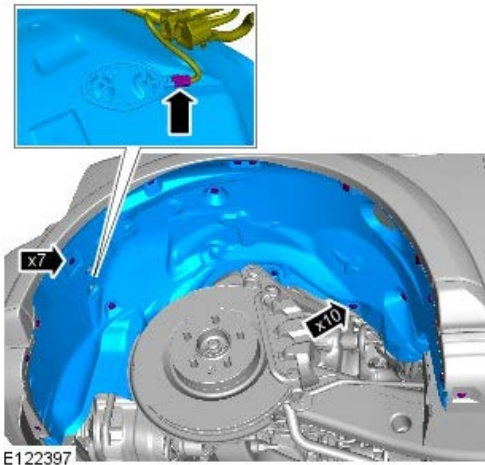
27.



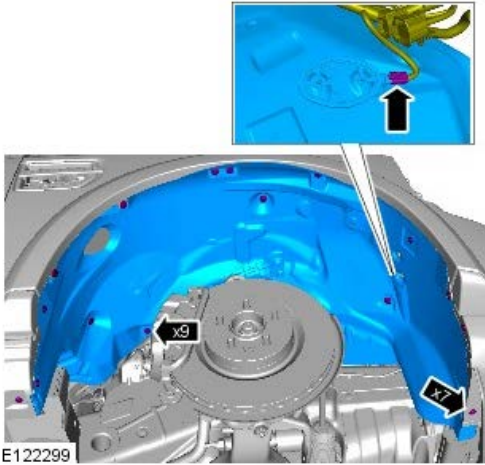
28. TORQUE: 20 Nm



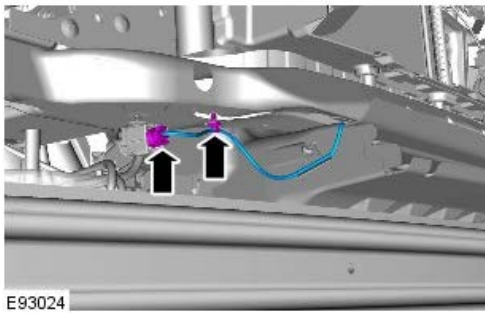
29.



30.

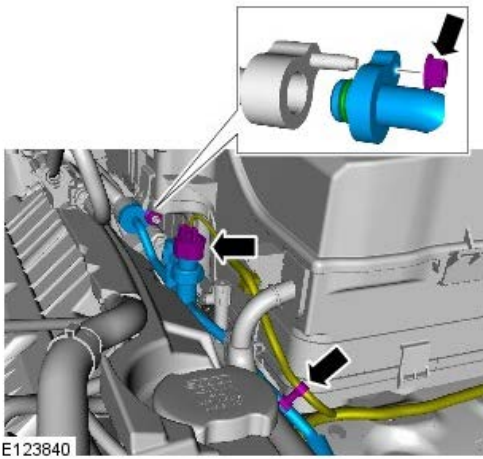


31.

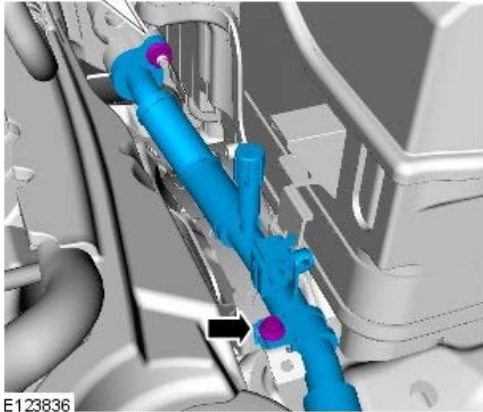
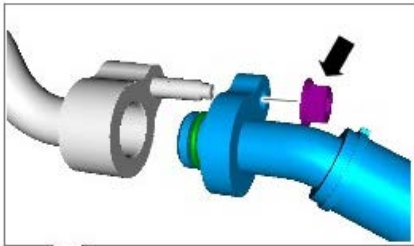


32.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

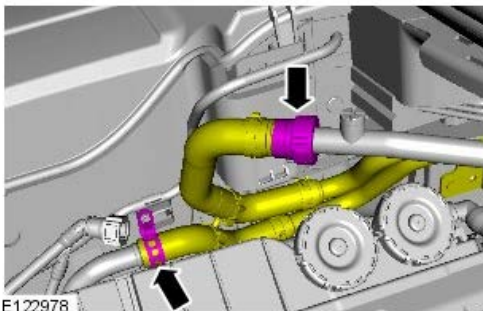
- TORQUE: 12 Nm
- Install new O-ring seals.



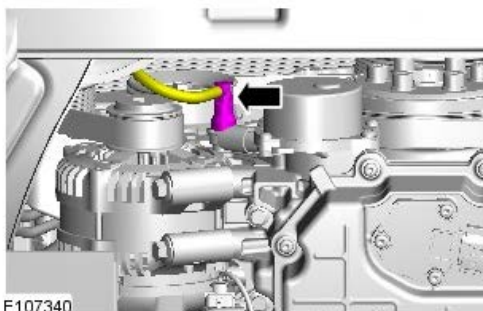
E123840



E123836



E122978



E107340

33.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

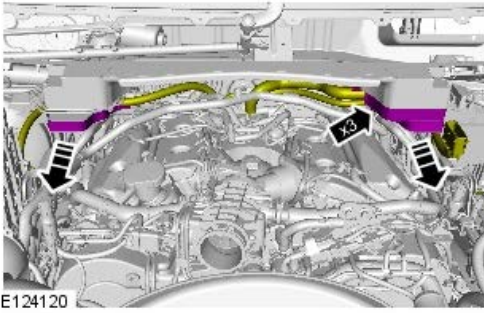
TORQUE: 12 Nm

- Install new O-ring seals.

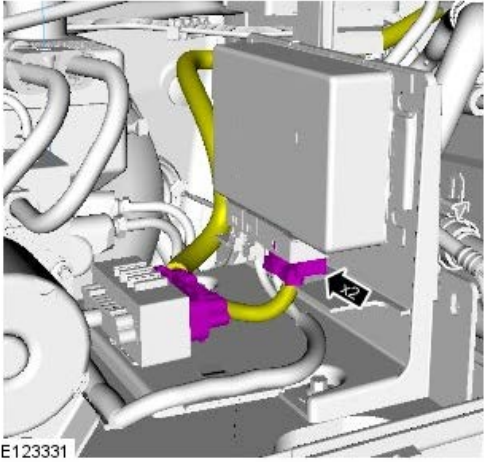
34.  WARNING: Be prepared to collect escaping fluid.

35.

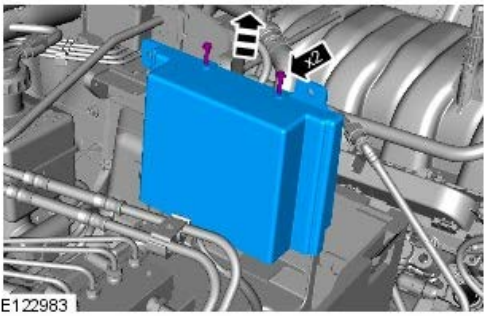
36.



37.

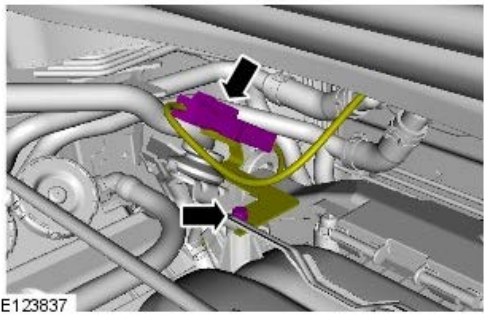


38. TORQUE: 8 Nm

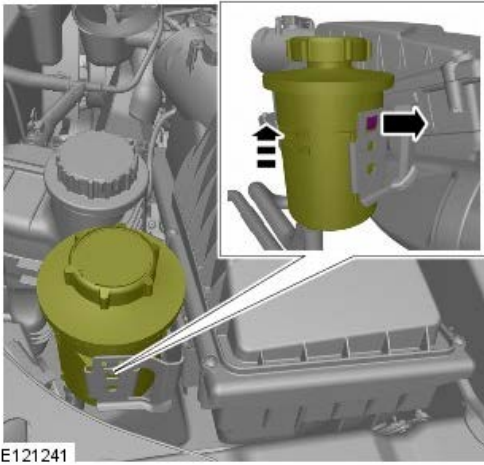


39. For additional information, refer to: [Auxiliary Battery Tray](#) (414-01 Battery, Mounting and Cables, Removal and Installation).

40. TORQUE: 10 Nm

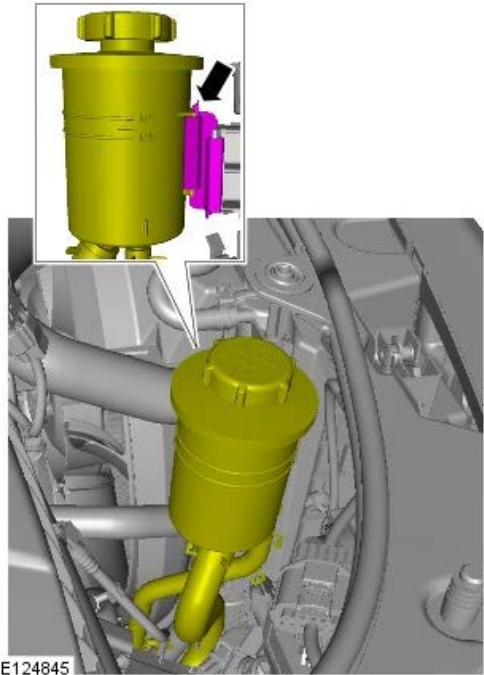


41.



E121241

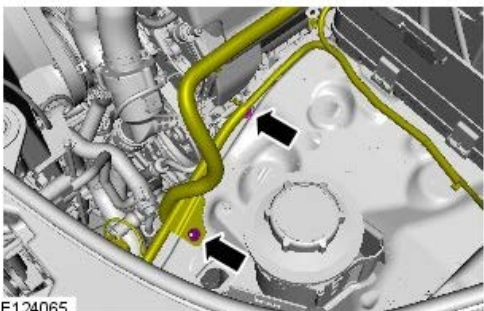
Vehicles with active damping
42.



E124845

All vehicles

43. TORQUE: 10 Nm



E124065

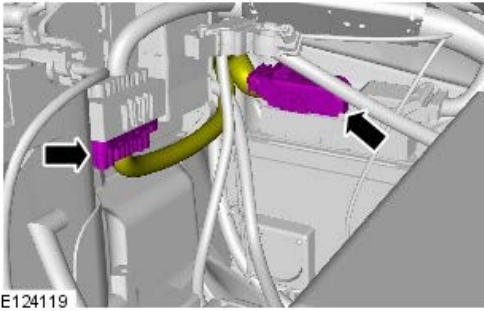
44.

45. For additional information, refer to: Rear Bumper Cover (501-19, Removal and Installation).

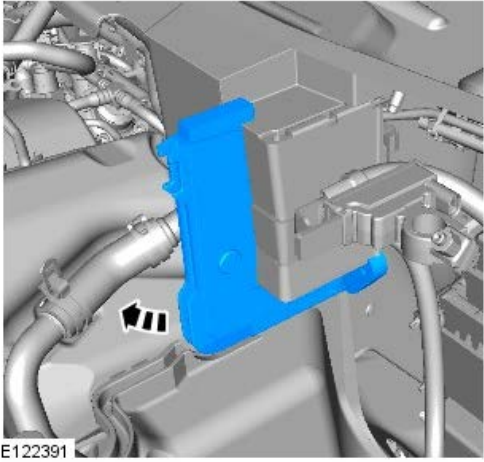
46. For additional information, refer to: [Air Cleaner LH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

47. For additional information, refer to: [Air Cleaner RH](#) (303-12B Intake Air Distribution and Filtering - V6 S/C 3.0L Petrol, Removal and Installation).

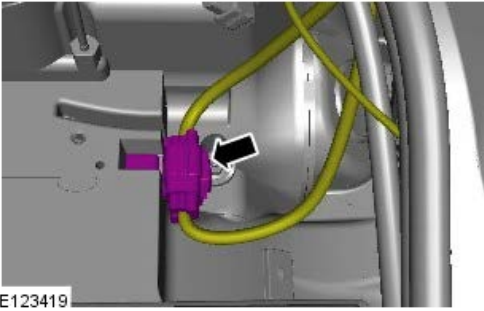
48.



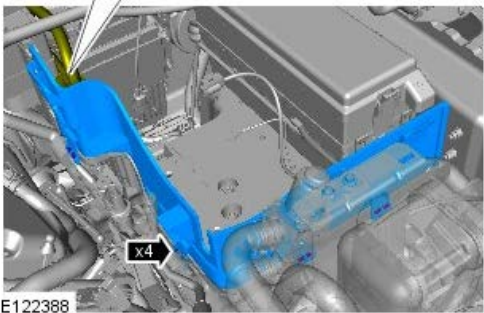
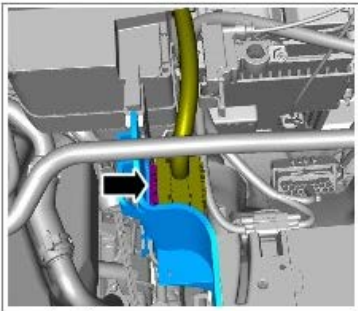
49.



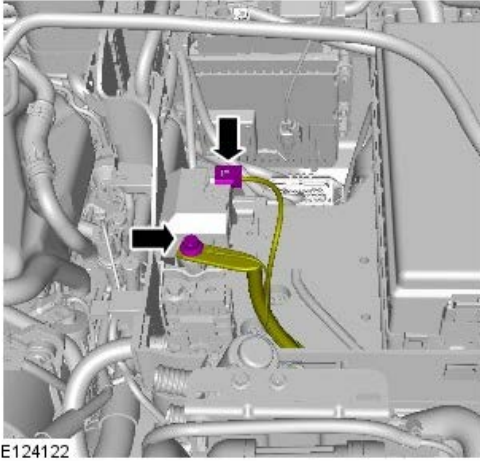
50.



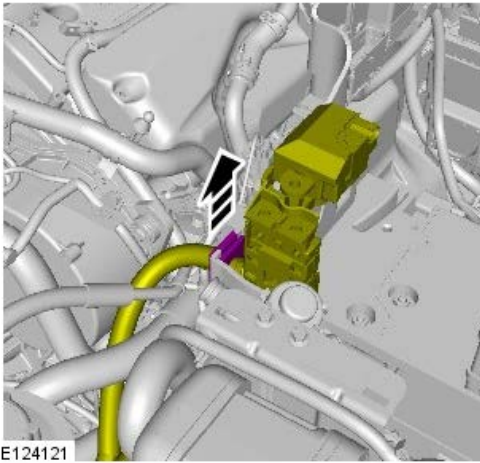
51.  NOTE: RHD illustration shown, LHD is similar.



52.



53.



54. For additional information, refer to: [Air Conditioning \(A/C\) System Recovery, Evacuation and Charging](#) (412-00 Climate Control System - General Information, General Procedures).
55. For additional information, refer to: [Battery](#) (414-01 Battery, Mounting and Cables, Removal and Installation).
56. Bleed the braking system.
For additional information, refer to: [Brake System Bleeding](#) (206-00 Brake System - General Information, General Procedures).
57. Check and top-up the coolant.

Full Frame and Body Mounting - Body TDV6 3.0L Diesel

Removal and Installation

Removal

NOTES:



Some variation in the illustrations may occur, but the essential information is always correct.

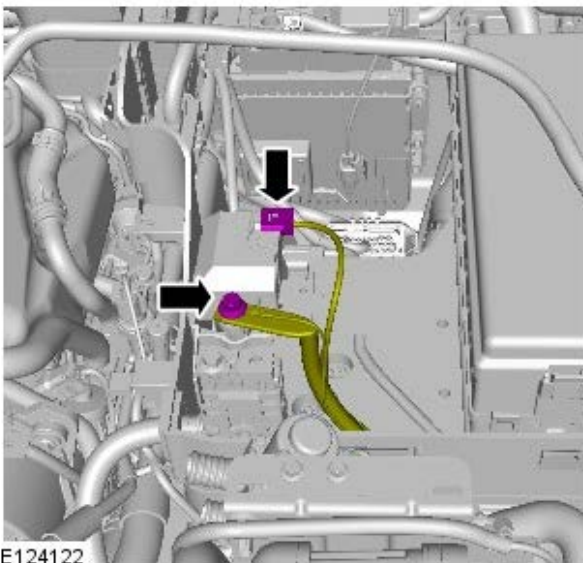


Some illustrations may show the engine removed for clarity.

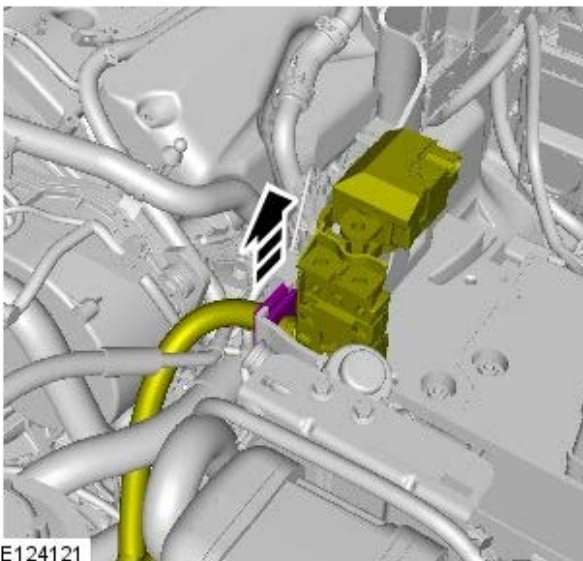
All vehicles

1. For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
2. Remove the battery.
For additional information, refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).

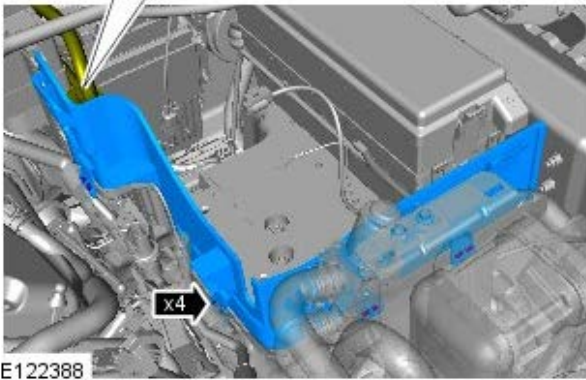
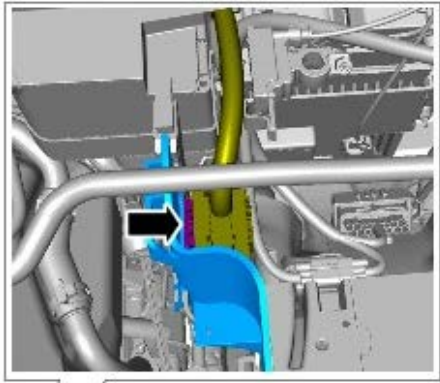
3.



4.

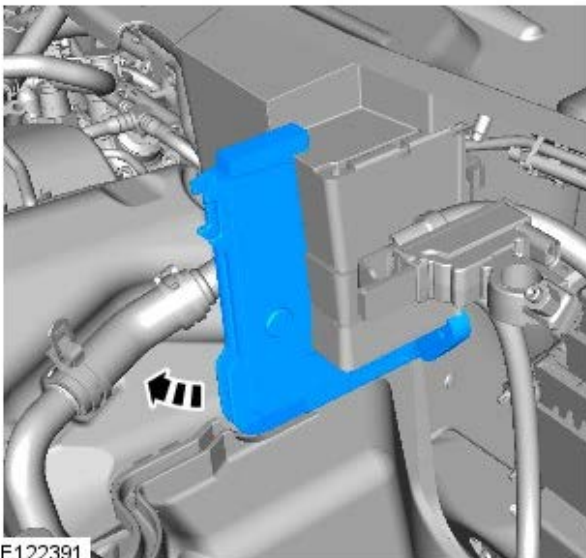


5.  NOTE: RHD illustration shown, LHD is similar.



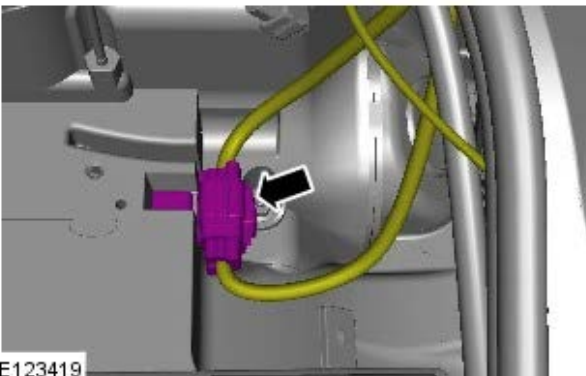
E122388

6.



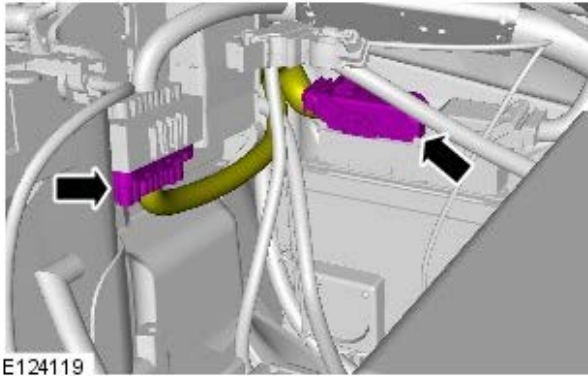
E122391

7.



E123419

8.

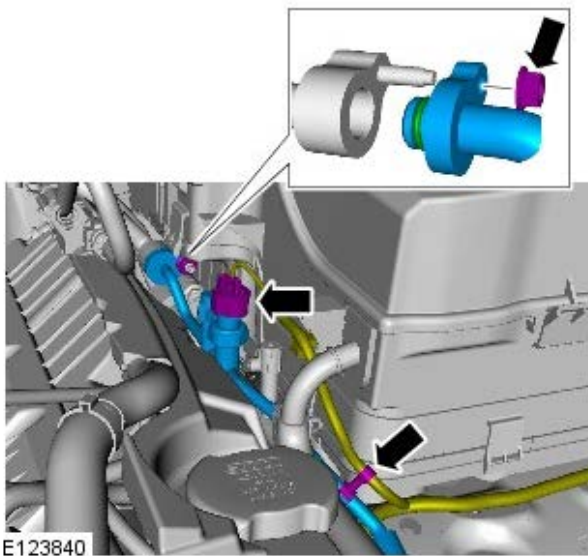


E124119


9. For additional information, refer to: Air Cleaner (303-12 Intake Air Distribution and Filtering - TDV6 3.0L Diesel, Removal and Installation).

10.


11. For additional information, refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).



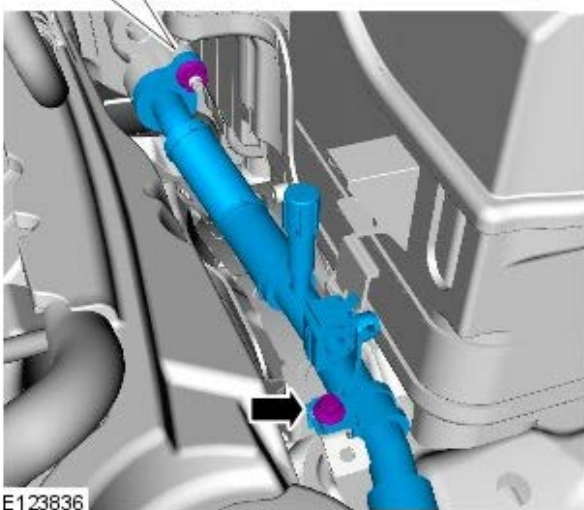
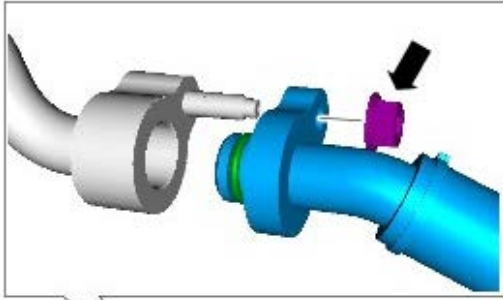
E123840

12.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.

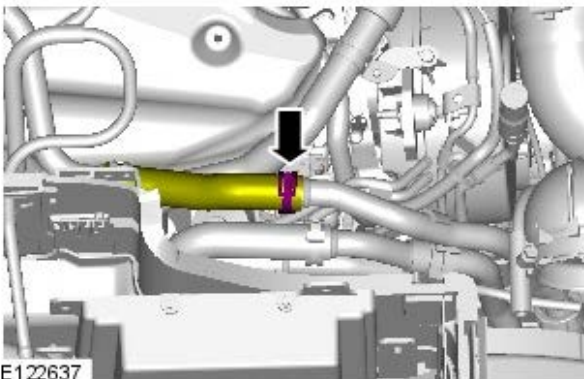
- Discard the O-ring seals.

13.  CAUTION: Make sure that all openings are sealed. Use new blanking caps.


- Discard the O-ring seals.



E123836

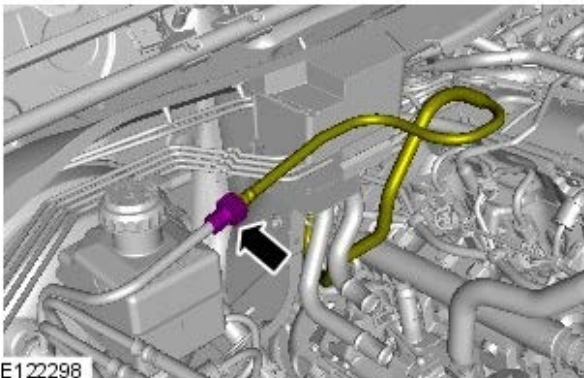


E122637

14.  **WARNING:** Be prepared to collect escaping fluid.

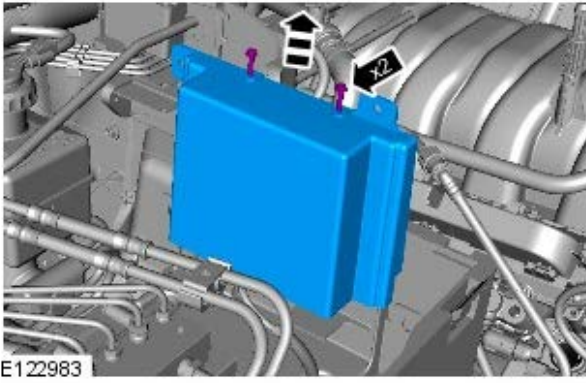
15. For additional information, refer to: Auxiliary Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

16.



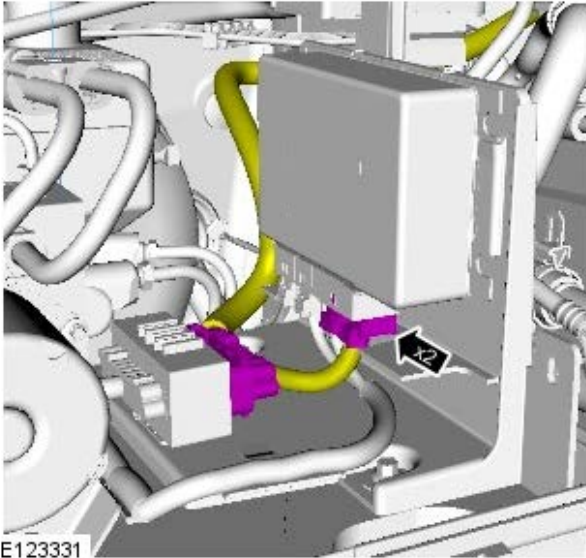
E122298

17.



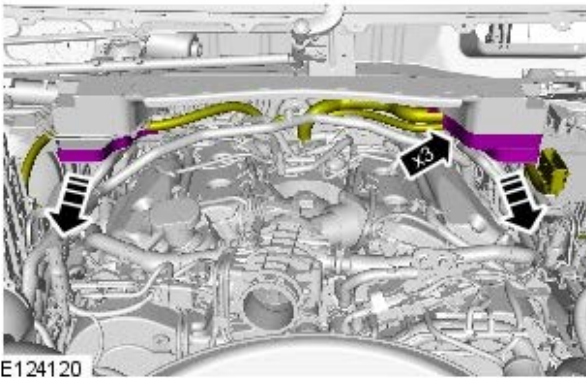
E122983

18.



E123331

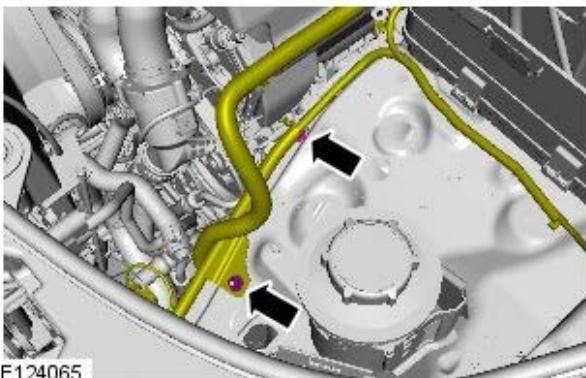
19.



E124120

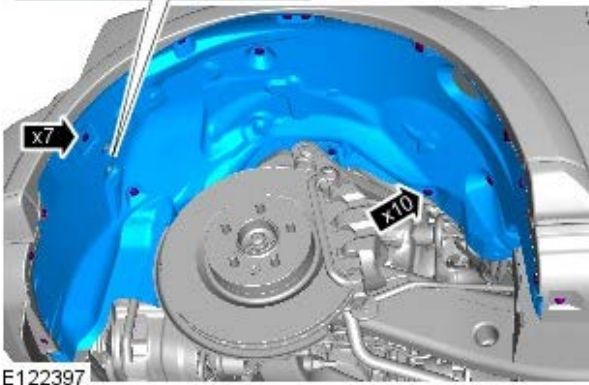
20. For additional information, refer to: Coolant Expansion Tank (303-03 Engine Cooling - TDV6 3.0L Diesel, Removal and Installation).

21.



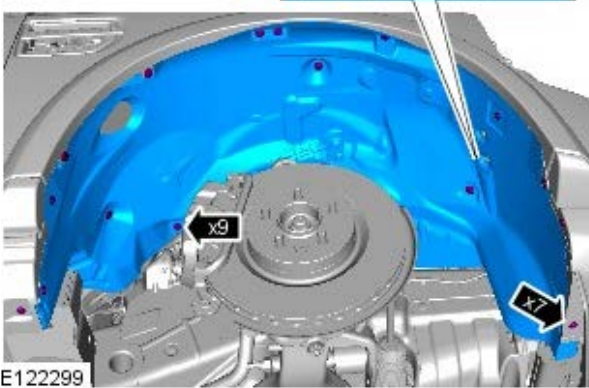
E124065

22.



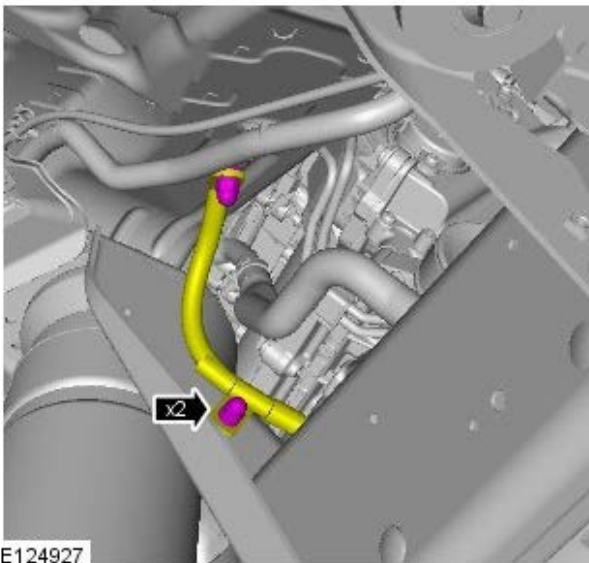
E122397

23.



E122299

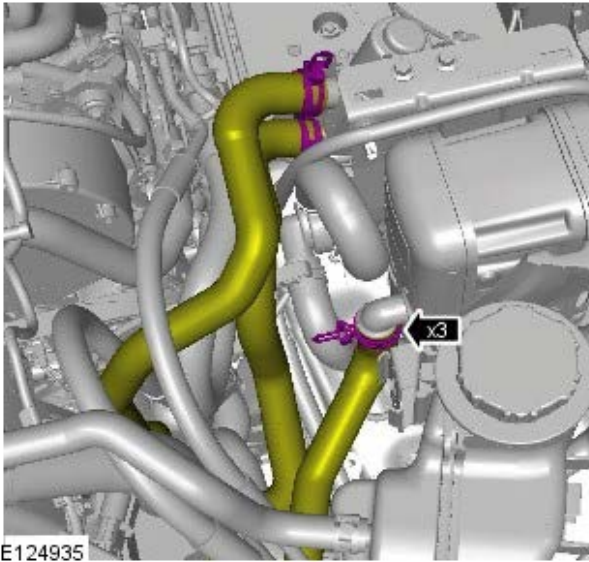
24.



E124927

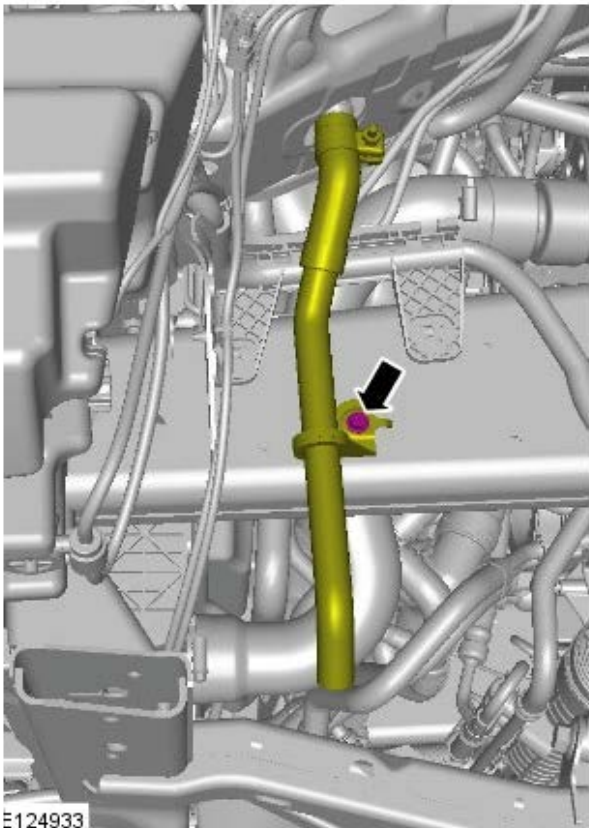
Vehicles with auxiliary heating

25.



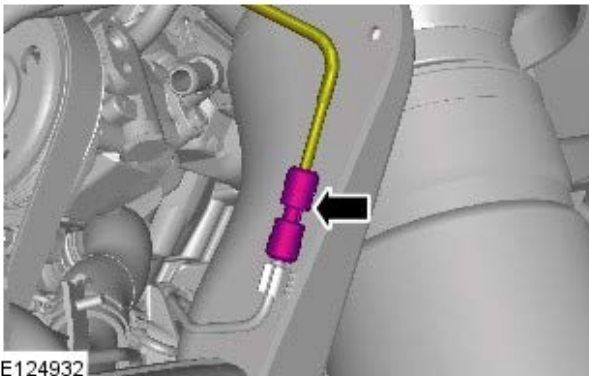
E124935

26.



E124933

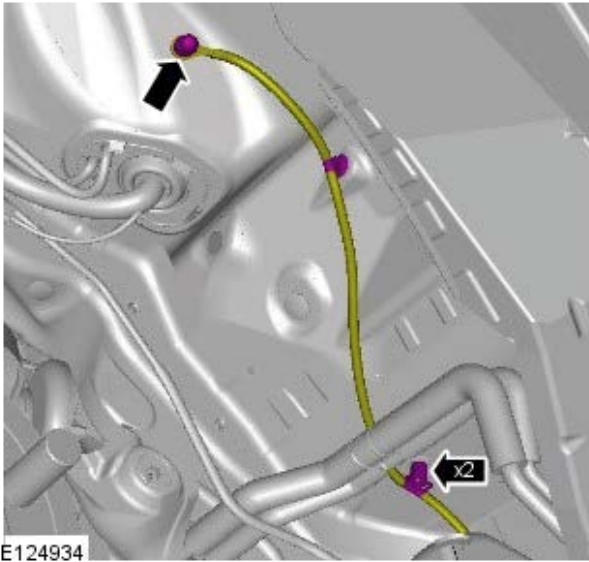
27.



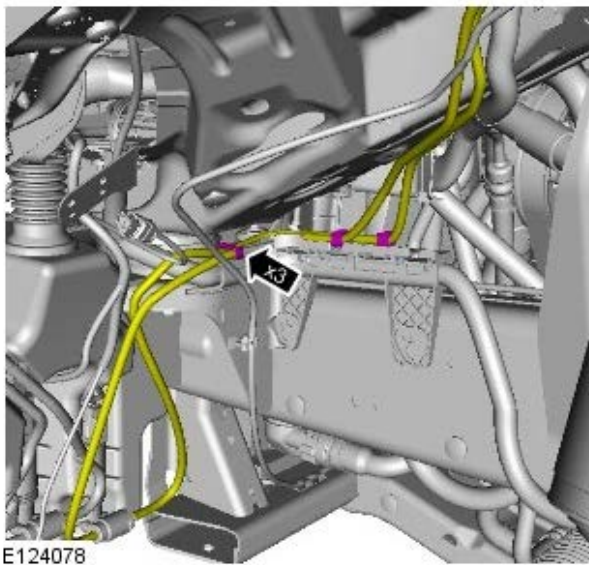
E124932

All vehicles

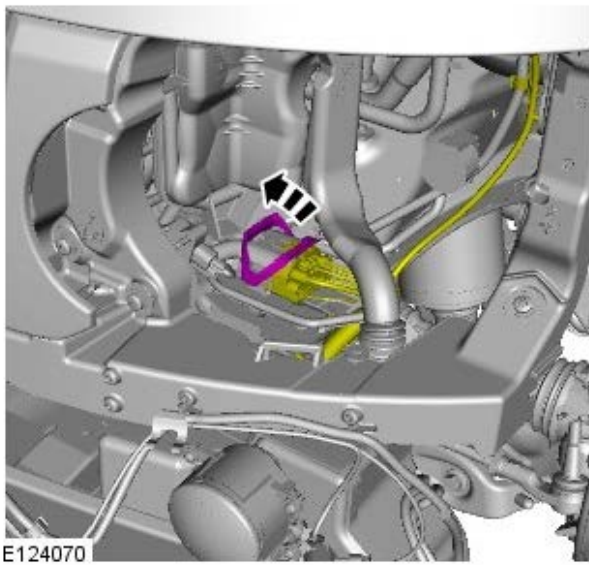
28.



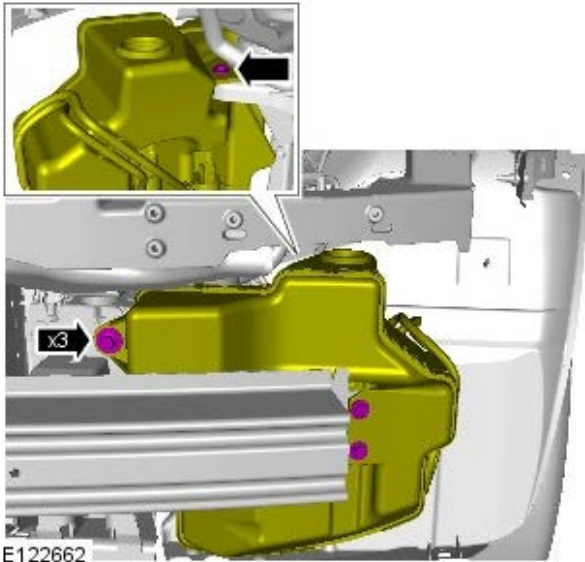
29.



30.

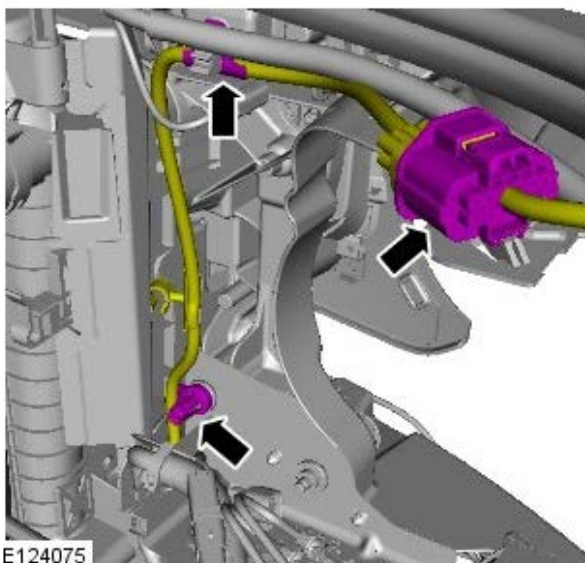


31.



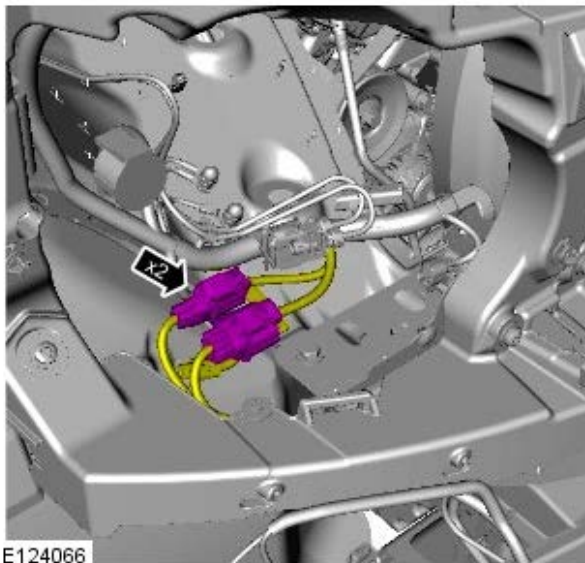
E122662

32.



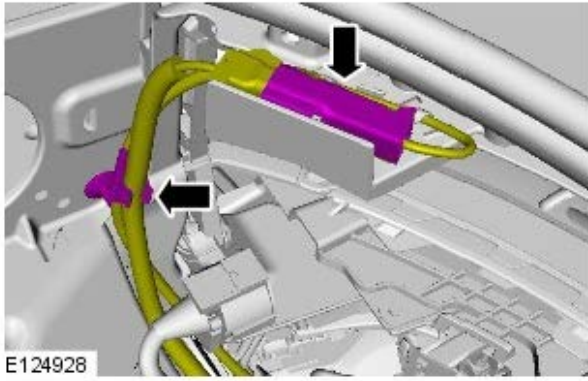
E124075

33.

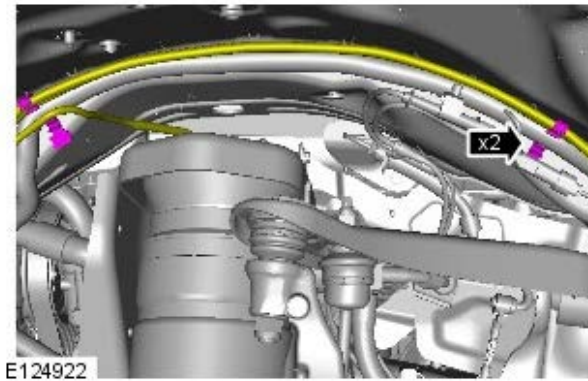


E124066

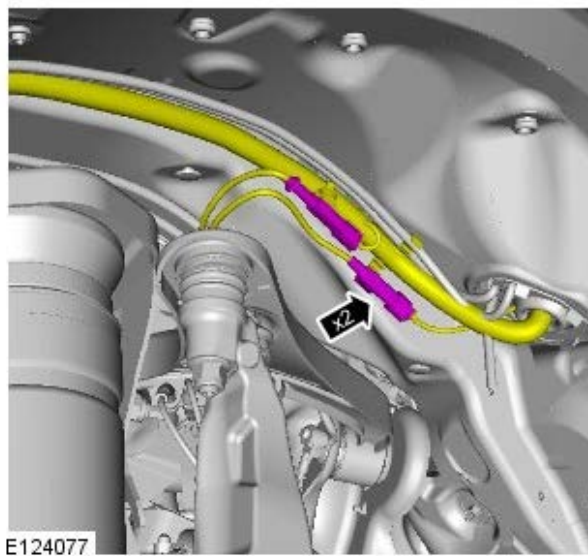
34.




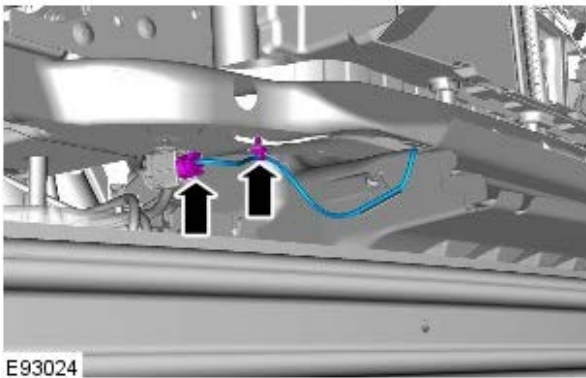
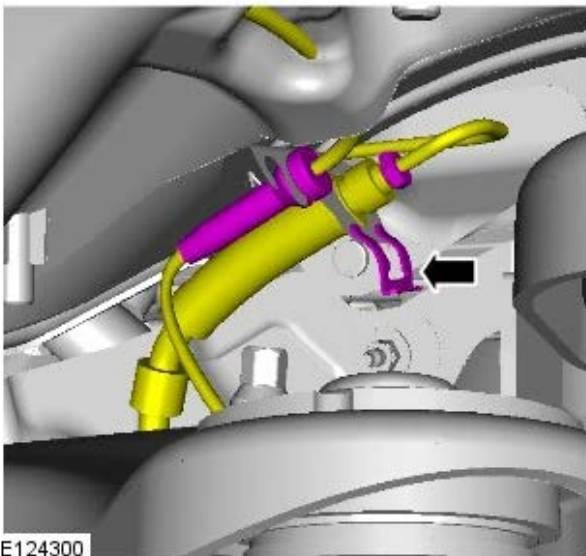
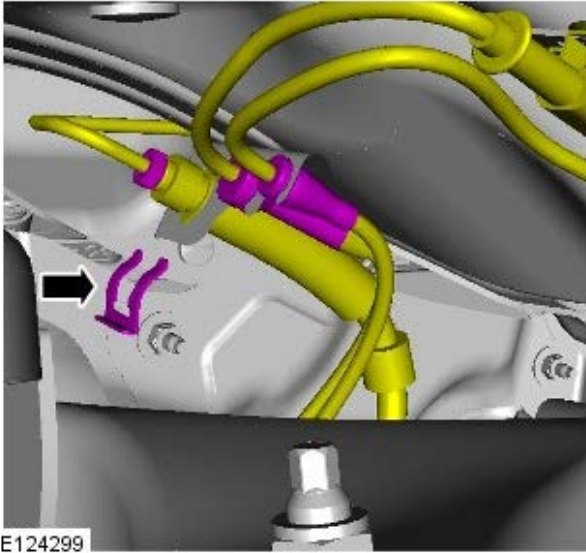
35.




36.



37.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.
- Position an absorbent cloth to collect fluid spillage.
 - Disconnect the line union.
 - Remove the clip.

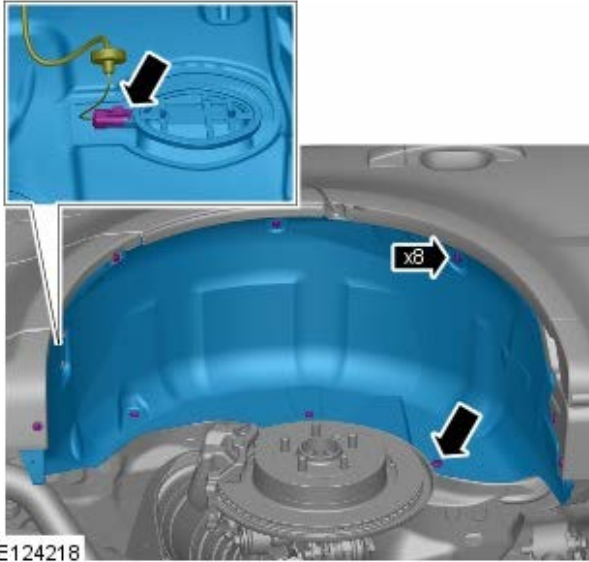


38.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

- Position an absorbent cloth to collect fluid spillage.
- Disconnect the line union.
- Remove the clip.

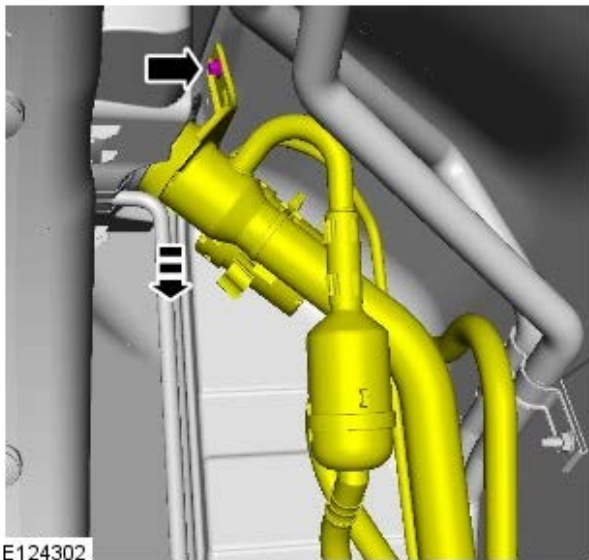
39.

40. For additional information, refer to: Fuel Filler Door Assembly (501-03 Body Closures, Removal and Installation).

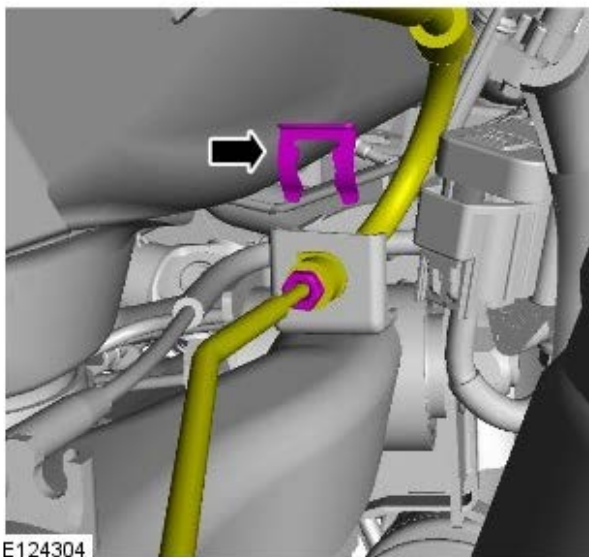


E124218


41.




E124302



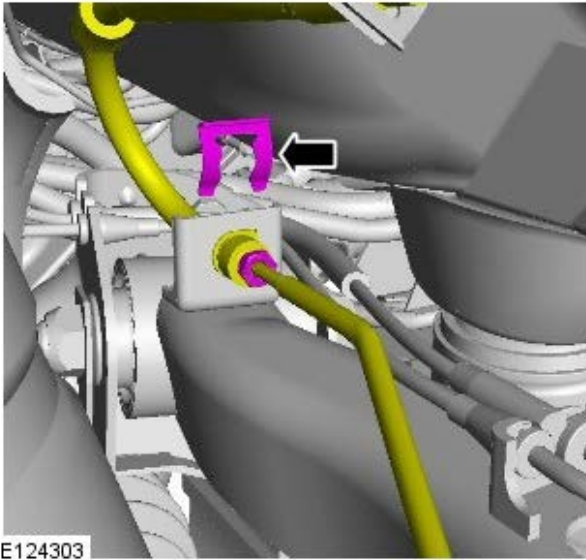
E124304

42.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

- Position an absorbent cloth to collect fluid spillage.
- Disconnect the line union.
- Remove the clip.

43.  **CAUTION:** Before disconnecting or removing the components, make sure the area around the joint faces and connections are clean. Plug open connections to prevent contamination.

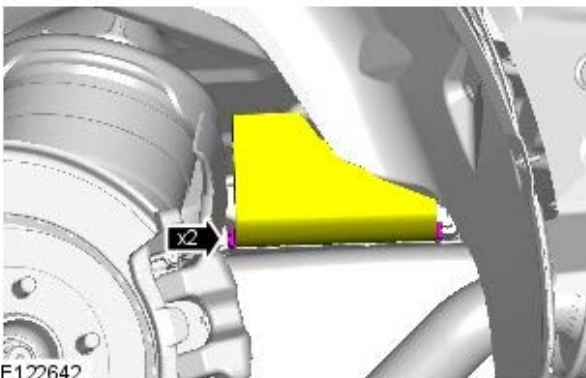
- Position an absorbent cloth to collect fluid spillage.



E124303

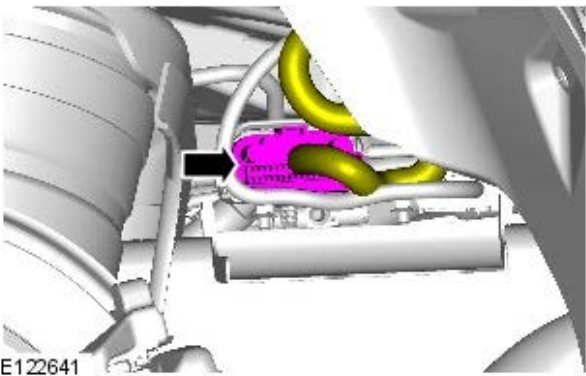
- Disconnect the line union.
- Remove the clip.

44.




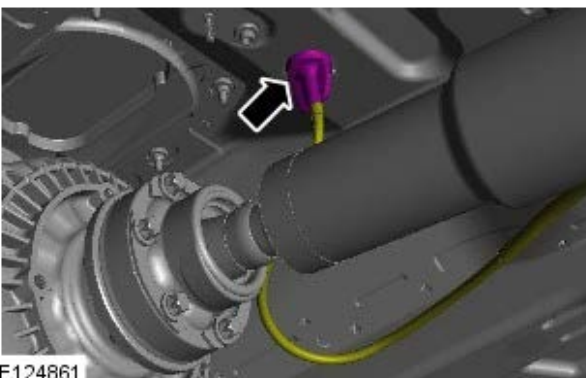
E122642

45.



E122641

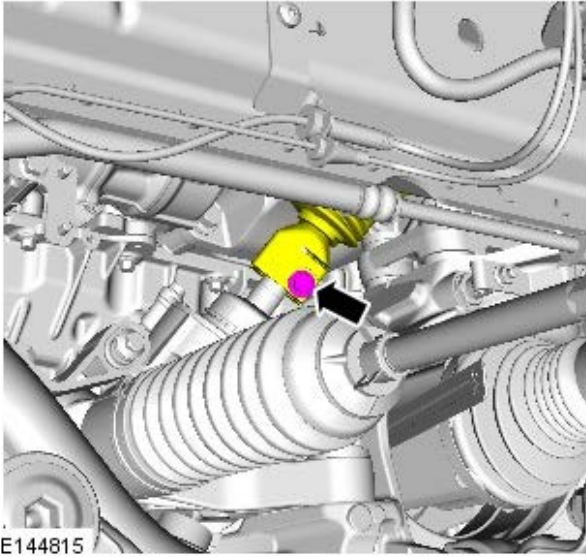
46.  CAUTION: Note the fitted position of the seal.



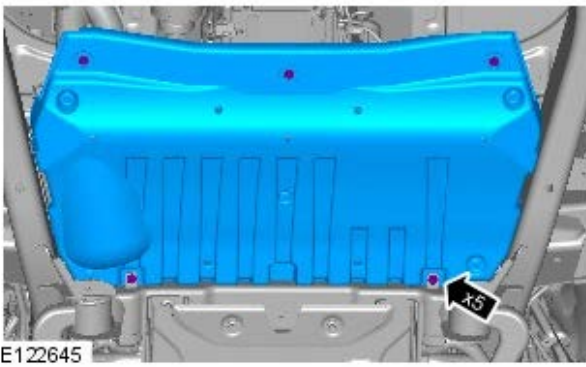
E124861

47.  NOTE: Discard the bolt.

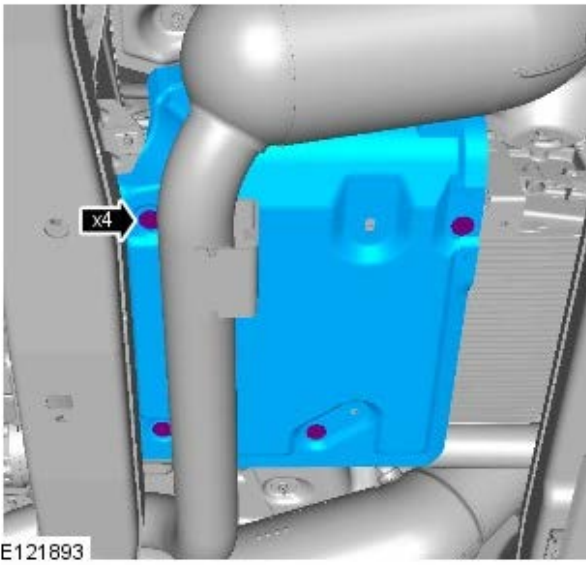
- Remove and discard the bolt.



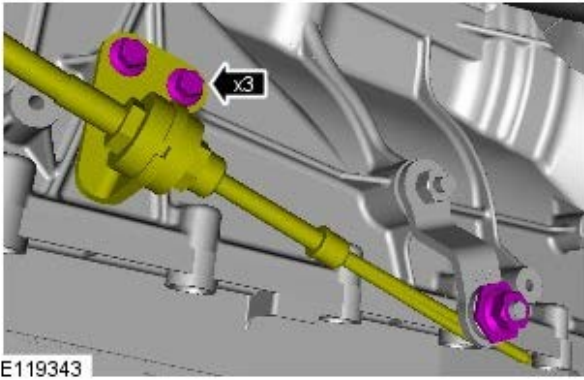
48.



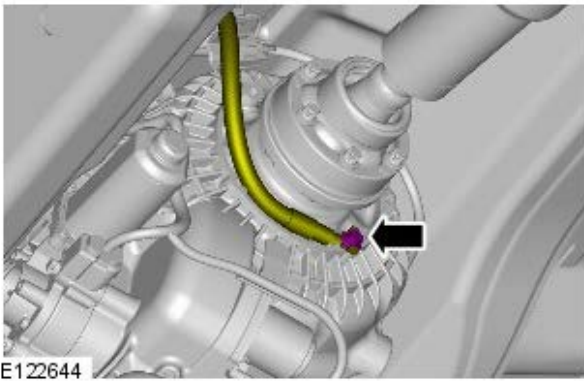
49.



50.



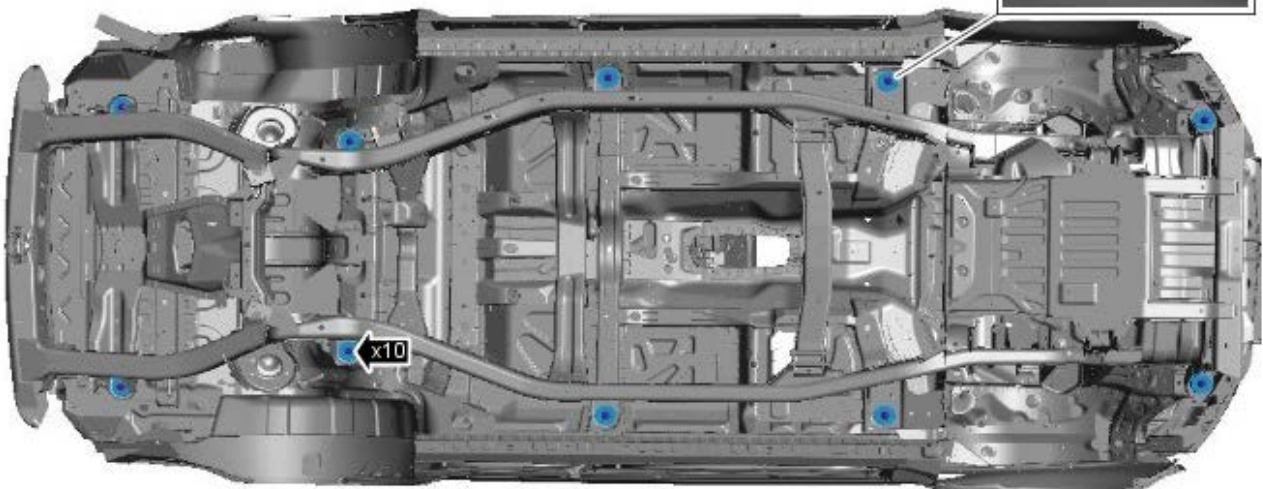
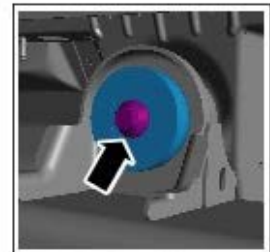
51.




52. Lower the vehicle onto its wheels.

53. Remove and discard the 10 body mount bolts.

- Remove the 10 spacing washers.



E124859

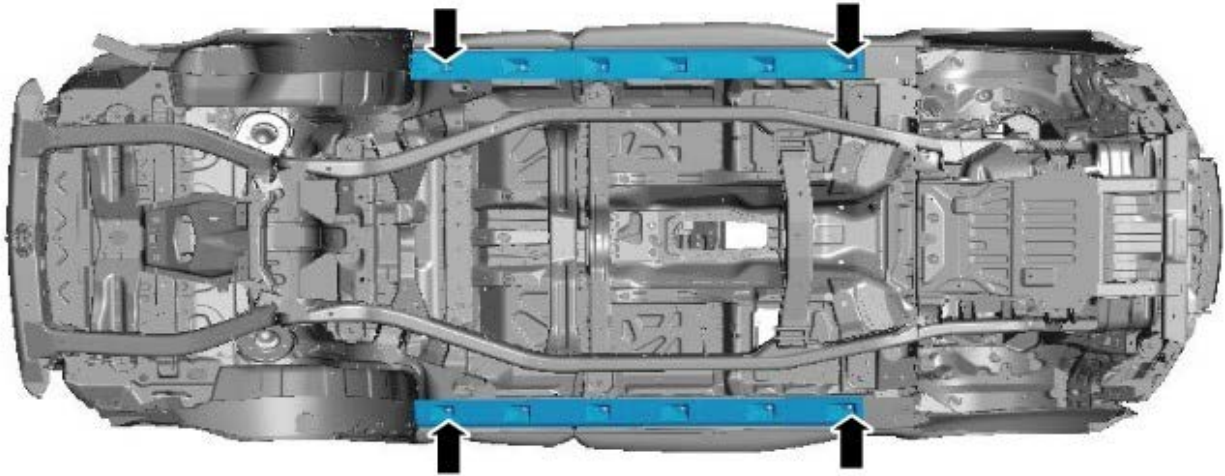
54.  CAUTION: To prevent the body becoming unstable when raised from the integrated body frame, install the vehicle tie down straps.



NOTE: Note the fitted position of the body mounts.

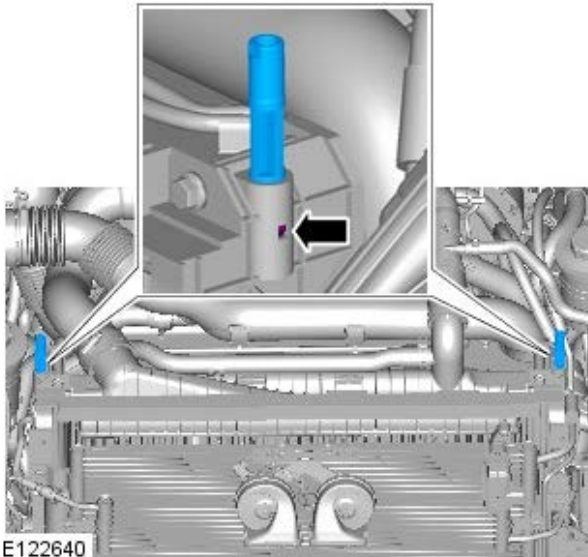
Using an assistant raise and support the body.

- Remove the body mounts.



E124860

55.



E122640

Installation

All vehicles

1. CAUTIONS:



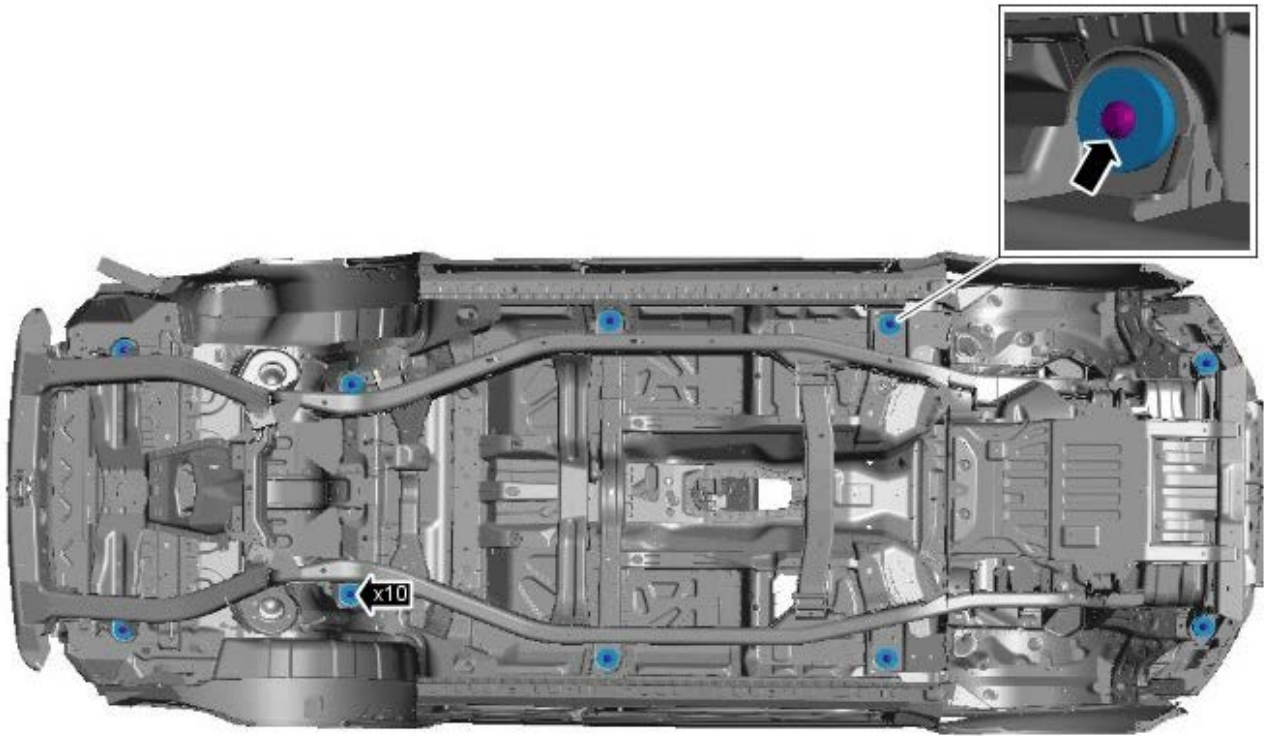
Make sure that new bolts are installed.



Make sure that all components are free and do not get caught up whilst lowering the body onto the integrated body frame.

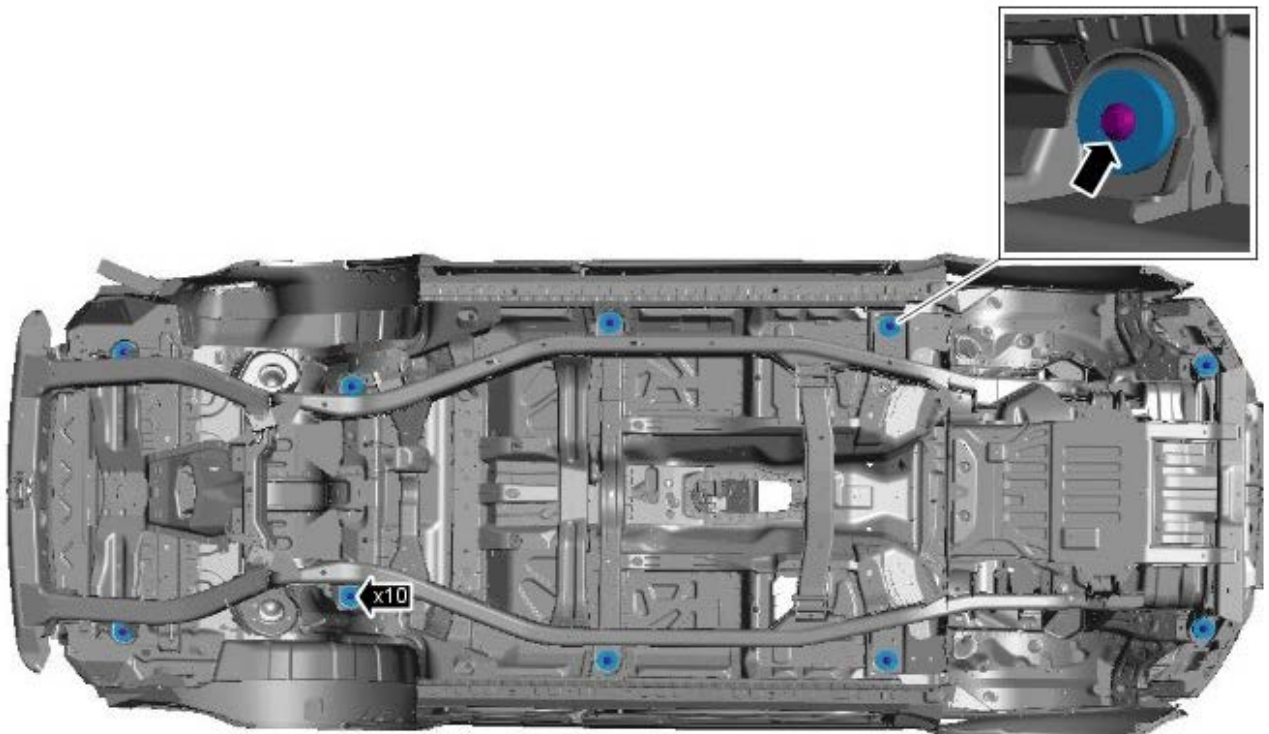
Using an assistant install the body to the integrated body frame.

- Install the body mounts.
- With assistance align the body and integrated body frame mounts.
- Install the bolts, but do not tighten fully at this stage.



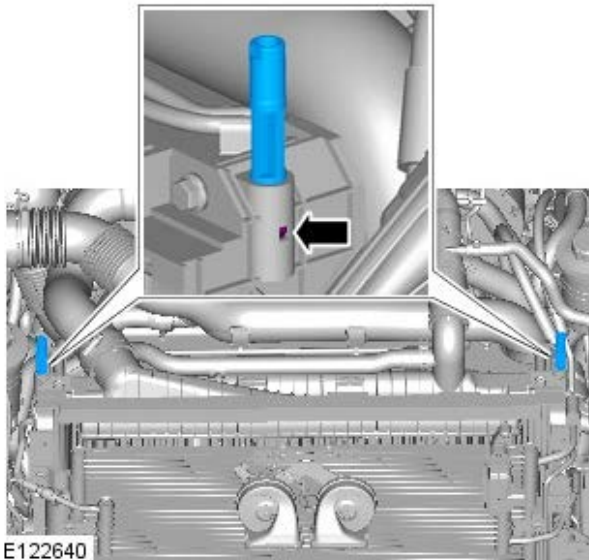
E124859

2. Remove the tie down straps securing the body.
3. TORQUE: 133 Nm

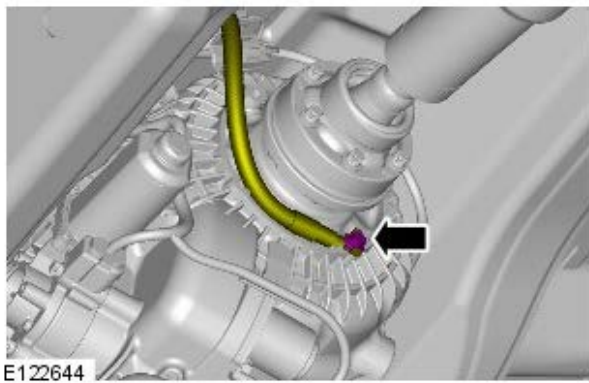


E124859

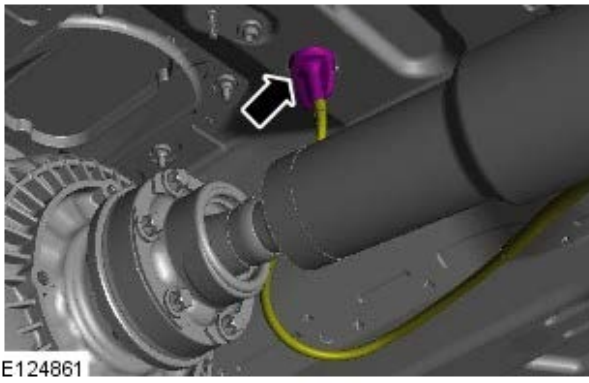
4.



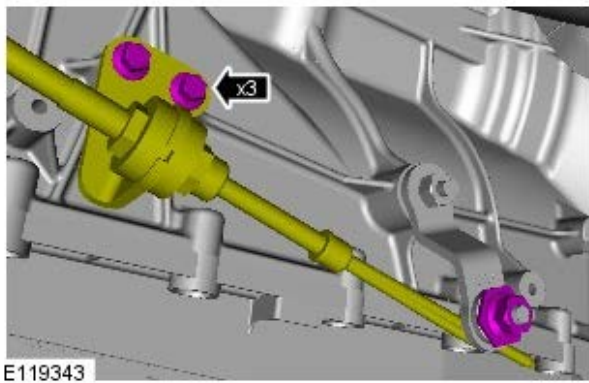
5. TORQUE: 25 Nm



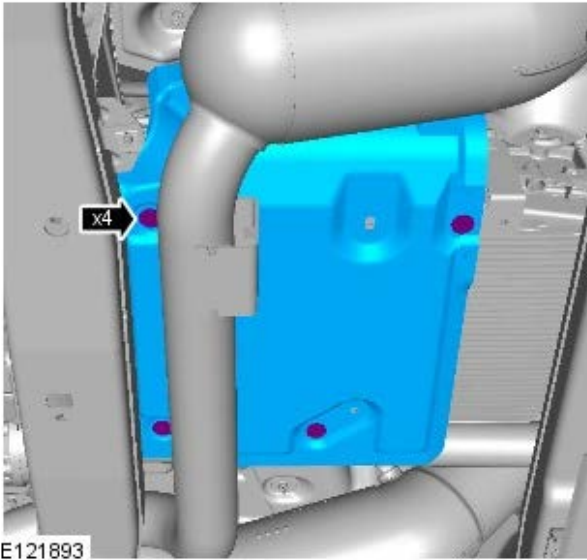
6.



7.

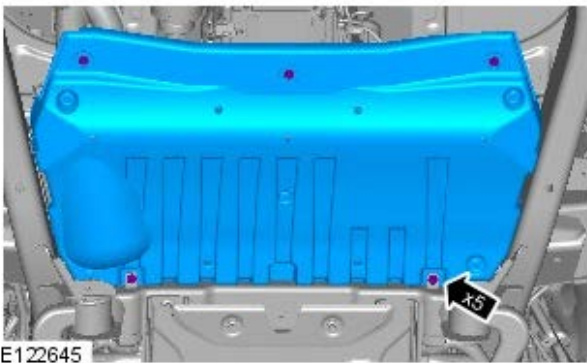


8. TORQUE: 12 Nm



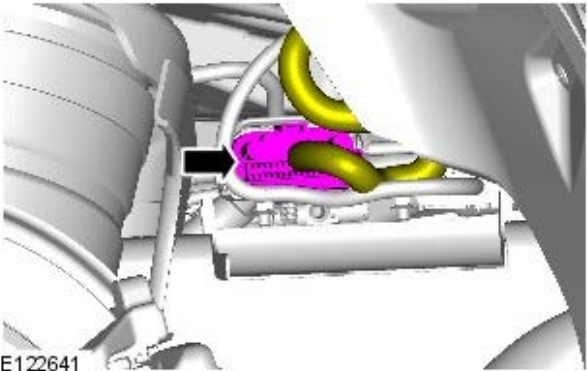
E121893

9. TORQUE: 12 Nm



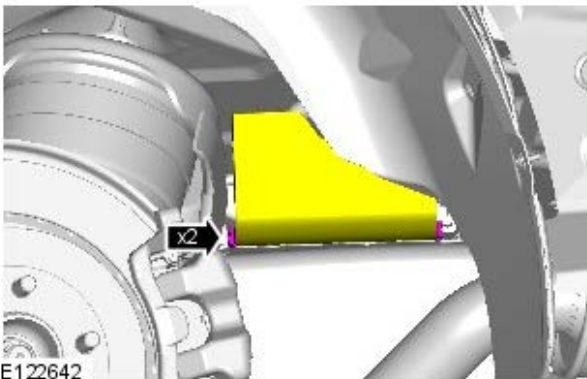
E122645

10.



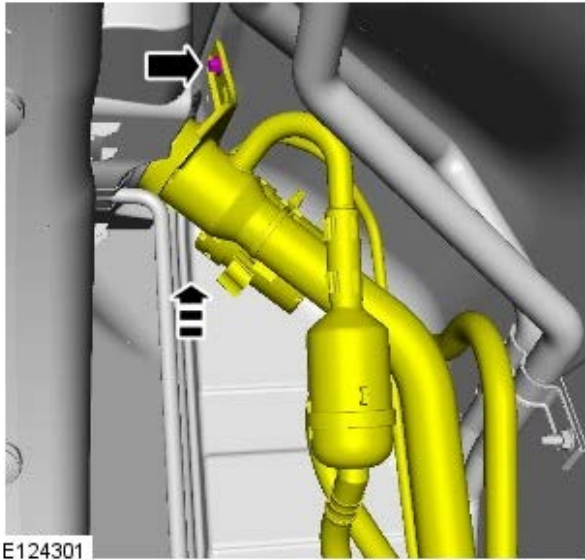
E122641

11.



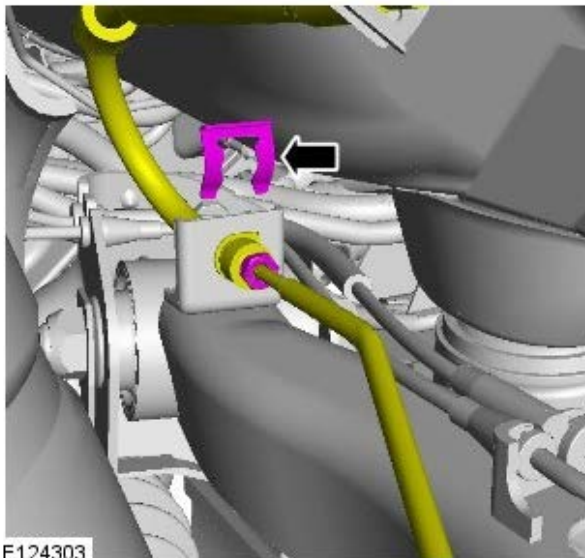
E122642

12. TORQUE: 12 Nm



E124301

13. For additional information, refer to: Fuel Filler Door Assembly (501-03 Body Closures, Removal and Installation).

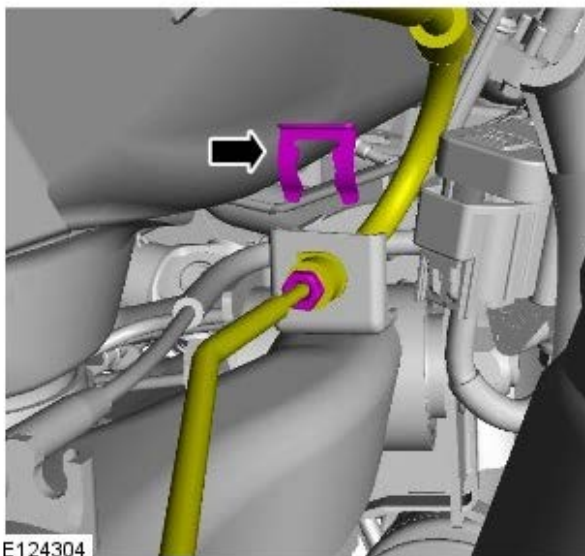


E124303

14.  NOTE: Remove and discard the blanking caps.

TORQUE: 16 Nm

- Clean the component mating faces.
- Secure the clip.



E124304

15.  NOTE: Remove and discard the blanking caps.

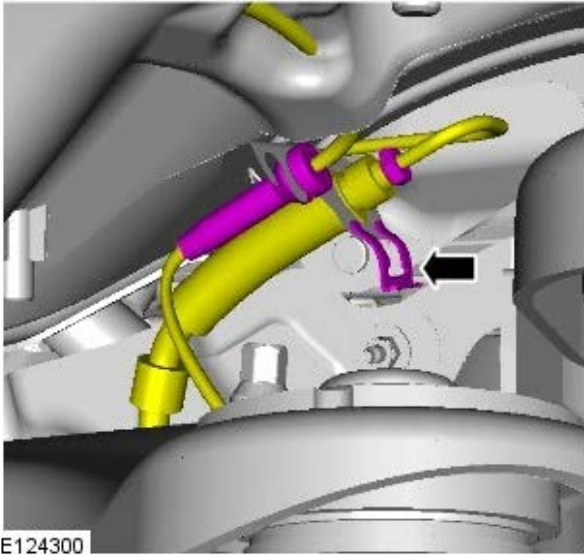
TORQUE: 16 Nm

- Clean the component mating faces.
- Secure the clip.

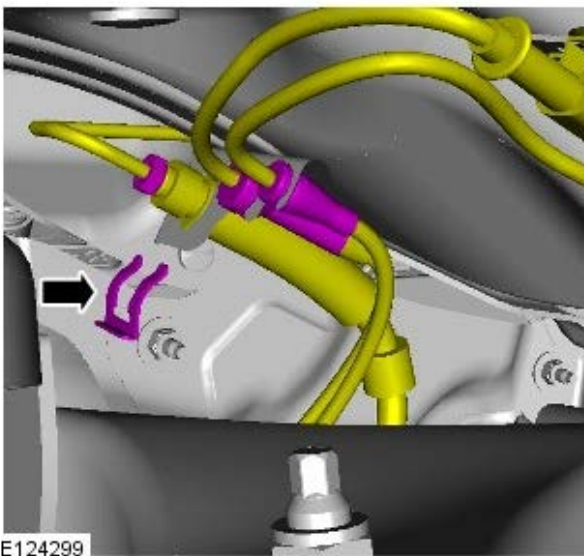
16.  NOTE: Remove and discard the blanking caps.


TORQUE: 16 Nm

- Clean the component mating faces.



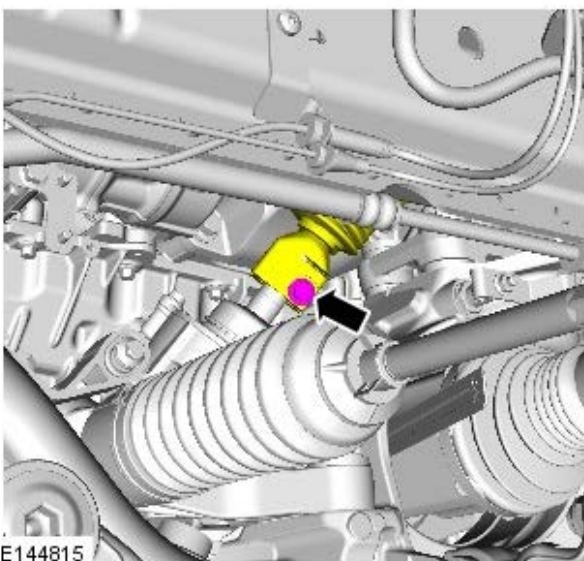
- Secure the clip.



17.  **NOTE:** Remove and discard the blanking caps.

TORQUE: 16 Nm

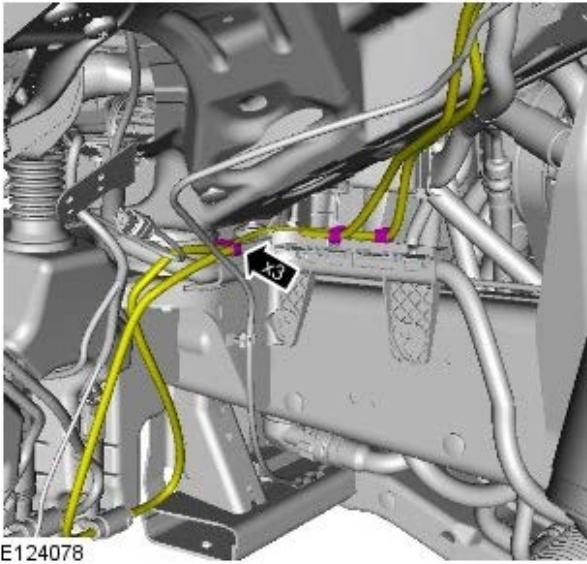
- Clean the component mating faces.
- Secure the clip.



18.  **WARNING:** Make sure that a new bolt is installed.

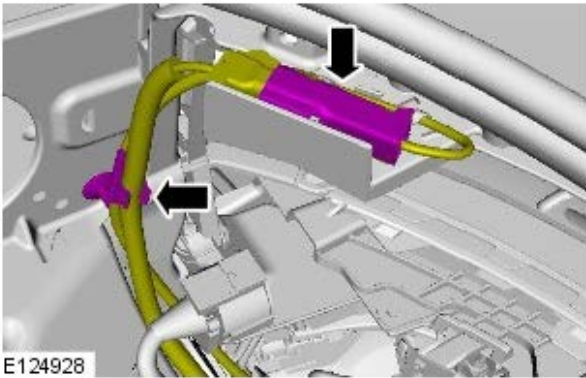
TORQUE: 25 Nm

- 19.



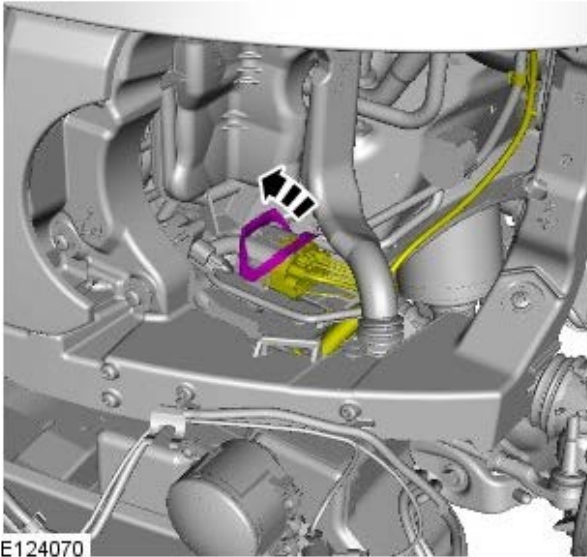
E124078

20.



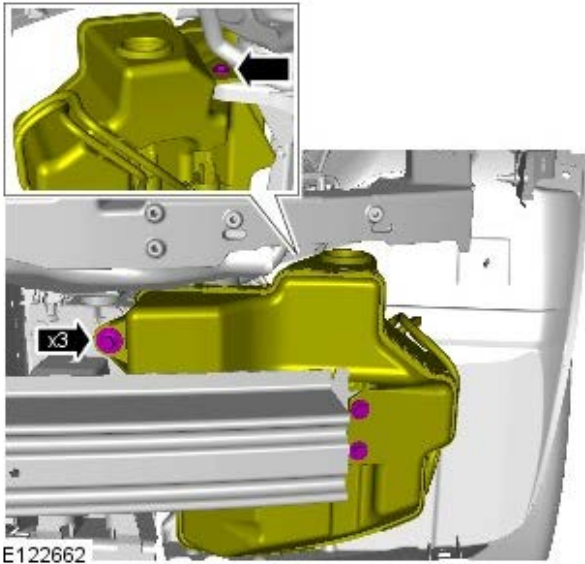
E124928

21.



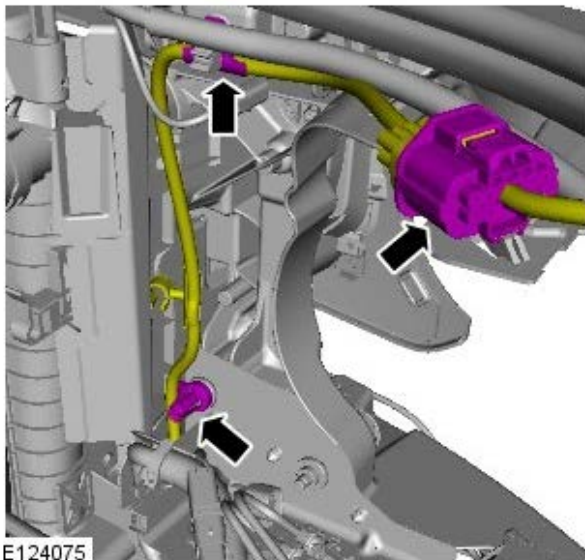
E124070

22. TORQUE: 12 Nm



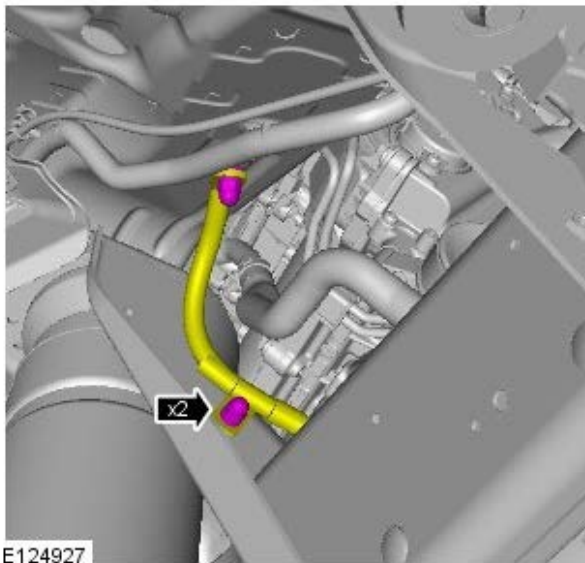
E122662

23.



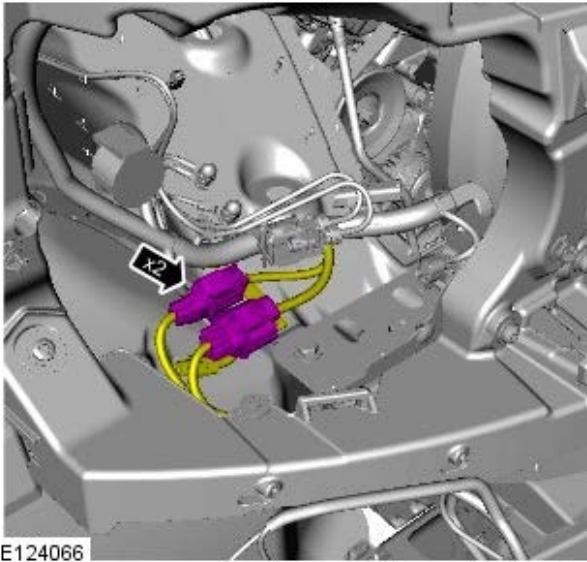
E124075

24. TORQUE: 20 Nm



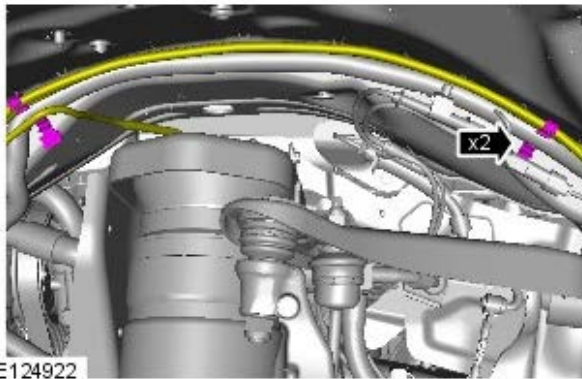
E124927

25.



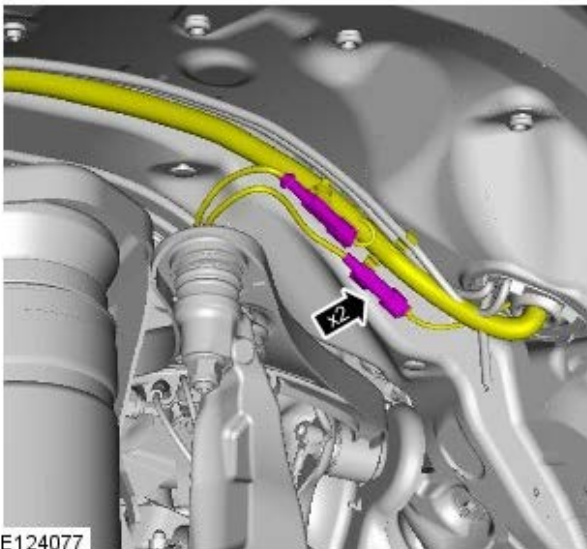
E124066

26.



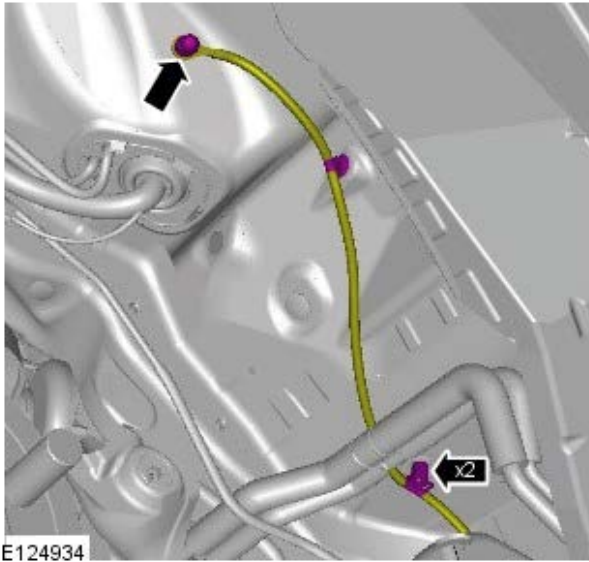
E124922

27.



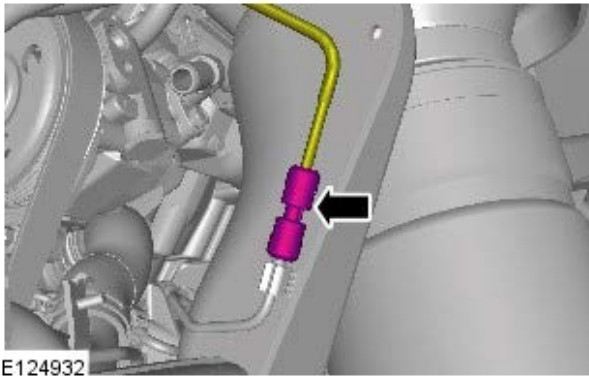
E124077

28. TORQUE: 20 Nm



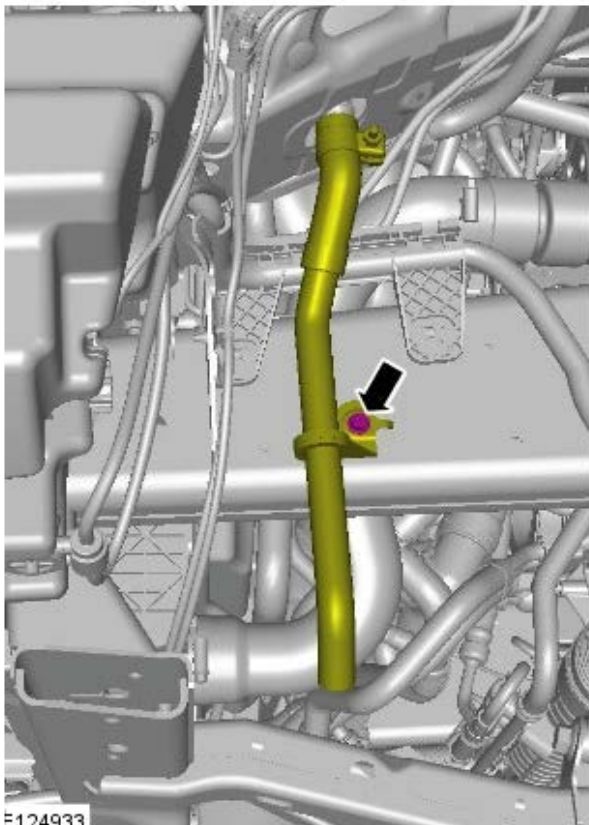
E124934

Vehicles with auxiliary heating
29.



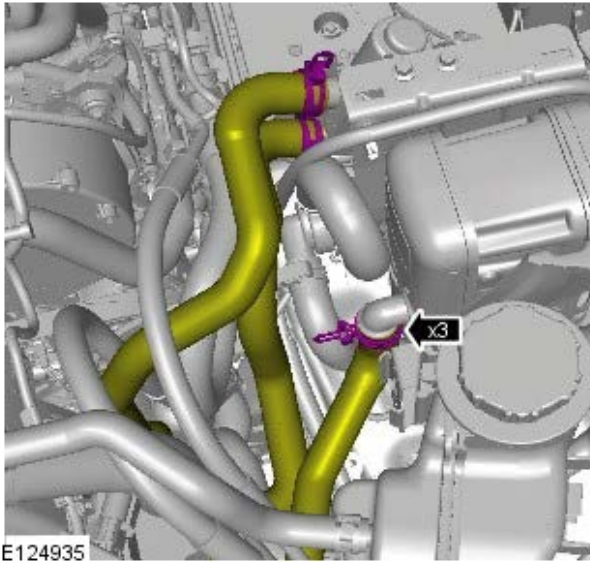
E124932

30. TORQUE: 10 Nm



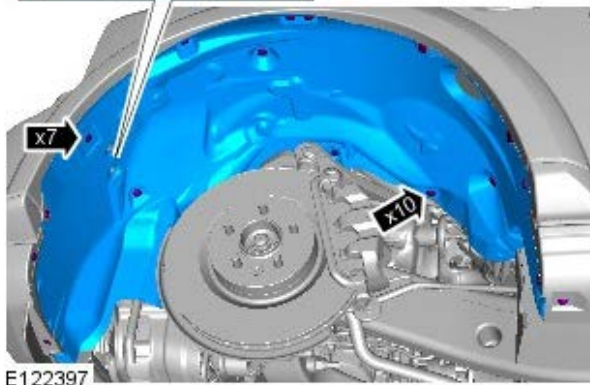
E124933

31.

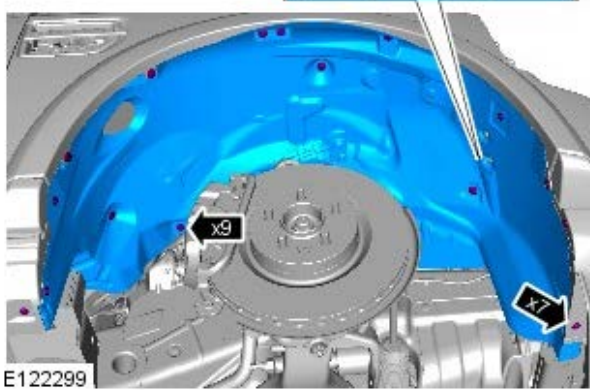


All vehicles

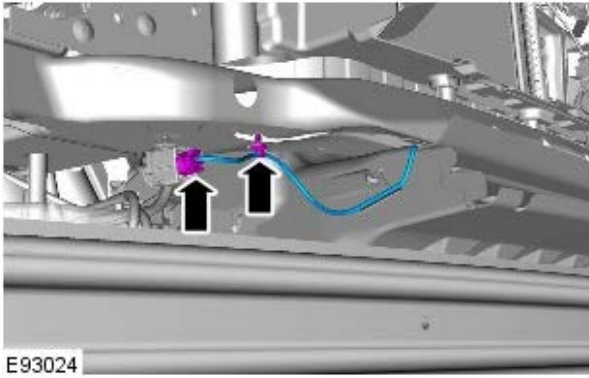
32.



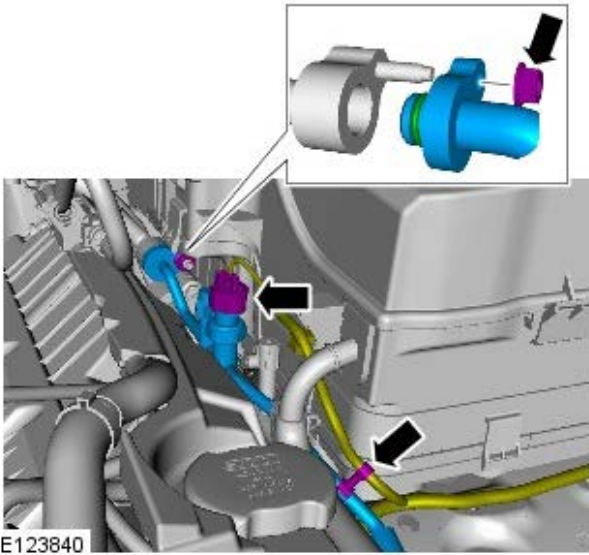
33.



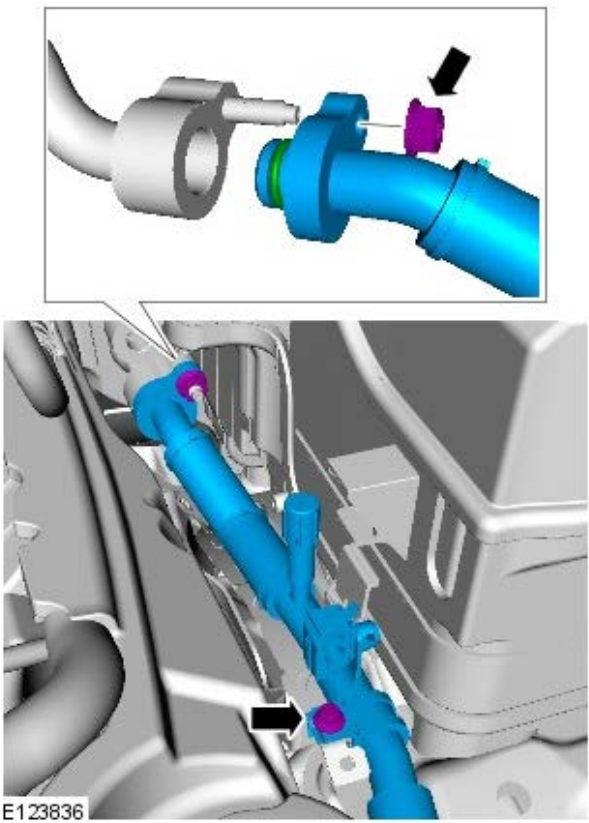
34.



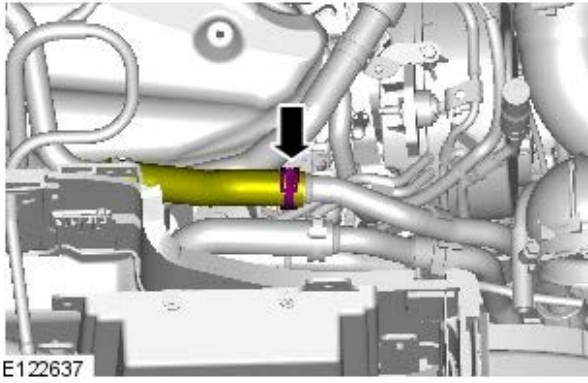
35. TORQUE: 12 Nm
- Install new O-ring seals.



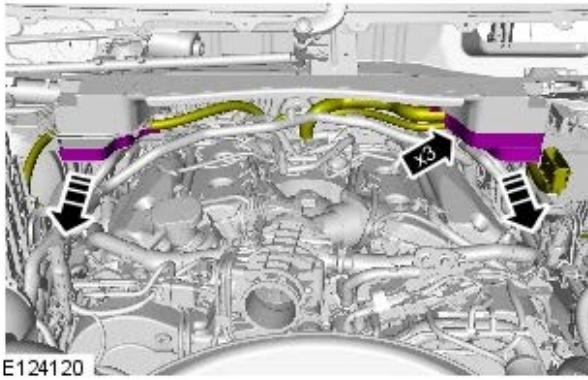
36. TORQUE: 12 Nm
- Install new O-ring seals.



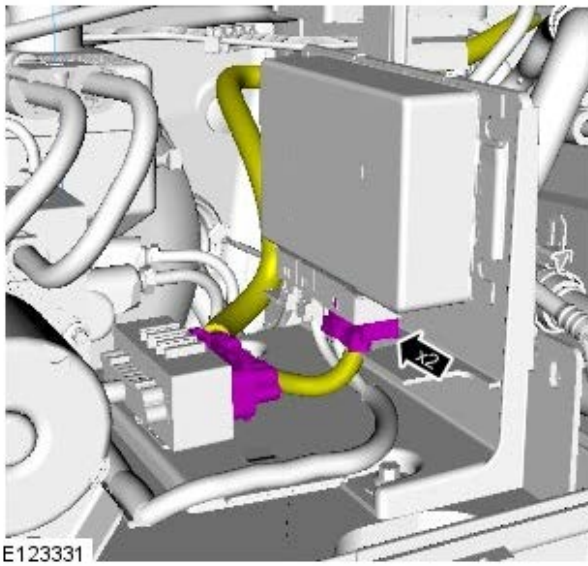
37.



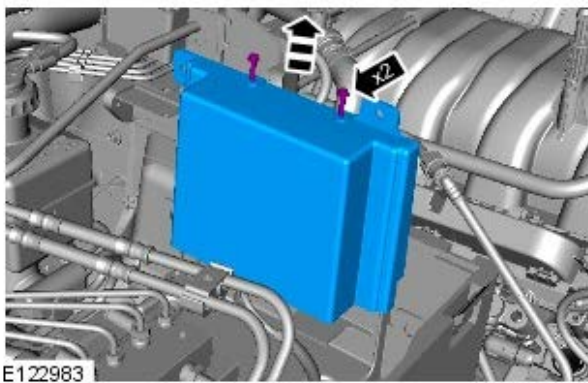
38.



39.

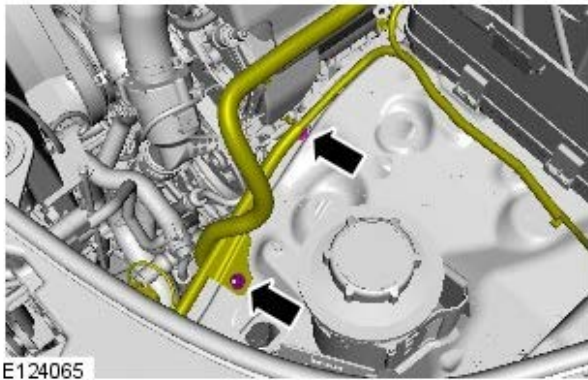
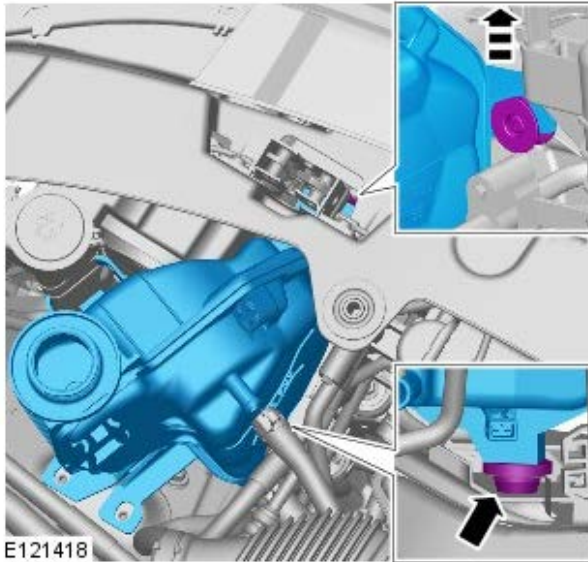
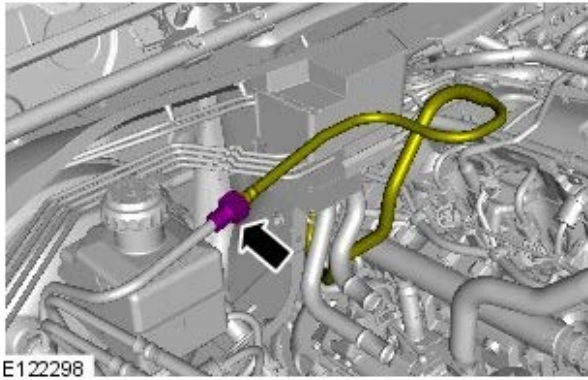



40. TORQUE: 8 Nm



41. For additional information, refer to: Auxiliary Battery Tray (414-01 Battery, Mounting and Cables, Removal and Installation).

42.



43.  **CAUTION:** Be prepared to collect escaping coolant.

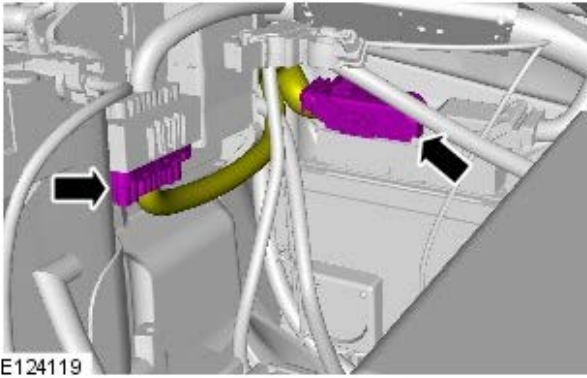
For additional information, refer to: Coolant Expansion Tank (303-03 Engine Cooling - TDV6 3.0L Diesel, Removal and Installation).

44. TORQUE: 10 Nm

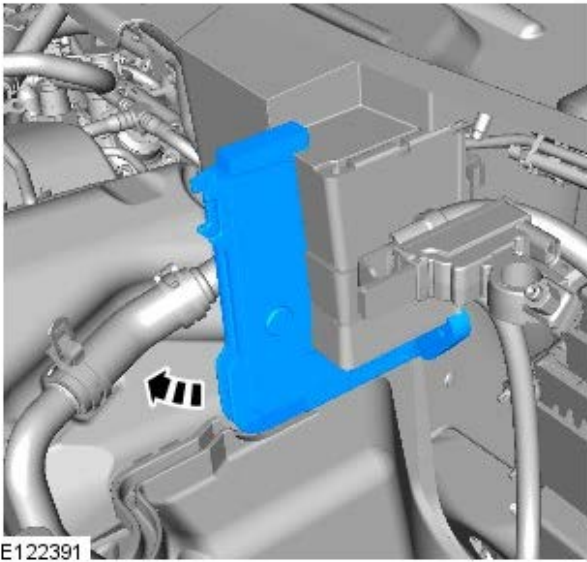
All vehicles

- 45.
46. For additional information, refer to: Rear Bumper Cover (501-19 Bumpers, Removal and Installation).
47. For additional information, refer to: Air Cleaner (303-12 Intake Air Distribution and Filtering - TDV6 3.0L Diesel, Removal and Installation).

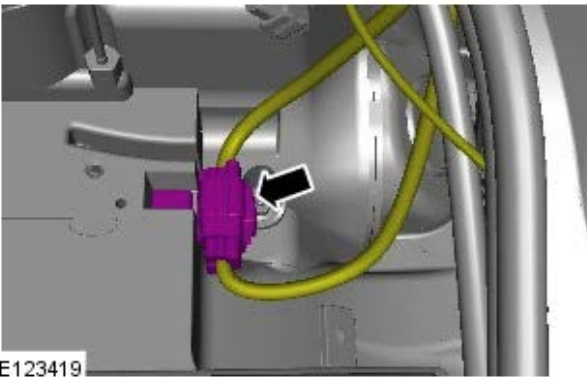
- 48.



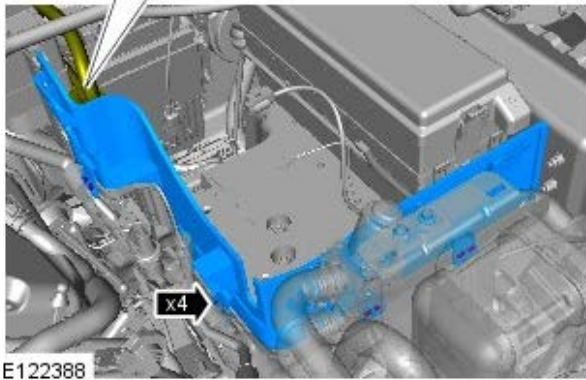
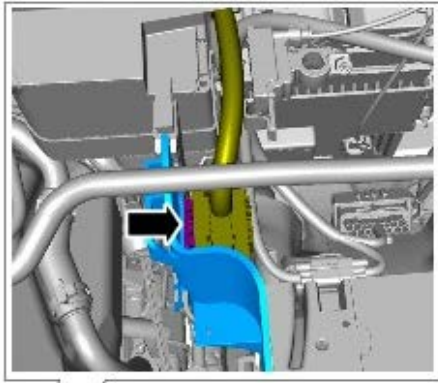
49.



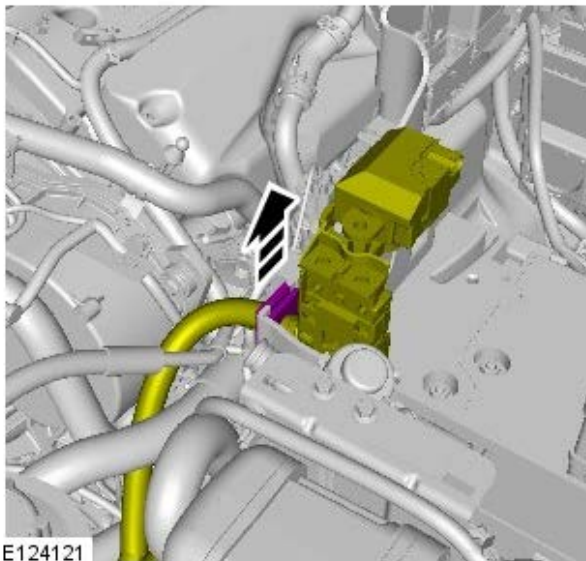
50.



51.  NOTE: RHD illustration shown, LHD is similar.



E122388

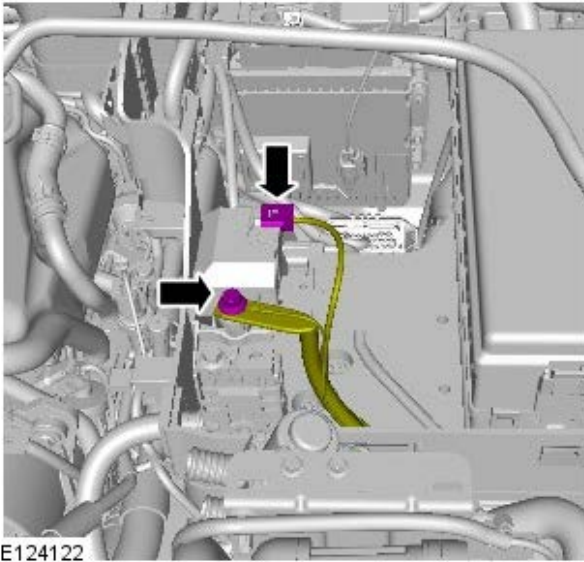


E124121

52.

- Cut the cable tie.

53. TORQUE: 10 Nm



E124122

54. For additional information, refer to: Battery (414-01 Battery, Mounting and Cables, Removal and Installation).
55. For additional information, refer to: Air Conditioning (A/C) System Recovery, Evacuation and Charging (412-00 Climate Control System - General Information, General Procedures).
56. Check and top-up the coolant.
57. Bleed the braking system.
For additional information, refer to: Brake System Bleeding (206-00 Brake System - General Information, General Procedures).